



Note

Jubula pennsylvanica (Hepaticae: Jubulaceae) new to Asia

Monalisa Dey⁽¹⁾, Devendra Singh⁽¹⁾ and D. K. Singh^(2*)

1. Botanical Survey of India, Central National Herbarium, Howrah – 711103, India.

2. Botanical Survey of India, CGO Complex, 3rd MSO Building, Block F (5th floor), Salt Lake Sector I, Kolkata – 700 064, India.
Tel. +91 33 23214050, Fax +91 33 23215631

* Corresponding author. Email: singh_drk@rediffmail.com

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ABSTRACT: *Jubula pennsylvanica* (Steph.) A.Evans, a species so far known only from North America, is recorded for the first time in Asia from Eastern Himalaya, India.

KEY WORDS: *Jubula pennsylvanica*, Jubulaceae, new record, Asia.

INTRODUCTION

The genus *Jubula* Dumort. is represented by seven species, two subspecies and two varieties in the world (Guerke, 1978; Udar and Nath, 1978; Chang and Gao, 1984; Srivastava and Sharma, 1990; Sim-Sim et al., 2002) of which six taxa, viz. *J. hattorii* Udar & V.Nath, *J. himalayensis* S.C.Srivast. & D.Sharma, *J. hutchinsiae* (Hook.) Dumort. subsp. *hutchinsiae*, *J. hutchinsiae* subsp. *javanica* (Steph.) Verdoorn, *J. japonica* Steph. and *J. kwangsiensis* C.Gao & K.C.Chang are known from Asia (Kamimura, 1961; Udar and Nath, 1978; Chang and Gao, 1984; Srivastava and Sharma, 1990; Piippo, 1990). Of these *J. hattorii*, *J. himalayensis* and *J. hutchinsiae* subsp. *javanica* are known from India (Singh, 2001). Among the Indian species, *J. hattorii* is known from West Bengal and Meghalaya in Eastern Himalaya, *J. himalayensis* from Uttarakhand in Western Himalaya, while *J. hutchinsiae* subsp. *javanica* is known from Assam, Sikkim and West Bengal in Eastern Himalaya and the Western Ghats in India (Chopra, 1938; Hattori, 1966; Udar and Nath, 1978; Srivastava and Sharma, 1990; Long and Grolle, 1990; Singh et al., 2008).

During the course of studies on the epiphyllous liverworts of Eastern Himalaya, the authors came across some interesting specimens of the genus *Jubula* from East district of Sikkim which differed from the hitherto known species from Asia. A subsequent morpho-taxonomic investigation on the specimens followed by literature review (Guerke, 1978; Schuster, 1992) revealed that the plants belong to typical *J. pennsylvanica*, so far known from North America only. The same has been described and illustrated in the present communication.

TAXONOMIC TREATMENTS

Jubula pennsylvanica (Steph.) A.Evans in Rhodora 7: 55. 1905; W.R.Guerke in Bryophyt. Biblioth. 17: 79. 1978; R.M.Schust., Hepat. & Anthocerot. of North America 5: 275. 1992. *Frullania pennsylvanica* Steph. in Hedwigia 22: 147. 1883. subsp. *pennsylvanica* Figs. 1 & 2

Plants blackish green in herbarium; shoot 8.0-28.0 mm long, 1.2-1.6 mm wide, irregularly branched throughout. Stem elliptical in outline in transverse section, 0.18-0.23 × 0.11-0.13 mm, 7-9 cells across the diameter; cortical cells in one layer, rectangular, 8.14-16.3 × 8.14-28.5 μm, slightly thick-walled; medullary cells in 22-31 vertical rows, polygonal, 16.3-44.7 × 12.2-28.5 μm, thin-walled. Leaves imbricate, widely spreading, leaf lobe ovate - oblong ovate, 0.55-0.89 mm long, 0.41-0.65 mm wide, apex sub acute - acute, often apiculate, margin entire, dorsal margin strongly arched, ventral margin almost straight - slightly arched; apical leaf cells rectangular - polygonal, 10.2-20.3 × 10.2-24.4 μm; median leaf cells polygonal, 20.3-32.5 × 14.2-24.4 μm; basal leaf cells polygonal, 24.4-44.7 × 16.3-30.5 μm; walls thin with minute trigones, intermediate thickenings absent; cuticle smooth; oil-bodies not seen; leaf lobule dimorphic, galeate or explanate, when galeate ovoid, 0.12-0.27 × 0.09-0.19 mm, with rounded apex and truncate mouth; explanate lobule lanceolate, 0.16-0.24 × 0.06-0.10 mm, apex apiculate; stylus not seen; first branch leaf reduced, lanceolate, 0.23-0.36 mm long, 0.09-0.16 mm wide, apex apiculate, margin entire, lobule absent. Underleaves distant - slightly contiguous, 2-3 times as wide as the stem,

