New floral distribution records of *Aquilegia nivalis* (Baker) Falc. ex B.D. Jacks and *Doronicum falconeri* C.B. Clarke ex Hook. f. from the Valley of Flowers National Park, Uttarakhand, India

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The Valley of Flowers National Park (VoFNP) is a world heritage site and second core zone of the Nanda Devi Biosphere Reserve (NDBR) located in Uttarakhand. The credit for the discovery of the Valley of Flowers and its global popularity goes to the British mountaineers Frank S. Smythe and R.L. Holdsworth who incidentally reached this valley after a successful expedition to Mount Kamet in 1931 (Kandari & Gusain 2001). Fascinated by its floral beauty and grandeur Smythe revisited the valley and published a book named "The Valley of Flowers" in 1938 narrating floral beauty and his mountaineering experiences in this then unknown Himalayan valley.

The Valley of Flowers lies between at 31^{0}41–31^{0}48'N and 79^{0}33'–79^{0}46'E in the upper catchment area of Alaknanda River which is a major tributary of the Ganges drainage system. A small snow fed stream, Pushpawati, which has its source in the Tipra Glacier, flows through this valley. It is almost a flat valley of about 5km length and 2km width with an altitudinal range varying from 3200 to 6675 m. The valley is surrounded by Gauri Parbat (6590m) and Rataban (6126m) in the east, Kunth Khal (4430m) in the west, Saptshring (5013m) in the south and Nilgiri Parvat (6479m) in the north. The Valley of Flowers is approached through an arduous trek of about 16km from the last motorable place Govindghat, which is 25km away from Joshimath town en route to Badrinath. From Govindghat one has to trek 13km to reach Ghangaria the base camp, and from Ghangaria the valley is situated at a distance of 3km (Kala et al. 1998; Rana et al. 2011).

For the last two decades we have been trying to search for populations of rare alpine endemics in Garhwal Himalaya and have already succeeded in the rediscovery of *Arenaria curvifolia* Majumdar (Caryophyllaceae), *Dicranostigma lactucoides* Hook.f. et Thoms. (Papaveraceae), *Gentiana infelix* C.B. Clarke, and *G. tetrasepala* Biswas (Gentianaceae) after a gap of more than a century (Rawat & Gaur 1996; Rawat & Rana 2007; Rawat 2009; Rawat et al. 2009; Rana et al. 2011).

During one of our recent botanical explorations in the Valley of Flowers National Park (Image 1), we noticed and collected a few interesting specimens of two alpine herbs belonging to Ranunculaceae and Asteraceae. On going through literature and herbarium studies, they were confirmed as *Aquilegia nivalis* (Baker) Falc. ex B.D. Jacks (Ranunculaceae) and *Doronicum falconeri* C.B. Clarke ex Hook.f. (Asteraceae). A perusal of literature indicated that both are rare species and are distributed from Pakistan to Himachal Pradesh (Polunin & Stainton 1984). Both are new records for the Valley of Flowers National Park (Kala et al. 1998) as well as additions to the Flora of Chamoli District (Naithani 1984). Though, these species were earlier known to occur in Uttarakhand

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Image 1. A view in Valley of Flowers National Park showing collection area

Image 2. *Aquilegia nivalis*

(Uniyal et al. 2007) they are meagerly represented in the herbaria indicating rare occurrence in this part of the Himalaya. *Aquilegia nivalis* is an endangered species as mentioned by Rao et al. (2003). Considering the rarity of records, photographs of the collection area and these two species are being given here for easy identification and subsequent monitoring. The voucher specimens were deposited and are being maintained at G.B. Pant University Herbarium Pantnagar (GBPUH) and H.N.B. Garhwal University Herbarium, Srinagar Garhwal, Uttarakhand (GUH).

Aquilegia nivalis (Baker) Falc. ex B.D.Jacks. in Index Kew. 1:167. 1893; Munz in Gentes Herb. 7:24. 1946. *A. glauca* Lindl. var. *nivalis* Baker in Gar. Chron. 2(10): 76. 1878. *A. vulgaris* L. var. *jucunda* Hook.f. & Thomson in Fl. Brit. India 1:24.1872. Rau, Flora India 1:43. 1993. (Image 2)

Specimen examined: 07.vii.2010, Kunth Khal, Garhwal Himalaya, India, coll. C.S. Rana, 19577 (GUH) (Image 3).

