



## Nine species of *Riccia* (Mich.) L., additions to Bryoflora of South India

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### Abstract

Nine species of *Riccia* (Mich.) L. (Ricciaceae, Marchantiales, Hepaticapsida) viz., *Riccia abuensis* Bapna, *R. aravaliensis* Pande & Udar, *R. attenuata* Pande in Pande & Udar., *R. beyrichiana* Hampe ex Lehm. *R. ciliata* Hoffm, *R. dictiospora* Howe., *R. duplex* Lorb. & K. Muller, *R. glauca* L. and *R. lamellosa* Raddi collected from different localities in Andhra Pradesh, are being reported as new distributional records to Southern Peninsular India; of these, *Riccia duplex* Lorb. & K. Muller, *R. glauca* L. and *R. lamellosa* Raddi are new to Peninsular India and *Riccia lamellosa* Raddi is also new distributional record to India.

**Keywords:** *Riccia* new records, Bryoflora of Southern India

### Introduction

The genus *Riccia* (Mich.) L. (Ricciaceae; Marchantiales) was established by Micheli in 1729 Nova Plantarum Genera in an Italian Botanist, P.F. Ricci. Later it was validated by Linnaeus in 1753. *Riccia* are common thalloids liverworts distributed throughout the world having distinct forming rosette habit with simple and primitive morphological and internal characters. *Riccia* comprises 150 species worldwide (Daniel et al., 2014); in India 39 species (Singh, 2014, Asthana & Srivastava 2020 and Sreenath et al., 2020) are known to occur, of which 20 species are reported from different parts of South India (Daniels 2010; Dandotiya et al., 2011; Uwe Schwarzi 2013; Sandhyarani et al., 2014, Sreenath & Ravi Prasad Rao 2019, Asthana & Srivastava 2020, Sreenath et al., 2020, ENVIS: Bryophytes of Kerala 2021).

Part of our explorations for bryophytes in Andhra Pradesh, during 2016-2020, we could collect interesting thalloid liverwort specimens from different localities and districts of the South Indian state of Andhra Pradesh. After critical microscopic examination of these specimens are identified belonging to *Riccia* (Mich.) L. and species viz., *Riccia abuensis* Bapna, *Riccia aravaliensis* Pande & Udar, *Riccia attenuata* Pande in Pande & Udar., *Riccia beyrichiana* Hampe ex Lehm. Et Lindenb., *Riccia ciliata* Hoffm, *Riccia dictiospora* Howe., *Riccia duplex* Lorb. & K. Muller, *Riccia glauca* L., and *Riccia lamellosa* Raddi. Perusal of literature revealed that these species were so far have not been recorded from South Indian states and hence forms as new distributional records. Of these nine species, *Riccia duplex* Lorb. & K. Muller, *R. glauca* L. and

*R. lamellosa* Raddi are new records to Peninsular India and *Riccia lamellosa* Raddi is first time recorded from India.

## Materials and Methods

Extensive bryophyte explorations were conducted in all the districts of Andhra Pradesh during 2016 to 2020. All the bryophyte specimens were collected and were placed in zip lock polythene cover with labeled field number. Field observations were recorded on-site and photographs were taken with Nikon D3300. Collected material was air-dried at room temperature and preserved them in brown paper packets (12 × 18 cm) with detailed label (10 × 17cm). Critical examination of the specimens was done using micro forceps (Varin) VR-15 curved, VR-11 straight with fine sharp edges and sides were observed under light microscope (Olympus CH20i), light stereo microscope (Olympus SZ61) and micro measurements were taken by using ocular micro meter (ERMA). Microscopic photos were taken by using Moto g3 turbo equipped with 13 MP Camera. Identification was done following standard floras and relevant literature. Species-wise citation, descriptions, habitat and ecology, voucher specimens, field and microscopic photographs were provided in this paper. All the specimens were deposited in Sri Krishnadevaraya University Herbarium (SKU) Ananthapuramu. Abbreviated names used for the collectors are: AS (Ananthaneni Sreenath) and BR (Boyina Ravi Prasad Rao).

