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A note on the genus *Neolepidozia* (Lepidozioideae, Lepidoziaceae, Marchantiophyta) in India

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भारत में वंश *नेयोलेपिडोजिया* (लेपिडोजियोडी, लेपिडोजिएसी, मार्केंशियोफाइटा) पर टिप्पणी

शुभदीप मजूमदार एवं डी. के. सिंह

सारांश

वंश *नेयोलेपिडोजिया* फुलफोर्ड एवं जे. टेलर को भारत से पहली बार अभिलेखित किया गया है तथा *एन० वालिचियाना* (गोत्स्चे) फुलफोर्ड एवं जे. टेलर का भारत में पूर्वी हिमालय स्थित अरुणाचल प्रदेश के अंजाव और लोअर दिबांग घाटी जिलों से सचित्र वर्णन किया गया है। भारतीय पौधे मुख्य तने की पत्तियों के आकार और मुख्य तनों के पत्ती–पालियों की संख्या और आकार में प्रारूप से थोड़ा भिन्न हैं,लेकिन यह भिन्नता इस जाति द्वारा अपने विस्तार क्षेत्र में दर्शाये जाने वाले रूपांतर के अनुरूप है। यह लेख भारतीय ब्रायोफ्लोरा में इस जाति की उपस्थिति को प्रमाणित करता है।

ABSTRACT

The genus *Neolepidozia* Fulford & J.Taylor is recorded in Indian bryoflora and *N. wallichiana* (Gottsche) Fulford & J.Taylor has been described and illustrated from Anjaw and Lower Dibang Valley districts of Arunachal Pradesh in Eastern Himalaya, India. The Indian plants of the species are little atypical in the size of main stem leaves and the number and size of main stem leaf-lobes, but the deviations are limited within the variations exhibited by the species across its range of distribution.

Keywords: Arunachal Pradesh, India, *Neolepidozia*, New record

INTRODUCTION

The genus *Neolepidozia* Fulford & J.Taylor was segregated by Fulford and Taylor (1959) from the genus *Lepidozia* (Dumort.) Dumort. to include the species with (i) much larger, fewer cortical cells of the stem forming a distinct hyaloderm, (ii) symmetric, subquadrate–subrectangular or cuneate leaves with entire and more or less straight lateral margins without auricles at base and (iii) usually subulate branch emergent underleaf. *Lepidozia wallichiana* Gottsche – a species described by Gottsche (1845) based on the specimens collected by Nathaniel Wallich from Eastern Nepal, was amongst the species transferred by them (Fulford & Taylor, 1959) under the new genus. Though some of the above differences were subsequently acknowledged, *Neolepidozia* was not accepted as distinct genus (Hodgson, 1962; Schuster, 1963, 1969; Engel & Schuster, 1983; Sharma & Srivastava, 1993; Engel & Merril, 2004). While, Hodgson (1962) and Sharma and Srivastava (1993) regarded it as a synonym under the genus *Lepidozia*, Schuster (1963, 1969) and Engel and Schuster (1983) treated it as a subgenus under *Telaranea* Spruce ex

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Schiffn. Engel and Merrill (2004), however, placed *Neolepidozia* as a section under subgenus *Telaranea* of the genus *Telaranea*. Based on recent molecular phylogenetic studies (Cooper & al., 2011, 2012) necessitating redefining of the subfamily Lepidozioideae and delineating the taxonomic boundaries of its representative genera, however, Cooper (2013) and Cooper & al. (2013) once again reinstated the genus *Neolepidozia*.

Neolepidozia (=*Lepidozia*) *wallichiana* – a widely distributed species, has been recorded from several tropical and subtropical regions of Asia, Oceania and Central and South America (Hattori & Mizutani, 1958; Miller, 1960; Kitagawa, 1969; Mizutani, 1974, 1976; Onraedt, 1981; Grolle & Piippo, 1984; Mizutani & Chang, 1986; Tan & Engel, 1986; Menzel, 1988; Sharma & Srivastava, 1993; Piippo & al., 2002; Engel & Merril, 2004; Yamada & Iwatsuki, 2006; Zhu, 2006; Gradstein & al., 2010; Söderström & al., 2010, 2011; Chuah-Petiot, 2011; Wang & al., 2011; Long & Rubasinghe, 2014; von Konrat & al., 2014). Interestingly, Hattori and Mizutani (1958) and later Mizutani (1974, 1976) included India as well in the range of distribution of *N. wallichiana* (=*L. wallichiana*) without citing any reference or specimen of Indian origin.

