



A new species of *Gentiana* (Gentianaceae) from Eastern Himalaya, India

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ABSTRACT: *Gentiana sangsterensis*, a new species of *Gentiana* (Gentianaceae) is described from Arunachal Pradesh, situated in the eastern part of Indian Himalayan Region (IHR). This new species is distinguished from allied taxa by its unique foliar arrangement and basal leaf size, alongside specific floral modifications including stamen attachment, anther shape, and stigma surface texture. It is further characterized by wider plicae with erose margins, as well as distinct variations in capsule morphology and seed structure. To facilitate identification, we provide a detailed description, illustrations, and photoplate, supplemented by a comparative morphological table and a taxonomic key to the species of *Gentiana* sect. *Cruciata*.

KEY WORDS: Arunachal Pradesh, *Gentiana robusta*, *Gentiana tibetica*, novel species, Sangster Tso, Tawang.

INTRODUCTION

The genus *Gentiana* L. (Gentianaceae) comprises about 360 species and is widely distributed in the temperate and alpine regions of Northwest Africa (Morocco), America, Asia, Eastern Australia and Europe (Mabberley, 2017; Chen *et al.*, 2024). In India the genus is represented by 80 species with highest concentration of 68 species in the Himalayan region (Jayanthi, 2020; Lahiri *et al.*, 2022). Members of the genus thrive well in the elevations between 2400–5000 m a.s.l. and commonly distributed in the temperate, sub-alpine, and alpine habitats of Indian Himalayan regions.

During our routine plant exploration work in the Tawang district of Arunachal Pradesh under the project “Assessing impact of climate change on floristic and migration of vascular plants in alpine-subalpine landscape of western Arunachal Pradesh”, a few robust plants belonging to genus *Gentiana* with conspicuously large leaves were collected near Sangster Lake area (popularly called as ‘Madhuri Lake’) in Tawang district. The plants were first located in vegetative condition in July 2024 and subsequently collected in flowering stage in August 2024. Critical examination of the specimen and comparison with specimens of *Gentiana* in all major herbaria (APFH, ARUN, ASSAM, BSD, BSHC, BSI, CAL, DD, NBU) of India revealed no possible match with any other species. We also compared the specimen against images of *Gentiana* from multiple international herbaria (A, BM, E, K, L, LINN, MO, NY, P and PE) that revealed the collected specimens to be a new species hitherto unknown to science. Therefore, the same is being described here as a novel species. Subsequent study of literature (Clarke, 1883; Pringle and Sharp, 1964; Garg, 1987; Ho and Pringle, 1995; Aitken, 1999; Ho and Liu, 2001; Gupta *et al.*, 2012; Anilkumar *et al.*, 2015; Shabir *et al.*, 2018) suggests that the novel species belongs to the

Gentiana section *Cruciata* Gaudin and it allied to *Gentiana tibetica* King ex Hook.f. and *G. robusta* King ex Hook.f.

MATERIALS AND METHODS

The description of *G. sangsterensis* is based on live specimens collected during our field survey in Tawang district of Arunachal Pradesh, India and subsequent observations on herbarium specimens. Based on previous systematic works (Garg, 1987; Ho and Pringle, 1995; Aitken, 1999; Ho and Liu, 2001; Gupta *et al.*, 2012) it was compared with the most morphologically allied species, *G. tibetica* King ex Hook.f. and *G. robusta* King ex Hook.f. Flowering plants were photographed in situ using a Nikon Z50. Macro- and micro-morphological analysis was conducted dissecting flowers and observed under an Olympus SMZ1500 stereo-zoom microscope. Voucher specimens were prepared following Jain and Rao (1977) standards, and were deposited at the Central National Herbarium (CAL) in Howrah. An illustration and a coloured photo plate are provided herewith for its easy identification. To evaluate the conservation status of the new species according to IUCN (2022) criteria, locality coordinates were recorded using a Garmin eTrex® 30x GPS. These data were subsequently mapped onto a digital elevation model using QGIS 3.24.

TAXONOMIC TREATMENT

Gentiana sangsterensis S. Lahiri, M. Das & S.S. Dash, *sp.nov.* **Figs. 1 & 2**

Type: INDIA, Arunachal Pradesh, Tawang district, near Sangster Lake, 3800 m a.s.l., 27°43'8.8032" N, 91°49'36.282"E, 31 August 2024, S.Lahiri, Mona. Das & S.S. Dash 100952 (holotype: CAL0000310779; isotype: ASSAM & BSD).

