

In the floating leaves the distribution of stomata is variable. Generally they are restricted entirely to the upper epidermis; the lower having only a few of them. This is perhaps in agreement with the observations made by Gupta *et al.*² on *Nelumbo nucifera*. According to these authors the emerging, terrestrial leaves of this plant have a few stomata on the lower surface as well (being much fewer than those present on the upper surface). These slowly get disorganized and are finally lost as the area gets flooded and the plant comes to acquire the floating habit. Thus at maturity, the upper epidermis alone is provided with stomata.

Shinobu³ also reported the occurrence of stomata on the lower epidermis of the floating leaves of two species of *Potamogeton*, viz., *P. fryeri* and *P. gramineus*. He found a mean stomatal frequency of 3 and 4 per sq. mm. respectively on the lower epidermis of *P. fryeri* and *P. gramineus* as compared to the values of 136 and 147 per sq. mm. for the upper surface. He also recorded a difference in the occurrence of stomata on the lower epidermis of these plants according to their habitat.

In the present study, although the author did come across stomata on the lower epidermis of the floating leaves of *A. natans*, yet their frequency was much lower than that on the upper surface as recorded for the species of *Potamogeton*. However, their number per unit area is much higher to the figures recorded by him³ (see Table I). Moreover the submerged leaves also possess stomata on the upper surface although they are absent from the lower epidermis.

Thus as regards the distribution of stomata on the lower surface of the floating leaves of aquatic plants we have three situations. To the first category belong the leaves of *Nelumbo nucifera* where the mature leaves are completely devoid of stomatal apparatus (Gupta *et al.*²); those of *Potamogeton* species have only a few of them (Shinobu³) and finally the leaves of *Aponogeton natans* which have reasonably higher number of stomata distributed even on the lower surface (present work).

According to Shinobu³ the stomata in the lower epidermis of floating leaves are functionless and are relic ancestral features and so are the stomata occurring on the upper surface of the submerged leaves. This supports the idea of Porsch⁴ that the stomata are complex structures which once acquired, irrespective of their utility, appear to become hereditarily associated with the plant organ.

These findings also have agreement with Haberlandt's⁵ proposition that stomata in aquatic plants reflect an ancestral relationship with terrestrial plants.

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MICROSPOROGENESIS AND MALE GAMETOPHYTE IN *RAUWOLFIA SERPENTINA* (L.) BENTH. EX KURZ

Rauwolfia serpentina is an important medicinal plant belonging to Apocynaceae. No information existed on the embryology of the species till recently when Lamba (1974)¹ reported its megasporogenesis and female gametophyte. Earlier, Meyer (1938)² investigated the development of pollen and embryo sac in *Rauwolfia canescens*.

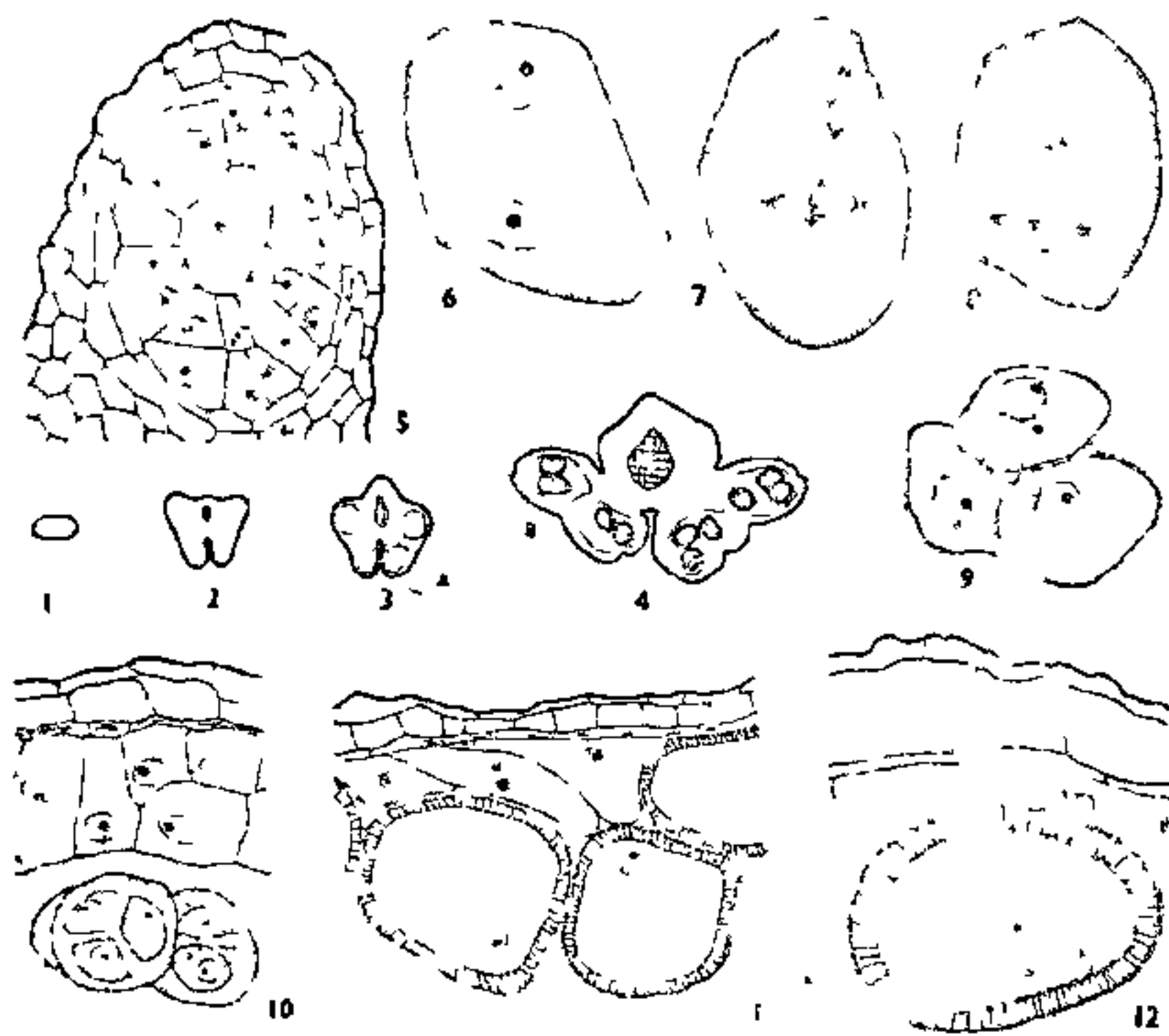
The material for the present work was collected round about Delhi. The flower buds were fixed in F.A.A. and usual embryological procedure was followed.

