

VARIATION IN *HELIANTHEMUM CANUM* (L.) BAUMG. IN BRITAIN

By M. C. F. PROCTOR

Department of Botany, University of Exeter

ABSTRACT

An account is given of variation in *Helianthemum canum* in the British Isles, based on both herbarium and cultivated material. There is significant variation in leaf-size and shape, leaf pubescence, and flower number, amongst other characters.

The British populations fall into three groups. The group most closely resembling neighbouring Continental populations comprises plants growing in lowland localities on Carboniferous Limestone near the coast of Wales and north-west England. A substantial proportion of the plants in all these populations have a felt of stellate hairs on the upper leaf surface.

The population on Cronkley Fell, in Teesdale, differs in its smaller and narrower leaves, which are subglabrous above, and always lack the stellate tomentum on the upper surface. The name 'var. *vineale* (Pers.)' is shown to be inapplicable to this plant, and subsp. *levigatum* subsp. nov. is proposed to replace it.

The Irish populations are characterised by coarse growth, large leaves, and more numerous flowers in the inflorescence. They are most closely approached by some Pyrenean plants.

The relation of the British plants to some Continental forms is discussed. In particular, it is concluded that the Teesdale plant is more closely related to the remaining British *H. canum* than to the Öland population with which some authors have united it.

INTRODUCTION

The genus *Helianthemum* is represented in central and northern Europe by *H. chamaecistus* and *H. apenninum*, and by the taxonomically complex aggregate of species including *H. canum*, *H. oelandicum* and *H. alpestre*. Of the latter group, *H. canum* is the only member reaching the British Isles. It is a very local plant in Britain, and here, as elsewhere on the edge of its area, its range is broken by a series of greater and lesser disjunctions (Fig. 1). Associated with these is marked inter-population variation. Each population tends to differ somewhat from every other, and the Teesdale population is distinct enough to have been commonly accorded taxonomic recognition as the 'var. *vineale*' of British authors. The variation of *H. canum* in Britain has attracted the attention of a number of botanists in the past, perhaps especially the late A. J. Wilmott. There are a number of herbarium sheets of *H. canum* collected and annotated by Wilmott in the British Museum herbarium and elsewhere, but his death in 1950 forestalled the publication of any conclusions.

Helianthemum canum has an equally disjunct distribution in other parts of central and northern Europe. In the south of Europe it has a more continuous area of distribution in calcareous montane grassland from north and east Spain (with southern outposts in Morocco and Algeria), through southern France, Italy, and the mountains of the Balkan Peninsula, to Asia Minor, and (taking the species in a broad sense) south Russia and the Caucasus. The most valuable taxonomic account of *H. canum* and its allies is the detailed and critical paper by Janchen (1907). Grosser's treatment of the group (Grosser, 1903) is

unsatisfactory, while the more recent monograph of the section *Chamaecistus* by Font Quer and Rothmaler (1934) is in some ways less modern in its approach to the paramorphs within *H. canum* than Janchen's earlier work. The *H. canum* group in the Soviet Union is treated in detail by Juzepczuk in *Flora U.R.S.S.* (Komarov, 1949). *H. canum* is disjunct

