

Biodiversity of *Gentiana Sikkimensis* C.B. Clarke in Sikkim Himalaya

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Abstract

The mountain ecology is a fragile ecology where the species are ecologically linked and grow maintaining ecological niche. Several species of alpine forest are unique in their diversity. This might be the result of the microclimatic conditions of mountain ecology. Since, this writing covers *Gentiana sikkimensis* Clarke and according to the report, the Himalayan region is bestowed with the different species of *Gentiana* upto ca. 71 species. Out of these species, *Gentiana sikkimensis* C.B. Clarke documented with taxonomic characters and proposed its five forma namely, *Gentiana sikkimensis* C.B. Clarke f. kat f. nov., *Gentiana sikkimensis* C.B. Clarke f. sam f. nov., *Gentiana sikkimensis* C.B. Clarke f. flee f. nov., *Gentiana sikkimensis* C.B. Clarke f. tarok f. nov. and *Gentiana sikkimensis* C.B. Clarke f. kuku f. nov., which are differing phenotypically, especially in flowering stages. The specific differentials of *Gentiana sikkimensis* C.B. Clarke f. kat f. nov. *Gentiana sikkimensis* C.B. Clarke f. sam f. nov. *Gentiana sikkimensis* C.B. Clarke f. flee f. nov. *Gentiana sikkimensis* C.B. Clarke f. tarok f. nov. and *Gentiana sikkimensis* C.B. Clarke f. kuku f. nov. are presence of one flower, three flowers, four flowers, six flowers and eight flowers, respectively. Additionally, the internodes of the plants vary, for instance, *Gentiana sikkimensis* C.B. Clarke f. kuku f. nov. measured 10–12 cm and *Gentiana sikkimensis* C.B. Clarke f. kat f. nov. measured 2–3 cm. However, these five forma have same flowering and fruiting periods. Thus, this writing presented the details of the five forma of *Gentiana sikkimensis* C.B. Clarke for the taxonomic usages.

Keywords: Forma, *Gentiana sikkimensis*, Sikkim Himalaya

INTRODUCTION

India is represented by 71 taxa of *Gentiana* across the Himalayan region and two species in Western Ghat [1–4]. One species, *Gentiana sikkimensis* C.B. Clarke is one of the reported species having serial number 9857, which was collected by C.B. Clarke from Yakla, Sikkim at 3353m on 16.10.1869 and was deposited in Kew, K 00843981. In this representative species, several plants having different flowers bearing plants are documented. In the detail study, it is found that these plants having different number of flowers growing in different habitats are taxonomically different, based on height, number of flowers,

leaves size etc. Thus, the purpose of this paper is to document the differently flowered *Gentiana sikkimensis* C.B. Clarke in the Sikkim Himalaya and placed under the forma for the taxonomic usages.

MATERIAL AND METHODS

Literature surveys were conducted to confirm the representative specimens [1, 5–7]

TAXONOMY

Gentiana sikkimensis

C. B. Clarke in J. D. Hooker, Fl. Brit. India. 4: 114. 1883.

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DISTRIBUTION

INDIA: Sikkim, Yakla, K 00843981, Coll. C.B. Clarke, s.n 9857, 3353m, 16.10.1869; K00843982, Singaleleh Darjeeling, West Bengal, Coll. No 12558, sn. 33530, 07.10.1870.

Perennial, Stem greenish to light purple, erect. Petiole slightly broadens at stem. Leaf blade elliptic. Upper leaves are crowded at the base of inflorescence, flower one to seven flowers, clusters, sessile. Corolla sky blue to deep blue to white strips, urceolate, Fl. August. Fr. September–October.

RESULTS AND DISCUSSION

In the Sikkim Himalaya, some authors have reported presence of new species or sub-species of *Gentiana* such as *Gentiana karelini*, *Gentiana arunii*, *Gentiana vernayl* subsp *favrei*, *Gentiana vernayl* (Dey and Maity, 2017; Maity et al.) [8–10]. In line with this, some publications are based on the taxonomic characteristics of *Gentiana* from India [1–2, 4–7, 11–12]. In accordance with those publications, the enumerated list of *Gentiana* of Sikkim, Himalaya presented with their protologues.

