

Taxonomic studies on Indian *Ophiorrhiza* L. (Rubiaceae):
with a new variety, new distributional record
of *O. medogensis* H.Li for India and
the identity of *O. recurvipetala*
Bhuyan, Baruah & Mehmud

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Taxonomic studies on Indian *Ophiorrhiza* L. (Rubiaceae): with a new variety, new distributional record of *O. medogensis* H.Li for India and the identity of *O. recurvipetala* Bhuyan, Baruah & Mehmud

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KEY WORDS
Arunachal Pradesh,
North-East India,
Ophiorrhiza,
second step
lectotypification,
new record,
new synonym,
new variety.

ABSTRACT

A new variety of *Ophiorrhiza* L., *O. medogensis* H.Li var. *shiyomiense* Hareesh & M.Sabu, var. nov. is described from Shi-Yomi district, Arunachal Pradesh. In addition, *O. medogensis* H.Li from Tibet/China is recorded for the first time from India from Dibang Valley District of Arunachal Pradesh. Based on the protologue, herbarium specimens and living materials, the recently published species, *Ophiorrhiza recurvipetala* Bhuyan, Baruah & Mehmud is synonymised under *O. ochroleuca* Hook.f. Taxonomy of *O. ochroleuca* and *O. medogensis* is described in detail along with colour photographs, ecology and distribution. IUCN status of all taxa under study is provided.

RÉSUMÉ

Études taxonomiques sur les Ophiorrhiza L. (Rubiaceae) indiens : avec une nouvelle variété, un nouveau signalement de O. medogensis H.Li pour l'Inde et l'identité de O. recurvipetala Bhuyan, Baruah & Mehmud.

Une nouvelle variété d'*Ophiorrhiza* L., *O. medogensis* H.Li var. *shiyomiense* Hareesh & M.Sabu, var. nov., est décrite du district de Shi-Yomi, Arunachal Pradesh. De plus, *O. medogensis* H.Li, originaire du Tibet/Chine, est signalée pour la première fois en Inde, dans le district de la vallée de Dibang, en Arunachal Pradesh. Sur la base du protologue, des spécimens d'herbier et du matériel vivant, l'espèce récemment publiée *Ophiorrhiza recurvipetala* Bhuyan, Baruah & Mehmud est synonymisée sous *O. ochroleuca* Hook.f. La taxonomie de *O. ochroleuca* et *O. medogensis* est décrite en détail avec des photographies en couleur, l'écologie et la distribution. Le statut IUCN de tous les taxons étudiés est fourni.

MOTS CLÉS
Arunachal Pradesh,
nord-est de l'Inde,
Ophiorrhiza,
seconde étape de
lectotypification,
signalement nouveau,
synonyme nouveau,
variété nouvelle.

TABLE 1. — Diagnostic morphological differences of *Ophiorrhiza medogensis* H.Li. var. *shiyomiense* Hareesh & M.Sabu, var. nov. with *O. medogensis* H.Li.

Characters	<i>O. medogensis</i> var. <i>shiyomiense</i> var. nov.	<i>O. medogensis</i> H.Li
Corolla colour	Pale yellow with green tinge towards the corolla lobes	White or white with pale pink on the base of corolla tubes and puberulent outside and on corolla lobes ridges externally
Corolla vestiture	Densely villous	Puberulent externally from the base towards the middle and pubescence on the ridges of the corolla lobes
Corolla throat Corolla tube length	Non-inflated 14-15 mm	Prominently inflated 17-18 mm

INTRODUCTION

The genus *Ophiorrhiza* L. belongs to the tribe Ophiorrhizeae in the subfamily Rubioideae (Bremer & Manen 2000). In India, the genus consists of 51 taxa, which are mainly reported in Northeastern states and Western Ghats (Hareesh *et al.* 2018, 2020). While conducting botanical survey in NE India in 2019, we noticed two accessions of *Ophiorrhiza*, one from Dibang Valley (Mayodia) and the other from Shi-Yomi district of Arunachal Pradesh. After critical studies with pertinent literature (Lo 1990; Deb & Mondal 1997; Chen & Taylor 2011; Hareesh *et al.* 2015a, b, c, 2017a, b, 2018, 2020; Hareesh & Sabu 2018), Dibang Valley (Mayodia) material was identified as *Ophiorrhiza medogensis* H.Li with some variations. The identity was confirmed by comparing the type specimen housed at KUN herbarium and protologue (Li 1980). Hence, the present gathering is a new record to the flora of India. The second material (Shi-Yomi) shows close resemblances with *O. medogensis*, however it shows differences in its floral morphology (Table 1), hence we described it as a new variety of *O. medogensis*. In addition to this, detailed studies on the protologue, herbarium specimens and living material, the recently published species, *Ophiorrhiza recurvipetala* Bhuyan, Baruah & Mehmud is synonymised under *O. ochroleuca*. A detailed floral morphology, colour photographs and ecology of the three taxa is provided for ease of identification.