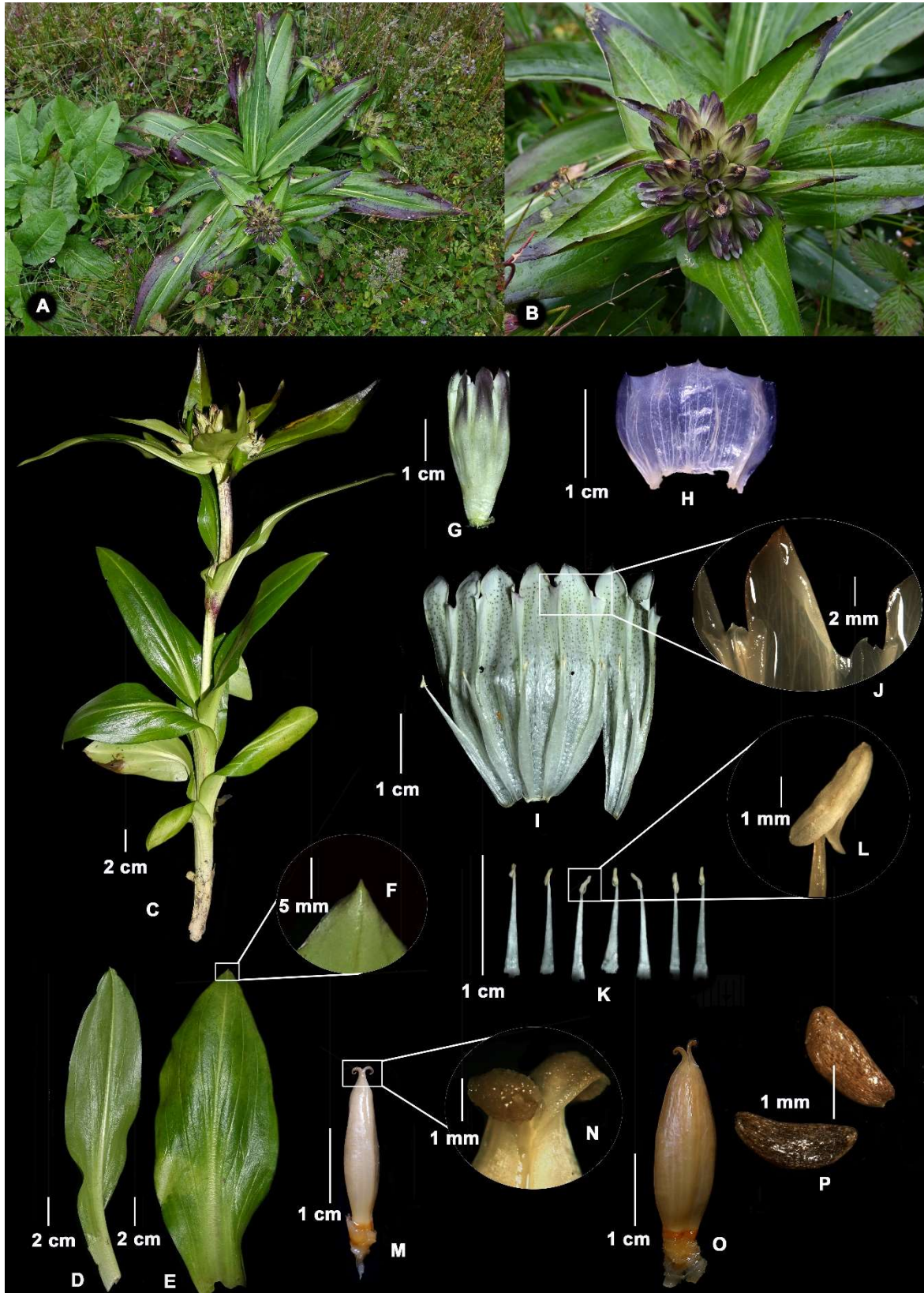


Fig. 1. Photographs of *Gentiana sangsterensis* S. Lahiri, M. Das & S.S. Dash **A.** Habit, **B.** Habit (close view), **C.** Flowering twig, **D.** Cauline leaf (abaxial side), **E.** Cauline leaf (adaxial side), **F.** Cauline leaf apex (close view), **G.** Flower, **H.** Calyx, **I.** Flower split open, **J.** Plicae, **K.** Stamens, **L.** Anther, **M.** Ovary, **N.** Stigma (close view), **O.** Capsule, **P.** Seeds (Photo credit: Subhajit Lahiri)

