

## REVISITING THE *HEDYOTIS*–*OLDENLANDIA* COMPLEX IN INDIA, WITH A NOTE ON *SCLEROMITRION*

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In recent years, new generic circumscriptions have been proposed in the *Hedyotis*–*Oldenlandia* complex. A comprehensive revision of Indian *Hedyotis sensu lato*, published in 2004, was based on a broad generic concept of the genus and does not uphold new generic delimitations. Therefore, the present article has been prepared to apply modern generic concepts to the Indian taxa. In India, 102 taxa are currently recorded under the *Hedyotis*–*Oldenlandia* complex, belonging to 12 genera (i.e. *Debia*, *Dentella*, *Dimetia*, *Edrastima*, *Exallage*, *Hedyotis*, *Involucrella*, *Kohautia*, *Leptopetalum*, *Neanotis*, *Oldenlandia* and *Scleromitron*). The characters of these genera have been reviewed and their species enumerated, and consequently, five new combinations are proposed. *Scleromitron* in India is discussed in relation to its phenotypic variation, and a key to the six recognised species is presented.

**Keywords.** Distribution, enumeration, *Hedyotis sensu lato*, India, nomenclature, taxonomy.

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### Introduction

Generic delimitations within the tribes Hedyotideae Cham. & Schltld. ex DC. and Spermaceae Bercht. & J. Presl of the family Rubiaceae are hotly debated and regularly updated (Mabberley, 2017). A particularly difficult group is formed by a pantropical assemblage of mainly herbaceous plants: the *Hedyotis*–*Oldenlandia* complex. The complex comprises about 500–600 species (Neupane *et al.*, 2015). In the *Flora of British India*, 80 taxa are recognised (Hooker, 1880) in the complex. In contrast, Dutta & Deb (2004) recognised 74 species classified in seven sections of *Hedyotis sensu lato* (i.e. *Anotidopsis*, *Diplophragma*, *Hedyotis*, *Involucrella*, *Kohautia*, *Oldenlandia*, *Scleromitron*) in the Indian subcontinent.

The various generic delimitations within the *Hedyotis*–*Oldenlandia* complex are often confusing. A widely defined genus *Hedyotis*, which includes *Oldenlandia* and several other smaller genera (Fosberg, 1943; Merrill & Metcalf, 1946; Lewis, 1961; Rogers, 1987; Wagner *et al.*, 1989; Fosberg & Sachet, 1991; Dutta & Deb, 2004), is not supported by the results of new morphological and molecular studies (Terrell & Robinson, 2003; Groeninckx *et al.*, 2009; Neupane *et al.*, 2009; Guo *et al.*, 2013; Wikström *et al.*, 2013; Wang *et al.*, 2014; Neupane *et al.*, 2015; Gibbons, 2020).

In this article, the species and sections of *Hedyotis sensu lato* recognised in India (Wight & Arnott, 1834; Bremekamp, 1952, 1974; Dutta & Deb, 2004) are critically reviewed in light of

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new insights from these recent studies. As a result, 12 genera are recognised in India (India to world species ratio in parentheses): *Debia* (2:4), *Dentella* (1:8), *Dimetia* (3:6), *Edrastima* (1:5), *Exallage* (6:22), *Hedyotis* (33:180), *Involucrella* (1:2), *Kohautia* (4:27), *Leptopetalum* (2:8), *Neanotis* (22:34), *Oldenlandia* (19:190) and *Scleromitrium* (6:24). Additionally, five new combinations are proposed, and the generic circumscriptions of *Oldenlandia* and *Scleromitrium* are discussed.

### Materials and methods

The Indian species in the *Hedyotis*–*Oldenlandia* complex are here reviewed based on recent insights into the generic delimitations within tribe Spermacoceae arising from the work of Kårehed *et al.* (2008), Groeninckx *et al.* (2009), Neupane *et al.* (2009), Guo *et al.* (2013), Wikström *et al.* (2013), Wang *et al.* (2014), Neupane *et al.* (2015) and Gibbons (2020). The Indian and worldwide distributions of the species and their morphologies are abstracted from Dutta & Deb (2004) and *Plants of the World Online* (POWO, 2021), and based on our field observations. Descriptive terminology is in accordance with Beentje (2016), and includes their definition of *lanceolate* as ‘narrowly ovate with tapering apex’.

