

GENUS *RICCIA* IN INDIA—II*
SPECIES OF *RICCIA* FROM SOUTH INDIA WITH DESCRIPTION OF
A NEW SPECIES AND NOTES ON THE SYNONYMY OF SOME
RECENTLY DESCRIBED ONES**

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ABSTRACT

With a view to describe the liverwort flora of relatively little explored territories of India, the species of *Riccia* from South India have been worked out. In all eleven species have been recognized (Chopra, 1938; Udar, 1957c; Pandé and Udar, present communication) excluding *R. fluitans*-complex which will be treated separately (as it should now be understood to be from India) in view of the cytological and cultural work by Lorbeer (1934) and Müller (1940, 1941). A new species, *Riccia tuberculata* Pandé et Udar, has been discovered from South India. This species is characterised by distinctive tubercular thickenings on the cells of some of the assimilatory filaments, a peculiar feature known so far only in *R. bistriata* Evans but the pattern in the two species are different. Two of our little known species viz. *R. melanospora* Kash. and *R. plana* Taylor have been described in detail along with illustrations. A latin diagnosis of the former has also been included to complete its description. Two of the recently described species viz. *R. intermedia* Jones, from Tropical Africa and *R. bengalensis* Khan from East Pakistan have been shown to be synonyms of *R. discolor* L. et L. and *R. billardieri* Mont. et N. respectively. A key, for facilities of separation and identification of all the species now known from South India, has been given.

INTRODUCTION

With a view to work out the details of the Bryology of some of the relatively little explored Indian territories Pandé and Srivastava made extensive collections of hepatics and mosses during September–October, 1950, from several localities in South India. The hepatics in this collection are now being systematically worked out by the authors who hope to present a detailed account of the liverwort flora in due course based on the study of different genera represented in this collection. A part of the collection, containing specimens of *Riccia*, has been worked out and the study has revealed several interesting as well as new or little-known species from the country. Already *Riccia crozalsii* Lev. and *R. warnstorffii* Limpr. have been reported as new to Indian flora (Udar, 1957c) based on a critical examination of this collection. The other species include *R. melanospora* Kash., *R. discolor* L. et L., *R. billardieri* Mont. et N., *R. gangetica* Ahmad, *R. huebeneriana* Lindenb., *R. plana* Taylor and a species which differs markedly from all the known species of the genus and deserves a new specific rank.

Chopra (1938) has listed only three authentic species from South India viz. *R. cruciata* Kash., *R. frostii* Aust. and *R. fluitans* L. Of these, *R. fluitans* has been recently shown, through cytological and cultural investigations (Lorbeer, 1934; Müller, 1940, 1941), to be a complex of four species, the segregates being *R. fluitans* L. emend K. Müller, *R. canalicuta* Hoffm., *R. duplex* Lorb. and *R. rhenana* Lorb.

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In view of these observations *R. fluitans-complex* in India needs a careful reinvestigation and the authors hope to present a detailed discussion on this aspect soon in a separate communication.

Thus, eleven species of *Riccia* (excluding *R. fluitans-complex*) occur in South India (Chopra, 1938 ; Udar, 1957c ; Pandé and Udar, present communication). The key given below will facilitate their separation and identification. For the sake of convenience the division of the genus *Riccia* into subgenera *Euriccia* and *Ricciella* has been adopted.

