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THE

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THE LIFE-CYCLE OF *TAMUS COMMUNIS* L.

By I. H. Burkill, M.A., F.L.S.

The life-cycle of *Tamus communis* is here discussed under five headings :—(1) fruit-ripening and seed-dispersal; (2) fertility; (3) the seed between fruit-ripening and the emergence of the seedling; (4) growth of the plant to maturity; and (5) flowering.

The genus *Tamus* has two species—*T. communis* and *T. edulis* Lowe. The latter is confined to Madeira and the Canary Islands: the former has a wide distribution around the Mediterranean, its western limit the shores of the Atlantic, its northern a line from Newcastle in Britain to Lenkoran on the Caspian Sea, its eastern and southern the deserts of western Asia and northern Africa. The line which makes its northern limits when drawn on a map slopes towards the south-east in this way :—from Newcastle in lat. 55° N. through Limburg in Belgium in 51°, Perl on the Mosel in 49° 50′, Merzig on the Saar in 49° 25′, the Black Forest in 48° 50′, north-east of the Lake of Constance in 47° 35′, Radkersburg in Lower Styria in 46° 40′, Veszprem to the north of the Balaton Sea and Grosswardein in 47°, the Crimea and on the north of the Caucasus near Stavropol in 45°, to Lenkoran in 38° 50′. When the biological data have been given an attempt will be made to indicate climatic features ruling to the north of this line that exclude it. To the south of the line it appears as a successful plant so generally that enclaves breaking the continuity of its distribution are unusual. It is, for instance, in every county and Watsonian vice-county of England and Wales to the south of the limit named; the Belgian botanists record it for every province of their country except the hollow land to the north; the Swiss botanists admit it to be in every Canton; and of the eighty-seven departments of France it is certainly in eighty* and probably in all. But curiously it is absent from all parts of Ireland, except two counties bordering Lough Gill.

* The writer owes this information to the kindness of Dr. F. Gagnepain.

1. Fruit-ripening and Seed-dispersal.

The period from flowering to the cessation of growth in the berries is in Britain about eighty days. At the end of the period the larger berries have attained a volume of 1·25 cubic cm. and some slightly exceed this: the smaller berries have a volume of, say, 0·75 cubic cm. or may be smaller. There is a complete range from one extreme to the other. After a further twenty days they turn yellow, and from yellow go red: these colour-changes are outward signs of the parting of the seeds from the placentas.

If the full-sized but still green berries be plucked and dropped into water, they sink: but ripe berries float. This alteration in specific gravity is due to the dying of the fruit-wall progressively from the placenta outwards and from the base of the berry upwards, with a shrinkage of its tissues and the creation of spaces that fill with air. Of such spaces there are none in the green berry.

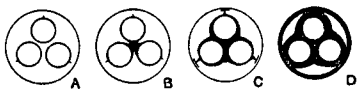

Fig. 1.—Sections through a berry at four stages in ripening: A, when green, the extension of the loculus outside the seed is indicated; B, when turning yellow, the placentas have been pulled apart; C, when the water-holding tissue has contracted considerably; and D, when this tissue has broken into three pads.

In the fruit-wall are nine vascular bundles: three of them run a course along the placentas; the other six run from the base of the berry to its apex at a little distance below the epidermis; they served the sepals, petals, and stamens when the flower was functional and now, these dead, they serve the fruit-wall, but do not branch at all in it. Three run just outside the external angles of the loculi, one outside each; and the other three run midway between them. A transverse section of the green berry shows that the seeds do not fill the whole of the locular space provided; but that the epidermal layer lining the loculi extends towards the bundle just outside the loculus, its two faces in contact. This epidermal layer consists of thin-walled transparent cells.

The outer epidermis—that which coats the berry—is more strongly constructed as befits its position. Its external walls are uniformly thickened, and the walls between its cells irregularly thickened. There are a few stomata in it. The fruit-wall between this outer and the inner epidermis consists of parenchyma without intercellular spaces, the cells decreasing in size towards the vascular bundles; and at all depths some of them, which are

[illegible] enlarged, hold raphides. There is chlorophyll in moderate quantities, rather more of it towards the surface than below and more in the smaller cells near the vascular bundles than elsewhere. Accompanying the chlorophyll is granular matter in small quantity. The raphides in the deeper cells are small, and lie in cloud-like masses in the cells; but those in the larger and more superficial cells are of the size which such needle-crystals usually attain and lie in bundles in the usual way, their ends pointing towards the base and apex of the berry.

The parenchyma is very turgid; and by this turgidity the two surfaces of the inner epidermis are pressed either against the seeds or together: it obliterates the cavity of any infertile loculus as well as the unoccupied corners of the fertile loculi. It is so hygroscopic that thick sections of a berry dropped into water become deformed by the strains set up between the swelling flesh and the resisting outer epidermis; and in this deformation vessels which may have been cut in the section are likely to be opened out of position. This turgid fruit-wall functions as a water-store for the developing seeds and, as will be shown later, does not cease growth at flowering, but grows for a time even when pollination has failed. One falls into a wrong habit of regarding the formation of such parenchyma as preparation for the later berry; but it is not until the parenchyma has carried through its original function of a water-store for the growing seeds that it also elaborates a little food—that, as it dies, it has secondarily the function of aiding in seed-dispersal.

Systematic botanists, in search of conciseness, define *Tamus* as a genus distinguished from *Dioscorea* by its berry, *Dioscorea* having a capsule. This is so; but does not embody the essence of the difference. This essence, as ontogeny demonstrates, is the production of the water-holding tissue in the ovary wall and its retention until the seeds are ripe, by which time it is too late to be rid of it and, dehiscence having become impossible, a fleshy fruit results.

Tamus, it must be claimed, originated from *Dioscorea* by the conversion of the capsule of the latter into a berry. This alteration in the nature of the fruit made alterations in the seed inevitable. The change in the fruit bringing inability to dehisce and inability to deliver the seeds to the scattering action of the wind, unencumbered by a load of moisture, removed the possibility of wind dispersal, and with it the need of the greatest possible lightness in the seed, permitting the weight of the seed to be increased and the surface to be diminished. The wing which had thus become superfluous became disadvantageous, for appendages incommode distributing birds, as is well seen when their depredations on crops of awned and unawned rice are studied, for they attack the unawned much more persistently than the awned; and again appendages hinder seeds from sinking

into the soil when they reach it. So the wing on the seed became in the berry of *Tamus* not only useless, but a handicap, and ceased to be formed ; the seeds became spherical, and the amount of endosperm was increased.

The wing of the seed of a *Dioscorea* grows late in fruit-ripening into an empty part of the loculus provided in advance. In the ripening fruit of *Tamus* there is equally an extension of the loculus beyond the part which the seeds fill. This extension may be regarded as a survival from the time when the ancestry of *Tamus* had seeds with wings, *i. e.*, belonged to the genus *Dioscorea* ; and is one of the characters which support the theory of its origin.

As the needs of the growing seeds led to the chain of modifications indicated above, it is clear that *Tamus* turned from the wind-dispersal of its ancestry to bird-dispersal, not because it profited from the agency of birds, but because the climate into which it was evolving or migrating taxed its developing seeds over-much by drying them. In other words, the berry originated climatically and not ecologically.

As the berry turns yellow, and from yellow to red, the dying of the fruit-wall progresses from the placentas outwards, as the diagrams of fig. 1 indicate. First, there is the death of the placentas causing the three loculi to unite. Then death spreading outwards (upwards also) pulls the inner epidermis away from contact with the seeds and opens the outer angles of the loculi. This is followed by an imperfect dehiscence which consists of a tearing of the tissues from the outer angle of the loculus towards the surface of the berry : and at the same time the tissues under the outer epidermis break down—a process aided by weakness due to the relatively large size of the cells which hold raphides, for where they are, there are fewer cell-walls to resist rupture. This imperfect dehiscence is another of the characters which support the theory of the origin of *Tamus*.

The freed raphides float in a watery juice which increases in amount as cell-walls are broken and the pectins (apparently yam-mucin in a large measure) break down into mucic acid and other products.

The condition of the berry is now that within a tough epidermis, in a rather watery juice, lie three somewhat navicular pads of parenchyma and the seeds which have matured, 1 to 6 in number. The humidity of a British autumn causes only a slow loss of water from the berry and permits it to hang on the dead vine for at least a couple of months with little alteration.

The bright red colouring-matter in it is a pigment insoluble in water, but soluble in alcohol. It occurs in other berries, and is not peculiar to *Tamus* (Hartsen in Comptes-rend. Acad. Paris, lxxvi. 385, 1873 ; and Zechmeister and Cholnoky, ex Chem. Abstr. xxv. 3029, 1931). These chemists comment on its

stability : it is a factor causing the berry to remain attractive so long.

There is some sugar in the berry when it is ripe ; and its taste is at first sweetish : Brenner, writing in Switzerland (in Kirchner, Loew and Schroeter, ' Lebengeschichte d. Blutenpflanzen Mitteleuropas,' i. pt. 3, 718 ; 1914) calls it " sour-sweet." A burning sensation follows the first taste—a sensation ascribed to penetration of the mucous membrane of the mouth by the raphides ; and the irritation extends to the throat and along the intestine as far as they may be carried. This juice from the berry, which conveys the irritating crystals to the surface of the mouth, on the more tender parts of the human skin produces irritation in varying degrees in different persons. Accompanying its mechanical poison is another—a saponin, poisonous enough to be classed as a sapotoxin : and fresh berries have at times caused the deaths of children who have eaten them.

What saponins are to the plant is not altogether clear : those which can be classed as sapotoxins will certainly protect it against animals susceptible to the poison, but they form a part only of the group : they and all the others as potential sources of sugar seem to be reserve food-stuffs (see Kolfer, ' Die Saponine,' 88 ; 1927), though they do not yield sugar readily. Most of them are very soluble in water. Sapotoxins introduced into the mammalian intestine stagnate digestion : in the blood-stream they break down the corpuscles. One differs from another in toxicity, some enormously ; and Kobert (Lehrb. d. Intoxicationen, ii. 752 ; 1906) has given a tabular statement with the saponin of *Dioscorea tokoro* Makino, as the most hæmolytic, while that of an unnamed species of *Dioscorea* is as far away from it as the forty-second place. Unfortunately, the power of the saponin of *Tamus* of breaking down blood-corpuscles has not been measured in terms of the others. It is certainly less than that of many, including the *Dioscorea* named ; but, as fatalities indicate, is still a sapotoxin.

The saponin of *Tamus*—presumably the same member of the group is in all parts of the plant—differs in amount in different parts. It occurs in the greatest quantity in two, both connected with the storage of foods, namely, the tuber and the berry. There is not enough of it in stems and leaves to kill sheep and goats which may eat the plant, presumably along with other herbage (Long, ' Plants poisonous to Stock,' ed. 2, 79 ; 1924) : and it is not difficult to boil it out of the tender new spring shoots so that these are eaten as a substitute for asparagus in Dalmatia, Cyprus, Algeria, and elsewhere. But the berries are decidedly poisonous : the eating of a few causes not a little disorganization of the system and the eating of many causes death. If few be eaten discomfort arises, succeeded by drowsiness and loss of control of the movements of the lower part of the body : if

many be eaten, vomiting and colic are rapidly succeeded by a complete paralysis of the lower part of the body and death supervenes : the large intestine, sharing the paralysis, can make no attempt to pass forward the source of the poison within it (see Cornevin, ' Les plantes vénéneuses,' 127, 1887, and Kobert, *tom. cit.* 516). The symptoms described in detail by Cornevin are those of saponin-poisoning, though some of the initial discomfort may be ascribed to the raphides.

These two poisons are carried forward from the green fruit to the ripe berry ; and the reason for their existence is to be sought in the green fruit. This they protect, whatever their place in metabolism. But all their protective function has passed away when the berry turns red, so that Nature paradoxically decorates in a bright colour an attractive and sweetish berry holding repellant crystals and a lethal poison. However, that which prevents Man from eating a berry does not necessarily make the berry a forbidden food at large.

The green fruits of *Tamus* seem to escape injury with considerable success. They are not uncommonly marked in Britain by black scars arising from the punctures of a sucking insect, but are not conspicuously damaged thereby. Sometimes just before maturity an animal, possibly always a small snail, rasps its way through the epidermis and eats the parenchyma, baring but not otherwise injuring the seeds : as it eats no more of the epidermis than it must in order to obtain the parenchyma, the epidermis evidently protects. No other injuries have been observed. To assess the relative protective values to the growing fruit of its toughened epidermis, its raphides, and its saponin is not easy.

Stahl in his classical paper on the feeding of snails on plants (Jenaisch. Zeitschr. xxii. 557 ; 1888) demonstrated that raphides have a protective value, but did not experiment with *Tamus*. The writer has offered to snails (*Helix aspersa* Müll.) the option of eating (1) blotting paper through which the juice of *Tamus* berries had been filtered in such quantity that it was coated with raphides, at the same time, being wet, holding the saponin ; (2) the same well-washed so that the saponin was not there, and (3) blotting-paper saturated with filtered juice and, therefore, holding the saponin without the raphides. The snails showed a preference for the saponin-holding paper over the raphides-holding paper, and ate least of the well-washed paper. But the raphides did not completely repel them, and, when they had been eating nos. 1 and 2, were recoverable in abundance from their fæces.

The saponin did not immediately injure the snails, and that it might have done so in time could not be ascertained as the season of *Tamus* berries is the time when snails begin to hibernate, and they in time ceased to feed.

That sapotoxins are protective bodies in the family Dioscoreaceæ is evident when a study is made of the subterranean parts of *Dioscorea* ; those species which bury their tubers deeply do not load them with great quantities of saponins, but others producing their storage organs in the surface-soil load them with substances which limit the ravages of animals such as wild pigs, and one of these substances is a sapotoxin. If the sapotoxin is protective in the tuber—and this cannot be disputed—so is it protective in the berry.

When the berry ripens the seed-coats harden and the seed no longer needs the protection of the fruit-wall. Ideally its poisons should disappear at once, but they do not. The fate of the saponin has not been worked out, but a slow decomposition seems probable. A rough experiment was made with the mollusc *Physa fontinalis* L. At the beginning of October the juice of ripe berries was filtered to remove raphides and other solid matter : this juice paralysed the mollusc in two minutes. Six weeks later juice, similarly filtered, only paralysed the snail after fifteen minutes. These water snails are exceedingly susceptible to the effect of saponin, and the experiment indicates a change which is probably in the main a loss of saponin. Though that poison may disappear in this way, the raphides remain to the end. In Britain the berries hang for a long time on the dead vines, untouched by birds ; and most of them in the end fall to the ground, where they were produced. But there is a little belated distribution by birds. Ridley (' Dispersal of Plants,' 1930) has collected statements that three species of birds in Britain eat the berries : he quotes Woodruffe-Peacock (pp. 458 & 476) as an authority for the starling and the missel-thrush carrying the seeds to new places, and (p. 463) Dymes for the eating of the berries by the chaffinch. Brenner (*op. cit.* p. 718) states that in Switzerland the blackbird eats them, and implies that other birds also do so.

At a time when missel-thrushes were eating yew-berries in the writer's garden and voiding the poisonous seeds unbroken in slimy stools everywhere (an occurrence which happens year by year in the garden), a laburnum tree was festooned with vines of *Tamus* so loaded with berries as to make the tree very conspicuous ; but for two months the *Tamus* never seduced the missel-thrushes from the yews, nor were any birds seen to go to them.

That the berries should hang neglected is, however, only what the hips of *Rosa* and the haws of *Crataegus* do. They are equally unsuccessful in attracting immediate attention. While waiting for attention the tough epidermis keeps the berries intact.

Brenner suggests that the seeds are not swallowed. But should they be, they are so hard that they would pass through the bird's intestine without injury. And it would seem advan-

tageous that they should be swallowed, so that the distance to which they are carried might be increased. Occasionally seedlings are seen so close together as to suggest that they have sprung from seeds once associated in a single stool; but this is rare. A bird which forsakes the bushes after feeding and voids swallowed seeds in the open, casts those seeds away, as *Tamus* is altogether unable to succeed away from shade. Horticulturists know that it should be given a sheltered place in a garden. Philip Miller in his 'Gardener's Dictionary' (1731) told his readers to sow the seeds under a bush. Seedlings do not come up in ploughed fields or fields in grass, though the hedges bounding them are so full of plants of *Tamus* that some seeds must reach the surface not immediately under the shelter of the hedge. It is the humidity a shaded position affords which is essential: it is necessary not merely for later growth, but for the germination of the seed.

In regard to humidity as a requisite for later growth, an experiment may be recorded here. The writer took ten rather small tubers from the ground in autumn and kept them in a potting shed through the winter—dry, but not more so than one usually keeps tubers. They were planted in spring in the open; but they did not send shoots above ground until after twelve months had passed. They had needed the moisture of the soil during the winter, and not having had it, were not only not ready to send up vegetative shoots when they were planted, but required the whole summer to repair the set-back.

Schjelderup-Ebbe (Ueber d. Lebensfähigkeit alter Samen, 62; 1936) records an attempt to germinate 100 seeds exactly 100 years old: it failed. We have as yet no knowledge how long a seed can live.

2. Fertility.

In a general way scarcely half of the female flowers which *Tamus* produces give rise to berries. This failure, while it may be due to want of pollination, is yet more frequently due to the parent plant casting off those it cannot nourish. This it does chiefly within a fortnight of flowering: and naturally the cast-off undeveloped berries are the later, *i. e.*, those towards the ends of the infructescences or secondary flowers on the pedicels of others. The latter are never numerous and are produced chiefly by individual plants on their more vigorous inflorescences. Most plants show little tendency to produce secondary flowers. In the drawing (fig. 2) there are two—Nos. 1 *a* and 2 *a*.

It is possible to ascertain fairly reasonably whether a flower has failed to form fruit from being redundant or from want of pollination; because when want of pollination is the cause, the failures are scattered about the inflorescence; but when redundancy is the cause, the failures are those of junior position. The same two causes operate in reducing the number of seeds

formed in a berry from the maximum of six. The following is the result of an examination of three plants on the same day from the same hill-top. *A* and *B* grew intertwined with a vigorous male; but *A* was an older better-established plant than *B*. *C* grew somewhat isolated. *A* produced 411 seeds in 81 berries, *B* 126 seeds in 38 berries, and *C* 231 seeds in 60 berries; the

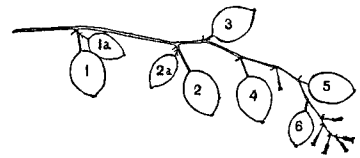

Fig. 2.—A paniculate infructescence: the berries not globose as is usual, but ovoid.

average number of seeds in a berry was :—for *A* 5·1, for *B* 3·3, and for *C* 3·8. *C* carried 55 shrivelling ovaries such as die unpollinated. The following table gives the number of seeds per flower on the first ten infructescences of each of the three plants. The table is arranged with the lowest infructescence below and gives the number of seeds in each berry in order of their standing :—

Plant *A*, vigorous, with a male intertwined.	Plant *B*, not vigorous, with a male intertwined.	Plant *C*, with no male near.
6 5 4 6	1 1	0 0 0 6 3 6 5
6 6 6 6 5	1 2 6	0 0 0 5 6 5 4 0
5 5 6 6	3	0 0 0 4 2 4 0
6 6 6 6	3 5	0 0 0 0 6 5 5 0
6 6 6 5	1 6 3	0 0 0 4 0 1
4 6 5 4	3 5	0 0 0 0 0
1 2 0 2 3 5	3 4 5	0 1 0 0 0 2
6 5 6 6 5	3 4 4	0 0 4 4
1 6 5 5 0	5 3	0 0 0 0 0 5 4
6 3 4 0	5 5	0 0 3 0 0 4
Failed .. .. 1 1 1 ..	.. .. ..	10 9 7 5 5 .. 1 2

There is a striking difference between the success of plants *A* and *B*, and the failure of *C*, mainly ascribable to want of adequate pollination.

It is abundantly evident that great differences must be anticipated in the quantity of seed produced; and that other causes come into play in addition to immaturity and distance from a male—for instance, causes of an edaphic nature and the

consequences of accidents, and climate determines many of them. In the autumn of 1935 an abundantly berried plant growing on a chalk upland near Leatherhead was examined in detail, berry by berry, for the number of seeds in each. It had only seven berries with the full complement of six seeds; 17 berries with five, 38 with four, 52 with three, 39 with two, and 15 with one seed: total 528 seeds in 168 berries. In a disused quarry not far from this spot, where by some chance four female plants occur but only a single male, a considerable greater infertility was seen which may be ascribed to want of pollination.

The following are the results of berry and seed counts at various places and times:—

Place and year.	No. of berries.	No. of seeds.	Average no. of seeds.	Remarks.
Leatherhead, 1935.	168	528	3·1	On chalk hill-top.
Paignton, 1936.	247	977	4·0	On loam, hedgerow.
Ditto	195	724	3·8	Ditto.
Ditto	240	827	3·4	Ditto.
Ditto	148	499	3·4	Ditto.
Ditto	44	149	3·4	Ditto.
Ditto	124	372	3·0	On loam, hedgerow. The fruits much marked by insect punctures.
Ditto	358	1039	2·9	In a roadside hedge; the berries numerous and small.
Ditto	306	863	2·8	On loam, in a hedgerow.
Ditto	324	843	2·6	On loam, in a hedgerow; the stem fasciated.
Leatherhead, 1936.	117	464	4·0	On loam, in a hollow among trees which had been thinned.
Ditto	90	380	4·2	With the last.
Ditto	41	105	2·6	On loam, struggling in the lower part of a high hedge.
Ditto	120	348	2·9	Ditto.
Ditto	149	512	3·4	Ditto in the upper part of the hedge.
Ditto	90	369	4·0	Sunny woodside on chalk.
Ditto	76	313	4·1	Ditto.
Ditto	95	309	3·2	Within the wood.
Ditto	89	250	2·8	Chalk hill-top, on the edge of a hazel coppice.
Ditto	325	916	2·8	Ditto.
Ditto	297	804	2·7	Ditto, and probably from the same tuber as the last.

Brenner (*op. cit.* i. pt. 3, 718; 1914) says that the berries in Switzerland hold four to five seeds; but he does not record any counts. It would be interesting to have them made in all parts of the area over which the plant is distributed; but chiefly along

the margins of the area, with the object of ascertaining why it cannot transgress the limits.

It may be asked if the ovules which fail to turn to seeds are distributed at random in the berries. The six ovules are in two tiers, three nearer to the stigmas than the other three—nearer therefore to the pollen-tube when it arrives in the ovary: they are also in three loculi, two by two, which suggests a possible competition for water or food between pairs. To enquire into this 600 berries were taken at random from a considerable number of plants, part of them growing on the chalk uplands near Leatherhead and part of them on the Reading beds at the foot of the chalk hills. In these berries 482 ovules of the upper tier had aborted and 478 of the lower. When a single ovule had failed it was in 87 cases one of the upper tier and in 67 cases one of the lower tier; in 23 cases two ovules had failed in the upper tier: and so on as below:—

Loss from the upper tier.	1	2	3	0	0	0	1	2	3	1	1	2	3	2
Loss from the lower tier.	0	0	0	1	2	3	1	1	1	2	3	2	2	3
In flowers with														
six seeds, 168	..	..	..	..	..	..	..	..	..	..	..	..	..	..
five seeds, 154	87	..	..	67	..	..	..	..	..	..	..	..	..	..
four seeds, 123	..	23	..	..	31	..	69	..	..	..	..	..	..	..
three seeds, 88	..	..	9	..	..	4	..	38	..	37	..	..	..	..
two seeds, 39	..	..	..	..	..	..	..	..	7	..	12	20	..	..
one seed, 28	..	..	..	..	..	..	..	..	..	..	..	..	11	17

The figures as regards the tiers indicate random abortion, except when one seed only had aborted, in which case this seemed to have happened in a rather greater proportion in the upper than in the lower tier. But abortion in the loculi is not at random. The instructive conditions are those where the loss is of two or of three ovules; and in them, as the figures indicate, there is a tendency to distribute the loss; for of 123 berries which had lost two ovules, there were but 17 in which the loss was confined to one loculus, the anticipated number if it were at random being 25, and of the 88 berries which had lost three ovules there were 42 in which one loculus had lost two, the anticipated number if it were at random being 52. This departure from the anticipated figures suggests that there is a tendency for the loss to be distributed between the loculi in consequence of the three water-pads standing in the same position in regard to water- and food-supplies from below, *i. e.*, if the plant is in a position to mature three ovules in a particular berry, it is not unlikely that they will be so placed as to share evenly the water-store in the three pads. Thus the importance of these structures which was emphasized on p. 3 is brought again to notice.

Berries with a volume of, say, 1 cubic cm. hold more seeds than berries with a volume of, say, 0·75 cubic cm. If it be desired to pluck a berry with 4, 5, or 6 seeds in it, the larger berries should be taken: if small berries be plucked, one must expect to find in them 3, 2, or 1 seed.

The proportion by volume of fruit-flesh in a berry while still green to a seed which is still green is about 10 to 1, but the proportion is greater in few-seeded small berries than in large many-seeded berries. Thirty large berries with a total displacement of 37 cubic cm. held 148 seeds, so that there were 4·6 seeds to a cubic cm. of fruit-flesh. From the same neighbourhood small berries held seeds at the rate of only three to a cubic cm. of flesh. With decrease in size the ratio of surface exposed to the air—evaporating surface—to the volume increases and would seem to tax the ability of the berry to maintain seeds from its six ovules proportionately; and it may well be that small berries, in spite of a greater proportion of flesh to a seed, can give that seed a start in life no better than the larger berry its 4, 5, or 6 seeds. At any rate the individual seeds, are of the same size whether from large or from small berries.

(To be continued.)

CRITICAL NOTES ON *LACTUCA* AND RELATED GENERA.

By G. Ledyard Stebbins, Jr.

In the course of a cytological and taxonomic study of those genera of the Compositae, tribe Cichorieae, most nearly related to *Crepis*, the writer has found necessary the redefinition of *Lactuca* in particular, and also of certain other genera. This necessitates the formation of a number of new combinations, which would be out of place in a cytological publication. For this reason these transfers will be made and discussed here.

I. Lactuca.

After a careful study of nearly all of the species involved, the writer has come to the conclusion that, as regards the species of Europe, Western Asia, and North America, *Lactuca* should be maintained in its broader sense—*i. e.*, including the genera *Mulgedium*, *Lactucopsis*, *Mycelis*, *Phaenixopus*, and the greater part of *Cicerbita*, as defined by Beauverd (Bull. Soc. Bot. Genève, sér. 2, ii. 99–145; 1910). The two characters which have been used most frequently in segregating these genera are the shape

of the achene, particularly the nature of its beak, and the presence or absence of an outer pappus. That the former is useless as a generic distinction in this, as well as most other genera of the Cichorieae has been amply demonstrated by Bornmüller (Mitt. Thür. Bot. Ver. xx. 28–29; 1905), Beauverd (*l. c.*), and others. The latter, though relied on by Beauverd as "le seul caractère qui . . . constitue par excellence l'attribut générique des *Cicerbita*," is no better as a generic distinction. As is evident from Beauverd's revision, it is unaccompanied by other differences of any sort, and results in a most unnatural separation of closely related species, and the union in the same genus of species which in every other respect are much more distantly related to each other. For instance, *Lactuca tenerrima* Pourr. is separated from its close relatives *L. perennis* L. and *L. capensis* Thunb., from the latter of which it differs by little else than the possession of an outer pappus and the character of the foliage, and is placed in the genus *Cicerbita* along with such totally different species as *C. alpina* (L.) Wallr. In North America *L. spicata* (Lam.) Hitchc. is separated generically from *L. canadensis* L., although there is good evidence that a natural hybrid between them, *L. Morssii* Rob., occurs not infrequently.

An attempt to find generic characters which will unite under *Lactuca* species that are clearly related to each other, and to exclude those species that are definitely unrelated, and are as close or closer to other well-recognized genera, such as *Prenanthes*, *Crepis*, and *Sonchus*, has proved very difficult. Nevertheless, the following criteria have been found to hold in the great majority of cases, and may, therefore, be considered the most important diagnostic characters of *Lactuca*:—

(1) The corolla-tube is generally more than half as long as the ligule, and in most species nearly or quite equals it. It is either completely glabrous or more often bears a ring of long hairs at the summit. In this respect *Lactuca* agrees with *Sonchus* and *Prenanthes*, but in many species of *Crepis* the corolla-tube is shorter and scabrous or short-pubescent throughout.

(2) The pappus bristles are relatively weak and few-celled in thickness (*cf.* Lund, Bot. Tidsskr. 1872, 121–182). While there is considerable variation in this respect, the presence of at least some bristles which at the base are no more than 4-celled in cross-section can be considered a diagnostic character of *Lactuca* and *Sonchus*, while a pappus of which all the bristles are more than 4-celled in cross-section at the base is characteristic of *Prenanthes* and *Crepis*. For a fuller discussion of this point see the monograph by Prof. E. B. Babcock and the writer on the genus *Youngia* (Carnegie Inst. Publ., in press).

(3) The achene is definitely flattened, and has two strong lateral ribs or wings, with a varying number of lesser ribs on each face. Whether beaked or not, moreover, it possesses a strongly

expanded pappus disk. The achenes of *Prenanthes*, though occasionally somewhat flattened, do not have lateral ribs which are definitely stronger than the strongest of those on either face, and the expanded pappus disk exists only in some transitional species, such as *P. scandens* Hook. f. Those of *Sonchus* are flattened or four-sided, as are those of *Lactuca*, but lack the expanded pappus disk. Those of *Crepis* are terete or subterete and the pappus disk is either not expanded or only slightly so as compared with *Lactuca*.

The basis for these differences is in the anatomy of the ovary (*cf.* Babcock and Stebbins, *l. c.*). In the majority of *Lactuca* species the ovary has only two or three vascular bundles, although in some four bundles are present. In *Crepis* the number of bundles is generally five, while in *Prenanthes* it varies from five to eighteen. In the typical species of *Sonchus* four bundles are present. In both achene and pappus characteristics the distinction between *Lactuca*, *Sonchus*, and *Launaea* has yet to be determined through a careful study of the African species of these genera. A complete presentation of the anatomical evidence will appear in a later publication.

Of these three characteristics, length of the corolla-tube is the least reliable, while the structure of the pappus and the number of vascular bundles in the ovary can be determined with certainty only with the aid of the compound microscope. Nevertheless, they group together species similar in habit, and those whose individual affinities are clearly with each other rather than with species excluded from the genus by means of these criteria, although occasional transitional species are found, which, in these as well as other characteristics, bridge the gap between *Lactuca* and its relatives. Such transitions are most frequent between *Lactuca* and *Prenanthes*, and would argue for the union of these genera, as proposed by Franchet (Morot, Journ. de Bot. lx. 291 ; 1895), were it not for the wide differences in every characteristic between species typical of the two genera and the equally puzzling transitions between *Prenanthes* and *Hieracium*, *Crepis*, and other genera. The most important habital characteristics of *Lactuca* are the tall leafy stems, with the cauline leaves little or not at all reduced, and the many-headed paniculate or racemose inflorescences. If *Lactuca* is defined according to the criteria described above, the following new combinations are necessary.

Lactuca aurea (Sch. Bip.), comb. nov. *Lactuca sonchifolia* Panč., Verzeichn. Serb. wild. Phanerog. 85 ; 1859 (ex Verh. Zool. Bot. Verein Wien, 6, Abhandl. 559), non Willd. (1804) ; *Mulgedium sonchifolium* Vis. & Panč. in Mem. Ist. Venet. xv. 5, t. ii. (1870) ; *M. aureum* Sch. Bip. ex Vis. & Panč. *l. c.* ; *Lactucopsis aurea* Sch. Bip. ap. Vis. & Panč. in obsv. *tom. cit.* 7 (1870) ; *Lactuca Visianii* Bornm. in Mitt. Thür. Bot. Ver. xx. 29 (1905).

Since the specific name *aurea* was validly published, with a complete description, under the genus *Lactucopsis*, even though the same species was described earlier in the same publication under a different generic and specific name, this name must be taken up to replace the invalid combination *L. sonchifolia*, rather than that proposed much later by Bornmüller. For advice on this puzzling question of nomenclature the writer is much indebted to Mr. C. A. Weatherby, of the Gray Herbarium, Harvard University.

Lactuca chungkingensis, nom. nov. *Crepis prenanthoides* Hemsl. in Journ. Linn. Soc., Bot. xxiii. 477 (1888), non *Lactuca prenanthoides* Scop. or Bornm.

As suggested by Diels (Engl. Bot. Jahrb. xxix. 633 ; 1901), this species certainly belongs in *Lactuca* rather than *Crepis*. It closely resembles and is obviously related to the various members of the section *Sororia*, particularly *L. yunnanensis* Franch. and *L. polypodiifolia* Franch., differing chiefly in the less contracted, erostrate apex of the achenes, and perhaps in flower colour. In its pappus structure and ovary anatomy, however, it is transitional toward *Prenanthes*.

Lactuca Hookeri (C. B. Clarke), comb. nov. *Prenanthes Hookeri* C. B. Clarke ex Hook. f. Fl. Brit. Ind. iii. 412 (1882) ; *P. alata* Hook. f. & Thoms. ex Clarke, Comp. Ind. 274 (1876), non Hook. f.

Three of the species included in *Prenanthes* in the 'Flora of British India' fall definitely into *Lactuca* as defined above. *Lactuca Brunoniana* (DC.) Franch., *L. violaefolia* (Decne.) Clarke, and *L. Hookeri* all have the weak pappus bristles of typical species of *Lactuca*, with the majority of them only 4 cells or less in cross-section at the base. All of these species, moreover, possess the ring of trichomes designated by Beauverd and others as the outer pappus, a character found in many species of *Lactuca*, but not in *Prenanthes*. In *L. Brunoniana* and *L. Hookeri* these are very short and inconspicuous and were apparently overlooked by Beauverd. The achenes of these three species are all definitely flattened, and have strong lateral ribs, while the ovary has two or three vascular bundles, as is characteristic of *Lactuca*. The writer has not yet seen specimens of *P. sikkimensis* Hook. f., but, judging from the description, this species also probably belongs in *Lactuca*. The two remaining species of British India, *P. scandens* Hook. f. and *P. khasiana* Clarke, have the pappus and achene characters of *Prenanthes*, although both are somewhat transitional toward *Lactuca*.

Lactuca Marschallii, nom. nov. *Sonchus prenanthoides* M. Bieb. Flora Tauro-Cauc. ii. 242 (1808) ; *Mulgedium prenanthoides* DC. Prodr. vii. 248 (1838) : *Lactuca prenanthoides* Bornm. in Mitt.

Thür. Bot. Ver. xx. 28 (1905), non Scop. Fl. Carn. ed. 2, ii. 100 (1772); *Cicerbita prenanthoides* Beauverd in Bull. Soc. Bot. Genève, sér. 2, ii. 121 (1910); *Prenanthes erucaefolia* Willd. ex Boiss. Fl. Orient. iii. 801 (1875), in syn.

The adoption of Article 61 in the 1930 rules of nomenclature invalidates the combination *Lactuca prenanthoides* for this Caucasian species.

Prenanthes triflora (Hemsl.), comb. nov. *Lactuca triflora* Hemsl. ex Forbes & Hemsl. in Journ. Linn. Soc., Bot. xxiii. 485 (1888). A new collection of this species from the type-locality (Szechuan: Omei Hsien, W. P. Fang, no. 2815), of which the writer has seen duplicate specimens in the U.S. National Herbarium and the Gray Herbarium of Harvard University, bears mature achenes, which were not available to Hemsley. These resemble closely the achenes of *P. khasiana* Clarke and *P. Henryi* Dunn, and, together with the coarse pappus bristles, all of which are many-celled at the base, and broad obtuse involucral bracts, more characteristic of *Prenanthes* than of *Lactuca* sect. *Sororia*, leave no doubt as to the true affinities of this species. In habit and involucral characteristics it is closer to the European *P. purpurea* L. than is any other Asiatic species.

Cicerbita.

Two of the species included by Beauverd (*l. c.*) in his revision of *Cicerbita* seem to the writer sufficiently distinct from *Lactuca* to be contained in a different genus. These are *Cicerbita alpina* (L.) Wallr. and *C. Pančičii* (Vis.) Beauverd. Both of these have a much coarser pappus than have the species of *Lactuca* subg. *Mulgedium*, such as *L. Plumieri* (L.) Gren. & Godr., and their nearly columnar, slightly compressed achenes, which are traversed by five equal ribs, are as near to those of *Prenanthes purpurea* L. as to those of any species of *Mulgedium*. In habit, moreover, these species are as close to *Prenanthes cacaliaefolia* (M. Bieb.) Beauverd as to any species of *Mulgedium*. *Cicerbita*, therefore, is here redefined as constituting a small genus which stands midway between *Lactuca* subg. *Mulgedium* and *Prenanthes*. From the former genus it differs in the characters mentioned above, while it differs from *Prenanthes* in the regularly imbricated bracts of the involucre and the more strongly compressed achenes, which are definitely constricted below the pappus disk. A third species agrees in these characters with the two mentioned above. This is:

Cicerbita abietina (Boiss.), comb. nov. *Mulgedium abietinum* Boiss. Fl. Orient. iii. 802 (1875); *Crepis abietina* Boiss. & Bal. in exs., nomen, Boiss. *l. c.*, Beauverd in Bull. Soc. Bot. Genève, sér. 2, ii. 115 (1910); *Lactuca abietina* Bornm. *l. c.*

Except for its yellow flowers, this species closely resembles *C. Pančičii* in habit, and the achenes, though smaller and reddish rather than yellowish in colour, are similar in shape. It is certainly not related to any known species of *Crepis*. Although it lacks the outer pappus found in *C. alpina* and *C. Pančičii* and was therefore excluded from *Cicerbita* by Beauverd, this distinction need not be considered of any more importance here than in *Lactuca*.

Dubyaea.

This genus, as first described by de Candolle (Prodr. vii. 247; 1838) contained three unrelated species, but the best known of them, *D. hispida* (Don) DC., fits very well with the generic description, and may be taken as the type-species. It was referred to *Lactuca* by Clarke (Comp. Ind. 271; 1876) as *L. Dubyaea*, on the basis of the somewhat flattened achenes and the habital resemblance to *L. Lessertiana* (DC.) Clarke, was placed in *Crepis* by Marquand and Shaw (Journ. Linn. Soc., Bot. xlviii. 194; 1929), and was described independently by Hutchinson (Kew Bull. 1916, 189) as *Crepis bhotanica*.

More recently a number of species from Eastern Asia have been described under *Lactuca* on the basis of their relationship to *L. Dubyaea*, though they bear no relationship whatever to any genuine species of *Lactuca*. If, furthermore, they are all transferred along with *D. hispida* (*L. Dubyaea*) to *Crepis*, some of them, such as *L. amoena* Handel-Mazzetti and *L. gombalana* Handel-Mazzetti, are equally out of place in that genus. They seem best placed in a genus by themselves, characterized by the large many-flowered heads, the coarse pappus bristles, and achenes which are fusiform and erostrate or slightly beaked, and are more or less definitely compressed, but with five main ribs about equal in strength, and in some species a varying number of lesser ones. While a complete monographic treatment of this genus will be undertaken in the near future, the new combinations necessary are made here, so that these species may be discussed in other publications.

Dubyaea amoena (Handel-Mazzetti), comb. nov. *Lactuca amoena* Handel-Mazzetti in Anz. Akad. Wiss. Wien, Math.-Nat., 1924, 23 (1925).

Dubyaea gombalana (Hand.-Mazz.), comb. nov. *Lactuca gombalana* Hand.-Mazz. *l. c.* (1925).

Dubyaea oligocephala (Sch. Bip.), comb. nov. *Paleya oligocephala* Sch. Bip. in Pollichia, xxii.–xxiv. 320 (1866).

Dubyaea tsarongensis (W. W. Smith), comb. nov. *Lactuca tsarongensis* W. W. Smith in Notes Bot. Gard. Edin. xii. 211 (1920).

Dubyaea tsarongensis subsp. **chimiliensis** (W. W. Smith), comb. nov. *Lactuca tsarogensis* f. *chimiliensis* W. W. Smith, *l. c.* (1920).

The writer wishes to acknowledge with thanks the advice and criticism of Prof. E. B. Babcock in the preparation of this manuscript.

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ADDITIONS TO THE MARINE FLORA OF SARK.

By Lilian Lyle.

The list of Marine Algæ for Sark is by no means complete. There are about thirty-eight species mentioned in Marquand's 'Flora of the Channel Islands' (1901) for this island. M. Chemin and a party collected among these islands in 1934 and added three new species to the flora. Without giving a full list of all gatherings, he noted about fifteen of the most conspicuous seaweeds of Sark. As two of the names occur in Marquand's list, the total for both is fifty-one.

Some shore-collecting this summer between June 16 and July 14 yielded about 114 species, 78 of which have not been noted before, and of these three are new to the Channel Islands. The number of species now known for Sark is therefore 130. Further work will doubtless augment the list and bring it more into line with the marine flora of Guernsey, which it very closely resembles.

Some of the caves were visited by motor-boat. In them vegetation was scarce owing to wave-action. Most noticeable was a velvety growth over the rocks, much worn down, and in the absence of tetraspores difficult to identify; but it was most likely *Rhodochorton Rothii*. Patches of *Catenella*, *Ptilota*, *Dasya arbuscula*, *Apoglossum ruscifolium*, *Chylocladia articula*, and *Corallina squamata* occurred here and there.

It was interesting to find a few samples of *Antithamnionella sarniensis*. Since 1921 it has been gradually disappearing from the Channel Islands. On the other hand, it has been reported for several places on the shores of England (Westbrook, 1930). A few specimens were gathered by the writer at Falmouth and Mevagissey in 1931, and Mr. Tregellis, by finding this alga on Lundy Island in September 1935, has added yet another locality to the increasing list of its habitats along the southern shores of England.

Asparagopsis armata was noted by M. Chemin in 1934 as new to the Channel Islands. This summer it was found growing, and also thrown up in bunches entangled among other algæ by the special attachment organs to which the species owes its name.

The three additions to the marine flora of the Channel Islands are :—

Enteromorpha intestinalis var. *cornucopiae* Kuetz.
Monostroma Grevillei Wittr.
Calothrix Contarenii Born. & Flah.

I was unable to visit the Guillot Caves or to find *Laminaria ochroleuca* or *Falkenbergia Hillebrandii*, M. Chemin's other new finds for the Sarnian Flora.

The following is a list of algæ gathered this summer, including those mentioned for Sark by Marquand and Chemin. The initials C.I. denote those species new to the Channel Islands; M. and C. are respectively for Marquand's and Chemin's exclusive findings: the asterisk marks all those species hitherto unlisted for this island :—

Cyanophyceae.

Calothrix Contarenii Born. & Flah. C.I.

Chlorophyceae.

Monostroma Grevillei Wittr. C.I.
**Enteromorpha ramulosa* Hook.
E. compressa Grev.
**E. intestinalis* Link.
**E. intestinalis* Link. var. *cornucopiae* Kuetz. C.I.
Cladophora pellucida Kuetz. C.
**C. rupestris* Kuetz.
**C. trichocoma* Kuetz.
**C. glaucescens* Harv.
**C. flexuosa* Harv.
**C. albida* Kuetz.
**C. arcta* Kuetz.
**C. lanosa* Kuetz.
Bryopsis hypnoides Lamour. M.
B. plumosa Ag. M.
Codium tomentosum Stackh.

Phaeophyceae.

Desmarestia aculeata Lamour.
D. ligulata Lamour. C.
Phloeospora brachiata Born.
Scytosiphon lomentarius J. Ag.
**Ectocarpus confervoides* Le Jol.
**E. confervoides* Le Jol. var. *arctus* Kuetz.
**E. fasciculatus* Harv.
**E. tomentosus* Lyngb.
E. granulosus Ag. M.
**Myriotrichia clavaeformis* Harv.
**Elachistea fucicola* Fries.

Sphacelaria cirrhosa Ag.
**S. cirrhosa* Ag. var. *fusca* Holmes & Batt.
**Cladostephus spongiosus* Ag.
**Stypocaulon scoparium* Kuetz.
**Myrionema strangulans* Grev.
**Chilionema Nathaliae* Sauv.
**Leathesia difformis* Aresch.
Chorda Filum Stackh.
**Laminaria saccharina* Lamour.
L. digitata Lamour.
L. Cloustoni Edmondst. C.
L. ochroleuca de la Pyl. C.
Saccorhiza polyschides Batt.
**Fucus spiralis* L.
**F. vesiculosus* L.
**F. serratus* L.
**Ascophyllum nodosum* Le Jol.
**Pelvetia canaliculata* Dene & Thur.
Himanthalia lorea Lyngb.
Halidrys siliquosa Lyngb.
**Cystoseira granulata* Ag.
**C. discors* Ag.
**Acinetospora pusilla* Born.
Taonia atomaria J. Ag.

FLORIDEAE.

**Erythrotrichia carnea* J. Ag.
**Porphyra leucosticta* Thur.
P. umbilicalis Kuetz.
**Acrochaetium Daviesii* Naeg.
Gelidium crinale J. Ag.
G. pusillum Le Jol.
G. corneum Lamour. M.
**G. aculeatum* Batt.
**G. attenuatum* Thur.
Chondrus crispus Stackh.
Gigartina stellata Batt.
Callophyllis laciniata Kuetz.
**Cystoclonium purpureum* Batt.
**Catenella repens* Batt.
**Rhodophyllis bifida* Kuetz.
**Calliblepharis lanceolata* Batt.
**Rhodymenia palmata* Grev.
**Lomentaria articulata* Lyngb.
**Champia parvula* Harv.
Chylocladia kaliformis Hook.
**C. ovata* Batt.
Plocamium coccineum Lyngb.

Cryptopleura ramosum Kylin.
**C. ramosum* Kylin var. *uncinatum* (Grev.).
**Delesseria sanguinea* Lamour.
**Membranoptera alata* Kylin.
**Apoglossum ruscifolium* Kylin.
**Hypoglossum Woodwardii* Kuetz.
**H. Woodwardii* var. *angustifolia* Kuetz.
Nitophyllum punctatum Grev. M.
Bonnemaisonia asparagoides Ag. M.
Asparagopsis armata Harv. C.
Laurencia obtusa Lamour. M.
L. pinnatifida Lamour.
**Polysiphonia macrocarpa* Harv.
**P. urceolata* Grev.
**P. violacea* Harv.
**P. fibrillosa* Grev.
**P. fastigiata* Grev.
**P. Brodiaei* Grev.
Falkenbergia Hillebrandii Falkenb. C.
Pterosiphonia fruticulosa Batten.
**Brogniartella byssoides* Bory.
**Dasya arbuscula* Ag.
**Spermothamnion Turneri* var. *monoica* Schmitz.
**Trailliella intricata* Batt.
**Ptilothamnion pluma* Thur.
Griffithsia corallinoides Batt.
G. flosculosa Batt.
Halurus equisetifolius Kuetz.
Bornetia secundiflora Thur. M.
**Monospora pedicellata* Solier.
**Rhodochorton Rothii* Naeg.
**R. floridulum* Naeg.
**Callithamnion Hookeri* Ag.
**C. tetragonum* Ag.
**C. granulatum* Ag.
**Ptilota plumosa* Ag.
Antithamnion plumula Thur. M.
**Antithamnionella sarniensis* Lyle.
Ceramium strictum Harv.
**C. Boergesenii* Peters.
C. rubrum Ag.
C. flabelligerum J. Ag.
C. echionotum J. Ag.
C. ciliatum Ducluz.
C. acanthonotum Carm.
Dumontia incrassata Lamour.
Furcellaria fastigiata Lamour. M.
**Lithophyllum incrustans* Fosl.

**Lithothamnion lichenoides* Fosl.
**Corallina officinalis* L.
**C. squamata* Ellis.
**C. virgata* Zanard.
**C. rubens* Ell. & Soland.
C. rubens Ell. & Soland. var. *corniculata* Hauck. M.

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SHORT NOTES.

The Flowers of Campanula latifolia L.—It is well known that in many genera of plants which normally produce blue flowers, individuals bearing white or perhaps more rarely pink corollas may occasionally be found. Albinism occurs in many species of *Campanula*, and white-flowered individuals, usually solitary, are sometimes to be seen growing wild in Britain among the normal blue or purple-flowered plants of *C. rotundifolia* L., *C. Trachelium* L., *C. glomerata* L., and perhaps others.

With *C. latifolia* white flowers are much more frequent. I have seen a habitat in Perthshire in which every plant was white-flowered, and a station in South Bavaria, where this species was growing in quantity, with a very large number of individuals showing white blooms, and very few with flowers of the violet-blue colour (similar to those of *C. Trachelium*) that may be regarded as normal. On the other hand, while at Rauschen, in Samland, East Prussia, last summer, where *C. latifolia* is abundant for some miles along the wooded sea-cliffs, I found nothing but the typical violet-blue form. Besides these two colours there is a third. In several districts in Yorkshire I have seen the species with flowers of a very pale lilac colour, to the complete exclusion of the violet-blue and white forms, and I learned from the late T. J. Foggitt that he considered this lilac colour uniform in that county. The flowers of this Yorkshire form are often relatively small, but except for the colour I fail to find any differentiating characters. It seems no more than a *forma lilacina*.

Recent British text-books describe the flower-colours of our Campanulas in very inaccurate and often conflicting terms. For *C. latifolia* Hooker and Arnott ('British Flora') give "blue, often white"; Withering ('British Botany') "blue, sometimes white"; Babington ('Manual') "blue"; Syme (E. B., ed. 3) very pale lilac, purple at the base or wholly purple"; and Hooker ('Student's Flora') "blue or white." Smith ('Flora Britannica') terms the flowers "cœruleo-violacei," which is much more correct for the common form. Syme's description is evidently taken from the Yorkshire plant.

Linnæus, in Sp. Plant. 165 (1753), where *C. latifolia* is stated to grow in England and Sweden, does not mention the colour of the flowers, but in an earlier work (Hort. Cliff. 64; 1737) he shows the blue-flowered plant as the typical form and adds a white-flowered variety. It is interesting to note that he writes here "crescit in septentrionalis Angliæ montosis, ut in agro Derbensi et Eboracensi." There are two sheets of this plant in Hort. Cliff., now in the British Museum Herbarium, one clearly a large-flowered blue form, the other doubtful. There is also a specimen in the Linnean Herbarium. This has rather small flowers of a colour now indeterminable.

The pre-Linnean botanists were aware of the variability of colour in *C. latifolia*. Clusius (Rarior. Plant. Hist. ii. 171; 1601), under the name *Trachelium majus Belgarum*, writes "violacei coloris flores . . . etiam albos interdum exalbidos: nonnunquam cineracei coloris." The last-named tint would perhaps represent our Yorkshire plant. Caspar Bauhin ('Pinax,' 94: 1623) gives "florum colore varians, albo, cœruleo et etiam cinereo." Morison (Plant. Hist. Oxon. ii. 459; 1680) states "flores . . . coloris ex albido tendentis ad violaceum," which seems to indicate again the Yorkshire form. And a French plant with variegated flowers is mentioned in John Bauhin's 'Historia,' ii. 807 (1651), as *Campanula pulchra*, with "flores . . . albidi cum cœruleo calathi effigie . . . in quinque lacinias longas partiti . . . E. Burgundia missa."

There are few good modern plates of this handsome plant. That of 'English Botany,' no. 302, drawn from a Bedfordshire specimen, is poor, as is also the figure substituted in Syme's third edition. A better plate is Svensk Bot. iv. t. 272.—H. W. Pugsley.

Mentha Muelleriana F. Schultz var. serratifolia Pugsley (in Journ. Bot. 1935, 77).—In view of the danger to which this plant is exposed in its original station at Salcombe, material supplied from cultivation by Mr. Pugsley has been planted at Seabbacombe Bay, South Devon, by Mr. G. T. Fraser.—A. L. Still.

NOTES ON PAPERS OF INTEREST TO STUDENTS OF BRITISH BOTANY.

WOODWALTON FEN.—The 'Handbook of the Society for the Promotion of Nature Reserves for 1936' contains a description by J. C. F. Fryer, O.B.E., of this, the largest of the Society's properties, an area of 360 acres on the boundaries of Huntingdonshire and Cambridgeshire. It is a remnant of the original uncultivated Huntingdonshire fenland. Parts of the Fen have, in the past, been under the plough, and much has been dug for peat, but its present condition is no more artificial than that of much of Wicken Fen, which was formerly regularly cut for litter or sedge. Mr. Fryer's account indicates how essentially unstable are conditions on a fen, and how rapidly changes take place even without direct human interference.

A general description of the vegetation and insect-life is given. At least five types of vegetation are represented: the "carr"—bush areas with sallow as the dominant shrub; the "litter" or grass area with reed grass dominant, but with a large admixture of other plants; the reed swamp proper; the damp woodland, mainly alder and birch; and a mixed fen containing both acid-soil plants (heather) and the more typical fen-plants. The dykes which divide the property provide another type of habitat.

Forty years ago, before the Fen was acquired by the late Charles Rothschild, it contained much rough litter used for cutting as hay or grazing, and in the summer forming a garden rich in marsh flowering plants. When grazing and cutting were discontinued the litter and marsh grassland were largely replaced by a pure stand of reed, but during the second decade the bush areas increased, sweeping over reed and litter, and largely suppressing the more interesting plants and insects—generally speaking, the Fen had become a jungle. In the past ten years reclamation work has been carried out by the Society. On removal of the bush the marsh-plants re-established themselves within a year or two, and by further cutting at different times of year and in appropriate areas it seems possible to decide whether the growth shall be litter or reed. The problem is how to retain the best type of litter, *i. e.*, the growth which contains the greatest mixture of interesting plants. The gift of a pump by Captain Purefoy has partly solved the difficulties arising from shortage of water due to improvements in local drainage. Nature, left to herself, would probably convert Woodwalton Fen into a forest, but this change can be postponed more or less indefinitely by a proper system of management.

Mr. Fryer's photographs depict salient features in the vegetation.

BRITISH BRYOLOGICAL SOCIETY.

THIS Society held its Annual Meeting at Cheltenham from May 29 to June 5, 1936, to study the varied flora of the two vice-counties of Gloucestershire, East (v.c. 33) and West (v.c. 34). The absence of the President, Dr. D. A. Jones, M.Sc., A.L.S., owing to illness, was much regretted. His place was taken by the Vice-President, Mr. J. B. Duncan. It was a small meeting, upwards of twenty members only being present.

Mr. H. H. Knight, the Local Secretary, whose knowledge of the Bryophyte flora of the area is unrivalled, planned a comprehensive series of excursions, in each of which he pointed out the most interesting plants. Some of the earlier records are now, unfortunately, being lost, owing to changes in terrain. For example, the area of the few and small Sphagnum bogs is becoming more restricted. Also with road changes the flora disappears. This is particularly the case with the wall-top flora of the Cotswold villages. Formerly the two mosses *Tortula pusilla* and *lamellata* were quite common in such situations, but are now never seen. However, there are large areas in the Forest of Dean woodland where the vegetation is unaltered, notably in the Buckstone woods above the River Wye.

The cold stormy weather, with north-east wind and heavy thunder-showers, rather spoiled the rambles.

On Saturday most of the day was spent on the hills at Whittington, where *Thuidium abietinum* and *Philiberti* were growing in the short turf and *Hypnum Sommerfeltii* on the oolitic walls. Then through Puckham wood with *Amblystegium confervoides* and *Seligeria pusilla* on the stones, and over the hills to Sevenhampton Marsh, where *Climacium dendroides* in fine fruit has been found. After a short halt near Notgrove Station to see *Cryphaea heteromalla* and *Zygodon conoideus* on Elders, Northleach was visited on the return journey.

Next day there was an afternoon ramble to Cleeve Hill and up to the summit (1070 feet), where the well-known golf links is situated. On the way *Cylindrothecium concinnum* was pointed out.

On Monday the drive was through Painswick to the woods above King's Stanley, where very heavy rain and tall wet undergrowth hindered work among the mosses, and consequently *Mnium serratum*, which grows in some quantity in the lower part of the wood was not found. Higher up in the wood *Bartramia Oederi* and *Lophozia Muelleri* were seen. Two interesting archæological sites were visited on Uley Downs:—the large earthwork of Uley Camp, covering the hill-top, with unusually high steep banks, and Uley Long Barrow, a perfect place of prehistoric sepulture, entered from the hill turf by a low stone doorway about 2½ feet square. It contains five rock chambers about 6 feet high.

On Tuesday a visit was made to the Forest of Dean, through Mitcheldean and Drybrook to explore Wigpool Common, a high open area with gorse and dwarf willow and some small *Sphagnum* bogs. These are rare in the Forest; several *subsecundum* forms and a few others, as *molluscum*, are found. The hepatics seen were *Odontoschisma Sphagni*, *Alicularia Geoscyphus*, and a few sterile stems of *Cephaloziella striatula*. A marsh at Foxes Bridge showed more Sphagna, with *Hypnum stramineum*.

On Wednesday, the western side of the Forest of Dean was visited. A stop was made at Staunton for the rocks and woods about the Buckstone. Continuous rain made the woods too wet for exploration. *Hedwigia ciliata*, *Leptodontium flexifolium*, *Pterogonum gracile*, and a few other mosses were found. Some of the plants that grow here are *Andreaea Rothii*, *Cynodontium Bruntoni*, *Dicranum fuscescens*, *Bazzania trilobata*, *Cephalozia media*, &c. At Tintern the party saw *Fissidens rivularis* in the locality recently found by Mr. E. W. Jones, and the new species *Lejeunea planiuscula* growing with *Metzgeria furcata* on Old Red Sandstone rock; also *Eurhynchium Swartzii* var. *rigidum* a new record for v.c. 35.

On Thursday a drive was taken over the Cotswolds. After visiting the wood at Hailes the drive continued up Stanway Hill and down the River Windrush to Lower Guiting, and another halt was made at Kineton Thorns. The finds here included *Bryum inclinatum* and *Reboulia hemisphaerica*, the latter a new record for v.c. 33. The journey continued through Stow-on-the-Wold, Burford, Bibury, and back through Cirencester.

On Tuesday evening the Annual Meeting took place, with election of Officers:—President and Treasurer, Mr. J. B. Duncan; Vice-President, Miss E. Armitage; Hon. Secretary, Mr. A. Thompson. The place chosen for next year's meeting is Bundoran in Sligo, during the summer of 1937.—ELEONORA ARMITAGE.

REVIEWS.

Illustrierte Flora von Mitteleuropa. By GUSTAV HEGI. Vol. I. Second edition, revised. Edited by Prof. Dr. K. SUESSENGUTH. Pp. xxiv, 528, 41 pls., 280 text-figs. J. F. Lehmann: Munich, 1936. Price M. 24.75 (cloth).

HEGI'S 'Illustrated Flora of Central Europe,' which was published in seven volumes appearing from 1908–1931, has gained a well-deserved reputation among all workers on the European flora. The first volume, containing the Pteridophyta, Gymnosperms, and part of the Monocotyledons, preceded by an introduction of 150 pages on general plant-morphology, was conceived on a less ambitious scale than later volumes, notably in the

omission of maps and illustrations of vegetation in the form of habit photographs. Up to the time of his death in 1932, Dr. Hegi had been collecting notes for the preparation of a new edition of the first volume in order to make it more in keeping with the later volumes. The work has been completed by Dr. Suessenguth, with the help of Dr. E. Bergdolt and Dr. J. Zimmermann.

The introductory matter has been reduced from 158 to 24 pages by the omission of the chapter on morphology, with which the floristic student is probably familiar, or which is supplied by one or other of the many general text-books on Botany. The space thus released is given to the systematic work proper to a Flora for increase of the text and the addition of text-figures, and without increase of size the volume now becomes comparable with those issued later. Additions and emendations consequent upon the lapse of thirty years have also been included. The number of plates remains the same, but text-figures have been increased from 172 to 280.

A review of the work given in this Journal in 1928 comments on the elaborate scale of its conception as a remarkably pleasing and up-to-date scientific account of the flora of Central Europe.

The nomenclature in the present volume occasionally provokes criticism, especially the alteration of names to render them philologically correct. Gaertner, when founding the genus of grasses, wrote *Agropyron*, but in conformity with its derivation from ἄγρος and πυρος the Flora inserts an "i" and writes *Agriopyrum* (in the key to the genera it reads *Agropyrum*). A more regrettable alteration is that of *Oplismenus* to *Hoplismenus* by the inclusion of the Greek aspirate, thus altering the position of the name in an index. It seems very doubtful thát, in the second case at any rate, there is an unintentional orthographic error for which the International Rules (Art. 70) allow correction. Such species-names as *Hydrocharis morsus ranae*, and *Zea mays*, also indicate lack of attention to the Rules. And why *Andropogon Ischaemon* (Linnæus wrote *Ischoemum*)?

In view of the great general improvement as compared with the first edition, serious workers on European botany will probably wish to acquire the new volume.—A. B. R.

The Botanical Society and Exchange Club of the British Isles. Report for 1935.

THE first part of this Report, by the late Secretary, Mr. W. H. Pearsall, differs somewhat from those of recent years and bears mark of thse supervision of the new Publications Committee of the Club. Three brief obituary notices are followed by a long list of Plant Records, which, although largely concerned with alien plants, contains many items of interest and is conspicuous, in comparison with recent Reports, by the absence of well-known

classical stations for rarities. A few points seem open to criticism. *Lotus angustissimus* L., almost certainly an introduction at Wonersh, is not shown as such ; and the *Hieracium aurantiacum* L. of Marston Green is probably not that species. Among succeeding papers Lt.-Col. Wolley-Dod contributes fresh rose-notes, with several new binominal names for hybrids ; Dr. Turrill has a paper on the inflorescence of *Solanum Dulcamara* L. ; and Mr. C. E. Britton an elaborate account of *S. nigrum* L. The " Plant Notes " refer chiefly to *Mentha* and *Potamogeton*, but include a description of a new variety *angustissima* of *Alisma ranunculoides* L. by Miss Vachell. Under " Reviews " are some criticisms of the present writer's paper, " On some Marsh Orchids," by Rev. T. Stephenson, who illuminates his remarks by algebraical signs and descriptive terms like " otiose," quite novel in botanical literature. The notes seem to create the erroneous impression that the name *Orchis latifolia* L. is proposed in a new sense, instead of being restored to its former usage throughout Europe for nearly a century. The reviewer apparently fails to distinguish *O. pardalina* Pugsl. from the common *O. majalis* Reichb. of the Continent, and in " a complete scheme of revised forms " shows the group *Subsesquipedales* as *Sesquipedales*, which could only represent the widely different species of Spain and North Africa. An important innovation in the Report is the final portion, " Abstracts from Literature," compiled, with assistance, by Mr. Wilmott. The form in which this is drawn up, with its cross-references, seems at first sight rather complicated, but it affords a vast amount of useful information respecting current work at home and abroad that may bear on the study of British flowering plants.

The second part of the Report, by the Distributor, Mr. A. B. Jackson, records a contribution of 1936 specimens by 20 members. This is by far the smallest exchange for the present century, and, following the decreasing numbers of preceding years, tends to show that interest in real systematic botany among British amateurs is steadily waning. Nevertheless the part contains, as usual, a number of interesting notes.—H. W. PUGSLEY.

Tous les Coloris. By A. PAINTER. Pp. 40, 28×22 cm., 19 trichromatic plates. Librairie Polytechnique Béranger, 1936. Price 30 fr.

A QUICK and reliable way of identifying a colour, together with a method of recording it by a simple formula, would be invaluable both to botanists and horticulturists. The nomenclature of colours is as vexed a question as that of plants and similarly requires a type-system to obtain precison. " One man's mauve is another man's violet," or perhaps even more poignantly " one woman's green is another woman's blue," judging by some of the matching tragedies at the shop-counters. Colours should

lend themselves to expression by formulæ and ' Tous les Coloris ' offers us such a standardisation which it behoves us to judge on its merits.

It is perhaps worth while to consider the subject in general ; for without a certain basis of knowledge and agreement as to terms no useful criticism can be made. " Colours " in the narrower sense of the pure colours (red, green, purple, &c.) are now referred to as " hues." In nature, however, every coloured surface has an admixture of " neutral colours " (black and white) in varying proportions giving a series of " shades " for each hue. Colours containing equivalent amounts of white are known as " isotints," equivalent amounts of black " isotomes," while equivalent amounts of any given hue are " isochromes " of that hue. The nearest approach to pure hues is found in certain vivid flower-colours and in some coal-tar dyes. To obtain a colour-system with which it is possible to identify any coloured surface we need a complete range of hues, a range of neutral colours, and then a combination of these two ranges mixed with each other in varying proportions. The number is limited only by the eye's lack of discriminatory power when colours approach each other sufficiently closely. Ostwald finds that 680 colours are sufficient for all ordinary purposes (at least 2535 can be discriminated).

M. Painter starts with a chromatic triangle, in the centre of his book, with three supposedly pure hues (red, blue, and yellow) at the corners, combining in various proportions to give a range of hues. Here we meet with the first and most important fallacy. This method of obtaining hues by a three-colour printing process on glazed paper can only be described as a complete failure. A first glance at the triangle shows that the greens and oranges, in particular, are entirely inadequate and that, in fact, all the intermediate hues are greatly diluted with white. This failure is inherent in the system of colour-reproduction used. In addition to the central triangle we are given a series of triangles in which, presumably, an attempt is made to imitate the admixture of neutral colours in various proportions. The paler triangles are produced by reducing the percentages of colour in the hues and mixing them once more in varying proportions. Thus we have combinations of 20 per cent. blue+20 per cent. yellow, 10 per cent. red+20 per cent. blue+20 per cent. yellow, &c., giving in effect a series of tints. In the other direction we have progressively darker triangles in which we get such queer combinations as 80 per cent. yellow+90 per cent. blue+60 per cent. red, giving, in effect, something which approaches the addition of black. Here, however, the method quite breaks down ; for where we ought to have, for example, a series of olive-greens, we get slaty colours with scarcely a trace of green visible in them.

Further criticisms might be made on the way in which the author, though obviously aware of Fechner's Law, has not

transformed his colour-gradations from mathematical to psychological equivalents (psychologically the addition of the first 10 per cent. of yellow, say, to blue has a much greater effect than the addition of a second 10 per cent.—the psychological effect is of the nature of a geometrical regression).

From a practical point of view " Tous les Coloris " should be renamed " Quelques Coloris " ; for it is impossible to match in it a bright scarlet, such a colour as cardinal red (i. e., *Lobelia cardinalis*) or a bright orange, while, as already stated, the greens are hopeless.

Ostwald and his school have realized the impossibility of using such methods of colour-printing for a colour-system. They very properly use a series of carefully dyed matt papers. To illustrate their books and to form their colour-charts small pieces of these are stuck in by hand. Unfortunately, there is no simple and convenient method of producing a colour-system on the lines attempted by M. Painter. At present there is no doubt that Ostwald's System, which is now coming more and more into use in the form of standardized coloured fabrics, &c., is the most efficient and scientific which we have for identifying and recording colours.—A. W. E.

Rock Gardens and Rock Plants. Report of the Conference held by the Royal Horticultural Society and the Alpine Garden Society, May 5–7, 1936. Edited by F. J. CHITTENDEN, F.L.S., V.M.H. Cr. 8vo, pp. 171, 36 pls. Royal Horticultural Society, London, 1936. Price 6*s*.

THE Conference, which had been arranged by a joint Committee of the two Societies took place at the Royal Society's Great Hall at Westminster, where a wonderful show of Alpines had been arranged. The Conference was opened by Lord Aberconway, President of the Royal Horticultural Society, supported by the Viscountess Byng of Vimy, President of the Alpine Garden Society. In his opening address his Lordship referred to the numerous accessions received from the expeditions of Wilson, Farrer, Forrest, and Kingdon Ward to China and the Himalaya, and stressed the importance of growing the plants out of doors under conditions rendered as natural as possible in our climate. The various papers included the History of Rock Gardening in different countries by the Lady Rockley, Rock-gardening in the Province of Quebec by F. Cleveland Morgan, in South Africa by Miss Stanford, and in Southern California by W. Hertrich. Other papers dealt with the Utilization of Sites, Cultivation, and Propagation, by well-known experts. The volume is generously illustrated by photo-plates showing features in various gardens and species of special interest. A volume of interest alike to the botanist or gardener.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on November 26, Dr. W. T. Calman, C.B., F.R.S., President, in the Chair, eleven Fellows were elected. Dr. George Taylor gave an account, illustrated with a series of lantern-slides, of the vegetation of the mountains of East Africa visited by the recent British Museum Expedition, the Aberdare Mts., Mt. Elgon, Virunga Mts., and Mt. Ruwenzori.

At the General Meeting on December 10, the President in the Chair, Prof. T. G. B. Osborn described, with the aid of lantern-slides, the types of vegetation in Australia in an imaginary journey from the McDonnell Ranges in the almost rainless interior to the south-east coast at Sydney.

BRITISH MYCOLOGICAL SOCIETY (vol. xx. pts. 3 & 4, Nov. 1936).—J. A. Nannfeldt of Upsala contributes notes on fifty type-specimens of British Inoperculate Discomycetes studied in the herbaria of the British Museum and the Royal Botanic Gardens, Kew. He finds that most of the British species have long been known on the Continent, though under different names. In a study of spores and spore-germination in wild and cultivated mushrooms, Dorothy M. Cayley finds that the wild species *Psalliota campestris* and *P. arvensis* have 4-spored basidia, each with two nuclei, whereas cultivated mushrooms are either 2-spored or 4-spored, and the number of nuclei may range from 2 to 8. Theodora B. Haines describes the results of inoculating cereals with spores of cereal rusts that do not usually cause their infection, and H. B. S. Montgomery his experiments as to the temperatures that are lethal to some wood-decaying fungi. Catherine C. Burt gives an account of a leaf-spot disease of Sweet William, *Heterosporium echinulatum*, hitherto unknown in its perfect stage. V. Petch discusses the supposed relationship between *Cordyceps militaris* and *Isaria farinosa*, entomophytic fungi, which prove to be unrelated; N. C. Preston describes the parasitism of *Myrothecium roridum* on plants of *Viola*; and G. Trapp that of *Botrytis cinerea* on *Aucuba japonica*.

'AMERICAN JOURNAL OF BOTANY.'—In the October number R. P. Wodehouse describes the pollen grains in species of seven genera of Alismataceae. The characters accord with the belief that the species are closely related, and that the family is closely related with the Butomaceae and, in part, the Hydrocharitaceae. The characters—namely, the possession of pores with flecked membranes and a strong tendency to develop fimbriate margins—suggest a further development of tendencies already established in the Ranunculaceae, but contrast with the one-furrowed form of grain characteristic of the higher Monocotyledons. In the

same number Le Roy E. Detling gives a taxonomic account of the genus *Dentaria* L. in the Pacific States. He gives reasons for the distinction between this genus and *Cardamine*. The twelve species and varieties described form an isolated geographical unit, the ancestral form of which, it is suggested, migrated into North America from Eastern Siberia when there was a land-connection between the two continents.

In the November number Irma E. Webber gives the results of a study of the anatomy of the woods of the Simarubaceae in relation to Engler's main taxonomic divisions of the family. On the whole, the results support the arrangement based on morphological characters. E. D. Merrill discusses the application of the name *Amaranthus viridis* L., which he employs for the widely distributed tropical weed with rugose utricles as the form represented in the original description, the specimen in the Linnean herbarium, and the references to Sloane and Piso. The European species with smooth utricles (*A. ascendens* Loisel.) that Linnæus also included among his cited references, and for which some botanists have adopted the Linnean name must be excluded.

'GENTES HERBARUM' (vol. iv. fasc. 1, Sept. 1936, *Arecastrum, Butia*).—In this fascicle the untiring veteran L. H. Bailey continues his studies on the Palms. His work on these two genera is based on that of Beccari, to whom is due the segregation of *Cocos* into seven genera, bringing it back to the Linnæan status, a monotype represented by the coconut, *C. nucifera*. The Queen Palm *Arecastrum Romanzoffianum* Becc. is a tropical South American species with a number of varieties, several of which grow well in the southern United States. *Butia* is also a native of South America, and the species call for study in their wild habitats. The author has made a careful study of those which are grown in the warmer parts of the United States, comprising five species with a number of varieties of *B. capitata*, which are keyed and described and figured in detail. Notes are added on a number of inadequately known acaulescent species which are not known to be in cultivation, at least in the United States.

'Gentes Herbarum' is published by the Bailey Hortorium of the New York State College of Agriculture at Cornell University, Ithaca, New York, U.S.A.

WE congratulate Mrs. F. Bolus, Curator of the Bolus Herbarium, Kirstenbosch, on whom the Cape Town University has conferred the degree of Doctor of Science, the first doctorate to be conferred by the University. Mrs. Bolus is well known for her work on the botany of the Cape Province.

THE LIFE-CYCLE OF *TAMUS COMMUNIS* L.

BY I. H. BURKILL, M.A., F.L.S.

(Continued from p. 12.)

3. THE SEED.

As the berries in fruit-ripening turn from green through yellow to red, the seeds turn from green to a dull yellow and then afterwards very slowly to a bay brown: finally they are chestnut-brown. During these colour changes they lose weight. Brenner (in Kirchner and others, Lebensgesch. d. Blutenpfl. Mitteleur. I pt. 3, 686; 1914) has given the loss as from 45 to 21 milligr. They lose volume at the same time, and the writer has thought the change in volume more interesting than the change in weight. The combined volume of 200 seeds extracted from berries just turning from green to yellow, on September 11, was 7·75 cubic cm. The seeds were dried in a living-room until October 22, when their volume was taken again: it was now only 3 cub. cm.

A dry seed swells again if moistened and kept moist, the swelling being largely in the seed-coat, but not altogether. Brenner says that a seed weighing 21 milligr. will take up 8 milligr. of water in three days and a further 4 milligr. in an additional period of three days, so that its weight comes up to 33 milligr. The writer's 200 seeds which, when perfectly dry, had a volume of 3 cubic cm., were placed in water after that volume had been ascertained on October 22, and on October 29 their volume had increased to 5·25 cubic cm.

The writer is very well satisfied with the way in which his data correspond with Brenner's, and would refer to Brenner's excellent account of the structure of the seed-coats (*op. cit.* 691).

The shrinking and swelling of the seed are of importance in the plant's life-history, for by their means the seed sinks into the soil in the interval between its fall to the surface and the emergence of the seedling. The seed, being smooth and without appendages, sinks the more readily for the absence of such wings as the seeds of *Dioscorea* possess. Earlier it was pointed out that seeds without appendages are apt for bird-dispersal: they are also apt for sinking into the soil; but one must assume that the loss of the appendages came to the seed stage by stage as it became adapted to sinking—not exactly to enable it to sink.

This seed is not ready to germinate when freed from the berry, but requires a period which has been termed a period of after-ripening. The term is not satisfactory, because the ripeness is of the berry, not of the seed; and because the seed can be driven, it seems, into an extremely quiescent state both before and after the period which is necessary to lead to germination. One cannot force a quiescent period on, for instance, the seed of a Diplorocarp of the tropical rain-forest: when the attempt

is made to do so the seed is killed. But conditions can force recurrent quiescent periods on the seed of *Tamus*; and the intervening periods of very slowly moving metabolism are what have been called periods of after-ripening. The expression may be tolerated, this comment having been made. We do not know how many periods of quiescence may be forced on a *Tamus* seed without killing it: the writer knows that it is not less than five, and considers that it is probably more than five.

After a few preliminary experiments the writer, in the autumn of 1931, took 200 seeds newly collected and sowed them under observation in a garden-frame at Leatherhead. The seedlings resulting appeared above ground as follows:—

In 1932 in June	1
and early July	3
In 1933 in April and May	97
In 1934 in the same months	76
In 1935 in the same months	5
In 1936 in May	5

Observation shows that almost two months elapse between the time when the young plant first thrusts its root-tip out of the seed and the appearance of the first green leaf above the soil. Therefore most of these seedlings burst their seed-coats between the middle of February and the middle of March; but in the first year this can scarcely have happened before the latter part of April. Calculating the intervals between sowing and the emergence of the young plants from the seed, we obtain:—

7 full calendar months in one case,
8 full calendar months in three cases,
16–17 in about half of the seeds,
28–29 in almost as many,
40–41 in five,
52 in another five.

In the preliminary experiments an occasional seed had been found to germinate in the spring after ripening, and the writer is fully satisfied that in nature this may take place; but the reader will notice that the first foliage leaf in that event reaches the light with the disadvantage of being a month or more late.

The writer was led to another experiment by reading Harrington and Hite's interesting paper on the "after-ripening" of apple-seeds (Journ. Agric. Res. xxiii. 153; 1923). The authors start with the knowledge that when an apple is ripe the seeds within it are not ripe, and they show that the latter continue to ripen within the apple physiologically, although morphologically they appear fully ripe: the authors show that the seeds, if removed from the interior of the apple, must be given storage under such humid conditions as they have within the apple and that the conditions must persist for six months. The writer

took 147 seeds of *Tamus* which had been collected in September 1933 and had been stored dry for a year and a half: they were spread on a porous tile standing in water within a glass-topped box, and over the glass a shade was placed. The reader will note that the experiment was begun in the wrong season, as the seeds were a year and a half old, and sowing was done in spring in March. Immediately the seed-coats took up water, and from that time were kept uniformly moist. The experiment was conducted in a living-room, where frost was excluded in cold weather, but where the summer temperatures went uncontrolled, though they were never excessive. In the winter the temperature in the corner where the box stood would go down to a little below 50° F.

The first seed germinated on September 20, 1935, followed by three more in October and a steady succession until January 14, 1936, by which time 78 had germinated and 69 had not. Then followed a pause which lasted until October 9, 1936, when one seed germinated, followed by three more on the next day, and more, so that by the end of October 42 had germinated: by mid-December 11 more followed, leaving 10 still entire. The first autumn frost had occurred just before October 9. The seeds were not exposed to it; but the reader will note from the circumstance how the conditions of the experiment were forcing germination in the face of the winter. It may well be, but has not been proved, that germination requires certain temperatures such as occur in spring—and, of course, these recur in autumn. Further sowings will be needed to prove this.

This experiment and observations on the seeds sown in the garden-frame point to the existence of an "after-ripening" period of six months*, for which moist conditions are essential. Harrington and Hite stated that not only is moisture necessary for the after-ripening of apple-pips, but low temperatures. It cannot be that *Tamus* seeds require low temperatures, for their after-ripening was induced by moist conditions persisting through summer on seeds tricked, so to speak, by storage dry through winter. Later experiments will be directed towards ascertaining if temperature is quite immaterial. *Tamus communis* grows wild where the winters are damp, and the first months after the seed has fallen to the ground obviously supply a part of the period necessary for after-ripening: they do occasionally in Britain, as has been made evident above, supply the whole, but with a late germination which cannot be entirely to the plant's advantage. The variable winter, which is Britain's normal winter, gives varying degrees of soil-moisture during which the seed by swelling and shrinking sinks into the soil. The deeper it goes the more constant becomes the humidity, and along with

* Brenner contrived to get a seed to germinate after five months on wet filter paper (*op. cit.* 692).

an arrest of the downward tendency a greater chance of the conditions for germination being fulfilled; but the chances of a completely humid unbroken six months occurring early in the life-time of the seed are small: and, as the second experiment showed, even six months of completely unbroken humidity did not suffice to set germinating many more than one-half of the 147 seeds used.

What seems to be an important result of the second experiment is the demonstration that the seeds which have failed to reach germination at the end of their first after-ripening period do not germinate until twelve months more have passed, even though kept uniformly moist. Harrington and Hite said of their apple-pips that there was a tendency to sink into a second dormancy. It is shown clearly that *Tamus* seeds do this. The phenomenon may be regarded as an anticipation of the plant's normal six months of growth above ground alternating with six months of slow change below ground—the alternation of a summer state with a winter state. It can be expressed thus :—

	Winter State.	*Summer State.*
The seed	Preparation for growth, during which moist conditions must exist.	Growth, with germination in the spring as its commencement.
The plant....	Preparation in the tuber for growth, during which moist conditions must exist.	The normal vegetative activity of the plant.

and there comes a time every six months when the tide of growth is reversed both in the seed and in the plant. If the winter phase is not complete when the change is due, the summer phase cannot begin but the winter phase cannot continue: the seed then lapses to the point at which the winter phase begins and waits until the period of the summer phase is past; the plant, if the tuber has not been allowed to complete its winter phase, like the seed, waits until the period of the summer phase is past, and the succeeding winter phase re-establishes its normal manner of growing (see p. 8 above). But the seed's periods do not seem to date from the ripening of the berry.

Tamus communis, as already stated, grows round the Mediterranean; and obviously the wet winters which mark the Mediterranean climate are such as suit its needs and provide what is required for "after-ripening." The same mild rainy winters occur in north-west Europe, and through most of the warmer part of this phytogeographic subregion *Tamus* finds itself at home. When we call it a Mediterranean plant some little qualification of the term is needed, as it extends so conspicuously beyond the Mediterranean flora. Some have called it an Atlantic plant. One has called it a western montane boreal plant; but that it is not.

Porous soils are those which enable the seed to sink most readily. Into the rather light soils over the Permian conglomerate

deposits of southern Devon they sink on the average to a depth of 1·5 cm. before they germinate. They sometimes sink thrice as far; and seedlings have been found rising from 12·5 cm. down. They carry their first functional leaf about 3 cm. above the soil, i. e., a seedling rising from 12·5 cm. down grew a petiole 15·5 cm. long. This effort is by no means their limit: the writer has caused them to produce petioles 20 cm. long by growing them in nutrient solution in a corner where they obtained but dim light. The effort was a tax, and so much growth had gone into the petiole that the tuber was very small. Miss Sparshott, in experiments with the seed of *Dioscorea elephantipes* Engl., found the tuber little developed when she had removed the endosperm from the germinating seed and so starved it (Journ. Linn. Soc., Bot., xlix. 596; 1935). The seedlings of *Tamus*, forced to make so great an effort to reach the light, were undoubtedly, likewise, without nutriment for this their storage organ.

4. Growth.

The first visible sign of germination is the appearance of a minute knob on the seed (A in fig. 3). This is produced by pressure from the embryo within the seed, the root-end of which is used as a ram: a subcircular crack is formed at the base of the knob (B in fig. 3) and the piece of the seed-coats so broken off is folded back like a lid while the root is protruded like a little white tongue (C in fig. 3). At this time the embryo is forty or fifty times as large as when the seed was parted from the maternal placenta. Solms-Laubach (Bot. Zeit. xxvi. 65; 1878) described the building-up of the embryo in the fertilized ovule: its primary stem and primary root are at first at opposite ends, the stem being, he says, "altogether apical or almost so," but is pushed to one side by a rapid development of the cotyledon so completely that, when the fruit is ripe and the seed is freed, the long axis of the embryo is through the cotyledon to the apex of the primary root (A in fig. 3). In the first stage of germination the greatest growth (though it is not much) occurs in the cotyledon and by it the root is extruded.

There is nothing strange in the cotyledon of a Monocotyledon, such as *Tamus*, usurping the pole of the embryo; in many Monocotyledons it usurps it at an even earlier stage—even so early that it may be said to be terminal at all stages: *Dioscorea paniculata* Michx. provides an instance (see Miss P. M. Smith's paper in Bull. Torrey Bot. Club, xliii. 551; 1916). Some botanists have ventured to construct out of this relative growth a theory that stem and cotyledon are interchangeable; but it is a case of the immediately needed organ holding up the development of another. In the first and second year of the life of *Tamus* a foliage leaf similarly holds up the development of the stem so as to make itself subterminal.

As germination continues, the elongation of the cotyledon pushes the primary bud through the rent in the seed-coats in the wake of the primary root. Two little ears are now seen opposite the base of the cotyledon (D in fig. 3); they are torn halves of the cotyledonary sheath. At the same time they are the organs which certain early observers and one recent interpreted as a second cotyledon. These observers felt that the reticulate venation of the leaf and the cambium of the tuber required that *Tamus* should be included in the Dicotyledons and hailed the ears as removing the last difficulty to their belief: but the ears are without vascular tissue and are developed as the edges of the pit (A in fig. 3) into

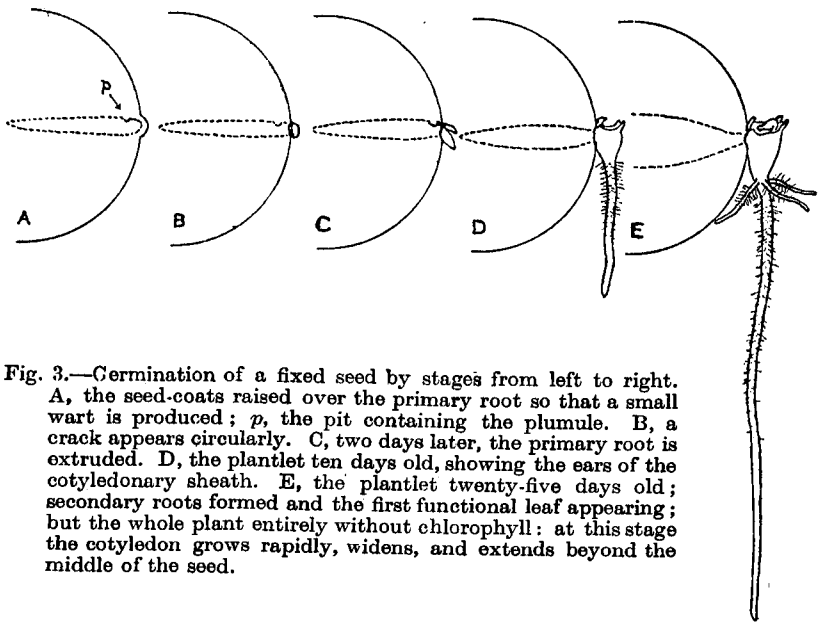

Fig. 3.—Germination of a fixed seed by stages from left to right. A, the seed-coats raised over the primary root so that a small wart is produced; *p*, the pit containing the plumule. B, a crack appears circularly. C, two days later, the primary root is extruded. D, the plantlet ten days old, showing the ears of the cotyledonary sheath. E, the plantlet twenty-five days old; secondary roots formed and the first functional leaf appearing; but the whole plant entirely without chlorophyll: at this stage the cotyledon grows rapidly, widens, and extends beyond the middle of the seed.

which the plumule sinks when the cotyledon takes the lead in the growing embryo. Nevertheless, the circumstance is interesting that the rim of the pit should grow most at the point where a second cotyledon would stand if present; but the growth occurs long after the true cotyledon has asserted itself. An observer (Bush in Bot. Gazette, ix. 13: 1884) claimed three cotyledons for *Dioscorea villosa*; and what he states is difficult to explain except by supposing that he had seen similar ears on the seedling of this ally.

The cotyledonary sheath protects the stem-apex, but is short-lived. The first functional leaf may be detected at an earlier stage through the rent in the sheath (E in fig. 3 and C in fig. 4).

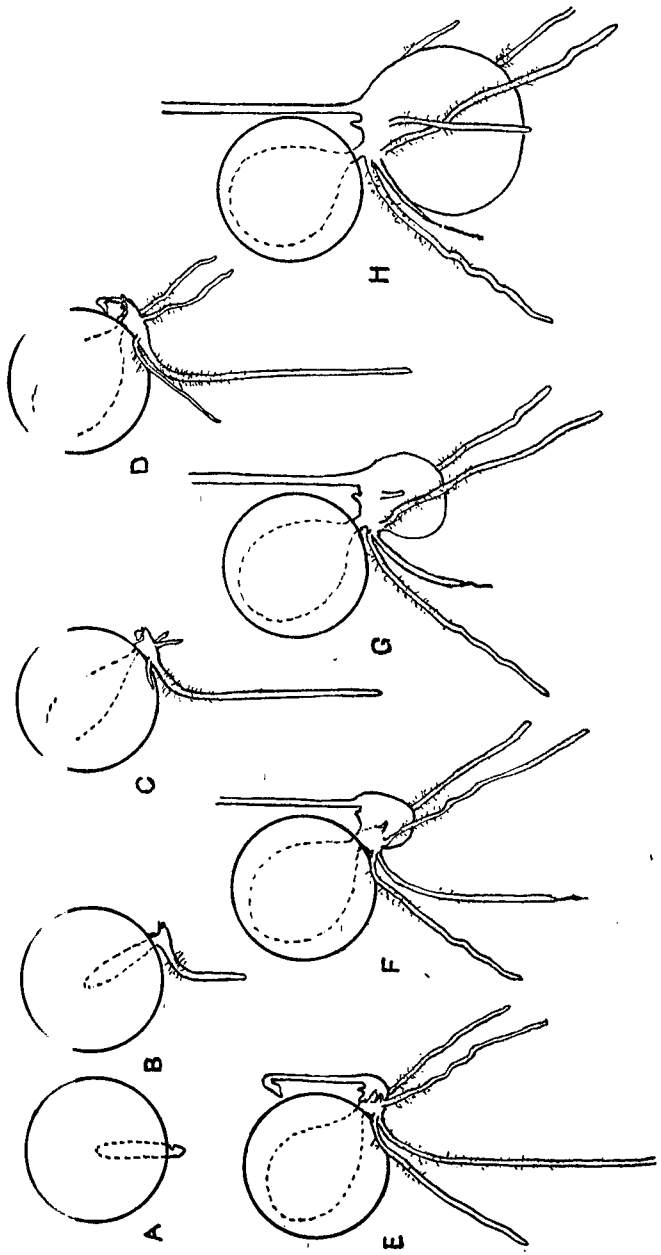

Fig. 4.—Eight stages in the germination of a seed, such as may occur in the soil. A, the cotyledon drives the primary root and bud through the seed-coats (in this case downwards with the bud to the right). B, the primary root elongating rotates the seed and pushes the bud to the right. C, secondary roots emerge and arrest the rotation. D, the first functional leaf enlarges. E, the epicotyl extrudes from the cotyledonary sheath. F, it enlarges and the cotyledonary sheath is lost: death may begin in the primary root, but does not always do so at this stage. G and H, further growth in the epicotyl, which being intense on the lower side tends to lift the emptying seed towards the petiole on its right: additional roots arise. The petiole when stage H had been reached may be 6·5 cm. long.

The seed being approximately spherical and more or less evenly weighted lies in the soil in any position: it may lie with the primary root upwards or downwards or laterally; and, moreover, it is possible that the pit containing the apex of the primary stem may be above the cotyledon or below or at the side of it. Nevertheless, 80 or 90 of every 100 seedlings at the age of two months lie in the soil with the seed above the tuber as in H of fig. 4.

Inasmuch as many Monocotyledons have contractile roots which pull the underground stems, etc., to lower levels in the soil should their position be too shallow, it was natural to assume their occurrence in *Tamus*: the assumption was made some thirty years ago, but cannot be upheld. On the contrary, instead of pulling the little plant into place, the roots push;

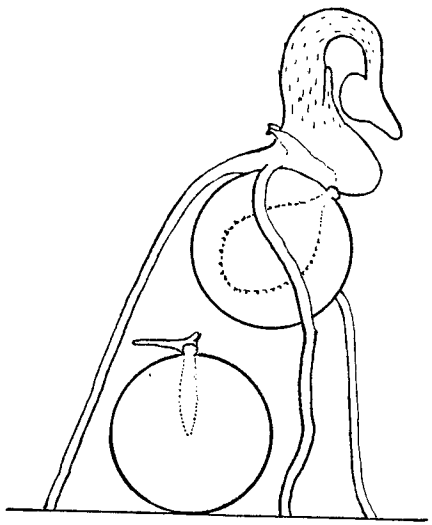

Fig. 5.—Below—a germinated seed placed with the young plant above, on the surface of sand. Above—the plant at six weeks: the primary root when it obtained anchorage pushed the seed to the right and rotated it; the first two lateral roots in turn obtained anchorage and then the three lifted the seed. The outline of the cotyledon is dotted.

but the chief factor in adjusting the plant lies in the circumstance that it grows to its form in response to gravity. Fig. 4 is designed to explain this, and fig. 5 to illustrate the thrusting action of the roots. The lower seed in fig. 5 had newly germinated when it was placed, at the age of three days, on damp sand, the plant above. The primary root thereupon found no anchorage until it reached the sand, which it penetrated in time and, having done so, secured itself by its root-hairs: its unfixed part thereafter by elongation pushed the seed over the surface of the sand and continued to move it towards the right until the lateral roots in their turn reached the sand and secured themselves: the elongation of the three roots then lifted the seed as if by stilts. This experiment has been repeated twenty times, sometimes with much more sliding along the sand than in the instance drawn. It is easy to understand from it that a seed in the soil is subjected

to pushing from the primary root and again from the earlier secondary roots until all are firmly anchored or until their respective pushings neutralize each other.

Open soils, such as suit *Tamus* best, lend themselves to these uncertain movements. When the extrusion of the primary root is upwards the movement will be more than when the extrusion is downwards; for when extruded upwards its positive geotropism causes it to descend along the seed-coat, and therefore to have a weaker hold on the soil than when extruded downwards. Had the seed in fig. 5 been in the soil, the sliding movement given to it would have been converted into a rotatory movement by which the stem of the little plant would have been brought to or below the equator of the seed.

In fig. 3 the stages of germination are not represented so far as tuber-formation: in the upper part of fig. 5 the next stage is seen, when the tuber arises as a lateral swelling of the epicotyl on whichever side is downwards. The seedling shown in fig. 5 had that side of the epicotyl downwards which was away from the ears of the cotyledonary sheath, and consequently from the tuber on that side. The seedling in fig. 4 had the side downwards where the ears were, and the tuber was formed between the ears and the first functional leaf. By the unilateral growth the adjustment of the position in the soil of the little plant is more effectively made than by any thrustings of the roots. The little plant in fig. 4 having been driven out of the seed downwards, the elongation of the primary root rotated the seed but slightly before secondary roots arrested the rotation: the first functional leaf began its growth; and, at its base between it and the ears of the cotyledonary sheath, the tuber appeared, pushing past the ears which soon disappear: the stresses of growth lifted the cotyledon and with it the seed towards the petiole of the first functional leaf, and thus raised the seed a little further over the tuber; meanwhile, the primary root began to perish. Botanists have a way of saying that the little tuber pushes the primary root aside; this, in rare cases, may happen, but is not very likely, as it perishes too early.

The simplest cases have been taken here to illustrate how the tuber arises, the one case when the lower side of the epicotyl happens to be on the side over the cotyledon and the other when it happens to be on the side under the first foliage leaf, these organs being on opposite sides of the plant: far more abundant in nature are cases where the lower part of the epicotyl is intermediate: the reader will be able to imagine these cases for himself. The epicotyl is such a small part of the plant that growth on one side involves some growth throughout and also possibly a little in the hypocotyl.

As the tuber grows it needs to push aside soil, and that above is likely to be more yielding than that below, with the consequence that it is easier to lift the emptying seed than to press it

down. The cotyledon perishes and the emptied seed-coats decay. The primary root has perished earlier. The tuber is now spherical, but has a vertical axis very strongly marked by the maintenance of the most meristematic tissue towards the centre of the earth and of a stem-bud at the other end. In its second year it elongates and acquires a cambium. Increasing in bulk thereafter it maintains its general proportions of length to diameter; but protuberances may arise laterally and the apex may become doubled. Brenner (*loc. cit.*) says that he has seen tubers weighing 10 to 13 kilogrammes, and he figures one which seemed to him to be thirty years old. It is conceivable that in a light soil even large tubers may sink by their own weight, as Bucherer suggests (Biblioth. Botan. xvi. 7; 1889), but usually the subsoil must arrest their movement, though when quite small they certainly descend. Brenner illustrates with a figure the way in which

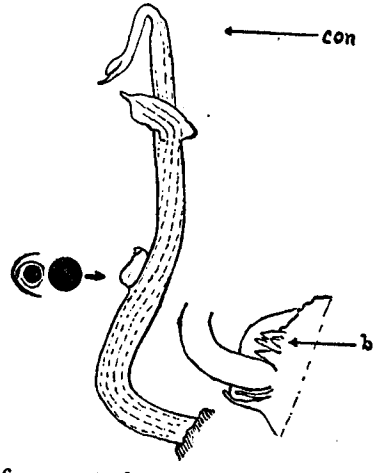

Fig. 6.—A new shoot in February; *con.*, the place where the cortex abruptly decreases in thickness: the lower scale-leaf with a well-developed bud in its axil with scales placed as in the diagram on the left. On the right a section through the base of the stem and the pit in which it lies, with rather misshapen scales and the bud (*b*) for the next year.

a fragment planted too deep carries upwards on a process its new bud so as to bring it to the right depth. This, it must be noted, is in the course of regeneration, and it may be that should a tuber sink so that the bud is only a little below the right depth, as an established bud it would not be so easily dispossessed of its leadership as to yield to an immediate readjustment. It has yet to be established what depth would kill it.

Whenever a permanent bud is destroyed—and this happens by no means rarely—it is replaced from the upper part of the tuber by another, arising in the most favourable place. Every part of the surface of the tuber can give rise to a new bud, but the polarity of the tuber determines that it shall rise at the upper end (see Proc. Linn. Soc. 1931–32, 60).

A frost may kill the uppermost part of a tuber, and regeneration from below will lower the level of the permanent bud then formed, perhaps out of future danger.

The plant in its first year has but one leaf, though the rudiment of a second is there: if the first be destroyed the second replaces it very rapidly. In the second year a short stem is produced, probably with two leaves, the stem ending abruptly at the second leaf which obtains a subterminal position. It must be assumed that these early leaves, which are without forerunner tips, can inhibit the growth of the stem and of other leaves, and that the cotyledon has a similar power against the growth of the primary stem. But it is not proved that the arrest of growth in the stem and the absence of a forerunner tip in the leaf which appears to arrest it are really connected.

The tuber does not normally enter into a complete rest in the winter in Britain, but the stem due to emerge from the soil next spring is already elongating as the shoot of the current year dies, and the bud from which it started was recognizable several months earlier. The growth of this shoot is made more successful by the depth of soil which covers it, and that this soil is needed is evident by the quantity of apices of upgrowing shoots which are killed by frost even in the south of England, their place being taken by buds from below (see this Journal, 1936, p. 155). The uprising shoot produces a rather fleshy cortex until it reaches the surface of the soil, where its thickness diminishes abruptly. It is those fleshy shoots which are eaten (see p. 5). The bend where it abruptly ceases forms a knuckle which is pushed through the soil.

(To be concluded.)

CRITICAL NOTES ON THE GENUS *IXERIS*.

By G. Ledyard Stebbins, Jr.

The genus *Ixeris* of the Compositae, tribe Cichorieae, was created by Cassini (Dict. Sci. Nat. xxiv. 49; 1822), for *I. polycephala*, a flaccid annual herb, with strongly calyculate involucres, yellow flowers, and slightly flattened, strongly 10-alate, beaked achenes, widely spread in south-eastern Asia. In 1859 Gray (Mem. Am. Acad. N. S. vi. 397) recognized in this genus several species of eastern Asia similar in habit and floral characteristics to *I. polycephala*, including the type-species of the genus *Chorisma* Don. In 1873 Bentham and Hooker (Gen. Pl. ii. pt. 1, 526) reduced both *Ixeris* and *Chorisma* to *Lactuca*, on the basis of the compression of their achenes, and included within the former, as a section, all the species of *Lactuca* with calyculate involucres. This treatment has been followed by all recent botanists, except those of Japan. Nakai (Bot. Mag. (Tokyo), xxxiv. 147–158; 1920) recognized *Ixeris* as including *I. polycephala* and its relatives, as well as the genus *Chorisma*, and created two new genera, *Crepidiastrum* and *Paraixeris*, for certain species closely related to *Ixeris* proper. Nakai's opinion has since been generally accepted by Japanese botanists.

In the opinion of the writer *Ixeris* is unquestionably distinct from *Lactuca*, and is more nearly related to *Crepis*. Its pappus bristles are identical in structure with those of *Crepis*, and therefore with many more cells in cross-section than have those of *Lactuca* (*cf. supra*, p. 13), even though they often appear under a hand-lens to be as weak, due to the small size of the cells. The achenes furthermore, though usually compressed, are not strongly so, and usually have ten equal ribs, as do those of most *Crepis* species. The ovary has five vascular bundles, as in *Crepis*. The corollas of *Ixeris* are also like those of most *Crepis* species, as the tube is only a quarter to one half as long as the ligule, and is frequently scabrous throughout. In habit, moreover, the species of *Ixeris* are closer to *Crepis* than to *Lactuca*, as most of them are scapose, with the cauline leaves few and reduced in size or absent, and the inflorescence is cymose or corymbose, rather than racemose or paniculate. The main differences between *Crepis* and *Ixeris* are in habit and the achenes. The species of *Ixeris* have in general slenderer stems, with a greater tendency toward glabrousness and entire leaves. The involucre is few-flowered and markedly calyculate, while in most *Crepis* species it is many-flowered and with the outer bracts loosely or not at all imbricated. The achenes of *Ixeris* are more or less flattened and strongly ribbed or alate, while in *Crepis* they are terete and usually with slender ribs. *Ixeris* is even more closely related to *Youngia*, but this relationship is discussed elsewhere (Babcock & Stebbins, Publ. Carnegie Inst. Wash., in press).

It is true that *Lactuca sororia* Miq. and its relatives resemble *Ixeris* in the character of their involucres and of their achenes. But these species have corollas and pappus bristles typical of *Lactuca*, and the achenes, though superficially like those of *Ixeris*, have two or three, or rarely four stronger ribs, corresponding with the 2–4 vascular bundles of the ovary. The habital resemblance of these species is definitely to *Lactuca*, and in their calyculate involucres they may be considered transitional toward *Prenanthes* rather than *Ixeris*. Although *L. sororia* was placed by Nakai (Bot. Mag. (Tokyo) xxxvi. 24; 1922) in the genus *Mycelis*, of which *Lactuca muralis* (L.) Fresen. is the type-species, the resemblance between these two species is in the writer's opinion purely superficial, or a case of convergent evolution, since *L. muralis* shows definite relationships to *L. deltoidea* (M. Bieb.) DC., and other species of the eastern Mediterranean and Caucasian region, while *L. sororia* is closely connected with a very different group of species of China and India.

In reviving the genus *Ixeris*, Nakai (*op. cit.* xxiv. 147–158; 1920) described two genera related to it, *Crepidiastrum* and *Paraixeris*. After careful study the writer has concluded that both of these should be merged with *Ixeris*. Although *Lactuca denticulata* (Houtt.) Maxim. was taken as the type-species of *Paraixeris*, *L. denticulata* var. *sonchifolia* (Bunge) Maxim. was placed in *Ixeris*, in spite of the observation of Maximovicz (Bull. Acad. Sci. St. Petersb. xix. 530; 1874) that forms intermediate between the two occur. The same fact has been observed by the writer in his study of the excellent series of specimens from China in the U.S. National Herbarium, the Herbaria of the University of California and of the Museum of Natural History, Vienna, and he has, in addition, seen other segregates of *L. denticulata* which combine the fall blooming habit and tall leafy stems of the typical form with the 10-ribbed achenes found in var. *sonchifolia* and in typical species of *Ixeris*, thus breaking down completely the distinction between the two genera as defined by Nakai (see below, under *Ixeris denticulata*). The experimental demonstration by Ono and Satô (Jap. Journ. Genet. xi. 169–179; 1935) that *Paraixeris denticulato-platyphylla* (Makino) Nakai is a natural, apparently fertile hybrid between the type-species of *Paraixeris* and that of *Crepidiastrum* is to the writer good evidence that, in spite of strong habital differences, the two are not generically distinct. The only differences other than habit between *Crepidiastrum* and typical species of *Ixeris* are the lack of a beak and the less prominent ribs on the achenes, neither of which are to the writer of fundamental significance.

An able and complete treatment of the Japanese species of *Ixeris* was made by Kitamura (Bot. Mag. (Tokyo), xlix. 280–297; 1935). The following species, not included in his treatment, also belong in this genus as conceived by the writer. A few which undoubtedly belong here, but which are not well enough characterized by the original descriptions so that their relationships or even their validity could be determined with certainty are omitted from this list.

Subgenus **CREPIDIASTRUM,** stat. nov. *Crepidiastrum* Nakai in Bot. Mag. (Tokyo), xxxiv. 147 (1920), as genus.

Ixeris ameristophylla (Nakai), comb. nov. *Cacalia ameristophylla* Nakai, *op. cit.* xxix. 13 (1915); *Crepidiastrum ameristophyllum* Nakai, *op. cit.* xxiv. 148 (1920).

Ixeris grandicolla (Nakai), comb. nov. *Crepidiastrum grandicollum* Nakai, *tom. cit.* 149 (1920).

Ixeris Keiskeana (Maxim.), comb. nov. *Crepis Keiskeana* Maxim. in Bull. Acad. Sci. St. Petersb. xix. 523 (1874); *Hieraciodes Keiskeanum* O. Ktze. Rev. Gen. Pl. i. 346 (1891); *Lactuca Keiskeana* Makino in Bot. Mag. (Tokyo), xxvii. 256 (1913); *Crepidiastrum Keiskeanum* Nakai, *loc. cit.* (1920).

Ixeris koshunensis (Hayata), comb. nov. *Crepis koshunensis* Hayata, Icon. Pl. Form. viii. 79, fig. 32 (1918); *Crepidiastrum koshunense* Nakai, *loc. cit.* (1920).

Ixeris lanceolata (Houtt.), comb. nov. *Prenanthes lanceolata* Houttuyn, Handleid. xxviii. 383, t. 66, f. 2 (1779); *Crepidiastrum lanceolatum* Nakai, *tom. cit.* (1920). For further synonymy, see Nakai, *loc. cit.*

Ixeris lanceolata subsp. **platyphylla** (Makino), comb. nov. *Crepis lanceolata* var. *platyphylla* Makino, *op. cit.* xvii. 88 (1903); *Crepidiastrum lanceolatum* var. *latifolium* Nakai, *tom. cit.* 151 (1920).

IXERIS LINGUAEFOLIA Gray in Mem. Am. Acad. N. S. vi. 398 (1859); *Crepidiastrum linguaefolium* Nakai, *tom. cit.* 152 (1920).

Ixeris Quercus (Lévl. & Van.), comb. nov. *Lactuca Quercus* Lévl. & Van. in Fedde Rep. viii. 141 (1910).

Ixeris taiwaniana (Nakai), comb. nov. *Crepidiastrum taiwanianum* Nakai, *loc. cit.* (1920).

Subgenus **PARAIXERIS,** stat. nov. *Paraixeris* Nakai, *tom. cit.* 155 (1920), as genus.

Ixeris chelidoniifolia (Makino), comb. nov. *Lactuca chelidoniifolia* Makino, *op. cit.* xi. 47 (1898); *Paraixeris chelidoniifolia* Nakai, *tom. cit.* 156 (1920).

Ixeris denticulata (Houtt.), comb. nov. *Prenanthes denticulata* Houtt. Handleid. xxviii. 385, t. 66, fig. 4 (1779); *Lactuca denticulata* Maxim. in Bull. Acad. Sci. St. Petersb. xix. 529 (1874); *Paraixeris denticulata* Nakai, *loc. cit.* (1920), which *cf.* for complete synonymy.

A study of the specimens of this widespread and variable species in the Herbarium of the University of California (cited below as U.C.), the U.S. National Herbarium (U.S.), and the Herbarium of the Natural History Museum, Vienna (V.), has made evident the presence of the following subspecies, which have definite geographic ranges. It is not unlikely that a study of a larger series would reveal still more subspecies. Those now recognized may be distinguished by the following key:—

A. Plant glabrous; cauline leaves, if pinnatifid, with 2–6 pairs of lobes; achenes merely scabrous above, the beak 0·2–1 mm. long, not more than 1/3 the total length of the achene.—B.
  B. Achenes 11–14-ribbed, 0·6–0·7 mm. broad, the beak 0·2–0·5 mm. long, not more than 1/5 the total length of the achene; cauline leaves broadest at or near the middle; anther-tube and stigma greenish or blackish; flowering in autumn.—C.
    C. Involucre 7–8 mm. long; inner bracts plane at apex; corollas 7·5–10 mm. long; achenes, including beak, 2·6–3·5 mm. long; pappus bristles 3·5–4·5 mm. long ..... Subsp. *typica*.
    C'. Involucre 8–9 mm. long; inner bracts corniculate at apex; corollas 11–13 mm.; achenes, including beak, 3·2–3·8 mm.; pappus bristles 4·5–5·5 mm..... Subsp. *longiflora*.
  B'. Achenes 10-ribbed, 0·3–0·4 mm. broad, with a beak 0·6–1 mm. long and 1/4–1/3 the total length of the achene.—D.
    D. Cauline leaves broadest at the base, salient-dentate or with narrowly deltoid or lanceolate, acuminate lobes; anther-tube and stigma yellow; flowering mostly in spring and summer.—E.
      E. Cauline leaves coarsely dentate, or with lanceolate-linear lobes 4–15 mm. long; inner involucral bracts not crested or tuberculate; involucre 5·5–6·5 mm. high ..... Subsp. *sonchifolia*.
      E'. Cauline leaves more finely dentate, the teeth 0·5–5 mm. long; at least some of the inner involucral bracts with a distinct tubercle or claw on the dorsal surface at the apex; involucre 4·5 mm. high ..... Subsp. *elegans*.
    D'. Cauline leaves broadest at or near the middle, denticulate, and usually sinuate or with a few ovate or deltoid, acute lobes; anther-tube and stigma dark greenish or black (*in sicc.*); flowering in autumn..... Subsp. *ramosissima*.
A. Leaves, stem, and branches puberulent; larger cauline leaves pinnatifid with 8–10 pairs of lobes; achenes strongly muriculate above, the beak 1·2–1·5 mm. long, nearly half the total length of the achene..... Subsp. *pubescens*.

Subsp. **typica** (Maxim.), comb. nov. *Lactuca denticulata* var. *typica* Maxim., *loc. cit.* (1874).

This is apparently the only subspecies found in Japan, since the keen eyes of Japanese botanists have detected only one minor variation (f. *pinnatipartita* (Makino), comb. nov.). In central China it is the most common subspecies, but it becomes less common in the northern and southern parts, and has not yet been seen by the writer from the western provinces (Kansu, Szechuan, Yunnan). The following are typical: JAPAN: Southern Hokkaido, *W. P. Brooks* in 1884 (U.C.). SIBERIA: Vladivostok and vicinity, *Topping* no. 2449 (U.S.). CHINA: Chihli; Tou Ping, *L. Chanet* no. A 576 (V.); Peiping, H. H. Hu in 1935 (U.C.); Hupeh; *Henry* no. 3108 (U.S.); Anhwei, Pei Chen, *R. C. Ching* no. 9061 (U.C., U.S.); Chekiang; *Barchet* no. 100 (U.S.); Kweichow; Chengfeng, *C. C. Chang* no. 4517; Kwangtung; Wan Tong Shan, *Tak & Chow* C. C. C. no. 14,725 (U.C.).

Subsp. **longiflora,** subsp. nov. A subsp. *typica* differt: caulis humilior, 2–3·5 dm. alta; capitula majora, 8–9 mm. longa; phylla interiora sub apice corniculata; corollæ 11–13 mm. longæ; achænia cum rostro 3·2–3·8 mm. longa; rostrum suum 0·3–0·6 mm. longum; pappi setæ 4·5–5·5 mm. longæ.

Southern China. The following have been examined: Kwangtung; Chung Tung Tai Tsan, *Ying Tak*, Lingnan University, no. 15,006 (TYPE, in Herb. Univ. Calif. no. 319,760); Fukien, without locality, *Metcalf & Chang* no. 677 (U.C.). In its corniculate involucral bracts and smaller size, this subspecies suggests subsp. *ramosissima*, but the heads, florets, and achenes are distinctly larger than those of any other subspecies, and the habit, the shape of the leaves, and that of the achenes place it next to subsp. *typica*.

Subsp. **sonchifolia** (Maxim.), comb. nov. *Prenanthes sonchifolia* Bunge, Enum. Pl. China bor. n. 226 (1830) nomen; *Lactuca denticulata* var. *sonchifolia* Maxim. *loc. cit.* (1874); *Ixeris sonchifolia* Nakai in Bot. Mag. (Tokyo), xxiv. 154 (1920).

Korea and Siberia to Northern and Central China. The following are typical:—KOREA: Port Chusan, *C. Wilford* in 1859 (V.). SIBERIA: Amur region, Blagowjestschensk, *Karo* no. 149 (V.). CHINA: Chihli (Hopei); Pei T'ai Ho, *Mr. & Mrs. W. Granger* in 1925 (U.C.); Kiangsu; Lungtan, *A. N. Steward* no. 5209 (U.C., U.S.).

Although in their typical forms this and the following subspecies are very distinct from subsp. *typica*, intermediate forms between them occur, as mentioned above. A good example of such a form is *Chien* no. 95, from Peking (V.), which has the low branching habit, as well as the yellow anthers and stigmas of subsp. *sonchifolia*, but with the basal and lower cauline leaves broad, obovate, and denticulate as in subsp. *typica*, and flowering in autumn (September 27). The achenes are intermediate, having 11–12 ribs, together with the relatively long beak of subsp. *sonchifolia*. Although somewhat immature, these achenes are apparently fertile, and the pollen grains are nearly regular and normal in size, suggesting that if this plant is a hybrid, it is a fertile one.

Subsp. **elegans** (Franch.), comb. nov. *Lactuca elegans* Franch. in Morot, Journ. de Bot. ix. 262 (1895).

Central and western China, in the latter region apparently the only subspecies occurring. The following agree well with Franchet's description: Shansi; Mien Shan, *R. W. Chaney* no. 1065 (U.C.); Kansu; Ho Lan Shan, *R. C. Ching* no. 194 (U.S.); Honan; Kikungshan, *A. N. Steward* no. 9639 (U.C., U.S.); Kiangsi; Lu Shan, *Steward* no. 2691 (U.S.); Szechuan; Sungpan Hsien, *W. P. Fang* no. 4407 (U.S.); Wanhsien, *Mrs. W. Granger* no. 20 (U.C.).

Quite distinct in its typical form, but the specimens from near the edge of its range (Shansi, Kiangsi) are definitely transitional toward subsp. *sonchifolia*, and in its involucres it is close to subsp. *ramosissima*. It apparently bridges the gap between subsp. *typica* and subsp. *sonchifolia* in its flowering time, as flowering specimens have been collected in May, June, July, September, and December.

Subsp. **ramosissima** (Benth.), comb. nov. *Brachyrhamphus* (†) *ramosissimus* Benth. in London Journ. Bot. i. 489 (1834); *Ixeris ramosissima* Gray in Mem. Am. Acad. n. s. vi. 397 (1859), excl. descr. and synonymy.

Southern China. HONGKONG: *C. Wright* no. 310 (U.S.); *A. Rechinger* no. 2348 (V.); *W. A. Setchell* in 1926 (U.C.). CHINA: Kwolohow; Langtai, *Tsiang* no. 9499 (U.C.); Kwangsi; E. Hin Yen, *Ching* no. 6702 (U.C., U.S.); Yunnan; Meng-tsze, *A. Henry* no. 9661A (U.S.).

