

Plagiochilion braunianum (Plagiochilaceae, Marchantiophyta) – an addition to the Indian bryoflora from eastern Himalaya

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Plagiochilion braunianum (Nees) S.Hatt., earlier known from China, Taiwan, Sri Lanka, Malesia and Melanesia, is here reported from Arunachal Pradesh, eastern Himalaya, India. In fact, the taxon *P. braunianum* was reported from Sikkim and Bengal in India already in 1861 by Mitten, but the accessions, collected by J. D. Hooker, that were the basis of this report have later been revised to belong to another species, *P. mayebarae*. This is, therefore, a new record for the Indian bryoflora. The species can be readily distinguished from the hitherto known Indian species of the genus in having suborbicular to reniform leaves with entire margin, except the ones immediately below the female bracts. Identification key to the Indian species of the genus is provided.

The genus *Plagiochilion* S.Hatt. is represented by 14 species in the world, distributed mostly in east and south-east Asia, South, Central and southern North America and Oceania (Table 1). *Plagiochilion braunianum* (Nees) S.Hatt. has earlier been reported from Sikkim and West Bengal in India under the synonym *Plagiochila brauniana* Nees based on collections by J. D. Hooker (Mitten 1861) and Kurz (Stephani 1904). Hooker's and Kurz's collections of *P. braunianum* from India were, however, treated as *P. mayebarae* S.Hatt. by Inoue (1964) – a view subsequently followed by Hattori (1966), Kachroo (1973) and Parihar et al. (1994). But, Singh et al. (2008) wrongly listed *Plagiochilion braunianum* from Sikkim based on Mitten's (*l.c.*) report. Interestingly the genus is so far known to occur in the east Himalayan bryogeographical region in the Indian bryoflora. It is very poorly represented in Indian herbaria and its taxonomy has not received any attention by the Indian bryologists.

During the course of our studies on liverworts and hornworts of Arunachal Pradesh in the eastern Himalaya, we came across the genus in Anjaw and West Siang districts with specimens fitting totally with *P. braunianum* in every morphological detail. Here it is described and illustrated to facilitate its identification. The present report

is the first one to verify the occurrence of this species in Indian bryoflora.

Plagiochilion braunianum (Nees) S.Hatt. in Biosphaera 1: 7. 1947 '*braunianus*'. *Jungermannia brauniana* Nees, Enum. Pl. Cryp. Jav. 80. 1830. *Plagiochila brauniana* (Nees) Lindenb., Sp. hepat. (*Plagiochila* fasc. 2–4): 117. 1844. (Fig. 1).

Plants light green – green when fresh, yellowish brown to brown in herbarium; shoots 15–47 mm long, 1–2 mm wide, sparsely branched, branching lateral intercalary, usually confined to the older part of the stem; branches 3–5 mm long, 0.5–1.2 mm wide. Stem oval to elliptical in outline in transverse section, 0.17–0.33 × 0.14–0.26 mm, 11–17 cells across the diameter, differentiated; cortical cells in (1–)2–3(–4) layers, subquadrate to rectangulate or polygonal, (2.5–)5.0–20.0 × 2.5–19.0 μm, thick-walled, light to dark brown; medullary cells subquadrate to rectangulate or polygonal, 9–30 × 5–25 μm, thin-walled, hyaline to yellowish. Rhizoids fasciculate, restricted to ventral surface at the base of leaf, hyaline to brownish. Paraphyllia absent. Leaves opposite, distant at the older portion of the stem, gradually contiguous to imbricate towards api-

Table 1. Distribution of genus *Plagiochilon*.

