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**SHORT COMMUNICATION**

# NOTEWORTHY ADDITIONS TO THE FLORA OF UTTARAKHAND, WESTERN HIMALAYA, INDIA

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# Noteworthy additions to the flora of Uttarakhand, western Himalaya, India

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**Abstract:** During recent botanical explorations, we recorded three interesting plant species from the alpine regions (>3500m) of the Uttarakhand State in the western Himalaya. After a detailed scrutiny of the literature and herbarium specimens, we ascertain their identity and report them as additions to the flora of Uttarakhand. In this paper descriptions of these species along with their phenology, distribution, photographs, ecology and phytogeographical notes have been presented.

**Keywords:** *Anemone rupestris*, flora, *Juncus rohtangensis*, new records, *Pedicularis pectinata* var. *roseus*, Uttarakhand.

The Himalaya, one of the important Global Biodiversity Hotspots due to its high diversity and endemism, endowed with an estimated 10,000 plant species, of which 71 genera and ca. 3160 species are endemic (Singh & Hajra 1996; Samant et al. 1998). The diversity of life forms, structure and composition of vegetation have always attracted a large number of naturalists, phyto-geographers, ecologists and several authors, who all have recognized the western Himalaya (Jammu & Kashmir, Himachal Pradesh and Uttarakhand) as an important floristic region of India (Hooker 1907; Chatterjee 1939). The state of Uttarakhand has about 68.4% of its geographic area under forest cover representing ca. 4,700 species of flowering plants (Uniyal et al. 2007), which account for 27% the Indian flowering plants. The state is bestowed with a diverse array of natural vegetation ranging from the sal forests of Tarai-Bhabar to treeless herbaceous meadows in the high alpine region. The mountains rise abruptly, resulting in a diversity of ecosystems that range from subtropical climate to perpetual snow beyond the alpine areas. In the state the alpine zone forms about 24.11% of the geographical area limited by a distinct tree line towards the lower elevation which ranges between 3300-3700 m above sea level. In Uttarakhand, the diversity in habitats and elevational gradients supports various ecosystems and transition zones of bio-geographical units such as the Shivaliks, the Lesser Himalaya, Greater Himalaya and Trans-Himalaya. Owing to its rich diversity of flora and fauna, UNESCO designated Nanda Devi and Valley of Flowers National Parks as World Natural Heritage site (http://whc.unesco.org/en/list/335) in Uttarakhand State. Interestingly, reports of several noteworthy species are still being discovered from this region signifying the need for intensive floristic explorations. This article deals with the three newly reported species from Uttarakhand with their description, ecology and

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phytogeography.

## Material and Methods

Several floristic surveys were conducted in the alpine regions of the Uttarakhand State. Photographs of plants were taken and specimens were collected and deposited in the herbarium of Wildlife Institute of India (WII), Dehradun. Upon detailed scrutiny of the literature and regional floras (Hooker & Thomson 1855; Hooker 1982–87; Karthikeyan et al. 1989; Press et al. 2000; Uniyal et al. 2007), taxonomic notes and herbaria (BSD, DD and WII) and virtual herbaria (K and MNHN), we recognized three species, viz., *Anemone rupestris* (Ranunculaceae), *Juncus rohtangensis* (Juncaceae) and *Pedicularis pectinata* var. *roseus* (Scrophulariaceae) as additions to the flora of Uttarakhand (Image 1). An earlier report of occurrence was from Kashmir for *A. rupestris* (Hooker 1872), from Rohtang pass for *J. rohtangensis* (Goel & Aswal 1987) and *P. pectinata* var. *roseus* (Agnihotri & Hussain 2008) in the western Himalaya. In this article, we present a brief description of each of the recorded species along with a photo-plate for easy identification, their distribution, ecology and phytogeography in the Indian Himalayan region.

### Description of the plants

***Anemone rupestris* Wall. ex Hook.f. & Thomson**

Flora Indica, 21. 1855.

