Ecballocystopsis indica n. gen. et sp., a New Member of Chlorodendrales.[1]

BY

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With Figures A to R in the Text.

THE alga forming the subject of this communication[2] was growing together with *Ecballocystis courtallensis*,[3] on a wet rock sprayed by the Honey Falls at Courtallum in South India. Although very closely related to *Ecballocystis*, it differs from this genus in possessing a filamentous habit, instead of the dendroid one characteristic of that genus (cf. Fig. L). This difference of habit results from differences in the method of division and behaviour of the daughter-cells, as will be apparent from the subsequent description.

The oblong-elliptic cells are attached end to end to form a long filament which often exhibits characteristic loops in the middle (Fig. L). The mature cells which are 11–16 μ broad and about one and a half to three times as long, closely resemble those of *E. courtallensis*. Young cells contain from four to eight elongate parietal chloroplasts (Figs. K, R), while in the fully developed ones the number increases to sixteen or thirty-two (Figs. I, G). The chloroplasts in the mature cells are disc- or lens-shaped with a very minute inconspicuous pyrenoid embedded in each (Fig. G). A single nucleus is suspended in the centre of the cell by means of numerous radiating cytoplasmic threads (Fig. F) which appear to be attached to the several chloroplasts. At the two poles the membrane shows small nodular thickenings (Fig. P) which are more obvious in the older cells (those of the second generation and onwards) and more prominent at the lower than at the upper pole. The rest of the membrane is relatively thin. The filament is attached to the substratum by a thick mucilaginous pad secreted by the lowermost cell (Fig. Q). This pad is very similar in appearance to that found in the same position in *E. courtallensis*.

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[2] I am indebted to Mr. R. V. Narayanaswamy for material of this alga.

[3] Iyengar, Ann. Bot., xlvi, 1932, 204–7.

[Annals of Botany, Vol. XLVII. No. CLXXXV. January, 1933.]

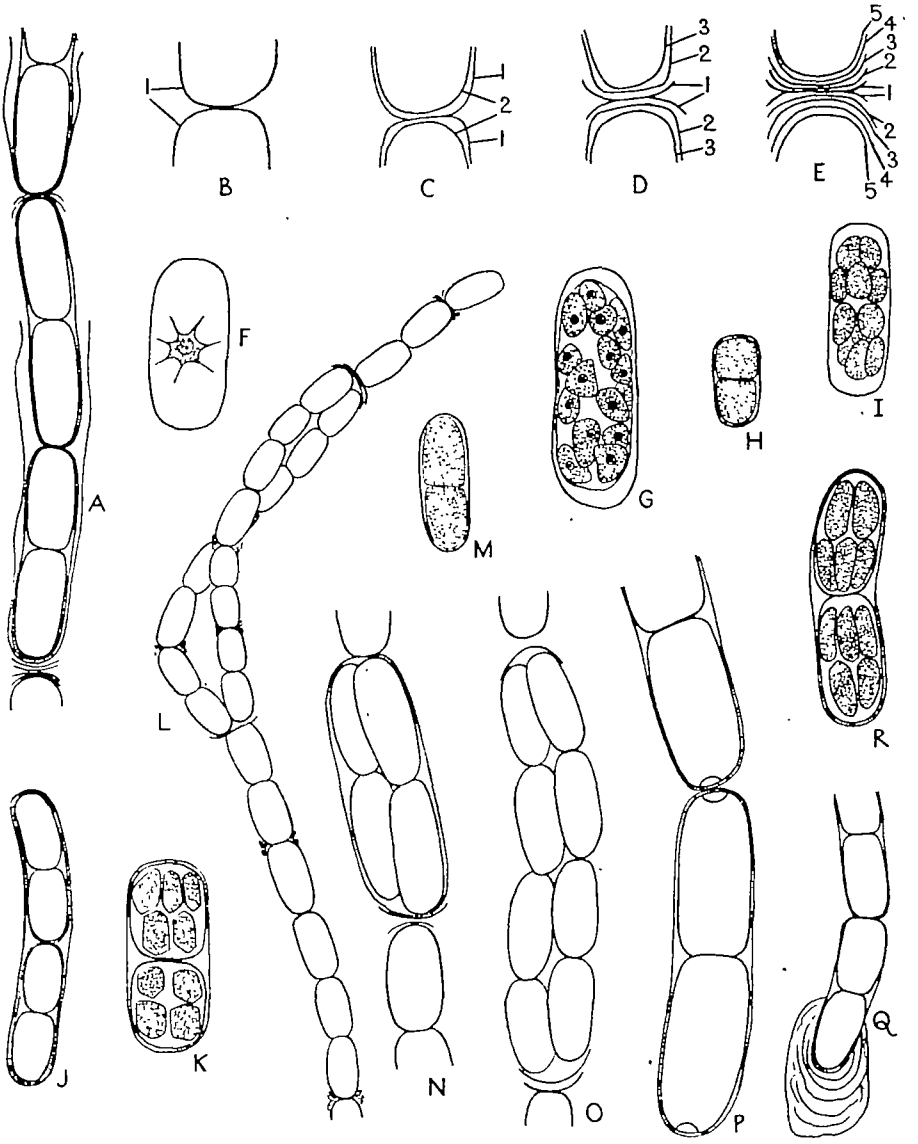
Cell-division and method of growth of the colony. The division of the protoplast is very nearly transverse, though a slight indication of obliquity can be detected (Figs. M, H). The two daughter-protoplasts soon surround themselves with separate walls of their own, inside the parent.

