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## NOTE

### NEW DISTRIBUTION RECORDS OF THE LEOPARD PLANTS *LIGULARIA AMPLEXICAULIS* DC. AND *LIGULARIA SIBIRICA* (L.) CASS. (ASTERACEAE) IN THE INDIAN HIMALAYA

Bikarma Singh, Sumit Singh & Bishander Singh

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**NEW DISTRIBUTION RECORDS OF THE LEOPARD PLANTS *LIGULARIA AMPLEXICAULIS* DC. AND *LIGULARIA SIBIRICA* (L.) CASS. (ASTERACEAE) IN THE INDIAN HIMALAYA**

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Asteraceae (Compositae) is a large family in the order Asterales, consisting of about 32,913 species belonging to 1,911 genera distributed worldwide (TPL 2013) and 999 species under 193 genera reported from India (Karthikeyan et al. 2009). According to Mabberley (2008), the genus *Ligularia* Cass. (Tribe: Senecioneae) is represented by 125 species in temperate Eurasia (China mostly). Generally well-known as a rhizomatous perennial herb, this genus has great medicinal value because of the presence of eremophilane sesquiterpenoids, which has cytotoxic properties (Xie et al. 2010). Most of the species under this genus are reported to have antibiotic, antiphlogistic, and antitumor properties, and have been used as folk medicine to treat asthma, bronchitis, hemoptysis, and tuberculosis (Wu et al. 2016).

In India, 18 species, one subspecies, and three varieties (Karthikeyan et al. 2009) are currently recognized under the genus *Ligularia*. These taxa are distinguished by several morphological characteristics such as rootlet shape, leaf shape, inflorescence type, capitula type, ray floret, pappus, and achene size (Nordenstam & Illarionova 2005; Flora of China Editorial Committee 2011).

During extensive field surveys for biodiversity inventory in Jammu & Kashmir State located in the northern-most part of Indian Himalaya, the author collected and came across specimens of two interesting perennial taxa that were characterized by having

aromatic roots, irregularly toothed orbicular to cordate leaves, radiate capitula, and pale brown achene with hairy pappus. After examining the various flora, comparing drawing/illustration (<http://www.plantillustrations.org>) and vouchers housed in various herbaria (RRLH - Regional Research Laboratory Herbarium, Jammu; DD - Herbarium of the Forest Research Institute, Dehradun; JU - Herbarium of Jammu University, Jammu; CAL - Central National Herbarium, Howrah), and consulting relevant published literature (Hooker 1875, Sharma & Kachroo 1981–1983, Dhar & Kachroo 1983, Kachroo et al. 1997), the specimens were identified as *Ligularia amplexicaulis* DC. and *L. sibirica* (L.) Cass. The studies also include the critical examination of the habit, habitat, community structure, vegetation composition, associated allied taxa, dissection of flower parts, and taxonomic key of

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both the species. Scrutiny of the literature reveals that *L. sibirica* and *L. amplexicaulis* have not been reported from Bandipora District of the Kashmir Himalaya.

*Ligularia amplexicaulis* described is a new record for the district of Bandipora of the Kashmir Himalaya. This species was previously recorded between the altitudinal range of 2,700m and 4,800m from Himachal Pradesh, West Bengal and Sikkim in India. *Ligularia sibirica* is reported in this study for the first time from the Kashmir Himalaya; this extends its recorded distribution in and around the southeastern Asian regions. The specimens from Bandipora extend the known *L. amplexicaulis* distribution from Paddar Valley of district Kishtwar to the extreme northern range of the western Himalaya and the specimens from Lidder Valley represent the first record of *L. sibirica* from the Kashmir Himalaya and extend its distribution range from Europe, Russia, and China to northern India.

The study area is located in the northern-most part of the Indian Himalaya along the upper reaches of the Kishanganga River, where temperate coniferous

forests represent the most common landscape (Fig. 1). Meher-Homji (1971) classified the climate of the Kashmir Himalaya as Mediterranean type. The mean temperature in summer of the study area ranges from 14°C to 25°C and fluctuates in winter from minus -20°C to 6°C. The average annual temperature recorded was 13°C and the average annual rainfall was 650mm. January is the coldest month with the temperature much below the freezing point and maximum humidity, which ranged between 85% and 90%.

