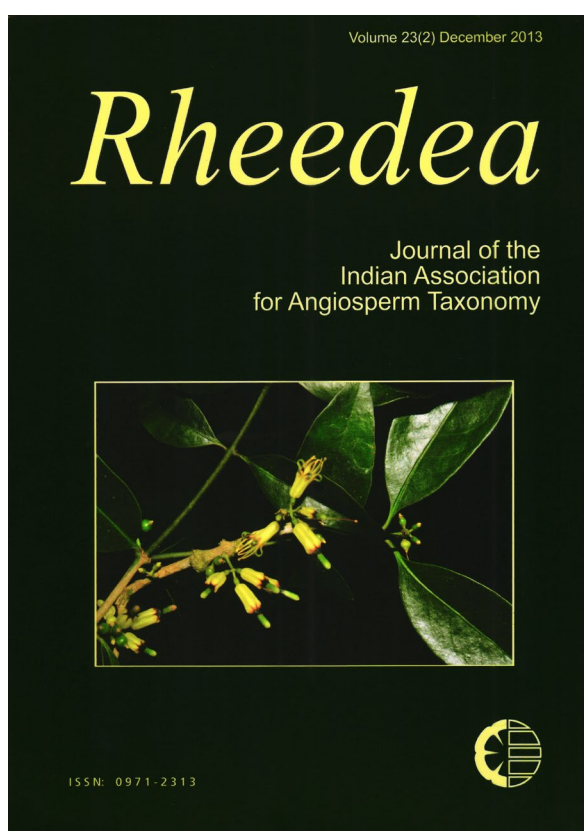




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How to cite:

Shekhar S., Pandey A.K. & A.A. Anderberg 2013. The genus *Inula* (Asteraceae) in India. *Rheedeia* 23(2): 113-127.

<https://dx.doi.org/10.22244/rheedeia.2013.23.02.07>

Received: 25.02.2012

Revised and accepted: 14.11.2013

Published in print: 31.12.2013

Published Online: 31.12.2013





The genus *Inula* (Asteraceae) in India

Shweta Shekhar, Arun K. Pandey* and Arne A. Anderberg¹

Department of Botany, University of Delhi-110007, Delhi, India.

¹Department of Botany, Swedish Museum of Natural History

P.O. Box 50007, SE-104 05 Stockholm, Sweden

*E-mail: arunkpandey@botany.du.ac.in

Abstract

A revision of *Inula* L. in India is provided based on field studies, and examination of herbarium collections. Twelve species of *Inula* are recognized in India: *I. acuminata*, *I. britannica*, *I. clarkei*, *I. falconeri*, *I. hookeri*, *I. kalapani*, *I. macrosperma*, *I. obtusifolia*, *I. orientalis*, *I. racemosa*, *I. rhizocephala* and *I. royleana*, of which two are endemic, *I. kalapani* and *I. macrosperma*. A key to the Indian species, descriptions and illustrations are provided along with data on flowering and fruiting, distribution, habitat, chromosome number, and ethnobotanical uses.

Keywords: Inulinae, Taxonomy

Introduction

The genus *Inula* L. (Inuleae-Inulinae) includes c. 100 species mainly distributed in warm and temperate regions of Europe, Asia, and Africa (Anderberg, 2009; Chen & Anderberg, 2011). Anderberg (1991), transferred a number of species to genera like *Duhaldea* DC., *Iphiona* Cass. and *Dittrichia* Greuter. Kumar & Pant (1995) included 20 species in their treatment of *Inula* in India. According to Karthikeyan *et al.* (2009), the genus in India is represented by 17 species and 2 varieties.

The genus *Inula* was first described by Linnaeus in *Species Plantarum* (1753), where he enumerated 13 species. However, later workers (Adanson, 1763; de Candolle, 1836; Bentham & Hooker, 1873; C.B. Clarke, 1876; Hooker, 1881; Grierson, 1975; Rechinger, 1980; Kumar & Pant, 1995) broadened the generic circumscription of *Inula* and included more taxa in it. Several of the sections recognized by earlier workers have been demonstrated to be more distantly related to *Inula s. str.* Recently, Chen and Anderberg (2011) reported 19 species of *Inula* and 7 species of *Duhaldea* from China of which 5 species of *Inula* and 4 species of *Duhaldea* occur in India. Analyses of phylogenetic relationships based on DNA sequence data (Pornpongrungrueng *et al.*, 2007; Englund *et al.*, 2009) have shown that the *Duhaldea* is in the basal clade of the Inuleae-Inulinae whereas *Inula (s. str.)* is in a more derived group. Thus, out of 20 species of *Inula* in India (Kumar & Pant, 1995), only 12 can be retained in *Inula (s. str.)*

and of the remaining 8, 6 belong to *Duhaldea*, 1 to *Dittrichia* and 1 to *Iphiona* (Anderberg, 1991). This paper deals with the critical examination of *Inula s. str.* found in India.