1. *Gentiana lacerulata* Harry Smith, Kew Bull. 1961;15:52.
2. *Gentiana himalayaensis* T. N. Ho in T. N. Ho & S. W. Liu, Bull Nat Hist Mus. London (Bot.). 1993;23:57.
3. *Gentiana huxleyi* Kusnezow, Mélanges. Biol Bull Phys-Math. Acad Imp Sci. Saint-Pétersbourg. 1893;13:64.
4. *Gentiana gilvostriata* C. Marquand. Bull Misc Inform Kew. 1931;83:1931.
5. *Gentiana emodi* C. Marquand ex Sealy, C. Marquand ex Sealy, S (1954). In: Bot Mag, Lond. Clxx. T. 230.
6. *Gentiana depressa* D. Don, Prodr. Fl. Nepal. 1825:125.
7. *Gentiana crassicaulis* Duthie ex Burkill, J. & Proc. Asiat Soc Bengal. 1906;2:311.
8. *Gentiana capitata* Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal. 1825:126.
9. *Gentiana argentea* (Royle ex D. Don) Griseb. In DC., Prodr. 9:107. 1845.
10. *Gentiana altigena* Harry Sm.: Harry Sm. (1926). In: Anz Akad Wiss Wien, Math-Nat. 1926;63:99.
11. *Gentiana albicalyx* Burkill, J. & Proc. Asiat. Soc. Bengal. 2: 314. 1906.
12. *Gentiana ornate* (Wallich ex G. Don) Grisebach, Gen. Sp. Gent. 277. 1838.
13. *Gentiana elwesii* C. B. Clarke in J. D. Hooker, Fl. Brit. India. 4: 115. 1883.
14. *Gentiana nivalis* L.L. (1753). In: Sp. Pl. 229.
15. *Gentiana robusta* King ex J. D. Hooker, Hooker's Icon. Pl. 1883;15:31.
16. *Gentiana nubigena* Edgeworth, Trans. Linn. Soc. London, Bot. 1846;20:85.
17. *Gentiana bryoides* Burkill, J. & Proc. Asiat. Soc. Bengal. 2: 316. 1906.
18. *Gentiana crassicaulis* Duthie ex Burkill, J. & Proc. Asiat. Soc. Bengal. 1906;2:311.
19. *Gentiana tubiflora* (Wallich ex G. Don) Grisebach, Gen. Sp. Gent. 1838:277.
20. *Gentiana springteana* J.S. Pringle. Pringle, J.S. In: Rhodora. (1966;68:213.
21. *Gentiana prostrata* var. *karelinii* (Grisebach) Kusnezow, Mém. Acad. Imp. Sci. Saint Pétersbourg. 1904;15:368.
22. *Gentiana decemfida* Buch, -Ham. Ex D. Don Buch.-Ham. Ex D. Don. In: Prod. Fl. Nep. 1825; 127.
23. *Gentiana gilvostriata* C. Marquand, Marquand, C. (1931). In: Bull. Misc. Inform. Kew. 1931:83.
24. *Gentiana himalayensis* T.N. Ho.
25. *Gentiana sagarmathae* Miyam. & H. Ohba, Miyam. & H. Ohba. In: J. Jap. Bot. 1996;71(1):45.
26. *Gentiana leucomelaena* Maxim.
27. *Gentiana loureiroi* (G. Don) Griseb. Published in: A.P. de Candolle, Prodr. 1845;9:108.
28. *Gentiana loureiroi* subsp. *Napulifera* (Franch.) Halda Halda. In: Acta Mus. Richnov. Sect. Nat. 1995;3(1):48.
29. *Gentiana maeulchanensis* Franch., Bull. Soc. Bot. France 1896;43:488.
30. *Gentiana meiantha* (C.B. Clarke) Harry Sm., Harry Sm. In: Notes Roy. Bot. Gard. Edinb. 1965;26:248.