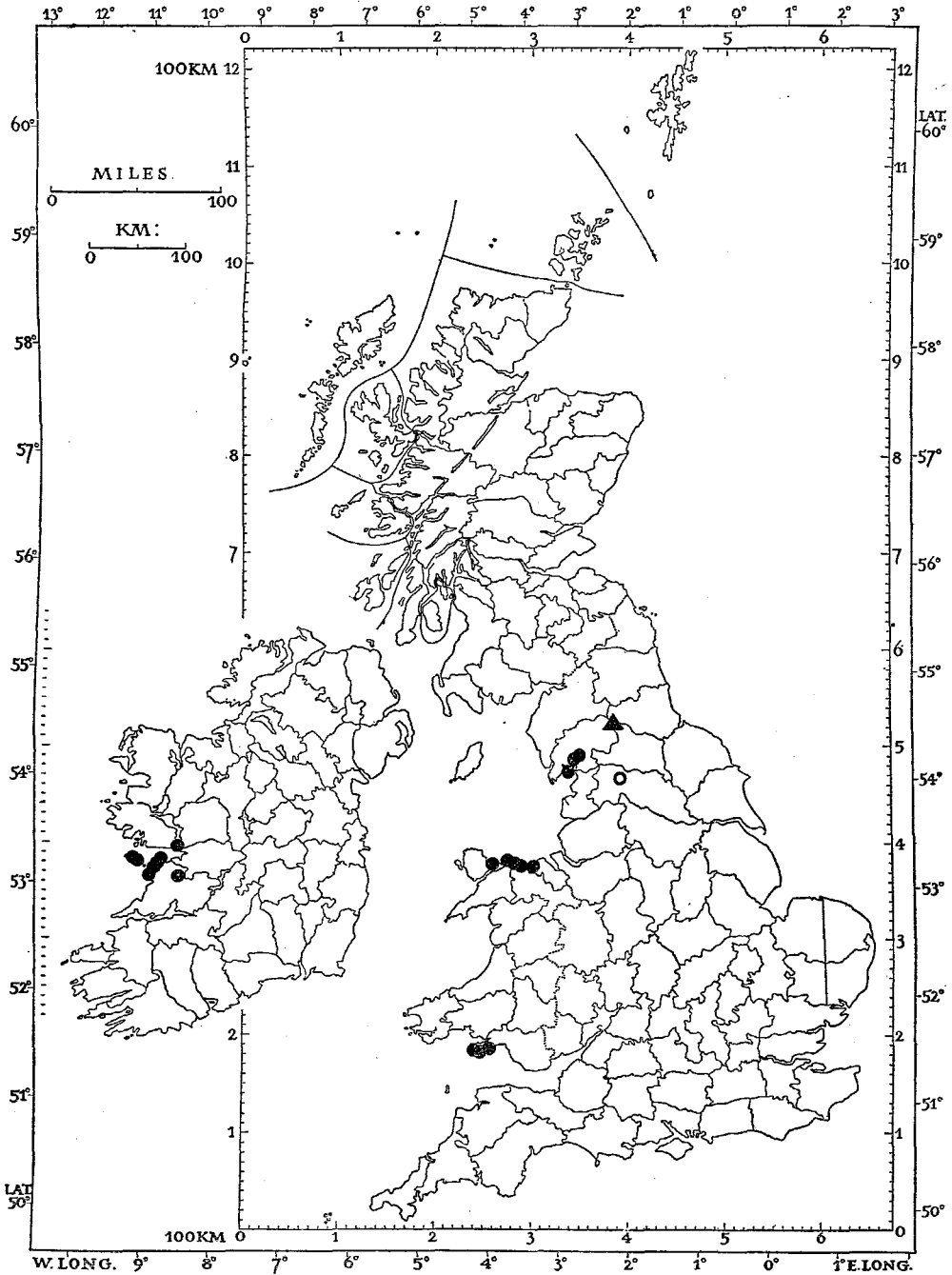


Fig. 1. Distribution of *Helianthemum canum* (L.) Baumg. in the British Isles. The Teesdale locality is indicated by the triangle. The open circle represents the Malham station, in which the plant has not been seen recently.

in S. Russia as it is in Britain, and shows a rather wider range of variation; and four paramorphs within the group are considered by Juzepczuk as distinct species.

The British *Helianthemum canum* populations fall into three groups: the Teesdale population, the western Irish populations, and the various populations on Carboniferous Limestone along the west coast of England and Wales. These three groups form not only convenient geographical units, but also recognisable taxonomic entities, which can be distinguished with fair certainty both in herbarium material and in cultivation. The lowland populations in Great Britain (Fig. 2, a & b; Plate 7, Fig. 1) vary a good deal amongst themselves, but on the whole they approximate most nearly to *H. canum* as it occurs on neighbouring parts of the Continent. Rather dense leaf pubescence is the rule, and their most striking feature is the occurrence of a proportion of individuals with a fine stellate felt over the upper leaf surface in addition to the usual more or less dense covering of coarser bristles. The Teesdale population (Fig. 2c; Plate 7, Fig. 2) is restricted to a few outcrops of metamorphic 'sugar limestone' near the summit of Cronkley Fell in N.W. Yorkshire. The site is bleak and exposed, and the plants are remarkably small-leaved and dwarf-growing amongst the closely cropped grass. The leaves are subglabrous or glabrous above, and never show any stellate tomentum on the upper surface. Plants from the limestone of the Burren district in the west of Ireland (Fig. 2, d & e) resemble the Teesdale population in the rare occurrence of stellate pubescence on the upper leaf surface. They differ from the Teesdale plant in their much larger and hairier leaves and coarser growth; differences which are obvious in the field and maintained in cultivation.

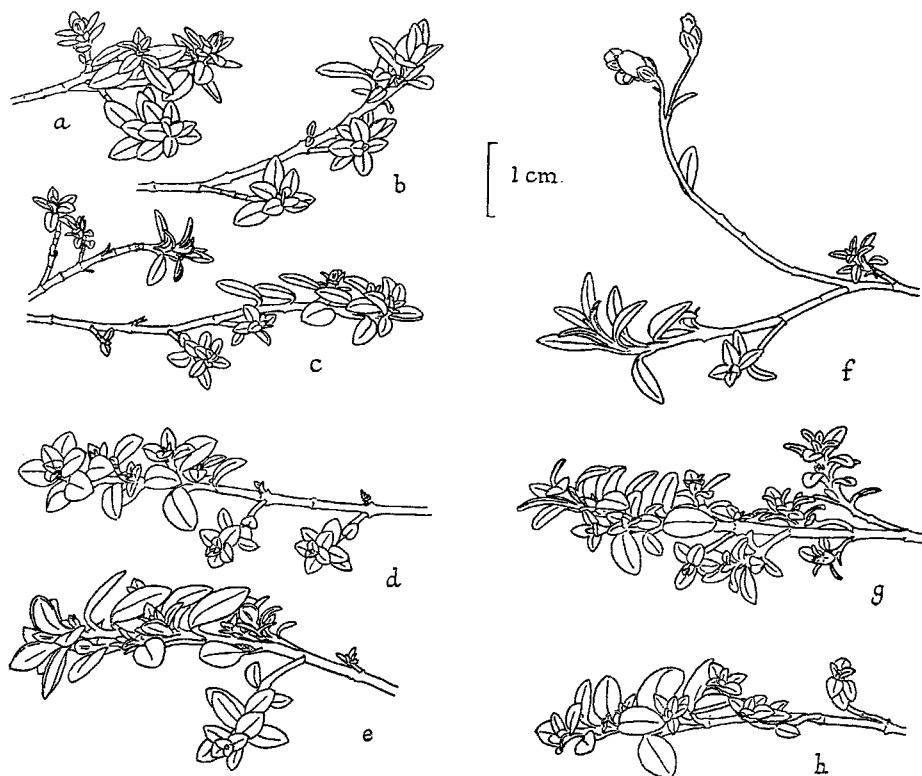


Fig. 2. Shoots of *Helianthemum canum* in cultivation, Oct. 1956. $\times 1$. a. Scout Scar. b. Humphrey Head. c. Teesdale. d. Black Head. e. Mullagh More. f. Södra Möckleby, Öland. g. Nüssenberg, nr. Laucha, Saxony. h. Cirque de Gavarnie, Htes. Pyrénées.