1. Thallus with compact assimilatory zone and narrow air spaces
Subgenus *Euriccia*.....3.
2. Thallus with loosely arranged assimilatory zone and wider air spaces. Subgenus *Ricciella*.....12.
3. (a) Plants monoecious.....4.
(b) Plants dioecious.....10.
4. (a) Thalli ciliate.....5.
(b) Thalli non-ciliate.....8.
5. (a) Spore black and perfectly opaque at maturity, 80–100 μ6.
(b) Spore dark brown at maturity, 50–90 μ7
6. Thallus bluish green, segments small, anteriorly sulcate, rest nearly flat, cilia small and broad, 100–150 μ long.1. *R. melanospora*.
7. (a) Thallus yellow green, segments narrow, linear, apex rounded, deeply sulcate anteriorly and sulcus broader behind, cilia large, spore 50–80 μ2. *R. warnstorfi*.
(b) Thallus bluish green, segments lanceolate, anteriorly deeply sulcate, rest very broadly channelled, spore 70–90 μ3. *R. crozalsii*.
8. (a) Spore winged.....9.
(b) Spore unwinged.....11.
9. Thallus small, about 3 times broader than high, characteristic tubercular thickenings on the cells of the assimilatory filaments, spore irregularly reticulate or papillate, 80–110 μ , wing crenate.....4. *R. tuberculata*.
10. Male plants comparatively smaller than female, spore unwinged, reticulate, 80–100 μ5. *R. discolor*.
11. (a) Thallus large, 4–6 times broader than high, spore reddish brown, reticulate, 90–140 μ , angles of reticulations drawn out into prominent projections.....6. *R. billardieri*.
(b) Thallus small, about 3 times broader than high, spore perfectly black and opaque at maturity, 8–16 small reticulations across the outer face, coarsely crenate in profile, 80–120 μ7. *R. gangetica*.
12. (a) Plants monoecious.....13.
(b) Plants dioecious.....16.
13. (a) Thalli narrow repeatedly branched.....14.
(b) Thalli very broad, cruciate or in rosettes.....15.
14. (a) Spore small, upto 60 μ8. *R. huebeneriana*.
(b) Spore much larger, 80–110 μ9. *R. plana*.
15. Thallus as a rule cruciform, spore upto 70 μ , reticulations more or less complete.....10. *R. cruciata*.
16. Thalli forming well defined rosettes, female rosette normally larger than male, the latter usually pinkish, spore incompletely reticulate, upto 60 μ11. *R. frostii*.

1. *Riccia melanospora* Kash.

R. melanospora is apparently one of our endemic species since it has not been reported so far from any other part of the world. The only published account

of this plant is its description by Kashyap (1929) which unfortunately is somewhat inadequate and lacks illustrations. Opportunity has, therefore, been taken to fill in this gap in our knowledge of this interesting plant and also to provide its latin diagnosis*.

R. melanospora was instituted by Kashyap (1929) to include a specimen of *Riccia* from Hoshiarpur. Later it was also reported by him (Kashyap, 1932) from Lucknow, on the basis of the material sent to him by Pandé, and from Kónsa Nag, 12,000 ft., Kashmir, on a collection sent to him by Dr. A. C. Joshi. In the present paper this species is being recorded for the first time from South India and possibility should not be excluded that the species may have a wider range of distribution and it may some day be discovered from some of the neighbouring countries.

Monoecious, bluish green; thalli small, simple or once furcate, in overlapping patches, occasionally forming distinct rosettes; ciliate, cilia 100–150 μ long, hyaline or pink, present both on margins and on surface; lobes oblong, upto 5 mm. long and 2 mm. broad; sulcate anteriorly and posteriorly broad, flat or broadly concave; air spaces narrow, assimilatory zone compact; *epidermal cells* rounded or oval, hyaline; ventral surface projecting prominently, hyaline in the middle but deep purple below the wings; *cross-section* semi-circular; about two times broader than high or as broad as high; *scales* large, hyaline or deep purple; sex organs in 1–4 rows, papillae very slightly projecting above; *sporophytes* bulge dorsally, occasionally developed near the margin of the thallus; *spore* dark and perfectly opaque at maturity, 80–100 μ in the maximum diameter, often much smaller, reticulate with 8–16 reticulations across the outer face, about 3.3 μ wide; winged, wings upto 6.6 μ , usually imperfectly developed, interrupted, quite often absent, tri-radiate mark conspicuous.

Coll. Pandé and Srivastava. *Loc.* Govt. Bot. Garden, Ootacamund. *Habitat* : Growing on red soil. *Date* : October 7, 1950. Pandé collection No. 4723, Lucknow University. (Text fig. 1).

R. melanospora is one of our xerophytic species and generally occurs on exposed places favouring particularly gravel foot paths. Under intense sun, when the atmosphere gets drier after monsoons, the wings are upturned exposing the deep purple scales.

The perfectly black and opaque colour of the spore masks the surface reticulations and also the wing but a treatment with dilute nitric acid for about half an hour brings out the details clearly. Prolonged treatment should, however, always be avoided.