Type: India, Sikkim, Gosain Than. 1831, Wallich 4696, (K) (Image 2)

Herbs, perennial with slender fibrous rootstock covered by a sheath of old leaf bases. Radical leaves 4–7; petiole 3–10 cm long, puberulent; leaf blade broadly ovate, 1–5×1–6 cm, 3-partite, 3-sect or 3-foliolate, sparsely hairy on both surfaces, base subcordate; central segment petiolulate, 3-sect or 3-parted, broadly rhombic; secondary segments shortly petiolulate, ultimate lobules narrowly ovate or linear-lanceolate. Scapes 2–6, 3–20 cm, puberulent. Involucral bract in 3 whorls, undivided, ovate-oblong, cuneate-obovate, 1–3 cm. Flowers solitary; pedicel 1–6 cm, puberulent or glabrous. Sepals 5 or 6, white, blue or purplish,lower surface white or purplish or rarely reddish, oblong-elliptic or obovate, 5–10×3–6 mm, sparsely puberulent

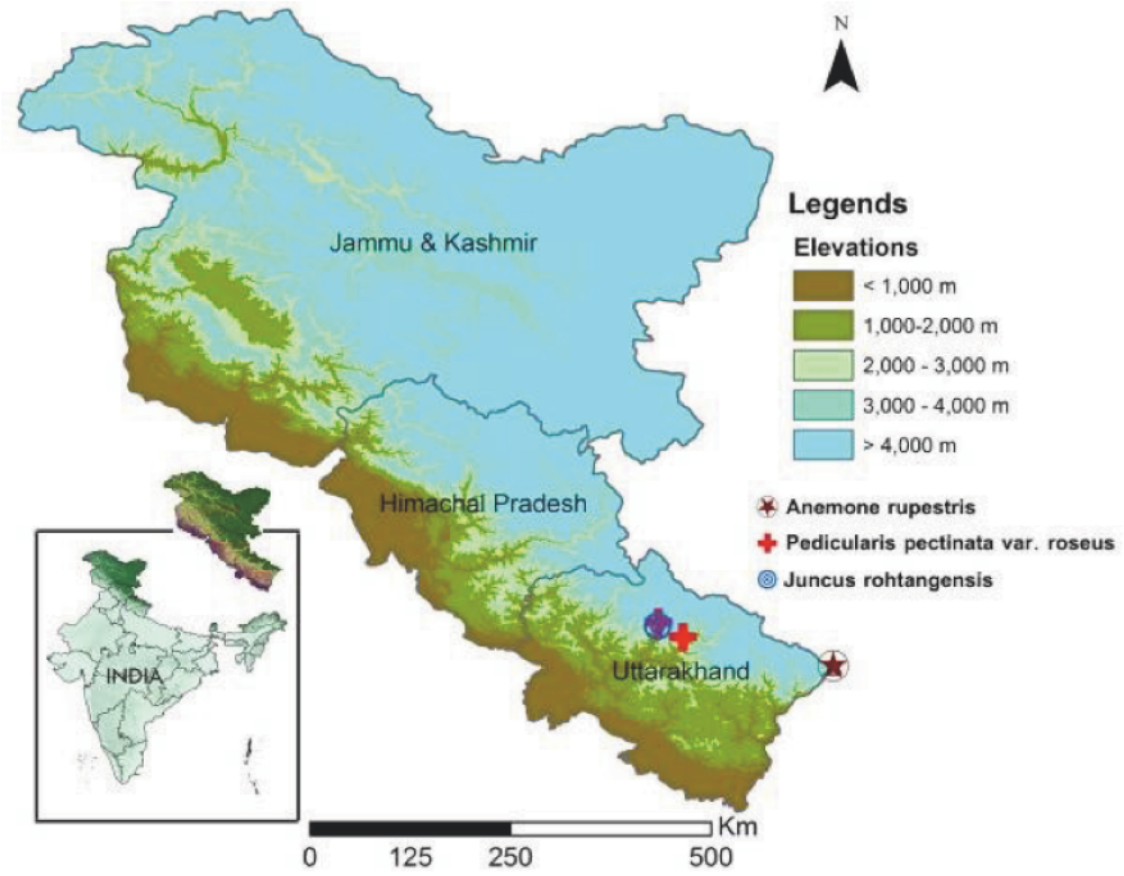


**Image 1. Map of the western Himalaya showing the occurrence and locations of the three species in the state of Uttarakhand**