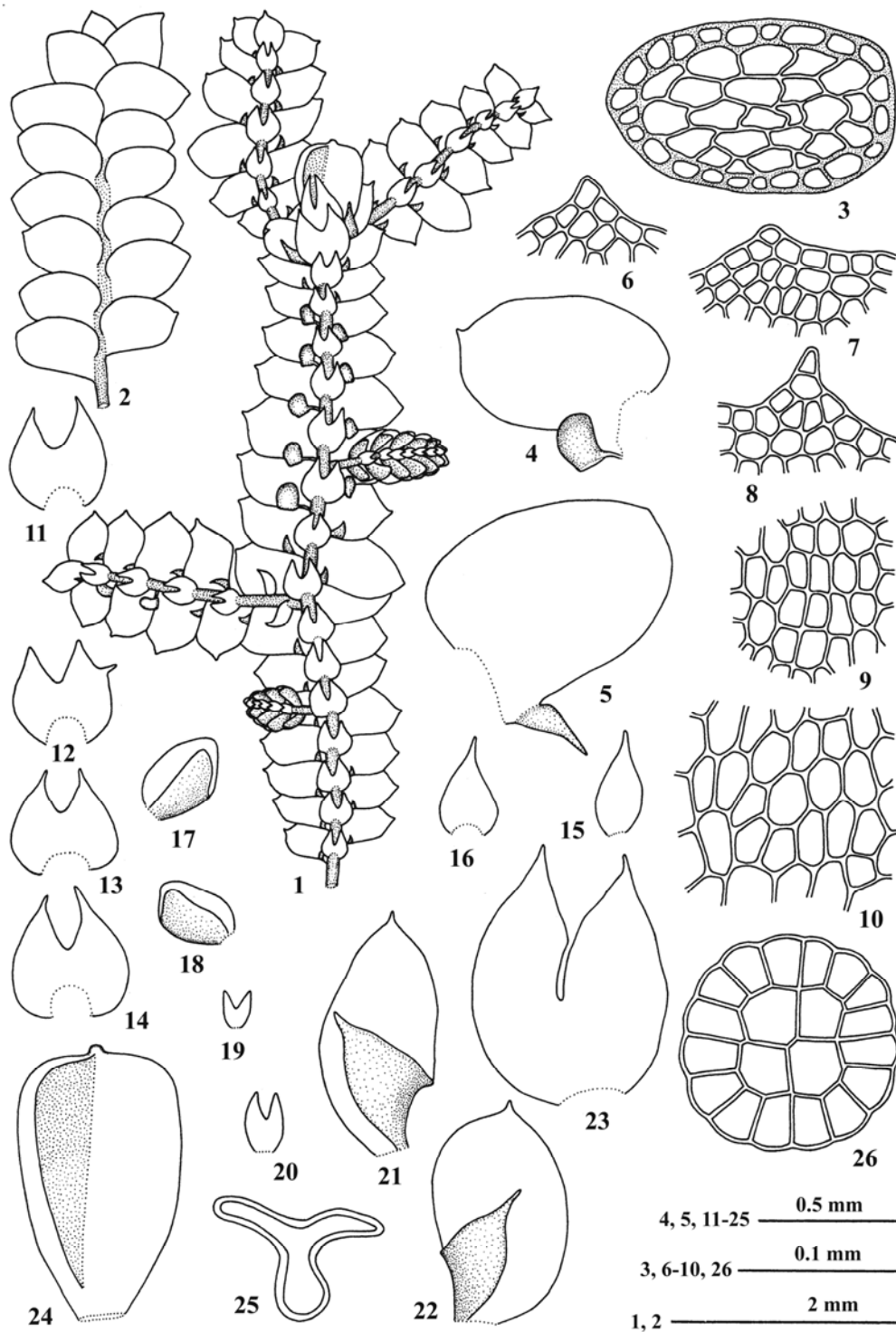


Fig. 1. *Jubula pennsylvanica* (Steph.) A.Evans subsp. *pennsylvanica*. 1: A portion of plant bearing androecial and gynoecial branches in ventral view (rhizoids not drawn). 2: A vegetative branch in dorsal view. 3: Transverse section of stem. 4, 5: Leaves. 6 – 8: Apical leaf cells. 9: Median leaf cells. 10: Basal leaf cells. 11–14: Underleaves. 15: First branch leaf. 16: First branch underleaf. 17, 18: Male bracts. 19, 20: Male bracteoles. 21, 22: Female bracts. 23: A female bracteole. 24: A perianth in ventral view. 25: Transverse section of perianth. 26: Transverse section of seta. (2–12, 14–16 drawn from *D. Singh* 36992B; others from *D. Singh* 39624A).