Perennial herbs up to 25cm high; stems simple, scapose, short, leafless or one-leaved. Radical leaves few, long-petioled, 2-ternate; leaflets sessile, with broad blunt teeth; cauline leaves - one or two or absent, similar to radical leaves. Flowers solitary, terminal, drooping, 3.5–5.5 cm across, dark purple. Sepals five, petaloid-purple, broadly ovate-orbicular, spreading. Petals, erect, funnel-shaped, spur much bent inwards, stamens numerous, inner ones reduced to scales. Carpels five or more, apocarpous. Fruit an etaerio of five follicles.

Flowering & Fruiting: June–July.

Distribution: India: Northwestern Himalaya (above 3000m), Jammu & Kashmir, Himachal Pradesh, Uttarakhand; Pakistan.

Ecology: Rare, in shady places at 3800–4000 m; Kunth Khal of Valley of Flowers, a small population of 07-17 plants was observed in the area.

Aquilegia nivalis is a rarely distributed species in the Himalaya. It differs from commonly found species *A. pubiflora* in having all basal leaves, bigger and dark coloured flower and distribution at comparatively higher elevation.

Doronicum falconeri C.B. Clarke ex Hook.f., Fl. Brit. India 3: 333. 1881; Mathur, Flora India 13: 203. 1995; Karthikeyan et al., Fl. Plants India 1: 225. 2009.

Specimen examined: 07.vii.2010, Kunth Khal, Garhwal Himalaya, India, coll. C.S. Rana, 19586 (GUH) (Image 4).

