(4) The distribution map supports the conclusion that the $2n = 30$ race is almost restricted to the southern unglaciated part of the country, and thus suggests the superiority of the $2n = 56$ race in invading new territory.

(5) A cytological comparison between the two races indicates that there is not sufficient evidence to determine the type of polyploid relationship between them.

(6) Doubleness of flower in both races is thought to have a genetical cause. In the $2n = 56$ race some unknown physiological factor may render it capable of setting seed. Both the cytological aspect and the subject of the physiologi cal control of semi-doubleness are in need of further investigation.

ACKNOWLEDGM ENTS

I am indebted to Professor M. Thomas and Dr. K. B. Blackburn of the Botany Department, King's College, Newcastle-upon-Tyne (University of Durham) for their unfailing interest during the progress of this work and to all those, too many to mention, who have generously supplied me with living material.

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VEGETATIVE REPRODUCTION IN *ARUM MACULUTUM*

By C. T. PRIME

Arum maculatum L. reproduces by seed, but before the corm is large enough to flower, daughters are budded off and these develop more rapidly than seedlings. *A. maculatum* is a gregarious plant growing in clumps or patches and this vegetative method of reproduction readily suggests how some of these may have come about. If the clump is a clone, then the plants would be expected to be identical. On the other hand, a bird or other dispersal agency might well drop several seeds close together. These seeds would most likely be of different genetic constitution, and in due course would give several closely associated plants showing more variation. There is also the third and most likely possibility, namely a combination of the two.

In order to get definite information on these points, certain clumps were dug up and the corms carefully mapped. In one quite typical area there were 233 plants, some in clumps, others more scattered. The general impression gained is that vegetative multiplication is more important than reproduction by seed. In this example about thirty to forty seeds could have accounted for the whole 233 plants. Thus vegetative multiplication is probably about six times as effective as reproduction by seed.

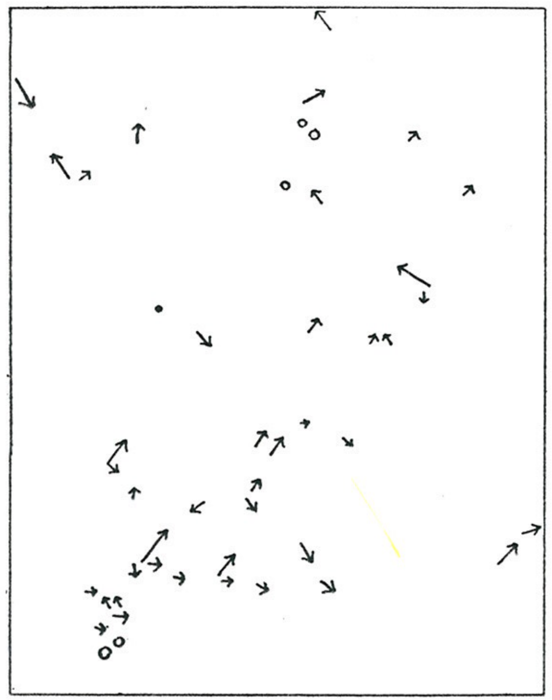

Fig. 1. Map of an *Arum* colony. The arrows indicate the direction of growth and length of corm, the circles indicate corms with a nearly vertical shoot. (Ground scale × ⅛; Corm lengths × ½).

Fig. 1 shows a much smaller area occupied by a group of plants all showing one leaf only. It will be noticed that the corms point in no particular direction and that some are beginning to reproduce vegetatively. It is evident that here the probability is that the great majority are seedlings. On the other hand, a colony is shown (Fig. 2) which was remarkably uniform in appearance. The spotting of the leaves was moderately reddish and it is of interest to note that the only plant which showed a very slight deviation from the rest was a small corm attached to the normal plant. It will be seen from this diagram that the direction of growth of the corms is such as to be completely compatible with vegetative reproduction from one original plant. This was perhaps more convincing in the field than the diagram would suggest. The possibility of some seedlings being present cannot be ruled out but, as these are usually found nearer the surface, the main fact seems clear enough. Further evidence is gained from the leaf measurements of the individuals in a clone. The leaf of *A. maculatum* does not reach full size until the plant is some years old. The measurements taken, therefore, were those from the third leaf of adult flowering plants. The number of mature plants in any one clone is not large but the table below gives the variation in leaf-length for three colonies which gave every appearance of being clones, compared with a similar number of individual leaf lengths chosen at random. The length variation is much less in the clones. This may be a reflection of the more uniform environment of the clone but other evidence, e.g. extreme similarity in the spotting, renders this interpretation the more unlikely.