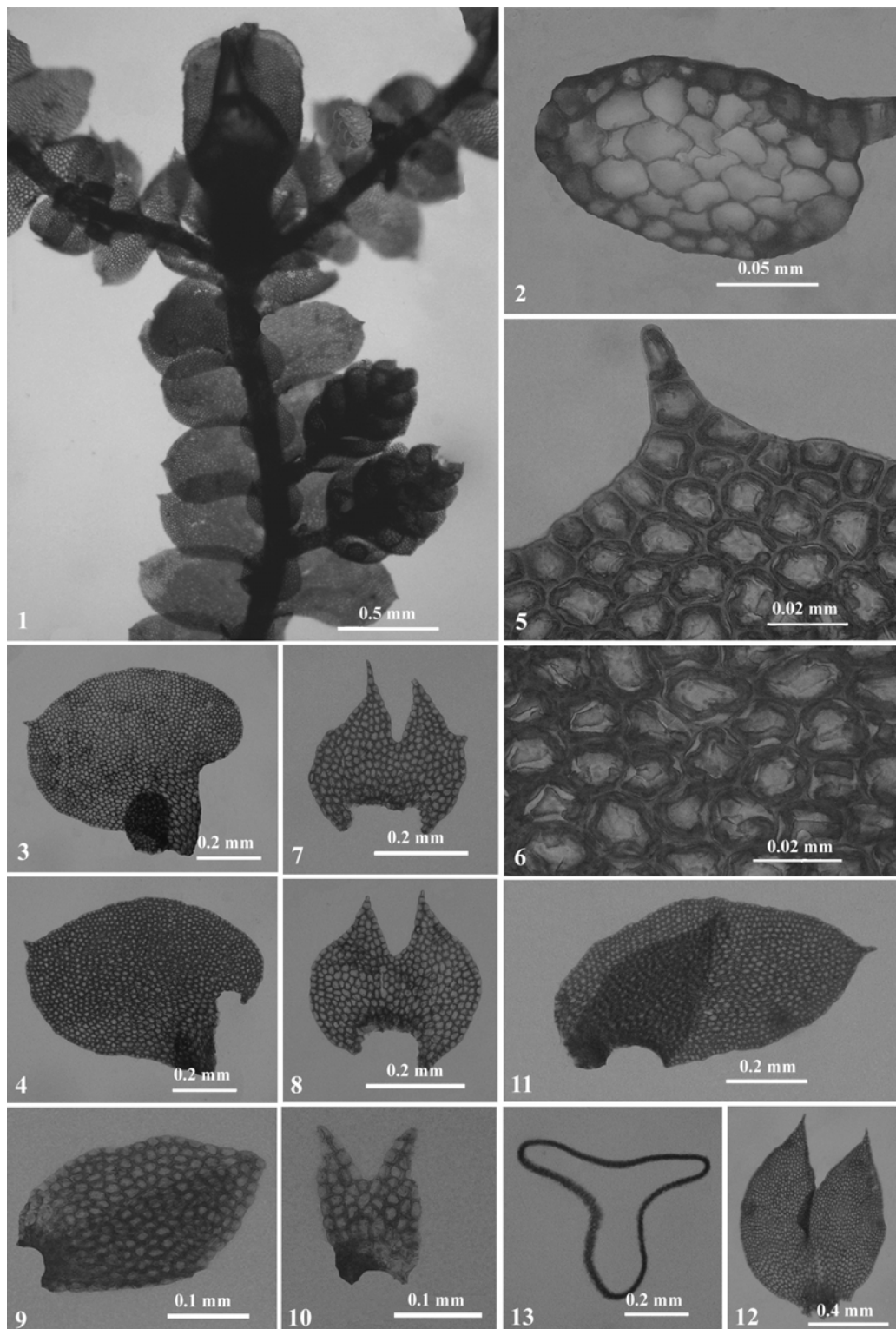


Fig. 2. *Jubula pennsylvanica* (Steph.) A.Evans subsp. *pennsylvanica*. 1: A portion of plant bearing androecial and gynoecial branches. 2: Transverse section of stem. 3, 4: Leaves. 5: Apical leaf cells. 6: Median leaf cells. 7, 8: Underleaves. 9: A male bract. 10: A male bracteole. 11: A female bract. 12: A female bracteole. 13: Transverse section of perianth. (2–6, 8 from *D. Singh* 36992B; others from *D. Singh* 39624A).



sub orbicular - ovate in outline, 0.22-0.42 mm long, 0.21-0.39 mm wide, bilobed to 1/2 of underleaf length, lobe apices long acute - acuminate, margin entire, very rarely with a single lateral cilium, sinus narrow - wide; first branch underleaf reduced, ovate, 0.25-0.35 mm long, 0.11-0.20 mm wide, apex apiculate, margin entire. Rhizoids few, fasciculated near base of underleaves. Gemmae absent.

Monoecious. Androecia terminal on short lateral branches; bracts in 3-9 pairs, closely imbricate, oblong ovate, 0.22-0.32 mm long, 0.15-0.23 mm wide, apex obtuse - sub acute, bract lobule strongly inflated, slightly smaller than bract lobe; bracteoles present throughout the androecium, oblong ovate, 0.12-0.21 mm long, 0.10-0.13 mm wide, bilobed to 1/2 their length. Gynoecia terminal on main shoot or long lateral branches with 