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Gentiana kurumbae, a New Species of Gentianaceae from the Western Ghats of Kerala, India

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ABSTRACT: A new species of Gentianaceae, *Gentiana kurumbae* is described from the Attappady hills of Palakkad district, Kerala State, India. A detailed description, information on habitat, distribution, phenology, relevant taxonomic and ecological notes are provided along with photographs and illustration. This species resembles *Gentiana pedicellata* var. *wightii*, but by having an erect and unbranched habit, *ca*. 15 mm long, broadly ovate-elliptic and chartaceous leaves with apiculate apex and serrulate margin. *Gentiana kurumbae* is characterized by bright blue flowers with very short pedicels up to 3 mm long, scabrous and linear-oblong to oblanceolate bracts with apiculate apex, acute calyx and corolla lobes with apiculate apex and stamens with filiform or minutely thickened filaments towards base.

KEY WORDS: *Gentiana,* Gentianaceae, India, Kerala State, Western Ghats.

INTRODUCTION

Gentiana L. (Gentianaceae), is a rather large genus consisting of 350 to 400 species. It occurs in temperate regions of Europe, Asia and America, as well as in most tropical mountain systems of the world, with the exception of Africa (Chen and Wang, 1999; Ho and Liu, 2001; Mabberley, 2005). According to major taxonomic work by Struwe *et al*. (2002), Gentianaceae contains 1600 species distributed in 87 genera. Recent taxonomic work and molecular phylogenetic studies on *Gentiana* revealed that the genus is monophyletic (Ho and Liu, 1996; Favre *et al*., 2014). In India, the genus *Gentiana* is represented by 62 species and 13 varieties, most of which are distributed in the montane to alpine life zones of the Himalayas, either only in Eastern Himalaya (19 species and 2 varieties) or Northwest Himalaya (24 species and 7 varieties) or in both regions (17 species and 2 varieties) (Gupta *et al.*, 2012). Only two species occur in the Western Ghats: *G. pedicellata* Wall. ex Griseb. var. *wightii* Kusn. and *G. quadrifaria* Blume. var. *zeylanica* (Griseb.) Kusn. Both these species have been recorded in Kerala State (Sasidharan, 2013).

Myers (1988) first identified 10 regions, the so-called hotspots of biodiversity, characterized by both a high proportion of endemics and major ecological threads to their persistence. In subsequent work, Myers (1990, 2000) identified further hotspots of biodiversity (in total 18), including two in India, the Eastern Himalayas and the Western Ghats. The Western Ghats were also considered as the most important biogeographic zone in Peninsular India by Ramesh and Pascal (1991), based upon its diverse topography and climate as well as its proportion of endemics: today, there are about 1500 species of endemics in the Western Ghats (Gopalan and Henry, 2000).

Taking the scope of an ecological study on the ecology fragmented evergreen forests in Attappady hills, Palakkad district, Kerala from 2008 to 2014, a *Gentiana* specimen with a unique combination of morphological traits was collected. After consulting relevant literature (Hooker, 1883; Gamble and Fischer, 1923; Matthew, 1983; Manilal, 1988; Vajravelu, 1990; Webb, 1990; Ho *et al*., 1996; Pradeep, 2000; Chen and Wang, 2000; Mohanan and Sivadasan, 2002; Sasidharan, 2004, 2013; Nair *et al.*, 2006; Hul, 2007; Gupta *et al.*, 2012; Karthikeyan *et al*., 2009; Wu *et al*., 2012; Favre *et al*., 2013; Favre *et al*., 2014) and herbarium specimens, we established that this specimen did not correspond to any species known to science from India. In this study, we describe this specimen as a new species: *Gentiana kurumbae sp. nov.*

TAXONOMIC TREATMENT

Key to the species of *Gentiana* in South India

1a. Plants < 2cm, flowers closing rapidly when touched..... .....***G. kurumbae***
1b. Plants > 4cm, flowers not closing when touched ……...……2
2a. Radical leaves much larger than cauline leaves, capsule stalk shorter than calyx lobes…… ***G. pedicellata*** var. ***wightii***
2b. Radical leaves smaller than cauline leaves, capsule stalk longer than calyx lobes ……...…….. ***G. quadrifaria*** var. ***zeylanica***

Gentiana kurumbae Anilkumar & Udayan, ***sp. nov.***

Fig. 1, 2

Type: **INDIA**, Kerala, Palakkad District, Attappady hills, Cherukolmala, 1750-1850 m, 18 September 2012, *K.A. Anilkumar* and *P.S. Udayan 4185* (holotype MH[1], isotypes SKC[2], CMPR[3], CALI[4]).

