NOTE

ON THE REDISCOVERY OF A RARE ROOT PARASITE *GLEADOVIA RUBORUM* GAMBLE & PRAIN (OROBRANCHACEAE) FROM UTTARAKHAND, WESTERN HIMALAYA, INDIA

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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 hemiparasites (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,
Rediscovery of a rare *Gleadovia ruborum* from Uttarakhand

Kumar et al.

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

*Gleadovia ruborum* Gamble & Prain, J. Asiatic 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. 0.8 cm 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.
near Mussoorie of Tehri Garhwal district, 30.415°N, 78.280°E, 2,450 m, coll. N. Page, A. Kumar, B.S. Adhikari & G.S. Rawat; 22202 (WIII, wet collection of the fruiting specimen along with rootstock of host plant), 08.vii.2020, India, Uttarakhand, Surkanda hill near Mussoorie of Tehri Garhwal district, 30.415°N, 78.280°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 Gleadovia ruborum from India and China (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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Table 1. Distribution range, habitat, host, elevation range, and phenology of Gleadovia species.

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

Species Distribution range Habitat Host Elevation (m) Flowering (fl.) Reference

- *G. ruborum* was recorded in its type locality despite best efforts. 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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Rediscovery of a rare Gleadovia ruborum from Uttarakhand

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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Communications

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— Suman Acharya, Hari Prasad Sharma, Rajeev Bhattarai, Beeju Poudyal, Sonia Sharma & Suraj Upadhyaya, Pp. 18959–18966

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— Suveena Thakur, Sunetet Bahdawj & Amar Paul Singh, Pp. 19137–19143

Descriptions of the early stages of Yogrosa egista sinha (Lepidoptera: Nymphalidae) with notes on its host plant Xylosma longifolium Clos from the western Himalaya of India
— Pranav Gokhale & M.A. Yathumon, Pp. 19144–19148

Notes

First photographic record of Mishmi Takin Budorcas taxicolor taxicolor and Red Goral Nemorhaedus baileyi from Kamlang Tiger Reserve, Arunachal Pradesh, India
— Chechta Singh & Deepit Gupta, Pp. 19149–19152

Utilisation of honey trap method to ensnare a dispersing sub-adult Bengal Tiger Panthera tigris tigris L. in a human dominated landscape
— Gobind Sagar Bhardwaj, Bahai Kari & Arvind Mathur, Pp. 19153–19155

First camera trap photographs of Indian Pangolin Manis crassicaudata (Mammalia: Pholidota: Manidae) from Pakistan
— Misbah Bint Raz, Faraz Akirim, Siddiqua Qasim, Syed Afaq Bukhari, Asad Aslam, Muhammad Waseem, Rizwana Imtiaz & Tariq Mahmood, Pp. 19156–19158

Photographic record of Lesser Flamingo Phoenicopterus minor (Aves: Phoenicopteridae) in Ramganga river, Bareilly, India
— Pichaimuthu Gangaiamaran, Aftab A. Usmani, G.V. Gopi, S.A. Hussain & Khursid A. Khan, Pp. 19159–19161

Total length and head length relationship in Mugger Crocodiles Crocodylus palustris (Reptilia: Crocodylidae) in Iran
— Asghar Mobarekii, Elham Abtin, Malhie Erfani & Colin Stevenson, Pp. 19162–19164

First record of the hoverfly genus Syrphus (Diptera: Syrphidae) for Pakistan
— Muhammad Ashgar Hassan, Imran Bodiah, Riaz Hussain, Azam Karam, Fazlullah & Aziz Ahmad, Pp. 19165–19167

Rediscovery of Watson’s Demon Stimulo awilehae awileheii (Elwes & Edwards, 1897) (Lepidoptera: Hesperiidae: Hesperiinae) from the Gaurishankar Conservation Area, Nepal; its existence confirmed through sign and visual evidence in Rolwaling Valley
— Gobind Sagar Bhardwaj, Bahai Kari & Arvind Mathur, Pp. 19137–19143

A new distribution record of Bradinopyga kankaensis Joshi & Sawant, 2020 (Insecta: Odonata) from Kerala, India
— Pranav Gokhale & M.A. Yathumon, Pp. 19137–19143

A new distribution record of Bionor angulosus (Karsch, 1879) (Araneae: Salticidae) from Kerala, India
— Nishi Babu, John T.D. Caleb & G. Prasad, Pp. 19177–19180

Notes on lectotypification of the Assam Ironwood Meseus assimans (King & Prain) Kosterin. (Calophyllaceae)
— Prantik Sharma Baruah, Sachin Kumar Borthakur & Bhabin Tanti, Pp. 19181–19184

On the rediscovery of a rare root parasite Gleedovia ruborum Gamble & Prain (Orobanchaceae) from Uttarakhand, western Himalaya, India
— Ankit Kumar, Navendu V. Page, Bhupendra S. Adhikari, Manoj V. Nair & Gopal S. Rawat, Pp. 19185–19188

Occurrence of vivipary in Ophiorrhiza rugosa Wall. (Rubiaceae)
— Biruna Bhuyan & Sanjib Baruah, Pp. 19189–19190

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