# CONTRIBUTIONS TO OUR KNOWLEDGE OF SOUTH INDIAN ALGAE—V*

BY M. O. P. IYENGAR†

Received July 9, 1973

(Communicated by Prof. T. V. Desikachary, F.A.SC.)

***Apiocystis globosa* Korch.** (Figs. 1–4)

(*A. brauniana* var. *caput-medusae* Bohl.)

[*A. caput-medusae* (Bohl.) Korsch.]

COLONY globose, with a short narrow or broad attachment, 8–32 celled; cells spherical; each cell with two pseudocilia, pseudocilia distinctly projecting outside, external portion of the pseudocilia with discernible sheath; chloroplast cup-shaped, massive with a pyrenoid; contractive vacuoles two, anterior.

Habitat: Epiphytic on other algae, in a pool, Madras; in a paddy field, Madras (leg. K. R. Ramanathan, 2-1-1941).

Colony 70–77 $\mu$ diameter, cells about 8·5 $\mu$ broad and 10·0 $\mu$ long, pseudocilia up to 52·5 $\mu$ long.

This form does not have a long stalk so distinctive of *Apiocystis brauniana* Näg., and has shorter pseudocilia and more cells per colony. This alga was originally described as *A. brauniana* Näg. (Iyengar, 1960, p. 395).

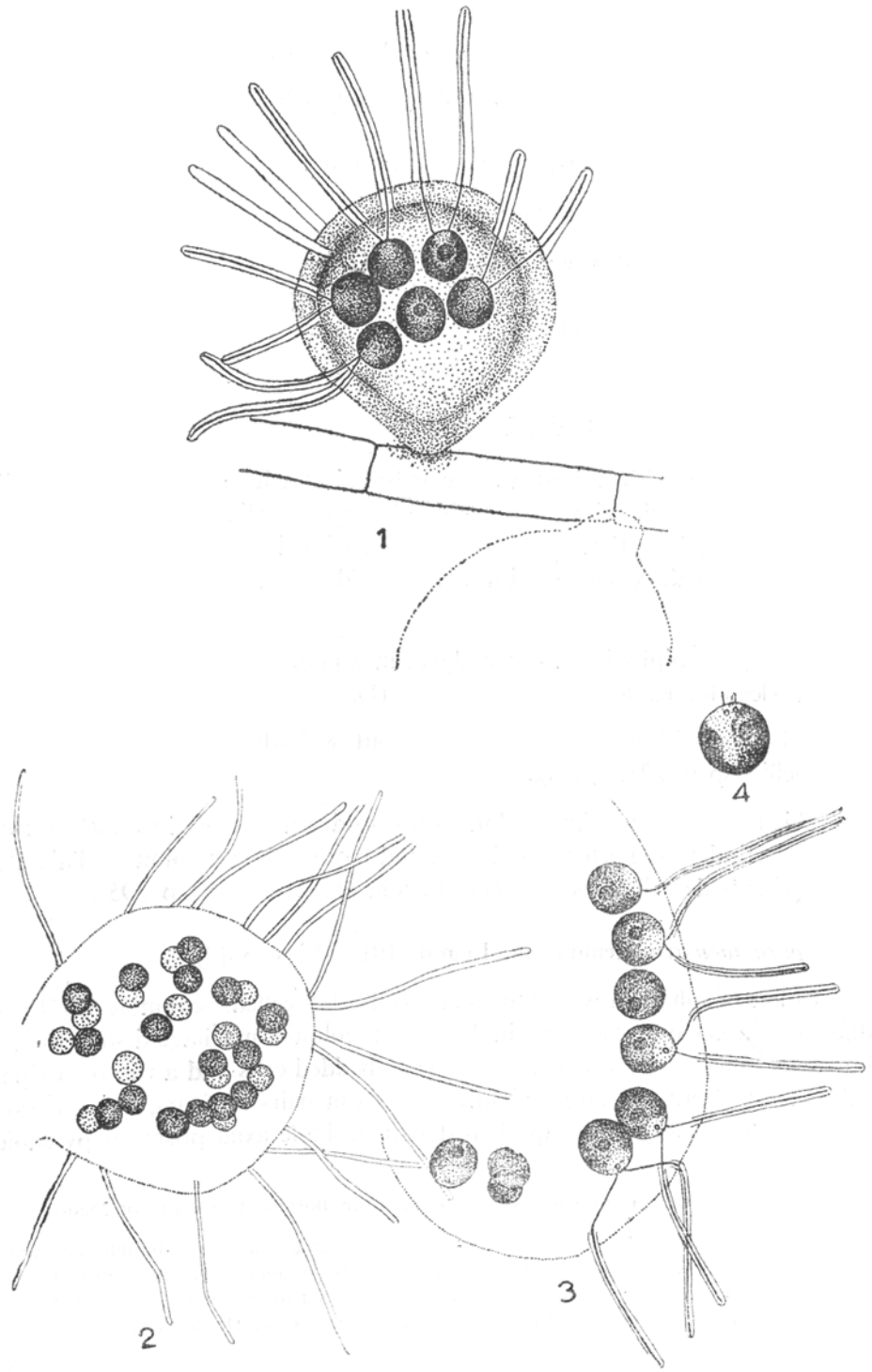
***Tetraspora lacustris* Lemm. em. Lemm.** 1915 (Figs. 5–13)

Colonies spherical with 4 to many cells, 4–8 celled, colonies 30–51 $\mu$ in diameter, larger ones 50–270 $\mu$ in diameter; colonial mucilage distinguishable into two zones, a central zone with the embedded cells and a rim or peripheral zone of about 12–20 $\mu$ thickness; cells in pairs or fours, 6–9 (–12·8) $\mu$ in diameter; chloroplast cup-shaped with a single axial posterior pyrenoid;

---

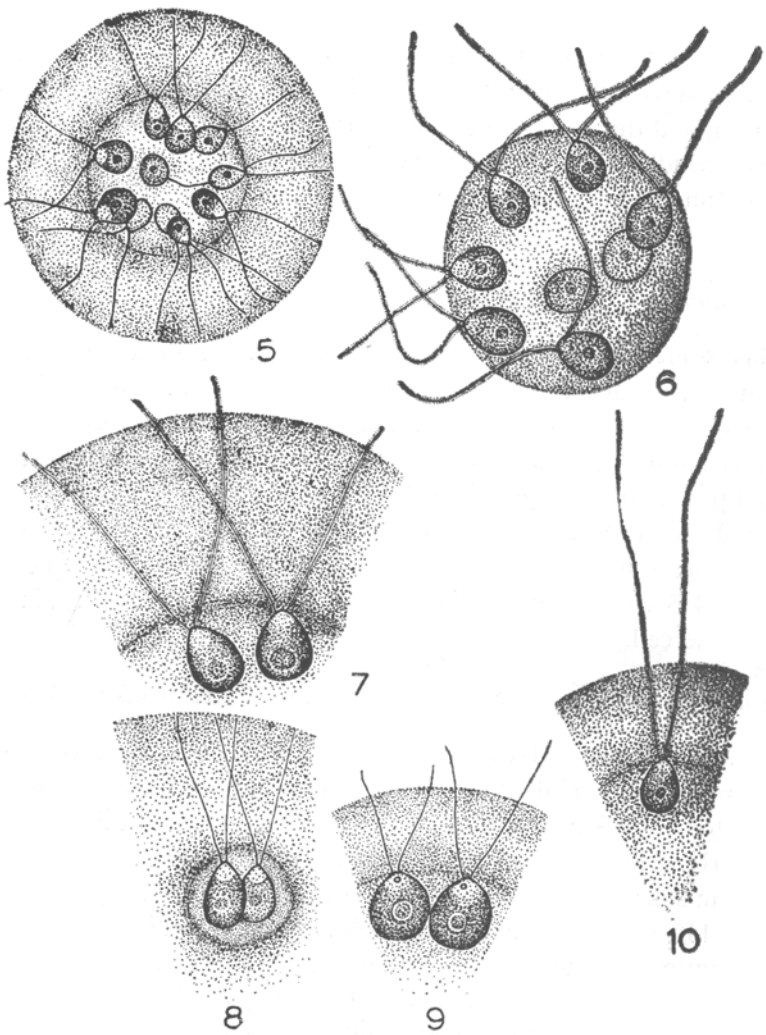
* Memoir No. 163, Centre for Advanced Study in Botany, University of Madras.