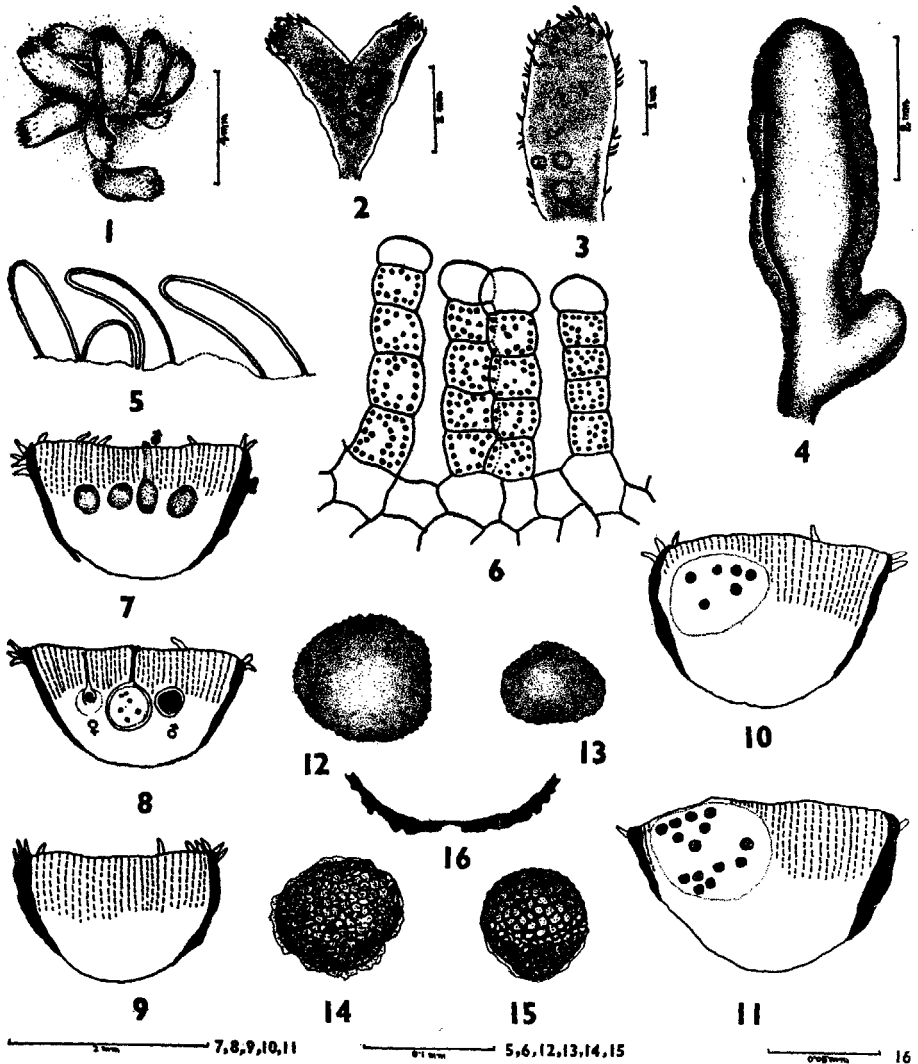
In its dark opaque spores and larger number of reticulations *R. melanospora* approaches *R. gangetica* but the latter is non-ciliate, with thalli distinctly channelled and spore larger and unwinged.

2. *Riccia warnstorfi* Limpr.

R. warnstorfi is certainly a luxuriantly represented species in South India although this is known so far only from this territory in India. An illustrated account of this has been already given by Udar (1957c) along with *R. crozalsii*. These two species are very recent additions to our hepatic flora.

* *Monoica*, parva, coeruleo-viridis, plus minusve glauca; *frons* ad 5 mm. longa, ad 2 mm. lata, simplex vel bifurcata; lobis linearibus, apice minute emarginato et truncato; fronte sulcata, caeteris partibus planis vel convexis, marginibus acutis, facie antica \pm dense spinosa, spinis hyalinis et purpureis, tenerrimis, 100–150 μ longis; thalli sectio crassa, duplo latior quam alta; *squamae* purpureae, imbricatae, margines haud superantes; *sporae* 80–100 μ fuscae, reticulatae, papillatae, reticulationibus 3.3 μ latis, angulis papillarum erectis; alata, ala irregulari et brevi, 3.3–6.6 μ . lata.

Coll. Pandé and Srivastava. *Loc.*: On way to Coonoor. *Habitat*: Growing on red soil. *Date*: October 7, 1950. Pandé Collection No. 3802; *Loc.*: Govt. Botanical Garden Ootacamund. *Date*: October 9, 1950. Pandé collection No. 3121, 3123, 3815 3817, 5124, 5125.