SYSTEMATICS

Family RUBIACEAE Juss.

Genus *Ophiorrhiza* L.

Ophiorrhiza medogensis H.Li var. *shiyomiense*

Hareesh & M.Sabu, var. nov.

(Fig. 1)

The new taxon shows similarities with *O. medogensis* H.Li, but differs from the latter in having densely villous corolla with non-inflated throat and pale yellow with green tinge towards the lobes.

TYPE. — **India.** Arunachal Pradesh, Shi-Yomi district, near Sikko Dido Water fall, 18.IX.2019, *M. Sabu & V.S. Hareesh 158760* (holo-, MBGH!; iso-, CAL!, MBGH!)

PHENOLOGY. — Flowering started in August.

ETYMOLOGY. — The varietal epithet is named after the type locality of the taxon, Shi-Yomi district, Arunachal Pradesh.

HABITAT, DISTRIBUTION AND CONSERVATION STATUS. — The new species is known only from type locality, near Siko Dido Water fall towards Mechuka, Shi-Yomi District of Arunachal Pradesh. The plants were growing in the moist sloppy areas at an altitude varying from 1100 to 1200 m a.s.l. During our expedition, we observed three populations with more than 50 mature individuals. It is growing in association with *Impatiens paramjitiana* Gogoi & Borah, *I. arguta* Hook.fil. & Thomson, *Pilea* sp. According to the present field observation data, the new species is tentatively classified as Data Deficient (DD) (IUCN 2017).

DESCRIPTION

Erect/decumbent herbs, 20-50 cm tall; stem branched, woody at base, terete, green to pinkish-green, pubescent; internodes 2-13 cm long. Stipules *c.* 1 cm long, with 2-4 subulate to filiform lobes, pubescent, persistent. Petiole 1-2.5 cm long, slender, pale green or rarely pale pink with densely pink pubescence. Leaf blades 3.5-9 × 1.75-4 cm, elliptic or ovate to ovate-lanceolate, acute or acuminate at apex, rounded to subcordate at base; margin entire, undulate, ciliate; adaxially green, rarely with yellow coloration, sparsely pubescent to pubescent, abaxially pale green, pubescent; secondary veins 9-14 on either sides. Inflorescence terminal corymb, 2-3 cm in diameter; peduncle *c.* 3 mm long, terete, densely villous; bract and bracteoles similar, lanceolate, 10-13 × *c.* 1 mm, green or rarely with purplish tinge, pubescent, prominently nerved, persistent. Pedicels 2-2.5 mm long, pale green, densely villous. Flowers 20-24 mm long. Hypanthium 1.5-2 × 2-2.5 mm, obovoid, pale green with dense pink villous hairs. Calyx lobes filiform, unequal in length, 3.5-6 × *c.* 0.5 mm, acute at apex, pale green to green, pubescent. Corolla infundibuliform, 18-20 mm long, pale yellow with green tinge towards the lobes, densely villous; lobes *c.* 2 × 1.5 mm, ovate, acute at apex, minutely keeled on back. Long-styled flowers: internally with a villous ring just above the middle of the corolla tube, followed by dense long pubescence towards the throat and small hairs to the lobes and glabrous below; stamens inserted in the middle of corolla tube below the villous ring; filaments 0.60-0.75 mm long; anthers oblong-linear 1.75-1.9 mm long, white or pale yellow; style filiform, 10-11 mm long, ciliate; stigma *c.* 2 mm long, linear to oblanceolate, pale yellow, glabrous to papillose. Short-styled flowers: internally with a villous ring just below the corolla throat, followed by dense short pubescence towards the lobes and dense long pubescence towards the base of corolla followed by 3 mm glabrous portion; stamens inserted just above the middle of corolla tube; filaments 1.5-1.75 mm long; anthers oblong-linear 1.75-2 mm long, white or pale yellow; style filiform, 4-4.5 mm long, ciliate; stigma 2-2.5 mm long, oblanceolate, pale yellow, glabrous to papillose. Ovary 2-celled, ovules numerous; disc 0.5-0.75 mm high. Capsule obcordate, 5-8 × 5-11 mm, pale green, pubescent; seeds angular, pale brown.

