

**TYPIFICATION AND NOVELTIES IN RUBIACEAE
FOR THE FLORA OF VIETNAM**

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ABSTRACT

Four Rubiaceous species viz. *Hedyotis diversifolia*, *Involucrella lithophila*, *Mouretia larsenii*, *Ophiorrhiza cana* are newly recorded for the flora of Vietnam. Morphology based identification key, taxonomic notes, and photo-plates of the newly reported species are provided. Moreover, the second-step lectotype has been designated for the name *Involucrella chereevensis*. These findings provide some new basic data essential for biodiversity research in Vietnam. key, taxonomic notes, illustration provided.

Keywords: Biodiversity, Rubiaceae, new record, Vietnam.

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INTRODUCTION

Rubiaceae (Order: Gentianales), commonly known as the Coffee family, includes three subfamilies namely Cinchonoideae, Ixoroideae and Rubioideae (Bremer, 2009; Razafimandimbison & Rydin, 2019) comprising 630 genera and about 13000 species found worldwide, mostly in tropical regions (Govaerts et al., 2022).

In Vietnam, this family is represented by ca. 86 genera and 510 species (Pitard, 1922; Ho, 2003; Tran, 2005). Of late, several new species belonging to Rubiaceae have been described from Vietnam including four species of *Argostemma* (Choudhary et al., 2013; Nuraliev et al., 2017; Bui et al., 2019; Do et al., 2020), two species of *Leptomischus* (Wu et al., 2020; Tran et al., 2021a), 15 new species of genus *Lasianthus* (Dang et al., 2022) along with several new records. The Rubiaceae are highly diverse in Indo-China, however, the taxonomic inventories of Rubiaceae in the regional flora remain incomplete. Vietnam is also expected to have more species of Rubiaceae than are currently known.

During our field surveys carried out during 2020–2022, we collected several interesting specimens belonging to Rubiaceae. A careful examination of the relevant Flora, monographs and type specimens (Pitard, 1922; Fukuoka, 1970; Lo, 1990; Ho, 2003 and Chen et al., 2011) revealed the occurrence of four species belonging to the genera *Hedyotis*, *Involucrella*, *Mouretia* and *Ophiorrhiza*, which were never recorded earlier from Vietnam. Their morphological characteristics are given below along with photo-plates to facilitate their identification (Figs. 1-4). Our literature review also revealed ambiguities associated with the typification of *Involucrella chereevensis*, and therefore, a second-step lectotype for this name has been designated.

MATERIALS AND METHODS

Specimen collection was performed by two research groups, one from the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology in

2020–2022, and the other one from the Vietnam National Museum of Nature. The herbarium specimens were deposited in HN and VNMN. The specimens were identified by using the taxonomic literature cited above and by comparison with Type specimens available in various world herbaria AAU, BM, BK, BKF, C, HN, HAN, IBSC, K, L, P, PE, PSU, SING, VNM, VNMN and W. In the account provided below, family names follow the recent system of classification (2016). The generic names and species are listed in alphabetical order. The acronyms follow Thiers (2021).

RESULTS AND DISCUSSION

Hedyotis Linnaeus, Sp. Sp. P1. 101. 1753, Gen. P1. ed. 5. 44. 1754

TYPE: -Lectotype of *H. fruticosa* (designated by Jarvis in Nicolson, 1992.-*Hedyotis fruticosa* L., nom. typ. cons.).

Asian-Pacific genus *Hedyotis* L. ca.180 species (Govaerts et al., 2022). In Vietnam, about 20-22 species of the *Hedyotis* sensu stricto, have been reported (Pitard, 1922; Ho, 2003; Tran, 2005).

Hedyotis diversifolia Geddes 1931. in Kew Bull. 220 (Fig.1).

Type: -THAILAND. Baw Rai, Krat, c. 200 m, 28 November 1924, A.F.G.Kerr 9464 (holotype: BM000945150 photo! BM; isotypes: BK: barcode BK257353 photo!, K: barcodes K000760351, K000760352 photos!).

Phenology: -In Vietnam (Flowering from March-April, fruiting from April).

Distribution and habitat:-THAILAND. Baw Rai, Khao Kuap Krat. (Fukuoka, 1970).-VIETNAM. Gia Lai, KBang (Kon Chu Rang Nature Reserve). Mang Yang (Kon Ka Kinh National Park (Kon Ha Nung Biosphere Reserve). It usually grows in shady, streamside areas or trails in evergreen forests.