† The late Professor M. O. P. Iyengar left behind a large amount of unpublished material. According to his desire these are being published as Contributions. It has been an embarassing duty for me. Aware of my limitations, I have endeavoured to present his observations to the best of my abilities. I crave forgiveness for my mistakes.—T. V. Desikachary.




FIGS. 1–4. *Apiocystis globosa* Korsch. Fig. 1. From a pool, Madras. Figs. 2–4. From a paddy field. Fig. 4. Showing a cell drawn enlarged with a lateral pyrenoid. (Fig. 1, × 1,600; Fig. 2, × 1,100; Fig. 3, × 1,500; Fig. 4, × 2,000.)

contractile vacuoles 2, anterior; pseudocilia 2, long in mature colonies with often 2/3 of their length protruding outside the mucilaginous limits of the colony, external portion often conspicuous with a clear outer thick sheath, 20–56 $\mu$ long.




FIGS. 5–10. *Tetraspora lacustris* Lemm. em. Lemm. Fig. 8. From Bannerghatta and the rest from Lalbagh. (Fig. 5, ×, 700; Figs. 6, 7, 9, × 1,500; Fig. 8, × 1,600; Fig. 10, × 1,100.)

*Habitat*: Fountain opposite glass house, Lalbagh, Bangalore (22–3–1952; 23–3–1952); pool on the way to Bannerghatta near Bangalore (13–1–1950).

The presence of a distinguishable sheath on the distal external portion of the pseudocilia is known in *Apiocystis*. The presence of fibrillar sheath is known in *Tetraspora* and is confirmed by electron microscope studies (*see* Herndon and Philpott, 1960; Lembi and Herndon, 1967; Rhodes and Stofan, 1967).

This alga agrees generally with *Tetraspora lacustris*, which has attracted a lot of attention recently (*see* Lund, 1956, p. 598). Inasmuch as Lemmermann has himself figured this species, though latter, as having pseudocilia we should accept this emended state (Lemmermann, 1915) and consider it a pseudociliate form and not a palmellate alga as has been considered by later workers (*see* Teiling, 1946).

***Tetraspora vandalurense* Iyengar sp. nov.** (Figs. 14–24)

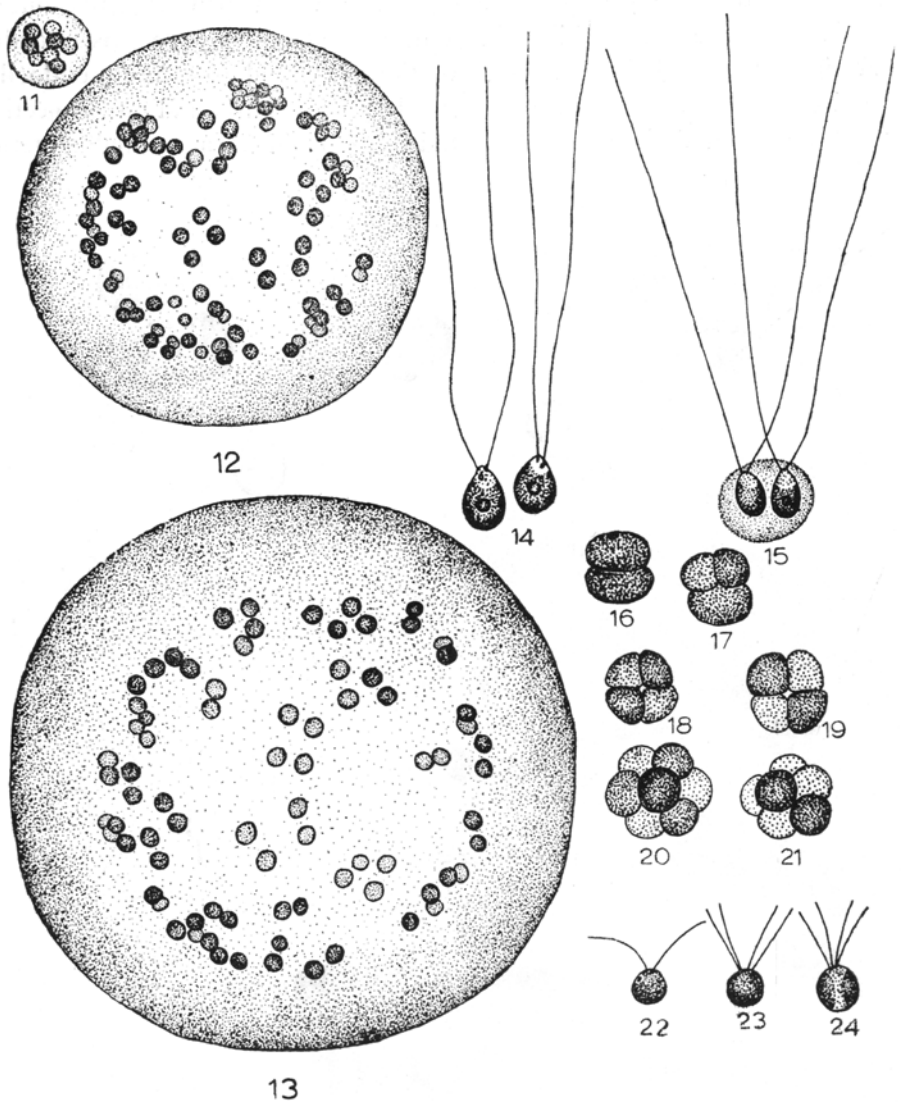
Thallus somewhat cylindrical, really flat and unrolled, elongate, very much branched; cells nearly ovate, with a narrow anterior and broadly rounded posterior, 6·6 – 9·5 $\mu$ broad and 9·5–15 $\mu$ long; cells with special individual envelopes around pairs of cells; chloroplast cup-shaped with a single basal pyrenoid; two pseudocilia for each cell, very long up to 95–110 $\mu$ long; cell division longitudinal forming 2–4 cells; swarmer formation observed, gametes isogamous, 2–4 or 8 formed in each cell; spherical or subspherical, 4–5 $\mu$ diam., biflagellated, each with an eyespot, flagella slightly longer than the cell.