MATERIAL

During 1952-3 most of the important British localities for *H. canum* were visited, and material was collected, as plants, seeds, or cuttings, for cultivation on the experimental plot in Cambridge. Mature plants were not easy to establish, and seeds or cuttings proved much more satisfactory. The experimental plants from Teesdale and Ireland were rooted from cuttings in the summer of 1953, but other samples were grown from seed in spring 1954, and some older collections were also included. All the plants grew vigorously in their first season of growth following establishment, and there was little to choose between the two methods of propagation. In many characters plants in their second season remained reasonably comparable with the first year plants. After this, however, many of the older shoots died back, to be replaced by new growth from near the base, and the leaf size and general appearance of any individual plant depended greatly on the accidents of its previous history. In particular, many of the plants on the plot were damaged by the Phycomycete, *Peronospora leptoclada* Sacc., during the summer of 1955.

Collections of herbarium material were also made. Abundant material of *H. canum* from Teesdale and Great Ormes Head was available in Cambridge. The other localities were poorly represented, and the results given here are based on material of my own collection.

RESULTS

Leaf length and breadth were measured in both herbarium and cultivated material. Leaf size varies a great deal in each individual plant, so that the selection of the leaves to be measured is important. Almost all the herbarium material used was collected at or shortly after flowering time, and measurement of the longest leaves on the vegetative shoots proved reasonably satisfactory in practice. No attempt was made to use the leaves of the flowering shoots, as these appeared to show more chance variation amongst themselves and contributed less to the characteristic appearances of the different populations. Measurements on the cultivated material were made late in the summer of 1954. At this time the vegetative shoots which had developed in early summer had virtually finished their growth, and had given rise to many pinnately arranged lateral branches bearing most of the leaves. In general the longest of these late-summer leaves from each plant were taken for measurement, the few remaining coarse early-summer leaves being ignored.

Leaf length and breadth are not independent characters, but show a strong correlation. Length/breadth ratio is hardly a more constant character of a population than either character taken singly, and it too shows a strong correlation with length. Some interesting features emerge from a comparison of the results from herbarium specimens and cultivated material (see Fig. 3). In wild-collected material there is clearly a great deal of individual variation, and with the resulting overlapping most of the populations form a graded series from rather small-leaved plants at Humphrey Head and on the Gower coast to the longer and narrower-leaved plants in Ireland and in the inland localities in Westmorland. Only two extreme populations stand significantly apart; the very small- (and narrow-) leaved Teesdale population, and the large-leaved population at Mullagh More in Ireland.

In the cultivated plants a very much more distinct separation of the populations is seen (Fig. 4). In the wild material Teesdale provided the only exception to a very close correlation between leaf length and length/breadth ratio. Under cultivation this close correlation is obscured in the material as a whole, though it still remains distinct within each of the two larger population groups. The Teesdale plant is still the shortest-leaved and for their length the leaves show a relatively high length/breadth ratio. In both these characters it differs little more from the other populations in Great Britain than they differ