The genus *Inula (s. str.)* comprises annual, biennial or perennial herbs. In India, the genus is distributed in Trans Himalaya, Western Himalaya and the Northeastern regions. Some species are glandular-hairy and aromatic (*I. racemosa*, *I. royleana*, *I. orientalis*). The flowering heads (capitula) are heterogamous and radiate (Fig. 1) and both rays and disc florets are yellow. The capitula are usually arranged in terminal corymbs or cymes but in some taxa they are solitary and pedunculate (*I. orientalis*, *I. racemosa*, *I. royleana*) or sessile and densely congested at the centre of the rosulate leaves (*I. rhizocephala*).

In India, *Inula* is well known not only for its diverse herbal and ethnobotanical uses but also for its biomedical properties (Parkash & Aggarwal, 2010; Jamma *et al.*, 2012). Species such as *I. kalapani* and *I. macrosperma* are rare and endemic where as *I. racemosa* and *I. rhizocephala* have become endangered due to habitat loss (Rao & Datt, 1996).

Present study is based on fresh and herbarium specimens. Field surveys were conducted in different parts of India *viz.*, Jammu and Kashmir, Himachal Pradesh, Meghalaya, Sikkim, and Uttarakhand. Data obtained from field survey

such as ethnobotanical uses, habitat, phenology and habit of the plants are provided along with notes on distribution and chromosome numbers.

In the following type information from the literature is provided for each species, but it is not our intention at this is to be considered as formal typifications.

Inula L., Sp. Pl. 2: 881. 1753; DC., Prodr. 5: 463. 1836; Benth. & Hook.f., Gen. Pl. 2: 330. 1873; Boiss., Fl. Orient. 3: 184. 1875; Compos. Indicae 116. 1876; Hook.f., Fl. Brit. India 3: 291. 1881; Gorskova in Shishkin, Fl. USSR 25: 433. 1959; Grierson in Davis, Fl. Turkey 5: 54. 1975; Ball & Tutin in Tutin *et al.*, Fl. Europea 4: 133. 1976; Rech.f., Fl. Iran. 145: 77. 1980; Anderb., Pl. Syst. Evol. 176: 97. 1991; Sarv. Kumar & Pant in Hajra *et al.*, Fl. India. 13: 11. 1995; Abid & Qaiser, Candollea 56: 317. 2002; Chen & Anderb. Fl. China 20-21: 837. 2011.

Type: Inula helenium L.

Annual, biennial or perennial herbs, erect or prostrate, generally hairy with variable indumentum, rarely glabrous (*I. kalapani*). Stems generally well-developed, often branched, rarely simple, and exceptionally very short (*I. rhizocephala*). Leaves simple, alternate, sessile or petiolate, sometimes in a basal rosette, hairy or glabrous. Capitula solitary, terminal or a few together arranged in corymbs or panicles, heterogamous, radiate, disciform or rarely discoid. Involucral bracts multiseriate, broad or narrow, imbricate; outer herbaceous, more or less foliaceous; inner usually rigid and more or less scariosus. Receptacles flat or slightly convex, smooth or somewhat alveolate, epaleate. Ray florets female, radiate to miniradiate (rarely missing), distally 2 or 3-toothed. Disc florets hermaphrodite. Corolla tubular, yellow, 5-lobed. Anthers caudate, with branched sagittate tails, apical appendices acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, rarely rounded (*I. rhizocephala*). Style bifid; style branches abaxially with acute sweeping hairs, not reaching the furcation; stigmatic lines confluent apically but basally separate. Cypselae shorter than the corolla, ellipsoid or more or less cylindrical, subterete, angled, slightly or distinctly ribbed, sclerenchymatous, glabrous or pubescent; epidermal cells each with one elongated crystal. Pappus bristles 1–2(–3)-seriate, scabrid to barbellate, persistent.

Distribution: Mainly temperate regions of Europe, Asia, but also reaching sub-Saharan Africa.

Key to the species

1. Plants acaulescent; leaves in a rosette, obovate-spathulate; capitula sessile, congested in the centre of the leaf rosette .. **11. *Inula rhizocephala***
1. Plants caulescent; leaves cauline, radical; capitula terminal on stems or branches, solitary or in corymbs 2
2. Carpopodium indistinct; leaf base cordate **2. *I. britannica***
2. Carpopodium distinct; leaf base not cordate .. 3
3. Stems thick as goose-quill, with a narrow, membranous wing; ligules deeply 3-fid **7. *I. macrosperma***
3. Stems pubescent, not thick as goose quill and not winged; ligules not deeply 3-fid 4
4. Outer involucre bracts broad, leaf-like, herbaceous 5
4. Outer involucre bracts narrow, rigid, sometimes herbaceous but not leaf-like, or more or less scariosus 6
5. Capitula solitary; 7–10 cm in diam.; all whorls of phyllaries green **12. *I. royleana***
5. Capitula in raceme; 3–5 cm in diam.; inner phyllaries purple **10. *I. racemosa***
6. Cypselae glabrous or nearly so 7
6. Cypselae silky or at least distinctly hairy 10
7. Pappus bristles white; cypselae c. 2 mm long ... 8
7. Pappus bristles reddish or pale reddish; cypselae not more than 1.5 mm long 9
8. Involucre shaggy; capitula 1–3; stems villous; rays as long as disc florets **5. *I. hookeri***
8. Involucre not shaggy; capitula solitary; stems hirsute; rays longer than disc florets **9. *I. orientalis***
9. Pappus bristles more than 5 mm long; cypselae hirsute; carpopodium basal 11
9. Pappus bristles less than 3 mm long; cypselae glabrous; carpopodium subbasal **6. *I. kalapani***
10. Stems and leaves papillate-glandular along with pilose hairs, leaves acute-obtuse **8. *I. obtusifolia***