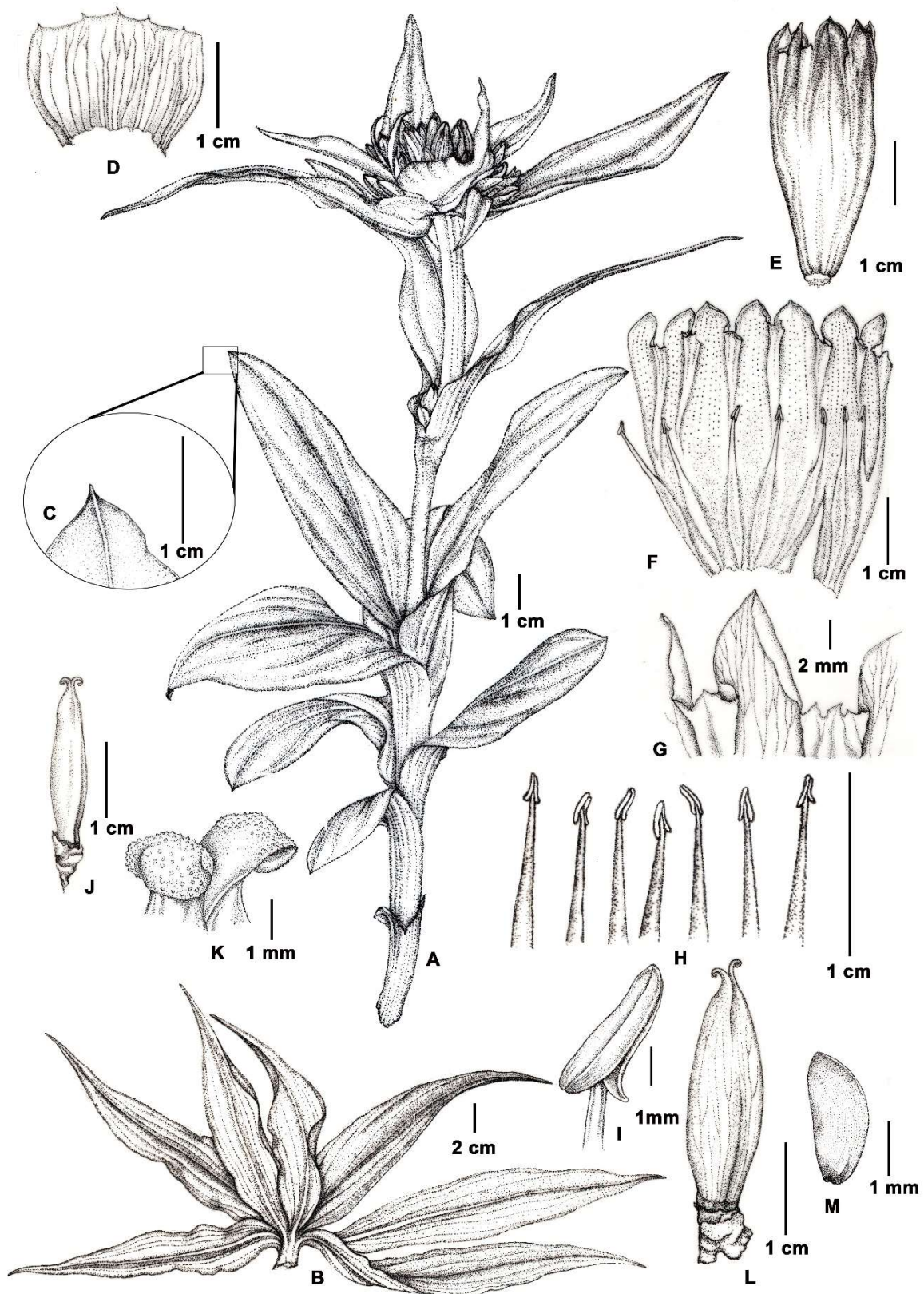


Fig. 2. Illustration of *Gentiana sangsterensis* S.Lahiri, M.Das & S.S.Dash. **A.** Flowering twig, **B.** Basal leaves, **C.** Cauline leaf apex, **D.** Calyx, **E.** Flower, **F.** Flower split open, **G.** Plicae, **H.** Stamens, **I.** Anther, **J.** Pistil, **K.** Stigma (close view), **L.** Seed. (Drawn by Monalisa Das from S.Lahiri, M. Das & S.S. Dash 100952)