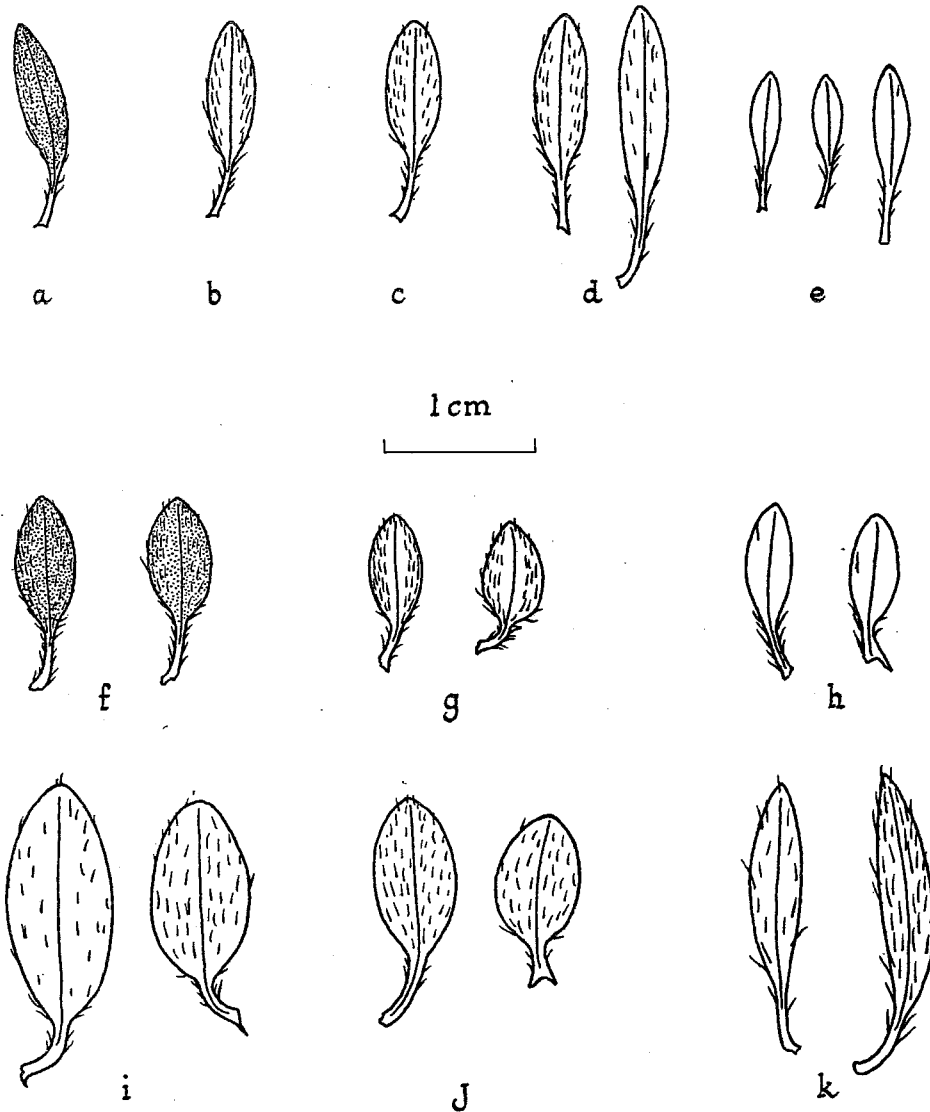


Fig. 3. Leaves of *Helianthemum canum* from British localities, $\times 2$. a. Whitbarrow. b. Great Ormes Head. c. Poulsallagh. d. Mullagh More. e. Teesdale. Leaves of *H. canum* in cultivation, $\times 2$. f. Humphrey Head. g. Rhossilli. h. Teesdale. i. Mullagh More. j. Black Head. k. Öland.

amongst themselves, but it is noteworthy that the Teesdale population lies off the almost linear trend of leaf variation of the other populations, which may be an indication that its distinctness from them is more far-reaching than their mutual differences.

The most striking results are provided by the Irish plants. In cultivation they became remarkably distinct from any of the other British populations, with coarse growth, and large broad leaves. Some botanists (e.g. Praeger, 1934) included the Irish plants at least tentatively with the Teesdale plant as 'var. *vineale*,' but it is clear that they are very different from it, and almost equally distinct from the lowland populations in Great Britain.

It is noticeable that plants from different populations do not necessarily show the same changes, or even parallel changes, on cultivation. Thus under wild conditions,

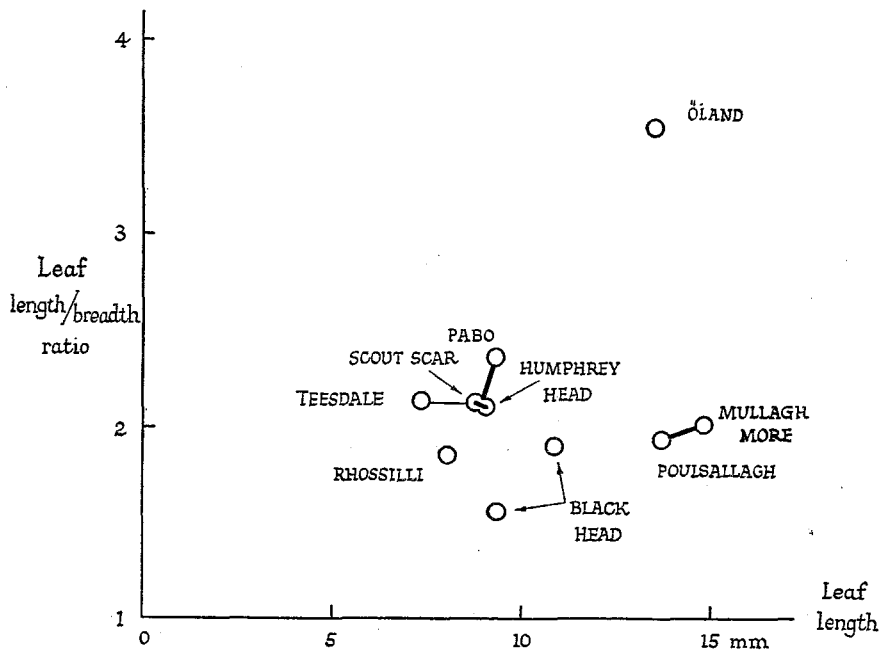


Fig. 4. Leaf size and shape in cultivated material of *H. canum*. Samples joined by thick lines do not differ at the 10% probability level in either length or length/breadth ratio (using Student's *t* distribution); those joined by a thin line differ in one or the other at the 10% but not at the 5% level. All other samples differ significantly at the 5% level in length, length/breadth ratio, or both.

plants from Humphrey Head are closely similar in leaf size and shape to plants from the Gower coast, and noticeably smaller than the Scout Scar population. In cultivation the Gower plants retain smaller and broader leaves than plants from Scout Scar; but the Humphrey Head and Scout Scar populations are now virtually indistinguishable in leaf size and shape, though they differ significantly from the Gower population. In other words, there is evidence that dwarfing in exposed maritime habitats is mostly purely phenotypic at Humphrey Head, but largely genetic in Gower. Similarly in the Irish populations, those on the west coast of the Burren are scarcely distinguishable in herbarium material, while the inland population at Mullagh More is distinctly larger-leaved. Cultivation shows that the Irish maritime populations are genetically heterogeneous, and that while the population in closed turf near Poulsallagh is potentially as large-leaved as that at Mullagh More, plants on the dry exposed slopes near Black Head constitute a definite small-leaved ecotype. A sample collected in closed turf below the road, a little to the south of Black Head, is intermediate between the two extremes. No doubt there exists a pattern of ecotypic adaptation to local habitat conditions. In the Gower population already mentioned the great exposure suffered by a large part of the population has apparently resulted in similar selection of a small-leaved ecotype; a process which has not occurred to any marked degree in the much smaller population under less severe conditions at Humphrey Head. It is interesting that in both these cases closely similar results are arrived at in different populations by ecotypic differentiation and by phenotypic plasticity. Clearly in an outbreeding species, such as this, strong ecotypic differentiation is unlikely to take place in response to small-scale and intricate habitat variation, and the variation pattern will reflect average conditions over rather broad areas. The Gower and North Wales populations of *H. canum* are extensive, and cultivation of further samples would probably show that they embrace within themselves much variation of this type.

Similar selection of a small-leaved form under conditions of extreme exposure is shown by the small Teesdale population. A particularly interesting feature here is the occurrence with *H. canum* of an exactly parallel and equally extreme form of *H. chamaecistus*. This has a closely prostrate habit of growth, small leaves almost or quite glabrous above, and short inflorescences; all characters which are kept in cultivation.