Since all the specimens of *I. denticulata* from Hongkong seen by the writer are of this subspecies, there is little doubt that this is the plant which Bentham described. In habit it resembles subsp. *typica* f. *pinnatipartita*, with which it agrees in flowering date. The crests on the inner involucral bracts, however, suggest those of subsp. *elegans*, and the flowers are somewhat smaller than in subsp. *typica*, the corolla being only 5·5–7 mm. long, as opposed to 7·5–10 mm. in subsp. *typica*. In this respect subsp. *ramosissima* agrees exactly with subsp. *elegans*. The colouring of the anthers and stigma are as in subsp. *typica*, but the achenes resemble those of subsp. *elegans* and subsp. *sonchifolia*.

Subsp. **pubescens,** subsp. nov. Ad subsp. *sonchifolia* et subsp. *elegans* proxima, sed differt: Caules et folia puberulentes; folia caulina lanceolata, 3–6 cm. longa, pinnatipartita, lobi 5–10 pares, dentati vel pinnatifidi; capitula 4·5–5·5 mm. longa; phylla interiora ad apicem plana; corollæ 6–8 mm. longæ; achænia cum rostro 3·5–4·2 mm. longa, ad basim rostri muriculata, alibi scabriduli; rostrum 1·2–1·8 mm. longum; pappi setæ 2–2·5 mm. longæ.

CHINA: Hupeh; without locality, *E. H. Wilson* no. 343. (Type, in Herb. Mus. Nat. Hist. Vienna, no. 1907: 10,227.)

Although agreeing with subsp. *sonchifolia* and *elegans* in its general habit, its yellow anthers and stigma, and the ribbing of its achenes this subspecies is strikingly different from any other in its pubescence, leaf-shape, and long-beaked muriculate achenes, and with further material available may deserve specific rank.

Subgenus **EUIXERIS,** subgen. nov. *Ixeris*, sensu Nakai, *loc. cit.* et Kitamura, *op. cit.* xlix. 280–289 (1935).

Ixeris gracilis (DC.), comb. nov. *Chondrilla* (*Crepis* ?) *gracilis* Wall. Cat. no. 3267, nomen ; *Lactuca gracilis* DC. Prodr. vii. 140 (1838).

Ixeris humifusa (Dunn), comb. nov. *Lactuca humifusa* Dunn in Journ. Linn. Soc., Bot. xxxv. 512 (1903).

Ixeris integra (Merrill), comb. nov. *Lactuca integra* Merrill in Philip. Journ. Sci. xx. 475 (1922).

Ixeris Lamii (Mattfeld), comb. nov. *Lactuca Lamii* Mattfeld in Nova Guinea, xiv. Bot. 522, t. 91 D (1929).

Ixeris laevigata (Blume), comb. nov. *Prenanthes laevigata* Blume, Bijdr. 816 (1826) ; *Lactuca laevigata* DC. Prodr. vii. 140 (1838) ; *Crepis laevigata* Sch. Bip. ex Zoll. Syst. Verz. 125 (1854) ; *Aracium laevigatum* Miq. Fl. van Neederl. Indie, ii. 111 (1856) ; *Lactuca Oldhami* Maxim. in Bull. Acad. Sci. St. Petersb. xix. 532 (1874) ; *Ixeris Oldhami* Kitamura in Acta Phytotax. et Geobot. iii. 134 (1934) ; *Lactuca stenophylla* Makino in Jap. Journ. Bot. iv. 10 (1910).

Examination of the numerous specimens of this species on hand reveals an extraordinary amount of variability both in vegetative and floral characteristics. Although the specimens from Formosa, which represent *I. Oldhami* (Maxim.) Kitamura, differ strikingly in habit from the small, nearly entire-leaved plant of Java, there is no consistent difference in floral characteristics. Each series, moreover, shows so much variation within itself that the writer is inclined to believe that several subspecies are present, and the exact relationships of *I. Oldhami*, as well as other forms, could be determined only by careful study of a complete series of specimens over the entire range of the species.

Ixeris papuana (S. Moore), comb. nov. *Crepis papuana* S. Moore in Trans. Linn. Soc., Bot. ix. 87 (1916) ; *Lactuca papuana* Mattfeld in Engl. Jahrb. lii. 449 (1929).

Ixeris prolixa (S. Moore), comb. nov. *Lactuca prolixa* S. Moore in L. S. Gibbs, Phytogeogr. & Fl. Arfak Mts. 184 (1917).

Ixeris pusilla (Mattfeld), comb. nov. *Lactuca pusilla* Mattfeld in Nova Guinea, xiv. Bot. 523, t. 91 C (1929).

Ixeris pygmaea (Zoll. & Mor.), comb. nov. *Lactuca pygmaea*, Zoll. & Mor. Nat. en Geneesk. Arch. Neerl. Ind. ii. 565 (1845) ; *Crepis nudicaulis* Schultz Bip. MS. in Zoll. Cat. p. 125 ; *Aracium pygmaeum* Miq. Fl. van Neederl. Indie, ii. 111 (1856).

Ixeris retrorsidens (Merrill), comb. nov. *Lactuca retrorsidens* Merrill in Journ. As. Soc. Straits, lxxvii. 245 (1917).

Ixeris riparia (Kerr), comb. nov. *Lactuca riparia* Kerr in Kew Bull. 1935, 333.

Ixeris sagittarioides (Clarke), comb. nov. *Lactuca sagittarioides* Clarke, Comp. Ind. 265 (1876) ; *Chondrilla sagittata* Wall. Cat. no. 3270, nomen ; *Lactuca sagittata* Hook. f. & Thomps. ex Hook. f. Fl. Brit. Ind. iii. 410 (1882), *in syn.*

Ixeris siamensis (Kerr), comb. nov. *Lactuca siamensis* Kerr, *loc. cit.* 1935.

Ixeris umbellata (Mattfeld), comb. nov. *Lactuca umbellata* Mattfeld in Engl. Jahrb. lxii. 449 (1929).

DUBYAEA.

(Addition to p. 17 above.)

Dubyaea atropurpurea (Franch.), comb. nov. *Lactuca atropurpurea* Franch. in Morot, Journ. de Bot. ix. 294 (August 1895), non *tom. cit.* 260 (July 1895) *. Franchet's second *Lactuca atropurpurea*, although it was apparently the species for which this name was intended, is invalid as a combination, and a new specific name would have to be taken up for it if it were retained in *Lactuca*. Nevertheless, the transfer of this species to another genus allows the retention of the specific epithet *atropurpurea* for both species.

Since no other specific name exists for it there is no question of priority involved, and therefore the revision of Article 60 made in 1935 does not apply here.

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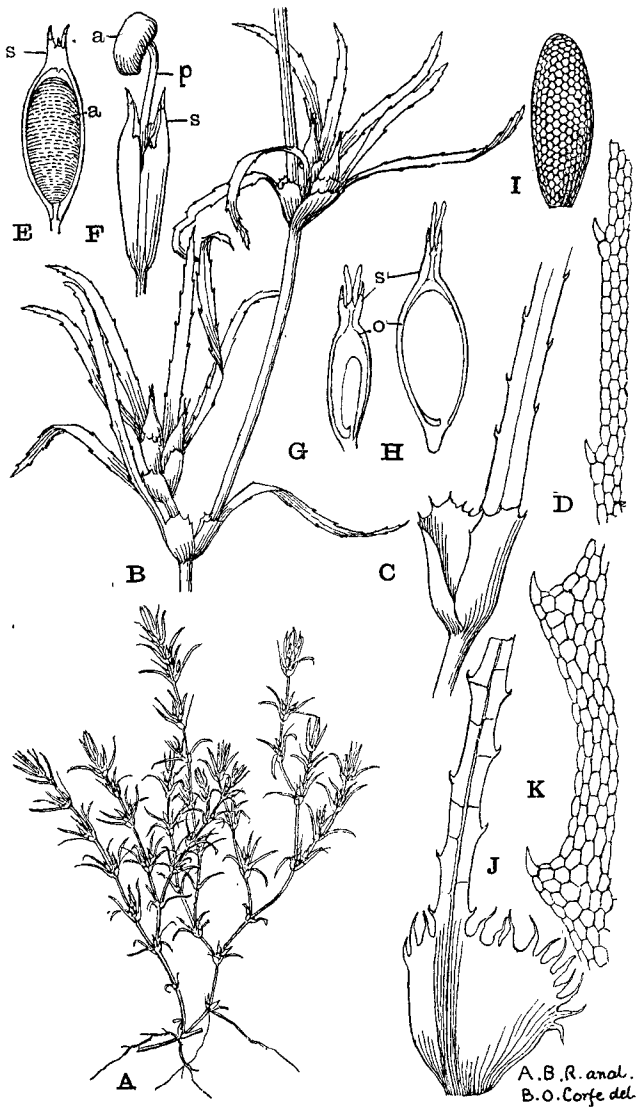
A NEW SPECIES OF *NAJAS* FROM CENTRAL AFRICA.

By A. B. RENDLE, F.R.S.

Najas (*Caulinia*) **Testui**, sp. nov. *N. affini* Rendle et *N. Welwitschii* Rendle affinis, ab utraque foliis minute spinuliferis haud denticulatis et a *Welwitschii* seminis testæ reticulatione, differt.

Herba parva submersa monoica, caulibus tenuibus basi limum permeantibus et radicantibus, superne effuse ramosis, ramis gracilibus dense foliatis patente ascendentibus ; *foliis* longiusculis brevibus subpatentibus planis lineari-angustatis, apice acutis, margine minute spinulifero, vagina late rotundata denticulis spinuliferis superne marginata, squamulis intravaginalibus minutis hyalinis anguste subulatis ; *floribus* in ramulis brevibus

* The epithet *atropurpurea* in the earlier reference (July) is subsequently altered to *grandiflora* in the *Errata* which follows the index at the end of the volume. The species is listed in the index (and also in 'Index Kewensis') as *grandiflora*, not as *atropurpurea*.—ED., JOURN. BOT.



A–I. *Najas Testui* Rendle. J, K. *N. affinis* Rendle.

A, portion of plant, $\times \frac{2}{3}$; B, portion of a shoot with branches at the nodes bearing female flowers, $\times 4$; C, lower part of a leaf with sheath, $\times 10$; D, leaf-margin showing two teeth, $\times 34$; E, male flower, $\times 18$ (*s*, spathe, *a*, anther, the two-lipped perianth is seen above the anther); F, same after elongation of the stalk (*p*) and dehiscence of anther (*a*), $\times 18$; G, female flower (*s*, spathe, *o*, ovary), $\times 14$; H, same in later stage with developing fruit, $\times 14$; I, seed, $\times 24$; J, lower part of leaf with sheath, $\times 10$; K, leaf-margin with two teeth, $\times 34$.

nodo binis subsessilibus, spathaceis; *spatha mascula* ovali-ellíptica collo breviter cylindrico ore spinifero instructa, anthera dehiscente super spatham apice ruptam pedicello elongato lata, *spatha fœminea* ut in mari sed collo longiore stylum brevem stigmata duo ferentem circumdante; fructu sub maturitate spatha incluso; *semine* anguste ovali-ellipsoideo, testa brunnea areolis subsexangularibus plurimis insculpta.

Plants about 10 cm. high, creeping through and rooting in the fine reddish mud, spreading and profusely branched above. Creeping stems about 1·5 mm. thick, ascending branches about 1 mm. thick, lower internodes 10–12 mm. long, becoming less than 10 mm. above. Fully developed leaves about 8 mm. long including the relatively broad sheath, barely ·5 mm. wide at the base, narrowing gradually upwards, the margin bearing 7–10 minute upwardly-pointing spine-cells on each side, the tip ending in a spine-cell, the larger sheath of the false pair of leaves enveloping the base of the branch, 1·5 mm. long, intravaginal scales barely ·5 mm. long. Flowers (generally 2) on short branchlets, solitary in the leaf-sheath, from which they protrude; male 2 mm. long including the very short stalk, perianth shortly 2-lipped above, closely investing the anther, the pedicel ultimately prolonged beyond the spathe bearing the dehiscing anther; female subsessile, about 2 mm. long, including the two projecting stigmas. *Seed* dull brown, 2 mm. long.

Hab. French Equatorial Africa: Ubangi-Chari, "dans un marais tributaire du Gbwetou affluent du Chinko," Jan. 22, 1922, *A. Le Testu* 3625. Type in Herb. Mus. Brit.

N. Testui belongs to my section *Spathaceae* of the subgenus *Caulinia*, characterized by the flowers of both sexes being surrounded by a spathe, and containing seven of the thirty-two known species. Three of the species are tropical African, one is Indian, and one occurs in Japan. Using for specific diagnosis the leaf-characters and the sculpturing of the seed-coat, *N. Testui* is distinguished by its small leaves, in which the characteristic toothing of the margin is reduced to a spine-cell projecting from the epidermis and the oval-ellipsoid seed with more or less hexagonal areolation.

For a general account of the morphology of the genus, see my "Systematic Revision of the Genus *Najas*" in Trans. Linn. Soc. ser. 2, v. 379 (1899).

NOTES ON POET'S NARCISSI.

By H. W. Pugsley, B.A., F.L.S.

In 1915 my account of this group of plants was published as a Supplement to this 'Journal' under the title of "*Narcissus poeticus* and its Allies." The group was treated as a Section *Ba Narcissus* of the genus *Narcissus* L., and was divided into two series, *Poetici* and *Radiiflori*, under which nine species,

with some varieties, were described. Two of these species, *N. hellenicus* and *N. exertus*, were new. The descriptions in almost every case were drawn up from living (generally cultivated) material, and special attention was directed to the difficulty or impossibility of determining *exsiccatæ* in this particular group owing to the obliteration of the floral characters in the process of drying. As a result of this difficulty the citation of *exsiccatæ* was omitted from the systematic descriptions. Of the nine species treated, six had been originally described near the beginning of the nineteenth century, and were based on garden plants of doubtful origin. An attempt was made in my paper to identify these cultivated forms with known wild plants and to ascertain their geographical distribution.

Since 1915 I have met with wild Poet's Narcissi on various occasions, and early last summer I visited the district east of Montreux, in Switzerland, which has been famed for their abundance since the time of Haller. Here I found that, when writing my paper, I had been led into error respecting the distribution of *N. radiiflorus* Salisb. and *N. exertus* Pugsl., and as this needs explanation and correction, it seems desirable at the same time to add a few notes on other members of the group. The cytology of this section of the genus, which might throw some light on the taxonomy, does not seem to have been investigated.

Series POETICI.

2. N. VERBANENSIS Roemer.—This species appears to be a connecting link between the two series, *Poetici* and *Radiiflori*, for while the stamens are usually unequal as in the first series, this feature is less marked and uniform than in the other species of that series, and the pollen shows the deep yellow colour of the *Radiiflori* rather than the sulphur-yellow tint seen in the other *Poetici*. There is a considerable difference in the breadth of the perianth-segments in different localities. I have collected this plant near Lugano (6. 4. 27); Campedone, near Pallanza (17. 4. 27)—a form with less clearly unequal stamens; and Lautaret, in Dauphiny (16.7.31). Dr. Walo Koch has also sent specimens from Monte Ceneri, Canton Ticino (2. 6. 36).

4. N. RECURVUS Haworth.—The occurrence of this plant at Saas-Fee, Canton Valais, Switzerland, was reported in my paper of 1915, and the uncertainty of its status there discussed. Last June I again visited Saas-Fee, and after some difficulty refound the plant in flower at its original station (15. 6. 36). It grows in very limited quantity on a grassy slope close to some of the chalets, and with it is another Narcissus, with different foliage, which, when I saw it, bore no flowers. Beyond the slope and in other parts of the meadow-land around Fee no

Narcissi were to be seen, and from the very limited habitat of the two species, it must be concluded that they were at some time introduced. Jaccard (Cat. Flore Valaisanne; 1895) does not mention any *poeticus*-form for Saas, but he records *N. Pseudo-Narcissus* L., with no indication of introduction, for "Saas" and "Fee." I took a few bulbs of the flowerless form for cultivation, and expect they will prove to be the *N. Pseudo-Narcissus* thus recorded.

5. N. MAJALIS Curtis.—This species is found to grow in the Pyrenees, as suggested in my paper. In the last week of May 1925 I collected it in the Val de Lys, near Luchon, Haute Garonne, with rather small flowers, and in meadows below the town, as a large-flowered form. Subsequently I saw it in quantity around Mont Louis, Pyrénées-Orientales. A fresh specimen from St. Baume, near Hyères, Dept. Var, was received early in May 1935 from the Dowager Countess Cranbrook. All of these wild plants showed the slender scape and pedicel of var. *patellaris* (Salisb.) Pugsl., but lacked its ample foliage and fimbriate, more deeply cupular corona.

Series RADIIFLORI.

6. N. RADIIFLORUS Salisbury.—In "*Narcissus Poeticus* and his Allies" (p. 28) it is stated that the common Narcissus of Les Avants and other localities in Western Switzerland differs widely from *N. radiiflorus* in its flat, discoid corona and its broader, obscurely trigonous fruits; and later in the paper this plant is described as a new species, *N. exertus*. The description was taken from fresh specimens collected at Les Avants on 16 May, 1914, and forwarded by Dr. G. Beauverd, and the flat, discoid corona, quite distinct from the small cup of *N. radiiflorus*, was the conspicuous feature of these plants. As herbarium specimens give no indication of the form of the corona, and I had no information of the existence of two really distinct forms at Les Avants, I assumed that the corona was normally flat in all the wild Narcissi of Western Switzerland. A few years ago I received fresh flowers with the same flat corona from Montreux. Last year (1936) I spent the first week in June at Château d'Oex, where I intended to collect a set of specimens of *N. exertus* for distribution. But to my surprise I could find only plants with cupular coronas, resembling *N. radiiflorus*, not only round Château d'Oex, but at Rossinières and Les Avants. Unfortunately, owing to a fresh fall of deep snow, all the flowers of Mont Cray, where I had seen Narcissi in 1908, were buried and inaccessible. It is thus clear that *N. exertus* is not the common Narcissus of Western Switzerland, and that the statement quoted above is inaccurate. I failed to locate any precise station for *N. exertus*, which perhaps flowers before the

radiiflorus-like plant on the lower grounds of this region, for the specimens sent me were collected at a comparatively early date.

The plant which I found last year in abundance is not absolutely identical with *N. radiiflorus* Salisb., as described in my paper. My description was drawn up from cultivated specimens, obtained from Lissadell, in Ireland, which agreed with Salisbury's original diagnosis (Prodr. Stirp. Hort. Chapel Allerton, 225; 1796) and the fuller account of Koch (Syn. Fl. Germ. ed. 2, 811; 1843). They are characterized not only by a small, cupular corona, with subequal stamens, but by a greenish-white perianth with narrow, cuneate-based segments, and by terete, narrowly ellipsoid fruits. In the Swiss plant the flowers are snow-white, often extremely beautiful, with remarkably variable perianths, ranging from distantly stellate to the broad, imbricated form seen in *N. recurvus*; and the fruits, on an average, are more or less broad, with a frequent tendency to become trigonous as in *N. exertus* and *N. stellaris* Haw. The question thus arises whether this Swiss plant, which clearly differs from *N. exertus*, is conspecific with *N. radiiflorus*.

In his Prodromus (*l. c.*), Salisbury gives a diagnosis of *N. radiiflorus*, without habitats, that might cover the Swiss form as well as that described by Koch. It runs thus:—"N. 1-florus; germine pyriformi; corollæ laciniis incurvulo-horizontalibus, obovatis, interioribus vix imbricatis; coronâ acetabuliformi, scarioso-crenulatâ; antheris omnibus extra tubum." *N. poeticus* L. Sp. Pl. is included among the synonyms. Here, like Curtis (Bot. Mag. no. 193), Salisbury is simply distinguishing the early-flowering form that he knew from his *N. patellaris*, which blooms much later; and it should be observed that the actual description, with its "coronâ acetabuliformi" and "antheris omnibus extra tubum" could not possibly have been taken from the true *N. poeticus* L., which at that date was unknown to him. In Trans. Hort. Soc. i. 365 (1812), he separates *N. poeticus* L. and writes of *N. radiiflorus*, "Wild in moist subalpine meadows of Switzerland; flowers here in gardens early in April, a little before the following [*N. poeticus*]; both charmingly fragrant." He now adds Redouté's *N. poeticus*, no. 160, to his synonyms, but makes no emendation of his original description, which was evidently intended to represent a plant cultivated in the garden at Chapel Allerton, such as that shown in his figure reproduced in my paper. Haworth (Narciss. Revis. 149; 1819; and Mon. Narciss. 14; 1931) describes *N. radiiflorus* in terms very similar to Salisbury's, and states that it flowers in April and was cultivated before 1626. He remarks that it grows in Swiss subalpine meadows according to Salisbury. The same plant was known to Herbert ('Amaryllidaceæ,' 317; 1837), and to Burbidge and Baker ('Narcissus,' 85; 1875); and it is reasonably certain that it is the form continuously cultivated in Britain under the names of *N. radiiflorus* or *N. angustifolius*, and identical with the Lissadell examples on which my description was founded. This cultivated form may thus be held to be typical *N. radiiflorus* Salisb. It was evidently brought into cultivation at a very early date, and was probably obtained from an Austrian habitat and not from Western Switzerland, for it agrees closely with the account furnished by Koch (*l. c.*), who was doubtless familiar with the Austrian Narcissi and emphasises the dirty-white perianth and the narrow fruit. At the end of May 1926 I saw flowers sold in the streets of Vienna, said to have been gathered in Steiermark (one of Koch's stations), which accorded well with his description. At the same time these Austrian Narcissi are probably not uniform, for Clusius (Rar. Plant. Hist. ii. 156; 1601), speaking of the plant found at Gaming, in Upper Austria, terms the flowers snow-white and the fruits triangular. On the whole, the Austrian and Eastern European forms of this group appear to produce smaller flowers with more uniformly stellate perianths than what may be seen in Western Switzerland, and these perianths are not always pure white; the fruits also are frequently narrower and more terete. Some of these forms may be separable from typical *N. radiiflorus* as varieties, but further observation of fresh material is necessary before their exact status can be determined, and in this connection *N. stellaris* Haw., *N. seriorflorens* Schur, *N. stelliflorus* Schur, and *N. tubulosus* Bald. will require consideration.

The Swiss plant under discussion, while showing the subequal stamens and small cupular corona (without white zone) of *N. radiiflorus*, differs, as already stated, in the extremely variable form of its perianth, which is usually snow-white in colour and often of large size, and further in its normally broader and more trigonous fruits. It will clearly require to be distinguished from *N. radiiflorus* either as a variety or a distinct species, but before this is done the range of variation of undoubted *N. radiiflorus* in wild habitats should be determined. If wild *N. radiiflorus* constantly produces more or less cuneate-based perianth-segments and narrow terete fruits, then the plant of Western Switzerland may be regarded as specifically distinct. But it is really desirable to examine fresh wild material not only of *N. radiiflorus* but of all the known forms of the series prior to any revision of their taxonomy. Haller's *N. uniflorus foliis uniformibus scypho brevissimo* (Hist. n. 1250; 1768), which is said to whiten the spring meadows of Western Switzerland, no doubt refers chiefly to this doubtful form.

7. N. STELLARIS Haworth.—I obtained specimens, apparently referable to this species, near Hallstadt, in Upper Austria,

on 26 May, 1926. *N. latifolius vi* Clusius (Rar. Plant. Hist. ii. 156; 1601), cited in synonymy here in my paper on account of its triangular fruits, belongs more probably to *N. radiiflorus*, for its corona presumably lacks the white circle which Clusius mentions under his *N. latifolius vii*; and it is possible that the capsules of some Austrian forms of *N. radiiflorus* may be more or less trigonous.

9. N. EXERTUS Pugsley.—It will be seen from the discussion under *N. radiiflorus* that the distribution of *N. exertus* in Switzerland is but little known, and that its only certain station is Les Avants, above Montreux. As in the case of *N. radiiflorus*, kindred forms grow in the Balkan Peninsula, and possibly also in Austria. When at Ragusa in April 1930 I saw in the market there bunches of Narcissi, said to have been brought from the neighbouring hills, that could only be referred to *N. exertus*. In these the perianth was of stellate form and of a dirty greyish-white colour, with the corona perfectly flat or even slightly convex. At Sarajevo, in Bosnia, I noticed a few days later another differing form (cultivated) with whiter perianths and broad imbricated segments.

The flowers of *N. exertus* are less beautiful than those of *N. radiiflorus*, owing to the flattening of the corona and its orange rather than really red margin. Redouté's figure cited (Lil. iii. 160) more nearly represents it than any other species, although the orange margin of the corona appears unusually narrow. But this plate, like others of Redouté's, is more ornamental than accurate. The perianth of *N. exertus* is probably less variable than my original description indicates. It would be interesting to know how far the flat coronas of many of the modern seedlings raised by Engleheart and other horticulturists are due to the influence of *N. exertus*, *N. poetarum* Haw., or *N. poeticus* L.

In concluding these notes, I would emphasize the necessity for annotating the labels of all specimens of Poet's Narcissi, when collected, with particulars of the form and colouring of the corona, and the position of the stamens. The shape of the fruit should also be stated, if possible. Most existing herbarium specimens, even those of recent date, are indeterminable and consequently of little value for want of this information; and botanists are still misled by relying for taxonomic characters on the shape of the perianth-segments, which can be seen in *exsiccatæ*, but are of relatively little value and occasionally very deceptive. I shall always be glad to receive fresh flowers of any wild forms of this group of plants.

REVIEWS.

Diseases and Pests of the Rubber Tree. By ARNOLD SHARPLES, A.R.C.Sc., D.I.C. Royal 8vo, pp. xv, 480, 70 figs., 4 col. pl. Macmillan & Co.: London, 1936. Price 25*s*.

THE Preface to this book begins: "The results obtained since 1931 at the Pathological Division, Rubber Research Institute, Malaya, and elsewhere, have proved of such outstanding importance that a permanent record becomes very desirable." This is an unfortunate beginning, and probably will unnecessarily perturb anyone who has taken the title at its face value. Again, in the Introduction it is stated: "There is no special aim to be attached to this book, beyond recording the progress of pathological research in Malaya." What is meant by these statements is probably to be inferred from a paragraph on page 14, "Continuous work over a prolonged period had prepared the way for a general plan of campaign in respect of rubber disease investigations in Malaya, and the period from 1931 to 1934 proved a specially fruitful time. As the years have passed it has become recognised more and more that the fungus diseases of rubber trees need observing from a new angle. Firstly, certain diseases have been shown to possess similar fundamentals, and when the question of control is being considered, diseases formerly classed as separate units must be grouped together so as to ensure full and economic control. Secondly, it is becoming more and more obvious that outside factors have the greatest significance in connection with rubber tree diseases. For instance, panel, stem, and leaf diseases are largely influenced by meteorological factors; the root diseases which appear in a rubber plantation entirely depend on the vegetation previously existing on the area, while direct atmospheric effects from lightning damage, scorching by the sun's heat, etc., play an important part in causing damage to certain areas."

The book is divided into three parts: General remarks on plant diseases, structure, reproduction, and physiology of fungi; Form and function; and Diseases and Pests. The two first parts occupy 73 pages and give a summary of elementary botany, with special reference to the rubber tree.

The section on Diseases and Pests has sectional headings—Root-diseases, Tapping Panel Affections, Stem Diseases, Leaf Diseases, Scorching and after-effects, and Miscellaneous. The various diseases are considered fully, and methods of treatment are given from the standpoint of the grower. "A broad treatment has been adopted as far as possible, which makes for a discursive account and leads to more repetition than might be considered necessary. Possibly, these obvious repetitions will not find favour with those readers possessing an intimate knowledge

of plant diseases. But in view of present-day working conditions, when the planter's daily routine duties are much more arduous than before the depression, they will seldom feel the urge towards long spells of serious reading. Intermittent periods of 'dipping-in' will be the rule, and, under the circumstances, it seems not an undesirable feature to repeat the items of special interest to planters wherever the opportunity arises."

It is to be regretted that the author has not pulled the book more together. Giving every allowance for his point of view, there is no justification for the very numerous quotations and long extracts given from books, papers, and reports: ten pages on end of extracts in small print cannot be justified in such a book.

The author was appointed Assistant Mycologist in the Department of Agriculture, Federated Malay States, in 1913, became Government Mycologist in 1916, and Head of the Pathological Division Rubber Research Institute of Malaya from 1931–1934. Anything he writes on the subject of rubber disease as such is therefore authoritative, and he has much to say that is sound sense.

The mycological part of his book leaves something to be desired. He wobbles over his authorities, gives a description of a new species of *Marasmius* (without Latin diagnosis) with one of the illustrations queried, and says "I was informed that the specific names written for printing in *The Review of Applied Mycology* are spelt without capitals, and this seems a good example to follow for the purpose of this book, both in the text and the list of fungi." There are four very good coloured plates, and some of the illustrations are excellent.—J. R.

Citrus Diseases and their Control. By HOWARD S. FAWCETT. Ed. 2. Royal 8vo, pp. xv, 656, 187 figs., 15 col. pl. McGraw Hill Book Co.: New York & London. Price 36*s*.

THE first edition of this book was published in 1925. I have always found it thoroughly sound and extremely useful. There has been a great deal of research carried out on citrus diseases since then, and Professor H. S. Fawcett has continued in the van of investigators; it is thirty years since his first paper on citrus diseases. The accumulation of new information from many countries has made a new edition desirable. The entire book has been revised, most of the sections rewritten, and many new ones added. The former edition had H. Atherton Lee's name as Junior Author, but he has now interest in other problems.

There has been some weeding out of illustrations, and the present number is 187 instead of 205; the excellent 15 coloured plates are retained. There are 64 more pages, and the "bibliography" has been greatly extended.

The rewriting has been done carefully, and the second edition retains the same high standard of scholarship which distinguished its predecessor.—J. R.

The Natural History of Barra, Outer Hebrides. Edited by J. E. FORREST, A. R. WATERSTON, and E. V. WATSON. Proc. Roy. Physical Soc. Edinb. xxii. pp. 241–296, with one map. October 1936.

THIS is an account of the results of a visit by nineteen members of the University of Edinburgh Biological Society to the Island of Barra for a fortnight in July 1935. Some thirty pages treat of the fauna, whilst seventeen are concerned with the flora. The island occupies an area about eight and a half miles long and over twenty square miles in extent. The ground rises to a maximum height of 1260 feet, and is mostly covered with moorland vegetation. There are eleven small fresh-water lochs and on the coast an appreciable extent of sand-dunes.

The sand-dunes are highly calcareous, a fact which, however, is not reflected, surprisingly enough, in their flora. The dune-loco yields *Lotus corniculatus* v. *crassifolius*, with *Cakile maritima*, *Atriplex hastatus*, &c. On the fixed dunes *Galium verum*, *Ranunculus acris*, and *Trifolium repens* are abundant over wide areas, and the presence of *Thalictrum dunense* and *Ophioglossum vulgatum* may be noted. *Ammophila arenaria* is the dominant, but the only other characteristic dune-species cited is *Agropyron junceum*. On the other hand, *Tussilago Farfara* and *Angelica sylvestris* are rather unexpected.

The dry type of *Calluna* heath, although covering a large area, would appear to be floristically poor, as only thirteen "vascular" plants are listed. The wetter areas yield such species as *Scirpus caespitosus*, *Anagallis tenella*, *Pinguicula lusitanica*, and various Cyperaceae. The fresh-water lochs present an interesting flora, which includes *Elatine hexandra*, *Potamogeton pectinatus*, and *Isoetes echinospora*. There are three small areas of woodland, of which one alone may contain some remnant of the original forest, represented by a few Scots Pines. The presence of *Anthyllis vulneraria* on the cultivated ground calls for comment, since it is not cited from the calcareous dunes, as one might expect, though present also on an acid peaty area where lime from the midden-beds is dispersed.

A list of 85 species of Bryophyta includes twenty-five new vice-comital records, whilst of the twenty-one species of Hepatics four are additions, of which one is the interesting *Moerckia Flotowiana*, a liverwort characteristic of dune-slacks, but here mentioned as present in the bryophytic flora of the woods. The list of marine algæ numbers 78 species, and, though admittedly

incomplete, includes *Cystoseira ericoides* and *Gelidium attenulatum*. A few fungi and some thirty lichens are also recorded, amongst the latter being the markedly oceanic *Lecidea tenebrica*.

The account, as a whole, is particularly noteworthy, as showing what can be accomplished even in a short period by co-operative effort, in which is to be included the services of those experts who assisted in the naming of specimens.—E. J. S.

Pflanzengemeinschaft und Umwelt—Ergebnisse und Probleme der botanischen Standortsforschung. By Dr. PAUL FILZER. 8vo, pp. viii, 98, 19 text-figs. Ferdinand Enke Verlag: Stuttgart, 1936. Price 5 R.M.

THE Gothic type and the over-picturesque diction may deter some English readers from making a closer acquaintance with this little book. But the picturesque language is restricted in its distribution and the main contents form a very attractive account of modern views and work—especially work done in Germany—on several interesting ecological topics. Of the five chapters the first deals with drought resistance, illustrative material being drawn from the North African deserts. The second, on the vegetation of the German beech-woods, is concerned mainly with the assimilation relations of sun and shade plants and this subject is returned to in the final chapter on sea-weeds. A chapter entitled " Struggle in the Mountains " gives an account of vegetation of screes, rock-ledges, and upland moors and pastures, and discusses, amonsgt other problems, the modern work on soil formation and on frost resistance. The fourth chapter is on halophytic vegetation. The treatment is throughout balanced and clear, and, although the teleological standpoint is emphasized, the book may be thoroughly recommended.—M. SKENE.

Recueil de quelques Travaux d'Anatomie Végétale exécutés à Liége de 1929 *à* 1935. M. Hayez, Imprimeur de l'Académie Royale de Belgique: Brussels, 1936.

THIS is a collection of separates of memoirs, notes, and reports that have appeared in the 'Mémoires' of the Académie royale de Belgique, the 'Bulletin biologique de France et de Belgique,' the 'Bulletin' of the Société botanique de Belgique and of the Société des Sciences de Liége. Prof. A. Gravis contributes a preface in which he acknowledges a subvention from the Patrimoine de l'Université de Liége, which has made possible the publication. The greater part of the volume also represents the work of Prof. Gravis, including his memoirs 'Théorie des Traces foliares,' 'Nanisme et Pédocarpisme du *Plantago Coronopus*' and 'Observations anatomiques et éthologiques sur les *Cactacées* et les *Lemnacées*,' lengthy papers published by the Academy, and a short paper on similar observations on *Genista radiata*. Two papers by J. Joyeux deal similarly with the Asparagineae and also with their taxonomy also published by the Academy, and there are short papers on the life-history of *Tussilago Farfara* by H. Fritsché, on the structure of the petiolar bundles of *Raphia*, by A. Monoyer, and on *Kleinia articulata* by D. Rousseau. Appended are some short notes and reports of meetings by A. Gravis.

Botany (*Elementary Science Series*). By E. R. SPRATT, D.Sc., and A. V. SPRATT, M.Sc. Sm. 8vo, pp. 156, frontispiece, and 121 text-figs. University Tutorial Press: London, 1936. Price 2*s*. cloth, 1*s*. 9*d*. stiff boards.

THIS is a useful little introductory book adapted for Junior classes in schools. It is well illustrated, and the numerous more or less diagrammatic line-drawings are carefully indexed. They include demonstrations of simple experiments in plant physiology. Simple language is used, so far as possible, and technical terms when employed are explained. Occasional lapses into " baby " language may irritate children of Junior Local and Lower Certificate Stage.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on January 7, Dr. W. T. Calman, C.B., F.R.S., President, in the Chair, Dr. Mary A. Pocock gave an account of studies in South African Volvocales. A new *Sphaerella* differs from previously known species in having only one pyrenoid in the cell. It occurs in shallow rain-water pans in granite or quartzite, and rapidly passes through its life-cycle, culminating in sexual reproduction. In gamete-formation it recalls the germination of the zoospore of *Volvox Rousseletii*. A new species of *Volvulina*, a very rare and imperfectly known genus recorded only from Australia, the Amazon, and near Leningrad, a small colonial Alga recalling *Pandorina* in appearance, was described. The new species is unique in having four or two small directive cells at the posterior pole which do not produce daughter colonies. Asexual reproduction is by the formation of daughter colonies, but, unlike all other colonial Volvocales at present known, there is no process of inversion in their development. Sexual reproduction is by gametes of two sizes, which escape into the water and there fuse. It thus shows heterogamy as opposed to the marked oogamy of *Pandorina*. In structure and reproduction this form stands alone among the colonial Volvocales, and possibly represents an

entirely distinct line of evolution from that of the *Gonium-Eudorina-Volvox* series.

Fertilization in *Eudorina elegans* has not been recorded previously, although Meyer has described fertilization in a monœcious species from Russia. The female colonies come to rest, the wall gelatinizes, and the large eggs lie quiescent in the mucilaginous matrix, gently waving their flagella; the spermatozoid bundles escape from the male colonies, swim actively in the water, and are eventually attracted to the mature female colonies, on the surface of which they disintegrate. The spermatozoids swarm over the mucilaginous surface into which they penetrate, swarming round the eggs, and fusion proceeds until the body of the spermatozoid has entirely disappeared into the egg. The two male and the two female flagella (of nearly equal length) continue to move gently for some time, so that the zygotes are easily distinguished from the unfertilized eggs. Eventually a wall is formed and the resting zygospore matures.

Dr. Eric Ashby read a paper on "The Determination of Size in Plants." This may be analysed into three determinants: initial biological capital, rate of interest, and the time over which accumulation of interest is maintained. Each of these determinants is in turn dependent on two variables: the genetic constitution of the plant, and the environment in which it is grown. A review was given of data bearing on this analysis, and evidence was adduced to show that genes determining size operate very early in the life of the plant, and affect the initial size of organs rather than their subsequent rates of development. The same relation was found to hold for animals.

At the General Meeting on January 21, the President in the Chair, Dr. Reinhard Dohrn, the Director, gave an account of the history and work of the Naples Zoological Station, founded by his father, Anton Dohrn; the first report of the Station was issued in 1874.

Dr. Rose Bracher described her work on the influence and quality of light on the movements of *Euglena limosa* in the tidal mud of the Avon estuary; and Dr. W. B. Turrill showed a number of species of plants from the Balkan Peninsula used locally for making tea as a beverage. These subjects included inflorescences of *Tilia tomentosa*, open flowers of *Althaea pallida*, leaves of *Salix triloba*, and several Labiates—*Origanum hirtum* and species of *Sideritis*.

The following papers were read in title—"Further Notes on the Genera *Fumaria* and *Rupicapnos*," by H. W. Pugsley; and "Studies in the Capparidaceae: 1. The Life-history of *Cleome Chelidonii* Linn. f.," by T. S. Ragharan.

CHANGE OF ADDRESS.—Rev. H. J. Riddelsdell to 4 Woloerley House, Goring, Reading, Berks.

THE LIFE-CYCLE OF *TAMUS COMMUNIS* L.

BY I. H. BURKILL, M.A., F.L.S.

(Concluded from p. 43.)

5. FLOWERING.

There is a numerical disproportion between the male and the female plants. Brenner (in Kirchner and others, Lebensgesch. d. Blutenpfl. Mitteleur. i. pt. 3, 714; 1914) says that males are two to three times as numerous as females. A census around Leatherhead revealed 295 males, 134 females, and 125 plants of three to four years' growth which had not reached flowering. As male plants flower about a year before females, the disproportion would be a trifle less than 295 : 134; and 2 : 1 would seem not far from the truth.

The excess of males means that in the colonization of new terrain the males are leaders and the females likely to be born into an environment favourable for pollination when they flower. At the same time, should a bird carry two seeds to a new terrain, the chances are a little weighted against success: but Nature never selects for spectacular leaps to new land, though always for slow penetration.

A mature male produces each year more inflorescences than a mature female: it begins to bear them lower down on the stem, and so freely that 85 per cent. of the leaf-axils carry them. But in the female only about 60 per cent. carry them. This production of male flowers in the lower leaves leads to a slightly earlier flowering of the male and the expanding of the female flowers in an environment prepared for them. Nature is in general thrifty in various ways with the female.

The size of the male panicle is closely related to the vigour of the part of the stem bearing it; and, finally, at the stem-tip solitary flowers replace the panicles. The size of the leaves dwindles with the size of the inflorescences. As many as 260 flowers have been counted on an unusually large panicle: a large panicle carries 100, and the average is about 40. Rarely a second small panicle is produced by a bud between the panicle and the subtending leaf: this phenomenon is much more frequent in species of *Dioscorea*.

The main axis of the panicle ascends, seeking the light, its direction in the first place determined by the axis from which it springs, but modified by light; for it has a certain measure of positive heliotropism. It ascends as a rule rather more than the petiole of the subtending leaf; but the position of the petiole is very inconstant. The larger branches of the panicle—axes of second rank—take their direction likewise from the axil (this time of a bract) which bears them. The pedicels of the flower

of a panicle are differently constructed, for each has at its base a pulvinus by which it is pointed more or less earthwards and a second less active pulvinus under the flower which brings about further adjustment. Since it is stimuli to the blade of the leaf which call out the adjusting movements of the pulvini of the petiole, so it would seem to be stimuli received by the perianth of the flowers, and especially by the sepals, which arouse the adjusting movements of the pedicel. But when the inflorescence is reduced to a single flower, the pedicel of this flower has no pulvini : in fact, this organ is the axis of an inflorescence and no genuine pedicel. In consequence, there is dimorphism among the male flowers, for one form has a pedicel with pulvini which causes it to face earthwards and the other (the distal and late flowers) may face in any direction, but tends to face more or less obliquely upwards.

The female flowers are usually racemose, but sometimes, as already explained, paniculate (see fig. 2, p. 9). There are very rarely as many as 25, and generally not more than 10 : from which number they fall to one at the ends of the stems. The axis does not ascend, but bends earthwards : and so do the pedicels, both obeying external forces in the same way, except that the pedicels take their initial direction from the axis bearing them and away from it. They do not have pulvini and are thicker than the male pedicels, as befits their longer life (*cf.* Goebel on *Sagittaria*, etc., ' Organographie,' i. 157 ; 1913).

The tropic reactions of the flowers are thus of some complexity : one reaction causes the flowers to face earthwards, and is connected with a need, common to both sexes, of protecting from rain the honey and in the male the pollen ; another thrusts the male flowers into some conspicuousness beyond the foliage, and is inoperative in the female. As the flowers are insect-pollinated, the exposure of the male and not of the female would be a maladjustment were they dependent on conspicuousness.

Since the male plants are more abundant and produce more flowers than the female, there are about thirty male to every female flower. As also the males are larger than the females and their bright yellow pollen is a bit of colour which the females do not possess, the human eye notices them, and the impression is easily acquired that they are in yet greater preponderance than 30 to 1.

But the human eye cannot be trusted to indicate what they are to insect visitors. Doubtless, owing to the extremely short range of vision of an insect, the yellow pollen cannot serve as more than a honey-guide when the flower has been found—a guide useful in orienting the insect's movements when at the flower. The insect's search is aided by a pleasant scent of honey which every fresh *Tamus* flower emanates. The human nose detects it when sufficient flowers are assembled together.

That insects find and visit the flowers can be demonstrated by other methods than watching. Watching is poor in results, except where over-pollination occurs; and *Tamus* is not over-pollinated as are so many of our conspicuous garden plants. An observer who would watch a plant of *Tamus* for insects for half an hour, has at the end of that time watched for no more than 0·5 per cent. of the duration of a flower, and has little reason for expecting to see pollination achieved in that time. But if *Tamus* flowers be taken and the stigmas examined under a compound microscope, scattered pollen-grains will be found with ease, unless the weather is altogether inauspicious. The plentiful crops of berries in autumn indicate abundant fertility.

Because Nature has ways of fruiting parthenogenetically, and C. F. Gaertner (Versuch. u. Beobacht. ü. d. Befruchtungsorgane, 1983 ; 1844) suggested that *Tamus* affords an instance, the following experiment was made :—Six well-developed female plants were selected in four different places near Paignton and were brought under experiment on June 29, 1935, and the two following days. First all flowers already open were removed ; then with a razor the perianth and stigmas of the full-sized buds were sliced away so as to render pollination impossible ; and this was repeated day after day until the last flowers had been mutilated. The unfertilized ovaries continued to grow and to round themselves for a fortnight and more after mutilation ; then before twenty days had elapsed, having turned yellow, they shrivelled. Not a single ovary made good ; and so many had been treated as to show emphatically that parthenogenesis does not occur.

The alternative, that insects are the agents which secure the abundant fertility, may be accepted. Insects which comb through the vegetation in their search for honey so thoroughly as to detect extrafloral nectaries, are much more likely to discover it in the flowers even though their green colour is that of chlorophyll than on extrafloral nectaries. These have been observed on *Tamus* :—

Hymenoptera. Apidæ. *Apis mellifica* L. in Belgium (*Plateau**), in Switzerland (*Brenner*), and in Britain. The writer has seen this bee twice in Surrey on male flowers, going from one to another at the rate of 14 and 16 flowers a minute ; and once on female flowers. *Bombus terrestris* L. in Surrey on three different days on male flowers, visiting all six nectaries in each flower at the rate of four flowers to the minute. *Bombus*, a different species, once, in Surrey, sucking honey. Brenner also mentions *Bombus*. *Anthrena* sp. in Belgium (*Plateau*). *Anthrena* sp. in Surrey diligently visiting male and female flowers indiscriminately and smothered in pollen. Braconidæ, 1 sp. in Surrey on male flowers. Lepidoptera, Tineidæ, 1 sp. in Derbyshire,

* F. Plateau's observations were published in Bull. Acad. Roy. des Sciences de Belgique, sér. 3, xxxiv. 628 (1897).

at honey on male flowers. Diptera. Empidæ. *Empis* sp. in Switzerland a frequent visitor (*Brenner*). *Empis* sp. in Derbyshire at honey on male flowers. Muscidæ. *Calliphora vomitoria* L. in Belgium (*Plateau*). *Lucilia* sp. in Surrey on male flowers. Muscid, undetermined, in Derbyshire. Anthomyiidæ, an undetermined sp. in Surrey on male flowers. Coleoptera. Melolonthidæ. *Trichius abdominalis* Men. in Belgium (*Plateau*). Undetermined beetles, in Surrey and in Devon, frequently in male flowers eating pollen. Thysanoptera, *Thrips*, in Britain, very common in the flowers of both sexes, probably in almost every instance *Anaphothrips tamicola* Bagnall, which is recorded also for southern France.

Some of these insects, such as *Apis* and *Bombus*, are among the best of pollinators—of the class which Loew termed eutropous. *Anthrena*, the Microlepidoptera and Empidæ belong to the serviceable class which he called hemitropous: the parasitic Hymenoptera, Muscidæ, and Coleoptera are in the rather disadvantageous class which he called allotropous: and *Thrips* is in that regarded as thoroughly disadvantageous or dystropous. But if *Anaphothrips tamicola* is tied to *Tamus*, because this is its food-plant, it will travel from one plant of *Tamus* to another, and in regard to pollination, as the Yucca moth to *Yucca*, may not be dystropous exactly. Its mobility requires study as well as its general relation to the plant.

The course of flowering is as follows:—There is no hour of day or night when flowers may not open; but the greatest number open between sunrise and noon, one of the stimuli which lead to opening being the drying of the air. In opening, the parts of the perianth recurve owing to diminished growth on the outer face, much as the young leaves do when they begin to function and spread away from the apex of the stem: the leaves just previously have had a curve inwards and now take a curve outwards, which is partly corrected later, and their position is finally adjusted by the petiole: the parts of the perianth before the flower open have similarly a curve inwards; then they—the sepals most markedly—take a curve outwards; their growth ending at that, there is no correction. In the opened male flower the exposed anthers dehisce by the drying of their surface, the drying beginning at the line remotest from the vascular bundle in the connective. If drying is completed, the anther-cell is everted: moisten it, and the eversion is arrested. The ellipsoidal pollen-grains at the time of exposure are slightly plasmolyzed. They are smooth; but adhere readily to objects brought into contact with them. They are avid of water, and take it up immediately they touch a moist surface. Their long axis then increases by 20 per cent. and their short axis by 40 per cent., and within an hour a pollen-tube is extruded from one of the ends, though often not from the actual pole. Left in

water this pollen-tube elongates to several times the length of the parent pollen-grain. It needs no sugar or other solute to stimulate it; distilled water is sufficient. That shelter from falling rain by the downward direction of the flower means much is now evident, for it is realized that a wet anther an hour after rain has fallen on it will bear germinated pollen in the place of easily transportable and useful dry pollen.

The flower lasts as a rule for $2\frac{1}{2}$ to $3\frac{1}{2}$ or rarely for $4\frac{1}{2}$ days, after which it collapses in an indefinite way. The secretion of honey is maintained while it is open.

In the female flower at opening the tips of the stigmas are directed towards the base of the flower; later they become horizontal: they grow during flowering as does the ovary, the changes being as represented in fig. 7. The duration of flowering

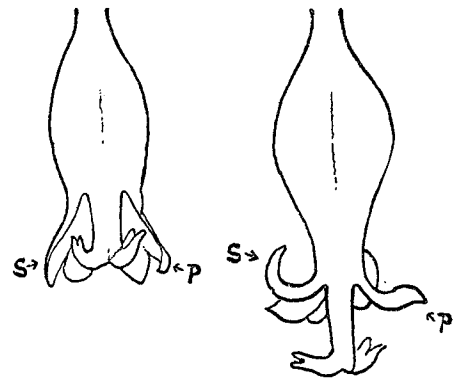


Fig. 7.—A female flower in section at opening and when three days old, showing the increase in size and change in the position of sepals (*s*), petals (*p*), and stigmas: ×7.

is as in the male or possibly a trifle longer. Honey is present in amounts equal to those in the male, but the approach to it is not quite so wide as in the male, the distance of the stigmas from the perianth being a little less than the distance between anthers and perianth.

Flowering proceeds acropetally on the female racemes, with an overlap in time, so that 1 to 5 flowers are open together, the first fading as, say, the sixth opens. In those rarer cases where the female inflorescence becomes a panicle by a little branching towards the base, there are naturally some flowers open low down when the oldest have withered. In the male the panicle offers open flowers to an insect visitor in all parts, and to the extent of about one-third at a time of the total number. Collectively, then, there is much more honey offered at one place in

the male than in the female. The male should lure the insect and pass it forward to the female when it has been charged with pollen, and the proportion of thirty male flowers to one female may meet the plant's needs less wastefully than might at first appear.

Conclusion.

A species cannot extend to areas where it cannot multiply: it is time, now, to link together what has been recorded of the way of life of *Tamus communis* and the facts of its dispersal.

As a member of the Dioscoreaceae it belongs to a family composed preponderatingly of tropical tropophytes: but it is not tropical; and, moreover, if a tropophyte be defined as a plant which is alternately a hygrophyte and a xerophyte, it is not strictly a tropophyte. It appears as a side issue from an ancestry which attained pantropic importance by being fitted for growth where hot-weather rains fall broken moderately by drought in cold weather. In contrast, although shrinking from strong frosts, it prospers on cold-weather rains and shows adaptations for resisting hot-weather drought. In brief, it evolved out of a climatic régime where heat and moisture are in apposition into a climatic régime where they are in opposition.

Its ancestral genus—*Dioscorea*—has come face to face with such reversed conditions in various parts of the world; but, except in *Tamus*, has met these conditions by dwarfing, without generic departure: such dwarfing we observe in Western Australia and the Andes, where species of the genus much below the average size snatch a growing season at temperatures which handicap them. We observe dwarfing also in that extremely interesting species *Dioscorea pyrenaica*, of the crests of the central Pyrenees, where it exists at the verge of extinction on the cold rains of a much curtailed summer.

Different antecedent conditions may be assumed for the varying success with which the reversed conditions have been met. *Dioscorea* was already much specialized when *Tamus* took origin; and fortuitously must have been so in the direction of the changed climate when and where the opening came. *Tamus* is to-day a thoroughly successful offshoot which has spread through the whole of the Mediterranean, and been able to take advantage of the climate, also with mild winters, of north-western Europe, to which it cannot at first have belonged.

As to its winter activities:—On p. 42 the growth through winter of new shoots was described, and the very early provision for them of buds which suffer repression until the reigning stem perishes: and on p. 35 the after-ripening of the seed through winter was described. Frost is known to be injurious to the shoots: that it injures the seed, though probable, is not proved. There is a 99 per cent. mortality between seed ripening and the establishment of a new plant.

The sinking of the seed into the soil was described on pp. 33 and 47, and of the young tuber on p. 40. It was shown how ample is the provision of buds for replacement both in the lower axils such as are underground and at the base of the shoot, and that the ability of all parts of the tuber to form buds on demand supplements this. One asks how far the need is produced by exposure to cold and how far by exposure to dryness. Observations are needed at the southern limits of the genus for comparison with those made near its northern, for the southern are dry and the northern cold.

On p. 2 the protection of the growing seeds against drought was described, the means adopted by Nature being the shelter of water-pads; and on p. 11 the importance of these pads was illustrated by figures indicating the positions of ovules which fail to form seeds. On p. 67 the growth of the water-pads irrespective of pollination was demonstrated. These pads serve the purpose of a water-store in no more than a local measure, while the tuber below ground is a general water-store.

Scantiness of rain, disadvantageous to growing seeds, may be advantageous to flowers; nevertheless, the flower is inverted, as are many which face wet climates. But this protecting of pollen and honey from rain must be weighed with an interesting circumstance in mind, namely, the susceptibility of the pollen to be set germinating by water alone (p. 68), so that if wetted while still on the anther it is rendered useless.

It has been claimed (p. 3) that the berry was evolved by way of nursing the seeds and not by way of dispersing them, and it is said (p. 7) that its success in securing dispersal by birds is indifferent. It was shown (p. 4) that the winglessness of the seeds was inevitable when wind-dispersal was abandoned. The means adopted for seed-dispersal is consequently by no means as deep-lying in the evolutionary history as the adaptation to the climate to which it is fitted.

If a map of the distribution of our plant be compared with meteorological maps, one observes, firstly, that it requires about 20 inches of rain in the year. Then one turns to the maps of monthly heat and rain; and here we may consider the southern limits first. They pass from the Atlantic coast of south-west Morocco along the Great Atlas and across Algeria to the coast of Tunis, where the continuity is broken: the plant reappears in Cyrenaica and then disappears again until the hills of Palestine are reached. Roughly the limit coincides with the isohyet of 2 inches of rain over each winter month: the rain is given in the Table on p. 72.

Its localities in Cyrenaica seem to be by streams where possibly it is not maintained entirely by local rain, and the rainfall records are rather inadequate. However, that rain limits it towards the south is certain. The isotherms are in nowise parallel to its limits.

It is otherwise towards the northern parts of Europe; for there the isotherms are very suggestive—not the summer isotherms, which cross the northern limit of *Tamus* at all manner of angles, but those of late autumn and early winter: that of 6° C. for the month of November is almost identical with the northern limit of our species all the way from the North Sea to the Caspian. The agreement is such as to suggest that the intensity of cold which comes in November determines largely where it shall grow and where it shall not, and causes it to be almost excluded from Germany, excluded from half of Austria and Hungary and from most of Russia. But, unfortunately, its limits in Britain do not coincide with the 6° C. isotherm of November; and its peculiar restricted occurrence in Ireland is inexplicable in terms of isotherms and isohyets. In consequence, one must ask the botanists of Bavaria, Lower Syria, Hungary, the Crimea, and Russia just north of the Caucasus to investigate its manner of surviving their winters, while the limiting factors in the British Isles are subjected to an extended scrutiny.

Our plant is recorded as having been cultivated in various German Botanic Gardens beyond its natural limits: unfortunately,

Inches of rain.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Morocco	3–5	2–4	2–5	½–5	½–3	0–½	0–½	0–½	½–1	1–4	2–5	1–
Coastal Algeria.	1–5	2–5	2–6	2–4	1–2	½–3	0–½	0–½	½–2	1–4	2–5	2–
Cyrenaica ...	3–4	1–2	½–1	½	½	0	0	0	½	½	2	3

their catalogues never record what precautions are necessary for its maintenance. If none, the start having been made with a tuber, the line at which it finds its natural limits towards the north-east, beyond which lie these gardens, may be determined much more by the inability of the seed to undergo the process of after-ripening than the inability of the tuber to supply uninjured the summer shoots in due season.

Tamus communis resists being eaten by animals by means of its saponin and its raphides (p. 5). The tuber is also protected by the soil. As both means of protection—poisonousness and deep burying—are very general in the genus *Dioscorea*, they belong to the inheritance of *Tamus*. A comparison with the species of *Dioscorea* suggests that the need of the saponin in the tuber is not preponderant. The stems get protection from the bushes they climb, whether thorny or twiggy. The leaves are commonly carried so high as to get protection from their position and show no great need for much poison in them. Snails eat them, but not very much. It has been suggested (p. 6) that the green berries are more carefully protected.

As yet nothing is known of the distribution of saponin in *Tamus edulis*: but it is recorded that those who eat its tubers give them a whole day's boiling, as if saponin is there which must be removed.

Naturalists have remarked that the plants of the Atlantic Islands, if exposed to the enemies of plants which are found in Europe, would be destroyed, and have deduced that, having had protection by isolation, they have not evolved inedibility. This generalization may or may not apply to the two species of *Tamus*.

The flowers are sufficiently visited by insects to be fertilized by their means in Britain, and probably everywhere. Their green colour and small size does not seem detrimental (p. 67).

Tamus communis in competition with other plants needs to live in a community of shrubs. It is killed where in a young plantation the trees grow above it. In this Journal (1936, p. 156) a comparison was made between vigorous hedge-row plants and those struggling in scrub, suggesting that the latter become unable at the end of summer to feed the tuber in full measure. It cannot grow in the open. A shrubby vegetation such as the maquis of the Mediterranean supplies what it needs in the way of plant associates. In countries like Britain, where fields are fenced, its abundance is greatly increased by the operations of farming; but that it is native cannot be questioned. It has been suggested that it is not native in Ireland: but Lloyd Praeger has accepted it ('The Botanist in Ireland,' 420; 1934). Bevis and Joffery ('British Plants,' 214; 1920), not aware of its way of occurring in Ireland or accepting the view that it is not a native, list it among plants which may have reached Britain when Ireland had already been cut off from Europe and Britain had not. But there is much enquiry to be made in regard to its reactions to the climate in Ireland before this theory be adopted. It may be kept in mind that the mitigating effect on the climate of large sheets of water has undoubtedly a beneficial influence: profiting by this influence it is particularly abundant near the numerous lakes of Switzerland, and the line of its northern limits is bent northwards near the Lake of Constance and near the Balaton Sea. So in Ireland it is on the two sides of a lough: but Ireland has other loughs where it is not found.

Lastly, for its relationship to *Dioscorea*. The remarkable secondary thickening of the tuber which occurs entirely for the purpose of increasing its storage room, links it to sections of *Dioscorea* found in the southern parts of Africa, not so intimately as to invalidate the genus in any way, but intimately enough to make it certain that some of them and *Tamus* had a remote ancestry in common. This same ancestry has left descendants in America, but none in Asia.

In Albania *Tamus communis* consorts with *Dioscorea balcanica* Kosanin, and on the south of the loftiest peaks of the Caucasus with *D. caucasica* Lipsky. This consorting is secondary.

The section of the genus of these two is best developed in Asia, and they are genuinely relics of the Tertiary Flora of Europe—that warm-climate flora which gradual cooling in Europe, suddenly culminating in the Ice Ages, all but extinguished. On the contrary, the ancestry of *Tamus* came up from the south, from a region which was forbidden to the Tertiary Flora just mentioned, doubtless climatically. The Tertiary Flora found an asylum towards Indo-China, as the genus *Cinnamomum* well illustrates; its absence from Africa points to the climate southward of Europe being continually in strong contrast. *Tamus* came into this contrasted climate early enough for the separation of its insular *T. edulis* from the continental *T. communis*: and now within both species disruption is appearing, whereon some botanists give specific rank to a *T. cretica* L. and a *T. parviflora* Kunth; and some endeavour to define even narrower divisions.

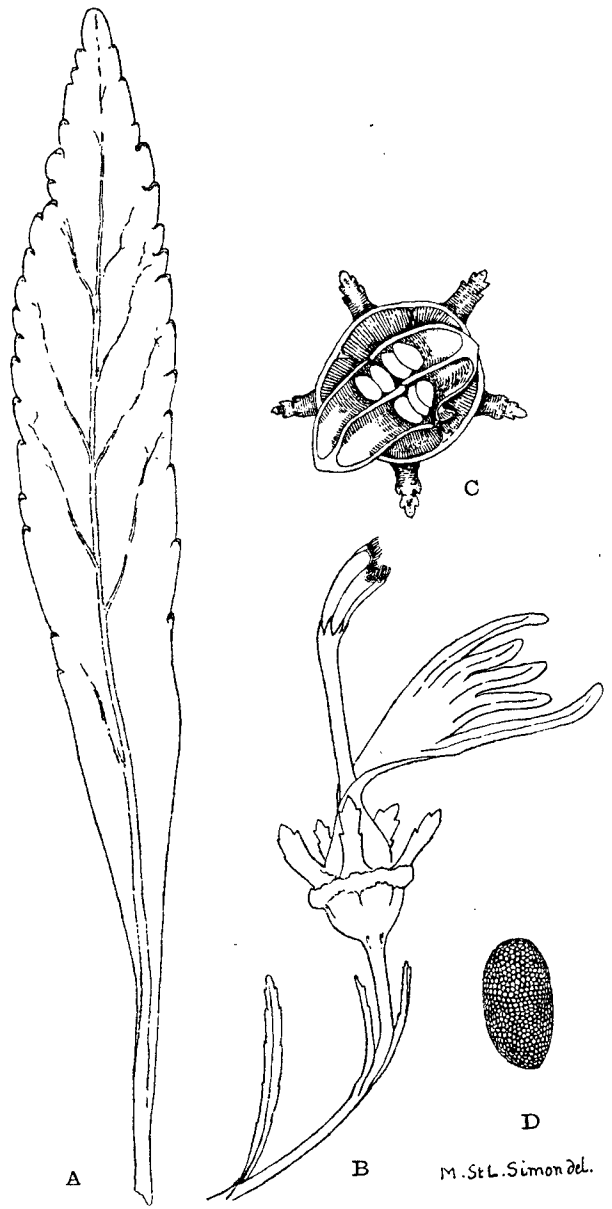
It has been suggested that *Dioscorea pyrenaica* bridges the gap between *Tamus* and *Dioscorea*. It is undoubtedly nearer to *Tamus* than are *D. balcanica* and *D. caucasica*, so much so that it belongs to that side of the great genus *Dioscorea* which is towards *Tamus*; but it does not represent a stage in the evolution of *Tamus*. However, like *Tamus*, it is not a relic of the Tertiary Flora, as Engler suggested, but a plant with remote African relatives. Sir David Prain and the writer, in a paper not yet published, have pointed out that the three European species of *Dioscorea*—*D. pyrenaica*, *D. balcanica*, and *D. caucasica*—have not joined in the Mediterranean flora but occur in little patches of heavy local precipitations either on its northern edge or, in the case of the second species, in an enclave towards it northern edge.

A NEW LOBELIA FROM ST. LUCIA.

By A. B. Rendle, F.R.S.

Lobelia (*Tupa*) **Santa-Luciae,** sp. nov. *L. infestæ* (Griseb.) Rendle affinis sed foliorum margine haud spinulifero, bracteis haud pedicello adnatis et corollæ majoris colore roseo differt.

Herba glabra perennis *foliis* radicalibus anguste oblanceolatis basi in petiolum angustatis, apice acutis, margine supra medium leviter crenato-dentatis; *racemo* elongato multifloro, pedunculo 3-pedale inferne paucifoliato supra medium florifero; *bracteis* anguste oblanceolatis acutis, margine sparse denticulatis, haud pedicello adnatis et eo brevioribus, bracteolis e medio pedicelli oriundis lineari-lanceolatis; calycis tubo (hypanthodio) hemisphærico, lobis late linearibus brevibus, supra medium obsolete denticulatis; *corolla* roseo-tincta, medio falcata, profunde fissa, lobis linearibus acutis vel subacutis; *andrœcio* corolla paullo



Lobelia Santa-Luciae Rendle.

A, leaf nat. size; B, flower, corolla spread out to show lobing, ×1½; C, fruit dehiscing, ×2; D, seed, ×12.

breviore glabro, antheris omnibus apice barbatis glabris ; *fructu* hemisphærico suberecto, valvis dehiscentibus lignosis recurvatis semina brunnea ellipsoidea minute reticulata extrudentibus.

Hab. St. Lucia, British West Indies, *H. E. Box.* " One clump only found on high knife-like ridge leading to summit of Mt. Gimie (3145 ft. alt.). Among undergrowth of aroids, large ferns, palms, etc., in wind-swept *Weinmannia-Freziera-Didymopanax* association in mossy forest in cloud-zone. Flowers conspicuously pinkish." Type in Herb. Mus. Brit.

The tall flowering stem, 1 cm. thick above the base, bearing a few successively smaller leaves below, rises from a short stout stem, which bears the radical leaves and a few short young leafy branches. Leaves papery when dry, with a prominent midrib, up to 2 dm. long including the petiole, by 2·2 cm. broad. Flowering apparently long-continued, the tall raceme, about 80-flowered, is still producing new flowers at the top ; the expanded flowers soon wither and develop fruit, the greater length of the inflorescence bearing ripening fruits above, and below open capsules extruding seeds or completely empty. Pedicels about 2 cm. long, stiff and ascending in fruit. Calyx-lobes 6 mm. long. Corolla about 2·5 mm. long ; the two anterior lobes more acute and longer than the three less deeply separated dorsal lobes. Anthers : 3 dorsal 5 mm., 2 ventral 4 mm. long. Fruit about 1 cm. in diameter ; seeds slightly rough from the very finely reticulated testa, 1·25 mm. long.

The species is a member of the Section *Tylomium* near *L. infesta* from St. Kitts, from which it differs in the obscurely bluntly denticulate leaf-margin, the bracts free from the pedicel, and the large pinkish not green flowers.

I am indebted to Lt.-Col. M. St. L. Simon for making the drawing.

ADDITIONAL NOTES ON THE GENUS *ARCTIUM*.

By A. H. Evans, Sc.D.

Since the publication of my two papers on the genus *Arctium* in this Journal (1913, 113 ; 1916, 145) it seems to have been generally accepted that there are only three species in Britain, excluding *A. tomentosum*, found as an alien in Gloucester Docks by Mr. Haines in 1918. But I have now to make two important announcements with regard to the nomenclature.

I had been in correspondence with Dr. Thellung, who had been specially working at the genus on the Continent, and very shortly before his death had sent him a large quantity of fresh specimens of *A. vulgare* in its different forms (termed A, B, C, D below, for convenience). He agreed with me that they should all be included in one species, despite their different appearance due to size, arachnoid heads, and so forth. Subsequently he

wrote that he had misinterpreted the figure of the Burdock in Hill's ' Vegetable System ' (iv. 28, figs. 1 *a*, *b*) when he referred it to *A. Lappa*. As this mistake caused him to use the later name *nemorosum* Lej. in preference to *vulgare* Hill, his admission leaves *vulgare* standing as the undoubted name of the middle-sized species of our three Burdocks.

Arctium Lappa presents no difficulty to the field-botanist who observes it in the young state and does not collect poor specimens. The bright green colour, round-ended leaf, and solid petiole always serve to distinguish it.

A. minus is also unmistakable if it be remembered that the small-headed green plant of dry soils becomes a much larger-headed and usually redder plant in woodlands. The phyllaries always close over the fruits when the plant is mature, even if they do not quite meet.

But *A. vulgare* is extraordinarily variable. It may be tall or short, green or red, but always has the mature fruits uncovered, as in *A. Lappa*, with spreading phyllaries.

Four main forms occur :—

(A) *Vulgare* proper, with stalks to the heads both above and below, generally very long. Plant usually reddish.

(B) Subvar. *pycnocephalum* with almost, but never absolutely, sessile heads. Colour variable.

(C) A short compact form, with small leaves and greyish green coloration, which I now name forma *viride*.

(D) Forma *subtomentosum* with densely arachnoid heads, otherwise resembling (C).

As to distribution :—

(A) which corresponds exactly with specimens of *intermedium* from Lange, occurs chiefly to the westward. It is common on the coasts of South Devon and up the west of Scotland to Arisaig, preferring a humid climate.

(B) is the prevailing form from Shetland to North Essex and Herts. It may be as tall as the type or quite short, and varies in colour from reddish to green. In an enclosure at Halidon Hill, Berwick, a large quantity of this form changed (without exception) into (A) one very wet summer.

(C) is quite plentiful in places, but is sporadic, with no special distribution.

(D) Forma *subtomentosum* Evans (*pubens* Bab. 1856, *cf.* Journ. Bot. 1913, 113), the counterpart of (C), with densely arachnoid heads, is only locally common, as near Wicken (Cambs) and in Anglesey.

All these forms keep constant, if undisturbed, but change under cultivation. Further information as to their precise distribution is still needed, but the species is usually rare in the Midlands.

SHORT NOTES.

CITATIONS MARKED WITH AN ASTERISK IN LINNÆUS'S 'SPECIES PLANTARUM.'—In reply to an enquiry by Mr. C. X. Furtado we have had occasion to investigate certain citations to which asterisks are appended in the 'Species Plantarum' of Linnæus. Since the significance of the asterisks does not appear to be generally known the matter seems to merit a short explanatory note.

In the preface to the first edition of the 'Species Plantarum' Linnæus has the following paragraph: "DESCRIPTIONES tantum in obscuris adhibere necessum fuit, easque sine ambagibus, ut obtinerem compendium tironibus gratum." In the second edition the same paragraph occurs, but with the addition of an asterisk after the word DESCRIPTIONES, indicating that this sentence explains the use of the asterisk in the text. One may suppose that this asterisk after DESCRIPTIONES was accidentally omitted in the first edition. The paragraph may be translated: "Only in doubtful cases was it necessary to cite descriptions, and those, straightforward ones, so that I might keep the handbook suitable for beginners."

Where Linnæus found it necessary to give a *description* (as distinguished from a *diagnosis* or sometimes a mere list of synonyms) in his earlier works (such as the 'Flora Zeylanica,' 'Hortus Cliffortianus,' and 'Hortus Upsaliensis') he usually indicated this by marking the corresponding citation in the 'Species Plantarum' with an asterisk. In the same way he occasionally appended an asterisk to citations of descriptions by other authors such as Guettard, Gronovius, C. Bauhin, and Tournefort.

Examples:—

L. Sp. Pl. p. 16. *Justicia echioides*—Fl. Zeyl. 21 *. [With description.]

L. Sp. Pl. p. 17. *Gratiola dubia*—Gron. Virg. 73 *. [With description.]

L. Sp. Pl. p. 32. *Valeriana montana*—Bauh. prodr. 87 *. [With description. Note that *Valeriana alpina prima, l. c.* p. 86, without description, is not marked with an asterisk in the 'Species Plantarum.']

L. Sp. Pl. p. 243. *Ammi glaucifolium*—Guett. stamp. 2, p. 433 *. [With description.]

L. Sp. Pl. p. 243. *Conium africanum*—Hort. Cliff. 92 *. [With description.]

L. Sp. Pl. p. 244. *Athamanta sibirica*—Hort. Ups. 60 *. [With description.]

T. A. SPRAGUE and A. W. EXELL.

OBITUARIES.

RICHARD FRANK RAND, M.D. (Edinb.), F.R.C.S. (1856–1937).

IN the late 'nineties a medical man home from South Africa called at the Museum with specimens from South Rhodesia, then botanically practically unknown, and with notes on his observations in the field. So began our acquaintance with Dr. Frank Rand, who, after a brilliant medical career as a student and a short professional period in the West Indies, where a severe attack of yellow fever left him with a chronic deafness, had settled in South Africa. He met Rhodes and fell under his spell, serving as medical officer in the famous pioneer column to Mashonaland in 1890, then as medical officer to the Chartered Company's Police, and later as the first hospital surgeon at Fort Salisbury. Malaria, its cause then unknown, was a terrible scourge among the early settlers, and Rand became known and loved for his successful treatment of the disease under appalling obstacles of absence of adequate hospital equipment and remedial drugs in the primitive conditions of the infant settlement.

During the Boer War and later in the Great War, when he served as Lt.-Col. S.A.M.C., his great experience of tropical diseases was an invaluable asset to the British forces.

The best years of his long life were devoted to Rhodesia, in practice at Salisbury and other places. Rand was a keen naturalist; botany was his great hobby, and in intervals snatched from his duties at home or on his visits through roadless country he studied and collected plants.

He was one of the earliest students of Rhodesian botany, and the packets he sent to the Museum from time to time yielded many novelties. These, with the notes of his observations, were published in the *Journal of Botany*. His "Wayfaring Notes," from Rhodesia and Johannesburg, which appeared at intervals from 1898 to 1912, and later in 1926, are most interesting reading—detailed observations on the relation of the plant to its environment, on its life-history, and especially on points of floral structure and dispersal of fruit or seed, are interspersed with suggestive remarks.

He spent his last years in England. London, he wrote, was no place for a pedestrian and septuagenarian; and he made his home finally at Brightlingsea in Essex, where he died very suddenly on January 3rd. He was born at Plaistow in Essex, October 12, 1856.

'The Times' of January 26 gave an appreciation of his great services to South Africa; he was offered a knighthood, but refused it on the plea of limited means. His friends knew him as kind and generous to a fault. His name is commemorated in

many of the new species he sent home from South Africa. He was elected F.L.S. in 1898, but resigned in 1915.

It may be useful to give a list of Rand's contributions to the Journal and of those bearing on his collections :—

" Wayfaring Notes in Rhodesia," 1898, pp. 141, 345 ; 1899, p. 204.

E. G. Baker. " Rhodesian Polypetalae," including Notes by Rand, 1899, p. 422.

S. Moore. " Dr. Rand's Rhodesian Labiatae and Scrophulariaceae," 1900, p. 463.

" Wayfaring Notes from the Transvaal (Johannesburg)," 1903, pp. 52, 194, 334 ; 1904, p. 21. With an Account of the Collections by S. Moore, 1904, pp. 131, 309, 398.

" Wayfaring Notes in Rhodesia," 1909, pp. 81, 130, with Notes on the Species by E. G. Baker and S. Moore ; 1911, p. 243 ; 1912, p. 58.

" Wayfaring Notes from Southern Rhodesia (Miami)," 1926, p. 227 ; p. 301, " Notes on Dr. R. F. Rand's Rhodesian Plants," by E. G. Baker, A. W. Exell, and S. Moore.

A. B. RENDLE.

FREDERICK VERNON COVILLE

(1867–1937).

WE note with regret the death of two well-known American botanists. Dr. Frederick V. Coville was Principal Botanist, Bureau of Plant Industry, Washington, and Honorary Curator of the National Herbarium. His official work was economic, but as the National Herbarium was formerly under the Department of Agriculture, he retained interest in it as Honorary Curator after its transfer to the Smithsonian Institute forty years ago. Dr. Maxon, who as Associate Curator has been for twenty-five years in actual administrative charge of the herbarium and a colleague for nearly forty years, speaks highly of his interest in the development of the herbarium and his helpful advice and direction in matters of policy. Though Dr. Coville's work has in later years been on the economic side, such as experiments with blue-berries and other acid-soil plants, his earlier work was taxonomic. 'The Botany of the Death Valley Expedition' (Contrib. U.S. Nat. Herb., 1893) was an account of an exploration of a remarkable xerophytic area ; he retained his interest in it, and as recently as last year published a note on a remarkable endemic genus (see this Journal, 1936, 248). He also monographed the Grossulariaceae for the 'North American Flora' (xxii. pt. 3, 1908). An account of Thomas Nuttall's botanical explorations in California (Proc. Biol. Soc. Washington, 1899) and of the Desert Botanical Laboratory of the Carnegie Institution (Carnegie Inst. Publ. 1903) were of general interest. Dr. Maxon, who writes feelingly of a period of close and friendly association for thirty-eight years, says " he was many-sided : apart from botany he was keenly interested in art, literature, and geographic exploration, and was, moreover, a sound business man of proven ability." He would have been 70 years old in March, and was then due to retire from Government service.—A. B. RENDLE.

MARSHALL AVERY HOWE

(1867–1936).

Two rather widely separated groups of botanists will be sorry to hear of the death of Dr. M. A. Howe on December 24th, 1936 ; he was born June 6, 1867. As Director of the New York Botanical Garden he has fame as a horticulturist : phycologists know him as one of the most exact and scholarly workers in their field. He also made valuable contributions to bryological literature, particularly concerning hepatics.

This is not the place to attempt any detailed consideration of his life and work ; nor, indeed, am I qualified to make it. That may be expected in periodicals with which he was intimately associated, such as the 'Bulletin of the Torrey Botanical Club' and 'Brittonia.' My knowledge of him is simply as a correspondent and through his work. Therein is a precision which may justly be called beautiful. He touched nothing which he did not, in some way, leave clearer than it was when he found it. A classic example is to be seen in his elucidation of the " species " in *Galaxaura* due to sexual dimorphism.

His work on the algæ of coral-reefs is, perhaps, his most outstanding memorial. He contributed the algal parts of the Floras of Bermuda and of the Bahamas. In distributing illustrative material he was most generous, as the algal collections of the British Museum will show. As a botanist he would, I think, desire no better epitaph than this : " He verified his references."—G. TANDY.

REVIEWS.

Growth Hormones in Plants. By P. BOYSEN JENSEN. Translated by G. S. AVERY and P. R. BURKHOLDER. 8vo, pp. xiv, 268, 64 text-figs. McGraw-Hill Publishing Company, Ltd. : London, 1936. Price 21*s*.

THAT the elongation and curvature of plant organs is controlled, not by some mysterious interaction between the cells but by the diffusion of a comparatively simple substance as it travels from one part of the plant to another, is one of the most striking

discoveries of plant physiology of recent years—one, moreover, worthy to be ranked with that of the secretion of the ductless glands of animals. English readers will therefore welcome the present book, which is based on the recent German work 'Die Wuchsstofftheorie und ihre Bedeutung für die Analyse des Wachstums und der Wachstums-bewegungen der Pflanzen' (Theories of Growth Substances and their Significance for the Analysis of Growth and Growth-Movements of Plants) by Professor Boysen Jensen of the University of Copenhagen. The work has been revised in various ways, as by the rearrangement, amplification, and condensation of some of the material of the German edition, by the introduction of new figures, and by the addition of an index; also by a summary to each chapter and 200 new citations of literature so as to bring the bibliography up to the end of 1935. Supplementing this main bibliography, which contains over 500 references, there is a list of literature pertaining to other hormones and similar substances affecting plant-growth.

It is in every way appropriate that Professor Boysen Jensen should be responsible for a book giving a full review of the literature dealing with the rôle of growth hormones in plants. He it was in 1911 who was the first to show that a decapitated coleoptile of the oat would respond normally to unilateral light when the tip was replaced and illuminated. This inevitably suggested the diffusion of some substance from the apex which controlled the growth and curvature. Proof came in 1928, when F. C. Went showed that a small block of agar would act on coleoptiles in the same way as the tip itself, if such blocks have been in contact for an hour or two with the cut surface of such tips. Evidently the agar now contained a growth-promoting substance which had diffused from the tips. The next major step was the isolation, from various plant materials and from urine, of plant hormones in such quantities that their chemical nature could be determined; this we owe to Kogl and his school from 1932 onwards. The substances are of such potency that 1 milligram of auxin is sufficient to bring about a curvature of 10 degrees in 50,000,000 decapitated oat coleoptiles.

It is a pity to note mistakes of language and clumsy expressions. One meets again the error that the financier's work "hypothecate" (*i. e.*, to mortgage) has something to do with an hypothesis, and also such ugly or clumsy expressions as "clinostated," "cause for," "evidence to prove the theoretical views which we now possess." These are, however, but blemishes. In translating and revising the book the authors say in the preface that it is their hope "to stimulate sound progress in this important new field of plant physiology." This hope is assuredly justified.—V. H. B.

Der Wasserhaushault der Alpenpflanzen. By ULRICH BERGER-LANDEFELDT. *Bibliotheca Botanica*, Heft 115. 4to, pp. 81, 44 text-figs. and diagrams. E. Schweizerbart'sche Vertagsbuchhandlung: Stuttgart, 1936. Price R.M. 27.

THIS study of the water-relations of some twenty species of alpine plants is chiefly of interest from the fact that the water-relations of the different species were all studied from a number of different methods of approach. In most instances data are furnished with respect to the transpiration per unit area of leaf surface by loss of weight immediately after detachment from the plant. Other data obtained were in respect to fresh weight and dry weight; osmotic pressure of the cell sap; also the ratios between transpiration and water-content, between transpiration and both fresh weight and dry weight, as well as determinations of the water-content per unit area and of relative transpiration.

The number of species from each type of habitat are in all environments too few to justify conclusions as to their characteristic features, but, in so far as the method of experimentation can be relied upon for comparative studies, the results are of considerable interest as showing a marked degree of divergence in respect to the daily march of transpiration which is represented graphically in the text-figures.

Some species, notably those of the Schneetalchen such as *Salix herbacea* and *Soldanella pusilla*, show a steady rise in the rate of water loss per unit of surface which attains a maximum about 1 P.M.; this is followed by a fall, and a second but slight rise again about 4 P.M. In two of the trees of the timber limit which were investigated, namely *Pinus Cembra* and *Pinus montana*, the course of transpiration is a steady morning rise to a mid-day maximum followed by a steady fall. Other species, however, notably *Geum montanum*, *Silene vulgaris* var. *alpina*, *Lunaria alpina*, and *Arabis alpina* show a fore-noon maximum and an afternoon maximum also, with a period of low transpiration rate of varying duration at mid-day which in *Arabis alpina*, however, appears to last some two and a half hours. The diurnal transpiration curves for the Pines are alike in form both in the sun and in the shade; but whereas *Picea excelsa* and *Larix europaea* when growing in the shade show a similar steady rise and fall, when growing in the sun the course of the transpiration change in these two species is almost reversed, showing a marked mid-day depression. One cannot but regret that the course of the transpiration for the different species rests in most examples on determinations for but a single day, so that differences as between one day and another or between one part of the year and another may occur as striking as those which the author finds between the sun and shade specimens of *Picea* and *Larix*.

The range of osmotic pressure observed in the species investigated was considerable, being lowest in *Sempervivum montanum* (7 atms.) and *Saxifraga Aizoon* (9·5). Most species had osmotic pressures ranging from between 10 atmospheres (*Arabis alpina*) and 17 atmospheres (*Salix herbacea*), whilst the Gymnosperms showed a range from 18·5 to 22 atmospheres.

Perusal of the data respecting the herbaceous plants as a whole reveals a positive correlation between the osmotic pressure and transpiration, both average and extreme, and less marked with respect to relative transpiration. There appears to be some correlation between stomatal aperture and transpiration loss.

The actual average rates of transpiration ranged from as little as 3·3 milligrams per sq. dm. per min. shown by *Larix* to nearly 28 milligrams shown by *Papaver aurantiacum*; whilst maximum values are recorded for *Silene vulgaris* var. *alpina* and *Thlaspi rotundifolia* of 53 milligrams and 40 milligrams respectively.

The impression left on the mind from a perusal of these data is that the ecological and physiological characters studied are probably more individual than communal, but the extensive rather than intensive method of approach renders any suggestion on this point necessarily tentative.

Only with respect to osmotic pressure is there any rough correlation between the physiological features studied and the habitat groups. These latter in the order Rock plants (4 spp.), Schneetalchen plants (3 spp.), Matt plants (2 spp.), Scree plants (3 spp.), and trees (4 spp.) do show increasing concentration of the cell sap. The author stresses the importance of the entire complex of transpiration water-content and osmotic conditions in the plant and recognizes two categories characterized respectively by relatively slight and marked fluctuations of the water-content and the osmotic pressure of the cell sap. The former group exhibits appreciable transpirational control, and this may manifest itself in a bimodal curve.—E. J. S.

British Trees and Shrubs. By H. GILBERT-CARTER, M.A. Sm. 8vo, pp. xv, 291. Clarendon Press: Oxford, 1936. Price 12*s.* 6*d.*

THIS is a concise descriptive account of British trees and shrubs, including those commonly planted, providing "a systematic introduction to our Conifers and woody Dicotyledons." The author records his indebtedness to Dr. Rehder's classical 'Manual of Cultivated Trees and Shrubs'; his own book is of the nature of an elementary work suited to the needs of the British student. Incidentally, it aims to illustrate Engler's system of taxonomy, which the author still believes to be the best system yet devised. He holds no brief for the so-called phylogenetic systems, which he rightly suggests may be multiplied

indefinitely; one may almost say "quot homines tot sententiae." He also uses the recent exhumation of the binominal *Quercus petraea*, which by the Rules displaces the well-known *Q. sessiliflora*, as a plea for a list of *nomina conservanda*. To effect this the workers interested should combine to produce a moderate and convincing list, and ensure sufficient representation at Botanical Congresses to defeat academic opposition. The author's remark that "America is as faithful to Engler's system as she is to the International Rules of Nomenclature" is presumably commendatory. If so, it lacks historical basis. Mr. Gilbert-Carter is not old enough to remember Vienna, the classic battle-ground between the "Orthodox" and Neo-American systems: his knowledge perhaps dates from 1930, when differences were finally settled at Cambridge. He is uncertain in his use of a capital initial for the specific epithet: he writes *Cinnamomum Camphora*, *Juniperus Sabina*, *Ilex Aquifolium*, but *Quercus ilex*, *Clematis vitalba*, and *Erica tetralix*.

These are, however, minor criticisms; the object of the book, to distinguish the plants by curt diagnoses, is well achieved, and it will usefully fill a gap in taxonomic literature. The systematy of the major divisions is briefly discussed, and concise descriptions, with keys where these are necessary, are given of the orders and families, and keys to the genera under the families. The etymology of generic names and specific epithets and their pronunciation are indicated in foot-notes. Quotations from the classics suggest the origin and antiquity of the names of some of the commoner species.

The text is well arranged and the book is light and of handy size.—A. B. R.

BRITISH COMMONWEALTH SCIENTIFIC CONFERENCE, LONDON, 1936.—The 'Report of Proceedings' has been published and is obtainable from H.M. Stationery Office, price 1*s.* 3*d.* The Conference discussed the work of the eight bureaux of Agriculture and of the bureaux of Entomology and Mycology. Suggestions were made for the wider appreciation of their work and the extension of their usefulness. The formation of a Forestry bureau was also suggested. The various bureaux function for the interchange of information between research workers in the various parts of the Commonwealth, and especially for the supply of reports of work in the different branches.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—The General Meeting on February 4, the President, Dr. W. T. Calman, C.B., F.R.S., in the Chair, was devoted to a series of Exhibits which had been

arranged in the Library. At the opening of the meeting it was announced that his Majesty King George VI. was pleased to continue the patronage of the Society vouchsafed by his Royal predecessors. Notes on some of the exhibits were given, and the Fellows then proceeded to the Library to inspect them. Those of botanical interest included exhibits from the Department of Botany, British Museum—type-slides of Diatoms, remarkable examples of selection and mounting (Mr. R. Ross), and Antarctic Lichens, from the South Shetlands, collected on the ' Discovery ' Expedition, 1934–5, interesting from their marked fruticulose habit (Mr. I. M. Lamb). The Director of the Royal Gardens, Kew, showed specimens of *Begonia* illustrating the effects of neon light exposure in increasing the size of the flowers; and from Kew also came an interesting series of Asiatic Gentians showing remarkable variety in size and habit (Mr. C. V. B. Marquand), specimens from a large collection of Mexican plants, some of which elucidated the little-known species of Sessé and Mociño (Mr. A. A. Bullock) and a brilliant collection of South African " Everlastings " (Dr. J. Hutchinson). Dr. E. J. Collins showed crocuses in flower, including some collected by Mr. Edward K. Balls in Asia Minor; Capt. George Sherriff a beautiful series of celluloid transparencies, coloured photographs of Tibetan plants, including new species of *Meconopsis* and *Primula*; and Mr. W. T. Stearn some toys made from wood of *Magnolia hypoleuca*. An interesting exhibit by Mr. S. Savage was a rediscovered portion of Johann Anders Murray's herbarium, presumably a remnant of a collection presented by Mr. Hibbert in 1818, which was sold at the disposal of the Society's general collections in 1868; and a translation of Linnæus's recipe for the glue used for his herbarium specimens, found in an autograph note in his interleaved copy of the ' Philosophia Botanica.' A book entitled ' Metamorphoses,' shown by Miss P. M. Taylor, was a clever series of caricatures of microscopic subjects by the late Dr. Marianne van Herwerden, cytologist and geneticist.

' Boissiera ' (' Mémoires du Conservatoire de Botanique et de l'Institut de Botanique systématique de l'Université de Genève ').—This new publication is devised as a Supplement to ' Candollea,' the official organ of the Conservatoire and Botanic Garden of Geneva, for the reissue of memoirs associated in some way with the Conservatoire that have appeared in publications not exclusively botanical. The Director, Dr. B. P. G. Hochreutiner, is the editor. Fascicles will appear at irregular intervals and in varied format under this title, which will recall the author of the ' Flora Orientalis ' as ' Candollea ' recalls the name of the authors of the ' Prodromus.' Fascicle 1 is appropriately devoted to a posthumous memoir by Dr. J. Briquet, " Les caractères de la dissymétrie et de l'hétérophyllie foliolaires chez les Méliacées

à feuilles composées," reprinted from the ' Mémoires de l'Institut National Genevois,' xxiv. (1935).

Prof. Hochreutiner also announces the publication, under his direction, of a photographic reimpression of Vol. I. of Edmund Boissier's ' Flora Orientalis.' The work has been done under the auspices of M. William Barbey-Boissier's children and the Institute of Systematic Botany of the Geneva University. This volume is wanting in many libraries, as when published in 1867 a much smaller number was printed than of the subsequent five volumes. The volume, which contains 1051 pages, with preface and index, may be obtained from the above-named Institute, price 26 Swiss francs.

' Blumea.'—Vol. ii. no. 3 (Dec. 1936) contains a revision of the Umbelliferae of the Netherlands Indies, including those of the Malay Peninsula, Borneo, and New Guinea, by P. Buwalda. Delimitation and arrangement of genera follow Drude's system in the ' Pflanzenfamilien.' An artificial key to the genera is given, the species are described in detail with relevant synonymy, and citations are given of the large number of specimens which the author has studied in the principal herbaria. Of the 83 species belonging to 22 genera, 8 genera with 25 species are indigenous. These fall into three groups: (1) *Hydrocotyle* and *Centella*, a widely spread group occurring at low and high elevations; (2) genera of Asiatic origin, chiefly mountain plants of the western Malay Archipelago, viz., *Sanicula*, *Pimpinella*, *Heracleum*, and *Oenanthe*; (3) *Oreomyrrhis* and *Trachymene*, with their centre of development in Australia, but spreading far northwards; they are mountain plants chiefly of the eastern parts of the Archipelago. There are some new species, and also new combinations. The best represented genus is *Trachymene*, with fourteen species. The American *Eryngium foetidum* has become completely naturalized. Eva Beer and H. J. Lam give a list of the Verbenaceae of Mr. Brass's recent New Guinea collection, including two new species of *Clerodendron* and a new *Premna*. J. Th. Kester gives a short account of the history and contents of the extensive Weber-van Bosse Herbarium of Algae.

Revision of Asiatic Roses.—G. A. Boulenger (Bull. Jard. Bot. de l'État, Bruxelles, xiv. fasc. 2) has completed his monographic revision of the Asiatic species of *Rosa*. The fourth and final instalment contains the completion of the *Eglanteriae*, the *Chinenses*, *Bracteatae*, *Banksianae*, and *Microphyllae*. In all he recognises 94 species in Asia, 15 of which occur in other parts of the World, which with ten species in Europe (including north-west Africa), gives a total of 104 for the Old World. There are 18 species exclusively American according to Mrs. Erlanson, with whose conception of species the author agrees. This sum

total of 122 known species contrasts widely with the several hundreds admitted by some authors.

The genus is a circumpolar group of arctic origin ; the species are more numerous in temperate regions, a small number only having passed into the tropics. The polyploid species are the most primitive, and are represented in only one of the seven sections into which the genus is divided, the *Eglanteriae*, which the author places at the base of his classification as the most generalised, representing the lowest grade of evolution in its morphological characters and occupying the most northern geographic area.

THE genus *Washingtonia* is the subject of L. H. Bailey's 'Gentes Herbarum,' iv. fasc. ii. (Dec. 1936). The author gives the result of many years' study of the species of this palm in cultivation and in the wild in California, Arizona, and Mexico. They are among the most widely planted of palms, and as the botanical names were first applied to plants of unknown nativity in cultivation there is no type-locality for the species, five of which have been proposed with differences not clearly defined. Prof. Bailey recognizes two species only, the grey-green *W. filifera* of California and Arizona, and the brilliant-leaved *W. robusta* of Southern California and Mexico. The study is illustrated by beautiful photographs, showing the remarkable statuesque habit of the palm due to the persistence of the dead leaves, which in nature envelop the trunk to the base, forming a stout column bearing aloft the crown of pinnate leaves.

'JOURNAL OF THE INDIAN BOTANICAL SOCIETY.'—In the October number B. Sahni summarizes the palæobotanical evidence for Wegener's theory of continental drift with special reference to India and adjoining countries. The two contemporaneous but very unlike floras, the *Glossopteris* flora of Indo-Australia, and the *Gigantopteris* flora of Sino-Sumatra now lie dovetailed with each other, but the former is regarded as having been evolved in a temperate climate just emerged from glaciation, the latter in a warmer climate analogous to that of the European coal measures. Hence it is suggested that the two provinces originally lay far apart, north and south of the Tethys sea, and have since drifted towards each other.

MISS M. S. CAMPBELL, c/o Dept. of Botany, British Museum (Natural History), Cromwell Road, London, S.W. 7, is collecting all data relating to the flora of the Outer Hebrides. She would be glad to receive any information on the subject, particularly with reference to publications (excluding the 'Journal of Botany,' 'Annals of Scottish Natural History,' and the B.E.C. Reports), collections (other than those in the National Herbaria), and personal records and notes.

THE ALGAL VEGETATION OF A CAVE.

BY V. M. GRUBB, D.Sc., F.L.S., AND
M. T. MARTIN, M.Sc.
(Botanical Department, Westfield College, Hampstead, N.W.).

THE VEGETATION OF A CAVE.

Since little is known of the algal vegetation of caves, the opportunity was taken of studying a deep cave during a visit to Lough Ine, Co. Cork. The account given here refers to the spring flora found in April 1936 ; it is therefore not exhaustive, but is an indication of the interesting succession of plants which may be found in such situations.

The cave, which is on the south-west face of Bullock Island, near Lough Ine (see map, Renouf, 1931), is about 300 feet deep. At low-water spring tide the entrance is about 22 feet high and 15 feet wide ; there is little diminution in height throughout, though the cave gradually narrows towards the far end. Even at extreme low water the floor is never uncovered, with the exception of the far end. The carboniferous slates making up the walls and roof are tilted almost perpendicularly, forming continuous ledges as well as sheer vertical faces. On Cotton's definition (1912) this cave would be classed as semi-exposed. It opens on to the sea at a point where the currents of Barloge Creek meet those of the Atlantic ; consequently the water surging into the cave is subject to a very heavy swell, and the vegetation consists both of the encrusting species characteristic of an exposed cave and the rich growth of red algæ found in more sheltered positions.

Some collections from this cave have been made by Rees (1935), who states that no algæ are found at the far end, but that the first representative is *Plumaria elegans*, which occurs 36 feet from the entrance. However, in scrapings taken at intervals from the rocks on the north side, we found the first vegetation at 92 feet from the entrance, and this consisted of the calcareous *Lithophyllum incrustans* together with minute plants of *Ptilothamnion lucifugum* and sporelings of *Phyllophora epiphylla* less than 5 mm. in height. These three species grew together in small cracks and crevices in the rock. Five feet nearer the entrance small plants of *Plumaria elegans*, ·5–1 cm. in height, were found.

A sample taken at 75 feet from the mouth of the cave showed an increase in the number of species. Red and green stains on the slate of the vertical rock-face in this region were found to be *Hildenbrandia prototypus* and *Protoderma marina*. At the time when these records were made (bright sunlight at midday) the intensity of the light reaching this vertical face was less

than 0·03 per cent. of the total daylight. On a horizontal ledge in the same region, this had increased to 0·06 per cent. of total daylight, and here, in addition to rather larger specimens of the species found at 92 feet, there were also *Cladophora rupestris*, *Ulothrix flacca*, *Ectocarpus confervoides* with plurilocular sporangia, several species of Diatoms, and *Halosphaera viridis* and *Oscillatoria* sp. growing among the creeping bases of the *Ptilothamnion*.

Ten feet nearer the entrance, though measurements of the light intensity showed no appreciable increase, two new encrusting species were found on horizontal ledges—*Cruoriopsis Hauckii*, bearing tetraspores, and a more delicate form with radiating rows of cells which closely resembled *Erythrodermis Alleni*. The filamentous forms such as *Ptilothamnion* and *Plumaria* were well grown here and formed a dense matted turf over the surface.

The intensity of light received on the north wall at 50 feet from the mouth of the cave was rather less than before, since a ledge of rock jutted out and shaded this region. The composition of the vegetation showed no change apart from the addition of *Membranoptera alata*.

An increase to 1·4 per cent. of the total daylight was noted at 35 feet from the entrance. Here there was a marked increase in the variety and size of the flora, particularly in the lower littoral region. On the vertical rock-faces extending from high-water mark to mid-tide level, only encrusting forms were found, *e. g.*:—

Hildenbrandia prototypus.
Cruoriopsis Hauckii.
Lithophyllum incrustans.

On shelves and ledges from mid-tide level to low-water mark there grew a thick felt of algæ consisting of:—

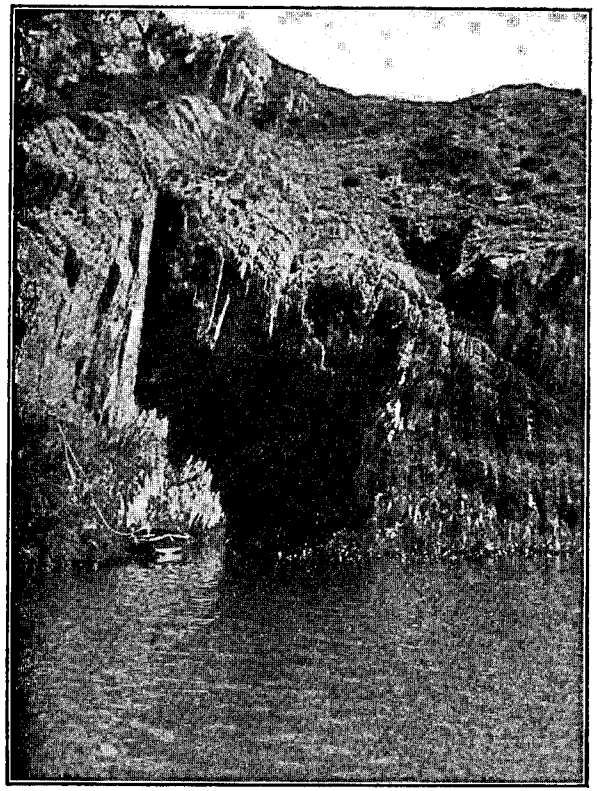
Cladophora rupestris.
Ulva Lactuca.
Ectocarpus confervoides.
E. Hincksiae (pluriloc. sporangia).
E. tomentosus (pluriloc. sporangia).
Phyllophora epiphylla.
Melobesia farinosa (tetrasporic and epiphytic on *Phyllophora*).
Lomentaria articulata.
Membranoptera alata.
Erythrodermis Alleni.

Plumaria elegans was well grown and tetrasporic, while *Ptilothamnion* was only found creeping as a minute form on small shells and round the bases of other algæ.

The light intensity at 25 feet from the cave-mouth had increased to 3·3 per cent. of total daylight. The disappearance of *Lithophyllum incrustans* was noted here and the appearance in the upper part of the littoral region of a marine lichen *Arthopyrenia halodytes* bearing both perithecia and spermogonia.

Ptilothamnion had also almost disappeared, though the creeping bases were still found growing epiphytically on plants of *Corallina officinalis*. In addition the following occurred from mid- to low-tide level:—

Sphacelaria cirrhosa.
Ceramium rubrum.
Callithamnion Hookeri (cystocarpic and tetrasporic, growing on limpets).
Rhodochorton sp. (sterile).
Catenella repens.
Phycodrys rubens.
Phyllophora membranifolia.
Polysiphonia fibrata.
Lyngbya sp.



The entrance to the cave on Bullock Island, Lough Ine.

The light received in the shade at the mouth of the cave was still only 8·4 per cent. of the total daylight, but a large assortment of littoral forms showing a marked zonation was found here. Vegetation grew up to 12 feet above low-water spring tide,

and consisted towards the upper limits of patches of *Lichina pygmaea* about two feet in diameter growing on the vertical surface of the rock. Mixed with these were small plants of *Pelvetia canaliculata* (sterile). The next two feet below this were covered with clumps of *Fucus serratus* and *F. ceranoides*; both were fertile, and *Polysiphonia fastigiata* bearing spermatia was found growing on the *Fucus serratus*. These were followed by about four feet of bare rock with no algæ growing on the surface and only a few in occasional crevices. The red algal zone occupied the last three feet above low-water spring tide, the algæ growing both on the vertical face and filling any small creeks and pools. In addition to the algæ mentioned in the last list, the following were also found :—

Cladophora trichocoma.
Dictyota dichotoma.
Laurencia pinnatifida.
Lomentaria articulata.
Chondrus crispus.
Porphyra umbilicalis.
Callophyllis laciniata.
Ceramium acanthonotum.
Rhodymenia palmata.
Callithamnion tetricum.
Polyneura Hilliae.
Membranoptera alata.
Polysiphonia urceolata.
Cryptopleura ramosum.
Rhodymenia palmetta.
Gelidium corneum var. *pinnatum.*
Phyllophora Brodiaei.

The following grew at and below low-water spring tide :—

Laminaria digitata.
L. Cloustoni.
Sacchoriza bulbosa.
Himanthalia lorea.

Together with many of the red algæ listed above. The encrusting *Petrocelis cruenta* and *Ralfsia verrucosa* were also found here.

One of the most striking facts brought out by the study of a cave of this type is the large number of algal species which are capable of growth in a region where the light intensity is very low. Although it was only possible to make records during a number of days of brilliant sunshine in early April, yet even these are sufficient to show that at least 14 species of algæ can grow in a position where at midday in spring they only receive 0·06 per cent. of the total daylight. It is not surprising that the majority of these species belong to the Rhodophyceae, since members of this group are known to occur at considerable depths where they can receive but little light.

Most of the algæ found within the cave grew more luxuriantly and became fertile nearer the mouth. *Ptilothamnion lucifugum*, however, is in a different category. This species is only known from within caves (Cotton, 1912, p. 139), and unlike most shade-loving red algæ has never been found in the pools of more exposed positions nor beneath the shelter of larger algæ. The problem of the distribution of *Ptilothamnion* and the connection between this and the intensity and duration of the light is worthy

of further investigation, since, in the Bullock Island cave, plants of this species increased in size and luxuriance up to about 50 feet from the mouth and then gradually became smaller and more scanty, disappearing entirely before the entrance was reached.

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Riggs, T. K. 1935. "The Marine Algæ of Lough Ine." 'Journal of Ecology,' xxiii. 69–133.
Renouf, L. 1931. "Preliminary Work of a new Biological Station" (Lough Ine, Co. Cork, I.F.S.). 'Journal of Ecology,' xix. 410–438.

CORTIA HOOKERI C. B. Clarke.

By C. Norman, F.L.S.

The genus *Cortia* was based by de Candolle on a Wallich plant from Nepal (*Schultzia ? Lindlei* Wall. Cat. 589) and named by him *Cortia Lindleii* (DC. Prodr. iv. 187; 1830). But Don had already named this plant *Athamanta depressa* (Don, Prodr. 184; 1825). This point is considered below at the conclusion of this paper.

Clarke, in the 'Flora of British India' (iii. 701), retained de Candolle's species (and name) and added a second—*Cortia Hookeri*—based on plants collected by J. D. Hooker in Sikkim. This has long been recognized as unsatisfactory, and investigation proves it to consist of two distinct plants. Clarke himself evidently half realized this, and he correctly noted the points of difference, the most important of which lies in the fruit. The differences here are really important, but Clarke was misled (if I rightly understand him) by supposing that both fruits could be found growing on one plant. This is not so, and indeed could not be so without violating the whole conception of the classification of the Umbelliferae by their fruits.

Apart from their fruit characters the plants are not always easy to distinguish, and Hooker himself failed to distinguish them, for he mounted both on the same sheets in his herbarium. Both are cushion plants with pubescent rays and dense crowded sessile umbels, and, though normally differing widely in leaf-characters, this is not always the case, since the leaves are somewhat variable.

Unfortunately neither plant in my opinion can be rightly assigned to the genus *Cortia*. It is hoped that the figures of the fruits will make this clear.

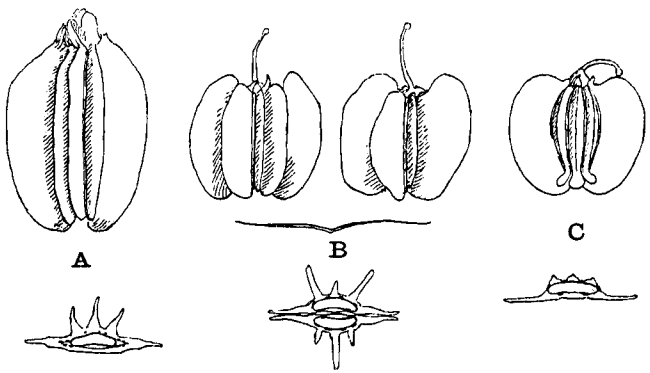
For the plant with the many winged fruits it seems to be necessary to institute a new genus—*Cortiella*,—since I know no European or Asiatic genus to which it can be referred. The

second plant may, I think, fitly be referred to *Selinum*. The fruit is much like that of the European *S. pyrenaeum* Gouan, and the leaves are of the *Selinum* type.

Full accounts of the plants concerned, and some remarks on the synonymy of *Cortia Lindleii* DC. and on the second species of *Cortiella*, are given below.

CORTIELLA, gen. nov.

Calycis dentes anguste lineares acutæ, mox deciduæ. Petala ovata integra vel minute emarginata. Fructus albidus glaber subquadratus, basi cordatus, inæqualiter late 5-alatus. Mericarpia a dorso compressa, jugis lateralibus semper alatis, jugis dorsalibus, alteri mericarpii 2 (exterioribus), alteri 1 (centrali), valde alatis. Semen subplanum.



A, carpel of *Cortia depressa* (Don) Norman (*C. Lindleii* DC.); B, fruit of *Cortiella Hookeri* Norman, showing the two faces; C, carpel of *Selinum cortioides* Norman. (All ×3.)

Herba perennis minute puberula acaulis cæspitosa. Folia oblonga bipinnatisecta. Umbella composita, in summo plantæ sessilis, multiradiata. Bracteæ involucri longæ pinnatisectæ, involucelli similes, sed pro rata minores.

Species one or two in the Eastern Himalayas and Tibet.

The affinities of this genus are perhaps with *Cnidium* in the Apioideae–Acumineae–Seselinae *Drude*.

Cortiella Hookeri (C. B. Clarke), comb. nov. *Cortia Hookeri* C. B. Clarke in Flor. Brit. Ind. ii. 702 (1879), *pro parte*.

A cæspitose perennial with leaves about 7 cm. long, oblong in outline; pinnæ about ·5–1 cm. long, pinnatisect, ultimate segments narrow, linear acute, varying in length. Main umbel sessile, much congested, and sometimes surrounded by small secondary (lateral ?) umbels on long peduncles with 4–6 short rays bearing fertile flowers. On these secondary umbels the involucral

bracts of both kinds can be seen—they are usually invisible on the main umbel. Fruit about 5 by 4 mm., white, the wings of the dorsal ribs slightly narrower than those of the lateral. Styles very long. The fruit, with two dorsal ribs winged on one carpel and only one winged on the other, is, I believe, unique in Asiatic Umbellifers.

Hab. SIKKIM: Jongri, 13,000 ft., *J. D. Hooker* (type in Herb. Kew.); Momay, 14,000–18,000 ft., *J. D. Hooker*. TIBET: Phari, *King*; *Dungboo*; Nain La, *Kingdon Ward* 6000 ft., near Naka La, *Younghusband* 175: all in Herb. Kew; Sauga Choling, *Kingdon Ward*, 11,849, Herb. Mus. Brit.

In addition to the localities cited above, there are sheets in the Kew Herbarium on which Hooker has mixed not only the plants (*Cortiella Hookeri* and *Selinum cortioides*), but also the localities. The localities on these sheets are the following: Naukota, 14,000 ft.; Lama Kongra, 14,000 ft.; Dongkiah Pass, 18,000 ft.; Samdong, 16,000 ft., and the Kinchin Jhao Glacier, all in Sikkim. It is impossible now to say with certainty which locality refers to which species. All were collected by J. D. Hooker.

2. **Cortiella Hedinii** (Diels), comb. nov. *Pleurospermum Hedinii* Diels in Sven Hedin, 'Southern Tibet,' 52, tab. vi. figs. 5–6 (1922).

Differs from the preceding only by the coarser leaves and obtuse segments. Whether it is really distinct from *C. Hookeri* I am not certain, but think it desirable to consider it so for the present.

Hab. Tibet (Eastern), Camp XLIV., *Sven Hedin*, s.n. (Herb. Borol.); Tibet (Northern), Camp XXVI., *Sven Hedin*, s.n. (Herb. Borol.); Amne Matchin Mts., Koko Nor, *Hao* 1144 (Herb. Mus. Brit.).

Selinum cortioides, sp. nov. *Cortia Hookeri* C. B. Clarke, *loc. cit.*, pro parte.

Herba perennis cæspitosa acaulis. *Folia* ambitu oblonga cum petiolo 8 cm. longa, 2 cm. lata, 4-jugata pinnatisecta, pinnis ±1·5 cm. longis, segmentis ultimis anguste linearibus acutis ±5 mm. longis. *Umbella* magna in summo plantæ sessilis, radiis numerosis crassis puberulis quam folia plerumque brevioribus. *Involucri bracteæ* 0, involucelli anguste lineares acutæ. *Fructus* suborbicularis basi profunde cordatus; mericarpia a dorso compressa, jugis dorsalibus elevatis *imo basi tantum* tubulatis (eis *Selini pyrenaei* Gouan similibus), juga lateralia late alata; commissura plana neque concava. Styli longissimi.

Though occasionally somewhat alike, this can nearly always be distinguished from *Cortiella Hookeri* by its much longer leaf-segments if fruit is wanting. The abortive wings at the base of the carpels show a good deal of variation and are sometimes absent or nearly so. Since reference has been made to the similarity of the fruit of this species to that of *Selinum pyrenaeum*

Gouan, it is perhaps proper to add that some authors refer the latter to Angelica—a view with which I cannot agree.

Hab. SIKKIM: Phalloot, 13,000 ft., *S. Kurz*, s.n. (type in Herb. Kew.); Yakla, 18,000 ft., *C. B. Clarke* 9911 (Herb. Kew.).

Apparently confined to Sikkim.

The remarks as to the mixed sheets in connection with *Cortiella Hookeri*, of course, apply here. Especial attention may be called to the sheet from Kinchin Jhao Glacier, which contains five good specimens of *Selinum Cortioides*.

Cortia depressa (Don), comb. nov. *Athamanta depressa* Don, Prodr. 184 (1825). *Cortia Lindleii* DC. Prodr. iv. 187 (1830). *Schultzia ? Lindlei* Wall. Cat. 589. *Cortia nepalensis* Norman, in Journ. Bot. lxvii. 245 (1929).

In identifying *Athamanta depressa* Don with *Cortia Lindleii* DC., I am relying on a sheet in the Wallich Herbarium written up in what I believe with reasonable certainty to be Don's handwriting. This was evidently C. B. Clarke's opinion too, for he cited *Athamanta depressa* Don as a synonym of *Cortia Lindleii* DC. in the 'Flora of British India.'

In connection with Wallich's name *Schultzia ? Lindlei* it is interesting to find that in his herbarium one of the sheets contains a species of *Schultzia*, in addition to several specimens of *Cortia depressa*, all from Kumaon. It is proposed to return to the discussion of this plant in a later paper.

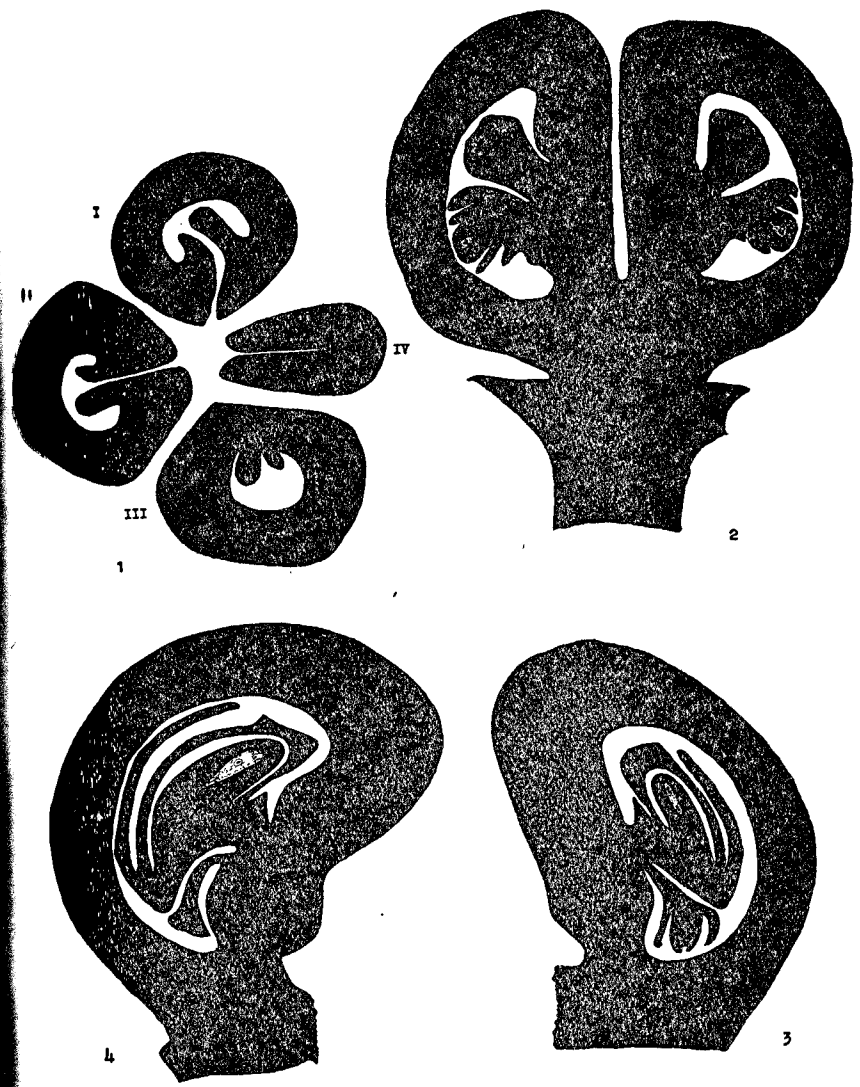
EVIDENCE FOR REDUCTION IN THE NUMBER OF CARPELS AND OVULES IN THE MENISPERMACEAE.