TABLE 1

Leaf length in clones of *A. maculatum*.

Leaf length	No. of leaves			
	Clone A	Clone B	Clone C	Random choice
cm.				
8– 8·9	1	–	–	1
9– 9·9	4	–	–	2
10–10·9	5	1	–	–
11–11·9	1	2	3	1
12–12·9	–	2	4	1
13–13·9	–	4	3	3
14–14·9	–	–	1	–
15–15·9	–	–	–	2
16–16·9	–	–	–	–
17–17·9	–	–	–	1

It is therefore quite possible by studying the clumps in the field in this way to get a fair idea of how they have come into being.

THE MOVEMENT OF CORMS THROUGH THE SOIL

It will be evident from the diagrams that there is actual movement of the corms through the soil. Salisbury (1942) has noted that in heavy soils the resistance to growth may be considerable and says that comparative measurements of rhizome increments in heavier and lighter types of soil show that the annual increment is considerably influenced by this factor.

Attempts were made to measure the movement through the soil by marking the fruiting spike with stiff steel wire and noting the distance between the new shoots and the wire the following year. Other methods were also used; several corms dug up in the resting period (August) were arranged round a central rod or placed carefully in line, and the positions of their shoots measured in successive years. In experiments involving 87 corms the total distance moved was 99 cm., an average of 1·12 cm per corm. The considerable variation in the individual result is plainly related to many factors. One is the point of origin of the bud giving rise to the next year's shoot, i.e. whether it originates,

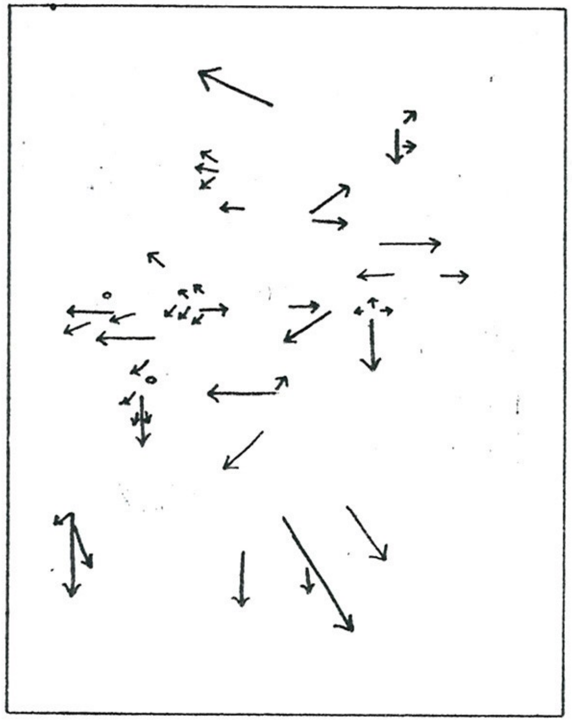

Fig. 2. Map of an *Arum* colony. The arrows indicate the direction and growth of length of corm. (Ground scale × ⅛; Corm lengths × ½).

with reference to the main axis, behind, to the side of, or in front of the previous year's shoot. Another is the size of the corm itself which will be influenced by the habitat, and another the texture of the soil which will resist the movement.

The clone shown in Fig. 2 measured about 40 cm. across and the only data available suggest that the plant takes seven years to flower from the time of sowing. The first corms are small and in the first seven years it might be said that the corms move about

TABLE 2.

The death rate of *Arum* corms.

Date	Number of corms used	Number of originals lost
1948–49	200	16
1949–50	200	24

3·4 cm. through the soil in growing. Therefore it seems that the age of a colony about 45 cm. in diameter is not less than twenty or thirty years.

A certain number of corms die or are lost in any given year. In some experiments the results given in Table 2 were obtained.