TEXT-FIG. 1. *Riccia melanospora* Kash.

Fig. 1. Habit. 2. Branched thallus. 3. A thallus with a sporophyte at the margin. 4. Thallus, ventral. Note conspicuous scales. 5. Cilia. 6. Cross section of thallus showing assimilatory filaments and epidermis. 7-9. Cross section of a thallus at apex, in the middle and at the base respectively. 10-11. Cross sections showing superficial marginal sporophytes. 12-13. Dark and opaque spores. Note the disparity in size. 14. Spore, outer face. 15. Spore, inner faces. 16. Wing magnified.

3. *Riccia crozalsii* Lev.

R. crozalsii is a rather extremely rare species to come across and only one rosette is represented in the collection. In this country so far this species is known only from S. India and an illustrated account has already been given by Udar (1957c) from a part investigation of the South Indian hepatics in Pandé Collection.

Coll. Pandé and Srivastava. *Loc.*: Govt. Botanical Garden, Ootacamund, *Habitat*: Growing on red soil. *Date*: October 9, 1950. Pandé Collection No. 3814, Lucknow University.

4. *Riccia tuberculata* Pandé et Udar, *sp. nov.*

Monoica, glauco-virens; *frons* ad 5 mm. longa, ad 2 mm. lata, simplex vel bifurcata, lateribus ascendentibus, marginibus acutis, sulcus ad apicem profundus et acutus; *squamae* magnae, integrae, imbricatae, atro-purpureae, marginem superantes; *sporae* 80–110 μ , brunneae, conferte papillatae et irregulariter lamellatae, ad angulos papillatae, facies internae plus minusve regulariter lamellatae; anguste alatae, margo alae papillatae, 6.6 μ .

Monoecious, bluish green; *thallus* upto 5 mm. long, 2 mm broad, simple or once furcate, overlapping or isolated, often forming rosettes; *segments* ovate-linear, prominently convex ventrally, apex rounded or acute, dorsally sulcate, sulcus prominent anteriorly; wings more or less convex, margin acute and ascending; *scales* large, overlapping, dark purple, *conspicuously extending beyond the margins*; *epidermal cells* oval-papilliform, hyaline; air-spaces narrow; *assimilatory filaments* compact with characteristic tuberculate thickenings noticeable on the walls of the cells of some of these, thickenings extending upto the epidermal cells from the base of the assimilatory filaments and occasionally also present on some cells of the lower compact zone; antheridia and archegonia in the mid-dorsal line in a row, papillae projecting above the surface; *sporophytes* uniseriate, bulging prominently on the dorsal surface; *spore* dark brown, 80–110 μ along the maximum diameter, *densely papillate to irregularly reticulate on the outer face*, more or less regularly reticulate on the inner faces, tri-radiate mark conspicuous; winged, wings upto 6.6 μ wide having a warty surface and crenulate margin.

Coll. Pandé and Srivastava. *Loc.*: Runnymede, Madras State, South India. *Habitat*: Growing on red soil. *Date*: October 6, 1950. Pandé Collection No. 3803, Lucknow University. (Text fig. 2).

The characteristic band of thickening found on the walls of the green cells represents a feature noted earlier only in the case of *R. bistrata* (Evans, 1919). The pattern of thickenings of *R. tuberculata* Pandé et Udar is, however, very different from *R. bistrata*. In the latter the band of thickening is uniform while in *R. tuberculata* it is distinctly tuberculate. Besides, the two species differ in sexuality, vegetative features and characters of spore as well.

The specimen of *Riccia* from South India has, therefore, been referred to a new species, *Riccia tuberculata* Pandé et Udar, *sp. nov.*

