

After giving off traces to the sepals, petals and stamens, the remaining stele assumes once again the form of the closed ring (figure 9). At this level a few layers of cells of the floral axis lying outside the main stele are deeply stained. From the closed ring of main stele two dorsal carpellary traces are the first to demarcate and emerge from the remaining stele, which is discerned as two lateral bands, two median lateral traces organise and traverse higher up into the ovary wall and ultimately fade away at the apex of the ovary (figures 10-17). The primary dorsal bundles run through the whole length of the style and fade away in the stigma (figures 18-22). Subsequent to the organisation of the median lateral traces, the two common ventral bundles fuse together to form a core of vascular tissue (figures 11-13). The ventral supply extends into the placenta which is fused with the the ovary wall along the anterior side. At about this level the core-like ventral tissue assumes triangular outline (figure 13). The ovule receives a massive trace from posterior angular part, while the traces given off from the other two angular zones of the vascular tissue traverse into the placenta and eventually fade away (figures 14-16) and these traces represent the supply to the suppressed ovules of the anterior carpel. The single surviving ovule, therefore, captures the vascular supply of the suppressed ovule of the posterior carpel also. The gynoeceal condition may, thus be interpreted as one derived from a 2-carpellary syncarpous 4-loculate condition with one ovule in each locule borne on anatomically parietal placenta. The pistil can, therefore, be described as pseudomonomerous.

Thus, from the foregoing description of the floral vasculature of *Phryma* and from the comparison made with existing data<sup>8</sup> it becomes apparent that in the basic plan of the flower and in essential floral anatomical features, like, 3-traced sepals, 1-traced petals and stamens, suppression of posterior stamen and its vasculature and the nature of the vascular supply to the pistil, this taxon seems to bear close similitude with some verbenaceous taxa, particularly those of the sub-family Verbenoideae. It has also a feature compatible with that of *Lantana*, *Lippia*, *Petrea* and *Stachytarpheta* in the abortiveness of anterior carpel, but may be reckoned as advanced over the aforesaid genera in having 1-loculate and 1-ovulate ovary. Further, despite its close alliance with certain of Verbenoideae, it preserves its distinctiveness in having such features, like, the reflexed fruit, traces arising independently from the main stele to the different whorls of the flowers, uniloculate and uniovulate condition of the ovary and the sub-basal ovule showing upwardly directed micropyle. From the analysis of the features of the monotypic genus *Phryma*, the impression gained is that the placement of this genus, which

manifests a separate evolutionary history from the other taxa of Verbenaceae, in a new tribe Phrymeae seems to be justified. The present study would then support the contention of earlier workers<sup>1-3,9,10</sup> in retaining *Phryma* in Verbenaceae, although Cronquist<sup>6</sup> preferred segregating it into an independent family.

The authors express grateful thanks to Professor Dr N. J. Heyden of University of Maryland, College Park, USA for supplying the fixed floral material and to Drs G Muttu Kumar, B. S. M. Dutt, B. G. S. Rao and Vastavaya S. Raju for kindly sending some of the references not accessible to the authors. RVR is obliged to Professor A. S. Rao for facilities and to CSIR, New Delhi for a fellowship.

30 April 1983.

1. Bentham, G., and Hooker, J. D., *Genera Plantarum*, 1876, 2, 1131.
2. Baillon, H., *Hist. Plant*, 1892, 11, 78.
3. Hutchinson, J., *The families of flowering plants.*, London, Vol. 1, 1959.
4. Engler, A. and Prantl, K., *Die naturlichen Pflanzenfamilien*, Leipzig, 1936.
5. Wettstein, R., *Handbuch der Systematik in der Botanik*, Wein, 4 Aufl, 1935.
6. Cronquist, A., *The evolution and classification of flowering plants*, Boston, 1968.
7. Lipscomb, H. A., *Diss. Abstr.*, 1969, B29, 4549.
8. Rao, V. S., *J. Indian Bot. Soc.*, 1952, 31, 297.
9. Thorne, R. F., *Evol. Biol.*, 1976, 9, 35.
10. Takhtajan, A. L., *Bot. Rev.*, 1980, 46, 225.