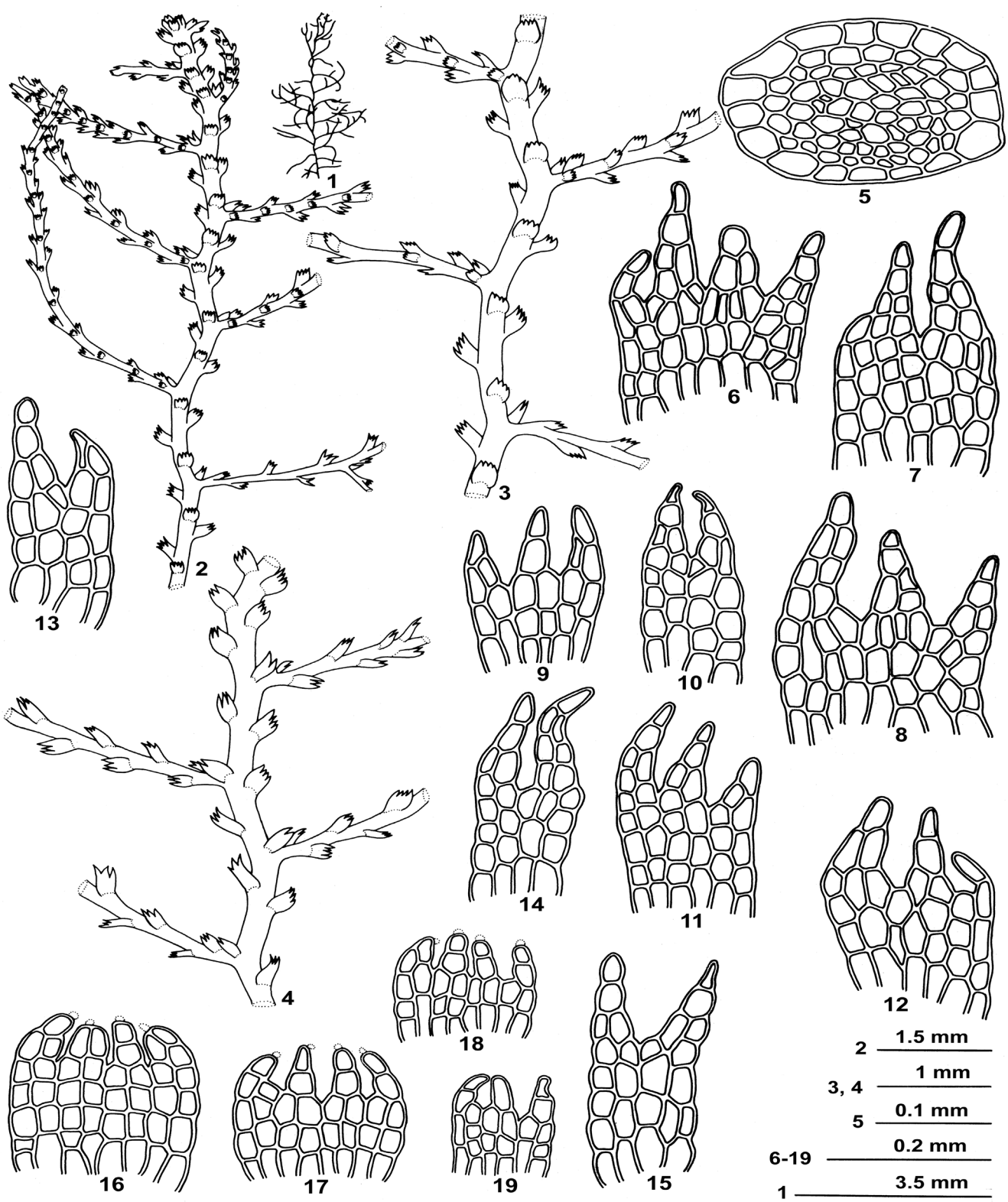
Kitagawa (1969) gave an account of liverworts collected by him from Waterfall Botanic Gardens, Penang Hill and on way from Penang Hill to 'Tiger Hill' in Penang Island of Malaysia and reported *L. wallichiana* (=*N. wallichiana*) from Penang Hill. He (Kitagawa, 1969) listed Eastern Himalaya in its range of distribution probably referring to the occurrence of the species in Nepal. In their taxonomic revision of 'Indian Lepidoziineae', Sharma and Srivastava (1993) provided excellent description and illustration of this species on the basis of its type from Nepal as well the specimens from Sri Lanka, Taiwan, etc., but none from India, and the earlier reports by Hattori and Mizutani (1958), Kitagawa (1969) and Mizutani (1974, 1976). Therefore, as none of these reports are substantiated by the study of any specimen of Indian origin, or any credible literature reference, all previous records of *N. wallichiana* (=*L. wallichiana*) from India appear to be doubtful.