**Table 1.** Morphological comparison between *Gentiana sangsterensis* and its allied species.

Characters	<i>Gentiana sangsterensis</i>	<i>Gentiana tibetica</i>	<i>Gentiana robusta</i>
Stem	35–60 cm	40–50 cm	up to 30 cm
Petiole	sessile to subsessile in basal leaves; 3–4 cm in cauline leaves	5–7 cm in basal leaves; up to 3.5 cm in cauline leaves	2–3 cm in basal leaves; c. 2 cm in cauline leaves
Basal Leaf			
Leaf size	30–35 × 7–9 cm	9–16 × 4–5.5 cm	8–23 × 2–4.5 cm
Leaf shape	lanceolate	narrowly elliptic to ovate-elliptic	elliptic-lanceolate to ovate-elliptic
Leaf margin	entire, slightly repand	scabrous	scabrous
Leaf apex	acute to long attenuate	acuminate to acute	acuminate
Leaf nerves	7	7–9	3–5
Cauline Leaf			
Leaf arrangement	6–7 pairs	3–5 pairs	3–5 pairs
Leaf size	15–19 × 5.5–8.5 cm	9–16 × 4–5.5 cm	3.5–6.5 × 0.7–1.7 cm
Leaf base	attenuate	obtuse to subtruncate	obtuse
Leaf margin	entire to partially repand	scabrous	scabrous
Leaf apex	acute-mucronate	acuminate–acute	acuminate
Leaf nerves	5–7	3–5	1–3
Leaf nature	coriaceous	membranous	membranous
Calyx			
Calyx tube	0.9–1.2 cm	0.6–0.8 cm	1.2–2 cm
Corolla			
Corolla outside colour	greenish white with dark purple towards apex	outside tinged dark brown	yellow-white, greenish white, or yellow-green
Corolla size	3.5–4.5 cm	2.6–3.2 cm	3–3.5 cm
Plicae shape	horizontally truncate to shortly triangular	triangular, oblique	triangular to truncate, oblique
Plicae margin	erose	denticulate	margin denticulate
Plicae size	4–6 mm	0.5–1.5 mm	2–2.5 mm
Stamen			
Attachment	stamens inserted just below the middle of the corolla tube	stamens inserted at the middle of the corolla tube	stamens inserted at basal part of the corolla tube
Filament	0.8–1 cm	0.7–0.9 cm	1–1.3 cm
Anther shape	oblong	narrowly ellipsoid	narrowly ellipsoid
Anther size	3.2–4.2 mm	1.5–2 mm	2.5–3 mm
Pistil			
Stigma	surface papillate	surface not papillate	surface not papillate
Capsule			
Shape	lanceoloid–oblong	ovoid to ellipsoid	ovoid to ellipsoid
Size	2.2–3 cm long	1.8–2.2 cm long	1.8–2 cm long
Seed			
Shape	ovoid, curved	ellipsoid to ovoid	narrowly ellipsoid
Size	2–2.8 mm	1.3–1.5 mm	1.5–1.7 mm

Diagnosis: *Gentiana sangsterensis* is morphologically allied to *G. robusta* but is distinguished by its significantly larger habit and lanceolate basal leaves with sessile to subsessile petioles. It features a higher density of cauline leaves (6–7 pairs) with 5–7 nerves. The calyx tube is uniquely truncate and dentiform at the apex, while the large corolla is greenish-white with dark purple shading externally and brown spotting internally. Additional diagnostic features include wide plicae (4–6 mm) with erose margins, oblong anthers on stamens inserted below the middle of the corolla tube, a papillate stigma, and large, lanceoloid-oblong capsules containing curved, ovoid seeds. While similar to *G. tibetica*, *G. sangsterensis* differs by the presence of internal corolla spotting and its distinct plicae and seed morphology.

