This form of 'induced immunity' or 'infection immunity' has the potentiality to develop into a successful method of plant disease control.

Further studies are in progress for a better understanding of the biochemical changes incited by the pre-inoculant in the host.

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EMBRYOLOGY OF PITTOSPORACEAE—II

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ABSTRACT

The family Pittosporaceae comprises 9 genera which are chiefly confined to Australia (Willis, 1966). They are trees, shrubs or undershrubs with flexuose or straggling branches as *Sollya*. The extipulate leaves exhibit alternate or whorled phyllotaxy. The flowers are usually bisexual, hypogynous, tetracyclic and pentamerous (except the gynoecium which is bicarpellary syncarpous) and are borne in corymbose, umbelliform or paniculate inflorescences (Hutchinson[2]).

THE information on the embryology of Pittosporaceae is meagre. Davis[1] reviewed the earlier literature on the embryology of the family. Subsqeuently only a few taxa of the family have been embryologically investigated (Sheela and Narayana[5]; Narayana and Sundari[3,4] and Sundari and Narayana[6]). The present paper deals with the embryology of *Sollya fusiformis* Hort., and *Sollya heterophylla* Lindl. The materials for the present study were obtained from Australia, through the courtesy of Dr. Hj. Eichler, Mr. R. H. Kuchel and Dr. J. S. Beard.

The anther is tetrasporangiate. The archesporium, differentiated in each of the anther lobes, is a plate of 4-cells (Fig. 1). The archesporial cells divide periclinally producing a primary parietal layer to the outside and a primary sporogenous layer to the inside. The differentiated anther wall comprises the epidermis and three wall layers (Fig. 2). The hypodermal layer develops characteristic banded thickenings and functions as the endothecium. The innermost wall layer functions as the tapetum of the secretory type. The middle layer becomes crushed during the development of the anther.

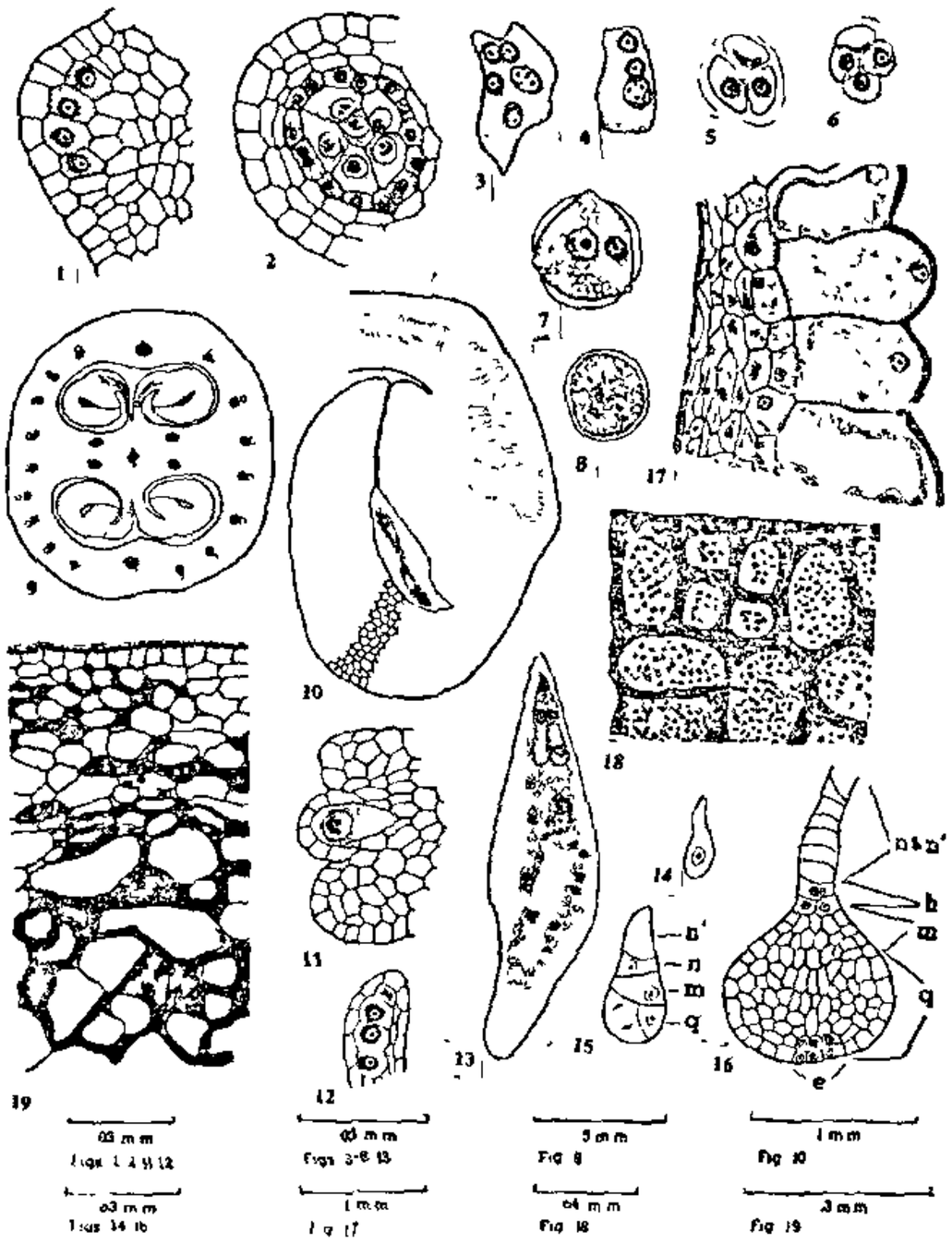
The tapetal cells are uninucleate to start with. As the microspore mother cells enter meiosis, they become multinucleate and the cytoplasm becomes vacuolate. Nuclear divisions are followed by nulear fusions. The degree of polyploidy in the tapetal cells depends on the number of fusing nuclei (Figs. 3, 4). They are completely absorbed by the time the pollen grains attain maturity.