Sl.no.	Name of the species	Distribution	References
1.	<i>P. braunianum</i> (Nees) S.Hatt.	China, Fiji, India (Arunachal Pradesh – present report), Indonesia, Malaysia, New Caledonia, New Guinea, Philippines, Solomon Is., Sri Lanka, Taiwan	Chopra 1943, Inoue 1964, Onraedt 1981, Grolle and Piippo 1984, Tan and Engel 1986, Menzel 1988, Zhu 2006, Gradstein et al. 2010, Söderström et al. 2010, 2011a, Chuah-Petiot 2011, Thouvenot et al. 2011, Wang et al. 2011
2.	<i>P. bryhnii</i> (Steph.) Inoue	Bolivia, Colombia, Ecuador	Inoue 1964, Uribe and Gradstein 1998, Gradstein et al. 2001, 2003
3.	<i>P. combinatum</i> (Mitt.) Inoue	Hawaii	Staples and Imada 2006
4.	<i>P. conjugatum</i> (Hook.) R.M.Schust.	Australia, New Zealand	Glenny 1998, McCarty 2006
5.	<i>P. fimbriatum</i> (Mitt.) Inoue	Bhutan, India (Sikkim, Meghalaya), Thailand	Mitten 1861, Chopra 1943, Inoue 1967, Long and Grolle 1990, Parihar et al. 1994
6.	<i>P. giulianettii</i> (Steph.) Inoue	New Guinea	Inoue 1964
7.	<i>P. herzogii</i> Inoue	Indonesia	Inoue 1971
8.	<i>P. heteromallum</i> (Lehm. & Lindenb.) Hässel de Menéndez	Argentina, Bolivia, Chile, Colombia, Jamaica, Lesser Antilles, Mexico, Peru, Puerto Rico	Pagán 1939, Hässel de Menéndez 1983, Gradstein et al. 2003, Söderström et al. 2011b
9.	<i>P. intermedium</i> R.M.Schust.	Venezuela	Schuster 1980
10.	<i>P. mayebarae</i> S.Hatt.	China, India (Sikkim, West Bengal), Japan, Nepal, Taiwan	Inoue 1964, Hattori 1966, 1975, Parihar et al. 1994, Yamada and Iwatsuki 2006, Zhu 2006, Singh et al. 2008, Pradhan and Joshi 2009, Wang et al. 2011
11.	<i>P. oppositum</i> (Reinw., Blume & Nees) S.Hatt.	Australia, China, Fiji, India (West Bengal), Indonesia, Japan, Malaysia, Myanmar, New Caledonia, New Guinea, Philippines, Samoa, Solomon Is., Sri Lanka, Taiwan, Thailand, Vanuatu, Vietnam	Herzog 1939, Chopra 1943, Inoue 1964, Onraedt 1981, Grolle and Piippo 1984, Tan and Engel 1986, Menzel 1988, McCarthy 2006, Yamada and Iwatsuki 2006, Zhu 2006, Lai et al. 2008, Söderström et al. 2010, 2011a, Chuah-Petiot 2011, Thouvenot et al. 2011, Wang et al. 2011
12.	<i>P. pachycephalum</i> (De Not.) Inoue	Indonesia, Malaysia, New Guinea, Philippines, Thailand	Grolle and Piippo 1984, Tan and Engel 1986, Menzel 1988, Sukkharak et al. 2008, Chuah-Petiot 2011
13.	<i>P. proliferum</i> (Mitt.) R.M.Schust.	New Zealand	Glenny 1998
14.	<i>P. theriotanum</i> (Steph.) Inoue	China, Indonesia, Japan, Malaysia, New Caledonia, New Guinea, Thailand	Grolle and Piippo 1984, Menzel 1988, Yamada and Iwatsuki 2006, Zhu 2006, Lai et al. 2008, Söderström et al. 2010, Chuah-Petiot 2011, Thouvenot et al. 2011

cal portion of stem, ventrally connate by (1–)2–8(–14) cells, occasionally dorsally connate by 2–3 cells, orbicular to suborbicular or reniform, 0.7–1.7 × 0.9–1.7 mm, apex rounded, margin entire, ventral and dorsal base not decurrent; leaves immediately below the female bracts with small, (2 –)3–12(–16) teeth along the margin; teeth 1–3 cells long, 1–2 cells wide at base; apical leaf cells subquadrate to rectangulate, 7.5–21.0 × 7.5–24.5 µm, moderately thick-walled with large nodulose trigones; subapical leaf cells polygonal, 12.5–40.0 × 12.5–30.0 µm, thin-walled with nodulose trigones; median leaf cells subquadrate to polygonal, 24.0–55.0 × 17.5–35.0 µm, thin-walled with large nodulose trigones; basal leaf cells much elongated,

rectangulate to polygonal, 39.0–90.0 × 17.5–30.0 µm, thin-walled with large nodulose trigones, intermediate thickenings occasionally present; surface smooth; oil bodies not seen. Underleaves absent. Asexual reproductive bodies not seen.