During the course of studies on the Hepaticae and Anthocerotae of Arunachal Pradesh, the authors came across lepidozioid plants collected on the way from Metaliang to Methumna in Anjaw district and Mayudia to Tiwarigaon in Lower Dibang Valley district of Arunachal Pradesh with the cortical cells forming distinct hyaloderm, more or less symmetric leaves with entire lateral margin and subulate branch-emergent underleaves – typical of the genus *Neolepidozia*. Further, morpho-taxonomic studies on the specimens and review of relevant literature (Hattori & Mizutani, 1958; Fulford & Taylor, 1959; Sharma & Srivastava, 1993; Engel & Merril, 2004) revealed them to be *N. wallichiana*. The present communication, therefore, confirms the occurrence of *N. wallichiana* in India and provides detailed description and illustration of the species to facilitate its easy identification in Indian bryoflora.

DESCRIPTION

Neolepidozia wallichiana (Gottsche) Fulford & J.Taylor, Brittonia 11 (2): 84. 1959. *Lepidozia wallichiana* Gottsche in Gottsche, Lindenb. & Nees, Syn. hepat. 204. 1844; D.Sharma & S.C.Srivast. in Bryophyt. Biblioth. 47: 42. 1993. **(Fig. 1-19)**

Plants pale green when fresh, yellowish brown in herbarium; shoots (5-) 8–36 (-62) mm long, 0.5–0.9 mm wide, pinnately branched; branches irregular, lateral intercalary, at right angles to the main axis, 1–9 mm long, slender, distant, alternate. Stem oval – slightly elliptical in outline in transverse section, 0.22–0.27 × 0.16–0.18 mm, 8–11 cells across the diameter, cells well differentiated; cortical cells in one layer, larger than medullary cells forming a distinct hyaloderm, sub quadrate–rectangulate, 22.5–58.0 × 10.0–32.5 µm, hyaline, thin-walled; medullary cells rectangulate–polygonal, 6.3–30.2 × 5.0–25.2 µm, hyaline, thin-walled. Leaves on the main stem distant, obliquely inserted, quadrate–sub rhombic, 0.33–0.38 × 0.20–0.26 mm, widest at middle, mostly 4-lobed, occasionally 3-lobed, rarely 2-lobed to 1/3–1/2 of the leaf length; lobes narrowly – broadly triangulate, spreading, mostly divergent, sometimes convergent, acute, asymmetric, sub equal, 2–5 cells long, 1–4 cells wide at base, 1–2 cells uniseriate at apex, apex acute, sinus narrow–wide; apical leaf cells sub quadrate–polygonal, 32.5–60.5 × 15.0–35.3 µm; median leaf cells sub quadrate–polygonal, 45.4–121.0 × 10.0–25.2 µm; basal leaf cells sub quadrate – polygonal, 48.0–181.4 × 10.0–32.5 µm, moderately thick-walled, trigones indistinct; disc almost symmetric, 3–5 cells long, 6–8 cells wide at base; dorsal margin slightly smaller than ventral margin; branch leaves mostly distant sometimes contiguous – imbricate at the younger portion of the stem, narrower than the main stem leaves, rectangulate, 0.22–0.40 × 0.12–0.20 mm, widest at middle,