Fig. 1. *Inula* L.: **a.** *Inula obtusifolia* A.Kern.; **b.** *I. orientalis* Lam.; **c.** *I. racemosa* Hook.f. (Based on: a. S. Shekhar 1126; b. S. Shekhar 1058; c. A.K. Pandey 10028).

- 10. Stems and leaves tomentose, leaves acuminate-apiculate **3.I. clarkei**
- 11. Leaves linear-lanceolate, acuminate, venation prominent below **1. I. acuminata**
- 11. Leaves linear, acute-acuminate, venation obscure below **4. I. falconeri**

1. *Inula acuminata* Royle ex DC., Prodr. 5: 471. 1836; Hook.f., Fl. Brit. India 3: 294. 1881; Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pakistan & Kashmir 752, 1972; Rech.f., Fl. Iranica 1980; Sarv.

Kumar & Pant in Hajra *et al.*, Fl. Ind. 13: 11. 1995; Abid & Qaiser, Candollea 56: 323. 2002. **Fig. 2**

Type: In Indicae prov. boreali-occident Royle *s.n.* (Holo- G-DC. IDC No. 27. 913).

Annual, 25–45 cm high. Stems erect, shining, glabrous at base, pubescent above, sometimes branched. Leaves 2.5–8 × 1–1.5 cm, sub-erect, elongate, hastate, glabrous, and gradually tapering from the broad base, margin obscurely dentate. Capitula few, sub-corymbose, 1.5–2.5

cm in diam. Involucral bracts 4-seriate, green, narrow, linear-acuminate, erect, puberulous; outer bracts lanceolate, 5–15 × 1.5–2 mm, herbaceous; inner linear, acute or acuminate, membranous, puberulous. Ray florets 10–15 mm long, recurved. Disc florets *c.* 6 mm long. Anther caudate, with branched-sagittate tails, apical anther appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae narrowly obovate or oblong, 1–1.5 mm long, sparsely hirsute or nearly glabrous, sometimes with a few, short, erect hairs, 3-ribbed, yellowish brown. Pappus uniseriate, 5–6 mm long; bristles 22–30, golden-brown.

Flowering & Fruiting: July to September.

Distribution: India (temperate regions of Trans Himalaya and Western Himalaya: Jammu & Kashmir) and Pakistan.

Habitat: Grows on damp places, on calcareous rocks, between 1700 and 2900 m.

Specimens examined: INDIA, **Jammu & Kashmir**, Baramulla, 12.9.1985, *A. Meebold* 1048 ; Srinagar, 15.9.1865, *D. Koelzii* 236933; Kashmir, 7.9.1893, *J.F. Duthie* 13999 (CAL); Bhaderwah, Kashmir, 12.8.1989, *Naqshi, Shaukat & Kachroo* 10116 (KASH).

2. *Inula britannica* L., Sp. Pl. 2: 882. 1753; DC., Prodr. 5: 467. 1836; Boiss., Fl. Orient. 3: 193. 1875; Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pakistan & Kashmir 752, 1972; Grierson in Davis, Fl. Turk. 5: 65. 1975; Ball & Tutin, In Tutin *et al.*, Fl. Europeae 4: 135. 1976; Rech. f. Fl. Iranica 96, 1980; Gorschkova, Fl. USSR 25 465, 1959; Sarv.Kumar & Pant in Hajra *et al.*, Fl. India 13: 11. 1995; Abid & Qaiser, Candollea 56: 322. 2002; Chen & A. Anderb. Fl. China 20-21: 841. 2011.

Fig. 3.