BY A. C. JOSHI, M.Sc.

IT is generally believed that the presence of a large number of carpels in a flower and many ovules in a carpel are primitive features in the angiosperms, and the smaller number of carpels and ovules are results of reduction. These beliefs, however, have been recently challenged by Dr. Hamshaw Thomas*. It has become imperative, therefore, for those who have faith in the classical theory of carpel morphology, or who believe that the time has not yet arrived to give it up, to bring forward more evidence in its support. During my recent studies on the embryology and development of the flowering plants, I have come across such evidence in the family Menispermaceae. The plant investigated is *Cocculus villosus* DC.

As in most Menispermaceae, the flowers of *Cocculus villosus* have three carpels. A fourth carpel, however, is frequently present. Rarely it is also fertile, generally it is a reduced structure,

* 'New Phytologist,' xxxiii. 173 (1934).



Cocculus villosus DC. Fig. 1, transverse section of the gynœcium of a young female flower showing four carpels, one, no. IV., is abortive, nos. I., II., III., and IV. indicate the order of separation from the thalamus from below upwards. Fig. 2, vertical section of a female flower showing two carpels, each with two equally developed ovules at the megaspore mother-cell stage. Fig. 3, vertical section of a carpel at a later stage; the lower ovule is aborting, the upper is at the 4-nucleate embryo-sac stage. Fig. 4, vertical section of a carpel from an open flower; the lower ovule has been crushed into a small scale, the upper is well developed and shows a complete embryo-sac. All figures, × 85.

with no loculus and bearing no ovules (fig. 1). Microtome sections of the flowers clearly show that the carpels arise at different levels and are borne spirally on the floral axis. Fig. 1 brings it out clearly: the carpels according to their origin from the receptacle are numbered I., II., III., and IV., respectively.

The number of ovules in the family Menispermaceae in each carpel is generally described to be one. In *Cocculus villosus* also this is so in the mature condition of the carpels. In the early stages of flower development, however, one ovule develops from each of the two margins of the carpel (fig. 2). The carpels are thus two-ovuled, with one ovule arising at a slightly lower level than the other. As the margins of the carpels fuse, the two ovules come to lie in the same line and one definitely comes to be situated below the other. Even then both of the ovules continue to develop equally (fig. 2). The primary archesporial cell differentiates in both the ovules, and by cutting of the primary wall-cell gives rise to the megaspore mother-cell. Even up to the last stage of megaspore mother-cell, no difference appears in the size of the two ovules, but as the megaspores begin to be formed growth stops suddenly in the lower ovule. The upper ovule facing the style continues to grow further, so that in a short time it becomes much larger than its companion ovule and begins to crush it (fig. 3). As the flower opens, only one ovule is seen in each carpel: the lower is crushed into an insignificant scale lying beneath it (fig. 4).

The following conclusions are thus quite clear about *Cocculus villosus*:—(1) There has been reduction in the number of carpels during the past history of the species. (2) The carpels are arranged spirally. (3) The one-ovuled carpels have originated from two-ovuled forms as a result of suppression of one of the ovules.

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NOTES ON TROPICAL AFRICAN SPECIES OF *HIBISCUS*.

By Edmund G. Baker, F.L.S.

In 1868 Dr. Masters gave an account in 'The Flora of Tropical Africa' of the species of *Hibiscus* then known from tropical Africa. But since this date many districts have been explored and many papers written on this subject.

To mention only two of these, in 1900 Dr. Hochreutiner, in the Annuaire Jard. Bot. Genève, monographed the genus, and in 1921, in 'Die Vegetation der Erde,' ix., 'Die Pflanzenwelt Afrikas,' iii. pt. 2, Dr. Ulbrich enumerated all the then known species from Africa, placing them in their Sections.

Certain readjustments of some of these Sections seems necessary.

Section 7. *Panduriformes* Ulbrich should, I think, include his Section 11. *Furcaria* DC. Subsect. 5, *Friesia* Ulbrich, and Sect. 12, *Parapavonia* Ulbrich, should go to *Kosteletzkya*.

Sect. *Azanza* DC. includes trees and shrubs, the involucre being much joined at the base and having short lobes. The genus *Symphyochlamys* Garcke (in Engl. Jahrb. xxxiii.) is closely allied to this Section and requires careful study.

Section 5. *Bombycella* DC., shrubs or herbs with generally small flowers which are either vermilion or pink or white, rarely yellow, has now nearly fifty members.

There is considerable confusion in Herbaria with regard to the true *H. micranthus* Linn. fil. This plant was collected by Koenig in the Coromandel, and specimens from him are in the British Museum Herbarium.

The description of *H. micranthus* Linn. fil. (*sensu stricto*) is as follows:—Shrubby with slender rod-like spreading branches thinly covered with spreading hairs. Leaves suborbicular or ovate, serrate, in the type 10–20 mm. long, 10–20 mm. broad; petiole very short, 2–10 mm., rarely more. Peduncles axillary, generally longer than the leaves. Bracteoles linear, short, about 3 mm. long, shorter than the calyx. Calyx about 5 mm. long, teeth lanceolate. Flowers white or pink. Petals 7–9 mm., reflexing. Capsule globose. Seeds cottony.

There are also specimens of *H. rigidus* Linn. fil. collected by Koenig. The leaves are ovate grossly serrate, serrations irregular and larger than in *H. micranthus*.

The true *H. micranthus* Linn. fil. is not common in tropical Africa, but I think that *H. parvifolius* Hochst. in Pl. Schimp., no. 2275, and *H. intermedius* Hochst. in Pl. Schimp. no. 2211, are forms of this species.

H. micranthus Linn. fil. var. *ovalifolius* Hochr. is founded on *H. ovalifolius* Vahl. But this is described by Vahl as being founded on *Urena ovalifolia foliis cordato-ovalibus, serratis, hispidis*, Forskal, and the description states that the flowers are the size of *H. vitifolius* L. It apparently should be placed with *H. calyphyllus* L. and not under *H. micranthus* Linn. fil.

Sect. 11. *Furcaria* DC. Subsect. *diversifolia* Ulbrich includes *H. diversifolius* Jacq. The true plant is figured by Jacquin in his Icones Pl. Rar. tab. 551. It has simple upper leaves and 3–5-lobed lower leaves, and an aculeate stem.

Thanks to the kindness of Mr. P. J. Greenway, I have studied the species of *Hibiscus* in the Amani Herbarium, and find the following novelty:—

Hibiscus (Sect. *Furcaria*, Subsect. *diversifolia*) **Greenwayi**, sp. nov. *Suffrutex* suberectus caulis aculeis vestitus. *Stipulæ* subnullæ. *Folia* longe petiolata, lamina trilobata basi cordata 4–7 cm. longa, 4–7·5 cm. lata, lobis terminalibus obovatis apice

rotundatis 30–45 mm. longis ; petiolis 5–10 cm. longis. *Flores* axillares breviter pedunculati. *Petala* flava 6–7 cm. longa. *Epicalycis* bracteolæ lineares 11–15 mm. longæ rigidæ. *Calyx* 18–20 mm. longus, sepalis lanceolatis. *Capsula* 20–22 mm. longa apice acuta, seminibus glabris.

Hab. WEST USAMBARA : Kijango Magoma, *Braun* 2696. N.W. USAMBARA : S.W. Umba Steppe, Mnazi, 1500 ft., Jan. 1930, *P. J. Greenway* 2034 (type in Herb. Amani). " Yellow-flowered shrubby herb with straggling stems growing in association with Acacia-Sansieveria in Acacia Desert Grass Country. Not very common."

Leaves conspicuously lobed to about the middle ; *bracteoles* linear or linear-lanceolate, rather rigid ; sepals lanceolate.

Allied to *H. diversifolius* Jacq., figured in Jacq. Icon. Pl. Rar. tab. 551. The upper leaves are entire, the lower leaves 3–5-lobed, but the middle lobe is considerably longer than the lateral lobes. *H. Greenwayi* differs from *H. Keilii* Ulbrich by the inflorescence, the larger yellow flowers, and the leaves.

Sect. 8. *Calyphylli* Ulbrich. This Section includes herbs or shrubs with large flowers and with the bracteoles of the epicalyx either narrowing below or not so, the seeds are either glabrous or pubescent, never cottony.

Thanks to the kindness of Dr. Burtt Davy, I have studied the specimens of this genus from the Herbarium of the Imperial Forestry Institute at Oxford. I find the following novelty from the Mongalla Province of the Sudan allied to *H. dongolensis* Delile, but with much smaller fruit :—

Hibiscus (*Calyphylli*) **mongallaensis,** sp. nov. *Caulis* erectus teres ad *H. dongolensem* Delile accedens, differt primo intuitu capsulis multoties minoribus, foliis diversis etc. *Folia* petiolata membranacea demum utrinque glabra, ovata vel suborbicularia, leviter lobata basi cordata margine serrata, 3–5 cm. longa, 2·5–4·8 cm. lata, petiolis teretibus 2–5 cm. longis. *Flores* axillares parviusculi. *Calyx* 6–8 mm. longus, lobis lanceolatis medio lineis viridibus notatis. *Bracteolæ* lineares 7–10 mm. longæ. *Capsula* 10–12 mm. alta apice mucronata ; seminibus sparse pubescentibus.

Hab. SUDAN : Mongalla Province, Naramum. Plant growing in gravelly river-bed in gorge. Alt. 2500 ft., *W. R. H. Martin,* Imp. Forestry Inst. 55,238.

Allied to *H. dongolensis* Delile, but noticeable in the Section *Calyphylli* by its small capsules, only 10–12 mm. high. The leaves are of a different shape from those of *H. dongolensis.* There are five linear bracteoles 7–10 mm. long.

Hibiscus (*Ketmia*) **eburneopetalus,** sp. nov. *Herba* perennis ad *H. articulatum* Hochst. et *H. Ledermannii* Ulbr. accedens. *Caules* 1 vel plures 6–11 cm. alti ex eadem radice lignosa et crassa orti. *Stipulæ* parvæ lineari-lanceolatæ. *Folia* petiolata ovata interdum lobata margine serrata utrinque pubescentia, lamina 20–30 mm. longa, 10–25 mm. lata, petiolis hirsutis 4–9 mm. longis. *Flores* singuli axillares, pedunculi 20–25 mm. longi. *Involucri bracteæ* parvæ 3–4 mm. longæ lineari-lanceolatæ. *Calyx* ±10 mm. longus, lobi ovato-lanceolati 6–7 mm. longi dorso uninervii. *Petala* alba ±20 mm. longa. *Capsula* ignota.

Hab. PORTUGUESE EAST AFRICA : Mucombeze, *G. Le Testu* 911 (Type in Herb. *G. Le Testu*). " Fleurs blanc d'ivoire."

The true *H. articulatus* Hochst. has oblong-lanceolate trinerved calyx lobes, involucral bracts generally 10, sublinear, and subglabrous polymorphous leaves. The present plant is pubescent with shorter stems and short linear-lanceolate involucral bracts.

Hibiscus (Sect. *Calyphylli*) **Tisserantii,** sp. nov. Ad *H. dongolensem* Delile accedens differt primo intuitu foliis petiolisque pubescentibus, calycis lobis 5–7-nerviis. *Caulis* erectus teres pubescens. *Stipulæ* filiformes 3–7 mm. longæ. *Folia* ovata vel ovato-suborbicularia, basi subcordata, apice acuta vel obtusa, margine grosse serrata, pubescentia, lamina 3–6 cm. longa, 30–35 mm. lata, petiolis pubescentibus 10–15 mm. longis. *Flores* apicem versus caulium subaggregati ; pedicelli 8–10 mm. longi. *Bracteæ* filiformes pubescentes 10–12 mm. longæ. *Calycis* lobi lanceolati dorso 5–7-nervosi, 15–16 mm. longi, calycis tubus brevis. *Petala* flava 40–45 mm. longa. *Capsula* in specimine nostro parviuscula, seminibus glabris.

Hab. OUBANGUI-CHARI : Kaga Tagra, *Tisserant* 1604 (Type in Herb. *G. Le Testu*). " Fl. jaune centre brun rampant sur rochers."

An ally of *H. dongolensis* Delile, but the leaves, petioles, and stems are pubescent and the flowers aggregated towards the summit. The calyx is 5–7-nerved, whilst in *H. dongolensis* it is trinerved.

Hibiscus (Sect. *Furcaria*) **Torrei,** sp. nov. *Caulis* erectus aculeatus ad *H. furcatum* Roxb. accedens, differt primo intuitu foliis diversis bracteis diversis pedunculis brevioribus. *Stipulæ* lineares subulatæ. *Folia* petiolata ovata interdum lobata, utrinque pubescentia, margine serrata, basi cordata vel subcordata, lamina 5–10 cm. longa, 4–15 cm. lata, petiolis aculeatis 10–30 mm. longis. *Flores* breviter pedunculati, pedunculis 2–5 mm. longis. *Involucri bracteæ* sæpissime 9 furcatæ 10 mm. longæ. *Calyx* 10–18 mm. longus ; segmentis ovato-lanceolatis apice acutis dorso uninerviis. *Petala* flava 4–5 cm. longa. *Capsula* 15–20 mm. alta pilis longis vestita, seminibus minute punctatis sparse squamosis.

Hab. MOZAMBIQUE : Distr. Niassa, *A. R. Torre,* 435 (Type in Herb. Conim., specimen in Herb. Mus. Brit.).

The distinguishing features are the distinctly aculeate stems and petioles, the rather small furcate bracts, the capsule covered with long hairs, and the minutely punctate seeds. Roxburgh, in his 'Flora,' describes the bracts of *H. furcatus* as follows:—"Each leaflet enlarged beyond the middle, from the base of the enlargement on the upper side issues a clavate erect or incurved segment, these form a cancellated dome over the inner 5-parted glandular bristly calyx." It differs from *H. Mastersianus* Hiern in the more strongly aculeate stem etc.

MENTHA HIRCINA Hull.

By A. L. Still.

Under the popular name of "Savage Peppermint," Sole describes and figures a hairy Mint, *M. piperita sylvestris*, with the main characters of *M. piperita officinalis* Sole, but a coarser plant with "a goatish peppermint smell." Hull gave this the name *M. hircina*, and left no room for doubt that he was dealing with Sole's plant. Fraser, while citing Sole and Hull, also identified this Mint with *M. pubescens* auct. pl. as a hybrid of *M. aquatica*×*longifolia*. This supposition appears reasonable from the characters of the plant; and it would not be surprising to find a series of forms connecting it with *M. palustris* Sole, to which the same parentage is ascribed on strong evidence. Such hybrids are placed by Continental botanists under the general head of *M. dumetorum* Schultes, and classed as several varieties or "formæ." In treating of these, Topitz makes no reference to *M. hircina* Hull. His *M. dumetorum* var. *limnogeton* Top., as figured and described, would fit Hull's plant. Under *M. piperita* var. *officinalis* Sole he says "plants occur with scattered hairs on stem and leaf." Such plants are well known to all students of Mints. Under *M. piperita* var. *poicila* Top. he says, "S. Tyrol, France (here also a plant with heavier foliage, thickly pilose, and with broader leaves)." From my own observations on British Peppermints, I think this var. *poicila* Top. is probably a habitat form of var. *officinalis* Sole. Fraser based his description of *M. hircina* Hull on a specimen gathered by Mr. Stonestreet, now in Hb. Fraser at Kew. This plant is hairy, but not densely so. As Fraser says, "the modern specimens being collected for *M. hircina* Hull are all too hairy for this plant, and are the next variety—var. *hirsuta* Fraser var. nov. (*M. aquatica*×*longifolia*)." But if one compares one of these modern specimens with Sole's figure and also with Stonestreet's sheet, it appears evident that Sole's plant was Fraser's variety and not Stonestreet's "type." The latter seems to me like a hairy form of *M. piperita* var. *subcordata* Fraser. I have seen two similar specimens—one from cultivation, in Dr. E. H. Metcalf's herbarium at Reading, and one wild, sent by Dr. J. H. Salter from Aberystwyth. They are usually pilose, not shaggy; and I understand that such

forms are not unusual in fields of Peppermint. I hope to investigate them in the coming season.

In 1935 Mr. R. Knowling showed me a Mint from Yorkshire which he thought might be *M. piperita*×*aquatica* (*M. Fraseri* Druce, Rep. B. E. C. 1927, 315); but, owing to the activities of "slashers," the specimen was not in flower and no opinion could be given. Miss C. M. Rob sent me a better specimen later on and I expressed the opinion that it seemed to be *M. hircina* Hull, supposed to be a hybrid of *M. aquatica*×*longifolia*. To this Miss Rob replied that to the best of her knowledge there was no *M. longifolia* within twenty miles, whereas *M. piperita* var. *officinalis* Sole and *M. aquatica* L. were growing close by. This, of course, did not rule out the possibility of a *longifolia* cross, as Mints have a way of dying out; but the matter had to remain in abeyance until satisfactory material could be obtained.

In August 1936, I found a Mint at Danehill in Sussex, which puzzled me. It had the appearance of a Peppermint, but was very hairy and rather pale in the flower. I concluded that it was a form of *M. hircina* Hull. *M. aquatica* grew not far away, but there was no sign of *M. longifolia*. On a second visit I found a small colony of what was at once recognised as *M. piperita* a few yards away. This started a train of thought, which led me to Bedwyn, Wilts. By the kindness of Mr. J. D. Grose, I was enabled to visit Bedwyn Brail, where we found Peppermint growing in an isolated spot, and with it a densely hairy form. Again *M. aquatica* was present, but, so far as I know, there is no record of *M. longifolia* anywhere in that district. Pursuing my train of thought, I wrote to Miss Rob, asking for a specimen of the Peppermint from Aldborough, and was delighted to receive not only this, but a fine specimen of the hairy plant we had been discussing. This satisfied me that, in all three cases, we were concerned with a hairy "sport" of *M. piperita*, and that *M. longifolia* was not involved in its origin. I at once got in touch with botanical friends, whom I asked to examine colonies of *M. piperita* and *M. hircina* to see if further instances of association could be found. It was late in the season, and I did not get any definite confirmation, but Mrs. Sandwith kindly sent me such material as she could get from the colony of *M. hircina* at Weston-in-Gordano. This is now growing in a pot, and, apart from its hairiness, is exactly like Peppermint in leaf and scent, and in its purple-tinted foliage; and I should not be surprised if future search should reveal the presence of normal *M. piperita* in or near the same spot. The two plants grow more or less together at Compton Dando, though I have not seen specimens; but here the evidence is weakened by the occurrence of *M. longifolia*. Mr. R. Corstorphine informs me that he knows of three localities in Angus where the two forms grow together. Fraser also gathered both forms from the Dour Burn, but, so far as I know, he did not find *M. longifolia* there.

Druce noted that what he called *M. Fraseri* grew in four stations in Scotland, in company with *M. aquatica* and *M. piperita*, a fact which led him to suggest that it was probably the hybrid of these two Mints. I have not been able to see specimens; but suspect that his plant was really a form of *M. hircina*.

The "sport" theory receives support from the fact that a certain amount of transition is noticeable. The Danehill *M. piperita* had not quite a clean Peppermint odour, but in this respect resembled the hairy form, which smelt, where fresh, of a mixture of Peppermint and *Stachys*. At Bedwyn much of the Peppermint was decidedly hairy on the stems, but normal in colour of leaf and flower. The question has been raised whether these hairy forms may be hybrids of *M. piperita*× *M. aquatica*. There is no inherent impossibility in this; but seed is rarely produced in *M. piperita*. Dr. Metcalf puts the proportion at not more than one seed to three thousand flowers. It is rare for this plant to develop pollen; and, if *M. aquatica* were the seed parent, one would expect greater divergence from the Peppermint form, and a good deal of variety in the offspring; whereas the uniformity is remarkable. On the positive side, we have the occurrence of hairy forms in fields of Peppermint, often in upland soils far from any colony of *M. aquatica*, where the crop is cut down before seed could mature.

In expressing the opinion that *M. hircina* Hull is a "sport" of *M. piperita* var. *officinalis* Sole, and not a hybrid of *M. longifolia* Huds., I do not necessarily maintain that *M. spicata* Huds. is a good species. If, in future, botanists should agree that this last Mint is itself only a "sport" or hybrid of *M. longifolia*, as has been suggested, the question would fall to the ground, since *M. piperita* L. would then rank as a special case of *M. longifolia*×*aquatica*.

I have given the steps by which I was led to form my opinion at some length, because they illustrate the importance of observing, and collecting in some cases, the Mints which accompany a peculiar plant. Much light may be thrown upon the origin of hybrids in this way, and Trautmann laid great stress upon it in his letter to me last year, It requires considerable experience to detect small differences in Mints in the field, which may be of great importance. Some of the hybrids of *M. rotundifolia* and *M. arvensis* require close examination to detect the influence of the former parent, and definite information about its presence or absence at the station of origin is very helpful.

References.

Sole. Menth. Brit. 53, t. 24 (1798).

Hull. Brit. Fl. i. 127 (1799).

Topitz. Menthenflora v. Mittel-Europa in Bot. Centralbl. xxx. 213, 216, 217 (1913).

Fraser. Menth. Brit. 221, in Rep. Brit. Exchange Club, 1926.

EUPHORBIA GLAUCESCENS Willd.: AN OBSCURE SPECIES FROM BRITISH INDIA.

By Dr. Leon Croizat.

Some references were added to Hooker's 'Flora of British India' by Clarke and Stapf (Kew Bull. 1894, 200). The source of those additions is an extremely rare paper, "Botanische Bemerkungen auf der Hin- und Rückreise von Trankenbar nach Madras, vom Herrn Missionair Rottler zu Trankenbar, mit Anmerkungen von Herrn Professor C. L. Willdenow" (Gesell. Naturforsch. Fr. Berlin, Neu. Schrift. iv. 180–224, pls. iii.–v.; 1803). Clarke and Stapf write (*op. cit.* 204):—

"*Euphorbia glaucescens* Willd. (i. e. *E. rosea* Rottl. not of Rotz.) in Neue Schriften, iv. p. 183. Not taken up in Hook. f. Fl. Brit. Ind. Boissier in DC. Prodr. xv. part 2, p. 116 [*an error for* 166] reduces it to *E. Gerardiana* Jacq. which appears doubtful."

The name is interesting. It is early enough to suggest the possibility that it may have priority, and if the species is to be reduced to *E. Seguieriana* (*E. Gerardiana*) a revolutionary addition is made to the flora of the Deccan Peninsula*.

The presence of *E. Seguieriana* in India, of course, is possible, if not certain. Blatter and Hernandez admit it in the flora of Waziristan (Journ. Bomb. Nat. Hist. Soc. xxxvii. 405; 1934), and their determination, carefully checked against *E. Buhsei*, *E. sogdiana*, *E. kopetdaghi*, and *E. humilis*, eventually may be found to stand. At any rate, *E. Seguieriana* reaches the shores of Lake Aral (*cf.* Prokhanov, Consp. Syst. Tith. As. Med. 166; 1933). The species belongs to an Eurasian element that probably in mid-Tertiary times entered the valleys of the Indus and of the Ganges, ultimat ly reaching Yunnan along the foothills of the Himalayan ranges. But floristically absurd is the presence of *E. Seguieriana* in the Tranquebar region, where Rottler collected *E. glaucescens*. So far as *Euphorbiaceae* suggest, that part of India in the main has received its genera and species from the south and from the east. The principal floristic component here is Gondwanic and early Tertiary. Thus the doubts of Clarke and Stapf are not unjustified.

* *E. Seguieriana* Necker (Act. Theo.-Pal. ii. 493; 1770) is so named because of *Tithymalus foliis brevibus aculeatis* of Seguier (Plant. Veron. i. 154, pl. iii. fig. 1; 1745), a botanist of Nimes, France, who was active in Western Venetia. Seguier's polynomial *Tithymalus* is the Spurge that Allioni later introduced into binary nomenclature as *E. nicaeensis* (*cf.* lunulate nectaria illustrated in Seguier's plate, and Parlatore's use of Seguier's polynomial in synonym to Allioni's species, Fl. It. iv. 531; 1867), not the species which Necker supposed to be that of Seguier. Thus Necker's name is due to an erroneous identification of the plant described by Seguier. It must be adopted, nevertheless, because it is the same as *E. Gerardiana* Jacq. (Fl. Austr. v. 17, pl. ccccxxxvi.; 1778) and antedates it. Recorders of nomenclatural oddities may notice here a classic instance in which a wrong interpretation has introduced a legitimate binominal.

However, the "riddle" of *E. glaucescens* and its synonyms is scarcely a riddle, once it is known that under the authorship of Willdenow are two identical names, as follows :—

(*a*) *E. glaucescens* Willd., 1803 (Neu. Schrift. iv. 183), known to Clarke and Stapf and unknown to Boissier.

(*a'*) *E. glaucescens* Willd. ex Schlect., 1813 (Enum. Pl. Hort. Berol., Suppl. 28), known to Boissier and unknown to Clarke and Stapf.

The latter is a *nomen nudum*, followed by the usual symbols stating that the plant is a perennial from the root-stock requiring the cold house. This *E. glaucescens* is described by Sprengel (Pl. pug. sec. 66 ; 1815) as follows : "Umbel many-rayed dichotomous, involucels ovate, leaves lanceolate, glaucous, very glabrous, very entire, mucronate, lower ones reflexed. Habitat unknown. Stem about 18 in. long, branching, the upper branches umbel-bearing. Umbels flavescent. Very near to *E. oleaefolia*, which differs by its procumbent stems, leathery much broader leaves that tend to persist, the lower ones not reflexed" [*translation mine*]. Link keeps *E. glaucescens* apart from *E. Seguieriana* (*E. Gerardiana*) and describes it symbolically (Enum. Pl. Hort. Berol. ii. 16 ; 1822) as a plant that thrives in the open, adding that it has lunulate nectaria and is doubtfully distinct from *E. nicaeensis*.

The descriptions, the order of the species in the lists, the comparisons, and the critical notes of Sprengel and Link leave almost no room to doubt that Boissier errs in reducing *E. glaucescens*, 1813, to *E. Seguieriana* (*E. Gerardiana*)*. *E. glaucescens*, 1813, is a form of the vast and difficult group of species around *E. nicaeensis*. In the absence of specimens it is not easy to decide how to dispose of it. The fact that the presentation mentions the cold house seems to imply that it was introduced in the botanic garden of Berlin by the same collector who sent to Willdenow *E. veneta*, *E. fragifera*, *E. pinea*, etc., from the neighbourhood of Trieste. That it might be *E. pannonica*, a somewhat controversial species of the Pannonic-Pontic domain, cannot be denied. That it is *E. nicaeensis* in the form known to Host as *E. serotina* is very probable. It is open to question whether *E. glaucescens*, 1813, truly is Willdenow's. Technically the authorship stands, but Schlechtendal, who edited the Supplementum to the 'Enumeratio,' can easily be convicted of having gathered in names of various merit. The binominal here dealt with to all appearances originated with the collector, who sent seeds not only to Berlin, but to Halle and Copenhagen as well. Once received it was maintained ; similar names sometimes are treasured in botanic gardens.

* Boissier claims (DC. Prodr. xv. pt. 2, 166 ; 1862) having seen the type of Willdenow's species. Conflicts between the literature and the material in the herbarium are not unknown. The writer, in case of doubt, favours for evident reasons the evidence from the literature.

E. glaucescens, 1803, emphatically is Willdenow's. The publication being available in the original only to the very fortunate few (Gesell. Naturfosch. Fr. Berlin, Neu. Schrift. iv. 183 ; 1803), it is here given *verbatim* :—

"(10) *Euphorbia rosea* ? Retz. [*in Rottler's account*] (*b*) . . . .

"(*b*) [*foot-note by Willdenow*]. Ist nicht *Euphorbia rosea*, sondern eine neue Art, der ich folgende Benennung gebe :

"*Euphorbia glaucescens* subdichotoma diffusa, foliis ellipticis integerrimis inferioribus emarginatis, pedunculis multifloris axillaribus.

"Radix crassitie pennæ columbinæ simplex perpendicularis nodosa. Caules plures digitales usque 5-pollicares decumbentes plerumque simplices interdum dichotomi. Folia elliptica obtusa integerrima unguicularia glabra, subtus glauca, inferiora emarginata. Cymæ axillares tri- vel quinquefloræ longitudine folii vel breviores. Flores parvi. Capsulæ glabræ."

The locality is not given, but Rottler implies (*tom. cit.* 181) that the specimen was collected near Siakhi, apparently a caravanserai too insignificant to be recorded on the usually available maps. Internal textual evidence locates this point within a day's march, or thereabouts, from Tranquebar, and it is not too much to hope that some of our Indian friends can determine the *locus classicus* of the original *E. glaucescens*.

Rottler was familiar with *E. rosea*. Specimens of his collection were seen and verified by Boissier ("ad Tranquebar, Rottler in Herb. Petrop.," DC. Prodr. xv. pt. 2, 50 ; 1862) and by Hooker ("from the Carnatic to Tranquebar, on the coast, Rottler, &c.," Fl. Br. Ind. v. 251 ; 1887), and it is safe to assume that the original *E. glaucescens* and *E. rosea* are closely related, but not wholly alike. If one is to judge from descriptions it is almost certain that Rottler's plant is identical with *E. auriculata* Boiss., which in the words of its author (*tom. cit.* 50) is glaucescent and differs from *E. rosea* in being glabrous, with the floral leaves not imbricate and not narrowed, and in having a smooth involucre and capsule, and styles spatulate at tip.

Hooker professes (*loc. cit.*) to be unable to distinguish between *E. rosea* and *E. auricularia*. Gamble, however, speaks of *E. auricularia* (Fl. Pres. Madr. vii. 1275 ; 1925) as the coast-form of *E. rosea*, from which it is distinguished by having more rounded and fleshier leaves and shorter and broader "glands" [*quote-marks mine. Gamble probably means petaloid appendages to the nectarium*].

The species of the group *E. rosea* are not yet free from synonymic and taxonomic difficulty, which discourages reductions made only from description. The writer, however, does not see difficulty in the fact that Willdenow's species is glaucescent to the very limit of its specific name, but is recorded in the diagnosis as glaucescent only on the lower face of the blade. The contradiction is probably due to an imperfection of the record or

to Willdenow's intention of laying stress upon the manifest glaucescence of the lower face of the blade in the type of the new species. The conclusion of these notes is expressed in the following synonymy :—

E. GLAUCESCENS Willd. Neu. Schrift. iv. 183 ; 1803 (*E. auricularia* Boiss. in DC. Prodr. xv. pt. 2, 50 ; 1862. *E. rosea* f. *auricularia* [Boiss.] Gamble, Fl. Pres. Madr. vii. 1275 ; 1925).

E. NICAEENSIS All. Fl. Ped. i. 285, pl. lxix. fig. 1 ; 1785 (*E. glaucescens* Willd. ex Schlecht. Enum. Pl. Hort. Berol., Suppl. 28 ; 1813).

THE *IXORA* SPECIES OF BURMA AND THE ANDAMAN ISLANDS.

By C. E. B. Bremekamp.

In his 'Forest Flora of British Burma' (ii. 20 ; 1877) and, similarly, in his "Contributions towards our Knowledge of the Burmese Flora" (pt. 2 in Journ. Asiat. Soc. Beng. xlvi. 144 ; 1877), Kurz records from Burma and the Andaman Islands 25 wild growing species of *Ixora*. Among this number there are, however, 8 species which are now assigned to allied genera. Of the remaining 17, 13 were collected in Burma and 4 in the Andaman Islands. About forty years later Brandis in his 'Indian Trees' (388 ; 1906) quotes 17 species from Burma and 3 from the Andamans. Since then the number of Burmese species has risen to 20, one new species having been added by Hole in 1919, and two by Craib, respectively in 1914 and 1932. The genus, however, is better represented than these figures indicate. In this paper 35 species are enumerated from Burma and 7 from the Andamans, but, as the collections on which this study was based were not very large, these figures, too, are to be taken as provisional only : when more material becomes available a further increase is doubtless to be expected.

At present the number of Burmese species is of about the same order as that of the Siamese species recorded by Craib in his 'Floræ Siamensis Enumeratio' (ii. 147 ; 1934). Craib's list comprises 38 species and a number of varieties of which some will have to be raised to specific rank. The Malay Peninsula is apparently somewhat richer : Ridley enumerates in his 'Flora of the Malay Peninsula' (ii. 91 ; 1923) 25 species, but in comparing this figure with that given above for the Burmese species we must bear in mind that Burma is four to five times as large as the Malay Peninsula, and, as the area occupied by the various species is as a rule but small, the larger size of Burma is, of course, an important factor. The greater richness of the Malay Peninsula is not unexpected, for in this genus the greatest density of species is found in the Malay Archipelago : Borneo, which is but slightly larger than Burma, and probably less thoroughly explored, has yielded already 66 species (Bremekamp, "The *Ixora* Species of the Sunda Islands, the Moluccas, and New Guinea," in Bull. Jard. Bot. Buitenz., *in the press*). Westwards, on the other hand, the number of species decreases. India without Burma, with an area about six times as large as that of the latter, has according to Brandis, *l. c.*, but 14 species, and 5 of these are, moreover, confined to Assam, Sikkim, and the eastern part of Bengal. In Gamble's 'Flora of Madras' (ii. 627 ; 1921) 17 species are enumerated.

In view of the fact that the genus reaches its richest development farther southwards, it is not surprising that Tenasserim has yielded more species than the rest of Burma ; but it is noteworthy, nevertheless, that the majority of the Tenasserim species have their nearest allies not in the Malay Peninsula but in the north. This, however, is no general rule : the species with red, orange-red, and deep yellow flowers, for example, are confined to the southern part, and the section to which they belong has its main distribution in the Malay Archipelago.

The species found in the Andamans and Nicobars are not known from elsewhere. As the distance between these islands and the mainland is larger than the average extent of the areas occupied by species of *Ixora*, this was perhaps to be expected. Nevertheless, as the species occurring in these islands belong partly to groups whose areas extend from India to the western part of the Malay Archipelago, and partly to groups with a slightly less extensive area, there is no reason why a species showing a distribution as wide as that of these groups might not be represented also. I know, however, but one species which fulfils this condition, namely, *I. nigricans* R. Br. ex Wight & Arn., which extends from the Indian Peninsula to Java and Bali : nevertheless, it has not yet been found here. As from this species a number of forms, sometimes regarded as varieties and sometimes as species (*I. erubescens* Wall. ex G. Don, *I. affinis* Wall. ex G. Don, *I. arguta* (Hook. f.) King & Gamble, *I. plumea* Ridley, *Pavetta acutiflora* Reinw. ex Korth., and *P. subulata* Teysm. & Binn.), have been separated, one might perhaps be inclined to doubt its wide distribution. The authors who accepted these forms as distinct species overrated, however, the importance of the differences, and paid too little attention to the fact that they can be found in material from any part of the area delimited above. The names *I. nigricans* R. Br. and *I. erubescens* Wall. have been taken from the Wallich Herbarium. Both were published in 1834, the first by Wight and Arnott, the second by Don. That but one of the two names was published by each evidently means that they regarded the plants as identical ; that by Wight and Arnott another name was chosen than by Don was, of course, an accident.

Of the species occurring in the Andaman Islands *I. rosella* Kurz and *I. macrosiphon* Kurz have their nearest allies in the Nicobars, the Malay Peninsula, and the western part of the

Malay Archipelago. In the Nicobars the group is represented by a species with somewhat narrower, in herbarium material finely granulate, leaves. It was identified by Kurz with a plant collected in Bangka, and described by Teysmann and Binnendijk as *Pavetta Kurziana*: Kurz called it *Ixora Kurziana* (Teysm. & Binn.) Kurz. As his identification, however, cannot be accepted, the name *I. Kurziana* (Teysm. & Binn.) Kurz must be retained for the plant described by Teysmann and Binnendijk. For the plant from the Nicobars described by Kurz I propose the name **I. nicobarica** Brem., nom. nov.

I. brunnescens Kurz, which occurs both in the Andamans and in the Nicobars, has its nearest allies in the Indian species: *I. arborea* Roxb. ex Sm. (*I. parviflora* Vahl, non Lam.) and *I. brachiata* Roxb. *I. undulata* Roxb. belongs probably also to this section.

The four remaining Andaman species are related to plants found in Assam, Burma, the Malay Peninsula, and the Malay Archipelago, and need no special comment.

In the following list the species are arranged in subgenera, sections, and series. Full descriptions and a discussion of these groups will be found in my paper on "The *Ixora* Species of the Sunda Islands, the Moluccas, and New Guinea," to which I have referred already. Titles of works which are quoted repeatedly are abbreviated in the following way:—

Kurz, "Contributions towards our Knowledge of the Burmese Flora," pt. 2 in Journ. Asiat. Soc. Beng. xlvi. 1877 : Contr. Bur. Fl.

Kurz, 'Forest Flora of British Burma,' ii. 1877 : For. Fl. Bur. ii.

Hooker f., 'Flora of British India,' iii. 1880 : F. B. I. iii.

King and Gamble, "Materials for a Flora of the Malayan Peninsula," no. 15 in Journ. Asiat. Soc. Beng. lxxiii. 1904 : Mat. F. M. P.

Brandis, 'Indian Trees,' 1906 : Ind. Trees.

Ridley, 'Flora of the Malay Peninsula,' ii. 1923 : F. M. P. ii.

Pitard in Lecomte, 'Flore Générale de l'Indo-Chine,' iii. 1924 : F. I. C. iii.

Craib, 'Floræ Siamensis Enumeratio,' ii. 1934 : Fl. Siam. En. ii.

Bremekamp, 'The *Ixora* Species of the Sunda Islands, the Moluccas, and New Guinea' in Bull. Jard. Bot. Buitenz., *in the press* : Brem. Ix.

Subgenus Eu-Ixora Brem.

Branchlets of the inflorescence all opposite and articulate; flowers in distinct triads. Bracts and bracteoles always present; the bracts at the base of the branchlets and pedicels.—Pantropic.—1–37.

Section Ixorastrum Brem.

Inflorescence subsessile or moderately pedunculate, erect. Calyx-tube short, but distinct. Corolla red, orange, or deep yellow, in cultivated varieties sometimes white. Stamens much shorter than the corolla-lobes; anther-cells short.—India to Micronesia; absent in Upper Burma and the Andamans.—Species 1–6.

1. I. fulgens Roxb. Fl. Ind. ed. Carey, i. 378 (1820); Wight, Ic. t. 151; F. B. I. iii. 146, syn. *I. salicifolia* (Bl.) DC. et *I. Lobbii* Loud. excl.; Mat. F. M. P. 79; Ind. Trees, 389, syn. *I. Lobbii* excl.; F. I. C. iii. 325 p.p.; an Fl. Siam. En. ii. 157 incertum; non ex Robinson in Philipp. Journ. Sci. Bot. vii. 412, 1912, nec ex Merrill, Interpret. Herb. Amb. 487, 1917 quæ est *I. longifolia* Sm. *I. glaucina* (Teysm. & Binn.) Kurz, Contr. Bur. Fl. 118 et For. Fl. Bur. ii. 26 (1877) quoad specimina birmahica foliis nitidis instructa, non quoad specimina birmahica alia, nec quoad typum; non *Pavetta glaucina* Teysm. & Binn. in Nat. Tijdschr. Ned. Ind. xxix. 245 (1867).

Distr. Known with certainty from Tenasserim only.

Tenasserim: Tavoy District, Kaleinaung Reserve, alt. 150 m., leg. *Ba Pe*, 873 Herb. Dehra Dun; Mergui District, Loikpok Chaung, alt. 120 m., leg. *Mr. Braybon's Collector*, 139 Maymyo Herb.; Eastern Tenasserim, alt. 50 m., leg. *Kerr*, 21,610 Herb. Dehra Dun.

Roxburgh described this species from a plant cultivated in the Botanic Garden, Calcutta. It was supposed to have been introduced from the Moluccas, but this was obviously a mistake, probably due to a superficial resemblance to the plant described and figured by Rumphius under the name "*Flamma sylvarum*." The plant figured by Wight is doubtless the one described by Roxburgh, and Wight's figure leaves no doubt as to its identity. A nearly related species, which I have described under the name *I. Junghuhnii* (Brem. Ix. n. 5), occurs in Sumatra. The specimens described by Kurz under the name *I. glaucina* belonged probably partly to this species and partly to the following; the type-specimen, a plant collected by Teysmann in Bangka, could not be traced, but judging from the description, I think that it must have looked more like *I. Lobbii* Loud. I have not seen the Siamese specimen quoted by Craib; it was collected a Chantaburi, which seems rather a long way from the other localities.

(To be continued.)

SHORT NOTES.

Trees and Lightning.—The Fourth Annual Report of the Survey of Thunderstorms in the British Islands contains a report on the trees struck, by Mr. Sidney Dark. The only kinds of which a considerable number have been struck during the four years, 1932–5, are oak (61), elm (32), ash (26), and poplar (13). Only one beech appears in the record, "but it cannot be emphasized too strongly that while certain trees are, undoubtedly,

more susceptible to lightning-stroke than others, nothing whatever seems to be absolutely exempt." Records from Epping Forest, in south-west Essex, extending over many years, indicate that no one has ever heard of a beech, birch, holly, or hornbeam being struck, and there seems to be a case for the opinion that smooth-barked trees are not so frequently struck as rough-barked, or at any rate that certain species are more immune than others. The solution of the problem will probably only be found by experiments on " tree-currents " and on the electrical constants of tree-sections. There is need for many more recorders throughout the country. Information as to methods of recording may be obtained from Mr. Dark, 21 Fernwood Avenue, Streatham, London, S.W. 16.

Flora of Fife and Kinross.—The Trans. and Proc. of the Botanical Society of Edinburgh, xxxii. pt. 1, is mainly devoted to a " List of the Flowering Plants and Ferns recorded from Fife and Kinross " (v.c. 85) by William Young. No complete flora of this vice-county has so far been published. The author gives a list of the books and herbaria that he has consulted to bring together the records included. He has, however, not consulted Boswell-Symes herbarium, presented a few years ago to the British Museum by Mr. F. J. Hanbury, nor Dr. Lauder Lindsay's herbarium at Glasgow. The list fills 164 pages, and a folding map of the area reproduced from the Ordnance Survey is included. The nomenclature of the 'London Catalogue,' 10th edition, has been followed. Citation of specimens indicates distribution in the area, and first records are also indicated. In an Introduction the author gives a brief account of the district and its botanical divisions and notes of earlier work. It will be useful if the Society will publish the Flora in separate form, and thus make it available to a larger number of workers.

Trees and Shrubs of Glamorgan.—Mr. H. A. Hyde has issued as a reprint from the Glamorgan County History (vol. i. 1936) an interesting account of the trees and shrubs which are grown out-of-doors in that county. At the outset he points out that while there is in Glamorgan no collection of trees that would challenge comparison with the best-known collections in England, there are several containing specimens which are among the finest of their kind in these islands. This enumeration is the outcome of a rapid survey made during 1933 of thirty-three gardens in the county, which resulted in a list of approximately 500 species and varieties of woody plants with their dimensions, including height, girth, and spread of the trees. Among the most noteworthy of these the following deserve special mention :—The European Silver Fir at Aberpergwm, probably the second tallest in Britain ; the Sycamore at Baglan House, certainly the largest recorded in Wales ; the Pencil Cedar (*Juniperus virginiana*) at Cefn Mably, the tallest known

in Britain ; the Aleppo Pine at Margam, which is almost the only known example of its kind in the British Isles. The Weeping White Lime at Tal-y-Garn is a tree of remarkable beauty, as will be seen from the excellent photograph which illustrates it. The picture of *Cornus capitata* at Llys. Esgob. Landaff is also very pleasing. Mr. Hyde has made a valuable contribution to horticultural literature, and his example should be followed in other counties.—A. B. J.

OBITUARIES.

Arthur Reginald Horwood (1879–1937).

Arthur Reginald Horwood, who died at Brentford on February 21st, will be chiefly remembered for his work in connection with Leicestershire botany. He was born in Leicester, May 29, 1879, the son of the Rev. F. E. Horwood, Rector of S. Croxton. He was educated at St. John's Foundation School, Leatherhead. After being engaged for a short period as a private tutor and army coach, he was appointed in 1902 as an assistant in the Leicester City Museum and Art Gallery. Horwood paid considerable attention to the local flora and did a good deal of field-work in association with the writer, the Rev. T. A. Preston, the Rev. H. P. Reader, and other local botanists of that period. When in 1911 the Leicester Literary and Philosophical Society decided to publish a new county flora of Leicestershire and Rutland, Horwood became general editor of the scheme with the help of sectional editors. Unfortunately, he lost his principal co-workers through death and other causes, and the work of compiling the Flora had to be undertaken single-handed at short notice to be ready for the visit of the British Association to Leicester in 1933. Its preparation involved an immense amount of labour, and the result, a monument of his industry and enthusiasm, is a bulky volume of nearly nine hundred closely printed pages in small type, which appeared under the joint authorship of Horwood and the late Earl of Gainsborough. It is planned on ecological lines, and contains a very full list of localities. A review appeared in this Journal in 1934, p. 27.

Horwood had previously tried his hand at several books of a more popular character. His 'Plant Life of the British Isles,' in three volumes published between 1914 and 1916 includes descriptions of common plants illustrated by photographs, but is mainly a compilation, and contains little if any original work. A critical notice of the introductory volume appeared in this Journal for 1914, p. 78. Other books of a similar character, including 'Practical Field Botany' (1914) and 'The Outdoor Botanist' (1920), also came from his pen, and in addition he published a large number of papers on a wide range of botanical subjects.

Horwood relinquished his post of sub-curator at the Leicester Museum in 1922, and in 1924 joined the staff at Kew as temporary botanist. Here he did useful work in the Herbarium on the European and Oriental collections. Of late years his spare time has been mostly occupied by journalistic work of a very varied character, and in this connection he contributed numerous articles to various farm and trade journals. He also edited the late Dr. J. B. Hurry's book, 'The Woad Plant' (1930). He was an extremely hard and conscientious worker, though his methods did not perhaps always meet with the approval of his colleagues.

His remains were interred in Scraptoft Cemetery, Leicester. He is survived by his second wife and four sons. Horwood was elected a Fellow of the Linnean Society in 1913. He accumulated a large herbarium of British plants, which were eventually divided between the National Museum of Wales, the Leicester Museum, and Kew.—A. B. JACKSON.

FREDERICK WILSON STANSFIELD
(1854–1937).

BORN at Todmorden, Lancs, Dr. Stansfield represented the third generation of botanists and fern growers. His early years were spent on his father's fern nursery. He qualified in medicine and surgery in 1889, and practised for a time in Derby, going to Reading in 1893, where the remainder of his life was passed. He ginead the M.D. (Manch.) in 1900 for a thesis on cancer houses, and the D.P.H. (Cambs) in 1893.

He was Public Vaccinator for Reading, and also President of the Association of Public Vaccinators of England, a Past President of the Reading Pathological Society (1935–36), and Past President of the Oxford and Reading Branch of the British Medical Association.

He was a Fellow of the Linnean Society (elected 1927) and one of the founders (in 1891) and past President of the British Pteridological Society, and since 1917 Editor of the Society's 'Fern Gazette,' adding the office of Hon. Secretary in 1926.

Dr. Stansfield was a botanist of no small attainments and a prolific writer on biological subjects. He contributed a paper on the production of apospory by environment in an apparently barren fern to the Linnean Society's Journal (1899), whilst his constributions to the 'Pteridological Society's Gazette' are without number. As a fern hunter, grower, and raiser he has been responsible for the preservation and raising of some of the choicest varieties of British Ferns.

Endowed with an unusually retentive memory and an unrivalled knowledge of the subject, his death is an irreparable loss to the Society with which he has been so long identified. His modesty was proverbial, and his generosity unbounded.

He passed away on Sunday, March 1st, from the effects of pneumonia, following an attack of influenza. A funeral service at the Unitarian Church, London Road, Reading, was attended by a large number of friends, patients, and representatives of bodies with which he had been identified, and he was laid to rest in the same grave as his wife, who predeceased him some ten years, in the Old Caversham Cemetery.—W. B. CRANFIELD.

REVIEWS.

Methods in Plant Physiology: a Laboratory Manual and Research Handbook. By WALTER E. LOOMIS and CHARLES A. SHULL, with a Chapter on Statistical Methods by GEORGE W. SNEDECOR. Roy. 8vo, pp. xviii, 472, 94 text-figs. McGraw-Hill Book Company, Inc.: New York and London, 1937. Price 25*s*.

IN this volume the authors have amassed a large number of experiments in all branches of plant physiology, from which the teacher will have no difficulty in arranging a course of instruction according to the time and equipment at his disposal. The experiments are arranged according to the subject-matter, "rather than by the skill required in their execution," but the degree of difficulty is indicated by an appropriate symbol.

Excellent advice is given to the student and, in brief, the book will be of great use: its value is enhanced by a chapter on statistical methods by Professor G. W. Snedecor and by an appendix containing physical constants, conversion tables, and other information which the physiologist commonly requires. To the professed plant physiologist the text presents no difficulties, but how does it strike those who have little or no expert knowledge?

A soldier-friend once told me—but, be it remembered, on the ruling of Mr. Justice Stareleigh in Bardell *v.* Pickwick, what the soldier said is not evidence—that during the war a non-technical officer was employed at the War Office to read and comment on the various instructions before they were issued. With this in mind, I asked a friend to read a number of the experiments taken at random: this he did, and told me that he had no difficulty in understanding what he had read, but he was annoyed to find that on occasion he was told to refer to another source to get the full details; he also thought experiment 29 *b* was brutal. This experiment certainly has defects, and might well be replaced by the porometer devised by Francis Darwin.

In response to the authors' invitation, allusion may be made to certain features which require improvement. More accurate results would be obtained by the use of the potometer shown in fig. 8 if the pipette were horizontal and not vertical. Experiment 98, on the relation of wave-length of light to chlorophyll-formation, is rather sketchy, and some of the methods would, apparently, introduce a serious temperature factor; and the direction that "the light transmitted by the various [coloured]

screens should be as nearly equal as possible " is of little use without further directions.

With regard to amplification, it would be well to insert Wilmott's bubble method of measuring carbon assimilation immediately after experiment 77, which is the well-known method of collecting the gases liberated by submerged *Elodea* in the light.

The plotting of the spectra of daylight and of chlorophyll is difficult, owing to indefinite demarcation; greater precision is given by first plotting the characteristic lines of potassium, which give " landmarks " from the red to the violet. This inclusion, with the requisite directions, would improve experiment 92.—T. G. H.

Monographia das Malvaceas Brasileiras. Fasc. I. O Genero Sida. By Honorio da C. Monteiro Fihlo. 8vo, pp. 56, 11 pls. Ministerio da Agricultura: Rio do Janeiro, 1936.

This is the first part of a monograph of the Brazilian Malvaceae, and deals with the genus *Sida*. It contains a clavis of the South American species arranged in their groups.

The first important paper on the Brazilian species of *Sida* was by St. Hilaire and Naudin in the 'Annales des Sciences Naturelles,' sér. 2, xviii., in 1842. It contains descriptions of eleven new species, besides mentioning some of the older species. In dealing with the Brazilian species of *Sida* it is important that these species should be carefully studied and properly recognised. But the author places six of these among his especies incertas.

If the author had been able to study the plants in the Paris Herbarium he would have been able to clear up some of these uncertainties. For instance, there are specimens in Paris of *Sida dubia* St. Hil. & Naud., which is a true *Sida*, with oblong-lanceolate leaves, lamina 15–20 mm. long; petioles 6–7 mm.; peduncles slender, 10–11 mm.; calyx 8–9 mm.; with ten carpels. *S. suborbicularis* St. Hil. & Naud., has an involucre, and is, I think, a *Pavonia* near *P. speciosa* H. B. K. There are also specimens of *Sida bihamata* St. Hil. & Naud., but the material is very poor, and I do not recognise it as a species of *Sida*. Also specimens of *S. adscendens* St. Hil. & Naud.; the author's clavis character for this is " Folhas breve pecioladas Peciolas com 4–6 cm. de comprimento," but the petioles are 4–6 mm., not cm. long. We could give a good deal of information about certain other species placed among the Species Incertæ. We have in the British Museum Herbarium good material of *S. myriantha* Pl. & Lind. It is a close ally of *S. densiflora* Hook. & Arn., but differs in the shorter staminal column and in the pubescence on the calyx. *S. Bakeriana* Rusby is a close ally of *S. glomerata*.

We are fortunate also in having a co-type of *Sida carpinifolia* Linn. fil., a species much misunderstood by authors. It was

gathered by Masson in the Gardens of the Monastery of St. Francis, in Madeira, and has ovate-lanceolate serrate leaves, with axillary cluster of flowers and about eight biaristate carpels. It is quite distinct, and should not be placed as a variety of *S. acuta* Burm. *S. stipulata* Cav. is certainly allied to *S. acuta* Burm.; the new species the author describes as *S. arrudiana* requires careful comparison with this.

If the author could take a trip to Europe and work in some of the Herbaria he would find a great deal of material, which would materially help in any further work on the Brazilian Malvaceae.—E. G. Baker.

Notes on the Cornish Flora. By Edgar Thurston, C.I.E. (Reprinted from the 'Journal of the Royal Institution of Cornwall,' xxiv. pt. 3, 1935.) Truro, 1936.

These notes, compiled by the late Mr. Thurston, form a further Supplement to Davey's 'Flora of Cornwall.' They comprise an exhaustive list of plant records for the years 1930–34, some furnished by local botanists, and others extracted from papers in this Journal, the Reports of the Exchange Clubs, and various other sources. In addition to localities much interesting miscellaneous information (*e. g.*, on *Anthyllis Vulneraria*, var. " Amaranth Purple," and on *Viscum album*) is included. Critical genera, particularly *Rubus*, are not neglected, and there are some corrections of erroneous records in the original Flora. The notes have evidently been carefully prepared and the relevant literature thoroughly explored. A few points invite criticism. It is noticed that *Centaurium* is used for *Erythraea*, and *Helleborine* for *Epipactis*, and in the latter genus *H. violacea* and *H. purpurata* are treated as different species. The work, which is well printed, will be most useful to botanists interested in the Cornish flora.—H. W. P.

Modern Biology. By E. J. Holmes, M.A., B.Sc., and R. D. Gibbs, M.Sc., Ph.D. Sm. 8vo, pp. xvi, 272, 163 figs. Cambridge University Press: London, 1937. Price 3*s.* 6*d.*

This book sets out to present elementary biological teaching in a direct and vital form. The authors do not stress details which are essential only to those who wish to pass an elementary examination in botany or zoology, but rather aspects of the sciences which should be part of the general knowledge of everyone. The book is therefore useful in enabling the young student to grasp the essentials of the subject at once; but the precise knowledge necessary to its true understanding is inevitably lacking in a book of this size. It is unfortunate that the generalities are sometimes so sweeping as to be inaccurate or

misleading, as in the description of the structure of wood on p. 131 and the dormancy of seeds on p. 237. In particular, the wording of the legend of fig. 163 is careless. The illustrations, especially the photographs, are excellent: that under the heading of the chapter on Protoplasm looks particularly alive, and many of the others remind the school-boy that woodlands and sea-coast are as essential as the class-room and laboratory. Many interesting and ingenious experiments are described in the practical work which follows each chapter.—W. R. PHILIPSON.

Travaux de l'Institut Botanique. General Editor, Prof. A. A. KORSCHIKOW. Vol. I. Large 8vo, pp. 195. University of Charkov: Kieff/Charkov, 1936.

THE fifteen articles in this new publication are mainly of taxonomic interest: two deal with the freshwater algæ, namely, the microflora of the pools of the Taganrog district and the taxonomic position of *Chaetopeltis orbicularis*, two with minute fungi (aquatic Phycomycetes from Kharkov and environs), and a new species of *Aphanomyces*. I. Zoz and M. Klokov contribute several articles on phanerogams of the Ukraine—a revision of the genus *Heleocharis* R. Br. in the Ukraine, notes on *Tulipa Biebersteinana*, sens. ampl., *Lithospermum Czernjajevi*, sp. nov., related to *L. arvense*, an analysis of the group *Centaurea margaritacea*, sens. ampl., *Syrenia Talijevi*, sp. nov. (Cruciferae), *Thymus littoralis*, sp. nov., from the shore of the Sea of Azov, and a yellow-flowered form of *Fritillaria meleagroides*. Ecology is represented by articles on the virgin terrains on the borders of the Black Sea, on the steppes of the Northern Crimea, and on the ecology of *Festuca arundinacea*. The volume opens with an article on the products of assimilation of free nitrogen by *Azotobacter*. The text is in Russian, but there is a brief *résumé* in French of each article, Latin diagnoses are given of the new species, and lists of species are in ordinary print. The articles are illustrated by line-drawings, maps, and folding tables.

Lily Year-Book (No. V.), 1936. The Royal Horticultural Society. Edited by F. J. CHITTENDEN, F.L.S., V.M.H. 8vo, pp. 131, frontis., 38 pls., and text-figs. Royal Horticultural Society: London, 1936. Price 5*s.* paper, 6*s.* cloth.

THE fifth issue of the Lily Year-Book is a record of lily-culture for the year in the form of special articles and discussions. The frontispiece is a portrait of the French botanist, Pierre Duchartre (1811–1894), of whose work Mr. Cotton gives an account, and whose 'Observations sur le genre *Lis*' (1870) was followed by other papers on the genus; Mr. F. C. Stern, Chairman of the

Editorial Committee, in a Foreword, gives a brief review of the work of the year. Lily-cultivation in New Zealand, India, South Africa, Hong Kong, and North America is described by various experts, and W. R. Price writes on the Formosan lily. Dr. M. A. Tincker describes experiments at Wisley on propagation from bud-scales placed in various positions in the soil, and Dr. Fred Stoker writes on the functions and mode of action of the contractile roots. Other articles deal with the cultivation of Fritillaries, and the nomenclature of *Lilium Bolanderi* and allied species, and there is a Lily bibliography compiled by l'Abbé Souillet. The discussions at the meetings of the Lily Group on planting, Japanese lilies, and lilies exhibited are reported. The plates, which are of the high standard that we associate with the Society's publications, represent species and varieties of interest as grown in cultivation.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on February 18, the President, Dr. W. T. Calman, C.B., F.R.S., from the Chair, reported the deaths of Prof. Max Weber and Prof. Federico Raffaelle, Foreign Members. Dr. T. A. Sprague exhibited a specimen of *Ulex europaeus* from Dorset, showing foliage characteristic of seedlings due to the plant having been cut down nearly to the base in the previous year.

Dr. V. J. Chapman gave a lecture illustrated with lantern-slides—'Glimpses of the Ecology of North America and Jamaica.' Some account was given of the vegetation and character of the sand-dunes bordering lake Michigan, and of the progression landwards of the various stages culminating in established woodland. Also of the sparse salt- and heat-enduring flora of the arid plain near the Great Salt Lake of Utah, and of the halophytic vegetation on the Californian coast. Some features of the forest vegetation of the Blue Mts. in Jamaica, were also described.

At the meeting on March 4, the President in the Chair, two new Fellows were admitted and eleven were elected.

Mr. R. Washbourn and Mr. R. F. Jones gave an account illustrated with lantern-slides of the fauna and vegetation of Lake Huleh, an expansion of the River Jordan north of Lake Tiberias. The margins of the shallow lake and the adjoining swamp afforded an interesting association of the Papyrus with the Common Reed (*Phragmites communis*) and *Jussieua repens*. The aquatic flora and that of the lake shores seemed to be composed mainly of familiar palæarctic species.

Dr. V. Hagen gave an interesting lantern lecture on the fauna and flora of the Galapagos Islands. The remarkable endemic species are becoming extinct, largely owing to the

greed of collectors, and efforts are being made for the preservation of what remains of one of the most specialised biologic areas, notable also for its visit by Charles Darwin and the part it played in arousing his interest in the origin of species.

A paper entitled "The Genus *Potamogeton* L. in Tropical Africa" by J. E. Dandy, M.A., F.L.S., was read in title.

At the General Meeting on March 18, the President in the Chair, Dr. A. B. Rendle gave an account of the typification and nomenclature of the two Linnæan species of the Apocynaceous genus *Rauvolfia*.

HARTLEY BOTANICAL LABORATORIES PUBLICATIONS: No. 17.—"On the Place of Ontogeny in Floral Enquiry" by Prof. McLean Thompson is an exposition of the purpose and methods of floral enquiry pursued by the author in his work on the elucidation of the floral structure of the Leguminosae and Scitamineae and its bearing on theories of floral morphology. It has been called forth by adverse criticism by Dr. Kozo Poljanski in a recent article in the 'New Phytologist.' In conclusion, the author remarks that there will be a long period of uncertainty as to the meaning of angiospermy and the lines of angiospermic descent (two distinct problems), while facts are being collected and collated from both living and fossil plants.

TYPES OF NORTH AMERICAN GRASSES.—In the January number of the 'American Journal of Botany' Mrs. Agnes Chase gives the result of studies of types of doubtful species by the late Dr. Hitchcock and herself in various European herbaria. The examination of Steudel's types in the Caen herbarium has elucidated a number of doubtful species, most of which are relegated to synonymy. Dr. Hitchcock had identified several of Lamarck's species in the Paris Herbarium.

ORCHID REVIEW.—The January number contains notes on the orchid flora of the dry plains of the north of San Domingo by R. A. Julia, an unpromising dry area with thorn-bushes and giant Cacti, but containing a wealth of Orchid species. Also descriptive notes of the north-east Indian *Dendrobium Pierardi*, sent to Kew by Roxburgh in the early nineteenth century, and of the Costa Rican *Oncidium bryolophotum* and *Sigmatostalix costaricensis*, the latter apparently a rare species.

BIRD SANCTUARY.—The Royal Society for the Protection of Birds appeals for £2000 needed for the completion of purchase of an area of 1200 acres at Dengemarsh on the south coast of Kent for a bird sanctuary. This stretch of shingle, the only considerable stretch of coast now remaining on the South Coast east of the Isle of Wight where terns can nest, has been carefully nursed and safeguarded since 1904, but is now threatened under a town extension plan. Contributions should be sent to the Hon. Secretary of the Society, 82 Victoria St., London, S.W. 1.

NOTULÆ BRYOLOGICÆ.—I.

By H. N. DIXON, M.A., F.L.S.

NECKERA TUMIDA Dicks.

What has been supposed to be this plant is the one figured in the Bry. javanica, t. 199, as *Meteorium tumidum* Mitt. (Musc. Ind. Or. 86). It is not, however, the plant of Dickson and Mitten, but a quite distinct species, and is, in fact, the common species of *Calyptothecium* with a wide distribution over India, Malaya, and Oceania. It is the same plant as that described by Brotherus in 1900 as *C. philippinense*, and for some time I have been in the habit of using this name for the common plant. Recently, however, I have been led to compare this with *C. Urvilleanum* (C. M.) Broth., known from several islands in the Pacific, and I can find no difference between them, a conclusion in which I am supported by Mr. E. B. Bartram. The correct name for this plant will therefore be *C. Urvilleanum* (C. M.) Broth.

The error in the Bry. javanica has led to the description, in 1909, of *Pterobryopsis Maxwellii* Card. & Dix., a South Indian plant which proves to be identical with the *Neckera tumida* of Dickson.

A comparison of the original plant of Dickson, communicated to Mitten, shows that the two species may easily be distinguished by the following characters:—

Neckera tumida Dicks. Leaf-base clasping, but without marked auricles. Nerve strong, reaching to near apex. Branching and leaves dense. Upper cells short.

N. Urvilleana C. M. Leaf-base with large auricles. Nerve weaker, especially at base, reaching to about three-fourths of the leaf. Branching distant. Leaves laxer. Upper cells elongate-rhomboid.

As to the taxonomic position of these plants, it is exceedingly difficult to say whether they should be placed in Neckeraceae under *Calyptothecium* or in Pterobryaceae under *Pterobryopsis*. (A discussion of this question will be found in Journ. Bot. 1909, 161, 162.)

According to Brotherus's arrangement ('Musci,' ed. 2), in which he follows Fleischer, the differences between the two genera are reduced to the following:—

Pterobryopsis. Capsule with stomata. Præperistome absent. Endostome rudimentary.

Calyptothecium. Stomata absent. Præperistome present. Endostome with linear processes.

These distinctions, however, are not constant. Brotherus places *Meteorium Wightii* Mitt. in *Calyptothecium*, in spite of the fact that it has no endostome, while *Neckera tumida*, as shown by *Pterobryopsis Maxwellii*, has no præperistome, but the processes are developed (*cf.* Journ. Bot. 1909, 163, and t. 497, figs. 1–4). It upsets, in fact, Fleischer's distinctions between the two genera.

It will probably be thought best to make the presence or absence of a præperistome the crucial character. In that case *Neckera Urvilleana* C. M. remains under *Calyptothecium*, while *Neckera tumida* Dicks. will be placed in *Pterobryopsis*, where the form of the leaf-base makes it more at home.

The synonymy may then be given (in part) as follows :—

Pterobryopsis tumida (Dicks.), comb. nov.

Syn. *Neckera tumida* Dicks. ; *Pilotrichum tumidum* Brid. ; *Meteorium tumidum* Mitt. ; *Pterobryopsis Maxwellii* Card. & Dix. *Calyptothecium Maxwellii* Broth.

Distr. Ceylon ; South India.

CALYPTOTHECIUM URVILLEANUM (C. M.) Broth.

Syn. *Neckera Urvilleana* C. M. ; *Meteorium tumidum* Bry. jav. (*nec* Mitt.) ; *Calyptothecium tumidum* Fleisch. ; *C. philippinense* Broth. ; *C. praelongum* Mitt.

Distr. India ; Ceylon ; Malaya ; Philippines ; Yunnan ; South China ; Pacific ; New Guinea.

CHAETOMITRIUM BORNENSE Mitt.

In a paper on Bornean mosses in Journ. Linn. Soc., Bot. xliii. 314, I gave *C. Elmeri* Broth. as a synonym of the above. This was an error, induced by a specimen at Kew from Perak, coll. Wray, labelled "*Pilotrichella perakensis* Broth. MS." I wrote to Brotherus as to the publication of this, and he replied :—"After having got fertile specimens from the Philippines I find that *P. perakensis* is a *Chaetomitrium*, which I have described in Musc. nov. Philipp. ii. under the name of *Ch. Elmeri*." The Perak plant was obviously the same as the Bornean plant of Mitten, and I therefore gave *C. Elmeri* as a synonym. Brotherus was wrong, however, in determining the Perak plant as the same as the Philippines moss. The two are quite distinct. Apart from the totally different fruit, the leaves in the Bornean plant are regularly arranged in spiral series, as in *Pilotrichella* and *Orthostichopsis*, which is not the case with *C. Elmeri*, and there are other differences.

This correction should have been made in my recent paper on Bornean mosses, Journ. Linn. Soc., Bot. l. (1935), but was overlooked.

It may be desirable to take the opportunity of making another correction in this recent paper, under this genus. The plant referred there, on p. 108, to *C. torquescens* was not that species, but was *Trichosteleum fissum* (Hampe) Jaeg., a species hitherto only known from Samoa and Fiji. *C. torquescens* must therefore be erased from the Bornean list ; and the Key on p. 107 needs to be corrected, most simply by substituting the name *Trichosteleum fissum* for *C. torquescens* in clause 6,

POROTRICHUM RAMULOSUM Mitt.

This name has been given to two mosses, viz. :—

(a) *Isothecium ramulosum* Mitt. in Kew Journ. of Bot. viii. 353 (1856). This Mitten transferred to *Porotrichum* in Trans. & Proc. Roy. Soc. Victoria, 1883, 84.

(b) *Neckera ramulosa* Mitt. in Journ. Linn. Soc., Bot. vii. 160 (1863). Dusén, in the Exsiccata, M. Camer., no. 282 (1892–93) issued this plant under the name *Porotrichum ramulosum*, under which name it has remained. Dusén incorrectly on the printed label has "*Porotrichum ramulosum* Mitt.," giving no synonym.

(*a*) is now placed under *Camptochaete*, as *C. ramulosa* (Mitt.) Jaeg. ; but the adoption by Mitten of the combination for it of *Porotrichum ramulosum*, in 1883, renders the *P. ramulosum* of Dusén a later homonym, which therefore must be rejected (even if it had been properly published with synonym). No other specific epithet, so far as I am aware, has been applied to the moss, which therefore requires a new one. I propose for it the name **P. cameruniae** Dix., nom. nov. (syn. *Neckera ramulosa* Mitt.).

GONIOBRYUM Lindb.

This genus is generally held to consist of three species, of an almost entirely subantarctic distribution, viz., *G. reticulatum* (H. f. & W.) Lindb. *G. subbasilare* (Hook.) Lindb., both confined to Fuegia and the southern part of South America, except that a single station in Samoa is cited by Mitten in the 'Flora Vitiensis' for the latter, which, however, stands in great need of confirmation.

The third species is *G. pellucidum* (Mitt.) Broth., confined to Australasia, and published in Journ. Linn. Soc., Bot. x. 175 (1868), as *Photinophyllum pellucidum* Mitt., who describes it as "like *P. subbasilare* in size and habit, but with more pellucid leaves, which are also serrate, with duplicate teeth." This plant is recorded in the 'Handbook of the New Zealand Flora' as *Rhizogonium subbasilare* Schimp. Mitten makes no reference to this, which is accounted for by the fact that his paper was read in March 1867, while the Handbook N.Z. Fl. containing this record was not published till some time in 1867. Paris quotes these Australasian records of *G. subbasilare* with a ?, and Brotherus refers to them, stating that all the plants that he has seen from that region belong to *G. pellucidum*. He gives no other character to separate the two species but the leaf-toothing, single in *G. subbasilare*, bigeminate in *G. pellucidum*. It is quite true that most of the Australasian plants show double toothing, while single toothing is characteristic of the Fuegian moss ; but this character is not constant. I have a plant from Tasmania (coll. Weindoerfer, 1929) which has the toothing nearly all single,

with a very rare double tooth. And in an original gathering of *G. subbasilare* by Dr. Lyall (Hermite Island, Cape Horn, ex herb. Spencer H. Bickham) I find the toothing about equally single and double throughout the same stem.

The character is evidently of no specific importance, or even of varietal value (the same thing occurs in other mosses, e. g., *Hookeriopsis utacamundiana*), and *G. pellucidum* must be reduced to the synonymy of *G. subbasilare*.

What now is *G. reticulatum*? It is a little-known plant, described from a sterile specimen and not known in fruit. There is a single specimen in Herb. Mus. Brit., with a MS. label of Wilson's, "*Hypnum reticulatum*, Hermite Isld. I really think now that is distinct from *Br. vagans* MSS. W. Sept. 19, 1845." *Br. vagans* is *Bryum vagans* H. f. & W., now placed in *Philonotis*. In Fl. Antarct., under *Hypnum reticulatum*, the note is added :—

"The many points of correspondence between this moss and *Bryum vagans* nobis have not escaped our notice. The specimens being few and barren, we are unable to pronounce with confidence on the validity of the species."

After a careful comparison of the types of the two species, with a greater range of specimens than Wilson had at his disposal of *P. vagans*, I think they must certainly be united, *G. reticulatum* being a slender, subdistichous form, with the nerve and border a shade narrower than it is usually (but not always) in *P. vagans*. The latter is recognized as a highly variable plant, and I have forms coming very close to *G. reticulatum*, notably one from Punta Arenas, Fuegia, pr. fontem S. Antonio, coll. Benove, 1922.

G. reticulatum then becoming a synonym of *P. vagans*, *Goniobryum* is left as a distinct monotypic genus, with *G. subbasilare* the type and only species *.

Rhizogonium reticulatum Hampe in Linnæa (1859–60), xxx. 636, has been shown to be identical with *G. pellucidum*, i. e., *G. subbasilare*.

Meteorium divergens Mitt.

Brotherus, in the 'Musci,' places this with *Meteoriopsis squarrosa* (Hook.), and with no others as allied. This, however, is not its true position. Brotherus may have had a wrongly named specimen sent to him, as a specimen of *M. squarrosa* on the same sheet at Kew (probably placed there for comparison by Mitten) is wrongly labelled *M. divergens*, as are even some others named by Mitten himself. The type is undoubtedly the plant

* Since the above was in print, I find that Herzog has described from the Bolivian Cordillera a *Goniobryum subaloma*, sp. nov., a plant with almost unbordered subentire leaves. It is without fruit and appears to me doubtfully placed in this genus, rather than, e. g., *Meesea*.

from Silhet (Hook. & Thoms. 803). This has the leaves not squarrose and recurved, but straight, rigidly divergent from the stem, and densely arranged. The true position is probably not determinable without fruit. It is, in the leaf-arrangement and structure, very close to *Aerobryum speciosum*, and may very probably belong to that genus. In any case it has no very near affiance with *Meteoriopsis squarrosa*.

Anoectangium pusillum Mitt.

Mitten described this African species, from Kilimanjaro, in Journ. Linn. Soc., Bot., xxii. 305 (1886).

In 1894 Paris, 'Index Bryologicus,' substituted the name *A. kilimandjaricum* for this, on the ground that *A. pusillum* had already been used by Wilson for an Indian moss "in Kew Journ. of Bot. ix. p. 325 (1857)." This was, however, superfluous, since Mitten had already, in Trans. Roy. Bot. Soc. Edinb. xxxi. 115, in 1888, in the Appendix to Balfour's 'Botany of Socotra,' replaced his name by *A. Hanningtonii*, owing to the name *pusillum* "having been used for two other species." One of these is doubtless *A. pusillum* Wils., mentioned above; he does not specify the other, and I have been unable to trace such a name.

It is doubtful whether either of these names was necessary. Wilson's name was not effectively published; it is a *nomen nudum*, and could not invalidate a later, validly published name; and the fact that Mitten referred to a second *A. pusillum*, which he does not specify, cannot be held, either, to do so. No such name appears in Paris's 'Index,' and in all probability it was a MS. name known to Mitten but never published.

There seems to be no reason why *A. pusillum* Mitt. should not stand for the African moss.

Paris's intervention has had another unfortunate effect, as his *A. kilimandjaricum* must invalidate *A. kilimandscharicum* Broth., founded, in 1912, on a quite different species, which becomes a later homonym, since the two are but orthographic variants. It requires, therefore, a new name, and I propose, in order to preserve as far as possible the connection with the discarded name, **Anoectangium eukilimandscharicum** Dix., nom. nov.

Dendrocyathophorum Dix.

In a paper, "Decas Generum Novorum Muscorum," in Journ. Bot. Jan. 1936, I published the above genus, based on an Assam specimen collected by Dr. Bor. I had overlooked the existence of a Japanese moss, *Hypopterygium paradoxum* Broth., placed by Cardot in a new Section, *Eurydictyon*. I have since recognized that the two are not only congeneric, but with practical certainty (I have not seen the Japanese plant) conspecific.

This rather remarkable example of disjunction in distribution is curiously paralleled by *Orthomniopsis japonica*, which was known from only two localities in Japan until discovered in Assam, also by Dr. Bor. In the latter case, however, the moss has since been found in the Philippines and in New Guinea.

The trouble does not end here. In a recent publication (Journ. Sci. Hiroshima Univ. (Mar. 1936), ser. B, div. 2, vol. iii. 22) Horikawa and Noguchi, recognizing the generic status of *Hyp. paradoxum*, have raised Cardot's Section to the rank of a genus, as *Eurydictyon* (Card.) Horikawa & Noguchi, gen. nov., with the single species *E. paradoxum* (Broth.), adding as a synonym *Cyathophorella Aoyagii* Broth.

As the publication of my genus precedes that of *Eurydictyon* by the narrow margin of two months the moss must go by the name of **Dendrocyathophorum paradoxum** (Broth.) Dix., comb. nov. Syn. *Hypopterygium paradoxum* Broth.; *Dendrocyathophorum assamicum* Dix.; *Eurydictyon paradoxum* Hor. & Nog.; *Cyathophorella Aoyagii* Broth.

Eurhynchium tortipilum Dix. & Thér.

This was published in Rev. Bryol. N. S. iv. 165, in 1932. Prof. Lazarenko has called my attention to the resemblance between it and *Brachythecium eustegium* Besch., and on comparing them I am convinced that the two are identical. It did not occur to us to compare it with a *Brachythecium*! The foliation is more like that of *Eurhynchium striatum* perhaps than of any other moss, and the lid in our plant is clearly rostrate, normally above half the length of the capsule, sometimes considerably so. It varies, however, and may have been shorter in Bescherelle's specimen, but in all my plants (and I have several in fruit) it is distinctly rostrate. It should be known as **Eurhynchium eustegium** (Besch.), comb. nov.

Tortula luteola Mitt.

This species has been inadvertently omitted from Brotherus, 'Musci.' It will not be found in Paris's 'Index' under *Tortula*, but as *Barbula luteola* Mitt. it is referred to *T. pungens* H. f. & W.

Under that species Paris has as synonym *Barbula luteola* Mitt. in Kew Misc. 1857, 258. This is quite incorrect. It should read: *Tortula luteola* Mitt. in Kew Journ. Bot. viii. 258 (1858).

But, obviously, as *T. pungens* was not published till 1860 in the 'Flora Tasmanica,' Mitten's name has priority. A specimen in Herb. Hort. Bot. Edin. has in Mitten's hand "*Tortula luteola* Mitten in Kew Miscell. 1857. *T. pungens* H. f. & W., Fl. Tasm." "Coll. James Mossman, 1850, on trees," showing that Mitten recognized the identity of the two.

Barbula pseudo-pilifera Hampe & C. M. (1853) is the same thing, as Mitten had already concluded. Hampe's original specimen is a meagre plant, scarcely determinable, but through the kindness of the Berlin Museum I have been able to compare C. Mueller's specimen of the type, and it is quite inseparable from *T. pungens*. Rodway ('Tasmanian Bryophyta, Mosses') keeps the two separate, while noting that they are very similar. He bases the difference on some slight fruiting characters; but of the two specimens which I received from him the plant from Margate is sterile while the one from Sheffield is fruiting *Barbula subtorquata*, and it is probably this fruit which he is describing in the above work; he gives it as having the lid equalling the capsule in length, and this is the case with the *Barbula*. The 'Flora Tasmanica' does not describe the lid of *T. pungens*.

T. pseudo-pilifera is a good species, Brotherus includes it in *Barbula*, but its correct place is in *Tortula*. It will be known as **Tortula pseudo-pilifera** (Hampe & C. M.), comb. nov. Its position in the genus, with that of the nearly allied New Zealand species, *T. flavinervis* Dix., is somewhat uncertain, but it is probably a *Syntrichia*, with the nerve excurrent into a longer or shorter, *yellowish, entire*, mucro or short arista, the length of which varies considerably even on a single stem.

T. pseudo-pilifera is a well-marked species. Apart from the smooth, yellow, cuspidate point the nerve is exceedingly strong and deeply channelled, the margins usually widely recurved. A rather marked feature is the presence in the supra-basal cells of longitudinally seriate papillæ, in the cells where the upper obscure ones pass into the elongate hyaline basal cells, which occupy a shorter portion of the leaf than is usual in *Syntrichia*.

Macromitrium levatum Mitt.

Mitten founded this species on a specimen gathered on Cameroons Mountain by Mann. In the same publication and page he published *M. Menziesii*, based on plants from "Sierra Leone, Menzies in Herb. Hooker," and also from "Fernando Po and Island of St. Thomas." The only distinguishing characters that he gives between the two are rather smaller cells in the latter, and the mature capsule smooth and plicate only in the neck, while in *M. levatum* he describes it as "slightly and irregularly plicate when old; before the fall of the operculum it is smooth." These differences are obviously slight.

I have recently had for examination some material of these plants from the R. Bot. Garden, Edinb., which throw some light on their relationship. They are labelled "*Schlotheimia turbinata* Tayl. MSS. 1843"; "Sierra Leone, G. Don (Menzies)," from Menzies's herbarium; and "Sierra Leone, from Mr. Geo. Don," in Menzies's hand; these show that Menzies himself was not the collector, but that he received them from G. Don. They are the original gathering on which Mitten based his *M. Menziesii*.

As regards the areolation, I have compared the Sierra Leone plant with a specimen of *M. levatum* collected by Miss Steele at

8100 feet on Mt. Cameroon, *i. e.*, almost the exact locality where Mann collected it. The areolation varies to a very slight extent in different leaves, but is certainly not larger in *M. levatum*—in fact, if there is any difference the larger cells are those of *M. Menziesii*.

Then as regards the capsule. Menzies's specimens are in good condition and quantity, fruiting freely, and show probably better material than Mitten had at his command. Mitten's own specimens at Kew, however, do not fully bear out his description. In his specimen of *M. Menziesii*, I. St. Thomas, coll. Mann, there are quite ripe and quite smooth capsules, as described, but also older, mature capsules distinctly plicate, several almost and one or two quite throughout their length, as in *M. levatum*; while in another specimen (Fernando Po, coll. Mann, det. Mitten) the capsules, while operculate, are strongly ribbed throughout their length.

Potier de la Varde ("Mousses de Gabon," in Mém. Soc. Nat. Sc. Nat. et Math. Cherbourg, 1936, 130) gives certain distinctions between the leaves of *M. levatum* and *M. Menziesii*, but these can be founded only on two forms of the same species; they are in no way borne out by the original specimens of *M. Menziesii* as compared with the Cameroons Mountain *M. levatum*, in which the leaves are identical in size and direction.

There is no question that the two are one and the same species. Jaeger altered the name of *M. Menziesii* (already employed for a Tahiti moss) to *M. Mannii*. This must pass into the synonymy of *M. levatum*. I have already pointed out (South Afric. Journ. Sci. xviii. 317) the identity of certain other species with *M. Mannii*, and these too must go as synonyms of *M. levatum*. To these also *M. perundulatum* Broth. (mentioned there with some doubt) must certainly be added.

Barbula asperifolia Mitt.

Published in the Musc. Ind. Or. 34 (1859). I have lately had occasion to examine the type of this in the Kew collection, in connection with a specimen sent from the Edinb. R. Bot. Gard, labelled "India, Herb. Menzies." The Indian specimen agrees exactly with Mitten's plant, only being a rather more slender form, and is in fruit. The fruit shows by the peristome that it is a *Didymodon* rather than a *Barbula* (Mitten described his species from a sterile specimen), and there can be no doubt that it is identical with *D. rufus* Lor. Baumgartner, who had seen the Kew specimen, has written that it is "very near *D. rufus*." The Edinburgh specimen confirms the identity. Mitten's name is very appropriate, and it may be recalled that Limpricht describes *D. rufus* as having the nerve "beiderseits rauh" and the leaf-cells as "beiderseits lang papillös-mamillös."

Brotherus gives the distribution of *D. rufus* as arctic and high alpine in Europe and N. America, and Siberia and Central Asia. It is therefore not unexpected that it should occur at high altitude in Sikkim. I have specimens from Shensi and Chahar, in China, in my herbarium.

Foreauella Dix. & Potier de la Varde.

Foreauella indica Dix. & Varde was published as a new genus and species in 1927 in Archiv. Botan. Bull. Mens. nos. 8–9, 175.

The history of this moss is very complex. When examining specimens, at Kew, of *Pylaisia secunda* (Hook.) Jaeg. recently I recognized that it was identical with the *Foreauella*. It was based on a Nepal specimen of Wallich's, sent to Schwaegrichen by Hooker under the MS. name of *Leskea secunda* Hooker. Schwaegrichen published it as *Hypnum orthothecium* (Suppl. iii. pt. 1, t. 220; 1827). Schwaegrichen's name was, however, ignored by Hooker and Harvey, and the plant was republished as *Leskea secunda* by Hooker in 1840.

It is not obvious why Hooker ignored Schwaegrichen's name; still less is it obvious why Jaeger, followed by Paris, make *H. orthothecium* Schwaegr. a synonym of the later *Leskea secunda* instead of *vice versa*. I am inclined to think that the explanation of the first problem is that Hooker, in describing his *Leskea secunda* in 1840, may have forgotten that he had many years earlier sent a specimen of the same moss, also from Nepal, coll. Wallich, under the same MS. name, which Schwaegrichen had published as *H. orthothecium*. This is the more likely since the earlier plant was a fruiting specimen (Schwaegrichen figures the capsule, though, as Wilson has observed, somewhat incorrectly), while Hooker's *L. secunda*, 1840, was based on a sterile plant. Mitten, in the 'Musci Ind. Or.,' recognized the identity of the two.

Hypnum orthothecium seems to have been entirely overlooked by recent authors, and the plant appears to have been dropped altogether by Brotherus in the 'Musci.'

It is clear that Schwaegrichen's name has the priority, and the plant must be known as **Foreauella orthothecia** (Schwaegr.) Dix. & Varde. *Foreauella indica* must fall into synonymy, together with *Pylaisia secunda* (Hook.) Jaeg., and all the synonyms given by Paris under that.

Its distribution appears to be fairly wide, including Burma, Assam, Laos, and the Philippine Is. It seems to occur in many parts of India.

Since the publication of *Foreauella* I have found that the plant exists in different herbaria under various MS. names, and it may be useful to mention one of these.

It occurs in Hampe's herbarium as *Rhyncho-Hypnum curvatirameum* Hampe MS., and was distributed by Miss Roberts in 'Himalayan Mosses,' pt. 2, as *Stereodon curvatirameus* (Hampe) Broth. MS. (*ined.*).

AN UNDESCRIBED SPECIES OF *SCLEROTINIA*.

By Margaret A. Keay, M.A. (Cape).

In November 1933 Professor F. T. Brooks isolated a fungus suspected to be a species of *Sclerotinia* from diseased plants of *Gypsophila elegans* Bieb. The plants were being grown near Biggleswade, Bedfordshire, for commercial purposes, and many leaves and stems near ground-level were rotted.

Experiments have shown that the fungus is very pathogenic to *Gypsophila elegans* and to the following members of the Caryophyllaceae:—*Lychnis alba* Mill., *Silene gallica* L., *Silene maritima* With., *Spergula arvensis* L., and *Stellaria media* Cyrill. It proved to be weakly parasitic to *Lactuca sativa* L., and to young plants of *Pisum sativum* L., *Vicia Faba* L., and *Cichorium Intybus* L., but it failed to attack *Cerastium arvense* L., *Dianthus barbatus* L., *Dianthus deltoides* L., *Helianthus tuberosus* L., and *Trifolium pratense* L. The pathogenicity of this fungus has been found to be markedly different from that of *Sclerotinia Sclerotiorum* de Bary, *S. Trifoliorum* Eriks., and *S. minor* Jagger.

The fungus has been grown on the following media:—oatmeal, 5 per cent. malt extract, potato dextrose, and Dox's agars, and on liquid 5 per cent. malt extract and liquid Dox's solution. On all these media the appearance of the cultures is different from that of parallel cultures of *S. Sclerotiorum*, *S. Trifoliorum*, and *S. minor*. A great deal of fluffy mycelium is produced, especially at 5° and 10° C., and this gradually advances over the surface of the medium. When cultures are held up to the light the mycelium is observed to have a silky sheen; in young cultures it is white, but as a culture ages it becomes slightly buff-coloured. Numerous microconidia have developed on all the media used. No other condidial stage has been noted in any culture, whether descended from the original isolation or established from ascospores.

Upon malt-extract, potato-dextrose, and oatmeal agars, and on liquid 5 per cent. malt-extract a black plectenchymatous tissue is produced. Upon malt-extract or potato-dextrose agars this tissue does not always develop, but in most cultures on liquid malt-extract the whole surface of the liquid has been encrusted with a continuous black sheet of tissue which is covered by a fine web of hyphæ and which produces a slimy matrix on the under surface. The thickness of the plectenchyma varies from 1–3 mm., and extremely warty sclerotia may be produced on its surface. On oatmeal agar the formation of this tissue is fairly constant. In cultures in Petri dishes or conical flasks the plectenchyma appears in irregular patches or covers the whole surface of the medium, or forms one or two concentric rings. Similarly

in test-tubes it is produced in patches or as a continuous sheet. In some cultures warty sclerotia develop on the surface of the plectenchymatous tissue or are suspended amongst the fluffy mycelium above it. The latter type of sclerotium, which frequently fails to harden, is more symmetrical in shape than that which is produced on the plectenchyma. The sclerotia are very variable in size, 2–10×2–5 mm. They are generally smaller than those of *S. Sclerotiorum* and *S. Trifoliorum*, but always larger than those of *S. minor*. On all media "organs of attachment" are less common and smaller than in cultures of *S. Sclerotiorum* and *S. Trifoliorum*.

Experiments with cultures on 5 per cent. malt extract agar have shown that the fungus grows over a temperature range of 0–25° C. At 25° C. growth was fairly rapid at first, but soon slowed down, and then ceased; at 0° C. it was very slow, and stopped before the surface of the medium had been covered. The mycelium spread, and sclerotia and microconidia were produced most rapidly at 20° C.

The mycelium on Dox's agar is less dense, but microconidia are produced in great abundance, the clusters being obvious to the naked eye as small white aggregations. On this medium the formation of a plectenchyma has never been observed, and the sclerotia are usually smaller and less warty. From these numerous apothecial stipes develop, the majority of which remain as short projections, but a few in each culture may attain a length of from 5–10 mm. When such cultures are exposed to the light the tips of some of the longer stipes become swollen and urceolate, and the inner and outer surfaces are covered with a mass of microconidia. A few of these urceolate tips have expanded to form disc-shaped apothecia with asci and ascospores. This behaviour of the sclerotia on Dox's agar is one of the most striking characteristics of the fungus. Occasionally apothecial stipes have developed in cultures on malt extract and oatmeal agars, and ripe apothecia have been obtained from cultures on the latter medium. This development of stipes and apothecia in culture distinguishes the fungus from the strains of *S. Sclerotiorum* and *S. Trifoliorum* studied by the writer, in which no such development has ever been observed. Apothecia have also been obtained by burying the sclerotia in pots of damp sand, and it is interesting that they have arisen from pieces of the plectenchyma treated in a similar manner. Sclerotia buried in the spring of 1934 produced ascocarps in the autumn of the same year, and sclerotia and plectenchyma buried in the spring and early summer of 1935 developed apothecia one month after burial.

The investigations have proved that this fungus is quite different from *Sclerotinia Sclerotiorum*, *S. Trifoliorum*, and *S. minor*; no description of any *Sclerotinia* has been found

which agrees with the species under consideration. It has been decided, therefore, to describe the fungus as a new species; this conclusion is supported by Professor Whetzel, to whom a culture was sent.

Sclerotinia serica, sp. nov. ascomatibus pluribus aut e sclerotio aut e plectenchymate orientibus; stipello deorsum attenuato; cupula supra russea-brunnea nitida, primo rotunda centro depresso, deinde elliptica, aut plana aut convexa, 2–5 mm. lat., infra pallidiore; ascis aut cylindraceis aut cylindreo-clavatis 155–270×11–22 μ, plerumque circ. 194×16·4 μ; cacumine iodo tincto non cæruleo; sporidiis 8, inæqualiter monostichis hyalinis, nonnumquam guttulis 2 indistinctis ad extremos, inæqualiter ovatis, cacuminibus acutis, 14–22·6×6·8–17·2 μ plerumque circ. 20·65×10·12 μ; paraphysibus tenuibus clavatis, 4–5 μ lat.; microconidiis globosis hyalinis, 2·8–5 μ lat., clara guttula suffultis; in apice conidiophorum orientibus; conidiophoris brevibus obclavatis solitariis vel gregariis; sclerotiis nigris, forma et magnitudine valde variis, verrucosis, nonnumquam cum plectenchymate.

Hab. Biggleswade, Beds, parasitic on *Gypsophila elegans.* The name suggests the silky sheen of the mycelium.

Apothecia produced just above the soil surface, several arising from a sclerotium or plectenchyma; length of stalk variable, attenuated downwards, upper part with the same colour as the under surface of the apothecium; diameter 1 mm.; lower part brownish black; diameter 0·5 mm.; upper surface of disc light reddish brown, shiny, at first circular with the centre depressed, later elliptical, flat or with the centre raised; under surface paler; diameter 2·5 mm. *Asci* cylindrical to cylindro-clavate, length 155–270 μ, average 194 μ, breadth 11–22 μ, average 16·4 μ; unthickened at top, tip not stained blue with iodine, protruding slightly beyond the paraphyses at maturity; ascospores 8 per ascus, irregularly uniseriate, hyaline, sometimes with 2 faint guttules at the ends, irregularly oval with slightly pointed ends, one more so than the other; length 14–26·6 μ, average 20·65 μ; breadth 6·8–17·2 μ, average 10·12 μ. *Paraphyses* clavate, 4–5 μ broad. *Microconidia* globose, hyaline, 2·8–5 μ in diameter, average 3·9 μ, with one bright guttule; borne apically on short obclavate conidiophores either singly or in clusters. *Sclerotia* black, variable in size, warty; plectenchyma produced on some media.

The Botany School, Cambridge.

POLLINATION OF *RANUNCULUS FICARIA* L. BY INSECTS.

By Eric M. Marsden-Jones, F.L.S.

Experiments carried out to test the fertility of *R. Ficaria* indicate that insect visits are indispensable for the full production of viable seed. Plants on selfing are either completely sterile or only produce a small proportion of viable seed. Failing insect visits self-pollination takes place.

R. Ficaria is usually hermaphrodite, but it may also be gyno-monœcious and tricœcious. The flowers are slightly protandrous. Pollen and nectar are accessible to short-lipped insects, the nectar being secreted in a small scale at the base of the petal.

The following observations were made in order to determine the frequency of insect visits, the species which visit, and the object of their visits, whether in search of pollen, nectar, or both. Thirty-five observations were made between March 15th and May 29th, 1931, under different weather conditions and in various localities. Twenty-six hours fifteen minutes were spent observing; Greenwich time is given for all the observations:—

I. *March 15th.*—Hedge bank, Cogshill Lane, Potterne, Wilts, from 2.30 to 2.45 p.m. Bright sun, wind slight, S.W. Only a few flowers were open and the only insect seen visiting was *Apis mellifica* ☿.

II. *March 17th.*—Hedge bank, Cogshill Lane, Potterne, from 12.15 to 12.45 p.m. Bright sun, wind slight, S.E. There were still only a few flowers open. Insects visiting, *Apis mellifica* ☿ and *Orthellia caesarion* ♀.

III. *March 23rd.*—Hedge bank, Cogshill Lane, Potterne, from 12.15 to 12.35 p.m. Sunny intervals, wind slight, S.W. The flowers were now fairly numerous. Insects visiting, *Meligethes ovatus* ♀, *Halictus decipiens* ♀, and *Apis mellifica* ☿.

IV. *March 23rd.*—Experimental Ground, Potterne Biological Station, from 2.55 to 3.5 p.m. Sunny intervals, wind slight, S.W. There were in the experimental ground two beds containing 250 plants of *R. Ficaria.* Many flowers were open. Insects visiting, *Bombus lapidarius* ♀, *Apis mellifica* ☿, and *Eristalis tenax* ♀.

V. *March 25th.*—Experimental Ground, from 2.5 to 2.35 p.m. Bright sun, gentle breeze, wind E. In the beds there were several plants with pale flowers, a very careful watch was kept on these flowers to see how *Apis mellifica* would react to them. They were visited with as much regularity as those which were full yellow, no preference being shown for the latter. Insects visiting, *Andrena gwynana* ♂, *Apis mellifica* ☿, *Vanessa urticae* ♀, *Eristalis tenax* ♀, and *Pollenia rudis* ♂.

VI. *March 26th.*—Hedge bank, Cogshill Lane, Potterne, from 2 to 2.40 P.M. Bright sun, gentle breeze, wind E. Insects visiting, *Meligethes picipes* ♂ and ♀, *Halictus decipiens* ♀, *Andrena nitida* ♀, *Apis mellifica* ☿, *Pollenia rudis* ♂, *Orthellia caesarion* ♂, *Pyrellia eriophthalma* ♂, and *Musca autumnalis* ♂ and ♀.

VII. *March 27th.*—Field called Nettens, Potterne, from 12.15 to 12.55 P.M. Bright sun, wind slight, S.W. Insects visiting, *Meligethes picipes* ♂ and ♀ (crawling over the stamens and carpels), *Andrena nitida* ♀, *Apis mellifica* ☿, *Vanessa urticae* ♀, *Pyrellia eriophthalma* ♂, and *Musca autumnalis* ♂ and ♀.

VIII. *March 28th.*—Experimental Ground, from 2.30 to 3 P.M. No sun, wind slight, N.E. The flowers remained closed, with the exception of a few which were nearly over, such flowers do not close. No insects were visiting.

From March 28th to April 3rd the weather was very cold and dull, several short observations were made between these dates, but no insects were seen to visit.

IX. *April 4th.*—Experimental Ground, from 2.30 to 3.15 P.M. Sun during part of the observation, wind slight, N.W. The amount of sun per day is an important factor in pollination by insects, especially when spring flowers are concerned, as there is a considerable and rather sudden drop in temperature at this time of year when the sun becomes obscured. It was noticed that there was a great falling off in the number of insects visiting during the time the sun was not shining. Insects visiting, *Meligethes picipes* ♂ and ♀, *Andrena nitida* ♀, *Apis mellifica* ☿, and *Melinda caerulea* ♂.

X. *April 8th.*—Nettens, Potterne, from 3.50 to 4.30 P.M. No sun, wind slight, S.W. Although there was no sun there were bright gleamy intervals, but the wind was cold. Parts of the field were yellow with flowers, which were wide open at the beginning of the observations, but had perceptibly closed by 4.30. Insects visiting, *Meligethes picipes* ♂ and ♀, *Bombus terrestris* ♀, *Pyrellia eriophthalma* ♀, and *Scatophaga stercoraria* ♀. *Apis mellifica* was not seen visiting.

XI. *April 10th.*—Experimental Ground from 11.30 A.M. to 12.15 P.M. Bright sun, wind slight, N.E. Insects visiting, *Meligethes picipes* ♂ and ♀, *Halictus morio* ♀, *Andrena nitida* ♂, *A. gwynana* ♂ and ♀, *Bombus terrestris* ♀, *Apis mellifica* ☿, *Eristalis tenax* ♀, *Pollenia rudis* ♂ and ♀, and *Scatophaga stercoraria* ♂ and ♀.

XII. *April 10th.*—Shady part of Cogshill Lane, Potterne, from 2.50 to 3.45 P.M. Sun during the whole of the observation, but not very powerful, slightly obscured by light cloud; wind slight, N.E. This observation was made to ascertain what insects might visit plants growing under trees. As the trees were still without leaves a certain amount of sunlight reached the plants, but dense shadows were thrown by the trunks and branches. *Apis mellifica* was not seen, though lower down the lane plants growing in full sun were being well visited by this species. Insects visiting the shade plants, *Meligethes picipes* ♂ and ♀ (one flower contained five specimens crawling over the petals, stamens, and carpels, all very well dusted with pollen), *Rhamphomyia sulcata* ♀, *Pyrellia eriophthalma* ♂, *Pegohylemyia fugax* ♀, and *Scatophaga stercoraria* ♂ and ♀.

XIII. *April 11th.*—Damp meadow, Cadley Farm, Potterne, from 2.55 to 3.5 P.M. Bright sun, wind slight, S.E. The meadow was yellow with flowers, but considering the number and the favourable conditions insects were not very numerous. Insects visiting, *Meligethes picipes* ♂ and ♀, *Andrena chrysosceles* ♀, *Apis mellifica* ☿, and *Scatophaga stercoraria* ♂ and ♀.

XIV. *April 12th.*—Experimental Ground, from 12.30 to 1 P.M. Very little sun, wind gusty, N.W. This observation was made in order to see what insects might visit on a day that was not favourable. At first there were gleams of sun through the clouds, but at the end of fifteen minutes it became dull and cold. During the last ten minutes no insects visited. The flowers were not fully open and they closed slightly during the observation; at 1.45 P.M. they were again examined and found to be completely closed. Insects visiting, *Meligethes picipes* ♂ and ♀, *Andrena trimmerana* ♂, *Apis mellifica* ☿, and *Scatophaga stercoraria* ♂ and ♀.

XV. *April 12th.*—Shady part of Cogshill Lane, Potterne, from 12.10 to 12.50 P.M. Sun during most of the observation; wind gusty at times, cold, N.W. The flowers of plants growing on the bank on the north side of the lane, in complete shade, did not open. The plants under observation were mostly in shade cast by the trunks and branches of the trees, but their flowers were open. On the whole, these shade and semi-shade plants were being well visited considering that the day was not favourable owing to the cold wind. No Hymenoptera were seen visiting plants in dense shade, only those on which the sun more or less directly shone being visited. Insects visiting, *Meligethes picipes* ♂ and ♀, *Andrena trimmerana* ♀, *A. nitida* ♂, *Apis mellifica* ☿, *Eristalis pertinax* ♀, and *Scatophaga stercoraria* ♂ and ♀.

XVI. *April 16th.*—Experimental Ground from 12.25 to 12.55 P.M. Dull, with bright intervals, wind slight, N. The flowers were only half open. Insects visiting, *Meligethes picipes* ♂ and ♀, *Andrena nitida* ♂, *A. gwynana* ♀, *Apis mellifica* ☿, and *Eristalis tenax* ♀.

XVII. *April 22nd.*—Nettens, Potterne, from 2.25 to 3.5 P.M. Bright sun, wind moderate, gusty, N.W. The whole field was now yellow with flowers which were at their maximum for

florifery. In most places the grass had grown considerably and was now above the flowers. *Apis mellifica* ☿ was most frequent, so frequent indeed that the humming could be heard. The flowers were being very well worked, more insects were on the wing than would have been expected owing to the gusty wind. Insects visiting, *Andrena albicans* ♂, *A. nitida* ♂, *Eristalis pertinax* ♂ and ♀, *Pyrellia eriophthalma* ♂, and *Scatophaga stercoraria* ♂.

XVIII. *April 23rd.*—Experimental Ground from 10.40 to 11.40 A.M. Intermittent sun, wind strong, very cold, S.E. veering to S.W. Not a good morning for insects to be on the wing. The flowers were only half open. Insects visiting, *Meligethes picipes* ♂ and ♀, *Apis mellifica* ☿, *Eristalis pertinax* ♂ and ♀, *Scatophaga stercoraria* ♂.

XIX. *April 29th.*—Experimental Ground, from 1.40 to 3.40 P.M. A still afternoon, bright but no sun. Wind N.W. Since the observation on the 23rd the weather had been very cold, wet, and windy. Most of this time the flowers remained closed, or were only partly open. During this observation the flowers were open at first, but closed slightly towards the end. Insects visiting, *Meligethes picipes* ♂ and ♀ and *Apis mellifica* ☿.

XX. *April 29th.*—Nettens, Potterne, from 5.40 to 5.55 P.M. A still evening, bright sun. Wind N.W. The only flowers open were those which were partly over. Insects visiting *Tachyporus hypnorum* ♂ and ♀ and *Meligethes picipes* ♂ and ♀.

XXI. *April 30th.*—Cogshill Lane, Potterne, from 10.5 to 11.35 A.M. Bright sun during most of the observation, wind slight, N.W. The hedge bank was yellow with flowers which were slightly past their best. Insects visiting, *Meligethes picipes* ♂ and ♀, *Halictus nitidiusculus* ♀, *Apis mellifica* ☿, *Eristalis pertinax* ♀, *Pyrellia eriophthalma* ♂, *Coelomyia mollissima* ♂ and ♀, *Scatophaga stercoraria* ♂ and ♀, and *Mosillus subsultans* ♂ and ♀.

XXII. *April 30th.*—Nettens, Potterne, from 2.15 to 3 P.M. Bright, but no sun until 2.30, strong breeze at times, wind N.W. The field was yellow with flowers, now slightly past their best, and in many places the grass was well above them. Insects visiting, *Tachyporus hypnorum* ♂, *Meligethes picipes* ♂ and ♀, *Eristalis pertinax* ♀, *E. nemorum* ♂, *Pyrellia eriophthalma* ♂, *Musca autumnalis* ♂, *Coelomyia mollissima* ♂ and ♀, and *Scatophaga stercoraria* ♂.

XXIII. *May 5th.*—This was divided into three parts Blackberry Lane Cogshill Lane, and Nettens, Potterne. Wind strong and cold, W. to S.W. Hedge bank Blackberry Lane, from

1 to 2.30 P.M. Sun during most of the observation. The plants were numerous and the grass was just above the flowers, which were only three-quarters open and a little past their best. Insects visiting, *Tachyporus hypnorum* ♂, *Meligethes picipes* ♂ and ♀, and *Coelomyia mollissima* ♀. Cogshill Lane, from 2.40 to 2.55 P.M. Bright sunny periods. The flowers were partly covered with grass and very much past their best, three-quarters open. Insects visiting, *Meligethes picipes* ♂ and ♀, *Bruchus atomarius* ♀, and *Melanostoma mellinum* ♀.

Nettens, from 3 to 3.30 P.M. Sun during most of the observation. The flowers were very abundant though past their best, and were much covered with grass, three-quarters open. Hive bees were on the wing, but were not visiting *R. Ficaria*, they confined their visits to *Taraxacum* which was now in full flower. One bee was seen hovering over a flower of *R. Ficaria*, then flying to *Taraxacum*. Insects visiting, *Tachyporus hypnorum* ♂ and ♀ and *Meligethes picipes* ♂ and ♀.

XXIV. *May 6th.*—Experimental Ground, from 9.55 to 10.25 A.M. Sun, wind gusty and rather cold, S.E. The flowers were fully open, still very numerous, though slightly past their best. Insects visiting, *Meligethes picipes* ♂ and ♀, *Bombus terrestris* ♀, *Apis mellifica* ☿, *Eristalis pertinax* ♂ and ♀, *E. nemorum* ♀, and *Egle aestiva* ♂ and ♀.

XXV. *May 6th.*—Sunny hedge bank, Stourhead, Wilts, from 12 to 12.30 P.M. Bright sun, very hot, wind S.W. A still afternoon. There were a considerable number of plants with flowers fully open, partly covered by grass. Insects visiting, *Meligethes picipes* ♂ and ♀, *Halictus decipiens* ♀, *Melanostoma mellinum* ♂ and ♀, *Ascia floralis* ♀, *Coelomyia mollissima* ♂ and ♀, and *Egle aestiva* ♂ and ♀. Another colony of plants, growing in shade, in the same locality was observed from 1 to 1.10 P.M. The flowers were fully open and were being visited by *Coelomyia mollissima* ♂ and ♀.

XXVI. *May 7th.* Experimental Ground from 8.30 to 9.30 A.M. No sun until 8.50, wind cold, gusty, S.W. veering to N.W. An early observation to see what insects might visit at this hour. About half the total number of flowers were partly open, the rest completely closed. From 8.30 to 8.50 the only insect visiting was *Apis mellifica* ☿. Between 8.50 and 9.5 the following were visiting, *Meligethes picipes* ♂ and ♀, *Apis mellifica* ☿, *Lycaena argiolus* ♂, *Melanostoma mellinum* ♀, *Eristalis pertinax* ♀, and *Egle aestiva* ♂ and ♀. The sun became obscured at 9.5 and it was again very cold; no insects visited between 9.5 and 9.30. At 9.30 some of the flowers were fully open, but only a small proportion in comparison with the number of flowers per plant in the beds.

XXVII. *May 7th.*—Nettens, Potterne, from 2.5 to 3.10 P.M. Bright sun, cold strong breeze, wind S.W. veering to N.W. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes picipes* ♂ and ♀, *Andrena nitida* ♀, *Apis mellifica* ☿, *Melanostoma mellinum* ♀, *Rhingia campestris* ♂, *Egle aestiva* ♂ and ♀, and *Scatophaga stercoraria* ♂ and ♀. Although the hive bees passed over *R. Ficaria* in this locality on May 5th they were now again visiting, and it was interesting to see that those visiting *R. Ficaria* remained constant to that plant, passing over *Taraxacum*, while those visiting the latter plant did not visit *R. Ficaria*.

XXVIII. *May 9th.*—Nettens, Potterne, from 10.55 to 11.30 A.M. Bright sun, slight breeze, wind N.W. The first really hot day. The grass was much taller and the flowers in the lower part of the field less numerous. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes picipes* ♂ and ♀, *Apis mellifica* ☿, *Chilosia albitarsis* ♂, *Melanostoma mellinum* ♂ and ♀, *Eristalis pertinax* ♀, and *Egle aestiva* ♂ and ♀. This observation was continued from 11.30 to 11.50 on a large colony of plants growing at the top of the field, partly on a hedge bank and partly in the grass, under trees, either in partial or full shade. They were later flowering than those in the open field and were only slightly past their best. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Andrena nitida* ♀, *Apis mellifica* ☿ (the Hymenoptera in sunny spots only), *Empis trigramma* ♂, *Egle aestiva* ♂ and ♀, and *Scatophaga stercoraria* ♀.

XXIX. *May 11th.*—Nettens, Potterne, from 10.35 to 11.30 A.M. Bright sun, gentle breeze, wind N.W. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes picipes* ♂ and ♀, *Andrena nitida* ♀, *A. gwynana* ♀, *Apis mellifica* ☿, *Chilosia albitarsis* ♂ and ♀, *Platychirus albimanus* ♂ and ♀, *Melanostoma mellinum* ♂ and ♀, *Ascia podagrica* ♀, *Rhingia campestris* ♂ and ♀, *Egle aestiva* ♂ and ♀, and *Scatophaga stercoraria* ♀. From 11.30 to 11.45 a further observation was made on the plants in partial shade already described. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes aenus* ♂ and ♀, *Apis mellifica* ☿ (in sunny spots only), *Empis trigramma* ♂ and ♀, *Melanostoma mellinum* ♂ and ♀, *Phaonia serva* ♂, and *Scatophaga stercoraria* ♂ and ♀.

XXX. *May 13th.*—Spinney, Tutt's Clump, Bradfield, Berks, from 10 to 11.15 A.M. Bright, with intermittent sun. Gentle breeze, wind S.E. The spinney was composed of coppice *Fraxinus* and *Corylus*, *R. Ficaria* was numerous, and the spinney was yellow with flowers only slightly past their best. They were later in this locality than at Potterne with the exception of the shade plants in Nettens. The plants were mostly growing in full sun, but some in partial shade. Insects visiting, *Meligethes aeneus* ♂ and ♀, *M. erythropus* ♂ and ♀, *Halictus rubicundus* ♀, *Andrena trimmerana* ♂, *A. nitida* ♀, *Nomada alternata* ♂ and ♀, *Apis mellifica* ☿ (the Hymenoptera in sun only), *Empis trigramma* ♀, *Melanostoma mellinum* ♂ and ♀, and *Coelomyia mollissima* ♂ and ♀.

XXXI. *May 15th.*—Shade plants, Nettens, Potterne, from 2.35 to 3.5 P.M. Sun shining through light cloud, strong breeze, cold wind N.E.

Since the 11th the weather had been cold and wet, and, in consequence, the flowers were very battered. The plants were, with the exception of two small patches, in full shade, from the now expanding leaves of the trees. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes aeneus* ♂, and *Empis trigramma* ♀. The observation was continued on plants in the open part of the field, from 3.15 to 3.30 P.M. Intermittent sun. There were only a very few flowers left, the grass was now long and very much above them. Insects visiting, *Meligethes aeneus* ♀ and *Melanostoma mellinum* ♂ and ♀. The plants were fruiting well. For florifery, the Nettens shade plants were still well in flower compared with those in the open field and the hedge bank in Cogshill Lane.

XXXII. *May 21st.*—Shade plants, Nettens, Potterne, from 2.50 to 3.30 P.M. No sun, rather warm, moderate breeze at times, wind S.E. The flowers were still fairly numerous, more conspicuous than on the last observation which was made after cold wet weather. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes aeneus* ♂ and ♀, and *Agriotes pallidulus* ♀.

XXXIII. *May 23rd.*—Spinney, Tutt's Clump, Bradfield, from 10.20 to 11.40 A.M. Dull, with short sunny periods, slight breeze, wind S.W. The flowers were nearly over and made no conspicuous show as ten days previously. The shade from the *Fraxinus* and *Corylus* was much more dense, still there were many patches of sunlight, the effect was light and shade, when the sun was shining. The undergrowth was, in many places, above the flowers. Insects visiting, *Meligethes aeneus* ♂ and ♀ and *M. viridescens* ♂ and ♀. This observation was continued between 2.15 and 2.50 P.M. Bright sun. Many patches of plants in full sun. Insects visiting, *Tachyporus hypnorum* ♂ and ♀, *Meligethes picipes* ♂, *M. aeneus* ♂ and ♀, *M. viridescens* ♂ and ♀, *Agriotes pallidulus* ♂ and ♀, *Micropterix calthella* ♂ and ♀, *Platychirus albimanus* ♂ and ♀, *Melanostoma mellinum* ♂ and ♀, and *Ascia podagrica* ♀.

XXXIV. *May 25th.*—Shade plants, Nettens, Potterne, from 1.20 to 2 P.M. Bright sun, strong breeze, wind S.W. There were still a fair number of flowers, some half, others three-quarters open. The shade was dense from the fully expanded leaves of the trees, but broken in a few places by patches of sunlight. Insects visiting, *Tachyporus hypnorum* ♂ and ♀,

Meligethes aeneus ♂ and ♀, *M. picipes* ♂ and ♀, and *Pegohylemyia discreta* ♀.

XXXV. *May 29th.*—Shade plants, Nettens, Potterne, from 3 to 3.30 P.M. Intermittent sun, strong breeze, wind S. The plants were in full shade with only slight glints of sun in a few places. The flowers were now practically over, only about sixty left; they had gone off very quickly since the 25th. There were no insects visiting; this was not surprising as the few remaining flowers made no show, and the counter attraction of *Ranunculus acris* and *R. bulbosus* was very great.