Sectional and generic notes, nomenclatural novelties, distributional notes and new species records have been gathered from published literature and floristic accounts (Wight & Arnott, 1834; Beddome, 1874; Kurz, 1877; Hooker, 1880; Gamble, 1921; Blatter, 1934; Bremekamp, 1952; Yamazaki, 1966; Rao & Hemadri, 1973; Bremekamp, 1974; Babu, 1977; Henry *et al.*, 1979; Henry & Swaminathan, 1982; Deb & Dutta, 1983, 1985, 1986a, 1986b; Sivarajan & Biju, 1990; Ravikumar, 1999; Murugesan & Balasubramaniam, 2007; Viswanathan & Manikandan, 2008; Karuppusamy & Ravichandran, 2014; Jose *et al.*, 2015; Soumya *et al.*, 2017; Nandikar & Kishor, 2019; Prabhukumar *et al.*, 2019; Kumar *et al.*, 2020). For the plant names and authors, the *International Plant Name Index* (Royal Botanic Gardens, Kew, Harvard University Herbaria & Australian National Herbarium, [continuously updated](#)) has been followed throughout the text.

Nomenclatural decisions have been made following the Shenzhen Code of the *International Code of Nomenclature* (Turland *et al.*, 2018). The synonymisation of *Hedyotis auricularia* subsp. *venosa* (Blume) Deb (1983) is based on specimens examined at WAG and L. Other taxonomic conclusions and amendments have been reached based on the specimens at BM, E, K and P available through *JSTOR Global Plants* (*JSTOR Global Plants*, [continuously updated](#)). Photographs of living plants were taken with a Nikon D5000 DSLR camera (Nikon, Tokyo, Japan).

### Results and discussion

#### *The Hedyotis*–*Oldenlandia* complex in India

Although the revised enumeration of 102 Indian taxa is presented here following the modern generic classification, we found that some of the generic circumscriptions in

the *Hedyotis*–*Oldenlandia* complex have been not resolved satisfactorily, particularly in *Oldenlandia* and *Scleromitron*. Because most of the genera recognised in this complex are speciose in tropical Asia, the results of more comprehensive study of Asian taxa are awaited to resolve these taxonomic ambiguities. These limitations of the generic classification are also discussed here.

### *Debia Neupane & N.Wikstr.*

*Debia* is characterised by ovate to oblong, whorled, decurrent distal leaves; terminal cymes with elongated peduncles [often shortly pedunculate in *D. andamanica* (Kurz) Neupane & N.Wikstr.]; reflexed calyx and corolla; loculicidal dehiscent locules; and keeled capsules (*D. andamanica*) (modified from Neupane *et al.*, 2015). It consists of four species, mainly distributed in tropical Asia, and is represented in India by two species.

The Indian species were previously part of *Hedyotis* sect. *Anotidopsis* Hook.f. and *Hedyotis* sect. *Oldenlandia* (L.) Wight & Arn. Section *Anotidopsis* is recognised based on terminal capitate to subcapitate, pedunculate cymes; narrowly winged capsules; and recurved calyx teeth (Dutta & Deb, 2004). It previously comprised two species: *Hedyotis brunonis* Merr. and *H. andamanica* Kurz. The latter is now recognised as *Debia andamanica* (Figure 1A), and the former is now doubtfully placed in the genus *Oldenlandia*. *Hedyotis ovatifolia* Cav., previously grouped in section *Oldenlandia*, is now known as *Debia ovatifolia* (Cav.) Neupane & N.Wikstr.

*Debia andamanica* is endemic to the Andaman and Nicobar Islands, India, and *D. ovatifolia* is known from Myanmar. Both species can be recognised by their ovate, whorled leaves and terminal cymes. However, reflexed corolla lobes (Neupane *et al.*, 2015) are inconsistent for the circumscription of the genus *Debia*, because they are absent in *D. ovatifolia*.

### *Dentella J.R.Forst & G.Forst*

This genus is characterised by its strictly pentamerous, solitary flowers; subdentate corolla lobes; and indehiscent dry capsules. *Dentella* is more speciose in Australia (six species, all endemic); the remaining two species occur in Asia. *Dentella concinna* Airy Shaw is a poorly known Malaysian species. *Dentella repens* J.R.Forst & G.Forst (Figure 1B) occurs throughout tropical Asia and is naturalised in other places (e.g. Madagascar: Razafimandimbison & Manjato, 2019).

The Indian populations of *Dentella repens* are often considered as a variety, namely *D. repens* var. *serpyllifolia* (Wall. ex Craib) Verdc., due to their glabrous capsules. Because it is so widespread, a certain amount of variation in capsule hairs (densely to sparsely hairy to glabrous; Cook, 1996) should be expected, and much, if not all, of this variation would not be of taxonomic significance. Therefore, we uphold the Indian populations as *Dentella repens*.