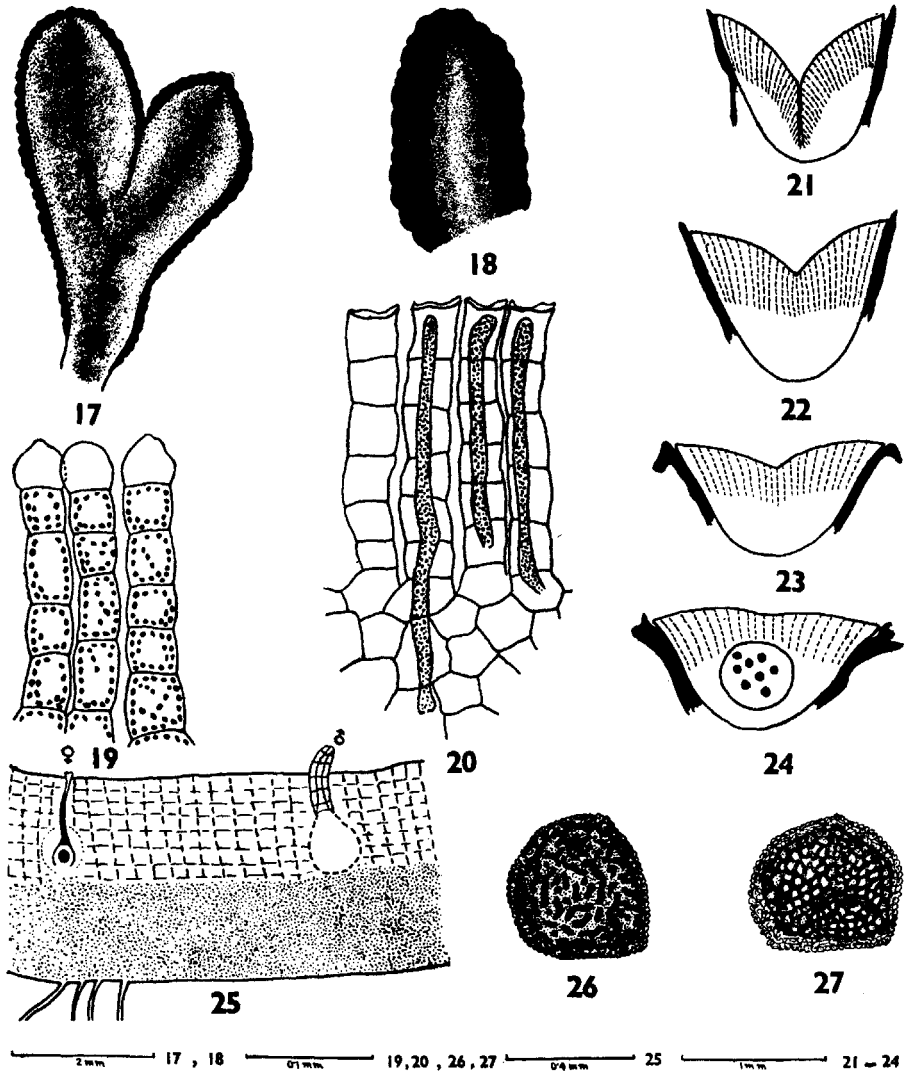
5. *Riccia discolor* L. et L.

A detailed description and a critical discussion of *R. discolor* has been presented in two earlier communications (Udar, 1957a; Pandé and Udar, 1957).

Recently Jones (1957) described a new dioecious species from Tropical Africa, *R. intermedia* Jones, which is apparently identical with *R. discolor*.

Through the courtesy of Dr. E. W. Jones beautiful type specimens of *R. intermedia* were obtained and on examination the authors have failed to notice any significant feature which would separate it from *R. discolor*. Dr. Jones had the

obvious difficulty as he could not secure authentic published accounts of *R. discolor* and, in his excellent paper, he makes a reference to the difficulty he experienced in not being able to compare his Tropical African Riccias with Indian species. It has since been possible for the authors to present a detailed account of this species



TEXT-FIG. 2. *Riccia tuberculata* Pandé et Udar.

Fig. 17. Thalls, dorsal. 18, Same, ventral. Note large prominent scales which almost coalesce. 19. Thallus in cross-section showing assimilatory filaments with epidermal cells. 20. Same showing characteristic tubercular thickenings. 21-24. Cross sections of thallus at the apex, behind the apex, in the middle and at the base, respectively. 25. V.L.S. of thallus showing its monoecious character. ♂, antheridium; ♀, archegonium. 26. Spore, outer face. 27. Spore, inner faces.

(Pandé and Udar, 1957). Since India and Africa are tropical countries and geographically largely identical, the possibility of finding common species in these two countries becomes all the more probable.

In a recent paper on the Ricciaceae of East Pakistan, Khan (1957) has described *R. discolor* as monoecious. This species is *strictly dioecious* (see Udar, 1957a; Pandé and Udar, 1957) and always distinct male and female thalli have been found in the Pandé Collection from practically all parts of India including the neighbouring territory of West Bengal. The plants usually grow intimately mixed with a monoecious species, *R. billardieri*, and a good deal of confusion becomes evidently possible if the plants are not carefully isolated for study. A reinvestigation of the specimens of *Riccia* described by Khan (1957) from East Pakistan, thus, becomes necessary in the light of the above observations.