## Results and Discussion

*Riccia abuensis* Bapna, Trans. Brit. Bryol. Soc. 4: 249 – 253. f. 1 – 13. 1962; Bapna&Kachro, Hapat.in India. 2: 446 – 447. 2000.

Plants thalloid, aquatic or submerged-terricolous, thallus as in lax patches, thalli forming as incomplete rosettes, light green to yellowish green, narrow, ribbon like, 2 – 4 cm × 0.6 – 0.95 mm; 3 – 6 times dichotomously branched, dorsal surface not alveolate; lobes linear, apex emarginate and scales absent; rhizoids smooth-walled; air chambers in several layers. Monoecious, sporangia projecting ventrally. Spores brown to dark brown 51 – 68 (-75) µm, reticulate, 6 -7 reticulations on outer face, triradiate mark faint, winged.

**Habitat and ecology:** Terricolous in sub-merged watery areas of semi-moist deciduous forests, mostly mono-dominant plants sometimes associated with other *Selaginella* sp. (Selaginallaceae).

**Distribution: World:** Endemic to **India:** Rajasthan (Mount. Abu.).

**Specimens examined:** India, Andhra Pradesh, Prakasam district, Nallamalais, Gundlabrahmeswaram Wild Life Sanctuary, near Isukagundam, 03 August 2017, 53533A, BR & AS.

*Riccia aravaliensis* Pande & Udar J. Indian bot. Soc. 36. 248. 1957; Bapna & Kachro, Hapat. in India. 2: 447. 2000.

Plants thalloid, terricolous, as isolated patches, thalli bluish green, 0.5 - 1.2 cmx 1–2.5 mm, 1 -3 times furcate thick, with acute margin; lobes ovate with prominent sulcus anteriorly, air spaces narrow; scales large not extending beyond margin. Monoecious; sporophyte slightly projecting dorsally; spore dark brown, 80 – 110 µm reticulate, lamellate with only large areoles across outer face, winged, wing upto 7 µm wide, pinkish, triradiate mark prominent.

**Habitat and ecology:** Terricolous on soil covered rock substratum near water seeping areas near huge rocks, mostly mono-dominant plants, sometimes associated with *Oropetium thomaeum* (Poaceae) and other acrocarpous mosses.

**Distribution: World:** Endemic to **India:** Rajasthan and Uttarakhand.

**Specimens examined:** India, Andhra Pradesh, Ananthapuramu district, Ramagiri Mandal, Dubbarlapalli, Addarallavanka, Nagaraju Bavikattachenu Agri farm, Near water stagnating rocks, 08 October 2019, 57012B, AS; Kadapa district, Palakondalu waterfalls, 3 December 2019, 57067A & 57068A, AS.

*Riccia attenuata* Pande & Udar., Proc. Nat. Inst. Sci. India 258. 92. f. 1 – 6. 1959; Bapna & Kachro, Hept. In India.2: 447. 2000.