1-2 subfloral innovations; bract lobe oblong ovate - lanceolate, 0.70-0.84 mm long, 0.34-0.46 mm wide, apex apiculate, margin entire, bract lobule ovate - lanceolate, 2/3 - 3/4 as long as the bract lobe, apex apiculate, margin entire, keel arched; bracteoles broadly obovate, 0.75-0.96 mm long, 0.50-0.76 mm wide, bilobed to 2/3 of their length, lobe apices apiculate, margin entire. Perianth obovate, 0.80-1.20 mm long, 0.45-0.63 mm wide; keels 3 (2 lateral, 1 ventral), lateral keels sharp, compressed, ventral keel broad, inflated; beak short. Seta orbicular in outline in transverse section, 115.0-132.5 μ m in diameter, with 16 outer cells surrounding 4 inner cells; capsule spherical, 0.48-0.52 mm in diameter. Mature sporophyte not seen.

Habitat: Epiphyllous, growing on the leaves of *Microsorium* sp. and dicotyledonous angiosperms in moist and shady places, in association with *Heteroscyphus bescherellei*, *Lejeunea obscura*, *L. tuberculosa* and *Metzgeria lindbergii*.

Distribution: India [Eastern Himalaya (Sikkim) - present study], North America (Guerke, 1978; Schuster, 1992).

Specimens examined: India - Eastern Himalaya, Sikkim, East district, Dalapchand, ca 1650 m, 27. 02. 2006, D. Singh 36992B (CAL); Phendung khola, ca 1850 m, 28. 02. 2006, D. Singh 39623A, 39624A (CAL).