Lectotype: Herb Burser 15 (1): 41 (UPS)

Biennial to perennial herb, 15-40 (75) cm tall. Stem erect, villous. Leaves 5.5–9.5 × 1.5–3.0 cm, sessile; lanceolate, elliptical or ovate, cordate or auriculate, clasping, acute-acuminate, entire or serrulate, base cordate-auriculate; margin entire to minutely dentate; lower surface villous, scarcely glandular,

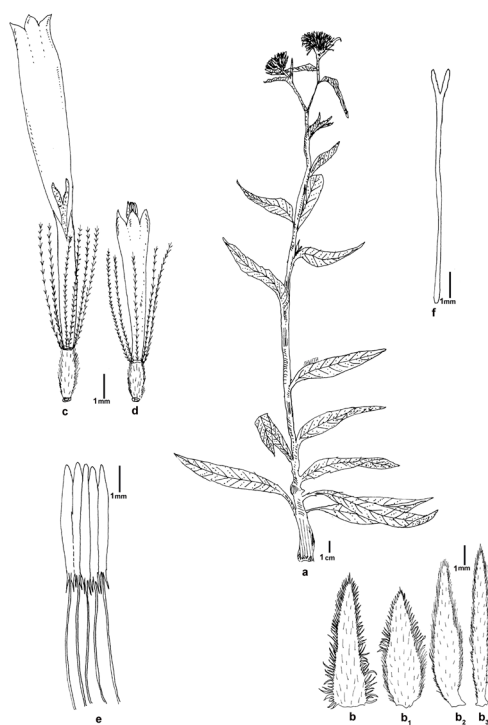


Fig. 2. *Inula acuminata* Royle ex DC.: **a.** Habit; **b-b₃**, Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e.** Anthers; **f.** Style & Stigma. (a from *Koelzii* 236933, CAL; b, c, d from *Duthie* 13999, CAL; e, f from *Naqshi, Shaukat & Kachroo* 10116 KASH).



Fig. 3. *Inula britannica* L.: **a.** Habit; **b-b₂**, Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e, e₁**, Anthers; **f, f₁**, Style & Stigma. (a-f from *Naqshi & Shaukat* 9138, 9229, KASH).

upper surface sparsely pubescent. Capitula 1–8, 2.5–5 cm in diameter, peduncles 1–4 cm long densely villous. Involucral bracts flaccid, 3–4 seriate, outer sub-foliaceous, linear-subulate, 8–25 × 2–5 mm, ±villous; inner membranous, puberulous and glandular. Ray-florets, 10–15 mm long. Disc florets 4–5 mm long. Anther caudate, with tails, appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae 1–2 mm long, narrowly obovate-oblong with sparsely golden-brown hirsute surface, 8–10 ribbed, reddish brown. Pappus 5–6 mm long uniseriate, bristles 20–24, free or basally connate, reddish brown-golden.

Chromosome number: 2n=16, 32.

Vernacular name: British Elecampane, British Yellow head, Meadow fleabane.

Flowering & Fruiting: June to September.

Distribution: China, Europe, India (Jammu & Kashmir); Iran, Japan, Pakistan, South Korea, Turkey, Russia, Tajikistan, Turkmenistan, Uzbekistan.

Habitat: Grows on roadsides, wastelands and fields, sandy to wet places, moist meadows, stream-sides, ditches and wet woods, altitude ranges between 1700 and 2500 m.

Uses: Plant is used for the treatment of nausea, hiccups and excessive sputum. The flowers are used for treatment of intestinal diseases, bronchitis and inflammation (Wang *et al.*, 2005; Khan *et al.*, 2008, 2010a).

Specimens examined: INDIA, **Jammu & Kashmir**. Dawar, 12.8.1989, Naqshi & Shaukat 9229; Dawar, 12.8.1990, Naqshi & Shaukat 9138 (KASH).

3. *Inula clarkei* (Hook.f.) Stewart in Nasir & Ali, Ann. Cat. Vasc. Pl. W. Pakistan Kashmir 753. 1972; Sarv.Kumar & Pant in Hajra *et al.*, Fl. Ind. 13: 11. 1995; Abid & Qaiser, Candollea 56: 321. 2002. *I. obtusifolia* Kerner var. *clarkei* Hook. f., F. Brit. India 3: 294. 1881.

Type: INDIA, **Kashmir**, Mustag Paas, 11,500', Clarke (K).

Perennial herb, 15–35 cm tall. Stem white, tomentose, branched from base. Leaves 3–5 × 1–2 (3.0) cm, rigid, tomentose, oblong or ovate-elliptic, acuminate-apiculate, base rounded; margin obscurely denticulate. Capitula solitary

terminal, c. 2.5–4 cm in diameter. Involucral bracts green, villous, pubescent, 4–5 seriate; outer herbaceous, lanceolate, acute, 8–15 × 2–3 mm; inner membranous, acuminate. linear-lanceolate, acute, rigid, pubescent. Ray-florets c. 15–28 mm long. Disc-florets c. 7–9 mm long. Cypselae 2–3 mm, oblong, yellowish-brown, dense sericeous, silky with 10–12 ribs. Pappus 6–7 mm long, uniseriate, bristles 20–24, golden yellow.

Flowering & Fruiting: June to September.

Distribution: India (Jammu & Kashmir); Pakistan.

Habitat: Grows between 2400 and 3500 m.

Specimens examined: INDIA, R.R. Stewart s.n.; Duthie s.n. (DD).