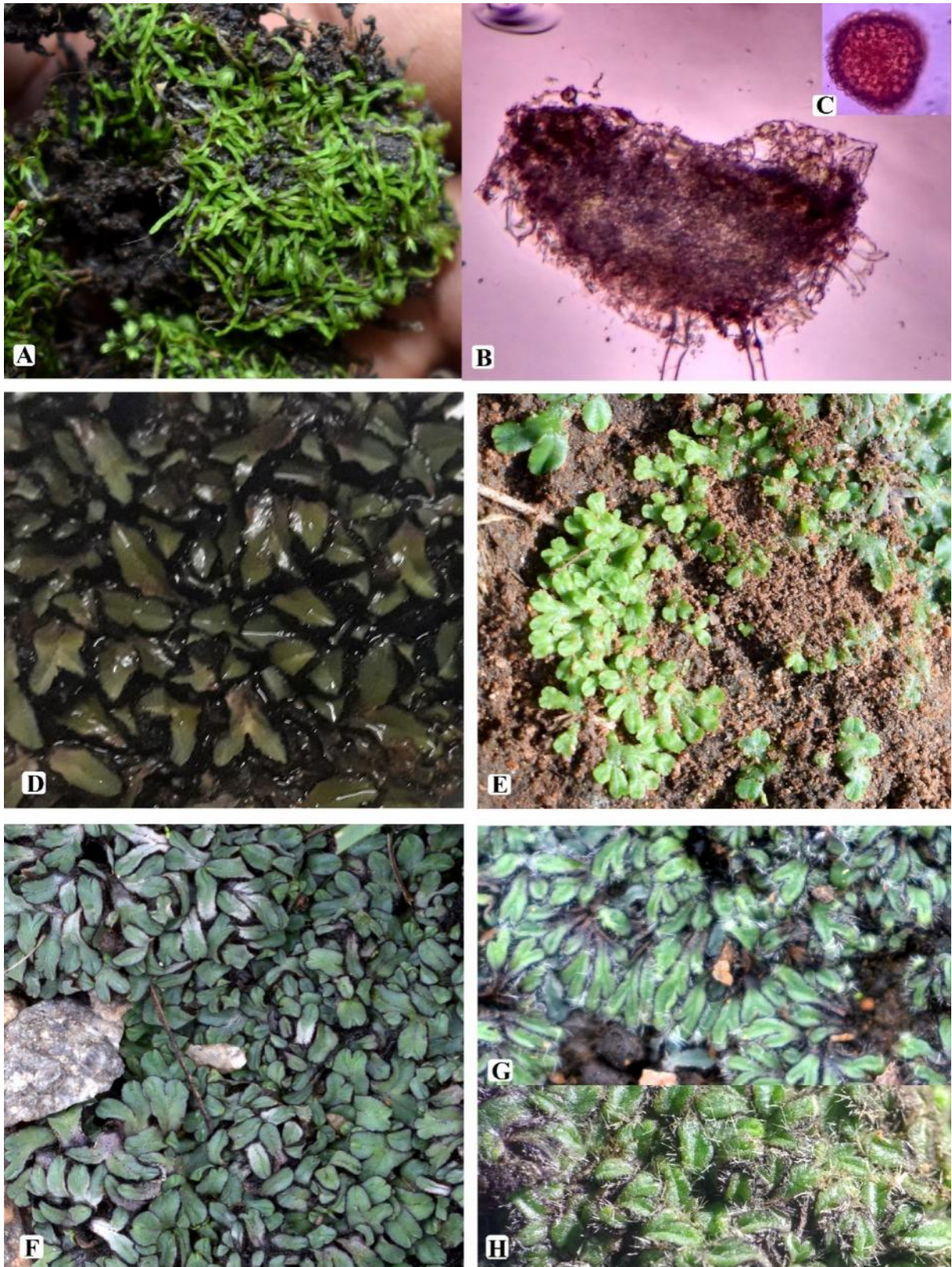


Plate 1: A-C. *Riccia abuensis* Bapna, D.*R. aravaliensis* Pande & Udar, E.*R. attenuata* Pande, F.*R. beyrichiana* Hampe ex Lehm. and G-H. *R. ciliata* Hoffm.

Plants thalloid, thalli complete or incomplete rosettes, 3 – 6 × 2 – 2.3 mm, sulcate, sulcus deep anteriorly, 1 – 2 furcate, scales hyaline, inconspicuous; rhizoids both smooth and tuberculate; in cross section 10 – 15 times broader than high; wings greatly attenuated on both the sides; air spaces *Ricciella* type; epidermal cells hyaline. Monoecious plants. Spores light brown, rounded, 65 – 85 µm in diameter, reticulate with 5-7 reticulations on outer face, inner face incompletely and irregularly reticulate, wing 6.6 µm wide, crenate, surface warty.

