

# Little known *Plagiochila* (Dum.) Dum. (Plagiochilaceae : Hepaticae) from India

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Seven little known species of *Plagiochila* (Dum.) Dum. in India, viz. *P. arbuscula* (Brid ex Lehm. & Lindenb.) Lindenb, *P. sciophila* Nees ex Lindenb. *P. beddomei* Steph. *P. chinensis* Steph. *P. devexa* Steph., *P. fruticosa* Miltt. and *P. parvifolia* Lindenb are described. Among these, *P. arbuscula* (Brid. ex Lehm. & Lindenb.) Lindenb. is a new record for India and *P. chinensis* Steph, *P. devexa* Steph. and *P. fruticosa* Mitt. are new records for peninsular India.

**Key-words** – *Plagiochila*, Plagiochilaceae, Eravikulam National Park, South India.

THE genus *Plagiochila* (Dum.) Dum., with over 1,600 species, is the largest genus of Hepaticae in the world (Geissler & Bischler 1989). Southeast Asia and the neotropics are considered to be the centres of diversity of this genus (So & Grolle 1998). The genus also extends to North America, Africa and Europe. The genus is well studied in Asian countries such as Japan (Inoue 1958 a, b), Bhutan (Long & Grolle 1990) and China (Grolle & So 1997, 1998, 1999, So 2001). Although the genus is well represented in India, it was not subjected to thorough investigation. In Asia, the foundation for the studies on this genus was laid by Inoue (1984). So and Grolle (2000) provided a checklist of the species of *Plagiochila* in Asia.

The genus is divided into three subgenera, viz. subg. *Paraplagiochila*, subg. *Metaplagiochila* and subg. *Plagiochila*. The subg. *Plagiochila* is further divided into sections. In India the studies on this large group were started by Inoue (1960). He described three species, viz. *P. flexuosa* Mitt., *P. gollani* St. and *P. firma* Mitt. from Himalayan region. In 1965, he published synopsis of *Plagiochila* of the Himalayan region including north-western India, Nepal, Sikkim and Bhutan. In India the genus is known by about 85 species (Inoue 1960, 1962, 1963, 1964, 1965; Udar 1976; Srivastava & Dixit 1994, 1996) and in South India, which still remains bryologically least explored, known by about 10 species (Inoue 1960; Udar 1976, So, 2001). Most species are known by single collection

made in the 19th century. Recent report of So and Grolle (2001) on several little known *Plagiochila* of Asia includes eight species from India, most of which are from Himalayas.

The status of seven little known *Plagiochila* species, viz. *P. arbuscula* (Brid. ex Lehm. & Lindenb.) Lindenb, *P. sciophila* Nees. ex Lindenb, *beddomei* Steph. *P. chinensis* Steph., *P. devexa* Steph. *P. fruticosa* Mitt. and *P. parvifolia* Lindenb., collected from the shola (montane wet temperate) forest of Eravikulam National Park (1, 400-2, 697 m altitude) in South India is discussed.

The Park is situated in the crest of the Western Ghats in the high ranges of Idukki District of Kerala state between 10° 15' and 10° 20' N and between 77° and 77° 10' E. This area has perhaps the largest, relatively undisturbed high elevation Shola forest ecosystems in the entire Western Ghats (Nair 1994). The Anamudi (2,697m), the highest peak south of the Himalayas is also situated in this park. The area is of high conservational status, as a good population of the Nilgiri Tahr (*Hemitragus hylocrius*), a rare, endangered species of mountain goat endemic to the southern Western Ghats, thrives here.

All the *Plagiochila* specimens collected during the study are deposited in the Calicut University Herbarium (CALI). An illustrative account of seven little known *Plagiochila* species from South India are provided with relevant notes.



*Plagiochila arbuscula* (Brid. ex Lehm. & Lindenb.) Lindenb., Sp. Hepat. (*Plagiochila* fasc. 1): 23. 1839; So, Syst. Bot. Monogr. 60: 103. 2001. *Jungermannia arbuscula* Brid. ex Lehm. & Lindenb. in Lehm. Nov. Stirp. pugillus 4: 63. 1832. *Plagiochila belangeriana* Lindenb., Sp. Hepat (*Plagiochila* fasc. 2-4): 109. 1840. *P. formosae* Steph., Sp. Hepat. 6: 157. 1918. *P. longa* Dugas, These Fac. Sci. Paris (ser. A, n. 1170): Contrib. Etude *Plagiochila* : 131, 186. 1928. (Fig. 1. a-h).