4. *Inula falconeri* Hook. f., Fl. Brit. India 3: 294. 1881; E. Blatt., Beaut. Fl. Kashmir 1: 158-161. 1927; Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pakistan & Kashmir 752, 1972; Sarv.Kumar & Pant in Hajra *et al.*, Fl. Ind. 13: 11. 1995; Abid & Qaiser, Candollea 56: 323. 2002.

Fig. 4

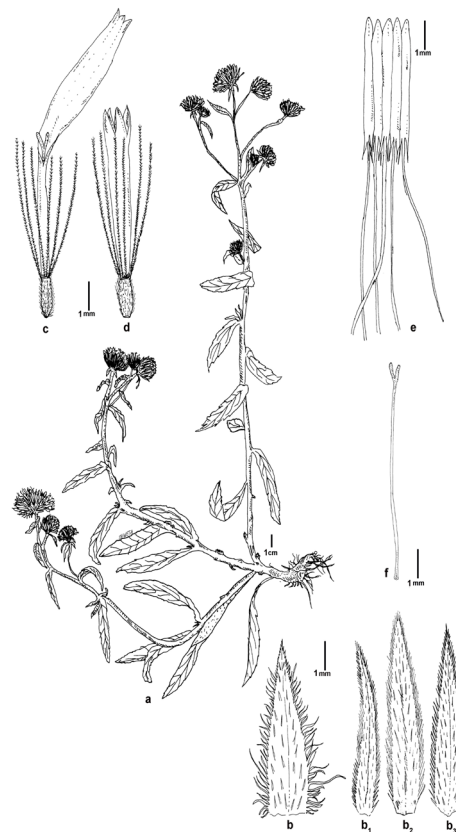


Fig. 4. *Inula falconeri* Hook.f.: **a.** Habit; **b-b₃.** Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e.** Anthers; **f.** Style & Stigma. (a from Stewart 20484, CAL; b, c, d from Stewart 87784, DD; e, f from Stewart 87785, DD).

Type: WESTERN TIBET, Falconer 3933 (K).

Annual or perennial herb, 30–45 cm tall. Stem erect, slender, glabrous to sparingly hairy, simple or branched. Leaves 2.5–8 × 0.5–1.0 cm, linear or oblong, amplexicaul, gradually contracted above the base, veins obscure. Capitula corymbose, 1.0–2.0 cm in diameter. Involucral bracts green, 4-seriate, linear, acute, pubescent or tomentose, erect or recurved, c. 5–15 × 1.5–2.0 mm, acuminate, margins pubescent, dorsal surface scarcely glandular. Ray florets, c. 10 mm. Disc-florets c. 6 mm long. Anther caudate, apical anther appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae 1–1.5 mm long, narrowly-obovate, oblong, yellowish-brown, sparsely golden brown hirsute surface with few short, erect hairs. Pappus uniseriate, c. 5–6 mm long, bristles 25–28, golden-yellow.

Flowering & Fruiting: June to August.

Distribution: India (Jammu & Kashmir), Pakistan and Western Tibet.

Habitat: Grows between 2300–2500 m high altitudes.

Uses: Allelochemical extracts used in allelopathy and also contains antifungal and anti-inflammatory activity (Khan *et al.*, 2009, 2010b, c, Cheng *et al.*, 2011)

Note: This species is similar to *I. acuminata*, but differs in having linear, acute-acuminate leaves with very obscure veins below.

Specimens examined: INDIA, **Jammu & Kashmir**, Skardu, Baltistan, 7.8.1940, R.R. Stewart 20484, (CAL). Skardu, Baltistan, 7.8.1940, R.R. Stewart 87784, 87785 (DD).

5. *Inula hookeri* C.B. Clarke, *Compos. Indicae* 122. 1876; Hook. f., *Fl. Brit. India* 3: 294. 1881; Sarv. Kumar & Pant in Hajra *et al.*, *Fl. India* 13: 11. 1995; Chen & A. Anderb. *Fl. China* 20: 841. 2011. **Fig. 5**

Type: INDIA, **Sikkim**, J.D. Hooker s.n. (K000250056).

Perennial herb, 60–150 cm tall. Stem branched, villous above, loosely lanate at first. Leaves 6–15 × 2.5–4 cm, elliptic-lanceolate, acute, apex acuminate, pubescent and shortly glandular on surfaces but more sparsely hairy on upper surface, veins conspicuous; lower leaves sessile, narrowed



Fig. 5. *Inula hookeri* C.B. Clarke: Habit. (from Bennet & Naithani 152607, DD).

into a petiole up to 5 mm long, upper leaves sessile; margin minutely glandular-dentate. Capitula terminal, solitary or 2–3 together, up to 6–10 cm in diam. Involucral bracts 3–4 seriate, slender, almost filiform, 1.5–4 mm, villous, recurved, shaggy with long silky hairs, persistent, brown villous and reflexed in fruit. Ray-florets 5–7 mm long, linear, deeply lobed and conspicuously veined. Disc-florets 5–9 mm long. Anther caudate, apical anther appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae 1.5 mm, ellipsoid, glabrous, with 12 ribs. Pappus dirty white, c. 6–8 mm long, uniseriate, 30–45, bristles free or basally connate, sub-equal to disc-florets.

