ONION ROOT GIBBERELLINS

The naturally-occurring gibberellins of seeds and leaves of higher plants have been well investigated while those of roots have relatively been little studied. Therefore it is of interest to examine the native gibberellins of actively growing roots. The roots of onion plant, Allium cepa were selected for this investigation.

Onion plants were grown from bulbs in pans of sand under natural conditions in the garden. Twenty days after planting the roots were separated from the plants, washed, and were subjected to the extraction of gibberellins according to the method of Corcoran and Phinney. The roots (about 20 g.) were ground in acetone-water (1:1), the macerate was left for 24 hours at 15°C and was filtered. The filtrate was concentrated on a boiling water bath and was used for paper chromatographic analysis of gibberellins.

The sheets (Whatman No. 1) were run unidirectionally in an ascending technique in three different solvent systems (Table I). Dried papers were sprayed with the chromogenic reagent, 0.5% aqueous potassium permanganate to detect gibberellin-like substances which appear as yellow spots on purple background.

The analysis showed that two compounds positive to permanganate reagent were present in the extract. The chromatographic behaviour of these substances is summarized in Table I.

<table>
<thead>
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<th>Substance</th>
<th>Rf</th>
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<tr>
<td>1</td>
<td>0.36</td>
<td>0.22</td>
<td>0.48</td>
</tr>
<tr>
<td>2</td>
<td>0.46</td>
<td>0.08</td>
<td>0.44</td>
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Substance 1 had identical behaviour in all the solvents tried in respect of Rf with the authentic sample of Gibberellic acid (gibberelin A3). Additional confirmation was also obtained by spraying the sheet with 0.05% ferric chloride in 3% methanol sulphuric acid. Both the unknown and the authentic samples had no colour in visible light, but fluoresced blue green under U.V. light.

Bioassay of the above native gibberelllic acid was done using rice seedling test. The spot corresponding to A3 was eluted with acetone:water (1:1) from the unsprayed sheet and eluate was evaporated to a small known volume and was tested for biological activity. The elongation of second leaf-sheath in rice seedlings of variety BCP I was measured and it was found that 6 g. of root material was equivalent to 1.0 µg. of authentic gibberellic acid in biological activity. Substance 2 is at the moment unidentified.

Thus the present investigation has revealed occurrence of gibberelin A3 and an unidentified gibberellin in onion roots and it is highly probable that roots of other plants also contain similar native gibberellins. It is pointed out that gibberellic acid promotes synthesis of phenolic compounds which in turn control growth by way of increased auxin content.

Phenolic acids of onion roots have recently been studied by the present authors and further work on the levels of native gibberellins and phenolic substances during different developmental stages will be most helpful in understanding the growth of roots.

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SOME OBSERVATIONS ON THE EMBRYOLOGY OF HOLBOELLIA LATIFOLIA WALL.

The family Lardizabalaceae is given an independent status by Engler and Prantl, Hutchinson and Kendal, while Bentham and Hooker treat it as a tribe of the Berberidaceae. The earlier embryological findings on this family include those of Veske on Holboellia latifolia, Vesler on Akebia quinata, and Swamy on Decaisnea insignis. The first two authors reported formation of parietal cells in the ovules. In addition, Vesler made some observations on the pollen grains and embryo-sac. Swamy, besides investigating pollen and embryo-sac, also traced the development of endosperm.

The material of Holboellia latifolia was collected from the Lloyd Botanic Gardens,
Darjeeling, and Tonglu in the same district, during May–June 1962. The plant is a monoeccious climbing shrub. The unisexual flowers are green or purplish-green and sweet-scented. There are 6 sepals arranged in two whorls, 6 minute orbicular petals, 6 free stamens, and 3 distinct carpels with oblong stigmas.

The anther wall consists of an epidermis, fibrous endothecium, two or three middle layers and a secretory tapetum. The tapetal cells contain 2 to 4 nuclei each which later fuse to form polyploid masses.

The reduction divisions in the microspore mother cells are simultaneous resulting in tetrahedral and decussate tetrads. The mature pollen grains are tricolpate and 2-celled at the time of shedding (Fig. 1).

In the female flowers the anthers degenerate. The contents may, however, develop up to the uninucleate pollen grain stage.

The ovary shows parietal placentation bearing numerous sub-sessile ovules, separated from each other by multicellular, uniseriate hairs developed from the inner epidermal cells of the carpel wall. These ovules are orthotropous, bithegmic and crassinucellate with well-developed parietal tissue formed also by periclinal divisions of the nucellar epidermis (Figs. 2, 3). The micropyle is organized by the inner integument alone.

Generally there is single (sometimes two) megaspore mother cell. It divides to form a dyad (Fig. 4), of which the upper dyad cell may sometimes remain undivided (Figs. 5, 6). When both the dyad cells divide (Fig. 7) mostly T-shaped tetrads of megaspores (Fig. 8), and rarely the linear ones, are produced. The chalazal megaspore functions and the development of the embryo-sac thus conforms to the Polygonum type (Maheshwari).

The functional megaspore divides to form 2, 4, and 8-nucleate gametophytes (Figs. 9, 10). The micropylar quartet organizes earlier than the chalazal quartet. The mature embryo-sac consists of an egg apparatus, two polar nuclei and three antipodal cells (Fig. 10). The latter are ephemeral and degenerate even before fertilization.

The endosperm is cellular. The first division of the primary endosperm nucleus is transverse resulting in large micropylar and a small chalazal chamber (Fig. 11). Both the chambers contribute towards the endosperm formation, but divisions are more rapid in the chalazal region. This is also true of Dicotsalia.

A comparative study indicates that Lardizabalaceae deserve the status of an independet family and need not be merged with the Berberidaceae.

Figs. 1–11. Fig. 1 Mature pollen grain. Fig. 2. Ovule. Fig. 3. Portion of ovule enlarged to show megaspore mother cell. Fig. 4. Dyad. Figs. 5–6. Lower dyad is dividing while the upper one is degenerating. Figs. 7–9. T-shaped tetrads of megaspores. Figs. 9–10. Two-nucleate and mature embryo embryo-sacs respectively. Fig. 10. The polar have fused. Fig. 11. Fertilized embryo-sac showing two-celled endosperm and persistent synergid. (Fig. 2, × 100; Others, × 450).

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