Commentary

M O P Iyengar (1886–1963)

Professor M O P Iyengar (figure 1) served a major part of his life teaching at the Presidency College, Madras, and the last dozen years as Professor at the new established University Research Laboratory also at Madras (now Chennai). After retirement he was provided with facilities to work at home and he did so till the end. Iyengar aimed to obtain a comprehensive knowledge of India's algal wealth, its diversity and ecology. Teaching and research had to be oriented towards understanding our algae: their morphology, reproductive features, ecology and so on. Before Iyengar's time, we lacked working models of algae found and studied here. We depended on those that did not belong to our environment and whose biological features were not known to us. Our knowledge of Indian algal flora was minimal. It depended solely on the contributions of a few travellers, where primary base was outside India.

Chennai was and is well served by a variety of aquatic situations. In Iyengar's time it offered suitable sites for algal hunting – a long beach front, beach pools, agricultural fields, irrigation ponds

Figure 1. M O P Iyengar (1886–1963).

and so on. With the arrival of the monsoons these get filled up with freshwater and become regenerated. Beach pools support a good algal growth, especially unicellular algae, Volvocales, oftentimes as a monoculture. These finish a life cycle in a few days' existence. Algae reproduce and dry up with a production of a large number of zygotes, giving the sand a brown colouration. With intermittent precipitation, a couple of such cycles occur during a season and provide enough material for study. Bigger ponds and reservoirs of similar temporary nature may support other algal forms. Iyengar studied these temporary pools all through his active life and recorded many new species and their life cycles. The habitats have a longer life, show a succession of species and end up with flagellates or with blue-green algae. In high altitudes, the species are different have longer lives and even develop blooms. Such habitats were regularly visited, and the algae studied, during mid-term college holidays. Thus Iyengar was provided by nature with a continued harvest of good material and a variety of organisms.

Iyengar's earlier studies began with the Volvocales and these provided the material for his publications, both from Madras and from Professor Fritsch's laboratory in London. At the University research department, as a Professor and Director, he was joined by full-time research scholars. Many in-depth studies of the colonial Volvocales resulted during this period. Their work revealed the occurrence of singular patterns of inversion both in the vegetative and reproductive stages of development among the spherical or globular genera. The fertization stages were also recorded.

Iyengar studied the lower green algae which were all then included in the Volvocales. A pseudofilamentous alga, *Ecballocystopsis* Iyengar (figure 2), led him to conceive of a new way of developing a filamentous condition, a step in the development of a multicellular condition. The two sibling cells do not separate from each other as in unicellular Volvocales though each gets enveloped in a complete cell wall. They remain enclosed in the remnants of the parental envelope partially or totally. With further divisions, parental envelopes of different generations begin to get ruptured but the daughter cells are kept together by fragments of parental envelopes of the immediate previous generation. The upshot is a linear, end-to-end association of daughter cells of many generations but without any organic continuity (like protoplasmic connections) between the neighbouring cells. Instead of producing a mass of cells, a multicellular condition is arrived, a pseudofilamentous condition. The objective was to understand the morphological steps representing the probable evolutionary steps to achieve a multicellular organism and ultimately the structural framework to achieve a land habit. The alga is known to occur in one other locality in India only. Iyengar described another interesting alga from India, *Fritschiella* (figure 3), which show a heterotrichous habit, one part of the body being subterranean and one part, aerial.

The same type of strange colonial association is seen in a few other pseudofilamentous genera. In these, the shape of the cells and the structure of and manner of holding by the parental cell-wall fragments differ. In one genus, named *Gilbertsmithia* Iyengar (figure 4), the eight daughter cells formed from each parent cell take on the shape of a rosary. The eight are attached to each other by eight fragments of the parent cell. In the next generation a compound of the eight rosaries is formed. Iyengar waited many years to see the complete life cycle of his favourite organism, sometimes in vain. Many years later Prof. Smith visited India and saw it. These species constitute the floral components of an unusual habitat, and are called muddy water algae. Thus a palmelloid association is made up of partial remnants of parent walls and mucilage derived by gelatinization of portions of the parent wall. This was earlier postulated by Smith as a step towards the development of a multicellular organization. A similar interest was developed in studying another alga which probably had a general layout of cells as we see in Volvox, a spherical motile organism with the cells arranged around the balloon's periphery. But it lacked flagella. The cells had a multinucleate condition but had also some certain primitive characteristics such has vacuoles seen in Volvocales.

