



## Taxonomic notes on *Isodon* (Nepetoideae, Lamiaceae) from Xizang, China: A new species and a new combination

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**ABSTRACT:** *Isodon elegans*, a new species from southeastern Xizang, China, is described and illustrated based on morphological evidence and geographic distribution, as well as our recent phylogenomic studies of the genus. It was previously misidentified as *I. parvifolius*, but the two species can be easily distinguished by lamina shape, calyx tooth shape, and corolla color and indumentum. Meanwhile, *I. rungshiaensis*, previously treated as a variety of *I. irroratus*, is elevated as an independent species within the genus. The two species are phylogenetically distantly related, and can be distinguished by the lamina shape and indumentum, petiole length, and corolla color.

**KEY WORDS:** Dry valley, Himalaya, *Isodon elegans*, *Isodon rungshiaensis*, Isodoninae, Ocimeae, Yarlung Zangbo River.

### INTRODUCTION

As currently circumscribed, the tribe Ocimeae (Nepetoideae, Lamiaceae) consists of 43 genera and over 1200 species grouped into seven subtribes (Harley *et al.*, 2004; Zhong *et al.*, 2010; Zhao *et al.*, 2021). The monotypic subtribe Isodoninae, which contains only *Isodon* (Schrad. ex Benth.) Spach, differs from other subtribes of Ocimeae by a unique combination of characteristics, including pedunculate and bracteolate cymes, slightly or strongly 2-lipped (3/2) calyces, strongly 2-lipped (4/1) corollas, and free filaments inserted at the base of the corolla tube (Li, 1988; Paton and Ryding, 1998; Harley *et al.*, 2004; Chen *et al.*, 2019). Although *Isodon* is widely distributed in tropical and subtropical Asia, recent rapid radiation within the Hengduan Mountains has established this region as the diversity center of the genus (Yu *et al.*, 2014; Chen *et al.*, 2025).

In his monograph on *Isodon*, Li (1988) recognized 96 species, organizing them into four sections and ten series. However, our ongoing taxonomic revision suggests that the species diversity of *Isodon* is significantly underestimated and it comprises at least 140 species (Chen *et al.*, 2025). Additionally, our recent phylogenomic analyses indicate that all sections and series proposed by Li (1988) are not monophyletic (Chen *et al.*, 2022, 2025). Instead, the genus can be divided into four clades (Clade I–Clade IV), with the largest Clade IV further divided into four subclades (Clade IVa–Clade IVd).

Clade IVb comprises all shrubs distributed in the Himalaya, especially in the dry valleys of the Yarlung Zangbo River, with *I. rugosus* (Wall. ex Benth.) Codd extending to the Hajar Mountains in the Arabian

Peninsula. Besides the five previously recognized species [*I. aurantiacus* Y.P.Chen & C.L.Xiang, *I. namikawanus* Murata, *I. pharicus* (Prain) Murata, *I. rugosus*, *I. wardii* (C.Marquand & Airy Shaw) H.Hara], Chen *et al.* (2025) also revealed one additional, as-yet-undescribed species within this clade. Moreover, *Rabdosia irrorata* var. *rungshiaensis* C.Y.Wu & H.W.Li, now synonymized under *I. irroratus* (Forrest ex Diels) Kudô (Li, 1988; Li and Hedge, 1994), is also embedded within this clade and shown to be distinct from *I. irroratus* (Chen *et al.*, 2025).

In light of these findings, we describe a new species, *I. elegans* Y.P.Chen & C.L.Xiang, and propose one new combination, *I. rungshiaensis* (C.Y.Wu & H.W.Li) Y.P.Chen & C.L.Xiang, below.