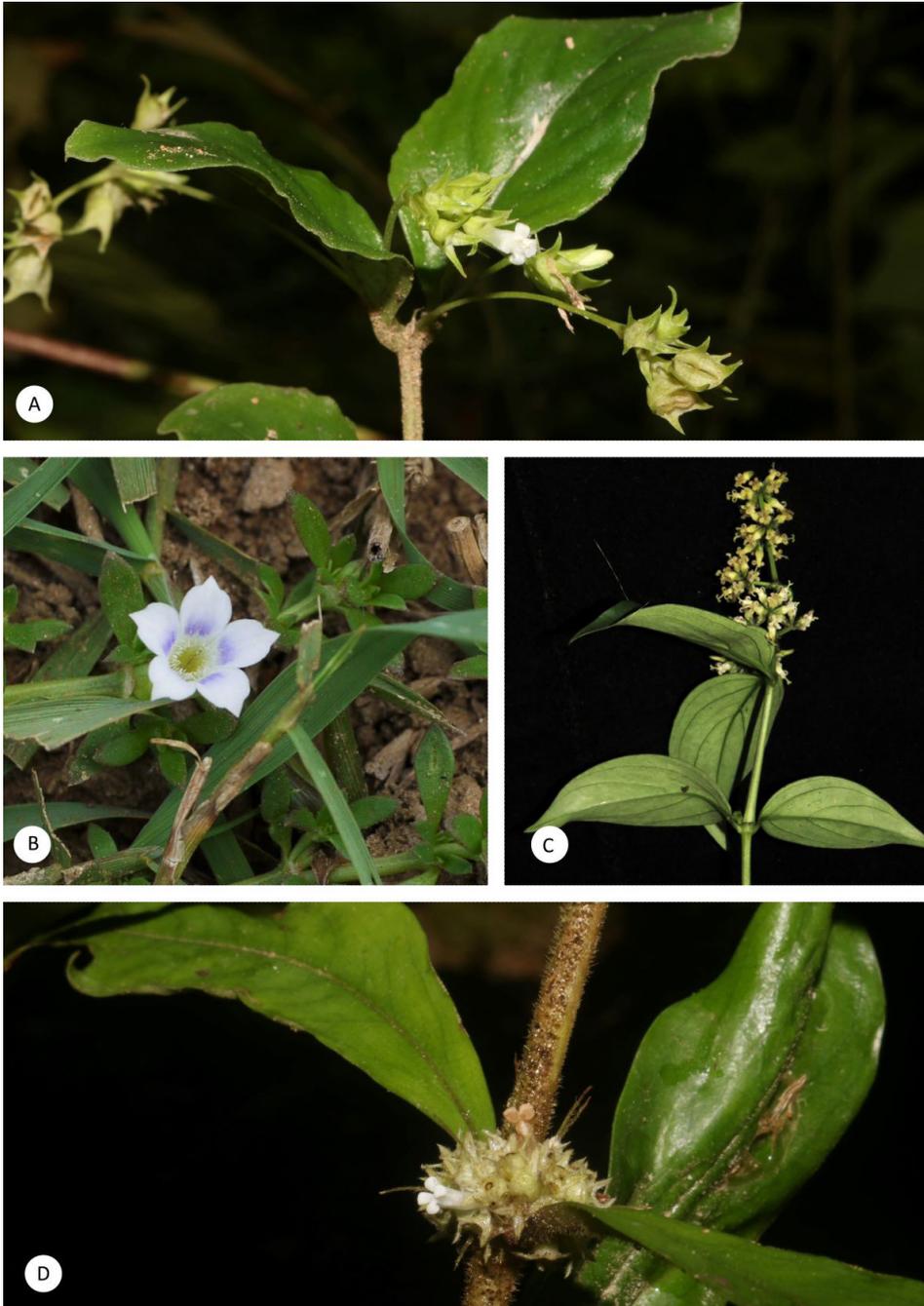


Figure 1. Field photographs. A, *Debia andamanica* (Kurz) Neupane & N. Wikstr.; B, *Dentella repens* J.R. Forst & G. Forst; C, *Dimetia capitellata* (Wall. ex G. Don) Neupane & N. Wikstr.; D, *Exallage paradoxa* (Kurz) Bremek. Photographs: A, Mayur Nandikar; B, Dinesh Valke; C, Reuben C. J. Lim; D, K. C. Kishor.

### *Dimetia* (Wight & Arn.) Meisn.

*Dimetia* can be identified by its climbing or scandent habit, capsule exerted beyond the calyx lobes, septicidal dehiscence and narrowly winged seeds. About six species are distributed in tropical Asia. Three taxa, namely *Dimetia capitellata* (Wall. ex G.Don) Neupane & N.Wikstr. (Figure 1C), *D. capitellata* var. *subpubescens* (Kurz) Nandikar, **comb. nov.** [basonym: *Hedyotis capitellata* var. *subpubescens* Kurz, J. Asiat. Soc. Bengal 46(2): 135 (1877)] and *D. scandens* (Roxb.) R.J.Wang, are found in Northeast India.

In an Indian context, *Dimetia* has been treated under *Hedyotis* sect. *Diplophragma* Wight & Arn. (Dutta & Deb, 2004), which has similarities with the present circumscriptions of *Hedyotis sensu stricto* and *Exallage*. However, *Hedyotis sensu stricto* differs from *Dimetia* in having the capsule included within the calyx lobes, and *Exallage* differs in having an indehiscent capsule.