DISCUSSION

J. pennsylvanica subsp. *pennsylvanica* is characterized by monoecism of the plants (Figs. 1: 1; 2: 1); ovate - oblong ovate leaf lobes with sub acute - acute, often apiculate apices and entire margins (Figs. 1: 1, 2, 4-8; 2: 1, 3-5); leaf lobule dimorphic, both galeate as well as explanate (Figs. 1: 1, 4, 5; 2: 3, 4); bilobed underleaves with entire margins, very rarely with a single lateral cilium (Figs. 1: 1, 11-14; 2: 1, 7, 8) and female bracts and bracteoles with entire margins (Figs. 1: 21-23; 2: 11, 12). It can be readily distinguished from

other species of the genus in having leaf lobes with entire margins. The present discovery of *J. pennsylvanica* from India also constitutes its first record in Asian bryoflora. The species shows an interesting bicentric, trans-oceanic disjunct distribution of considerable phytogeographical significance.

Key to the Asiatic taxa of *Jubula*

- 1a. Leaf lobe 0.25-0.3 mm long, 0.11-0.16 mm wide; lobule 47-75 μ m long, 34-60 μ m wide *J. kwangsiensis*
- 1b. Leaf lobe more than 0.5 mm long, more than 0.4 mm wide; lobule more than 120 μ m long, more than 60 μ m wide 2
- 2a. Plants dioecious; male bracteoles present only at the base of androecium *J. hattorii*
- 2b. Plants monoecious; male bracteoles present throughout the androecium 3
- 3a. Female bracts and bracteoles with irregularly toothed or spinose margins 4
- 3b. Female bracts and bracteoles with entire margins 6
- 4a. Leaf lobes with densely spinose - ciliate margins, spines 4-12; lobules without a spinose appendage; underleaves 3-4 times as wide as stem, margins densely spinose - ciliate *J. japonica*
- 4b. Leaf lobes with dentate margins, teeth (0-) 1-7; lobules usually with a spinose appendage; underleaves about 2 times as wide as stem, margins dentate, teeth (0-) 1-3 5
- 5a. Plants 1.3-3.0 mm wide with leaves; stem 250-275 μ m in diameter; leaf lobe margins with 5-7 teeth
..... *J. hutchinsiae* subsp. *hutchinsiae*
- 5b. Plants 1.0-2.0 mm wide with leaves; stem 150-200 μ m in diameter; leaf lobe margins with (0-)1-3 teeth.....
..... *J. hutchinsiae* subsp. *javanica*
- 6a. Stem 11-12 cells across diameter; leaf lobes as long as wide, ovate- sub triangulate, 1.14-1.20 mm long, 1.03-1.20 mm wide, with 1(-2) teeth at apex; explanate lobules absent
..... *J. himalayensis*
- 6b. Stem 7-9 cells across diameter; leaf lobes longer than wide, ovate-oblong ovate, 0.55-0.89 mm long, 0.41-0.65 mm wide, without apical teeth; explanate lobules present
..... *J. pennsylvanica* subsp. *pennsylvanica*

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亞洲新紀錄種 - 賓州毛耳葉蘚

Monalisa Dey⁽¹⁾, Devendra Singh⁽¹⁾ and D.K. Singh^(2*)

1. Botanical Survey of India, Central National Herbarium, Howrah - 711103, India.

2. Botanical Survey of India, CGO Complex, 3rd MSO Building, Block F (5th floor), Salt Lake Sector I, Kolkata - 700 064, India.
Tel. +91 33 23214050, Fax +91 33 23215631

* 通信作者。Email: singh_drk@rediffmail.com

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摘要：本文首次報導描述分布於東喜瑪拉雅山印度境內的賓州毛耳葉蘚 (*Jubula pennsylvanica* (Steph.) A. Evans)，本種紀錄僅分布於北美洲，故亦為亞洲新紀錄種。

關鍵詞：賓州毛耳葉蘚、毛耳葉蘚科、新紀錄種、亞洲。