Annual unbranched erect herbs up to 7–15 mm tall; stem short, base quadrangular. Leaves 3–6 pairs, glabrous, opposite decussate, lower leaves broadly ovate and upper leaves ovate-elliptic to lanceolate, 5–7 × 3–4.5 mm long, lamina thick fleshy, 3.5–5 × 3.5–4.5 mm long, 3-nerved from the base, abaxially the mid vein thickened and slightly depressed, margins minutely serrulate; petioles serrulate on margins, 2–3 × 2–2.5 mm long, apex acute with a apiculate apex. Flowers bright blue, terminal or axillary; pedicel 1–2 mm long. Bracts opposite decussate, linear-oblong to oblanceolate with apiculate apex, *ca*. 6 × 2 mm long, margins serrulate. Calyx 5-lobed, obconic, *ca*. 7 mm long, with 10 ribs; ribs cartilaginous, lobes linear, *ca*. 2 mm long, fleshy with apiculate apex; calyx tube *ca*. 5 mm long. Corolla bright blue with light green base and dark blue strips in each folds, 10 mm long; lobes 5 with plicae in between, lobes lanceolate shorter than tube, *ca*. 2 mm long, acute to apiculate at apex, plicae obtuse or emarginated, less than *ca*. 0.5 mm long; opened corolla *ca*. 7 mm across. Stamens 5, included, inserted at middle of corolla tube; anthers oblong, *ca*. 1 mm long; filaments filiform or minutely flattened towards the base, glabrous, *ca*. 2 mm long. Carpel *ca*. 7 mm long; ovary *ca*. 4 mm long, glabrous with many ovules; style *ca*. 3 mm; stigma 2-lobed and coiled. Fruit and seed not seen.

Additional specimens examined: **INDIA**, Kerala, Palakkad District, Attappady hills, Cherukolmala, 1750-1850 m, 15 October 2012, *Anilkumar 4877* (CMPR).

Diagnosis: This species resembles *G. pedicellata* var. *wightii* but differs from this species by having an erect and unbranched habit, *ca*. 15 mm long, broadly ovate-elliptic and chartaceous leaves, with apiculate apex and serrulate margin. *Gentiana kurumbae* is characterized by having bright blue flowers with very short pedicel up to 3 mm long, scabrous and linear-oblong to oblanceolate bracts with apiculate apex, acute calyx and corolla lobes with apiculate apex and stamens with filiform or minutely thickened filaments towards base.

Note: The plants are easily identifiable by their blue flowers but the flowers are suddenly closing on touch or shake. The plant without flower is very difficult to find in the grasslands because of its small size. This may be a strategy to prevent damage to the flower and it reproductive organs by weather conditions or herbivores.

Phenology: Flowering and fruiting occur between August and October.

Distribution, Habitat and Ecology: *G. kurumbae* is known only from type locality of Cherukolmala in the Attappady region of the Western Ghats of Kerala, where it occurs in grasslands at an elevation between 1750-1850 m. Its distribution appears to be very sparse within these grasslands. This species grows along typical species of moist mountain grasslands along with others as *Drosera peltata* Smith (Droseraceae); *Alysicarpus racemosus* Benth. (Fabaceae); *Indigofera pedicellata* Wight & Arn. (Fabaceae); *Biophytum sensitivum* (L.) DC. var. *candolleanum* (Wight) Edgew. & Hook.f. (Oxalidaceae); *Valeriana hardwickii* Wall. var. *arnottiana* (Wight) Clarke (Valerianaceae) and *Senecio lessingianus* (Wight & Arn.) Clarke (Asteraceae).

Etymology: The specific epithet of the new taxon is in honor of the Kurumba tribal community, living in the interior forests of Attappady. The Kurumba tribal community kindly provided valuable help during field collections for the first author's Ph.D. programme (2008-2015) in Kannur University, Kerala.