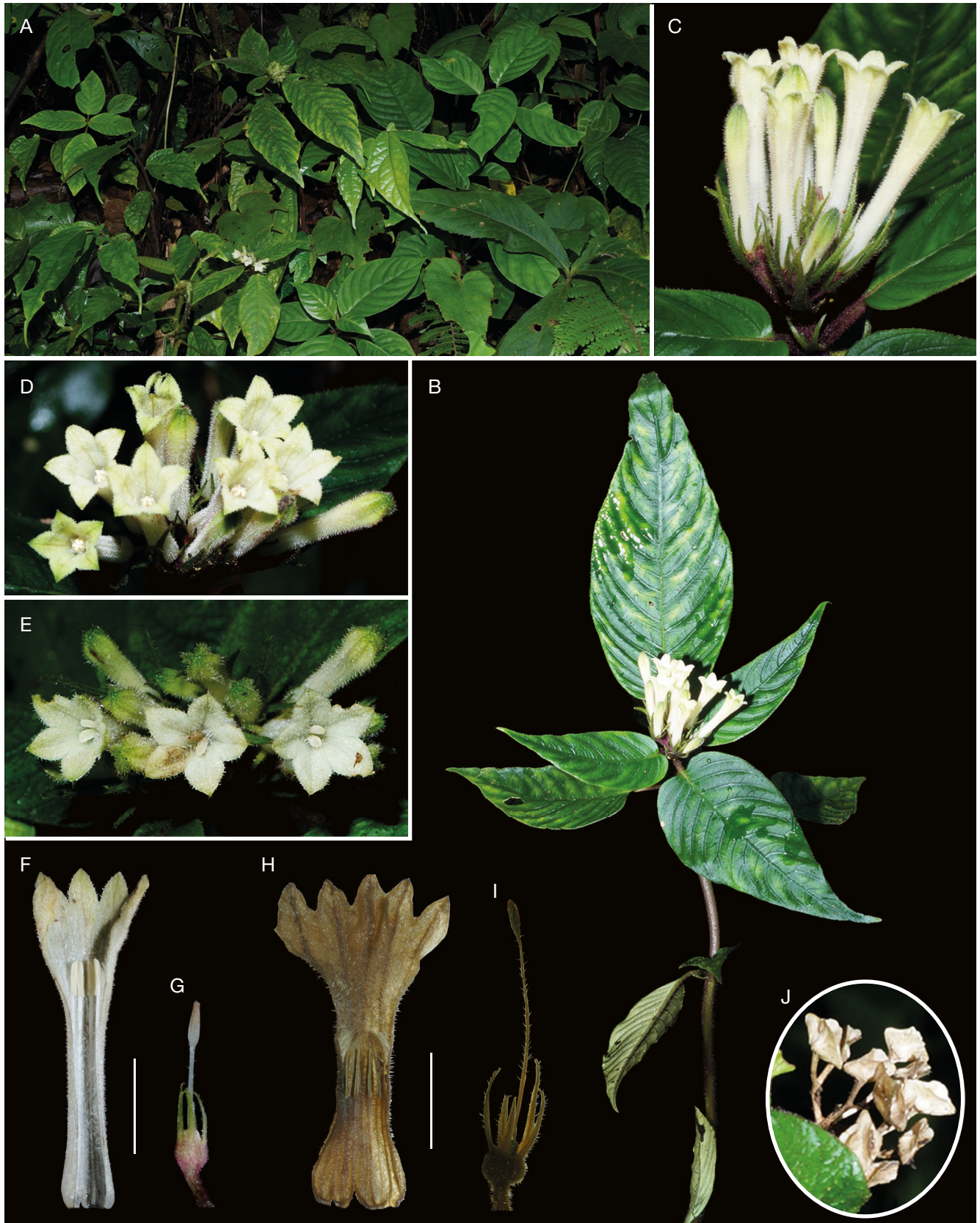


FIG. 1. — *Ophiorrhiza medogensis* H.Li var. *shiyomiense* Hareesh & M.Sabu, var. nov.: **A**, habit; **B**, a twig with inflorescence; **C**, inflorescence side view; **D**, inflorescence (short-styled); **E**, inflorescence (long-styled); **F**, **G**, floral parts of short-styled flower: **F**, split-opened corolla showing stamens; **G**, calyx with style and stigma; **H**, **I**, floral parts of long-styled flower: **H**, corolla showing stamens; **I**, calyx with style and stigma; **J**, infructescence. Scale bars: 5 mm. Photos by V.S. Hareesh.

Ophiorrhiza medogensis H.Li
(Fig. 2)

Acta Phytotaxonomica Sinica 18 (1): 116 (Li 1980).