### MATERIALS AND METHODS

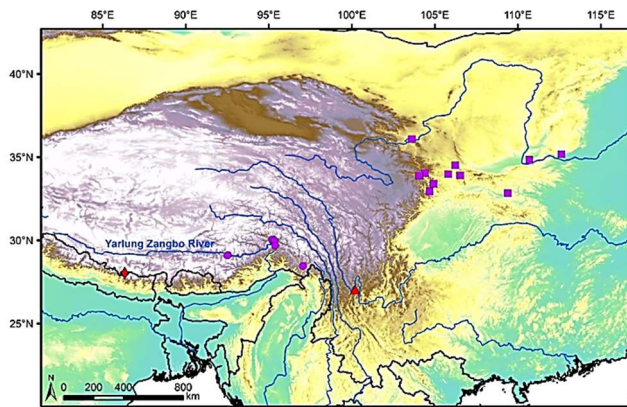
Since all the species mentioned above, along with their morphologically similar counterparts, were included in the phylogenomic study of Chen *et al.* (2025), phylogenetic relationships among these species were discussed based on Chen *et al.* (2025). Morphological data were compiled from the protologues of published names and other taxonomic and floristic literature on *Isodon*, and our field collections and direct examination of specimens from 30 herbaria (A, AU, BM, CDBI, CSFI, E, G, GXMI, HHBG, HIB, IBK, IBSC, K, KUN, KYO, L, LBG, LE, MO, MW, NAS, P, PE, S, SYS, SZ, TAI, TI, W, and WUK; abbreviations follow Thiers, 2024). Occurrence records for all *Isodon* species were downloaded from the Global Biodiversity Information Facility (GBIF, <https://www.gbif.org/>) and supplemented with specimen records from herbaria and our field expeditions. Erroneous records were carefully identified and removed to ensure accuracy.

**Table 1.** Morphological and geographic comparisons between *Isodon elegans* and *I. parvifolius*.

Characters	<i>I. elegans</i>	<i>I. parvifolius</i>
Lamina	Ovate to broadly ovate, 1–5 × 0.5–3 cm, base truncate to subcordate	Ovate, elliptic, or oblong, 1–2 (–5) × 0.5–1 cm, base broadly cuneate to subrounded
Calyx	Campanulate, 2-lipped to 1/2–2/3 its length, teeth narrowly triangular	Tubular-campanulate, 2-lipped to 1/3–1/2 its length, teeth ovate triangular
Corolla	Violet, 11–12 mm long, densely pubescent outside	White to lilac, 8–9 mm long, densely tomentose outside
Distribution	Restricted to southeastern Xizang, China	Distributed in northern China (Gansu, Shanxi, Shanxi, and Henan)

**Table 2.** Morphological and geographic comparisons between *Isodon rungshiaensis* and *I. irroratus*.

Characters	<i>I. rungshiaensis</i>	<i>I. irroratus</i>
Lamina	Ovate triangular, 1.5–6.5 × 1.5–5.5 cm, base decurrent, abaxially sparsely puberulent	not ovate to broadly ovate, 1.5–3 × 1–2.5 cm, base decurrent, abaxially sparsely pubescent
Petiole	0.5–4 cm long	1–5 mm long
Cymes	3–15-flowered, longer than the bracts	3–5-flowered, shorter than the bracts
Calyx	Densely puberulent and glandular puberulent outside	Densely pubescent and glandular pubescent outside
Corolla	Ivory to lavender, densely glandular puberulent outside	Violet, densely pubescent and glandular pubescent outside
Distribution	Rongxia Town, Xizang, China	Northwestern Yunnan, China

**Fig. 1.** Geographic distribution of *Isodon elegans* (purple circles), *I. parviflorus* (purple squares), *I. rungshiaensis* (red diamond), and *I. irroratus* (red triangle).

## RESULTS AND DISCUSSION

*Isodon elegans* is primarily distributed along the Yarlung Zangbo River in southeastern Xizang (Fig. 1). It was previously misidentified as *I. parvifolius* (Batalin) H.Hara (Wu and Li, 1977; Li, 1983, 1988; Li and Hedge, 1994), likely due to the shared characteristic of densely gray tomentose leaves (Fig. 2). However, *I. elegans* (corresponding to *Isodon* sp. 9 – genbank accession no. SRR31865675 in Chen *et al.*, 2025) is shown to be a member of Clade IVb, closely related to *I. wardii*, whereas *I. parvifolius* is recovered in Clade IVd and sister to *I. rubescens* (Hemsl.) H.Hara. The presence of densely gray tomentose leaves in *I. elegans*, *I. parvifolius*, and several other *Isodon* species suggests that this trait may represent a case of convergent evolution, potentially as an adaptation to dry habitats (Chen *et al.*, 2024). Despite this superficial similarity, *I. elegans* and *I. parvifolius* are readily distinguishable by several morphological traits (Fig. 2). The leaf shape in *I. elegans* is ovate to broadly ovate with a truncate to subcordate base, whereas in *I.*

*parvifolius*, it is typically ovate, elliptic, or oblong with a broadly cuneate to subrounded base (Table 1). Additionally, *I. elegans* has campanulate calyces with narrowly triangular teeth, while in *I. parvifolius*, the calyces are tubular-campanulate with ovate-triangular teeth. Corolla color further distinguishes the two species: *I. elegans* has violet corollas, whereas *I. parvifolius* has white to lilac ones. Geographically, the two species occupy distinct ranges: *I. elegans* is restricted to Xizang, while *I. parvifolius* is confined to north-central China and is absent from Xizang (Fig. 1).

