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RESEARCH ARTICLE

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Resurrection of the genus *Haplanthus* (*Acanthaceae*: *Andrographinae*)

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Key words

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new combinations
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Abstract A systematic morphological study of *Andrographis* (*Acanthaceae*: *Andrographinae*) in India has revealed that the genus *Haplanthus* is distinct from *Andrographis.* We resurrect the genus *Haplanthus* here with four species, one of which contains three varieties. Five new combinations are proposed: *H. laxiflorus*, *H. laxiflorus* var. *parishii*, *H. laxiflorus* var. *recedens*, *H. ovatus*, and *H. rosulatus*. In addition, the following four names are lectotypified here: *Gymnostachyum andrographioides*, *G. ovatum*, *G. parishii*, and *Haplanthus tener* var. *elongatus*.

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INTRODUCTION

The genus *Haplanthus* Nees was established with a single species, *H. tener* Nees and distinguished from *Andrographis* Wall. ex Nees by having the corolla subactinomorphous, five-lobed with a curved tube, and monothecous anthers that are hairy throughout the connectives (Nees 1832). Subsequently, Nees (1847) transferred two more species of *Justicia* to *Haplanthus*: *H. tentaculatus* (L.) Nees and *H. verticillaris* (Roxb.) Nees.

Anderson (1867) transferred *H. tener*, the type of *Haplanthus*, to *Andrographis* but renamed it as *A. tenuiflora* T.Anderson, based on a nomen nudum, *Justicia tenuiflora* Wall., which has never been validly published, but with reference to a description of *H. tener.* According to Art. 55 of ICN (McNeill et al. 2012), the name *A. tenuiflora* is an illegitimate superfluous name because the epithet 'tener' ought to have been adopted. Accordingly, Kuntze (1891) proposed a new combination *A. tenera* (Nees) Kuntze. However, Bremekamp (1948) pointed out that this plant was described as early as 1826 by Blume under the name of *Justicia laxiflora* Blume. Later, Lindau (1895) transferred it to *Andrographis* as *A. laxiflora* (Blume) Lindau, which is presently treated as the correct name for this species (Sreemadhavan 1969, Karthikeyan et al. 2009, Hu et al. 2011).

Anderson (1867) retained four species in *Haplanthus*: *H. hygrophiloides* T.Anderson, *H. plumosus* T.Anderson, *H. tentaculatus* (L.) Nees, and *H. verticillaris* (Roxb.) Nees. According to Art. 48.1 of ICN (McNeill et al. 2012), a later homonym *Haplanthus* T.Anderson (1867) non Nees (1832) was thus published by him inadvertently. In consequence of Andersons error, Kuntze (1903) proposed a replacement name *Haplanthodes* Kuntze for this later homonym but failed to propose new combinations for the species concerned. Later, Sreemadhavan (1964) proposed another replacement name, *Bremekampia* Sreem. for *Haplanthus* T.Anderson, probably unaware of the earlier substitute name *Haplanthodes*. However, according to Art. 52.2 of ICN (McNeill et al. 2012), the name *Bremekampia* is not a superfluous illegitimate name because it does not include all the original elements of *Haplanthodes* Kuntze. The effort of Santapau (1967) to conserve the name *Haplanthus* Nees ex T.Anderson against *Haplanthus* Nees for nomenclatural stability was rejected by the committee for spermatophyta who instead recommended to accept *Haplanthodes* Kuntze as the correct name (McVaugh 1968). Subsequently Majumdar (1971) and Panigrahi & Das (1981) made the necessary combinations for all four recognised species under *Haplanthodes.*

Li (1983) described a new genus *Haplanthoides* H.W.Li with the sole species *H. yunnanensis* H.W.Li from Yunnan, China. The name *Haplanthoides* differs from Kuntzes name *Haplanthodes* only in the presence of one character 'i'. Therefore these two names are sufficiently alike to be confused and might be treated as homonyms. However, *Haplanthoides* was later treated as a synonym of *Andrographis*, with *H. yunnanensis* considered to be a synonym of *A. laxiflora* (Blume) Lindau (Chu 1991, Hu 2002, Hu & Cui 2006, Hu et al. 2011).