*Habitat*: Growing attached to water plants, Vandalur lake, (11–1–1958)

Thallus aliquantum cylindricalis, revera planus non plicatus, elongatus et valde ramificatus; cellulae fere ovatae, cum anteriore arcto et posteriore late rotundato, 6·6–9·5 $\mu$ latitudinis et 9·5–15 $\mu$ longitudinis; cellulae cum involucris specialibus individuis circum cellulas binas; chloroplastus cupulatus cum solo pyrenoide basali; duo pseudocilia pro unaquaque cellula, usque ad 95–110 $\mu$ longitudinis; divisio cellularum longitudinalis formans 2–4 cellulas, formatio gametae observata, gametae 2, 4, 8 formatae in unaquaque, cellula; fere sphericales vel subsphericales, 4–5 $\mu$ diametri, biflagellatae, unaquaque cum stigmate, flagella aliquantum longiora cellulis, isogama.

*Type*: Figs. 14–15

Cell division was initiated in the evenings around 8 p.m. in material that was brought to the laboratory for observation. Actual liberation and fusion of gametes were observed in the morning between 7 a.m. and 10 a.m.

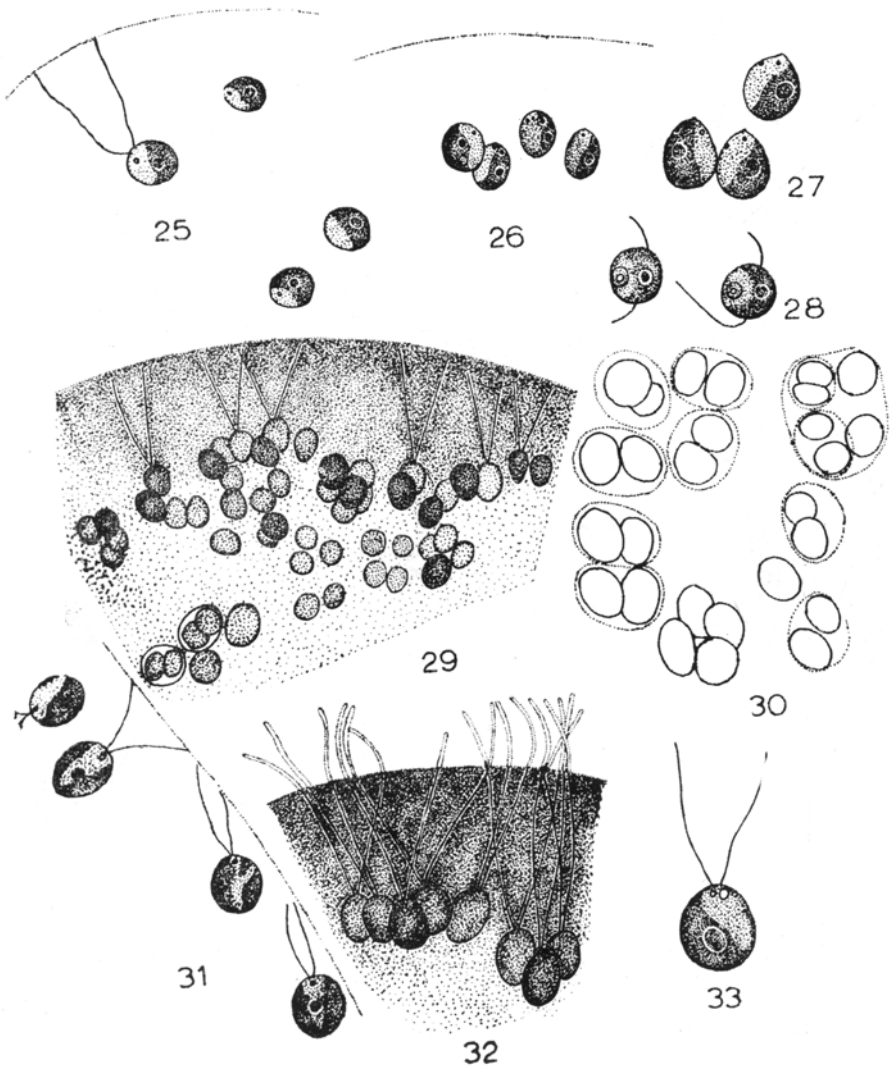



FIGS. 11–24. Figs. 11–13. *Tetraspora lacustris* from Lalbagh. Figs. 14–24. *Tetraspora vandalurense* Iyengar sp. nov.: Figs. 16–21. Cell division preceding swarmer formation; Fig. 22. gamete; Figs.2 3–24. Planozygotes. (Figs. 11, 12, × 385; Fig. 13, × 500; Figs. 14–21, × 1,050: Figs. 22–24, × 1,500.)

***Tetraspora laterale* Iyengar and Ramanathan sp. nov.** (Figs. 25–28)

Thallus microscopic, more or less round, attached to water plants, 280–370 $\mu$ in diameter with a large number of cells arranged near the periphery:

gelatinous matrix homogeneous, but limited by a thin firm refractive outermost layer, somewhat reddish in nature; cells with two pseudocilia, pseudocilia up to 3–4 times as long as the cells, end of the pseudocilia embedded in the outermost layer of the gelatinous matrix and not projecting beyond the colonial limits; cells rounded to ovoid with a small anterior




FIGS. 25–33. Figs. 25–28. *Tetraspora laterale* Iyengar and Ramanathan sp. nov. Figs. 25–27. Cells showing structure and pseudocilia. Fig. 28. Cell in polar view showing the chloroplast in sectional view. Figs. 29–33. *Tetraspora risoensis* Ramanathan sp. nov. (Figs. 25, 26, 30, 31, × 1,500; Figs. 27, 28, 33, × 2,100; Fig. 29, × 750; Fig. 32, × 1,100.)

papilla, often slightly longer than broad, 5·3–6·7 (–11) $\mu$ broad and 6·7–8·7 $\mu$ long; chloroplast cup-shaped, often situated obliquely or even laterally; pyrenoid single, lateral; contractile vacuoles two, anterior; eyespot extremely minute, near the anterior end.

Thallus microscopicus, plus minusive rotundus, affixus plantis aquaticus, 280 - 370 $\mu$ in diametro cum magno numero cellularum, collocatarum propissime peripheriae; matrix gelatinosa homogenea sed limitata strato exteriorissimeo tenui firma refractiva, aliquantum rubri coloris; cellulae cum duobus pseudociliis, pseudocilium ad fer vel quater longius quam cellulae, extremitas pseudocilii inclusa in extimo strato matricis gelatinosae et non emergens extra limitas coloniales; cellulae rotundatae vel ovoideae cum parva papilla anterior, saepe leviter longiores potius quam latae, 5·3–6·7 (–11) $\mu$ latae et 6·7–8·7 $\mu$ longae; chloroplastus cupulatus saepe situs oblique vel lateraliter quidam; pyrenoides singularis lateralis; vacuoli contractiles duo, anteriores; stigma maxime minutum prope terminum anteriorem.

*Habitat*: Growing attached to leaf bases of old paddy leaves inside the water, paddy fields, Madras (24–11–1939).