Leaf pubescence is a valuable character which changes little on cultivation. The pubescence comprises hairs of several types. The lower surface is thickly covered with a felt of long stellate hairs. The upper surface is more or less sparsely clothed with stiff and rather closely appressed bristles, generally in groups of several together. In addition, the upper surface is sometimes covered with a light stellate felt, giving the leaves a distinct grey appearance. Though the stellate tomentum varies in density, most plants show either a rather close covering of appressed stellate hairs or none at all. The distribution of pubescence of the upper surface in the material studied is summarised in Fig. 5.

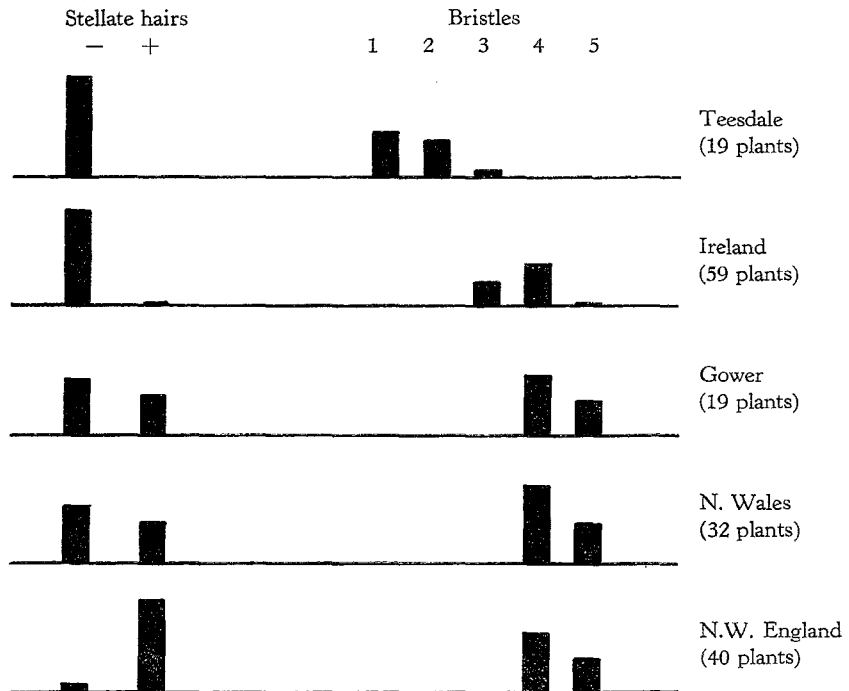


Fig. 5. Distribution of leaf pubescence characters in British populations of *Helianthemum canum* (from herbarium material). Ordinates are percentage frequencies. The bristle classes represent roughly: 1, almost or quite glabrous; 2, c. 10-12 bristles on leaf; 3, c. 25 bristles on leaf; 4, c. 50 bristles on leaf or c. 10 on a square area from midrib to margin; 5, very dense, covering c. 1/5 area of leaf or more.

As would be expected, the Teesdale plant stands out with its generally sparse pubescence, and the rather hairier Irish plants are also clearly separated from the remaining populations. In these, the stellate pubescence seems to occur in a much higher proportion of plants in Westmorland than in North Wales or Gower. Any more detailed examination of its distribution would require more material than was used in the present study, and the sampling technique would need to be carefully devised to avoid bias in sampling for such a conspicuous character. Janchen (1907) found similar variation in most of the Continental populations he studied; stellate-pubescent plants were abundant in some but

rare or absent in others. Field observation in this country suggests that where they occur plants with stellate pubescence tend to predominate in the driest rocky areas, and to be sparse in the moister areas of closed turf; a conclusion consistent with Janchen's observations. The question merits more attention, particularly in relation to the differentiation of the Irish and Teesdale populations.

The number of flowers in the inflorescence is a character of some weight in the *H. canum* group. It is not an easy character to use unless ample material is available, as it depends to some degree on environment, and shows a wide variation even on an individual plant (Fig. 6). In general, flower number tends to increase from north to south in Europe, but there is much local variation. The mean flower numbers for some

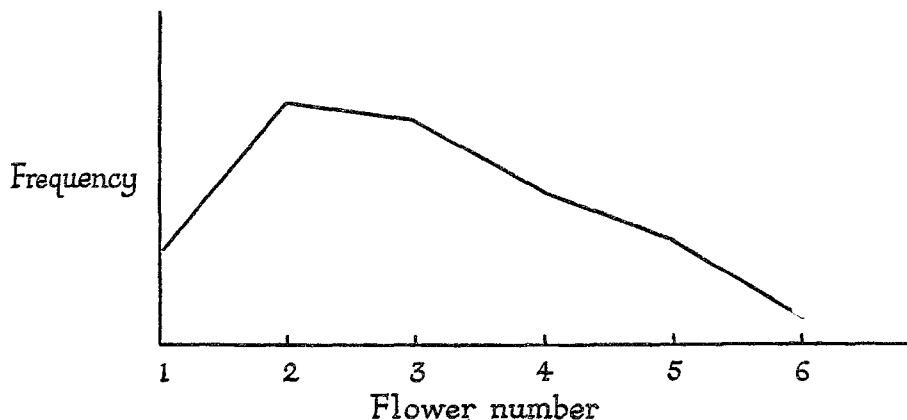


Fig. 6. Distribution of flower number in a wild population of *Helianthemum canum*; Whitbarrow, May 1952. 167 inflorescences counted; mean number of flowers/inflorescence 3.02.

of the British plants cultivated are given in Table I, together with figures for some Continental plants for comparison. A hundred or more inflorescences were counted in each case, a complete sector of the plant being stripped from the centre to the edge. The figures are probably all somewhat too low, as the counts were made at the end of the flowering period, and a proportion of flowers which dropped off, having failed to set seed, must have been missed.