Complete list of insects observed visiting *R. Ficaria*, their approximate frequency, and the object of their visits:—

COLEOPTERA: *Tachyporus hypnorum* F., ♂ and ♀, very frequent, pollen and nectar. *Meligethes rupipes* Gyll., ♂, once, nectar. *M. aeneus* F., ♂ and ♀, very frequent, pollen and nectar. *M. viridescens* F., ♂ and ♀, very frequent, pollen and nectar. *M. ovatus* Sturm., ♀ twice, pollen and nectar. *M. picipes* Sturm., ♂ and ♀, very frequent, pollen and nectar. *M. erythropus* Gyll., ♂ and ♀, very frequent, pollen and nectar. *Agriotes pallidulus* Ill., ♂ and ♀, frequent, pollen and nectar, but mostly nectar. *Bruchus atomarius* L., ♀, once, nectar.

HYMENOPTERA: *Halictus rubicundus* Christ, ♀, four times, pollen and nectar. *H. nitidiusculus* Kirb., ♀, once, nectar. *H. decipiens* Perk., ♀, four times, nectar. *H. morio* F., ♂ and ♀, four times, nectar. *Andrena albicans* Kirb., ♂, once, nectar. *A. trimmerana* Kirb., ♂ and ♀, three times, nectar. *A. nitida* Fourc., ♂ and ♀, frequent, pollen and nectar. *A. gwynana* Kirb., ♂ and ♀, frequent, pollen and nectar. *A. chrysosceles* Kirb., ♀, once, nectar. *Nomada alternata* Kirb., ♂ and ♀, five times, nectar. *Bombus lapidarius* L., ♀, once, nectar. *B. terrestris* L., ♀, three times, nectar. *Apis mellifica* L., ☿, very frequent, pollen and nectar.

LEPIDOPTERA: *Vanessa urticae* L., ♀, four times, nectar. *Lycaena argiolus* L., ♀, once, nectar. *Micropteryx calthella* L., ♂ and ♀, frequent, nectar.

DIPTERA: *Rhamphomyia sulcata* Mg., ♀, twice, pollen and nectar. *Empis trigramma* Mg., ♂ and ♀, six times, nectar. *Chilosia albitarsis* Mg., ♂ and ♀, frequent, pollen. *Platychirus albimanus* F., ♂ and ♀, frequent, pollen. *Melanostoma mellinum* L., ♂ and ♀, very frequent, pollen and nectar. *Ascia podagrica* F., ♀, twice, pollen. *A. floralis* Mg., ♀, three times, pollen. *Rhingia campestris* Mg., ♂ and ♀, six times, pollen and nectar. *Eristalis tenax* L., ♂ and ♀, frequent, pollen and nectar. *E. pertinax* Scop., ♂ and ♀, frequent, pollen and nectar. *E. nemorum* L., ♂ and ♀, three times, pollen and nectar. *Pollenia rudis* F., ♂ and ♀, four times, pollen and nectar. *Melinda caerulea* Mg., ♂, once, pollen and nectar. *Orthellia caesarion* Mg., ♂ and ♀, three times, pollen and nectar. *Pyrellia eriophthalma* Macq., ♂ and ♀, frequent, pollen and nectar. *Musca autumnalis* Deg., ♂ and ♀, frequent, pollen and nectar. *Phaonia serva* Mg., ♂, once, pollen and nectar. *Coelomyia mollissima* Hal., ♂ and ♀, very frequent, pollen and nectar. *Pegohylemyia fugax* Mg., ♂, once, pollen and nectar. *P. discreta* Mg., ♀, once, nectar. *Egle aestiva* Mg., ♂ and ♀, frequent, pollen and nectar. *Scatophaga stercoraria* L., ♂ and ♀, very frequent, pollen and nectar. *Mosillus subsultans* F., ♂ and ♀, frequent, pollen and nectar.

List of insects observed visiting plants growing in shade:—

COLEOPTERA: *Tachyporus hypnorum* F., ♂ and ♀, frequent, pollen and nectar. *Meligethes aeneus* F., ♂ and ♀, frequent, pollen and nectar. *M. picipes* Sturm., ♂ and ♀, very frequent, pollen and nectar. *Agriotes pallidulus* Ill., ♀, once, nectar.

HYMENOPTERA: *Andrena trimmerana* Kirb., ♀, once, nectar. *A. nitida* Fourc., ♂ and ♀, frequent, pollen and nectar. *Apis mellifica* L., ☿, frequent, pollen and nectar.

DIPTERA: *Rhamphomyia sulcata* Mg., ♀, twice, pollen and nectar. *Empis trigramma* Mg., ♂ and ♀, five times, nectar. *Melanostoma mellinum* L., ♂ and ♀, four times, pollen. *Eristalis pertinax* Scop., ♀, once, pollen and nectar. *Pyrellia eriophthalma* Macq., ♂, four times, pollen and nectar. *Phaonia serva* Mg., ♂, once, pollen and nectar. *Coelomyia mollissima* Hal., ♂ and ♀, very frequent, pollen and nectar. *Pegohylemyia fugax* Mg., ♂, once, pollen and nectar. *P. discreta* Mg., ♀, once, nectar. *Egle aestiva* Mg., ♂ and ♀ five times, pollen and nectar. *Scatophaga stercoraria* L., ♂ and ♀, frequent, pollen and nectar.

SUMMARY.

(1) Experimental evidence clearly indicates that plants of *R. Ficaria* are either completely self-sterile or produce only a small proportion of viable seed when self-pollination takes place.

(2) Insect visits are absolutely necessary for the full production of viable seed.

(3) Forty-eight species of insects comprising Coleoptera, Hymenoptera, Lepidoptera, and Diptera were observed visiting during the observations.

(4) Weather conditions play an important part in the pollination of *R. Ficaria*; under suitable conditions this plant is adequately visited to ensure satisfactory pollination.

(5) Beetles of the species *Meligethes* are important pollination agents, especially of plants growing in shade.

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SHORT NOTES.

ALISMA COREANA AND RUPPIA TAQUETII.—Among the many new species described from Korea by the late H. Léveillé are *Alisma coreana* and *Ruppia Taquetii*, both based on plants collected in Quelpart by Taquet. Léveillé's herbarium is now at the Royal Botanic Garden, Edinburgh, and by the kindness of the Regius Keeper I have been permitted to examine the type-specimens of these two species in order to determine their systematic position :—

ALISMA COREANA H. Lév. in Fedde, Repert. Sp. Nov. viii. 286 (1910). "Corea : Quelpaert, in oryzetis Hannon, 28 sept. 1908 (Taquet, 1520)." (This number 1520 cited by Léveillé is a misprint, for the number on Taquet's label is 1529.) The type-sheet bears four plants, which are all good flowering specimens of SAGITTARIA PYGMAEA Miq. (1865).

It is interesting to note that Taquet's number 3271, collected in the same locality in June 1909, consists of sterile young plants of *S. pygmaea*, mostly with winter-tubers still attached. This gathering was described by Léveillé (*op. cit.* xi. 67 (1912)) as a new genus *Hydrolirion* of Hydrocharitaceae ; see note in Journ. of Bot. lxxi. 44 (1933).

RUPPIA TAQUETII H. Lév. in Fedde, Repert. Sp. Nov. ix. 323 (1911). "Corea : Quelpaert, in lacunis parvae insulae Saiseun, 6 jul. 1910 (Taquet, 4029)." The type consists of fruiting material of typical RUPPIA MARITIMA L. (1753), *i. e.*, the species often called *R. rostellata* Koch (1824). There is nothing to justify the separation of Taquet's plant as a distinct species.—J. E. DANDY.

SCENT OF ORCHIDS.—The 'Orchid Review' for April contains an account of the scent of Orchid flowers by Dr. J. J. Smith. Some species are classed as sweet-scented, fragrant, aromatic, or unpleasant, others under a number of different odours recalling characteristic scents, such as creosote, chlorine, cocos-oil, benzoin, pear-drops, anise, or those associated with familiar plants. Some species have mixed odours—a specimen of *Dendrobium aureilobum* from the Buitenzorg Gardens had a sweet scent of saffron and cocos-oil, one from another source had the scent of roses ; *Vanda Hindsii* smelt of soap with cinnamon. The type of *V. sumatrana* has a sweet scent, with carbolic acid ; a form from South Sumatra suggests a mixture of lemon, cinnamon, and "bugs."

OBITUARIES.

JOHN GRIMSHAW WILKINSON, M.Sc., THE BLIND BOTANIST (1856–1937).

BORN at Leeds, January 6, 1856, John Grimshaw Wilkinson, whose fame as a blind botanist was widespread, entered business as a grocer, but at the early age of 22 was attacked by a severe and dangerous illness which left him totally deprived of sight. Up to this time his hobby was painting in water-colours, and several fine examples of his skill in this art still exist. It was only after this illness that his interest in botany was awakened by the discovery during a stroll in one of the parks near Leeds that he could distinguish many of the common trees by the sense of touch. From this moment he trained this sense, partly in his fingers, but mainly at the tip of his tongue, which he called his "microscope." At the time of his death, which occurred in his 82nd year, at Leeds, February 28, 1937, he had acquired a sound knowledge of trees, shrubs, and most of the common wayside plants. He had a wonderful memory, storing up a vast amount of knowledge gained not only from rambles in the country, but also from standard text-books (such as those of Sachs and Prantl and Vines) read to him for many years by his most devoted mother and certain friends who visited him regularly. The writer of this notice walked some hundreds of miles with him on botanical excursions between the years 1881 and 1893, and during that time, with a keen mutual interest in the British flora, enjoyed many a happy day, picking up specimens as they attracted his eye and handing them over to Wilkinson, who examined them carefully with the tip of his tongue. On these occasions he also utilised to good purpose the associated senses of taste and smell. Upon being told the name of the plant he rarely forgot its characters as revealed to him by this unique method of examination. The experiences gained in the field were supplemented by regular weekly readings from Hooker's 'Students' Flora' and other systematic works, and the characters too minute for him to appreciate were discussed together and memorised in a most remarkable manner.

At a somewhat later period Wilkinson paid special attention to trees and shrubs, both British and exotic. He visited many public parks and private estates, becoming acquainted with the heads of the various gardening staffs in Yorkshire and neighbouring counties. The knowledge gained by him in this direction was later put to useful purpose when, at the request of the Leeds Naturalists' Club he undertook to advise the Corporation of Leeds as to the planting and labelling of trees in the public parks of that city. It was probably as a public appreciation of this service and of his remarkable achievements that the University of Leeds conferred upon him the honorary degree of M.Sc. in 1915.—P. H. GRIMSHAW.

CEDRIC ERROLL CARR (1892–1936).

CEDRIC EROLL CARR was born at Napier, New Zealand, November 16, 1892. He was educated in England. On leaving school (Dulwich) he started life as an assistant on a rubber estate

near Malacca. Then came the Great War, and Carr, completing his agreement, volunteered for service. He was twice wounded. The war over, he returned to Malacca, and subsequently became manager of a remote Chinese-owned estate at Tembeling in Pahang. There, in a solitude which a man of less vitality would have called perdition, he threw himself with tremendous energy into a study of the orchids—a study he had begun almost on leaving school. He collected and brought into his garden all that he could find, and, in spite of heat, mosquitoes, and all manner of discomforts, would sit far into the night dissecting and drawing their flowers. It is surprising how much he learned with few books and no help; the secret of his success being the accuracy of his drawings from life. The slump caused him to forsake rubber in 1931: he then successively made a collecting expedition in Sumatra from Berartagi, a study of the orchids in the herbarium of the Botanic Gardens, Singapore, a collecting expedition on Mount Kinabalu, Borneo, a study of orchids in the herbarium of the Royal Botanic Gardens, Kew, and a collecting expedition to Mount Victoria in New Guinea. On the march back from this last long expedition he was taken ill and died from blackwater fever in hospital at Port Moresby on June 3, 1936.

All his publications are on Malaysian orchids; a list of these follows. His collections, by reason of their detailed memoranda, have very great value:—

1928. "Orchid-pollination Notes." Journ. Malay Br. Roy. As. Soc. vi. 49–71, pls. v.–xvii.
1929. "Some Malayan Orchids." Gardens' Bull. Straits Settlements, v. 1–50, pls. i.–xvii.
1930. "Some Malayan Orchids.—II." *Ibid.* 124–160, pls. i.–iv.
1932. "Some Malayan Orchids.—III." *Ibid.* vii. 1–60, pls. i.–v.
——. "The Genus *Tæniophyllum* in the Malay Peninsula." *Ibid.* 61–86, pls. vi.–xiv.
1933. "Some Malayan Orchids.—IV." Journ. Malay Br. Roy. As. Soc. xi. 66–110, pls. i.–xiii.
1934. "*Dendrobium Takahashii*, sp. nov." Orchid Rev. xlii. 14.
——. "*Coelogyne Zurowetzii*, sp. nov." *Ibid.* 44.
1934. "On a Collection of Orchids from the Solomon Islands." Kew Bull. 375–383.
1935. "Some Malayan Orchids.—V. The Orchidaceæ of the Oxford University Expedition to Sarawak, 1932." Gard. Bull. Straits Settlements, viii. 69–129.
——. "Two Collections of Orchids from British North Borneo.—Part I." *Ibid.* 165–240.

The above notice is abridged from an obituary notice by Mr. E. J. H. Corner.—I. H. BURKILL.

REVIEWS.

Die Blüten der Coniferen. Edited by MAX HIRMER.—Teil 1. *Entwicklungsgeschichte und vergleichende Morphologie des weiblichen Blütenzapfen der Coniferen.* By MAX HIRMER. *Bibliotheca Botanica*, 1936, Heft 114, Lief. 1, 4to, pp. 100, 12 pls., 31 text-figs. Price R.M. 42.—Teil 2. *Zur Morphologie und Entwicklungsgeschichte der weiblichen Blütenzapfen der Cupressaceae.* By CHARLOTTE PROPACH-GIESELER. *Ibid.* Lief. 2, pp. 56, 13 pls., 16 text-figs. Price R.M. 27.—E. Schweizerbart'sche Verlags-Buchhandlung: Stuttgart, 1936.

A CENTURY has passed since Robert Brown first concerned himself with the question whether the ovule of the conifers developed on a modified leaf or took its origin directly from the stem. During that century a mountain of literature has accumulated about the problem of the morphology of the ovulate cone of this ancient phylum, but still to-day the problem is undecided. During that time we

> "....have heard great argument
> About it and about, but evermore
> Came out by that same door as in we went."

To this vexed controversy these two papers are the most recent contribution; and they are undoubtedly papers of considerable importance. It is not possible in the limits of a short review to survey again the field of this discussion, nor even adequately to compare the ideas here put forward with those already current or advanced recently by others; it must merely suffice to indicate their scope.

The cone structure is approached from the point of view of its ontogenetic development in the bud, an aspect largely neglected by most of the older writers, but the importance of which has been increasingly realized in recent years. Contributions to our knowledge of such development had already been made by Mlle Herzfeld, Goebel, and others, and in 1933 there appeared two papers by Lanfer and Hagerup respectively, approaching the problem from this angle. But these papers by Hirmer and Propach-Gieseler far exceed in scope anything preceding them. They cover the whole gamut of the conifers with the natural exception of some of the less accessible genera, and, in any case, it is doubtful, even had all the genera been available, if any modification of the essential view-point would have been made. The second paper deals with cone development in the Cupressaceæ (in the sense used by Pilger), the paper by Hirmer covering all the other groups. A third paper is proposed dealing with the male cone. Fossil conifers, particularly those differing from the modern genera, but which are definitely referable to the conifers, are included as helping to elucidate certain structural aspects of the modern types. The papers are illustrated by a profusion

of plates and drawings which merit particular praise, the photographs being technically excellent, the drawings bold and clear. Such perfection is only to be expected however from the laboratory of Prof. Hirmer.

Two main views, as is well known, are held with regard to the nature of the bract and scale in the conifer strobilus. One view claims that the bract-scale complex is double, the ovuliferous scale, free from or fused with the bract, being a definite axillary structure. Different conceptions are held of the nature of this axillary structure, but to many it appears to be a reduced fertile shoot, Hagerup for example comparing it leaf for leaf with a vegetative bud and incidentally even homologizing the integuments of the ovules with the first leaves—a view, considering the antiquity of the conifer ovule, with which the reviewer cannot agree. To others the bract-scale complex is a single leaf-like sporophyll associated with outgrowths of the ovular placenta, swellings of the sporophyll, etc. Hirmer accepts neither of these views. From the results of the ontogenetical study he undoubtedly concludes that the bract-scale complex is a double structure even in such thin cone-scales as those, say, of *Libocedrus*. The presence of the second set of vascular strands in the cone scale seems important to him in such cases, although the inversion of these strands, which has played so important a part in the development of the axillary theory, is claimed, as has also been done by R. B. Thomson, to be of nutritional importance only. The doubling of the structure, however, according to Hirmer, arises from the serial splitting of a single original sporophyll into an adaxial and an abaxial part. He draws a close parallel with the Sphenophyllales. Such a serial splitting he claims is shown by *Sph. fertile*, both parts remaining fertile, and, from this basal type, he indicates the development of variations, in many of which the abaxial part has become sterile and leaf-like, the adaxial remaining fertile and bearing varying relationships to the sterile part with regard to relative development and fusion. In the conifer the bract is the sterile abaxial part of a similar sporophyll. The fertile adaxial part is primitively a stalked peltate structure carrying ovules marginally. From its definite nature, and, owing to the earlier development of the bract in relation to a protective function, the adaxial structure may sometimes appear to arise in an axillary position—but such an origin is secondary. This adaxial fertile part may be modified in many ways. The ovules may develop on the inner edge only of the peltate area, or laterally only as in *Pinus* and allied genera; inversion or erectness of the ovules is related to the length of the stalk or its suppression; the sterile outer edge of the peltate area gives the ovuliferous scale of the Pinaceae (in Pilger's sense) or the zone in the cupressinean and taxodinean types which corresponds to it, but which has fused with the bract; the epimatium of the Podocarps is a growth, over the seed, of the edge of the primitive peltate plate—

and so on. Extreme modifications of form appear in *Taxus* and *Torreya*, while the cone of *Cephalotaxus* is compound; but all can readily be included in the same plan if the primary thesis be admitted.

The picture presented is clear, complete, and acceptable. But has Prof. Hirmer proved his point? That depends entirely on the critic's prejudices. From essentially similar developmental data, particularly in *Cryptomeria* and *Pinus*, Hagerup, as already mentioned, not only considers that there is a shoot axillary to the bract, but carefully relates its first leaves separately to the structures shown in the cones. Clearly until the older rocks yield an unmistakable series of fossil cones leading to an admittedly primitive type no one can say that any suggestion is proved. And there are weaknesses in Hirmer's position. He even seems to suggest himself that the adaxial peltate structure may possibly be an axillary structure after all. But his insistence on the nature of this structure would appear definitely in accord with the present trend of botanical thought. The conifers are a group of very ancient lineage. It is eminently probable that the main plan of the archaic cone was achieved early, either before or at least independently of the present vegetative organization; the cone must be interpreted in terms of some such archaic plan and not with reference to present-day vegetative form. There is, of course, nothing new in this idea. Goebel states it in his 'Organographie,' Zimmermann states it in his 'Phylogénie' when he postulates *Trichopitys* as a possible basal coniferous type, the reviewer has claimed it for many years, and so on; but Hirmer has now stated it with a wealth of detail and an exactness of plan which demands attention. It will be a matter of interest, however, to see how far the details of the scheme will stand the test of future discoveries.

Apart from the general thesis, the ontogeny described by Pilgach-Gieseler for species in the *Sabina* section of *Juniperus* is of special interest, showing as it does quite conclusively that the species with a single apparently terminal ovule are quite in line with the others. In the whole section the development of the young cone is typically cupressinean, but if fertility is reduced to a single ovule its early growth causes a slight displacement of the parts, so that it assumes a position, apparently terminal, but really strictly related to its particular bract.

But why does Prof. Hirmer make *Podocarpus* feminine? And, if feminine, why at times make it masculine?—J. DOYLE.

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1 *List of the Flowering Plants and Ferns recorded from Fife and Kinross* (*v.c.* 85). By WILLIAM YOUNG. Trans. & Proc. Bot. Soc. Edinb. xxxii. pp. 1–173, with map (1936).

THE Botanical Society of Edinburgh are to be congratulated for the manner in which they have chosen to mark their Centenary.

By the publication, as part of their ' Transactions and Proceedings,' of a list of flowering plants and ferns of Fife and Kinross (noted in the last number of this Journal) they are responsible for a contribution which will earn the gratitude of students of British field botany. It is somewhat surprising, considering the amount of attention which has been paid to the area by students of the Universities of Edinburgh and St. Andrews, that no comprehensive modern list of the plants of the vice-county has been available. As so many Fellows of the Society have helped in the survey and added to the knowledge of this local flora, the choice of publication is at once appropriate and fortunate. The author, Mr. W. Young, has spent a life-time in Fife, and this circumstance combined with an abiding interest in plants makes him singularly qualified for his task. It may be said at the outset that the data are admirably presented and, while certain details may be criticised, the work will form an invaluable guide to field-botanists.

In the introduction a short account of the topography is given. It would have been an advantage, however, to have presented a brief sketch of the geology with lists of the characteristic plants of the igneous rocks, and of the limestones and other sedimentary rocks, especially since many of the rarer and more interesting species are associated with particular geological formations. For the purpose of presentation of the records nine districts are recognised, a subdivision which seems unnecessarily detailed, as these districts are not based on major topographical features, and are rather unequal. The subdivision could have been conveniently condensed by the amalgamation of districts 3 and 4, and 5, 6, 7, and 8, thus leaving five. The history of botany in the county as given by the author is somewhat sketchy, and several additions could be suggested to the lists of field-botanists who have contributed records, as, for instance, John Hope, R. Graham, and George Don. While the author does not pretend that his list of references is complete, there are many notable omissions among those given. Perhaps the first separate list of Fife and Kinross plants to be published was that contained in Watson's ' Botanical Guide ' (1837), the records having been extracted from Greville's ' Flora Edinensis ' and Woodforde's list of plants growing around Edinburgh (1824). This list is not mentioned, and for the guidance of future workers the following additions to the bibliography might also be suggested :—

Anon. ' Scots Magazine,' lxvi. 170 (1804).
Balfour, I. B. Trans. Bot. Soc. Edinb. viii. 508 (1866); *op. cit.* xi. 192 (1871).
——. Ann. Scot. Nat. Hist. 1900, 169 (1900); *op. cit.* 1901, 37 (1901).
——. Notes R. Bot. Gard. Edinb. iv. 123 (1907).
Boswell Syme, J. T. ' English Botany,' ed. 3 and Suppl. (1863–1892).
Druce, G. C. Notes R. Bot. Gard. Edinb. iii. 53 (1904).
—— ' Comital Flora,' Arbroath, 1932.

Drummond, T., Clark, T. B., & Brown, J. Trans. Bot. Soc. Edinb. xi. 470 (1873).
Lyte, R. Trans. Bot. Soc. Edinb. xii. 248 (1875).
Lawson, G. ' Phytologist,' iii. 129 (1848).
Maughan, R. Mem. Wern. Nat. Hist. Soc. i. 215 (1811).
Neill, P. (" N."). ' Scots Magazine,' lxxiii. 565 (1811); *op. cit.* lxxiv. 484 (1812).
Parnell, R. ' Grasses of Scotland,' Edinburgh, 1845.
Sibbald, R. ' Scotia Illustrata.' Edinburgh, 1684.
Smith, R. Scot. Geogr. Mag. xi. 385 (1900).
Walker, J. ' Essays on Natural History and Rural Economy ' [p. 380]. London and Edinburgh. 1812.
Watson, H. C. ' The new Botanists' Guide to the Localities of the Rarer Plants of Britain.' London, 1835–37.
——. ' Topographical Botany ' and Suppl. 1873–1930.
Woodforde, J. ' A Catalogue of the indigenous Phenogamic Plants growing in the Neighbourhood of Edinburgh.' Edinburgh, 1824.

These works contain records of Fife and Kinross plants and should be consulted by students of the flora of this area.

The list, the nomenclature of which is based on the tenth edition of the ' London Catalogue,' attempts to bring together all records, but more effort might have been made to ascertain the first records of species—when these are given they are frequently erroneous. The earliest reference to Fifeshire botany given is Sibbald's ' History of Fife ' (1710), but in that author's ' Scotia Illustrata ' (1684) several plants are recorded from Fife, including *Eryngium maritimum* from " near *Largo* upon *Fife-side*," *Lavatera arborea* (as *Malva maritima arborea*) from " *Inch-Garvy* and *Mykrie-Inch* in the Firth of *Forth*," *Orobanche major* (probably *O. rubra* Sm.) from " Upon the Buck of *Bruntisland*," and for *Calystegia Soldanella* Br. (as *Soldanella maritima minor*) he says " *It groweth near the Ely.*" These are perhaps the earliest records of Fife plants. Many Fife plants are preserved in the Boswell Syme Herbarium (now in the British Museum (Nat. Hist.)), and no flora of the area can be considered complete until all the Fife records have been extracted from this Herbarium. Throughout the work many of the records given are based on specimens in the Royal Botanic Garden, Edinburgh, and for some of these no collector is given.

The flora of Fife has suffered greatly by the hand of Man. The drainage of lakes, marshes, and bogs, quarrying, making of roads and railways, and the erection of factories have all contributed to the extinction of rare plants. Details of such instances might well have formed part of the introduction. It is stated that *Oxytropis uralensis* Sm. was destroyed by the excavation of a railway cutting, but Boswell Syme (in Engl. Bot. iii. 71 ; 1864) records that the Queensferry station of this plant was threatened by quarrying operations in 1848. Incidentally the first record of this plant from Fife cannot be claimed for Mackay, since John Walker (see ' Essays on Natural History,' 1812) stated that he first found it in 1761 " in the hills west of North Ferry."

It is becoming increasingly difficult to keep pace with the present flood of botanical literature, and lack of attention to recent papers, in which records are given ready for incorporation, has led to several unintentional errors of which the following may be mentioned. The only record of *Fumaria purpurea* Pugsley is credited to Druce, whereas the original record of the species is based on a plant in the Boswell Syme Herbarium from Dunearn Hill, and is probably included in the present list under *F. Boraei* Bab. In the same genus *F. micrantha* Lag. is referred to synonymy under *F. densiflora* DC., although Pugsley in his account of *Fumaria* (in Journ. Bot. l., Suppl. 1 ; 1912) rejected de Candolle's name as a *nomen ambiguum*. The treatment of *Euphrasia* calls for comment, and the author's remark that " This genus requires investigation " is difficult to understand in view of the recent publication of a comprehensive account of the group (Pugsley in Journ. Linn. Soc., Bot. xlviii. 467 ; 1930). *E. Rostkoviana* Hayne is stated to be " Very common," but up to the present the species has been recorded only from one Scottish locality (in Selkirk) and probably the Fife records refer to *E. brevipila* Burnat & Gremli which is the commonest Scottish species and of which there appears only a single unlocalised record in the list under review. A paper on British marsh orchids published two years ago has been overlooked. Pugsley then showed (in Journ. Linn. Soc., Bot. xlix. 553 ; 1935) that *O. incarnata* L. was a coloured form of the continental *O. sambucina* L., and not represented in Britain. The Fife records accredited to *O. incarnata* L. refer to *O. latifolia* L., and the paragraph published under the latter species is superfluous. Rigid acceptance of the ' London Catalogue ' as a basis is probably responsible for these discrepancies, as it is also for the treatment of *Quercus* which is represented by one species, *Q. Robur* L., with two varieties, *pedunculata* (Ehrh.) and *sessiliflora* (Salisb.) (mis-spelt, as in the ' London Catalogue,' *sessilifolia*). Modern authorities recognise two distinct species. It should be remarked that the author anticipates emendments to his list, and in his introduction states that " Many of the old records were based on specimens which do not now exist, so it has been impossible to verify them. . . . Inevitably there will have been errors of identification, but rather than omit doubtful records it has been thought advisable to include them so that future botanists may know what to look for in any particular district. For the above reasons those making use of this Flora should consider critically records of closely allied species shown as occurring in the same locality by different botanists." It had been the author's intention to attempt to verify the old records by visits to the localities, but circumstances did not permit of this. This will be a task for future workers, for which the list will form an invaluable basis.

It would appear that the following plant records require to be accepted with caution : *Cerastium cerastoides* Britton, *Hieracium vulgatum* Fr., *H. nigrescens* Willd., *H. chrysanthum* Backh., *H. atratum* Fr., *Statice maritima* var. *planifolia* Syme, and *Poa alpina* L. These are all montane plants, and their occurrence in Fife would seem to require confirmation. Also the frequency of the following species may require emendation : *Spergularia rubra* Pers., " Very common," *Adoxa Moschatellina* L., " Very rare," *Veronica Tournefortii* C. Gmel., " Rare," *Galeopsis Ladanum* L., " Frequent " (the usual British plant is *Galeopsis angustifolium* Ehrh.), and *Rumex Hydrolapathum* Huds., " Frequent." The records of *Salix repens* L. require much further analysis since Dr. Floderus critically examined our British material. It was then shown that typical *S. repens* is a very rare plant in this country, and most plants masqueradng under that name are either *S. arenaria* L. or hybrid forms. Floderus also pointed out that the plant usually referred to as *S. cinerea* L. by British authors is really *S. atrocinerea* Brot. We note that the recently described species *Zostera Hornemanniana* Tutin appears under *Z. marina* var. *angustifolia* Hornem.

In spite of these remarks the author is to be congratulated on the results of his painstaking work. The general plan of the list is excellent, the work seems devoid of typographical errors, and the printing with well-chosen founts is admirable. Perhaps the most serious omission is an Index, but, since the present work is the first part of a new volume, opportunity may be taken to remedy this deficiency.—G. TAYLOR.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on April 8, the President, Dr. W. T. Calman, C.B., F.R.S., in the Chair, Dr. E. M. Delf gave an account of regeneration in some Brown Algae. By means of specimens and lantern-slides the production of new outgrowths, often intercalary in origin and often giving rise to new individuals, was demonstrated in a number of genera.

Mr. Ronald Good gave an account of a Botanical Survey of Dorset on which he has been engaged for some years. In a series of annotated maps the distribution is indicated of several hundred species.

Dr. E. J. Collins showed, by means of a series of lantern-slides, the form and structure characteristic for the leaf of various species of *Crocus*.

THE RAY CLUB OF CAMBRIDGE celebrated its Centenary by a dinner at Trinity College on March 16—the Master of Trinity, Sir J. J. Thomson, presiding. A feature of the occasion was the

reading of biographical notes on John Ray by Prof. Sir Albert Seward, excerpts from an interesting sketch prepared by him as a souvenir of the Centenary. The Club was founded on March 11, 1837, "for the cultivation of Natural Science by means of friendly intercousre and mutual instruction" to replace the Friday evening parties which Professor Henslow had held at his house since February 1828.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.—The forty-second Annual Congress will be held at Hastings from June 8–12. The President-Elect is Prof. F. E. Weiss, D.Sc., F.R.S., and the subject of his address will be "Competition and Co-operation in Nature." Dr. R. W. Butcher, President of the Botanical Section, will speak on "Our Changing Flora" and Lt.-Col. A. H. Wolley-Dod will give a paper on "The New Sussex Flora." Afternoon excursions have been arranged to places of natural historic and archæological interest. The Hon. General Secretary is Mr. W. C. FISHLOCK, 19 South View Avenue, Reading.

SOUTH-WESTERN NATURALISTS' UNION.—The fifteenth Annual Conference will be held at Taunton from May 14–17 under the Presidency of Mr. F. R. Rowley, F.R.M.S. Excursions have been arranged to Exmoor and other places of interest, and Mr. H. St. George Gray, F.S.A., will give an evening lecture on "The Lake Villages of Somerset." Particulars may be obtained from the Hon. Sec., Mr. M. BLACKMORE, "Uplands," Torrs Park, Ilfracombe.

PRIX AUGUSTIN PYRAMUS DE CANDOLLE.—The Société de Physique et d'Histoire Naturelle de Genève announce a prize of 1000 francs for the best unpublished monograph of a genus or family of plants. Authors may be of any nationality, but members of the Society are excluded. Manuscript must be sent to the Secretary of the Society before October 31, 1937.

IN connection with the projected new 'British Flora' under the editorship of Professor A. G. Tansley, Professor R. R. Gates has undertaken to prepare an account of the *Oenothera* species naturalized in various parts of the British Isles. In order to make this account as complete as possible, Professor Gates would be glad to hear, from local botanists or others, of localities in any part of the country where *Oenothera* is growing wild. A notification of the area would be still more useful if accompanied by notes and specimens, if possible in flower. Address: King's College, Strand, London, W.C. 2.

"VIRUS DISEASES OF PLANTS."—Dr. J. Henderson Smith (Head of the Department of Plant Pathology, Rothamsted Experimental Station) will give a course of three lectures on this subject in the Metallurgical Theatre of the Imperial College of Science, South Kensington, at 5.30 P.M., on Thursdays, May 13, 20, and 27. Admission free without ticket.

NOTES ON THE OUTER COVERING OF CHAROPHYTE FRUITS.

BY G. O. ALLEN.

THESE notes are based on two brief conversations (and some correspondence about the many specimens of fruits, dry and in liquid, that he made over to me) that I had with the late Canon G. H. Bullock-Webster towards the close of his life. They amplify to some extent what has already appeared in 'British Charophyta.' I submitted them to him for perusal, but he was evidently not able to look them through.

A Charophyte fruit consists chiefly of a nut-like ellipsoid body, the oosphere (which occupies the centre of the oogonium and after fertilization becomes the oospore with a thickened exterior wall), and an outer protective portion of five enveloping spiral cells. These spiral cells normally disintegrate, except for their posterior (*i. e.*, nearest the interior of the fruit) walls which are apparently utilised in the formation of the membrane of the oospore: their lines of junction also remain to form the conspicuous spiral ridges on the surface of the oospore. The membrane actually consists of four delicate laminæ, of which the most important is the outer coloured one, as it usually exhibits in *Nitella* a characteristic decoration.

The two remaining parts of the fruit are the five- or ten-celled coronula at the apex of the spiral cells and a stalk-cell at the base forming the point of attachment to the branchlet.

Sometimes in the genus *Chara* these spiral cells do not altogether disappear. In outward form they remain much as before, the spiral lines being quite conspicuous, but actually it is the thin tough outer surface only which is retained, the contents being replaced by a secretion of lime. In this way the oospore becomes encased in a hard protective shell, the surface having a greyish shell-like appearance with often a metallic sheen. Not all the fruits of a particular plant become encrusted: some take on lime-shells, whilst others do not.

This condition is extraordinarily like that of a fossil *Chara* fruit: and it is indeed these very lime-shells which are found as fossils. In one fossil from the Norwich Crag, Bullock-Webster detected a fragment of membrane, no small tribute to the protective abilities of the lime-shell that it should preserve so delicate a tissue for perhaps some ten million years!

In view of this close resemblance in size and shape between some of the types of fossil fruit and the fruits of living species of *Chara*, the late James Groves has expressed the view in his 'Fossilium Catalogus (Charophyta)' that such types may reasonably be assigned to that genus.

The coronula, it may be noted, does not take up lime, a fitting provision, it would seem, to facilitate the germination of the

spore. Consequently this organ is never found in a fossil state, an initial difficulty in the separation of fossil fruits into the two main divisions of Charophytes. The stalk-cell also has not been found fossil, no doubt from the same cause. In addition to the petrified spiral cells or casts of them, the actual oospore has occasionally been found in a fossil state.

Cases are also forthcoming of the spiral cells of *Lamprothamnium* and *Lychnothamnus* secreting lime, but no fossil forms of these have yet been found, some showing at most a resemblance to the latter genus.

The spiral cells in *Tolypella* also secrete lime sometimes, and two types from the Lower Headon Beds (Eocene) of Hampshire have been referred "almost certainly" by Reid and Groves to this genus, and a third doubtful one "apparently the smallest Charophyte fruit known from the Tertiary" by Groves from the Bembridge Beds (Oligocene).

The spiral cells in *Nitella* do not absorb lime, and this no doubt accounts for no fossils being found, with the exception of very late deposits where the fruits are those of common living species. "But in the cherts of earlier [than Tertiary] formations in which thin-walled cells are perfectly preserved, if plants with the flattened type of fruit existed one would expect to find some trace of them" ('British Charophyta,' ii. 85).

In the collection of Bullock-Webster, who made an intensive study of Charophyte fruits, is a specimen of *Lamprothamnium papulosum* J. Groves from Hamworthy (Dorset) showing very beautifully the lime-shell developed under the enveloping cells.

Fruits of what "seems to be an undoubted Charophyte" ('Fossilium Catalogus') have been discovered as far back as the Coal Measures (Nova Scotia): and recently, according to an American geologist, fruits showing definite charophyte affinities have been found in the Devonian.

Corresponding to this protective covering of lime in the fruits of *Chara* and other genera, there is a very different feature fairly commonly seen in *Nitella*, in the form of a minute growth to which the name "felting" has been given by Groves and Bullock-Webster. Whilst the fruit is immersed in liquid this covering cannot be observed, but becomes apparent as the fruit dries. It is important to note that this felting covers the whole surface of the fruit, including the ridges, thus largely obscuring the membrane markings. Its general appearance is indicated in Brit. Char. i. pl. v. fig. 9. "Felting" in all cases is similar in appearance, and has been observed in a number of species of *Nitella*.

The outer coloured membrane of a Charophyte fruit in almost all species shows a decorated surface. There are three main types of decoration—granules, tubercles, and reticulations,—though in some few cases the decoration combines two types. By tubercles are meant round raised portions that do not touch one another or hardly do so, whereas by granules are meant prominences that are all contiguous at the base.

The tuberculated and reticulated types are only found in *Nitella*, species of *Chara* in all cases showing a somewhat similar granulate form, often faint or obscure.

Spegazzini, in describing a new species, *N. Arechavaletae*, from Uruguay, in 1883, remarked on the reticulation on the oospore membrane. With this exception, Nordstedt was the first to investigate oospore membranes, and he examined those of most species in which the finding of ripe fruit had been recorded. T. F. Allen speaks of "Nordstedt markings." It is in the study and delineation of the membranes of *Nitella* that the greatest advance has been made in recent times, thanks to the admirable drawings under high magnifications by Bullock-Webster, who devoted special attention to this for many years. Every *Nitella* that passed through the hands of the late James Groves was examined and the membrane drawn with great skill. A comparison between these and the illustrations published by Nordstedt will indicate the extent of the advance. The subject receives considerable attention in 'British Charophyta,' where (vol. i. (ii)) is a conspectus for all British species.

In addition to the three main types of decoration there are some cases of *Nitella* with practically no decoration, or at most some approximation to wrinkling. Among these latter are *N. opaca* and *N. flexilis*, whose scabrous type of membrane is depicted in Brit. Char. i. pl. iv. In a few species the decoration is of a composite character, usually somewhat elongated tubercles on a granulate ground.

There is considerable variety also to be found amongst the three main types: for example, the granules vary in size, and some of the granulate show a tendency towards the tuberculate and the reticulate. In the tuberculate also the markings may be scattered evenly or in lines, or patterned so as to show a tendency towards the reticulate.

Amongst the reticulate, the net-work may be beaded as in *N. tenuissima* or nodose or with raised points at the angles of the meshes or the threads may sometimes be very broad and flat or somewhat irregular ("coralloid"). Nordstedt calls one of his eight types "spongy," the membrane being loose and often like felt: these were no doubt cases of felting which obscures the true decoration, and not a separate type.

So far as investigations have as yet proceeded, the type of decoration appears to be constant and characteristic for each species.

The study of oospore membranes and fossil forms of Charophytes would seem to offer two of the most promising fields for the advancement of our knowledge of this group.

NOTES ON *RUBI*.

By William Watson.

(Continued from Journ. Bot. 1935, p. 256.)

VII. *Rubus Leightoni* Leight.

Among the brambles included in Leighton's Fl. Shropsh. (1841) there is one, *Rubus Leightoni*, that had not been described before. Leighton placed it next after *R. radula*. It was adopted as a species by Babington in a similar position in his 'Manual' of 1843; and was repeated in every subsequent edition as a variety, first of *R. rudis* (eds. 2–4), then of *R. radula* (eds. 5–8). The name, but not the bramble, has been overlooked by Rogers and subsequent students of British brambles.

Leighton's full description and his no. 17 Fasc. Shropsh. Rubi, issued in 1847 in illustration of the descriptions in the 'Flora,' both show that *R. Leightoni* is the same as *R. Radula* c. *anglicanus* Rogers in Journ. Bot. 1894, 47; and as a matter of fact in Hb. Mus. Brit. there is a specimen of *R. Leightoni* collected and so named by Leighton, which is identified by Rogers as *anglicanus*. Other published synonyms are *R. linguifolius* Genev. in Mém. Soc. Acad. Maine-et-Loire, 1860, 63; *R. ericetorum* Lefv. in Bull. Soc. Bot. France, 1877, 223; *R. radula* subsp. *anglicanus* Rogers in Handb. Br. Rubi, 63 (1900).

Leighton's name, *Rubus Leightoni*, being the oldest published and legitimate name, must supersede all the others if the bramble is once more regarded as a species distinct from *R. radula*. It is in my opinion not only distinct from *R. radula*, but belongs to another group, the *Grandifolii*. Lectotype: no. 17, Fasc. Shropsh. Rubi, in Hb. Mus. Brit. First discovery in Britain, by Salter, in 1837 at Parkstone, Dorset, specimen in Hb. Br. Linn. (the Linnean Society's British Herbarium).

I have seen *R. Leightoni* in v.c. 9 (Dorset), 11 (S. Hants), 17 (Surrey), and 31 (Hunts), and dried specimens from v.c. 3 (S. Devon), 10 (I. of Wight), 38 (Warwick), 40 (Salop), and 55 (Leicester). It has been much confused with *R. sectiramus* W. Wats., a species ranging from N. Som. and W. Glos. to Surrey and W. Kent.

VIII. *Rubus phaeocarpus*, nom. nov.

Salter states in Phyt. 1845, 100 & 138, that he met with a strange bramble late in September 1844 in a hedge between Week-hill Hanger and Oakhanger, near Selborne, Hants, Babington and he held it to be an undescribed species, and Salter therefore published it in Ann. Nat. Hist. xv. 307 (March 1845) as *Rubus Babingtonii*. The actual specimen is still in Hb. Br. Linn., and is only a very strong example of *R. scaber* Wh., published in 1825. Babington also published a description of the same Selborne bramble in Synop. Br. Rubi, 21 (1846), as *Rubus Babingtonii*; but he afterwards, in Br. Rubi, 187 (1869), allowed that it was only a strong state of *R. scaber*. The name *R. Babingtonii* Salt. ought in these circumstances to have given way to *R. scaber* Wh. and dropped out of use. Unfortunately, however, Rogers applied the name in the 'Handbook' to a fresh bramble, and to put matters right an unused name must now be adopted for the false *Babingtonii* of Rogers.

Rubus phaeocarpus, nom. nov. Series *Apiculati*. *R. Babingtonii* c. descr. in Rogers's 'Handbook of British Rubi,' 69 (1900), non Salter. Lectotype, specimen in Hb. Mus. Brit. labelled *Rubus Babingtonii* Bell Salter, collected by W. Moyle Rogers, August 9, 1894, Mortimer Common, Berkshire, and issued as part of no. 94 in the Set of British Rubi.

The prickles and pricklets on strong stems have a swollen base, as is frequent in the *Apiculati*. Quinate leaves are common, the leaflets are rather small, all have a subcordate base and are softly and densely hairy beneath; the principal teeth are slightly larger than the rest and are prominent or patent. Thick and often yellowish hair covers the panicle and extends to the calyx. The peduncles and the pedicels are long and patent. The fruit sepals redden conspicuously within at the base and become convex and patent. The fruit is somewhat fuscous before maturity.

The variety *phyllothyrsus* (Frid.) attached to *R. Babingtonii* in the 'Handbook' stands for a bramble collected at Crowell Hill, Oxfordshire, and issued also under no. 94 in the Set of British Rubi. Sudre made this into a new species which he called *R. Adamsii* after the collector of the specimens. I have myself collected the bramble on Crowell Hill, and am of the opinion that it is the same as the mistaken "*Rubus uncinatus*" of Beamond Coll, Bucks, which I identify as *R. festivus* M. & W. The Surrey bramble once identified as *R. Babingtonii* var. *phyllothyrsus* is a different plant, viz., *R. formidabilis* L. & M.

IX. *Rubus tereticaulis* Rogers, non P. J. Mueller.

Rubus tereticaulis of Rogers's 'Handbook' is based on specimens found in Norfolk by E. F. Linton and identified by Focke as *R. tereticaulis* P. J. Muell. This determination Focke adhered to in his 'Monograph' of 1902–3, but he seems to have abandoned it in his work of 1914. Linton's bramble certainly differs irreconcilably from authentic specimens which I have seen of *Rubus tereticaulis*, as well as from Mueller's description.

Sudre thought that the Norfolk bramble was *R. Menkei* Wh., but it does not agree with Focke's specimens of *R. Menkei* obtained from Pyrmont, the original locality for the type, nor with Weihe and Nees's description.

Neither Focke's nor Sudre's determination therefore can be accepted: the bramble is not *R. tereticaulis* nor *R. Menkei*. Linton himself, with the advantage of seeing it in abundance in a fresh state, considered that it was a form of *R. Bellardii*, by which he perhaps meant the only form then named, viz., *R. Bellardii* var. *dentatus* Bloxam. This, as Focke often pointed out, is synonymous with *R. scaber* Wh.

After a re-examination of Linton's specimens and my own specimens from Sprowston Wood and Mousehold Heath, I have no doubt that Linton's plant is *R. scaber*. I know of no occurrence of the typical *R. tereticaulis* of Mueller in Britain, and therefore see no reason for retaining the name in the British list.

Weihe's *R. scaber* is described by Focke as having stamens far exceeding the styles, and the carpels somewhat hairy. The Norfolk, like the East Kentish, Surrey (Streatham Common, and Wareham Hill, Brook), and Leicestershire *scaber*, has short stamens and glabrous carpels and also glabrous petals. The same form occurs in the West of France, as Genevier and Bouvet describe it with these characters—although under the wrong name of *R. Bellardii*. It is a matter for further enquiry whether quite the German form of *R. scaber* occurs at all in this country.

Weihe and Nees give the sepals of *R. scaber* as reflexed after flowering. As they give this character for nearly all their brambles, even for *R. fusco-ater*, *R. pallidus*, *R. infestus*, *R. rudis*, and *R. Hystrix*, which all have the sepals patent to clasping already in young fruit, it would seem that they must have taken the character very soon indeed after the fall of the petals and before the sepals had taken their characteristic direction.

In our *R. scaber* the sepals are sharply reflexed in flower, but rise very soon after flowering is over to patent and erect. This agrees with Focke's description of the German *R. scaber*, as he gives the sepals as erecto-patent after flowering. It is probable therefore that there is in this respect no real difference in our plant from the plant of Weihe and Nees.

X. *Rubus Turneri*, sp. nov.

In 'English Flora,' ii. 404 (1824), Smith, describing his *Rubus glandulosus*, quotes specimens which he had received from four English botanists: the specimens are still in Hb. Smith. The specimen first mentioned by Smith was gathered by Dawson Turner in woods at Rydal, Westmorland, and this is the bramble now under consideration: it is different from the rest. The specimen next mentioned by Smith as having been received from Borrer is *R. mutabilis* Genev. var. *Naldretti* J. W. White, and the two others, received from E. Forster and Bicheno, are *R. Lejeunei* Wh. Smith's description incorporates characters from all these specimens. The *Rubus glandulosus* of Bellardi, from whom Smith adopts the name, is different.

Turner's specimen consists only of a panicle in flower, but has the following notes appended by him: "Petals long linear. Calyx-leaves long and lanceolate." The petals would nowadays be described as "narrow obovate." They appear to have been white or nearly white, and this agrees with Smith's "petals white, narrower than in any of the foregoing."

Borrer went to the Rydal woods in 1845 and collected Turner's bramble in flower. One of his specimens is in Hb. Borrer, determined by him as "*R. apiculatus* (*R. gland.* Smith)"; another is in Hb. Babington. Turner recognized Borrer's specimens as identical with his own (Babington, Brit. Rubi, 208).

Turner's bramble is rather closely related to *R. Lejeunei*. In both species scattered long gland-tipped acicles are present, the rachis is loosely hairy and the stalked glands rarely exceed the hair in length, but on the pedicels the hair is shorter and is exceeded by the glands. The differences from *R. Lejeunei*, however, given later, are too considerable to allow of its being attached as a variety to *R. Lejeunei*. It is accordingly described as a distinct species.

Rubus Turneri, sp. nov. (Series *Grandifolii*). *Turio* acutangulus rubens aculeatus aciculatus parce pilosus; *aculei* mediocres inæqualissimi undique sine ordine orti, e basi parva sæpe glanduliferi declinati, rarius recurvi, glandulis brevibus aciculisque raro longis glanduliferis immixtis; *folia* ternata vel quinata pedata, supra strigosa, subtus pubescentia, petiolo obsolete canaliculato petiolulisque aculeis declinatis vel leviter falcatis armatis, stipulis latiusculis; *foliolum terminale* obovatum lobato-serratum tenuiter acuminatum deorsum contractum, petiolulo proprio amplius ter longius; *foliola intermedia* brevissime petiolulata. *Ramus florifer* acutangulus pilosus, glandulis aciculisque inæqualibus crebris plerumque immersis, aculeis acicularibus munitus; *paniculæ* vix ad apicem decrescentis foliosæ superne confertæ inferius interruptæ *ramuli* medii triflori patentes, inferiores in axillis erecto-patentes pluriflori; *pedicellorum glandulæ* breves at tamen pubescentiam superantes; *sepala* pallide virentia tomentosa, anguste albo-marginata, crebre glandulosa et aciculata, tenuiter appendiculata, reflexa; *petala* alba longa obovata in unguem sensim attenuata, ad apicem dentata infra modo pubescentia; *stamina* longa alba; *germina* glabra vel glabrescentia.

Distinguished from *R. Lejeunei* Wh., its nearest ally, by the leaves green beneath, the leaflets sharply lobate-serrate and very shortly stalked; by the absence of long prickles on the panicle; by the crowded and leafy panicle with ascending lower branches; by the white flowers, the long linear-pointed sepals, etc.

Cotype specimens, Turner's and Borrer's specimens, all from Rydal Woods, in Hb. Smith (Linnean Society), Hb. Borrer (Kew), and Hb. Babington (Herb. Mus. Brit.), respectively.

Only the specimen in Hb. Babington includes stem-pieces with leaves.

Synonym, *Rubus Koehleri* Wh. b. *cuspidatus* Bab. Synop. 27 (p. max. pte.).

Distribution, v.c. 2 (E. Cornwall), 69 (Westmorland), 72 (Dumfries).

XI. *Rubus Selmeri* Lindeb. var. *microphyllus* Lindeb.

On Hayes Common, W. Kent, along with the normal form of *Rubus Selmeri* grows a markedly smaller form, which I identify with *R. Selmeri* var. *microphyllus* in Lindeberg's Hb. Rub. Scand. no. 34 (1884). The latter bramble was found on an island lying off the south-west coast of Norway in a region in which *R. Selmeri* also is found. The same small form of *R. Selmeri* grows with the usual form on West Mortimer Common, Berks. In Hb. Kew. there is a specimen of small *Selmeri*, which Bagnall stated to be abundant in Sutton Park, Warwickshire. In Fl. Warw. Bagnall also records *R. affinis*, the then usual name for *R. Selmeri*, for the same station. G. Braun found the small form in Minden, N.W. Germany, where Weihe had already discovered the large form. It can hardly be open to doubt, therefore, that the small bramble is, as Lindeberg and Areschoug treat it, a derivative of *R. Selmeri*.

From several specimens in Hb. Kew., collected in Yorkshire by J. G. Baker, it is evident that *R. Bakeri* of Yorkshire, as understood by J. G. Baker, was the same bramble, viz., small *R. Selmeri*. Messrs. Barton and Riddelsdell have recently in Journ. Bot. 1935, 126, shown that *R. Bakeri* is a name that cannot be maintained, as Lees accidentally included in his description characters belonging to the stem and leaves of *R. radula* Wh. subsp. *echinatoides* Rog. They rename the bramble *R. pistoris*, but it does not transpire whether its relationship to *R. Selmeri* has been considered.

In addition to the occurrences above reported, and to those given by Messrs. Barton and Riddelsdell, small *R. Selmeri* has been collected in two stations in Northumberland (specimens in Hb. Kew.) and two stations in Co. Down, Ireland (specimens in Hb. Kew. and Hb. S. London Bot. Inst.). On the other hand, the records under *Rubus pistoris* for Staffs and Brandon Wood, Warwick, cannot stand, as the plants were *R. pyramidalis* Kalt. var. **parvifolius,** comb. nov. (Frid. & Gel. Bot. Tidsskr. xvi. 86 as forma) and *R. cardiophyllus* L. & M. var. *fallax* W. Wats. respectively.

A specimen in Hb. Kew. collected by Gilbert at Bewdley, Worcs, determined by Rogers as *R. rhamnifolius* subsp. *Bakeri* F. A. Lees, also is *R. pyramidalis* Kalt. var. *parvifolius*. The stalked glands on the inflorescence, the narrow leaflets softly pilose beneath, and the straight prickles on stem and panicle should prevent confusion with *R. Selmeri*.

XII. *Rubus cardiophyllus* L. & M. var. nov. *fallax*.

This small genetic form of one of the commonest of British brambles has often been identified as *R. Bakeri*, just as *R. Bakeri* (i. e. *R. Selmeri* var. *microphyllus*) was for a time called *R. rhamnifolius* var. *microphyllus* (the name *rhamnifolius* being mistakenly used for *R. cardiophyllus*). It is widely but sporadically distributed, and to assist recognition it seems advisable to call attention to it by naming it. It has recently been introduced into the north-east corner of the south Rubetum at Kew Gardens.

Rubus cardiophyllus L. & M. var. nov. **fallax,** a forma vulgari præsertim differt floribus reliquisque partibus multo minoribus, foliolis tenuiter subæqualiter serratis, paniculæ angustæ aculeis magis inæqualibus sæpissime parvis declinatis vel leviter falcatis.

Type-specimen in Hb. Mus. Brit., collected at Milford Heath, Surrey, September 1934, as *Rubus cardiophyllus* L. & M. a small genetic form. Compare Rep. B. E. C. 1934, 964.

Exsiccata : (1) Bognor Common, W. Suss., Rogers, as *R. rhamn.* W. & N. var. *Bakeri* (F. A. Lees), in Hb. Mus. Brit. (2) Lodsworth Common, W. Suss., Marshall and Rogers, as *R. Bakeri* F. A. Lees, in Hb. Mus. Brit. (3) By Lough Corrib, near Cong, W. Galway, Ireland, Marshall, as *R. Bakeri* F. A. Lees, teste Rogers, in Hb. Mus. Brit. (4) Tunbridge Wells Common, W. Kent, Gilbert, as *R. imbricatus* Hort. (*R. rhamn.*, a strongly marked form—Rogers) in Hb. Kew. (5) Fradley, Staffs, Bagnall, as *R. rhamn.* var. *Bakeri* Arnold Lees (as *R. pistoris* Barton & Riddelsdell in Journ. Bot. 1935, 128) in Hb. Kew. (6) Brearton Lane (? Thirsk, N.E. Yorks.), F. A. Lees and A. E. Baker, as *Rubus* simulating *Bakeri* (Lees), "*R. Bakeri* F. A. Lees very nearly typical—H. J. Riddelsdell 1934" in Hb. Mus. Brit. (7) East Clandon Common, Surrey, C. E. Britton, as *R. Bakeri* F. A. Lees ? (*R. Bakeri* f.—Rogers) in Hb. S. London Bot. Inst. (8) West Moors, Dorset, Rogers, as *R. rhamn.* W. & N. sp. coll. a small f., in Hb. Kew. (9) Blackmoor, Woolmer Forest, N. Hants, W. Watson, in Hb. W. Watson.

Distribution : v.c. 9 (Dorset), 12 (N. Hants), 13 (W. Sussex), 16 (W. Kent), 17 (Surrey), 39 (Staffs), 62 (N.E. Yorks), Galway, Ireland.

R. cardiophyllus var. *fallax* has white, or at first faintly pinkish flowers, leaflets shortly acuminate nearly equally serrulate, a narrow closely felted and pubescent panicle, armed with many short but unequal straight rarely slightly falcate prickles, terminal leaflet of the upper ternate leaves on the flowering branch obovate-cuneate, the lower branches of the panicle equalling the petioles of the subtending leaves.

R. Selmeri Lindeb. var. *microphyllus* Lindeb. differs in its sprawling stems, strongly curved prickles on the panicle rachis

stem and petioles, in its thinly hairy panicle rachis, short stamens, pink petals, long-pointed sepals of the terminal flower, etc.

The false *Bakeri* (*R. Bakeranus* Bart. & Riddels.) differs in its patently pilose stem and panicle, its spreading panicle formed of long peduncles and pedicels, the lower branches equalling the subtending leaves, its equal fewer longer prickles (some decidedly falcate) on the flowering branch, the long-pointed often caudate irregularly to doubly toothed leaflets, the round-based not narrowed terminal leaflets on the flowering branch, the pink petals, etc.

R. sciaphilus var. nov. **microphyllus** (Frid. & Gelert, Bot. Tidsskr. xvi. 73, as forma), for which the only known station in Britain thus far is Seal Chart, W. Kent, is rather similar to *R. cardiophyllus* var. *fallax* in habit, shape of leaflets, and colour of flowers, but differs in the leaves green beneath, the green sepals aciculate and glandular, the panicle pyramidal, becoming corymbose by the development of long axillary lower branches.

XIII. *Rubus scissus*, nom. nov.

The name *Rubus fissus* Lindl. has been universally misapplied ever since it was published in Lindley's Synop. Brit. Flora, ed. 2, 92 (1835). Lindley intended it to replace the name *R. fastigiatus*, which he had wrongly used for a Scottish bramble in ed. 1 (1829). His specimen labelled *Rubus fastigiatus* is still in Hb. Lindley, and is the same bramble as that afterwards described as a new species, *Rubus Rogersii*, by E. F. Linton in Journ. Bot. 1894, 213. Specimens in Hb. Borrer cut by Borrer from the bush in the garden of the Horticultural Society in 1829, and labelled in Borrer's hand "*R. fastigiatus* Lindl. in Hort. *R. fissus* Lindl. Syn. ed. 2" are likewise *R. Rogersii* Lint.

Lindley's description clearly points to *R. Rogersii*: he says "Stem arched . . . Prickles strong . . . Leaves frequently septenate, shining smooth and flat above, pubescent beneath, much less membranous than in *R. suberectus*. Terminal leaflet . . . with a long point . . . Calyxes reflexed from the fruit." Further, in Lindley's herbarium there is a specimen of the bramble to which the name *fissus* was transferred ("false *fissus*" for convenience of reference) and this he has labelled "*R. suberectus* var.," showing that he distinguished it from his *R. fissus*.

The evidence is thus complete that *R. Rogersii* Lint. is the bramble that Lindley described as *R. fissus*. Lindley's name must accordingly be restored to that bramble, and a new name be found for the false *fissus*.

Rubus scissus, nom. nov. (Series *Suberecti*). *Rubus fissus* Leight. in Fl. Shropsh. (1841), 225; *R. fissus* Rogers, Handb. Br. Rubi (1900), 20, excl. synon.; *R. fissus* Focke, Synop. Rub. Germ. (1877), 109, excl. citations of Babington's descriptions; non *R. fissus* Lindl.

Lectotype: Specimen ref. no. 29 in Hb. Borrer at Kew, collected by Leighton in 1836 at Almond Park, Shrewsbury, and determined (wrongly) "*R. fissus*" by Lindley. Further specimens with ref. nos. 28 and 29 of the same bramble collected by Leighton in the same year and at the same place, and determined by Lindley as "*R. fissus*" are contained in Hb. Babington (in Hb. Mus. Brit.).

According to Rogers, Handb. 20, *R. plicatus* Leight. is *R. fissus* Lindl. Leighton's description of *R. plicatus* in Fl. Shropsh., however, very clearly indicates *R. nessensis*. There are in Hb. Borrer and in Hb. Babington specimens gathered by Leighton at Shawbury Heath, Shropshire, in 1847 (six years after the publication of Fl. Shropsh.), which are the false *fissus*: they are labelled by Leighton "*R. plicatus* a. of Babington's Synopsis, not *R. plicatus* of Fl. Shropshire." Rogers's cited synonym, therefore, was an error, taken over perhaps from Babington without verification.

Babington in Synop. Br. Rubi (1846), 7, rightly objected to Lindley's identification of Leighton's Almond Park bramble as *R. fissus*, but himself went wrong in determining the specimen of false *fissus* in Lindley's herbarium as *R. fissus*, and the type-specimen of *R. fissus* as *R. affinis* Wh. & N. (see Br. Rubi, 71).

The stem of *R. scissus* is usually only two feet high, and is oblique and slightly arched rather than suberect. The leaves fall in autumn, and numerous very short suckers are then sent up around the bush and are generally killed by the frost. In the open the mature stem is rather sharp-angled, and is armed all round with purple, somewhat falcate, and exceedingly slender prickles. The leaves are a dull yellowish green, plicate, and conspicuously strigose above. On quinate leaves the terminal leaflet is triangular in the upper part, but on septenate leaves it is cordate-ovate. The lower leaflets are imbricate. Petiole and petiolules are deeply grooved. The petals are pinkish or white, often multiplied into a double or triple set, fugacious, the stamens being left spreading, but changing to a pale lavender. The sepals are attenuate-acuminate, usually with a pricklet or two on the back, often prolonged into a slender leafy point: after flowering they curve upwards and become patent. The fruit is small and imperfect. In West Kent *R. scissus* comes into flower almost at the end of May, a few days after *R. nessensis*.

(To be continued.)

NEW SPECIES FROM TROPICAL AFRICA.

(1). By A. W. Exell.

Enneastemon angustifolius, sp. nov. (Annonaceae). *Frutex* c. 1·5 m. altus, ramulis primo appresse puberulis mox glabrescentibus. *Folia* breviter petiolata, petiolo 3–4 mm. longo primo

appresse pubescente mox glabrescente, lamina oblanceolata apice acuminata acuta basin versus cuneata basi rotundata, 6–14×2–4·3 cm., supra glabra subtus glauca sparse appresse puberula, costa media supra depressa subtus prominente, costis lateralibus 5–7-paris. *Flores* solitarii vel 2–3-fasciculati pedicellati, pedicello gracili ad 1 cm. longo, appresse pubescente basi bracteato, bracteis minutis, in axillis foliorum dispositi. *Sepala* ovata, 1 mm. longa, basi connata. *Petala* 6, uniseriatim inserta extus tomentella, 3 majora ovato-lanceolata, 4×2 mm., 3 minora anguste elliptica, 3·5×1·2 mm. *Stamina* 9, filamentis 0·5 mm. longis, thecis 0·4 mm. longis, connectivo applanato, 0·2 mm. lato. *Carpella* c. 12, cylindrica, c. 0·7 mm. longa, sericea. [Fructus ignotus.]

Hab. NIGERIA: Ijebu Province, Shasha Forest Reserve, Ajebandele, Rapids of Oni, under trees in rocky island in river, fl. May, *P. W. Richards* 3469. (Typus in Herb. Mus. Brit.)

"Shrub, *c.* 1·5 m. high; flowers creamy white tinged with reddish brown; leaves glaucous beneath."

Near *Enneastemon nigritanus* (Bak. f.) Exell, but with much narrower leaves, which are oblanceolate instead of elliptic and have a much finer reticulation on the lower surface.

Dioscoreophyllum podandrium, sp. nov. (Menispermaceae). *Scandens* ramulis volubilibus pilis strigosis rigidiusculis vestitis. *Folia* longe petiolata, petiolo ad 7 cm. longo striguloso, lamina ambitu transverse elliptica profunde trilobata basi cordata vel subhastata, 9·5–10×13–15 cm., lobis oblongo-ellipticis apice longe et abrupte acuminatis, supra subtusque præcipue ad nervos strigulosa. *Flores* ♂ pedicellati, pedicellis gracilibus 1·5–6 mm longis, glabris basi bracteatis, bractea lineari ad 2 mm. longa apice setulosa, in racemos elongatos ad 18 cm. longos axillares dispositi [♀ non vidi]. *Sepala* 3+3, reflexa leviter concava, exteriora 4–4·2×1·9–2·1 mm., interiora, 3·9–4×2–2·1 mm., glabra vel fere glabra. *Petala* 0. *Stamina* 6, in synandrio depresse globoso, 2 mm. in diam., stipitato, stipite 1·2–1·8 mm. longo glabro, connata.

Hab. NIGERIA: Benin Province, Okumu Forest Reserve, Nikrowa, fl. March, *R. Ross* 107. (Typus in Herb. Mus. Brit.)

"Herbaceous climber, about 5 m. high; stem hairy; corolla green, reflexed in flower."

Agrees with *Dioscoreophyllum Gossweileri* Exell in having a stipitate synandrium, but differs in having the lobes of the leaves more divergent, in the strigose stems, the longer inflorescences, and the depressed globose synandria. It differs from all other species of the genus hitherto described by its clearly stipitate synandrium.

An unnumbered leafless specimen, consisting of a male inflorescence only, collected by P. A. Talbot at Oban, S. Nigeria, is very similar to *Ross* 107 so far as the male flowers are concerned.

Combretum kabadense, sp. nov. *Arbor* parva, ramulis primo tomentellis demum glabrescentibus. *Folia* (immatura) opposita alternata vel plerumque 3–4-verticillata petiolata, petiolo 9–12 mm. longo tomentello, lamina elliptica anguste elliptica vel oblongo-elliptica, apice nonnunquam leviter acuminata plerumque rotundata nonnunquam obtusa, basi rotundata vel acuta, 2·5–5·5×1·5–2·7 cm. (immatura) supra juventute præcipue ad nervos pubescentia et lepidota, lepidibus conspicuis albis margine haud contiguis, demum glabrescentia et sparse lepidota, subtus tomentella et lepidota, lepidibus ob tomentellum densum vix conspicuis, costis lateralibus 7–9-paris. *Flores* tetrameri sessiles subpræcoces in spicas densas 3·5–5·5 cm. longas axillares, rhachide tomentelloso dispositi. *Receptaculum* superius 3·5×3·5 mm. (calycis lobi inclusi), tomentellosum et inconspicue lepidotum superne cupuliforme inferne infundibuliforme, inferius fusiforme 2–2·5 mm. longum tomentellosum. *Calycis lobi* late deltoidei, 0·5–0·8×1·8 mm. *Discus* infundibuliformis, 1·7×2 mm., margine libero dense piloso instructus. *Petala* albida lamina suborbiculare, 1·2×1·2 mm., unguiculata, ungue gracile 0·5 mm. longo, glabra. *Stamina* 8, filamentis fere uniseriatim insertis, 3·5 mm. longis, antheris late oblongis, 0·8 mm. longis. *Stylus* 4·5 mm. longus, glaber. [*Fructus* ignotus.]

Hab. ANGLO-EGYPTIAN SUDAN: Mongalla Province, Kabada Hills, north of Juba–Yei road between Ganzi and Wandi, c. 700–800 m. alt., *J. E. Dandy* 460. (Typus in Herb. Mus. Brit.)

"Small deciduous tree, flowering with the young leaves just appearing. Petals white."

This species belongs to Sect. *Glabripetalae* Engl. & Diels, and is near *C. elgonense* Exell and *C. laboniense* M. B. Moss. It differs from the former in having velutinous flowers and rhachis (conspicuously scaly and only slightly pubescent in *C. elgonense*) and shorter spikes; it differs from the latter by having scales among the indumentum on the lower surface of the leaf and by the smaller flowers. All three species are as yet insufficiently known to form any definite opinion as to the value of the characters which at present distinguish them.

W. J. Eggeling 1523 (Herb. Imperial Forestry Institute; fragm. in Herb. Mus. Brit.) from Kobboko, W. Nile, Uganda, with mature leaves, may well belong to *C. kabadense*. As the specimen is in quite a different stage of development from *Dandy* 460 it cannot be identified with it with certainty.

Combretum Greenwayi, sp. nov. *Frutex* valde ramosus usque ad 5 m. altus, ramulis primo rufo-lepidotis ceteroque glabris vel fere glabris. *Folia* opposita vel subopposita breviter petiolata,

petiolo ad 3 mm. longo rufo-lepidoto, lamina obovata vel oblongo-obovata, apice rotundata nonnunquam brevissime mucronulata, basi cuneata vel rotundata, 3·5×1·5–3·2 cm., supra lepidota, lepidibus margine haud contiguis, infra in sicco dense albo- vel flavido-lepidota et sparse rufo-lepidota, costis lateralibus 3–5-paris. *Flores* valde immaturi in spicas axillares (et terminales ?) dispositi. *Fructus* 4-alatus, 2–2·3×1·8–2 cm., alis tenuibus c. 7 mm. latis, ambitu suborbiculare, corpore subdense, alis sparse lepidotis.

Hab. TANGANYIKA TERRITORY: Usambara, S. Umba Steppe, Mshwanda, alt. 430 m., *Greenway* 2030 (Typus in Herb. Mus. Brit.; Herb. Amani). KENYA: "North of Mombassa," *A. Whyte* s. n. (Herb. Mus. Brit.).

This species belongs to Sect. *Brevirameae* Engl. & Diels. It can be distinguished from *C. parvifolium* Engl. by its almost glabrous leaves and by the apparent absence of the horizontal branching which is characteristic of *C. parvifolium*.

According to Greenway the new species grows on black cotton soil, forming a dominant association with *Acacia* spp. in *Acacia*-desert-grass country.

B. D. Burtt 5338, from Mkomazi, has almost glabrous leaves, and approaches *C. Greenwayi*, but it seems more likely to be a glabrous form of *C. parvifolium*.

Combretum Grotei, sp. nov. *Frutex* vel *arbor* parva, ramulis primo rufo-lepidotis demum glabris. *Folia* opposita vel subopposita breviter petiolata, petiolo ad 2·5 mm. longo dense lepidoto ceteroque glabro, lamina obovata vel elongato-obovata, apice rotundata plerumque mucronulata basi cuneata, 1–4·5×·7–2 cm., supra dense lepidota sed lepidibus margine vix contiguis infra densissime lepidota, lepidibus margine contiguis ceteroque glabra vel fere glabra. *Flores* tetrameri in spicas abbreviatas ad 2·5 cm. longas axillares et terminales dispositi. *Receptaculum* superius superne cupuliforme inferne breviter infundibuliforme, 2×2·2 mm., dense rufo-lepidotum, inferius fusiforme 1·7 mm. longum dense rufo-lepidotum. *Calycis lobi* deltoidei 0·6 mm. longi. *Discus* 1·5 mm. in diam., margine dense pilosus. *Petala* late obovata brevissime unguiculata, 1·1×1·1 mm., glabra. *Stamina* 8, filamentis 2·5 mm. longis glabris. *Stylus* 4 mm. longus pilosulus. *Fructus* 4-alatus, alis tenuibus c. 4 mm. latis, ambitu ovale, 1·4–1·6×1–1·2 cm., dense lepidotus sparse pubescens vel fere glaber.

Hab. TANGANYIKA TERRITORY: Moshi, Kilimanjaro, upper forest region, alt. 2500 m., *Grote* 5071 (typus in Herb. Amani); Kilimanjaro, Bismarckhugel, 3000 m., *Grote* 5076 (Herb. Amani); Mhesa, Ruvu River, 500 m. alt., *Greenway* 2107 (Herb. Amani; Herb. Mus. Brit.). Pangani: Handeni Distr., *Swynnerton* s. n. (Herb. Mus. Brit.).

This species also belongs to Sect. *Brevirameae* Engl. & Diels, and is near *C. parvifolium* Engl. & Diels, from which it differs in the scaly but otherwise glabrous leaves and in the much smaller fruits. The leaves and fruits are much smaller than in *C. Greenwayi* described above. According to Greenway *C. Grotei* is a common shrub in the *Acacia*-desert country, and is often dominant.

(2). BY CECIL NORMAN.

Polyscias Letestui, sp. nov. (Araliaceae). *Arbor* 7–8 m. alta. *Folia* permagna ±60 cm. longa 6-jugata pinnata rhachide demum glabra; foliolis oppositis breviter vel longiuscule petiolatis ± 18×9 cm. late ovatis vel oblongis acutis tenuiter chartaceis, basi rotundatis vel subcordatis, superne glabris, inferne tomento fulvo stellato leviter vestitis. *Inflorescentia* multi-ramosa, *ramis* stellato-tomentosis, umbellulas ±1 cm. longe pedunculatas permultas racemose dispositas gerentibus. *Petala* delapsa; *fructus* ovati costati glaberrimi in apice pedunculi dilatato sessiles. Styli 2.

Hab. GABOON: Mongombo, *Le Testu* 8814 (typus in Herb. Le Testu); Haut-Ogooué, *Le Testu* 8027.

Nearest to *P. Alberscaria* Harms and *P. kikuyuensis* Summerhayes, both having the flowers in umbels; but both are described as having *pedicelled* flowers and fruits and in *P. kikuyuensis* the fruit is rather densely tomentose.

Pimpinella physotrichioides, sp. nov. (Umbelliferae). *Herba* biennis caule tereti striato, ±1·50 m. alta glabrata, superne ramosa. *Folia* basalia et caulina inferiora simplicia, ambitu ovato-triangularia acuta, 3–7 cm. longa et versus basim 4–5·5 cm. lata, basi truncata vel subcordata, margine dentata mucronata; folia caulina superiora ad bracteas pinnatisectas reducta. *Umbellæ* plurimæ multiradiatæ, radiis erectis 3·5–4 cm. longis glabris, pedicellis ±1 cm. longis. *Involucri* bracteæ 0, involucellorum 0 vel 1 anguste linearis acuta. *Fructus* ovatus tuberculis papillosis vestitus, disco dilatato conspicuo, stylopodiis parvulis vix ovatis. *Styli* breves divaricati.

Hab. FRENCH EQUATORIAL AFRICA: Oubangi Chari, Waka, "en haute savanne boisée près Ippy," *Tisserant* 1922. (Typus in Herb. Le Testu.)

Differs from all other tropical African species in the fruit, which is not unlike that of *Physotrichia Welwitschii* Hiern. In foliage, however, and in the lack of involucral bracts, it is a true *Pimpinella*. *P. Olivieri* Boiss. from western Asia has similar papillose fruits.

Diplolophium Tisserantii, sp. nov. (Umbelliferae). *Herba* ± 2 m. alta rigida, caule tereti folioso, vix ramoso. *Folia* homomorpha, lamina ternatim pinnatisecta usque 20 cm. longa,

segmentis ultimis 7–10 cm. longis et 2–4 mm. latis, linearibus acutis costa inferne prominente, petiolo quam lamina breviore per totam longitudinem anguste vaginante. *Umbellæ* multiradiatæ radiis validis minute pubescentibus, exterioribus quam centrales duplo longioribus, pedicellis numerosis inæquilongis. *Bracteæ* involucri et involucellorum conspicuæ, omnino generis. *Fructus* oblongus ±5 mm. longus, calycis dentibus triangularibus acutis; mericarpia a latere compressa, pilis brevibus tuberculisque obtecta. *Styli* longi erecti.

Hab. FRENCH EQUATORIAL AFRICA: Oubangui-Chari; dans la circonscription de la Waka, 60 km. N. Moroubas, *Tisserant* 553 (typus in Herb. Le Testu); Haute Kotto, *Le Testu* 3638.

Nearly allied to *D. africanum* Turcz. and *D. zambesianum* Hiern, differing from both by the broad leaf-segments and more especially by the fruit. In the older species the fruit is at all times densely hairy and the ridges are visible. In *D. Tisserantii* the young fruit appears to be merely clothed with short stiff hairs, but as it ripens the hairs tend to disappear and the fruit is seen to be covered with small tubercles, and the ridges are invisible.

After flowering in this species and *D. africanum* the umbels contract and close like those of *Daucus Carota*.

(3). BY A. C. HOYLE.

Hymenodictyon oreophyton, sp. nov. (Rubiaceae). *H. biafranum* Hiern in Oliv. Fl. Trop. Afr. iii. 42 (1877) p.p. quoad spec. Cameroonense, Hutch. & Dalz. Fl. W. Trop. Afr. ii. 70 (1931) p.p. Affinis *H. biafrano* Hiern, a qua inflorescentia basin versus ramulosa, pedicellis et floribus brevioribus, ramulis in sicco nigrescentibus, stipulis longioribus, fructu et seminibus majoribus, recedit.

Arbor 10 m. alta, ramulis ab initio fere glabris complanatis minute striatis. *Stipulæ* glabræ deltoideo-ovatæ deciduæ, apice obtusæ et dentatæ. *Folia* glabra rubescentia 8–14 cm. longa 3·5–6 cm. lata obovata, apice brevissime et obtuse acuminata, basi acuminata et in petiolum decurrentia; nervi laterales utrinque 5–6 tenuissimi, venis inconspicuis; petioli 1–2 cm. longi. *Paniculæ* spiciformes terminales, 10–12 cm. longæ; pedunculus 3–4 cm. longus complanatus ferrugineo-pubescens; rhachis costatus ferrugineo-tomentellus; ramuli 2 ex axillis bractearum in apice pedunculi; bracteæ foliaceæ membranaceæ albidæ reticulatæ deciduæ 3–9 cm. longæ 1·5–5 cm. latæ glabræ, petiolo 1–2·5 cm. longo; bracteolæ caducissimæ subulatæ circiter 8 mm. longæ ciliatæ. *Flores* numerosi; pedicelli circiter 1 mm. longi crassiusculi puberuli ovario subæquilongi. *Calycis lobi* 5 lanceolato-subulati 1·5–2·5 mm. longi puberuli et ciliati. *Corollæ tubus* 4 mm. longus furfuraceus, dentibus 5 deltoideis acutis, 1 mm. longis, utrinque minute puberulis. *Stamina* inclusa, versus basim corollæ tubi affixa; antheræ basifixæ oblongæ apiculatæ 1·5 mm. longæ, loculis basi breviter auriculatis, filamentis applanatis æquilongæ. *Stylus* 6–7 mm. longus glaber, stigmate clavato. *Capsula* coriacea glabra 14–20 mm. longa 4–7 mm. lata, extra atro-rubescentia, sparse et irregulariter sed prominenter lenticellata, utrinque longitudinaliter medio canaliculata. *Semina* numerosa utrinque alata, seminis nucleus elliptico-compressus 1·5 mm. longus; ala lineari-lanceolata circiter 13 mm. longa 1·5 mm. lata, basi bilobata, irregulariter dentata membranacea.

Hab. WEST TROPICAL AFRICA: Cameroon Mountain, Ebang, at 5000 feet, *A. T. Johnstone* J.320/32 (typus in Herb. Kew.) and Imperial Forestry Institute Herb., Oxford, with flowers, May 1932; Cameroons Mountain at 4000 feet, *Mann* 1194, with fruits, Feb. 1862; Litoka, at 4500 feet, *T. D. Maitland* 1074, with flowers, April 1930. "Tree in secondary bush." "A small tree in open part bordering 1922 crater."

Hymenodictyon reflexum, sp. nov.; *H. biafranum* (non Hiern) Wernh. in Cat. Talb. Nig. Pl. 129 (1913), Hutch. & Dalz. *loc. cit.* p.p. Affinis *H. oreophyton* Hoyle, a qua bracteis primo ordinis verisimiliter minoribus, bracteolis conspicuis reflexis coriaceis falcatis in statu florescente persistentibus, foliis latioribus, ramulis in sicco rubescentibus nec nigrescentibus, recedit.

Arbor (?), ramulis novellis glabris teretibus apice complanatis minute striatulis. *Stipulæ* glabræ deltoideo-ovatæ obtusæ deciduæ. *Folia* glabra 9–14 cm. longa 4·5–7 cm. lata, obovata vel elliptica, apice brevissime acuminata, basi cuneata et leviter in petiolo decurrentia, supra nitidula rubescentia; nervi laterales utrinque 4–6 tenuissimi, venis inconspicuis; petioli 1–2 cm. longi. *Inflorescentia* et *flores* velut in *H. oreophyton* (q. v.) similes; bracteæ usque ad 5·5 cm. longæ 2·5 cm. latæ; bracteolæ 8–13 mm. longæ usque ad 1·5 mm. latæ, lineari-lanceolatæ falcatæ reflexæ coriaceæ persistentes, infimæ nonnunquam basin versus inciso-lobatæ; pedicelli 1·5–2 mm. longi. *Calycis* lobi usque ad 2·5 mm. longi. *Corollæ tubus* 4–5 mm longus. [*Fructus* non visus.]

Hab. WEST TROPICAL AFRICA: S. Nigeria, Oban, *P. A. Talbot* 213 (typus in Herb. Mus. Brit.); Herb. Kew.

THE *IXORA* SPECIES OF BURMA AND THE ANDAMAN ISLANDS.

BY C. E. B. BREMEKAMP.

(Continued from p. 111.)

2. I. GRIFFITHII Hook. in Bot. Mag. t. 4325 (1847); Brem. Ix. n. 56. *Pavetta congesta* (Roxb.) Miq. ex Miq. Fl. Ned. Ind. ii. 1, 269 (1857) quoad specimen Wallichianum; an *Ixora congesta* Roxb. Fl. Ind. ed. Carey, i. 387 (1820) species moluccana dicta,

parum descripta et absentia typi haud certe noscenda, dubiosissima ; *I. congesta* Roxb. ex F. B. I. iii. 146, ex Boerl. Handl. Fl. Ned. Ind. ii. 1, 136 (1891), ex Mat. F. M. P. 76, ex Ind. Trees, 389, ex F. M. P. ii. 93, ex Fl. Siam. En. ii. 154. *I. glaucina* (Teysm. & Binn.) Kurz, Contr. Bur. Fl. 148 et For. Fl. Bur. 26 quoad specimina birmahica foliis opacis instructa (*vide supra*).

Distr. Tenasserim, Malay Peninsula, East Sumatra, Borneo.

TENASSERIM : Attaran and Mergui, *fide* Brandis, *l. c.*

3. I. JAVANICA (Bl.) DC. Prodr. iv. 487 (1830) ; Fl. Siam. En. ii. 158 ; Ridley in Journ. Bot. lxxii. 252 (1934) ; Brem. Ix. n. 26. *Pavetta javanica* Bl. Bijdr. Fl. Ned. Ind. 949 (1826). *Ixora amoena* Wall. ex G. Don, Gen. Syst. iii. 571 (1834) ; F. B. I. iii. 146 ; Ind. Trees, 389. *I. stricta* Roxb. var. *Blumeana* Kurz, Contr. Bur. Fl. 148 et For. Fl. Bur. 24 (1877) ; F. B. I. *l. c.*, in nota. *I. stricta* Roxb. ex Mat. F. M. P. 80 ; non Roxb. Fl. Ind. ed. Carey, i. 388 (1820) quæ est *I. chinensis* Lam. Encycl. iii. 344 (1789), *cf.* Merrill, Interpret. Herb. Amb. 487 (1917). *I. stricta* Roxb. var. *amoena* (Wall. ex G. Don) Ridley, F. M. P. ii. 94 (1923).

Distr. Tenasserim, Malay Peninsula, Sumatra, West Java.

TENASSERIM : Amherst, Wall. Herb. 6121 *a* ; Chopedong, Wall. Herb. 6121 *b* ; Tavoy, Wall. Herb. 6121 *c* ; *ibid.* leg. *Helfer* 2986 Herb. Kew. ; Mergui, leg. *Parish* 251, Herb. Kew.

4. I. PSEUDOJAVANICA Brem. Ix. n. 25 ; typus : *Korthals* s.n. Hb. Leiden 908.219.774 in Java lectus. Ab *I. javanica* (Bl.) DC. foliis brevius petiolatis, angustioribus (lanceolatis an lanceolato-oblongis), sicc. haud conspicue fusco-reticulatis, distinguenda.

Dist. Tenasserim, Malay Peninsula, Sumatra, West Java.

TENASSERIM : Tavoy District, Tavoy Hermingyi (12 miles from Tavoy), alt. 30 m., leg. *C. Gilbert Rogers*, 307 T Herb. Dehra Dun ; Mergui District, Awgyi, alt. 0 m., leg. *nat. coll.* 10,892 Herb. Dehra Dun ; Forests near Tenasserim, alt. 60 m., leg. *C. E. Parkinson*, 1649 Herb. Dehra Dun.

5. **Ixora ovalifolia,** sp. nov. ; typus : *Po Khant* 11,356, Herb. Dehra Dun. *I. javanicae* (Bl.) DC. affinis, sed ramis obtuse quadrangularibus, foliis brevius petiolatis, basi sublate rotundatis, venulis subtus distinctis sed sicc. haud conspicue fuscatis, floribus minoribus luteis, ab ea sat distincta.

Arbuscula 4·5 m. alta ; rami obtuse quadrangulares, veteriores cortice griseo-brunneo opaco vestiti. *Folia* petiolo crassiusculo canaliculato 2–3 mm. longo ; lamina ovata an lanceolata 14–16 cm. longa et 4·8–7·5 cm. lata, apice longius acuminata et mucronata, basi late rotundata an subcordata, subcoriacea, opaca, sicc. supra griseo-brunnea et subtus grisea, costa basin versus canaliculata, nervis utroque latere costæ 11–12 subtus prominulis, venulis laxe reticulatis subtus distinguendis, sed sicc. haud conspicue fuscatis. *Stipulæ* late triangulares in aristam

vagina paulo longiorem, an ei subæqualem, exeuntes. *Inflorescentia* longius pedunculata, subcontracta, puberula, floribus circ. 45 ; pedunculus 3·2 cm. longus, internodio 3 mm. longo, foliis rudimentariis munito, præcessus, basin versus glaber ; internodia basalia axis et ramulorum infimorum 6 mm. longa ; alia 3 mm. haud superantia. *Flores* laterales triadum pedicellis 0·6 mm., flores centrales pedicellis 0·3 mm. longis, muniti ; bracteæ triangulares, basales 1 mm. longæ, aliæ breviores ; bracteolæ bracteis forma similiores, ovario multo breviores. *Ovarium* glabrum. *Calyx* glaber tubo 0·2 mm. longo, lobis late triangularibus tubo æquilongis. *Corolla* lutea tubo 2·3 cm. longo et 0·9 mm. diam., lobis 4·8 mm. longis et 3·2 mm. latis, obtusis, haud ciliatis. Filamenta 1·1 mm. ; antheræ 3 mm. *Stylus* sparsissime pilosus ; pars exserta, stigmatibus 1·5 mm. longis comprehensis, 3·5 mm. longa.

Hab. TENASSERIM : District Tenasserim, Victoria Point, leg. *Po Khant*, 11,356 Herb. Dehra Dun.

6. **Ixora lacuum,** sp. nov. ; typus : *C. E. Parkinson*, 14,382 Herb. Dehra Dun. *I. javanicae* (Bl.) DC. affinis, sed foliis basi acutis et conduplicatis, venulis sicc. haud conspicue fuscatis, floribus salmoneis, calyce longius lobato, ab ea recedens.

Frutex ; rami teretes, novelli soli visi. *Folia* petiolo anguste sed profunde canaliculato 4–5 mm. longo munita ; lamina oblonga 13–20 cm. longa et 5–7 cm. lata, apice caudato-acuminata, basi acuta et conduplicata, herbacea, opaca, sicc. supra griseo-brunnea et subtus dilute brunnea, costa basin versus canaliculata, nervis utroque latere costæ 10–11 subtus prominulis, venulis vix distinguendis et sicc. subtus haud conspicue fuscatis. *Stipulæ* triangulares in aristam vagina longiorem exeuntes. *Inflorescentia* longius pedunculata, laxe corymbosa, puberula, floribus circ. 45 ; pedunculus 2·5 cm. longus, internodio brevi, foliis rudimentariis munito, præcessus ; internodia basalia ramulorum infimorum 8–10 mm. ; internodium basale axis 6 mm. ; internodia alia breviora. *Flores* laterales triadum pedicellis 1 mm., flores centrales pedicellis 0·5 mm. longis, muniti ; bracteæ triangulares, basales 2 mm. longæ, aliæ breviores ; bracteolæ ovato-triangulares 0·6 mm. *Ovarium* glabrum. *Calyx* glaber tubo 0·2 mm., lobis ovato-triangularibus 0·6 mm. longis. *Corolla* salmonea tubo 3·2 cm. longo et 0·8 mm. diam., lobis 7·5 mm. longis et 4·2 mm. latis, obtusis, haud ciliatis. Filamenta 1 mm. ; antheræ 3·6 mm. *Stylus* pilosus ; pars exserta, stigmatibus latioribus 1·8 mm. longis comprehensis, 4 mm. longa.

Hab. LOWER BURMA : Rangoon, Royal Lakes, leg. *C. E. Parkinson*, 14,382 Herb. Dehra Dun.

Two more species belonging to this section have been recorded from Burma, namely, *I. coccinea* L. and *I. chinensis* Lam. (*I. stricta* Roxb.), but neither of them grows wild. It is true

that the latter (under the name *I. stricta* Roxb. var. *Roxburghiana* Kurz) has been quoted by Kurz as growing wild in Upper Tenasserim and in the neighbourhood of Rangoon, but this is doubtless a mistake: his specimens may have belonged to one or both of the two species described above.

Section BRACHYPUS Brem.

Inflorescence subsessile or moderately pedunculate, erect or nodding. Bracts and bracteoles narrow. Flowers white or pink. Stamens usually about as long as the corolla-lobes; anther-cells long. Style glabrous.—From India to the Malay Peninsula.—Species 7–23.

Series *Subpaniculatae* Brem.—Inflorescence distinctly, rarely fairly long, pedunculate, subpaniculate, erect. Peduncle not preceded by a short internode, and the leaves at its base not, or but slightly, reduced. Central flower of the triad sessile and ebracteolate. Calyx divided to the base. Corolla outside and inside glabrous.—From the southern slopes of the Himalaya and from South China to the Malay Peninsula; one species in the Andamans and one in Bangka.—Species 7–12.

I. cuneifolia Roxb. Fl. Ind. ed. Carey, i. 380 (1820); Wight, Ic. t. 709; F. B. I. iii. 144 et Ind. Trees, 389, quoad specimina assamica, syn. excl.; non Contr. Bur. Fl. 150 nec For. Fl. Bur. ii. 21 (cf. *I. pubirama* et *I. Lacei*).

Distr. Assam.

I have seen no Burmese specimens of this species: those mentioned by Kurz and others from Lower Burma and Tenasserim belong to other species. It might occur, however, in Upper Burma.

7. I. BUTTERWICKII Hole in Ind. For. xlv. 16 (1919) et in Ind. For. Rec. vii. pt. 4, i. t. 1 (1919); Fl. Siam. En. ii. 150 var. excl.

Distr. Central Burma and Siam (*fide* Craib, *l. c.*).

CENTRAL BURMA: Yamethin District, Inbinyedwet, alt. 90 m., leg. *Butterwick*, 19,784–19,786 et 19,976–19,979 Herb. Dehra Dun; 19,978 dupl. Herb. Kew.

Craib, *l. c.*, compared this plant, which is doubtless nearly related to *I. cuneifolia* and the three following species, with *I. spectabilis* Wall. ex G. Don. The latter (*vide infra*) belongs, however, to another section. *I. Butterwickii* differs conspicuously from its allies by its very large obovate leaves and by the rather long peduncle of its inflorescence.

8. **Ixora Lacei,** sp. nov.; typus: *J. H. Lace*, 2974 Herb. Dehra Dun. *I. cuneifolia* Roxb. var. *Roxburghii* Kurz, Contr. Bur. Fl. 150 et For. Fl. Bur. ii. 21, non *I. cuneifolia* Roxb. Fl. Ind. ed. Carey, i. 380. Ramis foliisque glabris, foliis et majoribus

ut apice attenuatis an subcaudatis, inflorescentiæ subglabræ ramulis acutangule patentibus, floribus majoribus ab *I. cuneifolia* Roxb., foliis basi subobtusis utrimque nitidulis et utrimque venulos exhibentibus, floribus minoribus ab *I. Ackeringae* (Teysm. & Binn.) Val. ex Brem. distinguenda.

Habitus ignotus. *Rami* et folia glabri; rami novelli 2·2–3 mm. diam.; veteriores non vidi. *Folia* petiolo canaliculato 5–6 mm. longo; lamina lanceolata circ. 15 cm. longa et 5·5 cm. lata, apice attenuata an subcaudata, basi subobtusa, subcoriacea, utrimque nitidula, sicc. pallida, nervis utroque latere costæ circ. 8 supra prominulis et subtus prominentibus, venulis laxe reticulatis utrimque prominulis. *Stipulæ* subquadratæ in aristam validam vagina bis longiorem exeuntes. *Inflorescentia* longius pedunculata, subglabra, e floribus circ. 120 composita; pedunculus 2·8 cm. longus, basi foliis ordinariis munitus; ramuli acutangule patentes; internodia basalia ramulorum infimorum 2·8 cm.; internodium basale axis 4 cm., internodia alia multo breviora. *Flores* laterales triadum pedicellis 2 mm. longis muniti. Ramuli infimi foliis sessilibus 5 cm. longis et 2·6–2·9 cm. latis suffulti. Bracteæ bracteolæque angustissime lineares; bracteolæ florum lateralium ovario subæquilongæ. *Ovarium* puberulum. *Calyx* subglaber lobis ovatis subobtusis 0·8 mm. longis. *Corolla* tubo 1·4 cm. longo, lobis linearibus obtusis 4 mm. longis et 1 mm. latis. Filamenta 1·5–1·8 mm.; antheræ 3 mm. *Styli* pars exserta, stigmatibus 1·8 mm. longis comprehensis, 4·8 mm. longa.

Hab. LOWER BURMA: District Myaungmya, Labwuta, leg. *J. H. Lace*, 2974 Herb. Dehra Dun.

9. **Ixora pubirama,** sp. nov. *I. cuneifolia* Roxb. var. *puberula* Kurz, Contr. Bur. Fl. 150 et For. Fl. Bur. ii. 21 (1877). *I. puberula* Wall. Cat. n. 6145 (quoad *a* et *b* in Herb. Wall.) nomen tantum; non *I. puberula* (Hiern) Kuntze in Rev. Gen. Pl. i. 287 (1892) quæ est *Pavetta puberula* Hiern. *I. Lacei* similior, sed ramis foliisque dense puberulo-pubescentibus, inflorescentiæ pubescentis ramulis patentissimis, ab ea faciliter cognoscenda.

Frutex circ. 3 m. altus; rami novelli dense puberulo-pubescentes 2·5–3·5 mm. diam., veteriores cortice griseo nitidulo vestiti. *Folia* petiolo canaliculato puberulo-pubescente 5–10 mm. longo; lamina lineari-lanceolata 16–20 cm. longa et 6–6·5 cm. lata, apicem versus attenuata an subcaudata, basi acuta an subacuta, foliorum superiorum tamen interdum subrotundata, subcoriacea, opaca, sicc. utrimque olivacea an griseo-brunnea, supra glabra et subtus brevissime puberula an scabrido-puberula, nervis utroque latere costæ 7–12 subtus prominentibus, venulis laxe reticulatis subtus partim prominulis. *Stipulæ* late triangulares extus puberulæ, in aristam validam vagina paulo longiorem exeuntes, axilla pilosæ. *Inflorescentia* longius pedunculata, pubescens, floribus 100–150; pedunculus 3–5·5 cm. longus, basi foliis ordinariis

munitus; internodia basalia ramulorum infimorum 2·5 cm.; internodium basale axis 3–4 cm.; internodia alia peripheriam versus longitudine gradatim decrescentia. *Flores* laterales triadum pedicellis 1·5–3 mm. longis muniti. Ramuli infimi foliis multo reductis 1·2–2 cm. longis suffulti. Bracteæ bracteolæque angustissime lineares; bracteolæ florum lateralium ovario subæquilongæ. *Ovarium* puberulum. *Calyx* sparse pubescens lobis ovatis acutis 1·1 mm. longis. *Corolla* dilute rubella tubo 1·5 cm. longo, lobis linearibus obtusis 5–5·5 mm. longis et 1·3 mm. latis. Filamenta 2·5 mm.; antheræ 4–4·5 mm. *Styli* pars exserta, stigmatibus 3 mm. longis comprehensis, 6 mm. longa.

Hab. LOWER BURMA: District Bassein, Maggiziu, alt. 0 m., leg. *C. E. Parkinson*, 213 Maymyo Herb.; District South Pegu, Salu Reserve, leg. *Ba Pe*, 11,667 Maymyo Herb.; North Tenasserim, Moulmein, and Attaran River, Wall. Herb. 6145 *a* et *b*.

Kurz (Contr. Bur. Fl. 150 et For. Fl. Bur. ii. 21) describes three varieties of *I. cuneifolia*. With the first two I have dealt above (cf. *I. Lacei* et *I. pubirama*). Of the third variety, which he calls *pumila*, I have seen no specimen, but judging from the description I regard it as very probable that this variety also will have to be raised to specific rank.

10. **Ixora eludens,** sp. nov.; typus: *A. Long*, 10,318 Maymyo Herb. Foliis caudatis, corollæ tubo longiore et graciliore, staminibus quam lobis corollæ distincte brevioribus, a speciebus prioribus distincta.

Frutex circ. 1·5 m. altus; rami novelli subglabri 2–4 mm. diam.; veteriores nondum vidi. *Folia* petiolo canaliculato parce puberulo circ. 10 mm. longo; lamina lineari-oblanceolata an lineari-oblonga 20–27 cm. longa et 5·5–8·5 cm. lata, apice caudata et mucronata, basi acuta, subcoriacea, utrimque opaca, sicc. utrimque olivacea, supra glabra et subtus costa nervisque parce et brevissime puberula, nervis utroque latere costæ 8–10 supra interdum subimpressis et subtus prominentibus, venulis laxe reticulatis subtus partim prominulis. *Stipulæ* late triangulares in aristam validam vagina bis longiorem exeuntes, extus parce puberulæ deinde glabrescentes, axilla dense pilosæ. *Inflorescentia* longius pedunculata, parce puberulo-pubescens, e floribus 75–150 composita; pedunculus 3 cm. longus, basi foliis ordinariis munitus; internodia basalia ramulorum infimorum 2 cm.; internodium basale axis 2–3 cm.; internodia alia peripheriam versus gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis 1–2 mm. longis muniti. Ramuli infimi foliis multo reductis 6 mm. longis suffulti. Bracteæ filiformes peripheriam versus longitudine decrescentes; bracteolæ florum lateralium anguste lineares ovario paulo breviores. *Ovarium* parce puberulum. *Calyx* subglaber lobis ovatis acutis 1 mm. longis. *Corolla* alba tubo gracili 2·1–2·2 cm. longo, lobis linearibus

obtusis 6·5–7·5 mm. longis et 1·1–1·3 mm. latis. Filamenta 2 mm.; antheræ 4 mm. *Styli* pars exserta, stigmatibus 3 mm. longis comprehensis, 7 mm. longa.

Hab. LOWER BURMA: District Bassein, Alegyaung, leg. *A. Long*, 10,318 Maymyo Herb.

(To be continued.)

SHORT NOTES.

* PAEONIA CORALLINA Retz. figured in English Botany, 1513, ed. 3, pl. 1.—The colour of the flower is made a rich red into which hardly any blue enters. Was this in consequence of J. E. Smith's remark on J. Sowerby's sketch for E. B. 1513 "A nasty dull colour; it ought to be a fine red"? F. N. A. Garry, "Notes on the Drawings for English Botany," in Journ. Bot. 1903, Suppl. p. 11.

The colour of the Steep Holme Peony, as evidenced both by a plant as *Paeonia mascula* Miller from Steep Holme, grown by C. Goode, of which I have a specimen dried 1931, not having therefore lost its original colour, and another which I have seen (1931) growing in the garden of Mr. A. Latchmore, Hitchin, a plant in flower, procured personally by Mr. A. Latchmore from Steep Holme in 1930, is a bluish purple, a peculiar colour which accords ill with other flowers, and is very distinct from the "rich red" of garden peonies as often grown.

A stamen drawn enlarged in English Botany shows a filament much longer than the anther. The plant therefore, according to Coste, cannot come under *P. corallina* Retz. The same feature, filament longer than anther, appears in Mr. Goode's plant, and in a sheet distributed 1922, by Mr. S. H. Bickham, through the Watson Exchange Club, 1922.

The leaflets are characterized by Syme as oval or elliptical, and in the plate are shown as the latter. In Mr. Bickham's sheet of 1922, referred to above, they are relatively broader and much more obtuse.

Mr. Bickham had previously distributed in the Watson Exchange Club as *P. corallina* in 1919 a sheet which he afterwards desired should be corrected to *P. peregrina*. It has entire more or less acute elliptic leaflets, glaucous beneath like the others. Like the other three sheets named it has filaments longer than anthers.

Coste makes the distinction between *P. corallina* and *P. peregrina* that the former has anthers longer than the filaments and the latter anthers shorter than the filaments. His figure for *P. peregrina* makes the leaflets more subdivided, so much more so that the leaves of Mr. Bickham's 1919 sheet are more like those of Coste's figure for *P. corallina*.—J. E. LITTLE.

* This note was found by Miss Little among her father's papers.

NOTE ON SALIX ALIENA Flod.—Dr. Björn Floderus has described this species from Alaska, in Arkiv f. Botan. K. Svensk. Vetenskaps. xxvii. A. N : O 2, pp. 1–3, pl. 1, Feb. 5, 1935.

The species is based on specimens collected by Prof. W. A. and Mrs. C. B. Setchell, including No. 587 from the snout of Muldrow Glacier, at the base of Mt. Eielsen, in Mt. McKinley National Park. This number is cited as the type of *S. Setchelliana* Ball, in Univers. Calif. Publ. Bot. xvii. 410, pl. 72. As the latter name was published Sept. 7, 1934, it has priority over *S. aliena* Floderus.—J. BURTT DAVY.

GENTIANA DEPRESSA D. Don.—In the April number of the Journal of the Royal Horticultural Society Mr. C. T. Musgrave discusses the flowering season of this beautiful little Himalayan alpine. It was described by Don (Prodr. Flor. Nepalensis) in 1825, and there are specimens from Wallich in the British Museum Herbarium. More recent specimens collected by Prof. K. N. Sharma in Nepal, and now in the same herbarium, show plants in flower in May, at 13,000 feet elevation, and in August and October of the same year, at 16,000 and 15,500 feet respectively; a plate of the latter, a fine sheet of twenty-three specimens, is given. The writer suggests that the flowering season probably depends largely on whether climatic conditions favour formation and maturing of buds early enough in the summer to enable the flowers to open in the autumn. Should anything happen to prevent autumn flowering, such as unsuitable weather for the formation of the buds in the summer, or an early fall of snow in autumn, buds which have not opened in autumn may be carried through the winter and open in the following spring. Mr. Musgrave finds that in cultivation in this country flowering is largely governed by weather conditions in the summer, and may be postponed until October or November, or buds may be carried through the winter and flower in April, but in that case the flowers were poor.

OBITUARY.

ALBERT WILLIAM BORTHWICK, O.B.E. (1872–1937).

BRITISH Forestry has sustained a loss by the death on April 19 of Albert William Borthwick, Professor of Forestry since 1926 in the University of Aberdeen. Botanists will remember that at the Aberdeen Meeting of the British Association in 1934 he presided over the Botany Section, the subject of his address being "Some Aspects of Forest Biology." In 1929 Borthwick went with the British Association to South Africa, and the writer has pleasant recollections of an excursion with some leading members of the Forestry Sub-section to the beautiful Knysna province,

which he was privileged to join and in which Borthwick also took part.

Born on October 16, 1872, the third son of the late Mr. W. H. Borthwick of Crookston and Borthwick Castle, Midlothian, Borthwick was educated at Madras College, St. Andrews, and graduated B.Sc. and later D.Sc. at St. Andrews University. After graduation he spent four years at the University of Munich studying Continental methods of Forestry. On his return he was appointed Lecturer in Plant Physiology at Edinburgh University and in 1900 Lecturer in Forest Botany, a post which he held until 1915. From 1915–19 he was engaged in the maintenance of home-grown timber supplies for purposes of the War, and for these services he received the O.B.E. When the Forestry Commission was set up in 1919 he was appointed Chief Research and Education Officer to the Commission, a post which he held until he was elected, in 1926, to the newly founded Chair of Forestry in the University of Aberdeen.

I am indebted to his colleague Prof. J. R. Matthews of Aberdeen for details of his career.—A. B. RENDLE.

REVIEWS.

Early Science in Cambridge. By R. T. GUNTHER, M.A., Hon. LL.D., Curator of the Oxford Museum of the History of Science. Cr. 8vo, pp. xii, 513, frontisp. and numerous plates and text-figs. Printed for the author: University Press, Oxford, 1937. Price £2 2*s*.

DR. GUNTHER has a happy knack of breathing life into the dry bones of ancient scientific instruments, and the present volume, which originated in the exhibition of historic scientific apparatus in the Old Schools, Cambridge, in 1936, is far more than a descriptive catalogue of the exhibits. It has become a remarkably interesting account of the origin and development of the various branches of scientific study at the University, comparable with 'Early Science in Oxford' by the same author.

An introductory chapter notes points of interest in the development of the town and its surroundings, the fens, rivers, and drainage, and the rise of Societies, Museums, &c. Succeeding chapters deal with various branches of science, from Mensuration and Mathematics to Geology and Mineralogy. The development of the study of each science at Cambridge is described, with notes on its workers and exponents, and descriptions, with excellent and numerous illustrations, of the instruments and methods. A chronological list of the professors up to the present date are given in each case.

Chapter XIV. deals with Botany—William Turner, John Ray, Nehemiah Grew, and Stephen Hales, were Cambridge men whose

names will always be honoured in the history of Botany. Adam Buddle, a fellow of St. Catharine's Hall (1686–91) was the pioneer in Essex botany; his collection is in the Sloane Herbarium at the British Museum (Natural History), unfortunately divorced from the descriptive notes, which remained at Bloomsbury when the herbarium was transferred to South Kensington.

Stephen Hales, the greater part of whose work was done at Teddington, of which he was Incumbent, was not only the Father of Plant Physiology, but appears repeatedly in the volume as one of the founders of the Royal Society of Arts (1754), inventor of a deep-sea bucket, contriver of a planetarium (exhibit no. 198), and in connection with his work on gases, the circulation of the blood, and his efforts towards ameliorating life on ships, and especially his experimental work on ventilation, which reduced the number of deaths in Newgate from seven or eight a week to about two a month.

Of special interest is the inclusion of some of John Ray's letters, a facsimile of one to Timothy Burrell at Cuckfield, written from Black Notley, "July 22, —90," is included, and an Appendix B contains some unpublished letters to Peter Courthope of Danny Park, Sussex, by the courtesy of Sir William Campion. The special interest lies in the fact that Dr. Gunther has now completed the publication of all the known outstanding letters of Ray; these will be found in the Ray Society's volume of 1848, their volume of 'Further Correspondence' by Dr. Gunther in 1928, and the 'Journal of Botany,' 1934.

One is a little surprised to find a reproduction of a group of botanists at the British Association meeting at Edinburgh in 1892, featuring the President of the Section, Carruthers, seated next to Thiselton Dyer, and including Ray Lankester, Goebel and other eminent contemporary botanists, among whom are the two last Cambridge professors. An interesting historic picture.

In this his most recent, we trust not his last, contribution to the history of science Dr. Gunther has given us a valuable work of reference, and withal a delightful volume into which to dip.—A. B. R.

The Useful Plants of West Tropical Africa. By J. M. DALZIEL, M.D., B.Sc., F.L.S., late of the West African Medical Service. An Appendix to the *Flora of West Tropical Africa* by J. HUTCHINSON and J. M. DALZIEL. Roy 8vo, pp. xii, 612. Published under the authority of the Secretary of State for the Colonies by the Crown Agents for the Colonies, London, 1937. Price 18*s*.

As remarked by the Director of the Royal Botanic Gardens, Kew, under whose ægis the volume has been prepared, the

publication of an Economic Appendix to a Flora is a novel and useful link between botanical knowledge and economic work in the region concerned. And Dr. Dalziel was specially fitted for the task from his long service in the West African Colonies, his interest in their flora, and as the author of 'A Hausa Botanical Vocabulary,' which has enabled him to get together much information as to the uses made by the natives of their indigenous plants. The book is a record "of some of the native plants in common use—domestic, commercial, medicinal, etc.—among the people themselves, with indications in certain cases of their possible value in other directions. The known or suggested applications of most of the exportable indigenous products of West Africa are outlined." The author's field-notes, covering many years of observation, afforded the nucleus, and these have been supplemented from notes and native names with herbarium specimens or recorded in literature. A great source of information exists in the publications of Dr. A. Chevalier and his collaborators, covering French West Africa, which represents the greater part of the area included in the Flora. The text is preceded by a Bibliography which is additional to works cited in volume i. of the Flora. The arrangement of families follows that of the Flora; that of genera and species is alphabetical.

The author's method is inclusive. Some of the entries record merely the native name or indications of local medicinal use, but, on the other hand, there is a great amount of information on more or less useful species. In each case the distribution is indicated with the native names associated with the plant in the different countries. Native uses of the plant or its parts are described in detail, based on the author's own knowledge or on records in literature, the authority for which is cited. To take an example—*Lophira alata* Banks (Ochnaceae) is a widely spread timber tree. The question of its distinction specifically from *L. procera* is discussed, obvious characters of stem, leaf, and flower are described, and the properties and uses of the timber; notes are given on the medicinal uses of bark and leaves and the use of the seeds. Cucurbitaceae contains species some of which are introduced merely as records of native names or as remedies for common diseases; useful species such as Colocynth, Melons, Pumpkin, Calabash, and Loofah are treated in detail. Calabash (*Lagenaria vulgaris*) is regarded by A. Chevalier as the only one of the cultivated plants common to America and Africa which was equally present in both continents prior to Columbus, and Vavilow believes that it was originally Asiatic and could have been carried by ocean currents. On the other hand, of *Tamarindus indica*, widely planted, Dr. Dalziel says, "probably originally African and introduced long ago to India and not vice versa." An interesting association between the tamarind and baobab, expressed in a semi-scandent habit of the former, is noted.

Africa is poor in palms, but *Borassus*, *Hyphaene*, *Raphia* (wine-palm), and the Coco-nut supply food, drink, and domestic uses. *Elaeis guineensis* (oil-palm) and its varieties are treated at length, as becomes one of the most important of the West African useful plants ; it serves in West Africa the many uses of the coco-nut palm in the East. Useful grasses include *Pennisetum* (Pearl Millet), *Sorghum* (Great Millet or Guinea Corn), Rice, and Maize.

There is a detailed index to vernacular names, and also indexes to common and scientific names.

Dr. Dalziel's *magnum opus* is an invaluable contribution to African economic botany.—A. B. R.

Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich, und der Schweiz. X. Abt. 3, *Dinoflagellatae (Peridineae)*, Teil 2, Lief. 3 & 4. By J. SCHILLER. 8vo, pp. 321–590, text-figs. 274. Price M. 18 and M. 14.—XI. *Heterokonten*, Lief. 1. By A. PASCHER. Pp. ii & 160, text-figs. 126. Price M. 20. Akademische Verlagsgesellschaft : Leipzig, 1937.

THE two parts of the Peridineae volume complete the taxonomic description and end with a comprehensive bibliography and index. It would appear that the author does not contemplate any general consideration of the class, such as is to be found in other parts of the 'Kryptogamenflora.' The value of a comprehensive taxonomic survey such as the author has undertaken is, however, materially enhanced if the experience acquired by long contact with the forms in question is embodied in a general account in which the essential characteristics and their more important variants are brought out. In the opinion of the writer the omission of such an account is to be regretted.

A considerable part of the first instalment is occupied with a description of the species of *Ceratium*, and, apart from this, deals with a number of smaller families (Heterodiniaceae, Goniodomaceae, Oxytoxaceae, etc.). The opening pages of the last instalment include the amœboid, palmelloid, coccoid, and filamentous types which Klebs and Pascher have made familiar. As in other sections of the volume dealing with Peridineae there are numerous clear illustrations which amplify the specific diagnoses.

The first instalment of the volume treating of the Heterokontae comprises the greater part of the introductory matter, and deals with the general morphology, the details of cell-structure, and reproduction. No such comprehensive account of the class has ever yet been published, and, compiled as it is by Pascher, to whom we are already indebted to so marked an extent for the amplification of our knowledge of the Heterokontae, its appearance will contribute materially towards a better understanding of the class. Pascher's account is full of new facts, and reference is made to a considerable number of new genera whose full description will no doubt follow in later parts. Although the range of form is appreciably widened, even the comprehensive studies of the author have not so far disclosed the existence of any motile colonial types, nor of the more highly organized motile unicells such as occur in Chrysophyceae etc. Nor is Pascher able to add in any way to our previous knowledge of sexuality in this class, although his critical remarks on the cases of sexual reproduction reported by Borzi are valuable and decidedly to the point.

Apart from the characteristics of the class that are already familiar Pascher lays special stress on the dorsiventrality of all motile stages, the clear nature of the cytoplasm, which is probably related to a fluid consistency, and on the difference between the structure of the two unequal flagella to which Vlk first drew attention. The last two features are also met with in Chrysophyceae. In fact, one may well agree with Pascher that the more our knowledge of the Heterokontae widens the more does the evidence for affinity with the Chrysophyceae increase and the more markedly do they appear removed from the Chlorophyceae. The discovery of pyrenoids in the chloroplasts of Heterokontae, with which Pascher deals at length, has removed one of the formerly recognized differences between them and Chlorophyceae, although it remains doubtful in the writer's mind whether the pyrenoids of Heterokontae (and Chrysophyceae) can actually be compared with those of the Green Algæ.

Pascher's account is accompanied by numerous excellent illustrations, for the most part drawn by him, although a considerable number of them have already been published in his earlier papers. The whole work marks a contribution to knowledge of considerable importance.—F. E. FRITSCH.

Lebensgeschichte der Blütenpflanzen Mitteleuropas. Edited by Dr. W. WANGERIN and Dr. C. SCHRÖTER. Lief. 53/54. Bd. iii. Abt. 5, *Lythraceae*. By HELEN SCHOCH-BODMER, F. BUXBAUM, and W. WANGERIN. Roy. 8vo, pp. 128, 68 text-figs. Eugen Ulmer, Stuttgart, 1937.

THE family Lythraceae is represented in Central Europe by *Lythrum* and *Peplis Portula* L. Three species of *Lythrum* occur, *L. Salicaria* and *L. virgatum* comprising the subgenus *Salicaria*, distinguished as a genus by Tournefort, and *L. Hyssopifolia*, a member of the other subgenus, *Hyssopifolia*, to which the

remaining twenty-one species belong. The chief subgeneric difference lies in the inflorescence, dichasia in large terminal inflorescences in the former, flowers solitary or two in the leaf-axils in the latter. About one-half the volume is given to an exhaustive monograph of *L. Salicaria* (by Schoch-Bodmer) represented by three varieties, *intermedium*, *vulgare*, and *tomentosum*: geographical distribution, ecology, morphology, vegetative and floral, the remarkable heterostyly, fruit, seed, teratology, and pharmacology are described and discussed in detail with the help of numerous clear illustrations. *L. virgatum*, which also shows the characteristic heterostyly, and *L. Hyssopifolia* are treated in a similar manner but more briefly by F. Buxbaum; and W. Wangerin supplies a general introduction and the account of *Peplis Portula*. A list of important special literature includes 117 items.