Specimens examined. VIETNAM. Gia Lai province, Mang Yang district, 14°12'28.1"N, 108°18'54.3"E ca. 895 m a.s.l., 26 March 2022, B. H. Quang, BHQ409 (HN). (Kon Ka Kinh National

Park; KBang district (Kon Chu Rang Nature Reserve). 14°27'53.3"N, 108°35'22.6"E ca. 900 m a.s.l., 23 April 2022, B. H. Quang,

D. V. Hai, N. T. Cuong, D. T. Hoan, T. D. Binh, T. N. Minh, BHQ 814 (HN).

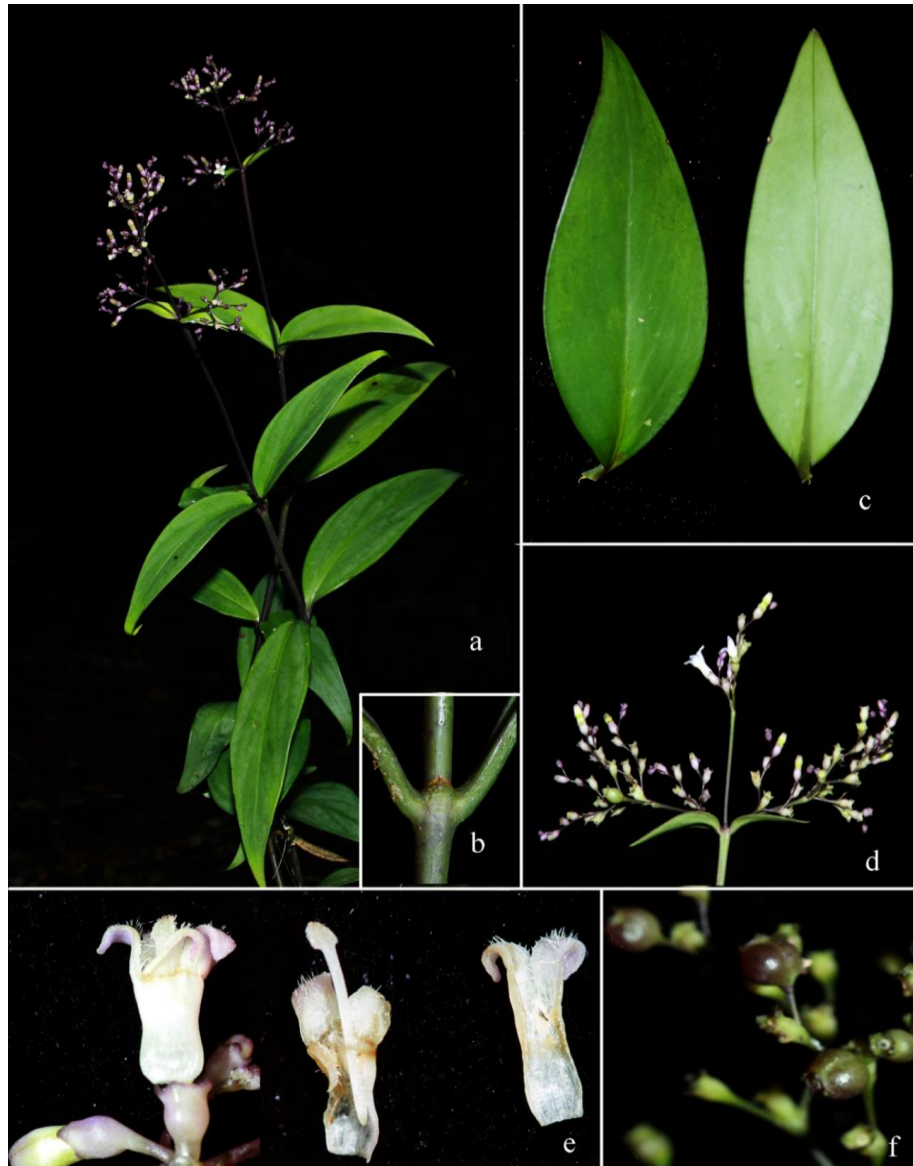


Figure 1. *Hedyotis diversifolia* Geddes. a) Habit; b) stipule; c) adaxial and abaxial leaf surfaces; d) inflorescences side view; e) long-styled and short-styled flower; f) fruiting branch)
[Photos by Bui Hong Quang]