Description: Perennial herbs, 35–60 cm tall. Stem ascending, stout, simple, glabrous. Basal leaves sessile to

subsessile, winged, connate at base, leaf blade lanceolate, 30–35 × 7–9 cm, attenuate at base, margin entire, slightly repand, apex acute to long attenuate, veins 7. Cauline leaves 6–7 pairs; petiolate, petiole 3–4 cm, connate; uppermost leaves 1–3 pairs, sessile, spreading; lamina lanceolate, 15–19 × 5.5–8.5 cm, leaves decreasing in size toward stem apex, base attenuate, margin entire to partially repand, apex acute-mucronate, glabrous on both surfaces, coriaceous, glossy, dark green adaxially, light green abaxially; multicostately-veined, nerves 5–7; mid vein prominent, reaches up to apex, slightly keeled abaxially, whitish, subsidiary veins less prominent, inconspicuous towards apex. Inflorescences crowded into terminal clusters, many-flowered, subtended by upper leaves, occasionally in axillary whorls. Flowers sessile, 4.6–5.2 cm. Calyx 1.3–1.8 cm, tube spathe-like, 0.9–1.2 cm, membranous, glabrous, split on 1 side, jointed,



forming tubular shape, apex truncated, lobes 5, dentiform, 0.4–0.6 cm. Corolla greenish white, dark purple towards apex on dorsal surface, creamy white, pellucid brown dotted on ventral surface, 3.5–4.5 cm, corolla tube 3.1–4 cm; lobes 6–7, 0.4–0.5 × 0.3–0.4 cm, ovate, apex acute to obtuse, margin entire, plicae horizontally truncate to shortly triangular, margin erose, 4–6 mm wide. Stamens inserted just below the middle of the corolla tube, filaments 0.8–1 cm, flattened toward base; anthers creamy white, oblong, 3.2–4.2 mm, basifixed. Style 2–2.8 mm; stigma bifid, 2-lobes, hook-like, surface papillate; ovary lanceoloid-oblong, 1.8–2 cm long, stipitate. Capsule lanceoloid-oblong, 2.2–3 cm long; gynophore 5–7 mm long. Seeds ovoid, curved, dark brown, 2–2.8 mm, seed coat reticulate.

Flowering & Fruiting: July–August.

Habitat and Distribution: *Gentiana sangesterensis* is found in the grassy areas with abundant light in the alpine woodland of Western Arunachal Pradesh, India (Fig. 3).

Etymology: The specific epithet ‘sangesterensis’ refers to the Sangester Tso (popularly called as ‘Madhuri Lake’) of Tawang district, Arunachal Pradesh.

Conservation status: *Gentiana sangesterensis* is only known from its type locality in Tawang district of Arunachal Pradesh, where only 5–8 mature plants were located. This newly described species faces threat due to anthropogenic activities, high tourist influx, and grazing. Due to non-availability of sufficient data at present, this novel species has been assigned to the “Data Deficient” (DD) category based on the IUCN categories and criteria (IUCN, 2022).

Notes: Due to its monopodial nature, well-developed rosette and distinctly larger basal leaves, the newly described species, *Gentiana sangesterensis* is placed in sect. *Cruciata* Gaudin.

Species within section *Cruciata* are defined by monopodial branching, caudices encased in fibrous leaf-base remnants, and well-developed rosettes of broad basal leaves. *Gentiana sangesterensis* is uniquely distinguished from all other known Indian species in this section by its 6–7 pairs of cauline leaves and plicae with erose margins.

While its general habit aligns it with *G. crassicaulis*, *G. robusta*, and *G. tibetica*, the new species remains distinct. It is separated from *G. crassicaulis* and *G. tibetica* by the specific attachment point of the stamens to the corolla tube. Furthermore, it differs from *G. robusta*, which possesses filiform calyx lobes and a shorter gynophore.

Key to the species of *Gentiana* section *Cruciata* Gaudin from Indian Himalayan Region

- 1a. Stamens inserted at the middle of the corolla tube 2
- 1b. Stamens inserted just below middle or at basal part of corolla tube 3
- 2a. Plants 20–40 cm tall; stem leaves acute to obtuse at apex *G. crassicaulis*
- 2b. Plants 40–50 cm tall; stem leaves acute to acuminate at