*Rabdosia irrorata* var. *rungshiaensis* was originally described based on its differences in the leaf morphology from the type variety: ovate triangular laminae with a truncate base and 0.5–4 cm long petioles (Wu and Li, 1977). Li (1988) later treated it as a synonym of *I. irroratus*. However, our recent phylogenomic analyses revealed that *R. irrorata* var. *rungshiaensis* (corresponding to *Isodon* sp. 3 – genbank accession no. SRR31865626 in Chen *et al.*, 2025) belongs to Clade IVb, whereas *I. irroratus* is placed within Clade IVd (Chen *et al.*, 2025). Currently, *R. irrorata* var. *rungshiaensis* is only known from its type locality, i.e., Rongxia Town in southern Xizang, and *I. irroratus* is also restricted to its type locality, i.e., the Yulong Snow Mountain in northwestern Yunnan (Fig. 1). Based on our examination of the type specimen and our own collections, we identified distinct differences beyond leaf morphology, notably in the cymes and corollas (Fig. 3). In *R. irrorata* var. *rungshiaensis*, the cymes are 3–15-flowered and exceed the length of the bracts, whereas in *I. irroratus*, the cymes are 3–5-flowered and shorter than the bracts. Furthermore, *R. irrorata* var. *rungshiaensis* has ivory to lavender corollas that are densely glandular-puberulent outside, contrasting with the violet corollas of *I. irroratus*, which are densely pubescent and glandular-pubescent outside. More detailed comparisons between the two species are summarized in Table 2. As no valid



combination has yet been made for *R. irrorata* var. *runghshiaensis*, we elevate it to specific status and provide the new combination below.

The key to all currently known species of Clade IVb is also provided:

#### Key to the species of Clade IVb of *Isodon*

1. Abaxial surface of lamina white or gray, densely tomentose or stellate tomentose ..... 2  
Abaxial surface of lamina light green, subglabrous or sparsely pubescent ..... 5
2. Abaxial surface of lamina densely stellate tomentose. *Isodon rugosus*  
Abaxial surface of lamina densely minute tomentose ..... 3
3. Plants covered with orange glands; corolla tube included in calyx ..... *I. aurantiacus*  
Plants covered with colorless glands; corolla tube extended from calyx ..... 4
4. Base of lamina truncate to subcordate; calyx densely tomentose ..... *I. elegans*  
Base of lamina cuneate to broadly cuneate; calyx pubescent and glandular puberulent ..... *I. namikawanus*
5. Lamina less than 2 cm long; corolla less than 1 cm long ..... *I. pharicus*  
Lamina over 2 cm long; corolla over 1 cm long ..... 6
6. Bracts longer than cymes; corolla densely pubescent ..... *I. wardii*  
Bracts shorter than cymes; corolla densely glandular puberulent ..... *I. runghshiaensis*

## TAXONOMIC TREATMENT

*Isodon elegans* Y.P.Chen & C.L.Xiang, *sp. nov.*

Fig. 2

**Type:** CHINA. Xizang, Jiacha County, Anrao Town, among thickets, N29°07'54.2", E92°32'23.0", alt. 3259 m, 17 Sept. 2016, C.L. Xiang et al. *XC1493* (holotype: KUN!; isotypes: K!, KUN!, PE!).

**Diagnosis:** *Isodon elegans* is morphologically similar to *I. parvifolius* but differs by having laminae with a truncate to subcordate (vs. broadly cuneate to subrounded) base, narrowly triangular (vs. ovate triangular) calyx teeth, and violet (vs. white to lilac) and 11–12 mm long (vs. 8–9 mm long) corollas.