Dioicous. Male plants not seen. Gynoecia terminal on main shoot, usually with one subfloral innovation; bracts in single pair, larger than leaves, oblong to oblong-ovate, connate 1/2–3/5 of its length both ventrally and dorsally, 1.7–2.3 mm long, 1.5–1.9 mm wide at middle, margin with numerous teeth; teeth 1–6 (–7) cells long, 1–3 cells wide at base, 1–2 uniseriate cells at apex; ventral margin often with a tooth, 0.20–0.25 mm long, 0.06–0.09

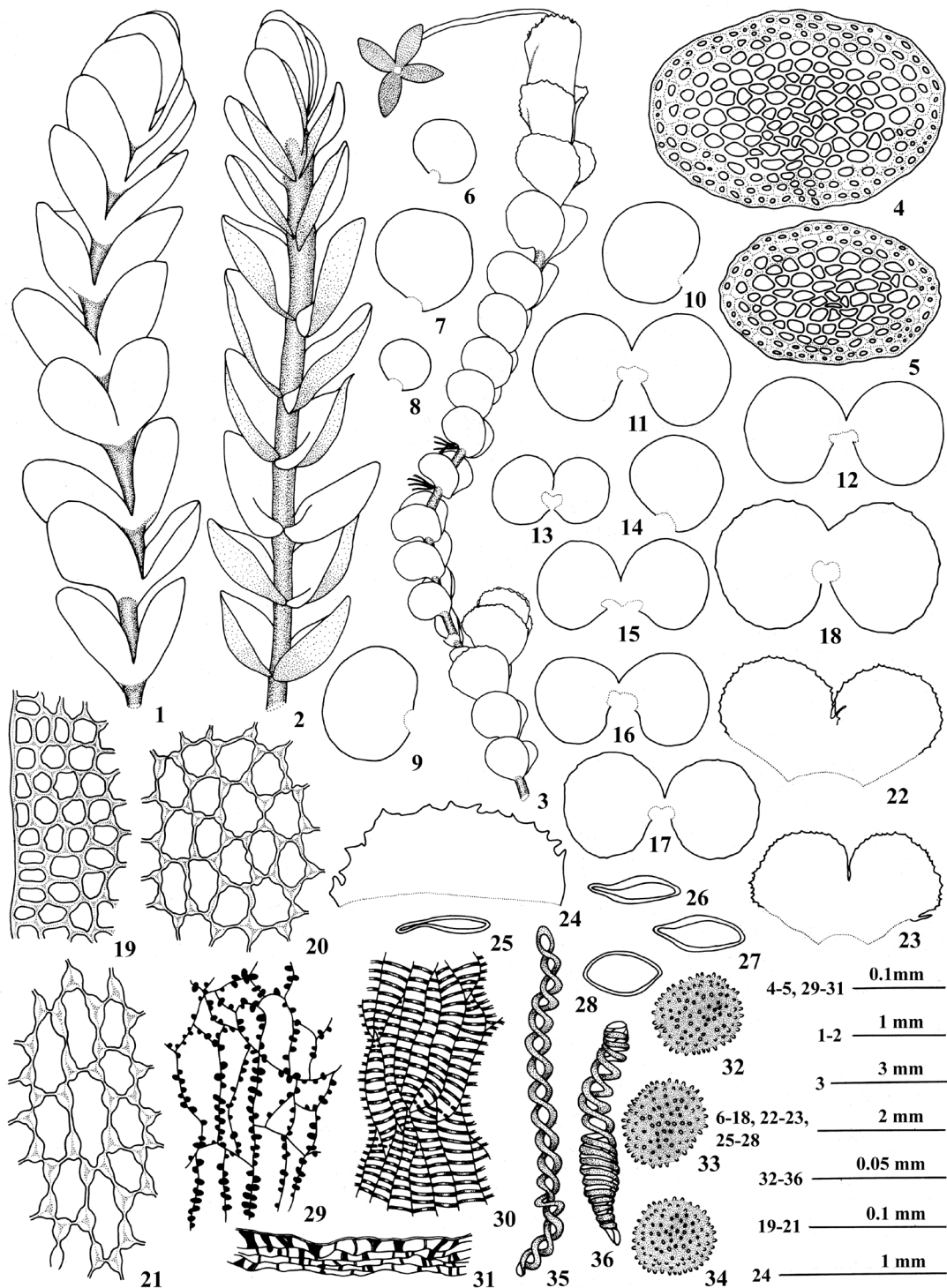


Figure 1. *Plagiochilium braunianum* (Nees) S.Hatt. (1) a portion of plant in ventral view. (2) a portion of plant in dorsal view. (3) a portion of female plant bearing gynoecia in lateral view. (4, 5) transverse sections of the stem. (6-16) leaves. (17, 18) leaves immediately below the female bracts. (19) apical leaf cells. (20) median leaf cells. (21) basal leaf cells. (22, 23) female bracts with tooth. (24) perianth mouth. (25-28) transverse sections of perianth. (29) cells from the outer layer of capsule wall. (30) cells from the inner layer of capsule wall. (31) transverse section of the capsule wall. (32-34) spores. (35, 36) elaters (19-21, 24 drawn from 57650A; others from 212J/1985)