Taxonomic notes. *Hedyotis diversifolia* is morphologically similar to *Hedyotis corymbiformis* Geddes, from which it differs in its longer and densely hairy capsule, about 4 mm (vs. 3 mm); cyme glomerule-like, with

capitate flowers (vs. terminal and distinctly peduncled); leaves 7–12 cm long, 1–2.5 cm wide (vs. 7–14 cm long and 3–4.5 cm wide). *Involucrella* (Benth. & Hook.f.) Neupane & N.Wikstr., 2015. *Taxon* 64 (2): 316

TYPE: -(Lectotype designated by Neupane & N.Wikstr., 2015)-*Involucrella coronaria* (Kurz) Neupane & N.Wikstr.

Annual or perennial herbs. Leaves oblong, ovate or lanceolate. Inflorescences terminal or pseudoaxillary on short lateral stems, sessile cymes with densely clustered sessile flowers or loose terminal paniculate cymes. Seeds irregularly angular with 3–5 pits/depressions on either side of the seed. (Neupane et al., 2015).

Currently, this genus is known by three species *Involucrella chereevensis* (Pierre ex

Pit.) Neupane & N.Wikstr, *Involucrella coronaria* (Kurz) Neupane & N.Wikstr., and species *Involucrella lithophila* M.D.Yuan & R.J.Wang. They are narrowly distributed in Cambodia, China, India, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. (Pitard, 1922; Fukuoka, 1970; Ho, 2003; Tran, 2005 and Neupane et al., 2015). *I. lithophila* is being reported here as the first record to the flora of Vietnam. Whereas, the second-step lectotype is designated here for the name *I. chereevensis*.

Key to all species of genus *Involucrella*

- 1a. Stipules ovate to lanceolate..... *I. chereevensis*
- 1b. Stipules triangular..... 2
- 2a. Inflorescences terminal or axillary in upper leaves, cymose to paniculate, glabrous..... *I. lithophila*
- 2b. Inflorescences terminal or heads half-included in the embracing bases of the involucre-like uppermost leaves..... *I. Coronaria*

Involucrella chereevensis (Pierre ex Pit.) Neupane & N.Wikstr., 2015. Taxon 64 (2): 316

Type: -CAMBODIA. province de Samrong-tong, mt. Chéréev, *Pierre 2053* (P: barcode P04235415). First-step lectotype designated by Neupane & N.Wikstr., 2015: 316. (second-step lectotype **designated here**: P: barcode P04235419 photo!).

Synonyms: *Oldenlandia chereevensis* Pierre ex Pit. In Lecomte, Fl. Indo-Chine 3: 143. 1922. -*Hedyotis chereevensis* (Pierre ex Pit.) Fukuoka in S. E. Asian Stud. 8: 332. 1970.

Syntypes: - Annam [Vietnam]. Sud-Annam: province de Nha Trang [Khanh Hoa province], massif du Hon Ba, altitude 1000, 20–22 September 1918, (*Chevalier, A.J.B. 38826*, P: barcode P04235414, photo!); - Cambodge [Cambodia]. Mont de Pursat, 18 June 1875, (*F.J. Harmand & Leg. Godefroy 420*, P: barcodes P04235416, P04235420, photos!).

Nomenclatural notes: The protologue of *Oldenlandia chereevensis* Pierre ex Pit. refers to three specimens collected in the province

de Samrong-tong, mt. Chéréev, by *Pierre 2053*, *Chevalier, A.J.B. 38826* and *F. J. Harmand & Leg. Godefroy 420*. The specimen with the number of collections made by *Pierre 2053* deposited in P barcode P04235415 was designated by Neupane & N.Wikstr 2015 as Lectotype.

However, we found another specimen of the same *Pierre 2053* deposited in P (P04235419). Hence, the second-step lectotypification is necessary (following Art. 9.17, Turland et al., 2018 of the Shenzhen Code). Thus the specimen at P with barcode P04235419 is designated here as a second-step lectotype. Other specimens at P P04235414, P04235416, P04235420 are either incomplete or in fruiting, not representing all characters as per the protologue. Therefore, they are designated here as Syntypes following Arts. 9.3 and 9.11 (Turland et al., 2018) of the Shenzhen Code.