British Fruits. By HILDA M. COLEY. Thirty-two folio coloured plates showing our more familiar fruits at the various stages of their development from flower to fruit. Two series of 16 plates each. Lutterworth Press, London, 1937. Price 3*s.* 6*d.* each series.

IN a previous number of the Journal we noticed series of coloured plates issued by the Lutterworth Press illustrating British Trees and British Wild Flowers. The present publications deal with British-grown fruits. Miss Coley is known for her delicate and accurate work as a flower artist, and her two series illustrating the fruits and their development are a useful and decorative addition to an educational series.

To the first series there is an introductory pictorial key to the various types of fruit—other sheets represent almond, peach and nectarine, cherries, plums, walnut, tomato, gooseberries, currants, grapes, cucumber, marrow, apple, pears, medlar, and wheat. In the second series are barley, oats, hazel, sweet chestnut, pea, scarlet runner bean, dwarf french bean, broad bean, mustard, caraway, strawberry, raspberry, loganberry, blackberry, mulberry, fig. There is no descriptive text apart from the labelling of parts in the drawings, but a book providing descriptions and other matter by the same author is announced. Three-colour reproduction has its limitations, especially when cheap production has to be considered, and within these limits the printers have been very fairly successful. The pictures generally illustrate a flowering shoot and stages showing the development of fruit and seed from the flower. The pea is a beautifully clear study, but floral details in catkin-bearing plants are not clearly shown. In most cases the course of development is carried through, but sometimes, as in blackberry, a very pretty picture, intermediate stages are omitted The use of the term seed is not always strictly botanical, and it is a mistake to index the radicle in the bean as the first shoot.

The plates will form an instructive decoration for the schoolroom.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on April 22, the President, Dr. W. T. Calman, C.B., F.R.S., President, in the Chair, Miss M. S. Campbell showed specimens of the bizarre orange from the South of France, a chimæra showing a mixture of characters of the two parents, a lemon and a sweet orange. Prof. F. E. Weiss, in an explanation of the exhibit, pointed out that it was a "strip" chimæra with some slight modifications, not a periclinal one.

Dr. G. P. Bidder, in an interesting paper entitled "The Perfection of Sponges," gave an account of the remarkable simplicity of the biology and life-history of the sponges.

Dr. P. W. Richards described some features of the Tropical Rain Forest, as studied by the Cambridge Botanical Expedition to Nigeria; he demonstrated the presence of an altitudinal zonation in the forest. Mr. R. Ross described the stages of secondary growth in areas that had been cleared and abandoned after a few years cultivation by the natives; and Mr. G. C. Evans gave an account of some physiological work conducted in the forest.

At the General Meeting on May 6, the President in the Chair, Dr. H. A. Spoehr, Director of Natural Sciences, Rockfeller Foundation, New York, U.S.A., and Prof. N. E. Svedelius, Director of the Botanic Gardens and Institution of the University, Upsala, were elected Foreign Members.

Dr. T. A. Sprague and Miss M. S. Sprague gave a summary of their paper on the herbal of Valerius Cordus. Valerius was the son of Euricius Cordus, classical scholar, poet, and Professor of Medicine at Marburg, best known as the author of the 'Botanologicon' (1534). His maternal uncle was Joachim Ralla, who owned the principal druggist's shop in Leipzig. Trained by his scholarly father and business-like uncle, Valerius achieved distinction in pharmacy, pharmacognosy, and botany. His 'Dispensatorium,' or pharmacopœia, was adopted by the city of Nuremberg. His 'Historia Plantarum,' or herbal, consists of about 485 descriptions of medicinal and economic plants and their products. These are so superior to any previously published ones that Valerius Cordus may be considered as the Father of descriptive botany. At that date (c. 1540) the principal textbooks on materia medica were the Latin translations of Dioscorides by Ruellius and Marcellus Vergilius and Pliny's Natural History, and the terminology used by Valerius Cordus was largely drawn from those works.

Hence, in order to interpret his descriptions, the authors had to prepare a series of glossaries of botanical terms from Pliny (1st century) to Ruellius (1516).

Like many pharmacognosists, Valerius was a very careful observer, and he gave clear descriptions of various types of inflorescence, such as the pentachasium, passing into dichasia and monochasia, of *Euphorbia dulcis*, the scorpioid cyme of *Sedum mite*, and the false capitulum of *Echinops sphaerocephalus*. He described the placentation in *Capsicum annuum* and *Corydalis intermedia*, and the radicle and cotyledons of *Strychnos Nux-vomica*. He paid special attention to vegetative propagation, noting the bulbils of *Dentaria bulbifera* and the production of new corms on the top of the old ones in *Gladiolus* and *Crocus*, and at the side of them in *Colchicum*.

The 'Historia Plantarum' is illustrated by about 270 woodcuts added by Konrad Gesner, and taken mainly from the Latin edition of Bock's herbal (1552). Over 40 of these actually represent different species from those described by Valerius Cordus.

Among British plants first recorded in the herbal are *Butomus umbellatus*, *Dentaria bulbifera*, *Cotoneaster integerrimus*, *Silaum Silaus*, *Oxycoccus quadripetalus*, *Menyanthes trifoliata*, *Lathraea Squamaria*, and *Adoxa Moschatellina*.

Miss E. R. Saunders showed, from her examination of the flowers, that the apparently abnormal position in the genus *Hypericum* of *H. peplidifolium* Hochst. was based on errors of observation. The reported presence of five carpels succeeding three staminal bundles was shown by examination of material sent from East Africa to be in error; only three carpels are present, and the species thus falls into line with the general development in the species of the genus.

A paper entitled "A Cytological Study of some New Zealand Species and Varieties of *Danthonia*," by J. W. Calder, M.Sc., Canterbury Agricultural College, Lincoln, New Zealand, was read in title.

ROYAL SOCIETY.—John Ernest Holloway, D.Sc. (Auckland), Botanical Department, University of Otago (N.Z.), and Thomas Godfrey Mason, Sc.D. (Dublin), Head of the Physiological Department, Cotton Research Station, Trinidad, have been elected into the Fellowship of the Society.

OXFORD UNIVERSITY.—Prof. T. G. B. Osborn, D.Sc., Professor of Botany, the University of Sydney, New South Wales, has been appointed to succeed Prof. A. G. Tansley, F.R.S., in the Oxford Professorship.

CORRECTION.—Dr. F. BOLUS. We regret that owing to misinformation we congratulated Mrs. F. Bolus in our January number on a doctorate conferred by the Cape Town University. We should have written Stellenbosch University.

NEGLECTED SYRIAN PLANTS OF BANKS AND SOLANDER.

BY Dr. A. EIG,
The Hebrew University, Jerusalem.

IN my contribution on *Astragalus* sect. *Platyglottis* (Journ. Bot. 1934, 123) I remarked that Dr. Rendle (in litt.) had drawn my attention to an unknown species of this section from Syria, *A. suberosus* Russell. He informed me that Mr. Baker suggested the identity of this plant of Russell's with my *A. palaestinus*. Thereupon I remarked that it is rather *A. tuberculosus* DC., and not *A. palaestinus* Eig, which must be regarded as the synonym of *A. suberosus*. During my visit to the British Museum in the summer of 1935 I studied this plant of Russell's and became satisfied that my version was true. This case led me to a study of Russell's plants in general. It resulted in an elucidation of the synonymy of numerous Syrian (which are mostly also Palestinian) plants, and this result is now given *.

Alexander Russell (1715 ?–1768) was the physician of an English factory at Aleppo from 1740 to 1753, and he devoted his leisure to studying the nature of the land in which he lived. In 1756 he published "The Natural History of Aleppo and Parts adjacent," reporting a long list of plants, some of them with illustrations. The names of these plants, both known before and newly described, are pre-Linnæan (non-binary), and therefore the new species are not valid.

Patrick Russell (1727–1805), who succeeded his brother as physician at Aleppo in 1753, resumed the study of the natural history of this part of Syria, and published in 1794 a revised edition of Alexander's book under the name: 'The Natural History of Aleppo by Alexander Russell, M.D., The Second Edition, Revised, Enlarged and Illustrated, with Notes by Patrick Russell, M.D." In this second edition the list of plants is still longer, but the names are binary and the new species described are therefore valid. It must be borne in mind also that this list of plants was prepared not only on the basis of Alex. Russell's collection, to which was afterwards added the collection of Patrick Russell, but also of some other collections.

* [The late James Britten, during his long tenure of office in the British Museum Herbarium, was greatly interested in the rich historic collections, and especially in the Banksian herbarium, the foundation of the Department of Botany, as a separate entity. Among other valuable pieces of work he had made a systematic study of the list of plants in Patrick Russell's edition of his brother's 'Natural History of Aleppo'—identifying the species, collating them with the herbarium and annotating the list in the book. Except for a few isolated notes he did not publish the results of this work. It is fortunate that Prof. Eig has been able to bring his great knowledge of the Syrian flora to bear on the elucidation of the species described as new in the list, and thus to render them available for botanists generally.—A. B. RENDLE.]

In the preface to the second edition Patrick Russell mentions that the catalogue of plants has been prepared and arranged by Sir Joseph Banks and the late Doctor Solander. But it remains doubtful whether the authorship of the new plants of this catalogue should be attributed to Solander only or rather to both Banks and Solander. The latter was Keeper of the Banks Herbarium, and is regarded by most authorities to be solely responsible for the description of the new species. This is, for example, the opinion of the editors of the Kew Index, of Dr. O. Kuntze, Thellung, etc. Dr. Rendle, whom I consulted on this subject, is of opinion that the authors' names must be given as those of Banks and Solander *. Since Patrick Russell in his preface emphasizes that " the list is arranged by Sir Joseph Banks and Doctor Solander," it appears to me that in our case at least the authors' names should be left as Banks and Solander (Banks & Sol.).

It is most astonishing that this important source of the knowledge of Syrian plants has never been adequately studied by the botanists concerned with the flora of that country †.

Altogether in the above list 74 plants are described as new. Of these I was able to study 65 in the British Museum Herbarium. The types of the remaining nine species described in the second edition, *Alsine aristata*, *Ranunculus pallidus*, *Thymus hirtus*, *Tragopogon nervosum*, *Cnicus armatus*, *Carthamus canescens*, *Chrysanthemum tenuissimum*, *Centaurea lyrata*, and *Orchis collina*, I could not find, and their identification is still wanting.

Two of the type-specimens, that of *Onosma pilosum* and of *Antirrhinum calycinum*, are in such a bad condition that their identification required a great deal of work and time, which my short visit did not allow me. The identification of one of Russell's plants, that of *Stachys pungens* Banks & Sol., is still occupying me. Sixty-one types of the Banks and Solander plants which have been identified are subdivided into the following four main groups :—

I. Twenty-two species of Banks and Solander which must be restored. These plants have been described later by other authors and under other names, by which they were generally known :—

RUBIA ROTUNDIFOLIA Banks & Sol. (1794). Syn. *R. Aucheri* Boiss. (1843). See Britten in Journ. Bot. xxxix. 278 (1901).

* For an appreciation of Banks's botanical work see " Banks as a Botanist,' by James Britten in Proc. Linn. Soc. London, 1919–20, p. 15.—A. B. R.

† Boissier in his preface to the ' Flora Orientalis ' (p. xxiii) refers to the catalogue with some figures and several new species which he says have been omitted for the most part in general works owing to their inadequate description. He suggests that several might probably be found in the Banks Herbarium at the British Museum !—A. B. R.

HELIOTROPIUM MYOSOTOIDES Banks & Sol. (1794). Syn. *H. aleppicum* Boiss. (1849).

ANCHUSA STRIGOSA Banks & Sol. (1794). Syn. *A. strigosa* Labill. (1809).

JUNCUS TENAX Banks & Sol. (1794). Syn. *J. acutus* L. var. *Tomasinii* Buch. (1890) ; see A. B. Rendle in Journ. Bot. xxxviii. 80 (1900).

ALOPECURUS UTRICULATUS Banks & Sol. (1794). Syn. *A. anthoxanthoides* Boiss. (1853). Non *Phalaris utriculatus* L. (1767) ; *Alopecurus utriculatus* (L.) Pers. (1805) ; necnon *A. utriculatus* Soland. ex Fiori, Nuov. Fl. An. d'Italia (1923) ; *A. utriculatus* (L.) Russ. in Post, Fl. Syr. Palest. et Sinai, ed. 2, 1036.

[**Alopecurus Rendlei,** nom. nov.*. *A. utriculatus* (L.) Pers. (1805). *Phalaris utriculatus* L. (1767). Non *A. utriculatus* Banks & Sol. (1794).]

DIANTHUS STRICTUS Banks & Sol. (1794). Syn. *D. multipunctatus* Ser. (1824). Non *D. strictus* Sibth. & Sm. (1825).

SILENE TRINERVIS Banks & Sol. (1794). Syn. *S. racemosa* Otth. MS. apud DC. (1824). ? *S. Sibthorpiana* Reichenb. (1830–32) †.

SILENE RIGIDA Banks & Sol. (1794). Syn. *S. gonocalyx* Boiss. (1842). See F. N. Williams in Journ. Bot. lii. 339 (1914).

LYTHRUM JUNCEUM Banks & Sol. (1794). Syn. *L. Graefferi* Ten. (1811–15). See Britten, " R. Brown's List of Madeira Plants " in Journ. Bot. xlii. 41 (1904).

EUPHORBIA PETIOLATA Banks & Sol. (1794). Syn. *E. lanata* Hlob. (1826).

EUPHORBIA PUNGENS Banks & Sol. (1794). Syn. *E. biglandulosa* Desf. (1808).

RANUNCULUS MILLEFOLIUS Banks & Sol. (1794). Syn. *R. myriophyllus* in Boiss. Fl. Orient., Post, Fl. Syria, Palestine etc., non Banks & Sol.‡.

RANUNCULUS SERICEUS Banks & Sol. (1794). Syn. *R. cassius* Boiss. (1841). Non *R. sericeus* Poir. (1810).

* Dedicated to Dr. A. B. Rendle, who called my attention to the synonymy of *A. utriculatus* Banks & Sol.

† Neither *Silene Sibthorpiana* Reichenb. (*S. trinervis* var. nov. **Sibthorpiana**) nor *S. dichotoma* Ehrh. are Syrian or Palestinian plants.

‡ In Russell's book there is no specific name *Ranunculus* " *myriophyllus.*" It seems that Schroeder (1799) was the first to make this mistake, followed by De Candolle, Boissier, and others. The reason why Schroeder changed the name of *R. millefolius* for *R. myriophyllus* was apparently the existence of *R. millefoliatus.* But these are two different names and both are legitimate.

ASTRAGALUS GUTTATUS Banks & Sol. (1794). Syn. *A. conduplicatus* Bertol. (1844). *A. pictus* Boiss. (1859).

ASTRAGALUS SUBEROSUS Banks & Sol. (1794). Syn. *A. tuberculosus* DC. (1802).

ASTRAGALUS RUSSELLII Banks & Sol. (1794). Syn. *A. Rauwolfii* Pall. *A. Russellii* Boiss. (1849). *A. Russellii* Russ. in Post, Fl. Syria, Palestine etc. ed. 2 (1932).

ASTRAGALUS CEPHALOTES Banks & Sol. (1794). Syn. *A. andrachne* Bunge (1869). Non *A. cephalotes* Pall. (1800).

TRIFOLIUM ARGUTUM Banks & Sol. (1794). Syn. *T. xerocephalum* Fenzl. (1842).

TRIGONELLA UNCINATA Banks & Sol. (1794). Syn. *T. monantha* C. A. Mayer (1831). Non *T. uncinata* Ser. (1825).

HYPERICUM PALLENS Banks & Sol. (1794). Syn. *H. cuneatum* Poir. (1816).

HYPERICUM THYMIFOLIUM Banks & Sol. (1794). Syn. *H. serpyllifolium* Lam. (1797).

ANTHEMIS SCARIOSA Banks & Sol. (1794). Syn. *A. cariosa* DC. (1837).

CENTAUREA RIGIDA Banks & Sol. (1794). Syn. *C. myriocephala* Sch. Bip. (1875). *C. Russelliana* Bk. (1840). Non *C. rigida* Willd. (1813).

II. Seven species of which the author's name has been given generally as Russell and which should be Banks and Solander :—

LINUM PUBESCENS Banks & Sol. EUPHORBIA ARGUTA Banks & Sol. PIMPINELLA ERIOCARPA Banks & Sol. SALVIA BRACTEATA Banks & Sol. MARRUBIUM CUNEATUM Banks & Sol. STACHYS PUMILA Banks & Sol. CAMPANULA STRIGOSA Banks & Sol.

To these two groups may be added *Alyssum strigosum* Banks & Sol. (1794), which is a good species duly described by its authors, but subsequently forgotten. The specimens of this from Syria have been reported generally under the name of *Alyssum hirsutum* M. B., which is a different plant not growing in Syria.

III. Seventeen species for which Banks's and Solander's names should be kept within parentheses before the author's name, as the species which they described have since been transferred to other genera :—

HETERANTHELIUM PILIFERUM (Banks & Sol.) Hochst. (1841). *Elymus pilifer* Banks & Sol. (1794).

Boissiera squarrosa (Banks & Sol.), comb. nov. *Pappophorum squarrosum* Banks & Sol. (1794). *Pap. pumilio* Trin. (1831). *B. pumilio* (Trin.) Hack. (1885). *B. bromoides* Hochst. (1838).

Loliolum * subulatum (Banks & Sol.), comb. nov. *Triticum subulatum* Banks & Sol. (1794). *Nardurus orientalis* Boiss. (1884). *Festuca aleppiça* Steud. *N. subulatus* (Banks & Sol.) Eig (1935 Man.). *Loliolum orientale* (Boiss.) Krecz. & Bobr. (1934).

SMILAX ASPERA L. (1753) var. **rigida** (Banks & Sol.), comb. nov. *S. rigida* Banks & Sol. (1794). *S. mauritanica* Desf. (1798). *S. aspera* L. var. *mauritanica* (Desf.) Boiss. (1884).

Biarum gramineum (Banks & Sol.), comb. nov. *Arum gramineum* Banks & Sol. (1794). *B. Russellianum* Schott (1860) †.

Helicophyllum intortum (Banks & Sol.), comb. nov. *Arum intortum* Banks & Sol. (1794). *A. Rauwolfii* Blume (1835). *H. Rauwolfii* (Blume) Schott (1860). *Eminium intortum* (Soland.) O. Ktze (1891).

AETHIONEMA CARNEUM (Banks & Sol.) B. Fedtsch. (1904). *Thlaspi carneum* Banks & Sol. (1794). *A. cristatum* DC. (1821).

Chorispora purpurascens (Banks & Sol.), comb. nov. *Brassica purpurascens* Banks & Sol. (1794). *C. syriaca* Boiss. (1842).

STERIGMOSTEMUM SULPHUREUM (Banks & Sol.) Bornm. (1911). *Cheilanthes sulphureus* Banks & Sol. (1794). *Sterigma sulphurea* DC. (1821).

Prosopis farcata (Banks & Sol.), comb. nov. *Mimosa farcata* Banks & Sol. (1794). *M. stephaniana* M. B. (1800 & 1808). *Acacia stephaniana* Willd. (1806). *Lagonychium stephanianum* M. B. (1819). *Prosopis stephaniana* (M. B.) Kunth (1825).

Onobrychis echinata (Banks & Sol.), comb. nov. *Medicago echinata* Banks & Sol. (1794). *O. aurantiaca* Boiss. (1849). Non *O. echinata* (Guss.) Dietrich.

Lisaea strigosa (Banks & Sol.), comb. nov. *Caucalis strigosa* Banks & Sol. (1794). *Lisaea syriaca* Boiss. (1844).

SCANDICIUM STELLATUM (Banks & Sol.) Thell. (1925). *Scandix stellata* Banks & Sol. (1794). *S. pinnatifida* Vent. (1800).

* *Loliolum* Krecz. & Bobr. in Add. Flora U.R.S.S. ii. 766 (1934).

† *Arum syriacum* Russ., mentioned by Boissier, Fl. Or. v. 34 (1884), and by Dinsmore in Post's 'Flora,' ed. 2, 551 (1933), is a mistake. There is no such name in Russell's book ; the name is of Sprengel.

Caccinea macranthera (Banks & Sol.), comb. nov. *Borago macranthera* Banks & Sol. (1794). *C. Russellii* Boiss. (1849).

AJUGA LAEVIGATA (Banks & Sol.) Boiss. (1779). *Teucrium laevigatum* Banks & Sol. (1794).

BALLOTA RUGOSA (Banks & Sol.) Benth. (1834). *Marrubium rugosum* Banks & Sol. (1794). *B. saxatilis* Sieb. in J. & C. Presl (1822) and Benth. (1834).

Mericarpaea ciliata (Banks & Sol.), comb. nov. *Valantia ciliata* Banks & Sol. (1794). *M. vaillantioides* Boiss. (1843).

IV. A group of sixteen Banks and Solander species which should be mentioned among the first synonyms for other species :—

MELICA MINUTA L. (1767). *Melica capilans* Banks & Sol. (1794).

KOELERIA PHLEOIDES (Vill.) Pers. (1805). *Festuca phleoides* Vill. (1785). *F. glomerata* Banks & Sol. (1794). *F. compacta* Banks & Sol. (1794).

ERUCARIA HISPANICA (L.) Drude (1914). *Sinapis hispanicum* L. (1753). *E. aleppica* Gaertn. (1791). *Myagrum pinnatum* Banks & Sol. (1794).

CALEPINA IRREGULARIA (Asso) Thell. (1905). *Myagrum irregularis* Asso (1779). *Crambe amplexicaulis* Banks & Sol. (1794).

HOLOSTEUM UMBELLATUM L. (1753). *Arenaria umbellata* Banks & Sol. (1794).

CALYCOTOME VILLOSA (Poir.) Link (1808). *Spartium villosum* Poir. (1789). *S. lanigerum* Banks & Sol. (1794).

HYMENOCARPUS CIRCINATUS (L.) Savi (1798). *Medicago circinata* L. (1753). *Anthyllis biflora* Banks & Sol. (1794).

VICIA MONANTHA Retz. (1783). *V. gracilis* Banks & Sol. (1794). *V. calcarata* Desf. (1800).

VITIS ORIENTALIS (Lam.) Boiss. (1867). *Cissus orientalis* Lam. (1791). *C. pinnata* Banks & Sol. (1794).

MALABAILA SEKAKUL (Mill.) Boiss. (1849). *Tordylium sekakul* Mill. (1768). *Pastinaca sekakul* Banks & Sol. (1794).

CONVOLVULUS BETONICIFOLIUS Mill. (1768). *C. pubescens* Banks & Sol. (1794). *C. hirsutus* Stev. (1808).

NEPETA HELIOTROPIFOLIA Lam. (1787). *Satureja stricta* Banks & Sol. (1794) *.

* I compared the specimen of Russell with that of Tournefort, the original specimen of *Nepeta heliotropifolia*.

CHARDINIA ORIENTALIS (Mill.) O. Kuntze (1887). *Xeranthemum orientale* Mill. (1768). *X. orientale* Banks & Sol. (1794).

The recognition of these names of Banks and Solander necessitates renaming some species and varieties that were described later :—

Ranunculus insulae-Mauritiae, nom. nov. *R. sericeus* Poir. (1810). Non *R. sericeus* Banks & Sol. (1794).

Dianthus Stefanoffi, nom. nov. *. *D. strictus* Sibth. & Smith (1825). Non *D. strictus* Banks & Sol. (1794).

Astragalus Grossheimii, nom. nov. †. *A. cephalotes* Pall. (1800). Non *A. cephalotes* Banks & Sol. (1794).

Helicophyllum intortum (Banks & Sol.) var. **Olivieri** (Schott), nom. nov. *H. Rauwolfii* (Blume) Schott var. *Olivieri* (Schott) Engl. (1879).

RANUNCULUS MILLEFOLIUS Banks & Sol. var. **hierosolymitanus** (Boiss.), nom. nov. *R. hierosolymitanus* Boiss. (1867). *R. myriophyllus* var. *hierosolymitanus* (Boiss.) Post (1883).

DIANTHUS STRICTUS Banks & Sol. var. **gracilior** (Boiss.), nom. nov. *D. multipunctatus* Ser. var. *gracilior* Boiss. (1867). Var. **axilliflorus** (Fenzl), nom. nov. *D. multipunctatus* Ser. var. *axilliflorus* (Fenzl) Boiss. (1867). Var. **subenervis** (Boiss.), nom. nov. *D. multipunctatus* Ser. var. *subenervis* Boiss. (1867). Var. **velutinus** (Boiss.), nom. nov. *D. multipunctatus* Ser. var. *velutina* Boiss. (1849). Var. **micranthus** (Boiss.), nom. nov. *D. multipunctatus* Ser. var. *micrantha* Boiss. (1849).

SILENE TRINERVIS Banks & Sol. var. **Sibthorpiana** (Reichenb.), nom. nov. *S. racemosa* Otth. var. *Sibthorpiana* Boiss. (1867). Var. **glabrescens** (Post), nom. nov. *S. dichotoma* Ehrh. var. *glabrescens* Post (1896). Var. **porphyrostegia** (Bornm.), nom. nov. *S. dichotoma* Ehrh. var. *porphyrostegia* Bornm. (1932).

TRIFOLIUM ARGUTUM Banks & Sol. var. **moriferum** (Boiss.), nom. nov. *T. xerocephalum* Fenzl var. *minus* Boiss. (1872). *T. xerocephalum* Fenzl var. *moriferum* (Boiss.) Dinsm. (1931). Var. **cruentum** (Bornm.), nom. nov. *T. xerocephalum* Fenzl var. *cruentum* Bornm. (1898).

TRIGONELLA UNCINATA Banks & Sol. var. **genuina** (Sir.), nom. nov. *T. monantha* C. A. M. var. *genuina* Sir. (1931). Var.

* Dedicated to the well-known taxonomist and phytogeographer of Bulgaria.

† Dedicated to the best modern specialist of the flora and vegetation of Caucasus.

pinnatifida (Thell.), nom. nov. *T. monantha* C. A. M. var. *pinnatifida* Thell. (1912). Var. **macroglochin** (Sir.), nom. nov. *T. monantha* C. A. M. var. *macroglochin* Sir. (1931).

HYPERICUM PALLENS Banks & Sol. var. **fragile** (Post), nom. nov. *Hypericum cuneatum* Poir. var. *fragile* Post (1896). Var. **pallidum** (Post), nom. nov. *H. cuneatum* Poir. var. *pallidum* Post (1896).

EUPHORBIA PETIOLATA Banks & Sol. var. **microphylla** (Post), nom. nov. *E. lanata* Sieb. var. *microphylla* Post (1891).

CENTAUREA RIGIDA Banks & Sol. var. **major** (Boiss.), nom. nov. *C. myriocephala* Sch. Bip. var. *major* Boiss. (1875).

I must express my best thanks to Mr. J. Ramsbottom, Keeper of the Department of Botany, British Museum, for the facilities I received in studying the plants of Banks and Solander, and to Dr. A. B. Rendle for the readiness to print this article and for some useful suggestions regarding the synonymy of the Banks and Solander plants.

BIBLIOGRAPHICAL NOTES.

CIII. New Names published anonymously by Robert Sweet in 'The News of Literature and Fashion' (1824–26). By H. K. Airy-Shaw, F.L.S.

In Sweet's 'British Flower Garden,' ii. tt. 125, 126 (1825), are to be found references to 'News of Literature and Fashion' as the place of publication of the genus *Whitleya* (Solanaceae), with the species *W. stramonifolia*, and of the hybrid passion-flower *Passiflora Colvillii*. Less explicit references occur in the same author's 'Hortus Britannicus,' under the genus *Polyspora* Theaceae), with the species *P. axillaris*, and under *Hakea Lamberti* Proteaceae). *Whitleya* is the only name from the N. L. F. cited in the 'Index Kewensis,' and that is erroneously attributed to "D. Don, . . . ex Sweet, Brit. Flow. Gard."* It is evident that the N. L. F. itself was not consulted by the compilers. *Hakea Lamberti* is omitted from the 'Index.'

With the object of ascertaining whether these names were validly published in the periodical mentioned, the writer went carefully through the copy preserved in the library of the British Museum (Bloomsbury). From the extracts given below it will be seen that all the names were accompanied by valid diagnoses or descriptions, in every case antedating the currently accepted dates of publication of the names concerned.

* D. Don did not take over the 'British Flower Garden' until 1831: see Loudon, Gard. Mag. xi. 160 (1835).

The descriptions are included in articles under various headings, such as "Botany," "Agriculture," "Gardening," etc. These articles are anonymous throughout, but, from the frequent references which they contain to plants grown in the nurseries of "Mr. Colvill, of Fulham," where Sweet was employed at the time (1819–26), and of "Messrs. Whitley, Brames, and Milne, of Chelsea," with whom Sweet had worked from 1815 to 1819 (see Loud. Gard. Mag. xi. 159; 1835), coupled with the references to the N. L. F. in Sweet's own publications, there can be very little doubt that Sweet was the author.

On p. 205 of vol. ii. no. 42 (issued Sat., 26 March, 1825), under "Horticultural directions for the ensuing week," is an enumeration of the "sorts" of *Camellia* "at present in cultivation in the gardens," with the following final paragraph:—

"The plant that has been described in various publications by the name of Camellia axillaris has now ripened its seeds, and proves not to belong to that genus or even natural order, having a dry capsule with five cells, opening at the point, each of the cells containing several winged seeds; it therefore belongs to the natural order Ternstroemiaceae and the tribe Gordoniae [*sic*]. It differs from the other genera of the tribe in producing several seeds in each cell, and may be named Polyspora axillaris."

This is the first publication of the genus *Polyspora* and of the combination *P. axillaris*. The correct citations are therefore as follows:—

POLYSPORA [Sweet] in News of Lit. & Fashion, ii. 205 (1825), and Hort. Brit. 61 (1826), ed. 2, 73 (1830), ed. 3, 89 (1839); G. Don in Loud. Hort. Brit. 292, 503 (1830), and Gen. Syst. i. 574 (1831); Hook. in Curt. Bot. Mag. lxix. t. 4019 (1843); Airy-Shaw in Kew Bull. 1936, 499, in adnot.

P. AXILLARIS [Sweet], *ll. cc.*; G. Don, *l. c.*; Loud. Gard. Mag. xi. 56 (1835); Hook. *l. c.*; Airy-Shaw, *l. c.*

Camellia axillaris Roxb. ex [Ker], Bot. Reg. t. 349 (1819); Sims, Bot. Mag. t. 2047 (1819).

A further reference to the same periodical occurs in Sweet, Hort. Brit. 349 (1827), where we find the name *Hakea Lamberti* N. L. F. This name, though mentioned by subsequent authors (as an undescribed species), was omitted from the 'Index Kewensis.' The original description in vol. ii. (no. 51), 346, issued Sat., 28 May, 1825, is here reproduced:—

"Description of a very curious new species of *Hakea*, raised at the nursery of Mr. Colvill, from seeds given him by A. B. Lambert, esq., who received them from King George's Sound in New Zealand [*sic!*] and which we name Hakea Lamberti.

"*H. Lamberti*, an upright branching shrub. *Leaves*, rigid, variable: lower one sessile, entire, elliptic, obtuse, with a sharp

mucro, regularly toothed with sharp spinous teeth, glaucous: others pinnatifid, or bipinnatifid, at the base, with entire elliptic points, also toothed with longer sharp teeth : upper ones, petiolate, pinnatifid, or bipinnatifid : segments numerous, flat, linear, terminated by a sharp spine, entire, or rarely toothed ; of a bright green colour."

The following references to this name have been traced :—

HAKEA LAMBERTI [Sweet] in News of Lit. & Fashion, ii. 346 (1825), and Hort. Brit. 349 (1827), ed. 2, 447 (1830) ; G. Don in Loud. Hort. Brit. 40 (1830) ; Steud. Nomencl. ed. 2, i. 719 (1840) ; Meisn. in DC. Prodr. xiv. 419 (1856) ; Benth. Fl. Austr. v. 495 (1870).

In D. Don's edition (ed. 3) of Sweet's 'Hortus Britannicus,' 589 (1839), the species of *Hakea* are arranged in groups. *H. Lamberti* comes under the heading : "§ 1. Leaves all filiform. ** Capsule bicalcarate near the apex." The flowers are said to be white, and the date of introduction is given as 1823. The discrepancy between Sweet's description of the leaves and that given in Don's group character suggests that Don had not seen Sweet's original description, or else that he had some other plant in mind, but the bicalcarate capsule is a character of *Hakea lissocarpha* R. Br. (Prot. Nov. 27 ; 1830) and *H. bipinnatifida* R. Br. (*l. c.* 28), both Western Australian species with variously pinnatifid leaves.

In response to the writer's request, Professor F. T. Brooks was good enough to institute a search in the Lindley Herbarium at Cambridge for any specimen which might throw light on the identity of *H. Lamberti*, but unfortunately without result. It seems probable that this plant must remain a "species obscura."

Two further names, published in this periodical for the first time, remain to be noticed. They formed the subjects of plates in Sweet's 'British Flower Garden' two months after their first appearance, and consequently found their way into current literature. The Latin descriptions (and probably the English, but these have not been checked) were reprinted in the 'British Flower Garden' *verbatim* from the N. L. F. ; only those parts, therefore, which differ are here reproduced :—

Vol. iii. no. 6, 94 (6 Aug. 1825). "Description of a beautiful new hybrid species of passion-flower, now in bloom at Mr. Colvill's nursery."

"*Passiflora Colvillii.*" [Latin and English descriptions follow.]

"There can be no doubt but the present handsome plant will prove as hardy as the common passion-flower (*P. cærulea*), and will, therefore, be a great acquisition to our hardy climbers ; at any rate it will succeed well by being protected with a mat in severe weather, and a little dry litter put about its roots.

The seed from which it was raised was ripened at the nursery of Mr. Colvill, and is the produce of the hardy North American *P. incarnata*, that had been intentionally fertilized by the pollen of *P. cærulea*."

× PASSIFLORA COLVILLII [Sweet] in News of Lit. & Fashion, iii. 94 (1825), Brit. Flow. Gard. ii. t. 126 (1 Oct. 1825), and Hort. Brit. 354 (1827), ed. 2, 217 (1830), ed. 3, 258 (1839).

P. caerulea L. var. *Colvillii* (Sweet) G. Don in Loud. Hort. Brit. 270 (1830), and Gen. Syst. iii. 53 (1834).

Vol. iii. no. 7, 108 (13 Aug. 1825). "Description of a curious new genus of plants, belonging to the natural order SOLANEAE, which has flowered and ripened its seeds at the nursery of Messrs. Whitley, Brames, and Milne, at Fulham, and which we propose to name WHITLEYA."

[Latin and English descriptions follow.]

"The plant which forms this very distinct genus is a native of Nepaul, and was raised from seed in 1802, at Messrs. Whitley and Co.'s nursery. In character it approaches the nearest to the *Anisodus* of Link, in Professor Sprengel's 'Systema Vegetabilium,' vol. i. p. 512, which is also a native of Nepaul."

WHITLEYA [Sweet] in News of Lit. & Fashion, iii. 108 (13 Aug. 1825), Brit. Flow. Gard. ii. t. 125 (1 Oct. 1825), and Hort. Brit. 298 (1827) ; Dumort. Anal. Fam. Pl. 24 (1829).

Anisodus Link & Otto, sec. G. Don, Gen. Syst. iv. 457 (1837).

Scopolia Sect. *Anisodus* Dunal in DC. Prodr. xiii. 555 (1852).

W. STRAMONIFOLIA [Sweet], *ll. cc.*

Physalis stramonifolia Wall. in Roxb. Fl. Ind. ed. Carey & Wall. ii. 242 (1824).

Scopolia anomala (Link & Otto), comb. nov.

Nicandra anomala Link & Otto, Ic. Pl. Sel. 77, t. 35 (1823) ; cf. Flora, ix. 2, 495 (1826).

Anisodus luridus Link & Otto, *l. c.*, *nom. provis.* ; Spreng. Syst. i. 699 (1825) ; Sweet, Hort. Brit. ed. 2, 383 (1830), ed. 3, 503 (1839).

A. stramonifolius G. Don in Loud. Hort. Brit. 61 (1830).

Scopolia lurida Dunal, *l. c.*

NOTES ON *RUBI*.

BY WILLIAM WATSON.

(Continued from p. 863.)

XIV. *RUBUS CAMBRENSIS*, SP. NOV.

IN the 'Manual of British Botany,' ed. 5 (1862), 102, Babington published the description of a new bramble, *Rubus macrophyllus* Wh. e. *glabratus*, of which he stated later, in 'British Rubi' (1869), 154, that he had derived almost all his knowledge from a series of specimens sent to him by H. C. Watson. According

to the specimen in Hb. Babington, Watson found the bramble in 1854 in Woodstock Lane, Long Ditton, Surrey. The specimen is *R. corylifolius* Sm. var. *conjungens* Bab., and this bramble is still abundant in Woodstock Lane. Babington's description seems to have been written mainly from Watson's specimens, but in his herbarium there are two other specimens named *glabratus* gathered by Babington himself at Turk Mountain, Killarney, 6 September, 1843, and at Llanberis, 6 September, 1848, respectively, and therefore antedating first publication of his description. Both of these are *R. silvaticus* Wh. They have the sepals appendiculate, and have evidently furnished that character in the description of *glabratus*. The description of *R. macrophyllus* Wh. var. *glabratus* Bab. is thus founded on two different systematic groups.

In ' British Rubi,' 158, Babington claims a specimen collected by Warren at Knutsford, Cheshire, as *R. macrophyllus* var. *glabratus*. This is in Hb. Babington, and is *R. Lindebergii* P. J. Muell. Being collected in 1865, after first publication of *glabratus*, it cannot have influenced the description. The same, however, cannot be absolutely affirmed of another specimen quoted by Babington, which was collected by Leighton in Almond Park, near Shrewsbury, in 1836, and determined by Lindley as *R. vulgaris*. This is not either *conjungens* or *silvaticus*—it may be *Lindebergii*—and there is no recognizable correspondence between it and the description of *glabratus*.

Rogers applied the name *glabratus* Bab. to a bramble which is found mainly in Wales and the Welsh border and a few other western and Scottish counties, first in Journ. Bot. 1894, 43, as *R. macrophyllus* W. & N. e. *R. glabratus* Bab., and then in the ' Handbook,' 31, as *R. nemoralis* P. J. Muell. var. *glabratus* Bab., at the same time rejecting the Surrey record, and with it the correct interpretation of the name. This mainly Welsh bramble has stem-prickles slender and narrow-based, and leaflets finely denticulate-serrate, pubescent not pilose beneath, and therein does not answer to Babington's description. It is not a variety of *R. nemoralis* P. J. Muell., which was a single bush found by Mueller in Alsace and now extirpated. It should stand as an independent species.

Rubus cambrensis, sp. nov. (Series *Silvatici*). *R. glabratus* W. Wats. c. descr. in Rep. B. E. C. 1929, 169 ; non *R. glabratus* H. B. K. (1823).

Lectotypes, no. 34, 'Set of British Rubi,' in Hb. Kew., being two specimens collected by A. Ley and E. F. Linton on a heath near Athelstane's Wood, Herefordshire, and by A. Ley and W. M. Rogers in Huntsham Wood, Ross, Herefordshire, respectively. It is cultivated in the north Rubetum at Kew Gardens, ref. no. 496 : 95.

XV. *Rubus Silurum*, sp. nov.

Ley's bramble, also subordinated to *R. nemoralis* P. J. Muell., by Ley and by Rogers, is a species distinct from *R. nemoralis* and also from *R. cambrensis*. Ley's name can be retained, with specific rank, as follows :—

Rubus Silurum (A. Ley), sp. nov. (Series *Silvatici*). *Rubus nemoralis* P. J. Muell. var. *Silurum* A. Ley c. descr. in Journ. Bot. 1894, 142, and Rogers, ' Handbook of British Rubi ' (1900), 31. Lectotype, no. 109, Set of British Rubi in Hb. South London Bot. Institute, collected by A. Ley in hill pastures near Eardisley, Herefordshire, 11th August, 1896.

XVI. *Rubus vectensis*, nom. nov.

In Hb. Brit. Linn. there is a specimen of a bramble labelled *Rubus corymbosus* gathered on August 16, 1844, near Apse Farm, Isle of Wight, and another (also named *R. corymbosus* on a label of Salter's) collected by Borrer on August 29, 1844 (locality not stated). In Hb. Borrer there is a further specimen collected at Apse Heath in August 1844, and named *R. corymbosus*. No *Rubus corymbosus* had been described by 1844, and the name seems to have been applied provisionally by Salter. All three specimens are *R. Sprengelii* Wh.

In May of the following year Salter described in the 'Annals and Magazine of Natural History,' ser. 1, vol. xv. 306 (1845), a bramble which he said inhabited the Isle of Wight and had a *corymbose* panicle, and claimed it as a new species, *Rubus Borreri*. As the description may not be readily available the following extracts are transcribed to show that it was *R. Sprengelii* : " Stem . . . round ; prickles . . hooked ; leaflets . . . with concolorous hairs beneath ; panicle corymbose, lower branches long, . . . upper branches shorter, terminal flower somewhat sessile ; prickles of the panicles few . . . ; calyx ovate-lanceolate, much acuminate . . . loosely embracing the fruit; fruit . . . hemispherical, composed of small . . . drupes." This description fits the three specimens labelled *Rubus corymbosus*.

A fourth specimen of the same bramble, viz. *R. Sprengelii*, in Hb. Brit. Linn. is labelled *R. Borreri* on a label of Salter's. It was gathered at Ninham Farm, near Shanklin, Isle of Wight, September 20, 1845, and it serves to confirm by its agreement with the published description of *R. Borreri* that the bramble intended by Salter's description was *R. Sprengelii*.

It will be observed that all four of the above specimens were collected late in the season, and that the description describes the fruit but not the flowers. It was perhaps for this reason that Salter failed to realize that he was dealing with the same bramble when he subsequently described two Cheshire specimens of *R. Sprengelii* for Babington in 1846, giving details of the

flowers, but saying nothing of the fruit: see no. 14, Babington's Synop. Br. Rubi, 17 (1846). The following extracts from this description may be compared with the above description of *R. Borreri*: "Caule . . . tereti, aculeis uncinatis, . . . foliolis concoloribus . . . , paniculæ . . . ramis divaricatis . . . , sepalis ovatis acuminatis . . . patentibus.

Babington soon noticed the error: in Bot. Gazette, 1848, 120, he wrote: "*Rubus Borreri* is undoubtedly the larger and stronger form of *Rubus Sprengelii*, and would never have been separated from it had the figure of the species ('Rubi Germanici,' t. 10) been more characteristic of its usual state. An authentic specimen from Dr. Weihe (Reichenbach Fl. exsicc. 784) of *Rubus Sprengelii* is our *Borreri*." Babington was certainly right: beyond any possible doubt *Rubus Borreri* Salt. is only *Rubus Sprengelii* Wh. Salter himself recognized that this was so (see Fl. Vect. 155).

In Hb. Borrer there is a specimen named *R. Borreri*, collected by Salter in the Isle of Wight in July 1845—that is, after his description of *R. Borreri* had been published, and therefore not by any possibility underlying the description. The specimen is not *R. Sprengelii*, and does not agree with Salter's description of *R. Borreri*. Rogers saw this specimen and was so far misled by it that with Babington's encouragement he published a description of it (Journ. Bot. 1892, 270) as the authentic *R. Borreri*. It is right to add that in Hb. Borrer there is another specimen of this same bramble, gathered by Salter in August 1844 near Ninham Farm, Isle of Wight. It is labelled by Salter, "This is probably *R. radula* W. & N."; and he cannot therefore have had it in view in drawing up his description of *R. Borreri*.

A new name is now required for the *false* "*Borreri*."

Rubus vectensis, nom. nov. (Series *Apiculati*). Synonyms: *Rubus Borreri* Rogers in Journ. Bot. 1892, 270, c. descr.; *Rubus Borreri* Focke, Rubi Europæi, 232; *Rubus Borreri* Sudre, Rubi Europæ, 120; non *Rubus Borreri* Bell Salter, Ann. Nat. Hist. xv. 34, nec W. Watson, 'London Naturalist' for 1930, 72.

Lectotypes: two specimens in Hb. Borrer (Kew), labelled *Rubus Borreri* and collected by Salter in the Isle of Wight, July 1845.

I have seen *R. vectensis* in v.c. 9 (Dorset), 14 (E. Sussex), 16 (W. Kent), 34 (W. Gloster), and in South Kerry, Ireland; and I have seen dried specimens from v.c. 10 (I. of Wight), 13 (W. Sussex), 35 (Monmouth), and 36 (Hereford), and from Guernsey. It comes true from seed.

XVII. *Rubus leucostachys* Smith.

Since Babington and Bloxam, all authors in this country and on the Continent have taken it for granted that *Rubus*

leucostachys Sm. (Engl. Fl. ii. 403, 1824) and *R. vestitus* Wh. (in Bluff & Fingerhut, Comp. Fl. Germ. i. 684, 1825) are one and the same bramble, and the only dispute has been as to which name should be used. E. F. Linton and Rogers, combating Focke's statement that *R. leucostachys* Sm. had been an aggregate conception and had not been applied to a definitely circumscribed species, asserted (Journ. Bot. 1905, 202) that if there had been one bramble more than another that had always been clearly recognized by British botanists, it was *R. leucostachys*. Both parties were under an entire misapprehension.

The original specimens collected by Borrer near Henfield, sent to Smith on December 8, 1823, and by him used for his description, are still in Hb. Smith. One of them bears Smith's reference to the description in Engl. Flora, and corresponding to this in Smith's description both Borrer's specimens and Borrer's manuscript description are quoted and referred to as to a standard of comparison: they are evidently Smith's type-specimens.

Other specimens labelled *Rubus leucostachys* by Smith in Hb. Mus. Brit.; Borrer's plate in Engl. Bot. Suppl. 2631, and the accompanying description down to the point where he goes on to refer to a second bramble; Sowerby's specimens in Hb. Mus. Brit.; the specimen from Borrer in Hb. Lindley: all relate, unquestionably, to the same bramble as that represented in Hb. Smith, and all fit Smith's description. It is not *Rubus vestitus* Wh., but is a bramble which I have found to be frequent or locally common in West and East Sussex, Surrey, West Kent, Berks, Bucks, Middlesex, and South Essex. It was fully described by me as a species distinct from *R. vestitus*, under the later synonym *Rubus leucotrichus* Sud. in Rep. B. E. C. 1927, 503.

Smith's reference in his description to Borrer having sometimes found a form of *R. leucostachys* with heart-shaped leaflets may possibly be thought to point to a confusion with another bramble. The specimen giving rise to the observation, however, is in Hb. Smith and is without doubt *Rubus leucostachys*.

Rubus vestitus Wh. was, moreover, known to Smith and was distinguished by him in Engl. Flora as *Rubus rhamnifolius* W. & N. b. *cordifolius* W. & N. on specimens sent by E. Forster which are still in Hb. Smith.

Smith's species is therefore perfectly circumscribed and typified, and by the rules it is incumbent on botanists to use the name *Rubus vestitus* for the bramble described by Weihe, and *Rubus leucostachys* for Smith's bramble.

This point having been made clear, it may now be well to give a few instances of the confusion which Focke, Boulay, and Sudre pointed out existed among British botanists regarding *Rubus leucostachys*, but which Rogers and E. F. Linton repudiated.

Rubus leucostachys of Lindley, according to the example obtained by Borrer in 1829 from the alleged authentic bush in

the Horticultural Society's garden, is a gross example of *R. vestitus* Wh., and not of *R. leucostachys* Sm. as supposed by Borrer: but *R. leucostachys* Lindley, ed. 1, 93, by the description is *R. leucostachys* Sm., as Borrer rightly determines in E. B. Suppl. 2631, being doubtless based on the specimen in Hb. Lindley sent by Borrer from Henfield.

Edwin Lees was simply mistaken when he said, in Phyt. iii. 358, that the specimens of *R. leucostachys* Sm. in Hb. Smith, and also the plate E. B. Suppl. 2631, were *R. vestitus* Wh.; and he again completely missed the truth by depending on specimens of *R. Lindleianus* named *R. leucostachys* Sm. by Lindley for Leighton in 1836, and on Lindley's description of *R. leucostachys* in ed. 2, which it is true is *R. Lindleianus*.

Borrer, in the remarks he added to his main description of plate 2631 of E. B. Suppl., was wrong in referring to *R. leucostachys* the *second* bramble of Sussex forests and Epping Forest—which is *R. vestitus*,—right in referring it to *R. diversifolius* Lindl., wrong again in taking it to be different from Nees's authenticated specimen of *R. vestitus* sent to Lindley and now in Hb. Borrer.

It must be owned that British botanists have never understood *Rubus leucostachys* Sm.

XVIII. *Rubus diversifolius* Lindley.

Rubus diversifolius Lindl. in Synop. Brit. Fl. ed. 1 (1829), 93, has for very many years been taken to be a highly glandular and prickly bramble of the group *Corylifolii*. This interpretation of the name is erroneous. Lindley's description comes under the heading of "Stem with neither bloom nor glands." The distinctive characters are as follows: "Leaves orbicular, acute, equally serrated. Panicle with roundish leaves at the base."

The Corylifolian bramble generally identified as *R. diversifolius* Lindl. has conspicuously stalked glands on the stem, the terminal leaflets elliptical or obovate and long-pointed, both on the stem and on the flowering branch. It differs therefore from Lindley's description. The specimen labelled *Rubus diversifolius* in Lindley's herbarium has the roundish acute leaflets of Lindley's description and is *R. vestitus* Wh.

When Lindley's 'Flora' was published, Borrer called at the Horticultural Society's garden and took a specimen from the bush labelled *R. diversifolius*. The specimen is in Hb. Borrer: it agrees with Lindley's description of *R. diversifolius* and is *R. vestitus* Wh.

Lindley states at the end of the description of *R. diversifolius* that he suspects that it is *R. cordifolius* of the English Flora. This suggestion is right; both are *R. vestitus* Wh.

It is perfectly plain that by *Rubus diversifolius*, ed. 1, Lindley meant *R. vestitus* Wh. in Bluff and Fingerhut's Comp. Fl. Germ. i. p. 684 (1825). Such was Babington's opinion also (Br. Rubi, 117). Lindley's name must therefore be dropped as merely a later synonym of *R. vestitus* Wh., and for the Corylifolian bramble for which it has been generally employed we must use the next oldest name, *Rubus myriacanthus*, which Focke published in Abh. Naturw. Ver. Bremen, 1871, p. 467, in place of *R. diversifolius* as employed by Babington and Warren.

XIX. *Rubus thyrsiflorus* Weihe.

One of the most frequent brambles in the woods of Buckinghamshire is *Rubus thyrsiflorus* Wh. It is not admitted as a British species in the 'London Catalogue' or in Rogers's 'Handbook,' but is nevertheless described in the latter under the mistaken name of *R. hirtus* W. & K. subsp. *flaccidifolius* (P. J. Muell.), from specimens so named by Focke for E. F. Linton collected at Woburn Sands, Beds and Bucks. Other specimens collected by Linton at the same time and place were determined by Rogers as *R. uncinatus* P. J. Muell., but they are certainly *R. thyrsiflorus* also.

Besides seeing *Rubus thyrsiflorus* Wh. in countless stations in Bucks, I have met with it on Crowell Hill, Oxon, on Putney Heath and Wimbledon Common, Surrey, in Middlesex, and at Warwick Park, Tunbridge Wells, West Kent.

Babington wrongly gave the name *R. thyrsiflorus* to the bramble called "*R. velatus* Lefv." in the 'Handbook' and to some other British brambles. Old records or determinations of *R. thyrsiflorus* in Great Britain are accordingly not to be relied upon.

The following description of *R. thyrsiflorus*, based on many years' study of the plant in the field and under cultivation, may enable others to find it:—

Stem procumbent, obtuse-angled, hairy and *furnished with* scattered *short stalked glands*, many short *acicles and pricklets*, *some glandtipped*. *Prickles* many, weak, *short* declining from a moderately broad base, subequal and confined to the angles, *discrete from the smaller arms*. *Leaves somewhat crowded*, yellowish-green, 3.4.5-nate pedate, *petiole short, flat or convex* above, *armed with* weak, *nearly straight prickles*. *Leaflets imbricate*, broad, *acute* or shortly acuminate, becoming plicate and rugose in the open, subglabrous above, green and hairy on the veins beneath, unequally somewhat doubly and sometimes rather coarsely serrate. *Terminal leaflet* roundish ovate-cordate to broadly elliptical or slightly obovate entire. *Lower panicles leafy* to the apex, pyramidal with long half-erect deeply divided axillary and leafy branches: *upper panicles* short equal few-flowered, nearly naked, often nodding. Terminal leaflets acute and broad, much as on the stem, terminal leaflet base entire. *Rachis flexuous*, copiously shortly hairy, prickles short, acicular, declining, stalked glands mostly short and with the acicles

equalling, only a few exceeding, the hair. *Calyx-segments* large long-pointed, densely hairy and felted, greyish-green with a narrow white border, glandular and aciculate at the base, patent for a time after flowering. *Petals narrow*-elliptical, attenuate into a rather long claw, *usually glabrous, white* or pinkish. *Stamens* erect *about as long as the styles. Anthers and styles greenish. Young carpels* densely hairy.

The more distinctive characters are the short and weak straight prickles, the short petioles and petiolules, causing the leaflets to be imbricate, the short-pointed leaflets, the leaves becoming large in the shade, those in the panicle then overlying the rachis. Panicle flexuous when weak, the lowest branch often continuing the direction of the flowering branch, so that the panicle is nodding; lower panicles often furnished with linear-lanceolate leaves to the apex, or in any case with long bracts, as long as the branch they subtend. These simple upper leaves are eglandular above, but bear a few stalked glands on or near the basal margins. Petals very fugacious.

R. thyrsiflorus shows a preference for moist level and low situations in woods, and it is only in such places that the large broad cordate leaflets are formed. It comes true from seed.

NEW ASIATIC SCITAMINEAE.

By H. N. Ridley, C.M.G., F.R.S.

Burbidgea stenantha, sp. nov. (Zingiberaceae). A *B. schizocheila* Wright cui affinis caulibus elatioribus foliis majoribus petalis anguste lanceolatis, superno latiore apiculato acuto, differt.

Herba gracilis 41 cm. alta, caule basi incrassato. *Folia* lanceolata longe caudato-acuminata, cauda 2 cm. longa, basi angustata, 20 cm. longa 3 cm. lata, petiolis 5 mm.–1 cm. longis, ligula oblonga obtusa 1 cm. longa. *Racemus* terminalis densus multiflorus. *Calyx* tubulosus ruber, 1 cm. longus, lobis 3 brevibus ovatis acutis. *Corolla*, tubo gracili 2·5 cm. longo, lobis 2 linearibus cuspidatis pallide flavis, supremo latiore oblongo pallide flavo, cuspide rubro, 1–5 cm. longis. *Labellum* anthera adnatum pallide flavum lanceolato-lineare, apice bifido pubescente 5 mm. longo. *Stamen* longius, connectivo prolongato oblongo-lineari apice denticulato; antheræ loculis brevibus linearibus pubescentibus. *Stylus* gracilis ad basin pubescens; stigma obovatum. *Staminodia* 2 lineari-oblonga. *Ovarium* 1–5 mm. longum cylindricum hirtum. *Capsula* cylindrica 3·1 cm. longa, pubescens, longitudinaliter dehiscens in uno latere. *Semina* 3 mm. longa, 1 mm. crassa, cylindrica, arillo tenui laciniato.

Hab. Borneo: Sarawak (*Hewitt*), cult. in Hort. Bot. Singapore; Kuching (*Haviland* 3123). Orange-red. Gunong Tenpok; Upper Baram, 3000–4000 feet alt. (*Moulton* 6699 (type), 6700, 6171, 6751).

This species is very distinct in the very narrow petals and lip and numerous flowers, as also in the light yellow colouring. The flowers, however, become red in withering. In Journ. Roy. As. Soc. Str. Br. liii. 175 (1909), I described the fruit of this species from plants cultivated in Singapore under the name of *B. schizocheila* Wright.

Burbidgea pubescens, sp. nov. A *B. pauciflora* Valeton cui affinis foliis lanceolatis subtus pubescentibus, caulibus floribusque pubescentibus, petalis angustis lanceolatis, connectivo staminis acuminato, haud dentato, differt.

Herba pedalis. *Folia* herbacea lanceolata cuspidato-acuminata, cuspide longo, basi angustata, subtus minute puberula, 30 cm. longa 7·7 cm. lata, nervis 5–6 paribus ascendentibus, petiolis 5 cm. longis, vagina 18 cm. longa multinervia puberula, ligula pubescente oblonga-obtusa 1 cm. longa. *Racemus* 11 cm. longus pubescens. *Flores* dissiti ad 14, pedicellis 4–5 mm. longis pubescentibus. *Calyx* tubulosus velutino-pubescens 3 cm. longus, lobis brevissimis. *Corolla*, tubo gracili puberulo 3 cm. longo, lobis angustis lineari-lanceolatis acuminatis 1·1 cm. longis, dorsis pubescentibus. *Labellum* ad stamen appressum 7 mm. longum, oblongo-lineare, dorso puberulo, bifidum, lobis brevibus oblongis albo-ciliatis. *Anthera* subæquilonga, connectivo producto longo lineari acuminato integro.

Borneo: Mt. Kinabulu ad Kiau, Nov. 1915 (*Mrs. Clemens* 9039).

This has the habit of *B. pauciflora* Valeton, Ic. Bogor. iii. pl. 203, which was collected by Nieuwenhuis at some unrecorded locality in Borneo, and cultivated at Buitenzorg, but the flowers are very narrow, resembling those of *B. stenantha* Ridl. The foliage of *B. pauciflora* Val. is also very narrow. But it specially differs from all in its pubescence, the other species being quite glabrous.

Five species of the genus are now known, all Bornean, but there is an undescribed plant from Tonkin (*Petelot* 3106) in Herb. Kew. which appears to belong to this genus, though not well enough preserved for description.

Guillainia vittata, sp. nov. *Alpinia vittata* Hort., *A. Sanderae* Hort. (Zingiberaceae).

Species a *G. Reckingeri* Gagnepain cui affinis caulibus et inflorescentia brevioribus, corollæ lobis oblongis, foliis, rachide et bracteis glabris, connectivo integro.

Herba caulibus pluribus cæspitosis, basi dilatatis, 24 cm. longis. *Folia* lanceolata acuminata herbacea viridia fasciis longitudinalibus albis ornata, 18 cm. longa 5 cm. lata, vaginis 5–7 cm. longis, ligula oblonga apice rotundata 5 mm. longa. *Capitulum* sessile

terminale nutans densum 2–4 cm. longum. *Bracteæ* magnæ oblongo-ovatæ, apice rotundatæ sub-retusæ, albæ 3 cm. longæ; *bracteolæ* minores pedunculis appressis roseæ 1 cm. longæ; bracteæ florales ovatæ lanceolatæ roseæ 2 cm. longæ. *Flores* bini, pedunculo viridi 1 cm. longo, pedicello æquilongo. *Calyx* tubulosa, dentibus 3 ovatis mucronatis subæqualibus, 2·5 cm. longa, rosea. *Corolla*, tubo gracili 2 cm. longo, lobis ovato-oblongis obtusis recurvis albis 1·5 cm. longis. *Labellum* anguste lanceolatum cymbiforme integrum album 1·5 cm. longum. *Anthera* oblonga, apice retuso vel connectivo producto brevi integro. *Stylus* brevior gracilis, stigmate infundibuliformi facie stigmatica inferiore. *Stylodia* ad basin styli, connata in tubo brevi crasso 6-dentato. *Ovarium* 5 mm. longum.

Hab. New Ireland (*Micholitz*).

Alpinia vittata of gardens was introduced by Micholitz to cultivation in 1877, and was said to be a native of New Ireland. Its bright green leaves with broad splashes of white made it attractive and it is still found in cultivation as a pot-plant. The species though frequently flowering has never been described nor referred to its correct genus, *Guillainia*, a genus of which there are several species occurring in the Polynesian islands to New Guinea. It is most nearly allied to *G. Rechingeri* Gagnepain, a native of Bougainville Islands, but is altogether a much smaller plant with a much smaller cluster of flowers, of which there are two to each of the large white bracts. The connective of the anther when present is quite entire, not toothed as in *G. Rechingeri* Gagnep., and the cylindric circle of stylodes is quite different in shape. The plant is altogether glabrous.

Stachyphrynium borneense Ridl., sp. nov. (Marantaceae). Species a *S. sumatrano* (Miq.) Schum. cui affinis foliis subtus glabris vaginis et bracteis minute cancellatis hirtis, *calycis* lobis lanceolato-triangularibus acutis, differt.

Herba caulibus pluribus congestis basi incrassatis elatis, vaginis minute cancellatis hirtis. *Folia* petiolis gracilibus 30–60 cm. longis, genu 7 mm. longo, lamina herbacea oblonga glabra longe cuspidato-acuminata 15–20 cm. longa, 5 cm. lata, nervis transversis copiosissimis, costa superne depressa subtus elevata. *Spica* 2 cm. longa, pedunculo in vaginis celato 10–11 cm. longo, gracili. *Bracteæ* lanceolatæ acuminatæ, infima 2·5 cm. longa, minute cancellatæ et hirtæ, virides. *Sepala* 3 æqualia lanceolata acuta. *Corolla* alba, tubo superne dilatato 1·4 cm. longo, lobis oblongis rotundatis 3 mm. longis. *Cucullus* oblongus, apice rotundato, dente longiusculo erecto. *Labellum* ellipticum obtusum integrum.

Hab. Borneo: Sarawak, base of Mount Matang, 1903 (*Ridley* 11,796, type) and 1915, sine no.; S. Borneo, Banjermasin (*Motley* 852), common, flowers white.

This is certainly very closely allied to *S. sumatranum* (Miq.), of which, however, I have only seen very incomplete specimens and a quite insufficient description. This species, however, appears to have a long rhizome with distant leaf-tufts, while in *borneense* the plant makes a densely cæspitose mass. The bracts in the latter species are hairy, especially at the tip, and like the leaf-sheaths minutely cancellate. The calyx-lobes are described in *S. sumatranum* as ovate, while they are acute and lanceolate-triangular in *S. borneense*.

OBITUARY.

William Hales, A.L.S.

(1874–1937).

Many London botanists heard with regret of the death of William Hales, who, as Curator of the Chelsea Physick Garden for thirty-eight years, had rendered useful service to London teaching Botany. The old Physick Garden took on a new lease of usefulness when it passed in 1899 from the possession of the Apothecaries Company to the City Parochial Foundation and became available for the use of the London Schools of Botany. The Trustees were fortunate in securing the services of William Hales, who, after preliminary training and some years' service at the Edgbaston Gardens, entered Kew as a student gardener in 1894. During his period of training Hales had, by attending evening classes, gained a knowledge of the principles as well as the practice of gardening, and throughout his long service at Chelsea showed a keen interest in the education of gardeners. He served on the committee which drew up the scheme for the Royal Horticultural Society's National Diploma of Horticulture, for which, in 1918, be became an examiner. He also served as External Examiner in the Practice of Horticulture for the B.Sc. examination in Horticulture at the Universities of London and Reading, and had for many years been a member of the Board of Examiners at the Royal Horticultural Society.

An insight into tropical vegetation was afforded when the Trustees of the Garden in 1926 sent him on a four months' tour to Ceylon, Java, and Malaya.

The Society recognized his services to Horticulture by the award of their Veitch Memorial Medal in 1930, the Associateship of Honour in Horticulture in 1932, and the award of the Victoria Medal of Honour in 1935. In 1912 he was elected to the Associateship of the Linnean Society.

Hales was born at Milverton, Warwickshire, in 1874, where he started his gardening career at the age of 12. His death came suddenly at his home in the Chelsea Garden, after a period

of ill-health, on May 11. His friends will cherish the memory of a kindly unassuming helpful friend and colleague.

An appreciation of his work, with a portrait, appeared in the 'Gardener's Chronicle,' 1935 (pt. 1, p. 20).—A. B. RENDLE.

SOUTH-WESTERN NATURALISTS' UNION.

ANNUAL CONFERENCE.

THE Fifteenth Annual Conference of the South-Western Naturalists' Union was held at Taunton Castle, Somerset, May 14–17, by kind permission of the Somerset Archæological and Natural History Society.

The visiting members and delegates were welcomed on the Friday evening in the Great Hall (scene of the famous "Bloody Assize") by Mr. H. St. George Gray, the hon. secretary and treasurer of the Taunton Field Club, and by representatives of the Somerset Archæological and Natural History Society.

Mr. Gray in his opening remarks wished the Union a continued success; he then spoke briefly on the history of the Castle, and told members how it had eventually become the home of the Natural History Society. Dr. W. Watson then welcomed the visiting members on behalf of the Society's botanical section, and explained briefly some of the local flora which was likely to be discovered on the excursions to be made during the week-end.

At the council meeting on the following morning the officers of the Union were re-elected as follows:—President, F. R. Rowley, F.R.M.S.; Hon. Treasurer, Dr. Stanley Smith, M.A.; Hon. Secretary, Michael Blackmore. New societies who had affiliated themselves to the Union were: Cornwall Bird-Watching and Preservation Society and Torquay Natural History Society (Ornithological Section). The Secretary reported that the membership of the Union now stood roughly at 2396, comprising fifteen affiliated societies. An improved financial position was reported by Dr. Smith the Treasurer, who said that the balance had increased from £17 15*s.* 9½*d.* to £18 7*s.* 10*d.*, and the Union was in a better position than for several years past.

The President, F. R. Rowley, F.R.M.S., late Curator of the Exeter Museum, in his address on "Modern Museums and their Aims," dealt with the American Museum of Natural History as an example of an up-to-date collection of specimens, in which the taxidermist's art had reached a very high state of perfection; and by means of lantern-slides he described the highly skilled work necessary for the preparation of museum specimens. The children's museum at Brooklyn, America, was described at some length, and the President mentioned many facts which illustrated how much work was being done for the youth of America in order that they might appreciate the natural sciences. As a contrast to the American Museums, he mentioned the

Open-air Museum in Stockholm, the embodiment of an idea which had met with much opposition, but which fully justified its establishment.

Fine weather favoured the Whit Sunday excursion to Dunkery, Exmoor. A herd of twenty wild red deer were observed on the skyline near Dunkery Beacon, and the swift-flying Emperor Moth was seen is some abundance. Dr. Watson described the main types of local flora on the moor. Dr. Stanley Smith also gave a short lecture on the geology.—M. BLACKMORE.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

FORTY-SECOND ANNUAL CONGRESS.

THE forty-second Annual Congress of the Union was held at Hastings, June 8–12, under the presidency of Professor F. E. Weiss, F.R.S., at the invitation of the Corporation, the Hastings Natural History Society, the Hastings and St. Leonard's Museum Association, and the Bexhill Museum Association. The members were welcomed on the first evening in the Hall of the White Rock Pavilion by the Right Worshipful the Major and Mr. Anthony Belt, F.L.S., President of the Hastings Natural History Society, and the new President was introduced by the retiring President, Prof. G. D. Hale Carpenter, Hope Professor of Zoology, Oxford University. The President's address, entitled "Competition and Co-operation in Nature," was a clear and interesting exposition of examples of the association in nature between plants and animals or between different groups of plants, illustrated by a series of lantern-slides. The examples included the association between *Hydra* and a green Alga, between Alga and Fungus in the Lichen, instances of myrmecology where ants are provided with a home as in the species of the Bull-thorn Acacia, and instances of competition between plants for air and light in grassland and as exemplified by arrangement of roots or bulbs at different soil-levels.

In the Botanical Section the Hon. Secretary, Mr. F. O. Whitaker, gave a report of the work since the last meeting, and the Chairman, Dr. A. B. Rendle, referred to the completion of the 'Flora of Sussex,' which, initiated on the occasion of his Presidency of the Union at the Hastings Meeting in 1927, had been fathered by the Section and compiled by Lt.-Col. A. H. Wolley-Dod, who gave a general account of the 'Flora' (see p. 210).

Dr. T. A. Sprague, F.L.S., of the Royal Botanic Gardens, Kew, was elected President for the next meeting.

The President, Dr. R. W. Butcher, B.Sc., F.L.S., gave his address on "Our Changing Flora."

Dr. Butcher showed how the British flora was constantly changing, due, first, to a gradual change in physical factors such

as soil and climate, secondly to biological factors such as plant competition, grazing animals, and disease, thirdly to the appearance of new varieties and hybrids, and fourthly to the activities of man. It was man who produced the most rapid and most marked changes.

South Haven Peninsula, Dorset, the Breck District, and the English Lakes were taken as examples of physical factors changing the flora. At the first-mentioned place a line of sand-hills had, since 1700, enclosed and entirely cut off from the sea a small bay. This is now a fresh-water lake known as Littlesea, and all the plants growing there must have developed within 250 years. In the Breck District the leaching of chalk from the upper layers is accompanied by the disappearance of certain rare plants. In the English Lakes the vegetation is changing as the lakes become more and more silted.

Similarly, drainage of the soil and the lowering of the water-table has brought about the extinction of certain rare plants, especially in the Fens.

Plant-competition also is bringing about changes—for example, the robust germanic plants are getting the better of many of the rare alpine plants on Ben Lawers.

Sheep, horses, and rabbits live on herbage, and, when in large numbers, they prevent many plants from flowering and seeding, and perhaps exterminate certain species. In some places where rare plants grow an animal-proof fence around a small area is badly needed. Disease also may reduce the abundance of certain forms of a plant, as in the case of *Zostera marina*.

Man causes the greatest and most rapid changes. He has drained the land, exterminated bog plants, and brought the the weeds of arable land ; he spreads seeds and plants far beyond their natural range and has imported a large number of plants from the New World. These are now a conspicuous element of our flora. The present distribution of these " aliens " shows that their abundance is determined primarily by soil-conditions and climate, and only very little by the efficiency of seed-dispersal or the place and circumstances of their introduction. Man has made roads and roadsides, canals, railways, and scrap-heaps, all of which have their characteristic species. Recently, widening and alteration of the roads has led to the extermination of many plants, and the cutting of the roadsides tends to make the less resistant plants rare and green grass dominant, with the result that the beauty of the roadsides is taken away.

There are also changes going on in plants themselves. Varieties small and great have been described, though we do not know how and when they have arisen and whether they are constant or whether they will return to the typical state.

Though hybrids sometimes arise, very few of the so-called hybrid plants have had their origin proved beyond doubt.

Spartina Townsendii is an example of a plant which is the result of hybridization between a native and an American plant. This has spread rapidly along the south coast, though its parents are very rare.

An afternoon excursion was made along the shore from Cooden Beach to Norman's Bay under the guidance of Miss W. Walsh, The Sea-Kale, *Crambe maritima*, on the shingle in profusion in full flower was a fine sight. In addition to the usual non-shore species the use of chalk in building the railway embankment had introduced a number of calciphilous plants. After a tea and reception by the Local Council in the fine De La Warr Pavilion at Bexhill, the members were received at the small but well-arranged local Museum by the Curator, Mr. H. J. Sargent. Mr. Sargent also conducted an excursion to the dunes at Camber Sands bounding the wide-spreading flats between the cliffs of Winchelsea and the sea. An interesting recent introduction of the Sea-Kale was noted ; seeds, evidently left by a high tide, had produced regular lines of young plants.

A public evening lantern lecture on " The Cinque Ports," by Mr. J. E. Ray, F.R.Hist.S., attracted a large and appreciative audience.

By invitation of the Mayor, Alderman Arthur Blackman, J.P., the members visited the Durbar Hall and Congress Museum. The Durbar Hall, a beautiful structure of Indian work presented by the late Earl Brassey, contains an excellent series of exhibits of native dress, culture, etc., from different parts of the world collected by Lady Brassey in her memorable voyages in ' The Sunbeam.'

The Assembly of Representatives of Affiliated Societies concluded the meeting. The Annual Report of the Council was read by the Hon. Secretary, Mr. W. C. Fishlock, and Dr. C. Tierney, as delegate to the British Association, read a report of the Conference of Affiliated Societies at the Blackpool Meeting last September.

Prof. Julian Huxley, F.Z.S., was elected President for the year 1938–39, and Mr. Alexander Farquharson, M.A., of Le Play House, Hon. Secretary in place of Mr. Fishlock, who did not seek re-election.

An invitation to hold the Congress at Worthing in 1938 was brought by Councillor Migeod and gratefully accepted.

The success of the Congress was much helped by the energetic Local Secretary, Capt. T. Dannreuther, R.N. (Hon. Editor of the Union), and his Assistants, aided by fine sunny weather.

A pleasing feature was the issue of a handbook, " Hastings, a Survey of Times Past and Present," edited by Mr. Anthony Bolt, President of the local Natural History Society (published by Messrs. Brooker & Saville, Hastings, price 3*s.* 6*d.*).

FLORA OF SUSSEX.

THE 'Flora of Sussex' is now in the hands of the printers, and it is expected that it will be published in the autumn. This will complete the quartet of the south-eastern county Floras of Surrey, Hants, Kent, and Sussex, replacing the somewhat inadequate Flora of Arnold, and bringing it up to the standard of its neighbouring counties.

The area of the county is less than that of Hants (including Wight) and of Kent, but double that of Surrey. In its flora are reckoned 1412 species, including well-established aliens. This is greater than any of the other counties, which have, respectively, Hants 1399 (including Wight), Kent 1376, and Surrey 1311. The last-named county may have a relatively richer flora than that of Sussex, but having no seaboard the number of its recorded species is considerably lowered.

Sussex has no less than 32 species not known in any neighbouring county, among which are *Ranunculus tripartitus*, *Bupleurum opacum*, *Seseli Libanotis*, *Phyteuma spicatum*, *Sibthorpia europaea*, *Ornithogalum pyrenaicum*, *Hymenophyllum tunbridgense*, and *Phegopteris Robertiana*. There are about thirty-six species which have their first British records in the county.

Special research has been made for the first notices in herbaria or manuscript books, and notes of species which are now published for the first time, in addition to the first printed notice, which alone constitutes a record. A large number of these are extracted from Markwick's manuscripts now at Hastings, an account of which was given in this Journal for 1933, p. 348.

The usual botanical divisions arranged by watersheds have been adopted as in most other county Floras, and those laid down by Hemsley in Arnold's Flora have been followed as closely as possible. Watson's vice-counties of East and West Sussex have not been used as botanical boundaries, but indications have been made in the Flora as to which of these two vice-counties stations near his boundaries belong. It may be remarked here that Watson's East and West Sussex are not the same as those used in the county for administrative purposes.

Comparatively few new county records appear in the Flora, most of them having been published as soon as the plants have been found in Reports of the Botanical Exchange Club.

The book will be published at 15*s*. (15*s*. 6*d*., including postage) by Messrs. Brooker & Saville, 16 Robertson Street, Hastings, to whom applications for copies may be sent at once.—A. H. WOLLEY-DOD.

REVIEWS.

Conspectus Floræ Angolensis. Elaborated by the Botanical Institute of Coimbra, with the collaboration of the British Museum. Edited by Dr. L. WITTNICH CARISSO. Vol. I. fasc. 1. Pp. ix–xxiv, 1–176. *Ranunculaceae–Malvaceae*, by A. W. EXELL and F. A. MENDONÇA. 8vo. Instituto Botanico, Coimbra, 1937. Price, $50 Esc.

THE botanical wealth of Angola was indicated by the publication by the Trustees of the British Museum, 1896–1901, of the 'Catalogue of the African Plants collected by Dr. Friedrich Welwitsch, 1853–61,' prepared by Philip Hiern and other botanists. Since then large consignments have been sent to the Museum by another collector, Mr. John Gossweiler, and an account of these has been published at intervals as a Supplement to the *Journal of Botany*. A botanical mission to Angola, organized by the Botanical Institute of the University of Coimbra in 1927, revealed the need for an up-to-date critical revision of the material not only in Portugal, but also in London and Berlin, and the expenses of publication of a Conspectus of the flora were undertaken by the Agency-General for the Colonies at Lisbon. The collaboration of the Department of Botany of the British Museum, which had been mainly responsible for previous work, was ensured and Mr. A. W. Exell, a member of the staff, was granted leave of absence to Coimbra in 1934 and Sr. F. A. Mendonça of the Coimbra Botanical Institute spent several months in London in 1935.

The present volume is the first instalment of this joint undertaking. It includes the families of the Dicotyledones, Polypetalae from Ranunculaceae to Malvaceae—the arrangement of families adopted is that of Bentham and Hooker; in some cases the systematic arrangement of genera is that of more recent monographs. The Flacourtiaceae have been elaborated by Dr. H. Sleumer and the Dipterocarpaceae by Dr. Helen Bancroft. A preface by Dr. Carisso and an Introduction by F. A. Mendonça indicating the plan of the work are printed in Portuguese and English; the text is in Portuguese, but the employment of a vocabulary as near as possible to Latin should render the keys easily intelligible to those unfamiliar with the Portuguese language.

Keys are included under the families to the genera and under the genera to the species. Synonymy relevant to Angola is quoted, the geographical distribution in the different districts is given, with citation of localities and collectors, and there are brief notes on habitat. A small map shows the division of the area into districts.

Workers at Angolan botany may have experienced difficulty in finding localities cited in the literature, many of which were obscure or transitory, and vernacular names have often been

replaced by Portuguese names. These difficulties will be, so far as possible, resolved by a list of place-names that have fallen into disuse with their modern equivalents.

The 'Conspectus' will be a valuable addition to Colonial Floras, and we shall look forward to its completion.—A. B. R.

Polynesian Botanical Bibliography, 1773–1935. By E. D. MERRILL. Bernice P. Bishop Museum Bulletin 144. Roy. 8vo, pp. 194. Published by the Museum, Honolulu, Hawaii, 1937. Price $3.00.

THIS is a new and much enlarged edition of the Bibliography of Polynesian Botany by the same author issued as a Bulletin of the same Museum in 1924. The earlier edition listed 1300 titles, the present includes about 2600. Dr. Merrill has spread his net widely, and the volume represents the results of a great amount of work, especially as an attempt has been made to examine each paper admitted to the list. Where bibliographic sources alone have been available the few papers concerned are marked "not seen." A helpful inclusion is a note on the scope or contents of each item.

All papers appertaining to the taxonomic botany of Polynesia have been included, but not general works based primarily on Asiatic and Australian material. Those on Polynesian ecology, phytogeography, and plant pathology are included, but not those on plant physiology, genetics, and morphology. Important items in forestry, economic botany, pharmacology, and horticulture are also admitted. Dr. Merrill comments on the difficulty presented by such vague titles as "Orchidaceae novae," "Lichenes exotici," "Gramineae Novae" which should be rigidly avoided. He also expresses "mixed feelings" regarding the actual value of bibliographic work. He may be assured that he has laid all future workers at Polynesian botany under a great obligation.

If a future edition is contemplated a small paper by I. H. Burkill, "On a Collection of Plants from New Britain" (Proc. Camb. Philos. Soc. ix. pt. 2; 1896), may be noted as an addition, as pointed out by our Departmental Librarian, Mr. J. Ardagh.—A. B. R.

Die kontraktile Zelle der Pflanzen. By SILVIA COLLA. Sm. 8vo, pp. 168, figs. 77. Gebrüder Borntraeger, Berlin, 1937. Price R.M. 12.

THIS book is a summary of knowledge of contractile cells, particularly from the physiological point of view, although one chapter, which is devoted to their morphology, gives accounts of the contractile structures, with figures, in *Berberis*, *Mahonia*, *Martynia*, *Mimulus*, *Sparmannia*, *Dionaea*, *Centaurea*, and other plants. Changes in the cell-wall, cytoplasm, vacuoles, and

nucleus during contraction are described. Chapter III. describes further the movement-mechanisms in various contractile organs. Chapter IV. analyses the movements in detail, using kymograph and film records, much of this being from the author's own work.

The laws of contraction in relation to electrical, thermal, mechanical, and other stimuli, in *Berberis*, *Mimosa*, and other plants are explained, including summation of stimuli, tetanus, etc., but no mention is made of American work on these reactions in *Dionaea*. The physical-chemical changes during contraction are also considered, including changes of potential, pH and rH, concentration of crystalloids, changes of colloidal condition, and permeability.

The last Chapter (VII.) is devoted to a comparison of the contractility in these plant-cells with other forms of contraction, as in striped muscle, contractile Protozoa, explosive and autonomous movements in plants. The book ends with an extensive list of literature and an index.

An extraordinary omission is the absence of any mention of contractile roots. *Aldrovanda* receives frequent mention, but *Utricularia* does not appear at all. Apart from these omissions, the work is a useful treatment of the contractile tissues of plants in their more strictly physiological aspects.—R. R. GATES.

Lebensgeschichte der Blütenpflanzen Mitteleuropas. Lief. 53/54. *Lythraceae*. E. Ulmer, Stuttgart. The price of this volume, omitted from the notice in the June number, is R.M. 8, less 25 per cent.

Die Pilze Mitteleuropas.—I. *Die Röhrlinge* (*Boletaceae*). By FRANZ KALLENBACH. Lief. 16–17 (1936). II. *Die Gallertpilze* (*Tremellineae*). By WALTER NEUHOFF. Lief. 3–4 (1936). Werner Klinkhardt: Leipzig. Price 5 M., less 25 per cent. each part.

KALLENBACH'S monograph on *Boletus* is approaching its conclusion. Owing to the author's illness there has been considerable delay in the appearance of the parts, and a lag between the text and the plates has made this delay the more regrettable. There can be no doubt that it will be for long the standard work on this fascinating genus, for the plates have kept to a very high level and the text is so complete and well documented that it can be used for reference. The first number under review contains the greater part of the description of plate 39, *Gyrodon lividus* Fr. The remaining plates illustrate *B. felleus* Bull.-Fr., *B. badius* Fr., and *B. aereus* Bull.-Fr.: there is a black and white plate. *Gyrodon lividus* is not recorded for this country as such, but Kallenbach suggests that it is the same as *B. caespitosus* Massee, a species described in Massee's 'Fungus Flora,' but not included in his drawings, which were purchased by the Department of Botany,

British Museum, in 1892. The plate and description of *Boletus pseudoscaber* show clearly the "form" of *B. scaber* which the author has in mind. It is rather firm, with a somewhat tomentose cap and flesh, which changes colour particularly in the stem. It certainly occurs in this country. The text of twelve pages deals with none of the species in the accompanying plates; so far as we can judge, however, they require no special comments. We wish Herr Kallenbach a speedy return to good health, so that he may complete this work to which he has so whole-heartedly devoted himself with such excellent results.

Dr. Neuhoff's monograph on the Tremellineæ does not lend itself to the attractive pictorial display which characterises the Boleti, and two species are usually figured on one plate. The species illustrated in colour are *Exidia gemmata* (Lév.) Bourd. & Maire, *E. glandulosa* Fr., *E. truncata* Fr., *E. pithya* Fr., *E. Grilletii* (Bourd.) Neuh., *E. badia-umbrina* (Bres.) Neuh., and *Guepinia helvelloides* (DC. ex Fr.) Fr.; all are described except the last, and there are three plates of photographs. *Exidia gemmata* has as synonyms *Exidia nucleata* (Schwein.) Rea, *E. albida* Massee, and *Tremella violacea* Tul.; *E. truncata* and *E. glandulosa* (Bull.) Fr. are regarded as the same fungus, and *Sebacina fugacissima* Bourd. & Galz. as a synonym of *Exidia Grilletii* (Bourd.) Neuh. It is obvious that a number of species recorded as British need reconsideration in view of Neuhoff's careful and detailed descriptions. There are several other species in the family which will not bear critical examination, but a glance through the plates of this monograph will show how much alike well-defined species are and how, therefore, detailed microscopic data are necessary—and these are meagre or wanting in the older descriptions.—J. R.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the Anniversary Meeting on May 24, the President, Dr. W. T. Calman, C.B., F.R.S., in the Chair, the Treasurer, Mr. Francis Druce, gave his financial report. During the year the Society has received a bequest of £100 from the late Lord Wakehurst, and £1241 from the Herbert Spencer bequest. The Treasurer pleaded for an increase in the number of Fellows to enable the Society satisfactorily to carry on its work. The Assistant Secretary's report showed that 29 Fellows had been lost by death, withdrawal, and removal, and 29 had been elected. The present number of Fellows is 735. During the year six Foreign Members and two Associates had died.

The President presented the Traill Award for the encouragement of work upon protoplasm to Dr. C. F. A. Pantin, F.R.S., with reference to his researches on the mechanism of amœboid movement, and the Linnean Gold Medal to Dr. F. F. Blackman, F.R.S., in recognition of his work on Plant Physiology.

The President then gave his address on "James Eights, a pioneer Antarctic Naturalist."

The Officers elected for the next year were:—President, Mr. John Ramsbottom, O.B.E.; Treasurer, Mr. Francis Druce; Zoological Secretary, Mr. M. A. C. Hinton, F.R.S.; Botanical Secretary, Mr. I. H. Burkill. New members of Council elected were Miss M. L. Green, Dr. H. S. Holden, Mr. F. Howarth, and Prof. F. E. Weiss, F.R.S.

Miss E. R. Saunders points out that the report of her examination of the flowers of *Hypericum peplidifolium* (General Meeting on May 6, see p. 184) was inaccurate, in that her statements referred to the number *not of carpels* but of *styles* (the one number does not necessarily coincide with the other); and that the number of bundles of stamens is *also five*, though previously it had been held to be three. We much regret this misrepresentation.

'THE LONDON NATURALIST,' 1936.—The recent issue of the 'Journal of the London Natural History Society' records work by the newly formed Ecological Section. A survey of the fauna and flora of 200 acres of Limpsfield Common, Surrey, has been planned, and a map is printed showing proposed subdivisions of the area. R. W. Robbins gives a list of thirty-three plants, with their distribution, found by the members on a small selected bracken area on Epsom Common in June 1936. C. L. Collenette writes on the preservation of bracken in Richmond Park, on which much of the bird-life depends. There is evidence of deterioration of the bracken, which may be due to hardening of the ground and weakening of the young shoots on wheel-tracks and deer-paths. Removal of humus down to the underlying clay or gravel causes its disappearance. J. E. Lousley comments on the value of photographs as an addition to herbarium sheets, and H. J. Burkill contributes a list of plant-gall records for the past year. A summary of a paper by Dr. Dudley Stamp on the Land Utilisation Survey of Great Britain, read before the Society, is given. Reports are given of the various other activities of the Society, and a Supplement "A London Bird Report for 1936" is a record of bird-life within twenty miles of St. Paul's Cathedral.

'THE GARDENS' BULLETIN, STRAITS SETTLEMENTS.'—In vol. ix. pt. 2 (May 1937) R. E. Holttum continues his critical descriptive work on Malayan Ferns in three papers—"Notes with Descriptions of new Species of *Davallia* and *Diplazium*," "Further Notes on Philippine Species of *Stenochlaena*, *Lomariopsis*, and *Teratophyllum*," and an "Historical, Morphological, and Taxonomic Review of *Lomagramma*." The last-named genus extends from Assam and South China through Malaysia to Polynesia: the species are illustrated in ten plates, and several novelties are described. C. X. Furtado continues his work on Malaysian Palms, with notes on *Daemonorops* and *Calamus*. Leon Croizat redescribes as

Euphorbia Ridleyi, *E. Synadenium* Ridl., an invalid homonym, an isolated species in the Malay Peninsula, which he regards as an early Tertiary relict. He also comments on the unsatisfactory character of the genus and its subdivision as at present understood. C. G. G. J. van Steenis discusses the use of the terms Malaysia and Malaya in plant geography; he defines the former as a biogeographical term, and suggests that the latter be avoided for phytogeographical purposes.

'BLUMEA.'—The completion of vol. ii. (pp. 239–389) contains forty-six pages of descriptions of new Brazilian Velloziaceae (*Barbacenia* and *Vellozia*) by Drs. Goethardt and Henrard. The collections of Glaziou provide a large proportion, but specimens from other collections in various European herbaria have also been studied. Dr. Henrard also contributes an exhaustive critical examination of the synonymy of the species of *Vulpia* as a distinct genus of the tribe Festuceae. W. J. Lütjeharms claims conservation for the genus *Rhipidium* Cornu (Saprolegniaceae) against four earlier homonyms; and W. M. Docters van Leeuwen gives some account of the vegetation of the Salajar Islands between Celebes and Flores, several of which were visited by him on a short trip in 1913. J. G. Wood and L. G. M. Baas Becking discuss cases of divergence in characteristic species occurring in similar habitats in different parts of the world. An Index to vol. ii. is included.

'THE BOTANICAL REGISTER.'—In the 'Journal of the Arnold Arboretum,' xviii. 183–4 (1937), Ethelyn M. Tucker gives a list of the dates of the plates of the 'Botanical Register' founded by the botanical artist Sydenham Edwards and John Bellenden Ker in 1815. The thirty-three volumes were published in parts issued on the first of each month from 1815–47. The plates are dated, but, owing to the fact that the volume year was, for vols. i. to xxi., from March to February or January, and that the date on the title-page was for the first nineteen volumes that of the early plates and for vols. xx. and xxi. that of the last plates, this citation of the dates may be helpful in the absence of the covers of the parts.

INTRODUCTION OF THE POTATO INTO EUROPE.—Dr. Redcliffe N. Salaman in 'The Masters Lectures' (Journ. Roy. Hort. Soc., June 1937) discusses at length the subject of the introduction of the potato, the first cultivation of which in South America must have taken place more than 3000 years ago. The first European to describe it was Costellanos in 1537, and it was growing near Seville as early as 1572. There were at least two introductions into Europe, one *via* Spain, the other *via* England. Drake may have been the introducer and Raleigh the cultivator in the latter case. Both introductions were probably from Peru, or from modern Ecuador or Colombia, rather than from Chile or the Island of Chiloe.

NOTES ON BRITISH HYPOCREACEAE.—III.

BY T. PETCH, B.A., B.Sc.

(Continued from Journ. Bot. lxxiv. 193; 1936.)

21. OOMYCES CARNEO-ALBUS (Libert) B. & Br.

The genus *Oomyces* was founded by Berkeley and Broome on *Sphaeria carneo-alba* Libert. That fungus occurs on the leaves of *Aira caespitosa*, and was first collected in this country by Broome at Spye Park, Wilts. It appears to be uncommon, but was collected again by Broome at Batheaston in January 1851 and March 1859, by Massee at Lyndhurst, by Dr. Carlyle at Carlisle in June 1886, and by J. Menzies near Perth in May 1912. As there has been considerable misconception concerning the nature of the fungus, the following details may be of service.

The conical stromata are erumpent, not superficial, and about 0·6 to 0·75 mm. high, 0·5 mm. diameter, with a truncate, slightly convex apex, punctate with the mouths of the immersed perithecia, which are from three to seven in number. The cortex of the stroma is thin but tough, while the interior is subgelatinous, the flask-shaped perithecia being attached by their apices to the upper surface of the stroma, and extending vertically downwards almost to the base. The asci are very long, narrow cylindrical, 5–6μ diameter, with a rounded, not capitate, apex, and are accompanied by linear paraphyses, branched at the apex. The long linear spores are not continuous, but multiseptate, 1·5μ diameter.

Six species have since been described in *Oomyces*, but, judging from their figures and descriptions, none of these is co-generic with *O. carneo-albus*. In no case is more than one perithecium present in the stroma, and the character of the stroma is different. As has been pointed out previously, species of *Hypocrella* which have the perithecia embedded singly in processes of the stroma, may have the stroma so far reduced that the processes appear to be separate perithecia, but on examination it is found that the processes are masses of parenchymatous stromatic tissue, in each of which a single perithecium is embedded. *O. monocarpus* Möller, *O. albosuccineus* Rehm, and *O. incanus* Rehm appear to be reduced forms of *Hypocrella*. *O. javanicus* v. Höhnel and *O. caespitosus* Syd. suggest *Ophionectria*, while *O. Ichnaspidis* (Zimm.) v. Höhnel is an abnormal form of *Podonectria coccicola* (E. & E.) Petch.

22. HYPOCREA LENTA.

A note on *Hypocrea lenta* was published in Journ. Bot. lxxiii. 190 (1935). I regret that, when compiling the information therein, I overlooked Currey's "Supplementary Observations"

in Trans. Linn. Soc., Bot. xxv. 244. There Currey wrote, " The name Tode after this plant in my former paper is a mistake. *S. lenta* Tode seems distinct from *S. lenta* Schwein. I do not know the former plant." The specimen which Currey examined was from Schweinitz. As regards British specimens, one in Herb. Kew. *ex* Herb. Currey, Wood Heath, Chislehurst, Aug. 17, 1855, is marked by him " *S. rufa* or *S. lenta* Sch., I think the latter " ; another, sub *H. lenta* in Herb. Kew. and Herb. Brit. Mus. is from St. Catherine's, C. E. Broome, Nov. 30, 1866 ; while a third, sub *H. contorta* in Herb. Brit. Mus., was recorded by Phillips and Plowright from Foxley Wood. All these are the same species, which has been known as *Hypocrea lenta*, *H. rigens*, and *H. contorta*, but for which the earliest correct name appears to be *Hypocrea Schweinitzii* (Fr.) Sacc. On the other hand, the specimen on Gorse, Ascot, in Herb. Brit. Mus., is not that species ; it may be *H. rufa*, but it is a poor specimen, not determinable without destruction.

It would seem possible that the original *Sphaeria lenta* Tode, on the trunk and roots of Beech, may have consisted of small examples of *Ustulina vulgaris*, though Tode described the latter fungus in the same publication as *Sphaeria versipellis*.

23. Hypocrea lactea Fr.

Hypocrea lactea Fries was originally described as *Sphaeria lactea* by Fries in Vetensk. Acad. Handl. 1816, 141, and again in Obs. Mycol. ii. 321, t. 8, fig. 4 (1818), and Syst. Mycol. ii. 337 (1823). He transferred it to *Hypocrea* in Summa Veg. Scand. 383 (1849). It was white, thin, plane, fleshy, naked, with a glabrous margin, spreading two inches or more over rotten wood and soil. The ostiola were punctate, rarely papillate. It was near *H. citrina*, but was distinguished from that species by its naked surface. The figure cited shows a cream-coloured stroma, like *H. citrina*, but without a byssoid margin.

There are two specimens from Fries in Herb. Kew. One of these, labelled " *Hypocrea lactea* Fr. Upsala, 1853, E. P. Fries," is *H. citrina* in everything but colour, which is now brownish through age. The other, labelled " *Sphaeria lactea*, Upsala, July, leg. Lbd.," is quite different, and is *H. stipata* (Libert) Fckl. From Fries's description and figure, it would appear that *H. lactea* is a weathered or pallid form of *H. citrina*, and that the first of the foregoing specimens represents it correctly.

Fries did not give any spore measurements for *H. lactea*. Those quoted in ' Saccardo ' are from Fuckel, Symb. Mycol. 185 (1869). But Fuckel's specimens on *Poria medulla-panis*, issued in ' Fungi Rhenani,' no. 995, are *H. farinosa* B. & Br. in the copies in Herb. Kew. and Herb. Brit. Mus. Specimens collected by Plowright at Castle Rising, Norfolk, on *Poria medulla-panis*, and recorded as *H. lactea* in " New and rare British Fungi," no. 208, are *H. farinosa*. A specimen from Taunton, September 1911, in Herb. Kew. *ex* Herb. Ellis, is also *H. farinosa*, but another specimen from Taunton, 1911, sub *H. lactea*, in Herb. Brit. Mus. *ex* Herb. Hawley, is *H. citrina*.

24. Hypocrea delicatula Tul.

This species was described and figured by Tulasne (Sel. Fung. Carp. iii. ; 1865). He described the perithecia as turbinate, but they are, as figured, globose, about 180μ diameter, with a subcylindrical apex, about 40μ high and 50μ diameter. It was collected by Broome in Fir plantations at Lucknam, Wilts, in April 1866, but subsequent records in this country are erroneous. Specimens collected at Ascot by the Rev. G. H. Sawyer, now in Herb. Kew. sub *H. delicatula*, are *H. citrina*, as are also the specimens collected at Hereford in October 1874, and distributed as *H. delicatula* in Plowright, Sphaer. Brit. iii. no. 2. Other specimens from North Wootton in Herb. Kew., referred by Cooke to *H. delicatula*, are the immature stromata of *Hypomyces ochraceus*.

In *Hypocrea delicatula* Tul., *H. farinosa* B. & Br., and *H. stipata* (Libert) Fckl., the perithecia are seated upon, or partly or wholly immersed in a byssoid subiculum. In Saccardo, ' Sylloge Fungorum,' the genus *Hypocrea* is defined as having a fleshy stroma, which is rarely almost obsolete, while Winter, in Rabenhorst, Krypt. Flora, stated that the stroma is fleshy or byssoid, occasionally much reduced. It would appear advisable that the species which have only a byssoid subiculum, which resemble *Hypomyces* in subiculum and perithecia, but have the *Hypocrea* type of ascospore, should be separated from the species which have their perithecia immersed in a fleshy stroma, and I propose for them the genus

PROTOCREA, *gen. nov. Hypocreacearum, perithecia simplicia, in subiculo byssino insidentia v. immersa ; asci octospori ; sporidia bilocularia, hyalina, loculis duobus in asco secedentia.*

The species which are known at present to fall in this genus are **Protocrea farinosa** (B. & Br.), **Protocrea delicatula** (Tul.), and **Protocrea stipata** (Libert).

25. Hypomyces.

The name *Hypomyces* was suggested by Fries (Syst. Orb. Veg. 105 ; 1825), and was adopted by Tulasne (Ann. Sci. Nat. sér. 4. xiii. 11 ; 1860). Tulasne stated that he had founded his generic description on the study of a number of species. He defined it as having two kinds of conidia, viz. microconidia, or conidia proper, and chlamydospores, and ascospores shortly apiculate and bilocular. However, he placed first in his list *Hypomyces lactifluorum*, and this has been taken as the

type-species, another illustration of the fallacy of this method of selecting type-species, for neither conidia nor chlamydospores have been recorded for *Hypomyces lactifluorum*. There is little doubt that the underlying idea of the genus was a biological one, and that it was intended to contain all *Nectria*-like fungi which were parasitic on other fungi. Hence Tulasne included in it species with uniseptate, apiculate ascospores, others with uniseptate obtuse ascospores, and others with continuous ascospores.

Naturally, the genus invited division, and Saccardo (' Sylloge Fungorum,' ix. 944 ; 1891) instituted the genus *Peckiella* for species of *Hypomyces* with continuous spores. There was, however, an existing genus, *Byssonectria* Karsten, in which they should have been placed. Seaver (in ' Mycologia,' ii. 49 ; 1910) retained both genera, *Byssonectria* with subiculum very scanty and *Peckiella* with subiculum profuse, but the distinction is impracticable.

Maire (in Ann. Mycol. ix. 323 ; 1911) instituted the genus *Nectriopsis* for species of *Hypomyces* which have one-septate ascospores, with ends rounded or subacute, but not apiculate. This undoubtedly clashes with the subgenus *Hyphonectria* of Saccardo, and if adopted will necessitate the transfer of over fifty species of *Hyphonectria* to *Nectriopsis*. I propose to retain Saccardo's name for this group.

Finally, Sydow (in Ann. Mycol. xviii. 186 ; 1920) instituted the genus *Apiocrea* for species of *Hypomyces* which, like *H. chrysospermus*, have apiculate ascospores, very unequally one-septate.

The result of these changes is to leave in *Hypomyces* only those species which have apiculate, equally one-septate ascospores. It becomes a morphological, instead of a biological genus. The British species will now stand as follows :—

Hypomyces ochraceus Tul. ; syn. *H. apiculatus* (Peck) Seaver, *H. terrestris* Plowr. & Boud.
Hypomyces rosellus (A. & S.) Tul.
Hypomyces aurantius (Pers.) Tul.
Hypomyces Broomeanus Tul.
Hypomyces asterophorus Tul.
Apiocrea chrysosperma (Tul.) Syd.
Apiocrea Tulasneana (Plowr.), comb. nov.
Hyphonectria violacea (Schmidt), comb. nov. ; syn. *Hypomyces candicans* Plowr.
Hyphonectria Berkeleyana (Plowr. & Cooke), comb. nov.
Hyphonectria aureo-nitens (Tul.), comb. nov.
Hyphonectria Solani (Reinke & Berth.), comb. nov.
Byssonectria viridis (A. & S.), comb. nov. ; syn. *Hypomyces luteovirens* (Fr.) Plowr., *Hypomyces ater* Cooke.
Byssonectria lateritia (Fr.), comb. nov. ; syn. *Hypomyces luteminosus*, as far as regards British specimens.

26. HYPOMYCES CHRYSOSPERMUS Tul.

Sepedonium chrysospermum (Bull.) Link is the fungus which covers *Boleti* and other fungi with masses of golden yellow chlamydospores. Its perithecial stage, described by Tulasne as *Hypomyces chrysospermus*, is rare or overlooked, only three gatherings of it having been recorded in this country, the first by Berkeley at Coed Coch, the second by Plowright and Stevenson at Chapelton Wood near Forres, September 1879, and the third by Mr. J. Ramsbottom at Dartington, September 1935. There is also a specimen in Herb. Kew., collected by Cooke in Queen's Cottage Gardens, August 1886. Tulasne described the ascospores as lanceolate, 23–30 × 5–6·5 μ, usually very unequally one-septate, so much so that one loculus may appear to be a small appendage to a continuous spore. Because of the latter character, Sydow created for this species the genus *Apiocrea*.

Berkeley's specimen appears to be wholly immature, the perithecia being collapsed and cup-shaped. In Cooke's specimen, the perithecia found were again immature. In Stevenson's specimen in Herb. Kew., the ascospores measure 21–27 × 5–6 μ, and are verrucose, lanceolate, apiculate at both ends, very unequally one-septate, but regularly lanceolate, not with the smaller loculus forming an appendage as in Tulasne's figure. In the specimen from Dartington, however, the ascospores are 9–16 × 3–4 μ, lanceolate or narrow oval, verrucose, ends usually rounded and with a short apiculus at the upper end, and usually with the septum median or nearly so, the greatest inequalities observed being a spore 13 μ long, with loculi 9 μ and 4 μ respectively, and another of the same length, with loculi 8 μ and 5 μ respectively. This last specimen scarcely agrees with the idea of the genus *Apiocrea*.

The chlamydospores in a conidial specimen on *Boletus* gathered at random at North Wootton measured 13–22 μ in diameter. In Stevenson and Plowright's specimen they are 13–16 μ and in the Dartington specimen 10–15 μ. Thus there is no correlation between the size of the chlamydospores and that of the ascospores. Nor is it the case that perithecial examples always have small chlamydospores, for in Berkeley's specimen from Coed Coch the chlamydospores are 16–26 μ.

Seaver (' Hypocreales of North America ') stated that the ascopores in American forms of this species are smaller than reported for European specimens, and gave the dimensions 12–15 × 4 μ, but, as regards their shape, he described them in terms which agree with Tulasne's description. Peck gave the ascopores of the American *Hypomyces boletinus*, which, according to Seaver, is a synonym of *H. chrysospermus*, as 20–25 × 6–7 μ, thus agreeing with Tulasne as to size.

It would appear that both in Europe and America there is a large-spored and a small-spored form of *Hypomyces chryso-*

spermus on *Boletus*. Whether these can be regarded as distinct species is doubtful on the available evidence.

27. HYPOMYCES OCHRACEUS (Pers.) Tul.

Persoon described this species in 'Synopsis Fungorum,' 18 (1801), as *Sphaeria ochracea*, terrestrial, effused, ochraceous, with a subtomentose margin, ostiola prominent; suborbicular or unequally effused, half an inch wide, 1 line thick, surface tuberculate; very rare, on moist soil in woods. Tulasne included it in Sel. Fung. Carp. iii. 41 (1865) as *Hypomyces ochraceus*, and gave a full description and detailed figures. He stated that it occurred on various species of *Russula*, on which it produced a white mycelium. The affected agaric soon collapsed, and the mycelium spread over the soil and over any adjacent substances. This mycelium bore a conidial stage, and in the denser parts compound chlamydospores, but when that phase was over and the mycelium was about to disappear, stromata up to 20 mm. diameter or more were formed, white, straw-coloured, ochraceous, or egg-yellow, and these finally bore innumerable perithecia. The ascospores were 35 μ or more in length.

In 'Notices of British Fungi,' no. 1175*, Berkeley and Broome remarked that *Hypomyces ochraceus* Tul. was in all probability *Cryptosphaeria aurantia*, Grev. t. 78, and that *Blastotrichum puccinioides* Preuss was evidently a state of that or some closely allied species. By the last remark they no doubt intended to convey that the chlamydospores figured by Tulasne resembled Preuss's figure of *Blastotrichum puccinioides*. The chlamydospores are the latter species, but *H. ochraceus* is not *Cryptosphaeria aurantia*. Plowright recorded that Greville's specimens were *Hypomyces aurantius*.

In his 'Monograph of the British Hypomyces,' Plowright stated that he had never met with this species. Cooke reproduced Tulasne's figures of the conidiophore etc., but instead of copying the figure of the terrestrial perithecial stromata, he gave a figure showing the fungus on the under surface of an agaric. This may have been taken from one of Greville's specimens of *Cryptosphaeria aurantia*; it is not a copy of Greville's pl. 78.

Plowright was probably misled by Berkeley and Broome's reference, and expected to find *Hypomyces ochraceus* on an agaric. The perithecial stage does not occur on an agaric, as far as is known, but on the ground where an agaric has decayed. Plowright found it several times in the neighbourhood of King's Lynn, but failed to recognise it, and redescribed it as *Hypomyces terrestris* Plowr. & Boud. The conidial stage is common at North Wootton on *Lactarius rufus*, and both the conidia and the chlamydospores may be found on the decaying agaric, but the perithecial stromata are apparently rare.

Plowright described and figured the stroma as pale flesh-colour and the perithecia as reddish, and the same colours are

shown in a drawing which Boudier sent him. In a recent collection by Mr. A. A. Pearson in Epping Forest, the perithecia are crowded and red, making the whole appear red, but the margin of the stroma is orange, becoming ochraceous. In another recent collection, from North Wootton, the apices of the perithecia are red, but the stroma is white. In a specimen from Haslemere, September 1930, in Herb. Kew., the stroma is ochraceous, but the apices of the perithecia are red, while in a specimen collected by Miss Wakefield at Midhurst the stroma and perithecia are ochraceous. In morphological characters, no difference has been observed between these collections, and it would appear that the colour is variable.

As correctly determined by Miss Wakefield, *Hypomyces terrestris* Plowr. & Boud. is the same as *H. apiculatus* (Peck) Seaver. The latter name is therefore another synonym of *H. ochraceus* (Pers.) Tul. The conidial and chlamydospore stages occur on *Russula* and *Lactarius*.

In Herb. Brit. Mus. there is a specimen marked *Hypomyces ochraceus*, J. Renny, January 27, 1872, *ex* Herb. Broome, and in Herb. Kew. one from King's Lynn, B.M.S. Spring Foray, 1930. Both these are *Hypomyces aurantius* with chlamydospores. *H. aurantius* sometimes has chlamydospores, but they are of a different shape from those of *H. ochraceus*. In the former, they are oblong-oval, or more or less cylindrical, one- to three-septate, constricted at the septa, 18–48 × 12–18 μ; in the latter, they are fusoid or narrow-oval, one- to four-septate, the central cell strongly inflated, 48–140 × 24–33 μ, frequently budding from the central cell.

28. HYPOMYCES AUREONITENS Tul.

Hypomyces aureonitens was described by Tulasne in Sel. Fung. Carp. iii. 64 (1865) from specimens on *Merulius tremellosus* Pers. He did not give any figures of it. The perithecia were seated on a golden yellow subiculum, and were globose, obtuse, scarcely papillate, with an obscure, punctiform, somewhat umbilicate ostiolum, at first clothed with very scanty golden tomentum, subsequently becoming sordid ochraceous and more glabrous. The asci were narrow linear-cylindrical, obtuse, without paraphyses, and the ascospores obliquely uniseriate, ovate-oblong, one-septate, somewhat constricted, either end more or less acute, 10–13 × 3·5 μ. Tulasne stated that because of the naked perithecia, only slightly immersed in the subiculum, the fungus resembled a *Nectria*, and in respect of the ascospores it stood indecisively between that genus and *Hypomyces*.

With the perithecia, and apparently arising from the same mycelium, was a conidial form with stout, hyaline conidiophores, 100–200 μ high, 6–8 μ diameter, usually simple below and terminating above in short branches, repeatedly dichotomous and at the same time diminishing greatly in diameter. The conidia

were produced in apical chains, and were linear-ovate, continuous, 4–5×2·5 μ.

Hypomyces aureonitens was recorded by Plowright from specimens on *Stereum hirsutum*, gathered in Pwll-y-crochan Wood, near Colwyn, North Wales, October 1880, and was described and figured in his 'Monograph of the British Hypomyces.' The plates in that paper were drawn by Cooke, sometimes from Plowright's sketches, sometimes from Tulasne, but in the present case the published figures are quite different from Plowright's drawings and the Welsh specimens, and, as there were no Tulasne figures to be copied, it can only be surmised that they are a graphic interpretation of Tulasne's description.

Cooke's figures of the conidial fungus show a *Penicillium* with a conidiophore repeatedly di- or tri-chotomous at the apex, forming a fan-shaped tassel, with conidia in terminal chains. Plowright's drawing shows a stout-stalked conidiophore, dividing into three (or bearing two lateral branches) at the apex, the branches becoming vertical and parallel to one another and bearing clusters of similar branches above, while the conidiophore terminates in a confused mass of conidia. Plowright's drawing represents a *Gliocladium*, and examination of his specimen in Herb. Brit. Mus. confirms that. It is to be noted that Grove, in recording *Gliocladium penicillioides* Corda for this country on *Stereum* (in Journ. Bot. xxiii.; 1885), stated that he could not perceive on the conidia of his specimen the gelatinous coat figured by Corda, and that Plowright had informed him that he did not notice it on the conidia figured in 'Grevillea' for *Hypomyces aureonitens*. There does not seem to be any doubt, however, that the common *Gliocladium* on *Stereum* in this country, which occurs in Plowright's specimen of *Hypomyces aureonitens*, is *G. penicillioides*, as it agrees perfectly with the latter in the peculiar structure of the conidiophore. That the conidia have a mucous coat is evident from the fact that they adhere in a globule of mucus at the apex of the conidiophore, but the coat is not visible on isolated conidia. It may be that Corda over-emphasised that feature, or that under some conditions of moisture that appearance may be produced. In 'Anleitung,' p. 55, he stated that the gelatinous coat was thicker than the spore.

Saccardo, in Syll. Fung. ii. 468 (1883), named the conidial stage of *Hypomyces aureonitens*, *Penicillium socium*, from the figure in Plowright's Monograph, while in Syll. Fung. iv. 80 (1886) he named it *Penicillium Hypomycetis*, from the same source, changing the latter name to *Gliocladium Hypomycetis* in Ann. Mycol. vii. 434 (1909). These names, in so far as they relate to anything real, are synonyms of *G. penicillioides*.

In a paper published after his death (Centralb. Bakt. Abt. 2, lx. 20; 1923), von Höhnel dealt with the identity of various species of *Gliocladium*, and stated that *Verticillium Aspergillus* B. & Br. was evidently a *Gliocladium*, which he named *G. Aspergillus* (B. & Br.) v. H. He pointed out that Tulasne described a *Penicillium*-like fungus for *Hypomyces aureonitens* which was evidently near *G. Aspergillus* and probably only a more luxuriant form, and that Plowright figured the same fungus on *Stereum hirsutum*. Examination of the type of *Verticillium Aspergillus* in Herb. Kew. confirms von Höhnel's conjecture, the fungus being *G. penicillioides*.

Hypomyces aureonitens was collected again, on decaying *Stereum* in company with *Gliocladium penicillioides*, at Buckden, Yorks, in September 1936. The subiculum is scanty, golden yellow or white. The perithecia are minute, 0·15–0·18 mm. high, 0·12–0·15 mm. diameter, ovoid, golden yellow or pallid, sparsely clothed with yellow or white hyphæ or almost naked, with a punctate, darker, ostiolum. The asci are cylindrical or narrow-clavate, 90×4–7 μ, with the ascospores uniseriate or obliquely uniseriate, and the ascospores are oval, narrow-oval, or fusoid, ends rounded or one end subacute, hyaline, verrucose when mature, one-septate, 9–13×3–4 μ, ultimately becoming constricted at the septum, with the upper cell usually the broader. The fungus is a *Hyphonectria*, and must stand as **Hyphonectria aureonitens** (Tul.), comb. nov.

29. HYPOMYCES LUTEOVIRENS (Fr.) Plowr.

Fries, in Vetensk. Acad. Handl. 251 (1817), described *Sphaeria luteovirens*, giving as a synonym *Sphaeria viridis* A. & S. (1805). He disagreed with Albertini and Schweinitz, in that they had placed the fungus in their section *Compositae*, next to *Sphaeria citrina*, but he evidently believed that they were dealing with the same fungus. In Syst. Mycol. ii. 339 (1823), Fries again described *Sphaeria luteovirens*, with a form " b. magis tomentosa et viridis. *S. viridis* A. & S." The details given in the second description appear to have been taken chiefly from Albertini and Schweinitz. There is no doubt that all these descriptions refer to the same species, which was said to be parasitic on *Russula* and *Lactarius*.

Berkeley and Broome in 1851 ('Notices,' no. 594) took as *Hypocrea luteovirens* Fr. a species which grows on *Boletus*, and in this they were followed by Tulasne, who transferred it to *Hypomyces*. This error was pointed out by Plowright, who described the fungus on *Boletus* as *Hypomyces Tulasneanus*, and that on *Lactarius* as *H. luteovirens*. Saccardo (Syll. Fung. ii. 472; 1883) adopted the name *Hypomyces viridis* (A. & S.) Karst. for the latter species, as did Winter (in Rabh. Krypt. Flora, ii.; 1887), probably because *viridis* is the earlier name. But if the nomenclature of fungi begins with Fries, it would seem that the name should be *Hypomyces luteovirens*. As the ascospores are continuous, it will stand as *Byssonectria viridis* or *Byssonectria luteovirens*.

30. HYPOMYCES TULASNEANUS Plowr.

As stated above, Plowright described this species from specimens on *Boleti*. It has been collected twice in this country—at Laxton, Northants, by Berkeley, and at Mattishall, Norfolk, by Plowright. Examination of the herbarium specimens of both these collections shows that the mature ascospores are very unequally one-septate, and the fungus must therefore be included in *Apiocrea*, as **Apiocrea Tulasneana** (Plowr.), comb. nov.