#### BREEDING BEHAVIOUR IN *PSEUDODRYNARIA CORONANS* (WALL.) CHING

S. P. SINGH AND S. K. ROY  
Centre of Advanced Study in Botany Banaras  
Hindu University, Varanasi 221 005, India.

THE reproductive mechanisms, which determine the distributional patterns of a fern taxon can be studied in their uniquely free-living, autotrophic gametophytes. A number of morphological features such as the sequence of gametangial ontogeny, their location on the gametophyte and the frequency of unisexual gametophytes influence the determination of intra-gametophytic selfing or inter-gametophytic crossing to take place in a population of gametophytes. The extent of the genetic load in the sporophyte of a fern is

dependent upon the genetic constitution of the fusing gametes and it can be a decisive factor of the breeding system of the fern in question. If the availability of the fusing partners is unconditional the distribution of the taxon would be even, but if that is conditional, the distribution of the species in the ecological niche would be limited.

Spores of *P. coronans* were surface-sterilized with 2% sodium hypochlorite solution and then uniformly sown on 25 ml of auto-clave-sterilized (15 lb/in<sup>2</sup>) inorganic nutrient medium<sup>1</sup> at pH 5.4 in petridishes and were maintained at 24 ± 2° C under continuous white fluorescent illumination at an intensity of 250 lumens ft. c. Before initiation of gametangia the gametophytes were randomly transferred to fresh agar medium into three sets of populations viz. (A) singly isolated gametophytes; (B) 25 pairs of gametophytes and (C) 15 composite cultures of gametophytes (30 gametophytes in each petriplate). These gametophytes were allowed to grow upto maturity and watered twice a week. For every kind of culture a corresponding unwatered set was maintained to note apogamy.

The spores had no dormancy period and germinated within 5 days showing 93% germinability. Antheridial and archegonial initiation started 27 and 35 days respectively after germination. Morphologically the gametophytes remained unisexual because of

protandry. Therefore, this type of gametangial sequence would eliminate the chances of selfing (intra-gametophytic) and encourage inter-gametophytic selfing and crossing.

First sporophytic leaf initiated in composite culture 65 days after germination (92.5%) followed by pair cultures (54%) and lastly on isolate (13.3%) indicating that sporophytes of *P. coronans* are heterozygous for recessive sporophytic lethals and as such, carry genetic load. In isolate cultures, sporophyte formation was delayed and was observed only after repeated watering in two samples 100 days after germination. After the experiment, some of the gametophytes, unable to show the emergence of sporophytes, showed dead embryos at different stages of abortion.

The pattern of gametangial ontogeny conferred a high probability of inter-gametophytic selfing in populations B and C. Intra-gametophytic selfing as evident from the absence of sporophyte in population A was highly impaired as a result of genetic-incompatibility between the gametes of same genetic constitution (table 2). In population A only two isolated protalli produced sporophytes after prolonged duration and after repeated watering. During this time there were numerous gametangia and many more self fertilization would also have occurred because of the gametangial development on proliferated portions of the

TABLE 1

*Sex ratio in composite culture of P. coronans.*

Days after sowing	Sample size	Sterile	Male	Female	Hermaphrodite
35	30	22	—	8	—
40	30	14	2	10	4
45	30	1	5	12	12
50	30	—	3	2	25

TABLE 2

*Breeding test for hybridization of P. coronans. Percentage of sporophyte formation in isolate, pair and composite cultures.*

Sex expression	Population	No. of gametophytes studied	No. of gametophytes produced	Percentage of gametophytes producing sporophytes
Male to Hermaphrodite	Isolate (15 samples)	15	2	13.3
	Paired (25 samples)	50	27	54
	Composite (30 gametophytes) 15 samples.	450	416	92.5

gametophytes. Klekowski<sup>2</sup> described such cases as the consequence of leaky lethals in *Osmunda regalis*. But such is not the case in our material under the experimental condition permitted. It may be that during the prolonged life of a few prothalli which passed into the secondary stage of reproduction by adventitious proliferation of gametophytic branches the probability of the production of a mutant gamete would be significant on the numerical strength of gametes produced. With such a mutant gamete having altered lethality the chances of the lethal genes to become homozygous would lessen thereby encouraging the formation of the sporophyte under exceptional cases. At any rate, such sporophytes would also be heterozygous and therefore the plants would continue to prefer cross-breeding. In such conditions an even distribution of the members of the species under any ecological niche cannot be expected.

Financial assistance by UGC to SPS is gratefully acknowledged.