TYPE SPECIMEN. — **Tibet.** Guangxi, Xizang, Medog Xian, in silvis, Quinghai-Xizang, 1720 m, 10.IX.1974, *Complex Expeditio* 74-5072 (holo-, KUN; iso-, PE[PE00808294, PE00808295]!).

SPECIMEN DATA. — **India.** Arunachal Pradesh, Dibang Valley district, Near Mayodia, c. 1700 m, 22.IX.2019, *M. Sabu & V.S. Hareesh* 158780 (CALI, MBGH).

HABITAT, DISTRIBUTION AND CONSERVATION STATUS. — *Ophiorrhiza medogensis* was known only from Xizang of Medog of China/Tibet on slopes of the broad leaved forest at an altitude around 1700 m. In India, it is growing in the sloppy areas near the Mayodia, Dibang Valley district and near Siko Dido Water fall, Shi-Yomi District of Arunachal Pradesh, NE India. The plants were growing in the moist sloppy areas at an altitude varying from 1100 to 1700 m a.s.l. in association with *Amomum sericeum* Roxb., *Henckelia pumila* (D.Don) A.Dietr., *Elatostemma* sp., *Impatiens arguta* Hook.f. & Thomson, *Pilea* sp. At present, *O. medogensis* perceives no serious threat to its existence in the field. During our expedition, we observed three populations with more than 50 mature individuals. According to the present field observation data, the new species is tentatively classified as Data Deficient (DD) (IUCN 2017).

DESCRIPTION

Erect/decumbent herbs, 20-60 cm tall; stem branched, woody at base, terete, green to brownish-green, densely villose; internodes 2-10 cm long. Stipules 3-6 long subulate or linear with 1-3 filiform lobes, pubescent, persistent. Petiole 1-2 cm long, slender, pale green with densely pink pubescence. Leaf blades 3-11.5 × 1.5-3.5 cm, elliptic or ovate to ovate-lanceolate, acute or acuminate at apex, cuneate or rounded to subcordate at base; margin entire, undulate, ciliate; adaxially green, abaxially pale green, densely pubescent on both surfaces; secondary veins 7-16 on either sides. Inflorescence terminal corymb, 2.5-3.5 cm in diameter; peduncle 3-5 mm long, terete, densely villose; bract and bracteoles similar, lanceolate, 6-10 × c. 1 mm, green pubescent, prominently nerved, persistent. Pedicels 2-2.5 mm long, pale green, densely pink villose. Flowers 22-25 mm long. Hypanthium 1.75-2 × 2.5-3 mm, obovoid, pale pink with dense pink villose hairs. Calyx lobes filiform, unequal in length, 4-7 × c. 0.5 mm, acute at apex, pale pink, pubescent. Corolla infundibuliform, 20-23 mm long, white with pale pink tinge from base towards the middle of corolla tube, puberulent from the base towards the middle and pubescent on the ridges of the corolla lobes externally; lobes c. 3.5-4 × 3.5-4 mm, ovate, acute at apex, minutely keeled on back. Long-styled flowers: internally with a villous ring just above the middle of the corolla tube, followed by dense long pubescence towards the throat and small hairs to the lobes and glabrous below; stamens inserted in the middle of corolla tube below the villous ring; filaments 0.50-0.75 mm long; anthers oblong-linear 2.75-3 mm long, white or pale yellow; style filiform, 12-13 mm long, ciliate; stigma c. 3.5 mm long, linear to oblanceolate, white pale yellow, glabrous. Short-styled flowers: internally with a villous ring just below the corolla throat, followed by dense short pubescence towards the lobes and dense long pubescence towards the base

of corolla tube; stamens inserted just above the middle of corolla tube; filaments 1.75-2 mm long; anthers oblong-linear 2.75-3 mm long, white or pale yellow; style filiform, 5-5.5 mm long, ciliate; stigma 2.5-3 mm long, oblanceolate, pale yellow, glabrous to papillose. Ovary 2-celled, ovules numerous; disc 0.75-1 mm high. Capsule obcordate, 5-6 × 7-12 mm, pale green, pubescent; seeds angular, pale brown. Flowering August-October, Fruiting October-December.