Plant materials were collected in August 2015 from the hilltop of the Bandipora District around the Razdhan Pass (34.553°N & 74.641°E, elevation 3,492m). Techniques for collecting plants included square quadrat method of sampling herbs by 1x1 m size. The specimens were collected and processed as per herbarium techniques (Jain & Rao 1977).

The present communication deals with the taxonomic description, phenology, habitat and ecology, associated vegetation composition, distribution, and species discovery history of *L. sibirica* and *L. amplexicaulis*. The

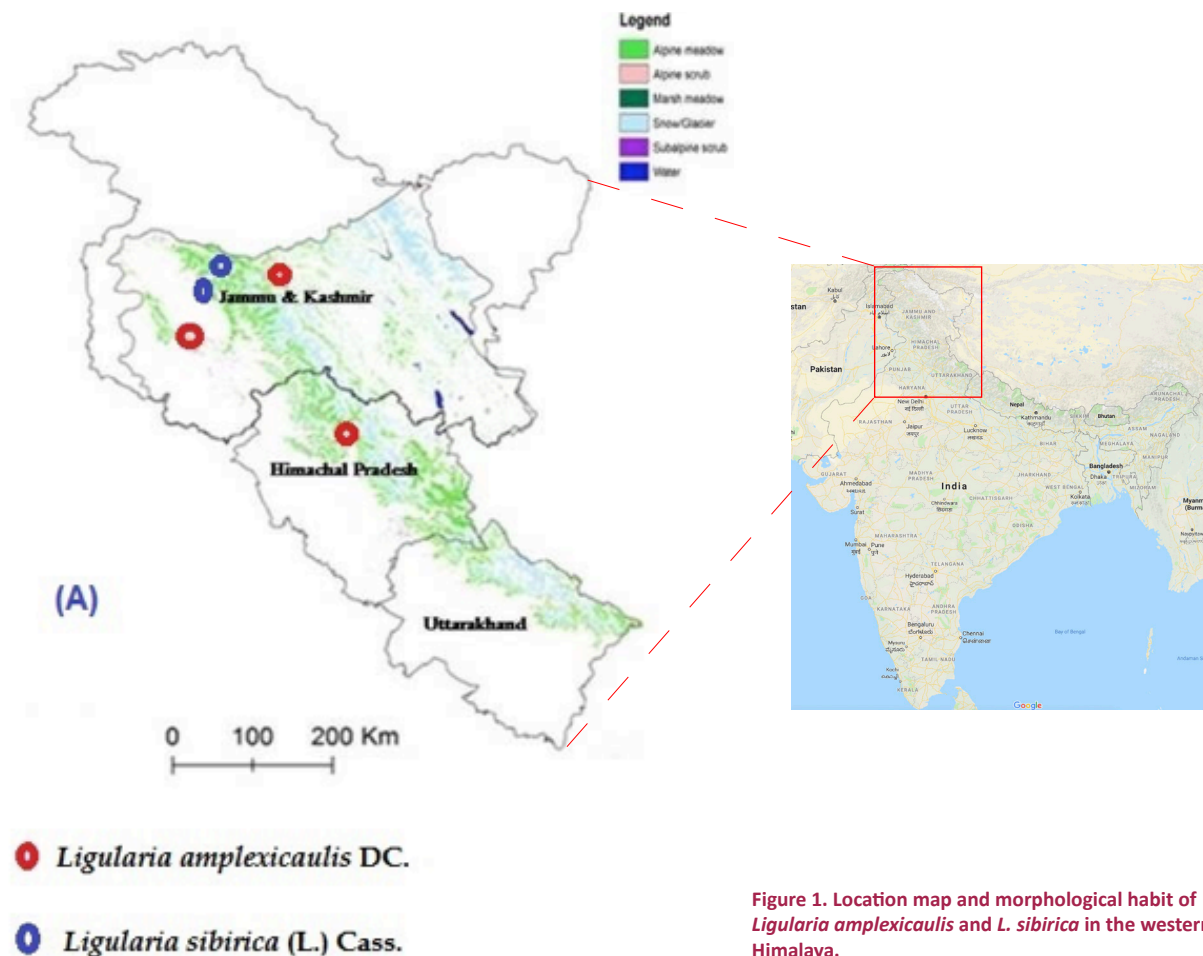


Figure 1. Location map and morphological habit of *Ligularia amplexicaulis* and *L. sibirica* in the western Himalaya.

identified and authenticated materials were deposited at the Council of Scientific and Industrial Research, Janaki Ammal Herbarium (RRLH), CSIR-IIIM, Jammu (J&K State).