The most striking result which emerges from this table is the high flower number (and inflorescence length) of the Irish plant. It is most nearly approached in flower number by the population from the Cirque de Gavarnie in the Pyrenees, but exceeds this by a

TABLE I.

Flower number and inflorescence height in cultivated material of *Helianthemum canum*. Flower numbers are means from 100 or more inflorescences; heights are means of 10 measurements.

Locality	Mean flower number	Inflorescence height (c.m.)
Scout Scar	4.04	6.7
Teesdale	3.30	6.1
Teesdale (1952)	3.75	—
Black Head	4.91	10.8
Cirque de Gavarnie	4.35	9.0
St. Adrien, nr. Rouen	3.27	—
Nüssenberg, Saxony	2.58	9.0

substantial margin. Data are not available for a comparable series of plants from all the British localities, but it seems that in most other cases the mean flower number must lie between about 3 and 4.5.

The figures from herbarium material in Table II show a similar trend, but all the figures, and especially those for Teesdale and North Wales, are probably biased by the natural tendency to collect conspicuous or well-grown specimens.

TABLE II.
Mean flower number in herbarium material of *Helianthemum canum* from British localities.

Locality	Mean fl. number	Infls. counted	Standard deviation
Westmorland	3.61	118	1.37
Teesdale	2.71	52	0.73
N. Wales	4.30	130	1.33
Ireland	5.22	155	1.88

DESCRIPTIONS OF BRITISH FORMS OF *H. CANUM*

It will be useful at this point to summarise the main features of the British *H. canum* populations.

(a) *Wales and N.W. England*

The plants from these populations are the most like those from the neighbouring parts of the Continent, and probably transgress little outside the Continental range of variation. They are variable in habit, but form more or less compact mats of prostrate shoots, less coarse in growth than the Irish plants, and less strictly prostrate than the Teesdale population. Leaves rather short (the longest c. 6-10 mm.; 7-11 mm. in cultivation), shortly petioled; more or less densely hairy with the abundant long bristles on the upper surfaces. In addition, a substantial but variable proportion of individuals in all the populations have a light or dense covering of short stellate hairs on the upper leaf surface. Inflorescence c. 6-8 cm., most commonly 2-5-flowered. Buds globose, c. 3 mm. long, sepals stellate-pubescent and pilose; petals c. 5-7 mm. Flowering pedicels erect to spreading, often slightly deflexed after flowering, and more or less spreading in fruit.

The leaves form rather condensed rosettes towards the stem apices in late summer and autumn. In this feature there is a range of variation between the continental central European populations, with a marked and almost bud-like forward-facing autumn rosette of leaves separated only by very short internodes, and the populations in oceanic parts of western Europe in which broad flat leaves persist well down the stem and the apical rosette is scarcely noticeable. The English and Welsh plants, with the flattish upward-facing rosettes, occupy an intermediate position in this range. They are not usually vigorous plants in cultivation, often forming a smaller or looser mat of vegetative growth than the Teesdale plant and seldom very much larger; and they seem more prone to dying back during the winter than the other British plants.

(b) *Teesdale* (Fig. 2c; Fig. 3 e & h; Plate 7, Fig. 2)

Differs from the lowland English and Welsh plants most strikingly in its small leaves which are glabrous or subglabrous above, and varies little. Habit closely prostrate, forming a flat intricately branched mat tightly appressed to the ground. Leaves small (the longest c. 6 mm. × 2 mm.; c. 8 mm. × 3.5 mm. in cultivation), thick, subacute or

subobtusely, and slightly revolute at the margin, dark green and almost or quite glabrous above, densely stellate-tomentose below, with a shortish to rather long petiole. Inflorescence short (c. 3-6 cm.), most commonly 1-3-flowered (c. 2-5-flowered in cultivation). Buds globose, c. 3 mm. long, sepals stellate-tomentose and lightly pilose, petals c. 5-6 mm.

The Teesdale plant is very distinct from the other British forms of *H. canum* in cultivation, and in the field the phenotypic expression of its distinctive features is intensified by the bleak habitat. The leaves form distinct apical rosettes in autumn; and in this respect the Teesdale plant more closely resembles central European forms than do any of the remaining British *H. canum* populations.

(c) *Ireland* (Fig. 2 d & e; Fig. 3 c, d, i, & j)

Coarser in growth than the other British forms, forming dense spreading mats of prostrate shoots. Leaves large (c. 7-12 mm. × 2-4 mm.; 9-15 mm. × 5-7 mm. or more in cultivation), subacute to obtuse, flat or slightly revolute at the margin, green and sparsely hairy above (rarely lightly stellate-tomentose), densely stellate-tomentose below, with a shortish to rather long petiole. Inflorescence tall (c. 6-10 cm.), most commonly 4-6-flowered, sometimes branched. Buds globose, c. 4 mm. long, sepals stellate-tomentose and pilose, petals c. 5-7 mm.

In the field Irish plants may differ little in leaf size from those from the west coast localities in Great Britain, but they usually differ obviously in their sparsely hairy and often rather long-petioled leaves. Their noticeably long winter internodes may be attributed at least in part to the direct influence of the western Irish climate; though in cultivation (and apparently also in the field) they form the least distinct winter rosettes of any of the British forms, the large flat leaves persisting well down the stem throughout the winter.

DISCUSSION

The group including *H. canum* and the *H. alpestre*-*H. oelandicum* aggregate is an intricate one, and has suffered much taxonomic and nomenclatural confusion. In Britain this has involved mainly the Teesdale plant. Syme (1873) says, "I am indebted to Mr. J. G. Baker for pointing out to me that the Teesdale plant is *H. vineale* Pers.", and the plant has been widely known to British botanists by this name.