**Habitat and ecology:** Terricolous on moist soil in shade and moist places of semi-moist or dry-deciduous forests, mostly mono-dominant plants.

**Distribution: World:** Sri Lanka and **India:** Assam.

**Specimens examined:** India, Andhra Pradesh, Kadapa district, Lankamalleswaram Wild Life Sanctuary, Lankamala hills, 01 December 2019, 57050, AS.

***Riccia beyrichiana* Hampe ex Lehm.et Lindenb.** In Lehm. Nov. Strip. Pug. 7: 1 1839; Pande & Udar, Proc. Nat. Inst. Sci. India. 258. 97. f. 7 – 12. 1959; Bapna & Kachro, Hapat. India. 2: 447 - 448. 2000.

Plants thalloid, thallus large, forming as complete rosettes, up to 6 cm in diameter, thallus shiny, grayish-green, margins violet and generally becoming brown with age; thalli 3 – 4 × 1.5 – 3.2 mm, furcately branched, branches ovate-rounded to subacute-rounded or emarginate at apex; median deep groove up to ½ of the branch width or smaller, distinct up to base, narrow at apex; lateral edges rounded. Ventral scales pigmented with orange-brown tinge. Rhizoids many, smooth and tuberculate. Thallus 3 to 4 times as broad as high in cross section; epidermal cells rounded to ovate. Monoecious plants, sporangium common; spores pale to dark yellowish-brown, up to 120 µm, rounded, winged, wing up to 10 µm, wing margin irregularly crenulate.

**Habitat and ecology:** Terricolous or rupicolous on soil covered rock substratum, near water seeping areas on semi dry top hills, associated with *Riccia ciliata* (Ricciaceae).

**Distribution: World:** Afghanistan, Algeria, Azores, Balears, Belarus, Belgium, Bulgaria, Corsica, Czech Republic, Denmark, England, Estonia, Faroes, Finland, France, Germany, Greece the Netherlands, Iceland, Ireland, Italy, Macedonia, Malta, Norway, Poland, Portugal, Russia, Sardinia, Spain, Sweden,

Tunisia and **India:** Assam, Himachal Pradesh and Meghalaya.

**Specimens examined:** India, Andhra Pradesh, Ananthapuramu district, Gundumala Fort, Hill top, 10 August 2019, 55863B, AS.

***Riccia ciliata* Hoffm.Deusch.** Fl. 2: 95. 1795; Steph., Hep. 1: 11. 1900. Macviear. Std. Handb. Brit. Hep. 15. f. 1 – 3. 1926; Hapat. India. 2:449. 2000.

Plants thalloid, terricolous or rupicolous, thallus forming as incomplete rosettes or dense patches to 3 – 8 cm in diameter, thalli 5 – 9 × 1.5 – 2.5 mm, light green to glaucous green, lateral sides and base of lobes green, margins whitish green; thalli 2 to 3 times furcately branched, branches oblong, rounded at apex, median groove absent; lateral edges rounded; ciliate at margins, cilia 380 – 500 µm long, smooth, most abundant in the upper part, rolled up when dry, slightly curved to strait when moist. Ventral scales hyaline to light brown. Rhizoids more, smooth and tuberculate. Thallus 1.5 to 2 times as broad as high in cross section. Monoecious, antheridial papillae on the surface of the thallus, archegonial necks 6 – 8 celled. Sporangium common. Spores' ovoid to rounded 85 – 98 µm in diameter, brownish, winged, wing 3 – 5 µm wide, smooth.

**Habitat and ecology:** Terricolous on soil covered rock substratum, near water seeping areas on top of dry hills, associated with *Riccia bayrichiana* (Ricciaceae) and *Bryum argenteum* (Bryaceae).

**Distribution: World:** Albania, Algeria, Austria, Bosnia-Herzegovina, Canary Islands, Caucasus, Corsica, Crete, Croatia, Cyprus, Czech Republic, England, Europe, France, Greece, Israel, Italy, Jordan, Libya, Lebanon, Montenegro, Morocco, Portugal, Sardinia, Sicilia, Slovakia, Spain, Syria, Switzerland, Tunisia, Turkey, Southwest Asia and **India:** Sikkim.