More recently McDade et al. (2008) included five species from the subtribe *Andrographinae* in a molecular phylogenetic study on the family *Acanthaceae* and confirmed its monophyletic nature. However, they have highlighted the need for extra denser sampling from *Andrographinae* and a critical assessment of morphological characters that may delineate different genera of this group.

MATERIALS AND METHODS

The present systematic study on *Andrographis* (*Acanthaceae*: *Andrographinae*) in India (Gnanasekaran 2015) is primarily based on the critical examination of fresh specimens collected from different states of India, deposited at MH and herbarium specimens housed at B*, BM, BSI, C*, CAL, CALI, E*, FRC, FRLH, G*, K*, KUN, L*, MH, P*, RHT, S*, SKU, and TBGT using the optical microscope (Nikon SMZ1500) coupled with digital DS-Fi1 camera. In addition, micro-morphological characters of pollen grains and seeds were examined using the Scanning Electron Microscope (Evo M18, Carl Zeiss).

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* Digital images.

Table 1 Comparative diagnostic characters between the genera *Andrographis*, *Haplanthus*, and *Haplanthodes*.

Characters	*Andrographis*	*Haplanthus*	*Haplanthodes*
Cladodes in inflorescence	Absent	Absent	Present
Corolla	Distinctly 2-lipped (Zygomorphic)	Subequally 5-lobed (Subactinomorphic)	Subequally 5-lobed (Subactinomorphic)
	Upper lip retuse or notched or minutely 2-lobed, less than 1 mm depth	Upper lip deeply 2-lobed, over 2.5 mm depth	Upper lip deeply 2-lobed, over 2.5 mm depth
	Tube straight	Tube curved	Tube curved
Stamens	Exserted	Included	Included
Anthers	Pilose or woolly only at base of connective; very rarely glabrous (*A. lawsonii*)	Woolly throughout the connective on dorsal side	Woolly throughout the connective on dorsal side
Filaments	Not pouched at apex, dilated at attachment	Pouched at apex, filiform at attachment	Pouched at apex, filiform at attachment
Pollen grains	Prolate or subprolate	Oblate	Oblate
Ovules	6–8 in each cell	6–8 in each cell	3–4 in each cell
Seeds	10–14 per capsule	8–16 per capsule	6–8 per capsule
	Not to hardly compressed	Compressed	Not to hardly compressed
	Distinctly single grooved	Not distinctly grooved	Distinctly two grooved
	Almost circular outline in cross section	Oblong outline in cross section	Almost circular outline in cross section
	Glabrous	Glabrous	Hygroscopic hairy

RESULTS

In the present study, the three allied genera, namely *Haplanthus*, *Haplanthodes*, and *Andrographis*, were compared using macro- and micro-morphological characters and the distinguishing characters are summarised in Table 1. The genus *Haplanthus* can be distinguished from *Andrographis* by having the following characters (Fig. 1):

i. corolla subactinomorphic vs zygomorphic;
ii. corolla tube curved vs straight;
iii. stamens included vs exserted;
iv. filaments pouched at apex vs not pouched;
v. anther connectives hairy throughout dorsally vs hairy only at the base or glabrous (*A. lawsonii*);
vi. pollen grains oblate vs prolate or subprolate
vii. seeds compressed and not distinctly grooved vs not to hardly compressed with a distinct groove; and
viii. seeds with an oblong vs almost circular outline in cross section.

From *Haplanthodes*, *Haplanthus* differs in the following characters:

i. cladodes (reduced abortive branchlets) in inflorescence absent vs present;
ii. ovary with 6–8 vs 3–4 ovules per locule, corresponding to 8–16 vs 6–8 seeds per capsule;
iii. seeds compressed and not distinctly grooved vs hardly compressed with two distinct grooves; and
iv. seeds without hygroscopic hairs vs with hygroscopic hairs.

Consequently, the genus *Haplanthus* is reinstated here as a distinct genus from *Andrographis* and four species and one of which contains three varieties. Amongst these, five new combinations are necessary.

TAXONOMIC TREATMENT

Haplanthus

Haplanthus Nees (1832) 115, non *Haplanthus* T.Anderson (1867). — Type: *Haplanthus tener* Nees (= *H. laxiflorus* (Blume) Gnanasek., G.V.S.Murthy & Y.F.Deng).