31. SPHAEROSTILBE GRACILIPES Tul.

In 'Notices of British Fungi,' no. 1148*, Berkeley and Broome stated that *Stilbum fasciculatum* B. & Br. was the conidial stage of *Sphaerostilbe gracilipes* Tul. The perithecial stage has been recorded only once in this country, on oak twigs with the conidial stage at Hebden Bridge, Yorks, in the 'Flora of Halifax' (1904). The specimen on which that record was based is now in Herb. Kew. *ex* Herb. Crossland, with Crossland's drawings of the fungus and a note by him, "Specimens were submitted to Mr. G. Massee (March 16, 1897), who replied '*Sphaerostilbe gracilipes*, ascigerous and *Stilbum* conditions new to us.'" The specimens are undoubtedly *Stilbum* (*Stilbella*) *pellucidum* Schrad., parasitic on some Tremellaceous or Tuberculariaceous fungus. There are no perithecia present.

32. GIBBERELLA ACERVALIS (Moug.) Sacc.

Gibberella acervalis was recorded for Norfolk by Plowright in 'Mason's History of Norfolk' (1884), and in Herb. Brit. Mus. there is a specimen *ex* Herb. Phillips, labelled "Shelton. 2. 1873. Plowright det." Unfortunately the specimen appears to be immature, and it is not possible to confirm the identification. It bears erumpent clusters of umbilicate, almost smooth, brown perithecia, which are seated on an immersed brown stroma.

This fungus was collected by Mougeot on *Salix Caprea*, and was forwarded by him to Fries, who described it as *Sphaeria acervalis* Moug. (Elenchus Fung. ii. 83; 1828). The description is "emersa, nuda, in acervulos minutos congesta, atra, peritheciis globosis subconnatis rugulosis, demum umbilicatis." Fries added that the species was anomalous in his tribe *Caespitosae*, in that the stroma developed beneath the epidermis and was exposed by the rupture of the latter. When fully developed, the stroma was obliterated by the rather prominent perithecia. The asci were filiform, with very small spores. Mougeot also sent specimens to Duby, who published it as *Sphaeria coacervata* (Moug., *in litt.*), 'Botanicum Gallicum,' ed. 2, pt. 2, 692 (1830).

Desmazieres (in Ann. Sci. Nat. sér. 3, vi. 71; 1846) recorded a var. *samorum*, found on the fruits of Ash, and stated that the

account given by Fries of the asci and spores was incorrect. In the type on *Salix Caprea*, which he had received several times from Mougeot, as well as in specimens on the fruits of *Acer Negundo* and on the samaras of the Ash, the asci were clavate and 66–100 μ long, while the ascospores were ovoid, or pyriform, or most usually oblong, obtuse, three-septate, 20 μ long. Desmazieres issued specimens on *Acer Negundo* in Pl. Crypt. France, ed. 1, no. 1260, var. *Juniperi* on dry branches of *Juniperus virginiana* in no. 1758, and var. *samorum* on fruits of Ash in no. 1759.

Montagne, in 'Flore d'Algérie,' i. 478, recorded *Sphaeria acervalis* on branches of *Lentiscus*, dry stems of *Chenopodium album*, old leaves of *Agave*, and fragments of the pericarp of *Lagenaria vulgaris*. He stated that the asci and spores were the same as in *Sphaeria pulicaris*, though he cited Desm. Crypt. France, no. 1260.

Fuckel (in Symb. Mycol. 166; 1869) included this species as *Gibbera acervalis*. He gave the asci as oblong, sessile, 76 × 10 μ, and the spores as oblong-ovate, straight, three-septate, 18 × 6 μ. He issued specimens on *Salix Caprea* in 'Fungi Rhenani,' no. 2043. Saccardo transferred it to *Gibberella* (in 'Michelia,' i. 318; 1878), and included it in the 'Sylloge Fungorum' with Fries's description and microscopic details from Fuckel. Wollenweber, in 'Fusaria autographice delineata' (1916) figured the spore of *Gibberella acervalis* as one-septate, thus making it a *Lisea*, and he raised Desmazieres's var. *Juniperi* to the rank of a species as *Gibberella Juniperi* (Desm.) Wollr., while in 'Pyrenomyceten-Studien,' ii. 206 (1926), he gave the spores of *Gibberella* (*Lisea*) *acervalis* as one-septate, 15 × 4·7 μ, and those of *Gibberella Juniperi* as three-septate, 20 × 6 μ, or one-septate, 15·3 × 6·3 μ.

Mougeot sent a specimen of *Sphaeria acervalis* to Hooker on January 25, 1825. That is now in Herb. Kew., labelled in Mougeot's handwriting, "*Sphaeria acervalis* nob., *bacculata* Pers., *in litt.*, 10 Jan. 1825. Ad ramos dejectos *Salicis Capreae*, Autumno." This specimen was examined by Currey, who gave the spores as one-septate, 12·5 μ long. The spores are ellipsoid or fusoid, one-septate, usually symmetrical, sometimes slightly inequilateral, 11–17 × 5–6 μ, or oblong-oval, three-septate, 18–22 × 6–7 μ. It is obviously a *Gibberella*, not quite mature. In *Sphaeria acervalis* Moug. var. *Juniperi* Desm. Crypt. France, no. 1758, the spores are chiefly three-septate, narrow-oval or oblong-oval, sometimes slightly inequilateral, sometimes fusoid, straight, 15–18 × 6–8 μ, or one-septate, 18 × 5 μ; the perithecia are the same as in Mougeot's specimen. In the available specimen of var. *samorum*, Desm. Crypt. France, no. 1759, the perithecia are immature. In a specimen of 'Desm. Crypt. France, no. 1260, on *Acer Negundo*, the perithecia are over-ripe,

most of the ascospores having germinated; they are narrow-oval or oval, ends rounded, sometimes subcymbiform, straight or slightly curved, three-septate, 18–25×6–9 μ, or one-septate, 18×6 μ. In Fuckel, 'Fungi Rhenani,' no. 2043, the perithecia are the same as in Mougeot's specimen, but the spores are mature, narrow-oval, three-septate, rarely inequilateral or fusoid, 14–18×6–7 μ. *Sphaeria acervalis* Mougeot, *Sph. acervalis* Moug. var. *Juniperi* Desm., and *Gibbera acervalis* (Moug.) Fckl. are the same species, which must stand as *Gibberella acervalis* (Moug.) Sacc.

The stroma develops beneath the epidermis, rupturing it. It is plectenchymatous, and may form an evident cushion, or it may spread out over the host in a thin byssoid film. In the former case, the group of perithecia is often surrounded by the upturned epidermis. The perithecia are cæspitose in small flat clusters, sometimes solitary, and are globose, ovoid, or conoid, about 0·25 mm. diameter, but sometimes up to 0·3 mm., collapsing centrally, minutely rugose, black. In the herbarium specimens, the wall is purple-brown or purple-violet by transmitted light, thin, with thicker darker areas on the upper part. The asci are cylindrico-clavate, sessile, 80×9–13 μ, and the spores are narrow-oval or oblong-oval, ends rounded, usually symmetrical, rarely inequilateral or fusoid, three-septate, 14–22×6–7 μ, or ellipsoid or narrow-oval, one-septate, 11–18×5–6 μ, generally not constricted at the septa.

33. Sphaeria affinis Grev.

Sphaeria affinis was described by Greville in 'Scottish Cryptogamic Flora,' pl. 186, fig. 1 (1826), from specimens collected at Appin by Carmichael on *Ephebe lanata* Waino. It was subgregarious or scattered, sessile, orange-coloured, globose, desitute of orifice, whitish and filamentous at the base. The ascospores were large, mostly oblong, one- or two-septate. Carmichael suggested that it was the plant figured in 'English Botany,' plate 2318, and Greville considered that probable. Fries ('Elenchus Fungorum,' ii. 93; 1828) suggested that the fungus was a *Peziza*, but Berkeley ('English Flora,' v. pt. 2, 263; 1836) stated that he saw no reason for doubting that it was a *Sphaeria*. However, in 'Notices of British Fungi,' no. 607 (1851), Berkeley and Broome wrote, "It appears that *Sphaeria affinis* is nothing more than the fruit of the *Stigonema*," i. e., *Ephebe lanata*."

Berkeley sent part of the Appin collection to Bornet, who described it in Ann. Sci. Nat. sér. 3, xviii. 165 (1852). He stated that the perithecia were globose, membranous, and seated on a byssoid tissue; the asci clavate and eight-spored; and the spores elliptical, elongated, pale yellow, three-septate, and

produced at each end into a long hyaline point, of which one was straight and the other curved. Bornet also stated that the lower figure of plate 2318 of 'English Botany' represented *Collema muscicola*, not *Ephebe lanata*.

In 1850 Roussel found this species at Fontainebleau, and it was redescribed by Desmazieres (in Ann. Sci. Nat. sér. 4, iv. 128; 1855) as having subpapillate perithecia, and spores sigmoid, three-septate, 30×10 μ, with a seta, 10–15 μ long, at each end. There are specimens of this collection in Herb. Kew. and Herb. Brit. Mus.

Saccardo (in 'Michelia,' i. 317) instituted a new genus, *Paranectria*, for this species, taking his description from Desmazieres. Cooke (in 'Mycologia Scotica,' 362; 1879, and 'Grevillea,' viii. 9) dissented, and, stating that he had examined authentic specimens from Greville and Roussel, declared that Saccardo must have been dealing with a different species. Though the perithecia he examined were immature, Cooke decided that *Sphaeria affinis* was a *Nectria*, which he described as *Nectria affinis* (Grev.) Cooke, with spores probably not exceeding 12 μ in length. Accordingly, in 'Sylloge Fungorum,' ii. (1883), Saccardo included *Nectria affinis* (Grev.) Cooke, from Appin, and *Paranectria affinis* (Grev. ?) Sacc., from Fontainebleau, querying the occurrence of the latter in Great Britain. But there is no doubt whatever that Cooke was mistaken, and that the Appin specimen, which is *Sphaeria affinis* Grev., agrees with Saccardo's description of *Paranectria affinis*, as is also evident from Bornet's account of it.

The Appin specimen has globose membranous perithecia, 0·25–0·33 mm. diameter, superficial, united to the host by a pad of white mycelium, from which hyphæ sometimes extend over the perithecium, and may bind two or three perithecia in a cluster. The perithecia are ostiolate, but the ostiolum is not, or very slightly, elevated. The asci are at first oblongo-clavate, 40–45×12–14 μ, with the spores obliquely uniseriate, but as the spores mature the ascus becomes ovate, 18 μ diameter, and the spores in a more or less parallel bundle. In the ascus, the obliquely uniseriate spores may appear sigmoid. When mature, the ascospores are hyaline, three-septate, with a central, fusoid, sometimes inequilateral body, 24–34×6–8 μ, attenuated into a long point, up to 15 μ long, at each end, the upper usually curved and the lower straight.

34. Hypocrea gelatinosa (Tode) Fr.

Hypocrea gelatinosa was described by Tode in 1791 as *Sphaeria gelatinosa*, compound, pulvinate, gelatinous, yellow, with straw-coloured perithecia in a single layer, extruding separate globules of spores. He distinguished two forms, *lutea* and *viridis*, of the same shape, colour, consistency, and size, and both growing

on wood. *Lutea* was straw-coloured, soft, almost gelatinous, without a conspicuous or separable cortex, even, but becoming papillate when mature, containing globose yellow perithecia with a vivid yellow ostiolum and pale yellow spores. *Viridis* was at first white, with white pruina, becoming yellow and glabrous, with a papyraceous cuticle which was inseparable from the context, and dark green perithecia, which stood out like black granules on the old fungus. It has been suggested that Tode's *lutea* was the immature form of *viridis*, but on the contrary he described and figured the extruded spore masses of the former, but stated that he had not seen the fructification of the latter.

Fries (Syst. Mycol. ii. 336; 1823) described *Sphaeria gelatinosa* as fleshy, convex, opaque, white internally, with prominent darker perithecia, citing *S. gelatinosa* Tode, and giving the forms, a. *pallida* (*S. pallida* Pers.), b. *lutea*, c. *viridis*, and d. *umbrina* (*S. luteo-umbrina* Schum.). He stated that it was gregarious, 1–3 lines wide, pulvinate, soft, with loosely adherent, evanescent mycelium at the base, and, when dry, equal, punctate with the perithecia. He added that the forms reported were often only the product of age. It will be noted that the word gelatinous has now disappeared from the description.

Berkeley (in 'English Flora,' v. pt. 2, 238; 1836) repeated Fries's description, adding that the fungus was rare, and varied in colour, pallid, yellowish, green or umber, dotted with the darker ostiola. Cooke ('Handbook of British Fungi,' 774; 1871) quoted Berkeley, adding, from Currey, that the spores were colourless, 5μ long, nearly round when free. Fuckel (Symb. Mycol. 184; 1869) gave the part-spores as pale yellow, unequal, the upper globose, 4μ diameter, and the lower ovate, 3μ wide. Saccardo ('Sylloge Fungorum,' ii. 524; 1883) stated, *inter alia*, that the stromata were pulvinate or hemispherical, equal when moist, but somewhat collapsed and wrinkled when dry, rather soft, punctate with projecting perithecia, at first pallid, then yellowish, finally green; he cited Fuckel's measurements of the spores, but described them as olivaceous or pale yellowish, and entered the species among those having coloured spores. Winter (in Rabh. Krypt. Flora, ii. 140; 1887) followed Saccardo.

Thus, the older mycologists, from Fries to Cooke, appear to have regarded *Hypocrea gelatinosa* as a species with hyaline or pale yellowish spores, but at the present day, following Saccardo and Winter, it is usual to take it as having dark green spores. Such spores, in *Hypocrea*, usually become olivaceous in the herbarium. To such an extent did the older view prevail that when Cooke and Massee were sent the form with dark green spores in 1888, they re-described it as *Hypocrea moriformis*. This green-spored form has been transferred by Seaver to a new genus, as *Chromocrea gelatinosa* (Tode) Seaver.

There is little doubt that Tode's *lutea* and *viridis* are two distinct species. *Viridis* appears to be the commoner, a fact which has probably influenced mycologists. When fresh, it is subtranslucent, the perithecia with their dark green contents being visible through the stroma. I have not seen *lutea* in a fresh condition, but from the herbarium specimens it does not appear to have been translucent when fresh. Currey had specimens of *lutea* (now in Herb. Kew.), from Hurst Wood, October 1856, and at first labelled them with a new name, but subsequently crossed that out and assigned them to *Hypocrea gelatinosa*. Those examples are on dead leaves, and there are others on the same substratum in Herb. Brit. Mus., from Tumby, Lincs, October 1905, undetermined, *ex* Herb. Hawley, marked "Stroma ochraceous externally when fresh." I propose to distinguish this form as *Hypocrea lutea*. The following description has been drawn up from the herbarium specimens :—

Hypocrea lutea, comb. nov.; *Sphaeria gelatinosa* f. *lutea* Tode, Fung. Meckl. ii. 48 (1791).

At first white, circular, byssoid, plane, becoming fleshy, pulvinate or discoid, up to 2 mm. diameter, sometimes with a narrow byssoid margin, ochraceous when fresh (Hawley), red-brown when dry, sometimes subtranslucent above, minutely tuberculate with perithecial elevations; outer layer of the stroma and walls of the perithecia yellow-brown; internally white, friable, sometimes with a harder core at the base; perithecia globose or vertically ovoid; asci cylindrical, 90–100$\times$5μ; part-spores unequal, globose, 4–4·5μ diameter, or oval, 5$\times$3·5–4·5μ, sometimes 7$\times$4μ, hyaline, minutely warted. On dead leaves, Hurst Wood, October 1856 (Currey), Herb. Kew.; ditto, Tumby, Lincs, October 1905 (Hawley), Herb. British Museum.

There are specimens of this species, as *Hypocrea gelatinosa* f. *foliicola*, in Karsten, Fungi Fenniae Exs. no. 469, in Herb. Kew. and Herb. Brit. Mus.; Sydow, 'Mycotheca Marchica,' no. 4635, in Herb. Brit. Mus.; and Sydow, 'Mycotheca Germanica,' no. 693, in Herb. Kew.

PLANTAGO LANCEOLATA VAR. *ANTHOVIRIDIS* WATS.

By Walter Watson, D.Sc., A.L.S.

In May 1919 a ribwort plantain differing from the type was noted in a lane near Taunton. It was noted in the same place for three consecutive years, and also found in other localities in the Taunton area. As it remained constant in its characters a short notice of it was given in this Journal (1921, 355), the name *anthoviridis* (erroneously given as *anthoviride*) was suggested for it, and other notes have appeared since. Mr. F. Rilstone, to whom I showed the plant when we were botanizing together

in Merionethshire, found the plant in Cornwall, made some references to it in the Reports of the Botanical Society and Exchange Club, and, in a note in this Journal (1935, 234), called attention to some variations present. This was followed by a short note from me (1936, 22), in which the hope was expressed that some experiments that were being carried out would result in obtaining plants from "selfing." Previous experiments had been inconclusive, because of contamination with pollen from plants of the type, but suggested that the factors causing greenness of anthers and shortness of filaments were recessive.

In 1935 the plant in my garden was in flower earlier than any other *Plantago lanceolata* noticed in the vicinity, so that it was almost certain that "selfing" had occurred. The first lot of seeds which ripened were taken from the plant, and it was assumed that all the seeds—or, at any rate, a very high percentage of them—had resulted from "selfing." On February 19, 1936, about eighty of these seeds were planted on a plot in my garden. Between July 1 and August 15 nine plants of the type were removed. Before the end of August thirty-six plants which were in flower, or had flowered, were pulled up and all, with one possible exception, were the var. *anthoviridis*. Five other plants flowered at a later date and were removed, and four of these belonged to the variety. A few which did not reach the flowering stage were left *.

The results show that the "selfed" plant breeds true, as of fifty plants which flowered during 1936 in the plot forty were the variety. The nine to ten plants of the type were probably due either to plantain seeds from other sources which were in the soil or to a small quantity of seed having been formed by the aid of pollen from a plant of the type. The first is certainly the principal cause of the occurrence of the typical plants, as the plot on which they were grown was previously a grass one with plantains and docks present. Even in 1936 some docks, in addition to the typical plantains, were removed, showing that contamination from previous years had occurred.

Further observations and measurements were made of the stamens in the form of the var. *anthoviridis* which shows some approach to the type (see this Journal, 1935, 234, and 1936, 22) in the greater emergence of the anthers, and comparisons were made with the type. It was found that the filaments were shorter, either curved or less patent than in the type. The anthers still retained the greenish tint and were smaller, though relatively longer. The pollen-grains vary in both type and variety, but the mature ones of the latter usually have a diameter little more than three-quarters that of the former.

The following description is more complete than that given in the 1921 note :—Stamens erect or almost so, never patent

* Since this was written, twenty-seven more plants have appeared on the plot and twenty-five of these are the variety.

as in the type; filaments shorter, and often much shorter; anthers greenish yellow and long-elliptical instead of whitish and oblong-spheroidal; pollen-grains usually imperfect and small (18–20 μ) when the anthers are almost sessile: when the anthers are longer many of the pollen-grains are larger, but usually under 30 μ (in the type they are usually over 30 μ). Plant sometimes more robust with longer and more narrowly lanceolate leaves, and with longer cylindrical spikes, but these characters are too variable, both in type and variety, for any reliance to be placed on them.

BIBLIOGRAPHICAL NOTES.

CIV. WILLDENOW'S 'HORTUS BEROLINENSIS.'

By WILLIAM T. STEARN.

CARL LUDWIG WILLDENOW'S 'Hortus Berolinensis,' a two-volume folio work, describing and illustrating in colour 108 new or little-known plants cultivated in the Berlin Botanic Garden early last century, was published at Berlin in ten fascicles between 1803 and 1816. A note by B. B. Woodward in 'Cat. Books Brit. Mus. (Nat. Hist.)' v. 2324 (1915) removed part of the uncertainty as to their dates and contents, but left much unsettled. Willdenow's preface to vol. i. is dated "8 Aprilis 1806," the title-page simply "MDCCCVI." Wildenow * died July 10, 1812; an obituary in 'Ges. Naturf. Fr. Berlin Mag.' vi. p. xi (1814) states that he had already published three parts of the second volume. His successor, Heinrich Friedrich Link, brought the work to an end; Link's epilogue to vol. ii. is dated "4 Aprilis 1816" and the title-page "MDCCCXVI." The library of the Botanisches Museum in Berlin-Dahlem possesses fascicles 1–7 in their original wrappers. Contemporary periodicals, such as 'Allgemeines Teutsches Garten-Magasin' (Weimar), which listed from time to time the new horticultural and botanical publications available at the Easter and Michaelmas book-fairs of Leipzig, 'Fortsetzung des Allg. Teutsches Gart.-Mag.' (Weimar), 'Botanische Zeitung' (Regensburg), 'Göttingische gelehrte Anzeigen'

* Willdenow was born August 22, 1765, in Berlin, where his father, Johann Carl Willdenow (1737–90), was an apothecary; he too qualified as an apothecary and then went on to study medicine at the University of Halle, graduating in 1789; he then returned to Berlin, became Professor of Natural History at the Royal Medico-chirurgic College in 1798, and Botanist to the Academy of Sciences and Director of the Royal Botanic Garden on Johann C. A. Mayer's death in 1801; in 1804 he travelled through Austria to north Italy and in 1810 through Holland, Belgium, and France; when in 1810 King Friedrich Wilhelm of Prussia founded the University of Berlin to counteract Napoleon's seizure of Halle, Willdenow became its first Professor of Botany. His herbarium is now at the Botanisches Museum in Berlin-Dahlem. For the dates of publication of Willdenow's most important work, 'Caroli a Linné Species plantarum . . . editio quarta . . . curante Carolo Ludovico Willdenow' (5 vols. in ten: Berlin, 1797–1810; vol. vi. was added by Link in 1824–25), see J. Briquet, 'Règles Internat. Nomencl. Bot.' art. 39 (1906), [ed. 3, art. 45 (1935)].

(Göttingen), the half-yearly catalogue of the Leipzig bookseller J. C. Hinrichs ('Verzeichnis neuer Bücher'), and Millin's 'Magasin encyclopédique' (Paris), reviewed or mentioned the fascicles as they appeared. Together these establish publication as follows :—

Volume.	Fascicle.	Contents.	Date.	Authority.
I.	1.	Pls. 1–12.	1803.	Hinrichs, Verz., Juli–Dec. 1803, 119; Mag. Ency. **9,** iv. (16) 545–8 (Nivose an 12, i. e., Dec. 1803); Bot. Zeit. **3** (7) 112 (Apr. 1804).
I.	2.	Pls. 13–24.	1804.	Gött. Anz. **1804,** i. (48) 470–6 (March 1804); Mag. Ency. **9,** vi. (22) 269–72 (1804).
I.	3.	Pls. 25–36.	1804.	Hinrichs, Verz., Jan.–Jun. 1804, 136; Bot. Zeit. **3** (22) 337–44 (Nov. 1804); All. Teut. Gart. Mag. **1** (8) 361 (1804, prob. Oct.); Gött. Anz. **1804,** iii. (199) 1979–82 (Dec. 1804).
I.	4.	Pls. 37–48.	1805.	Hinrichs, Verz., Jan.–Jun. 1805, 166; All. Teut. Gart. Mag. **2** (5) 205 (1805, prob. June); Mag. Ency. **1806,** iii. 208–9 (May 1806).
I.	5.	Pls. 49–60.	1805.	All. Teut. Gart. Mag. **2** (10) 423 (Oct. 1805); Hinrichs, Verz., Juli–Dec. 1805, 61; Bot. Zeit. **5** (3) 44–7 (Feb. 1806).
I.	6.	Pls. 61–72, preface, plan A.	1806.	All. Teut. Gart. Mag. **3** (6) 230 (June 1806); Hinrichs, Verz., Jan.–Jun. 1806, 120; Mag. Ency. **1806,** v. 478–80 (Oct. 1806); Bot. Zeit. **6** (6) 81–7 (Mar. 1807); Gött. Anz. **1807,** i. (56) 553–75 (April 1807); Schrader, Neues Journ. Bot. **2,** ii.–iii. 110–130 (1808).
II.	7.	Pls. 73–84.	1806.	All. Teut. Gart. Mag. **3** (6) 375 (Sept. 1806).
II.	8.	Pls. 85–96.	1809.	All. Teut. Gart. Mag. **6** (6) 228 (June 1809); Hinrichs, Verz., Juli–Dec. 1809, 62.
II.	9.	Pls. 97–108.	1812.	Hinrichs, Verz., Jan.–Jun. 1812, 107.
II.	10.	Plan B+ Epilogue.	1816.	Fort. All. Teut. Gart. Mag. **2** (1) 39 (1816); Hinrichs, Verz., Jan.–Jun. 1816, 113.

Besides the above Willdenow published an 'Enumeratio plantarum horti Regii botanici Berolinensis' (2 vols., 1099 pages, Berlin, 1809, between January and June), to which a 'Supplementum post mortem autoris editum' (70 pages, Berlin, 1814, between July and December) was published by D. F. L. von Schlechtendal. Link followed this with an 'Enumeratio plantarum horti Regii botanici Berolinensis altera (vol. i., 458 pages, Berlin, 1821, between January and June; vol. ii., 478 pages, Berlin, 1822, between January and June) and later with a 'Hortus Regius botanicus Berolinensis descriptus' (vol. i. 384 pages, Berlin, 1827, between July and December; vol. ii. 376 pages, Berlin, 1833, between July and December).

SHORT NOTES.

THE CORRECT NAMES OF THE SMALL-FLOWERED MALLOWS.—C. V. Morton ('Rhodora,' xxxix. 98; March 1937) gives the following key to the small-flowered Mallows. There is confusion with regard to *M. rotundifolia* L., as Linnæus had two plants under this name. The author considers that the name *M. rotundifolia* should be used for the plant formerly known as *M. pusilla* Withering :—

Bractlets of the calyx ovate..... *M. nicaeensis* All.
Bractlets of the calyx linear or linear-lanceolate.
  Claw of petals glabrous ..... *M. parviflora* L.
  Claw of petals bearded.
    Carpels reticulate, sharp-margined ..... *M. rotundifolia* L., p.p. (*M. pusilla* With., *M. borealis* Wallm.).
    Carpels smooth, round-margined ..... *M. neglecta* Wallr. (*M. vulgaris* Fries, *M. rotundifolia* Auct. Angl.).

There are specimens of *M. neglecta* Wallr. from Wallroth in Herb. Kew.—E. G. B.

ERIGERON MUCRONATUS DC. IN BERKSHIRE.—This Mexican garden plant has become naturalized on a stone retaining-wall on the Thames at Abingdon, where it appears to be thoroughly at home. Specimens have been deposited in the British Museum (Natural History) Herbarium.—J. BURTT DAVY.

REVIEWS.

Flora of Tropical Africa. Edited by Sir ARTHUR W. HILL, K.C.M.G., F.R.S. Vol. x. pt. 1. *Gramineae* (continued). By C. E. HUBBARD. 8vo, pp. 192. L. Reeve & Co., Ltd.: Ashford, 1937. Price 15*s*.

THE continuation of the Gramineae marks a welcome step towards the completion of this important Flora. The presen

number includes the genera from 86. *Arundinella* to 101. *Agrostis*, which is not quite finished, and in the form of its detailed critical descriptive work follows the standard of the later parts of the Flora—a marked contrast with those of the early volumes when the material and literature were scanty, nomenclature less exacting, and synonymy a mere bagatelle. The late Mr. Hiern, who elaborated several families for the Flora, once told the writer that the number of species described in a day was a mark of industry. But we have changed all that !

Mr. Hubbard has the great advantage of working on foundations laid by the late Dr. Stapf, and the part naturally bears evidence of his work on the family. But individual critical work is also apparent in the author's occasional recasting of genera, and there has in addition been a great influx of new material to determine. New species and varieties have been described in the ' Kew Bulletin ' : this obviates the disadvantage of the insertion of the Latin diagnosis required by the Rules.

Among the more serious changes may be noted the reconsideration of distinctive generic characters between *Trichopteryx*, *Tristachya*, and *Danthoniopsis*, and the restoration of Hochstetter's genus *Loudetia*—to which the majority of the species of *Trichopteryx* are transferred ; these changes have necessitated the introduction of many new combinations and the scrapping of familiar names. The replacement of *Avenastrum*—an illegitimate name—by the less pleasing but legitimate *Helictotrichon* is a regrettable necessity ; and *Phaenanthoecium* (!), a new monotypic genus from the Sudan and Abyssinia, illustrates the difficulty in the present day of finding short and pleasing names for new genera.

A fair proportion of the genera or species are familiar to British botanists : *Aira caryophyllea* appears in somewhat different forms, and there are varieties of *Deschampsia caespitosa* ; *Phragmites communis* comprises a large number of variations due to differences in habitat or representing distinct geographical races ; *Koeleria cristata* is represented in four varieties ; and there are thirty-six species of *Agrostis*.

It is rare to find a misprint in this carefully edited ' Flora '—" temperature " for " temperate " on p. 100 is an unusual example.

We congratulate Mr. Hubbard on the progress of his work, and look forward to its completion.—A. B. R.

Dendro-Chronological Studies. By STELLAN ERLANDSSON. 4to, pp. vi, 120, 5 pls., 32 text-figs. Data 23, Fr. Stockholms Högskolas Geokronol. Inst. : Uppsala, 1936.

THIS paper describes an intensive investigation of annual growth-rings in trees as indicators of climate and weather

conditions. The correlation of tree-growth with climatic factors over a period of years is complicated by the existence of non-climatic accidental factors (silvicultural operations, local variations in soil, incidence of fungus and insect attack, etc.) and the difficulty of analysing the effect of the various factors involved. The effect of the non-climatic factors was eliminated so far as possible by studying a large number of trees distributed over a wide and varied area and by the use of statistical methods of analysis.

The author's investigations show that the development of the annual ring in the particular district concerned (northern Sweden and Finland) depends mainly on the temperature conditions during the month of July. There is a doubtful relation between tree-growth and the amount of precipitation either during the growing season or in the preceding winter. Naturally the relative importance of temperature and precipitation is not the same everywhere, and the conclusions drawn from this investigation are not of general application. In the arid regions of western North America, for example, tree-growth is primarily dependent on the amount of precipitation, and there is evidence that the same is true of Central European forests.

The author's researches into the influence of solar radiation and the 11-year sun-spot cycle are of interest in connection with the work of Douglass (' Climatic Cycles and Tree Growth '). Douglass has demonstrated a direct influence of the solar cycle on tree-growth, but under normal climatic conditions this effect is probably secondary to that of temperature and precipitation. The author has evolved a method of calculating the incremental growth of trees from meteorological data which shows a remarkably close agreement with actual measurements. He goes so far as to suggest that it may be possible to forecast the future increment of forest crops, but is unwilling to commit himself as to the practical applications of this procedure.—B. J. RENDLE.

A Monograph of the Genus Heuchera. By CARL OTTO ROSENDAHL, FREDERIC K. BUTTERS, and OLGA LAKELA. Minnesota Studies in Plant Science.—II. 8vo, pp. 180, 5 figs. University of Minnesota Press, Minneapolis, and Oxford University Press, London, 1936. Price 13*s.* 6*d.*

THE Linnæan genus contained one species, *Heuchera americana*. Torrey and Gray ('Flora of North America,' 1840), to whom is due the sectional division of the genus, recognized 15 species ; Rydberg (1905) described 72 species, which the senior author of the present monograph reduced, in the same year, to 27, treating many of the others as varieties. In the

present monograph 51 species are recognized, as well as varieties and hybrids.

In an introduction the authors discuss the taxonomic position and morphological characters of the genus, of which they recognize five sections, by the addition of one (*Rhodoheuchera*) to the four established by Torrey and Gray. The existence of somewhat promiscuous hybridization between the species, which are probably generally self-sterile, has often rendered difficult the sharp distinction of species, owing to the numerous intergradations that occur, and certain rules for guidance have had to be adopted. Characters of the hypanthium, the structure intervening between the inferior portion of the ovary and the base of the sepal limbs, afford useful sectional characters ; characters both sectional and specific are also found in sepals, petals, and stamens, and especially in the parts of the ovary. Phyletic relationships of the sections and subsections are discussed.

The synoptical taxonomic treatment is detailed and critical, and includes keys to the sections, subsections, and species as well as full descriptions of each category, with synonymy. Geographically arranged lists of the specimens examined are given. A proportion of new species, varieties, and forms are included.

Botanists interested in the genus will welcome this detailed and careful revision.—A. B. R.

Leguminous Forage Plants. By D. H. Robinson, Ph.D. 8vo, pp. viii, 119, text-figs. 35. Edward Arnold & Co.: London, 1937. Price 6*s*.

Dr. Robinson is Head of the Biology Department, Harper Adams Agricultural College, Newport, Shropshire, and therefore appreciates the needs of students of Agriculture and others interested in farm-crops. There has been a lack of a convenient book in English which describes leguminous forage plants sufficiently well for the inexperienced individual to recognize them. To supply this want the author describes and illustrates, by sketches drawn by himself from living specimens, each species together with its seedling.

An introductory chapter describes general characters, especially of fruit and seed, with notes on germination and nitrogen-fixation. Successive chapters deal with the True Clovers (*Trifolium* spp.), the Medicks (*Medicago*), other Pasture Plants, Birdsfoot Trefoils (*Lotus*), Kidney Vetch (*Anthyllis*), Plants grown as Field Crops (Sainfoins, Lupins and Melilot), and Pulse Crops sometimes grown for Fodder), Field Beans,

Vetches, Field Peas, and Soya Bean. Our climate is, as a rule, too wet to allow of remunerative crops of Soya as a seed, though it might be successful as a green crop. An Appendix gives some seed-statistics—weight per 1000 and per bushel, reasonable standards of purity and germination, &c., with figures of each seed.

The book should well serve the purpose for which it has been devised.

The Plant Diseases of Great Britain. A Bibliography. Compiled and annotated by G. C. Ainsworth, B.Sc., Ph.D. 8vo, pp. xii, 273. Chapman & Hall, Ltd. : London, 1937. Price 15*s*.

The literature of plant pathology grows very rapidly, and it is to be feared that most plant pathologists have to be satisfied with abstracts of those original papers which do not deal directly with the particular crops with which they happen to be mainly concerned.

Dr. Ainsworth's aim in the book under review has been " to attempt to collect together in a convenient form the key references for the principal plant diseases of Great Britain, so that descriptions of the symptoms, the causal agents, and methods of control may be quickly found and additional information discovered." The form of the bibliography has much in common with the Ministry of Agriculture's "Reports on the Occurrence of Fungus Diseases of Crops in England and Wales" and the British Mycological Society's "List of Common Names of British Plant Diseases."

The host-plants are grouped as cereals, fodder crops, root crops, and so on ; in the more important diseases the references follow from general accounts through descriptive to methods of control. A brief summary of the contents of the majority of the papers is given in the manner of an annotated list of references ; these notes vary in length and aim at giving information about the papers which cannot be gained from the title. The notes vary also in value ; some really are summaries, but a few annoy by merely stating that something is a detailed study and give no clue as to what results are worthy of note.

The book does not attempt completeness either in the list of diseases or of references, and so the author cannot be criticised, except for his choice, which I do not think would be everyone's.

The bibliography will be useful in botanical laboratories and to those beginning the study of plant pathology who can afford the high price.—J. R.

BOOK-NOTES, NEWS, ETC.

'JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY.'—Vol. lxii. pt. 5 (May) contains a discussion by J. R. Sealy on the distinctive characters of the four genera of Amaryllidaceae, *Zephyranthes*, *Pyrolirion*, *Hippeastrum*, and *Habranthus* established by Dean Herbert, but combined by Baker in his 'Handbook of the Amaryllideae' into two, *Zephyranthes* and *Hippeastrum*. There has been some confusion in the distribution of individual species among these genera. The author is of opinion that all four genera are distinct. He gives a diagnosis for each followed by a list of the species that should be included therein. This has necessitated the making of a few new combinations.

Dr. E. Green reports progress on the work at the Wisley Garden on the production of rust-resistant strains of Antirrhinums. Some progress has been made, but forms with colours desired in horticulture have not yet been developed.

'BULLETIN DE LA SOCIÉTÉ ROYALE DE BELGIQUE, Vol. ix.—Under the title 'Les Champignons Séminicoles des Forêts Tropicales,' L. Hauman summarizes the present knowledge of the minute and obscure fungi associated with seeds, mainly based on observations in the Congo. After a general discussion of what is known as to their form and occurrence, he describes seventeen species included in four genera. He suggests that they are much more plentiful than has been thought, for a single observer in a few days at one place in the Congo forest found seven species, six of which were new and three represented new types. Their taxonomic position is uncertain, as, except in three species, perithecia have not been observed.

Mme Nihoul-Ghenne describes the anatomy of the Crucifer, *Subularia aquatica*, which is found to be that typical of water-plants; and Mlle B. Moulaert describes the anatomy and histology of the epiphyllous buds on the leaves of *Drosera rotundifolia* and *D. intermedia*, which develop new individuals. Other papers deal with various aspects of the Belgian flora.

'AMERICAN JOURNAL OF BOTANY,' May.—As a result of the study of the style and stigma with reference to the nature of the carpel, Kenneth W. Hunt concludes that the carpel has been derived from portions of a primitive dichotomous branch system through the intermediate stage of an unspecialized, palmately three-lobed appendage. Leaf and carpel are both considered to have evolved along independent lines of specialization from this primitive three-lobed appendage. A. S. Foster reviews evidence for the development of other than epidermal cells from the primary dermatogen, and shows that the marginal growth of the bud-scales in species of *Rhododendron*, by means of periclinal and anticlinal divisions, contributes new cells to the ground meristem and to the epidermal layers.

FIG. 1.

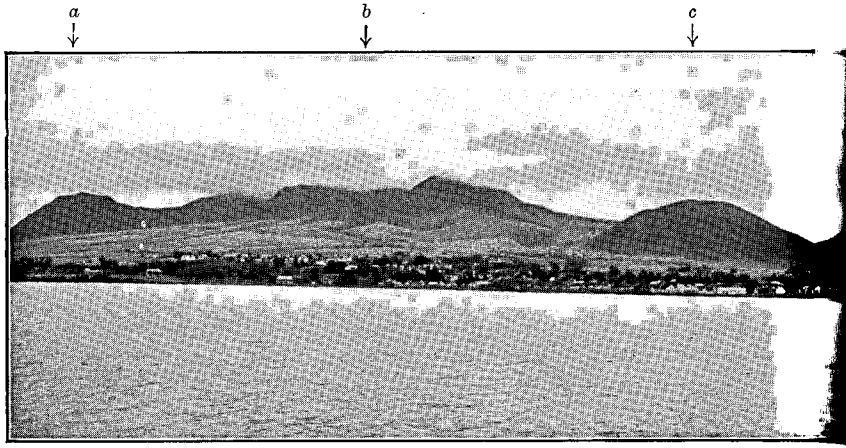


FIG. 2.

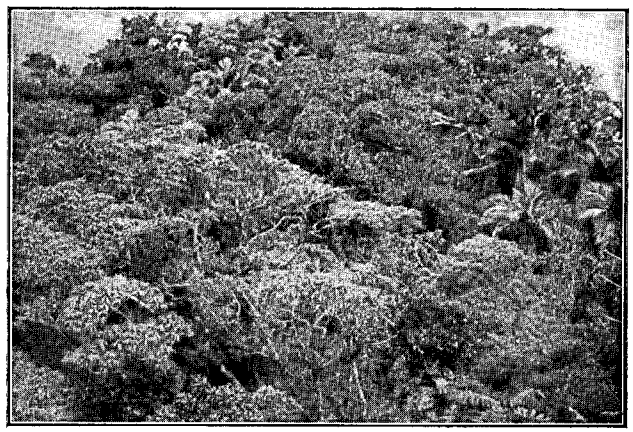


Fig. 1.—Panorama of Basseterre Harbour.
Fig. 2.—*Freziera-Acrista* association.

PTERIDOPHYTA OF ST. KITTS.

BY H. E. BOX AND A. H. G. ALSTON.

(PLATE 612.)

MR. BOX has followed up his collection from Antigua, which was described in this Journal in February 1935, with one from St. Kitts. Very little has been published on the Pteridophyta of St. Kitts, though considerable collections have been made, notably by Britton and Cowell. Dr. N. L. Britton and Mr. John F. Cowell visited the island in 1901 and published a short note in 'Torreya,' ii. 11–13 (1902), but gave no general list of the collection. Urban gives a short list of collectors in Symb. Antill. iii. 153. The earliest collection was that of Sir Hans Sloane, who visited St. Kitts in 1687.

A brief note on the vegetation of St. Kitts, abstracted from a letter from Sir Hercules Robinson, was published in Hooker's 'Journal of Botany and Kew Garden Miscellany,' ix. 115–19 (1857). The most extended list is that of W. H. Alexander—'The Flora of St. Christopher,' in Bull. Amer. Geogr. Soc. xxxiii. 207–19 (1901): it is a list of economic plants, wild and cultivated: he states that there are about 300 species of ferns in the island. Otherwise, except for references in general works, there is nothing dealing with St. Kitts.

OUTLINE OF THE PLANT ECOLOGY, WITH SPECIAL REFERENCE TO THE FERN FLORA. BY HAROLD E. BOX, F.R.E.S.

The island of St. Kitts, or more correctly St. Christopher's, is situated in lat. 17° 20′ N. and long. 62° 45′ W., at a distance of 45 miles west of Antigua. It has a total area of 65 square miles and is roughly the shape of a pear, lying north-west to south-east, with the "stalk" elongated and broadening out into a well-defined south-eastern peninsula, the extremity of which is separated from the island of Nevis by a shallow channel only two miles in width. To the north the Dutch island of St. Eustatius (Statia) lies at a distance of six miles.

The southern promontory is three miles in breadth, and is joined to the main island by a narrow strip of land less than a mile wide; it embraces numerous low conical hills and ridges, separated from each other by sea-level sandy flats with salt ponds, very characteristic of this section of the island. This part of the island may be dismissed from our account, as the conditions are quite unsuitable for fern-growth. The only species likely to occur here are the common salt-marsh ferns, *Acrostichum daneaefolium* and *A. aureum*, neither of which has been found in the island. The loose sandy soil and rocky hills, constantly

exposed to sea-breezes, and with a rainfall of probably less than thirty inches annually, support little more than dry grassland or xerophytic *Croton* (*C. astroites*), *Lantana*, or *Leucaena* scrub, reminiscent of the drier parts of Antigua, though in protected gullies in the hills (which here do not exceed 600 ft. elevation) a dry type of scrubby woodland occurs, dominated by *Bursera gummifera* or *Pisonia subcordata*. There is practically no cultivation, but much waste land is given over to grazing of a poor type, chiefly by goats.

The main part of St. Kitts, where sugar-cane is the staple crop, is roughly oval, fourteen miles long and about five miles in average width. It consists essentially of two high mountain groups, whose summits exceed 3000 ft., separated at the middle of the island and at its greatest breadth by a well-defined saddle-like plateau (Phillips level), nearly 1500 ft. in elevation. From sea-level the land slopes upwards gradually and with remarkable uniformity to about 1200 ft., then more steeply to about 2500 ft., above which the forest-clad mountains rise, often nearly sheer, to magnificent peaks. In the south-eastern part of the main island lies the Basseterre Valley, and beyond the More Hills ecologically part of the south-eastern peninsula described above. About three to four miles above Basseterre, on the windward coast, are the Canada Hills, rising to 1260 ft.

The high mountains of the interior of the main island consist of two extinct volcano groups—Mt. Misery and Verchild's Mountain to the north-west, and the " South-East Range," with Olivee's Mountain the highest peak, to the south-east, of the Phillips Level divide. The following excellent description of Mount Misery, one of the most beautiful peaks in the West Indies, and its famous crater, is taken from K. W. Earle's ' Report on the Geology of St. Kitts ' (1922) :—

" The peak of Mount Misery (3,711 ft. high) on the rare occasions when it is not veiled in cloud, is seen to consist of a jagged cone-shaped pinnacle rising from the lip of the crater on its eastern side. On the western side the peak rises in a sheer cliff some 1,700 ft. high from the base of the crater, and some 1,000 ft. above the lip. On the south side it is separated by an impassable striding edge from another cliff several hundred feet high, rising from the forest-clad slope of the mountain base. On the north side only is the peak accessible, and the ascent is difficult and not one to be undertaken lightly, as the last 300 ft. or so entail cutting a way through heavy undergrowth* breast high and clambering on hands and knees over slippery moss-clad rock-surfaces. The crater is some three-quarters of a mile long and 500–700 ft. deep at different points. The descent is

* Consisting largely of the ferns *Dicranopteris furcata* (L.) Underw. and *D. bifida* (Willd.) Maxon.—H. E. B.

very steep, and in most places impossible. At the base of the basin the southern part is flat and generally holds rain-water varying in amount from a few inches to 2 or 3 ft., but no true crater-lake occurs. A cliff overhangs the lake. In the centre is slightly rising ground, covered in densely-growing tree-fern, which leads upwards by a small watercourse (dry) to the only active *soufrière* (boiling sulphur spring) in the island."

I have made three ascents to the summit of Mt. Misery and two visits to the heart of the crater below.

There is another crater with a shallow " crater-lake " (Dodan's Pond) near the summit of Verchild's Mountain, St. Kitts's second highest peak, but the heights of Olivee's Mountain, in the South-Eastern Range, consist of more rounded peaks and narrow ridges rising precipitously 500 ft. or more above the forested gorges below.

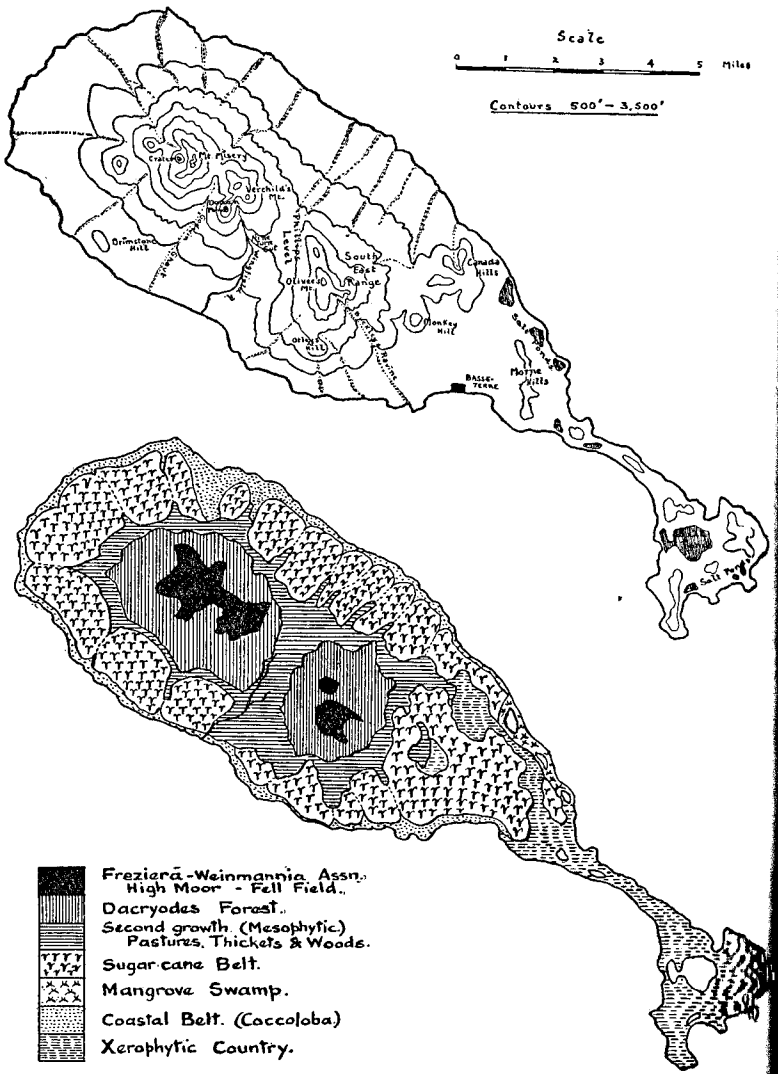
Notable isolated mountains are Brimstone Hill (779 ft.), and Otleys Hill (1789 ft.), flanking the western slopes of Mt. Misery and Olivee's Mt., respectively, and Monkey Hill (1174 ft.), a rounded prominence a mile to the north of Basseterre. The Canada Hills may be considered as the eastern group of the South-Eastern Range, and, with Monkey Hill, enclose a rich and highly cultivated area of sugar-cane over 1000 ft. above sea-level, known as " The Valley."

Owing to the steep gradients of the country and the extreme porosity of the soil—for the most part a light volcanic ash—there are no permanent streams other than the Wingfield River, which has its sources on the leeward slopes of Verchild's Mountain, and drains into the sea through Wingfield Estate at Old Road Town, immediately west of the divide which rises to Phillips Level. Very characteristic of the St. Kitts landscape, however, are the numerous deep clefts or " ghauts," V-shaped in section, which radiate from the mountains, penetrating the sloping glacis of volcanic ash to the sea ; though generally dry, these " ghauts " may become raging torrents in times of sudden heavy rains.

The annual rainfall of St. Kitts varies from less than 30 inches in the extremely xerophytic south-eastern peninsula, to well over 100 inches in the forested mountains of the interior and upland estates. In general, the south-eastern section of the main island south of Otley's Hill on the leeward and to the Canada Hills on the windward coast are definitely dry, with an average of less than 45 inches of rain annually.

Practically the only cultivation is sugar-cane, of which there are roughly 8500 acres. There is no peasants' cane industry, as in Antigua, and the general standard of the estates' cultivation is high. Very few fruits or ground provisions are grown, even the humblest vegetables being imported regularly from Nevis and elsewhere.

The sugar-cane belt is almost continuous round the island, from sea-level to about the 800 ft. contour, but broadening out



Contour and vegetation maps of St. Kitts.

considerably in the Basseterre Valley, where it extends southward to the foot of the Morne Hills. A few estates grow canes to nearly

1200 ft. above sea-level, and above the 1000 ft. level there are traces of abandoned estates in many places; these have been rendered unprofitable owing to the difficulties of haulage to and from the railway sidings below, and have reverted to second growth woodlands or pastures. The lower slopes of all the high mountains are covered with magnificent virgin forests, which have been well protected by estate-owners supported by the law; there is to-day very little, if any, encroachment on the forest-reserves above the 1500 ft. level.

On the main part of St. Kitts the vegetation falls naturally and almost ideally into well-marked zones defined by altitude. Exceptions naturally occur, such as on Brimstone Hill, which is unique in St. Kitts in that it is partly composed of limestone, and the Canada Hills, which may be dealt with separately below. Five primary vegetation zones may be recognized. These, with their more characteristic fern-flora, may be described as follows:—

I. The Coastal Belt.

For the most part a narrow strip encircling the island, dominated by *Coccoloba uvifera* (Sea-grape) or less commonly *Hippomane Mancinella* (Manchineel), though the *Coccoloba* may penetrate two or three miles inland to nearly 1000 ft. above sea-level, noticeably in the north-east of the island. On the southern part of the windward coast at Connaree, immediately below the Canada Hills, are the only true Mangrove swamps (*Laguncularia*, *Avicennia*, *Conocarpus*, rarely *Rhizophora*) in the island. No ferns have been found in the coastal belt.

II. The Sugar-cane Belt.

This extends from above the coastal belt to the lower slopes of the mountains at an average elevation of about 800 ft., and almost continuous round the island. Trees are exceedingly scarce—the encouragement of more trees in the sugar-cane belt is a great *desideratum*—and the few rows of *Tabebuia leucoxylon* (White Cedar) or isolated *Tamarindus indicus* (Tamarind) are conspicuous where they occur. The ghauts penetrate this belt radially at frequent intervals, and the rounded ridges between them, where not cultivated in sugar-cane, are covered with pasture or low *Guava* (*Psidium*)-*Flemingia* thickets.

The typical fern of the sugar-cane belt, absent however in the dry sections of the island, is the "Silver Leaf," *Pityrogramma calomelanos*, frequently found in road and railway cuttings, or more rarely as a cane-field weed in the wetter estates. *Lycopodium cernuum* and abundant immature *Dicranopteris bifida*, and *Cyathea arborea*, also occur on the sides of cuttings, where they are protected. Upon the occasional trees *Polypodium polypodioides* and *P. lycopodioides* are not uncommon as epiphytes.

In hedges and in the vicinity of estate gardens common terrestrial ferns are *Dryopteris subtetragona* at low altitudes and *Blechnum occidentale* on the upper estates. The ancient masonry walls of the numerous old sugar-works harbour a few characteristic species, such as *Pteris longifolia*, *P. serrulata*, and *Psilotum nudum*, and innumerable immature *Pityrogramma calomelanos* and *Dryopteris* sp. or spp. On the sides of an old well *Aneimia adiantifolia* has been found.

III. Second-growth Mesophytic Formations (800–1500 ft.).

Constant cutting for timber and fuel has resulted in every stage of transition from open pasture, native carpet grass (*Axonopus compressus*), or induced Guinea-grass (*Panicum maximum*)) through *Guava-Miconia* thickets, to closed forest, dominated by *Inga laurina* (Spanish Oak, " Pois Doux ") or *Hymenaea Courbaril* (Locust). In damp protected situations the Sierra Palm (probably *Acrista monticola*) abounds, and there are also occasional pure stands of the common tree-fern *Cyathea arborea*.

The characteristic and almost ubiquitous fern of this zone is the terrestrial *Blechnum occidentale*, and ascending the ridges the demarcation between the second-growth formations and virgin forests above is indicated everywhere near the 1500 ft. contour by the gradual disappearance of societies of *Blechnum* and their replacement by *Selaginella flabellata* as the chief constituent of the forest floor. Occasional small societies of *Adiantum tetraphyllum* occur in the *Inga laurina* woods, and in the *Guava-Miconia* thickets several species of *Dryopteris*, the most typical being *D. Sprengelii*. Isolated plants or small societies of *Cyathea* exist on the sites of old landslips, and juvenile plants of this tree-fern with dense hanging masses of *Dicranopteris* abound on cliff-walls and the edges of ravines. On Phillips Level there are large areas of a prickly bracken, *Hypolepis repens*, interposed with the Guava bushes and *Rubus rosaeifolius*, which abound here ; also numerous large clumps of *Dryopteris reticulata* and *Struthiopteris exaltata*.

The ghauts form an ecotone with intermediate types of vegetation, and in some of them the separation of mesophytic from extreme xerophytic associations may be but a few hundred yards, and depending upon orientation rather than altitude ; the tree-fern, *Cyathea*, has been noted as low as 250 ft. altitude in some of the ghauts on the windward side.

The lower Wingfield Ravine, carrying the only permanent stream of the island, is well wooded, and in its lower reaches there are still some splendid shade-trees, among which *Hura crepitans* is the most conspicuous. The mesophytic nature of

the vicinity is indicated by the abundance of Melastomaceae and Piperaceae as under-shrubs, and by numerous *Cecropia peltata*, and occasionally *Heliconia* sp. among the palms and tree-ferns.

Within the narrow swampy belt by the stream are many fern species, several apparently confined to this locality. Among these are the terrestrial *Dryopteris meridionalis*, *D. mollis*, and *D. oligophylla*, with *Adiantum tetraphyllum* and *Selaginella flabellata* in deep shade ; *A. tenerum* and *Asplenium cristatum* on boulders and cliff-edges ; the epiphytic *Polypodium aureum*, *P. phyllitidis*, and *Nephrolepis biserrata* in crowns of trees ; and *Polypodium lycopodioides*, *P. astrolepis*, and *P. piloselloides* on their trunks.

In the Canada Hills, at the eastern extremity of the South-Eastern Range, and within a mile of the windward coast, conditions are noticeably different from other localities, and the general vegetation is in many ways similar to that of the hilly south-western part of Antigua. The hills are rugged, with many rocky outcrops and a thin loose stony soil ; the boundaries are largely under-thickets of *Leucaena glauca*. Dominant trees are *Anacardium occidentale* (Cashew), *Annona* spp., *Persea gratissima* (Avocado), *Crescentia Cujete* (Calabash), *Tabebuia leucoxylon*, *Tecoma stans*, *Coccoloba pubescens*, *Ficus populnea*, and *Bursera gummifera*. Under-shrubbage or thickets are composed of *Erythroxylon* sp., *Cordia dasycephala*, *Lantana Camara*, *Coccoloba nivea*, *C. punctata*, *Randia aculeata*, etc. Towards the sea are waste lands occupied by *Chrysobalanus Icaco*, *Lantana* (*L. involucrata*), and *Croton* spp. The general xerophytic nature of the district is indicated by the numerous Cacti (*Opuntia*, *Cereus*) and Agaves.

In the Canada Hills proper the only ferns are *Adiantum villosum*, *Asplenium pumilum*, *Cheilanthes microphylla*, and *Polypodium polypodioides* ; the first three have not been found elsewhere in St. Kitts, but are characteristic of the more wooded sections of Antigua.

The remaining vegetation zones are primitive forests which have suffered very little interference from Man. These virgin forests and associated formations cover the mountainous interior and, as ecotones, spread down the ravines sometimes well into the second-growth formations. Ferns more or less characteristic of these virgin and second-growth forested ravines above 1200 ft. altitude are *Anetium citrifolium*, *Anisosorus hirsutus*, *Asplenium salicifolium*, *Diplazium arboreum*, *D. striatum*, *Dryopteris megalodus*, *D. Poiteana*, *Olfersia cervina*, *Stenochlaena sorbifolia*, *Tectaria* spp., and two filmy-ferns, *Trichomanes membranaceum* and *T. polypodioides*, *Selaginella flabellata*, with immature *Cyathea* and *Dicranopteris* and small *Peperomia* spp., and mosses as the principal rock covering.

IV. Dacryodes-Sloanea Forest (1500–*c.* 2500 ft.)*.

Magnificent closed-canopy climax forest, dominated by *Dacryodes hexandra*, *Sloanea* sp.†, and the palm (? *Acrista monticola*); lianes are abundant and very characteristic. The large forest-trees carry a luxuriant growth of epiphytes: *Clusia*, *Marcgraavia*, Aroids (*Anthurium*, *Philodendron*, *Monstera*), *Cardulovica*, *Peperomia*, *Columnea*, *Psychotria*, *Polypodium* spp. (*P. pectinatum*, *P. brasiliense*, *P. phyllitidis*, *P. taenifolium*), *Elaphoglossum* spp. (*E. Dussii*, *E. apodum*, *E. Underwoodianum*), *Polytaenium Feei*, *Vittaria lineata*, and *Trichomanes* (*T. alatum*, *T. crispum*).

The tier of shrubs consists of young *Dacryodes* and *Sloanea*, various Melastomaceae, Piperaceae, Myrtaceae, and Lauraceae, *Cecropia*, *Cephaelis*, *Gonzalea*, *Tabernaemontana*, *Hemitelia muricata* (the typical forest tree-fern of St. Kitts), *Struthiopteris exaltata*, and several of the larger species of *Dryopteris*.

The forest floor is sparsely occupied by seedlings of the forest trees, especially the palm, sedges (*Scleria*), and a few grasses (*Olyra*, *Paspalum nutans*) in more open places, but dominantly by an almost pure association of *Selaginella flabellata* and *Dryopteris L'Herminieri*. This association of pteridophytes is very characteristic of the higher mountain forests in St. Kitts.

Rising towards the peaks, the ridges between the ravines become narrower, gradually assuming a sharp wedge-like formation, with little room for larger trees. These ridges support the *Dacryodes* type of forest lower down, but are largely dominated by *Clusia* (? *rosea*) above; where land-slips have occurred, the scars are rapidly occupied by young *Cyathea* or hanging masses of *Dicranopteris bifida*.

V. Freziera-Weinmannia Association; the Mossy Forest Zone (2500–3200 ft.); The High Moor-Fell Fields of the Summits.

Above the *Dacryodes* forests is a zone of constant atmospheric saturation. Moisture is everywhere and it is fern country *par excellence*. The dominant trees are *Freziera undulata*, *Weinmannia pinnata*, *Clusia* sp., and the Sierra Palm ‡, and among the sub-dominants may be mentioned *Didymopanax attenuatum*, *Eugenia* spp., *Ocotea* sp., and the coniferous *Podocarpus coriaceus*. The association with local modifications occupies

* For the identification of many plants in this and higher zones I am indebted to Mr. C. F. Charter, B.A.

† Two species of *Sloanea* have been reported from St. Kitts—*S. Massoni* Sw. and *S. truncata* Urb. Grisebach confused the latter with *S. sinemariensis* Aubl., a species from Guiana.—A. H. G. A.

‡ The Palma de Sierra of Porto Rico is *Acrista monticola* O. F. Cook: it also occurs in Martinique, but no specimens have been seen from St. Kitts.—A. H. G. A.

the exposed upper ridges and ravines in the cloud zone on all the St. Kitts mountains above 2500 ft. Beginning as light, but nevertheless closed-canopy forest, it forms a rather abrupt contrast with the dark primeval forests below. Upwards it passes imperceptibly through the Mossy Forest (*Freziera-Weinmannia-Podocarpus*) into the summit formation by a gradual decrease in stature, even to nanism, of its chief constituents.

On these upper wind-swept ridges the distorted trunks of the dominant trees form, with masses of ferns and young palms, an almost impenetrable thicket. Every limb of every tree is covered with tangled masses of sodded hanging mosses, aroids, orchids (*Ornithidium coccineum* is dominant among these), *Columnea hirsuta*, *Psychotria parasitica*, *Polypodium* spp., and filmy ferns; the beautiful *Utricularia montana* is not uncommon. The commonest shrubs are *Weinmannia pinnata*, *Hedyosmum arborescens*, *Palicourea* sp., *Gonzalea spicata*, numerous Melastomaceae, *Eugenia* spp., and *Podocarpus*. Where trees have fallen and rotted they are covered with a dense growth of the clambering fern (*Dicranopteris*), club-moss (*Lycopodium tortum*), mountain grass (*Isachne arundinacea*) or cutting sedges (*Scleria*). Herbaceous plants are abundant; among them may be mentioned *Lobelia* (*Tupa*) *cirsiifolia*, *Sauvagesia erecta*, *Viola stipularis*, *Galium hypsocarpum*, Orchids (*Ponthieva petiolata*, *Malaxis spicata*, and others), and the grasses *Paspalum nutans* and *P. conjugatum*. Edges of precipices and rocks generally harbour *Pitcairnia angustifolia*, an abundant Bromeliad (? *Aechmaea* sp.), ferns (*Dicranopteris*, *Lycopodium*), mosses, liverworts, and lichens.

Dominant among the larger ferns of the *Freziera-Weinmannia* association are *Hemitelia muricata*, *H. grandifolia*, *Struthiopteris exaltata*, and *S. striata*, all attaining luxuriant growth. When there is true forest the *Selaginella flabellata-Dryopteris L'Herminieri* consociation may persist to above 3000 ft., but gradually the latter becomes replaced by *D. limbata* among the dense herbage, in which stunted plants of *Struthiopteris striata* soon become dominant.

Of the epiphytes the Hymenophyllaceae are the most abundant, chiefly *Hymenophyllum hirtellum*, *Trichomanes alatum*, *T. pusillum*, *T. crispum*, *T. rigidum*, and *T. trigonum*, but many Polypodiaceae are equally conspicuous, e. g., *Polypodium asplenifolium*, *P. duale*, *P. loriceum*, *P. mollissimum*, *P. taenifolium*, *P. taxifolium*, *Asplenium auritum*, *A. salicifolium*, and *Nephrolepis rivularis*. *Lycopodium taxifolium* and *Psilotum nudum* also occur as epiphytes in the mossy forest zone. On the sodden humus of the ground *Selaginella substipitata* and *S. tenella* may be found among the mosses and liverworts.

Above the mossy forest zone the ridges, bounded by almost sheer precipices, unite irregularly to form upland plateaux, several acres in extent. The plant-associations are essentially

of the same composition as in the mossy forests, but greatly modified to the conditions prevailing. The individuals seldom reach a height exceeding two feet, and the whole, whilst having some of the features of " upland savannah," may be best described, using Warming's classification, as " high moor–fell field " with many of the characters of his " dwarf-shrub heath."

Except in the immediate lee of protective cliffs, trees and shrubs are rare. Most of the ground, where not occupied by " brakes " of *Dicranopteris* which overhang the edges of the plateau, is densely covered with a thick carpet of low vegetation barely knee-high, consisting of dwarf *Freziera* and *Weinmannia* among ferns, bromeliads, and herbaceous plants; the two mountain grasses *Isachne angustifolia* and *I. rigidifolia* are common. There is an astonishing uniformity and a square metre sample would give a close approximation to the whole. In this heath formation, only three pteridophyta occur regularly, *Struthiopteris striata* (dominant), *Dryopteris limbata*, the rosette forms of which are ideally adapted to the conditions, and *Lycopodium tortum*.

The Crater.

Except in the south, where the peak of Mount Misery stands over 1000 ft. above, the circular rim of the crater is of fairly uniform level, about 2700 ft. above sea-level; there are, however, several pinnacle rocks of imposing appearance. The inside wall is almost perpendicular in every direction, and the descent to the bottom of the crater is far from easy. The vegetation of the upper part of the crater rim, both inside and out, is of the *Freziera-Weinmannia-Podocarpus*, incipient mossy forest, type, but still retaining mesophytic characters. *Clusia* is abundant, and it is by means of its roots that the descent is largely facilitated. The larger terrestrial ferns are *Hemitelia grandifolia*, *Polybotrya cervina*, *Dryopteris megalodus*, and *Struthiopteris striata*, all of which reach luxuriant proportions. The ground is largely of the *Selaginella-Dryopteris* association of the *Dacryodes* forests. The epiphytes are transitional between those of the *Dacryodes* forest and the mossy forests, and *Elaphoglossum* spp. are common among the mosses.

The crater-rim is largely hung by festoons of *Dicranopteris*, and many parts of its walls are clothed with this fern or, when there is sufficient hold, by almost pure stands of *Cyathea arborea*. The wooded parts of the crater-wall consist very largely of the larger terrestrial ferns mentioned above as undergrowth, but *Hemitelia muricata* is also abundant.

The crater-bottom is well wooded, except in the vicinity of the lake and the stream which joins it. The soufrières are of course devoid of vegetation. There are vast numbers of *Clusia* among other trees and palms, and *Clusia* is one of the

first colonisers of the gypsum layer of the boiling waters of the sulphur springs; immature *Dicranopteris*, however, occurs where conditions are too adverse for other plant-growth. *Pityrogramma Schaffneri* is one of the most characteristic plants of the crater interior.

The lake lies immediately below a sheer cliff on the north-east side of the crater-bottom. It is bordered by aquatic sedges (? *Eleocharis* and *Cyperus* sp.). Rank grasses (*Paspalum conjugatum*) mixed with *Dryopteris gongylodes* form a clear consociation on the mud-flats by the southern side of the lake; a few yards beyond the grass disappears leaving an almost pure society of *D. gongylodes*. To the west *D. gongylodes* does not occur; there is here an association of the grass *Andropogon bicornis* and *Lycopodium tortum*, giving way to a veritable brake of *Dicranopteris* as the soufrières are approached.

List of Species. By A. H. G. Alston, B.A.

This list is based on two collections received at the British Museum (Natural History) from Mr. Box. The first collection consisted of duplicates of plants sent to the Smithsonian Institution at Washington and named by Dr. W. R. Maxon, who has kindly permitted me to use his identifications. A few additional records have been added from the references to St. Kitts in previous papers.

Hymenophyllaceae.

Trichomanes alatum Sw. Fairly common on trees in mountain forest near the crater, 2500 ft., 254.

T. crispum L. Infrequent on mossy tree-stems in mossy forest zone (*Freziera* assn., 2500–3500 ft.), ridge above the crater, 2800 ft., 271. Common, on trees in mossy forest, S.E. Range, Olivee's Mt., 2000 ft., 391.

T. hymenophylloides v. d. Bosch. On trees in forest, Belmont, *Britton & Cowell*, 410. On trees in forest, Wingfield Estate, *Britton & Cowell* 452 (*teste* Slosson in Bull. Torrey Bot. Cl. xlii. 655).

T. Kraussii Hk. & Gr. Local, on trees in primitive mountain forest, S.E. Range, Olivee's Ravine, *c.* 1300 ft., 388.

T. membranaceum L. Fairly common on tree-trunks in mountain forest, Nine Turn Gut, 251.

T. polypodioides L. Fairly common on tree-trunks in mountain forest, Nine Turn Gut, 252.

T. pusillum Sw. Local, on tree-trunks in primitive forest by ravine, S.E. Range, Olivee's Mt., 2000 ft., 402.

T. RIGIDUM Sw. Decidedly uncommon, on moisture-saturated tree-stumps in mossy forest zone, ridge above the crater, 2700 ft., 280.

T. TRIGONUM Desv. (*T. Kaulfussii* Hk. & Gr.). Uncommon, very local, on moisture-saturated tree-trunks in *Freziera* forest, ridge above the crater, 2500 ft., 279.

HYMENOPHYLLUM GRATUM Fée (*H. vestitum* v. d. Bosch, p.p.). Fairly common, on trees in mountain forest near the crater, *c.* 2500 ft., 253.

H. POLYANTHOS Sw. Mixed with *Nephrolepis rivularis* (no. 392), on prostrate trees in mossy forest, S.E. Range, Olivee's Mt., summit, 2700 ft., 392 A.

CYATHEACEAE.

CYATHEA ARBOREA (L.) Sm. The common tree-fern of St. Kitts, ravines and lower slopes, generally in second-growth assn., Wingfield Ravine, 377. Tall tree-fern, in high mountain forest (*Freziera-Weinmannia* assn.), S.E. Range, Olivee's Mt., 2500 ft., 397.

HEMITELIA GRANDIFOLIA (Willd.) Spreng. A semi-arboreous fern, common, dominant locally, on rich ground in mossy forest zone, ridge above the crater, 2700 ft., 283.

H. MURICATA (Willd.) Fée. The commonest tree-fern, and an important constituent of the *Dacryodes hexandra* assn., in deep mountain forest, mountains above Belmont, 2000 ft., 281. Common, in mountain forest at middle elevation, S.E. Range, Olivee's Mt., from 2000 ft., 398.

POLYPODIACEAE.

DRYOPTERIS BRACHYODUS (Kze.) O. Ktze. *Britton & Cowell*, 407 (*teste* C. Chr.).

D. DECUSSATA (L.) Urb. (*teste* Urban, Symb. Antill. iv. 19).

D. GONGYLODES (Schkuhr) O. Ktze. Forming dense society (Society A) on muddy soil at edge of the Crater Lake, *c.* 2600 ft., 256.

D. L'HERMINIERI (O. Ktze.) C. Chr. Abundant, but in pronounced zones locally, creeping rhizome with "runners," with no. 258 (*Selaginella flabellata*), forming dense floor vegetation in *Dacryodes* forest, 1800–2500 ft., 273.

D. LIMBATA (Sw.) O. Ktze. Common locally, "rosette" form of exposed summit, Mt. Misery, at the summit, 3711 ft., 289. Summit of Mt. Misery, 3700 ft., important constituent of low herbage covering summit peaks, 295. Uncommon, shade form of forest, in shady ravines in "mossy forest," Mt. Misery, 3000 ft., 299.

D. NEPHRODIOIDES (Klot.) Hieron forma GUADALUPENSIS (Fée) C. Chr. Common, side of trail in second-growth forest, S.E. Range, Olivee's Ravine, 800–1000 ft., 387. Common, side of trail in mountain forest, S.E. Range, Olivee's Mt., *c.* 2400 ft., 399.

D. MERIDIONALIS (Poir.) C. Chr. Rather infrequent and local, among grass and bushes in rather exposed places, Wingfield Ravine, *c.* 250 ft., 364.

D. OLIGOCARPA (Humb. & Bonpl. ex Willd.) O. Ktze. Summit of Mt. Misery, *Britton & Cowell*, 529 (teste C. Chr.).

D. OLIGOPHYLLA Maxon. Uncommon and local, in second-growth forest, Wingfield Ravine, *c.* 300 ft., 378.

D. OPPOSITA (Vahl) Urb. Wingfield Estate, forest ravine, *Britton & Cowell*, 446 (teste C. Chr.).

D. PATENS (Sw.) O. Ktze. Common, in second-growth, S.E. Range, Olivee's Ravine, *c.* 1000 ft., 380.

D. POITEANA (Bory) Urb. Local, side of trail in second-growth forest, S.E. Range, Olivee's Ravine, 900–1000 ft., 386.

Dryopteris quadrangularis (Fée), comb. nov. *Polypodium molle* Jacq. Collect. iii. 188 (1789), non Schreb. (1771); *Nephrodium quadrangulare* Fée, Gen. Fil. 308 (1850–2); *Dryopteris mollis* (Jacq.) Hieron in Hedw. xlvi. 348 (1907).

Common, among grass under shrubs in rather exposed places, Wingfield Ravine, *c.* 250 ft., 375.

This species appears to be quite distinct from the common Arabian and African *D. dentata* (Forsk.) C. Chr., to which it is usually referred, though forms similar to and perhaps conspecific with this species are also known in Africa. The two species may be separated as follows :—

D. dentata (Forsk.) C. Chr.	*D. quadrangularis* (Fée) Alston.
Pinnæ lobed halfway to costa, more rigid than in *D. quadrangularis*.	Pinnæ lobed more than halfway to costa.
Lowest six pairs of pinnæ reduced.	Lowest pair of pinnæ slightly reduced.
Hairs on rachis mixed, mostly short.	Hairs on rachis all long.
Rachis usually purple.	Rachis usually yellowish.
Rhizome horizontal.	Rhizome ascending.

D. RETICULATA (L.) Urb. Common locally, edges of second-growth mesophytic forest in uplands, Phillips Level, 1400 ft., 263.

D. SPRENGELII (Klf.) O. Ktze. Common, among grass etc., in exposed places by side of stream, Wingfield Ravine, *c.* 250 ft., 371. Locally common, among shrubs in second-growth formation (*Cecropia* etc.), Molyneux Ghaut, *c.* 1000 ft., 403. Molyneux Estate, *Britton & Cowell*, 312 (*teste* C. Christensen). Lambert Estate, *Britton & Cowell*, 637 (*teste* C. Christensen).

D. SUBTETRAGONA (Link) Maxon. Common, under trees in second-growth forest, Wingfield Ravine, *c.* 250 ft., 374. Common, second-growth thickets, roadsides, etc., Milliken Estate, 1100 ft., 404.

POLYBOTRYA CERVINA (L.) Kaulf. Rather infrequent and local on ground in mossy forest (*Freziera* assn.), mountain ranges north of the crater, 2250 ft., 288. Locally common, rich moist soil in mountain forest ravine, Nine Turn Gut, 1200 ft., 361.

TECTARIA HERACLEIFOLIA (Willd.) Underw. Common, on damp rocky cliffs in second-growth forest, Wingfield Ravine, *c.* 300 ft., 369.

T. MARTINICENSIS (Spreng.) Copel. Common, sides of stream in shady places, Wingfield Ravine, *c.* 250 ft., 379.

T. PLANTAGINEA (Jacq.) Maxon. Very local, rare, mossy trunks and boulders in mountain forest ravine, Nine Turn Gut, 352. Infrequent, probably rare, on loose wet soil among rocks in deep ravine in mountain forest, Nine Turn Gut, *c.* 1350 ft., 268.

T. TRIFOLIATA (L.) Cav. Infrequent and local in St. Kitts, rich soil on moist banks of deep ravine in mountain forest, Nine Turn Gut, *c.* 1350 ft., 266. Locally common, mossy boulders and cliffs in mountain-forest ravine, Nine Turn Gut, 1200 ft., 358.

BOLBITIS CLADORRHIZANS (Maxon) Ching. Local and rare, among boulders by side of stream, S.E. Range, Olivee's Ravine, *c.* 1000 ft., 381.

NEPHROLEPIS BISERRATA (Sw.) Schott. Common, on fallen tree-trunk in second-growth forest, Wingfield Ravine, *c.* 250 ft., 365.

N. RIVULARIS (Vahl) Mett. Local, on prostrate trees in mossy forest, S.E. Range, Olivee's Mt., 2700 ft., 392.

HEMIDICTYUM MARGINATUM (L.) Presl (*teste* Hooker, Exot. Ferns, t. 73).

DIPLAZIUM CRISTATUM (Desrouss.) Alston (*D. arboreum* (Willd.) Presl). Rare, rich soil in *Dacryodes-Sloanea* forest, Nine Turn Gut, 1200 ft., 357. Rather infrequent and local, on prostrate tree-trunk in forest, Wingfield Ravine, *c.* 300 ft., 373.

ASPLENIUM AURITUM Sw. Only seen once, rare, on crown of tree in mountain forest, nr. Nine Turn Gut, *c.* 1300 ft., 259. Uncommon, on mossy tree-trunk by side of trail, lower slopes (windward) Mt. Misery, 2000 ft., 297.

A. CRISTATUM Lamk. Common, on rocks and rich soil in second-growth forest by stream, Wingfield, *c.* 250 ft., 368.

A. PUMILUM Sw. Local, shady rocky banks in relatively dry wooded area, Canada Hills, 349.

A. SALICIFOLIUM L. Scarce, rich soil on moist banks of deep ravine in mountain forest, Nine Turn Gut, *c.* 1350 ft., 265.

STRUTHIOPTERIS EXALTATA (Fée) Broadh. Fairly common, on ground in deep mountain forest, windward slopes of Mt. Misery, 2500 ft., 311.

S. STRIATA (Sw.) Broadh. Common, on rich ground among shrubs in rather open places in mossy forest zone, ridge above the crater, 2700 ft., 284. Important constituent of low herbage covering summit peak, abundant locally, summit of Mt. Misery, 3700 ft., 296.

BLECHNUM OCCIDENTALE L. Abundant, dominant undergrowth in second-growth thickets and forest, Wingfield Ravine, *c.* 200 ft., 370. Abundant, second-growth thickets, roadside hedges, etc., Wingfield, 409.

STENOCHLAENA SORBIFOLIA (L.) J. Sm. Fairly common, but very local, with *Trichomanes* spp. on mossy boulders in ravine in mountain forest, Nine Turn Gut, *c.* 1350 ft., 261. Rare, on prostrate tree-trunk, in mountain forest, S.E. Range, Olivee's Mt., 2400 ft., 400. Box's specimens are juvenile, but are no doubt this species, which is recorded by Underwood (Bull. Torr. Club, xxxiii. 600).

PITYROGRAMMA CALOMELANOS (L.) Link. Ubiquitous, except in forested mountains and low dry coastal area, Wingfield, 407. Weed in cornfields, Hope Estate, 800 ft., 408.

P. SCHAFFNERI (Fée) Weatherby (*P. peruviana* (Desv.) Maxon). Common, on moist ravine banks on walls of the crater, 294.

CHEILANTHES MICROPHYLLA Sw. Locally common, shady rocky slopes in relatively dry wooded areas, Canada Hills, 350.

HYPOLEPIS REPENS (L.) Presl. In large societies locally forming brakes, clearings in second-growth mesophytic forest in uplands, Phillips level, 1400 ft., 264.

ADIANTUM TENERUM Sw. Rare and local in St. Kitts, shaded rocky cliffs in ravine, Wingfield Ravine, *c.* 300 ft., 376.

A. TETRAPHYLLUM Humb. & Bonpl., ex Willd. Rare, rich soil in *Dacryodes-Sloanea* forest, 1200 ft., Nine Turn Gut, 362. Abundant, floor of second-growth forest, Wingfield Ravine, *c.* 200 ft., 372.

A. VILLOSUM L. Common locally, floor of dry type forest, Canada Hills, 348.

PTERIS BIAURITA L. (*teste* Urban, Symb. Antill. iv. 48).

P. LONGIFOLIA L. Common, walls of old buildings, Wingfield, 405.

P. SERRULATA Linn. f. Very local, with no. 405 (*P. longifolia*) on walls of old buildings, Wingfield, 406.

ANISOSORUS HIRSUTUS (L.) Underw. & Maxon. Very local, among boulders in forest by edge of stream, S.E. Range, Olivee's Mt., *c.* 1000 ft., 382.

VITTARIA FILIFOLIA Fée. 1800 ft., *Rodger*, 24 (B.M).

V. LINEATA (L.) J. Sm. Cheekles (*teste* Krug). This species is not represented in Mr. Box's collection, but he states that it is common.

POLYTAENIUM FÉEI (Schaffn.) Maxon. Scarce, on trees in mountain forest, *c.* 1350 ft., Nine Turn Gut, 262.

ANETIUM CITRIFOLIUM (L.) Splitg. Rare, mossy boulders in mountain forest ravine, 1200 ft., Nine Turn Gut, 353. Only seen once, on tree-trunks in mountain forest, *c.* 1300 ft., nr. Nine Turn Gut, 260.

COCHLIDIUM SEMINUDUM (Willd.) Maxon. Rare, only found once, on mossy tree-trunk among filmy ferns, Mt. Misery, *c.* 3000 ft., 312. Local, mossy tree-trunks, Verchild's Mt., nr. Dodan Pond, *c.* 2700 ft., 359.

POLYPODIUM ASPLENIFOLIUM L. (? *P. suspensum* L.). Common, on mossy tree-stems in mossy forest zone (*Freziera* assn.), ridge above the crater, 2800 ft., 272. Common at higher altitudes, on trees in mossy forest, S.E. Range, Olivee's Mt., 2700 ft., 393.

P. ASTROLEPIS Liebm. Infrequent and local, on trunk of Mango-tree in mesophytic zone (second-growth), trail from Belmont to the crater, 1500 ft., 286. No. 286 in U.S. Nat. Mus. is mixed with *P. piloselloides*.

P. AUREUM L. Rather uncommon and confined to second-growth mesophytic woodlands, where it occurs on trees or occasionally on ravine walls (*teste* Box, not collected).

P. BRASILIENSE Poir. Local, rare, crowns of low trees in mountain forest ravine, Nine Turn Gut, 1200 ft., 355.

P. DUALE Maxon. Fairly common, with epiphytes on mossy logs and tree-trunks, Mt. Misery, nr. summit, 293. Upper slopes of Mt. Misery, 2500–3700 ft., sin. num.

P. JUBIFORME Kaulf. Local, mossy tree-trunks, Verchild's Mt., *c.* 2500 ft., 356.

P. LORICEUM L. Rare, on prostrate tree-trunk in mossy forest, Mt. Misery, 3000 ft., 300,

P. LYCOPODIOIDES L. Rather infrequent, on loose soil on rocky ground by side of Crater Lake, the crater, 2100 ft., 285.

P. MOLLISSIMUM Fée. Local, on mossy limbs of trees, Mt. Misery, nr. summit, 3600 ft., 291.

P. PECTINATUM L. Common, on decayed tree-stump in deep ravine in mountain forest, also on trees, Nine Turn Gut, *c.* 1350 ft., 267.

P. PHYLLITIDIS L. Common, on trees and rocks in second-growth forest, S.E. Range, Olivee's Ravine, *c.* 900 ft., 385.

P. PILOSELLOIDES L. (*teste* Maxon). On trunk on Mango-tree in mesophytic zone, trail from Belmont to crater, 286 p.p. (not seen).

P. POLYPODIOIDES (L.) Watt. Common, rocks and tree-trunks in rather dry places, Wingfield Ravine, *c.* 250 ft., 366.

P. SECTIFRONS Kze. Mt. Misery, *Breutel* (*teste* Mettenius, Polyp. p. 99).

P. TAENIFOLIUM Jenm. Only seen once (a small colony), on rotten tree-stump in mountain forest, near the crater, 2800 ft., 255. Common, on trees in mossy forest, S.E. Range, Olivee's Mt., 2000 ft., 391.

P. TAXIFOLIUM L. (*P. L'Herminieri* Fée). Common, on mossy tree-stems in mossy forest zone (*Freziera* assn.), ridge above the crater, 2800 ft., 270.

ELAPHOGLOSSUM APODUM (Kaulf.) Schott. Rather infrequent, on tree-trunks in mountain forest (*Dacryodes hexandra* assn.), N.E. slopes of Mt. Misery, *c.* 2500 ft., 278.

E. DUSSII Underw. (*E. petiolatum* Auct.). Common, on tree-trunks throughout mountain forest region, N.E. slopes of Mt. Misery, 2500 ft., 275.

E. UNDERWOODIANUM Maxon. Fairly common locally, on mossy tree-trunks, S.E. Range, Olivee's Mt., 2500 ft., 396.

E. UNDULATUM (Willd.) Moore. Fairly common, on mossy tree-trunks in deep mountain forest, slopes of Mt. Misery, 2500 ft., 298.

HYMENODIUM CRINITUM (L.) Fée. Infrequent, at base of tree-trunks in mountain forest (*Dacryodes hexandra* assn.), N.E. slopes of Mt. Misery, *c.* 2500 ft., 274.

GLEICHENIACEAE.

DICRANOPTERIS BIFIDA (Willd.) Maxon. Forming dense society (Society B) on muddy soil at edge of the Crater Lake, *c.* 2600 ft., 257.

D. FURCATA (L.) Underw. Mt. Misery, *Britton & Cowell* (*teste* Underwood in Bull. Torr. Club. xxxiv. 257 (1907)). Abundant on mountains above 2700 ft., clambering through shrubs, also frequently forming dense thickets by itself, Mt. Misery, nr. summit, 3600 ft., 290.

PSILOTACEAE.

PSILOTUM NUDUM (L.) Beauv. Common, walls of old disused buildings, also on trees, Wingfield, 367.

LYCOPODIACEAE.

LYCOPODIUM CERNUUM L. *Masson* (B.M.)—not collected by Box, who no doubt confused it with *L. tortum*.

L. DICHOTOMUM Jacq. *Britton & Cowell*, 304 (*teste* Underwood & Lloyd in Bull. Torr. Club, xxxiii. 111).

L. SIEBERIANUM Spring. Mt. Misery, among ferns, *Britton & Cowell*, 547 (*teste* Underwood & Lloyd in Bull. Torr. Club, xxxiii. 106).

L. TAXIFOLIUM Sw. Rare, with ferns and mosses on tree-trunk, S.E. Range, Olivee's Mt., 2500 ft., 401.

L. TORTUM Sieber ex Underw. & Lloyd. Common locally, open exposed places on ridges in mossy forest zone, ridge above the crater, 2900 ft., 269. Subdominant, constituent of low summit vegetation, S.E. Range, Olivee's Mt., summit, 2780 ft., 395. This is probably only a montane state of *L. cernuum*.

SELAGINELLACEAE.

SELAGINELLA FLABELLATA (L.) Spring. Abundant throughout forested area, dominant on floor of mountain forests, ravines, shaded woods, etc., slopes of Mt. Misery, 2500 ft., 258.

S. ROTUNDIFOLIA Spring. Upper slopes of Mt. Misery, 2500–3700 ft., s.n.

S. SUBSTIPITATA Spring. Fairly common, on water-soaked ground among rocks with mosses, Mt. Misery, nr. summit, 3500 ft., 292. Common, on ground in wet places, in mossy forest, S.E. Range, Olivee's Mt., summit, 2780 ft., 394. Upper slopes of Mt. Misery, 2500–3700 ft., s.n.

S. TENELLA (Beauv.) Spring (*S. albonitens* Spring). Locally common, mossy boulders in mountain forest ravine, Nine Turn Gut, 1200 ft., 351.

EXPLANATION OF PLATE 612.

Fig. 1.—Panorama of Basseterre Harbour from the sea, showing the characteristic St. Kitts landscape. (*a*) Ottley's Hill; (*b*) Serange with Olivee's Mt. in clouds; (*c*) Monkey Hill; (*d*) Canada Hills.

Fig. 2.—*Freziera-Acrista* association on forested slopes above 2500 ft.

NEW *CONVOLVULUS* FROM BRITISH BELUCHISTAN.

By K. P. BISWAS, M.A., F.R.S.E.

Convolvulus beluchistanensis, sp. nov. affinis *C. sericeo* Burm. f. et *C. omanensi* Moore.

Herba erecta plus minus diffusa ferrugineo-villosa, 15–30 cm. alta; caule lignoso suberecto, indumento sericeo. *Folia* solitaria vel basi aggregata, superiora sessilia vel rarius subsessilia, et forma variabilia, lanceolata, obovato-spathulata, vel rarissime ovata, undulato-crispata raro integra, adpresse-lanosa, nervis prominentibus depressis. *Capitula* pedunculata pauciflora; pedunculis axillaribus elongatis; bractea ovato-elliptica acuta. *Flores* sessiles; sepala 5, subæqualia ovata, obovata vel lanceola ta, apice anguste acuta vel acuminata, dense ciliata; corolla in sicco rosea æqualis anguste campanulata, limbus nonnunquam plicatus plus minusve 5-angulatus vel lobatus, angulatus, apice vel dorso ciliatus; stamina ad basin corollæ affixa inæqualia, filamentis basi sæpe dilatatis, antheræ oblongæ, polline oblongo-rotundato; ovarium hirsutum 2-loculare 4-ovulatum; stylus filiformis; stigmatibus 2-lobulatis, lobulis linearibus. *Capsula* villosa; semina oblonga, angulosa, apice attenuata-obtusa, brunnea.

Hab. British Beluchistan: Pasni, *Ramchandra Rao & Karandikar*, March to September 1932–35; Nos. 30, 20 (340), 119, 403. Type No. 30 in Hort. Bot. Calcutt., co-types in Herb. Kew. and in Herb. Mus. Brit.

Plant branched from the base, branches erecto-patent, hairy, 15–30 cm. tall. Leaves at the base crowded, long-petioled, oblanceolate-spathulate, rounded at the apex, margin entire, petiole 1–1·5 cm. long, blade to 2 cm. long, 5 mm. broad; towards the upper part of the stem sessile or subsessile, variable, lanceolate leaves 7–20 mm. long, 2–10 mm. broad, ovate leaves 10–20 mm. long and 7–17 mm. broad, nerves often bifurcating at the tips below the margin, villose on both the surfaces, rounded at the apices. Peduncles up to 30 mm. long; bracts 7–10 mm. long, 5–8 mm. broad. Flowers when dried pink, up to 15 mm. across, 15–17 mm. long; sepals villose, 5–10 mm. long, 2–5 mm. broad; corolla-limbs not spreading, densely hairy along the main lobular veins on the dorsal side. Stamens 5–7 mm. long, often unequal, rarely equal, in length; anthers 1 mm. broad; style 1–5 mm. long, ending in two 2–5 mm. long linear-lobed stigmas; ovary globose, 1 mm. in diameter, bilobed, 4-ovuled. Seeds 3-ribbed, attenuated at the apices, obtuse, about 3–4 mm. long.

This species is allied to *C. sericeus* Burm. f. ('Flora Indica' 47, tab. 9, fig. 3; 1757) from Persia. The elongated peduncle bearing few-flowered capitula and the less open campanulate flowers are distinctive characters from *C. sericeus*. The plant also resembles *C. omanensis* S. Moore (Journ. Bot. xxxvii. 405;

1899), but differs in its diffusely branched, not congested, habit, leaves very variable, the basal different from the upper leaves, the corolla densely fringed, with long cilia along the main lobular veins on the dorsal side, and the villous capsule.

I am indebted to Dr. A. B. Rendle for his valuable suggestions and criticisms and to Dr. George Taylor for drawing attention to the type-specimen of *C. omanensis* S. Moore in the British Museum Herbarium.

THE *IXORA* SPECIES OF BURMA AND THE ANDAMAN ISLANDS.

By C. E. B. Bremekamp.

(Continued from p. 175.)

11. **Ixora andamanensis**, sp. nov. ; typus : *C. E. Parkinson*, 140 Herb. Dehra Dun. Ramis foliisque glabris ad *I. Lacei* et ad *I. Ackeringae* vergens, foliis majoribus, inflorescentia uberiore, longius pedunculata, ab eis faciliter distinguenda.

Habitus ignotus. *Rami* et folia glabri ; rami novelli 4–4·5 mm. diam. ; veteriores nondum vidi. *Folia* petiolo canaliculato crasso 5–12 mm. longo, lamina lanceolata an lanceolato-oblonga 15–23 cm. longa et 6·2–9·5 cm. lata, apice acuminata, basi varians inter acutam et rotundatam, prope petiolum tamen semper contracta, chartacea, utrimque opaca an supra nitidula, sicc. supra saturate brunnea an interdum olivaceo-brunnea et subtus dilute brunnea, costa basin versus impressa, nervis utroque latere costæ 10–12 subtus prominentibus, venulis laxe reticulatis subtus partim prominulis. *Stipulæ* late triangulares carinatæ et in aristam vagina paulo longiorem exeuntes, axilla dense pilosæ. *Inflorescentia* longe pedunculata, laxissima, peripheriam versus pubescens, e floribus circ. 200 composita ; pedunculus 6–10 cm. longus, basi interdum foliis magnitudine reductis munitus, internodio præcedente tamen normaliter facto ; internodia basalia ramulorum infimorum 6–10 cm. ; internodium basale axis 6–11 cm. ; internodia alia peripheriam versus gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis 2 mm. longis muniti. Ramuli infimi et interdum ramuli jugi secundi foliis plerumque multo reductis suffulti ; folia quæ ramulos infimos suffulciunt interdum tamen usque ad 14 cm. longa. Bracteæ bracteolæque filiformes ; bracteolæ florum lateralium ovario paulo breviores. *Ovarium* subglabrum. *Calyx* glaber lobis ovato-triangularibus acutis 0·6 mm. longis. *Corolla* tubo 1·6 cm. longo, lobis oblongis obtusis 4·5 mm. longis et 1·7 mm. latis. Filamenta 1·3 mm. ; antheræ 4 mm. *Styli* pars exserta stigmatibus 1·8 mm. longis comprehensis 5 mm. longa.

Hab. Andaman Islands : Havelock, leg. *C. E. Parkinson*, 140 Herb. Dehra Dun.

Note.—In one of the inflorescences the basal branchlets are doubled, *i. e.*, in the axil of the subtending leaves, instead of one branchlet, two have been developed, one, as is usual in Dicotyledons, above the other. Similar serial branchlets have also been observed in the inflorescence of *I. cuneifolia*, and are shown in Wight's figure. I have not found them in any other species.

12. **Ixora Kingdon-Wardii**, sp. nov. ; typus : *Kingdon Ward*, 9072 Herb. Mus. Brit. Ab *I. cuneifolia* et a speciebus ei affinibus supra enumeratis, foliis angustioribus nervos plures exhibentibus, ovario glabro, calycis lobis majoribus sat distincta.

Arbor parva ; rami novelli, folia, inflorescentiæ, omnes glaberrimi ; rami novelli 2 mm. diam., veteriores cortice griseo-brunneo nitidulo vestiti. *Folia* petiolo profunde canaliculato 9–10 mm. longo ; lamina lineari-oblonga 13–17 cm. longa et 3·4–4·4 cm. lata, caudato-acuminata, basi acuta an contracta, subcoriacea, opaca an supra nitidula, sicc. supra olivaceo-brunnea et subtus dilute brunnea, costa canaliculata, nervis utroque latere costæ circ. 14, sicut venulis laxe reticulatis, subtus prominulis. *Stipulæ* subquadratæ an pentagonales in aristam vagina distincte longiorem exeuntes, axilla parce et breviter pilosæ. *Inflorescentia* longius pedunculata, e floribus circ. 120 composita ; pedunculus 3 cm. longus, basi foliis ordinariis munitus ; internodia basalia axis et ramulorum infimorum 4 cm. ; internodia alia peripheriam versus gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis 0·5–1 mm. longis ; ramuli infimi foliis multo reductis, circ. 1 cm. longis, suffulti ; bracteæ filiformes ; bracteolæ florum lateralium lineares, ovario plerumque distincte longiores. *Ovarium* glabrum. *Calyx* glaber lobis late-linearibus subacutis 1·3 mm. longis. *Corolla* extus dilute rosea et intus alba, tubo 1·8 cm. longo, lobis ovato-oblongis obtusis 5 mm. longis et 2·2 mm. latis. Filamenta latiora 2·5 mm. ; antheræ 2·5 mm. *Styli* pars exserta stigmatibus 1·2 mm. longis comprehensis 4 mm. longa.

Hab. Upper Burma : Hills east of the Mali Kha, alt. 1200–1500 m., leg. *Kingdon Ward*, 9072 Herb. Mus. Brit.

The following species, though collected beyond the border, may find a place here, as it may also be found in Upper Burma :—

Ixora tibetana, sp. nov. ; typus : *Kingdon Ward*, 12,475 Herb. Mus. Brit. *I. Kingdon-Wardii* affinis, sed foliis latioribus, pedunculo brevi, corolla longiore, faciliter distinguenda.

Frutex an *arbor parva* ramis novellis foliisque glabris ; rami novelli 2–2·5 mm. diam., veteriores cortice griseo opaco vestiti. *Folia* petiolo profunde canaliculato 6·5–8 mm. longo ; lamina elliptica an obovata 15–17 cm. longa et 6·5–7·5 cm. lata, acuminata, basi acuta, herbacea, opaca, sicc. haud conspicue decolorata, costa basin versus canaliculata, nervis utroque latere costæ

circ. 11 subtus prominulis, venulis laxe reticulatis vix distinguendis. *Stipulæ* triangulares in aristam vagina distincte longiorem exeuntes, extus subglabræ, axilla pilosæ. *Inflorescentia* breviter pedunculata, longitudine magna ab internodiis basalibus axis et ramulorum infimorum adepta quasi in corymbas tres divisa, parce puberula, e floribus 75–100 composita; pedunculus 7–8 mm. longus, basi normaliter foliis ordinariis munitus; pedunculi inflorescentiarum quæ inflorescentia prima deleta apice ramulorum lateralium brevium oriuntur basi tamen foliis reductis muniti; internodia basalia axis et ramulorum infimorum 4·5–5 cm. longa; alia multo breviora. *Flores* laterales triadum pedicellis 1 mm. longis instructi; ramuli infimi foliis reductis, 1–1·3 cm. longis, suffulti; bracteæ filiformes; bracteolæ florum lateralium oblongæ, ovario breviores. *Ovarium* glabrum. *Calyx* glaber lobis lanceolatis subacutis 1·5 mm. longis. *Corolla* alba tubo 2·4 cm. longo, lobis ovato-lanceolatis acutis 5·5 mm. longis et 2·5 mm. latis. Filamenta latiora 2 mm. longa; antheræ 4 mm. *Styli* pars exserta stigmatibus 1·9 mm. longis comprehensis 3·8 mm. longa.

Hab. SOUTH-EAST TIBET: Jamiri, alt. 1200–1500 m., leg. *Kingdon Ward*, 12,475 Herb. Mus. Brit.

Series *Compactiflorae*, series nov. A serie priore inflorescentia corymbosa et contracta, pedunculo basi foliis reductis an rudimentariis munito et internodio brevi præcesso, corolla interdum puberula an barbata diversa. Typus: *I. acuminata* Roxb.

A Sikkim et Assam usque ad Tenasserim.—Species 13.

13. **Ixora Parkeri,** sp. nov.; typus: *R. N. Parker*, s.n., Herb. Dehra Dun 52,045. Ab *I. acuminata* Roxb. pedicellis longioribus, calycis lobis brevioribus, corolla minore extus sparse puberula, ad faucem haud barbata, valde diversa.

Frutex ramis foliisque glabris; rami novelli 2·5 mm. diam., veteriores cortice primum luteolo, deinde griseo-brunneo opaco, vestiti. *Folia* petiolo anguste sed profunde canaliculato 10 mm. longo, lamina oblongo-elliptica 20–23 cm. longa et 5·8–7 cm. lata, apice caudata, basi acuta, chartacea, opaca, sicc. haud conspicue decolorata, pallida tamen, costa basin versus canaliculata, nervis utroque latere costæ circ. 13 supra subimpressis et subtus prominulis, venulis subdense reticulatis vix conspicuis. *Stipulæ* ovatæ in aristam gracilem, vagina paulo longiorem, exeuntes, axilla haud pilosæ. *Inflorescentia* breviter pedunculata, peripheriam versus puberula, floribus 75–100; pedunculus 3·5 mm. longus internodio 2 mm. longo foliis rudimentariis munito præcessus; internodium basale axis 1 mm.; internodia basalia ramulorum infimorum 4–4·5 mm.; internodia alia peripheriam versus longitudine paulo decrescentia. *Flores* laterales triadum pedicellis 3 mm. longis; ramuli infimi bracteis suffulti; bracteæ omnes anguste triangulares; bracteolæ florum lateralium lineari-triangulares ovario plus quam dimidio breviores. *Ovarium* puberulum. *Calyx* puberulus lobis ovato-oblongis subobtusis 0·7 mm. longis. *Corolla* rubella, tubo extus sparse et minutissime puberulo, intus glabro, 2·2 cm. longo, lobis extus pubescentibus et intus glabris, 6 mm. longis et 2·5 mm. latis, subobtusis. Filamenta 1·3 mm.; antheræ 3 mm. *Styli* pars exserta stigmatibus 2·2 mm. longis comprehensis 4·4 mm. longa.

Hab. TENASSERIM: District Mergui, Maliwun, Victoria Point, leg. *R. N. Parker*, s.n., Herb. Dehra Dun 52,045.

Series *Subsessiles* Brem.—Inflorescence subsessile or shortly pedunculate, sometimes nodding, corymbose. Peduncle usually not preceded by a short internode, and the leaves at its base not or but slightly reduced. Central flower of the triad pedicellate and bracteolate. Calyx usually with a short but distinct tube.—From the southern slopes of the Himalaya to the Malay Peninsula and the Lingga Archipelago.—Species 14–20.

14. **Ixora birmahica,** sp. nov.; typus: *R. N. Parker*, 2272 Herb. Kew. *I. subsessili* Wall. ex G. Don valde affinis, foliis majoribus, inflorescentia breviter sed distincte pedunculata, laxiore et puberula, ab ea distinguenda.

Frutex circ. 2·5 m. altus ramis foliisque glabris; rami novelli graciles 1·8 mm. diam., mox cortice griseo et nitidulo, deinde brunnescente et opaco vestiti. *Folia* petiolo 8–14 mm. longo; lamina linearis 11–18 cm. longa et 3–4 cm., rare usque ad 5 cm. lata (lamina foliorum aliquorum minorum circ. 6 cm. longa et 2 cm. lata), apicem versus sensim in caudam longam et acutissime exeuntem attenuata, basi acuta, subcoriacea, supra subnitidula, sicc. supra griseo-olivacea et subtus brunnea an interdum badia, costa supra prominula, nervis utroque latere costæ 14–15 (in foliis minoribus 7) subtus prominulis, venulis principalibus nervis parallelis et subtus paulum prominulis, venulis aliis laxe reticulatis vix distinguendis. *Stipulæ* triangulares in aristam rigidam incurvatam, vagina aliquoties longiorem, exeuntes, cum arista 9 mm. longæ. *Inflorescentia* breviter pedunculata reflexa laxa puberula; pedunculus 6–10 mm. longus; internodium basale axis 7–10 mm.; internodia basalia ramulorum infimorum 11–15 mm.; internodia alia peripheriam versus longitudine decrescentia. *Flores* laterales triadum pedicellis 1·5–2·5 mm., flores centrales pedicellis 0·2–1·0 mm. longis muniti. Ramuli basales foliis minutis 6 mm. longis, a stipulis late triangularibus, in aristam 2·5 mm. longam exeuntibus, connectis, suffulti; bracteæ angustissime triangulares, subpatentes; bracteolæ florum omnium anguste triangulares, basi ovarii insertæ et eo paulo breviores. *Ovarium* minute puberulum. *Calyx* minute puberulus tubo 0·1 mm. alto, lobis lanceolatis acutis, 0·8 mm. longis et 0·5 mm. latis. *Corolla* alba, extus intusque glabra, tubo gracili, 2·8 cm. longo et 0·5 mm. diam., lobis ovatis an oblongis, acutis, 4·5 mm.

longis et 1·8 mm. latis, margine mox reflexis. Filamenta 2·5 mm.; antheræ 4 mm. *Styli* pars exserta stigmatibus 1·2 mm. longis comprehensis 3 mm. longa.

Hab. TENASSERIM: Tavoy District, Zimba Valley, leg. *R. N. Parker*, 2272 Herb. Kew.: " common shrub in the evergreens "; Ye, Yetagun Reserve, leg. *Ba Pe*, 4830 Maymyo Herb.

15. **Ixora aciculiflora,** sp. nov.; typus: *Su Koe*, 6232 Maymyo Herb. Speciei priori et *I. subsessili* affinis, sed foliis oblongis in caudam longam, acutissime exeuntem, contractis, nervos plures exhibentibus, pedunculo paulo longiore, basi foliis minutis sed nondum rudimentariis munito et internodio brevissimo præcesso, corollæ fauce parce piloso, sat distincta.

Arbuscula 3 m. alta ramis foliisque glabris; rami novelli gracillimi 1·2 mm. diam., veteriores cortice griseo-brunneo primum nitidulo deinde opaco vestiti. *Folia* petiolo 3–7 mm. longo; lamina oblonga 6–13 cm. longa et 2–4·2 cm. lata, apice in caudam anguste triangularem 1·5–3 cm. longam, acutissime exeuntem, contracta, basi acuta, chartacea, sicc. saturate brunnea, costa supra prominula, nervis a venulis principalibus difficiliter distinguendis utroque latere costæ 8–13 tenuioribus sed utrimque tamen distinctis, venulis minoribus laxe reticulatis vix conspicuis. *Stipulæ* triangulares in aristam vagina fere ter longiorem exeuntes. *Inflorescentia* breviter pedunculata, laxa, puberula, floribus usque ad 45; pedunculus 8–12 mm. longus internodio brevissimo foliis 5–12 mm. longis munito præcessus; internodium basale axis 2–4 mm.; internodia basalia ramulorum infimorum 5–7 mm.; internodia alia peripheriam versus gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis usque ad 2 mm., flores centrales pedicellis usque ad 0·8 mm. longis, interdum tamen brevissimis, muniti; ramuli infimi bracteis suffulti; bracteæ omnes filiformes, basales 3 mm. longæ, aliæ peripheriam versus longitudine decrescentes; bracteolæ florum omnium lineares, basi ovarii insertæ, adpressæ, ovario paulo longiores. *Ovarium* subglabrum. *Calyx* glaber tubo brevissimo, lobis triangularibus acutis 1 mm. longis. *Corolla* dilute rubella, extus glabra, tubo 2·7 cm. longo, intus glabro, lobis oblongis acutis 5·5 mm. longis et 1·8 mm. latis, ad orem tubi parce pilosis. Filamenta 1·2 mm.; antheræ 3 mm. *Styli* pars exserta stigmatibus 1·3 mm. longis comprehensis 2·7 mm. longa.

Hab. TENASSERIM: District Mergui, Bankachon, leg. *Su Koe*, 6232 Maymyo Herb.

16. **Ixora mandalayensis,** sp. nov.; typus: *Ing Kan*, 561 Herb. Dehra Dun. Foliis basi rotundatis an truncatis, corolla longiore, a speciebus duabus supra descriptis et ab *I. subsessili* diversa; ab *I. Brandisiana* Kurz (*vide infra*) foliis nitidulis nervos vix exhibentibus, bracteolis ab ovario remotis, faciliter distinguenda.

Habitus ignotus. *Rami* et folia glabri; rami veteriores cortice griseo opaco vestiti. *Folia* normalia petiolo 3–4 mm. longo; lamina lineari-oblonga 6·5–9 cm. longa et 2·3–2·8 cm. lata, apice acuminata, basi rotundata an truncata, subcoriacea, utrimque nitidula, sicc. saturate olivacea, nervis utroque latere costæ circ. 10 vix conspicuis. Folia alia basi pedunculi et interdum alibi inserta sessilia, ovato-oblonga, 0·8–4 cm. longa et 0·5–2 cm. lata, apice acuta, basi subcordata, nervis utroque latere costæ tamen 10. *Stipulæ* late ovatæ in aristam 4 mm. longam, vagina ter longiorem exeuntes. *Inflorescentia* breviter pedunculata, laxa, subglabra, e floribus circ. 45 composita; pedunculus 1·5 cm. longus, basi foliis sessilibus supra descriptis minutus et internodio pedunculo subæquilongo præcessus; internodia basalia axis et ramulorum infimorum circ. 20 mm. longa; internodia ordinis secundæ 4–13 mm.; internodia ordinis tertiæ 2·5–5·5 mm. *Flores* laterales triadum pedicellis 5–6 mm., flores centrales pedicellis 1–3·5 mm. longis muniti; ramuli infimi foliis late ovatis, 8 mm. longis, suffulti; bracteæ subpatentes oblongæ an peripheriam versus subulatæ, basales 3·5 mm. longæ, peripheriam versus usque ad 1 mm. decrescentes; bracteolæ florum omnium late triangulares, 0·7–1·5 mm. infra ovarium insertæ, 0·7 mm. longæ. *Ovarium* glabrum. *Calyx* glaber tubo 0·1–0·2 mm., lobis ovatis acutis 0·5–0·7 mm. longis. *Corolla* extus glabra tubo 3·7 cm. longo, intus glabro, lobis ovatis acutis 5 mm. longis et 1·4 mm. latis, ad orem tubi barbatis, sicc. venulis cœrulescentibus signatis. Filamenta 1·4 mm.; antheræ 3·5 mm. *Styli* pars exserta cum stigmatibus 1·3 mm. longis 3·5 mm. longa.

Hab. UPPER BURMA: Maymyo, Mandalay–Lashio Road, leg. *Ing Kan*, 561 Herb. Dehra Dun.

17. I. BRANDISIANA Kurz in Journ. Asiat. Soc. Beng. xli. 316 (1872); Contr. Bur. Fl. 148 et For. Fl. Bur. ii. 25; Fl. Siam. En. ii. 163 in observatione ad *I. Parkinsonianam* Craib; non F. B. I. iii. 142; nec Ind. Trees, 388.

Distr. Upper Tenasserim.

There has been much uncertainty with regard to this apparently very rare plant. A specimen presented by the Herb. Hort. Bot. Calc. to Herb. Kew. as type of this species was collected by Parish at Martaban. As Craib has pointed out, it is entirely different from the plants described by Hooker fil. It cannot be the type, however, for Kurz states that the latter was collected by Brandis at Attaran. As it answers the description given by Kurz quite well, and at any rate much better than Hooker's specimens, and better also than any other Burmese plant I have seen, it may safely be regarded as representing Kurz's species. As the original description was apparently not sufficiently clear, a new one follows.

Rami et folia glabri ; rami veteriores cortice griseo opaco vestiti. *Folia* ordinaria petiolo 2 mm. longitudine haud superante ; lamina ovato-lanceolata 12·5–13 cm. longa et 4·5 cm. lata, apice caudato-acuminata, basi subcordata, subcoriacea, opaca, sicc. supra nigrescens et subtus saturate rubra, nervis utroque latere costæ 9–10 utrimque prominulis, venulis vix conspicuis. Folia basi pedunculi inserta et interdum folia aliqua inter folia normalia intercalata sessilia, ovata, 6 cm. longa et 3·2 cm. lata, basi subcordata an cordata, apice breviter acuminata, nervis utroque latere costæ circ. 7 munita. *Stipulæ* triangulares in aristam 2·5 mm. longam et vagina paulo longiorem contractæ. *Inflorescentia* pedunculata, laxa, subglabra, floribus circ. 45 ; pedunculus 1·5–2·5 cm. longus basi foliis minoribus supra descriptis munitus et internodio pedunculo subæquilongo præcessus ; internodia basalia ramulorum infimorum 18–22 mm. ; internodium basale axis 13–15 mm. ; internodia ordinis secundæ 3–10 mm. ; internodia ordinis tertiæ 3–4 mm. *Flores* laterales triadum pedicellis 1·5–2 mm., flores centrales pedicellis 0·5–1 mm. longis muniti ; ramuli infimi foliis ovato-triangularibus, breviter petiolatis, 5 mm. longis, suffulti ; bracteæ subpatentes ovato-triangulares, basales 3 mm. longæ, peripheriam versus usque ad 1·5 mm. decrescentes ; bracteolæ florum omnium triangulares, basi ovarii insertæ, 1–1·8 mm. longæ. *Ovarium* glabrum. *Calyx* glaber tubo brevissimo, lobis triangularibus acutis 1–1·2 mm. longis. *Corolla* extus glabra tubo 4 cm. longo, intus glabro, lobis linearilanceolatis acutissimis 7 mm. longis et 1·6 mm. latis, ad orem tubi barbatis, sicc. nigrescentibus. Filamenta 1·6 mm. ; antheræ 3·5 mm. Stigmata 1·1 mm. longa.

Hab. TENASSERIM : Martaban, leg. *Parish*, s.n., anno 1859, Herb. Kew., lectotypus.

(To be continued.)

SHORT NOTES.

CARDUUS PYCNOCEPHALUS L. (restr.).—Those who have read the note on the above by J. E. Lousley in the *Journal of Botany*, 1935, 257, will be interested to hear that the plant still occurs in good quantity on the Hoe at Plymouth.

My attention was first drawn to it late in 1936, when, at the request of the Botanical Section of the Devonshire Association, I sought it in order that it might be recorded with certainty in the new 'Flora of Devon' in course of preparation by the Section. It was not, however, until June of this year that I was able to make a proper search, and I was quickly rewarded by finding two stations in which the plant grows in large pure colonies. One of these is on the Hoe itself, and the other on the grassy slope below the Citadel at the extreme eastern end of the Hoe. These two stations adequately confirm the original record (by I. W. N. Keys in 'Flora of Devon and Cornwall,' 1868, quoted by Briggs in 'Flora of Plymouth,' 1880, under *Carduus tenuiflorus* Curt. :—"Hoe and under the Citadel, Plymouth, in which situations the var. *C. pycnocephalus* Jacq. also occurs") and show that the plant has completely established itself at Plymouth.

In addition to the two chief stations, scattered plants in ones and twos may be found in various spots beside paths and on the sea-front, and it is in similar situations that *C. tenuiflorus* (which is here less abundant than *C. pycnocephalus*) is also found.

In the herbarium of the Plymouth Institution, at the Athenæum, Plymouth, there is a good representative specimen of *pycnocephalus* labelled as follows :—"Carduus tenuiflorus var. pycnocephalus Jacq.—Slope under the Hoe, Plymouth, just above the men's Bathing Place, S. Devon, June 2, 1882. Coll. T. R. A. Briggs," and I propose to add a specimen gathered in June this year. —E. MASSON PHILLIPS.