### *Edrastima* Raf.

This genus is represented by characters such as a glabrous corolla tube and distinctly beaked capsule. It is distributed throughout the tropics and subtropics. Of a total of five species, three are found in tropical Africa and one in America; *Edrastima trinervia* (Retz.) Neupane & N.Wikstr. is recognised in tropical Asia.

*Edrastima* was previously part of *Hedyotis* sect. *Involucrella* Hook.f. (Dutta & Deb, 2004). However, *Edrastima trinervia* (synonyms: *Hedyotis trinervia* Roem. & Schult., *Oldenlandia trinervia* Retz.) is recognised as distinct due to its glabrous corolla tube. The generic key character of a 'distinctly beaked capsule' as recognised by Neupane *et al.* (2004, 2015) has been found to be inconsistent, because in *Edrastima trinervia* the capsule apex does not protrude from the calyx and is obtuse.

### *Exallage* Bremek.

*Exallage* has often been grouped as part of *Hedyotis* sect. *Euhedyotis* Wight & Arn. (1834) (syn. section *Hedyotis* L. *auct.* Dutta & Deb, 2004). However, it can be separated from the other species in the *Hedyotis*–*Oldenlandia* complex by its axillary inflorescence and its crustaceous, hard, indehiscent, globose fruits with tumescent apices (Bremekamp, 1952; Neupane *et al.*, 2015; Nandikar & Kishor, 2019). About 22 species are distributed in tropical Asia, mainly in Southeast Asia.

Six taxa are represented in India, namely *Exallage auricularia* (L.) Bremek. [including *Hedyotis auricularia* L. subsp. *venosa* (Blume) Deb, **syn. nov.**], *E. cristata* (Willd. ex Roem. & Schult.) Nandikar & K.C.Kishor, *E. fulva* (Hook.f.) Neupane & N.Wikstr., *E. insularis* (Spreng.) Neupane & N.Wikstr., *E. paradoxa* (Kurz) Bremek. (Figure 1D) and *E. ulmifolia* (Wall.) Bremek. All these also occur in Southeast Asia, except for *Exallage paradoxa*, which is endemic to the Andaman Islands, India. *Hedyotis auricularia* subsp. *venosa* has been found to be

conspecific, because leaves in *H. auricularia* L. are consistently broadly elliptic-lanceolate and 3- to 7-nerved.

### Hedyotis L. sensu stricto

*Hedyotis* is a genus of perennial herbs, shrubs and small trees characterised by a pubescent corolla throat, included capsule apex, and septically, late-dehiscing capsules (modified from Dutta & Deb, 2004; Neupane *et al.*, 2015). Other characters, such as those of the stipule, leaf (shape, size and venation) and inflorescence, are extremely variable. Often, seeds are ridged and winged (characters also known in *Dimetia*).

About 180 species of *Hedyotis sensu stricto* are distributed in tropical Asia and the Pacific Northwest, with 33 species represented in India. Tamil Nadu and Kerala States are home to *Hedyotis albonerva* Bedd., *H. articularis* R.Br. ex Wight & Arn., *H. articularis* subsp. *santapau* (Shetty & Vivek.) Deb & Ratna Dutta, *H. barberi* (Gamble) A.N.Henry & Subr., *H. beddomei* Hook.f., *H. buxifolia* Bedd., *H. devicolamensis* Deb & Ratna Dutta, *H. eualata* (Gamble) A.N.Henry & Subr., *H. eualata* var. *agastyamalayana* A.N.Henry & Subr., *H. gamblei* A.N.Henry & Subr., *H. hirsutissima* Bedd., *H. leschenaultiana* DC., *H. leschenaultiana* var. *wynaadensis* (Gamble) Deb & Ratna Dutta, *H. pruinosa* Wight & Arn., *H. purpurascens* Hook.f., *H. ramarowii* (Gamble) R.S.Rao & Hemadri, *H. swertioides* Hook.f., *H. travancorica* Bedd. and *H. verticillaris* Wight & Arn. *Hedyotis membranacea* Thwaites, *H. trimenii* Deb & Ratna Dutta and *H. viscida* Bedd. occur in the Western Ghats of Sri Lanka, whereas *H. fruticosa* L., *H. tetrandra* (Roxb.) Craib and *H. uncinella* Hook. & Arn. (Figure 2A) are distributed in eastern India and Southeast Asia. *Hedyotis congesta* R.Br. ex G.Don is distributed in the Andaman Islands and Malaysia (Nandikar & Kishor, 2019). Its resemblance to *Hedyotis prostrata* Blume remains doubtful (Nandikar & Kishor, 2019). Neighbouring Sri Lanka is more speciose, having c.27 endemic taxa compared with c.26 taxa endemic to peninsular India. Section *Diplophragma* Wight & Arn. (1834) is now included within the new generic circumscription of *Hedyotis sensu stricto* in India.