The original description of *Cistus vinealis* by Willdenow (1799) is as follows:

"*Cistus vinealis* W.

C. suffruticosus procumbens exstipulatus, foliis petiolatis oblongis obtusis subtus incano-tomentosis, floribus racemosis."

Though this description disagrees in no way with the Teesdale plant (except perhaps "foliis . . . obtusis"), it agrees equally well with other forms of *H. canum*, and Willdenow clearly intended it to apply to the populations "in Germaniae vineis, inque Helvetia." These are in most respects more closely comparable with the plants of the lowland limestone areas in Great Britain than with the Teesdale plant (cf. material cultivated from Saxony, Fig. 2g). Persoon (1805) repeats Willdenow's description and gives the same localities. Thus the name *H. canum* var. *vineale* (Pers.) cannot be used in a restricted sense for the Teesdale population.

Janchen (1907) included in "*H. canum* f. *vineale* (Willd.) Syme & Sowerby" all the central and west European forms, with the exception of the Teesdale and Öland plants, and the diverse forms in the south of France and the Iberian peninsula. Janchen agreed with Willkomm (1856) and Grosser (1903) in uniting the Teesdale and Öland plants, though he used Hartman's name *canescens* (1820, as var.) rather than Willkomm's later

name *microphyllum* (1856, as var.). Like Grosser, he placed them under *H. oelandicum*, as a variety of which the Öland form was originally described.

Fortunately, through the kindness of Dr. R. Sterner, I have been able to cultivate several samples of *H. canum* from Öland, which have shown conclusively that the Öland form is quite distinct from the Teesdale plant. Apart from its marked differences in leaf size and shape (Fig. 2f; Fig. 3k; Fig. 4) and hairier leaves, it has a looser habit, and flowers continuously throughout the latter part of the summer (as noted by Sterner, 1936). In this last feature it differs not only from all the British populations, but also from material cultivated from Saxony, the Seine valley, and the Pyrenees; though similar flowering on the current season's shoots during the latter part of the summer certainly occurs and is probably widespread in south Europe.

The Teesdale population lies much closer in all its characters except leaf pubescence to the more widespread lowland forms in Great Britain; that is, it belongs to Janchen's *H. canum* f. *vineale* rather than to his *H. oelandicum* f. *canescens*, the latter name belonging properly to the Öland plant. It remains to consider Willkomm's very appropriate epithet *microphyllum* (1856, as var.). Willkomm included three plants under this: the Öland plant (for which the earlier epithet *canescens* Hartman (1820, as var.) is available, the Teesdale plant, and a plant from N. Spain. No indication is given in the description which was regarded as the type form, but the Spanish plant is figured. Further, Font Quer & Rothmaler (1934) and Guinea (1954) have used this epithet (the former as *H. canum* var. *canescens* f. *microphyllum* (Willk.) F.Q. & Rothm. and the latter as *H. canum* var. *microphyllum* (Willk.) Guinea) for north Spanish taxa, which neither include nor closely resemble the Teesdale plant. Thus it appears that there is no name available for the Teesdale form, though it is certainly distinct enough to merit some recognition. Sub-specific rank appears the most appropriate for a geographical variant of this kind, and the name *H. canum* subsp. *levigatum* is proposed for it.

***Helianthemum canum* subsp. *levigatum* Proctor subsp. nov.**

Habitus perprostratus, ramis multis ad terram adpressis. Folia crassa, parva, longissima, c. 6 mm. × 2 mm. (in horto c. 8 mm. × 3.5 mm.), angusta subobtusata vel subacuta, supra viridia subglabra vel glabra semper sine pilis stellatis, subtus stellato-tomentosa, margine leviter revoluta. Inflorescentia humilis (c. 3-6 cm.; in horto c. 6-8 cm.), vulgatissime 1-3-flora (in horto 2-5-flora). Alabastra globosa, c. 3 mm. longa; sepala stellato-tomentosa et leviter pilosa; petala c. 5-6 mm. longa. Habitat in pascuis siccis in 'sugar limestone' prope summum Cronkley Fell, Teesdale, Yorkshire.

Holotypus in Herb. Univ. Cantab.: v.c. 65, N.W. York; Cronkley Fell, Upper Teesdale, E. S. Marshall, 2 July, 1886.

The Teesdale plant is well represented in all the more important British herbaria, so it is unnecessary to cite further specimens.

It has been shown that the Irish plants are very clearly distinct from the other British populations. They are less strikingly distinct when they are compared with a series of Continental forms. Thus a plant in cultivation from the chalk cliffs of the Seine valley south of Rouen was somewhat intermediate in leaf characters between plants from Carboniferous Limestone in Great Britain and in Ireland, though it scarcely approached the Irish plants in coarseness of habit. The Pyrenean population cultivated (which appeared to agree most closely with *H. canum* f. *piloselloides* (Lap.) Janchen) was the most like the Irish plants in general appearance, resembling them particularly in the rather flat leaves, and the tendency of the lower leaves on the shoots to persist into the autumn and winter. Janchen's comment, that the leaves of his west Pyrenean and north Spanish

f. alpinum (Willk.) Gross. are green or lightly tomentose above, is perhaps significant in this connection. The resemblance is an interesting one, suggesting a parallel with a 'Lusitanian' distribution like that of *Saxifraga hirsuta*, but it may reflect simply the selection of similar forms in response to somewhat comparable habitat conditions. The Irish plants differed in their larger and less hairy leaves, coarser habit, and longer inflorescences. They are possibly distinct enough from any Continental form to be worth recognition as an independent subspecies. However, they are undoubtedly close to at least some populations of *f. piloselloides* (Lap.) Janchen and *f. cantabricum* F.Q. & Rothm., and without a more detailed knowledge of the variation in these it would be premature to separate them, though further study may show that separation is both practicable and desirable.