NOTES

Ophiorrhiza medogensis was considered as a Himalayan endemic species distributed in Tibet/China, which shows close resemblances with *Ophiorrhiza subcapitata* Wall. ex Hook.f., but differs in having filiform stipules with 2/3 lobes, linear ciliate bracts and long ciliate calyx lobes. It is a large white flowered species with densely pubescent inflorescence, with a wide range of variations in the lamina hairy nature. The present collection from Mayodia of Arunachal Pradesh of India is the extended distributional record of this taxon to the flora of India. While describing *O. medogensis*, it was mentioned that the inflorescence has only long styled flowers and long calyx lobes. However, the collection from Arunachal Pradesh possesses both long-styled and short-styled flowers in a single population, which are mentioned in detail in the species description. In addition, it also shows variation in the size of the corolla lobe i.e. c. 2 mm less than the type material.

Ophiorrhiza ochroleuca Hook.f.
(Fig. 3)

Flora of British India 3: 78 (Hooker 1880).

Ophiorrhiza recurvipetala Bhuyan, Baruah & Mehmud, *Nordic Journal of Botany* 39: e03048 (2021) **syn. nov.** — Type specimen: **India**, Assam: Dima Hasao district, hilly areas near Jatinga, 14.XI.2019, *B. Bhuyan & S. Baruah* 0019 (holo-, ASSAM; iso- BUH).

TYPE. — **India.** Sikkim, alt. 2-5000 ft, s.n., *J.D. Hooker* 5-*Ophiorrhiza* (lecto-, first-step lectotype designated by Deb & Mondal on 1997; second-step lectotype designated here, K[K000031179]!; isolecto-, CAL[CAL0000010928]!; K[K000031178]!; L[L0281127]!; P[P04004375]!; W[W0074652]!).

SYNTYPES. — **India.** Khasia Mts, alt. 0-4000 ft, s.n., *J.D. Hooker & Thomson* 5-*Ophiorrhiza* (syn-, CAL[CAL0000010927]!; E[E00327639]!; L[L2940737]!; M[M0198352]!; NY[NY00132371]!; P[P02273392]!; W[W0074651, W18083]!).

SPECIMEN DATA. — *Ophiorrhiza ochroleuca*: **India.** Arunachal Pradesh: Papum Pare District, Sagali, 28.V.2017, *V.S. Hareesh* 152672 (MBGH); West Kameng District, near Sessa Village, 31.V.2017, *V.S. Hareesh* 152697 (MBGH).

HABITAT, DISTRIBUTION AND CONSERVATION STATUS. — *Ophiorrhiza ochroleuca* is distributed in India, Bhutan, China (Yunnan), India and Myanmar. In India, it is distributed in Sikkim, West Bengal, Meghalaya, Assam, Arunachal Pradesh, Nagaland and Manipur at an altitude that ranges from 2 to 5000 feet. Like other *Ophiorrhiza* species, this is also growing in moist shady areas in association with *Impatiens drepanophora* Hook.f., *I. pseudolaevigata* Gogoi, B.B.T.Tham & Liden, *Ophiorrhiza debiana* Hareesh, A.Joe & M.Sabu, *Tacca* sp., *Pilea* sp. etc. According to the present field data, the new species is tentatively classified as Data Deficient (DD) (IUCN 2017).