Since the latest revision of *Hedyotis sensu lato* (Deb & Dutta, 2004), seven new species, namely *H. indirae* K.M.P.Kumar & Aiswarya, *H. kottangathattiensis* M.B.Viswan. & Manik., *H. nairii* Murug. & V. Balas., *H. rajasekaranii* Karupp. & V.Ravich., *H. shettyi* K.Ravik. & V.Lakshm., *H. shoolamudiana* Sunil, Naveen Kum. & K.M.P.Kumar (as ‘*shoolamudianus*’) and *H. sithiravaraiensis* Muruganand., Devanath., S.Ravik. & D.Naras., have been described (Ravikumar, 1999; Murugesan & Balasubramaniam, 2007; Viswanathan & Manikandan, 2008; Karuppusamy & Ravichandran, 2014; Prabhukumar *et al.*, 2019; Kumar *et al.*, 2020; Muruganandam *et al.*, 2020), mainly from the southern Western Ghats of Tamil Nadu and Kerala.

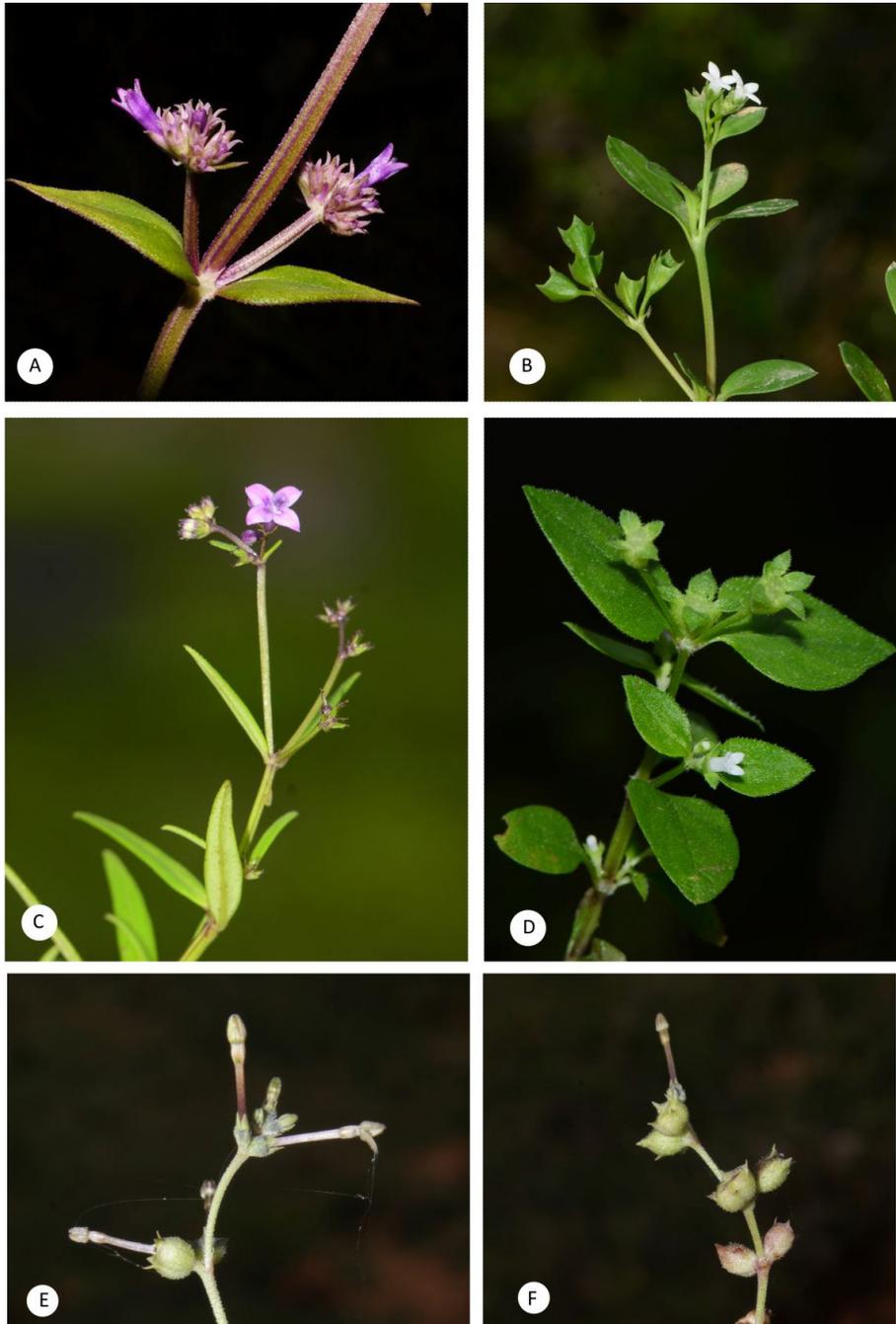


Figure 2. Field photographs. A, *Hedyotis uncinella* Hook. & Arn.; B, *Leptopetalum biflorum* (L.) Neupane & N. Wikstr.; C, *Neanotis foetida* (Hook. f.) W.H. Lewis; D, *Neanotis tubulosa* (G. Don) Mabb.; E and F, *Kohautia aspera* (Heyne ex Roth) Bremek. Photographs: A, Nidhan Singh; B–F, Mayur Nandikar.

### *Involucrella* (Benth. & Hook.f.) Neupane & N.Wikstr.

This genus is characterised by terminal capitate cymes amid involucre-like distal leaves, and membranous, irregularly dehiscent capsules. Two species are found in Asia (Neupane *et al.*, 2015). *Involucrella coronaria* (Kurz) Neupane & N.Wikstr. (syn. *Hedyotis merguensis* Hook.f.) is distributed in Mizoram and Tripura States in India (Dutta & Deb, 2004).

### *Kohautia* Cham. & Schtdl.

*Kohautia* can be recognised by its weak habit, brevistylous or longistylous flowers (stigma positioned below or above the anthers), and slender corolla tube with included stamens. Walpers (1843) grouped the *Kohautia* species into *Hedyotis* sect. *Kohautia*; however, the recent generic circumscription upheld the genus *Kohautia*, with 27 species distributed from Africa to Australia (Neupane *et al.*, 2015).