mm wide, (2–3)9–12 cells long, 3–4 cells wide at base, 3–8 uniseriate cells at apex. Perianth exerted, cylindrical, 1.7–3.8 mm long, 1.3–2.0 mm wide, dorsiventrally compressed, eplicate, mouth broad, spinose-dentate at apex, teeth 10–17 in number, 1–7 cells long, 1–3 cells wide at base, 1–2(–3) uniseriate cells at apex, sometimes biseriate; apical cells triangulate, $12.5\text{--}25.0 \times 7.5\text{--}17.5 \mu\text{m}$; subapical cells rectangular to polygonal, $22.5\text{--}35.0 \times 7.5\text{--}22.5 \mu\text{m}$; median cells rectangular to polygonal, $25.0\text{--}60.0 \times 12.5\text{--}30.0 \mu\text{m}$; basal cells elongated, subquadrate to rectangular, $40.0\text{--}95.0 \times 12.5\text{--}25.0 \mu\text{m}$; trigones large, nodulose, intermediate thickenings occasionally present; capsule brownish, dehiscent into four valves; valves narrowly ovate, $1.45\text{--}1.51 \times 0.58\text{--}0.65 \text{ mm}$; capsule wall 4–5 stratose; cells of the outer layer subquadrate to rectangular, $53\text{--}146 \times 20\text{--}46 \mu\text{m}$ with nodular thickening on radial walls; those of inner layer rectangular, $120\text{--}160 \times 12\text{--}34 \mu\text{m}$, usually with complete or incomplete, semi-annular thickening bands. Spores globose to subglobose, yellowish brown, $22.0\text{--}38.4 \mu\text{m}$ in diameter, spinulose. Elaters yellowish brown to reddish brown, $87.5\text{--}325.0 \mu\text{m}$ long, $7.5\text{--}15.0 \mu\text{m}$ wide with 2 (–3) spiral thickening bands.

Habitat: Lignicolous, growing in moist shady places along with *Anastrepta orcadensis*, *Anastrophyllum bidens*, *Bazzania sikkimensis*, *B. tricrenata*, *Blepharostoma trichophyllum*, *Delavayella serrata*, *Jamesoniella elongella*, *Lepidozia* sp., *Metacalyptogea alternifolia*, *Plagiochila corticola*, *P. semidecurrens*, *Scapania ferruginea* and mosses.

Distribution: See Fig. 2, Table 1.

Specimens examined: India: eastern Himalaya, Arunachal Pradesh, Anjaw district, on way to Jachhup from Hotspring ($28^{\circ}12'N$, $97^{\circ}18'E$), ca 3200 m, 02.11.1985, D.K. Singh 212J/1985 (ASSAM); West Siang district, Menchukha, on

way to Shastri camp from Yarlaung ($28^{\circ}40'N$, $93^{\circ}59'E$), ca 2460 m, 04.09.2012, S. Singh Deo 57650A (CAL).

Discussion

The Indian plants of *Plagiochilon braunianum* are characterized by orbicular to suborbicular or reniform, nondecurent leaves with entire margins (Fig. 1: 6–16). However, the leaves immediately below female bracts bear (2–)3–12(–16) small tooth (Fig. 1: 17, 18). The leaves are connate by (1–)2–8(–14) cells on ventral side and occasionally by 2–3 cells dorsally (Fig. 1: 11–18). The leaf cells are moderately thick-walled towards apex and margins, but thin-walled in rest of the portion with large nodulose trigones and occasional intermediate thickenings (Fig. 1: 19–21). The female bracts are connate both dorsally and ventrally by 18–27 cells with irregularly dentate margins and they often have a tooth at the ventral insertion (Fig. 1: 22, 23). The perianth is up to 3.8 mm long, considerably exerted, cylindrical with irregularly dentate mouth (Fig. 1: 3, 24).

