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NOTE

On the rediscovery of a rare root parasite *Gleadovia ruborum* Gamble & Prain (Orobanchaceae) from Uttarakhand, western Himalaya, India

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The family Orobanchaceae Vent. comprising ca. 2,060 species under 90 genera are distributed across all continents except Antarctica (McNeal et al. 2013). Commonly known as the broomrape family, Orobanchaceae includes holoparasites (non-photosynthetic) that depend on their hosts and hemi-parasites (photosynthetic), most of which were earlier kept in Scrophulariaceae. *Pedicularis* L. with ca. 600 species (Li et al. 2019) followed by *Euphrasia* L. (250–300 species), *Castilleja* Mutis ex L.f. (200–210 species), *Buchnera* L. (130–140 species), and *Orobanche* L. (80–100 species) are the largest genera under this family (POWO). The genus *Gleadovia* Gamble & Prain, a member of Orobanchaceae is native to the western and eastern Himalaya in India and southwestern Yunnan to western Hunan, China. Described by J.S. Gamble and D. Prain in 1900, *Gleadovia* is currently represented by four species namely *G. ruborum* Gamble & Prain (type species; Uttarakhand in western Himalaya, India and China: 1900), *G. mupinensis* Hu (China: 1939), *G. banerjiana* Deb (Manipur, India: 1957) and *G. konyakianorum* Odyuo, D.K. Roy & Aver. (Nagaland, India: 2017).

During a recent floristic exploration (June–July 2020) in and around Surkanda in the outer Himalayan range of Uttarakhand, western Himalaya, an interesting plant species of family Orobanchaceae was observed. Detailed study of the characters observed in the field, scrutiny of literature (Gamble & Prain 1900; Issar 1966; Wu & Raven 1998; Agarwal 2017; Roy 2017) and examination of online herbarium specimens at Kew (J.S. Gamble, 26949K! (K000999865 and K000999866)) and DD (Osmaston, 23093; Charlton Thomas, 20794) revealed that the taxon is a rare root parasite, *Gleadovia ruborum*, a species previously known only from three localities (Figure 1). The species was originally collected by M.F. Gleadov in 1898 and later described by J.S. Gamble and D. Prain in 1900 from Bodyar (Budher) near Chakrata, Uttarakhand. The species was recollected from the same locality by Osmaston in 1900. Later, it was also collected by Charlton Thomas in 1951 from Balate valley in eastern Almora (now in Pithoragarh district), Kumaon and Ramesh Bedi in 1964 (GKV 1234) from Yamuna Forest Division, Garhwal (Issar 1966).

The plant specimen of *G. ruborum* along with roots of the host, *Rubus pedunculosus* has been preserved (wet specimen) following standard methods and deposited at the herbarium of the Wildlife Institute of India, Dehradun (WII). Detailed information on the distribution range,

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known host, habitat, elevation range and phenology of *Gleadovia* species are provided in Table 1.

Gleadovia ruborum Gamble & Prain, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 69(2): 489 (1900).

Type: Northwestern Himalaya. Bodyar Jaunsar, 2,500–3,000 m; on the northern slopes in very shady forest of Fir and Deodar on the roots of wild Raspberry *Rubus niveus*; very scarce, Gleadov! Gamble! Duthie! Duthie's collectors!

Lectotype (Roy 2017): India. Erstwhile Uttar Pradesh Hills (now Uttarakhand): northwestern Himalaya, Jaunsar, Bodyar (on the northern slopes in very shady woods of Fir and Deodar), 2,500–3,000 m, June 1898, J.S. Gamble 26949-K! (K000999865); Isolectotypes-K! (K000999866); CAL! (Acc. No. 329959).

Fleshy, root-parasitic herb 10–18 cm high. Rootstock bulbous and swollen at the point of attachment with the host root. Stem largely sub-terranean, with ovate scales; lower scales rounded, upper oblong and sometimes bifid. Flowers in dense corymbose or paniculate inflorescences at the end of stem. Pedicel stout ca. 0.8cm long. Bracts solitary, ca. 1.5 cm long, sheathing, rounded; bracteoles two, 1.5–2.5 cm long, spatulate, acute, concave. Calyx 2.5–3 cm long, light red, tubular, somewhat inflated, equally five-lobed, lobes rounded, divided to less than half the tube length. Corolla up to 5 cm long, white at the base, reddish towards the apex, with dark longitudinal veins; tube much longer than the calyx, slightly curved, two-lipped; upper lip of two connate, rounded, lobes; lower lip of three narrow, acute lobes. Stamens 4; filaments bent at point of insertion; anthers spurred, connectives produced beyond the anther lobes, 3-fid at the apex. Ovary one-celled, ovate. Style shorter than the filaments; stigma of two fleshy, semi-orbicular lobes depressed in the centre; placenta 2 pairs, free below and above, confluent in the middle; ovules numerous. Seeds numerous, minute.

