brown with yellow tinge, ornamented with a network of crevices or striae which are dissolved in 2% KOH, uniseriate when young, later biseriate or irregularly arranged, 22–32 × 12–20 μm; paraphyses simple to branched, septate, embedded in yellow mucus.

Specimen studied: BHUPP 439, on soil, Pantnagar—Nainital road side, Leg. D.C. Pant, October 30, 1967.

Asci and ascospores, in the present specimen, are slightly larger than that described by Brummelen[1] for this species.

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EPIDERMAL STRUCTURE AND DISTRIBUTION OF STOMATA IN *APONOGETON NATANS* (L.) ENGL. AND KRAUSE

Aponogeton natans is a freshwater, floating aquatic herb of the family Aponogetonaceae which occurs rather commonly in the ponds of Northern India. The author observed a few plants growing in the mud outside the pond wherefrom the water had receded. These plants were completely aerial with their tuberous rhizomes buried in the soil. The present work was undertaken to study the distribution of stomata on the two surfaces of the aerial, floating, and submerged leaves and their correlation with the habitats to which they were exposed.

The material was fixed in FAA and subsequently stored in 70% alcohol. The epidermal peels from the upper and lower surfaces of aerial, floating and submerged leaves were taken out, stained with Delafield's hematoxylin and mounted in glycerine jelly.

In their gross morphology the aerial and floating leaves tend to be simple with a long, slender petiole. The latter usually terminates by a shallow, cordate base of the leaf. The submerged leaves on the other hand are linear lanceolate.

The aerial leaves possess polygonal epidermal cells with slightly curved walls—those of the lower epidermis being larger than the ones composing the upper tepidermis. The upper epidermal cells of the floating leaves on the other hand are elongated and smaller as compared to their counterparts on the lower surface, which are also polygonal in outline. Both the upper and lower epidermal cells in aerial leaves are smaller than those of the floating and submerged ones (Table I).

TABLE I

Frequency of epidermal cells and stomata on the upper and lower surfaces of leaves of A. natans *under various habitats*

Habitat	Surface	No. of epidermal cells per sq. mm.	Stomatal frequency per sq. mm.
Aerial	upper	2107	183
	lower	1212	21
Floating	upper	1761	179
	lower	1156	13
Submerged	upper	1740	21
	lower	1045	10

The aerial and floating leaves are amphistomatic but the frequency of stomata on the lower surface is much lower as compared to the upper (Table I). The stomata are oriented parallel to the veins. However, it is interesting to note that the stomata on the upper epidermis of the floating leaves are more regular in orientation and larger than those on the upper surface of the aerial leaves.

The cubmerged leaves possess stomata only on the upper surface. Even here the stomatal frequency is very low. Moreover, they are smaller in size as compared to those on the upper surface of aerial and floating leaves. The various types of stomatal complexes have been given in Table II following Dilcher[1].

TABLE II

Types of stomatal complex

Leaf types	Upper surface	Lower surface
Aerial	Brachyparacytic	Atinocytic
Floating	do.	do.
Submerged	do.	Stomatal complex absent

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 disorgtnized 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.

Shinobu[3] 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 him[3] (*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 (Shinobu[3]) and finally the leaves of *Aponogeton natans* which have reasonably higher number of stomata distributed even on the lower surface (present work).

According to Shinobu[3] 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 Porsch[4] 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's[5] preposition 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 microsporocytes contained in the same