#### Enumeration

1. *Ligularia amplexicaulis* DC., Prodr. 6: 314. 1838 (1837); R. Mathur in Hajra et al., Fl. India 13: 229. 1995; Grierson & Spring. in Grierson & D.G. Long, Fl. Bhutan (Ed. Spring.) 2 (3): 1574. 2001; Karthik. et al., Flow. Pl. India Dicot. 1: 248. 2009. *Senecio amplexicaulis* (DC.) C.B. Clarke, Compos. Ind.: 204. 1876 non Kunth, 1820; Hook.f., Fl. Brit. India 3: 348. 1881. *Senecio yakla* C.B. Clarke, Compos. Ind.: 204. 1876; W.W. Sm., Rec. Bot. Surv. India 4 (7): 384. 1913.

Perennial herbs, robust, 30–70 cm tall; stems slightly erect, 2–5 m in diameter depending on habit, young ones light green, old dark brown, slightly grooved, glabrous at base, slightly pubescent near flowering inflorescence;

rootstocks fibrous; fresh rhizomes aromatic. Leaves orbicular to reniform, 8–15x7–12 cm, base cordate, margins irregularly toothed, apex acute, glabrous on both the sides; sinus 1/3–1/4 or as long as leaf blades; veins raised, prominent, reticulate; petioles 8–20 cm long, slightly pubescent and interruptedly winged. Bracts leaf-like, ovate-lanceolate, 5–6x2–3 mm, margins entire, rarely dentate, connate below. Inflorescences radiate, corymbose, 3–8x0.6–1.7 cm; involucre campanulate, distantly pubescent; phyllaries 6–10 in rows, lanceolate, 5–7 mm long. Ray florets linear, 1–1.5 cm long; rays oblanceolate, 4–6 mm long, apex obtuse; tubes 4–8 mm long. Disc florets numerous, 4–7 mm long; limb 1–3 mm long, 5-lobed; tube 3–4 mm long. Achenes slightly pale brown, oblong, minute, 1–2 mm long, slightly ribbed. Pappus pale brown, 5–6 mm long, pubescent.

Phenology: The plant flowers between July and October. Fruiting starts in September and matured fruits can be seen till the end of October in Kashmir, Ladakh,



Image 1. Herbarium voucher and wild habit of *L. amplexicaulis*

and Himachal Pradesh.

**Habitat and ecology:** The plant prefers temperate meadows and rocky ledges. It grows well in open areas or sometimes along mountain slopes on forest margins at altitudes between 1,200m and 2,000m. Usually, flowers are hermaphrodite and insects are the main pollinators. Soils are characterized as sandy and loamy and plants prefer moist soil environment.

**Associated taxa:** Species of the genus *Ranunculus* L., *Fragaria* L., *Potentilla* L., *Nepeta* L., and *Caltha* L. and some subtropical and temperate grasses such as *Carex* L. and *Eragrostis* Wolf. were found growing along with *L. amplexicaulis* in the study area.

**Distribution:** Bhutan and India (Paddar Valley, Kishtwar and Razdhan Pass in Jammu & Kashmir, Uttar Pradesh, Sikkim, and West Bengal).

**Specimen examined:** 53138 (RRLH!), 26.viii.2015, India, western Himalaya, Jammu & Kashmir State, Bandipora District, Razdhan Pass, 34.553°N & 74.641°E, 3,492m, coll. B. Singh (Image 1).

**Economic importance:** Leaves are used as fodder for goats and sheep. Stems, leaves, and flowers are used in the Tibetan system of medicine to treat vomiting caused by indigestion.