Image 2. *Anemone rupestris* Wall. ex Hook.f. & Thomson


Image 3. *Pedicularis pectinata* var. *roseus* Agnihotri & T. Husain

or glabrous. Stamens brown, 3.5–4.3 mm; anther light bluish to yellow, cylindric; connective dark, narrow. Pistils dark, 2.8–3.3 mm, puberulent; style down-curved. Achene broadly ellipsoid, compressed, 2.5–4×1.6–2 mm.

Flowering and fruiting: May–September.

Distribution: India (Jammu & Kashmir, Uttarakhand (present record), Sikkim, Assam, Arunachal Pradesh), Bhutan, Nepal, China (Tibet).

Specimen examined: GSR & GS 14042 (WII), 04.vi.2004, 30°14'21.41"N & 80°58'18.74"E, 4200m, Nabhidhang, Pithoragarh District, Uttarakhand (Image 5).

Ecology and phytogeography: Species grows on dry valleys of alpine region in the eastern Kumaon close to Nepal and Tibet (China) boundary. The area is a transition zone in between the greater and trans-Himalayan floral elements. The habitat is broken rocky slopes with gravel and glacial moraines. Low rainfall (<100 mm/year) with prevalent snowfall in winter months is a peculiar climatic feature of the area. The species covers the entire arc of the Himalaya from Kashmir to Arunachal Pradesh and adjacent areas in Nepal, Bhutan and China.

***Pedicularis pectinata* var. *roseus* Agnihotri & T. Husain**

Phytotaxonomy 13. 2008.

Type: India, Himachal Pradesh, Kullu District, 20km before Rohtang pass, on the way from Manali to Rohtang, 3353m, 04 August 2008, T. Hussain & Party 250080A (LWG) (Image 3)

Perennial robust herbs, 15–80 cm tall; rootstock woody; stem erect or slightly decumbent, unbranched, cylindrical, glabrous. Leaves both radical and cauline; radical leaves long petioled; petiole 9–21 cm, glabrous; lamina 3–15×1–5 cm, pinnatipartite, unipinnate-dentate or bipinnate-dentate; cauline leaves in 1–5 whorls or pairs, petioled; petiole 1–6 cm; glabrous; lamina 3-15×1-5 cm broad, pinnatipartite, unipinnate-dentate or bipinnate-dentate; pinnae 17–20, linear-lanceolate, 0.2–1×1.5–5 cm, margin serrate-dentate, apex acuminate, venation reticulate; rachis prominent on ventral surface, winged. Inflorescence in terminal spikes, 2–20 fascicles, rachis densely hairy. Flowers bracteolate; bracts 1.2–1.5×0.6–0.7 cm, broadly lanceolate to lanceolate with acuminate tip, sessile, longer than calyx, densely hairy, margin entire at lower half while finely serrate at upper half with acuminate apex, pedicellate; pedicel 1–2 mm long. Calyx urceolate tubular, papery transparent, 10×4–6 mm, densely hairy at fine nerves, 10 prominent nerves, 5-lobed; posterior lobe linear acuminate entire, the lateral lobes linear, lanceolate or oblong lanceolate, with pointed acuminate tip. Corolla dark purple, throat of labium white; tube 12mm long, deflexed at the middle, almost equal in length to the calyx; galea robust with long incurved beak, swollen and split at anther bearing part, erect part 4mm long, anther bearing part 3mm long, then sharply bent tapering into a beak and slender up to the tip; beak truncate, 10mm long, apex emarginated, stigma protruding; labium 3-lobed, spreading up to 17×12 mm across, mid-lobe slightly projecting and half narrower than lateral ones, lateral lobes wide, reniform. Stamens inserted at the top of ovary; filaments up to 17mm long; anthers 2.5–1.5 mm, linear oblong, split; all the filaments densely hairy above and at the point of insertion; filaments densely hairy to glabrous at the neck; one pair densely woolly at the neck, while another pair completely glabrous at the neck. Style up to 35mm long, glabrous; stigma globose; ovary ovate-lanceolate, 3×1 mm.