Pioneers working in unexplored lands have great awards awaiting them and algae are no exception to this. Those days algae were sent to Iyengar for studying. *Characiosiphon* Iyengar (figure 5) is a hollow club-shaped alga, a coenocytic cell, first collected and sent to Prof. Iyengar by a preacher–teacher, Rev. Fr. Rapinat of St. Joseph's College, Tiruchirapalli. It attained a size of up to two cm height and was studied for its life history. The alga is known to occur in a few other localities in India. But now it is cultured in the USA owing to the interest taken by Prof. Starr, of the University of Texas at Austin, who studied many Iyengarian species of Volvocales for their life histories. Fritsch

came to India on an invitation for participating in a Symposium on Algal problems and for lecturing at the University of Madras. The alga seemed peculiar to him and to enable him to study it in a living condition, specimens were brought to Trichy and shown while he was there on his way to Pamban for studying marine algae. Prof. Fritsch was Iyengar's guide for Algal studies at London.

An active teacher all his life, Iyengar had acquired a reputation for the credibility for his observations and it was hazardous to contradict him. No wonder, because he was reticent to publish in a hurry. He would wait, often endlessly, to study rare algae with their peculiar and important charac-

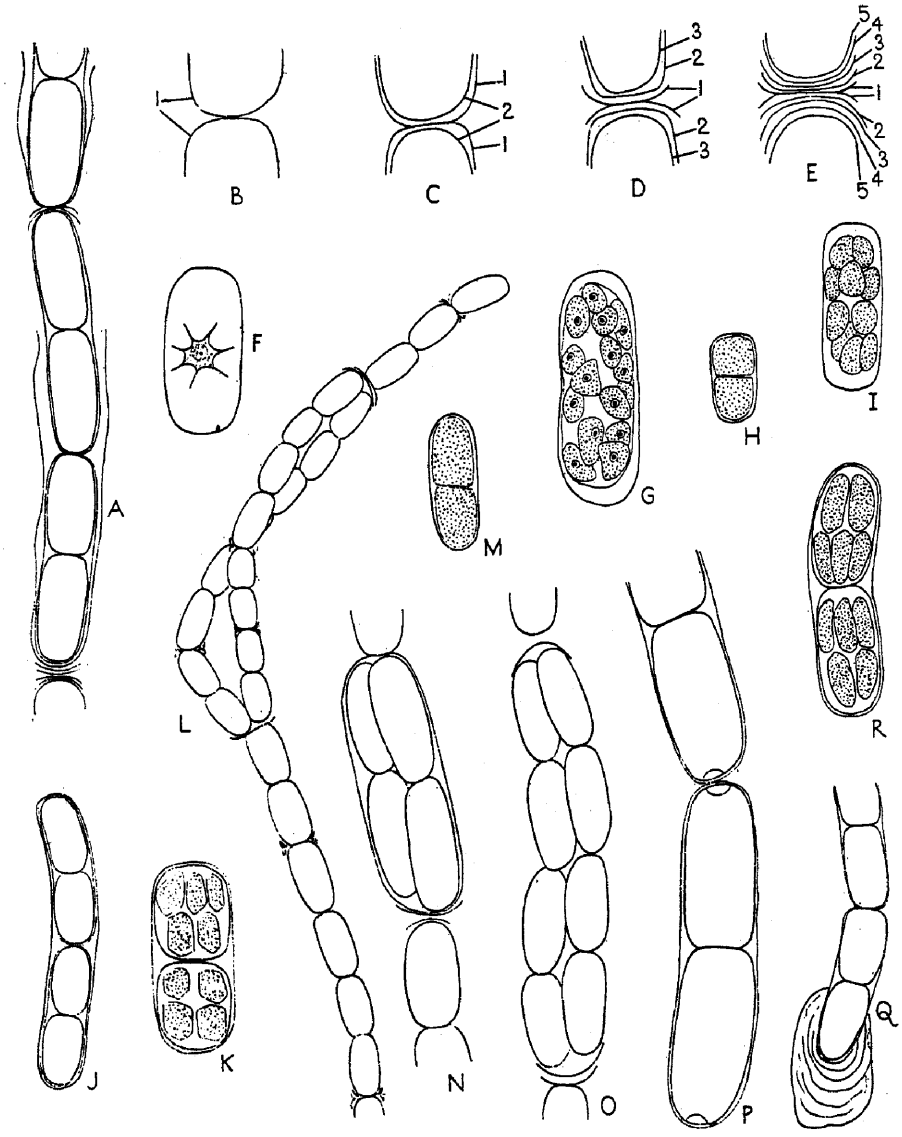

Figure 2. *Ecballocystopsis indica* sp. nov. (**A**) portion of filament showing the rupture of the wall of an earlier generation towards the top; (**B**–**E**) accumulation of end-pieces of walls of successive generations; (**F**) cell with nucleus, chloroplasts omitted; (**G**) cell with chloroplasts and pyrenoids; (**H**, **M**) division of protoplast; (**G**, **I**, **K**, **R**) cells with chloroplasts; (**J**) intact wall enclosing four cells belonging to two successive generations; (**L**) filament showing loop-formation; (**N**) division into four; (**O**) beginning of loop-formation as a result of cell-division into four; (**P**) cells showing nodular thickening of wall; (**Q**) base of filament with adhesive gelatinous pad. **A**, **M**, **J**, **Q** × 450; **B**–**G**, **I**, **K**, **N** × 890; **H**, **O** × 570; **L** × 295; **P**, **R** × 910. (*Ann. Bot*. 1933, vol. 47, p. 23).