31. *Gentiana micans* C.B. Clarke, J.D.Hooker, Fl. Brit. India. 1883;4:112.
32. *Gentiana verna* subsp. *pontica* (Soltok.) Hayek, Hayek. In: Prodr. Fl. Penins. Balcan. 1930;2:419.
33. *Gentiana veitchiorum* Hemsl., Hemsl. In: Gard. Chron. 1909;46:178.
34. *Gentiana urnula* Harry Sm., Harry Sm. In: Kew Bull. 1961;15:51.
35. *Gentiana tibetica* King ex Hook.fil., King ex Hook. Fil. (1883). In: Ic. Pl. T. 1441.
36. *Gentiana tetrasticha* C. Marquand, Marquand, C. In: Hooker's Icon. Pl. 1937;34:T. 3330.
37. *Gentiana straminea* Maxim., Maxim. In: Bull. Acad. Petersb. 1881;27:502.
38. *Gentiana squarrosa* Ledeb., Ledeb. In: Mem. Acad. Petersb. 1812;5:527.
39. *Gentiana springateana* D. Maity, Edinburgh Journal of Botany. 2014;71(3):289–296.
40. *Gentiana sikkimensis* C.B. Clarke, J.D Hooker, Fl. Brit. India. 1883;4:114.
41. *Gentiana riparia* Buch.-Ham. Ex Wall. Published in: Buch. -Ham. Ex Wall. In: Numer. List No. 4392. 1830.
42. *Gentiana recurvata* subsp. *Prainii*(Burkill) Halda, Halda. In: Acta Mus. Richnov. Sect. Nat. 1995;3(1):40.
43. *Gentiana recurvata* C. B. Clarke, J. D. Hooker, Fl Brit India. 1883;4:110.
44. *Gentiana prolata* Balf. f., Trans & Proc Bot Soc. Edinburgh. 1918;27:260.
45. *Gentiana phyllocalyx* C.B.Clarke, Clarke CB. In: Hook. F. Fl Brit Ind. 1883;4:116.
46. *Gentiana obconica* T. N. Ho, Ho TN. In: Acta Phytotax. Sin. 1985;23(1):45.
47. *Gentiana micantiformis* Burkill, Burkill. (1906). In: J As Soc Beng N S. 1906;2:315.

Further, this writing is focused on *Gentiana sikkimensis* Clarke, so the detail of taxonomic characters was studied and presented in this Table 1.

Table 1. Taxonomic information of new forma of *Gentiana sikkimens* is Clarke.

Particulars Plant	<i>Gentiana Sikkimensis</i> C.B. Clarke f. <i>Kat</i> f. nov. Perennial	<i>Gentiana Sikkimensis</i> C.B. Clarke f. <i>sam</i> f.nov. Perennial	<i>Gentiana Sikkimensis</i> C.B. Clarke f. <i>flee</i> f.nov. Perennial	<i>Gentiana Sikkimensis</i> C.B. Clarke f. <i>tarok</i> f.nov. Perennial	<i>Gentiana Sikkimensis</i> C.B. Clarke f. <i>kuku</i> f. nov. Perennial
Stem	Erect, simple, greenish	Erect, simple	Erect, simple	Erect, simple	Erect, simple
Internodes	2–3 cm	3–4 cm	6–8 cm	8–10 cm	10–12 cm
Petiole	Slightly broadened at stem apex	Slightly broadened at stem apex	Slightly broadened at stem apex	Slightly broadened at stem apex	Slightly broadened at stem apex
Leaf blade	Oblong, entire margin	Oblong, entire margin	Oblong, entire margin	Oblong, entire margin	Oblong, entire margin
Upper Leaves	Crowded covering the flowers at the base.	Crowded covering the flowers at the base.	Crowded covering the flowers at the base.	Crowded covering the flowers at the base.	Crowded covering the flowers at the base.
No of Flower	One flower	Three flowers	Four flowers	Six flowers	Eight flowers
Flowering Time	August–September	August–September	August–September	August–September	August–September
Fruiting Time	September–October	September–October	September–October	September–October	September–October

All above information is based on the field observations, where plant height, number of flowers, leaves sizes etc. are considered for the characterization of the forma of *Gentiana sikkimensis* C.B. Clarke. These different forms are placed under the *form* of *Gentiana sikkimensis* C.B. Clarke for taxonomic purposes.

The various forms of *Gentiana sikkimensis* C.B. Clarke exhibit distinct morphological characteristics, as shown in Figure1(a–g).