Phenology: -Flowering and fruiting from June to September

Distribution: -VIETNAM. Khanh Hoa province. -CAMBODIA.

Specimens examined. CAMBODIA. province de Samrong-tong, mt. Chéréev, *Pierre 2053* (P: barcode P04235415). -Cambodge [Cambodia]. Mont de Pursat, 18 June 1875, (*F.J. Harmand & Leg. Godefroy 420*, P: barcodes P04235416, P04235420, photos!). -Annam [Vietnam]. Sud-Annam: province de Nha Trang [Khanh Hoa province], massif du Hon Ba, altitude 1000, 20 September 1918/22 September 1918 (*Chevalier, A.J.B. 38826*, P: barcode P04235414, photo!).

Involucrella lithophila M.D. Yuan & R.J. Wang, 2020. *Phytotaxa* 464 (1): 60 (Fig. 2)

Type: -CHINA. Guangxi: Longzhou County, Nonggang National Nature Reserve, roadside, 107°2'13.08"E, 22°26'10.05"N, a.s.l., ca. 158 m, flowering and fruiting, short-styled flower, 17 August 2019, *Sheng Chen YS49* (holotype: IBSC: barcode IBSC0861073; isotypes: IBSC: barcodes IBSC0861072, IBSC0861071).

Phenology: -CHINA. Flowering from April to July–September, sometimes to December, fruiting from May to August–December.



Figure 2. *Involucrella lithophila* M.D.Yuan & R.J.Wang, a) habit; b) adaxial leaf surfaces; c) flower top view; d) flower side view; e) corolla (open); f) calyx; g) long-styled flower; h) fruits: i) top view; j) bottom view; k) seeds [Photos by Le Tuan Anh]

Distribution and habitat: -CHINA. Guangxi Zhuangzu Autonomous Region, China. It is currently found only on karst landforms, and grows on shady rocks. -VIETNAM. Quang Tri province, Cam Lo district, Cam Tuyen commune, grows in rock crevices in limestone areas. Not common.

Specimens examined. VIETNAM. Quang Tri province, Cam Lo district, Cam Tuyen commune, 16°46'76.5"N, 106°51'19.2"E ca. 200 m a.s.l., 10 July 2022, *Le Tuan Anh, LTA961*. (HN, VNMN).

Taxonomic notes. *Involucrella lithophila* is similar to *I. chereevensis* in its tetragonal stem, slender pedicels and cymose to paniculate inflorescences, but it differs from *I. chereevensis* in its smaller leaves, 0.5–2.8 × 0.3–1.2 cm (vs. 2.0–7.0 × 0.8–3.0 cm); secondary veins 2–4 (vs. 5–7); lobed stipules triangular, apex 3–5 (–7) lobed apically, glabrous (vs. ovate-lanceolate to triangular, acuminate to aristate, marginally lacinate or

with several filaments, puberulent). (Yuan & Wang, 2020).

Mouretia Pit., F. Gén. Indo-Chine [P.H.Lecomte et al.] 3:71, 1922

TYPE: -(lectotype designated by Tange 1997) - *Mouretia tonkinensis* Pit.

The genus *Mouretia* Pit., currently consists of five species in the world (Tange 1997), viz. *Mouretia tonkinensis* Pit., *Mouretia vietnamensis* Tange, *Mouretia inaequalis* (H.S.Lo) Tange, *Mouretia larsenii* Tange and *Mouretia oblanceolata* L.Wu, K.S.Nguyen, B.H.Quang & T.P.Anh. (Anh et al., 2021b). This genus occurs from South China to the Northern parts of Thailand, Laos and Vietnam, and its representatives prefer to grow on soils or rocks along small streams or nearby waterfalls, usually in the understory layer of subtropical evergreen forests (Tange, 1997; Ho, 2003; Tran, 2005; Chen et al., 2011 and Anh et al., 2021b).