**Description:** Shrubs 50–250 cm tall. **Stems** erect, much branched; **branches** gray, decorticate, subterete, glabrescent; **branchlets** brown, obtusely 4-angled, densely gray tomentose. **Leaves** decussate; **lamina** ovate to broadly ovate, papery, 1–5 × 0.5–3 cm, apex acute, base truncate to subcordate, margin entire or serrate, adaxially green, densely glandular puberulent and glandular, abaxially white, densely gray tomentose and glandular, lateral veins 3–4-paired, conspicuously elevated abaxially; **petioles** 0.3–3 cm long, densely gray tomentose. **Cymes** 3–11-flowered, forming panicles up to 20 cm long; **bracts** leaf-like, gradually reduced toward apex, margin entire, **bracteoles** linear, 1–3 mm long; **peduncles** 0.3–1 cm long, **pedicels** 2–5 mm long, densely gray tomentose. **Calyx** campanulate, 3.5–4.5 mm long, densely gray tomentose and glandular outside, 2-lipped to 1/2 its length; teeth subequal, 2–3 mm long, narrowly triangular, apex acuminate, fruiting calyx slightly dilated to ca. 5 mm long. **Corolla** violet, 11–12 mm long,

declinate, pubescent and glandular outside; tube ca. 4.5 mm long, saccate abaxially near base, ca. 2.5 mm in diameter; apex 2-lipped, posterior lip 4-lobed, sometimes dotted with purple spots, ca. 5 mm long, 6.5–7.5 mm wide, reflexed, lobes subrounded, anterior lip entire, concave, navicular, straight, 6.5–7.5 mm long, ca. 5.5 mm wide. **Stamens** 4, included; anther cells 2, confluent, divergent; filaments pubescent at base. **Style** included, glabrous, apex slightly subequally 2-lobed. **Mericarps** 4, brown, ovoid, 1.25–1.45 mm long, 0.9–1 mm wide, smooth and glabrous.

**Phenology:** Flowering from July to October, fruiting from August to November.

**Distribution and habitat:** Currently, *I. elegans* is only known from southeastern Xizang, China, and it mainly occurs along the Yarlung Zangbo River (Fig. 1). The new species usually grows in forests or among thickets on the dry valley slope at altitudes of 1300–3300 m.

**Etymology:** The specific epithet refers to the beautiful plants of the new species.

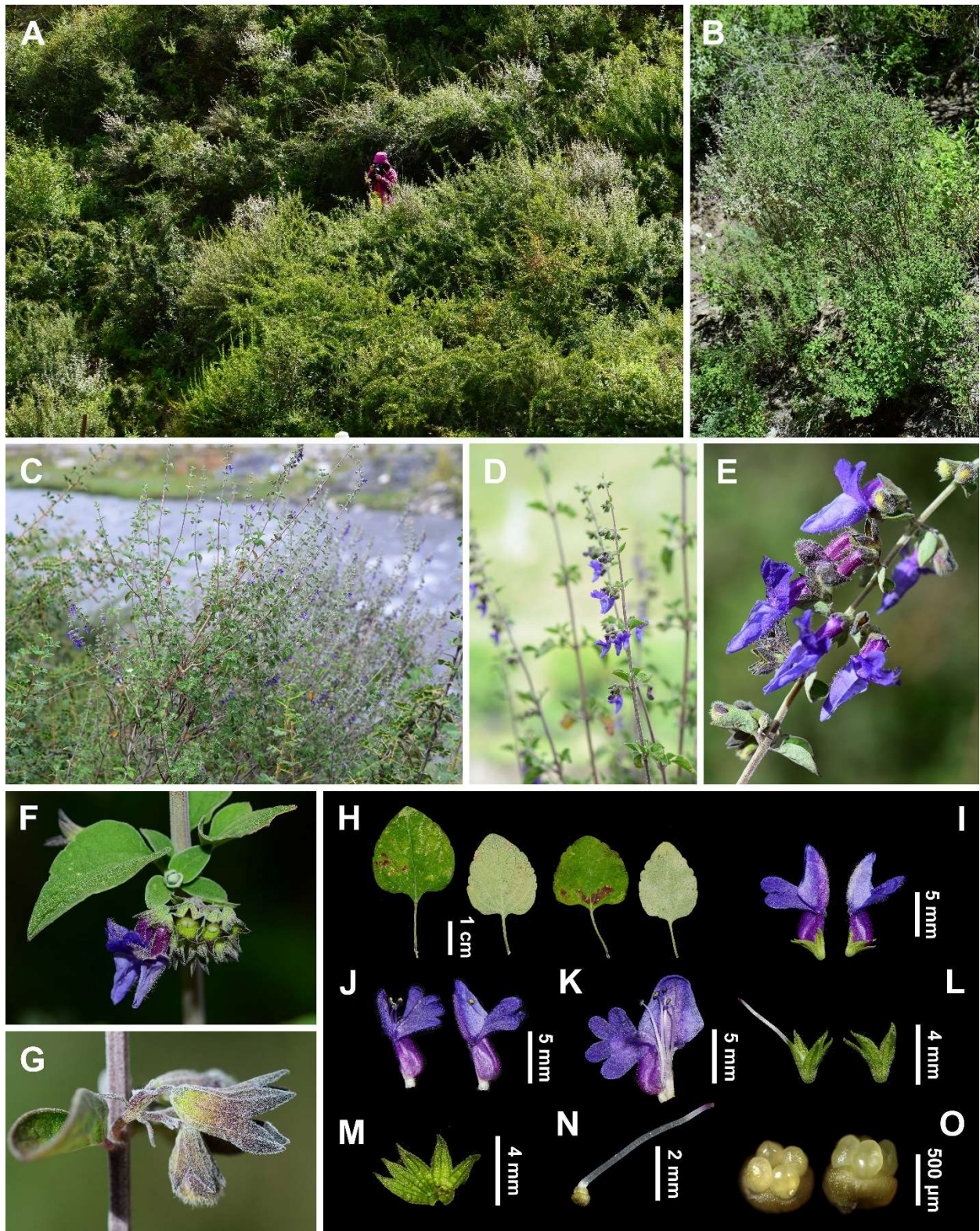
**Chinese name:** xiù lì xiāng chá cài (秀丽香茶菜).

