

POLLEN DEVELOPMENT IN A FEW ACANTHACEAE

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Embryological studies in Acanthaceae have been quite extensive (5-8, 12-14, 17, 18). In spite of this, the structure and development of anther and pollen remain either uninvestigated or partially investigated. As such it was considered worthwhile to investigate the structure and development of anther and pollen of the eight species - Thunbergia grandiflora Roxb., Thunbergia affinis S. Moore., Beloperone guttata Brandege., Jacobinia coccinea Hiern., Pseuderanthemum reticulatum Radlk., Pseuderanthemum graciliflorum Domin., Sanchezia nobilis Hook. and Pachystachys lutea Nees. collected from Singapore.

The ditheous anthers are 4-lobed. In B. guttata and J. coccinea the two theca are superposed. The hypodermal archesporium in each lobe consists of a plate of variable number of cells. The anther wall development conforms to the Dicotyledonous type (4) (Figs. 1-3). It comprises the endothecium, middle layer and tapetum besides the epidermis (Fig. 3).

The glandular tapetum is dual in origin and dimorphic in nature. The connective tapetum differs from the parietal tapetum in possessing larger cells with more number of nuclei. The tapetal cells arising from the connective elongate greatly and intrude into the anther (Fig. 12). The cells of the parietal tapetum are binucleate. Owing to nuclear divisions, the C-tapetal cells become bi-, tri-, tetra- or multinucleate (Figs. 5-9). If the divisions are followed by fusions, nuclei of different ploidy result (Fig. 10). Rarely two adjacent tapetal cells fuse resulting in larger cells with polyploid nuclei (Fig. 11). Usually the tapetal cells degenerate by the time the anther dehisces. But in B. guttata the tapetum remains intact even at the time of dehiscence of the anther (Fig. 12). 'Ubisch granules' develop on the inner walls of the tapetal cells. In P. graciliflorum they are large in size (Fig. 4).

The middle layer is ephemeral. The endothecium develops fibrous thickenings in all the species (Fig. 13) but in the species of Thunbergia (Fig. 14) and Pseuderanthemum (Fig. 4). Epidermis becomes cuti-

nized and contains starch. In S. nobilis the epidermal cells contain tannin.

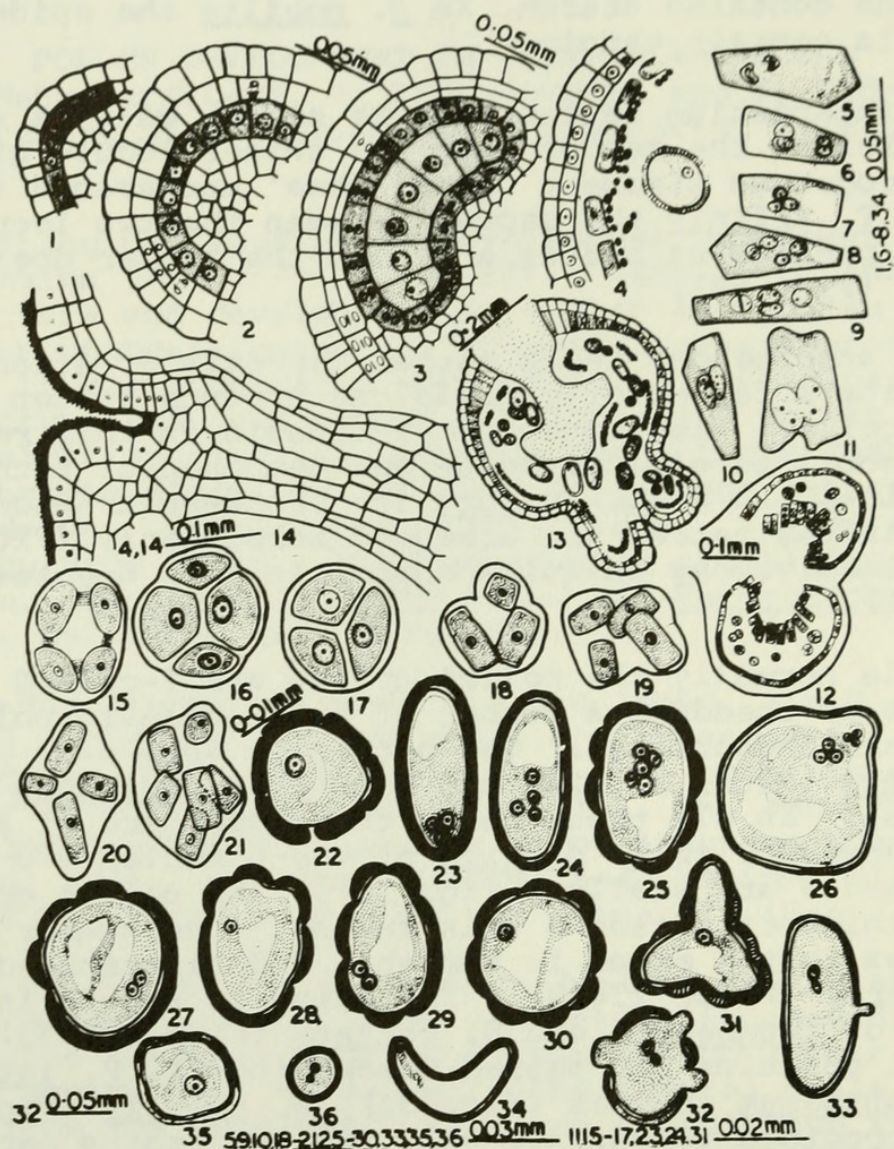
An interesting feature of the anther wall is the protrusion of the septum into the anther locule giving the sporogenous tissue a 'horse shoe' appearance (Fig. 3). In T. affinis the septum between the two locules remains persistent and as a result the anther does not dehisce (Fig. 14).