Haplanthoides H.W.Li (1983) 470, non *Haplanthodes* Kuntze (1903) 265, syn. nov. — Type: *Haplanthoides yunnanensis* H.W.Li.

Herbs perennial, up to 80 cm high. *Stems* subterete to 4-angled, glabrous to glandular-pubescent, swollen at nodes towards base of plant; rooting at lower nodes. *Leaf blades* ovate-elliptic, lanceolate, 2–10 by 1.5–5.5 cm, attenuate to decurrent or rarely obtuse at base, entire or undulate at margins, acute-acuminate at apex, light black or green above, pale below when dry; lateral veins 4–8 pairs, conspicuous on both surfaces, raised beneath. *Inflorescences* racemose, axillary and terminal, 4–20 cm long, forming a terminal lax or reduced panicle, sometimes flowers almost glomerulate in leaf axils; rachis 4-angled, branched, flowers densely clustered or single at each node on rachis, distantly arranged (interstices 0.3–1 cm), glandular-pubescent to glabrous; peduncles 1.5–5 cm long, glandular-pubescent. *Bracts* lanceolate, 1.5–2 by 0.1–0.4 mm, hairy or entire at margins, acuminate at apex, glandular-pubescent to glabrous, 1-veined. *Bracteoles* 2, linear to lanceolate, 1–1.5 by 0.1–0.25 mm, hairy or entire at margins, acuminate at apex, glandular-pubescent to glabrous. *Pedicels* 0–2.5 mm long, glandular-pubescent. *Calyx* 5-lobed; lobes subequal, lanceolate, 1.5–3 by 0.2–0.4 mm, hairy or entire at margins, acuminate at apex, antrorsely strigulose beneath, glandular-pubescent above. *Corolla* subactinomorphic, unequally 5-lobed, 8–12 by 5–8 mm, purplish; tube curved, inconspicuously ventricose, 3.5–6 by 2–2.5 mm, glandular-pubescent externally; upper lip deeply 2-lobed, over 2.5 mm depth, each lobe entire at margins, obtuse or acute at apex, glabrous inside, glandular-pubescent outside, 3-veined; lower lip 3-lobed, each lobe 3–4 by 2–3.2 mm, entire at margins, acute or obtuse at apex, 3-veined, hirsute at center of middle lobe internally, glandular-pubescent outside. *Stamens* 2, included, adnate to base of ventricose portion of corolla tube; filaments 3–4 mm long, pouched at apex, (where c. 0.7 mm across), filiform at point of attachment, retrorsely strigulose throughout; anthers bithecous, oblong, 1.2–1.5 by 0.5–0.6 mm; connectives woolly dorsally. *Ovary* oblong, 0.8–1.3 by 0.4–0.6 mm, glandular-hairy, 2-loculed; ovules 6–8 in each locule; style 3–4 mm long, antrorsely bristled; stigma linear, green. *Capsules* linear-oblanceolate, 10–22 by 2–2.5 mm, acute at apex, compressed at right angles to septum with a median longitudinal groove, glandular-hairy, 8–16-seeded. *Seeds* compressed, oblong-obovate in face view, 1.7–2.5 by 1–1.5 mm, oblique at base, truncate or narrowly obtuse at apex, very hard, glabrous, verrucose, brownish.

Distribution — Bangladesh, Bhutan, Cambodia, China, India, Malesia, Myanmar, Thailand, Vietnam.