2 March 1983; Revised 31 May 1983.

1. Klekowski, E. J. Jr., *Bot. J. Linn. Soc.*, 1969, 62, 347.
2. Klekowski, E. J. Jr., *Am. J. Bot.*, 1973, 60, 146.

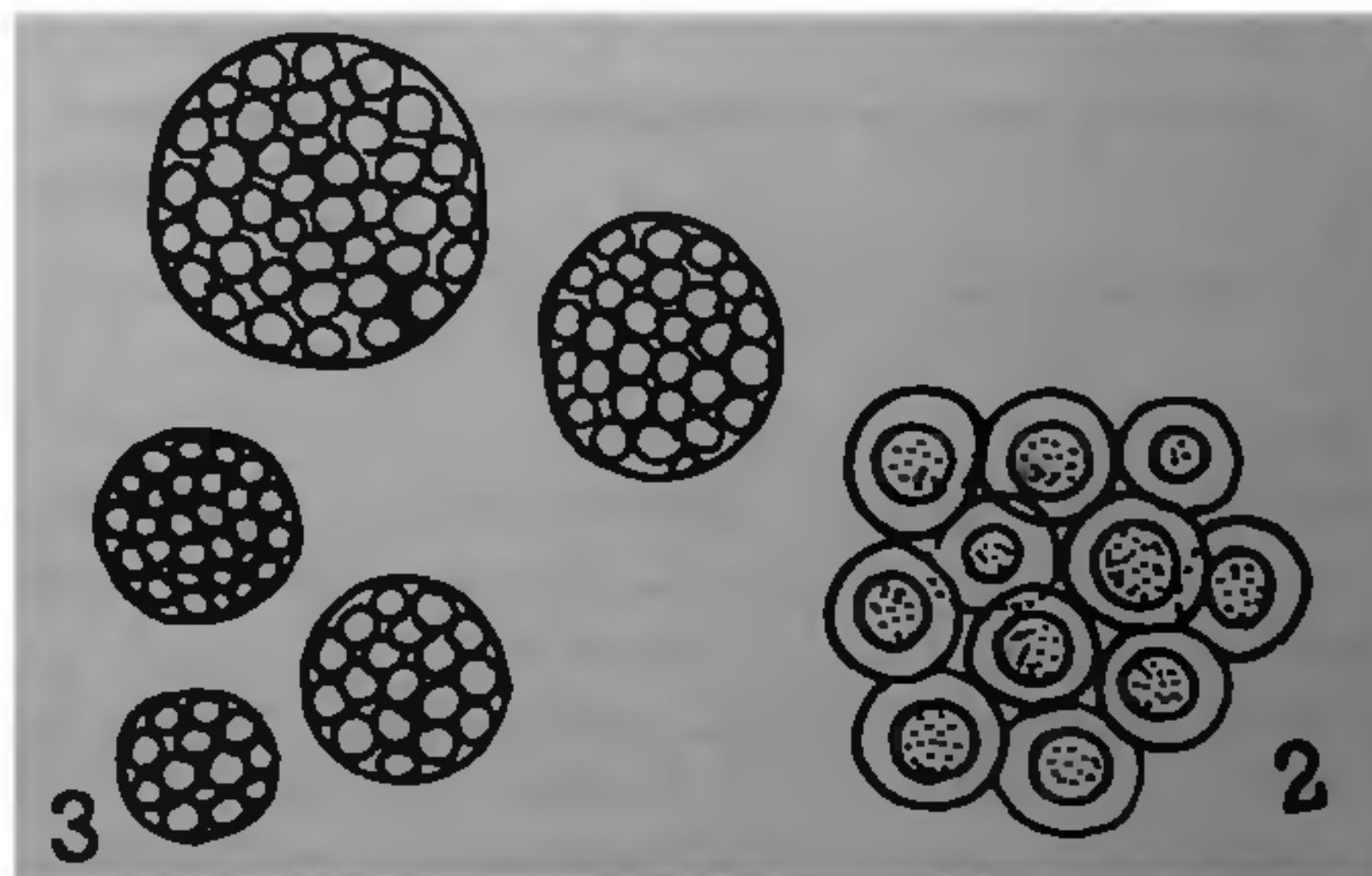
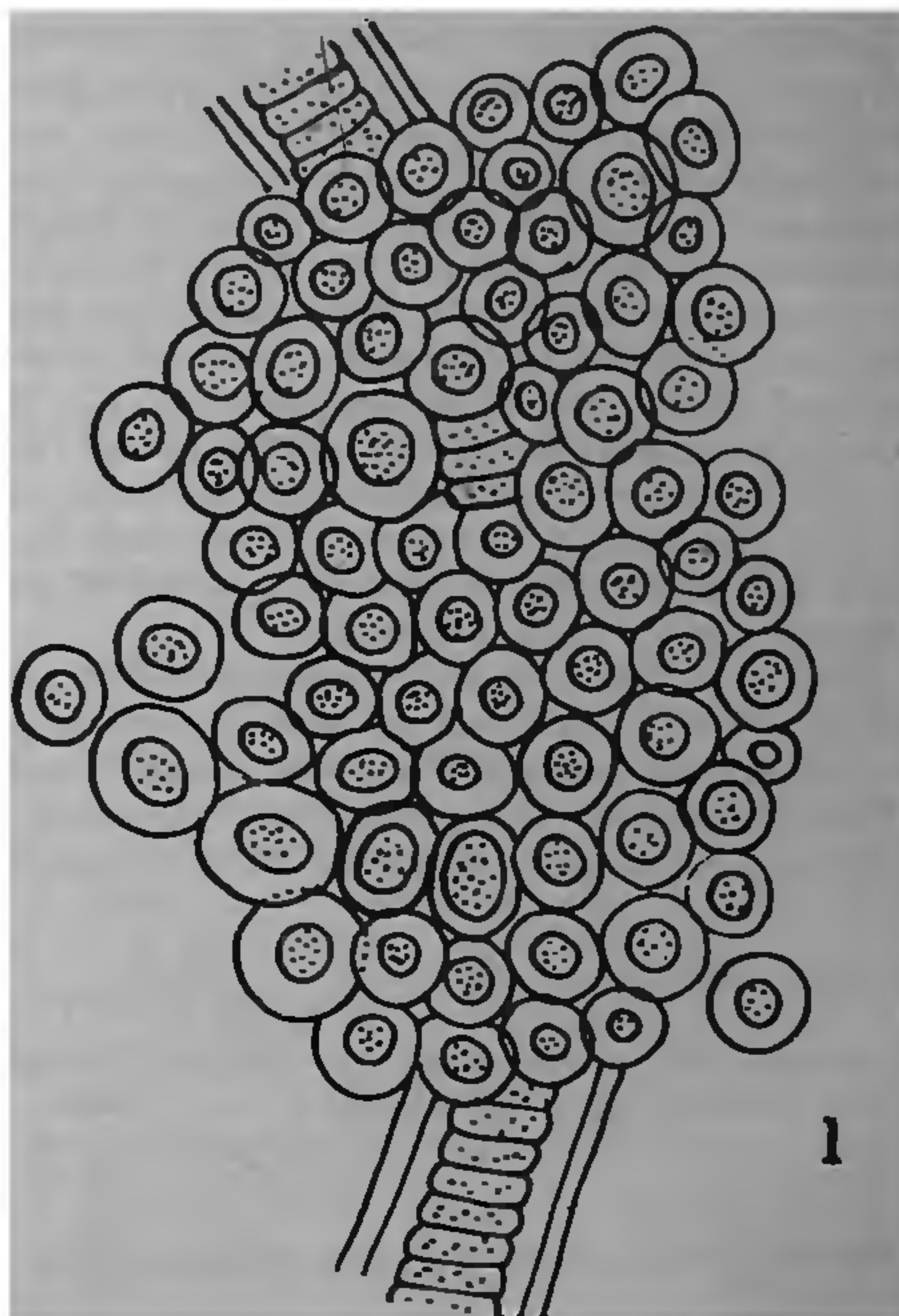
**XENOCOCCUS SCHOUSBOEI THURET  
(PLEUROCAPSALES, CYANOPHYTA) FROM  
INDIA**