Coll.: Pandé and Srivastava. *Loc.*: Mangalore. *Habitat*: Growing on red soil. *Date*: October 13, 1950. Pandé Collection No. 5495a, Lucknow University.

6. *Riccia billardieri* Mont. et N.

R. billardieri is one of the most widely distributed species in South India. Recently it has been worked out with respect to its synonymy and taxonomic details by Udar (1957a) and Pandé and Udar (1957), cytology by Udar and Chopra (1957) and sporeling germination by Udar (1957b).

In a recent paper Khan (1957) has described *R. bengalensis* Khan from Dacca, East Pakistan. The vegetative features of this species as well as the description of the spore strongly answers to *R. billardieri*, a very common species known from the adjoining territory of West Bengal. The species according to Khan (1957) is characterised by the presence of prominently projecting sex papillae which occur in two or three rows. These papillae are exactly alike in *R. billardieri* (see Udar, 1957a, Fig. 6) as well and the authors feel certain that both these specimens are identical.

Coll.: Pandé and Srivastava. *Loc.*: Mahe. *Habitat*: Growing on red soil. *Date*: October 11, 1950. Pandé Collection No. 4753, Lucknow University; *Loc.*: Mangalore. Growing mixed with *Cyathodium* sp. *Date*: October 13, 1950. Pandé Collection No. 4595, 4597, Lucknow University.

7. *Riccia gangetica* Ahmad.

In South India *R. gangetica* is apparently not so common as *R. discolor* and *R. billardieri*. A detailed account of this species and a discussion about its specific validity has been given by Udar (1957a) and Pandé and Udar (1957). The chromosome number and the origin of this species has been discussed by Udar and Chopra (1957) and Chopra and Udar (1957).

The specimens from South India are fertile but are extremely small in size being only 2 mm. long and about 0.5 mm. broad.

Coll.: Pandé and Srivastava. *Loc.*: Addenley Station. *Habitat*: Growing on red soil. *Date*: October 6, 1950. Pandé Collection No. 5107, Lucknow University.

8. *Riccia huebeneriana* Lindenb.

R. huebeneriana was first reported from India by Udar (1956) on the basis of a collection made by Pandé (from Darjeeling on way to Badampton) and another by Mr. Singhal (from Kisli forest, Madhya Pradesh). This is the first record of this species from South India where it is apparently rare.

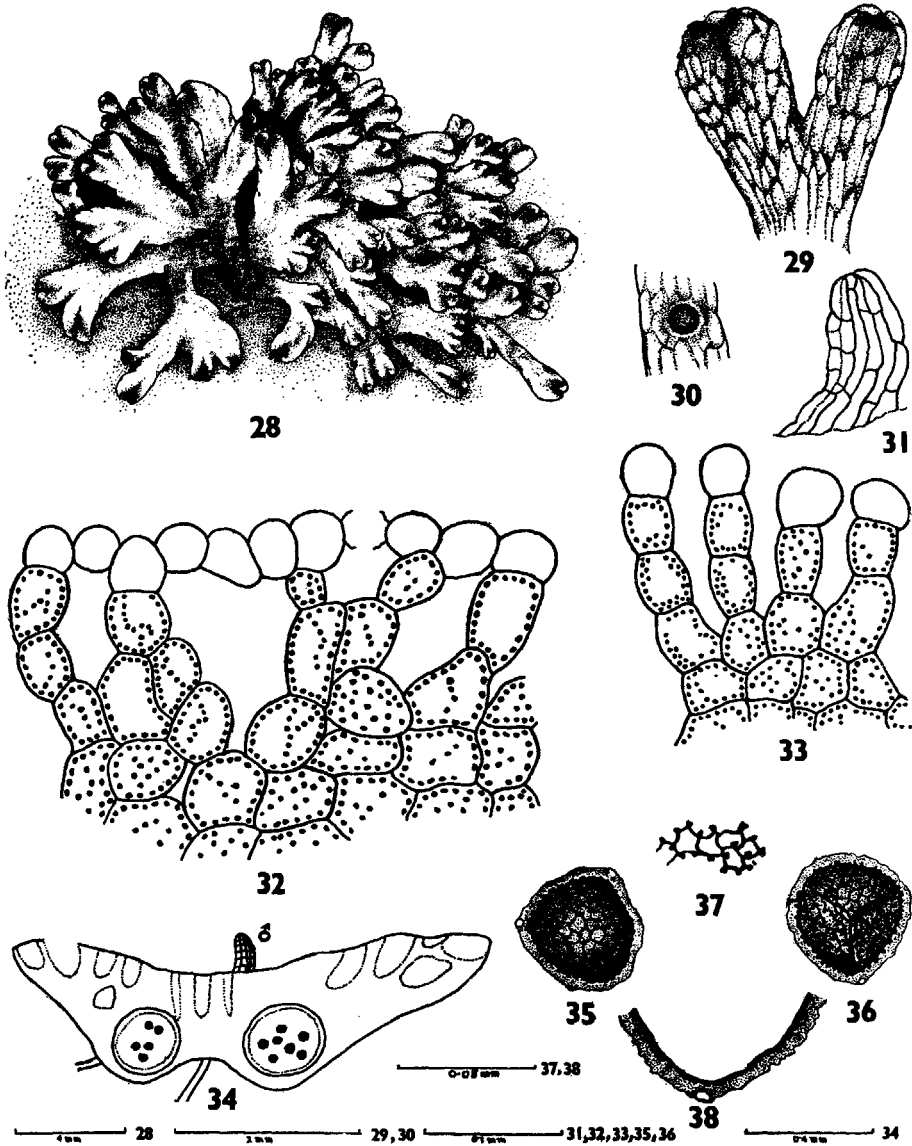
TEXT-FIG. 3 *Riccia plana* Taylor.