*Type*: Figs. 25–28.

Colony has a free border in which the cells are not seen but pseudocilia project from inside. The border is 21–25 $\mu$ broad. The mucilage is reddish-brown. The outermost layer of the mucilaginous matrix looks somewhat firm and refractive. Each cell is ovoid and possesses two pseudocilia which end in the outermost firm layer of the colonial matrix. It does not project beyond the periphery of the colony. Chloroplast is bell-shaped in some and in others it is obliquely placed with the pyrenoid situated slig tly laterally. In this position the chloroplast appears somewhat laminate. There are two contractile vacuoles in the anterior end which appears slightly beaked. There is an extremely small eyespot at the anterior end. It looks slightly roundish and can be seen only in high magnifications. There is a small papilla seen clearly after treatment with dilute iodine.

The alga comes near *T. lacustris* in the size of the cells and the colony. But differs from the latter in being not a planktonic form and in being an attached form. The cells in the present alga are ovate and not rounded as in *T. lacustris*. *T. laterale* differs from all other species in the chloroplast. The chloroplast is not really bell-shaped but laminate either placed basally

or laterally with a lateral pyrenoid. The presence of a small papilla and a small eyespot are other distinguishing features of the new species.

Ramanathan collected another species which appears to be new and is included here. He sent this material for a comparative study.

***Tetraspora risoensis* Ramanathan sp. nov.** (Figs. 29–33)

Colonies spherical, free floating, 300–630 $\mu$ diameter; cells many, ovate and somewhat longer than broad, 6·7–8·34 (–10·0) $\mu$ broad and 8·4–10·0 $\mu$ long with a cup-shaped chloroplast and a lateral pyrenoid; not papillate; 2 pseudocilia per cell, not projecting outside or only a little portion of extruded sheath projecting outside, short 13–36 $\mu$ long; eyespot absent.

Coloniae sphericales libere natantes, 300–630 $\mu$ diametri, multae cellulae, ovatae, paulo longiores quam latae, 6·7–8·4(–10·0) $\mu$ latae et 8·4–10·0 $\mu$ longae, cum chloroplasto cupulato et pyrenoide laterali nonpapillatae 2 pseudociliae per cellulum, vel non protrudentia vel solum parva pars vaginarum projectarum protrudens ad extra brevia, 13–36 $\mu$ longa; stigma abest.

*Habitat*: Floating in paddy fields, Adyar, Madras (24–12–1940).

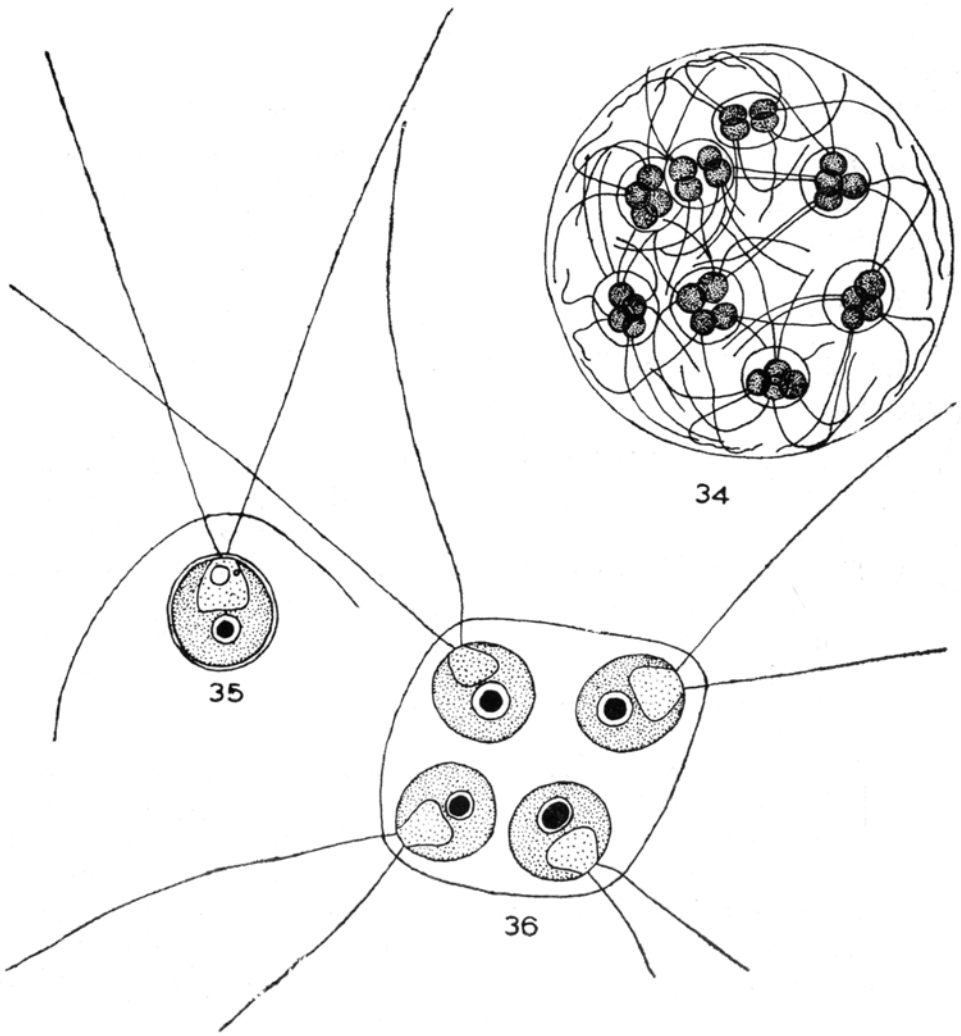
*Type*: Figs. 29–33.

This alga comes near *T. lacustris* and *T.limnetica* in its free floating habit. It differs from the former in the larger cells and in the shorter pseudocilia which do not project outside. It differs from the latter in the colonies being larger and the cells being bigger. The cells more ovate than rounded.

***Paulschulzia indica* Iyengar sp. nov.** (Figs. 34–67)

Colonies spherical, with 4, 8, 16, or 32 (rarely 64 cells) chlamydomonadine cells, 128–450 $\mu$ diam.; cells 10·0 to 16 $\mu$ diam. (rarely in older colonies up to 25 $\mu$ diam). arranged in a single layer at some distance from another along the periphery of the homogeneous gelatinous colonial envelope; each cell with two extremely long pseudocilia projecting through the mucilaginous envelope, 45 – 100 $\mu$ long; chloroplasts single, cup-shaped with a single imbedded pyrenoid; a nucleus present, contractile vacuoles two, anterior; eyespot absent; multiplication by the formation of daughter colonies by each

cell forming again a 4, 8, 16, or 32 celled colonies similar to the parent; asexual reproduction by the formation of 2–8 biflagellated swarmers formed in each cell, 4·5 – 7·5 $\mu$ broad and up to 12 $\mu$ long, flagella about as long as the body, up to 11 $\mu$ long.




FIGS. 34–36. *Paulschulzia indica* Iyengar sp. nov. (Fig. 34, × 900; Figs. 35, 36, × 2,500.)

