

Relationship between Shoot Apex and Effect of Gibberellic Acid on Elongation of Pea Stems

Brian and Hemming¹ have recently shown that gibberellic acid is relatively inactive in inducing the elongation of internode segments of dwarf pea. They have found, however, that in the presence of indolylacetic acid, gibberellic acid induces a more marked increase in the extension of the internode segments.

It is of interest to note from previous accounts² that gibberellic acid induces much more marked increases in the elongation of stems of intact green plants than it does in stimulating the cellular extension of isolated plant parts (that is, wheat coleoptiles, pea internode sections, etc.). This is in striking contrast to the classical auxins, such as indolylacetic acid, which are much more easily detected in bioassays with isolated segments grown in the dark.

With these interesting and unexplained differences before us, we have looked into the effect of gibberellic acid on the elongation of stems of Alaska pea seedlings from which vital (from a physiological point of view) portions of the anatomy of the plant had been severed. The seedlings used in these experiments were grown in the dark until they were six days old. Ten uniform seedlings were then decapitated, for each replicate, by cutting through the first node with a sharp razor, or de-rooted, or left intact. The seedlings were then immersed in either aqueous solutions containing 10 p.p.m. gibberellic acid or in distilled water. One set of seedlings was placed under red fluorescent lights, while the other set was kept in total darkness. After two days, the total height of the seedlings was recorded. The results are reproduced in Table 1.

Table 1. EFFECT OF GIBBERELIC ACID ON ELONGATION OF ETIOLATED PEA SEEDLINGS WITH DIFFERENT TISSUES REMOVED PRIOR TO TREATMENT IN LIGHT AND DARK

Tissues removed from seedlings	Total increments of growth (in cm.) for ten seedlings held in			
	Red light		Darkness	
	G.A. (10 p.p.m.)	Water	G.A. (10 p.p.m.)	Water
Shoot apices	2.4	2.7	4.6	2.0
Roots only	96.6	45.6	107.3	82.6
Roots and apices	5.3	2.1	3.7	2.9
None (Ck.)	93.2	50.4	106.0	87.3

Required for statistical significance: differences of 8.6 at 5 per cent level; differences of 9.7 at 1 per cent level.

Intact seedlings responded to gibberellic acid more markedly in red light than the dark, confirming the recent work of Lockhart³. Decapitated seedlings made little growth either in the presence of gibberellic acid or in its absence, regardless of whether they were grown in red light or in the dark. De-rooted seedlings with shoot apices responded to gibberellic acid much more markedly in red light than in the dark, acting similarly in this respect to intact seedlings. However, de-rooted seedlings, without shoot apices, which are, in effect, second internode segments, did not respond to gibberellic acid either in red light or in darkness, resembling decapitated seedlings with an intact root system.

The results of these experiments indicate that the shoot apex is necessary for maximum elongation of the second internode of Alaska peas and that gibberellic acid will not replace the stimulus for cellular extension that is probably derived from the apex.

In view of the report by Brian and Hemming¹ on a possible interdependence between indolylacetic acid and gibberellic acid, coupled with the results described here, there is some indication that there may be a close relationship between growth factors synthesized and translocated from the apex, and the exogenously applied gibberellic acid. One may speculate that this relationship is possibly a type of 'sparing action' by which exogenously applied gibberellic acid 'protects' against the inactivation of endogenous growth hormones, particularly where the inactivation mechanism is mediated by light. These and other questions will be discussed more fully in forthcoming publications in the Contributions from the Boyce Thompson Institute.

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March 25.

¹ Brian, P. W., and Hemming, H. G., *Nature*, **179**, 417 (1957).

² Brian, P. W., Hemming, H. G., and Radley, M., *Physiol. Plantarum* **8**, 899 (1955). Kato, Jiro, *Mem. Coll. Sci. Univ. Kyoto*, **B**, **20**, 189 (1953).

³ Lockhart, James A., *Proc. U.S. Nat. Acad. Sci.*, **42**, 841 (1956).

Unisexual Flowers in the Ericales

THE flowers of the Epacridaceae have been described as hermaphrodite^{1,2} or hermaphrodite, rarely dioecious³, but in the latter case no examples of dioecy are quoted. The following notes concerning species previously described as hermaphrodite indicate that unisexual flowers may be not uncommon in this family.

In November 1954 I noted that a lone plant of *Cyathodes colensoi* in the Christchurch Botanic Gardens flowered profusely but set no fruit. A year later a large population was examined at Lake Lyndon, Canterbury, and two types of plant were found which were obviously male and female. Five plants were labelled in the field, and only the two classified as female set fruit. Transplants from this population set no fruit in isolation, but did so with the appropriate hand pollination. The tiny stamens in the female may dehisce but contain no pollen (Fig. 1) and the flower illustrated by Cheeseman⁴ is of this type. Female flowers are smaller than males. Although pollination has not been observed, the flower structure suggests that insects are the main agent, for the stigma is inside the petal tube, the opening of which is only $\frac{1}{2}$ – $\frac{3}{4}$ mm. across and surrounded by hairs.

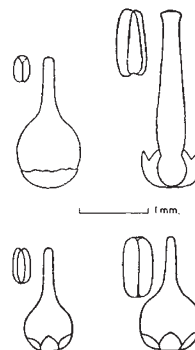


Fig. 1. Upper: *C. colensoi*, Lake Lyndon. Female, left; male, right. Lower: *C. acrota*, Kaiteriteri. Female, left; non-fruiting hermaphrodite, right