Figs -1–19: *Neolepidozia wallichiana* (Gottsche) Fulford & J.Taylor: **1.** Habit (schematic); **2-3.** Portions of the plant in ventral view (rhizoids not drawn); **4.** A portion of plant in dorsal view; **5.** Cross-section of stem; **6–8.** Leaves from main stem; **9–12.** Leaves from primary branch; **13–15.** Leaf near branch emergence; **16, 17.** Underleaves from main stem; **18,19**. Underleaves from primary branch (all figures drawn by Shuvadeep Majumdar from 48102C).

always longer than wide, mostly 3-lobed, rarely 2-lobed to 1/4–1/3 of the leaf length; lobes linear–broadly triangulate, mostly divergent, sometimes convergent, asymmetric, sub equal, dorsal lobe smaller than the ventral lobe, 2–4 cells long, 1–3 cells wide at base, 1–2 cells uniseriate at apex, sinus wide, acute at base, base oblique, disc 3–5 cells long, 4–6 cells wide at base, asymmetric, dorsal margin smaller than ventral margin; leaf near branch emergence small, 0.32–0.38 × 0.11–0.14 mm, 2-lobed to 1/4–1/2 of the leaf length; lobes linear–broadly triangulate, mostly divergent, sometimes convergent, sub equal, 2–4 cells long, 2–3 cells wide at base, 1–2 cells uniseriate at apex, thin-walled, trigones indistinct; surface smooth; oil bodies not seen. Underleaves of the main stem distant, transversely inserted, erect-spreading, almost encircling the stem, sub quadrate–rectangulate or polygonal, 0.09–0.30× 0.10–0.20 mm, widest at middle, wider than long, 4-lobed to 1/4–1/3 of the underleaf length; lobes distinct, incurved, mostly with slime papilla, 1–3 cells long, 1–2 cells wide at base, sinus narrow–wide; disc 3–5 cells long, up to 8 cells wide; branch underleaves small, sub quadrate–rectangulate or polygonal, mostly as long as wide, sometimes larger than wide, 3–4-lobed, bilobed to 1/3–1/2 of the underleaf length, 0.09–0.19 × 0.06–0.14 mm; lobes slightly divergent, 1–2 cells long, 1–2 cells wide at base, sinus narrow–wide, U-shaped–obtriangulate; disc 2–4 cells long, 6–8 cells wide; cells similar to leaf cells but smaller, apical lobe cells sub quadrate–triangulate, 35.3–63.0 × 20.2–30.2 µm, median lobe cells sub quadrate–rectangulate, 20.2–45.4 × 7.5–22.7 µm, basal lobe cells sub quadrate–rectangulate, 30.2–63.0 × 10.0–27.7 µm, thin-walled, trigones indistinct; branch emergent underleaves subulate. Rhizoids not seen. Androecial and gynoecial branches not seen.

Habitat: Lignicolous, growing in moist, shady places in association with *Heteroscyphus argutus* (Reinw. & al.) Schiffn., *Riccardia pearsonii* S.C.Srivast. & Udar, *R. sikkimensis* (Steph.) Pande & K.P. Srivast., *R. tenuicostata* Schiffn., *Scapania verrucosa* Heeg, *Conocephalum japonicum* (Thunb.) Grolle