As observed by Inoue (1964), we also find the species considerably variable. In the plants from Anjaw (212J/1985) the leaves are connate ventrally by 2–14 cells and only occasionally dorsally connate by 1–2 cells, whereas those from West Siang (57650A) have leaves connate ventrally by 1–4 cells and always dorsally connate by 1–3 cells. Similarly, bracts in the specimens 212J/1985 have 9–12 cells long ventral tooth at the point of insertion and the perianth mouth has 10–12 teeth. On the other hand, the bracts in the specimens 57650A have only 2–3 cells long, uniseriate tooth, while the perianth mouth exhibits 12–17 teeth. However, except for the variation in the size of ventral tooth in the bracts, both fit well within the overall range of variations, hence the plants from both of the locations are treated under *P. braunianum*.

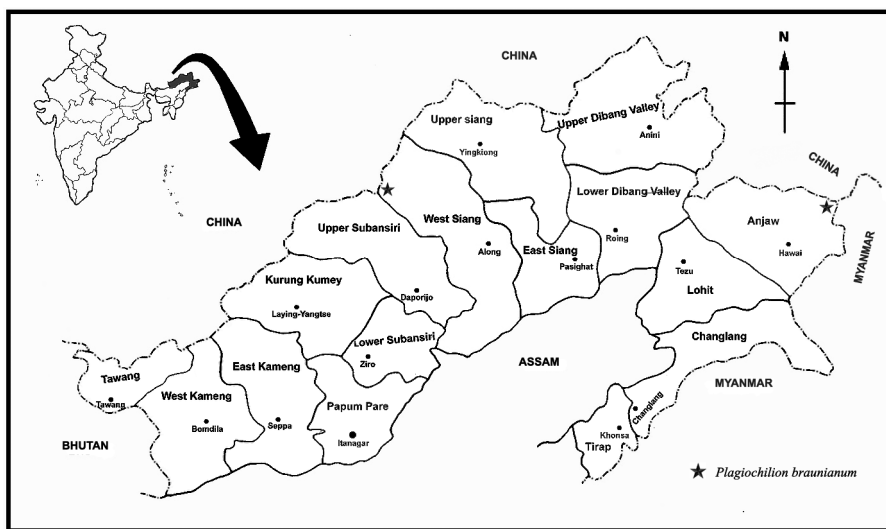


Figure 2. Map of Arunachal Pradesh showing distribution of *Plagiochilon braunianum* in India.

P. braunianum closely resemble *P. giulianettii* in having reniform leaves with entire margins and cylindrical perianth, but it is easily distinguished from the latter in having nondecurent leaf base, both dorsal as well as ventral, as against decurrent dorsal base in the latter; moderately thickened apical and marginal leaf cells and thin-walled basal leaf cells as compared to highly thickened marginal and basal leaf cells in the latter; gynoecea with a sub-floral innovation as compared to none in the latter and irregularly dentate female bracts and the perianth mouth as compared to entire female bracts and smooth perianth mouth in the latter (see also Inoue 1964).

In the presence of nondecurent leaves with entire margins and moderately thickened apical and marginal leaf cells, subfloral innovation and irregularly dentate margins of the female bracts and the perianth mouth, the Arunachal plants also resemble *P. mayebarae*. But, the former can be readily distinguished in usually having suborbicular to reniform leaves always with entire margins (always orbicular leaves often with 1–6 teeth along the margins in the latter), oblong to oblong-ovate female bracts (always orbicular in the latter) and cylindrical perianth (campanulate in the latter) (see also Inoue 1964).

Key to the Indian species of *Plagiochilon*

1a. Leaf margin entire throughout (except the leaf immediately below the female bracts)

.....*P. braunianum*

1b. Leaf margin irregularly dentate2

2a. Perianth campanulate; leaf margin entire or often with small, 1–6 teeth

.....*P. mayebarae*

2b. Perianth cylindrical; leaf margin dentate with 6 or more acuminate teeth3

3a. Leaf orbicular, nondecurent, cells of apex and middle thin-walled with large trigones

.....*P. fimbriatum*

3b. Leaf ovate to subreniform, dorsally decurrent, cells of apex and middle thick-walled with minute trigones

.....*P. oppositum*

The genus *Plagiochilon* shows an interesting distribution with half of its species confined to the Pacific region alone (Table 1). Of the remaining species, while *P. intermedium* R.M.Schust. is endemic to Venezuela, the others, viz. *P. braunianum* (Nees) S.Hatt., *P. brybnii* (Steph.) Inoue, *P. fimbriatum* (Mitt.) Inoue, *P. heteromallum* (Lehm. & Lindenb.) Hässel de Menéndez, *P. mayebarae* S.Hatt. and *P. oppositum* (Reinw., Blume & Nees) S.Hatt., show extended range of distribution beyond the Pacific rim.

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