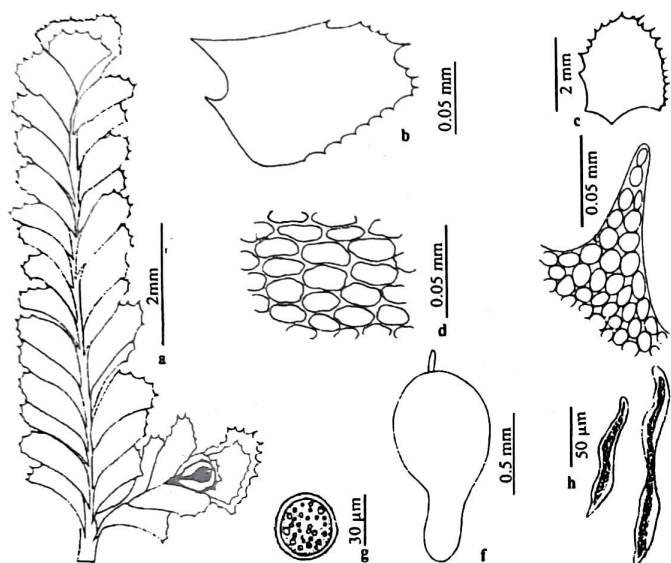


Fig. 1. a-h: *Plagiochila arbuscula* a: Portion of plant-dorsal view; b: leaf; c: perianth; d: middle leaf cells; e: leaf tip cells; f: sporophyte; g: spore; h: elater.

Plants dark green, 5-10 cm long, 4-4.5 mm wide, dark brown, arising from a creeping rhizome, highly dichotomously branched, branching predominantly terminal. Leaves imbricate, oblong-ovate, 2-2.4 mm long, 1-1.3 mm wide, dorsal margin almost straight, entire, base long, decurrent, apex irregularly dentate, with two larger teeth in some leaves, ventral margin spinose throughout, teeth 11-16 per leaf, 3-4 cells long at the spines, 1-3 cells wide at base, terminal cell acute, 14-30  $\mu\text{m}$  long, median cells rounded, 20  $\mu\text{m}$  long, 20-30  $\mu\text{m}$  wide, basal cells rounded to elongate, 40-45  $\mu\text{m}$  long, 36-40  $\mu\text{m}$  wide, trigones large. Underleaves vestigial. Paraphyllia absent. Androecia intercalary, gynoecia terminal, producing more bracts and perianths respectively; bracts larger, broadly ovate

and spinosely toothed than stem leaves. Sporophyte very small on lateral branches, up to 1.25 mm long, spores 28-30  $\mu\text{m}$  wide, elaters 100-200  $\mu\text{m}$  long, margin smooth; wavy.

**Distribution** : India (Kerala), China, Fiji, Indonesia, Japan, New Caledonia, Papua New Guinea, Samoa, Solomon Islands, Tahiti and Thailand.

**Specimen examined** : Poovar (2350 m alt.) 26.11.2001, Manju C. Nair 80365.

*P. arbuscula* belongs to sect. *Tayloriae*, which is characterised by the luxuriant flabellate branching system, irregularly dentate leaf apex, with two large teeth in some leaves and the large trigones. Although this species is widespread in east and south east Asia, Melanesia, Japan and northern Australia, it was not reported from India. This collection forms the first record of this species from India. So (2001), commented that this species has not been collected from the Himalayas, where the closely related *P. flexuosa* is rather common.

*Plagiochila beddomei* Steph., Bull. Herb. Boissier, ser. 2, 3: 876. 1903 & Sp. Hepat. 2: 361. 1903; So, Syst. Bot. Monogr. 60: 149. 2001. *P. humicola* Steph., Sp. Hepat. 5: 168. 1918. (Fig. 2. a-h).