WHITE-FLOWERED AZALEA PROCUMBENS.—On high ground (about 3100 feet) above Loch Mullardoch, near the borders of Ross and Inverness on May 27, 1937, I came across a white-flowered plant of *Azalea* (*Loiseleuria*) *procumbens*. The flowers were a lovely waxy white : the buds tinged with palest green or palest creamy-white; the leaves were more bright green than the leaves of the usual pink-flowered form. The plant was growing quite alone, although elsewhere on the hill the species was growing abundantly.—SETON GORDON.

FLORA OF SOMALILAND.—Prof. Chiovenda (Atti Ist. Bot. Universit. Pavia, ser. vii.) publishes his 'Flora Somala,' pt. iii., based on collections by Professors Pollacci, L. Maffei, R. Ciferri, and N. Puccioni in 1934 and 1935. The following novelties are described :—Capparidaceae, *Maerua Puccionii* ; Violaceae, *Rinorea somalensis* ; Portulacaceae, *Portulaca Ciferri* ; Malvaceae, *Hibiscus fallacinus* (*H. dongolensis* Chiov. non Delile) ; Leguminosae, *Indigofera* (*Trifoliolatae*) *Ciferri*, *I.* (*Stenophyllae*) *Maffeii* ; Asclepiadaceae, *Calotropis inflexa* ; Convolvulaceae, *Eremosperma*, gen. nov. ; Amarantaceae, *Pseudodigera*, gen. nov. ; Commelinaceae, *Aneilema benadirensis*.

In his "Nuovo contributo alla Flora della Somalia Italiana" (Atti Societ. Naturalist. Modena, lxvi. ; 1935), the same author describes the plants gathered in Italian Somaliland by Dr. Suckert in 1933. The novelties are as follows :—Zygophyllaceae, *Balanites Suckertii* ; Apocynaceae, *Conopharyngia humilis* ; Boraginaceae, *Cordia Suckertii* ; Euphorbiaceae, *Jatropha parvifolia*.—E. G. B.

REVIEWS.

Vergleichende Morphologie der höheren Pflanzen. By Dr. WILHELM TROLL. Bd. I. Lief. 2. Roy. 8vo, pp. 173–508, text-figs. 286. Gebruder Borntraeger: Berlin, 1937. Price, subscription R.M. 21.60, single R.M. 27.

THE author continues in this second issue the discussion of the morphology of the vegetative organs. He takes up the theory of the metamorphosis of leaves put forward by Goethe, pointing out that the German poet did not limit himself to the leaf, but included the node, *i. e.* the portion of the stem bearing the leaf. He thus anticipated the phyton-theory of Gaudichaud and the caulom-theory of Celakovsky, both of whom considered the plant-body to be built up of segments consisting of a portion of the stem with the respective leaf. After a discussion of Potonié's pericaulom-theory, which he does not accept, considering it to be speculative if not fantastic, he passes on to consider newer views, which are based on the consideration of the primitive leafless plants, the Psilophytales from the Devonian rocks. Judging from these the leaf is a structure of secondary origin, but Troll does not consider that the leaves of later plants were produced as Tansley has suggested "by foliar specialisation of short undivided branchlets of the thallus, instead of whole branch systems as in the Fern-type." He prefers Scott's conclusion that the fern fronds were born on typical stems, with their own organisation, distinct from that of their appendages. Troll's own view is that shoot, leaf, and root are essentially different organs of the plant and their sharp distinction is the basis of his morphology.

After such preliminary discussion Troll deals with various aspects and changes of the shoot system, such as the periodicity in the growth of the internodes, the suppression of internodes and consequent formation of rosette-plants, the stem-apex, and the development of leaves, the covering in of the stem by downward and upward extension from the foliar base, and the development of winged stems. In a further chapter he deals with leafless shoots, more particularly those occurring in ferns, which brings him back to the discussion of the primitive stems of the Psilophytales and of the rhizophores of *Selaginella*. The latter subject is again dealt with and more fully about 200 pages later on, in dealing with the problem of the morphological nature of the stigmarian axis of the Lepidodendra and Sigillariae. After a full discussion he adopts the view of the homology of *Stigmaria* with the hypocotyledonary rhizophores of *Selaginella spinulosa*. He makes no reference to the very striking correspondence, which, as Professor Long has pointed out, exists between *Stigmaria* and the root-producing base of *Isoëtes*.

The pages which intervene between the earlier and later discussions of *Selaginella* and allied *Lycopsida* deal with radial,

bilateral, and dorsiventral symmetry of stems, symmetry and asymmetry of leaves, anisophylly, and the influence of the symmetry of the stem on leaf-insertion.

The present part, like the previous one, is profusely illustrated with excellent and well-chosen drawings, which render it easy to follow the author in his elucidation of the various morphological problems with which he deals.—F. E. WEISS.

Soil Conditions and Plant Growth. By Sir E. JOHN RUSSELL. Seventh Edition. 8vo, pp. viii, 655, frontisp., 65 pls., and text-figs. Longmans, Green & Co.: London, 1937. Price 21*s*.

THE original edition of this extremely successful book appeared in 1912, and during the quarter of a century which has elapsed new issues have been called for at short intervals. "Its purpose," says the author in his new preface, "remains unaltered: it is to present the student with the broad outlines of the subject, including sufficient detail to give reality to the treatment, but avoiding always the tediousness of the card-index record." This purpose is well fulfilled in the selection of matter and general treatment, though (since the chapters are few and very long) a detailed table of contents would make it easier to grasp the plan of the book.

The enormous increase in complexity of the subject-matter since the first issue of the book is reflected in the greatly increased size of recent editions, though the author has striven to curtail this growth by omitting a good deal of material included in earlier issues. The rapid development of soil science during the last quarter of a century has been largely responsible for the number of new topics and the additional detail that have to be introduced. Sir John Russell insists, very properly, on the importance of the particular vegetation in determining soil-type; but perhaps he somewhat over-emphasises it at the expense of the other factors—parent rock, slope, exposure, water régime, and local climate,—although these are not, of course, neglected. The general impression one obtains in reading his account of the soil-types, is of the many obscurities and unsolved problems still remaining in this branch of science, in spite of the great and promising clarifications introduced by modern pedology into our view of the soil. It is indeed very difficult, if not impossible, in the present state of knowledge, to write a really satisfactory account of soils.

For the rest the treatment of the fundamental physiology of the growing plant in the earlier part of the book, of soil physics and chemistry, and of the biology of the soil in the concluding chapters provide recent information in full measure. This is not the place to criticize details, and it may confidently be said that this standard work well maintains the deservedly high reputation borne by the earlier editions.—A. G. TANSLEY.

Symbolæ Sinicæ. Botanische Ergebnisse der Expedition der Akademie der Wissenschaften in Wien nach Sudwest-China, 1914/1918. Teil I. *Algae.* By HEINRICH SKUJA. Pp. viii, 106, 3 pls., 12 text-figs. Springer: Vienna, 1937. Price R.M. 25.80.

OUR knowledge of Asiatic freshwater algæ is still very imperfect and the present contribution, listing upwards of 700 species, is greatly to be welcomed. Six new genera and 36 new species are described. The introductory matter deals briefly with geographical distribution and ecological groups. The algal vegetation is stated to be, in general, boreal in character, although Indo-Malayan and even Australian elements are recognisable. It may be doubted whether with our present knowledge such statements have much meaning.

The new genera are: *Handeliella* (Scytonemataceae), forming crusts with alternating strata of denser prostrate and looser erect filaments showing both true and false branching; *Nanurus* (Hydruraceae), which appears only doubtfully distinct from *Hydrurus,* from which it is chiefly distinguished by its scanty branching; *Psephonema,* doubtfully referred to Ulotrichaceae; *Chaetomnion* (Chaetophoraceae), rather like a robust *Chaetonema,* but believed to reproduce by aplanospores; *Pleurangium,* a partially submerged form provisionally referred to Chaetophoraceae, but showing many problematical features in its reproduction, perhaps an ally of *Trentepohlia*; and *Cladostroma* (Cladophoraceae), a genus which in the character of its filaments recalls Schmidle's *Chaetonella.* It is evident from the author's remarks that a good deal of the material was unsuitably preserved, and he may be congratulated on the successful way in which he has deciphered it.—F. E. FRITSCH.

Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. XI. Band. *Heterokonten.* By A. PASCHER. Lief. 2. Pp. 161–320, figs. 127–211. Akademische Verlagsgesellschaft: Leipzig, 1937. Price R.M. 20.

IN the opening pages of the second instalment of Pascher's Heterokontae, the author discusses in detail the affinities of the class, and once again emphasises the marked relationship with Chrysophyceae and Diatoms. Since this view was first put forward by Pascher in 1914, nothing has been published that speaks against it, and there is no doubt considerable evidence for the inclusion of the three classes in a common group, the Chrysophyta. It is unfortunate that the flagellate stages of Diatoms are so imperfectly known, since they might help to bridge the gap between this set of forms and the other two classes. A further section summarizes the little that is known of the distribution and biology of Heterokontae, and W. Vischer contributes an account of the culture of these organisms.

The taxonomic part deals with Heterochloridineae, Rhizochloridineae, and Heterocapsineae. Two new genera are described, viz., *Polykyrtos* (Heterochloridaceae) and *Malleodendron* (Heterocapsales), an interesting parallel to *Chlorodendron* among Chlorophyceae. A number of forms, previously included in Heterokontae, are excluded, viz., the *Chloramoeba* of Doflein, which is regarded as a colourless Flagellate with symbiotic green cells; the genus *Chlorochromonas,* which Perfilzew has shown to be an *Ochromonas*; and *Stichogloea,* which is referred to Chrysophyceae. On the other hand, *Ottonia,* which Schiller described as a member of Euglenineae, is included as a doubtful member of Heterokontae. Archer's *Chlamydomyxa* is discussed in detail, and it is suggested that some of the contradictory statements about this organism are due to confusion with *Myxochloris.*—F. E. FRITSCH.

Vascular Plants from Arctic North America collected by the Fifth Thule Expedition 1921–24. By JOHS. GRØNTVED. Roy. 8vo, pp. 93, with map. Gyldendalkse Boghandel: Copenhagen, 1936.

THIS is an enumeration of the plants collected by Dr. Knud Rasmussen's expedition to Arctic North America. The work of determination, begun by the late Prof. C. H. Ostenfeld, has been completed by Mr. Grøntved, who has also added to the determinations useful biological notes as to period of flowering, fruiting conditions, and state of development of the specimens.

The very considerable area covered falls into five districts, Keewatin, King William Island, Bylot Island, Cockburn Land, Melville Peninsula, and Southampton Island. The enumeration deals only with the vascular plants. The 1400 specimens collected represent 194 species, which include six vascular cryptogams, two conifers, 18 grasses, as many Cyperaceae, three Orchids, 16 willows determined by the late J. Enander, 18 species and varieties of *Draba,* treated in an Appendix by Mrs. E. Ekman, and 10 species of *Saxifraga.* There is also a short list of plants collected by Dr. Rasmussen near Point Hope in Alaska.

A note on earlier botanical investigations from Ross's and Parry's expeditions early last century onwards is included, and also a list of the more important literature.

Catechism Series. (1) *Botany.* Edit. 4. Parts 1 & 2. Sm. 8vo, pp. 164, with text-figs. (2) *Elementary Genetics.* By HANS GRÜNBERG. Pp. 87. E. & S. Livingstone: Edinburgh, 1937. Price 1*s.* 6*d.* each.

THESE small pamphlets are members of a series presumably designed to help medical students to pass examinations. The method, question and answer, recalls those by which our grand-parents were instructed. Good perhaps so far as they

went, but not going very far. Of the three mentioned above, Dr. Grünberg's is a readable introduction, the questions serving as paragraph-headings. The two on Botany are anonymous. They might serve as a glossary or as refreshers the night before an examination, but most teachers would prefer to recommend to their students a reputable text-book.

BOOK-NOTES, NEWS, ETC.

'JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY.'—Vol. lxii. pt. 8 (August) contains two papers of special interest to taxonomists. Dr. W. B. Turrill gives a general descriptive account, illustrated with plates, of the species of *Fritillaria* from the Balkan Peninsula and Asia Minor ; and J. R. Sealey discusses the species of *Camellia* in cultivation. After reference to the vicissitudes of nomenclature resulting in the priority of *Camellia* over *Thea*, Mr. Sealey gives an elaborate key to the eight species in cultivation followed by notes on their history, characters, and cultivation. There is a full discussion, including his MS. description, of the new species, *C. saluensis*, named, but not published, by the late Dr. Stapf. G. Fox Wilson, from the Wisley Laboratory, describes the damage to a variety of cultivated plants in the open in Britain caused by the Root-Knot Eelworm.

'AMERICAN JOURNAL OF BOTANY,' JUNE.—R. A. Laubengayer has studied the floral anatomy of a number of species of Polygonaceae, which he finds very uniform. His results favour the hypothesis that the fundamental plan is trimerous and whorled ; the five- and four-tepalled forms show fusion or suppression during development. All the individuals studied showed distinct perigyny of the insertion of the stamens. The lower part of the ovary, that below the ovule, is suppressed in its development, the lower part of the placenta being fused with the ovary-wall : the base of the cavity is not the base of the ovary, and the ovule is terminal to the placental axis and distinctly foliar in origin.

UNDESIRABLE SPLITTING OF GENERA.—In the 'Empire Forestry Journal,' xvi. no. 1, C. F. Symington, Forest Botanist, Kepong, Malaya, protests against the ruthless change in botanical names by the systematist without due consideration of the inconvenience thereby caused. He appeals to botanists to avoid, so far as possible, the division of existing genera. "Taxonomy may in such cases be just as adequately served by the creation of subgenera as by generic division, while the latter treatment may cause extreme inconvenience to the 'practical man.'" There are working systematists who would agree with him: genera-splitting may degenerate into a matter merely of personal opinion.

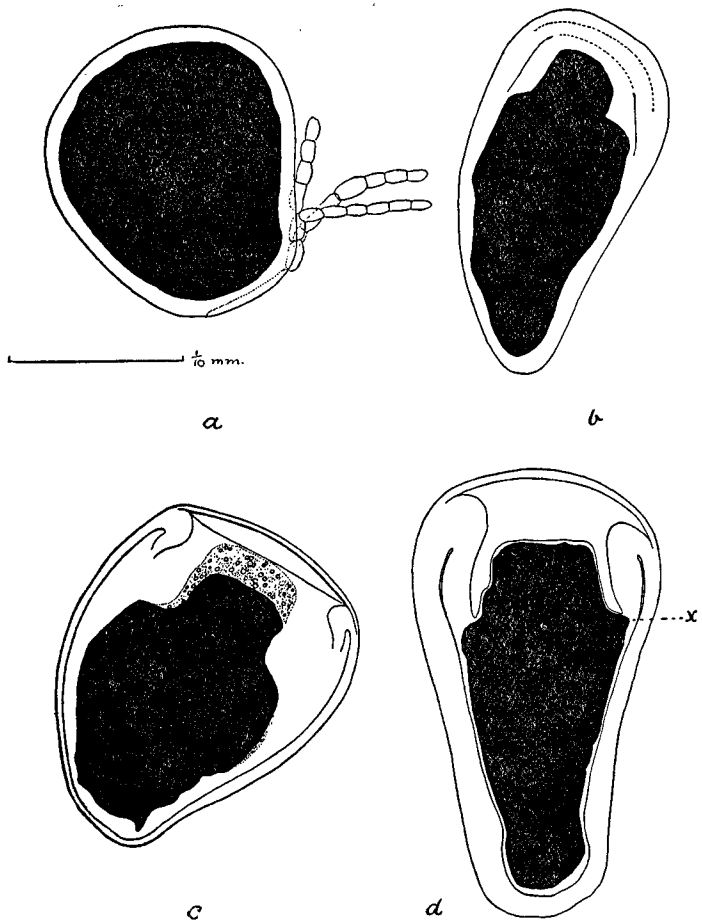


Fig. 1.—*Marginariella Urvilliana* (Rich.) Tandy.

Preparations from herbarium material, showing stages in the development of the oogonium and the extrusion of the oosphere.

(*a*) Oogonium from uppermost conceptacle of receptacle (Hb. Kew. Sheet V.). The mesochiton is not yet differentiated.

(*b*) Oogonium from middle of same receptacle, showing swelling and signs of differentiation in the mesochiton.

(*c*) Slightly older oogonium from middle of receptacle (Hb. Mus. Brit. Sheet IV.). The mesochiton is infolded and much swollen near the top of the oogonium. Between mesochiton and oosphere is a mucilaginous substance and a region appearing as though full of small droplets.

(*d*) Oogonium from middle of same receptacle (from Kew V.), showing folding, *x*, in upper region of mesochiton giving in optical section a characteristic "ear shape." The space above the top of the egg appeared to be full of deeply-staining mucilage.

Camera-lucida drawings of whole oogonia as seen in optical section; preparations and drawings by M. B. Hyde, M.Sc.

As in *M. Boryana*, the conceptacles of *M. Urvilliana* are arranged spirally around the receptacle, being somewhat longer vertically than they are deep radially. The older conceptacles occur towards the base of the receptacle, and all the oogonia in one conceptacle were at about the same stage of development (*cf.* however, p. 281).

Each conceptacle has numerous oogonia, separated by tufts of simple paraphyses, which do not reach to the opening of the ostiole: no basal cell could be distinguished. The youngest oogonium found is shown in fig. 1, *a*, taken from the uppermost conceptacle just below the apex of a receptacle from a specimen at Kew. The fragment was first soaked for a few minutes in sea-water and lactic phenol until the presumed original size was reached. In this condition it was still firm in texture, but soft enough to cut with a razor. In this conceptacle the oogonia had somewhat swollen walls, the outer membrane (exochiton) distinguishable from the undifferentiated gelatinous region within (*cf.* fig. 1, *a*).

An oogonium from a conceptacle situated lower down in the same specimen is figured in fig. 1, *b*. Here the oosphere is somewhat elongated, and a neck-like portion extends towards a cap of mucilage in the free part of the oogonium. The gelatinous substance around the neck appears to be splitting along the line indicated. In fig. 1, *c*, from another fragment, the lateral split is extended further, and the uppermost region above the neck of the oosphere is filled with a very dense mucilaginous substance, which on staining takes up dilute aqueous gentian violet more rapidly and more intensely than the rest. In fig. 1, *d*, the split has extended downwards so that the lower part of the oosphere is covered by a wall of three layers, the exochiton, the refractive region beneath it (here regarded as mesochiton), and a delicate innermost layer, probably the endochiton. In the region around the neck this mesochiton is more conspicuous, thicker, and infolded; with slight further swelling the folded region becomes more conspicuous, in optical section giving a typical "ear-like" appearance (*cf.* Delf & Hyde, 1936).

The lower edge of the infolded part passes imperceptibly into the endochiton (seen at *x* in fig. 1, *d*), and may perhaps continue as a thin film around the oosphere, indistinguishable from the endochiton itself. The upper part of the mesochiton is very sharply differentiated from the apical mucilage (as in *Boryana*, Delf & Hyde, 1936): (1) by its refractive properties in unstained preparations; (2) by its staining reactions, which are predominantly pectic; and (3) by its firmer consistency, as seen by its behaviour with acids, alkalis, and with Eau de Javelle.

The extreme base of a receptacle from the British Museum provided further evidence as to mode of ejection. Here there were three or four apparently empty conceptacles each with

whitish tufts of delicate threads at the mouth of the ostiole. A thick section was made, passing just above and just below an ostiole. By careful manipulation under a binocular dissecting microscope, these whitish threads were proved to be a number of separate strands passing through the ostiole*.

The success of this extremely delicate dissection lead to a closer re-examination of the surface of the remaining fragment, on which there were still two intact conceptacles. With suitable illumination, under the binocular dissecting microscope, two dark bodies were seen each attached by a flexible stalk (fig. 2, *b*).

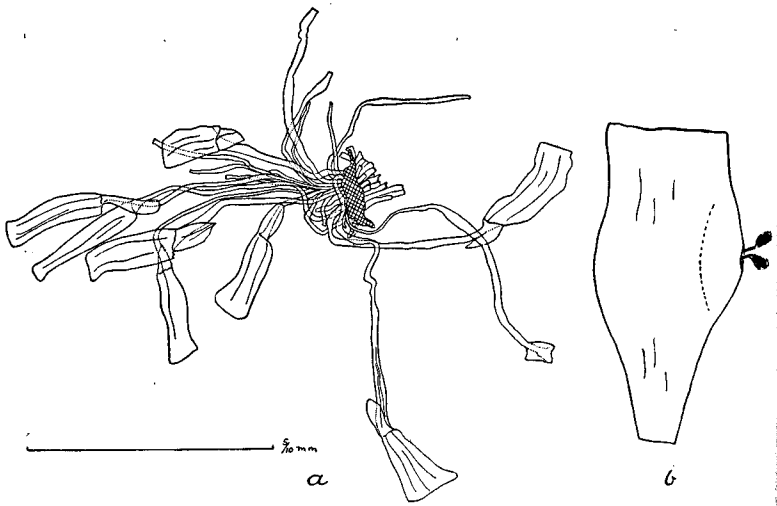


Fig. 2.—*Marginariella Urvilliana* (Rich.) Tandy.
Preparations from herbarium material in which extrusion of the oospheres has occurred.

(*a*) Dissection of an apparently empty conceptacle at the base of a receptacle (Hb. Mus. Brit. Sheet IV.). For clarity, several of the empty oogonia and some of the stalks have been omitted. The tissue round the ostiole was so closely adpressed to these stalks that it could not be separated by dissection: it is shown cross-hatched in the drawing. Camera-lucida drawing × 144 before reproduction.

(*b*) Lowest part of a receptacle (Hb. Kew. Sheet IV.) cautiously swollen in sea-water, seen from the side and showing oospheres attached to slender threads which emerge from the ostiole. On focusing, the lower appears to be a solitary oosphere, but the upper is seen to be the result of three oospheres pressed together.

Drawn from a binocular dissecting microscope, using eyepieces × 8 and objectives × 4.

* The ring of tissue surrounding the aperture was closely adpressed to the stalks, and could not be separated by dissection. This tissue is shown cross-hatched in fig. 2, *a*. The dissection and drawings were made by Miss M. B. Hyde, M.Sc.

One appeared to be a solitary oosphere, the other a complex of three oospheres (distinguishable on focusing) crushed together at the top of a somewhat stouter strand of mucilage, probably of multiple origin. Neither of these could be discerned by the use of an ordinary microscope or by a hand-lens.

The stalks shown in fig. 2 were much shrunken in spite of the preliminary swelling, but their resemblance to those in *M. Boryana* (Delf & Hyde, 1936, fig. 3) is obvious. In view of this and of the stages in differentiation observed in the walls of immature oogonia, it could hardly be doubted that these stalks were in some way concerned with the release of the oogonia.

Preserved Material.

This conclusion has been amply confirmed by study of material from New Zealand, collected and preserved for the purpose under the direction of Mr. V. W. Lindauer. This consisted of parts of fertile pinnæ preserved in a weak solution of formalin in sea-water, the receptacles bearing numbers of oospheres projecting from each ostiole and suspended by delicate mucilaginous stalks. (Photographs 1 & 2.) The receptacles on most of the pinnæ were 6–8 cm. in length and 3–4 mm. across the wider diameter: but one piece had equally fertile receptacles 4–5 cm. in length and of similar diameter. The pinnæ have a characteristic curvature, not always visible in the herbarium specimens.

From this material it appears that the elongation of the oosphere and the formation of the neck region is no mere artefact, but is a real phenomenon accompanied by a differentiation of the mesochiton and of a circular line of dehiscence in the upper part of the exochiton (*cf.* fig. 3, *a*, *b*, *c*).

The narrowing of the upper part of the oosphere is apparently brought about by a ring-like swelling of the mesochiton surrounding it, and a split is apparent in the earliest stage at which this has been detected (fig. 3, *a*). Signs of wrinkling are seen in the mesochiton at a slightly later stage (fig. 3, *b*, *c*), as though it were swelling against pressure, and when the swelling is accomplished, the whole oogonium, as well as the oosphere, has increased almost to its full size (fig. 3, *d*).

At maturity it is possible to detect a delicate inner region, the endochiton, differentiated between mesochiton and oosphere, and giving mucilaginous reactions, whereas the mesochiton is more pectic in its composition (*cf.* fig. 1, *d* and fig. 3, *e*). This mucilaginous endochiton increases in volume, especially at the free end of the oosphere, where it forms the mucilaginous pad so conspicuous in both species of *Marginariella* in certain preparations of herbarium material. The combined pressure of endo- and mesochiton ruptures the exochiton, sometimes splitting it (fig. 3, *g*, *h*), sometimes pushing aside (fig. 2, *a*) or lifting off an apical cap of exochiton. Through the opening the oosphere squeezes,

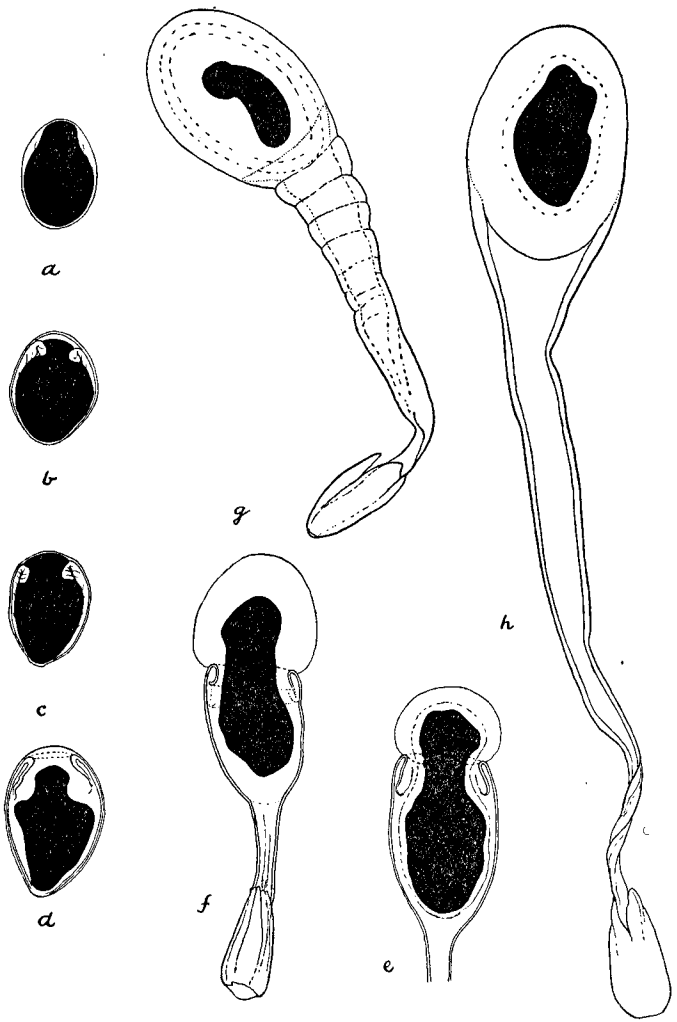


Fig. 3.—*Marginariella Urvilliana* (Rich.) Tandy.

Stages in the development of the oogonium and the extrusion of the oosphere.

(*a*) Mesochiton beginning to thicken near apex of oosphere, and showing first signs of "fold."

(*b*) Well-developed "fold" of mesochiton constricting the oosphere near its apex into a narrow "neck"; wrinkling seen in mesochiton.

(*c*) Endochiton visible round the oosphere, especially as a "cap" over the apex.

(*d*) Endochiton mucilaginous and much swollen

always enveloped with the mucilage of the endochiton, which becomes more conspicuous. During the escape the exochiton stretches and distends, shrinking again when left empty, but usually remaining *in situ*. At the same time the inner fold of the mesochiton opens out, either dragging the oosphere with it, or perhaps being itself dragged by the oosphere to which it remains attached (fig. 3, *e*, *f*). In the latter case, the force of expulsion may come from absorption of water by osmotically active material released into the base of the oogonium, or from the hydrostatic pressure of the superincumbent sea-water on the tissues forming the roof of the conceptacle.

However this may be, the oosphere is finally ejected, surrounded by the now swollen endochiton and held in place at the top of the elastic and tenacious mesochiton tube through which it has passed. The appearance depicted in fig. 3, *e*, *f*, would seem to indicate that the oosphere comes to rest after reaching the top of an *open* tube. In the later stages (fig. 3, *g*, *h*) this could not be clearly demonstrated, but it is believed that the top of the mesochiton tube fuses with the exterior of the swollen endochiton (as suggested in the figures by the finely dotted lines in this region), and preparations at the stage of fig. 3, *g*, have been found which support this interpretation. In fig. 3, *h*, the upper part of the tube has swollen walls in which the composition is more mucilaginous and less pectic than the lower part of the tube.

Comparison of the stages actually seen in *M. Urvilliana* with those seen and deduced for *M. Boryana* (Delf & Hyde, 1936, fig. 5) will show how close is the similarity between the two species, in this, as in other respects. In both, the mesochiton has, almost from the first, a surprisingly firm and resistant substance, in both, the application of dilute solutions of caustic potash to the ripe oogonium causes the extension of the tube before final disintegration occurs; in both, the endochiton appears as a dense and deeply staining mucilage, swelling readily in water or glycerine.

All the ripe oogonia are found in the same condition in one

(*e*) Exochiton (not shown here) has ruptured; the oosphere, surrounded by mucilaginous endochiton, protrudes from the top of the mesochiton.

(*f*) Exochiton seen as a sheath round the base of the mesochiton, which has elongated considerably; the oosphere, surrounded by mucilaginous endochiton, protrudes.

(*g*) Oosphere, surrounded by mucilaginous endochiton, has emerged from the end of the tube formed by the mesochiton, which is not yet fully extended.

(*h*) Oosphere with its surrounding endochiton remains attached at the end of the hollow tube of mesochiton. Note twisted base of mesochiton stalk, and empty exochiton sheath at its base. The horizontal broken line marks the level of the ostiole.

Preparations and drawings from preserved material by Miss M. T. Martin, M.Sc. All drawings made with camera-lucida to same scale, $\times 70$.

conceptacle, or all are empty of their oospheres ; thus it seems that the oogonia discharge their oospheres in fairly rapid succession, the tubular stalks being definitely compressed at the narrow passage of the ostiole, but still retaining their identity. When the contents of a conceptacle are successfully dissected, the

Fig. 4.—Diagram from camera-lucida drawing of part of a receptacle previously embedded in agar to keep the stalks in position. The stalks are shown issuing from an ostiole situated on the far side of the specimen. The oospheres are irregularly contracted, possibly by the treatment with agar. (×45.)

constricted part of the tube expands again, only a slight indentation marking the former narrow part (fig. 3, *h*). The part of the tube within the conceptacle often appears twisted (fig. 3, *h*), as though from the movement of the oosphere hanging freely in the water outside the conceptacle. The ultimate length of

the tube is very considerable, as may be seen from the drawings (fig. 3), all made to the same scale by means of the camera-lucida. The longest stalks are from the more deeply placed oogonia, and are about twice the depth of the conceptacle. The oogonia which are nearer the ostiole seem to have correspondingly shorter stalks.

Fig. 4 is a diagram based on a camera-lucida drawing of part of a receptacle which had been previously embedded in 3 per cent. agar to keep the stalks in position. The opening of the ostiole was beneath the surface of the receptacle as viewed ; but with good illumination it could be seen that the stalks disappeared into it, as shown diagrammatically by the dotted lines. The oospheres are shaded arbitrarily to give a suggestion of their relative positions ; the mucilage is represented by the clear area around each.

In addition to the large ripe or nearly ripe oogonia in the conceptacles of the preserved material, a number of very small oogonia could sometimes be detected, showing that when one crop was ready for discharge another was already being initiated : sometimes, however, a conceptacle had no such rudiments, even after all the oogonia were empty. Such small oogonia could not be detected in dried material ; but a similar succession of crops was described for *Sargassum* (Tahara, 1913; Kuneida, 1926) and for *Bifurcaria brassicaeformis* (Delf, 1935) and is well known in *Dictyota*, which also has marked periodicity of discharge.

Careful investigation of a considerable number of receptacles of the preserved material leads to the conclusion that most, if not all, of the conceptacles bear both antheridia and oogonia. On one pinna, where the receptacles were all slender in shape and predominantly antheridial in content, small oogonia could sometimes be detected, suggesting that after an initial male phase, the conceptacles would become bisexual.

All the other pinnæ examined had conceptacles predominantly female, but closer examination often revealed short antheridial tufts at the base of and between the oogonia. No such small tufts could be distinguished between the oogonia in herbarium material, where the more delicate structures were crushed and collapsed beyond recognition. This throws doubt on the supposed unisexual condition of the receptacles in *M. Boryana* (Delf & Hyde, 1936), although a local botanist, Mr. W. H. Gourlay, from observation of living material believes both species to be dicœcious.

It seems probable that the oospheres are retained in position until germination has taken place, as in *Sargassum* and *Cystophyllum*, but sporelings have not been found, in spite of careful search. The oospheres are very dense owing to their large size and heavy pigmentation, and in order to investigate their condition it was necessary to collect them, embed in wax, and section them by means of a microtome. Preliminary treatment with

agar, as described by Madge (1936), was found helpful for this purpose.

Cut transversely, about twenty-six consecutive sections (3 μ in thickness) made up one oosphere: or longitudinally about twenty. By careful examination of successive sections it was found that many oospheres had eight nuclei. Frequently, one was larger and central in position, the others showing signs of degeneration (as in fig. 5, which was drawn, however, from a section 7 μ in thickness); less often, eight well-developed nuclei were all evenly spaced near the periphery. In a few oogonia there were only four or six well-formed nuclei, none

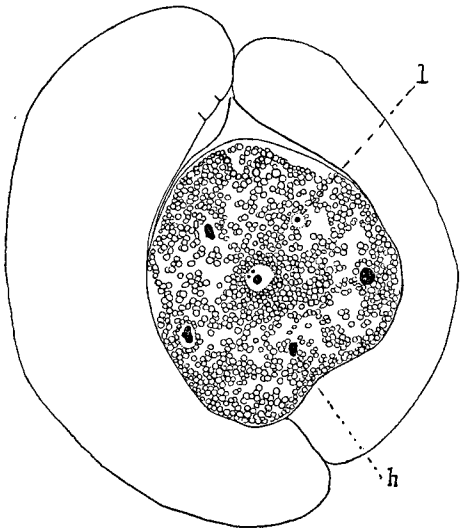


Fig. 5.—Thick section (7 μ) through the middle of an oosphere from the lower part of a receptacle, showing the central egg-nucleus and five peripheral deeply staining masses of chromatin representing degenerating nuclei. The nucleus marked *l* was only seen clearly at a low focus: that marked *h* came into view at an upper focus. (×280.)

being central in position, whilst in two a single central nucleus was seen with no sign of any other nucleus. Thus the whole contents of the oogonium are ejected before the oosphere itself has been organized, as in *Cystoseira barbata* and *Sargassum linifolium*, described by Nienburg (1910), and as in the species of *Sargassum* observed by Tahara (1911-13). Unpublished observations of the author indicate that the eight-nucleate condition is also found in the oogonium of *Bifurcaria brassicaeformis*; thus late maturation of the oosphere seems to be a feature common in fucoids which have only one oosphere to the oogonium.

SUMMARY.

From an examination of fresh material of *M. Urvilliana* preserved in a weak solution of formalin in sea-water, it has been found that :—

1. The oogonial wall has a three-fold differentiation which becomes evident when the oosphere has nearly reached maturity. These different layers are actively concerned in the expulsion of the oosphere.

(*a*) The *mesochiton* is early differentiated from the exochiton : it increases in thickness, and becomes folded around the top of the oosphere, which becomes contracted. The mesochiton is mainly pectic in nature, as in *M. Boryana*.

(*b*) The *endochiton* appears later as a delicate inner covering to the oosphere. It gives marked staining reactions, characteristic of mucilage. The substance of the endochiton accumulates, especially in the region above the neck of the oosphere, where it forms a dense cap of mucilage, which can be recognized also in preparations from herbarium material.

(*c*) The *exochiton* splits apically, presumably by the swelling of the mucilaginous cap, aided by that of the mesochiton in the region of the fold. Sometimes a cap of exochiton is lifted off, sometimes it is pushed aside, but remains adherent (*cf.* fig. 2, *a*), and sometimes it appears to be split into segments (fig. 3, *f*, *g*).

(*d*) The *mesochiton* unfolds and extends into a tube through which the oosphere passes on its way through the ostiole. The tube is attached to the interior of the now empty exochiton, and thus acts as an anchor to the oosphere, which remains pparently firmly seated at the other end.

2. It is probable that the contents of the ripe oogonia are discharged in rapid succession.

3. At the time of discharge, the rudiments of a new crop of oogonia can be detected. These very young oogonia cannot be recognized in herbarium material.

4. At the time of discharge, the oosphere is not yet organized. The three successive (presumably meiotic) nuclear divisions take place *after* emission, while the pre-oosphere is still attached to the parent plant. One nucleus takes up a central position, and the remaining seven may be found in various stages of degeneration.

5. Apparently female conceptacles may have small antheridial tufts at the base of and between the oogonia. On the other hand, receptacles on one pinna with well-developed antheridial contents had also signs of very young oogonia. This suggests an intersexual condition ; or possibly a well-marked male phase succeeded by a female phase. It is not, therefore, possible to conclude from herbarium material all the sexual potentialities of the conceptacles. On the other hand, the impression is gained from both herbarium and preserved material that all the receptacles

of one pinna are almost completely male or female in content: and this opinion is endorsed by observations of Mr. W. H. Gourlay, at the present time, who is familiar with living material.

6. The elaborate method of oogonial discharge in both species of *Marginariella* and the retention of the oospheres in the neighbourhood of the conceptacle are features characteristic of many fucaceous plants. They appear to be correlated with their occurrence in deep water and with separation of the sexes, but are not confined to a strictly unisexual or dicecious habit, as originally suggested (Delf, 1935).

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Explanation of Plate 613.

Parts of fertile pinnæ of *M. Urvilliana*.

A. Showing receptacles crowded along one edge and an occasional vesicle. The curved form of the pinna is said to be characteristic. (Nearly life-size.)

B. Two receptacles (magnified 4 times) showing oospheres extruded from conceptacles and held *in situ* by stalks. In the lower part of the receptacles they have almost disappeared, perhaps due to mechanical agitation during transit of material. The apex of each receptacle is sterile and pointed, the base ill-defined at the broken surface.

Photographs by Mr. J. A. Crabbe.

THE BRITISH ASSOCIATION AT NOTTINGHAM.

The British Association met at Nottingham from September 1 to 8 under the Presidency of Sir Edward Poulton, D.Sc., LL.D., F.R.S., the eminent entomologist and for many years Hope Professor in Zoology at Oxford. Still virile at the age of 81, Sir Edward, in his presidential address, told of the changes in the attitude of scientists to evolution during his long working life-time in biology of nearly sixty years. From personal recollection he traced from 1881 onwards the trend of evolutionary thought. He noted the decline of opposition to the fact of evolution in the early years of his experience, and referred to the dispute between physicists and zoologists as to the age of the earth, ultimately settled by the discovery of radio-activity, which gave the zoologists the extra time they wanted, and pleaded in support of the importance of Natural Selection in contrast to Lamarckism and the inheritance of characters acquired during life. His address attracted much public interest and has been fully reported in the Press.

Prof. E. J. Salisbury, D.Sc., F.R.S., was President of Section K (Botany). In his address, "The Modern Study of Plants in relation to Education," he emphasised the importance of botany as an educational subject.

Though no longer regarded merely as a harmless and elegant occupation for the female sex or of important technological significance for Medicine, "the high value of Botany as an educational subject and indeed its absolute necessity in any system of real cultural development are aspects which we botanists have failed to present and emphasise, perhaps too often even to realise ourselves.

"Whilst scientists justly claim that cultural value is the monopoly of no one subject and that those brought up in the classical tradition may be as much philistines as any scientist it is undoubtedly true that the immense cultural potentialities of scientific thought have too often been neglected for the sake of mere erudition. There is a general tendency for University teaching to become more and more vocational as the specialised demands of occupations become increasingly exacting. Too much attention is paid to the acquisition of mere information, especially if recent, too little to the principles which are involved.

"Furthermore our educational methods are, I fear, too often divided in their allegiance; on the one hand we aim at the provision of a liberal culture which will make for the greatest happiness of the individual, considered in terms of mental contentment and an abiding resource in later life; whilst on the other hand we aim at the equipment of the student for the earning of his daily bread to ensure bodily comfort. We are not sufficiently trustful that the provision of the former is, to employ the expressive northern phraseology, the 'gainest way' to the latter end, and so we adopt a sort of mental squint—which permits neither of the clear vision of the full beauty of integrated knowledge nor even of keeping our eyes on the main chance.

"Whilst activity and distinction in research is a necessary qualification of the teacher, the capacity to impart knowledge to others is no less essential. Too often in the selection for University posts aptitude as a teacher, which should be a first consideration, is entirely subordinated to distinction as an investigator.

"Whatever views we may hold with regard to the respective merits of the vitalistic and mechanistic schools of thought in relation to organisation, the incontrovertible fact is that in the present state of knowledge we are quite unable to express, and indeed cannot hold out any prospects of explaining, the phenomenon of life in terms of physics and chemistry alone.

"There are certain aspects of the universe such as heredity, development and the reaction of the organism to the environment which must be studied in other respects than merely the chemical

and physical states with which they are associated, and hence biological knowledge is as fundamental to our understanding of the world around us as either physics or chemistry. One great merit of botanical study from the standpoint of general education is that, if properly taught, it provides the best medium for training in accurate observation.

"From the cultural standpoint, plant life and all that it implies may be regarded as the foundation of a vast extent of human activity and the basis of a large and essential part of every human environment. Because neither we nor the animals could persist without plant life it follows that much of the present distribution of these organisms over the face of the earth can only be understood in terms of the plant life either of the present or the past. Even man's industrial activities have been largely localised and in part determined by the geographical distribution of vegetation whether it be that of the forests, of perhaps 280 million years ago, which gave origin to our coal deposits, or the vast extent of grasslands that have determined the location of pastoral communities.

"It is no exaggeration to say that an adequate appreciation of geography, unless merely descriptive, is not possible without an adequate background of botanical equipment. Yet teachers of geography, let alone students, are too often ill-equipped in this prerequisite. Despite the vast areas of the earth's surface devoted to the growth of foodstuffs, of textile fibres, of timber, rubber, tea, tobacco and innumerable other plant products, the plant remains perhaps the least known and appreciated of all man's servants by those who lay claim to any cognisance of their environment.

"One of the main purposes which the British Association should serve is to promote the co-operation between workers in different fields. But we only come together for a short week in each year, and so it is to the Universities that we must look mainly for the continuous fostering of a liberal outlook both on science as a whole and within the domains of each particular subject.

"In its earlier phases Botany was naturally concerned largely with description, and in such branches as Taxonomy, Morphology, Anatomy, Cytology, Mycology, Palæobotany and Plant Geography the descriptive aspect must necessarily play an important rôle just as in Ecology, Physiology, Bacteriology, and Genetics the experimental aspects should predominate. But in all, the cultural value can only be maintained if form and function are closely integrated. Each branch has its own contribution to make in this respect not only to the pure science but to its applied aspects in Agriculture, Horticulture, Pomology, Sylviculture and Plant Pathology.

"The retention of plant physiology within the domain of Botany has saved us from the worst evils of the study of form unrelated to function. This has also been one of the chief factors which led to that synthetic approach to our subject which concerns the relation of the plant to its surroundings. The supreme value of ecology, however, lies not so much in the attention which it focuses upon the mutual relations of organisms or even upon their relation to the environment, but in the synthesis which ecology achieves, into a single picture, of so many aspects of Botany itself and so many branches of human knowledge. Its high educational and cultural potentiality is an outcome of the fact that it is the very antithesis of that common failing of the human mind to think of different subjects as isolated compartments of knowledge and not as different facets of one and the same jewel.

"When we attempt to understand any plant community the necessary study of the physical environment leads us at once into realms of soil structure, into the physical problems connected with water retention and water movement involving colloid properties and surface action. So, too, the chemist and the meteorologist make their contributions to our concept of the habitat, whilst the bacteriologist, the mycologist, and the protozoologist all help us to envisage that teeming population of bacteria, fungi and protozoa in the soil which, by their proper balance, maintain a healthy circulation of chemical products and are a necessity for the maintenance of the supply of raw material for the higher plants and animals.

"When we turn from the study of the habitat to that of the vegetation which it supports we are at once confronted with the question as to the extent to which the one is in equilibrium with the other. The morphologist and the anatomist furnish the data upon which we base our judgment as to the degree to which the external form and internal structure have contributed to render the organisms suited to the environments that they frequent. The contribution of the systematist is to distinguish between the more critical species and races which exhibit a localisation that less meticulous examination might readily ignore and which often have an ecological importance far greater than the Linneons of which they are the segregates. The experimental conclusions of the physiologist in the laboratory must be applied by the ecologist to the elucidation of problems in the field complicated and often profoundly modified by the continual operation of the competitive factor. Finally, knowledge of the life-histories of the constituent organisms, the reaction of the various phases of their development to the environment, their modes of reproduction, their establishment and extension, comprise a mass of knowledge to which many astute observers

have contributed and amongst whom the amateur holds an honoured place in our esteem.

"The value of the ecological approach is also obvious in relation to everyday affairs.

"In any well-considered plan of land utilisation of catchment areas the ecological aspects are apt to be ignored. The land surface under its various guises may be likened to a sponge which absorbs the divers forms of precipitation and allows the water with more or less rapidity to find its way into the streams and rivers. Under ideal conditions the effectiveness of the sponge provided by forests may regulate the water drainage to such a degree that despite extreme fluctuations of rainfall the river levels exhibit no abnormal oscillation; but the effectiveness of the land surface for holding back the water varies according to whether it is under high forests, scrub, grassland, or arable. Each type of plant cover has its own absorptive factor and its own resistance to erosion. Furthermore, each vegetation type is not static but dynamic, and its rôle in this respect changes both with the seasons and with the passage of time. If therefore our land utilisation is to be properly conceived, due regard must be had to the proportions in which the various communities, whether natural or artificial, are present. If we are to avoid floods and droughts, we must preserve rural England for practical as well as æsthetic reasons. What sufficed to restrain extreme conditions a hundred years ago would not suffice to-day. Afforestation of the catchment area of the Thames and other rivers would, in the long run, be perhaps far more effective and less costly as a guarantee against future floods or droughts than grand scale engineering works, and whilst the former would produce ancillary assets of great value the latter would not.

"Another matter to which I should like to refer in this connection is the much discussed question of the preservation of natural areas. The public generally needs guidance on these matters which the student of plant life should furnish. Owing to the widespread ignorance of biological knowledge the dynamic character of vegetation is by no means widely realised. There are indeed many educated people to-day who think that to preserve an area all you need to do is to leave it alone. The fact that your open downland, presented to the National Trust, may, if left unhindered, ultimately cease to be downland and become woodland with the loss perhaps of the very features for which the area was preserved, is for most a novel concept. The transition phase between grassland and woodland that we term open scrub is perhaps at once the richest in species of flowers and insects of all our natural plant communities and the most transient. To preserve such it is necessary to remove trees and shrubs just at the period when they would appear to be approaching their prime. But an enlightened

policy of such control of national reserves and all that this implies will only be possible if the rising generation has been inculcated into a biological mode of thought.

"Mr. Ramsbottom, in his Presidential Address last year, admirably emphasised the practical importance of the study of mycology, the many ways in which fungi play an important part in industry and everyday life. The importance of algæ in relation to our fisheries has been revealed by the investigations carried out in the Marine Biological Station at Plymouth, whilst the Fresh Water Station of Windermere is rapidly increasing our knowledge of the rôle of algæ in relation both to fresh water fisheries and to water supply. The practical value of genetics and plant breeding in the production of better and more disease resistant strains is so obvious as to need no emphasis. Indeed it is probably true to say that no branch of botany could be cited that has not its important practical applications. Botany needs no defence in respect to the practical utility of its pursuit, ... it is, I feel, the contribution that botanical knowledge can make towards general culture and spiritual contentment that is its chief claim to rank high in our educational scheme.

"For the future I venture to suggest that it is not so much the paucity of data that needs to be made good, as the failure of the botanist to take his proper place as a man of affairs. We have been too content in the past to pursue the pleasant paths of pure science, heedless of the implications of our results, with the outcome that our subject has not received the measure of moral and financial support that its value to the community would justify."

Various branches of the science were represented by the papers read and discussed in the Section. Dr. M. J. Sirks, a visitor, emphasized the importance of the plasm in inheritance: the genes as such can show their action in the phenotype only by means of the plasm. A number of cases were cited in which the plasm plays a rôle as a counterpart to the genes. In an examination of the evidence used in phylogenetic problems Dr. S. Williams asked whether cytogenetics can be developed as a test in broad phyletic problems. Mr. R. D. Williams described investigations to determine the frequency of chlorophyll deficient mutants in red clover (*Trifolium pratense*); and Dr. T. J. Jenkin and Dr. P. T. Thomas demonstrated the cytology of interspecific crosses between six species of *Lolium*.

Prof. R. B. Thomson discussed the comparative anatomy of the male and female cone-scales of conifers. They are considered to be homologous structures which have become differentiated by factors associated with their function as male and female organs.

Dr. S. Williams and Prof. J. Walton discussed the morphology respectively of the rhizophoric parts of living and extinct

Lycopods ; and Prof. T. M. Harris gave a description of *Naiadita*, a very common fossil in the English Rhætic ; all the organs are typically Bryophytic and, on one view, it might be regarded as closely related to *Riella*.

Physiology was represented by papers on the effect of zinc sulphate on dwarf french beans (Miss G. N. Davies), an account of recent work on boron in relation to plant-disease (Dr. W. E. Brenchley), and the uptake of fixed nitrogen by the Leguminous host-plant from its root-nodules at different stages of plant-development (Dr. G. Bond). Dr. A. H. Campbell and Mr. A. E. Vines described the mechanism of the prevention of abscission of spruce-needles when attacked by the fungus *Lophodermium macrosporum*. Observations on the germination of seeds from plants cut down at various stages of growth were described by Dr. N. T. Gill.

Some observations on the aquatic and marsh plants of India and Burma were communicated by Mr. K. P. Biswas ; Miss A. Bennett described the vegetation of the limestone pavements at Hutton Roof and Farleton ; and Mr. J. W. G. Lund the algal vegetation of the margins of ponds.

Messrs. Chesters and Croxall and Miss K. M. Keene discussed the *Libertella* imperfect stage of certain fungi : all the species belonging to the *Allantosphaeriaceae* have a typical perithecial centrum in which the asci form a definite hymenium round the sides and base of the perithecium and in which the asci contain continuous allantoid spores. The characteristic imperfect stage in each individual life-history is a species of *Libertella*. Miss I. M. Wilson described the development and cytology of a Discomycetous fungus, *Peziza rutilans*.

The evolution of botanical nomenclature from the time of the ancient Greeks, and recent progress, was the subject of a paper by Miss M. L. Green. Sir Arthur Hill gave a short account of the Botanic Garden, Buitenzorg.

In a discussion on genetics and taxonomy Dr. W. B. Turrill referred to the methods and limitations of alpha taxonomy (old style) and described the ideas and ideals of omega taxonomy (new style). Mr. W. J. C. Lawrence gave an account of recent biochemical and genetical investigations on colour in flowers. Prof. J. R. Matthews gave examples of closely allied species presumed to have been derived from a common ancestral stock but which have different geographical ranges : in absence of genetical studies their origin is obscure. Dr. T. J. Jenkin stressed the importance of collaboration between the geneticist and the systematist.

In a joint symposium with the zoologists on recent work in genetics and cytology subjects of discussion were incompatibility, crossing over, and control of development. There was also a discussion with Section M (agriculture) on pasture problems.

The semi-popular lecture was by Dr. M. A. H. Tincker on "Growth-promoting Substances and Horticulture" : β-indolyl acetic acid and α-naphthalene acetic acid accelerate the development of roots from cuttings.

Many of the papers were illustrated by exhibits. Mr. E. Marsden Jones and Dr. W. B. Turrill showed specimens and flower dissections illustrating flower variation and sex in *Ranunculus acris*. They find a wide range of genetically inherited variations in wild British material, and suggest that there is a wide field for combined genetical and taxonomic research on our common species. Miss Joyce How demonstrated the effect of the pH of the medium on cultures of *Boletus elegans*.

Dr. B. Colson gave a demonstration of microphotographs showing dividing nuclei and chromosomes in several well-known fungi. *Phyllactinia corylea*, *Peziza aurantia* and *Neurospora tetrasperma* are all apogamous having a haploid number of 10, 6 and 6 respectively. The photographs showed a single reduction division in the asci. In *Pyronema confluens* the haploid number was 6, the diploid 12, and the tetraploid 24 : two changes of chromosome number were shown in the photographs of the dividing nuclei during the three nuclear divisions in the ascus.

Excursions were made to Gotham and the West Lake Hills, to some Derbyshire Dales and to Sherwood Forest and Newstead Abbey.

In the Forestry Department, the Chairman, the Hon. Nigel A. Orde-Powlett, deplored the present devastated or unproductive condition of estate woodlands, and suggested means by which voluntary improvement can most speedily be effected. Mr. W. O. Woodward discussed the possibility of a timber famine, Messrs. W. R. Day and R. G. Sanzen-Baker spoke on forestry problems near industrial areas, and there was a discussion on how the botanist can help the forester, and a symposium on mining timber. Excursions were made to Sherwood and Clipstone Forests and to various woodland estates.

The Conference of Delegates of Corresponding Societies had as President Prof. James Ritchie of Edinburgh. His address was on "The Outlook of Natural History." Prof. Ritchie spoke as a zoologist, but his arguments and suggestions will also apply to Botany.

Discussing the influence of specialization upon the outlook of the Natural History Societies Prof. Ritchie said :

"The stable work which has kept the local societies alive as contributors to knowledge has been the building up of local lists. Sometimes it was an all-round naturalist, sharp of eye keen in the discrimination of minute differences, overflowing with general interest in the world around him, who ventured, and ventured successfully, to name all kinds of plants and all

kinds of animals. That general activity has ceased; the accumulation of knowledge enforced restrictions, and the local naturalist limited his collecting and his identifications to a particular group which came to be his own pet hobby. . . . So he made his local collections, and from them his local lists.

"But this safe and comparatively simple outlet for the energy and enthusiasm of the local naturalist has of recent years become choked, blocked by time and progress. The very thoroughness of the listing, carried on through many years, has made more and more remote the possibility of discovering some new thing, and since it is discovery which gives the urge and flavour to all scientific investigation, the salt of local-list making has lost much of its savour. Moreover, the fact that new species have now become rare discoveries in civilized lands has driven the professional systematist to seek his discoveries in finer and more subtle discrimination between related forms, so that where specific identification was once regarded as all-sufficing, now the determination of sub-species and varieties, geographical races and sub-races, is deemed necessary.

"It would be a grievous blow to the usefulness of the societies and to their self-esteem as a corporate part of the organisation of science in this country were it to be felt that their day of co-operation in scientific progress had come to an end. It has not come to an end, of that I am sure, but I think that the direction of effort must be changed to meet the new conditions.

"In the development of scientific work during the present century two notable changes have been taking place. In the first place there is a marked tendency, due to the growing complexity of scientific problems, to forsake the old individualistic form of research—the researcher ploughing his lonely furrow—and to replace isolation by the collaboration of many workers, organised as a team, whose joint labours, carefully planned, converge upon some definite problem. The second notable change which has been taking place points the way along which the societies might well move, with profit to themselves and to science," the study of organisms as living things.

"A most striking difference between the collector's method, which predominated for so long, and the biological method, lies in the material of their study. The collector, and on the whole, the list maker, are looking for rarities, their material becomes more scarce the longer they labour, their collecting of rarities reduces still further a stock which may be dwindling, even towards extinction. Such things are undesirable. On the other hand, the student of life requires no rare material, the more common a creature is the better it suits his method, for his object is to learn something of the principles which regulate the lives of animals, and the more abundant his material the greater likelihood is there of the success of his observations. And there is still opportunity even in the most familiar creatures for the gain of new knowledge, if the inquiry be pushed far enough. Often it need not be pushed very far.

"The combination of these two modern tendencies offers a new outlook and a new field for the societies; the combination of organised co-operation or team work directed towards the solution of biological problems."

Another sort of attack is the experimental method in illustration of which Darwin's experiments on the intelligence of the earthworm and Lord Avebury's experiments with bees and wasps and coloured discs of paper were instanced.

Mr. John Ramsbottom followed appropriately with an account of the aims and objects of the Association for the Study of Systematics in relation to General Biology. The Natural History Societies can make valuable contributions by undertaking investigations requiring simultaneous observations in different areas, or information from large areas which single workers or small groups of workers would be unable to cover. The Association has appointed a Committee to suggest to the Societies suitable lines of research with a bearing on taxonomy. Its activities would be complementary to those of the Conference of Delegates.

Certain proposals have been put forward. It is suggested that the Committee might get together a panel of "referees," amateur or professional systematists, who would report upon specimens of our fauna and flora concerning whose identity there may be doubts: the nucleus of this panel could be recruited from the Societies: accurate systematic identification is an essential preliminary to any field or other biological work. Secondly, a panel of recorders, not for small local areas, but for the whole country, is suggested: our knowledge of the distribution of some groups, especially marine, is poor.

The Committee might also help in co-ordinating the assistance which Natural History Societies are giving, or could give, in the prosecution of research actually in progress on the British fauna and flora, and might also instigate new lines of research with a bearing on taxonomy, such as the study of the variability of isolated colonies of a species.

The speaker was confident that most amateur naturalists are willing to take considerable trouble to supply data and material, and he recorded the deep obligation of himself and his colleagues at the British Museum in this respect.

Prof. F. E. Weiss spoke on the beauties of Dovedale and its interest to the botanist. The valley of the Dove was suggested to the National Parks Committee appointed by the Government as a suitable area for a national park or nature reserve.

"This suggestion was supported by competent scientific opinion and by a large number of administrative authorities, and the importance of its preservation, both for its scientific amenities and for the enjoyment of the public, has been very widely recognised. Despite the inaction of the Government, which has not taken any steps to implement the recommendations of its Committee, the preservation of Dovedale and of the adjacent Manifold Valley has in recent years been brought nearer to realisation by munificent gifts of considerable stretches of land in and around the area which have been handed over to the National Trust. . . . If the apathy of the Government could be overcome by public pressure and the land between Dovedale and the Manifold Valley could be scheduled for the purpose of establishing a national park, one of the ideals of nature lovers might be realised by securing for the public in perpetuity one of the favourite beauty spots of the Midlands and North of England.

"Even if the complete scheme for a national park remains as something to be striven for, all must be grateful for the good beginning that has been made by the generous gifts of these benefactors. The land already acquired for the public includes open meadow land, the river and river banks, as well as woodland and scrub, so that a great variety of plants, birds, insects and other wild life is open to observation and study."

In conclusion, Prof. Weiss referred to some of the interesting plants to be found in Dovedale in successive seasons.

Mr. F. A. Holmes, a member of the Dovedale Committee of the National Trust, showed by aid of a large scale map the area held by the Trust and the remaining area required to complete the scheme for the much desired National Park.

Capt. C. W. Hume, M.C., Hon. Sec. of the University of London Animal Welfare Society, gave an interesting and detailed account of the Rabbit problem in Britain, and discussed the humanitarian aspect of trapping and the need for a scientific enquiry. A resolution was passed and subsequently approved by the Committee of Recommendations urging upon the Ministry of Agriculture the necessity of instituting an enquiry to ascertain the effects, in respect of efficiency, economic reactions and humaneness, of available methods of dealing with rodents and other wild animals that affect agriculture.

Another resolution was passed recommending the establishment of a close liaison between the British Association, through its Corresponding Societies' Committee, and the Association for the study of Systematics in relation to General Biology—with a view to the Corresponding Societies undertaking work bearing upon systematic problems.—A. B. R.

THE *IXORA* SPECIES OF BURMA AND THE ANDAMAN ISLANDS.

By C. E. B. Bremekamp.

(Continued from p. 266.)

18. I. SESSILIFLORA Kurz in Journ. Asiat. Soc. Beng. xli. 316 (1872); Contr. Bur. Fl. 148 et For. Fl. Bur. ii. 25. *I. rugulosa* Kurz ex F. B. I. iii. 146 p.p.; Ind. Trees, 388 p.p.

Distr. North Tenasserim, between 900 and 1200 m. alt.

This species and the two following differ from the preceding in the much shorter corolla-tube.

19. I. RUGULOSA Kurz, Contr. Bur. Fl. 148 et For. Fl. Bur. ii. 25 (1877); F. B. I. iii. 146 et Ind. Trees, 388, syn. *I. sessiliflora* Kurz excl.

Distr. Lower Burma (Pegu Yomah) and North Tenasserim.

This species is known in two specimens only: Wall. Herb. 6158 *a*, collected near the Attaran River, and a plant collected by Kurz in the central part of the Pegu Yomah. It occurs apparently at lower altitudes than *I. sessiliflora*, from which it differs in its tree-like habit, the somewhat larger leaves, and the pubescent inflorescence.

20. I. MEMECYLIFOLIA Kurz in Journ. Asiat. Soc. Beng. xli. 316 (1872); Contr. Bur. Fl. 147 et For. Fl. Bur. ii. 24. *I. erubescens* Wall. ex G. Don ex F. B. I. iii. 149; Ind. Trees, 388 et Fl. Siam. En. ii. 156, in syn.

Distr. Lower Burma and North Tenasserim, at fairly high altitudes.

LOWER BURMA: District Salween, Thetke Taung, alt. 1500 m., leg. *Po Chin*, 6871 Maymyo Herb.; District Tounghoo, Yemukyo Yoma, Shwegyin, alt. 1350 m., leg. *Po Chin*, 6668 Herb. Dehra Dun.

The type was collected by Brandis at Houndrow in Upper Tenasserim. As Kurz pointed out, it is doubtless nearly related to *I. sessiliflora*, but is easily distinguished by its broad subsessile leaves. With *I. erubescens* (*I. nigricans* R. Br. ex Wight et Arn.) it has very little in common.

Series *Pubescentes* Brem., series nov.—A serie priore foliis et inflorescentia pubescentibus, calycis lobis longioribus, diversa. Typus: *I. Brunonis* Wall. ex G. Don.—A Sikkim et Assam usque ad Peninsulam Malayensem.—Species 21–22.

21. I. VILLOSA Roxb. Fl. Ind. ed. Carey, i. 383 (1820); Wight, Ic. t. 150; Contr. Bur. Fl. 150 et For. Fl. Bur. 20; F. B. I. iii. 144; Ind. Trees, 388.

Distr. Sikkim, Assam, Burma (Pegu Yomah, *fide* Kurz, *l. c.*).

22. I. BRUNONIS Wall. ex G. Don, Gen. Syst. iii. 573 (1834); Contr. Bur. Fl. 147 et For. Fl. Bur. ii. 20; F. B. I. iii. 139; Mat. F. M. P. 72; Ind. Trees, 388; F. M. P. ii. 91 p.p.; Fl. Siam. En. ii. 151.

Distr. Lower Burma (Pegu Yomah, *fide* Kurz, *l. c.*), Tenasserim (Tavoy, *fide* Hooker f., *l. c.*), Malay Peninsula.

Series *Nigrescentes* Brem.—Differs from the series *Subpaniculatae* in the black discoloration of the young parts in herbarium material, the wider leaves, the often nodding or subpendulous inflorescence, the reduced leaves at the base of the peduncle, the long calyx-lobes, and the violet anthers.—From India through the western part of Further India to Sumatra, Java, and Bali.—Species 23.

23. I. NIGRICANS R. Br. ex Wight & Arn. Prodr. Fl. Ind. i. 428 (1834); Wight, Ic. t. 318; Contr. Bur. Fl. 149 et For. Fl. Bur. ii. 23, var. *erubescens* (Wall. ex G. Don) Kurz incl.; F. B. I. iii. 148 et Ind. Trees 389, var. *arguta* Hook. f. incl.; F. I. C. iii. 321, var. *ovalis* Pierre ex Pitard excl.; Brem. Ix. n. 66. *I. erubescens* Wall. ex G. Don, Gen. Syst. iii. 571 (1834); F. B. I. iii. 149; Ind. Trees, 389 et Fl. Siam. En. ii. 156, syn. *I. memecylifolia* Kurz excl.; *I. affinis* Wall. ex G. Don, *l. c.* in commentario ad *I. erubescentem*; Fl. Siam. En. ii. 147, var. *arguta* (Hook. f.) Craib et var. *plumea* (Ridley) Craib incl. *I. arguta* (Hook. f.) King & Gamble, Mat. F. M. P. 74 (1904); F. M. P. ii. 92. *I. plumea* Ridley in Journ. Asiat. Soc. Straits, lix. 117 (1911); F. M. P. ii. 92. *Pavetta acutiflora* Reinw. ex Korth. in Ned. Kruidk. Arch. ii. 2, 262 (1851). *P. subulata* Teysm. & Binn. in *op. cit.* iii. 403 (1855).

Distr. From the Indian Peninsula through Assam, Burma, the Malay Peninsula, Sumatra, and Java to Bali.

Section CHLAMYDANTHUS Brem.

This section differs from *Brachypus* mainly in the larger bracts, bracteoles, and calyx-lobes. The inflorescence is corymbose or subcapitate, and subsessile or shortly pedunculate. The style is glabrous.—India, Farther India, and the western part of the Malay Archipelago.—Species 24–26.

24. I. MULTIBRACTEATA Pearson ex King & Gamble, Mat. F. M. P. no. 15, 74 (1904); F. M. P. ii. 92; F. I. C. iii. 311; Fl. Siam. En. ii. 162; Brem. Ix. n. 67.

Distr. South Tenasserim, Malay Peninsula, North Sumatra.

TENASSERIM: District Mergui, Leikpok Chaung, alt. 120 m., leg. *Mr. Braybon's Collector*, 137 Maymyo Herb.

The often cultivated *I. Finlaysoniana* Wall. ex G. Don belongs to this section, and is very near *I. multibracteata*, but is easily distinguished by its leathery obtuse leaves with fewer nerves. It is not wild in Burma.

25. I. MERGUENSIS Hook. f. F. B. I. iii. 140 (1880); Mat. F. M. P. 72; Ind. Trees, 388; F. I. C. iii. 310 p.p.; Fl. Siam. En. ii. 161.

Distr. Tenasserim, Malay Peninsula.

SOUTH TENASSERIM: Thebyu, Theinkun Chaung, alt. 30 m., leg. *C. E. Parkinson*, 1923 Herb. Dehra Dun.

26. **Ixora capitulifiora,** sp. nov.; typus: *C. E. Parkinson*, 1198 Herb. Dehra Dun. Inflorescentia subcapitata ad *I. merguensem* vergens, calycis lobis glabris et longioribus, corolla haud barbata, ab ea tamen faciliter distinguenda. Corolla haud barbata ad *I. Korthalsianam* Kurz et ad *I. Kurzianam* (Teysm. & Binn.) Kurz accedens, foliis minoribus, inflorescentia subcapitata, calycis lobis longioribus ab eis valde diversa.

Habitus ignotus. *Rami* et folia glabri; rami novelli 2–2·5 mm. diam., mox cortice griseo-brunneo opaco vestiti. *Folia* petiolo crassiusculo usque ad 13 mm. longo, interdum tamen multo breviore; lamina oblongo-elliptica 8–16 cm. longa et 3·6–6 cm. lata, apice acuminata, basi acuta, herbacea, sicc. haud conspicue decolorata, costa basin versus canaliculata, nervis utroque latere costæ circ. 8 subtus prominulis, venulis laxe reticulatis utrimque distinguendis. *Stipulæ* late ovatæ an subtruncatæ in aristam vagina paulo breviorem exeuntes. *Inflorescentia* subsessilis, subcapitata, glabra, floribus circ. 50; pedunculus 1·5–2 mm., internodio 4 mm. longo, foliis 1·5–5 cm. longis munito, præcessus; internodia basalia axis et ramulorum infimorum 1–1·5 mm.; alia breviora. *Flores* laterales triadum pedicellis 0·6 mm. longis; ramuli infimi bracteis suffulti; bracteæ omnes anguste lineares, basales usque ad 5 mm. longæ, aliæ peripheriam versus longitudine decrescentes; bracteolæ florum lateralium 2–2·5 mm. longæ. *Ovarium* glabrum. *Calyx* glaber tubo subnullo, lobis linearibus 5–5·5 mm. longis et 2 mm. latis, acutis. *Corolla* alba, extus intusque glabra, tubo 1·8–2·1 cm. longo et 1·2 mm. diam., lobis obtusis 5·5 mm. longis et 2 mm. latis. Filamenta 1·2 mm.; antheræ 3 mm. *Styli* pars exserta cum stigmatibus 1·8 mm. longis 4·5 mm. longa.

Hab. ANDAMAN Is.: s.l., leg. *C. E. Parkinson*, 1198 Herb. Dehra Dun; South Andaman, Rogolochang, leg. *J. H. Lace*, 2818 Herb. Dehra Dun.

Section OTOBACTRUM Brem.

This section differs from *Brachypus* by its pendulous, generally long-pedunculate inflorescences, and the presence of a short internode, either with reduced and differently shaped leaves or with rudimentary leaves, at the base of the peduncle.—Tropical Asia and New Guinea.—Species 27–37.

a. Corolla-tube outside puberulous (species 27–31).

27. I. OPACA R. Br. ex G. Don, Gen. Syst. iii. 573 (1834); F. B. I. iii. 147; Mat. F. M. P. 77; Ind. Trees, 389; F. I. C.

iii. 328 p.p.; Fl. Siam. En. ii. 162 var. excl.; Brem. Ix. n. 78 *I. pendula* Jack var. *opaca* (R. Br. ex G. Don) Ridley, F. M. P. ii. 96 p.p.

Distr. Tenasserim (*fide* Hook. f. *l. c.*, et Brandis, *l. c.*), Malay Peninsula, Sumatra.

This species is probably a mixture. At any rate it deserves further study. I have not seen the specimen from Tenasserim referred to it by Hooker fil. and Brandis. The type was collected at Penang, and differs conspicuously from most of the specimens afterwards referred to this species.

28. I. MEEBOLDII Craib in Kew Bull. 1914, 29, var. *oblonga* Craib, *l. c.*, incl.

Distr. Lower Burma, Upper Tenasserim.

LOWER BURMA: District Insein, Hlaing Yoma Reserve, leg. *Ba Pe*, 11,606 Maymyo Herb.; District Moulmein, Papun, leg. *Meebold*, 17,349 (co-type) et 17,344·5 (type of var. *oblonga* Craib) Herb. Kew.; Moulmein, alt. 600 m., leg. *Lobb*, s.n., Herb. Kew. (type). UPPER TENASSERIM: Martaban, Herb. Wall. 8387.

I see no difference between the variety and the type.

I. Parkinsoniana Craib in Kew Bull. 1932, 428, is nearly related to *I. Meeboldii* and the three following species. The peduncle of its inflorescence is very long (20 cm.), and the inflorescence much more pubescent. The corolla is more densely pubescent, and the leaves are obtuse. The type was collected at Yanyao (leg. Kerr, 18,170 Herb. Kew.). In his Fl. Siam. En. (ii. 163) Craib erroneously states that the type was collected in Burma. I have not seen any Burmese specimens: those referred to it by Craib belong to *I. obtusiloba* (*vide infra*).

(To be continued.)

SHORT NOTES.

PREVENTION OF PLANT DISEASES.—The problem of preventing the introduction of plant diseases into a country is always a matter of concern to Governments, though sometimes quarantine measures seem to be affected by trade requirements.

When crossing to the continent recently in a Dutch steamer I noticed that among the flowers with which the smoke-room was artistically decorated were many fine blooms of *Antirrhinum*. To my surprise I found that most of their leaves were heavily infected with *Puccinia Antirrhini*. The boat had arrived at Harwich overnight from Flushing, and apparently the infected plants were going backwards and forwards across the North Sea. The fact that the plants were Dutch-grown matters little, but here was a disease, only recently recorded for Europe, being transported from one country to another in a way which apparently eluded all quarantine services.—J. R.

FURTHER NOTES ON ALDERNEY PLANTS.—Since the publication of the notes in Journ. Bot. 1933, 106, two further visits were paid to Alderney, May 26 to June 3, 1933 (A. B. J. & H. K. A-S.), and June 15 to 22, 1934 (A. K. J. & H. K. A-S.). The following plants were noted either as new to the island (marked *), or in localities not recorded in Marquand's Flora, or as still persisting in their recorded stations, or as adventives (marked †):—

Ranunculus hederaceus L.—Still in one spot in the Val Pammière (1934).

Lepidium Smithii Hook.—This had increased at Fort Tourgis by 1933. In 1899 Marquand noted only one plant.

Moenchia erecta (L.) Gaertn., Mey. & Scherb.—Mannez Quarry. Previously recorded only from La Tchue (1934).

**Stellaria apetala* Ucr. var. *glabella* (Jord. & Fourr.) Rouy & Fouc.—Mannez Quarry (1934). This form, characterized by its glabrous sepals, does not seem to have been previously recorded for the British Isles. It is, however, apparently not uncommon. It should perhaps be referred as a variety to *S. pallida* (Dum.) Piré (*S. Boraeana* Jord.).

Radiola linoides Roth.—Between Forts Houmet and Quenard. Associated with *Centunculus* (1934).

Geranium rotundifolium L.—Braye Bay (1933). Dump by harbour (1934). Only recorded from Whitegates by Marquand.

Trigonella ornithopodioides (L.) DC.—Sandy roadside, Clanque (1933).

†*Trifolium stellatum* L.—Short turf, Platte Saline, in small quantity. A Mediterranean species; presumably not native (1933–4).

Rubia peregrina L.—Still in its old locality at Corblets Bay in very small quantity (1934).

Centaurea aspera L.—Still persists in the localities mentioned by Marquand. The patch at the foot of the hill on the eastern side of Braye Bay appeared to be in jeopardy owing to the close proximity of a quarry dump (1934).

Centunculus minimus L.—Between Forts Houmet and Quenard. Associated with *Radiola* (1934).

Veronica officinalis L.—Cliff near Hanging Rock. Previously recorded only from the western end of the Island (1933).

Chenopodium ficifolium L.—York Hill Quarry (1934).

**Populus canescens* Smith.—Val du Sud. This species has not previously been noted from the Island. Marquand's record of *P. alba* from this locality may refer to it (1933).

**Juncus capitatus* Weigel.—Very sparingly on sandy roadside at Clanque. Not previously recorded from the Island (1933).

**Arum italicum* Mill.—The Terrace, St. Annes (1934). Recorded previously only from Jersey, Guernsey, and Sark.

**Carex distans* L.—At the foot of Fort Albert (1934). New to the Island.

†*Gaudinia fragilis* (L.) Beauv.—In some quantity in a grassy cutting near Whitegates. Associated with *Lolium*. Apparently well established. A South European species (1933).

**Poa irrigata* Lindm.—Above Watermill Farm (1934).

Sclerochloa rigida (L.) Link.—Rocks near Corblets (1933).—A. B. JACKSON, A. K. JACKSON, and H. K. AIRY-SHAW.

REVIEWS.

Studien über die monotypische Gattung Calluna *Salisb.*—I.–II. By ROLF NORDHAGEN. Bergens Museums Arbok 1937. Naturvidenskapelig rekke Nr. 4, pp. 1–55, und 1938 Nr. 1, pp. 1–70.

BRITISH botanists who are interested in the morphology of familiar plants are strongly advised to read this account of certain structural features of the common heather and the conclusions drawn from a comparison between *Calluna* and other genera of the Ericaceae. Amongst the unusual or important features to which attention is drawn, mention may be made of the following: the occurrence of two or more pairs of more or less modified leaves on the flower-bearing shoots between the bracteoles and the calyx; "obdiplosepaly", which is, however, not always shown; the presence, with varying frequencies, of 3- and 5-flowered lateral shoots; the unilateral orientation of the flowers; zygomorphy of the floral parts, except the calyx, induced by gravitation and correlated with pollination mechanism; anatomical characters of the corolla; and the seed-dispersal mechanism, the sepals and corolla-lobes closing over the septifragal capsule, but usually with one sepal spreading and so leaving a fairly wide aperture through which the wind-dispersed seeds escape, for the most part in late autumn.

The second part of these studies is comparative and theoretical. The results of the author's researches and numerous published accounts of genera of the Ericaceae, and of supposedly related families, are discussed, and it is concluded that *Calluna vulgaris* shows a combination of derived and primitive characters. The former are all connected with the unilateral orientation of the flowers. The differences between *Calluna* and *Erica* are greater than have been generally recognized. In several respects *Calluna* is more primitive than *Erica*, as, for example, in its low chromosome number ($n=8$). The phylogeny of *Calluna* remains unsolved, but it is possible that the genus had a common ancestor with the *Arbutoideae*.

An outline account of the distribution of *Calluna* and of other members of the *Ericoideae* leads to a discussion of the relationships and history of the whole group, with special reference to the connections between Europe and Africa. It is concluded that while in Europe the Ice Age had a very destructive influence on these members of the Bicornes, in Africa, instead of an Ice Age there was a Pluvial Period, which allowed continued further evolution and persistence, at least in the tropical and southern parts.—W. B. TURRILL.

Chronica Botanica.—Vol. III. Edited by FR. VERDOORN in collaboration with an Advisory Board and numerous Assistant and Corresponding Editors. 8vo, pp. 431, illustrated. Chronica Botanica Co.: Leiden, Holland, 1937. Price 15 Guilders.

THIS very informative annual is a testimony to the energy of the Editor and those associated with him in the work. On the same lines as previous volumes it is mainly a review of the activities of botanical institutes throughout the world during 1936 with announcements for 1937 and 1938. Obituary notices, sometimes with a photograph, are given of botanists who have died during the year. Immediately following the calendar is a preliminary programme of the Seventh International Congress to be held at Stockholm in July 1940, followed by reports or personnel of the various committees appointed at the last Congress. Also reports of other Congresses, past or to come, Associations, &c.

Discussions and Announcements which follow the Annual review include a standardized form for items in the 'Index Botanicorum' in course of preparation by Dr. Verdoorn, which will contain detailed biographies of all plant scientific workers "whose *curricula vitae* are of direct scientific interest." That of the late Dr. A. S. Hitchcock is the example given. C. X. Furtado of the Botanic Gardens, Singapore, criticises the amendment to Art. 36 of the International Rules accepting advanced separates when dated and placed on sale as effective publication. He also refers to the well-known disadvantages of publication in non-botanical and non-systematic publications. There is also a list of suggested abbreviations of herbaria for use in taxonomic publications. The volume concludes with lists of new periodicals and new and changed addresses.—A. B. R.

Annales Bryologici. Vol. IX. (1936). Edited by Fr. Verdoorn. 8vo, pp. 160. Illustrated. Chronica Botanica: Leiden, 1937. Price 6 Guilders.

This issue of the Year-Book contains nine papers by British, Continental, and American authors. H. N. Dixon suggests a scheme for the preparation of a new 'Index Bryologicus' to replace Paris's 'Index' (edition 2), now thirty-five years old; Dr. Verdoorn is hopeful of finding a publisher. Mr. Dixon also gives a list of mosses collected by Dr. A. F. G. Kerr on Mt. Pū Bia in French Laos. The collection indicates a rich bryological flora and contains eleven new species and one new genus. P. W. Richards enumerates a collection of bryophytes from the Azores, mainly from Pico, by Messrs. Tutin & Warburg, which includes seventeen species new to the islands. Th. Herzog continues his Studies on *Drepanolejeunea* and H. Eifrig (Rasberg) contributes a monographic revision of the Indo-Malayan species of *Taxilejeunea*. H. Castle (Connecticut) begins a revision of the genus *Radula*; this first part includes an historical introduction and a revision of the subgenus *Cladoradula*. A. Le Roy Adams (Ithaca, N.Y.) also supplies a first instalment of notes on the Warnstorf Sphagnum-Herbarium, which he has studied at Berlin-Dahlem. Warnstorf seems to have been a no more satisfactory guide than other well-known fathers of Sphagnology. W. & Ae. Döpp (Marburg) summarise some recent contributions to Moss-cytology. Finally, miscellaneous notes contain some obituary notices with portraits including those of Francis Cavers and Daniel Angell Jones.

Blumea.—Supplement I. Jubilee Volume for J. J. Smith. Pp. 253, with 17 pls. & text-figs. Rijksherbarium, Leiden, 1937.

This Supplement is a testimonial from many of Dr. Smith's friends in commemoration of his seventieth birthday and as an appreciation of his work, especially on the Orchids of Malaya. Notes of appreciation are contributed by J. Sibinga Mulder, formerly of Buitenzorg, and by the Director of the Royal Gardens, Kew, and there is a short "life" by H. J. Lam, Director of the Rijksherbarium, where Dr. Smith has for some years been an unofficial worker. The publication has been made possible by the generosity of many of Smith's friends, contributions from no less than thirty of whom are contained in the volume. Appropriately a number of the papers deal with Orchids. Oakes Ames describes some new species of the remarkable Philippine genus *Acoridium*, with notes on its history; R. C. Bakhuizen van den Brink gives a synopsis of the vernacular names and economic uses of the orchids of Java; H. G. Derx has an appreciation of Smith's work; W. M. Docters van Leeuwen

describes the biology of the saprophyte, *Epipogium roseum*, and R. E. Holttum some hybrids of *Arachnis* and *Renanthera*; V. S. Summerhayes reviews the tropical African genus *Rhipidoglossum*; and R. Mansfeld upholds Lindley's four tribes in a System of the family.

H. J. Lam reproduces a forgotten floristic map of Malaysia by Zollinger (1857), of special interest for its "modern" features; and H. N. Ridley discusses the origin of the flora of the Malay Peninsula. Other papers deal with a variety of subjects including marine Algae, Fungi, and Liverworts. Three of the plates depict Dr. Smith at his work in Java or recently in the Rijksherbarium.

Taxonomic Fern-Studies.—III.–V. By C. Christensen. Dansk Botanisk Arkiv, ix. Nr. 3, 1937.

This continuation of Dr. Christensen's series is very welcome and contains a great deal of valuable work. The parts have separate titles, beginning with: III. Revision of the Genera and Species of Ferns described by A. J. Cavanilles. The Herbarium of Cavanilles is, or was, preserved at Madrid in the state in which it was left by Cavanilles, and it is indeed fortunate that Dr. Christensen has published this re-examination of the types. IV. Revision of the Bornean and New Guinean Ferns collected by O. Beccari and described by V. Cesati and J. G. Baker. Beccari's collections are preserved at Florence and have been very little studied by botanists working at the Malayan Flora. He was one of the earlier Malayan collectors and visited the neighbourhood of Kuching in Sarawak and later Amboina and N.W. New Guinea. The third division of Dr. Christensen's paper—V. Description of 36 new Species of Ferns—deals with species from all over the world.—A. H. G. Alston.

Evolution without Natural Selection. By J. C. McKerrow. Sm. 8vo, pp. 63. Longmans Green & Co., Ltd.: London, 1937. Price 1*s.*

This application of the author's 'Novius Organum' to life in general and to human psychology is a somewhat abstruse psychological essay that claims to displace natural selection as a factor in evolution. The three chapters—life as a habit, eliminating adaptation and selection of variations, the emergence of man, and the evolution of sapience, appeal more to the zoologist than to the botanist.

BOOK-NOTES, NEWS, etc.

Orchid-Pollination through Pseudocopulation.—The 'Orchid Review' (Aug. & Sept.) reprints an article from Botanical Museum Leaflets, Harvard University, by Prof. Oakes Ames,

summarising our knowledge on the pollination of Orchids by male insects that apparently mistake the flower for a female of their species. In this Journal for 1929 appeared accounts of Col. Godfery's observations on species of *Ophrys* supplementing those of M. Pouyanne in Algeria, and of Mrs. Coleman's observations in Australia on *Cryptostylis*. Prof. Ames discusses the evolutionary significance of pseudocopulation in these two genera belonging respectively to two of the basic subdivisions of the monandrous Orchids and widely separated geographically. The taxonomic positions assigned to these two genera indicate that the phenomenon "is a peculiarity of the lowest groups of the family, and therefore may be considered an ancient and long-established association."

'ESSEX NATURALIST,' vol. xxv. pt. v. (April–Sept. 1937), contains Mr. J. Ramsbottom's Presidential Address to the Essex Field Club, entitled "Dry Rot in Ships." Arising from records by Jas. Sowerby of fungi on wood in Deptford dockyard in the earlier years of last century, which were found to be associated with his reports for the Admiralty on the damage to ships by dry rot, the address is an interesting detailed account of the damage to the navy from use of unseasoned timber and lack of ventilation in historical times up to the supplanting of the wooden walls by iron ships. Jas. Sowerby's reports to the Admiralty in 1812 and 1813, hitherto unpublished, are reproduced.

'ARCHIVES DE BOTANIQUE (CAEN)'.—Vol. vii. (1934–6) contains two important contributions on the flora of Madagascar—a revision of the species of *Impatiens* by H. Perrier de la Bathe, with full descriptions of eighty-three species, many of which are new, and a revision of the Cyperaceae (part 3) by H. Chermezon including the genera *Scirpus* to *Carex* with additions and corrections to the two earlier parts which appeared in the Ann. Mus. Colon. Marseille in 1919 and 1922 respectively. Two short papers by Prof. Chermezon deal respectively with the Cyperaceae collected in the Haut-Oubangi by Tisserant and in Senegal by Trochain.

OBITUARY.—We hear with regret of the death of Miss Lorrain Smith, the well-known lichenologist, and of Prof. A. J. Ewart, of Melbourne. We hope shortly to publish some appreciation of their work.

CORRECTION.—In Bibliographical Note, p. 192, line 8, *for* "only name from the N. L. F. cited in the 'Index Kewensis'" *read* "only name cited from the N. L. F. in the 'Index Kewensis.'"

CONTRIBUTIONS TO OUR KNOWLEDGE OF BRITISH ALGÆ*.

BY J. W. G. LUND, M.Sc.

VI. SOME NEW BRITISH ALGAL RECORDS.—I.

DURING the examination of the littoral microflora occurring on certain sediments in four ponds in Richmond Park, Surrey, a number of algæ new to science or hitherto unrecorded for the British Isles have been encountered. It is proposed to deal with these algæ in this and succeeding contributions. In addition to the six algæ described below, which are new records for the British Isles, a number of others have been found which have been recorded only rarely; the most important of these are :—

Heteromastix angulata Korsch. (1, 2).
Pyramimonas delicatulus Griff. (Also observed at Pickmere, Cheshire.)
Scourfieldia complanata G. S. West.
Spermatozopsis exultans Korsch. (2).
Chromulina ovalis Klebs.
Chrysococcus rufescens Klebs. (Also observed in ponds in Kew Gardens, Surrey; Ennerdale Water, Westmorland; two ponds near Sheffield, Yorkshire.)
Hyalobryon ramosum Laut. (1, 3).
Pseudomallomonas anglica Carter (4).
Uroglenopsis americana Lemm.
Chroomonas Nordstedtii Hansg. (Also observed in Kew Gardens.)
Gymnodinium aeruginosum Stein. (Also observed near Sheffield, Yorkshire, and Foolow, Derbyshire.)
Hemidinium nasutum Stein.
Colacium arbuscula Stein.
Eutreptia viridis Perty.
Phacus triqueter (Ehrenb.) Duj. (3).

It appears likely that the majority of these algæ and others to be dealt with later are of common occurrence. They have hitherto been overlooked, probably, in some cases, because of their small dimensions. Moreover, it would seem that their most usual habitat is the marginal regions of lakes and ponds, where they appear to occur especially among vegetable detritus.

HOLOPEDIUM GEMINATUM Laut. (fig. 1, A–C). The cells are united into plate-shaped colonies, similar to those of *Merismopedia*, but show quite an irregular arrangement (fig. 1, B & C). The cells are placed with their long axes at right angles to the surface

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of the colony (fig. 1, A), and may appear more or less angular due to mutual pressure; they measure 3·5–6 μ wide and 10–13·5 μ high. The colonies may reach a width of 2–2·5 mm. This alga was present in small quantities on the surface of the littoral deposits in the Upper Pen Pond throughout 1936. It has previously been recorded from Sweden, Germany (5, 6), and Latvia (7).

CYLINDROSPERMUM ALATOSPORUM F. E. Fritsch (fig. 1, D & E). This species is characterized by the well-developed, striated mucilage envelope around the spores (spore with membrane 10–15·5 by 25·5–30·5 μ; membrane 2–3 μ wide). The envelope

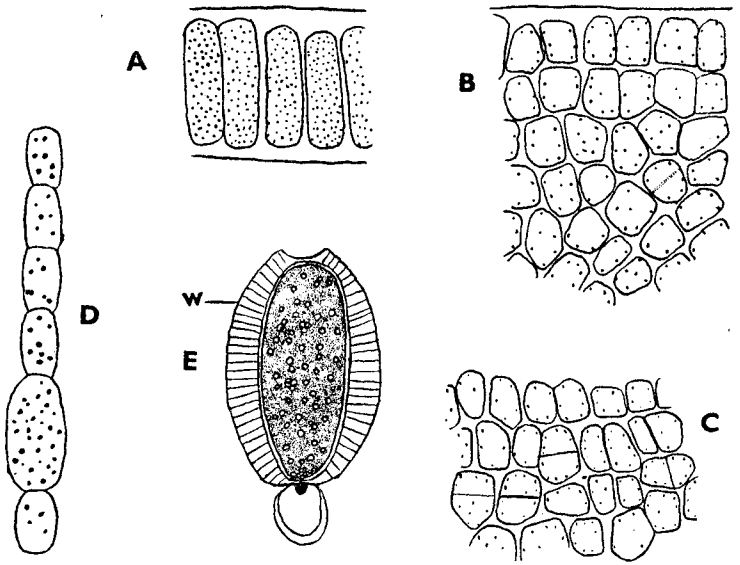

FIG. 1.—A–C. *Holopedium geminatum* Lauterborn. A. Portion of colony in longitudinal section. B. Cells from marginal region. C. Cells from central region of a colony, surface view. D, E. *Cylindrospermum alatosporum* F. E. Fritsch. D. End of filament with young spore and heterocyst. E. Ripe spore and heterocyst; *w*, wing of spore. (All × 1100.)

is especially prominent along the lateral margins of the spore, so that the latter appears winged. The vegetative cells are more or less barrel-shaped (3·5 by 7–8·5 μ), while the heterocysts are oblong (4–6 by 7–8·5 μ). The latter differ from those recorded by Fritsch (8) in that they show shedding of the outer layers of the wall only occasionally.

This alga, hitherto only recorded from the Cape Peninsula (8) and North Sumatra (9), occurred abundantly in a culture of mud from the littoral region of the Upper Pen Pond covered with a 0·05 per. cent. solution of potassium monohydrogen phosphate. A few specimens have been observed in nature on the surface of the littoral mud in the Lower Pen Pond. It is of interest to note that the habitat is the same as that of the South African material.

TRACHELOMONAS VARIANS Defl. (fig. 2). A form of *Trachelomonas*, probably belonging to this species, occurred abundantly in a small stagnant pond from October 1936 to March 1937, and in smaller quantities since. It was also observed in small numbers in the two Pen Ponds and the Leg-of-Mutton Pond. I have also observed specimens in ponds in Epping Forest, Kew Gardens, and near Sheffield, Yorkshire. It is probably of common occurrence, being confused with *T. volvocina* Ehrenb.

The individuals measure 22·5–26 μ, the commonest dimension being 24 μ. The shape of the envelope is described by Deflandre (10; see also 11) as being "subsphérique ou très largement ellipsoidale, jamais parfaitment sphérique," though the forma *globosa* is characterized by its almost spherical envelope. While a large number of my specimens agree with Deflandre's description of the type, others had perfectly spherical envelopes (fig. 2, D). The envelopes were generally smooth, although the forma *spiralis* Defl. (10), which is characterized by having spiral markings, was observed on a few occasions. The envelope always possesses a well-defined collar which is produced further towards the inside than towards the outside (fig. 2, D, G). The aperture is often orientated obliquely in relation to the envelope. The latter, except in young individuals, is dark brown in colour. The flagellum varies from once to twice the length of the cell. Deflandre (10, 11) states that there are numerous discoid or polyhedral chloroplasts lacking pyrenoids, and separate chloroplasts are clearly distinguishable in many of my individuals (fig. 2, A). In others, although this may appear to be the case under low powers of the microscope, examination with water or oil-immersion objectives shows that the chloroplasts are actually more or less united to one another and, in extreme cases, may form one single reticulate chloroplast (fig. 2, B, D, E, F, G). The eye-spot lies below the inner opening of the collar, and the large nucleus is situated laterally. Paramylon is stored as rod-shaped granules (fig. 2, C).

This species principally differs from *T. volvocina* Ehrenb. and its varieties in the nature of the collar, the lack of pyrenoids, and the numerous discoid or polyhedral chloroplasts, which are often more or less united to form a reticulum. It is doubtful whether the collar is typical of the species or not, as *T. volvocina* var. *cervicula* (Stokes) Lemm. is recorded as possessing a similar

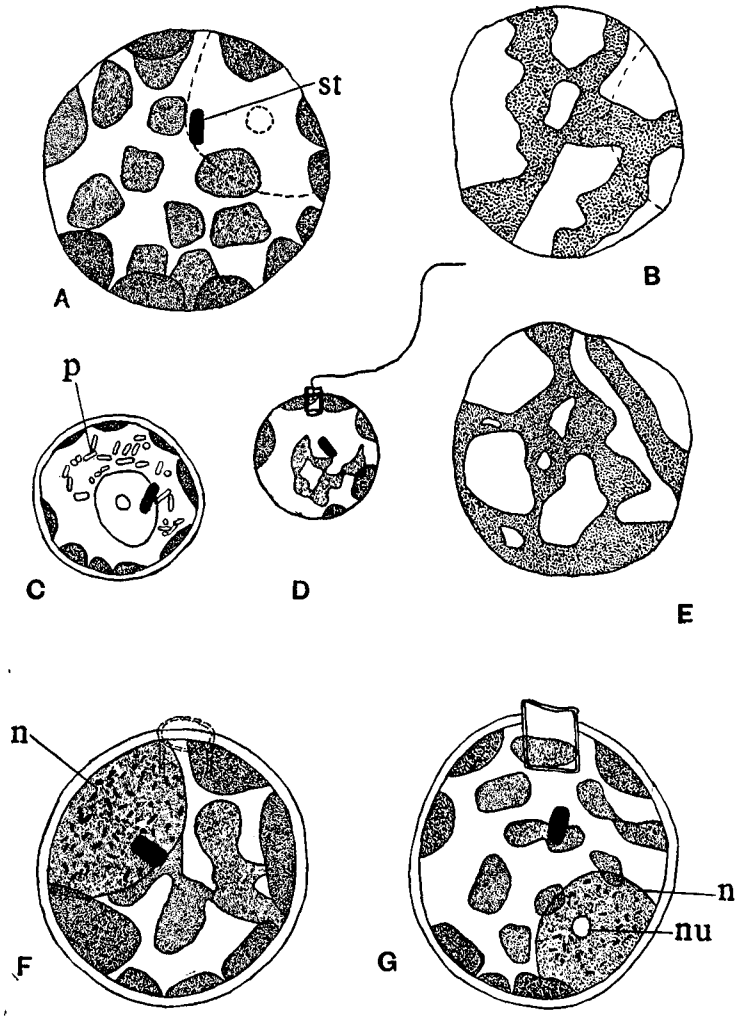

FIG. 2.—*Trachelomonas varians* Defl. A, B, E. Protoplasts isolated from their envelopes and showing variations in the structure of the chloroplasts. C. Cell seen from above. D, F, G. Cells in longitudinal view. *n*, *nu*, nucleolus; *p*, paramylon; *st*, stigma. (A, B, E, F, G, ×1600; C, ×800; D, ×560.)

collar (10, 11); the protoplast of this variety is, however, undescribed.

CHRYSAMOEBA RADIANS Klebs (fig. 3, A–F). This alga was first described by Klebs (13); later a full account of its structure was given by Doflein (14), although his alga is possibly a different species from that described by Klebs (see below).

The rhizopodial state (fig. 3, A–E) is predominant, motility being of relatively short duration. The non-motile cell (approx. 4·5–8·5 by 5–12 μ) lacks a flagellum, but has a number of fine radiating rhizopodia, which are only very rarely branched. The motile stage is represented by *Chromulina*-like swarmers which are highly metabolic. The swarmers are usually more or less egg-shaped. There is a single, commonly band-shaped,

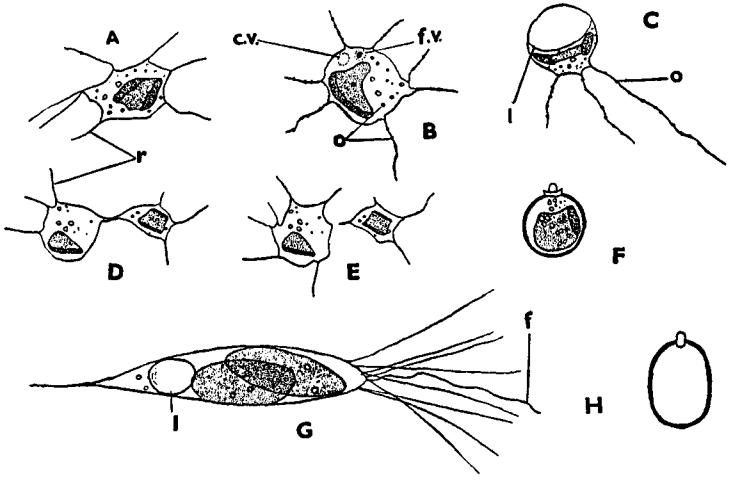

FIG. 3.—A–F. *Chrysamoeba radians* Klebs. A–E. Rhizopodial stage; D, E. Stages in cell-division. F. Cyst. G, H. *Mallomonas akromonas* Ruttner. G. Motile cell. H. Cyst. *c.v.*, contractile vacuole; *f*, flagellum; *f.v.*, food-vacuole?; *l*, leucosin; *o*, oil; *r*, rhizopodium. (A–F, ×900; G, ×1600; H, ×900.)

chromatophore, which is of very variable size in relation to that of the cell (fig. 3, A–E). The colour is also variable, and sometimes the chromatophore may be very small and pale. Reduction has been recorded also in the chromatophores of other Chrysophyceae. I have not observed holozoic nutrition, and in only two cases have possible food-vacuoles been seen in the cells (fig. 3, B, *f.v.*). There are two contractile vacuoles, pulsating alternately. A stigma is lacking. The food reserves are leucosin (fig. 3, C, *l*) and oil. The latter is invariably present and frequently occurs in large amounts. The rhizopodia may have a beaded

appearance owing to the contained oil-droplets (fig. 3, B, C, *o*). The cyst (7·5–9 μ) is spherical, with a smooth wall (fig. 3, F). The pore has a projecting collar and is closed by a plug which is not silicified. The cyst contains abundant food-reserves.

Klebs (13), in his original description of the species, stated that there were two chromatophores in the cell, but Doflein (14) found only one. He points out that in the curved band-shaped chromatophores of Chrysomonadineae (especially in species of *Chromulina* and *Ochromonas*) the part connecting the two flaps may not be clearly visible in living material and only evident after staining. His drawings of living cells of *Chrysamoeba*, however, show that a single chromatophore is sometimes at least visible without staining. Kleb's figures of the rhizopodial stage do not show two chromatophores clearly. In my material a single chromatophore was easily discernible in the living cell, and I am inclined to agree with Doflein that *C. radians* Klebs actually has only a single chromatophore.

Chrysamoeba radians has frequently appeared in large amounts when mud from the Leg-of-Mutton Pond has been covered with distilled water. In nature it has been observed growing on decomposing water-plants.

MALLOMONAS AKROMONAS Ruttner (fig. 3, G, H). The long spindle-shaped cells (4·5–8·5 by 22–35·5 μ) of this species are characterized by the restriction of the silicified needles, which are few in number, to the anterior end of the cell (fig. 3, G). There are two parietal chromatophores, and oil and leucosin (fig. 3, G, *l*) are the reserve products. The length of the flagellum is approximately equal to half that of the cell. The cysts (fig. 3, H) are oval to elliptical in shape (7–9·5 by 10–13 μ).

This alga was present in small quantity during November and December 1936 in the littoral plankton of the two Pen Ponds. A few specimens were observed in February and March 1937 in a small stagnant pond. I have also observed it in the littoral plankton of a disused reservoir near Foolow, Derbyshire, in November 1936. Professor Harris informs me that he has observed it in the Reading district, and Mr. Scourfield that he has observed it in ponds in Epping Forest. It is probably a widespread winter plankton form. It is known (see 15) from Austria, Germany, Belgium, and Russia as a constituent of the winter plankton of ponds and lakes.

MESOSTIGMA VIRIDE Lauterborn (fig. 4). The structure of the specimens observed agrees closely with the descriptions of Lauterborn (16, 17) and Pascher (18), although neither of them observed resting stages.

The naked individuals are markedly flattened in a plane at right angles to the insertion of the flagella (*cf.* fig. 4, I). The longest axis is thus transverse (12–17 μ), the antero-posterior

axis being greatly abbreviated (3·5–4 μ). The face of the cell bearing the flagella is slightly concave, whilst the dorsal face is convex. Viewed from the anterior or posterior face (fig. 4, A) the cell usually appears more or less oblong, but departures from this general shape occur (fig. 4, H). The anterior face is not always uniformly concave, but frequently shows a spiral twist, as is well illustrated in fig. 4, I, which is reproduced from Pascher (18). The periplast is rigid and often shows a delicate surface striation (fig. 4, A). The two equal flagella are inserted on the concave surface of the cell, lying between the centrally placed stigma and the margin of the cell (fig. 4, A). The stigma is large and oval to rectangular in shape. The single chromatophore

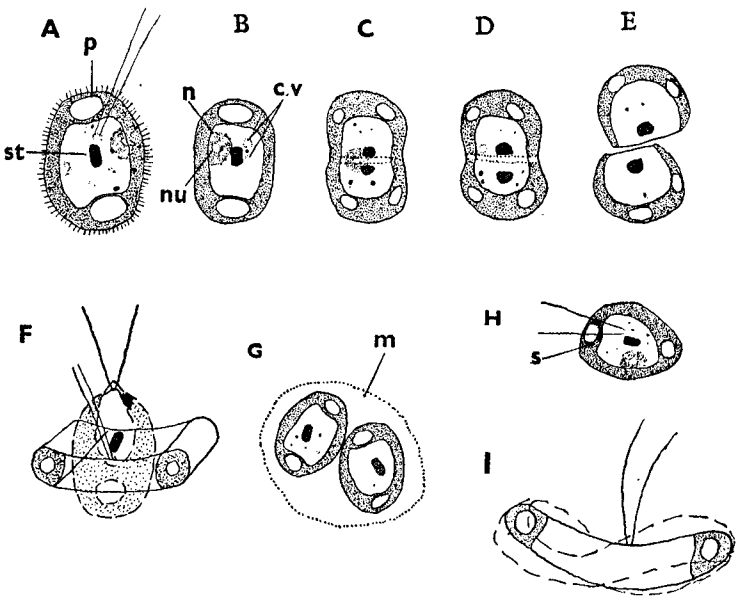

FIG. 4.—*Mesostigma viride* Lauterborn. A. Cell from anterior face, showing periplast markings. B–E. Stages in division. F. Diagram of medium sector of *Mesostigma*-cell superimposed on *Chlamydomonas*-cell. G. Resting stage. H. Motile cell. I. Lateral view of cell, diagrammatic (after Pascher). *c.v.*, contractile vacuole; *m*, mucilage; *n*, nucleus; *p*, pyrenoid; *s*, starch; *st*, stigma. (A, ×1250; B–E, H, ×1100; G, ×800.)

forms a parietal ring running round the circumference of the cell, but leaving the concave and convex surfaces free (fig. 4, A, F, I). The two pyrenoids are situated at the two ends of the chromatophore, as viewed from the flagellar (anterior) surface of the cell (*cf.* also diagram of side view, fig. 4, I). The nucleus

with a clear nucleolus usually lies towards one margin of the cell, and is seen to one side of the stigma (fig. 4, A–C). The two contractile vacuoles are situated near to the points of attachment of the flagella (fig. 4, B). They are formed by the fusion of smaller vacuoles and pulsate alternately. The storage product is starch (fig. 4, H). In motion the cell rotates around its long (*i. e.*, transverse) axis, so that the face bearing the flagella is directed laterally to the direction of movement.

Division takes place when the organism is at rest. The process is remarkable in that the stigma divides into halves. Usually in the Volvocales the stigma is either lost during division with the production of two new stigmata in the daughter-cells, or one daughter-cell retains the stigma of the parent-cell while the other cell or cells form them *de novo*. In *Mesostigma* the stigma at the beginning of division (fig. 4, B) shows a slight constriction; this is followed by the appearance of a clear area across the cell (fig. 4, C, D), probably marking a line of constriction. The cell then becomes clearly constricted while each pyrenoid divides.

According to Pascher (18) other stages in the life-history of the alga are unknown, but Korschikoff (19) claims to have seen sexual fusion, although he gives no details (in his German summary) or figures of the process. Lauterborn (17) mentioned the occurrence of large and small individuals which he suggested might be gametes, though he gave no evidence in support of this view.

Occasional resting stages have been observed in which the cell is enveloped by a wide mucilage-envelope. Sometimes more than one cell is found within the mucilage-envelope (fig. 4, G), but there is no production of a definite palmella-stage. The stages described appear to be only temporary resting stages, since when material is placed on a slide a resumption of motility is generally observed.

Korschikoff (19) places *Mesostigma*, together with *Heteromastix*, *Monomastix*, *Pedimonas*, and tentatively *Phacomonas*, in a new group, the Protochlorineae, which he considers as bridging the gap between the Flagellata and the Volvocales. Pascher (18) has criticized this view, and has pointed out that in their structure and in the possession of sexuality *Mesostigma*, *Heteromastix*, and *Pedimonas* are to be considered as specialized members of the Polyblepharidaceae.

The morphology of the cell differs from that of other members of this family in that the individual is pronouncedly flattened along the antero-posterior axis and the two flagella are attached excentrically on the concave anterior face of the cell (fig. 4, I). The plane of division is longitudinal and passes through the short axis of the cell. Pascher (18) suggests that it is derived from a chlamydomonad type which has become flattened

antero-posteriorly (see diagram, fig. 4, F). The parietal chromatophore may be considered to be derived from the prevalent basin-shaped type of Chlamydomonadaceae, the band-like shape being developed in relation to the flattening of the cell.

Mesostigma has been recorded from Central Europe (16, 17, 18) and from Charkow, Russia (19). I have observed it in a pond at the Royal Botanic Gardens*, Kew, Surrey, as well as in the two Pen Ponds. Professor Harris informs me that he has observed it in the Reading district. Lauterborn (17) and Pascher (18) both emphasize its occurrence in muddy portions of ponds, rich in bottom-living diatoms and where there is a good growth of aquatic plants. The habitat in Kew Gardens quite corresponds with this, while that at Richmond, where the alga is sparse, is less obviously muddy. In these habitats the alga is more abundant in the layers of water in close proximity to the mud than in the actual surface-water of the littoral regions.

In conclusion, the author wishes to acknowledge his indebtedness to Professor F. E. Fritsch, F.R.S., for advice and criticism.

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* The author's thanks are due to Sir A. W. Hill, Director of the Royal Botanic Gardens, Kew, for permission to collect algæ in the ponds.

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NEW SPECIES OF GNAPHALEAE.

By W. R. PHILIPSON, B.A.

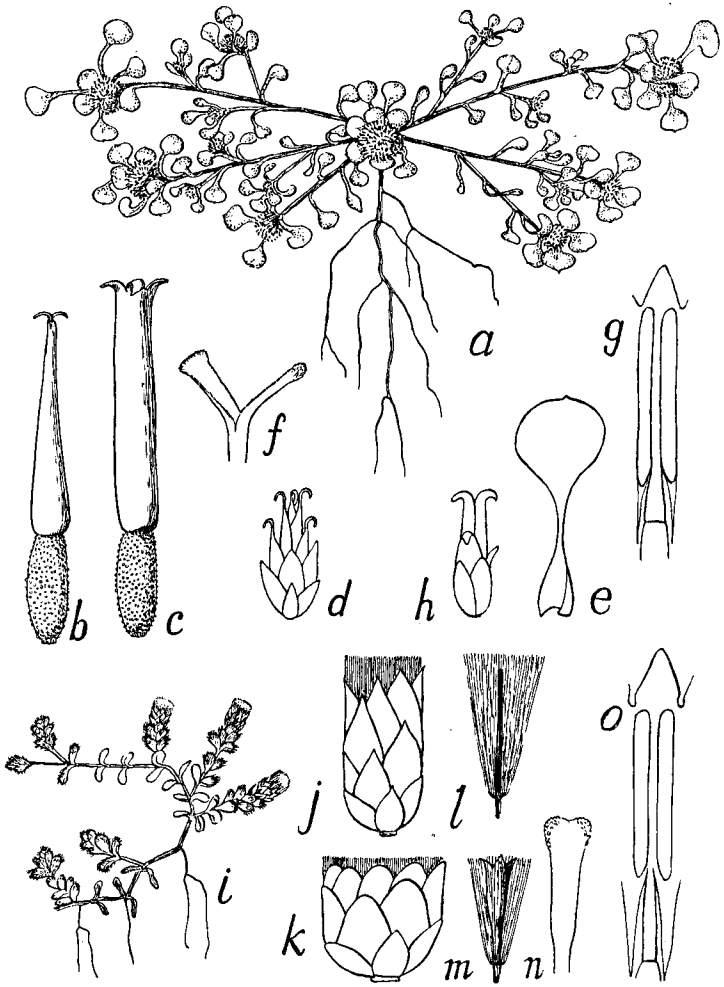
Stuartina hamata, sp. nov. *Herba* annua, ramis numerosis prostratis usque 6 cm. longis omnino lanata nisi rami vetustiores et folia demum superne glabrata. *Folia* suborbiculata in petiolum attenuata, apice subito apiculata, usque 9 mm. lata, petiolo usque 8 mm. longo basi expanso amplexicauli. *Capitula* minuta, 3 mm. longa, in glomeribus terminalibus disposita. *Involucri squamæ* externæ obovatæ lanatæ, internæ apice in hamos rigidos productæ; receptaculum parvum nudum. *Flosculi* externi 4 feminei, flosculus internus 1 hermaphroditus; corolla feminea 1·55 mm. longa superne angustata 4-dentata, hermaphrodita 1·75 mm. longa tubulata 5-lobata; antheræ ·75 mm. longæ, caudis anthopodio longioribus; stylus bifidus, rami feminei filiformes, hermaphroditi truncati, breves. *Achenia* cylindrica, punctata, epapposa. (Figs. *a–h.*)

Hab. NEW SOUTH WALES: Coonabarrabra, in 1883, *Lamont* 215 (Herb. Mus. Brit., type); ENGLAND: Linthwaite, Yorks, introduced in wool, in 1886, *Shaw* s. n. (Herb. Kew.).

This species is clearly related to *S. Mulleri* Sond., which previously constituted a monotypic genus. The recurved apices of the inner involucral bracts are present in both species. In *S. hamata* the mid-rib is excurrent and bent into a rigid hook, while in *S. Mulleri* the lamina of the bract is recurved. It is extraordinary that a species which has been introduced and collected in England should not have been recognised as distinct in Australia.

Rutidosis heterogama, sp. nov. *Herba* perennis, ramis erectis vel arcuatis usque 3 dm. altis, leviter scabris, capitula solitaria gerentibus. *Folia* alterna sessilia, circa 3·5 cm. longa, 2 mm. lata, revoluta, vel nonunquam folia inferiora plana et latiora, costa inferne prominente. *Capitula* solitaria 1·3 cm. longa, 2 cm. lata; pedunculi 3–5 cm. longi, bracteis paucis parvis. *Involucri squamæ* latæ, ovatæ obtusæ vel acutæ, membranaceæ, nitentes, aureo-fulvæ, leviter transverse rugosæ; receptaculum

convexum, scrobiculatum, nudum. *Flosculi* plerumque hermaphroditi, aliquot exteriores feminei; corolla 5-lobata, feminea



Figs. *a–g.*—*Stuartina hamata* Philipson: *a*, whole plant; *b*, ♀ floret; *c*, ☿ floret; *d*, capitulum; *e*, leaf; *f*, ☿ style-arms; *g*, anther; *h*, capitulum of *S. Muelleri* Sond. *i–o*, *Luciliopsis Benthamiana*: *i*, flowering branch; *j*, *k*, ♀ and ♂ capitula; *l*, *m*, ♀ and ♂ florets; *n*, ♂ style apex; *o*, anther. *a*, *i*, ×1; *b*, *c*, ×20; *d*, *h*, *j–m*, ×5; *e*, ×2; *f*, *g*, *n*, *o*, ×50.

leviter expansa, hermaphrodita abrupte dilatata; antheræ 1·75 mm. longæ ecaudatæ; stylus bifidus, ramis 1·75 mm.

longis truncatis. *Achenia* 1·5 mm. longa fusca tuberculata; pappi squamæ circa 10, 1·5–2 mm. longæ ciliatæ.

Hab. NEW SOUTH WALES: Kingstown, Newcastle, in 1804, *R. Brown* 2271 (Herb. Mus. Brit., type; and Herb. Kew.); Hunter River, *R. Brown* 2271 (Herb. Kew.); without locality, *Bauer* s. n. (Herb. Kew.).

This species is very similar in habit to *R. leptorhynchoides* F. Muell., but differs chiefly in the more membranaceous and more shining involucral bracts, which do not descend on to the longer peduncle. Another readily observable character separating these two species is the woolly covering of the base of the stem in *R. leptorhynchoides*, of which there is no trace in *R. heterogama*. Less noticeable are the shorter pappus scales and achenes and the more numerous female florets, from which the specific epithet is derived. *R. leptorhynchoides* has always been described as homogamous, as have all other members of the genus, but I have also found a few female florets in some specimens of this species. The present species, according to Brown, is a plant of grassland, sending up new shoots from a woody rootstock.

Rutidosis acutiglumis, sp. nov. *Herba* annua erecta tomento cinereo vestita, ramis usque 25 cm. altis. *Folia* alterna sessilia usque 6 cm. longa, 7 mm. lata, lanceolata vel lineari-lanceolata, acuta, apicibus glabris, costa prominente, folia summa minora bracteiformia. *Capitula* solitaria terminalia, 8 mm. longa, 10 mm. lata. *Involucri squamæ* multæ, dense imbricatæ, externæ parvæ lanceolatæ membranaceæ, internæ ovatæ fuscæ, appendicula acuta membranacea; receptaculum convexum scrobiculatum nudum. *Flosculi* omnes hermaphroditi; corolla 2·55 mm. longa, prope medium abrupte dilatata, 5-lobata; antheræ 1·55 mm. longæ, ecaudatæ; stylus bifidus, ramis truncatis. *Achenia* 1 mm. longa fusca tuberculata; pappi squamæ circa 6·1 mm. longæ, rigidæ, marginibus integris.