Etymology: Genus *'Gleadovia'* is dedicated to M.F. Gleadov who was first to discover it in 1898 and *'ruborum'* refers to red corolla with darker veins.

Specimen examined: 22201 (WII, wet collection of flowers), 20.vi.2020, India, Uttarakhand, Surkanda hill

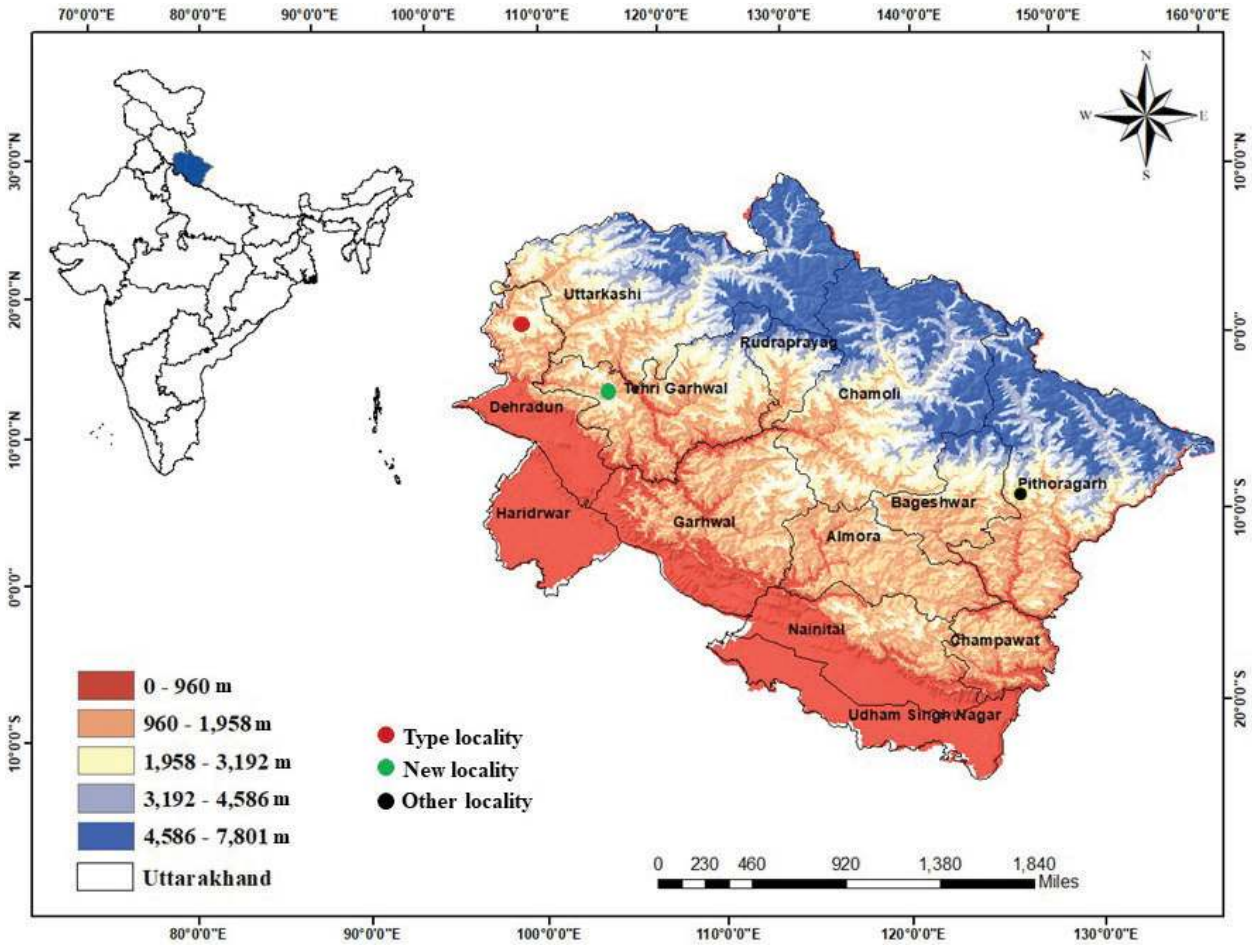

Figure 1. Map showing distribution of *Gleadovia ruborum* in Uttarakhand, India.