Chromosome number: 2n=20.

Vernacular name: Hooker's fleabane.

Flowering & Fruiting: July to October.

Distribution: Bhutan, China, India (Sikkim, Arunachal Pradesh), Myanmar, Nepal.

Habitat: Grows between 2400–3900 m elevations; on mountain slopes, shrub-lands, sparse, temperate forests and grasslands.

Uses: Roots are used against drowsiness and possess cytotoxic activities (Cheng *et al.*, 2012).

Specimens examined: INDIA, **Arunachal Pradesh**, Thunglung to Lum La, Kameng district, 22.10.1977, S.R. Bennet and H.B. Naithani 152607, 152608; Sir Basil Gauld 97311 (DD). **Sikkim**, s.l. 1867, J.D. Hooker K000250056 (K); Lachen, 27.8.1999, 22410; Lachen, North Sikkim District, 25.8.1982, P. Chakraborty 1305, 1306; Lachung to Yanthang, North Sikkim District, 12.10.1985, D.C.S. Raju 8363, 8402; On the way to Yanthang, North Sikkim District, 14.9.1988, S. Kumar & S. Singh 8583, 8584; Kishong La, 21.9.1996, Sujit Kumar Jana 34917, 34918; Lachen to Chungthang, North Sikkim, 11.9.2002, D. Maity 41007, 41008; Lachen, 27.8.1999, G.P. Sinha & A. Maity 41301, 41302, 41303 (BSHC).

6. *Inula kalapani* C.B. Clarke, Compos. Ind. 123. 1876; Hook. f., Fl. Brit. India 3: 295. 1881; Sarv. Kumar & Pant in Hajra *et al.*, Fl. India 13: 11. 1995.

Fig. 6

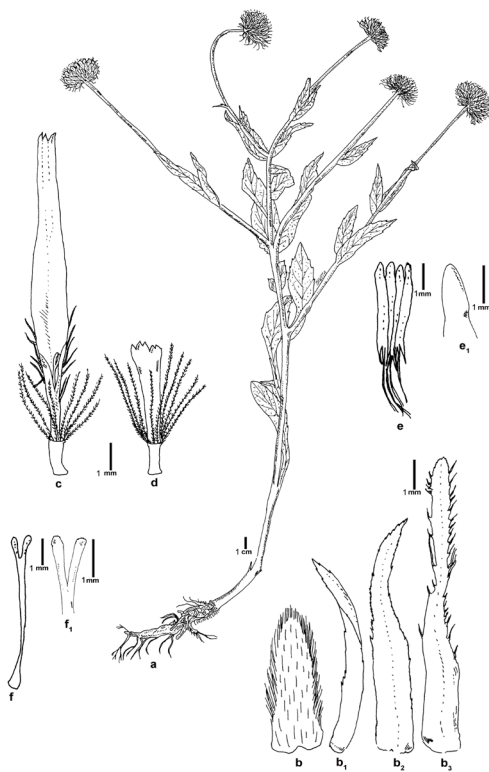


Fig. 6. *Inula kalapani* C.B. Clarke: **a.** Habit; **b-b₃.** Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e, e₁.** Anthers; **f, f₁.** Style & Stigma. (a from Joseph 40127, ASSAM; b, c, d from Clarke 38233, CAL; e, f from Clarke 44076, CAL).

Type: INDIA, **Meghalaya**, Khasia mountain, Kalapani river, 4000–5000', J. D. H. & T.T. s.n. (K).

Erect herb, 30–45 cm tall. Stem simple or sparingly branched, pubescent or hirsute. Leaves 5–7.5 cm, cauline and radical; radical leaves elliptic, ovate or lanceolate, obtuse or acute, sub-dentate, long, petiolate; cauline leaves erect or spreading, oblong or ovate-oblong, amplexicaul at base, dilated, 2–4 cm long. Heads corymbose, few, 0.5–1 cm in diameter. Involucral bracts green, few, linear, acute, spreading or recurved, hirsute. Ray-florets 8 mm long. Disc-florets c. 4–6 mm long. Cypselae minute, up to 1.2 mm long, glabrous. Pappus 3 mm long, uniseriate, bristles 28–37, reddish.

Flowering & Fruiting: June to September.

Distribution: India: Arunachal Pradesh (Kameng district), Meghalaya (Khasi hills), endemic.

Habitat: Grows near river bank and sandy soil, amidst grasses in open places down the hills at 1300–1500 m elevation.

Specimens examined: INDIA, **Arunachal Pradesh**, Senge, Kameng district, 18.9.1969, J. Joseph 40127 (CAL); Senge, Kameng district, amidst grasses in open places down the hills, 19.9. 1964, J. Joseph 40127b (ASSAM). **Meghalaya**, Upper Kalapani to Mairang, 1.6.1868, 7301; Khasi hills, 15.6.1876, 290; Khasi hills, 12.5.1878, 780 (DD); Maophlong, 4 June 1885, C.B. Clarke 38233; Shillong, 4 June 1886, C.B. Clarke 44076; Khasi, 1913, C.B. Clarke 290 (CAL); In Kynshi-Markasa, 10 miles away from K.&J. Hills district, 17 June 1958, G. Panigrahi 16337; K&J Hills, 543 (ASSAM).