Hab. QUEENSLAND: Marathon Station, west of Hughenden, *Hubbard* 7772 (Herb. Kew.).

This species very closely resembles *R. helichrysoides* F. Muell. in habit, in the size of its capitula, and in the few and entire pappus scales. It differs, however, most remarkably from this and other species of the genus in the numerous narrow outer involucral bracts and the lanceolate and paleaceous apices of the inner bracts. In *R. helichrysoides* the bracts are ovate with a ciliate margin and are golden brown. The present species, according to Hubbard, "grows in open *Astrebla lappacea* grassland, on heavy dark brown soil."

Helichrysum chionoides, sp. nov. *Frutex* ramosissimus 2–3-pedalis. *Folia* alterna, basi vaginantia; vaginæ circa 4 mm. longæ, 1·5 mm. latæ, dense imbricatæ, externe lanatæ, 1-nervosæ; laminæ lineares, 1–1·2 cm. longæ, 2–3 mm. latæ, utrinque dense tomentosæ, marginibus revolutis, apicibus obtusis, mucronibus glabris, costa inferne prominente superne leviter canaliculata, laminæ recentes expansæ, vetustiores deflexæ. *Capitula* 1·5 cm. longa, 1·8 cm. lata, circa 5 ad apicem ramorum in corymbis disposita. *Involucri squamæ* multæ expansæ, ovatæ vel lanceolatæ, acutæ, externæ colore fusco suffusæ, internæ eburnæ nitentes; receptaculum nudum. *Flosculi* plerumque hermaphroditi, aliquot exteriores feminei; corolla 3 mm., feminea filiformis, hermaphrodita tubulata; antheræ 1·5 mm. longæ, caudis anthopodio longiores; styli rami truncati. *Achenia* fusca; pappi setæ uniseriatæ paullo longiores quam corolla, liberæ sub-plumosæ.

Hab. KENYA: Aberdare Mountains, Kinangop: in grassland, 12,500 ft., *Taylor* 1491 (Herb. Mus. Brit., type); alpine grassland, 10,500–12,500 ft., *Synge* 1127 (Herb. Mus. Brit.); moorlands, 12,000 ft., *Rammel* 3068 (Herb. Mus. Brit., Herb. Kew.); summit, 12,000–12,750 ft., *Galpin* 7932 (Herb. Kew.).

This species belongs to the group of ericoid Helichrysums which are characteristic of the highlands of East Tropical Africa. Of these it is most nearly related to *H. crenulatum* R. E. Fries, but it differs from it in having the capitula arranged in corymbs. *H. chionoides* is frequent on the open plateau of the Aberdare Mountains and reaches the summit of Kinangop. If forms a very beautiful bush covered with a continuous mass of shining whitish heads.

Gnaphalium marranum, sp. nov.*. *Herba* perennis vel annua, omnino lanata, basi ramosa, ramis erectis usque 3 dm. altis, corymbis terminalibus. *Folia* alterna sessilia usque 4 cm. longa, 7 mm. lata, lineari-oblonga vel anguste spathulata, utrinque lanata, mucrone glabro, costa inferne prominente. *Capitula* 6 mm. longa, 5 mm. lata in corymbis terminalibus disposita; receptaculum nudum. *Involucri squamæ* ovatæ, obtusæ, membranaceæ, externe lanatæ. *Flosculi* plerumque feminei, aliquot centrales hermaphroditi; corolla feminea filiformis 2·5 mm. longa, hermaphrodita tubulata longior; antheræ 1 mm. longæ, caudis quam anthopodium breve valde longioribus; styli rami truncati, flosculo femineo quam in hermaphrodito breviores. *Achenia* ·75 mm. longa, fusca; pappi setæ paucæ, lineares, liberæ.

Hab. ANGLO-EGYPTIAN SUDAN: Dafur Province, Marra Mountains: high-highest zones, *Lynes* 55 *b* (type); Great Central Plateau, 9000 ft., *Lynes* 55 *a*, summit of Jebel Uo, about 3070 m., *Dandy* 86, without precise locality, *Sandison* 32, (all in Herb. Mus. Brit.); near Bobbery, *Macintosh* 39 (Herb. Kew.).

This species resembles *G. luteo-album* L. in many respects, but differs from it in the greater woolliness of the whole plant and the usually perennial habit, also in the strongly-keeled mid-rib and the greater dimensions of the capitula and florets.

* As *Helichrysum abyssinicum* Sch. Bip., Garland in Journ. Bot. 1921, 48.

The character which most certainly distinguishes these two species is the glabrous achene, for in *G. luteo-album* the achenes are more or less covered by very short upwardly-curved glandular hairs. *G. marranum* is endemic to the Marra Mountains, where it is found only at high altitudes.

Luciliopsis Benthamiana, sp. nov. *Herba* perennis perpusilla, ramis prostratis implicatis. Rami multi tenues glabri. *Folia* subsessilia ovata, obtusa, 3 mm. longa, 2 mm. lata, juniora tomentosa specialiter ad apicem, ad apices ramorum congesta. *Capitula* solitaria terminalia, dioica, feminea 5 mm. longa, mascula 3·5 mm. longa. *Involucri squamæ* fuscæ, externæ ovatæ lanatæ, internæ lanceolatæ; receptaculum nudum. *Flosculi* multi; corolla feminea 4 mm. longa, filiformis minute 4-dentata, mascula 3 mm. longa anguste campanulata 5-lobata; antheræ 1·5 mm. longæ, caudis anthopodio longioribus; stylus femineus bifidus ramis truncatis, masculus clavatus. *Achenia* ?; pappi setæ uniseriatæ, in annulum concretæ, femineæ 4 mm. longæ, masculæ 3 mm. longæ. (Figs. *i–o.*)

Hab. Ecuador: Paramo de Sanacajas, in 1857–9, *Spruce* 5515 (Herb. Mus. Brit., type; and Herb. Kew.); Antisana, 14,000 ft., in 1849, *Jameson* 25 (Herb. Kew.), and s. n. (Herb. Mus. Brit., Herb. Kew.).

This minute alpine has been known for many years, as it was mentioned in Bentham & Hooker's 'Genera Plantarum,' ii. pt. 1, 302 (1873). It was, however, left undescribed, and I have now named it in honour of Bentham, to whose specimen of Spruce's gathering analytical notes are attached. It differs from *L. perpusilla* Wedd. in having broader leaves and in details of floral structure. According to Jameson, it "grows on boggy ground on the high plains of the Andes, and is but rarely seen in flower."

THE *IXORA* SPECIES OF BURMA AND THE ANDAMAN ISLANDS.

By C. E. B. Bremekamp.

(Concluded from p. 298.)

29. **Ixora salwenensis,** sp. nov.; typus: *Po Chin*, 6776 Maymyo Herb. *I. Meeboldii* valde affinis, sed foliis latioribus, stipulis brevius aristatis, inflorescentia laxa, corollæ tubo paulo longiore, lobis distincte brevioribus, faciliter ab ea distinguenda.

Frutex 0·90 m. altus ramis foliisque glabris; rami novelli 3–4 mm. diam., veteriores nondum vidi. *Folia* petiolo 1·2 cm. longo; lamina late oblanceolata an elliptica 16–18·5 cm. longa et 6·7–9·5 cm. lata, apice acuminata, basi acuta, subcoriacea, opaca, sicc. haud conspicue decolorata, pallida tamen, costa basin versus canaliculata, nervis utroque latere costæ 8–10 supra canaliculatis et subtus prominentibus, venulis subdense reticulatis subtus parce prominulis. *Stipulæ* ovatæ an late triangulares in aristam vagina breviorem exeuntes, axilla haud pilosæ. *Inflorescentia* laxa ramulis pedicellisque pubescentibus, e floribus 75–100 composita; pedunculus 7·5–12 cm. longus, parce puberulo-pubescens, internodio 0·5 cm. longo, foliis multo reductis 0·5 cm. longis munito, præcessus; internodium basale axis 4–6·5 cm.; internodia basalia ramulorum infimorum 5–6·5 cm.; internodia alia peripheriam versus gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis usque ad 3 mm. longis; ramuli infimi foliis rudimentariis lanceolatis 6·5 mm. longis suffulti; bracteæ anguste triangulares; inferiores 4 mm. longæ, superiores usque ad 1·5 mm. decrescentes; bracteolæ ovatæ subacutæ, ovario paulo breviores, puberulo-pubescentes. *Ovarium* subglabrum an puberulum. *Calyx* puberulus tubo subnullo, lobis 0·9 mm. longis acutis. *Corolla* alba, extus sparse puberulo-pubescens, tubo 2·3 cm. longo, intus glabro, lobis 3·5 mm. longis et 2 mm. latis, obtusis, subglabris. Filamenta 0·8 mm.; antheræ 3·3 mm. *Styli* pars exserta stigmatibus 1·5 mm. longis comprehensis 3·5 mm. longa.

Hab. Lower Burma: District Salween, Htithelaw, alt. 240 m., leg. *Po Chin*, 6776 Maymyo Herb.

30. **Ixora roseituba,** sp. nov.; typus: *R. N. Parker*, 3094 Herb. Kew. Foliis angustioribus, sicc. olivaceis an olivaceo-brunneis, ab *I. Meeboldii* et ab *I. salwenensis* diversa, ab *I. Meeboldii* insuper corollæ forma et ab *I. salwenensis* inflorescentia contracta recedens.

Frutex ramis foliisque glabris; rami novelli 2 mm. diam., veteriores cortice griseo-brunneo opaco vestiti. *Folia* petiolo 6–16 mm. longo; lamina linearis 10–16 cm. longa et 2·2–3·1 cm. lata, apice attenuata an subcaudata, in cacumen obtusum terminans tamen, basi acuta an cuneata, coriacea, opaca, sicc. olivacea an olivaceo-brunnea, costa supra prominula, basin versus canaliculata, nervis utroque latere costæ 10–13 supra interdum impressis et subtus prominulis, venulis laxe reticulatis vix conspicuis. *Stipulæ* ovato-triangulares in aristam vagina paulo longiorem exeuntes, intus breviter pilosæ. *Inflorescentia* contracta, ramulis pedicellisque dense puberulis, floribus circ. 60; pedunculus subglaber 5–9 cm. longus, internodio satis longo, foliis sessilibus, basi rotundatis, magnitudine plus minusve reductis, munito, præcessus; internodia basalia axis et ramulorum infimorum circ. 6 mm.; internodia alia longitudine gradatim decrescentia. *Flores* laterales triadum pedicellis 1·5–2 mm. longis; ramuli infimi bracteis suffulti; bracteæ omnes filiformes et puberulæ, basales 2·5 mm. longæ, aliæ minores; bracteolæ florum lateralium ovario dimidio breviores. *Ovarium* dense puberulum,

Calyx puberulus tubo subnullo, lobis ovatis obtusis, 0·6 mm. longis, scariosis. *Corolla* rosea extus puberula, intus glabra, tubo usque ad 2·5 cm. longo, interdum tamen distincte breviore, lobis 3–5 mm. longis et 1·5 mm. latis, obtusis. Filamenta 1·5 mm.; antheræ 3 mm. *Styli* pars exserta stigmatibus 1·5 mm. longis comprehensis 2·5–3 mm. longa.

Hab. TENASSERIM: District Mergui, Palauk Chaung, alt. 300 m., leg. *R. N. Parker*, 3094 Herb. Kew. (ex herb. Dehra Dun).

Ixora roseituba Brem. var. nov. **glabra** Brem.; typus varietatis: *C. G. Rogers*, 362 T Herb. Kew. Inflorescentia floribusque glabris a typo recedit.

Hab. TENASSERIM: District Tavoy, Sin Hat Hill, alt. 600 m., leg. *C. G. Rogers*, 362 T Herb. Kew. (a poor specimen, resembling *I. roseituba*, but perhaps more than a simple variety).

31. **Ixora obtusiloba,** sp. nov.; typus: *R. N. Parker*, 2478 Herb. Kew. *I. Parkinsoniana* Craib in Kew Bull. 1932, 428 et Fl. Siam. En. ii. 163 quoad specimina in Tenasserim lecta. *I. roseitubae* valde affinis, sed foliis latioribus, subtus venulos exhibentibus, et pedunculo basi foliis multo reductis munito, ab ea distinguenda, corollæ forma ab *I. Meeboldii*, inflorescentia subcontracta ab *I. salwenensi* recedens.

Frutex 1·2–2 m. altus, ramis foliisque glabris; rami novelli 2 mm. diam., veteriores cortice griseo opaco vestiti. *Folia* petiolo circ. 1 cm. longo munita; lamina oblanceolata an lineari-oblonga 12–16 cm. longa et 3·7–5·2 cm. lata, apice caudato-acuminata, in cacumen subobtusum terminans tamen, basi acuta, subcoriacea, opaca, sicc. olivacea, interdum tamen haud conspicue decolorata, costa basin versus impressa, nervis utroque latere costæ 10–12 supra subimpressis et subtus prominentibus, venulis subdense reticulatis utrimque sed præsertim subtus prominulis. *Stipulæ* triangulares in aristam vagina bis an ter longiorem exeuntes, intus haud pilosæ. *Inflorescentia* subcontracta 2·7–3 cm. diam., ramulis pedicellisque dense puberulo-pubescentibus, floribus 50–75; pedunculus 5 cm. longus, parce puberulo-pubescens, internodio 3–5 mm. longo, foliis multo reductis 4–9 mm. longis munito, præcessus; internodia basalia axis et ramulorum infimorum 0·6–0·8 cm., interdum usque ad 1·5 cm. longa; internodia alia gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis 1·5 mm. longis muniti; ramuli infimi bracteis suffulti; bracteæ omnes filiformes; basales 2·5 mm. longæ, parce pubescentes; aliæ breviores, dense puberulo-pubescentes; bracteolæ anguste triangulares ovario dimidio breviores, dense puberulo-pubescentes. *Ovarium* dense puberulo-pubescens. *Calyx* puberulo-pubescens tubo subnullo, lobis ovatis subimbricatis obtusis, 0·6 mm. longis. *Corolla* alba an dilute rubella, extus sparse puberulo-pubescens, intus glabra, tubo 2·1 cm. longo, lobis 3 mm. longis et 1·8 mm. latis, obtusis.

Filamenta 1·2 mm.; antheræ 2·5 mm. *Styli* pars exserta stigmatibus 1 mm. longis comprehensis 2·5 mm. longa.

Hab. TENASSERIM: District Mergui, Serawa Chaung, leg. *R. N. Parker*, 2476 et 2478 Herb. Kew.; District South Tenasserim, Ngawun Valley, alt. 90 m., leg. *C. E. Parkinson*, 1624 Herb. Kew.

b. Corolla-tube outside glabrous; the throat not bearded (species 32–35).

32. I. DIVERSIFOLIA R. Br. ex Kurz, Contr. Bur. Fl. 149 et For. Fl. Bur. ii. 22 (1877); F. B. I. iii. 141 quoad specimina in Tenasserim lecta; Mat. F. M. P. 83; Ind. Trees, 388; F. M. P. ii. 96; Fl. Siam. En. ii. 155. *I. oblonga* R. Br. ex Hook. fil.; F. B. I. iii. 148 (1880) speciminibus javanicis et siamensibus excl.; Ind. Trees, 389; Fl. Siam. En. ii. 162 quoad typum.

Distr. Tenasserim and Malay Peninsula.

The types of both *I. diversifolia* and *I. oblonga* were collected near Amherst, and both are imperfect specimens with the flowers still in bud. I see no difference between these two plants. As pointed out already by Kurz *I. diversifolia* comes very near to *I. paludosa* (Bl.) Kurz. The latter is a very common plant in Java, but it has also been found in South Sumatra and in the Lesser Sunda Islands. Kurz says of *I. diversifolia* that it grows in "tropical forests, especially in marshy places and on muddy banks": the habitat of *I. paludosa* might be described in the same words.

33. I. SPECTABILIS Wall. ex G. Don, Gen. Syst. iii. 572 (1834); Contr. Bur. Fl. 149 et For. Fl. Bur. ii. 22; F. B. I. iii. 141; Ind. Trees, 388; F. I. C. iii. 315 specimine siamensi excl.

Distr. Lower Burma, Tenasserim.

LOWER BURMA: District N. Arakan, below Tandin Falls, alt. 8 m., leg. *C. B. Smales*, 247 Maymyo Herb.; Karenni Country, Tongkyeghat, Choungmenah, leg. *Kurz*, 1444 Herb. Kew.; Martaban, Lime Hills near the Salween, Wall. Herb. 6133. TENASSERIM: Tavoy (?), leg. *Helfer* 2993 Herb. Kew.

The inflorescences in this species are often somewhat abnormal, the branchlets not being quite opposite and sometimes even not distinctly articulate at the base. The distinctive characters have been given by Kurz.

34. **Ixora orophila,** sp. nov.; typus: *C. E. Parkinson*, 5181 Maymyo Herb. Corolla brevituba ad *I. diversifoliam* et ad *I. spectabilem* accedit, *I. spectabili* insuper floribus subsessilibus similior; foliis caudato-acuminatis, nervos plures exhibentibus, ab eis sat diversa.

Arbuscula 4·5 m. alta, ramis foliisque glabris. *Folia* petiolo canaliculato 1–1·5 cm. longo; lamina lineari-lanceolata an lanceolata plerumque circ. 16 cm. longa et 4·5 cm. lata (foliorum

nonnullorum tamen brevior et paulo latior), apice caudato-acuminata, basi acuta an in foliis superioribus rotundata, herbacea, supra nitidula, sicc. haud conspicue decolorata, costa basin versus impressa, nervis utroque latere costæ 13–15 subtus prominulis, venulis vix distinguendis. *Stipulæ* ovatæ in aristam vaginæ æquilongam exeuntes, axilla pilosæ. *Inflorescentia* ramulis pedicellisque puberulis, floribus circ. 300; pedunculus subglaber 9 cm. longus, internodio longitudine normali, sed foliis sessilibus ovato-lanceolatis 11 cm. longis et 4·2 cm. latis, basi subcordatis, munito, præcessus; internodium basale axis 3·2 cm.; internodia basalia ramulorum infimorum 3·5 cm.; internodia sequentia rare 1 cm. longitudine superantia, plerumque multo breviora; pedicelli subnulli; flores ergo ad apicem axis et ramulorum congesti; ramuli infimi foliis 3 cm. longis suffulti; bracteæ filiformes, basales 3 mm. longæ, peripheriam versus usque ad 1·5 mm. decrescentes; bracteolæ florum lateralium triadis ovario paulo breviores. *Ovarium* puberulum. *Calyx* subglaber tubo subnullo, lobis 0·4–0·5 mm. longis. *Corolla* dilute rosea, extus intusque glabra, tubo 13·5 mm. longo et 0·3 mm. diam., lobis reflexis et margine revolutis 4·2 mm. longis et 1·5 mm. latis. Filamenta 1·2 mm.; antheræ 3·5 mm. *Styli* pars exserta stigmatibus 2·3 mm. longis comprehensis 4·5 mm. longa.

Hab. TENASSERIM: District Amherst, Kyaikywa–Mulayit Ridge, alt. 1200 m., leg. *C. E. Parkinson*, 5181 Maymyo Herb.

35. **Ixora amherstiensis,** sp. nov.; typus: *Mg. Tha Myaing*, 167 Herb. Dehra Dun. Foliis latioribus, subcoriaceis, opacis, supra venulos exhibentibus, floribus haud congestis, corollæ tubo breviore et lobis longioribus, ab *I. orophila*, ad quam alioquin valde accedit, sat diversa.

Habitus ignotus. *Rami* foliaque glabri; rami veteriores cortice griseo-brunneo opaco vestiti. *Folia* petiolo canaliculato 1–2·5 cm. longo; lamina lanceolata 12–16 cm. longa et 5–9 cm. lata, apice acuta an subcontracta, mucronata, basi acuta, subcoriacea, opaca, sicc. griseo-brunnea, costa basin versus canaliculata, nervis utroque latere costæ 15–16 supra prominulis et subtus prominentibus, venulis dense reticulatis supra prominulis sed subtus vix distinguendis. *Stipulæ* late triangulares in aristam vaginæ æquilongam exeuntes, axilla parce pilosæ. *Inflorescentia* ramulis pedicellisque puberulis, floribus 200–300; pedunculus 8 cm. longus, parcissime puberulus, internodio 1·5–2 cm. longo, foliis reductis sessilibus 1–7 cm. longis munito, præcessus; internodia basalia axis et ramulorum infimorum 2·7 cm.; alia gradatim longitudine decrescentia. *Flores* laterales triadum pedicellis 1 mm. longis muniti; ramuli infimi bracteis suffulti; bracteæ basales anguste lineares 3–4 mm. longæ, peripheriam versus angustiores et breviores, superiores inde filiformes; bracteolæ florum lateralium ovario breviores an ei subæquilongæ. *Ovarium* puberulum. *Calyx* puberulus tubo 0·1–0·2 mm., lobis 0·4–0·5 mm. longis. *Corolla* extus intusque glabra tubo 1·1 cm. longo et 0·5 mm. diam., lobis reflexis et margine plerumque revolutis 6 mm. longis et 1·2 mm. latis. Filamenta 1·5 mm.; antheræ 5·5 mm. *Styli* pars exserta stigmatibus 3 mm. longis comprehensis 6 mm. longa.

Hab. TENASSERIM: District Amherst, Mepale Block, alt. 200 m., leg. *Mg. Tha Myaing*, 167 Herb. Dehra Dun.

c. Corolla outside glabrous, but the lobes bearded at the base (species 36–37).

36. I. BARBATA Roxb. ex Sm. in Rees, Cycl. xix. n. 6 (1811); Roxb. Hort. Beng. 10; id. Fl. Ind. ed. Carey, i. 384; Wight, Ic. t. 185; Contr. Bur. Fl. 149 et For. Fl. Bur. ii. 22; F. B. I. iii. 148; Ind. Trees, 389; non ex Koorders et Valeton, Boomsoorten van Java, viii. 157 (1902), nec ex Koorders, Atlas der Baumarten von Java, t. 548 (1915) quæ est *I. Koordersii* (Ridley) Brem. Ix. n. 81.

Distr. Andaman Islands: MIDDLE ANDAMAN, leg. *C. E. Parkinson*, 76 Herb. Dehra Dun; Haddo, leg. *C. E. Parkinson*, 511 Herb. Dehra Dun.

37. **Ixora hymenophylla,** sp. nov.; typus: *M. C. Bonig*, 198 Herb. Dehra Dun. *I. barbatae* affinis, sed foliis tenuioribus, pedunculo brevi, pedicellis longis, floribus multo majoribus, ab ea faciliter distinguenda.

Habitus ignotus. *Rami* et folia glabri. *Folia* petiolo canaliculato 1–1·5 cm. longo; lamina lanceolato-elliptica 16–18 cm. longa et circ. 7·5 cm. lata, apice acuminata et in cacumen acutum terminans, mucronata, basi acuta, tenuiter herbacea, sicc. olivacea, costa canaliculata, nervis utroque latere costæ circ. 10 subtus prominulis, venulis laxe reticulatis. *Stipulæ* oblongo-triangulares in aristam vagina multo breviorem exeuntes, axilla longe pilosæ. *Inflorescentia* subsessilis an breviter pedunculata, laxe corymbosa, glabra, floribus 75–100; pedunculus 1–12 mm. longus internodio 2–5·5 cm. longo foliis sessilibus basi rotundatis 5·5–10 cm. longis et 5–7·3 cm. latis munito præcessus; internodium basale axis 2–3·8 cm.; internodia basalia ramulorum infimorum 3·5–4·5 cm.; pedicelli florum lateralium triadis 6 mm.; bracteæ basales subfoliaceæ 8 mm. longæ et 3·5 mm. latæ; aliæ minutissime filiformes, supremæ 1·2 mm. longæ; bracteolæ florum lateralium triadis 0·7 mm. longæ. *Ovarium* glabrum. *Calyx* glaber tubo nullo, lobis 0·6 mm. *Corolla* extus glabra tubo 3·7 cm., lobis 11 mm. longis et 3 mm. latis, obtusis, margine haud distincte revolutis, basi barbatis. Filamenta 1 mm.; antheræ 4·2 mm. *Styli* pars exserta stigmatibus 2·5 mm. longis comprehensis 5 mm. longa.

Hab. ANDAMAN ISLANDS: Great Nicolson, in evergreen forest, leg. *M. C. Bonig*, 198 Herb. Dehra Dun.

In spite of its subsessile inflorescence this species must be placed in the section *Otobactrum* : its undeniable affinity with *I. barbata* leaves us no choice. The short peduncle, however, is such an uncommon feature in this section that it might be an abnormality of the specimen described.

Subgenus PAVETTOIDES Brem.

Inflorescence sessile or shortly pedunculate ; the upper branchlets never decidedly opposite and never articulate ; basal branchlets subtended by rudimentary or reduced leaves provided with well-developed stipules ; upper bracts minute and ascending on the branchlets and pedicels, or absent. Flowers white or slightly tinted. Stamens as long as the corolla lobes.—From the Seychelles to Melanesia and North Australia.—Species 38–42.

Sectio AMPHORION Brem. sectio nov.

Inflorescentia breviter an modice pedunculata, subpaniculata ; ramuli infimi foliis reductis quorum stipulæ normaliter factæ, haud dilatatæ sunt suffulti. Flores parvæ. Corolla fauce haud barbata.—*Hab.* Indiam, Burmam, Insulas Andamenenses et Nicobaricas.—Typus : *I. brunnescens* Kurz. Species 38–39.

This section is represented in India by *I. arborea* Roxb. ex Sm. (*I. parviflora* Vahl, non Lam.) and *I. brachiata* Roxb. *I. Notoniana* Wall. ex G. Don, and *I. undulata* belong probably also to this group, but I have had no opportunity for studying these species.

38. I. BRUNNESCENS Kurz in Journ. Asiat. Soc. Beng. xli. 317 (1872) ; Contr. Bur. Fl. 147 et For. Fl. Bur. ii. 24 ; F. B. I. iii. 143 ; Ind. Trees, 389 ; non Fl. Siam. En. ii. 150.

Distr. Andamans and Nicobars.

ANDAMANS : South Cinque Island, leg. *C. E. Parkinson*, 534 Herb. Dehra Dun ; Long Island, leg. *C. E. Parkinson*, 746 Herb. Dehra Dun.

I. ARBOREA Roxb. ex Sm. in Rees, Cycl. xix. n. 5 (1811). *I. parviflora* Vahl, Symb. Bot. iii. 11, t. 52 (1794), non Lam. Illustr. n. 1473, t. 66, f. 2 (1791).

Distr. INDIA : this species has been recorded by Kurz (Contr. Bur. Fl. 149 et For. Fl. Bur. ii. 21) from the Prome District, Lower Burma (see also F. B. I. iii. 143 and Ind. Trees, 389), but this is probably a mistake. It may have been *I. undulata* Roxb., or a plant belonging to the following section, which comprises also some species with very small flowers (e.g. *I. elliptica* R. Br. ex Ridley). As I have not seen his specimen, I am unable to say anything definite. Brandis, *l. c.*, mentions the same species from the Nicobars, but this also looks very improbable.

39. I. UNDULATA Roxb. Fl. Ind. ed. Carey, i. 385 (1820) ; Wight, Ic. t. 708 ; F. B. I. iii. 147 ; Ind. Trees, 389 ; non F. M. P. ii. 98.

Distr. Sikkim, Bhutan, Assam, Upper Burma (*fide* Brandis, *l. c.*).

As I have stated already above, I am not sure about the position of this species. Hooker fil., *l. c.*, mentions it among the species with articulate inflorescence, but it is possible that the articulations are confined to the main ramifications. The plant is easily recognizable by the wavy margin of the leaves.

Section PAVETTOPSIS Brem.

Inflorescence subsessile, trichotomously or, rarely, pentachotomously corymbose ; the basal branchlets subtended by rudimentary leaves connected by enlarged stipules. Corolla-tube never bearded.—From the Seychelles to New Guinea and Melanesia, absent in India and the greater part of Burma.—Species 40–42.

40. I. FLUMINALIS Ridley in Journ. Asiat. Soc. Straits, lxxix. 84 (1918) ; F. M. P. ii. 97 ; Fl. Siam. En. ii. 157 ; Brem. Ix. n. 126. *I. grandifolia* Zoll. & Mor. var. *gigantea* King & Gamble, Mat. F. M. P. n. 15, 82 (1904). *I. grandifolia* Zoll. & Mor. ex F. M. P. ii. 97 p.p. & F. I. C. iii. 316 p.p. var. excl., non Zoll. & Mor. Syst. Verz. 65 (1846). *I. coriacea* (R. Br. ex Hook. f.) Ridley in Kew Bull. 1926, 69 quoad specimen citatum ; huius species typus nimis imperfectus (Wall. Herb. 6151) e infrutescentia sejuncta probabiliter ad *I. fluminalem* pertinente et e ramo fructifero foliis granulatis munito probabiliter ad *I. crassifoliam* Ridley non Merrill referendo compositus est. Pro *I. crassifolia* Ridley nomen novum **I. Ridleyi** propono.

Distr. Tenasserim, Malay Peninsula, Sumatra, and Borneo.

TENASSERIM : District Mergui, Nale Chan, alt. 15 m., leg. *Su Koe*, 6268 Maymyo Herb.

The style of *I. fluminalis* is pilose ; the two following species have a glabrous style.

41. I. MACROSIPHON Kurz in Journ. of Bot. xiii. 327 (1875) ; Contr. Bur. Fl. 147 et For. Fl. Bur. ii. 24. *I. grandifolia* Zoll. & Mor. var. *coriacea* (R. Br.) Hook. f. F. B. I. iii. 143 (1880) et Ind. Trees, 388, quoad specimina andamanensia.

42. I. ROSELLA Kurz in Journ. Asiat. Soc. Beng. xli. 317 (1872) ; Contr. Bur. Fl. 147 et For. Fl. Bur. ii. 23. *I. grandifolia* Zoll. & Mor. var. *rosella* (Kurz) Hook. fil. F. B. I. iii. 143 ; Ind. Trees, 388.

Distr. Andaman Islands : LONG ISLAND, alt. 30 m., leg. *C. E. Parkinson*, 766 Herb. Dehra Dun.

The greater part of the material on which this study was based was sent to me by Mr. C. E. Parkinson, Dehra Dun : it belongs partly to the Herbarium of the Forestry Institute, Dehra Dun,

and partly to the Maymyo Herbarium. In addition I had the opportunity of studying material kindly placed at my disposal by the Director of the Royal Botanic Gardens, Kew, and by the Keeper of Botany, the British Museum (Natural History), South Kensington. It is with great pleasure that I acknowledge the assistance I received from them.

NOTES ON MYCETOZOA.

By G. Lister, F.L.S.

Perichaena pedata, sp. nov. This minute species was first described as *P. variabilis* Rost.* var. *pedata* Lister (Journ. Bot. xlii. 139, pl. 459, figs. 3, 4; 1904) from a small colony of stalked sporangia found on dead leaves near Lyme Regis in April 1902. In the third edition of 'Mycetozoa,' p. 244, it is removed from *P. vermicularis* and placed under *P. chrysosperma* (Currey) Lister, a species in which the sporangia are occasionally stalked, and the capillitium is marked with scattered spinules: although the Lyme gathering had a practically smooth capillitium, it was considered that the presence of stalks and general habit showed that the form had a stronger affinity to *P. chrysosperma*. During recent years this same form has been found repeatedly, usually on dead leaves, in various parts of the country and retaining its characteristics; it therefore seems advisable that it should be given specific rank.

The reddish brown or tawny sporangia are usually provided with black stalks, 0·1–0·5 mm. long, although sessile and plasmodiocarp forms occur also; the sporangium-walls are membranous or slightly cartilaginous, of a single layer, and show a tendency to break up on maturity into polygonal areolæ; they are smooth or minutely papillose, and are clothed with a deposit of granular refuse-matter: the capillitium is a flexuose network of pale yellow or brownish threads, 2–2·5 μ diam., smooth or minutely warted, and usually marked with close-set or irregular constrictions: the pale yellow spores are very minutely warted, 9–10 μ diam.

Besides the Lyme Regis gathering it was obtained in Lesness Wood, Kent, on bark, November 1923, by the late St. John Marriott; near Stourbridge, Worcestershire, on dead leaves, August 1929 and July 1934, by Mr. E. Brazier; at Mendelsham, Suffolk, on dead leaves, February and March 1934, March 1935, April and September 1936, by Mr. A. Mayfield; at Hixton, Suffolk, on a twig, February 1935, by Mr. A. E. Ellis. It has

* Syn. *P. vermicularis* (Schwein.) Rost.

also been found near Skene, Aberdeen, by the late Rev. W. Cran, and by Mr. H. Bilgram, near Philadelphia, on bark.

From *P. vermicularis*, *P. pedata* differs chiefly in the sporangia being usually stalked, and in their walls breaking up into areolæ, and not being marked with distinct papillæ on the inner side. From *P. chrysosperma* it differs in the sporangia being usually spherical, and the capillitium not being spinulose. Pale forms may resemble *Hemitrichia minor* G. Lister, but the capillitium shows no trace of spiral markings.

Species nova, peridiis sparsis, stipitatis vel sessilibus, subsphericis, pallide badiis vel fulvis, 0·5 mm. diam., dehiscentibus plus minus in areolis; stipitibus nigris; capillitio flexuoso, non spinuloso, regulariter vel irregulariter constricto, 2 μ diam.; sporis pallide luteis, verruculosis, 9 μ diam.

Diderma cor-rubrum Macbride (N. Am. Slime-Moulds, ed. 2, 140; 1922). This species was founded on a single gathering made by Prof. Morton Peck in Iowa. The white sporangia have wrinkled walls and stout white furrowed stalks, which spread out below to form something of a hypothallus. The inner side of the sporangium-walls is dark red and is lined with a more or less separable shining membrane; the prominent columellæ are also dark red. The capillitium and spores resemble those of *D. montanum* Meylan, with which species it is united in 'Mycetozoa,' ed. 3, p. 84 (1924). An extensive gathering of an almost similar form, having wrinkled white sporangia, but still darker purplish columellæ and inner side to the sporangium-walls, was found in 1935 on dead wood in Melawa Forest, Kenya Colony, at an altitude of 5800 feet, by C. A. Thorold. It is very satisfactory that this second gathering entirely confirms the validity of Macbride's species. I am much indebted to Miss E. M. Wakefield for letting me examine the specimen which was sent by Mr. Thorold to the Herbarium of the Royal Botanic Gardens, Kew.

BIBLIOGRAPHICAL NOTES.

CV. Batters's 'List of the Marine Algæ of Berwick-on-Tweed.' By Geoffrey Tandy, M.A., F.L.S.

This important work is known to most phycologists as a volume bearing on its title-page the legend "Reprinted from Berwickshire Naturalists' Club Transactions, 1889." This is an inaccurate citation, as the title-page of the volume in which the List appears has "History/of the/Berwickshire/Naturalists' Club/Instituted September 22, 1831." There is no volume number on this page, but instead, the dates 1887–1889, and under the imprint the date 1890. With this title-page, apparently, were three leaves listing the contents of Parts I., II., and III. It was in Part II. that

Batters's List appeared. This Part has its own table of Contents which is headed "History of Berwickshire Naturalists' Club, Vol. XII. . . . Part II.—1888." This date I take to refer merely to that period of the Club's history and not to a time of publication. The date of publication is a matter for deduction, fortunately simple.

On p. 414 of Part II. the rainfall for December 1888 is recorded. This makes impossible the supposition that the Part appeared before 1889. Pages 416–418 are occupied by a list of "Donations to the Berwickshire Naturalists' Club, from Scientific Societies, Exchanges, &c., 1888–9." These are in chronological order, and the last of them is "York. Yorkshire Philosophical Society, Annual Report for 1889 . . ." The Part was not received in the General Library of the British Museum (Natural History) until "5 Mar. '90." These things, taken together, make it certain that Part II. did not appear until 1890.

There remains the possibility that the List was issued separately in advance of the whole Part; but this suggestion can be set aside likewise. Batters was in regular communication with most of the phycologists of the time, and some of their letters to him are preserved in the British Museum (Natural History). There are letters acknowledging the List from Bornet, Collins, Farlow, Foslie, Gomont, Murray, Pollexfen, Reinke, and Schmitz, all dated between September and November 1890.

It may be regarded as proved that there was no separate publication in 1889 and that the first publication of the List was in Part II. of Vol. xii. of the History of the Berwickshire Naturalists' Club. The authority for the new names in it should be: Batters in Hist. Berwicksh. Natur. Club, xii. . . . [1890]

OBITUARY.

Annie Lorrain Smith, O.B.E.

Miss Lorrain Smith was born October 25, 1854, a younger daughter of the Rev. Walter Smith of Halfmorton in Dumfriesshire and one of a large and talented family—three brothers attained professorial rank, two in philosophy, and one in pathology.

Some early years were spent as governess to private families and visits were made to Orléans and Tubingen. It was not till about 1888 that she seriously took up Botany, joining Dr. Scott's classes at the Royal College of Science. Fellow-students were George Brebner, Thomas Johnson, and Harold Wager. Dr. Scott frequently brought his students across to the Department of Botany at the Natural History Museum, and here Miss Smith began the acquaintance with the Cryptogamic Herbarium where the greater number of her working days were to be spent. Her first connection with the Department was the

remounting of the De Bary collection of microscopical slides that had recently been purchased. She thus gained an acquaintance with microscopic fungi and was able to prepare the exhibit of micro-fungi for the public gallery. Her connection with the Cryptogamic Herbarium as an unofficial worker was henceforth almost continuous up to the time of her eightieth birthday. There was a short break when from 1899–1901 she acted as assistant to Dr. Wm. Carruthers in his work as Consulting Botanist to the Royal Agricultural Society. This included testing farm seeds for germination, and Miss Smith wrote an account of the Fungi found on the seeds during germination (Journ. R. Microsc. Soc. 1901, 613). She also visited members of her family in the United States at America, and in 1914 went with the British Association to Australia.

Her earliest work was on the Seaweeds, at first in Dr. Scott's laboratory, and later at the Museum under George Murray, as notes contributed to the 'Phycological Memoirs' that Murray edited for a few years.

But Fungi soon claimed her attention. Papers were published on collections received at the Museum from tropical East Africa (Scott Elliott, J. W. Gregory, and W. E. Taylor), Angola (Welwitsch), and the West Indies (W. R. Elliott), and also notes on new or rare British Fungi. In 1897 she joined the British Mycological Society and contributed notes on new records and other papers to its 'Transactions' from vol. i. onwards. Also to the *Journal of Botany*. A useful piece of work was the preparation of a series of British Lichens for use of students in the Botanical Gallery—the characters of each genus were shown by a coloured drawing and the species were illustrated by selected specimens.

The death of James Crombie in 1906 interrupted his production of a 'Monograph of the British Lichens,' and the completion of the work was undertaken by Miss Smith. This, vol. ii. of the original work (1911), was followed by a rewriting of Crombie's vol. i. (1918), and the two volumes, produced with meticulous care, are a standard work. Miss Smith also prepared a small 'Handbook' (1921), a brief descriptive catalogue of the British Lichens, published, as was the 'Monograph,' by the Trustees of the British Museum. In the same year appeared her encyclopædic volume on 'Lichens,' one of the Cambridge Botanical Handbooks. Her work brought her in touch with lichenologists at home and abroad, and she became recognized as the British authority on the group. Up to the close of her association with the Museum she continued her work on the determination and arrangement of the collections of Lichens, contributing from time to time lists of collections from various parts of the world.

During the War, with its depletion of the staff, her help was invaluable; as Acting Assistant in the Department she became

responsible for work on the Fungi and Lichens. A useful piece of war work was the investigation of the fungi causing destruction of canvas.

The admission of women to the Museum staff came too late for Miss Smith, and she remained an " Unofficial worker " to the end, her remuneration being provided from a special fund. A Civil List Pension and the O.B.E., the latter conferred just before her 80th birthday, were public recognition of her services.

Miss Smith's interests were not confined to the Herbarium. She was one of the first group of women elected to the Fellowship of the Linnean Society (1904), and for many years regularly attended the meetings, serving on the Council from 1918 to 1921. In 1907 and again in 1918 she was President of the British Mycological Society. For many years also she was a helpful member of the Botanical Section of the S.E. Union of Scientific Societies (President in 1922) and of the Council of the South London Botanical Institute. Her services were readily given at Fungus forays, those of the Essex Field Club and others.

Very useful to other workers were her reviews and précis of current publications and recent work. For more than thirty years she prepared the Abstracts for the Fungi and Lichens for the ' Journal of the Royal Microscopical Society.' Her various Presidential addresses were valuable résumés or critiques bearing on her special groups.

She maintained her capacity and keenness for work long past the allotted span, but the death in 1933 of the sister with whom she had shared a home for fifty years was a grievous blow. Towards the end of 1934 her health failed perceptibly and the last few have been years of increasing weakness. She passed quietly away at her home in West Kensington on September 7.

Many younger workers will gratefully remember her generous help ; and those who have been closely associated with her for the great part of a lifetime will treasure the memory of a keen and conscientious worker and a kind and sympathetic friend.

A. Gepp,
A. B. Rendle.

SHORT NOTE.

The Red Whortleberry.—On September 29 and 30 last, I found *Vaccinium Vitis-Idaea* L., bearing both ripe fruits and flowers simultaneously and plentifully, in Glen Muick and other places in the Grampians of Aberdeen and Angus. Had this been a single occurrence it might, perhaps, be attributed to vagaries of the season, but I have noticed the same second flowering of this species in previous years. If fruit were scarce it might be assumed that there had been a check to the development of flowers at the normal season, but fruit was plentiful—this year, at least. If the second flowering had been very sporadic, the occurrence might not seem significant, but in some places both fruit and flowers appeared to be almost equally abundant on one and the same plant.

J. E. Smith's ' English Flora,' ii. 221, gives only June for the flowering season ; J. D. Hooker, Babington, and Johns give June and July ; the ' Flora ' of Bentham and Hooker says " early summer " ; while W. J. Hooker gives May–June. None of these authors mention date of fruiting.

It would be interesting to learn from field-botanists whether it is a common occurrence for this plant to flower twice in the season.—J. Burtt Davy.

REVIEWS.

British Stem- and Leaf-Fungi (Coelomycetes). Vol. II. Sphaeropsidales, comprising Sphaerioideae, with coloured spores ; Nectrioideae, Excipulaceae, and Leptostromataceae ; and Melanconiales. By W. B. Grove, M.A., M.Sc. Pp. xii+407. Cambridge University Press, 1937. Price 21*s.*

The doyen of British Mycology is to be congratulated most heartily on the completion of his second volume. Book-writing is no light task under any circumstances, and when one has regard to the fact that the author is now in his ninetieth year it does not add zest to the search for points to embellish a review.

The second volume follows the style of the first and there is nothing to add to what was said of this. Twenty-one new species and three new genera—*Sclerozythia* Petch, *Apomelasmia*, and *Rhodesia*—are described with their appropriate Latin diagnoses. The last-named is not a symbol of the author's imperialism, but a tribute to his friend the late Dr. P. G. Rhodes. In addition to a host-index and one of " binomial " names, there is a very useful index of Ascomycetes that have been assigned by authors to species contained in the work—often, it may be said, without any scientific justification.

Two unusual innovations are an Epilogue and a ballad entitled " *Phomopsis perniciosa*, an adventurous Coelomycete." The Epilogue is " to a friend who has that rare gift, Imagination, and to whom therefore I can speak out my mind with perfect freedom." In it there is a eulogy of Saccardo's system, a system which fifty years ago " replaced the chaos reigning up to that time" and is " distinguished by its simplicity and its beauty." But the system is artificial and its probable ultimate demolition is mourned, in my opinion quite unnecessarily, if we consider the slow rate at which imperfect forms are being related up to

their appropriate life-cycles, and assuming that such connections always exist.

The author admits that he has not followed the International Rules of Botanical nomenclature, and complains of their "inhuman rigidity." He accuses phytopathologists of "ineffectiveness," and ridicules what he terms Petripatellism, describing it as "the state of mind of a mycologist who studies his fungus in a laboratory, on agar-slants or *Petri-dishes*, without paying equal regard to what the fungus can do out of doors in the wide and untrammelled field."

There is much truth in this Epilogue, but some of the remarks seem out of place in a book which has numerous statements about genetic association for which there is no proof. If it be taken not too seriously and helps to stimulate considered comments on modern methods of mycological research its inclusion will have been more than justified.

One's general impression of the two volumes is that they have occasioned an enormous amount of careful work and that they will prove extremely useful in enabling students to find names for the numerous "spots" on stems and leaves, and references to supplementary accounts. As this is all the book sets out to do it may not be amiss to express the hope that one result of its publication will be the serious study necessary to eliminate a good percentage of the names and to join up others to their appropriate perfect forms.

The author has done his work well. It would have been greatly to the advantage of British students if it had been published at the beginning of the century.—J. RAMSBOTTOM.

Die Pilze Mitteleuropas.

THE fifth part of Band II. by B. Knauth and W. Neuhoff begins the description of the species of *Lactarius*. A preface gives a short account of Bernard Knauth (b. 1858) who died in September 1936; fortunately W. Neuhoff was associated with him since 1934 and so has been the better able to bring the work to fruition. There are ten pages of text describing three species—*Lactarius helvus*, *L. lilacinus*, and *L. spinosulus*. The descriptions are ample, though not quite so extensive as those of the *Boleti*, but following much the same general scheme—popular names, synonyms and literature, illustrations, exsiccati, original diagnoses, descriptions, forms and related species, edibility, occurrence and distribution, explanation of plate. Under the first there are given eleven popular names of *Lactarius helvus* from German mycological books; it would be interesting to learn whether any of these are names in use.

Lactarius tomentosus, as figured in Cooke's 'Illustrations' and recorded in English books, is regarded as a synonym of *L. helvus* and his *L. spinosulus* v. *violaceus* as not worthy of varietal rank.

One coloured plate figures *L. helvus*, and a second *L. lilacinus* and *L. spinosulus*. The plates are excellent, but have a pale blue background, which to me does not seem to have any advantages over white. A third plate gives drawings of spores $\times 3000$ of fourteen species: they show the same range as in the better-known spores of *Russula*. To judge from this first part, one may expect *Lactarius* to reach the same high standard as '*Boletus*' and 'Die Gallertpilze.'—J. R.

Moss Flora of North America North of Mexico. By A. J. GROUT, Ph.D. Vol. I. pt. 2. Pp. 63–135, pls. xxxix.–lxviii. Published by the Author, Newfane, Vermont, Aug. 1937. No price stated.

THIS part continues and completes Dicranaceae, followed by Leucobryaceae. Polytrichaceae, by Dr. T. C. Frye follows, and Calymperaceae, by Dr. W. C. Steere—a rather remarkable arrangement, probably induced by editorial exigencies rather than an intended taxonomic rearrangement.

The illustrations are, as usual, ample and valuable. Those for *Campylopus* are mostly taken (by permission) from Dixon and Jameson, 'Handbook of British Mosses.'

The somewhat bold step is taken by Dr. Frye of uniting *Psilopilum* Brid. with *Oligotrichum* Lam.; but the reasons given seem cogent, and it is rather refreshing in these times of "splitting" to find a merging of two genera into one by conjugation rather than multiplication by division of the contents!

Bryologists will regret to see on the cover a reference to the "impaired health of the author-editor."—H. N. D.

ECONOMIC BOTANY.

(1) *Overseas Plant Products.* By J. H. HOLLAND (late of the Royal Botanic Gardens, Kew). Sm. 8vo, pp. vii. 279. Bale, Sons and Curnow, Ltd.: London, 1937. Price 6*s*.

(2) *Economic Botany, a Textbook of useful Plants and Plant Products.* By ALBERT F. HILL, Research Assistant in Economic Botany, Harvard University. 8vo, pp. x, 592, text-figs. 223. McGraw-Hill Book Co.: New York and London, 1937. Price 24*s*.

(1) IN a Foreword Sir Arthur Hill, Director of the Royal Gardens, points out the value to those concerned with the raw materials of industry, of a list of overseas plant products with their botanical identifications. Such a list begun by Mr. Holland during his period of service in the Museum Department at Kew has been

completed after his retirement. The products enumerated, the author explains in his preface, comprise all the natural products of vegetable origin imported under the control of the Port of London Authority and into other ports; other products of economic value in the countries of production have also been included.

The arrangement is alphabetical under the trade or vernacular name, followed by the botanical, specific, and family names, the trade sources or countries of production, and an indication of uses. A classified bibliography indicates sources of further information. A number of main headings are included, such as drugs, gums, spices, etc., with references to the particular products. A distinction is made by printing the more important headings in capitals.

There could be no one better fitted for compiling such a work of reference than the author, and he has catalogued a vast amount of information in a readily accessible manner; there must be at least 3000 entries in the book, which will be an invaluable guide to all interested in economic botany.

(2) Mr. Hill's book falls in a different category from Mr. Holland's. It represents the outcome of several years' experience in presenting to students in an American University an introduction to the subject of economic plants. In so vast a field the material utilized in such a course must be limited. It is discussed under four headings—Industrial Plants and Plant Products, Drug Plants and Drugs, Food-Plants, and Food Adjuncts. The first is the most comprehensive, including nine chapters respectively on Fibres, Forest Products and Resources, Tannin and Dyestuffs, Rubber, etc., Gums and Resins, Essential Oils, Fatty Oils, etc., Sugars, Starches, etc. Food-plants are classified as Cereals, Legumes, and Nuts, Vegetables, and Temperate and Tropical Fruits. Special prominence is naturally given to plants of American origin.

The arrangement is technical, not botanical. The product supplies the paragraph heading under which its origin, preparation, and uses are described. For instance, "cellulose products" includes an account of the preparation and use of artificial fibres, cellulose nitrate products (guncotton, pyroxylin), etc. A useful historical and general account introduces each section.

The author presents a great amount of useful information in a readable and well-arranged form. There are naturally limitations in the treatment of so vast a subject in a comparatively small volume. A few suggestions occur. Where is woad now cultivated? Dr. Hurry's interesting "The Woad Plant and its Dye" reviewed in this Journal in 1931 (p. 142) gives an account of this byegone industry. In the brief treatment of the Forest Resources of Europe it is surprising to find our blackthorn or sloe included as a prominent hardwood; *Quercus*

sessilifolia should, of course, read *sessiliflora*; on p. 157 for *Castilla* read *Castilloa*.

A systematic list of the species discussed and a classified bibliography precede the Index at the end of the volume.

A. B. R.

Plant Ecology.

(1) *Plant Ecology.* By Hilda Drabble. 8vo, pp. 142, 12 pls. Edward Arnold & Co.: London, 1937. Price 7*s.* 6*d.*

(2) *Ecology in Town and Classroom.* By R. Bracher, M.Sc., Ph.D. Sm. 8vo, pp. 96, 9 text-figs., 3 pls. J. W. Arrowsmith: Bristol & London, 1937. Price 2*s.* 6*d.*

(1) Mrs. Drabble's attractive little volume supplies a readable introduction to the study of plants in their natural homes. Part I. is introductory, giving an account in eight short chapters of the essential facts relating to the soil and its organisms, the physiological processes, modifications of plant-organs for special work, and an explanation of the terms used in ecology. Part II. treats successively of the special characteristics of a number of communities and their vegetation, such as Oakwoods, Beechwoods, Heaths, Moorland, Fenland, Sand Dunes, Rocky Shores, etc.

The illustrations are a helpful feature, photographic representations of various habitats. For these and valuable suggestions the author is indebted to Prof. E. J. Salisbury. Instructions for work, a bibliography, a set of test questions, and an index conclude the volume, which is dedicated to the author's husband, the late Dr. Eric Drabble. It is regrettable that a useful and well-produced volume should be marred by frequent misspelling of plant-names. The neglect on occasion of the somewhat troublesome use of the capital initial for the specific epithet may be condoned, but there can be no excuse for *Mercuralis*, *Myrophyllum*, *Hydrocheris*, *Teuchrium*, and *Solidago vigaurea*, to cite a few only.

(2) In this volume Miss Bracher attempts to do for the town-dweller what was done for the field-worker in her 'Field Studies in Ecology,' noticed in this Journal in 1934 (p. 295). In place of "natural" types, woodland, sand-dunes, and the like, she describes examples of plant communities which, being in or near a town, come directly under human influence and may therefore be termed "artificial." The chapters deal with the vegetation of a street, waste ground (building sites, neglected gardens, and rubbish heaps), coal-tips, and tidal-river banks. Town communities afford good examples of colonization and succession, as man is continually providing new habitats for plants—for instance, streets are cleaned: a coal-tip shows stages from very sparse to closed vegetation. Town conditions also influence the

morphology and life-form of the plant. Suggestions are also given for ecological study, necessarily limited, in the class-room.

The lists of plants given in the various sections are all taken from actual localities.

A very suggestive little book.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—The Annual Dinner was held, by kind permission, at the Royal Societies' Club, on October 14, It was followed by a Reception by the President, Mr. John Ramsbottom, O.B.E., in the Rooms of the Society at Burlington House, at which a large number of the Fellows and their friends were present. Among the exhibits that were arranged in the Library was a collection of botanical drawings by the late Dr. A. H. Church, F.R.S., representing material for two additional volumes of his 'Types of Floral Mechanism.' The drawings, which are remarkable for their beauty of execution and botanical accuracy, have been presented to the Department of Botany, British Museum. Characteristic plants of the dry country of West Australia and a collection of toxic plants were shown by the Royal Gardens, Kew, on behalf of the Government Botanist, Mr. C. A. Gardner; and Dr. E. M. Delf showed specimens of characteristic Brown Algae of New Zealand.

Mr. W. E. Glegg gave a lecture, illustrated by lantern-slides, on Changing Bird-life in London.

SOUTH LONDON BOTANICAL INSTITUTE.—The twenty-seventh Annual Meeting was held at the Institute in the Norwood Road on October 15. The membership now stands at 300. During the past year the herbarium, library, and small botanical garden have proved of use and interest to teachers and students of botany. Evening lectures have been given by well-known botanists, and the Curator, Mr. W. R. Sherrin, has conducted a number of Saturday afternoon rambles.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.—H.M. Stationery Office publ. (price 6*d.*), Forest Products Research Records no. 21, 'The Growth and Structure of Wood,' by B. J. Rendle. This is a clearly written illustrated introduction to the structure, mode of growth, and properties of wood, and the technical terms used in describing them.

JOURNAL OF THE ROYAL HORTICULTURAL SOCIETY.—The September number contains an historical and descriptive account of the Day Lily *Hemerocallis*, by G. P. Baker. *H. flava* was known to Dioscorides as a medicinal plant familiar to the Egyptians, Romans, and Africans, but is presumed, like the other species of the genus, to have come originally from the Far East. The writer conjectures that it came by reason of the intercourse that was established between the nations of the Far East and Europe as far back as Alexander's time, 300 B.C.

THE BRITISH ELMS.

BY HELEN BANCROFT, M.A., D.Sc.

THE following suggested "working classification" of the British Elms summarizes the result of field and herbarium studies carried out over a considerable period in the British Isles and also in various European centres*.

The general arrangement of the descriptive matter follows that of Hooker's 'Student's Flora,' an arrangement also adopted by Gilbert-Carter in his recent work on 'British Trees and Shrubs.' The diagnoses of the individual types are rather more extensive than in either of these works; they aim, however, at giving only those points which seem to be essential for the ready differentiation of types and the distinguishing of specimens. For convenience of reference, the bibliography in connection with the question of nomenclature is also given.

ULMUS L. Elm.

Trees without latex, but with watery or mucilaginous sap having bitter and astringent properties; *bark* fissured, from light to dark grey in colour. *Leaves* alternate, distichous; lamina simple, with more or less asymmetrical base, and serrate, or doubly-serrate, margin; surface usually scabrid; stipules caducous. *Flowers* monoclinous, in lateral cymose clusters; in all British species, clusters more or less dense, appearing in winter or early spring (end of January to April) on the naked twigs. *Perianth* campanulate, usually 5-, rarely 4- to 8-fid, persistent; lobes imbricate in bud. *Stamens* usually 5, opposite perianth-lobes and adnate to perianth-tube; filaments straight in the bud; anthers extrorse. *Gynæceum* superior; ovary usually 1-, rarely 2-, locular, with one apical, pendulous, anatropous ovule in each loculus; *styles* 2, subulate, stigmatic on the inner surface. *Fruit* 1-seeded and indehiscent, forming a flat, oval or rounded, broad-winged samara, notched at the stigmatic end. *Seed* non-endospermic, testa thin; embryo straight; cotyledons large, flat or folded; radicle superior.

A genus widely distributed in North Temperate regions.

It is impossible to classify the British Elms into "species" in the conventional or Linnæan sense of the term, even when allowance is made for a certain amount of individual variation; this difficulty is due to the fact that, at the present time, the genus is evidently plastic, and in an active state of evolution by hybridization and variation. Certain "standard types" may,

* For details concerning these studies, see Bancroft, H., "Notes on the Status and Nomenclature of the British Elms," 'Gardeners' Chronicle,' xcvi. (1934); "The Elm Problem," 'Quarterly Journal of Forestry,' April 1935; "Elm Notes for 1935," 'Gardeners' Chronicle,' xcix. & c. (1936).

however, be recognized, together with forms intermediate between pairs of these standards; these "intermediates" are almost undoubtedly the result of hybridization. Many individuals occur which do not conform exactly to the characters of either a "standard" or an "intermediate," but which approximate more or less closely to one or other of these recognizable types; these specimens may be hybrid segregates, the result of "back-crossing," or ecological or geographical forms or varieties of a "standard" or "intermediate" type.

The leaf-characters are of essential importance in determining the relationships of the British Elms: it should, however, be noted that reference is made only to *the leaves of normal spring shoots*, for those of summer, epicormic and coppice shoots, and of suckers, do not provide the constant, or comparatively constant, differentiating characters requisite for classificatory purposes.

Other important features are the character of the young (current year) shoots, whether glabrous or pubescent; the general habit of the tree; and the fruit-characters, particularly with regard to the position of the seed in relation to the stigmatic notch.

The twigs of individual trees, particularly in the case of the Dutch and Smooth-leaved Elms, may be suberous. Examples bearing such twigs are often referred to as "variety *suberosa*." It is, however, important to realize that, in Elms, corkiness generally appears to be an expression of vigour, arising from such causes as hybridity, youth, or cutting back of the trees; it is thus not necessarily a character of taxonomic value, being frequently, at least, purely physiological in origin, and variable in its occurrence, according to conditions of growth.

Four "standard types" of British Elm may be distinguished, and these clearly correspond to the four types enumerated by Goodyer in 1636, namely:—

(1) *Ulmus folio glabro* (*U. nitens* Moench);
(2) *Ulmus folio latissimo scabro* (*U. montana* Stokes);
(3) *Ulmus vulgatissima folio lato scabro* (*U. procera* Salisb.); and
(4) *Ulmus minor folio angusto scabro* (*U. minor* Miller)*.

The distinctive characters of these types are as follows:—

1. U. NITENS Moench. Smooth-leaved Elm. *Habit* somewhat variable with rounded or cone-shaped crown. *Branches* rather long, the lower spreading and frequently upturned at the end after a horizontal or slightly descending initial course; upper branches ascending; young shoots slender and glabrous; older twigs sometimes becoming suberous. *Leaves* with distinct slender petioles, up to ½ in. or even more in length; apex of lamina shortly acuminate, base markedly asymmetrical, margin sharply and doubly serrate; surfaces in the young condition with many glandular hairs, which tend to shrivel as the leaf matures, leaving upper surface shining and generally quite smooth, and lower surface with scattered brown remains of glands and tufts of simple hairs in the axils of the lateral veins; texture of leaf somewhat coriaceous at maturity. *Fruit* oblong or obovate, with seed situated above the centre, immediately under the stigmatic notch. *Vegetative reproduction* by suckers abundant.

A tree of wide occurrence in Europe, but in Britain characteristic of the eastern and east-midland counties; a lowland type, occurring in hedgerows, wood-borders, and parklands.

Synonyms.—This Elm is the chief form listed in continental Floras* and herbaria under the somewhat comprehensive title "*Ulmus campestris* L." Other names applied to it are *U. glabra* Miller (Gard. Dict. ed. 8; 1768), a term which follows Goodyer's original description of the type as "*Ulmus folio glabro*"; *U. foliacea* Gilibert; and *U. carpinifolia* Borkhausen. The two latter names are cited in the 'Index Kewensis' as synonyms of "*U. campestris*," the reference evidently being to *U. campestris* in the continental sense, as noted above.

2. U. MONTANA Stokes. The Scottish, Wych or Mountain Elm. *Habit* fairly characteristic, with dome-like crown. *Branches* long and spreading, the lowermost generally having a downward tendency; first-year shoots stout and pubescent, older twigs smooth, not becoming suberous. *Leaves* large, obovate, typically "shouldered" below the long-pointed apex, occasionally tricuspidate, owing to the occurrence of points on the "shoulders"; lamina-base narrowed and varyingly asymmetrical; margin sharply and doubly serrate; petiole thick and very short, often hidden by the larger lobe of the lamina-base; upper leaf-surface very scabrous, with stiff pointed hairs directed towards the leaf-tip, lower surface softly pubescent. *Fruit* elliptical to ovate, with seed situated in the centre. *Vegetative reproduction* by suckers very rare.

A tree well represented in Europe, where it is characteristically a northern, or in lower latitudes a montane, type; occurring in woods and parklands from Ireland and the Channel Islands through England and Wales to Sutherland in the north of Scotland; much less common in the south of England than further to the north, where it may ascend to an altitude of well over a thousand feet; having apparently a preference for limestone soils.

* See Gerarde, J., 'The Herball, or Generall Historie of Plantes,' Johnson's edition, 1636, pp. 1478–82.

* See, for example, Coste, H., Flor. France, 1906; and Gillet et Magne, 'Nouvelle Flore française.' In Heukel's 'De Flora van Nederland,' ii. 58–60, 1909, "*U. campestris*" apparently includes all wild Dutch forms, however diverse.

Synonyms.—This type is the original *Ulmus campestris* of the Linnæan Herbarium, and presumably, therefore, of the 'Species Plantarum' (1753), although neither from the diagnosis, the citations, nor the information as to habitat there given is this completely without doubt. It should be noted that Moss (Cambr. Flora, ii. 96) believed the Linnæan specimen to be a product of hybridization between the Wych and Smooth-leaved Elms, but there does not seem to be sufficient reason for this opinion. Miller's term *U. scabra*, suggested in 1768 (*l. c.*), followed Goodyer's description of the type as "*Ulmus folio latissimo scabro*" (*l. c.* 1636); *scabra* is, however, by itself, a somewhat unsatisfactory term, for the leaves of various other Elms also are rough, even if to a less degree. The epithet *montana* was adopted by Stokes in 1787*; but it is actually pre-Linnæan, having been used by Bauhin (Pinax Theatri Botan. 427) in 1671. The earliest name given quite definitely to the Wych Elm after the publication of the 'Species Plantarum' is *U. glabra*, suggested by Hudson (Flor. Angl. 95) in 1762; and Gilbert-Carter, who apparently follows Moss in discounting the evidence of the Linnæan specimen, therefore maintains that *glabra* is the only valid epithet for this Elm (*l. c.* 75). It is here suggested, however, that if, owing to confusion arising from the wide applicability of the term "*campestris*," the original Linnæan name for the Wych Elm is to be neglected, it seems desirable that the use of the familiar and well-established term *montana*, in reference to that type, should be continued; for, while there is a certain objection to the epithet on account of the fact that in northern latitudes the Wych Elm is not necessarily a montane form, it has the advantage of not having been applied to any other Elm, as *glabra* has been (vide supra, *U. nitens* Moench). Moreover, *glabra* is misleading as a descriptive term, since it has reference to the smooth character of the surface of the older twigs, a comparatively unimportant point, and not, as might be expected, to the large and conspicuous leaves, which are actually more scabrid than those of any other British Elm.

3. U. PROCERA Salisb. English Elm. *Habit* distinct, with tall straight trunk; outline of tree typically asymmetrical owing to ready falling of branches. *Branches*: lower heavy, somewhat stiff, wide-spreading, horizontal to slightly drooping; upper ascending; main trunk and lateral branch systems ending in heavy masses of foliage; epicormic shoots often numerous; young shoots densely pubescent; older twigs occasionally suberous. *Leaves* very variable in size and shape even on normal spring shoots; terminal leaf typically large, broadly elliptical or ovate, often not very markedly asymmetrical,

* See Withering, W., 'Botanical Arrangement of the Vegetables in Great Britain,' ed. 2, i. 259.

lateral leaves smaller, more rounded or heart-shaped, very distinctly asymmetrical; apex shortly acuminate; margin doubly, but not very sharply, serrate; petiole fairly long; upper surface dark green and scabrid; lower densely and softly pubescent, and with broad diffused axil-tufts. *Fruit* small, more or less orbicular, with seed above the centre and immediately under the stigmatic notch; generally infertile. *Vegetative reproduction* by suckers very abundant.

A very common Elm of copses, hedgerows, and parkland in the lowland areas of midland and southern England, preferring, apparently, deep alluvial soils (*e. g.*, in the Thames and Severn Valleys); not known on the Continent of Europe in its distinctive form and habit, but very similar to a Dutch form of Elm in the characters of its young shoots, leaves, "leaf-mosaic," and fruits. The evidence indicates a relationship between the English Elm and this Dutch type, of which the English Elm may be an isolated insular or regional variety or product of hybridization. Infertility of the seed may account for the vegetative development of the type in this area; while reproduction by vegetative means is responsible to some extent, at least, for the comparative uniformity of its general characters.

Synonyms.—This Elm is the generally-accepted "*Ulmus campestris*" of English Floras, and is without doubt Goodyer's "*Ulmus vulgatissima folio lato scabro.*" In view of the fact that the Linnæan specimen of "*U. campestris*" is not of this type, it is impossible to maintain that the English Elm represents the standard Linnæus had in mind when listing "*U. campestris*" in the 'Flora Anglica' (1754, 13) (*cf.* the opinions of Moss (*l. c.* 96) and of Elwes and Henry*); and it therefore seems advisable to abandon *U. campestris* L. as a *nomen confusum*, and to adopt a more exact epithet for this form. Miller's term *U. sativa* (*l. c.*) seems to be the first post-Linnæan name which is capable of application to the English Elm; but, owing to that author's vague descriptions of the British Elms, a confusion has arisen between the nomenclature of the small-leaved and English types, Moss having adopted *U. sativa* for the former (*l. c.* 93)†. The earliest post-Linnæan name applied definitely to the English Elm, and to no other type, is *U. procera*, suggested by Salisbury (Prodrom. 391) in 1796; this term has reference to the tall habit characteristic of the tree. Druce subsequently used "*U. anglica*" to indicate the specifically English distribution

* Elwes, H. J., and Henry, A., 'Trees of Great Britain and Ireland,' vii. 1903 (1913).

† Confusion between the two types themselves may be due to the fact that the leaves of suckers, and of very young plants produced from suckers, of the English Elm are small and narrow, not unlike those of the Small-leaved Elm. Conversely, a case was recently noted in which young plants supplied by a nursery as English Elm had ultimately proved to be Small-leaved Elm.

of the type *; but, as an exact designation, this has little advantage over *U. procera*, the especially tall habit of the tree being almost as characteristic as its distribution; it is therefore suggested here that Salisbury's term should be generally adopted †. It may be noted that Smith referred to what, from the descriptions of the leaves and fruits, is undoubtedly the English Elm, as "*U. suberosa*," remarking that the bark, when a year old, is "covered with very fine dense cork, in deep fissures ‡; since, however, a tendency to corkiness of the bark is not exclusively, or even especially, a characteristic of the English Elm (v. *supra*), this term is obviously unsuitable.

4. U. MINOR Miller. The Small-leaved Elm. *Habit* characteristic; a comparatively small tree, with summit of main stem slightly curved, giving, with the very slender branchlets, a feather-like appearance in the leafless condition. *Branches* comparatively few, short, more or less spreading, upper ones with a somewhat ascending tendency; branchlets numerous; young shoots hairy. *Leaves* smaller than in any other British Elm; lamina symmetrical or only slightly asymmetrical at the base, margin *obtusely* doubly serrate; petioles short; upper surface of lamina dull and scabrous, lower surface with scattered hairs and fairly conspicuous axil-tufts *Fruits* small, narrow, and obovate, with the seed situated immediately under the somewhat conspicuous stigmatic notch; generally infertile. *Vegetative reproduction* by suckers abundant.

Represented in Europe and Western Asia; common in woods and hedges in East Anglia; occurring also in the south midlands, the Severn Valley, S. Wales, and in Hampshire; distribution-area overlapping that of *U. nitens* in the east and south midlands of England.

Synonyms.—This Elm is undoubtedly Goodyer's "*U. minor folio angusto scabro*," and Miller's use of *minor* as a specific epithet has priority (*l. c.*). Miller's term "*U. sativa*" was considered by Moss as referring to the Small-leaved Elm (*l. c.* 93), but there can be little doubt that Miller intended it to apply to the English Elm (*cf.* Elwes and Henry, *l. c.* 1901). Druce (*cf.* 'Comital Flora,' 266) applied the name *U. Plotii* to the Small-leaved Elm, being under the impression that it was "Plot's Elm" §; the true Plot's Elm, however, is a type with smooth, very narrow, and acuminate leaves, possibly a *minor* × *nitens* segregate.

The various common English names for this Elm are: "Lock Elm," a term having its origin in the fact that the timber, though of good quality, is difficult to work, causing "locking" of the saw; "Rock Elm," apparently an occasional local corruption of the previous term; "Feather Elm," a name having reference to the delicate feathery tracery of the leafless branches; "East Anglian Elm," indicating its distribution; and "Goodyer Elm."

* See Druce, G. C., 'The Comital Flora of the British Isles,' 266 (1932).

† *Cf.* Stearn, W. T., in "Notes from the University Herbarium, Cambridge," *Journal of Botany*, lxx. (Suppl.) (1932).

‡ See Smith, J. E., 'English Flora,' ed. 2, ii. 21 (1828).

§ See Moss, C. E., "British Elms," 'Gardeners' Chronicle,' li. 234 (1912).

ELMS OTHER THAN THOSE CONFORMING TO "STANDARD TYPES."

An Elm which may be regarded as truly intermediate between a pair of the foregoing "standard types" is

× U. VEGETA (Loudon) Schneider. The Huntingdon Elm. *Habit* tall and characteristic, with a conspicuous, though rather short, bole and long straight branches ascending at a narrow angle; branchlets drooping; young shoots slender, with scattered hairs, and with a few glands in the early stages; twigs not, or at least rarely, corky. *Leaves* large, somewhat similar in shape to those of *U. montana*, but narrower, only slightly "shouldered," and more shortly acuminate; markedly asymmetrical at base; petioles rather long, as in *U. nitens*; upper leaf-surface glandular and with some rough hairs, when young, smooth and shining when mature; lower surface with scattered glands and small axil-tufts. *Fruit* fairly large, with seed between centre and notch, but with seed-cavity slightly separated from base of notch. *Vegetative reproduction* by suckers infrequent.

A type of Elm occurring naturally and rather locally in hedgerows in Essex, Cambridgeshire, Huntingdonshire, and the Midlands; much planted in parks and gardens. Results of germination experiments* indicate that the Huntingdon Elm is a first-generation hybrid between *U. montana* and *U. nitens*, *i. e.*, a true "intermediate" between two "standard types."

Synonyms.—This Elm was described by Loudon ('Arboretum &c.,' iii. 1404) in 1838 as "*U. glabra* var. *vegeta*." Ley (Journ. Bot. xlviii. 68) adopted the term *U. vegeta* in 1910, following the naming of a specimen in the Lindley Herbarium. Schneider (Illustr. Handb. Laubholzk. i. 218) in 1906, however, had expressed the opinion that the type was a hybrid, and it is described as such, under the name "× *U. vegeta*," by Elwes and Henry (*l. c.* 1879) and by Moss (*l. c.* 91). Since Loudon was originally responsible for the epithet *vegeta*, and Schneider for the recognition of hybrid status, the correct designation of this Elm is "× *U. vegeta* (Loudon) Schneider," a designation which may be amplified and made more explicit by the addition of the parental types "*U. montana* × *U. nitens*."

Another form of Elm combining the characters of *U. montana* and *U. nitens*, but approaching more closely to *U. nitens* †, is

× U. HOLLANDICA (Miller) Moss. The Dutch Elm. *Habit*

* Henry, A., "On Elm Seedlings showing Mendelian Results," Journ. Linn. Soc. (Bot.), xxxix. 290 (1910).

† The *mature* leaves of *adult* trees certainly approach more closely to those of *U. nitens* than to those of *U. montana*; but it should be noted that *immature* foliage of *young* plants may very readily be confused with that of *U. procera*.

tall, with short bole and rather irregular thin and open branching. *Branches* wide-spreading, upper ones ascending; branchlets drooping; young shoots somewhat hairy; twigs, especially those of epicormic development and of suckers, often corky. *Leaves* rather large (but generally smaller than those of × *U. vegeta*), acuminate, typically not " shouldered "; markedly asymmetrical at the base; petiole fairly long; upper leaf-surface somewhat rough with stiff hairs when young, becoming almost smooth and slightly shining when mature; lower surface with axil-tufts, hairy midrib and lateral veins, and scattered hairs. *Fruits* abundant, variable in size; seed situated between centre and notch, cavity usually, but not invariably, reaching notch. *Vegetative reproduction* by suckers very abundant.

A hedgerow type, of fairly wide occurrence in England, locally abundant in the south and in East Anglia; no certain record of its natural occurrence on the Continent. A hybrid type with *U. montana* and *U. nitens* in its ancestry, but, in the absence of adequate germination and controlled breeding experiments, it is impossible to express an opinion as to which " filial generation " it represents; it may be an F_2 segregate, or the result of " back-crossing " of the F_1 type with one of the parental forms.

Synonyms.—The earliest reference to the Dutch Elm seems to be that of Plukenet (Almagest. Botan. 393) in 1696—namely, " *Ulmus major hollandica, angustis et magis acuminatis samaris folio latissimo scabro.*" It was undoubtedly this type on which Miller in 1768 (*l. c.*) founded his *U. hollandica*, and which Smith later described as *U. major**, neither author recognizing the hybrid nature of this Elm. Smith gave no reason for neglecting Miller's specific epithet; he evidently considered *major* a more suitable description. Miller's term has, however, priority; and it was accordingly adopted by Moss, who took the responsibility for the prefixing of the hybrid sign (*l. c.* 92); the resultant designation —" × *U. hollandica* (Miller) Moss "—is here used as being more in accordance with the Rules of Nomenclature than other combinations which have been suggested †.

Other recognized forms, the characters of which very certainly suggest hybrid origin, are the Cornish and Guernsey Elms; these appear to combine the characters of *U. minor* and *U. nitens*, but their exact status and composition have not been shown by experiment.

(?×) U. STRICTA Lindley. The Cornish Elm. *Habit* characteristic; subfastigiate or narrowly pyramidal, with a distinct main stem, as in *U. minor*, and a narrow crown of rather short ascending *branches*; young shoots almost smooth, degree of

* 'English Botany,' t. 2542 (1814). Also see 'English Flora,' ii. 21 (1825).
† *Cf.* Bancroft, *l. c.* 298–9 (1934).

pubescence variable, glands present in young condition; twigs sometimes corky. *Leaves* similar in texture and surface to those of *U. nitens*, but smaller and less asymmetrical at the base; serration even more obtuse than in *U. minor*, often suggesting crenation; axil-tufts fairly conspicuous; lamina bent inwards on the midrib. *Fruit* similar to that of *U. nitens*, with seed between centre and notch, but narrower; often not fertile. *Vegetative reproduction* by suckers abundant.

A hedgerow tree of Devon and Cornwall, and of Brittany, apparently well adapted to climatic conditions produced, in comparatively sheltered valleys, by proximity to the sea. In the absence of adequate and conclusive breeding experiments, it is impossible to say whether the Cornish Elm is, as its characters suggest, a true, or F_1, intermediate between the Smooth- and Small-leaved Elms, or whether it is a segregate of a later generation—or, indeed, whether it is an independent species, although this certainly does not appear to be the case.

Synonyms.—In addition to *U. sativa* Lindley (Synops. Brit. Flor. 227; 1829), the Cornish Elm has been referred to as *U. campestris* var. *stricta* Aiton (Hort. Kew. i. 319; 1789); *U. campestris* var. *cornubiensis* Loudon (*l. c.* 1326); and *U. nitens* var. *stricta* Henry (*l. c.* 1888–90). In view of the very distinct characters of the tree, Lindley's use of *stricta* as a specific epithet seems preferable; the hybrid sign should, of course, be prefixed if the type ultimately proves to be of hybrid origin.

(?×) **U. sarniensis** (Moss), sp. nov. The Guernsey, or Jersey, Elm; the Wheatley Elm. *Habit* characteristic, with a main stem, and pyramidal outline. *Branches* short, lower ones spreading, upper ones ascending; young shoots similar to those of (?×) *U. stricta*. *Leaves* similar to those of (?×) *U. stricta*, but with flat lamina, broader in proportion to length, with less conspicuous axil-tufts, and somewhat darker green in colour. *Fruit* rather larger than that of (?×) *U. stricta*, strongly notched, not abundant. *Vegetative reproduction* by suckers abundant.

A tree occurring characteristically in the Channel Islands, where it appears to be native and well established; it has also recently been observed, apparently naturally-occurring, on the mainland of Lower Normandy; and the same type (the " Wheatley Elm ") is known from the English Midlands; a form much planted in south-coast towns, and more recently elsewhere, in England. Its characters suggest its derivation from an original *U. minor* × *nitens* parentage; but *nitens* characters on the whole prevail, indicating a possible back-crossing of an original *minor* × *nitens* form (perhaps of (?×) *U. stricta* type ?) with *U. nitens*. The independent occurrence of this form of Elm in *minor-nitens* areas (Lower Normandy and the English Midlands) is readily understandable on the view of hybrid origin.

Synonyms.—This Elm has been described by Henry as a variety of *U. nitens* (*U. nitens* var. *Wheatleyi* Simon Louis : *l. c.* 1891–2) and by Moss as a variety of *U. stricta* (*U. stricta* var. *sarniensis* : *l. c.* 93), the latter author suggesting the possibility of its having arisen by hybridization between *U. nitens* and *U. stricta*. The epithet "*Wheatleyi*" is somewhat undesirable, since it was apparently applied on account of the fact that an Elm of this type was recorded from a small place named Wheatley, and not, as the form of the term would imply, by way of compliment to a botanist or arboriculturalist of that name ; the varietal epithet suggested by Moss—*sarniensis*—is preferable, and is adopted here as a specific term, with indication of the suggestion of hybrid status.

The construction of a key to the identification of the British Elms presents difficulties owing to the large number of varieties and hybrid-segregates which range between the standard and intermediate types here enumerated. Some guide to the identification of these eight types, however, may be provided by the following scheme :—

Young shoots and surfaces of mature leaves glabrous, or practically so.	
Trees of long-branched habit.	
Lower branches spreading, upper ascending; twigs often corky; suckers frequent	*U. nitens.*
Main branches ascending at a narrow angle; twigs not, or rarely, corky; suckers very infrequent	× *U. vegeta.*
Trees of short-branched habit.	
Branches ascending, giving subfastigiate form; leaf-lamina bent inwards on midrib, narrow in proportion to length ..	(? ×) *U. stricta.*
Lower branches spreading, upper ascending; leaf-lamina flat, broad in proportion to length	(? ×) *U. sarniensis.*
Young shoots and surfaces of mature leaves more or less hispid.	
Seed in centre of samara, removed from stigmatic notch	*U. montana.*
Seed above centre of samara, approaching, or immediately under, stigmatic notch.	
Trees of long-branched habit, and with rather broad and distinctly asymmetrical leaves.	
Trees often asymmetrical in outline; lower branches large and spreading, ending in dense masses of foliage; upper surfaces of mature leaves dull and markedly rough	*U. procera.*
Trees with short bole and irregular thin and open branching; upper surface of mature leaves slightly shining and only slightly rough	× *U. hollandica.*
Trees of short-branched habit, with narrow leaves, only very slightly asymmetrical	*U. minor.*

NOTES ON THE FLORA OF JAMAICA.

By A. B. Rendle, F.R.S.

(Continued from vol. lxxiv. p. 346.)

Marsdenia R. Br. (Asclepiadaceae).

The genus *Marsdenia* was established by Brown in the 'Memoirs of the Wernerian Natural History Society,' i. 28 (1811). Among the "Marsdeniae verae" characterized by a "stigma muticum" he includes (p. 30) *M. clausa*, based on a specimen from Swartz from Jamaica in the Banksian Herbarium, now in the British Museum Herbarium where Brown's manuscript description is also preserved. Brown's description, "caule volubili foliis lanceolatis utrinque acutis glabris : supra parum rugosis, fauce dense barbata," was copied by Roemer and Schultes (Syst. vi. 53), Sprengel (Syst. i. 844), and Decaisne (in DC. Prodr. viii. 615), and the name has been adopted by subsequent workers at West Indian botany apparently without reference to the type or to Brown's detailed manuscript description of the flower at the British Museum.

The specimen consists only of the end of a flowering branch, and most of the few flowers are much damaged, but it has been possible to make out the chief points of their structure. This examination shows that the species has been misunderstood.

Grisebach (Flor. Brit. W. Ind. 422 ; 1861) includes *M. clausa* R. Br., citing only specimens from Macfadyen and Wullschlägel from Jamaica, and stating that it also occurs in Cuba. He had presumably not seen Swartz's specimen, the type. Macfadyen's specimen is at Kew, written up "*Marsdenia clausa* R. Br." by Grisebach, and, by the courtesy of the Director of the Botanical Museum at Munich, I have been able to examine Wullschlägel's specimen, which has been also certified by Urban as *M. clausa* R. Br. These two specimens are identical, and might have come from the same plant, but the inflorescences are all very young ; neither specimen contains a fully developed flower, but examination of an advanced flower-bud indicates that they differ from Brown's specimen. The corolla-tube is much longer than the calyx and the lobes of the corona are short and blunt (fig. 2, B). The upper surface of the leaves is not rugulose as in Brown's plant. Grisebach's description does not help ; that of the flower excludes both Brown's specimen and the two Jamaican plants that he cites. It was probably drawn up from a Cuban plant.

Schlechter, in his revision of the West Indian Asclepiadaceae (in Urb. Symb. Antill. i ; 1896), includes under *M. clausa* R. Br. a number of species by various authors from Cuba and San Domingo, but omits Jamaica in the distribution. His description of the corona-lobes as "oblongis, apice truncato-rotundis"

definitely excludes Brown's species. It also excludes *M. campanulata* Griseb. (Pl. Wright. 521; 1862, and Cat. Cub. 176; 1866), which he cites, founded on Wright's Cuba specimen no. 1375, and very different from *M. clausa* R. Br.

Urban, in his 'Flora Domingensis' (Symb. Ant. viii. 554), includes *M. clausa* Br., with distribution also in Jamaica and

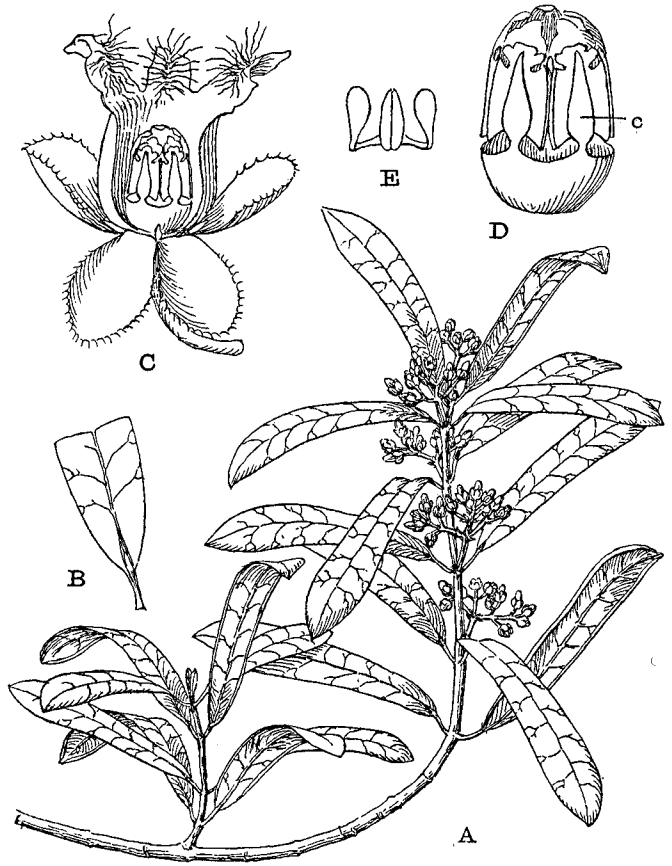


Fig. 1.—*Marsdenia clausa* R. Br. A, young flowering shoot, $\times \frac{2}{3}$; B, base of leaf showing small gland above the petiole on upper face, $\times 2$; C, flower, the corolla-tube cut away to show the gynostegium, $\times 6$ (the lobes were broken above); D, gynostegium, *c*, corona-lobe, $\times 12$; E, pollinia, $\times 25$. Drawn from type-specimen.

Cuba; but Urban had not seen Brown's specimen and presumably based his opinion on the Wullschlägel specimen cited by Grisebach, which, however, seems distinct from the specimens cited from Cuba and S. Domingo.

Urban cites as a synonym *M. agglomerata* Dcne. in Ann. Sci. Nat. sér. 2, ix. 276 (1838), and in DC. Prodr. viii. 614. By the courtesy of the Director of the Paris Herbarium I have been able to examine the type of this species. It is the plant collected by Poiteau in S. Domingo on which Poiret founded his *Apocynum agglomeratum* (Encycl. i. 407; 1810) a year earlier than Brown's *M. clausa*, and if the two species were synonymous, Poiret's name would take precedence. It differs, however, in having the sepals distinctly shorter than the corolla-tube and in the broadly tongue-shaped corona-lobes.

It would seem that *M. clausa* R. Br. is at present known only from the type-specimen collected by Swartz in Jamaica, from which the following description has been drawn up:—

M. CLAUSA R. Br. Young shoots very sparsely puberulous, otherwise glabrous. Leaves spreading, somewhat leathery, narrowly oblong, apiculate, narrowing below to a wedge-shaped to rounded base, margin revolute, conspicuously net-veined beneath with prominent midrib, bearing a small gland on upper face at the base; petiole short. Cymes rather dense, extra-axillary, shortly stalked, much shorter than the leaf. Calyx divided nearly to the base, lobes membranaceous, concave, broadly obovate, 3 mm. long, margin minutely ciliate, a minute gland between each lobe. Corolla campanulate-urceolate, glabrous without, tube as long as the calyx, "lobes as long as the tube" (*fide* Brown), densely bearded in the lower part. Corona-lobes lanceolate, acute, reaching almost to the top of the gynostegium. Stigma rounded.

Jamaica (without locality) *Swartz*. (Fig. 1.)

The specimens from Macfadyen and Wullschlägel represent a distinct species hitherto undescribed:—

Marsdenia Macfadyenii, sp. nov. *M. clausae* R. Br. affinis differt autem cymis subumbellatis, calycis lobis tubo corollæ valde brevioribus, coronæ lobis latis obtusis.

Suffrutex volubilis, ramulis juvenilibus sparse puberulis; *foliis* glabris lanceolato-oblongis vel anguste ovalibus, apice subacuto mucronulato, basi acuta, subtus nervo mediano prominente et reticulato-venosa, petiolo tenue breve sparse puberulo; *cymis* extra-axillariis multifloris foliis multo brevioribus; *calyce* membranacea profunde 5-partita, lobis orbicularibus vel breviter obovatis, margine ciliolatis; corolla campanulata, externe glabra, fauce barbata, lobis oblongis; *coronæ* lobis (immaturis) 5 latis, superne angustatis, obtusis, dorso antherarum affixis iisque brevioribus.

Hab. JAMAICA: without locality, *Macfadyen* (Herb. Kew., type); Manchester, Lititz savannah, trailing on wall, *Wullschlägel* (Herb. Munich). (Fig. 2.)

Leaves (on young flowering shoots) somewhat leathery, smooth, and dark-coloured above when dry, pale beneath, to

7 cm. long, including the petiole, by 1·6 cm. broad. Cymes solitary alternating at successive nodes, peduncles and pedicels sparsely puberulous. Corolla about 4 mm. long.

The description has been drawn up from a flower-bud apparently just about to open.

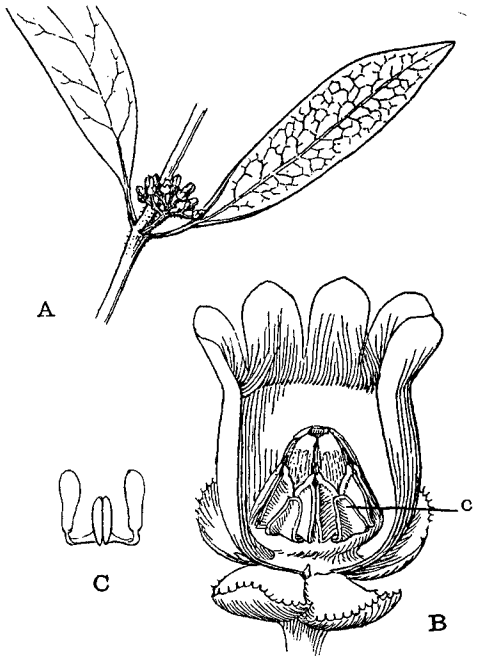


Fig. 2.—*Marsdenia Macfadyenii* Rendle. A, branch with pair of leaves and an inflorescence, $\times\frac{2}{3}$; B, flower, the corolla-tube cut away to show the gynostegium, *c*, corona-lobe, $\times 10$; C, pollinia, $\times 25$.

M. CAMPANULATA Griseb. in Mem. Amer. Acad. Arts & Sci. n.s. viii. 521 (1860) ("Plantæ Wrightianæ"), Cuba, *Wright*, 1375, cited by Schlechter as a synonym of *M. clausa* is a distinct species, as will be seen by the figure (fig. 3) drawn from a co-type in Herb. Mus. Brit. The flower is smaller, the suborbicular calyx-lobes are nearly as long as the broadly urceolate corolla-tube, the spreading lobes of which are about equal in length to the tube. The corona-lobes are broadly ovate about half the length of the anthers. The leaves are broader, more acute, and the margin is not revolute; the venation is also less conspicuous.

The following specimens from Cuba in Herb. Mus. Brit. are conspecific:—*Regel*, 393, and *Curtis*, 705.

Synonyms are *M. affinis* A. Rich. in Sagra Cub. ii. 100 (1850)

and *M. obovata* Turczan. in Bull. Soc. Nat. Mosc. xxv. ii. 321 (1852), both founded on *Linden*, 1846, from Cuba, a specimen of which I have seen in Herb. Kew.

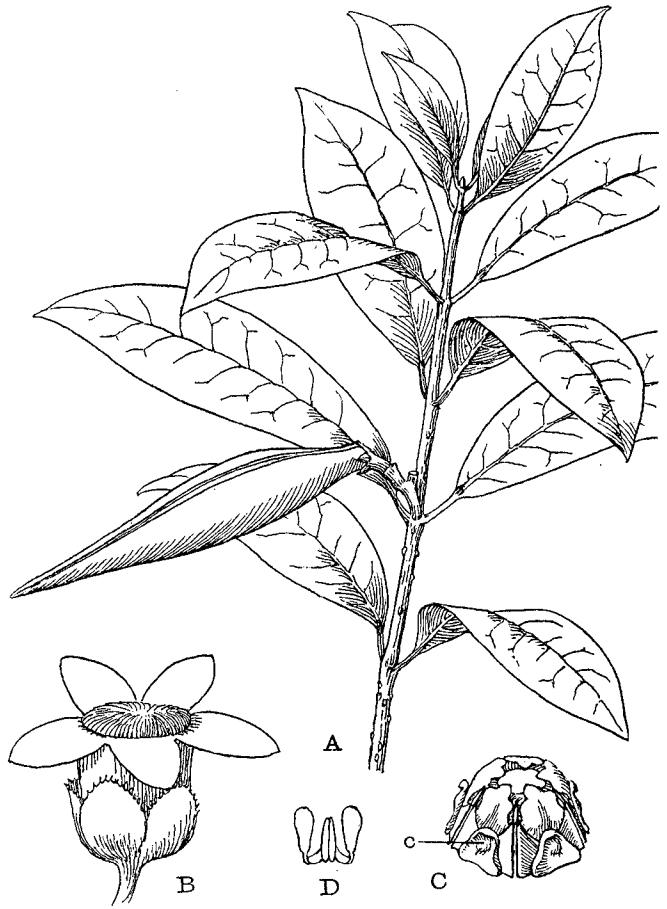


Fig. 3.—*Marsdenia campanulata* Griseb. A, branch bearing fruit, $\times\frac{2}{3}$; B, flower, $\times 6$ (the corolla-tube is drawn too long and should not exceed the calyx-lobes); C, gynostegium, $\times 12$; *c*, corona-lobe; D, pollinia, $\times 20$.

It may be noted that *M. saturejifolia* A. Rich. *l. c.* and *M. pauciflora* Turczan., *l. c.*, are both founded on *Linden*, 2165, from Cuba.

The figures were drawn by Miss B. O. Corfe to my dissections.

BRYOPHYTES OF WEST INVERNESS.

By E. C. Wallace.

Last July, in the company of Miss E. M. Lobley and Mr. R. Mackechnie, a fortnight was spent at Fort William. Our main purpose was to botanise on and about Ben Nevis, Miss Lobley paying special attention to the Sphagna in addition to mosses and hepatics, while we also studied the phanerogamic flora of the higher ground.

The district about Fort William has been fairly well worked for mosses and hepatics, though little has been done amongst the Sphagna, or on the higher ground of the less accessible hills.

Glen Nevis is well known as a rich locality for hepatics, especially the western "Atlantic" species of Britain. While we hardly expected to add to the list of recorded hepatics for West Inverness, v.c. 97, we had hopes of filling some gaps in the moss list. The results of our collecting, now that the material has been worked out, are very gratifying, quite forty new records amongst the mosses and Sphagna, and two hepatics. Miss Lobley and Mr. A. Thompson have determined the Sphagna, and I have worked out the mosses and hepatics with the kind help of Mr. J. B. Duncan and Mr. H. H. Knight for some of the critical species. Some of the more interesting and noteworthy of the plants are enumerated below, new county records being indicated by an asterisk:—

**Sphagnum Girgensohnii* Russ. var. *gracilescens* Grav. Bog near Polldubh, Glen Nevis.

**S. plumulosum* Roell. Corpach moss.

**S. strictum* Sulliv. Bog near Polldubh, Glen Nevis. This rare plant was found in some quantity and in fine condition, being the best developed of this species yet seen in Britain.

**S. amblyphyllum* Russ. var. *mesophyllum* Warnst. Arisaig.

S. cuspidatum Ehrh. var. **falcatum* Russ.; by loch on Ben Nevis. Var. **plumosum* Bryol. Germ.; Ben Nevis. Var. **submersum* Schp.; Corpach Moss.

**S. obesum* Wils. Ben Nevis.

S. inundatum Russ. var. **lancifolium* Warnst.; Polldubh, Glen Nevis. Var. **eurycladum* Sherrin; Ben Nevis. Var. **densum* Warnst.; Corpach Moss.

**S. auriculatum* Schp.; Ben Nevis. Var. *ovatum* Warnst.; Arisaig.

**S. contortum* Schultz. Arisaig.

**S. platyphyllum* (Sull.; Lindb.) Warnst. Coire Mhusgain, Glen Nevis.

**S. crassicladum* Warnst. Ben Nevis.

**S. turgidulum* Warnst. Ben Nevis.

**S. imbricatum* (Hornsch.) Russ. var. *cristatum* Warnst. Arisaig.

Andreaea alpina Smith. Rocks at sea-level, Trislaig, Ardgour.

A. nivalis Hook. and var. *fuscescens* Hook. Very fine on the summits of Ben Nevis and Aonach Beag.

Polytrichum strictum Banks. Corpach Moss, Glen Nevis.

**Ditrichum zonatum* Limpr. Coire Leis and Carn Dearg, Ben Nevis, with var. *scabrifolium* Dixon in Coire Leis.

Dichodontium pellucidum Schp. var. **fagimontanum* Brid. Coire Leis, Ben Nevis.

**Dicranella secunda* Lindb. Stob Ban.

**D. Schreberi* Schp. var. *elata* Schp. Arisaig, on sea-shore.

Campylopus Schwarzii Schp. Glen Nevis.

Dicranum molle Wils. cfr. Ben Nevis, Aonach Beag.

D. uncinatum C. M. Coire Leis, Ben Nevis; Stob Ban.

D. asperulum Mitt. Stob Ban.

**Barbula rigidula* Mitt. Roybridge.

Trichostomum mutabile Bruch var. *littorale* Dixon. Arisaig. Search was made for *T. limosellum* Stirt., but it was not seen.

**Zygodon lapponicus* B. & S. Glen Nevis.

**Ulota Ludwigii* Brid. Fort William, on hazel.

U. Drummondii Brid. Fort William, sparingly.

U. crispa Brid. var. *crispula* Hamm. With *U. Ludwigii*.

**Orthotrichum Lyellii* Hook. & Tayl. Glen Nevis.

O. affine Schrad. var. *rivale* Wils. Roybridge.

**O. stramineum* Hornsch. Trees in Glen Nevis.

Splachnum ampullaceum L. Seashore at Arisaig; Corpach Moss.

S. sphaericum Linn. fil. Aonach Beag.

Funaria ericetorum Dixon. Ben Nevis, c. 2000 ft. alt.

Conostomum boreale Swartz. Aonach Beag in large fertile tufts.

Webera Ludwigii Schp. Fruiting on Aonach Beag and in the corrie of Ben Nevis.

W. albicans Schp. var. *glacialis* Schp. Recorded first by Miss Lobley a few years ago, but found in greater luxuriance this time.

Fontinalis antipyretica L. A form very near var. *gracilis* Schp. on stones at margin of loch on Ben Nevis.

**Neckera pumila* Hedw. Trees in Glen Nevis.

Heterocladium heteropterum B. & S. Glen Nevis and eastern corrie of Ben Nevis, showing some approach to *H. Macounii* Best, which was found in Coire Mhusgain, Stob Ban.

**Pseudoleskea patens* Limpr. On rocks at head of Coire Leis, Ben Nevis, an extension of the known habitats of this rare plant in Scotland. Hitherto only known from the Ben Lawers district and one locality in Angus.

Brachythecium rivulare B. & S. var. **latifolium* Husn. Carn Dearg, Ben Nevis.

**B. glaciale* B. & S. Two places on Ben Nevis in the corrie below the summit and more abundantly on rocks in the eastern corrie of Aonach Beag. Some fruits were noticed, the first that Mr. Duncan thinks have been collected in Britain. Elsewhere in Scotland this plant is only known on the Ben Lawers range and sparingly in Glen Callater, Aberdeenshire, where I have seen it growing with *Pseudoleskea atrovirens* B. & S.

Eurhynchium praelongum Hobk. var. **Stokesii* Brid. Roybridge.

E. myosuroides Schp. var. **brachythecioides* Dixon. Two places on the rocks in Coire Leis, with *Pseudoleskea patens* Limpr. in one instance.

Plagiothecium elegans Sull. var. **collinum* Wils. Carn Dearg, Ben Nevis.

Hypnum cupressiforme L. var. **filiforme* Brid.; riverside woods, Roybridge. Var. **ericetorum* B. & S.; Roybridge.

**H. hamulosum* B. & S. Stob Ban, Glen Nevis.

H. molluscum Hedw. var. *fastigiatum* Bosw. Glen Nevis.

H. molle Dicks. Abundant in the Red Burn on Ben Nevis with a few patches of the much smaller fertile plant with abundant capsules. I have seen *H. arcticum* Sommerf. (not yet recorded for v.c. 97) fruiting in Glen Callater in a like habitat.

H. trifarium W. & M. Ben Chlianaig, Roybridge; Coire Leis, Ben Nevis.

Hylocomium umbratum B. & S. Roybridge, Aonach Beag, Stob Ban.

H. pyrenaicum Lindb. Sparingly on Aonach Beag with the last and *B. glaciale* B. & S.

Aneura palmata (Hedw.) Dum. Rotten logs in Glen Nevis.

Moerckia Blyttii (Moerck) Brockm. Higher ground on Ben Nevis and Aonach Beag.

Gymnomitrium adustum Nees. Coire Leis, Stob Ban.

G. varians (Lindb.) Schiffn. Frequent about the summits of Ben Nevis and Aonach Beag.

Marsupella Boeckii (Aust.) Lindb. Coire Leis, Ben Nevis, and on Aonach Beag.

**M. sphacelata* (Gies.) Lindb. Rocks in the Red Burn, Ben Nevis, abundantly.

Alicularia Breidleri Limpr. On earth near top of Ben Nevis.

Eucalyx obovatus (Nees) Breidl. Glen Nevis.

Jamesoniella Carringtonii (Balf.) Schiffn. Glen Nevis and on Ben Nevis abundantly, usually in company with *Anastrophyllum Donianum* (Hook.) Steph., *Herberta Hutchinsiae* (Gottsche) Evans, *Mastigophora Woodsii* (Hook.) Nees and *Scapania ornithopodioides* (With.) Pears.

Harpanthus scutatus (Web. & Mohr) Spruce. Shady rocks by sea-shore. Trislaig, Ardgour.

Cephaloziella Starkei (Funck) Schiffn. Tree-trunk in Glen Nevis.

Pleuroclada albescens (Hook.) Spruce. Large pure tufts about the summits of Ben Nevis and Aonach Beag.

Bazzania triangularis (Lindb.) Pears. Meall Cumhann, Glen Nevis.

B. Pearsoni (Steph.) Pears. Stob Ban.

Anthelia Juratzkana (Limpr.) Trevis. Coire Leis.

Diplophyllum taxifolium (Wahlenb.) Dum. Coire Leis.

Scapania gracilis (Lindb.) Kaal. var. *laxifolia* Carr. Stob Ban, Ben Chlianaig.

S. uliginosa (Swartz) Dum. Ben Nevis, Ben Chlianaig.

Radula Lindbergiana Gottsche. Aonach Beag.

**Madotheca Thuja* (Dicks.) Dum. Trislaig, Ardgour.

Frullania germana Tayl. Rocks by the sea at Arisaig and at Corran, Loch Linnhe.

It may not be out of place here to state that the hills east of Ben Nevis towards Loch Treig would seem to repay investigation by bryologists. Very few records are extant for these hills, save Aonach Mor, which Mr. Dixon has visited, and Aonach Beag, upon which I have spent a few hours.

When botanising in one of the eastern corries of Aonach Beag last year Mr. Mackechnie and myself noticed the greater wealth of all plants as compared with Ben Nevis, and our discovery there of *Juncus biglumis* L., *Carex Lachenalii* Schkuhr, and *Cystopteris montana* Desf. shows that, although these hills were visited years ago by E. S. Marshall and G. C. Druce, there are still plants awaiting discovery amid their vast and lonely corries.

OBITUARY.

Dr. L. W. Carrisso

(1886–1937).

The history of Africa is many-sided. Among its braver and more creditable pages are those devoted to many great men who gave their lives in the cause of science. We regretfully add another name, a compatriot of those who " por mares nunca de antes navegados " were the vanguard in African exploration.

Dr. Luis Wittnich Carrisso was born on February 14, 1886. He studied at the ancient University of Coimbra, where, in 1911, he gained his doctorate of Natural Philosophy. He also worked for a time at Geneva, under Professor R. Chodat, becoming greatly interested in plant geography and ecology. He was given the post of Assistant-Professor at Coimbra and after the death of Professor Julio Henriques in 1928 he was appointed to the professorial chair.

A heavy task of reorganization confronted him for Professor Henriques lived to a great age and it had required tact and diplomacy to relieve him of even a part of his considerable responsibility. The famous botanical garden at Coimbra had fallen into partial decay during the Great War and Dr. Carrisso set to work energetically to restore and improve it. Lack of money was always a difficulty, but he did much to add to its usefulness and beauty.

Gradually Dr. Carrisso devoted more and more of his thoughts to the botanical exploration and study of the great Portuguese possessions in Africa. In 1927 he made a preliminary tour of Angola with Dr. F. A. Mendonça, bringing home a valuable collection from the almost unknown province of Lunda. Two years later, as an interesting and fruitful educational experiment, he conducted a party of students from Portuguese Universities over much of the same ground in Angola.

Meanwhile Dr. Carrisso's great organizing ability advanced him to high positions in the State, so that he inevitably withdrew to some extent from active botanical research. He was President of the Coimbra Municipality, Rector of the University, a Representative of the National Assembly, Member of the Imperial Council, and President of the Commission for the Construction of Schools. His influence in Portugal was remarkable and his name one to conjure with. In all these social activities he was greatly assisted by his charming wife, who constantly accompanied him on his travels both in Africa and Europe.

In collaboration with the Botanical Department of the British Museum he planned a comprehensive work on the flora of Angola and edited the first part of it. At the beginning of the present year he was charged by the Portuguese Colonial Ministry to organize and lead a botanical mission to Angola. This he carried out with his usual success, and made himself loved by all for his unfailing kindness and consideration. His health had troubled him for some time previously, but his sudden death from heart-failure on June 14, 1937, in the Mossamedes Desert, near the historic spot where Welwitsch discovered *Welwitschia*, came as a great shock to his companions in Angola and to his many friends in Europe. In Portugal it was treated almost as a national calamity. His body was taken back to Portugal to be buried at Figueira da Foz, where he had for many years made his home.

Among his more important publications were papers entitled " Materiais para o Estudo do Plancton na Costa Portuguêsa," " Une Nouvelle Théorie de la Myrmecophilie," " La Myrmecophilie de la Section *Gerascanthus*," and numerous lectures concerning the history and development of the Portuguese colonies. He edited the first part of the ' Conspectus Floræ Angolensis,' which appeared shortly before his death. His name is commemorated by the genus *Carrissoa* Bak. f., and the species *Ritchiea Carrissoi* Exell & Mendonça.

Dr. Carrisso was a man who gained the affection of all who knew him and inspired in his servants and subordinates an almost feudal loyalty. To me he was always a good friend and an inspiring companion, who, on many memorable excursions, both in Portugal and in Angola, was always ready with some illuminating remark or interesting theory about the vegetation, the geology of the country, or the mode of life of the people. When we lost him in Angola his old friend John Gossweiler said to me : " You know, Mr. Exell, he was a great Portuguese gentleman."

A. W. Exell.

REVIEWS.

Flora Agaricina Danica. By Jakob E. Lange. Vol. I. Plates 1–40, 92 pp. text ; Vol. II. Plates 41–80, 103 pp. text. 1935–6. Published under the auspices of the Society for the Advancement of Mycology in Denmark and the Danish Botanical Society, Copenhagen.

Since 1914 Jakob E. Lange has been well known to mycologists for his Monographic ' Studies in the Agarics of Denmark,' the tenth of which was published in 1935. In these he has added much critical information such as can be obtained only by study in the field, the value of the descriptions being occasionally added to by a coloured plate. Now, fortunately for mycologists, the whole of his drawings are to be published in five volumes ; they number about eleven hundred, and have taken more than forty years to collect. The first two volumes contain eighty plates, each with several species. The plates are very well produced by chromolithography, a welcome change from process-

work, and particularly suitable for reproducing the accurate drawings of small species, for it gives one the satisfaction of being able to add to one's vision by using a lens. Many rare and some new species are illustrated, and the whole forms a most useful and critical series. To me there seems a general toning down of colour which is a little unsatisfactory, but few artists agree in the way they represent colour-values in toadstools. On the other hand, it would be difficult to imagine a more satisfactory technique for the smaller species; we can readily forgive the absence of the splashes of colour to which we are accustomed for accurate delineation of the characters of these small forms.

The genera treated are: *Amanita, Limacella, Lepiota, Armillaria, Tricholoma, Clitocybe, Collybia, Marasmius, Mycena, Omphalia, Pleurotus, Panus, Volvaria, Pluteus, Rhodophyllus.*

The generic descriptions are full and critical, and contain a good deal of interesting matter. *Amanitopsis,* as usual with continental writers, is made a section of *Amanita,* but the structure and the large spores seem to warrant generic rank. *Limacella* includes *Lepiota lenticularis. Armillaria,* quite rightly, is regarded as a very mixed assemblage, and, though not totally dismembered, is left with only *A. mellea, A. robustus,* and *A. focalis. Laccaria* is sunk in *Clitocybe,* but I imagine that if a detailed study were made of *L. laccata* it would prove sufficiently distinct for the genus to be upheld. The lumping of the genera *Entoloma, Leptonia, Nolanea, Eccilia,* and *Claudopus* into Quélet's genus *Rhodophyllus* will startle many British mycologists. It is generally known that they have all the same type of spore (pink, polyhedral) and basidia, but there seems little advantage in going back to Friesian subgenera without more detailed study than has so far been done. At present mycologists suffer chiefly from the splitting of genera, so perhaps lumping is a necessary leaven. The specific descriptions are brief, and a strange contrast to those of 'Die Pilze Mitteleuropas.' Taken with the drawings, however, they are probably sufficient, as they give the spore-characters and microscopic details of cystidia where these are of diagrammatic value, and contrasting characters are given in the keys to the genera.

There are several new species described, but they have no Latin diagnoses. We imagine that, in spite of this lack of conformity with the International Rules of Botanical Nomenclature, the names will be regarded as valid, but it is to be hoped that the author will see his way to rectifying the omission at the end of the work.

Dr. Lange is to be congratulated on his Flora, which will rank immediately as one of the foremost standard works on Agarics. Perhaps it should be added that N. F. Buchwald, M. P. Christiansen, C. Ferdinandsen, Poul Larsen, F. H. Møller, Ø. Winge "et al." are given as "collaborators." J. R.

Symbolæ Sinicæ. Botanische Ergebnisse der Expedition der Akademie der Wissenschaften in Wien nach Sudwest-China, 1914/18. Part II. *Fungi.* By KARL KEISSLER and HEINRICH LOHWAG. 83 pages, 3 text-figs. Julius Springer: Wien, 1937. Price R.M. 18.60.

WE are so accustomed to botanical explorers confining their attention almost solely to flowering plants that it is a matter of surprise to find that Professor Handel-Mazzetti made such extensive collections of cryptogams during his expedition to China. Our knowledge of the fungus-flora of that country, moreover, is still so meagre that any account of it is to be welcomed.

In the first thirty-six pages Dr. Keissler describes the Micromycetes; 220 species are recorded belonging to 127 genera. In order to retain priority twenty-one of the twenty-four new species were described in 1923–4, though the Latin diagnoses are repeated here; three new varieties and three new forms are also diagnosed. Useful notes are given on many of the other species. There is a general analysis of the geographical distribution of the species, which shows that about a quarter are cosmopolitan and a third occur in Europe.

Dr. Lohwag's account of the Hymenomycetes, which takes up thirty pages of text, includes portions by K. Keissler, V. Litschauer, G. Bresadola, and R. Singer; 273 species are listed, most of which are cosmopolitan. There are eleven new species described, and three which have already been published elsewhere. The most interesting fungus is *Gastroboletus Boedijini,* which Lohwag mentioned in 1926 when he proposed the genus. He now describes it "Parvus, habitum *Gastromycetes* referens. Pileatus et stipitatus. *Pileus* uti in *Secotio,* stipite paulo brevior et cum eius basi partim conjunctus. Hymenium tubulosum." A study of the development of the fungus would probably give much information of value in phylogenetic speculation. A second new genus with the suggested name *Boletogaster* proves to be only Murrill's *Ceriomyces jalapensis.* "Boletus cujus sporæ ellipsoidæ manifeste longitudinaliter sulcatæ sunt": striated spores seem rather a feeble reason for such a name, even if they are regarded as warranting the splitting off of another genus from the old *Boletus.* There are seven pages of index and then additions to corrections to pp. 2, 4, 5, and 6. J. R.

Exkursionsflora von Java. By Dr. S. H. KOORDERS. Bd. IV. Atlas. Edited by Frau A. KOORDERS-SCHUMACHER. Lief. 9, 8vo, 32 plates. G. Fischer: Jena, 1937. Price R.M. 4.

WITH these thirty-two plates, representing thirty-seven species of Leguminosae, the publication of the Atlas comes to an end. It was continued after Dr. Koorders's death in 1919 by his widow, parts 2–8 appearing between 1922 and 1926.

Frau Koorders-Schumacher died in 1934, but, owing to her illness and that of Forstmeister E. H. B. Brascamp, who explains in a foreword the reasons for discontinuing the publication, the present number, the plates for which were ready in 1927, has been delayed. There remain still about 1800 drawings for illustrations prepared under Dr. Koorders's supervision, and it is to be regretted that there is at present no prospect of their publication.

BOOK-NOTES, NEWS, ETC.

LINNEAN SOCIETY OF LONDON.—At the General Meeting on October 28, Mr. J. Ramsbottom, O.B.E., the President, from the Chair, reported the deaths of eight Fellows and a Foreign Member, Prof. Richard von Hertzog. The President also referred to recent improvements in the Meeting Room, including the renovation of the seating, the cost having been met from the Herbert Spencer bequest. Prof. Percy E. Newberry read a paper illustrated with specimens and lantern-slides, "On some African Species of *Olea* and the original home of the cultivated Olive Tree," and Mr. W. R. Philipson gave an account of his revision of the British species of the genus *Agrostis*.

Mr. C. E. Hubbard gave an account of Dr. E. Vaughan's paper on the naturalized flowering plants recorded from Mauritius since the publication in 1877 of Baker's 'Flora of Mauritius and the Seychelles.'

Two papers, "A Taxonomic Study of the Genus *Lavandula*," by D. A. Chaytor, and "Contributions to the Fungus Flora of Uganda.—I. The Meliolineae," by C. G. Hansford, were read in title.

Part II. of the 'Catalogue of the Manuscripts in the Society's Library,' 'Caroli Linnaei Determinationes in hortum siccum Joachimi Burseri,' the text of which has been edited by the Librarian, Mr. Spencer Savage, is now ready for delivery to Fellows and others. It is a quarto of 78 pages. The price to Fellows is 7*s.* 6*d.*, to non-Fellows 10*s.* 0*d.*

'CHRONICA BOTANICA,' vol. iii. of which was reviewed in our October number, will no longer be issued as a year-book, but will appear as a bi-monthly from February 1938. The annual subscription will be reduced from 15 to 7 guilders. Its aim will continue to be "promoting documentation, goodwill, and co-operation among plant-scientists," and it will also include preliminary notes on the results of recent research.

CROONIAN LECTURE.—"The transport of materials in plants" was the subject of this lecture, delivered at the Royal Society on November 4 by Prof. H. H. Dixon, F.R.S., Professor of Botany in Dublin University.

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