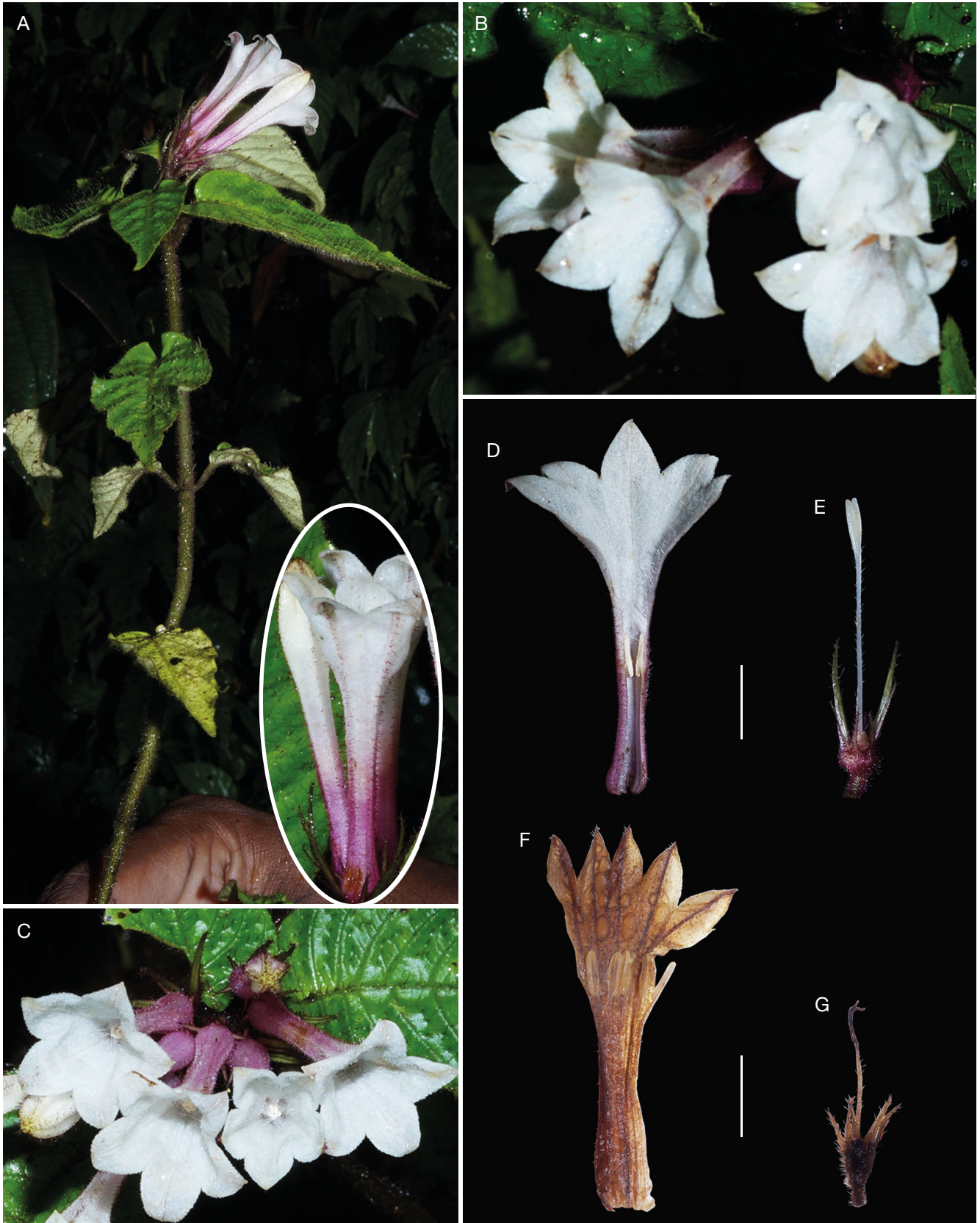


FIG. 2. — *Ophiorrhiza medogensis* H.Li: **A**, a twig with inflorescence (inset: part of inflorescence enlarged); **B**, inflorescence (long-styled); **C**, inflorescence (short-styled); **D**, **E**, floral parts of long-styled flower: **D**, corolla showing stamens; **E**, calyx with style, stigma and bracts; **F**, **G**, floral parts of short-styled flower: **F**, split-open corolla showing stamens; **G**, calyx with style and stigma. Scale bars: 5 mm. Photos by V.S. Hareesh.

REMARKS

Ophiorrhiza recurvipetala is a newly described species from Assam of North-East India. While describing the new species, the authors have compared it with *O. ochroleuca*, a species already having wide distribution across NE India, Bhutan, Myanmar and China. The extensive field works made by the authors during 2015 to till date in the Northeastern India in different seasons collected several gatherings of *O. ochroleuca*, especially from Arunachal Pradesh. The identity of these materials was confirmed by comparing with the type housed at (K and CAL) and protologue. However, we noticed many intermediate forms especially about internal nature of corolla tube, position of stamens and style length as mentioned in the protologue.

The newly published *O. recurvipetala* by Bhuyan *et al.* (2021) clearly matches with typical *O. ochroleuca*. The major differences that they have mentioned were “attenuate leaf base, inflorescence 3–4 cm across, 5–7 cm long peduncle, creamy white flowers, pubescent capsule, corolla tube hairy all over and strongly recurved corolla lobes with acute apex”. *Ophiorrhiza ochroleuca* also has wide range of variations in the lamina shape that varies from round to cuneate or attenuate leaf base and acute to acuminate apex. The inflorescence cross length and peduncle length also overlap with the *O. ochroleuca* as mentioned in earlier literature and also from the living collections. Bhuyan *et al.* (2021) have vaguely described the flower colour as creamy white. From the protologue images (Fig. 1B), it was clear that, it has yellowish green flower, which is typical for *O. ochroleuca*. Similarly, the indumentum on the fruit wall also shows variation from puberulent to pubescent. In addition to this, the recurved nature of the corolla lobe is the typical character of *O. ochroleuca* which is clearly mentioned by Deb & Mondal (1997) and is also clear from the present collections by the authors. The internal corolla tube nature, which is hairy all over is the difference discussed by the authors as the character not motioned by Deb & Mondal (1997). From our collection, throughout villose hairs are present in corolla tube in the short-styled flowers of *O. ochroleuca*. Whereas, the long styled flowers possess a villous ring in the throat of the corolla followed by glabrous nature. From these we concluded that all floral characters fall within the range of *O. ochroleuca*, hence *O. recurvipetala* is treated here as a synonym of *O. ochroleuca*.