7. *Inula macrosperma* Hook. f., Fl. Brit. India 3: 292. 1881; Sarv. Kumar & Pant in Hajra *et al.*, Fl. India 13: 11. 1995.

Fig. 7

Type: INDIA, **Sikkim**, J.D. Hooker s.n. (K000102223)

Erect herb. Stem glabrous or pubescent, smooth, shining, soft, glabrous or sometimes pubescent, winged; wings narrow, membranous. Leaves 7–10 × 2–3 cm, sessile, oblong-ovate, acuminate, base amplexicaul, decurrent, puberulous. Capitula 3.5–5 cm in diameter, pedunculate. Involucral bracts few, broadly lanceolate, 1.5–2 cm long, sub-acute, pubescent. Ray-florets up to 15 mm long deeply 3-lobed. Disc-florets 6–7 mm long. Anther caudate with radial endothelial tissue; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae oblong,



Fig. 7. *Inula macrosperma* Hook.f.: Habit. (from Maity 22944, BSHC)

up to 6 mm long, compressed, strongly and prominently ribbed, hispid distally. Pappus 2.5 mm long, uniseriate, bristles 35–48, reddish.

Flowering & Fruiting: July to September

Distribution: In India: Sikkim Himalaya.

Habitat: Alpine regions, high altitude

Specimens examined: INDIA, **Sikkim**, Sikkim, J.D. Hooker; North Sikkim, D. Maity 22944 (BHSC).

8. *Inula obtusifolia* A. Kern., Ber. Naturw. Ver. Innsbruck. 1: 111. 1870; Hook. f., Fl. Brit. India 3: 293. 1881; Koeie & Rech. f., Symb. Afganistan 2: 31. 1955; Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pakistan & Kashmir 752, 1972; Rech. f., Fl. Iranica 96. 1980; Abid & Qaiser., Candollea 56: 317. 2002; Chen & A. Anderb., Fl. China 20: 837. 2011.

Fig. 8

Type: INDIA, **Himachal Pradesh**, Lahul mountains, 13000-14,000', Jaeschke s.n. (WU).

Perennial herb with a woody rootstock; 12–30 cm tall. Stem rigidly flexuous, scabrid or hairy, dense papillate-glandular and pilose. Leaves sessile, 3–7 × 2–2.5 cm, elliptic-lanceolate, oblong or ovate-oblong, rounded at base, acute-obtuse, papillate-glandular with pilose hairs, rigid, often scaberulous above; margin obscurely denticulate. Heads, solitary terminal, one to three, variable in

size, 1.5–3.5 cm in diameter. Involucre depressed, semi-globose; involucre bracts 4–5 seriate, imbricate, outer bract herbaceous-foliaceous, lanceolate-oblong, acute-obtuse, 4–6 × 2–3 mm; inner membranous, acuminate, linear or linear-lanceolate, acute, rigid, pubescent. Ray-florets c. 8–20 mm long. Disc-florets 6–7 mm long. Cypselae oblong, c. 2–3 mm long, dark yellowish-brown, sericeous to villous, 10–12 ribbed. Pappus 5–7 mm long, uniseriate, bristles 22–28, golden yellow.

Flowering & Fruiting: June to August.

Distribution: In India: fairly common in the Western Himalaya covering Jammu & Kashmir (Kargil, Leh-Ladakh), Himachal Pradesh, upper Punjab and Uttarakhand, rarely in Assam; Outside India: Pakistan and China (W. Xizang).

Habitat: Grows in rock crevices, dry cliffs, slopes and stony grounds forming clumps at 2500-4500 m elevation.

Uses: Whole plant is used against tuberculosis, chest problems, cough and also as an antiseptic (Khan & Khatoon 2008).



Fig. 8. *Inula obtusifolia* A.Kern.: **a.** Habit; **b-b₃**, Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e, e₁**, Anthers; **f, f₁**, Style & Stigma. (a from Stewart 21094, CAL; b, c, d from Shekhar 5401, DUH; e, f from Shekhar 5402, DUH).