In transection the young microsporangium has a circular outline and is composed of homogeneous parenchymatous cells. Gradually it becomes slightly oval and 2-lobed and finally 4-lobed (Figs. 1-2). The wall of the quadrisporangiate anther consists of an epidermis, an endothecium, a middle layer and the tapetum (Figs. 3-5). The tapetal cells remain uninucleate throughout and some of them may undergo a periclinal division resulting in a 2-layered condition (Figs. 5-10). Their dense cytoplasm becomes vacuolate by the time tetrads are formed (Fig. 10). The glandular tapetum degenerates only after the pollen reaches the 2-celled stage (Fig. 12). However, Frye and Blodget (1905)³ and Anantaswamy Rau (1940)⁴ observed its collapse in some Apocynaceae soon after the separation of microspores.

As microspore mother cells prepare for meiosis (Figs. 6-8), their protoplasts recede from the original wall and a special mucilaginous wall fills this space. Divisional stages ranging from early prophase I to late telophase II may be noticed in the microsporoocytes contained in the same

microsporangium. During meiosis II the spindles may be oriented parallel or at right angles to each other (Figs. 7-8) forming isobilateral, tetrahedral (Figs. 9-10) and decussate tetrads. As the young microspores enlarge the special mucilaginous wall is consumed and the original wall of the mother cell breaks down (Fig. 9). In *Rauwolfia canescens*, Meyer (1938)² noted both successive and simultaneous divisions. However, in *R. serpentina*, the author observed only simultaneous divisions.

Due to the appearance of a vacuole the centrally situated nucleus of the richly cytoplasmic microspore is soon pushed to one side (Fig. 11). Subsequent to mitotic division in the microspore, the generative nucleus surrounded by a cytoplasmic sheath moves nearer the vegetative nucleus (Fig. 12). The mature pollen grain contains abundant starch (Fig. 12). The enlargement of the pollen grain is accompanied by the thinning of the exine. The pollen is shed at the 2-celled stage (Figs. 4-12) which is also the case in *Amsonia salicifolia* (Schnarf, 1931)⁵. Meyer (1938)² reported 3-celled condition in *Rauwolfia canescens* and some other Apocynaceae.



FIGS. 1-12.

In a mature anther the outer tangential wall of the epidermis becomes somewhat papillate. The cells of the endothecium elongate radially and develop fibrous thickenings (Fig. 12). The middle layers get flattened even before the formation of tetrads. The dehiscence of the anther is brought about by the breaking down of the thin walled cells at the junction of the pollen sacs (Fig. 4).

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CYTOLOGY OF PONGAM OIL TREE [*DERRIS INDICA* (LAMK.) BENNET]

Derris indica (Lamk.) Bennet² [Syns. *Pongamia pinnata* (Linn.) Pierre., *Pongamia glabra* Vent.] is an economically important tree growing widely upto an altitude of 1200 meters (S.L.) in tropical Asia. Pongam oil from the seeds has many medicinal and industrial uses. The reports of only the chromosome number for the species are $2n = 20$ ¹ and $n = 11$ and $2n = 22$ ^{3,4}. This communication deals with the karyotype and meiotic studies of the plant.

The seeds and flower buds were collected from different localities in Gujarat State. Following Tjio and Levan's (1950)⁶ oxyquinoline aceto-orcein squash technique, the mitotic preparations were made. The flower buds were fixed in Carnoy's fluid (6 : 3 : 1) before preparing the smears. The pollen fertility was determined by using Muntzing's mixture⁵.

The present investigation confirms the earlier reports of $n = 11$, $2n = 22$ ^{3,4}. The chromosomes within the complement can be classified into 2 categories, viz., the longer and the shorter types based on the length and ratio of the longest to the shortest pair of chromosomes. There are 5 pairs of long chromosomes (3.06μ to 3.90μ), of which 3 pairs are with nearly median and 2 pairs are with nearly sub-median centromeres. One of the 2 pairs with nearly median centromere is having a secondary constriction on the short arm. The short type of chromosomes is represented by 6 pairs (1.70μ to 2.55μ) having nearly sub-median centromeres without any secondary constriction (Figs. 1 and 1a).

Meiotic studies show the presence of 11 bivalents (Fig. 2). Frequent occurrence of abnormalities were encountered during the first and second meiotic divisions. The common abnormalities