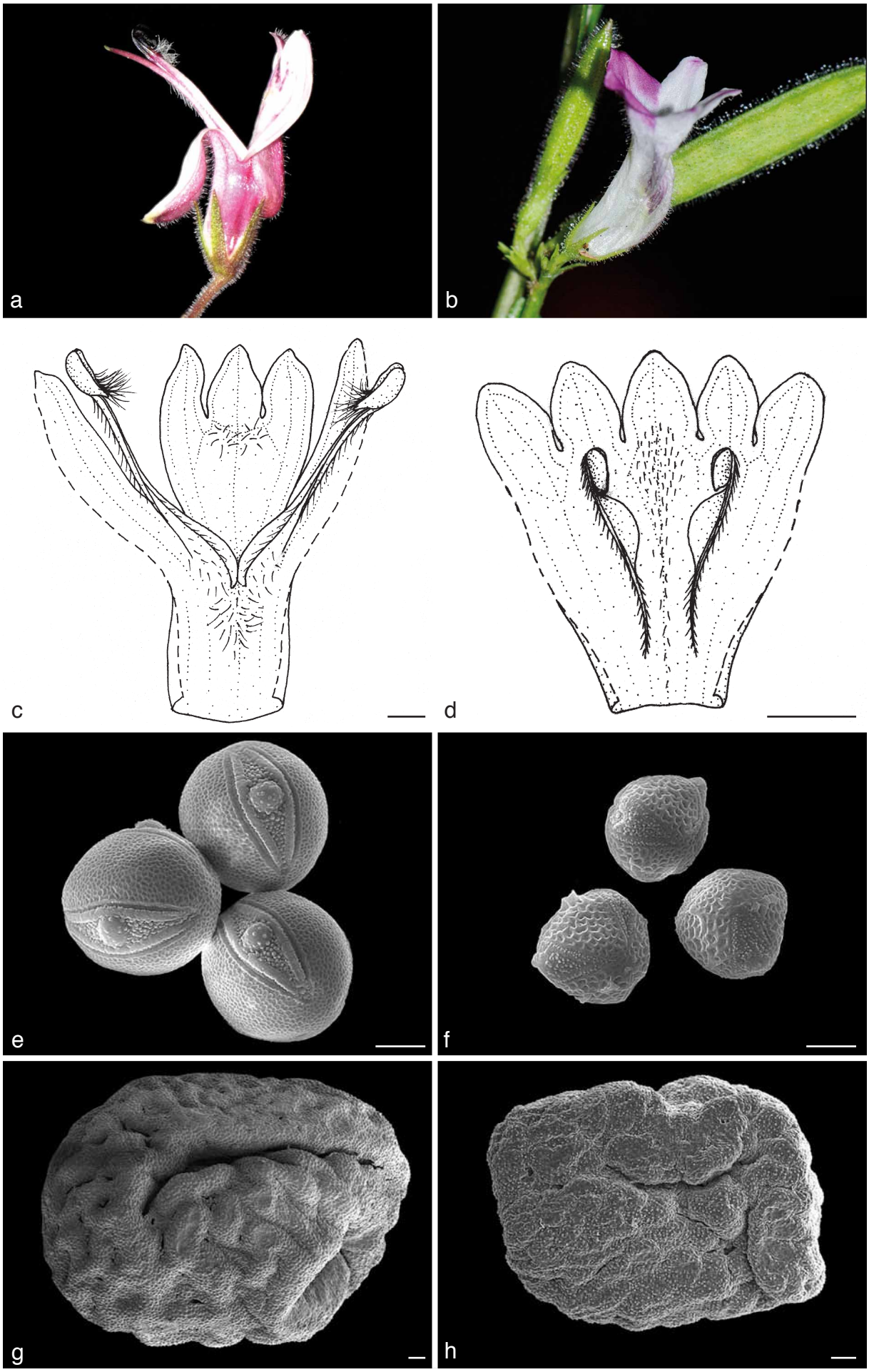

Fig. 1 Comparative diagnostic characters. a, c, e, g. *Andrographis*; b, d, f, h. *Haplanthus.* — a–b. Corolla; c–d. corolla split-open showing lobes and stamens; e–f. SEM photographs of pollen grains; g–h. SEM photographs of seeds. — Scale bars: c–d = 2 mm; e–f = 10 µm; g–h = 100 µm

Note — Scrutiny of literature and examination of specimens at various herbaria revealed that the species of this genus exhibit high levels of morphological variation. Therefore, it is prerequisite to incorporate molecular datasets along with these morphological characters to have better understanding and delimitation of species in this group.

KEY TO THE HAPLANTHUS SPECIES

1. Leaves rosulate, obovate-oblanceolate; capsules small, 10–12 mm long . . . . . 4. *H. rosulatus*
1. Leaves cauline; ovate-lanceolate, elliptic; capsules large, up to 22 mm long 2
2. Flowers axillary, verticillately arranged at nodes . . . . . 1. *H. hygrophiloides*
2. Flowers in axillary and terminal racemes or panicles . . . 3
3. Leaves ovate; inflorescence a terminal panicle, loosely arranged and somewhat recurved . . . . . 3. *H. ovatus*
3. Leaves ovate-lanceolate or elliptic; inflorescence axillary and terminal racemose panicle, not loosely arranged . . . . . 2. *H. laxiflorus*

1. *Haplanthus hygrophiloides* T.Anderson

Haplanthus hygrophiloides T.Anderson (1867) 503. — *Andrographis hygrophiloides* (T.Anderson) W.J.Kress & DeFilipps (2003) 483. — Type: *Brandis s.n.* (holo CAL0000019981), Myanmar, Pegu, s.dat.