teristics before publishing. Sometimes it happened that manuscripts would be sent to him for comments and in such instances he would send back his original observations and drawings to be utilized by the authors. This had other fallouts. He left behind a great deal of unpublished observations and drawings of very many new and rare algae. Volvocales covered about thousand printed pages in his posthumous publications. Iyengar was closely associated with the Indian Botanical Society from its inception and all his papers were published, after his return to India, in Indian journals.

Iyengar's interests covered other algae too. Many genera, representatives of other Orders of green algae, have been studied for structure, cytology, reproduction and taxonomy. He had collected marine algae from the southern coasts of India. He believed that a good knowledge of the taxonomy of the algal group is a prerequisite for any research. He was a generous person. He gave a good collection of blue-green algae from South India to Prof. Bharadwaja while he was doing his doctoral work with Prof. Fritsch. When I joined him in 1940 for research on blue green algae, he handed over to me a set collections he had made of these algae and a good taxonomic treatise as beginning tools. To obtain a basic knowledge of the native marine algal flora he made over his herbarium specimens and formalin preserved material to Dr F Boergesen for study. But he retained the marine green algae in his portfolio. Boergesen's publications and his herbarium sheets laid the foundation for Indian studies. All his herbarium sheets together with a set of Boergesen's own Indian collections were handed over to the Madras University and have now been enriched by collections from many other shores. His library was also donated to the Madras University Botany Department.

The educational needs on the subject, as was also felt at the beginning of the last century, have not been well addressed. Our knowledge of the Algal flora of India is largely based on studies from the peninsular part.

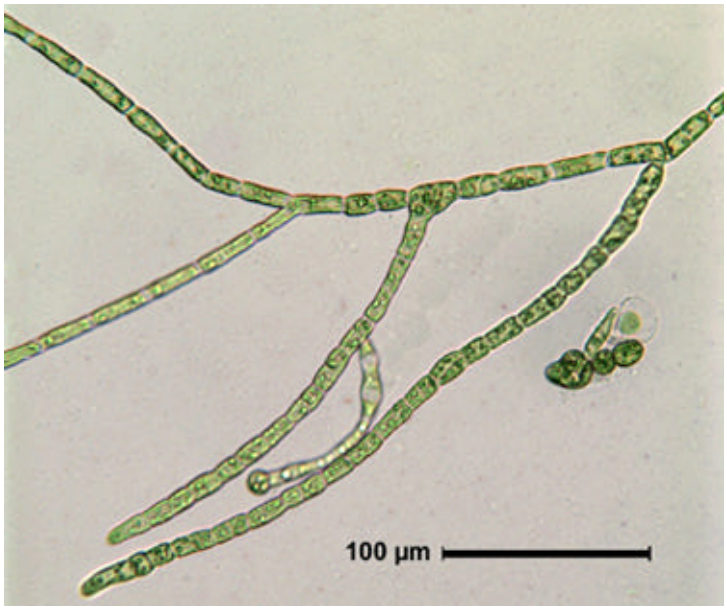

Figure 3. *Fritschiella* Iyengar, named for the British phycologist Felix Eugen Fritsch. The green thallus of *Fritschiella* has upright branches of uniseriate filaments, prostrate regions of tissue-like filaments, and colourless rhizoids that extend below the soil surface. The upright filaments are tufted and irregularly branched with cells that become increasingly elongated and conical towards the apex of the branch. The end cells lack caps. Each cell growing above ground has a single parietal chloroplast with several pyrenoids. These morphological features are an example of a parallel evolutionary adaptation to terrestrial life with the land plants. The flagellated reproductive cells show that *Fritschiella* is in fact closely related to the chlorophyte green algae, rather than to other green algae that gave rise to land plants.