Plants dark brown, 4-6 cm long, 4-5 mm wide, rarely branched, rhizoids infrequent. Leaves imbricate, obliquely inserted, broadly ovate, 2-2.6 mm long, 1.5-

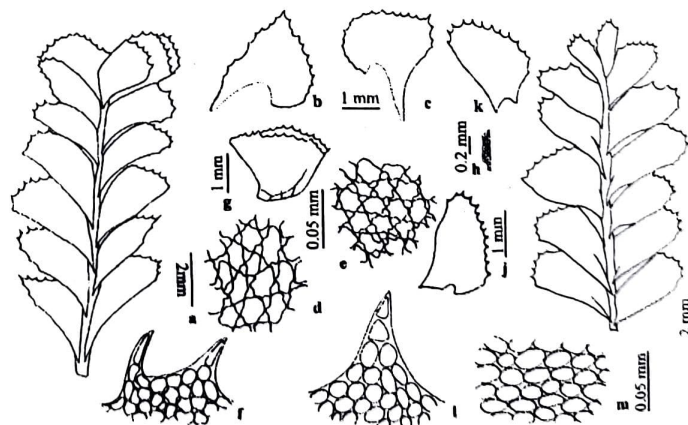


Fig. 2. a-h: *Plagiochila beddomei* a: Portion of female plant-dorsal view; b-c: leaves (scale : b,c-1 mm); d: lower leaf cells; e: middle leaf cells; f: leaf tip cells (scale : d,e,f-0.05 mm); g: perianth; h: paraphyllia; i-m: *Plagiochila chinensis*: i: Portion of plant-dorsal view; j-k: leaves; l: leaf tip cells; m: middle leaf cells (scale : l,m-0.05 mm).



2.6 mm wide, leaf base long decurrent, apex broadly truncate, irregularly spinose, with 7-11 teeth, ventral margin arched, overlap with opposite leaf base, terminal cell elongated, 50  $\mu$ m long, 20-25  $\mu$ m wide, trigones small, median cells irregularly rounded, 35-40  $\mu$ m long, 20-30  $\mu$ m wide, basal cells irregularly rounded to elongate, 50-65  $\mu$ m long, 36-40  $\mu$ m wide, trigones large, nodulose. Underleaves vestigial. Paraphyllia broad, entire margined, 1-2 near each leaf base. Male plants not seen, gynoecea on apical shoot, bracts similar to stem leaves, dentate throughout, perianth campanulate. Sporophyte not seen.

**Distribution :** India (Kerala, Tamil Nadu, Sikkim) China and Thailand.

**Specimens examined :** Kolukkumala (1975 m alt.) 22-09-2001, *Manju C. Nair 80162*, Amarshola (2050 m alt.) 24.09.01, *Manju C. Nair 80232*

*P. beddomei* belongs to sect. *Cardotiae*, which is characterized by simple shoots, moderately imbricate, triangular-ovate leaves with toothed margin, except in the basal half of the dorsal margin and the broad entire margined paraphyllia on the dorsal stem surface. As commented by So (2001), this is a very poorly known species. After the type specimen collected from the Nilgiri (Tamil Nadu) by Beddome in 18th century, it was Stephani who later described this species in 1918 from eastern India, but wrongly as *P. humicola* Steph. Despite the large hepatic collections from the Himalayas and adjoining areas, there was no recent collection of *P. beddomei*.

***Plagiochila chinensis*** Steph., Mem. Soc. Sci. Nat. Cherbourg 29: 223. 1894; Srivastava & Dixit, Geophytology 25: 92. 1996; So, Syst. Bot. Monogr. 60: 179. 2001. *P. simplex* var. *parvifolia* C. Mass., Mem. Accad. Agric. Verona, ser. 3, 73(2): 12. 1897. *P. hokinensis* Steph., Bull. Herb. Boissier, ser. 2, 3: 116. 1903 & Sp. Hepat. 2: 296. 1903 (Fig. 2. i-m).

Plants 2-3 cm long, 2-5 mm wide, sparingly branched, branches exclusively lateral intercalary, rhizoids scanty on basal part of shoot. Leaves oblong-ovate up to 1.5 mm long and 1 mm wide, dorsal margin recurved, base long-decurrent. apex subtruncate, 15-25 teeth per leaf, teeth 3-7 cells long, 1-2 cells wide at base, terminal cell elongated, 50  $\mu$ m long, median

cells rounded, 24-30  $\mu$ m long, 20-24  $\mu$ m wide, basal cells rounded to elongate, 50-60  $\mu$ m long, 35-40  $\mu$ m wide, trigones distinct. Underleaves vestigial. Paraphyllia absent. Sporophyte not seen.