Key to all species of genus *Mouretia* (data derived from Anh et al., 2021b)

- 1a. Leaves anisophyllous..... *M. inaequalis*
- 1b. Leaves isophyllous..... 2
- 2a. Habit erect to sub-erect; lateral veins 10–16 pairs; inflorescences umbrella-like or star-like cymes..... 3
- 2b. Habit procumbent; lateral veins 4–10 pairs; inflorescences head-like cymes..... 4
- 3a. Stipules obcordate (8–10 mm long); lateral veins 12–16 pairs; inflorescences umbrella-like cymes; peduncles 2–5.5 cm long; calyx lobes deltoid..... *M. oblanceolata*
- 3b. Stipule oblong to transversely oblong (2–3 mm long); lateral veins 10–11 pairs; inflorescences star-like cymes; peduncles 1–2 cm long; calyx lobes triangular..... *M. larsenii*
- 4a. Inflorescences terminal and solitary; peduncles 1–2 cm long; calyx lobes ovate to obovate; stipules rounded to reniform..... *M. tonkinensis*
- 4b. Inflorescences axillary and paired at nodes; peduncles 0.5–1 cm long; calyx lobes triangular; stipules oblong to obovate..... *M. vietnamensis*

Mouretia larsenii Tange, Nord. J. Bot. 17(2): 128 (1997) (Fig. 3).

Type: -THAILAND. Prae province., Ban Nam Klai, c. 20 km E of Prae (100°20'E18°02"). Evergreen gallery forest along the small stream through deciduous forest. Soil lateritic clay, altitude 500 m, 15 November 1993, *Larsen, K. & S. S. et al.*

45379. (holotype: AAU; isotypes: BKF, C, HAN, K, L, P, PSU, SING, W).

Phenology: -Flowering from July to September, fruiting from October to November.

Distribution and habitat: - THAILAND, VIETNAM. Gia Lai province, Mang Yang district, (Kon Ka Kinh National

Park). Kon Tum province, Sa Thay district (Chu Mon Ray National Park). This moisture-loving species is often found along streams and in evergreen forests. Not common.

Specimens examined. VIETNAM. Gia Lai province, Mang Yang district, (Kon Ka Kinh National Park), 14°13'07.5"N,

108°19'00.3"E ca. 895 m a.s.l., 26 March 2022, *B.H.Quang BHQ454* (HN); Kon Tum provinces, Sa Thay district (Chu Mon Ray National Park) 14°25'17.4"N, 107°43'59.2"E ca. 500 m a.s.l., 10 October 2020, *T. T. Bach, D. V. Hai, B. H. Quang, D. T. Hoan, T. D. Binh, V. A. Thuong, MOST 284* (HN).



Figure 3. *Mouretia larsenii* Tange a) Habit; b) abaxial leaf surfaces; c) inflorescence side view; d) inflorescences top view; e) inflorescences branch bottom view [Photos by Bui Hong Quang]

Taxonomic notes. *Mouretia larsenii* is a remarkable species because of its unique inflorescence. The flowers on the ring occur in four rows and have fused hypanthia. The

flowers of a normal ring are alternating in two rows on the upper side, but because the flowers develop from both prophylls in *Mouretia*, the rings have alternating pairs of

flowers instead. This explains why the inflorescence arms of *Mouretia larsenii* have four rows of corollas. (Tange, 1997).

Mouretia larsenii is similar to *Mouretia oblanceolata* in procumbent habit; isophyllous leaves with lateral veins. But it differs from *Mouretia oblanceolata* in star shaped inflorescence with 4 rows of flowers (vs. umbrella-like inflorescences). Stipule oblong to transversely oblong (2–3 mm long); lateral veins 10–11 pairs. peduncles 1–2 cm long; calyx lobes triangular (vs. Stipules obcordate (8–10 mm long); lateral veins 12–16 pairs; peduncles 2–5.5 cm long; calyx lobes deltoid). (Anh et al., 2021b).

Ophiorrhiza L., Sp. Pl. 1: 150 [1753]

TYPE: -(Lectotype (Verdcourt in Jarvis & al., *Regnum Veg.* 127: 71. 1993): Herb. Hermann 3: 50, No. 402 (BM-000594692).) - *Ophiorrhiza mungos* L.

Ophiorrhiza L. is a genus of mostly herbaceous plants, comprising 200–300 species worldwide and distributed mainly in moist tropical forests from East India to the Western Pacific and from South China to Northern Australia. (Wu et al., 2018). In Vietnam, they are represented by 14 species (Ho, 2003; Tran, 2005; Nguyen et al., 2020).