The cells of the primary sporogenous layer undergo a few mitotic divisions before they function as the microspore mother cells. The microspore mother cells undergo meiosis and form microspore nuclei. Cytokinesis takes place by simultaneous furrowing. Pollen tetrads show tetrahedral arrangement (Fig. 5). In *S. heterophylla*, however, decussate tetrads have also been observed (Fig. 6). Degeneration of one or more or all microspores, while still enclosed in the mother cell wall, has been observed (Figs. 5, 6). The pollen grains are 3-colporate and are 3-celled at the shedding stage (Figs. 7, 8). Accumulation of black granular bodies of unknown nature has been observed in some of the pollen grains (Fig. 8).

The ovule is ana-campylotropous, unitegmic and tenuinucellate. It arises as a small protuberance on the placenta. During growth it undergoes curvature as a result the ovule becomes ana-campylotropous (Fig. 10). The ovules are horizontally placed and best median sections are obtained in transverse sections of the ovaries (Fig. 9). The integument is 12–14 cell thick in *S. fusiformis* and 11–14 in *S. heterophylla*, on the antiraphe side. There is no differentiation of endothelium.

The archesporium in the ovule is hypodermal and single celled. The archesporial cell directly functions as megaspore mother cell without cutting off a parietal cell (Fig. 11). The megaspore mother cell undergoes meiosis giving rise to a tetrad of megaspores which show linear (Fig. 12) or 'T' shaped configuration The chalazal functional megaspore undergoes three