**2. *Ligularia sibirica* (L.) Cass.** in F. Cuvier's Dict. Sci. Nat. Ed. 2.26: 402. 1823; M.A. Rau, High Alt. Fl. Pl. W. Himal.: 134. 1975; Karthik. et al., Flow. Pl. India Dicot. 1: 250. 2009. *Othonna sibirica* L., Sp. Pl. 2: 924. 1753. *Cineraria sibirica* (L.) L., Sp. Pl. Ed.2.: 1242. 1763. *Senecio ligularia* Hook.f., Fl. Brit. India 3: 349. 1881. *Ligularia fischeri sensu* R. Mathur in Hajra et al., Fl. India 13: 230. 1995, p.p. non (Ledeb.) Turcz. 1838.

Perennial herbs, 50–150 cm tall; stems erect, 3–8 mm in diameter at base, glabrous, yellowish brown, pubescent; rootstocks fibrous; rhizomes aromatic with minute root hairs. Leaves basal; petioles 14–39 cm long, glabrous, base sheathed; leaf blades ovate-cordate or broadly cordate, 3.5–32x4.5–29 cm, base cordate, margins regularly dentate, apex rounded or obtuse, glabrous; veins raised, prominent; sinus 1/3–1/4 as



Image 2. Wild habit and herbarium voucher of *L. sibirica*

long as leaf blade, basal lobes sub-orbicular; petioles of cauline leaves slightly pubescent when young, 3–14 cm long; sheaths enlarged, 3–6 cm long. Bracts leaf-like, ovate-lanceolate, 2–3x1–2 mm broad, margins entire or denticulate, herbaceous. Inflorescence racemose, 10–30 cm long; involucre purplish red, broadly campanulate or campanulate-turbinate, 0.7–1x0.6–1 cm, base rounded; phyllaries 7–12, in two rows, lanceolate or oblong, 0.7–1 cm long, margins membranous, apex acute. Ray florets numerous, usually 5–9, yellow; lamina oblanceolate or oblong, 1–2.2x0.3–0.5 cm, apex obtuse; tube 5–8 mm in diameter. Disc florets numerous, 0.6–1.2 cm long; tubes 4–5 mm in diameter. Achenes brown, cylindric, 4–6x2–3 mm. Pappus yellow, 4–8 mm long, pubescent.

**Phenology:** The flowering starts in May and can be seen till the first week of September. Fruits start appearing in the middle of September, usually maturing in October. Dried fruits attached with inflorescence can be noticed till November in temperate belts of the Himalaya.

**Habitat and ecology:** The plant prefers marshy habitat. It grows well in sparse temperate forests or along slope side of forest margins at altitudes of 1800–3500 m. Single inflorescence arise at the tip of the plant and all flowers are usually hermaphrodite, i.e., both male and female organs are present on each flower. As observed in the field, insects are the main pollinators. Soils are characterized as sandy to loamy and the plant prefers moist soil environment.

**Associated taxa:** Species of the genus *Iris* L., *Ranunculus* L., *Aconitum* L., *Nepeta* L., *Primula* L., *Caltha* L., and some temperate grasses were found to be growing in the meadows along with *L. sibirica* in the western Himalaya.

**Distribution:** China, Tibet Province, Europe, India (Aru in Jammu & Kashmir State), Mongolia, Russia, and Siberia.

**Specimen examined:** 16241 (RRLH!), 29.vii.1977, India, western Himalaya, Jammu & Kashmir State, District Ladakh, Aru Valley, 34.554°N & 74.641°E, 2,400m, coll. B.M. Sharma. (Image 2)

## Conclusion

The detailed field survey and morphological observations of Asteraceae and their taxa, comparison and matching with herbarium vouchers kept at RRLH, DD, JU & CAL, and consultation of literature proved that the recently collected species of *Ligularia* from the western Himalaya represent the centre of origin of the genus from the Himalaya. The study also provided new distribution records of *L. sibirica* and *L. amplexicaulis* for India and an extension of the distribution records of other globally known *Ligularia* species in the Indian Himalayan regions.

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