Ophiorrhiza cana H.S.Lo, Bull. Bot. Res., Harbin. 10(2): 20, [1990] (Fig. 4)

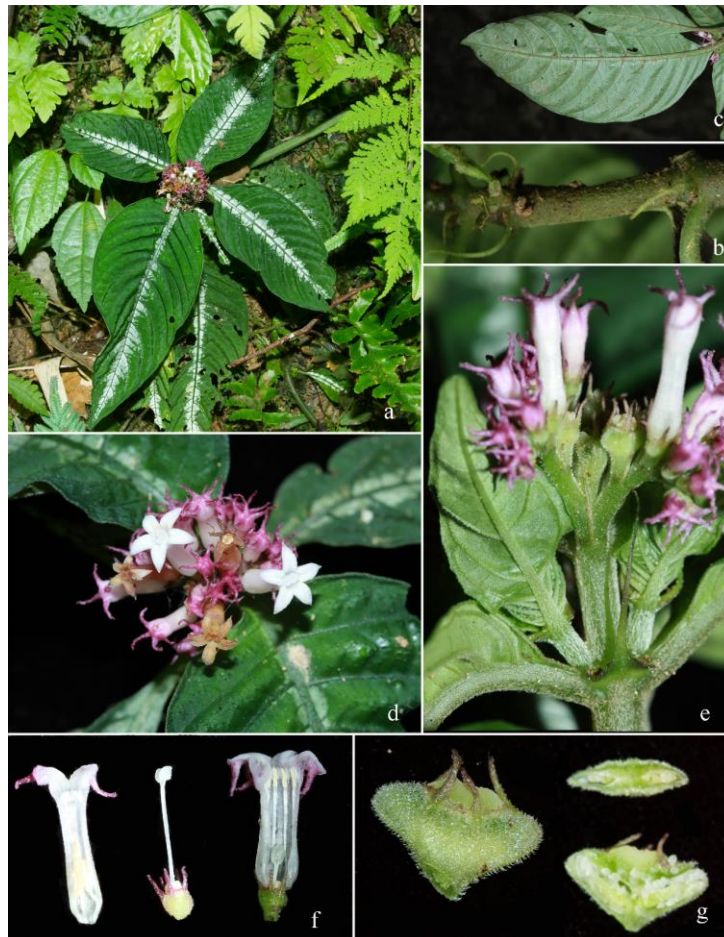


Figure 4. *Ophiorrhiza cana* H. S. Lo, a) habit; b) stipules; c) abaxial leaf surfaces; d) inflorescences top view; e) inflorescences side view; f) long-styled and short-styled flower; g) fruit side view and fruit (open) [Photos by Bui Hong Quang]

Type: -CHINA. Yunnan: without locality *Sino-Russ Exped. no. 370*, 1956 (holotype: IBSC: barcode IBSC 0005843 photo!; isotype: PE: barcode PE00808410 photo!).

Phenology: -Flowering from March to April, fruiting from April to May.

Distribution and habitat: -CHINA. Yunnan. -VIETNAM. Lai Chau province. Usually grows on the edge of evergreen forests in humid places. Common.

Specimens examined. VIETNAM. Lai Chau province, Muong Te district, Mu Ca commune (Mu Ca Protection Forest), 22°34'09.7"N, 102°25'46.1"E ca. 300 m a.s.l., 9 April 2022, *B. H. Quang, Quang322* (HN).

Taxonomic notes. *Ophiorrhiza cana* is similar to *Ophiorrhiza longicornis* in its procumbent habit, and elliptic-ovate to oblanceolate leaves. But it differs from *O. longicornis* in congested-cymose inflorescences, branched to 1 or 2 orders; corolla pubescent in throat but glabrous below inside tube, pubescent externally. *O. longicornis* possesses cymose to corymbose inflorescences, branched to 3 or 4 orders; corolla pubescent below middle inside tube, glabrous externally. (Chen et al., 2011).

CONCLUSION

The newly documented four Rubiaceae species to the flora of Vietnam i.e. *Hedyotis diversifolia*, *Involucrella lithophila*, *Mouretia larsenii*, and *Ophiorrhiza cana* provide the baseline data for biodiversity research and conservation in the country. Designating the second step lectotype to *Involucrella chereevensis* would untangle the taxonomic confusion related to its nomenclature.

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