**Additional specimens examined:** CHINA. Xizang: Bomi County, Tongmai Village, 23 Jul. 1965, Y.T. Zhang & K.Y. Lang 898 (PE00696569!, PE00696570!); *ibid.*, alt. 2350 m, 9 Sept. 1973, Qinghai-Tibet Exped. 73-1426 (KUN0270778!, KUN0270779!, PE00696217!, PE00696218!); *ibid.*, 25 Jul. 1977, B.Z. Guo et al. 21852 (NAS00508645!); *ibid.*, N30°03'50", E95°11'55", alt. 2373 m, 24 Aug. 2011, E.D. Liu et al. LED3308 (KUN1278977!, KUN1278978!); Bomi County, on the way from Gu Town to Tongmai, N29°59'36", E95°19'58", alt. 2373 m, 22 Aug. 2011, W. Fang et al. FW11305 (KUN1278954!, KUN1278959!, KUN1278972!); Bomi County, Gu Town, on the way from Dada to Bitong, 6 Aug. 2020, C.L. Xiang et al. *XC1869* (KUN!); Linzhi, alt. 2800 m, 18 Sept. 1963, J.X. Yang 2347 (KUN0270556!, WUK215523!); Linzhi, Bayi Town, alt. 3000 m, 4 Oct. 1989, G. Yao et al. 2348 (NAS00001805!); Linzhi, Chejiu, 31 Oct. 1989, G. Yao et al. 2471 (NAS00001823!); Linzhi, Bajie Town, 10 Oct. 2015, J. Hu et al. HJ05532 (NAS00597947!, NAS00597948!, NAS00597949!); Kahao, Lahit Valley, 4000–5000 ft., 26 Nov. 1916, F. Kingdon-Ward 7652 (K005573355!, K005573357!); Kahao, Zayul River, 5000 ft., 26 Jul. 1919, F. Kingdon-Ward 7151 (K005573356!); near Tamnyen, Tsangpo Valley, 9500 ft., 28 Jul. 1938, F. Ludlow et al. 5453 (BM!, EI, TI!); Lamdo, Tsangpo Valley, 10000 ft., 29 Jul. 1938, F. Ludlow et al. 5987 (BM!, TI!); Chamna, 9500 ft., 3 Oct. 1947, F. Ludlow et al. 13289 (BM!, TI!); Milin County (Tsela Dzong), 10000–11000 ft., 23 Jul. 1935, F. Kingdon-Ward 12037 (BM!, TI!); *ibid.*, 9500 ft., 10 Aug. 1938, F. Ludlow et al. 5453a (BM!, TI!); Motuo County, Jialasha, 13 Nov. 1982, S.Z. Cheng & B.S. Li 01771 (PE00696219!, PE00696220!, PE00923730!); *ibid.*, alt. 1300 m, 18 Feb. 1993, H. Sun et al. ETM-3436 (KUN0225101!, KUN0275044!); Jiacha County, Anrao Town, alt. 3412 m, 1 Sept. 2019, Y.P. Chen et al. EM914 (KUN!); Zayul, Rima, 5000 ft., 4 Apr. 1950, F. Kingdon-Ward 19284 (BM!); Zayul, near Rima Lohit Valley, 4500 ft., 11 Jul. 1950, F. Kingdon-Ward 20059 (BM!); Zayul, N28°27'44.81", E97°02'40.79", alt. 1500 m, 15 Sept. 2012, FLPH Tibet Exped. 12-1235 (PE02011018!, PE02011019!).