Flowering and fruiting: August–September.

Distribution: India (Himachal Pradesh, Kullu District;

Uttarakhand, Rudraprayag and Chamoli districts (present records)). Endemic to the western Himalaya.

Specimen examined: IDR 11493 (WII), 07.viii.2014, 30°41'42.75"N & 79°9'11.09"E, 3820m, Mandani Valley, Kedarnath Wildlife Sanctuary, Rudraprayag District, Uttarakhand (Image 6).

Ecology and phytogeography: The species was growing on moist mixed herbaceous meadows on the north-west facing slope in the alpine region (Mandani Valley). The associated species were *Potentilla argyrophylla, P. atrosanguinea, Geranium collinum, Bistorta macrophylla, Trachydium roylei, Geum elatum, Trollius acaulis, Phlomis bracteata* and tussocks of *Danthonia cachemyriana* and *Kobresia nepalensis* in between. The type locality is situated aerially 300km north-west and 2° higher in north latitude as compared to current locality in the similar habitat and climatic conditions. The area receives more than 1500mm rainfall annually with heavy snowfall during the winter months.

***Juncus rohtangensis* Goel & Aswal**

Indian Journal of Forestry, 262. 1987.

Type: India, Himachal Pradesh, Lahaul-Spiti District, Rohtang Pass, 4000m, 27 July 1970, B.S. Aswal 10554 (CDRI) (Image 4)

Perennials, 1–28 cm tall, caespitose; rhizome thin, c. 1.5 mm in diam.; stoloniferous or short creeping. Stem erect, terete, 0.3–0.8 mm in diam. Cataphylls 1–2, pale brown, not shining. Basal and sub-basal leaf usually 1, rarely 2, unitubular, septate, terete, 0.8–9.0 cm long, 0.4–0.75 mm wide, grass-green; sheaths 2–10 mm long, brown. Leaves on sterile shoots 1–18 cm long, 0.25–0.70 mm wide; sheaths 2–10 mm long; auricles obtuse, to 1 mm long, brownish to membranous. Lower bract 0.4–2.8 cm long, 0.4–0.8 mm wide, grass-green. Inflorescence a single sessile pseudolateral head; flowers 1–3; capitulum bracts 2, longer than flowers; sheath-like bract absent. Flowers 0.3–1.4 cm long, 1.2–2.5 mm wide; pedicels to 0.6–2.5 mm long. Tepals ±equal, ovate-lanceolate, ca. 3.5–6.5 mm long, 0.5–1.2 mm wide, acute, castaneous-brown. Stamens 6, shorter than perianth, 1.0–3.1 mm long; anthers longer than filaments, linear-ellipsoid, cream-yellow, 0.8–2.6 mm long; filaments 0.2–0.5 mm long. Style 0.8–4.0 mm long; stigmas 0.9–4.0 mm long, red. Capsule unilocular, ovoid-trigonous, acuminate, 2.0–4.5 mm long, 0.4–2.0 mm wide. Seeds ellipsoid, apiculate, 0.5–0.8 mm long, 0.2–0.4 mm wide, brown; appendages minute or absent. (http://e-monocot.org)

Flowering and fruiting: August–September.

Distribution: India (Uttarakhand, Rudraprayag District (present record); Himachal Pradesh, Lahaul-Spiti District; Sikkim, Chakung Chu), Nepal, Bhutan, China (Tibet).


**Image 4. *Juncus rohtangensis* Goel & Aswal**

Specimen examined: IDR 11492 (WII), 07.viii.2014, 30°39'14.38"N & 79°8'28.39"E, 4200m, Dwarakhal (Mandani Valley), Kedarnath Wildlife Sanctuary, Rudraprayag District, Uttarakhand (Image 7).