MADHU SENGAR AND D. C. PANDEY  
Botany Department, University of Allahabad,  
Allahabad 211 002, India.

THE occurrence of blue-green alga *Xenococcus schousboei* Thuret, a member of the order Pleurocapsales Geitler, (Cyanophyta), has not been reported from India<sup>1,2</sup>. During the course of a survey of some interesting forms of algae from the environment of Allahabad, the authors came across this interesting colonial blue-green alga viz *X. schousboei* Thuret from a cemented pond at the Sarojini Naidu Hostel, University of Allahabad. The alga was kept in culture for over a year in 1982 and the characters mentioned below were found to be constant.

The alga *X. schousboei* grew as epiphyte on another blue-green alga viz *Lyngbya* sp. (figures 1 & 2). The colonies are spherical solitary and scattered or grouped in confluent masses forming a pseudoparenchymatous, one celled layer, later becoming several cells in thickness, which completely covered the

filament of *Lyngbya* sp. The cells are 4-8  $\mu$ m in diameter, spherical or flattened and cell contents light bluish green in colour. Reproduction by cell division in three planes or by means of Endospores developed in large peripheral cells (figure 3). Endospores are usually spherical and vary in number up to 32 in a mature colony.



Figures 1-3. *X. schousboei* Thuret. 1. Epiphytic nature, 2. showing individual cells, 3. showing endospore forming cells ( $\times 800$ ).