Haplanthoides yunnanensis H.W.Li (1983) 470. — Type: *Chow 336* (holo KUN), China, Yunnan, Mengla, Menglun, in monte calcareo prope 56 km a Mengyang ad Mengla, 22 Feb. 1959.

Distribution — Myanmar.

Note — This species was originally placed in *Haplanthus* T.Anderson when described. Sreemadhavan (1964) did not transfer this species to *Bremekampia* but later it was treated under *Andrographis* by Kress & DeFilipps (2003). However, examination of type specimen revealed that this species should be treated under *Haplanthus* Nees. Under Art. 55.1 of ICN (McNeill et al. 2012), the name *H. hygrophiloides* T.Anderson (1867) is legitimate even though it was published under the illegitimate superfluous generic name *Haplanthus* T.Anderson (1867).

2. *Haplanthus laxiflorus* (Blume) Gnanasek., G.V.S.Murthy & Y.F.Deng, *comb. nov.*

Haplanthus laxiflorus (Blume) Gnanasek., G.V.S.Murthy & Y.F.Deng. — *Justicia laxiflora* Blume, Bijdr. (1826) 789. — *Andrographis laxiflora* (Blume) Lindau (1895) 323. — Type: *Blume s.n.* (holo L0003148), s.loc., s.dat.

Haplanthus tener Nees (1832) 115. — *Andrographis tenuiflora* T.Anderson (1867) 502, nom. illeg. — Type: *Wallich Numer. List No. 7185a* (holo K000014471), Myanmar, Tanintharyi, Tavoy, 2 Oct. 1827.

Haplanthus tener Nees var. *elongatus* Nees (1832) 116, syn. nov. — Type: *Wallich Numer. List No. 7185b* (lecto K000014473, here designated), Myanmar, Tanintharyi, Taong Dong, 24 Nov. 1826.

Gymnostachyum andrographioides T.Anderson (1867) 504, syn. nov. — Type: *Griffith s.n.* (lecto CAL, here designated), Myanmar, s.dat.

Distribution — Bangladesh, Bhutan, Cambodia, China, India, Malesia, Myanmar, Thailand, Vietnam.

Notes — The present study corroborates the views of Hansen (1985) and Hu et al. (2011) that this species is highly variable in habit, leaf shape and size, and structure of inflorescence. The indumentum pattern on the leaves, inflorescence rachises, pedicels, bracts, bracteoles, calyces and capsule also varies considerably. Clarke (1884) recognised two varieties in this species, var. *tenuiflora* and var. *recedens* C.B.Clarke. He further distinguished var. *tenuiflora* into three distinct variations: *tenuiflora*, *parishii* and *andrographioides*. Here, we recognise var. *parishii* and var. *recedens* as varieties distinct from var. *laxiflorus.*

The name *Haplanthus tener* var. *elongatus* is lectotypified here. Nees (1832) described this taxon based on the collections of *Wallich Numer. List No. 7185 b & c.* An examination of these specimens shows that the specimen '*7185b*' has two gatherings collected from Prome marked as '*7185b 1*' (K000014474) and Taong Dong marked as '*7185b 2*' (K000014473) and specimen '*7185c*' collected from Tavoy (K000014472). Of these, the specimen '*7185b 2*' is selected here as the lectotype for this name since it is complete with flowers and also matches with the description provided in the protologue.