Distribution: India [Eastern Himalaya: Arunachal Pradesh – present study], China, Indonesia, Japan, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Oceania, Central and South America [Gottsche, 1845 as *Lepidozia wallichiana*; Hattori & Mizutani, 1958 as *L. wallichiana*; Miller, 1960 as *L. wallichiana*; Kitagawa,1969 as *L. wallichiana*; Mizutani, 1974, 1976 as *L. wallichiana*; Onraedt, 1981 as *L. wallichiana*; Grolle & Piippo, 1984 as *L. wallichiana*; Mizutani & Chang, 1986 as *L. wallichiana*; Tan & Engel, 1986 as *Telaranea wallichiana*; Menzel, 1988 as *L. wallichiana*; Sharma & Srivastava, 1993 as *L. wallichiana*; Piippo & al., 2002 as *L. wallichiana*; Engel & Merril, 2004 as *T. wallichiana* (Gottsche) R.M.Schust.; Yamada & Iwatsuki, 2006 as *L. wallichiana*; Zhu, 2006 as *L. wallichiana*; Gradstein & al., 2010 as *L. wallichiana*; Söderström & al., 2010; Chuah-Petiot, 2011 as *T. wallichiana*; Söderström & al., 2011 as *T. wallichiana*; Wang & al., 2011 as *T. wallichiana*; Long & Rubasinghe, 2014; von Konrat & al., 2014].

Specimens examined: India: Eastern Himalaya, Arunachal Pradesh, Anjaw district, on the way from Metaliang to Methumna, c. 1650 m, 10.10.1985, D.K. Singh 16/5C (ASSAM); Lower Dibang Valley district, 6 km from Mayudia guest house towards Tiwarigaon, c.950 m, 07.05.2010, S. Majumdar 48102C, 48132A (CAL).

Other Specimens examined: Papua New Guinea. West Sepik Province.: Friedariver prospecting area of Frieda Copper Co. Kokomo Creek 2.5 km NW of Frieda Base Camp (helipad K 10), 550 m, 4^0 41□ S, 141^0 46□ E, 07.08.1981, Timo Koponen 35745, collection site no. 6, det. S. Piippo 1983 (CAL); Papua New Guinea. West Sepik Province.: Frieda river prospecting area of Frieda Copper Co. along trail in second growth tropical rainforest 0.5 km SWW of Frieda Base Camp, 500 m,4^0 42□ S, 141^0 47□ E, 04.08.1981, Timo Koponen 35359, collection site no. 8c, det. S. Piippo 1983 (CAL); Papua New Guinea. West Sepik Province.: Frieda river prospecting area of Frieda Copper Co. along Peache Creek 0.5 km N of Frieda Base Camp, 400 m,4^0 42□ S, 141^0 47□ E, 08.08 1981, collected by Timo Koponen 35990, collection site no. 8f, det. S. Piippo 1983 (CAL).

Additional illustrations examined: Sharma and Srivastava (1993: Pl. 7, figs. 1-23).

DISCUSSION

Neolepidozia wallichiana is characterised by small and delicate plants with short branches emerging at about right angles to the main stem (Figs. 1 – 4) and stem in transverse section being differentiated into a single layer of large, thin-walled epidermal cells and moderately thick-walled, smaller medullary cells (Fig. 5).

The plants of *N. wallichiana* from Lower Dibang valley district (S. Majumdar 48102C and 48132A) are much larger, up to 36 mm long (sometimes reaching up to 62 mm in length), very rarely with only 2-lobed main stem

leaves, hence vary considerably from those from Nepal, which are only up to 20 mm long (Sharma & Srivastava, 1993). Whereas, those from Anjaw district (D.K. Singh 16/5C) range from 15 – 25 mm in length having (3-) 4-lobed leaves. The plants from Nepal are only 13–20 mm long with the main stem leaf usually 4-lobed and the leaf-lobes 1–2 cells wide at base and 3–4 cells uniseriate towards apex (Sharma & Srivastava, 1993). The three Papua New Guinean specimens of the species examined by us have 9–16 mm long plants, but while Timo Koponen 35359 and Timo Koponen 35990 exhibit strictly 4-lobed main stem leaves, Timo Koponen 35745 shows (3-) 4-lobed leaves. In the features of main stem leaf-lobe, however, the Indian plants of the species compare well with Papua New Guinean plants, which also have main stem leaf-lobes 2–3 cells wide at base and 2–3 (-4) cells uniseriate towards apex. The Indian plants of *N. wallichiana* fully conform to the description provided by Sharma and Srivastava (1993), based on the type, and other specimens studied by us in all other significant morphological characteristics, like primary branch leaves and main stem underleaves.

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