Coloniae sphericales cum 4, 8, 16, 32 (raro 62) cellulis chlamydomonadinis, 128 – 450 $\mu$ diametri; cellulae 10–0 - 16 $\mu$ diametri (raro in coloniis veterioribus usque ad 25 $\mu$ diametri); dispositae in uno solo strato aliquotum distantes ab alterutra per peripheriam involucri colonialis gelatinosi

homogenei; unaquamque cellula habens 2 longissima pseudocilia protrudentia per involucrum mucilaginum, 40 – 100 $\mu$ longum; chloroplasti singuli, cupulati, cum uno solo pyrenoide invluso; nuclues adest; duo vacuoli contractilies, anteriores; stigma abste; multiplicatio formatione coloniarum filialium per unaquamque cellulam iterum formantum 4, 8, 16, vel 32 cellularum colonias similis parentis; reproductio asexualis formatione 2–8 biflagellatarum gregum in unaquamque cellula, 4·5–7·5 $\mu$ latitudinis et ad 12 $\mu$ longitudinis, flagella fere tam longa quam lata usque ad 11 $\mu$ longa.

*Habitat*: Planktonic in a pool containing muddy water at Nekkundram, near Madras, 25-7-1939 (also 3-3-1941, 5-12-1950; 8-12-1950; 4-1-1952; 17-2-1954; 23-9-1953; 14-11-1963).

*Type*: Figs. 34–36.

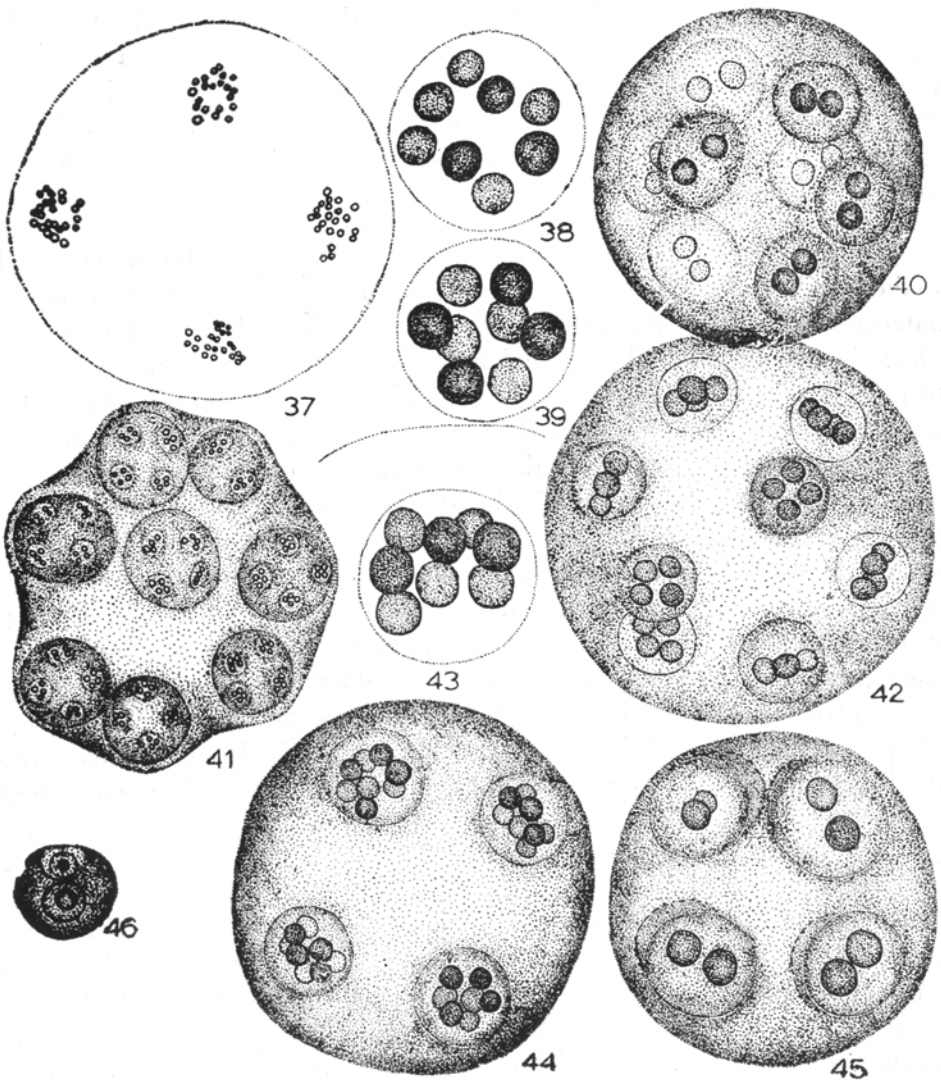
This alga was first described by Iyengar (1959, p. 396–7) without a Latin diagnosis.

This alga was found in large quantity as a planktonic form in a small pool at Nekkundrum about eight miles from Madras. The alga consists of a spherical colony with a homogeneous gelatinous envelope in which 8, 16 or 32 cells are arranged near the periphery more or less evenly distributed except on one side which appears to be somewhat free from cells. The cells are chlamydomonadine in structure and possess a bell-shaped chloroplast in which is imbedded a pyrenoid. A single nucleus and two contractile vacuoles are present near the anterior end.

Multiplication of the colony takes place by each cell of the colony dividing into a 4, 8, 16 or 32 celled colony. The daughter colonies continue to remain inside the envelope of the mother colony until they are fully developed and begin to form daughter colonies in their turn so that compound colonies with two or more generations are formed. The formation of daughter colonies resembling the mother colonies is very similar to what takes place in the colonial Volvocales resembling superficially very much a dividing Eudorina colony.

In a material which was brought to the laboratory (8–12–1950 and also 4–11–1953) and kept overnight for observations swarmer formation was observed in the morning at 8 a.m. Some of the cells of a few colonies divided into four or eight and the products began to move. They were spherical, ovoid or elliptic in shape. They had a cup-shaped chloroplast, with one

pyrenoid imbedded, two contractile vacuoles in front and two cilia about the same length of the body. They had an eyespot in the anterior portion. There was no papilla. These swarmers were often found in groups of 32. After some time they began to move out of the mother envelopes and began to swim outside. As they were swarming, good many of them became very much