**Specimens examined:** India, Andhra Pradesh, Ananthapuramu district, Gundumala Fort, hill top, 10 August 2019, 55867, AS; near Gorantla Samrajyamkonda, 15 September 2019, 55886A, AS.

***Riccia dictiospora* Howe,** New York. Bot. Gard. 14: 1 – 66. 1923; Udar, Proc. Indian Sci. Congr. 3: 40. 1950; *Riccia meallisteri* Howe. New York. Bot. Gard. 14: 1 – 66. 1923; Mc. Grag.Univ. Kansas Sci. Bull.37: 105.1955; Bapna and Kachroo, Hapat.of India. 2: 451: 2000.



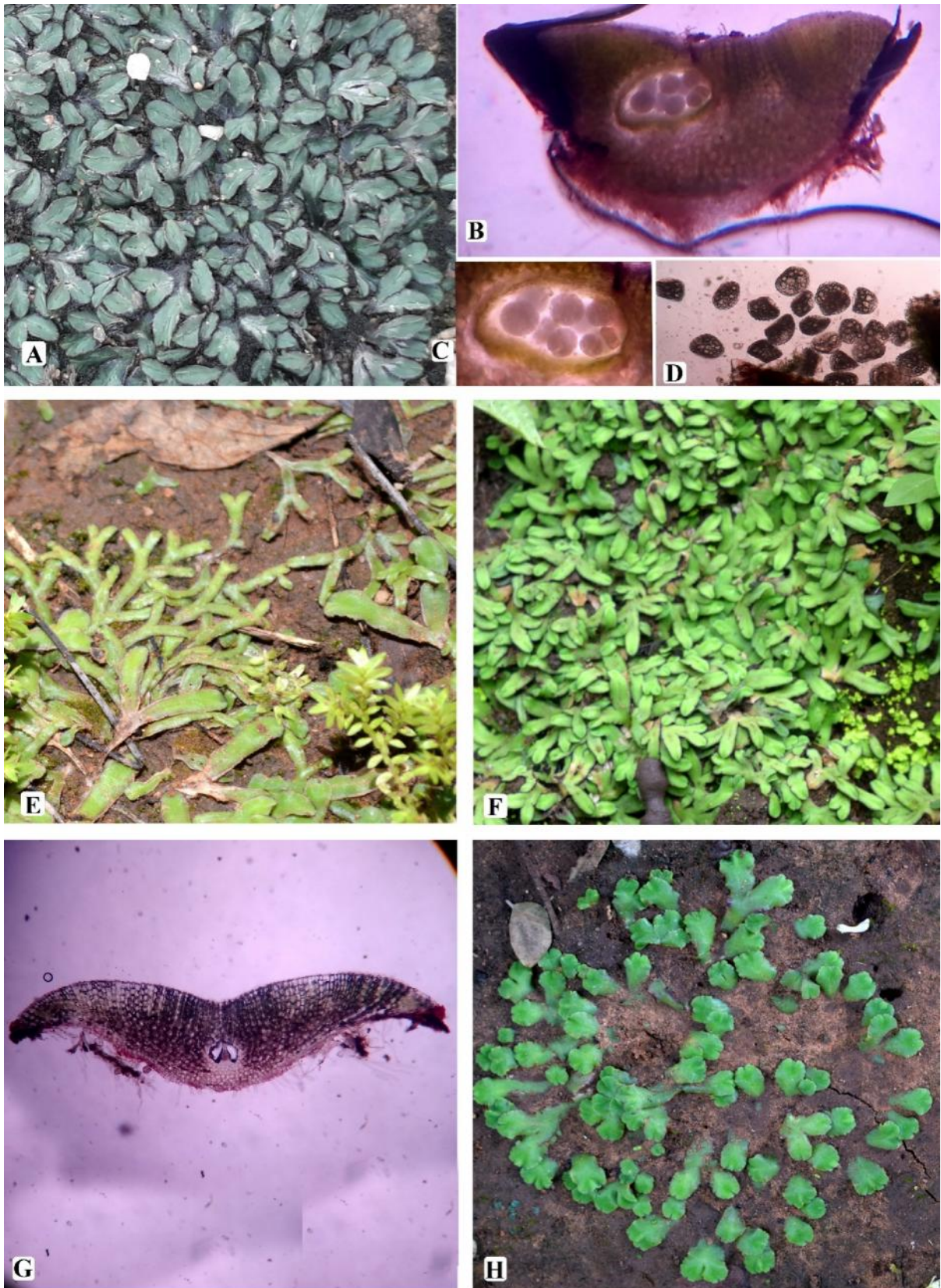


Plate 2: A-D. *Riccia dictiospora* Howe., *E.R. duplex* Lorb. & K. Muller, F-G. *R. glauca* L. and H. *R. lamellosa* Raddi.

Plants thalloid, terricolous, thalli bluish-green, 0.5 - 1.2 cm × 1 - 2.5 mm, 1 -3 times furcate thick, with acute margin; lobes ovate with prominent sulcus anteriorly, air spaces narrow; scales large not extending beyond margin, blackish purple. Monoecious; sporophyte slightly projecting dorsally; antheridial ostioles elevated; spore brown, 50 µm, reticulate, rather translucent.

**Habitat and ecology:** Terricolous on soil covered rock substratum, near water seeping areas of huge stones, associated with *Oropetium thomeum* (Poaceae).

**Distribution: World:** Africa, North America and **India:** Uttar Pradesh.

**Specimens examined:** India, Andhra Pradesh, Ananthapuramu district, Ramagiri Mandal, Dubbarlapalli, Nearaddarallavanka, Nagaraju Bavikattachenu, Near water stagnating rocks, 08 October 2019, 57012A, AS.

*Riccia duplex* Lorb.& K. Muller. Hedwigia 80: 100. 1941; Bir & Chopra, Bryologist, 75: 371. 1972; Bapna and Kachroo, Hepat.of India. 2: 451: 2000.