Conservation status: The only population of *G. kurumbae* known to date is the type locality in the Attappady Reserve Forest in Nilgiri Biosphere Reserve. A few degraded areas surrounding the type locality were identified, mostly due to the illegal cultivation of *Cannabis sativa* L., a practice otherwise almost entirely eradicated in the region by the forest department. The control of such habitat degradation in the Attappady Reserve Forest is however very difficult to achieve because of the remoteness of the area, therefore threads to the population of *G. kurumbae* still exist.

The area of occupancy of *Gentiana kurumbae* is confined to less than 1 km^2 in mountain grasslands of Cherukolmala in the Attappady region and the total number of population observed is about 200 individuals. The small size of the population, *G. kurumbae* is susceptible to go extinct by only random and local modification of its habitat. Based upon the strategies and criteria of the IUCN guidelines (IUCN, 2012) this species can be provisionally considered as 'Critically Endangered' (CR B1ab (i,ii,iv); 2ab (i,ii,iv); D; E) based on the extent of occurrence, area of occupancy, absence of sub-populations, and number of mature individuals. However, further studies and explorations are required to ascertain its status.

Morphologically resembling species: The authors also collected the *Gentiana pedicellata* var. *wightii* and *G. quadrifaria* var. *zeylanica* from Meenvani, a similar habitat about 15 km away from the population of the *G. kurumbae* and confirmed that the morphological differences observed are not due to phenotypic

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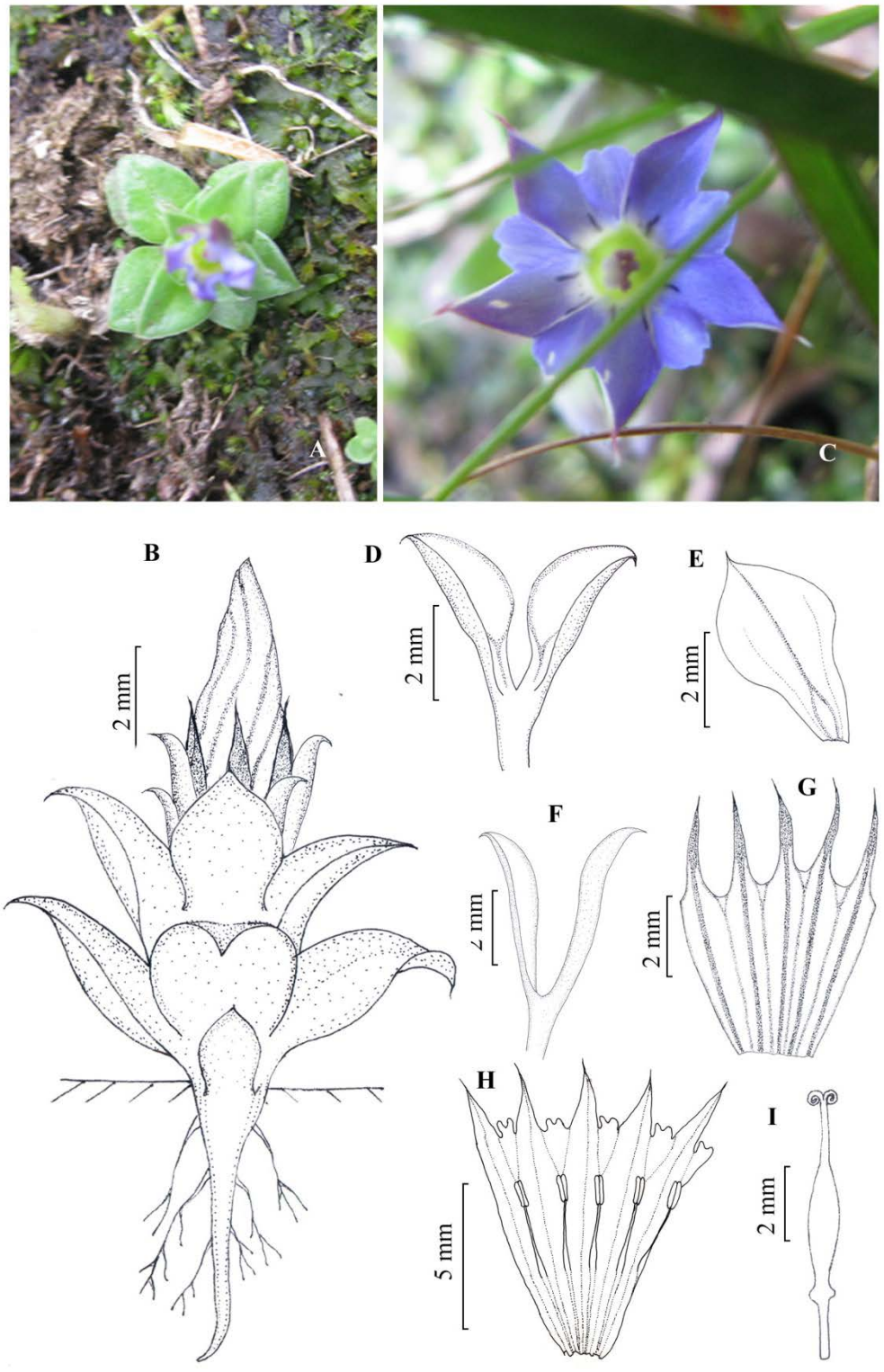