DISTRIBUTION OF *H. CANUM* IN THE BRITISH ISLES

In the following list no date or collector is given where I have seen the plant in a locality in the course of the present work. In all other cases the source of the information is quoted. National Grid references are added in brackets.

- V.c. 41. GLAMORGAN : (information largely from M. E. Griffiths, unpub.) Worm's Head (SS/393876); N.W. facing cliffs from Rhossilli (c. SS/409880) to Worm's Head, and S. facing cliffs from Worm's Head to Port Eynon (SS/468843); cliffs S. of Oxwich (c. SS/487856-512850); cliffs S. of Pennard, eastwards to Pwll Du Head (c. SS/540878-572863); cliffs between Caswell Bay and Langland Bay (c. SS/597870-605870).
42. BRECON : Trow (1911) gives a record for "Merthyr Tydfil": the main limestone outcrops on which the plant might occur are in Breconshire. A specimen in the University Herbarium at Oxford is labelled "Brecon, May 1859." (Both records are probably errors.)
49. CAERNARVON : Great Ormes Head (SH/750840-780830); Bryn Maelgwyn, Gloddaeth (SH/795805), and scattered from here to Little Ormes Head (SH/817828); near Pydew and Pabo (c. SH/810790).
50. DENBIGH : Bryn Euryn (SH/832798); Tan Penmaen Head (SH/880787); S. of Llysfaen (SH/888733; 895766; 900765) Cefn-yr-Ogof, Llanddulas (SH/914776).
51. FLINT : Craig Fawr, Meliden (SJ/059804); Moel Hiraddug, Dyserth (SJ/064782); W. side of Gop Hill, Newmarket (Dallman, 1911a) (c. SJ/084801).
52. ANGLESEY : Bwrdd Arthur (SH/585813); Mariandyrys (Griffith, 1894) (c. SH/600810).
64. M.W. YORK : Malham Cove (Lees, 1888) (SD/897641). A specimen collected by Lees in July 1880 is in Herb. Mus. Brit.; it is a rather small-leaved plant (longest leaves c. 7.5 mm. × 2.2 mm.), densely hairy but without stellate pubescence on the upper leaf-surface. It is evidently of the normal lowland type, and much like some material from v.c. 69. The plant has not been seen here since.
65. N.W. YORK : Cronkley Fell, Teesdale (NY/841283-845284).
69. WESTMORLAND : Underbarrow Scar (Scout Scar) from Brigsteer to the road west of Kendal (SD/485895-486924); south and west sides of Whitbarrow (c. SD/457851-438870); Humphrey Head (SD/392735).
- H9. CLARE : West Coast of Burren from Black Head south to Poulisallagh; cliffs of Moher (Praeger, 1934); Mullagh More, N.E. of Corrofin; Aran Islands (Praeger, 1934, &c).
- H16. GALWAY : Salthill, nr. Galway (Praeger, 1934).

ACKNOWLEDGEMENTS

Most of the work on which this paper is based was carried out at the Botany School, Cambridge, during the tenure of a research studentship given by the Nature Conservancy. I would like to thank Dr. H. Godwin for his stimulating interest in my work, Professor J. Caldwell, Dr. S. M. Walters, and Dr. E. F. Warburg for reading this paper in typescript, and Miss J. E. Tutin of the University Botanic Garden, Cambridge, for her patience and skill with experimental material; as well as the many people who provided material or helped in various other ways.

REFERENCES

- DALLMAN, A. A. (1911) Further notes on the flora of Flintshire. *J.Bot.*, **49**, 8-14.
- FONT QUER, P. & ROTHMALER, W. (1934) Genera plantarum ibericarum revisio critica. I Helianthemum Adans. subgen. Plectolobum Willk. sectio Chamaecistus ej. *Cavanillesia* **6**, 148.
- GRIFFITH, J. E. (1894) *The Flora of Anglesey and Caernarvonshire*. Bangor.
- GROSSER, W. (1903) Cistaceae. *Pflanzenreich*, iv, 193. Leipzig.
- GUINEA, E. (1954) *Cistaceas Espanolas*. Madrid.
- HARTMAN, C. (1820) *Handbok i Skandinaviens Flora*. Stockholm.
- JANCHEN, E. (1907) Helianthemum canum (L.) Baumg. und seine nächsten Verwandten. *Abhandl. zool.-bot. Gesellsch. Wien* **4**, 1.
- KOMAROV, V. L. (1949) *Flora U.R.S.S.*, **14**, 345. Leningrad.
- LEES, F. A. (1888) *Flora of West Yorkshire*. London.
- PERSOON, C. H. (1805) *Synopsis Plantarum*. Paris.
- PRAEGER, R. LL. (1934) *The Botanist in Ireland*. Dublin.
- STERNER, R. (1936) Helianthemum oelandicum (L.) Willd. och dess anförvänter på Öland. *Svensk Bot. Tidskr.* **30**, 419.
- SYME, J. T. BOSWELL (1873) *English Botany*, ed. 3, 2. London.
- TROW, A. H. (1911) *Flora of Glamorgan*. Cardiff.
- WILLDENOW, K. L. (1799) *Species Plantarum*, ed. 4. Berlin.
- WILLKOMM, H. M. (1856) *Icones et descriptiones plantarum Europae austro-occidentalis*. Leipzig.

PLATE 7.



Fig. 1.

Helianthemum canum, Whitbarrow, Westmorland, 30 May 1952,
with *Festuca ovina*, *Sesleria caerulea*, *Galium pumilum*. (\times c. 2/3).



Fig. 2.

Helianthemum canum subsp. *levigatum*, Cronkley Fell, N.W. York., 27 May 1952,
with *Festuca ovina*, *Sesleria caerulea*, *Dryas octopetala*. (\times c. 2/3).