Plants thalloid, found as aquatic or terrestrial; thalli green, 1 - 4 cm × 0.8 - 1.2 mm, repeatedly dichotomously branched, with acute angles, with rhizoids; lobes linear, cross section 3 times as broad as thick, margin obtuse, ventral scales small, hyaline only at the apices of branches; lunate, sickle-formed; paroicous plants, spores dark brown, 80 - 100 µm, wing 10 µm wide, yellow, areolate.

**Habitat and ecology:** Found as terrestrial on moist soil of deep shady places of moist or dry deciduous forests, associated with other land mosses.

**Distribution: World:** Europe and **India:** Himachal Pradesh.

**Specimens examined:** KNL Dt., Chalama Reserve Forest, near Sri Sarva Lakshmi Narasimhaswami Temple area, 25 August 2016, 51627, SKU, BR & AS; PKS Dt., NLM, GBM WLS., Dornala range, near ChinnaMantanala Basecamp, 27 September 2017, 53583, SKU, BR AS.

*Riccia glauca* L. in Spec. Plant: 1139. 1753; *Riccia major* Roth, Arch. Bot. (Leipzig) 1,3: 52. 1798; *R. venosa* Roth, Tentamen Fl. Germ.3: 433.1800; *R.*

*galuca-major* (Roth) Lindenb.Nova Acta Phys-Med. Acad. Caes. Leop-carol. Cur. 18 (1): 418. 1836; *R. ruppiniensis* Warnst.Kryptog. Fl. Mark Brandenburg 1: 71. 1902; Hepat.in India. 2: 453. 2000.