*Isodon runghshiaensis* (C.Y.Wu & H.W.Li) Y.P.Chen & C.L.Xiang, *comb. & stat. nov.* ≡ *Rabdosia irrorata* var. *runghshiaensis* C.Y.Wu & H.W.Li in C.Y.Wu, Flora Reipublicae Popularis Sinicae 66: 446, 586 (addenda). 1977. **Type:** CHINA. Xizang, Rongxia, alt. 3300 m, 30 Jul. 1959, *Nanjing University* 697 (holotype: PE00833743!).

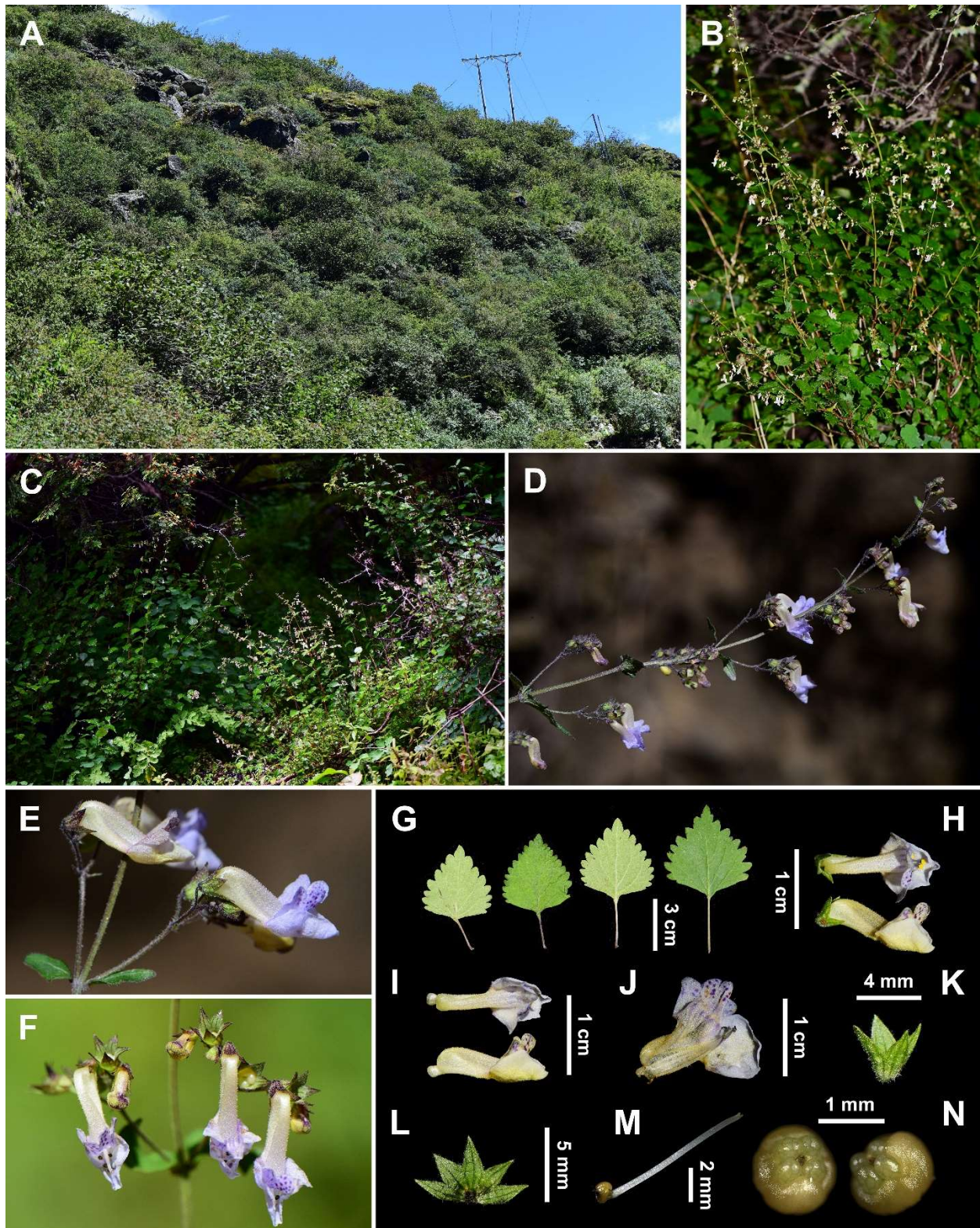
Fig. 3





**Fig. 2.** Morphology of *Isodon elegans*. **A.** Habitat; **B–C.** Habit; **D–F.** Inflorescences; **G.** Infructescence; **H.** Leaves; **I.** Flowers; **J.** Corollas; **K.** Dissected corolla; **L.** Calyces; **M.** Dissected calyx; **N.** Pistil; **O.** Ovaries.





**Fig. 3.** Morphology of *Isodon runghiaensis*. **A.** Habitat; **B–C.** Habit; **D–F.** Inflorescences; **G.** Leaves; **H.** Flowers; **I.** Corollas; **J.** Dissected corolla; **K.** Calyx; **L.** Dissected calyx; **M.** Pistil; **N.** Ovaries.



**Description:** Shrubs 50–120 cm tall. **Stems** erect, much branched; **branches** brown, decorticate, subterete, glabrescent; **branchlets** brown, obtusely 4-angled, sparsely puberulent and glandular puberulent. **Leaves** decussate; **lamina** ovate triangular, papery, 1.5–6.5 × 1.5–5.5 cm, apex acute, base truncate, margin serrate, adaxially green, sparsely puberulent and glandular, abaxially light green, densely glandular, lateral veins 3–4-paired; **petioles** 0.5–4 cm long, sparsely puberulent and glandular puberulent. **Cymes** 3–15-flowered, forming panicles up to 20 cm long; **bracts** leaf-like, gradually reduced toward apex, shorter than