Four species, namely *Kohautia aspera* (Heyne ex Roth) Bremek. (Figure 2E,F), *K. coccinea* Royle, *K. gracilis* (Wall.) DC. and *K. retrorsa* (Boiss.) Bremek., are distributed in the Indian subcontinent and the Arabian Peninsula. *Kohautia nagporensis* (Brace ex Haines) Santapau & Merch. is the only Indian endemic and is reported from central India, Gujarat State and Maharashtra State.

### *Leptopetalum* Hook. & Arn.

Members of this genus were previously grouped in section *Oldenlandia* (L.) Wight & Arn. and genus *Thecagonum* Babu [excluding *T. ovatifolium* (Cav.) Babu (= *Debia ovatifolia*)]. However, the species with a glabrous habit, winged, loculicidal dehiscent capsules, and pitted seeds have now been retained in *Leptopetalum* (Neupane *et al.*, 2015).

The genus consists of eight species distributed mainly in tropical Asia. Two species are represented in India, namely *Leptopetalum biflorum* (L.) Neupane & N.Wikstr. (syn. *Hedyotis hermanniana* Ratna Dutta) (Figure 2B) and *L. pteritum* (Blume) Neupane & N.Wikstr., these being found in Southeast Asia, India and the Andaman Islands (Nandikar & Kishor, 2019).

### *Neanotis* W.H.Lewis

*Neanotis* is recognised by characters such as its annual, herbaceous habit and pluriaperturate (6–12 apertures), coarsely reticulate pollen (Lewis, 1966; Neupane *et al.*, 2015). Characters including a fetid odour and peltate to planoconvex seeds with a distinct cavity can also be used to distinguish *Neanotis* from its allied genera.

About 34 species are distributed in tropical Asia to Australia, with 22 represented in India (POWO, 2021; WCVP, 2021). Of these, *Neanotis carnososa* (Dalzell) W.H.Lewis, *N. decipiens* (Hook.f.) W.H.Lewis, *N. foetida* (Hook.f.) W.H.Lewis (Figure 2C), *N. indica* (DC.) W.H.Lewis, *N. lancifolia* (Hook.f.) W.H.Lewis, *N. latifolia* Deb & Ratna Dutta, *N. longiflora* W.H.Lewis, *N. montholonii* (Hook.f.) W.H.Lewis, *N. prainiana* (Talbot) W.H.Lewis, *N. rheedei* (Wall. ex Wight &

Arn.) W.H.Lewis, *N. ritchiei* (Hook.f.) W.H.Lewis and *N. sahyadrica* Billore & S.K.Mudaliar are endemic to peninsular India.