Table 1. Distribution range, habitat, host, elevation range, and phenology of *Gleadovia* species.

Species	Distribution range	Habitat	Host	Elevation (m)	Flowering (fl.) and fruiting (fr.)	Reference
Gleadovia ruborum	Chakrata (Budher) and Mussoorie hills (Surkanda) in Uttarakhand, western Himalaya, India	Northern slopes in very shady *Cedrus deodara - Abies pindrow* and *Abies pindrow - Quercus floribunda* forests	Roots of wild raspberry, *Rubus pedunculosus*	2,500–3,000	Jun–Jul (fl.), Jul–Aug (fr.)	Gamble & Prain (1900), Issar (1966), Agarwal (2017), Roy (2017), present study
	Southwestern Yunnan to western Hunan, China	Temperate rainforest under bamboo; humid places in forests or thickets	Not ascertained	900–3,500	Apr–Aug (fl.), Aug–Oct (fr.)	Gamble & Prain (1900), Wu & Raven (1998)
Gleadovia mupinensis	Southcentral and Southeastern China	Roadsides, forests and humid places	Not ascertained	3,000–3,500	Apr–Jul (fl.)	Hu (1939), Wu & Raven (1998)
Gleadovia banerjiana	Koubru hill, Manipur, India	-	Roots of *Strobilanthes discolor*	1,800–2,000	-	Deb (1956)
Gleadovia konyakianorum	Nagaland, India	Semi-evergreen forest	Roots of *Strobilanthes* sp.	1,500–1,600	Apr (fl)	Odyuo et al. (2017)

near Mussoorie of Tehri Garhwal district, 30.415^{0}N, 78.280^{0}E, 2,450 m, coll. N. Page, A. Kumar, B.S. Adhikari & G.S. Rawat; 22202 (WII, wet collection of the fruiting specimen along with rootstock of host plant), 08.vii.2020, India, Uttarakhand, Surkanda hill near Mussoorie of Tehri District, 30.415^{0}N, 78.280^{0}E, 2,450m, coll. N. Page, A. Kumar, B.S. Adhikari & G.S. Rawat (Image 1).

Distribution range, host, and habitat: *G. ruborum* was first recorded in shady forest at Bodyar or Budher in Jaunsar, Dehradun district at 2,500 m above mean sea level by M.F. Gleadov in 1898 (Gamble & Prain 1900). Interestingly, it shows disjunct distribution as it has also been reported in northern Guangxi, Hubei, western Hunan and southwestern Yunnan areas of China (Hu 1939; eflora China). Notably, it has not been recorded anywhere else from India and China (Agarwal 2017). Issar (1966), Roy (2017), and Osmaston (1900) had recorded *Glaedovia ruborum* on the roots of *Rubus pedunculosus* (*R. niveus* Wall. ex. Hook; Agarwal 2017). Agarwal (2017) studied the flora of Chakrata hills in detail but he could not locate populations of *G. ruborum* in its type locality despite best efforts. In Surkanda (the new locality), all the four individuals were recorded on the roots of *Rubus pedunculosus* in *Abies pindrow-Quercus floribunda* forest at 2,450 m on northern slopes. The common species recorded in the vicinity (314 m^2) of *Gleadovia* were *Quercus floribunda, Abies pindrow, Viburnum cotinifolium, Daphne papyracea, Salix denticulata, Rosa macrophylla, Hypericum oblongifolium, Senecio rufinervis, Roscoea purpurea*, and *Geranium wallichianum.*

Conservation status: *G. ruborum* has been assessed as 'rare' and 'extremely rare' by Issar (1966) and Agarwal (2017), respectively. The IUCN conservation status of this species is yet to be assessed.