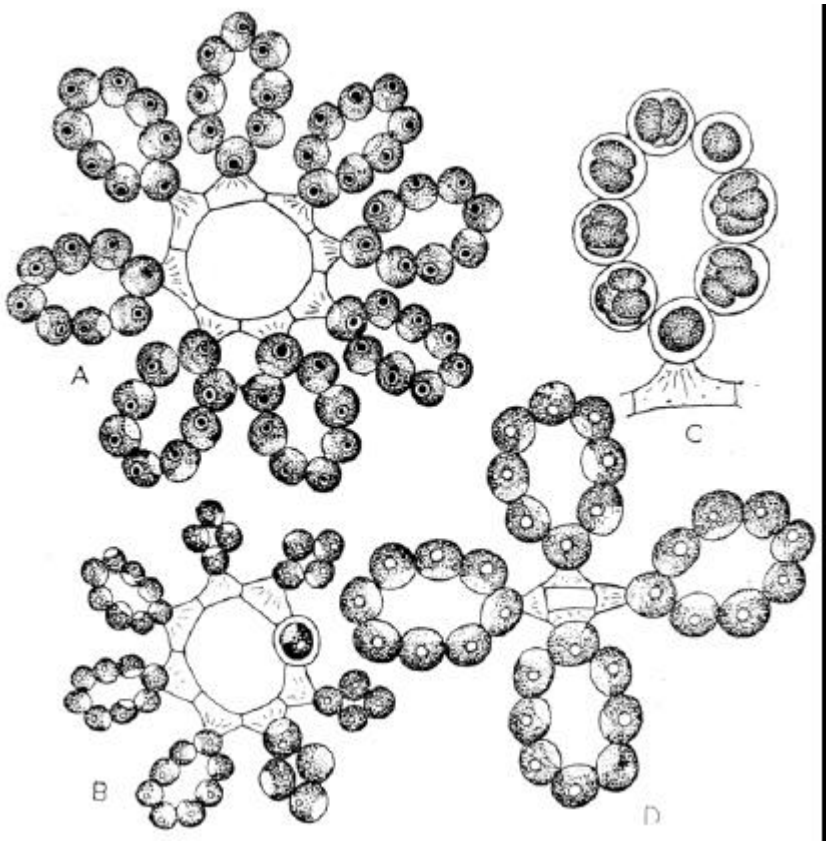

Figure 4. *Gilbertsmithia grandis* Iyengar gen. et sp. nov. (all after Iyengar) (all, × 130). (*Proc. Indian Acad. Sci*. 1975, vol. 81B, p. 46).

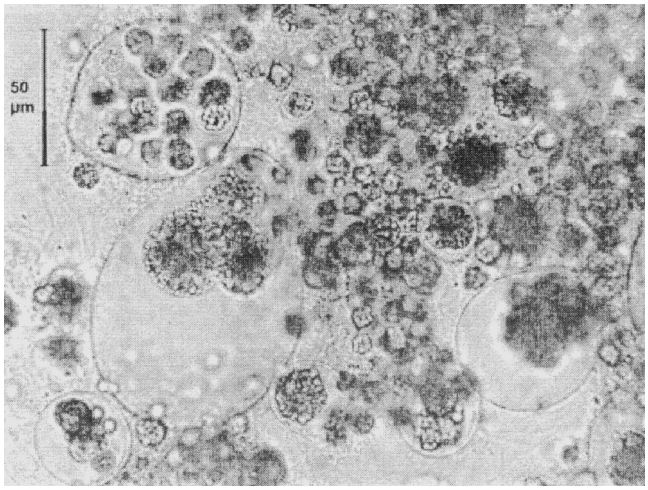

Figure 5. *Characiosiphon* is multinucleate and coenocytic, meaning that the thallus has no transverse cell walls and is siphonaceous. This green alga is found in freshwater habitats. *Characiosiphon* has a similar life cycle to *Protosiphon* but is larger, has multiple discoid plastids, and dwells in aquatic habitats rather than the damp soils or muddy banks where *Protosiphon* is found. *Characiosiphon* reproduces through zoospore production.

Iyengar's contributions came from a relatively small area. Large tracts of our country, north, south, east or west; high or low; aquatic or subaerial; freshwater or marine; thermal or cold water need our attention. The discovery of rare and interesting specimens and the results of their study by Iyengar and others indicate great scope for further studies.

Major parts of our land remain to be investigated. The islands belonging to India have to be studied before any efforts to understand how the global temperature changes affect our lands. Such changes probably affect aquatic situations and their fragile biota, and some may disappear even before we know what exists and where. The need is urgent. For studies in plant biodiversity, herbaria and literature are the basic needs. Every major country has large institutions which have these facilities. If we have to fill this void our nation has to take quick and extensive action. We have a well known Botanical Survey. But for some reason or the other repeated efforts to extend the same facilities to 'Algae' have come to naught and we do not have a National herbarium for algae in India. By writing about this I hope I may serve to initiate some action.

Reference

T V Desikachary 1968 Mandyam Osuri Parthasarathy Iyengar (1886–1963); *Biographical Memoirs of Fellows of the Indian National Science Academy*, No. 7, pp 12–21

T V DESIKACHARY
67, Palm Beach Drive,
Patterson Lakes,
Victoria 3197, Australia