**Specimen examined :** Kattumala (2350 m alt.) 27.10.2001, *Manju C. Nair 80256*.

*P. chinensis* belong to sect. *Plagiochila*, which is characterised by its flagelliform branches in some and the oblong-ovate leaves with recurved dorsal margin. It was known from India by a collection of Duthie made during 1892 from Uttar Pradesh. After a long gap, Srivastava and Dixit (1996) reported this species from Kumaon, Western Himalayas. The present collection thus forms a new record for Peninsular India. In Eravikulam National Park this species is very rare.

***Plagiochila devexa*** Steph., Bull. Herb. Boissier, ser. 2, 3: 340. 1903 & Sp. Hepat. 2: 324. 1903; So, Syst. Bot. Monogr. 60: 36. 2001. *P. deflexa* Mitt., J. Proc. Linn. Soc., Bot. 5: 97 1860, non Montagne & Gottsche, 1856. *P. rumcinata* Herzog, Ann. Bryol. 12: 76: 1939. *P. pseudomicrophylla* Inoue in Hara, Fl. E. Himalaya 1: 518. 1967. (Fig. 3. a-f).

Plants form compact patches. Shoots 1.5-2 cm long, 2.2-2.6 mm wide, glossy dark-brown; simple sometimes branched, branches lateral intercalary. Leaves imbricate, becoming more distant towards the base, oblong-orbicular, 1-1.2 mm long, 0.7-1 mm

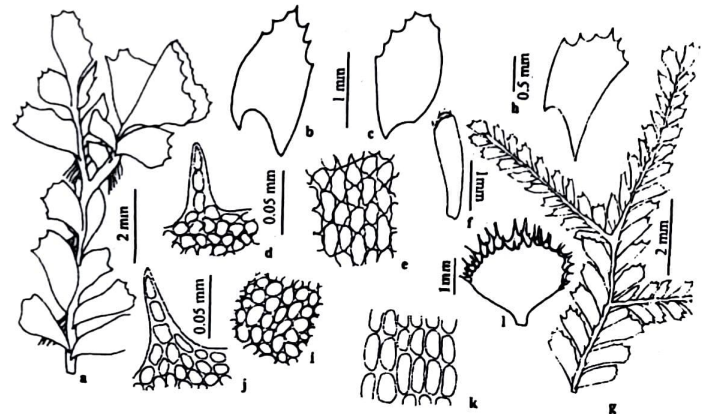


Fig. 3. a-f: *Plagiochila devexa* a: Portion of plant-dorsal view; b-c: leaves (scale: b,c-1 mm); d: leaf tip cells; e: middle leaf cells (scale: d,e-0.05 mm); f: perianth; g-1: *Plagiochila fruitcosa*; g: Portion of plant-dorsal view; h: leaf; i: middle leaf cells; j: leaf tip cells; k: basal leaf cells (scale: i,j,k-0.05 mm); l: perianth.



wide, dorsal margin slightly recurved, base entire, apex rounded, with 3-6 broad teeth, ventral margin arched, decurrent, marginal teeth usually 8-12 per leaf, 3-8 cells long, 2-4 cells wide at base, terminal cell elongated, 25  $\mu\text{m}$  long, median cells rounded, 15-20  $\mu\text{m}$  long 16-24  $\mu\text{m}$  wide, basal cells rounded to elongate, 30-45  $\mu\text{m}$  long, 30-35  $\mu\text{m}$  wide, trigones large, nodulose, walls moderately thickened. Underleaves vestigial. Paraphyllia present along some dorsal leaf base. Androecia terminal on main and lateral shoots, gynoecia terminal on main shoot, bracts more densely toothed and slightly larger than the normal leaves, perianth obovoid to cylindrical, highly dentate. Sporophyte not seen.

**Distribution :** India (Kerala, Sikkim, Himalaya), Bhutan, China, Nepal and Sri Lanka.

**Specimen examined :** Kattumala (2300 m alt.) 27.10.2001, Manju C. Nair 80260.

*P. devexa* belongs to sect. *Alatae*, which is characterised by its simple plants, leaves distant towards base and the trigones large and nodulose. Though Inoue (1965) excluded this species from the 'Synopsis of *Plagiochila* in the Himalayan region', So (2001) commented that *P. devexa* Steph. is widespread in the Himalayan region. After the type collection from the Himalaya, there was no recent report of this species from India. *P. devexa* was originally described by Mitten (1860) from the Himalayas as *P. deflexa* Mont & Gottsche. As this name is illegitimate, being a later homonym of *P. deflexa* Mont & Gottsche from the Sandwich Islands, Stepanni (1903) corrected it to *P. devexa* Steph. The present collection is a new record from peninsular India.