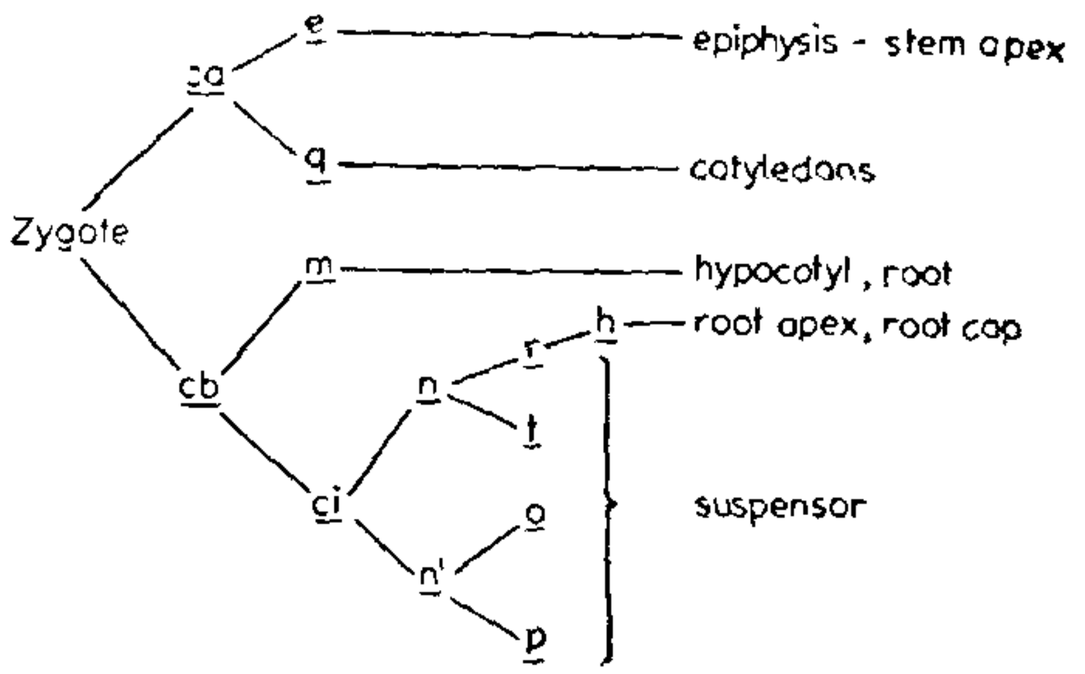
successive free nuclear divisions to give rise an 8-nucleate embryo sac of the Polygonum type. The egg apparatus consists of two hooked synergids which show filiform apparatus and an egg (Fig. 13). The polar nuclei fuse before fertilization. The antipodals are ephemeral. The embryo sac during its growth enlarges and crushes the cells of the integument along the sides. In some of the embryo sacs small nuclei were observed. As the nucellus is crushed very early during development, the probable source of these nuclei must be the cells of the integument which become crushed during the enlargement of the embryo sac. Starch grains are observed in mature embryo sac (Fig. 13).



FIGS. 1–7, 10, 12–13. *Sollya heterophylla.*
FIGS. 8–9, 11, 14–19. *Sollya fusiformis.*

Fig. 1. T.S. anther lobe showing archesporium. Fig. 2. T.S. anther lobe showing epidermis, wall layers, tapetum and microspore mother cells. Figs. 3, 4. Multinucleate tapetal cells. Figs. 5, 6. Pollen tetrads. Figs. 7–8. 2-celled and 3-celled pollen grains. Note dark granular bodies in Fig. 8. Fig. 9. T.S. ovary showing orientation of ovules. Fig. 10. Mature ovule. Fig. 11. L.S. ovule showing megaspore mother cell. Fig. 12. Linear tetrad. Fig. 13. Mature embryo sac. Figs. 14–16. Stages in embryogeny. Fig. 17. Mature seed coat. Fig. 18. Endosperm cells. Fig. 19. Mature pericarp.

The endosperm is *ab initio* nuclear and becomes cellular later. The cells of the endosperm become packed with food materials and the cell walls are greatly thickened (Fig. 18).



The embryo development conforms to the Geum variation of Asterad type (Figs. 14–16) of Johansen (1950). The following is the scheme showing the relation of the different organs of the mature embryo to the specific cells of the proembryo.

The fruit is a berry. The mature pericarp is 12–15 layered. The cells are loosely arranged and show accumulation of deep staining material (Fig. 19).

The seed is endospermic. The seed coat consists of radially elongated epidermal cells with greatly thickened outer tangential walls and 3 or 4 layers below it. The remaining cells become pressed during the development of the seed. The cells of the seed coat show accumulation of deeply staining bodies of undetermined nature (Fig. 17).

In characters like unitegmic, tenuinucellate ovules, single celled archesporium in the ovule, Polygonum type of embryo sac ontogeny, ephemeral antipodals, fusion of polar nuclei before fertilization and nuclear endosperm, the Pittosporaceae resemble Escalloniaceae.

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