In the current communication, we report a new locality of *G. ruborum* at 2,450 m in Surkanda near Mussoorie of Tehri Garhwal district, Uttarakhand. The present collection marks the rediscovery of the species after a gap of 57 years from a new locality in the Uttarakhand, western Himalaya. The new location is approximately 60km from the type locality. Intensive surveys in the right season, in temperate and sub-alpine shady moist forests with a dense undergrowth of *Rubus pedunculosus* may yield more distributional records and better understanding of its distributional range.

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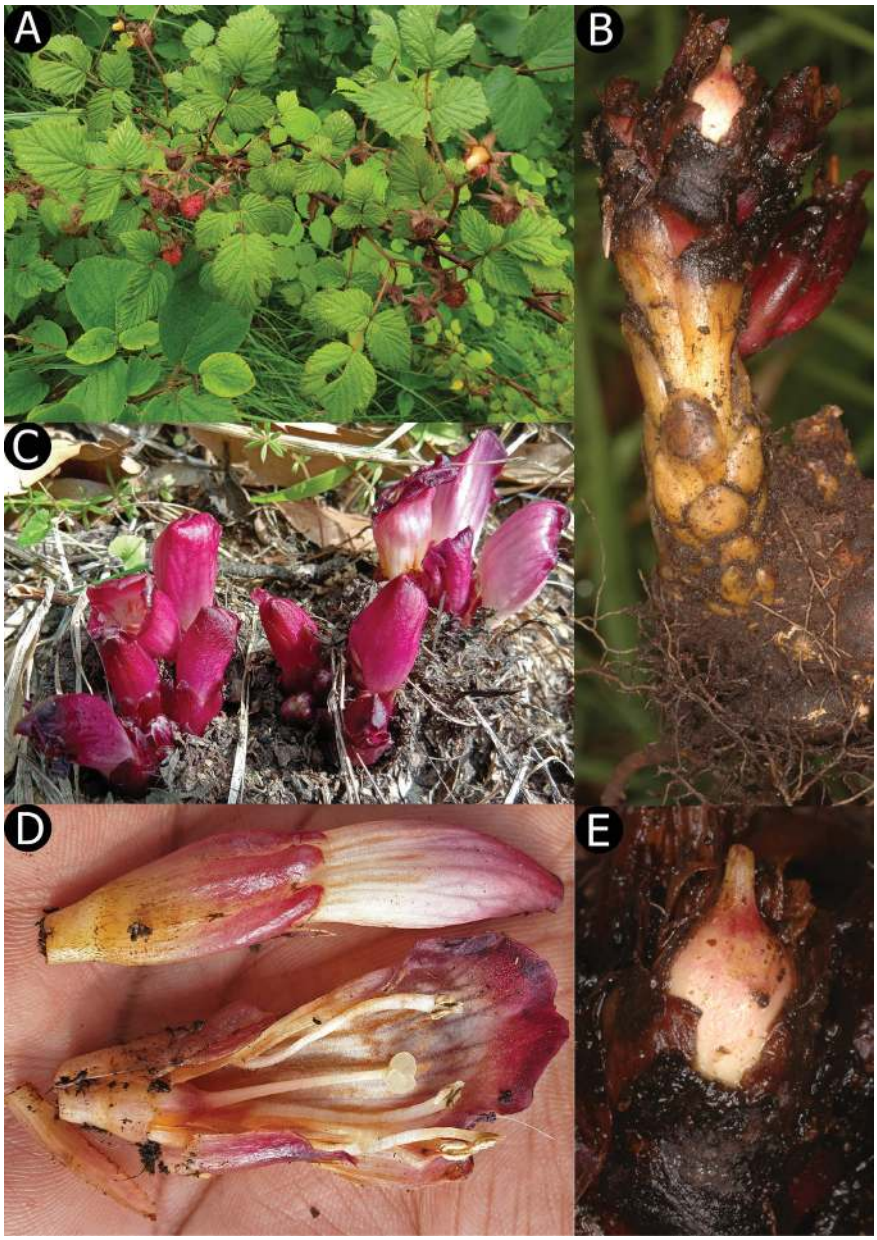

Image 1. Host and habit of *Gleadovia ruborum*: A—*Rubus pedunculosus* - the host species (© Amit Kumar) | B—Habit showing scales on the stem (© Navendu Page) | C—Inflorescences and flowers (© B.S. Adhikari) | D—Section of the corolla showing the stamens, stigma and the ovary (© Navendu Page) | E—Close-up of fruit (© Navendu Page).

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