***Plagiochila fruitcosa*** Mitt., J. Proc. Linn. Soc., Bot. 5: 94. 1860; So, Syst. Bot. Monogr. 60: 66. 2001. *P. bipinnata* Steph., Sp. Hepat. 6: 131. 1918. *P. tosana* Steph., iand 6: 227. 1921. (Fig. 3. g-1).

Plants greyish green glossy, 3-10 cm long, 2.1-2.6 mm wide, long creeping, possess rhizoids. Leaves ovate, rectangular; stem leaves 1.5-1.7 mm long, 0.5-0.8 mm wide; branch leaves 1-1.2 mm long, 0.4-0.5 mm wide, dorsal margin slightly recurved, base long, decurrent, 6-8 teeth per leaf, teeth 4-6 cells long,

4-6 cells wide at base, terminal cells narrow elongate, 25-30  $\mu\text{m}$  long, median cells rounded, 25-30  $\mu\text{m}$  long, 20-25  $\mu\text{m}$  wide, basal cells elongate, 30-45  $\mu\text{m}$  long, 25-30  $\mu\text{m}$  wide, trigones small. Underleaves vestigial. Paraphyllia absent. Androecia intercalary, long, spicate, bracts in 8-12 pairs, gynoecia terminal on branches, bracts irregularly toothed, broadly ovate, perianth triangular, companulate, mouth highly dentate. Sporophyte not seen.

**Distribution :** India (Kerala, Assam, Himalaya, Darjeeling, West Bengal), Bhutan, China, Japan, the Philippines and Thailand.

**Specimens examined :** Naikollimala (1900 m alt.) 26.09.2001, Manju C. Nair 80250, Poovar (2350 m alt.) 26.11.2001, Manju C. Nair CU 80363.

*P. fruitcosa* belongs to sect. *Dendroideae*, which is characterised by its smaller size of the leaves and the stem without paraphyllia. Although, this species was well known from the Himalayas (So 2001), there was no report from South India. The present collection is therefore a new record for South India.

***Plagiochila parvifolia*** Lindenb., Sp. Hepat. (*Plagiochila* fasc. 1): 28. 1839; So, Syst. Bot. Monogr. 60: 88. 2001. *P. phalangea* Taylor, London J. Bot. 5: 264. 1846; Srivastava & Dixit, Geophytology 25: 93. 1996. *P. yokogurensis* Steph., Bull. Bherb. Boissier 6: 104. 1897. *P. pseudoventricosa* Inoue, Bull. Natl. Sci. Mus., Tokyo, ser. B, 8: 393. 1965. (Fig. 4. a-f).

Plants dark green, 4-7 mm long, 2.3-3.5 mm wide, arising from a creeping rhizome, simple to highly branched, branches terminal. Leaves imbricate, horizontally spreading, oblong-ovate, 1.5-1.7 mm long, 1-1.7 mm wide, dorsal margin recurved, base long-decurrent, toothed towards apical half, with 8-14 spinose teeth, teeth 2-5 cells long, 2-3 cells wide at base, terminal cell slightly elongated, 25  $\mu\text{m}$  long, 10-14  $\mu\text{m}$  wide, median cells rounded, 15-20  $\mu\text{m}$  long, 20-30  $\mu\text{m}$  wide, basal cells rounded to elongate, 30-35  $\mu\text{m}$  long, 36-40  $\mu\text{m}$  wide, trigones medium sized to large. Underleaves vestigial in most specimens, present in some, bilobed with ciliate margin, 0.4-0.6 mm long, 0.2 mm wide. Paraphyllia absent. Androecia intercalary on main and lateral branches, bracts paired,



margin obliquely spreading, gynoecia terminal on main shoot, perianth numerous, mouth dentate, bracts larger and more broadly ovate than the stem leaves. Sporophyte not seen.

Distribution: India (Kerala, Tamil Nadu, Himalaya, Assam, Sikkim), Sri Lanka, Bangladesh, Bhutan, China, Japan, Indonesia, Korea, Myanmar, Papua New Guinea, the Philippines, Thailand and Vietnam.

Specimen examined : Mesthirikettu shola (2150 m alt.) 23.07.2001, Manju C. Nair 80030.