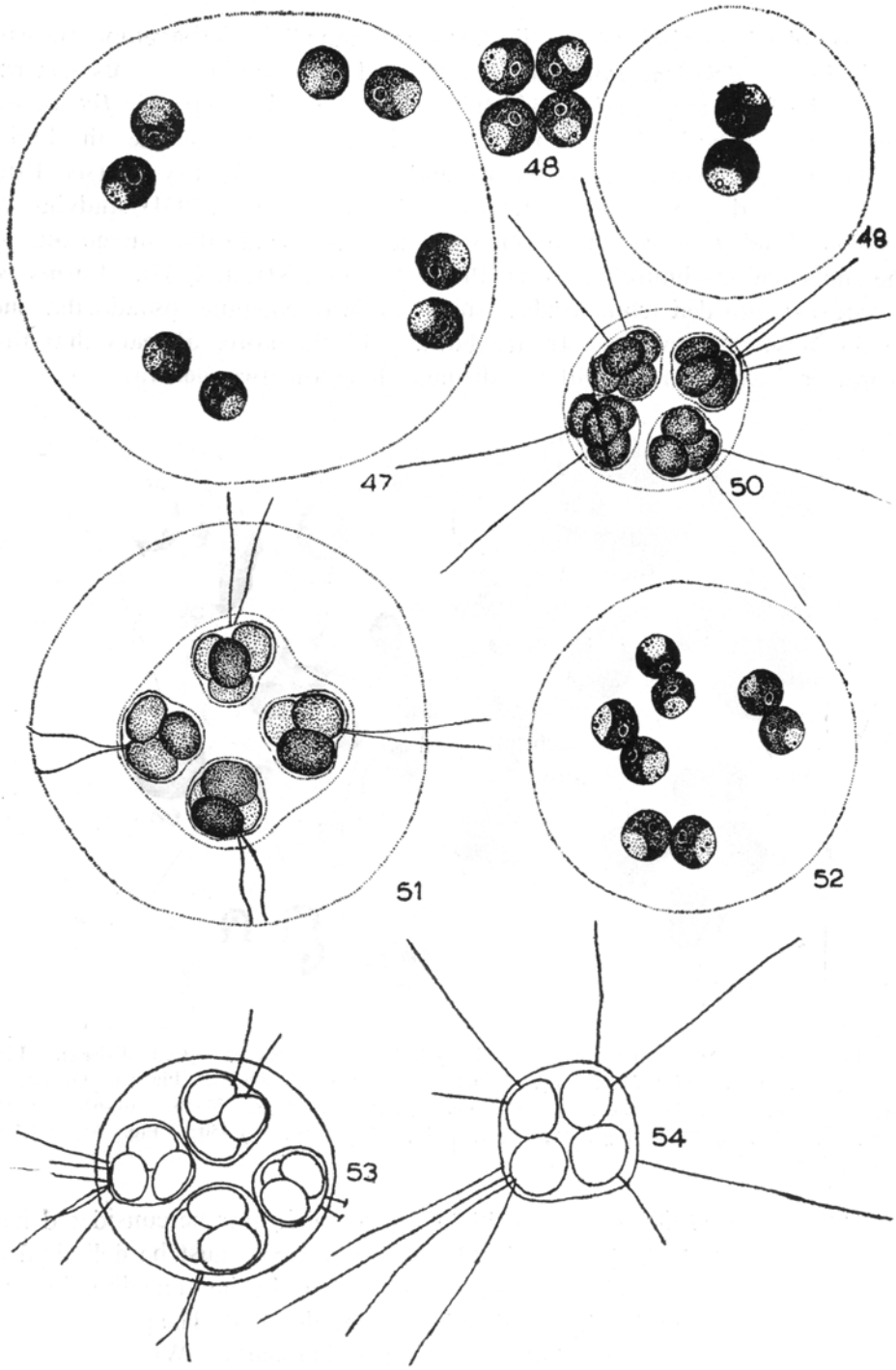

FIGS. 37–46. *P. indica* Iyengar. Figs. 37, 40–42, 44, 45. Colonies showing variations. Figs. 38, 39, 43. Daughter colonies showing variations in the arrangements of cells. (Figs. 38, 39, 43, × 1,100; Figs. 37, 41, × 175; Fig. 40, × 740; Fig. 42, 45, × 500; Figs. 44, × 700: Fig. 46, × 2,400.)

elongated and had a broad anterior portion with a narrower posterior portion. The extreme posterior portion in some cases was drawn out into a tail-like structure or condition. Swarmers were 4·5–7·5 $\mu$ broad and 6–7·8 $\mu$ long, sometimes up to 12 $\mu$ long.

In one collection of this species from paddy field soils made by K. R. Ramanathan (3–3–1941) the smaller ones of the swarmers appeared to behave as gametes and fused. Such instances were few. Hence detailed observations could not be made. However, it is indicative of the possibillty that the gametes are smaller than the zoospores and that sexual reproduction may be isogamous.

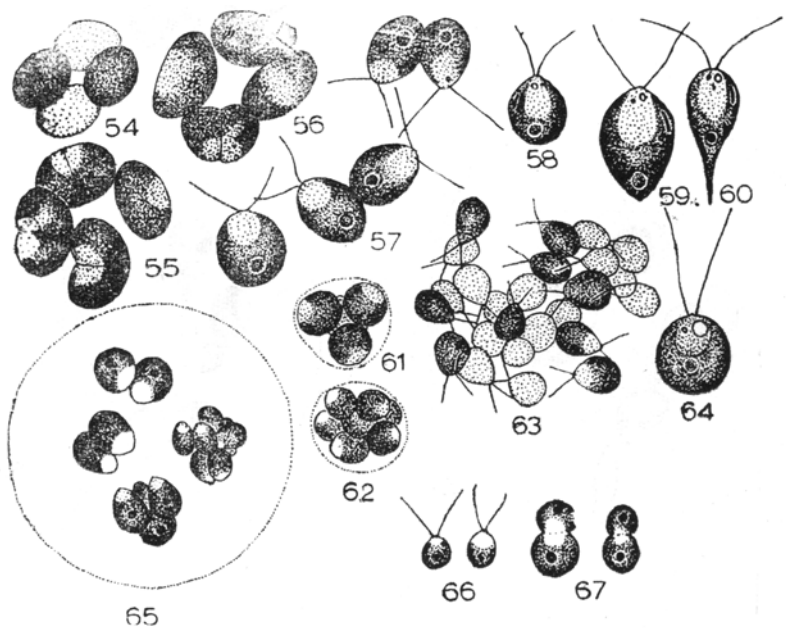
The present species differs from *P. pseudovolvox* (Schulz) Skuja a well-studied form (*see* Skuja, 1948). In *P. pseudovolvox* the integument or the outermost covering of the gelatinous colony is two layered, a broad outer layer which is radially striated and an inner homogeneous layer which is firmer. In *P. indica* the gelatinous envelope is not distinguishable into two layers but is homogeneous and fairly firm. The looser thick outer layer is absent. The cells of *P. pseudovolvox* are roundish but somewhat drawn out at the anterior and with a slight papilla, as judged from Skuja's figures. But in *P. indica* they are roundish and somewhat truncated at the anterior end. The chloroplast in *P. pseudovolvox* is definitely stellate with a median pyrenoid whereas in the Madras alga it is cup-shaped and solid and not stellately divided. In *P. pseudovolvox* colonies are 25–100 $\mu$ in diameter but those of the Madras alga are larger reaching a size of 450 $\mu$ in diameter. The pseudocilia in *P. pseudovolvox* are clearly visible but in *P. indica* they become visible only after a very careful staining. Likewise *P. indica* is distinguishable from the other species *P. elegans* (Woron.) Fott *see* Lund, 1957, p. 606; 1961, by its very large colonies, the large number of daughter colonies enclosed in common matrix and the size of the cells.