*Neanotis calycina* (Wall. ex Hook.f.) W.H.Lewis, *N. gracilis* (Hook.f.) W.H.Lewis, *N. ingrata* (Wall. ex Hook.f.) W.H.Lewis, *N. oxyphylla* (Wall. ex D.Don) W.H.Lewis, *N. rhombicarpa* T.Yamaz. and *N. urophylla* (Wall. ex Wight & Arn.) W.H.Lewis are distributed in the eastern and northeastern regions of India to Nepal and Bangladesh. *Neanotis monosperma* (Wall. ex Wight & Arn.) W.H.Lewis and *N. tubulosa* (G.Don) Mabb. [syn. *N. quadrilocularis* (Thwaites) W.H.Lewis] (Figure 2D) appear to be endemic to the Western Ghats of India and Sri Lanka. However, the latter species is doubtfully known from Thailand (Garrett 389 [TCD0017371]). *Neanotis hirsuta* (L.f.) W.H.Lewis and *N. wightiana* (Wall. ex Wight & Arn.) W.H.Lewis are distributed from India to China.

Until Lewis (1966) described the genus *Neanotis*, the species were partly grouped in the section *Anotis* Wight & Arn. (1834). However, some were classified under the genera *Hedyotis*, *Oldenlandia* and *Putoria* Pers. It remains difficult to differentiate some *Oldenlandia* species from *Neanotis*, due to the limited number of qualitative characters.

### Oldenlandia L. sensu stricto

This ill-defined genus in the *Hedyotis*–*Oldenlandia* complex comprises about 190 species distributed in the Old World tropics and shares many similarities with *Scleromitron* (Guo *et al.*, 2013; Wang *et al.*, 2014; Neupane *et al.*, 2015). Circumscription of the morphological characters and their similarities with those of allied genera makes *Oldenlandia* taxonomically challenging, and therefore it is difficult to estimate the number of species. In an Indian context, to circumscribe *Oldenlandia* we have used a combination of characters such as linear-lanceolate leaves; solitary to many-flowered, pedunculate cymes; usually inserted stamens; and loculicidally dehiscent capsules. These characters are artificial and are used here to define the genus in India, mainly represented by section *Oldenlandia sensu* Dutta & Deb (2004). They may or may not be applicable to *Oldenlandia* species outside the Indian subcontinent.

Nineteen taxa are reported from India, namely *Oldenlandia affinis* (Roem. & Schult.) DC., *O. attenuata* (Willd.) M.R.Almeida, *O. corymbosa* L., *O. corymbosa* var. *linearis* (DC.) Verdc., *O. dineshii* Sojan & V.Suresh, *O. graminicola* (Kurz) Deb & M.Gangop., *O. herbacea* (L.) Roxb., *O. hygrophila* Bremek., *O. monocephala* Kuntze, *O. paniculata* L., *O. pseudocorymbosa* (Bakh.f.) Raizada, *O. pumila* (L.f.) DC., *O. smitacrisnae* Nandikar & K.C.Kishor, *O. stricta* L., *O. stricta* subsp. *arenaria* (Haines) Nandikar, **comb. nov.** [basionym: *O. arenaria* Haines, J. Asia. Soc. Bengal Ser. 2(15): 315 (1920); endemic to Odisha], *O. stricta* var. *shuteri* (Hook.f.) Nandikar, **comb. nov.** [basionym: *O. shuteri* Hook.f., Fl. Brit. India 3: 69 (1880); Deb & Dutta (1985); endemic to Tamil Nadu and Andhra Pradesh], *O. umbellata* L. [syn. *Hedyotis puberula* (G.Don) Arn.] (Figure 3B–D), *O. vasudevani* M.Soumya & Maya (doubtfully distinct from *O. stocksii* Hook.f.) and *O. wallichii* Craib. Of these, *Oldenlandia graminicola* and *O. smitacrisnae* are endemic to the Andaman Islands, and all others except *O. monocephala* are endemic to Kerala.



**Figure 3.** Field photographs. A, *Oldenlandia stocksii* Hook.f. B–D, *Oldenlandia umbellata* L.: B, habit; C, brevistylous flower; D, longistylous flower. Photographs: Mayur Nandikar.

### *Ill-defined taxa in Scleromitron*

The *Scleromitron* clade identified by Neupane *et al.* (2015) and Gibbons (2020) included distinctly paniculate, corymbose species (*Hedyotis diffusa* Willd., *Hedyotis scabra* Wall. ex Kurz and *Oldenlandia linooides* Griff., and many other Southeast Asian taxa) that have been popularly recognised in India under *Hedyotis* and *Oldenlandia*. The endemic Indian species *Oldenlandia stocksii* Hook.f. (endemic to Goa, Karnataka and Maharashtra), known for its axillary, solitary to terminal 2-flowered cymes (Figure 3A), is also nested in *Scleromitron*. However, difficulties remain regarding the phenotypic distinctness of *Scleromitron* from its most closely related genera.

We believe that the taxa with terminal and axillary, paniculate or corymbose or simple cymes with pedicellate, often heterostylous flowers with distinctly exerted stamens deserve to be recognised in a distinct genus rather than in *Scleromitron*. However, a comprehensive morphological and molecular study throughout the distribution range would be required for their resolution, and therefore we consider them to be of uncertain generic placement.