*P. parvifolia* belongs to sect. *Subtropicae*, which is characterised by having its distal leaves highly fragmenting with the distal halves completely lost in some. The leaves are moderately imbricate, triangular-oblong-ovate and the leaf apex is truncate.

This is a highly variable and one of the most frequently encountered species in East Asia (So 2001). After the type collection from Myanmar this species has been repeatedly described under different names from various countries in Asia, which were subsequently synonymized by Inoue (1984). Srivastava and Dixit (1996) reported this species as *P. phalagea* from the Kumaon Himalaya.

*Plagiochila sciophila* Nees ex Lindenb., Sp. Hepat. (*Plagiochila* fasc. 2-4): 100. 1840; So, Syst. Bot. Monogr. 60: 112. 2001. *P. orientalis* Taylor, London J. Bot. 5: 261. 1846. *P. flavovirens* Steph., Sp. Hepat. 6: 156. 1918. *P. trochantha* Schiff. ex Steph., Sp. Hepat. 6: 226. 1921. *P. vygensis* Steph., Sp. Hepat. 6: 237. 1921. *P. subacanthophylla* Herzog, J. Hattori Bot. Lab. 14: 37. 1955. (Fig. 4. g-k).

Plants small, greenish brown in loose patches, 1.5-3 cm long, arising from a small creeping rhizome. Branches lateral intercalary. Leaves obliquely inserted, oblongovate, 1.1-1.4 mm long, 1 mm wide, dorsal margin slightly recurved, apex broadly rounded in some with two small teeth, teeth 4-6 per leaf in some, 1-2 cells long, 1-2 cells wide at base, terminal cell acuminate, 30-40  $\mu$ m long, 10-12  $\mu$ m wide, median cells rounded, 20-35  $\mu$ m long, 20-25  $\mu$ m wide, basal cells rounded, 30-45  $\mu$ m long, 30-36  $\mu$ m wide, trigones small. Underleaves vestigial. Paraphyllia absent. Plants sterile.

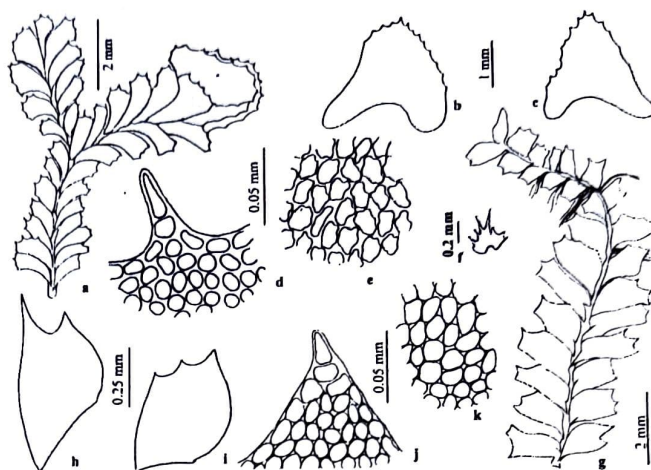


Fig 4. a-f: *Plagiochila parvifolia* a: Portion of plant-dorsal view; b-c: leaves (scale: b,c-1 mm); d: leaf tip cells; e: middle leaf cells; (scale: d,e-0.05 mm); f: underleaves, g-k: *Plagiochila sciophila*; g: Portion of plant-dorsal view; h-i: leaves (scale: h,i-0.25 mm); j: leaf tip cells; k: middle leaf cells (scale: j, k-0.05 mm).

**Distribution** : India (Jammu & Kashmir, Kerala, Tamil Nadu, West Bengal), Bhutan, China, Japan, Korea, Melanesia, Nepal, Pakistan, the Philippines, Thailand and Vietnam.

**Specimen examined** : Turners valley (1950 m alt.) 26.09.2001, Manju C. Nair 80295.

*P. sciophila* is one of the most common species of *Plagiochila* in Asia and being highly variable, it was treated under different names in Asian countries and elsewhere. It belongs to sect. *Tayloriae*, which is characterised by its variable shape of leaves with two small teeth, oblique insertion of the leaves and the leaf cells with small trigones. In India this species was described as *P. flavovirens* Steph. from Tamil Nadu and as *P. trochantha* Schiff. ex Steph. from West Bengal which later synonymised with *P. sciophila* Nees ex Lindenb.

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