[Validity of the genus *Paulschulzia* is open to doubt and its distinctness from *Tetraspora* is often questioned. Lund (1956, p. 610) has specially dealt with this point. According to Teiling (1942) and Skuja (1948), *Paulschulzia* is characterised by the compound colonies and in the colonies of *Tetraspora* having not more than four cells in the colonies. Lund (1956) points out the basic similarity in the mode of cell division leading to the formation of these colonies. Only two features, according to Lund (1956), can distinguish *Tetraspora* from *Paulschulzia*: (*i*) The envelope surrounding the colonies in *Tetraspora* being generally more diffluent and difficult to be seen and more or




FIGS. 47–54. *P. indica* Iyengar. Figs. 47, 49, 50, 51. Young colonies. Fig. 48. Showing arrangement of cells in fours. Figs. 50, 51, 53, 54 with daughter colonies, some with supernumerary pseudocilia. (Fig. 52, × 700; Figs. 51, 53, 54, × 1,500; rest, × 1,100.)

less completely lost before the cells reproduce, and (*ii*) in the envelopes persisting in *Paulschulzia* as a prominent feature and representing various generations. The other characteristic which is often stressed to separate *Tetraspora* from *Paulschulzia* is that the pseudocilia do not emerge outside the limits of the colonial thallus in the former and in *Paulschulzia* they do (*see* Ettl, 1954; *cf.* Lund, 1957, p. 611). Klyver (1929) and Geitler (1931) studying *T. gelatinosa* and *T. lubrica* have observed that the pseudocilia emerge out of the mucilaginous limits (*see also* Prescott, 1944; Smith, 1933). Forms of *Tetraspora* recorded from Madras show similarly emerging pseudocilia and so do those of *Paulschulzia* from Madras. It, therefore, appears that this character may not be useful for distinguishing the two genera.




FIGS. 54–67. *P. indica* Iyengar. Figs. 54, 55, 56, 61, 62, 65. Cell division. Figs. 57, 64. Swarmers. Figs. 58, 59, 60. Variations in swarmer shapes. Fig. 63. Groups of swarmers. Fig. 66. Gametes. Fig. 67. Gametic fusion. (Figs, 54–56, 61–63, × 1,500: Figs. 57, 64, × 2,400; Figs. 58, 59, × 2,140; Fig. 60, × 1,450; Fig. 65, × 1,100; Figs. 66, 67, × 700.)

Two other genera of pseudociliate forms which may be considered here are *Apiocystis* and *Fottiella* (Ettl, 1955). Ettl's genus must be delimited as to include only forms in which the pseudocilia point in the same direction and the reproduction is solely by motile cells (*see* Lund, 1957). The genus strongly reminds one of *Pascherina*. But has a tetrasporine habit. With the record

of variations in the emergence of the pseudocilia outside the colonial mucilaginous boundaries *Apiocystis* can be distinguished from *Tetraspora* only by the attached habit and the small colony with only a few cells. The former is not exclusive to *Apiocystis* and the latter is of doubtful validity. We have the account of Hirose (1954) which points out to a presence of *Apiocystis* stages in the life-history of *T. gelatinosa*. It appears, therefore, that only *Tetraspora* Link including *Apiocystis* Näg. and *Fottiella* Ettl can be considered distinct. Ettl suggests our distinguishing *Tetraspora* as attached alga and *Paulschulzia* as a planktonic form. This is a useful suggestion if one is inclined to keep these genera distinct for practical purposes. As Lund (1957) points out, even now there is clear case for reducing *Paulschulzia* to a subgeneric rank. In this emended sense *Tetraspora* Link will have two subgenera *Tetraspora* (incl. *Apiocystis* Näg.) and *Paulschulzia* (Skuja) Desikachary.—T. V. Desikachary.]

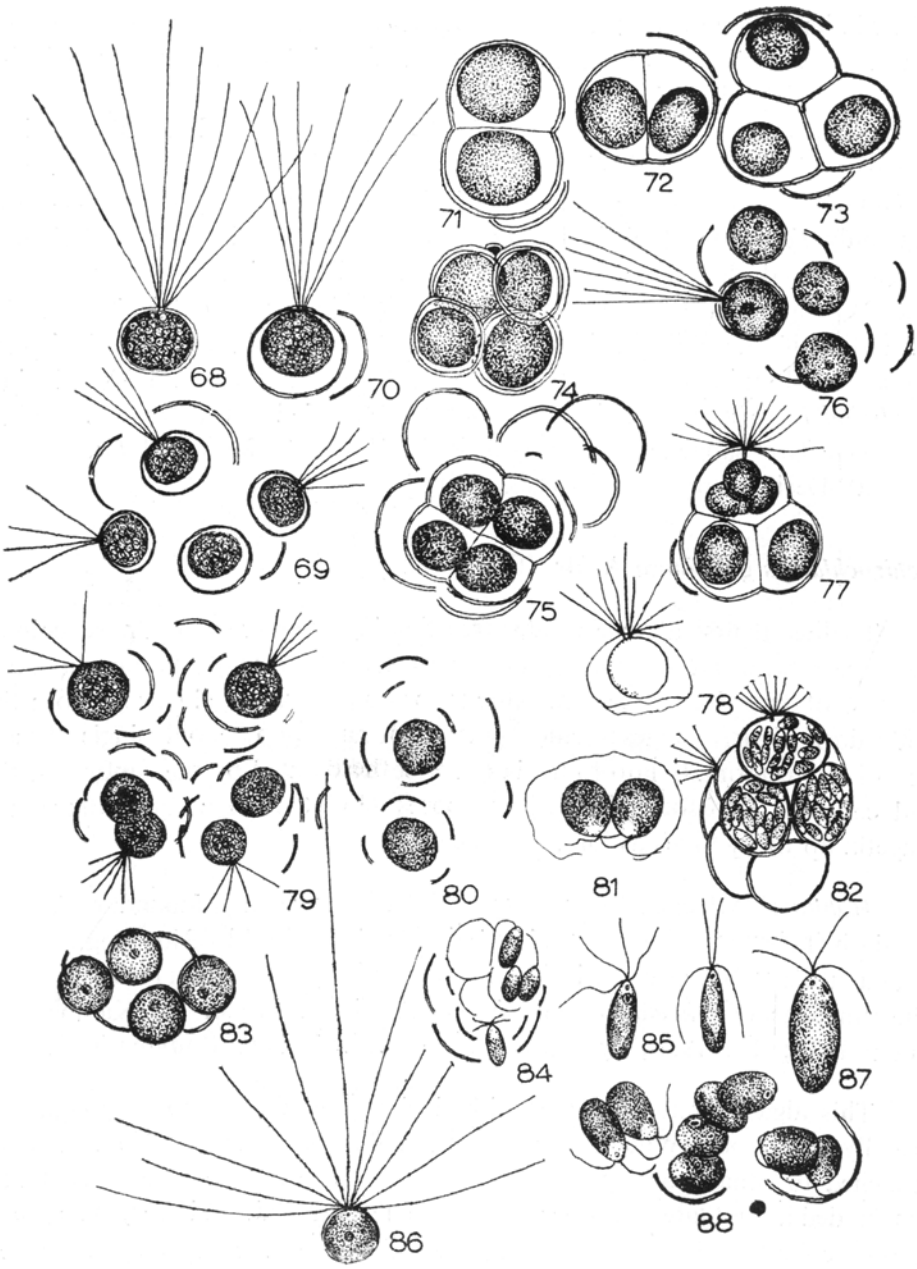
***Schizochlamys gelatinosa* A. Br.** (Figs. 68–88)

Thallus at first attached, later free floating, pale green to almost colourless; cells arranged at some distance from the periphery of the mucilaginous thallus, 10–15 $\mu$ diam.; cell wall thick; protoplast removed away from the wall during early stages; chloroplast cup-shaped, pyrenoid single, basal; cell division normally into four, daughter cells liberated by the rupture of the old cell wall into four pieces; zoospores $3{\cdot}3 \times 10{\cdot}0$ $\mu$, quadriflagellate, flagella up to $1\frac{1}{2}$ times as long as the cell.