### *Scleromitron (Wight & Arn.) Meisn.*

*Scleromitron* has been reinstated in recent years (Guo *et al.*, 2013; Wang *et al.*, 2014; Neupane *et al.*, 2015; Gibbons, 2020). It is characterised by its axillary cymes of subsessile, homostylous flowers, and erect, rigid calyx lobes, converging to the apex in the capsule (Wight & Arnott, 1834; Neupane *et al.*, 2015). Most Indian species of *Scleromitron* are reported to have a hairy corolla throat [*S. brachypodum* (DC.) T.C.Hsu being an exception], but this is not a constant character of the genus, as reported by Gibbons (2020) for the Australian taxa. The genus comprises 24 species distributed in tropical Asia and Australia (Gibbons, 2020; POWO, 2021).

In India, six species are represented in *Scleromitron*, namely *S. angustifolium* (Cham. & Schltdl.) Benth., *S. brachypodum* (DC.) T.C.Hsu, *S. cyananthum* (Kurz) Nandikar, **comb. nov.** [basionym: *Hedyotis cyanantha* Kurz, J. Asiat. Soc. Bengal, Pt 2, Nat. Hist. 45(2): 136 (1876)], *S. neesianum* (Arn.) Nandikar, **comb. nov.** [basionym: *Hedyotis neesiana* Arn., Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 18: 341 (1836); heterotypic synonym: *Scleromitron nitidum* Kurz] (Figure 4A), *S. pinifolium* (Wall. ex G.Don) R.J.Wang and *S. verticillatum* (L.) R.J.Wang (Wight & Arnott, 1834; Walpers, 1843; Dutta & Deb, 2004; Hsu & Chen, 2017). The Indian taxa can be recognised by their herbaceous habit; axillary, 1- to 6-flowered cymes with sessile to subsessile flowers (rarely terminal capitate cymes in *Scleromitron cyananthum* and *S. pinifolium*); exerted stamens and style; and ovoid crustaceous capsules with converging, erect, rigid calyx teeth.

*Scleromitron brachypodum* (Figure 4B–D) is often considered conspecific with *Hedyotis diffusa* (Roxburgh, 1820; Dutta & Deb, 2004; Rao *et al.*, 2019; WCVP, 2021). However, it is



**Figure 4.** Field photographs. A, *Scleromitrium neesianum* (Arn.) Nandikar. B–D, *Scleromitrium brachypodum* (DC.) T.C.Hsu: B, habit; C, flower; D, capsule. Photographs: Mayur Nandikar.

quite different from *Hedyotis diffusa* in having linear leaves, 1- or 2-flowered axillary sessile to subsessile cymes, urceolate flowers and larger fruits (modified from Sivarajan & Biju, 1990). It is a common species in wet lowlands and cultivated fields, and is distributed across the Asian subcontinent. One of our collections of *Scleromitrium brachypodum* from Amboli, Maharashtra (Nandikar & Bramhadande 002480 [NGCPR]) has sessile flowers and rigid calyx lobes, which clearly support the opinion of Hsu & Chen (2017) in recognising it in *Scleromitrium*.

An identification key to all reported species of *Scleromitrium sensu stricto* (species with sessile to subsessile, homostylous flowers and erect, rigid calyx lobes) in India is presented below.

### Key to the species of *Scleromitrium sensu stricto* in India

- 1a. Leaves linear, or narrowly elliptic; corolla tube pubescent within \_\_\_\_\_ 2
- 1b. Leaves setaceous, linear, or elliptic or elliptic-lanceolate; corolla tube glabrous within \_\_ 3
- 2a. Stem terete, glabrous; cymes axillary, 3- to 6-flowered \_\_\_\_\_ *S. angustifolium*
- 2b. Stem angular, sparsely hispid; cymes axillary and terminal, 5- to 15-flowered  
*S. pinifolium*
- 3a. Leaf apex bristle pointed; flowers blue in axillary and terminal in leafy cymes  
*S. cyananthum*
- 3b. Leaf apex acute or obtuse; flowers white in axillary, capitate cymes \_\_\_\_\_ 4
- 4a. Stipule cupular; filaments 4–4.6 mm long; capsule hispid \_\_\_\_\_ *S. verticillatum*
- 4b. Stipule deltate; filaments 1–2 mm long; capsule glabrous \_\_\_\_\_ 5
- 5a. Stem angular, often grooved; leaves elliptic, 30–60 × 0.5–20 mm, rounded to subcordate at base; cymes 2- to many-flowered; corolla lobes spreading \_\_\_\_\_ *S. neesianum*
- 5b. Stem terete; leaves linear or narrowly elliptic, 25–35 × 0.2–0.5 mm, cuneate to attenuate at base; cymes 1- to 2-flowered; corolla urceolate \_\_\_\_\_ *S. brachypodum*

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