Plants terrestrial medium to large sized, generally forming more or less rosettes up to 9 cm in diameter, thallus dull-bluish green to glaucous green, thalli 2 - 3 furcately branched, branches 2.5 - 6 × 1.2 - 2.5 mm, obovate or shortly oblong, rounded-subacute at apex; median groove narrow at apex, wide to about ¼ of the branch width, distinct almost to base; flanks slightly convex; ventral scales hyaline; rhizoids numerous and internally tuberculate or not. Thallus cross section of lobes 0.7 - 0.85 mm high and 3 - 4 times as wide as long; epidermal cells chlorenchymatous, sub epidermal cell walls hyaline and not thickened, epidermal cells 65 - 85 × 70 - 90 µm. Ventral scales brown minute, 75 - 95 × 35 - 45 µm. Monoicous plants. Spores yellowish to dark brown, rounded 75 - 90 µm, distal face with 7 - 9 alveoli across in diameter, lamellae rather thin with papillae, proximal face similarly ornamented but alveoli and tubercles smaller, spores winged, wings 5 - 7 µm wide, margin smooth.

**Habitat and ecology:** Found as terrestrial or racopilous on soil covered rock near water seeping rocky areas, associated with *Riccia poihaniana* and other *Riccia* spp. (Ricciaceae) and other dry acrocarpous mosses.

**Distribution:** World: Africa, Britain, Canary Island, Denmark, Europe, Finland, North America, Norway, Russia and **India:** Assam.

**Specimens examined:** India, Andhra Pradesh, Ananthapuramu district, Poolakunta, 03 October 2019, 55900, SKU, AS; Kurnool district, Nallamalais, Gundlabrahmeswaram Wild Life Sanctuary, Buggavagu Basecamp, 11 July 2017, 53517A, SKU, BR & AS.

*Riccia lamellosa* Raddi 1818, Opusc.Sci. (bologna) 2: 351.1818; *Riccia dufourii* Nees, Naturgesch. Eur. Leberm. 4: 390, 415. 1838; *Riccia austinii* Steph.Spec. Hep. 1: 28. 1898; *Riccia lamellosa* var. *americana* Howe, Bull. Torrey Bot. Club.25: 189. 1898; *Riccia americana* (Howe) Howe, Mem. Torrey Bot. Club 7: 24. 1899.



Plants thalloid, terricolous, thallus forming as complete or incomplete rosettes, thalli 3 - 4 times furcately branched, branching segments 2 – 2.5 × 2 – 2.8 mm wide, obovate, rounded or obtuse apically; thalli bluish green to pale-green; median groove shallow, distinct all along the lobes, widening to about ¼ of the branch width; lateral lobes subacute; upper edge divided into three convex parts on dorsally, lateral edges erect and upper part spread out. Ventral scales whitish brown, imbricate; thalli sections 2 – 3 times as broad as high; epidermal cells rectangularly-rounded, persistent at mid dorsal groove. Rhizoids numerous, smooth and tuberculate. Monoecious, Archegonia 1 – 2 rows, Antheridial papillae distinct or indistinct, along mid dorsal groove; sporangium common. Spores, brown, ovoid to rounded, 90 – 110 µm, winged, wing 6 – 8 µm, margin crenulate.

**Habitat and ecology:** Terricolous on very smooth and fine soil in dense forests, under tree shade, associated with *Fossombronia indica* (Fossombroniaceae) and hornworts.

**Distribution: World:** Albania, Algeria, Baleares, Canary Islands, Caucasus, Crete, Corsica, Cyprus, Egypt, Europe, France, Greece, Iran, Israel, Italy, Jordan, Lebanon, Libya, Madeira, Malta, Morocco, Portugal, Russia, Sardinia, Saudi Arabia, Sicilia, Spain, Syria, Tunisia, Turkey, Ukraine, Southwest Asia. A new distributional record to India.

**Specimens examined:** India, Andhra Pradesh, Kurnool district, Nallamalais, near Naramamidi Cheruvu Basecamp, 22 October 2017, 53604, BR & AS.

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