- apex *G. tibetica*
- 3a. Plicae triangular or ovate-triangular or triangular to truncate, 1–3 mm, oblique, margin entire or denticulate; anthers narrowly ellipsoid, 2–3 mm 4
- 3b. Plicae horizontally truncate to shortly triangular, margin erose, 4–6 mm wide; anthers oblong, 3.2–4.2 mm *G. sangesterensis*
- 4a. Calyx lobe 1–5, subulate; gynophore long, 0.7–2.2 cm 5
- 4b. Calyx lobe 3–5, filiform; gynophore short, 0.2–0.3 cm ... *G. robusta*
- 5a. Corolla dark blue, 3–3.5 cm; lobes ovate-orbicular, rounded at apex *G. decumbens*
- 5b. Corolla greenish white to pale yellow-green, 3–4.5 cm; lobes ovate-elliptic, obtuse at apex *G. straminea*

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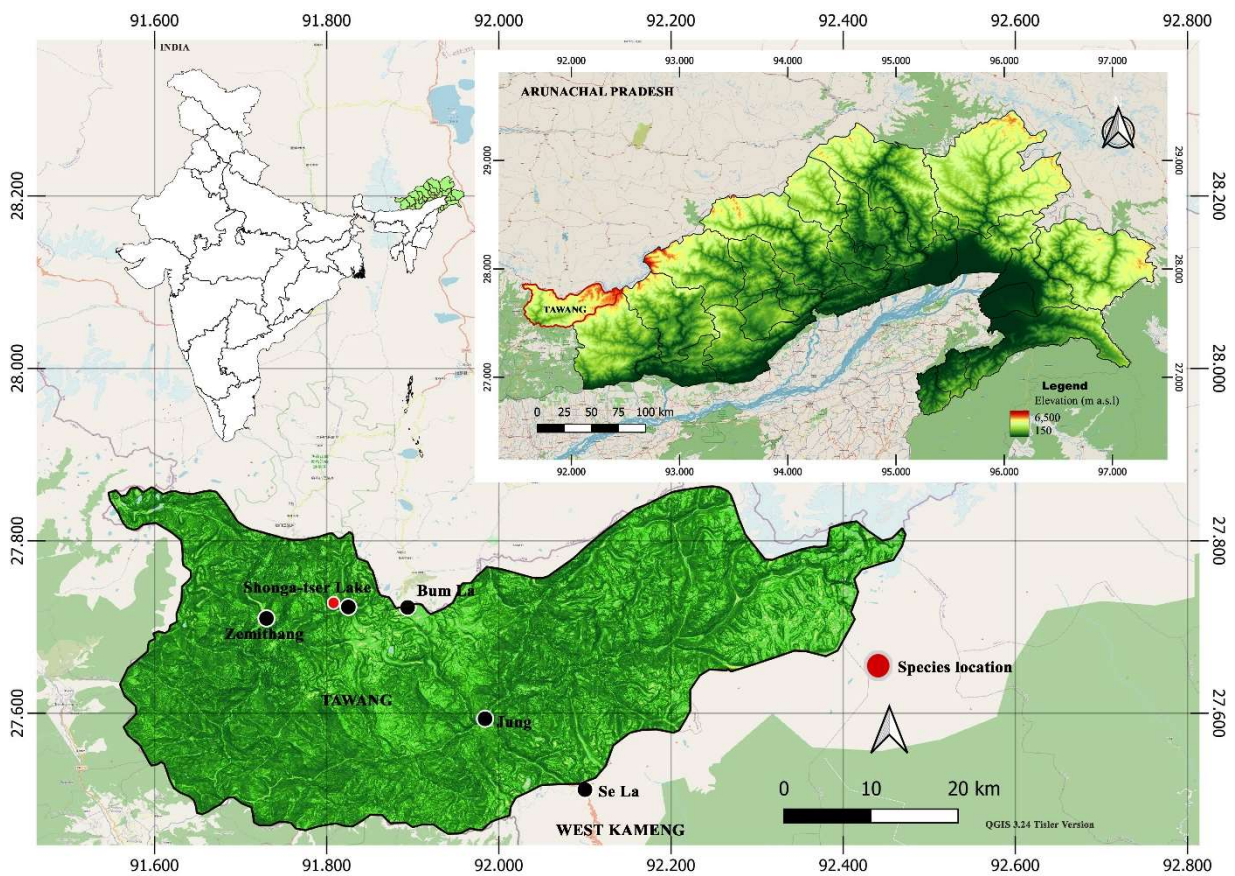


Fig. 3. Distribution map of *Gentiana sangsterensis* S. Lahiri, M. Das & S.S. Dash