

Water-conducting System of *Symphyogyna*

THE gametophytes of the liverwort genera *Hymenophyton*, *Podomitrium*, *Pallavicinia* and *Symphyogyna* contain an internal water-conducting system which is strikingly analogous to the xylem of simple vascular plants. This system is composed of one or more strands of narrow diameter, elongate, thick walled, densely pitted conducting cells that are devoid of protoplasmic contents at maturity. The presence of this system was first noted by William Jackson Hooker¹ in *Jungermannia* (now *Pallavicinia*) *lyellii*. Leitgeb² pointed out that the cells of the strand were elongate, possessed oblique end walls and that the cell walls were considerably thickened and possessed close-set pores. Tansley and Chick³ reported that the contents of the cells of the conducting strand disintegrate during development and demonstrated that the strand is actually an efficient water-conducting unit within the thallus.

A median longitudinal section through the midrib of a mature portion of a thallus of *Symphyogyna circinata* (Fig. 1, top) reveals the numerous pits within the thick walls of the conducting cells. However, even at highest

magnification the light microscope has proved inadequate to study details of the pits or to determine with certainty that the conducting cells are actually devoid of protoplasm at maturity. Electron micrographs of the conducting cells have shown that they are indeed empty at maturity. Quite unexpectedly they have also revealed that the pits are actually complete perforations in the walls between adjacent conducting cells (Fig. 1, middle and bottom). The pits are initiated about plasmodesmata in the walls of embryonic conducting cells. As the cells mature, a portion of the wall surrounding the plasmodesma is digested away to form a complete perforation in many, if not all, pits.

These liverworts are vascular plants in their own right at least in the possession of a fully differentiated water-conducting system.

JAMES L. SMITH

Department of Biology,
University of Colorado,
Boulder, Colorado.

¹ Hooker, W. J., *British Jungermanniae* (Longmans, London, 1812-1816).

² Leitgeb, H., *Untersuchungen ueber die Lebermoose*, 3 (O. Deistung, Jena, 1877).

³ Tansley, A., and Chick, E., *Ann. Bot.*, 15, 1 (1901).

Enhancement of the Fruit-setting Activity of Indolyl-3-acetic Acid by Alkyl Substitution on the α -Carbon

SINCE Gustafson¹ first demonstrated that parthenocarpic fruit growth could be induced in the tomato with indolyl-3-acetic acid, numerous investigators²⁻⁴ have extended these investigations to include derivatives of indole and other growth substances. Several structurally unrelated compounds (for example, substituted phenoxyacetic, benzoic acids, etc.) were found to be more active in promotion of parthenocarpic fruit growth than the indoles⁴. Further, modification by monochloro substitution in the benzene ring of indolyl-3-acetic acid or esterification of the carboxyl group with a methyl or ethyl radical resulted in derivatives with greater activity than the parent compound³. Enhanced fruit-setting activity of indolyl-3-acetic acid by alkyl substitution on the α -carbon, with special reference to D,L- α -methylindolyl-3-acetic acid, is herein described.

The D,L- α -methylindolyl-3-acetic acid (α -Me-IAA) was synthesized by reacting indole with lactic acid in the presence of potassium hydroxide in a high-pressure autoclave at 240°-260° C for 16 h⁵. The resulting product was treated as described by Schlender⁶ and crystallized from benzene-petroleum ether. The ethyl indolyl-3-acetate (EIA), indolyl-3-acetic acid (IAA), 4-chlorophenoxyacetic acid (4-CPA), and gibberellin A₃ (GA₃) were obtained from commercial sources.

The relative effectiveness of the three indole derivatives in inducing parthenocarpic fruit growth was determined by applying approximately 13 mg of a lanolin mixture at 10⁻⁵, 10⁻⁴, 10⁻³ and 10⁻² M concentration to tomato (*Lycopersicon esculentum* L. cv. Michigan-Ohio hybrid) ovaries of emasculated flowers. Lanolin alone was used for a control comparison. Three flowers of the first cluster of each of three plants were used for each chemical at each concentration. After seven days, ovary diameter and pedicel thickness were measured. A randomized block experimental design was utilized and the results were summarized by analysis of variance. When appropriate, differences among treatment means were delineated⁷.

The effect of α -Me-IAA, EIA and IAA on promotion of parthenocarpic fruit growth is illustrated in Fig. 1. The α -Me-IAA derivative was more active than IAA and equal to EIA at 10⁻⁴ and 10⁻³ M (Fig. 1). At 10⁻² M it was difficult to assess the relative activity on the basis of ovary diameter alone, since both α -Me-IAA and EIA were at a supra-optimal concentration. No stimulation of ovary growth was apparent in the lanolin controls.

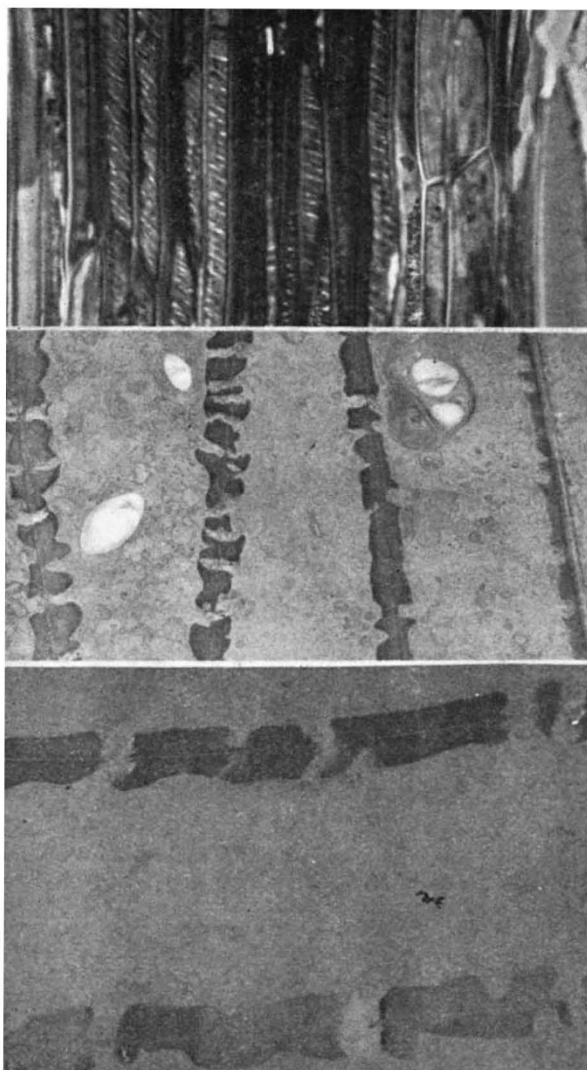


Fig. 1. *Symphyogyna circinata*. Top, longitudinal section through a mature conducting strand and inner cortex (periodic acid-Schiff's reagent; phase; \times c. 533). Middle, longitudinal section of immature conducting cells. The protoplasm of the cells is still well organized. Several of the pits show complete perforations (electron micrograph; \times c. 4,330). Bottom, longitudinal section of nearly mature conducting cells. Relatively little protoplasm remains in the conducting cells (electron micrograph; \times c. 7,330).