STUDIES IN THE BRITISH *EPIPACTIS*
VII. SEED DIMENSIONS AND ROOT DIAMETERS

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ABSTRACT

Seed-dimensions and root-diameters are characters of some taxonomic significance in *Epipactis* species. Preliminary data on these measurements is given in the tables.

Epipactis are notoriously variable plants, and it is not surprising that their quantitative characters show a wide amplitude and much overlapping between species. The data which follows indicates that the dimensions of the roots and seeds are more absolute characters and of taxonomic significance. It is not the result of a serious biometric study, but simply arose from examination of material that happened to be available. It is presented as an indication of where properly designed studies might be profitable.

SEED DIMENSIONS

The size of seeds is well known to be almost independent of the size and vigour of the parent plant. Dymes (1921, 1923) has shown that seed morphology is sometimes a useful taxonomic character in the Orchidaceae. Table 1 gives the dimensions of the seeds of all species of *Epipactis*, Section *Epipactis*, of Europe and the Mediterranean region, including five non-British species. Samples were mounted in Canada balsam, and measurements were made by means of a micrometer eyepiece on ten seeds taken at random (but rejecting twisted or undeveloped ones).

On the basis of size and shape of the seeds, the species fall mainly into two groups : (i) *E. purpurata*, *E. microphylla*, *E. leptochila*, and the three glabrous-stemmed species *E. phyllanthes*, *E. confusa*, and *E. persica*, with large seeds 1·15–1·3 mm. long, and about 4·5 times as long as broad (5·2 in the first species); (ii) *E. helleborine*, *E. atrorubens*, *E. muelleri*, and *E. dunensis*, with smaller seeds, 0·9–1·0 mm. long, length/breadth ratio about

TABLE 1
Seed dimensions of *Epipactis* species.

Species	*Number of collections*	*No. of seeds measured*	*Length, mm.*		*Breadth, mm.*		*Length/breadth*
			Mean	*s.d.*†	*Mean*	*s.d.*†	
E. purpurata	3	30	1·29	0·14	0·25	0·035	5·2
*persica	3	27	1·29	0·18	0·29	0·04	4·5
phyllanthes	17	170	1·28	0·12	0·28	0·045	4·5
*microphylla	1	10	1·16	0·06	0·26	0·04	4·5
*confusa	3	30	1·15	0·15	0·27	0·035	4·3
leptochila	2	20	1·15	0·04	0·27	0·03	4·3
*condensata	2	18	1·19	0·12	0·31	0·04	3·9
atrorubens	3	30	1·04	0·17	0·30	0·035	3·5
helleborine	4	40	0·97	0·09	0·27	0·025	3·4
dunensis	5	44	0·95	0·17	0·29	0·04	3·3
*muelleri	1	10	0·91	0·12	0·27	0·025	3·4

* Non-British † Standard deviation

3·4. The shorter seeds tend to a bluntly clavate shape, whereas the longer ones are more fusiform, with the areolation of the testa elongated. *E. condensata* Boiss. (*E. troodi* Lindb. f.) is somewhat anomalous, with very large seeds 1·2 mm. long but with a length/breadth ratio only 3·9. This species, from the Levant, is quite different in appearance from any of the other species mentioned, and need not be further discussed here.

The standard deviation of the pooled length measurements for each species was in most cases less than $\pm$ 10%, emphasising the absolute nature of the character. However, marked differences were sometimes found between different colonies of the same species, particularly with *E. atrorubens*. At present, too little data is available to say whether this is significant. Some influence of habitat and also of season is to be expected.

The almost identical dimensions of the seeds from *E. dunensis* and *E. muelleri* should be noted. This reinforces the suggestion (see Part V) that these two are very closely related.

Root diameter

The roots of *Epipactis* plants are emitted from the rhizome and the base of the stem and are, strictly speaking, all adventitious. They are cylindrical with no taper except at the extreme tip, and they are of practically uniform thickness regardless of their length or position, or of the age or size of the plant. The thickness is characteristic of the species : the thin wiry roots of *E. dunensis*, for instance, can be distinguished at a glance from the thick fleshy ones of *E. phyllanthes*.

Some data on the root diameters of all the European species (except *E. palustris*) is given in Table 2. Two or three pieces of root about 1 cm. long were cross-sectioned, and a random selection of sections was mounted in Canada balsam. The diameter of each section was measured in two perpendicular directions.

The standard deviations, as can be seen from the table, are mostly around $\pm$ 20%. The average diameters range from 1·5 to 3·1 mm. over the various species, so that the root diameter may provide a character of useful significance.

There is one apparent ecological effect here, that plants (*E. helleborine* and *E. phyllanthes*)

Table 2
Root diameters in *Epipactis* spp.

Species	*Number of*			*Root diameter, mm.*	
	Stations	*Plants*	*Measurements*	*Mean*	*s.d.*
E. purpurata	2	3	42	3·09	0·59
phyllanthes (inland)	7	7	84	2·94	0·37
phyllanthes (dunal)	2	3	32	2·26	0·30
*microphylla	1	1	12	2·61	0·42
*confusa	4	4	48	2·54	0·40
*muelleri	5	6	74	2·24	0·54
helleborine (inland)	3	3	50	2·19	0·48
helleborine (dunal)	4	4	48	1·88	0·29
leptochila	6	6	39	2·07	0·34
atrorubens	3	3	48	1·91	0·28
dunensis	2	4	74	1·48	0·28

* Non-British.

growing in dune sand have roots noticeably thinner than those from woodland habitats. These are separated in Table 2. Measurements from more stations will be needed before a satisfactory test of statistical significance can be applied (for *E. phyllanthes* the available data gave $P < 0{\cdot}05$ as between dune and inland colonies), but the existence of such a

difference would not be surprising. If granted, it brings an interesting corollary : the difference in root-diameters between *E. dunensis* and *E. muelleri*, which at first sight seems to separate them widely, might be explained (at least in part) as the result of their different habitats.

The specific root-sizes do not fall naturally into groups. Neglecting dune plants, they might be arbitrarily classified as (i) species with thick roots (2·5–3·1 mm.), *E. confusa*, *E. microphylla*, *E. phyllanthes*, *E. purpurata*; (ii) those with thinner roots (1·9–2·2 mm.), *E. atrorubens*, *E. leptochila*, *E. helleborine*, *E. muelleri*. Perhaps *E. dunensis* could be regarded as a third class, with very thin roots.

References

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