Regeneration from Mutilated Leaves in Monocotyledons

BY

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WITH PLATE CCLV.

It is a well-known fact that the Monocotyledonous plants which have been successfully regenerated from isolated leaves are remarkably few in number, and the cases hitherto recorded are all of regeneration from the leaf-base. This method of vegetative propagation is, of course, practised generally with the storage leaves of the bulb in *Lilium*, and it is also possible in *Hyacinthus*, *Ornithogalum* and *Allium*. Other instances of regeneration from leaf-bases are found in *Sansevieria*, *Lachenalia* (2), *Haemanthus* (3) and *Drimia* (4).

The writer has succeeded in regenerating the following species from mutilated leaves :—

Gasteria decipiens Haw.
,, *acinacifolia* Haw.
,, *cheilophylla* Baker
Drimiopsis Kirkii Hook. f.
Sansevieria zeylanica Willd. var. *Laurentii* N. E. Br.

Regeneration was also successful from mutilated leaflets of :—

Zamioculcas Boivinii Dcne.
,, *Loddigesii* Schott

In all these instances, with the exception of *Gasteria*, propagation was successful when the mutilated leaves were inserted in a rooting-medium of moist coco-nut fibre refuse, with a bottom temperature of 80° F. ; the relative humidity of the atmosphere in the propagating cases was maintained at 96–98 per cent.

During the first experiments on regeneration in *Gasteria*, the isolated portions of the leaves were inserted in an open sand-bed in a house devoted to Cacti, where regeneration from entire leaves had been accomplished previously. When the leaves were cut at a distance from the base, however, a large area of mesophyll was exposed ; and as the atmosphere and rooting-medium were dry, the wound dried and its surface receded considerably, leaving the cut base concave. An attempt

to root the cut leaves of *Gasteria* under the conditions which had proved successful in the other genera failed, as decay set in rapidly.

Eventually it became obvious that a compromise between these two extremes of moisture and drought might yield results, so the mutilated leaves were inserted in earthenware pans filled with slightly damp sand, the pans being sunk in the fibre of the propagating cases. Thus the wound-surfaces were in contact with slightly damp sand, while the remainder of the leaf was in an atmosphere with a relative humidity of 96–98 per cent., and under these conditions suberisation, and subsequently regeneration, took place successfully.

The decay which occurred when the cut leaves of *Gasteria* were inserted in the moist fibre was probably due to the fatty substances at the surfaces of the wounds leaching away before oxidation took place. Another factor in causing this decay may be involved. The reaction of the fibre used was under pH6, while that of the sand which was used with success latterly was pH8. Herklots (5), working with cut potato tubers, also found that alkaline conditions favoured suberisation. In the present experiments, however, the facility with which suberisation took place in the other genera inserted in fibre suggests that the moisture content was too high for *Gasteria*.

The roots from the mutilated leaves of *Gasteria* and *Sansevieria* are produced quite independently of the buds (see Plate CCLV)—a point which is of much interest in another connection (1). In *Drimiopsis* the roots are usually associated with the shoot organisations, but a few cases of roots arising independently were observed. In mutilated leaflets of *Zamioculcas*, a tuber-like swelling is formed, similar to that obtained at the bases. This structure is referred to elsewhere (6).

Schwarz (10) attempted the regeneration of *Gasteria* from isolated entire leaves, but succeeded in obtaining roots only. He records the same result for *Haworthia*, which is propagated successfully in this way at the Royal Botanic Garden, Edinburgh. Schwarz also obtained roots from leaves of *Anthurium panduraeforme*, but an attempt by the present writer to repeat the experiment with other species of *Anthurium* yielded no result ; no healing of the wounds took place.

Lindemuth (6), working with isolated leaves of Dicotyledons, observed that his results varied with the time of year, and that the variations were less marked in the case of evergreens than in others.

In the experience of the present writer, the time of insertion had very little influence on the results obtained with *Sansevieria* and *Gasteria*, but the experiments with *Zamioculcas* and *Drimiopsis* were not continued long enough for comparisons to be made. The best results were obtained by using leaves in an intermediate state of maturity, and old leaves were better than young leaves.

Regeneration from the leaf-base in the Monocotyledon is readily understood, as the leaves normally grow by means of a basal meristem ; and the supposed incapacity of the leaf to regenerate from any other

part except the base has been attributed to the absence of such meristem (9). It is clear from the results obtained by the writer, however, that either a meristem is present throughout the leaf before mutilation, or that subsequently certain cells regain a meristematic character.

The roots produced independently of the shoots and shoot organisations are closely associated with the vascular bundles of the leaves and probably arise from some kind of meristem. As the wound-buds originate from a phellogen in Dicotyledons and in isolated roots of *Dracaena*, it seems probable that the faculty of bud production in mutilated leaves of Monocotyledons will be explained by the formation of a phellogen giving rise to what Philipp (8) termed "initial" cork, as compared to the limited "etagen" type of cork formation characteristic of most Monocotyledons.