Fig. 28. Habit. 29. Areolate appearance of thallus. 30. A part of thallus showing ventrally projecting sporophyte, ventral view. 31. Antheridial papilla. 32, 33. Cross-section of thallus (enlarged) at the margin and in the middle respectively to show assimilatory zone and air spaces. 34. Cross-section of thallus at the point of dichotomy showing two ventrally projecting sporophytes and antheridial papilla δ projecting dorsally. 35. Spore, outer face. 36. Spore, inner faces. 37. Spore reticulations magnified. 38. Wing of the spore magnified.

Coll.: Pandé and Srivastava. *Loc.*: Compound of Mangalore School.
Habitat: Growing on red soil. *Date*: October 6, 1950. Pandé Collection No. 5879, Lucknow University.

This species is likely to be confused with *R. plana* Taylor. The spores in the latter are, however, much larger.

9. *Riccia plana* Taylor.

The Indian specimen of *R. plana* was originally referred to a new species of *Riccia*, *R. mangalorica* by Ahmad (Ahmad, 1942), who remarked that it may only be a variety of *R. plana*. Careful examination of the specimen of this plant has shown that it need not be segregated from *R. plana* (Udar, 1957a). As the only description of this liverwort, in literature on Indian Bryology, is based on a note by Ahmad (1942), a detailed account is presented below.

Monoecious, grey-green; *thalli* several times dichotomously branched, isolated or densely crowded and overlapping, occasionally forming rosettes; loosely arranged assimilatory zone with wide air-spaces; ventral surface concolorous, rhizoids simple and tuberculate, tubercles not prominent; *scales* hyaline and difficult to isolate; *thallus* in *cross section* usually 4–5 times broader than high, extremely variable depending on the size of *thalli*; *antheridial ostioles* conical, hyaline and transparent, about 250 μ above *thallus* surface; *sporophytes* projecting prominently on ventral surface; *spore* light brown to dark brown, tetrahedral, 80–110 μ along the maximum diameter, reticulate with 6–10 reticulations across the outer face, reticulations 7–10 μ wide, inner faces more or less incompletely reticulate, angles of reticulations project in the form of spines which may be truncate, entire or bifid, papillate in profile; winged, wing 3.3 to 6.6 μ wide, broader at angles where occasionally an irregular pit or perforation occurs, wing margin finely erose.

Coll.: Pandé and Srivastava. *Loc.*: Compound of Mangalore Girls' School.
Habitat: Growing on red soil. *Date*: October 6, 1950. Pandé Collection No. 5876 (fixed specimens), Lucknow University. (Text fig. 3).

This is one of the common species in South India.

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* Not seen in original.

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