Fig. 1. ***Gentiana kurumbae*** **Anilkumar & Udayan sp. nov. A & B: Habit. C: Close up of flower. D & E: Leaves. F: Bract. G: Calyx. H: Opened corolla showing stamens. I: Carpels. (Drawn from** ***Anilkumar 4185,*** **by Ms. Nijila Raj).**

Table 1. Diagnostic morphological characters of *Gentiana kurumbae sp. nov*. in comparison with two other allied taxa from south India, *G. pedicellata* var. *wightii* and *G. quadrifaria* var. *zeylanica*

Trait	*G. pedicellata* var. *wightii*	*G. quadrifaria* var. *zeylanica*	*G. kurumbae*
Habit	Branched, procumbent sub-erect herb	Branched, procumbent herbs	Un-branched erect herb
Plant height	10-15 cm tall	5-40 cm tall	0.7–1.5 cm tall
Stem	Green, sometimes purple	Green-white or purple	Always green
Radical and cauline leaves	Radical leaves larger than cauline leaves	Radical leaves smaller than cauline leaves	Not differentiated as radical or cauline leaves
Leaf Shape	Elliptic-linear-lanceolate	Ovate-cordate	Broadly ovate-elliptic-lanceolate
Leaf size	5–20 × 3–7 mm long	4–16 × 3–4.5 mm long	4–7 × 3–4.5 mm long
Leaf apex	Acute	Conspicuously acuminate	Acute with apiculate tip
Leaf base	Attenuate	Round-cordate	Round-attenuate
Lamina	Sub-coriaceous	Coriaceous	Fleshy, chartaceous
Leaf Margin	Entire	Entire	Serrulate
Petiole	3–12 mm long	1–2 mm long	2–3 mm long
Flowers	Blue	Blue	Bright blue
Pedicels	2–15 mm long	2–15 mm long	1–3 mm long
Bracts colour	White-pale green, sometimes purplish, smooth	White-pale green, sometimes purplish, scabrous	Green, scabrous
Bract shape	linear-lanceolate	ovate-lanceolate	linear-oblong to oblanceolate
Bract size	5–10 mm long	2.5–3.5 mm long	5–6 mm long
Corolla lobes	Acute-apiculate apex, plicae round or crenulate	Acute at apex, plicae emarginated	Acute with apiculate apex, plicae obtuse or emarginated
Filaments	Bottle shaped, more thickened towards the base	Bottle shaped, more thickened towards the base	Filiform or minutely thickened towards base

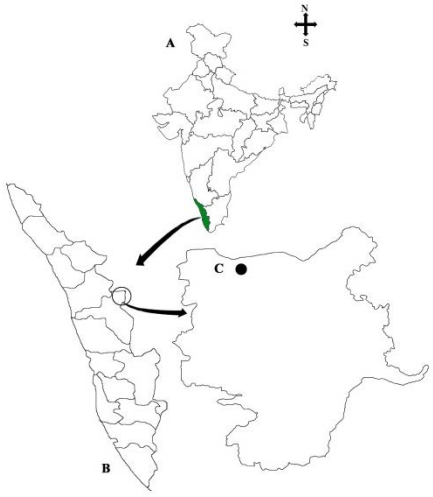

Fig. 2. The distribution of *Gentiana kurumbae* Anilkumar & Udayan A: India. B: Kerala. C: Cherukolmala in Attappady hills.

plasticity. *G. kurumbae* sp. nov. shows similarities with *G. pedicellata* var. *wightii* and *G. quadrifaria* var. *zeylanica* (Table 1).

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