TYPIFICATION

Hooker (1880) published the species name *Ophiorrhiza ochroleuca* Hook.f. and based it on the collections from Sikkim and Khasia mountains (Meghalaya). The protologue shows the type collection information as: “*Ophiorrhiza*, 5 *Herb. Ind. Or. H.f. & T.*” and “Sikkim and Bhotan Himalaya, alt. 1–5000 ft., common. Khasia Mts. alt. 0–4000 ft Cachar, *Keenen*”. It is evident that Hooker based his species description on syntypes and the species name needs typification. And in our search, we located 14 specimens housed in different herbaria (three sheets in W, two sheets each in CAL, K, L, P and single in E, M, NY), and all the labels of these specimens show the same collection info given within the protologue.

In 1993, John R.I. Wood annotated one of the two K sheets (K000031179) as the lectotype; the preceding specimen was collected by J.D. Hooker from Sikkim. However, Wood’s intended lectotypification was not effectively published and does not constitute as an act of typification. Furthermore, he did not annotate the specimens at CAL (CAL0000010928), K (K000031178), P (P04004375), W (W0074652) and L (L0281127); these specimens most likely belong to the same gathering. However, Schanzer annotated L (L0281127) specimens as isoelectotype referred from Wood’s annotation in the K (K000031179) specimen. Subsequently, Deb & Mondal (1997) mentioned that the “holotype” is housed at K and the CAL specimens are “isotypes”; they did not specify the relevant holotype specimen at K or comment on Wood’s annotation of the K specimen as the lectotype. In addition, they did not mention the specimens of P (P04004375), W (W0074652) and L (L0281127). Nevertheless, Deb & Mondal’s citation of “holotype” is construed here as an inadvertent act of lectotypification, and their usage of the term “holotype” is correctable (vide ICNafp Art. 9. 10; Turland *et al.* 2018).

Since the K has two specimens and since Deb and Mondal did not specify one of them as the “holotype”, their citation is treated as the lectotype [first-step].

We herewith narrow the typification by designating the K specimen (K000031179) as the lectotype [second-step] (vide Art. 9.17). Our choice agrees with Wood’s earlier annotation of the same specimen as the lectotype. Consequently, the second K specimen (K000031178), P specimen (P04004375), W specimen (W0074652) and L specimen (L0281127) are designated here as isoelectotypes.

Of the remaining original specimens from Khasia Mts. alt. 0–4000 ft collected by J.D. Hooker and Thomson in E (E00327639) is annotated as syntype. M. Wetter annotated NY (NY00132371) specimen as Type of *Ophiorrhiza ochroleuca* on 1983. Schanzer annotated the two specimens in W (W0074651, W18083) as isotypes and P02273392 & L2940737 as isosyntypes. The remaining two specimens (CAL0000010927, M0198352) did not have any annotation. Hence we considered all the above mentioned specimens from Khasia Mts. collected by J.D. Hooker and Thomson as syntypes. The altitude ranges 1–5000 ft of Sikkim specimen in the protologue is a typographical error of 2–5000 ft.

NOTES

Ophiorrhiza ochroleuca was so far treated in a homostylous species or unknown in the floral morphology (Lo 1990; Deb & Mondal 1997; Chen & Taylor 2011). Living collections from different localities of northeastern India revealed that the plant possess both long-styled and short-styled flowers (Fig. 3). The amended floral description along with colour photographs is provided for better understanding. Flowers are yellow or yellow-orange or greenish to pale yellow or rarely yellowish white. Corolla lobes prominently keeled or spurred dorsally. Long-styled flowers: internally glabrous with a villous ring in the throat of the corolla tube, followed by papillose towards the corolla lobes; stamens inserted just above the base of the corolla tube; filaments c. 0.5 mm long; anthers oblong-linear