cymes, **bracteoles** linear, 1–2 mm long; **peduncles** 0.5–3 cm long, **pedicels** 2–5 mm long, sparsely puberulent and glandular puberulent. **Calyx** campanulate, ca. 4 mm long, sparsely pubescent, densely glandular puberulent and glandular outside, 2-lipped to 1/2 its length; teeth subequal, ca. 2 mm long, narrowly triangular, apex attenuate, fruiting calyx dilated to 5–5.5 mm long. **Corolla** ca. 13.5 mm long, declinate, densely glandular puberulent outside; tube ivory, ca. 7 mm long, saccate abaxially near base, ca. 3 mm in diameter; apex 2-lipped, lavender, posterior lip 4-lobed, dotted with purple spots, ca. 5 mm long, ca. 6.8 mm wide, reflexed, lobes subrounded, anterior lip entire, subrounded, concave, navicular, straight, ca. 6.5 mm long, ca. 7.5 mm wide. **Stamens** 4, included; anther cells 2, confluent, divergent; filaments pubescent at base. **Style** included, glabrous, apex slightly subequally 2-lobed. **Mericarps** 4, brown, ovoid, 1.51–1.73 mm long, 1.11–1.32 mm wide, smooth and glabrous.

**Phenology:** Flowering from July to October, fruiting from August to November.

**Distribution and habitat:** *Isodon rungshiaensis* is now only known from the Rongxia Town in Xizang, China (Fig. 1). The new species usually grows in thickets or forests at an altitude of ca. 3300 m.

**Chinese name:** róng xiá xiāng chá cài (绒辖香茶菜).

**Additional specimens examined:** CHINA. Xizang: Dingri County, Rongxia Town, alt. 3280 m, 10 Sept. 2019, *Y.P. Chen et al. EM1105* (KUN!).

## ACKNOWLEDGMENTS

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