The death of the older corms suggests a factor which limits the size of the clumps. If the older die and are succeeded by daughters, which do not all point in the same directions as the parents and which grow and move more slowly, then a limit will be set to the size, or the clump will break up into smaller parts.

The cause of the death of the older corms is obscure; in the experiment given above there was no evidence of the corms being eaten and in most cases the remains could be found. It was thought possible that flowering and fruiting might cause exhaustion leading to death. This was tested by experiment with negative result. Thus in one experiment the corms that flowered weighed 186·1 gm. in 1950 but 246·4 gm. in 1951. Those which did not flower weighed 264·2 gm. in 1950, and 257·1 gm. in 1951.

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REVIEWS

An Irish Flora. D. A. Webb. 8vo., pp. xxx + 250, 160 line drawings. Dundalgan Press Ltd., Dundalk, second edition 1953; 13/6.

The first edition of Professor Webb's Irish Flora was of rather limited appeal to the British botanist since it omitted descriptions of all the rarer plants and was intended as an introduction to a flora which is considerably smaller than our own. The second edition has been enlarged in effect by about 50 pages and now includes at least a brief diagnosis of all Irish plants and a fuller, though still 'introductory,' treatment of critical groups. It should therefore appeal to a wider botanical public, though its usefulness to the complete beginner has been skilfully preserved.

The descriptions of species are concise (they average about 5 lines) but clear, and usually adequate for distinguishing the plants in the field. The number of technical terms employed is small and simple definitions of them, often supplemented by reference to the figures, are given in the glossary.

Vegetative characters are extensively and, as far as can be judged, effectively used, particularly in the keys. The key to the ferns is especially notable in this respect and it will be interesting to test it in the field, though it appears to work well in the herbarium. It would have been an assistance to the user if the genera had been numbered in the keys as they are in the text. In families such as Cruciferae and Compositae one is left, after working through the key to genera, with several pages to search through until (if ever) the arrangement of the genera in these families has been learned by heart.

It will be regretted by many that Professor Webb has continued to give measurements in inches and fractions of inches. These units are much less convenient for the measurement of most parts of plants than centimetres and millimetres, though there is perhaps less risk of errors appearing in the text. It is noteworthy that no dimensions are given for the lemmas and anthers of the species of *Glyceria* section *Fluitantes*, though to anyone using the metric system these provide the easiest means of distinguishing the species.

This is, however, a minor drawback and any botanical visitor to Ireland will find this book very useful and of a convenient size to go in the pocket. It will also prove of great assistance to anyone beginning the study of the British flora, as it provides an easy means of identifying the great majority of our common species.

T. G. Tutin.

Nordisk Kärlväxtflora I. N. Hylander. xv + 392 pp., 54 figs. and a map. Almquist and Wiksell, Stockholm, 1953; Sw. Kr. 58.

The appearance of the first volume of a new critical Flora of the 'Nordic' countries (Finland, Sweden, Norway, Denmark, Iceland and the Faeroes) is an event of major importance for European systematic botany. It is a tribute to the Linnean tradition in Sweden that such an ambitious project could be planned and executed, and this first volume sets a remarkably high standard in format, style and content.

The ten-page Introduction to the work contains much of interest to taxonomists concerning the scope of the Flora, the policy of admission of non-native species, nomenclatural treatment, and the like. Perhaps the most interesting general remarks concern the treatment of intraspecific variation. A glance at the main body of the Flora reveals the detailed nature of this treatment – *Sparganium erectum* L, for example, is given two pages of text and one of fruit illustrations – and the author's policy has been to condentrate attention on variation consisting of morphologically more or less distinct populations of reasonably wide distribution. In this field, as Dr. Hylander states, there is much that is obscure; and he has not hesitated to point out where knowledge is inadequate or entirely lacking. To risk a free translation (p. xiv): 'most Floras seem to me all too easily to give to the reader the dangerous impression that their treatment of systematic questions is final. A Flora must assuredly give as good a presentation as possible according to present knowledge; but it is almost equally important that it should indicate what we do *not* know but ought to!'

This first volume contains the Pteridophytes, Gymnosperms and the Monocotyledons, up and including