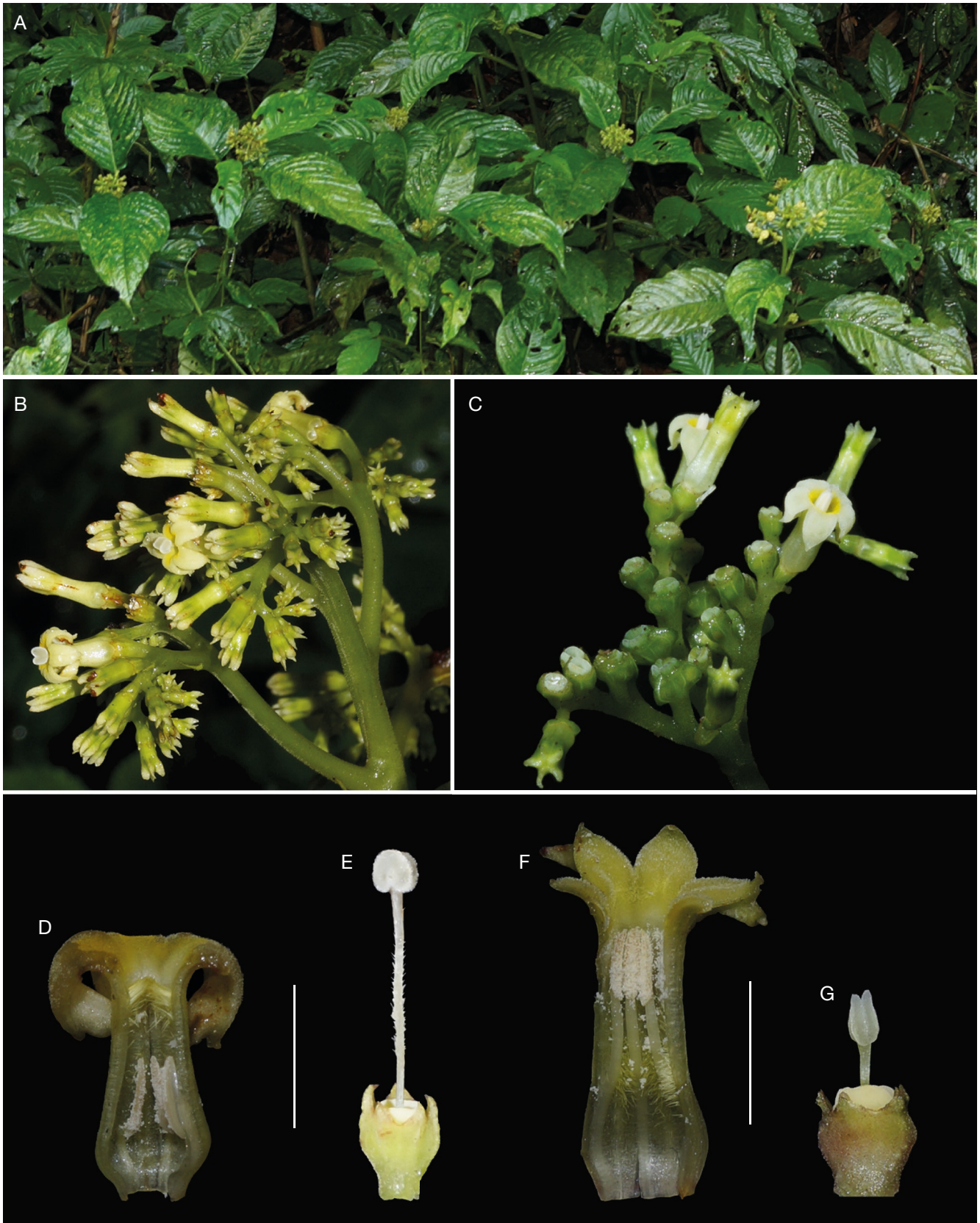


FIG. 3. — *Ophiorrhiza ochroleuca* Hook.f.: **A**, habit; **B**, inflorescence (long-styled); **C**, inflorescence (short-styled) showing immature fruits; **D**, **E**, floral parts of long-styled flower: **D**, split-opened corolla showing stamens; **E**, calyx with style and stigma; **F**, **G**, floral parts of short-styled flower: **F**, corolla showing stamens; **G**, calyx with style and stigma. Scale bars: 5 mm. Photos by V.S. Hareesh.

2.25-2.5 mm long, white to pale yellow; style filiform, 6.5-7 mm long, ciliate; stigma 1.5-2 × c. 1.5 mm, globose, white, papillose. Short-styled flowers: internally with a villous ring just below the middle of the corolla tube, followed by sparse long villous towards the throat and glabrous below, papillose towards the corolla lobes; stamens inserted just below the middle of corolla tube; filaments 3-3.5 mm long; anthers oblong-linear 2.25-2.5 mm long, white to pale yellow; style filiform, c. 1.5 mm long, glabrous; stigma c. 2 mm long, oblong, off-white, glabrous to papillose.

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