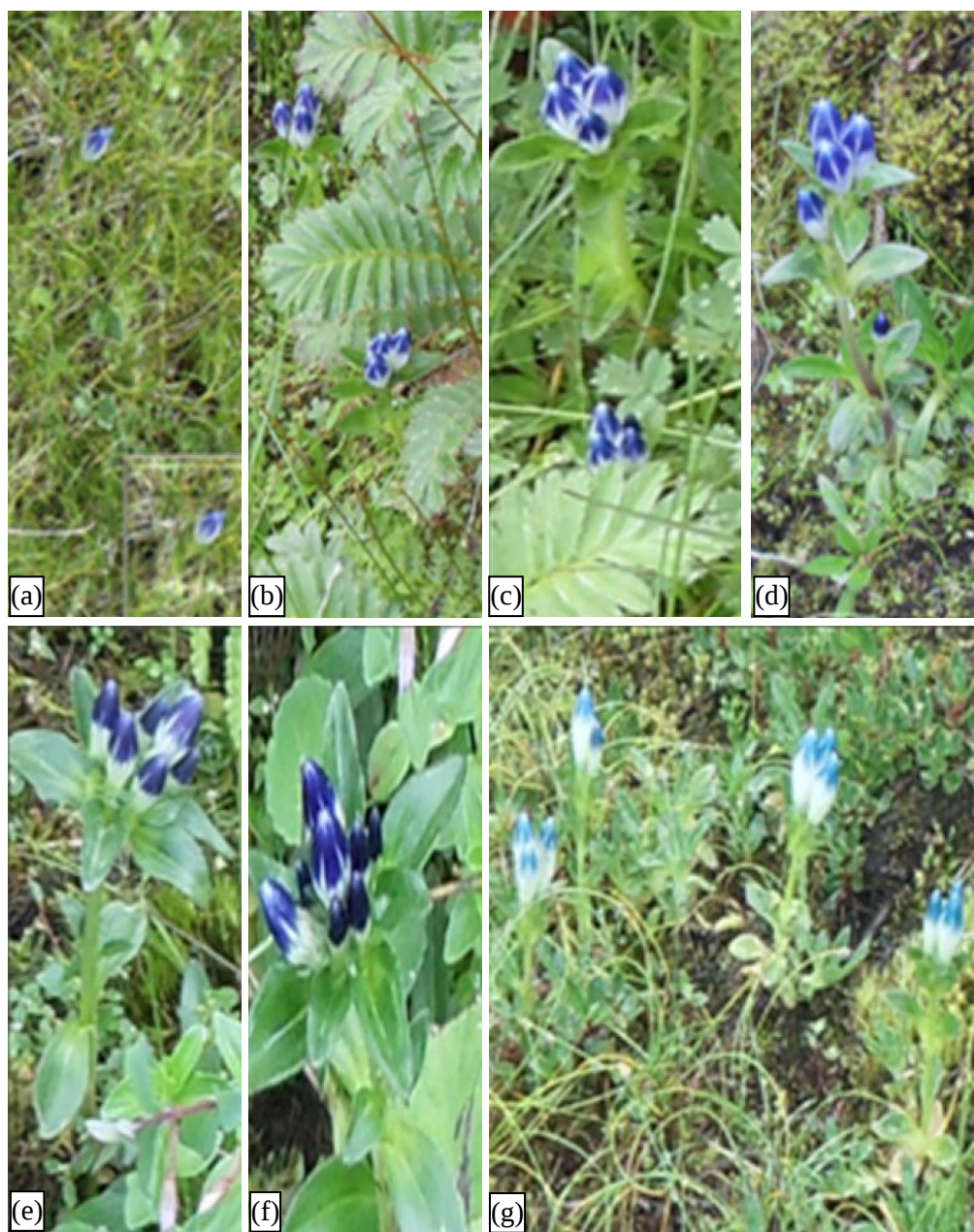


Figure 1. (a): *Gentiana sikkimensis* C.B. Clarke f. *nyat* f. nov.; (b): *Gentiana sikkimensis* C.B. Clarke f. *sam* f. nov.; (c): *Gentiana sikkimensis* C.B. Clarke f. *flee* f. nov.; (d): A form of *Gentiana sikkimensis* C.B. Clarke f. *flee* f. nov.; (e): *Gentiana sikkimensis* C.B. Clarke f. *tarok* f. nov.; (f): *Gentiana sikkimensis* C.B. Clarke f. *kuku* f. nov.; (g): A form of *Gentiana sikkimensis* C.B. Clarke f. *sam* f. nov (Light blue color).

Notes: These digital images are taken during the field trips to Lachen Reserve Forest, Lachung Reserve Forest, Khanchenzonga National Park and Dzongu Reserve Forest.

CONCLUSION

The Sikkim Himalaya is bestowed with many endemics as well as unique flora, where the microclimatic features of Sikkim Himalaya play a pivotal role in the development of the unique flora. In the present study, *Gentiana sikkimensis* Clarke studied and found the plants were differing in phenotypic characters. These characters were studied critically and noted five forma of *Gentiana sikkimensis* Clarke. Thus, this writing is presented with the descriptions for the taxonomic usages.

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