In *Ecballocystis* the oblique division of the protoplast and the attachment of the daughter-cells to the wall of the parent-cell by a basal secretion of fairly tough mucilage results in the lower daughter-cell growing past the upper one. Since this process is repeated in successive generations a dendroid colony is formed.[1] In the present alga the daughter-cells do not attach themselves to the wall of the parent-cell in this way. In fact, as explained below, the wall of the parent-cell undergoes complete gelatinization except at its two ends, and very soon disappears. As a result of the practically transverse division of the protoplast the elongating daughter-cells remain the one below the other. A small quantity of mucilage seems to be secreted at the base of each daughter-cell, but this merely helps to keep the cells attached to one another end to end. The wall of the parent-cell becomes much distended, but does not rupture immediately. The new cells grow, and in their turn form pairs of daughter-cells. Occasionally the old membrane of the cell of the first generation may be seen quite intact, enclosing the four cells of the third generation, pairs of which are enveloped by walls of the second generation (Fig. J). Usually, however, the wall of the first generation becomes ruptured when the cells of the second generation are formed, the rupture taking place, not apically as in *Ecballocystis*, but a little below the apex (Fig. A). Soon after most of the side portions of the original wall gelatinize from above downwards and disappear, the only parts of the wall of the first generation to persist being the two concave end-pieces. As the cells of the third generation divide, the two end-pieces of the first membrane become farther removed from one another.

These persisting end-pieces of the walls of successive generations undergo some slight gelatinization, but remain distinctly recognizable for quite a long time as a number of lamellations between adjacent cells. It is possible that they help to hold the cells together. Fig. B shows the end portions of the walls of two adjoining cells. When each of these has formed a pair of daughter-cells, the two pairs of walls will be visible at this point, as in Fig. C, where *1* represents the walls of the original cells, and *2* those of their daughters. When the latter in their turn form cells of a new generation, three pairs of walls will be found as in Fig. D, where *1*, *2*, and *3* represent the walls of the cells of the first, second, and third generations respectively. In Fig. E portions of the walls of five generations are seen.

Not infrequently the contents of some of the cells divide into four (Fig. N), the daughter-cells appearing as two parallel pairs in which the

[1] Iyengar, loc. cit., 206.



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.

two cells of a pair are attached end to end. When the cells of these pairs in their turn form daughter-cells, two short more or less parallel filaments are produced, as in Fig. O. Further divisions in these filaments lead to the formation of a larger or smaller loop (Fig. L).

As in the case of the species of *Ecballocystis*, no indications of the formation of motile spores have been found. Nor were any sporangial stages observed in the material. The method of reproduction of the alga thus remains to be established.

The absence of the dendroid habit, typical for *Ecballocystis*, is combined with the practical disappearance of the oblique division customary in that genus. The alga here described also differs from *Ecballocystis* in the non-disappearance of the apical portions of the walls of the cells of successive generations, although the lateral (longitudinal) walls gradually undergo complete gelatinization. Nor do the daughter-cells become attached to the wall of the parent. Certain other features of *Ecballocystis* are, however, retained, viz., the presence of several chloroplasts with pyrenoids, the polar thickenings of the wall, and a certain degree of polarity. The last feature is indicated by the rupture of the parent-wall near the apex, i.e., towards the upper end of the filament. The differences from *Ecballocystis*, combined with the *filamentous habit*, which is unusual among Chlorodendrales, warrants the establishment of a new genus which may be called *Ecballocystopsis*. The latter is no doubt closely related to *Ecballocystis*, but it appears to have departed appreciably from the ordinary construction of that genus and to have evolved in a new direction.

Ecballocystopsis gen. nov.

Colony filamentous; cells similar to those of *Ecballocystis*, dividing into two or four, division of the protoplast almost transverse, and being followed sooner or later by rupture of the parent-wall a little way below the apex; daughter-cells not attached to wall of parent-cell, the lower remaining permanently below the upper one, so that the cells of successive generations are arranged to form a row; walls of successive generations gradually gelatinizing, except at the two ends, the end pieces accumulating and indicating the number of divisions; reproduction unknown. Motile stages probably lacking.

Description.

Ecballocystopsis indica sp. nov. (Figs. A–R).

Cells oblong-elliptic, with 4, 8, 16 or 32 chloroplasts and walls showing polar thickenings. Filaments attached to the substratum by a thick mucilage pad secreted by the lowermost cell; certain filaments showing

loop-formation due to occasional division into four. Method of multiplication not known. Cells 11–16 μ broad and one and a half to three times as long.

Habitat. On a rock constantly sprayed by water from the Honey Falls at Courtallum in S. India, growing together with *Ecballocystis courtallensis* (R. V. Narayanaswamy).

In conclusion, the author wishes to express his great indebtedness to Professor F. E. Fritsch, F.R.S., for his guidance and help in preparing this paper.