Similarly, the name *Gymnostachyum andrographioides* is also lectotypified here. Anderson (1867) cited 'Hab. Assam, *Masters!;* Burmah, *Griffith!*' in the protologue without stating any other details such as field numbers and place of herbarium. A thorough search of these specimens at different herbaria resulted in locating only the *Griffith s.n.* collected from Burma at CAL (Acc. No.: 341233) with the name of this species annotated by the original author. Therefore, this specimen is chosen here as the lectotype of this name.

a. var. *parishii* (T.Anderson) Gnanasek., G.V.S.Murthy & Y.F. Deng, *comb. nov.*

Haplanthus laxiflorus (Blume) Gnanasek., G.V.S.Murthy & Y.F.Deng var. *parishii* (T.Anderson) Gnanasek., G.V.S.Murthy & Y.F.Deng. — *Gymnostachyum parishii* T.Anderson, J. Linn. Soc., Bot. 9 (1867) 504. — Type: *Helfer s.n.* (lecto CAL0000019987, here designated), India, Andaman Islands, s.dat.

Distribution — India.

Note — Anderson (1867) treated *H. tener* var. *elongatus* as a synonym of *G. parishii* whereas the type specimen of the former name matches well with var. *laxiflorus*. Therefore *H. tener* var. *elongatus* is here treated as synonym of *Haplanthus laxiflorus* var. *laxiflorus*. Examination of specimens cited by Anderson (1867) under *G. parishii* reveals that they are a mixture of two distinct taxa. *Helfer s.n.* is chosen here as the lectotype because all the other syntypes are identical with var. *laxiflorus*. The variety *parishii* can be distinguished from var. *laxiflorus* by being glabrous throughout, with very loose, filiform racemose inflorescences with a solitary flower in each node of the rachis.

b. var. *recedens* (C.B.Clarke) Gnanasek., G.V.S.Murthy & Y.F.Deng, *comb. nov.*

Haplanthus laxiflorus (Blume) Gnanasek., G.V.S.Murthy & Y.F.Deng var. *recedens* (C.B.Clarke) Gnanasek., G.V.S.Murthy & Y.F.Deng. — *Andrographis tenuifolia* T.Anderson var. *recedens* C.B.Clarke in Hook.f., Fl. Brit. India 4 (1884) 502. — Type: *Beddome s.n.* (holo BM001050065), Myanmar, Tenasserim, Mooleeyit, 2000 ft, s.dat.

Distribution — Myanmar.

Note — This variety has not appeared in any of the later works after it was originally described by Clarke (1884) but it is recognised here as a distinct variety under *H. laxiflorus*. It can be distinguished from the typical variety by having glabrous filiform habit with a very lax compound panicle with clusters of flowers in each node of the rachis.

3. *Haplanthus ovatus* (T.Anderson ex Bedd.) Gnanasek., G.V.S.Murthy & Y.F.Deng, *comb. nov.*

Haplanthus ovatus (T.Anderson ex Bedd.) Gnanasek., G.V.S.Murthy & Y.F.Deng. — *Gymnostachyum ovatum* T.Anderson ex Bedd., Icon. Pl. Ind. Orient. 60, 61 (1874) t. 250. — *Andrographis ovata* (T.Anderson ex Bedd.) Benth. & Hook.f. (1876) 1100. — Type: *Beddome s.n.* (lecto BM001050057, upper one, here designated), India, Odisha, Ganjam District, Myhendra (Mahendragiri) hills, 2000–4000 ft, s.dat.

Distribution — India.

Note — Beddome (1874) validated the manuscript name of Anderson based on the specimens collected from the Myhendra hills, Berhampore at 2000–4000 ft elevation. During the present study, the above cited collection was traced at BM; the sheet has three specimens with the barcode number BM001050057. Of these, the upper specimen is chosen here as the lectotype as it is complete and precisely matches the illustration provided in the protologue.

4. *Haplanthus rosulatus* (Bremek.) Gnanasek., G.V.S.Murthy & Y.F.Deng, *comb. nov.*

Haplanthus rosulatus (Bremek.) Gnanasek., G.V.S.Murthy & Y.F.Deng. — *Andrographis rosulata* Bremek., Dansk Bot. Ark. 23 (1966) 277. — Type: *Hansen*, *Seidenfaden & Smitinand 10786* (holo C10004735, seen digital image), Thailand, 1000 m, 19 Jan. 1964.

Distribution — Thailand.

Note — This species was treated as conspecific with *A. laxiflora* by Hansen (1985). However, it can be distinguished from the latter by the following characters: i) leaves rosulate vs cauline; and ii) capsules small (10–12 mm) vs large (up to 22 mm).

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