The sporogenous cells either directly or after undergoing a few mitotic divisions produce pollen mother cells. Simultaneous cytokinesis in them results in isobilateral, decussate and tetrahedral tetrads (Figs. 15-17). In B. guttata the rectangular microspores in the tetrad are arranged irregularly (Figs. 18-20). Polyspory is quite common in this species (Fig. 21).

While normally the pollen grains are 2-celled at the time of shedding a number of multinucleate pollen grains are encountered. The number is 3 or 4 in B. guttata (Figs. 23, 24) and 5 in T. grandiflora (Fig. 25). In all these cases the nuclei are of same size. However, in T. affinis of the 6 nuclei - 3 are larger and 3 are smaller (Fig. 26). The pollen grains have a thick exine and a thin intine. The number of apertures in the exine is variable and distributed irregularly (Figs. 27-30). The exine is smooth in the species of Thunbergia and B. guttata (Figs. 22-30), while it contains rod shaped thickenings in P. lutea, Pseuderanthemum species (Fig. 31), S. nobilis (Fig. 32) and J. coccinea (Figs. 35, 36). Pollen grains germinate In-situ in B. guttata (Fig. 33) and S. nobilis (Fig. 32). In T. affinis 3 pollen tubes emanate from a pollen grain (Fig. 32). In T. affinis the exine inhibits the growth of the pollen tube and thereby causes pollen sterility (Fig. 34). Pollen dimorphism is common in all the members (Figs. 35, 36).

Discussion

The anther in the family Acanthaceae shows interesting variations in its structure. In some members like B. guttata, S. nobilis, P. lutea and J. coccinea the endothecium develops fibrous thickenings while in the species of Thunbergia and Pseuderanthemum fibrous thickenings are absent. Such a condition is reported in Justicia betonica, Barleria prionitis and Ruellia



Figs. 1-3, 25, 27-30. Thunbergia grandiflora;
 Figs. 14, 26, 24. T. affinis; Fig. 4. Pseuderanthemum graciliflorum; Fig. 31. P. reticulatum;
 Figs. 13, 35, 36. Jacobinia coccinea; Figs. 5-12,
 18-24, 33. Beloperone guttata; Fig. 32. Sanchezia nobilis;
 Figs. 15-17. Pachystachys lutea.

Figs. 1-3. T.s. of anther lobes showing wall development and sporogenous tissue; 4. T.s. of mature anther lobe, note 'Ubisch bodies'; 5-11. Intrusive tapetal cells; 12. Anther lobe showing dimorphic tapetum; 13. T.S. of anther showing the intrusive wall. 14. Persisting septum in between the 2 locules; 15-20. Pollen tetrads; 21. Polyad; 22-31. Pollen grains; 32, 33. Germinating pollen grains; 34. Degenerating pollen grain; 35, 36. Pollen dimorphism.

tuberosa (16). In T. affinis the anthers do not dehisce but degenerate in toto leading to sterility.

The anther wall from the connective side in all the presently investigated species, intrudes into the anther locule giving the appearance of a placenta. Such a condition is reported in J. betonica (1, 16), Asteracantha longifolia (19), Justicia simplex (12) and Phlebophyllum kunthianum (1) and in Salvia mellifera (3) of the labiatae.

The tapetum is dimorphic in all the eight species investigated as in S. mellifera (3). In these two features - intrusive anther wall and dimorphic tapetum - some members of Acanthaceae and Labiatae show close kinship.

In B. guttata polyspory is of common occurrence. The accessory spores might have arisen as a result of divisions of one or more spores. Such a condition has been reported in Thunbergia species (9), Caesalpinia pulcherrima (15) and Eupatorium odoratum (11). According to Mukherjee polyspory is due to temperature fluctuations or other environmental characters. But in the present study polyads and normal tetrads are observed within the same anther. Therefore it may be said that in B. guttata polyspory might have resulted as mentioned by Maheshwari (10), due to the occurrence of lagging chromosomes which organise into micronuclei.

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