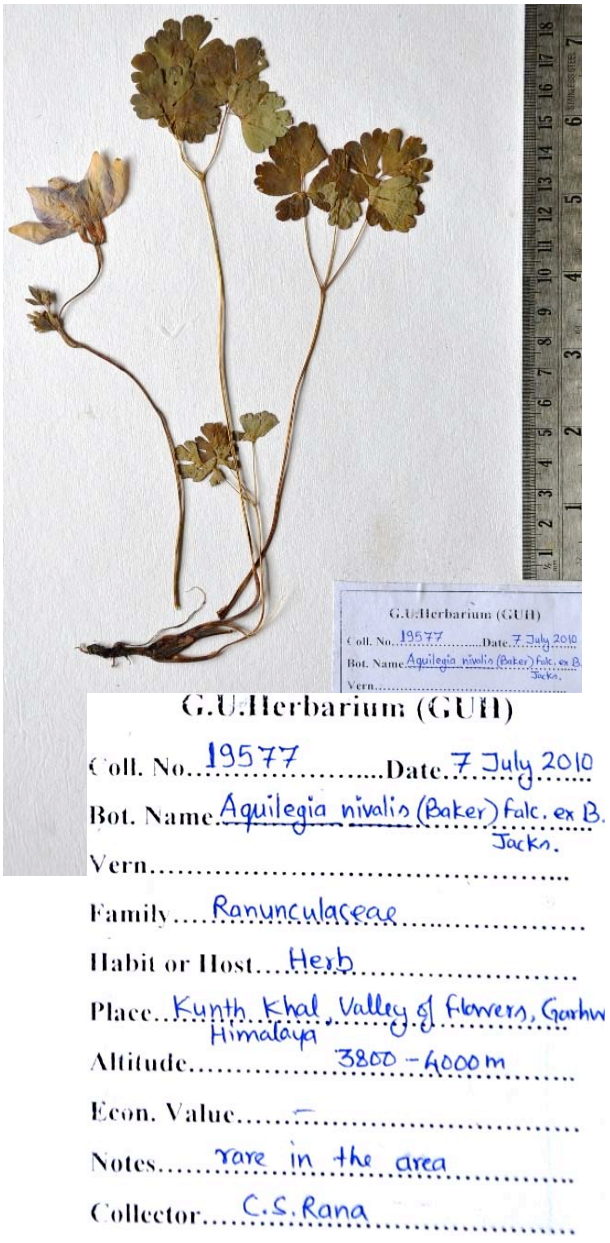

Image 3. Herbarium of *Aquilegia nivalis*

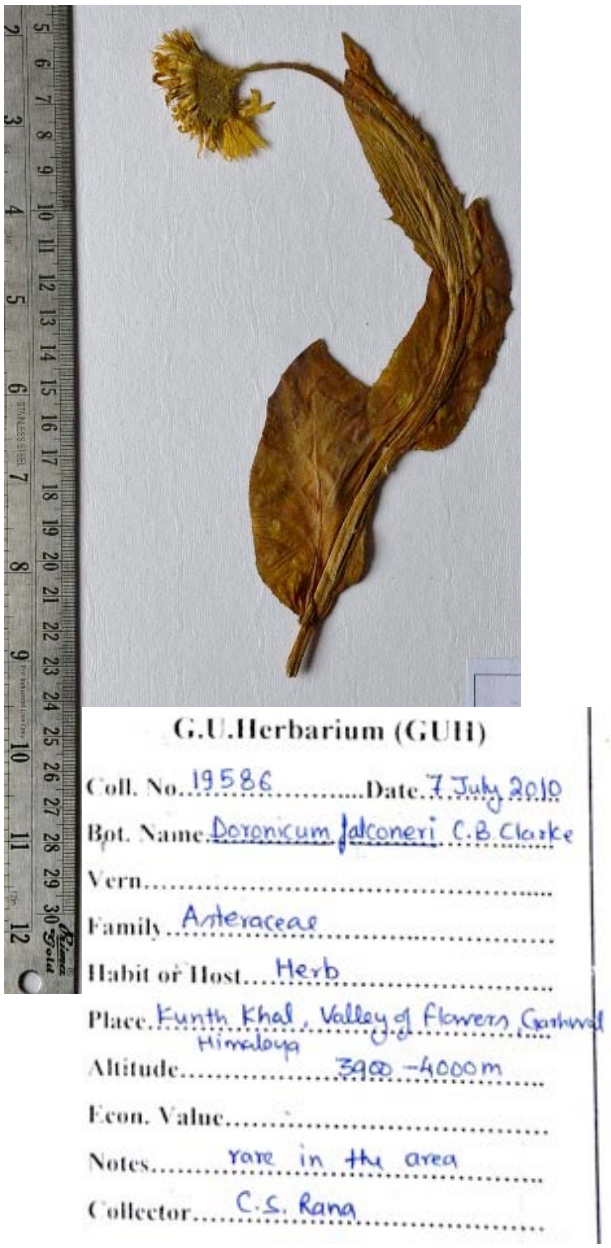

Image 4. Herbarium of *Doronicum falconeri*

Stout perennial erect herbs, up to 30cm high, puberulous. Stems simple, erect, ribbed. Leaves obovate to spathulate, acute, irregularly serrate, 2.5–8 x 2–4 cm, puberulous on upper surface, glabrescent on the lower surface; upper most cauline leaves lanceolate, serrate, sessile, amplexicaul; middle cauline leaves spathulate; basal leaves with 2–8 cm long petiole; Heads 3–5 cm across, radiate, solitary, pubescent. Involucral bracts lanceolate, 10–12 mm long, acute, serrate. Ray florets yellow, ca. 25mm long; ligule oblong, 20–22 mm long, 3–5 veined, tridentate; corolla tube 4–5 mm long, hairy outside. Disc florets 5–6 mm long; corolla limb 2–3 mm long, 5-lobed; lobes triangular-ovate, ca. 1mm long. Achenes broadly oblong, 1.5–2 mm long, ribbed, white pubescent on the ribs. Pappus of reddish-brown, scabrid deciduous hairs, 4.5–5 mm long; scanty, absent in ray achenes.

Flowering & Fruiting: June–July.

Distribution: India: Western Himalaya (between 4000–4500 m), Jammu & Kashmir, Himachal Pradesh, Uttarakhand; Pakistan.

Ecology: Rare, a small population of 9–12 individuals was observed in a small area on moist slope at 3900–4000 m, Kunth Khal of Valley of Flowers

National Park.

The presence of *A. nivalis* and *D. falconeri* in the Valley of Flowers National Park on the one hand shows richness of flora, and on the other hand indicates better chances of survival of these rare species in the area where anthropogenic stresses are at a minimum. However, since the population sizes are very small, a close watch on the fate of these species is needed in future.

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