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EXPLANATION OF PLATE.

Fig. 1.—*Gasteria decipiens* Haw. Root production from mutilated leaf fifteen days after insertion. The two portions were inserted at the same time. Possibly the difference in result may be co-related to their respective mass.

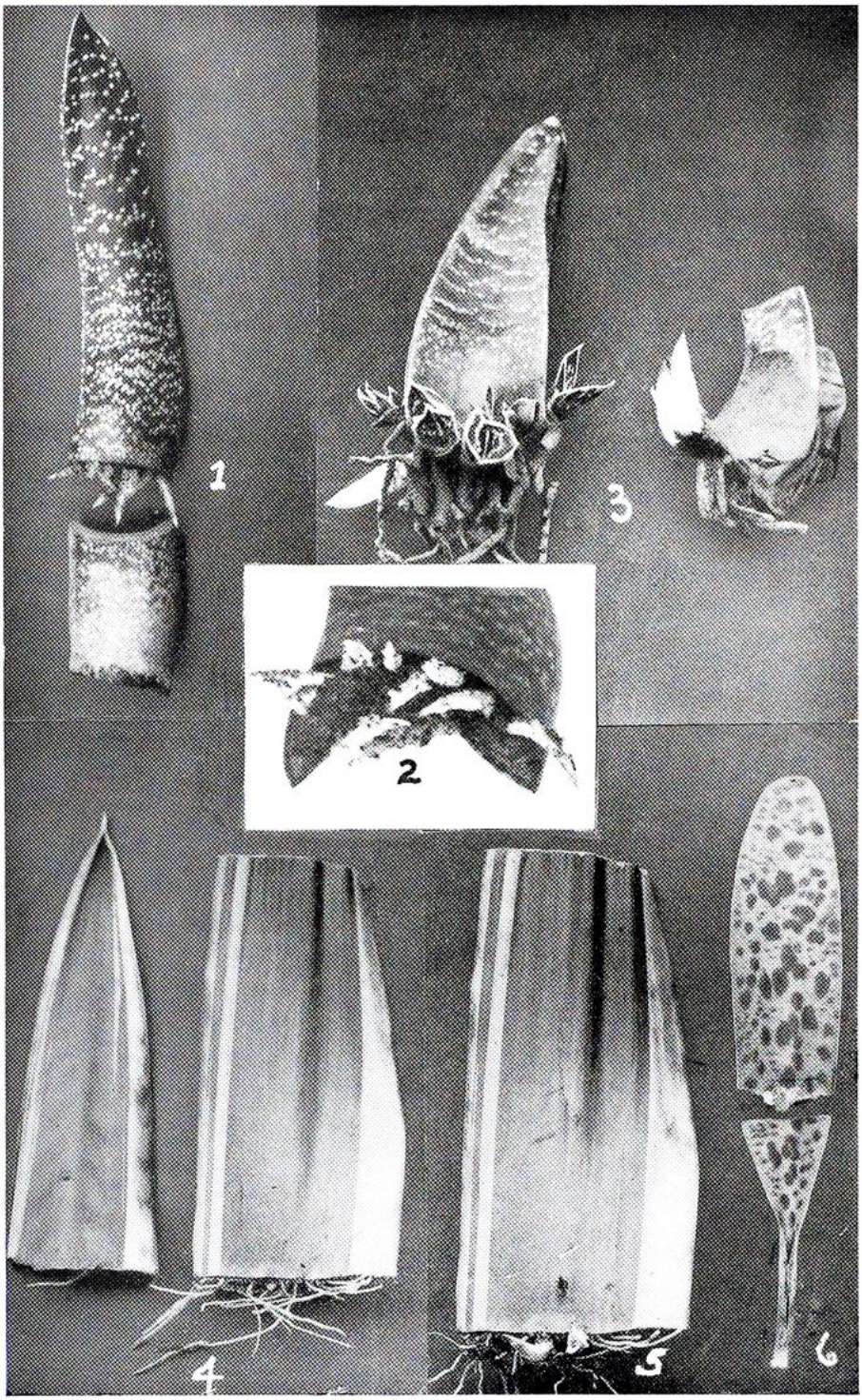
Fig. 2.—The proximal end of the mutilated part of the leaf in Fig. 1.

Fig. 3.—The same leaf as in Fig. 1, eleven weeks after insertion.

Fig. 4.—*Sansevieria zeylanica* Willd. var. *Laurentii* N. E. Br. Root production from mutilated leaf six weeks after insertion.

Fig. 5.—The portion of the leaf in Fig. 4 (right) eight weeks after insertion.

Fig. 6.—*Drimiopsis Kirkii* Hook. f. Regeneration from mutilated leaf four weeks after insertion.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