*Habitat*: Attached to grass roots in a hill stream, Manandur, Andhra Pradesh (February 1930); paddy ffelds, Madras (26–12–1940, leg,. K. R. Ramanathan); Beach pool, inside a *Gloeotrichia* colony (25–11–1941); inside the mucilage of *Chaetomorpha pisciformis*, in a stream at Kambakkam (14–9–1941; 1–1–1933; leg. M. O. P. Iyengar and K. R. Ramanathan).

This alga is frequently met with during the rainy season, though it is usually a rare form. When it occurs it is found in fair quantity. The alga grows attached to other water plants or objects in water. The gelatinous thallus is rounded at first later on it becomes more pear-shaped. It is very pale green, almost colourless in the older stages looking like a completely colourless mass of jelly.

The cells appear as if scattered without any order in the mucilage, but careful examination of the thallus shows that the cells are arranged at a




FIGS. 68–88. *Schizochlamys genosa*. Figs. 68, 69, 76, 83, 86 from Mamandur. Figs. 70–75, 77, 78, 81, 88. From Kambakkam. Figs. 79, 80. From paddy field. Figs. 82, 84, 85, 87. From beach pools. (Figs. 68, 70, 79, 81, 84, × 1,500; Figs. 69, 71–76, 77, 82, 83, 86, × 1,150; Figs. 85, 87, 88, × 2,100.)

certain distance from the periphery of the thallus, a narrow border portion being free of any cells. The centre of the thallus appears to be hollow as if filled with some fluid. The thallus is bound on the outside by a fairly firm layer.

The cells have a firm wall. On staining with aqueous gentian violet there is seen round each cell a delicate firm mucilaginous envelope which is quite distinct from the general envelope. Between the cell wall and the protoplast there is a space, more so in the younger cells. In the older cells the contents occupy the entire cell cavity. However, in the anterior portion the protoplast is nearer the cell wall. But staining with gentian violet or Delafield's Haematoxylin shows this space is occupied by mucilage. The cell in surface view is round but in the side view it is flattened on one side; the protoplast also more or less shows the same shape. There is a single pyrenoid and a central nucleus. There are two contractile vacuoles towards the flat anterior side. Eyespot is absent. A number of pseudocilia are found inserted at the anterior flatter side of the cell. These are not all of the same length. There is a definite arrangement of these pseudocilia. In side view there are two very long side ones and a few very long central ones and a few are rather short.

Inside the general mucilage were found in groups of two or four cells surrounded by denser mucilage. Inside each ring of denser mucilage were found the four pieces of cell wall and inside these the four cells. Sometimes are more than 4 pieces, probably belonging to generations. The cells are full of dense discoid strach grains.

The fact that zoospores have only 2 or 4 cilia suggests that the pseudocilia of the cells have nothing to do with the cilia of the motile cell. These must be special structures to keep in touch with other cells or for purposes of taking nutrition. Zoospore formation took place early in the afternoon.

Grateful thanks are due to Rev. Fr. T. N. Siquiera, S.J., Loyola College, Madras, for kindly translating the diagnoses into Latin.

## REFERENCES

Bourrelly, P. .. "Une algue planctonique du Lac Leman; *Gemellicysti lundii* nov.sp.," *Rev. gen. Bot.*, 1959, **66**, 40–43.

——— .. "Quelques Algues d'eau douce du Canada," *Int. Rev. ges. Hydrobiol.*, 1966 *a*, **51** (1), 45–126.

——— .. *Les Algues D'eau douce, Initiation à la systematique*, Tome I," Les Algues Vertes, Boubie et Cie, Paris, 1966 *b*, p. 511,

Ettl, H. .. " *Fottiella*, nová zelená rasa z celedi, Tetrasporaceae," *Preslia*, **1955**, **27**, 35–48.

Geitler, L. .. " Untersuchungen über das sexualle Verhalten von *Tetraspora lubrica*," *Biol. Zbl.*, 1931, **51**, 173–87.

Herndon, W. R. and Philpott, D.E. " The pseudocilia of *Tetraspora*," *Biol. Bull.*, 1960, **119**, 319–20.

Hirose, H. .. " Studies on the reproduction of *Tetraspora*," *Biol. J. Okayama Univ.*, 1954, **2**, 13–27.

Iyengar, M. O. P. .. " Some interesting green algae," *Proc. Symp. Algology*, New Delhi, **1959**, 1960, 380–406.

Klyver, F. D. .. " Notes on the life-history of *Tetraspora gelatinosa* (Vauch.)," *Desv. Arch. Protistenk.*, 1929, **66**, 290–96.

Korshikov, O. A. .. *Viznacnik prisnovodnik vodoroslei Ukrainaskoi SSR. Pidklas Protokokovi (Protococcineae)* " Ukr. Akad. Nauk. Kiev, 1953, pp. 440.

Lembi, C. A. and Herndon, W. R. " Fine structure of pseudocilia of *Tetraspora*," *Can. J. Bot.*, 1966, **44**, 710–12.

Lemmermann, E. .. " Beiträge zur Kenntnis der Planktonalgen. II. Beschreibung neuer Formen," *Bot. Zbl.*, 1898, **76**, 76–152.

———— .. " Das Phytoplankton sachsischer Teiche," *Ber. biol. Sta. Plön*, 1899, **7**, 96–135.

———— .. " Chlorophyceae—II," In Lemmermann *et al.*, *Die Süsswasserflora*, 1915, **5**, Jena.

Lund. J. W. G. .. " On certain planktonic green algae," *J. Linn. Soc. Bot.*, 1956, **55**, 592–613.

———— .. " Four new green algae," *Rev. algol. n.s.*, 1957, **3**, 26–44.

———— .. " The taxonomy and nomenclature of certain palmelloid planktonic green algae previously described," *J. Linn. Soc. Bot.*, 1961, **56**, 459–65.

Prescott, G. W. .. " New species and varieties of Wisconsin algae," *Farlowia*, 1944, **1**, 347–85.

Rhodes, R. G. and Stofan, P. G. " *Tetraspora*, *Chlorosaccus* and *Phaeospora*, a unique example of parallel evolution in the algae," *J. Phycol.*, 1967, **3**, 87–89.

Skuja, . .. " Taxonomie des Phytoplanktons einiger Seen in Uppland Schweden," *Symb. Bot. upsal*, 1948, **9** (3). 399.

Smith, G. M. .. *The Freshwater Algae of the United States.* McGraw-Hill, N.Y., 1933, pp. 716.

———— .. *Ibid.*, 2nd Ed., 1954, pp. 719.

Teiling, E. .. " Zur phytoplankton Schwedens," *Bot. Notiser*, 1946, p. 61–88.