Ecology and phytogeography: The species was found in the moist north-facing shady grassy slopes near Dwarakhal in the Kedarnath Wildlife Sanctuary. The species was growing in association with *Bistorta affinis, Sibbaldia cuneata, Koenigia nummularifolia, Kobresia nepalensis, Trigonotis rotundifolia, Oxygraphis polypetala* and *Helerpestris tricuspis.* In surrounding areas large populations of *Saussurea obvallata* and *Rheum moorcroftianum* also dominated. The distribution of the species is from Himachal Pradesh to Sikkim and adjacent parts of Nepal, Bhutan and China (Tibet) which shows a wide range of adaptability to climate and habitats.

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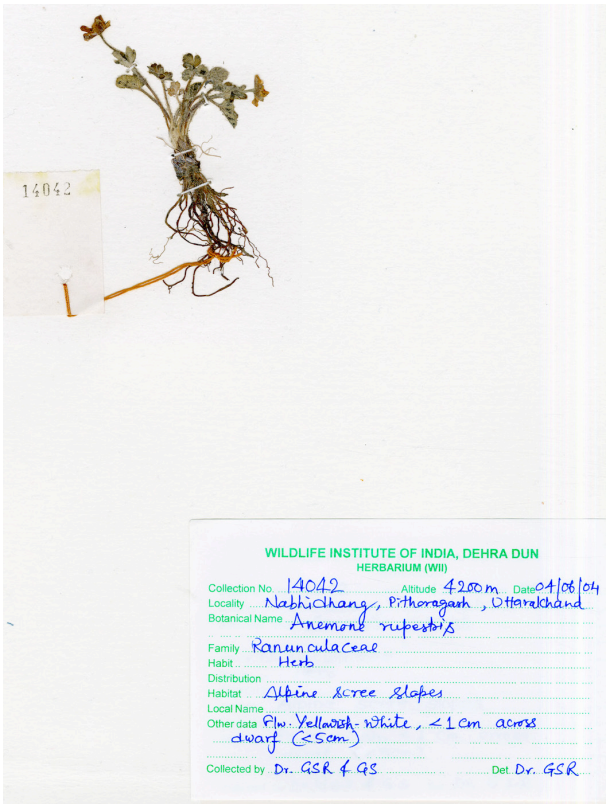


**Image 5. Herbarium details of *Anemone rupestris***

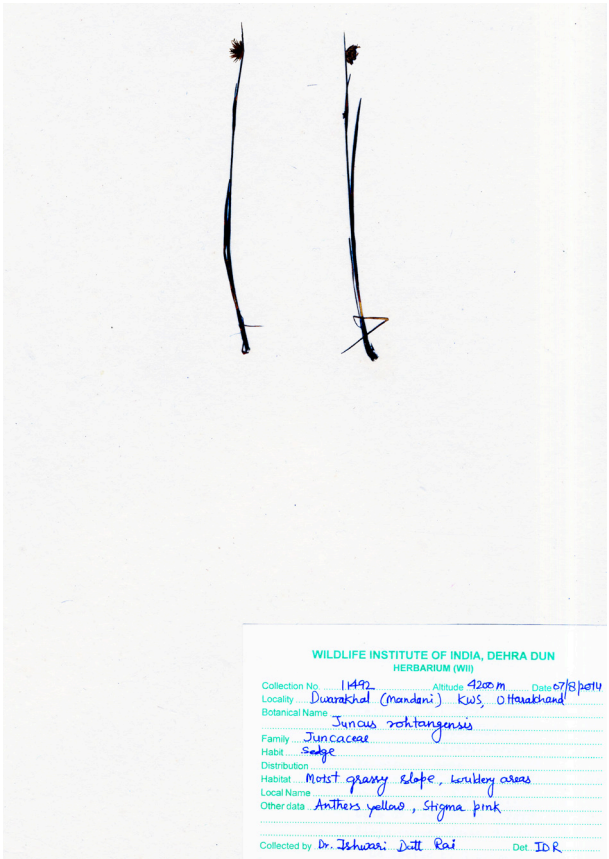


**Image 7. Herbarium details of *Juncus rohtangensis***


**Image 6. Herbarium details of *Pedicularis pectinata var roseus***

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