Specimens examined: INDIA, **Assam**, Durbasa Khola, 6.11.1962, C.R. Rao 54603; 4 km from Badapani, H.D. Deka, 39402, 15604, 15613 (ASSAM). **Himachal Pradesh**, Pangi, 4.9.1896, J.H. Lace 1487 (DD); Pangi, 1.9.1897, J.H. Lace 1487 (CAL); Bank of Chandra river near Tandi bridge, Lahul, 16.7.1941, N.L. Bor 92391; Bank of Chandra river near Tandi bridge, Lahul, 27.7.1941, N.L. Bor 92392 (DD); Pangi, 21.8.1964, Brandis 3913 (CAL). **Jammu & Kashmir**, Gilgit, 1885, G.M. Giles (CAL); Lowari range, 12.8.1895, W. Galton 17235 (DD); Lamayuro, Ladakh, 22.7.1905, A. Meebold 1049; Baltistan, 18.7.1892, J.F. Duthie (CAL); Ladakh, 6.8.1940, R.R. Stewart 87782 (DD); near Kharbu, Ladakh, 27.8.1940, R.R. Stewart 21094 (CAL); Ladakh, 29.8.1940, R.R. Stewart 87783 (DD); Kashmir, 2.6.1970, Gurucharan Singh 737a (KASH); Miru, Purang valley, 8.9.1970, U.C. Bhattacharyya 50507, 50508 (BSD); Kargil, 7.8.1975, Uppeandra Dhar 5067 (KASH); Tamgotsa, 20.8.1975, M.V. Vishwanathan 69879; way from Shyok to Durbak, 31.8.1975, M.V. Vishwanathan 67272 (BSD); Indus valley, Ladakh, 4.7.1976, J. Leonard 6809 (KASH); Drass-Kargil, 18.7.1976, B.M. Wadhwa 67259; Khalsi-Saspol road, 26.7.1976, B.M. Wadhwa 67260; Saspol, Ladakh, 28.7.1976, B.M. Wadhwa 67261; Ladakh, 8.8.1976, B.M. Wadhwa 67263; on the way down from Mathoo Phu to Mathoo village, 10.8.1976, M.V. Vishwanathan 67262; Suru village, 24.8.1976, B.M. Wadhwa 70239; Kargil, 4.8.1980, U.C. Bhattacharyya 75892, 98008; 155 km, on the way to Kargil, Ladakh, 12.8.1982, P.K. Hajra 96482, 99140; Gang La to Khardung La, 8.8.1988, H.J. Chaudhary & B.P. Uniyal 87514; Between Drass and Kargil, 28.7.1988, H.J. Chaudhary & B.P. Uniyal 87822 (BSD); Lamayuro, Ladakh, 9.9.1989, B.K. Kapatii 15752 (RRLH); Nimu & Khaltse village, Leh-Ladakh, 20.6.2011, S. Shekhar & A.K. Pandey 1101, 1102, 1103; Alchi village, Saspol, Leh-Ladakh, 21.6.2011, S. Shekhar & A.K. Pandey 1107, 1108, 1111; Drass, Kargil, 23 June 2011, S. Shekhar 1113, 1116, 1118; Khardung La, Leh-Ladakh, 27.6.2011, S. Shekhar & A.K. Pandey 1119, 1126, 1127 (DUH).

9. *Inula orientalis* Lam., *Encycl.* 3: 255. 1789. *Inula grandiflora* Willd., *Sp. Pl.* 3: 2096. 1803; DC., *Prodr. Sys. Nat. Reg. Veg* 5: 468, 1836; Boiss., *Fl. Orient.* 3: 184-214, 1875; 196; Clarke, *Compos. Ind.* 123, 1876; Hook.f., *Fl. Brit. India* 3: 294, 1881; E. Blatt., *Beaut. Fl. Kashmir*.1: 158-161. 1927; Stewart in Nasir & Ali, *Ann. Cat. Vas. Pl. W. Pakistan & Kashmir* 752, 1972; Gorschkova, in Shishkin, *Fl. USSR*, 25: 472, 1959.

Fig. 9

Type: East Mediterranean, *Tournefort s.n.* (MNHN)



Fig. 9. *Inula orientalis* Lam.: a. Habit; b₁- b₄. Phyllaries (from outer to inner); c. Ray floret; d. Disc floret; e. Anthers. f, f₁. Style & Stigma. (a from Duthie 809, CAL; b, c, d from Shekhar 1042, DUH; e, f from Shekhar 1044, DUH).

Perennial herb. 45–75cm tall. Stem erect, simple, rarely branched, stout, leafy, glandular, pubescent, hirsute below; inflorescence hairy and leafy throughout. Leaves 4–8 (-10) × 1–3 cm, sessile, elliptic, oblong or lanceolate, acute, base, hairy, cuneate, semi-amplexicaul; margin glandular, serrate, Capitula solitary, terminal, 4–7 cm in diameter. Involucral bracts hairy, toothed, blackish green, 4–5 seriate, linear-lanceolate, inner narrow and shorter, linear and outer leaf-like ligules 1.7 to 2 cm, thick hairy at margins midrib ending in a glandular apex. Ray-florets c. 25–30 mm long, bifid to 3-lobed; linear, oblong. Disc-florets, numerous, c. 5–8 mm long; corolla. Anther caudate, apical anther appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Cypselae 1–1.5 mm long, oblong-oblancoelate, sparsely hirsute, dark brown, with sparsely-golden brown hirsute surface, 5–10-ribbed. Pappus c. 6–7mm long, uniseriate, bristles 20–25, cream-golden.

Chromosome number: 2n=16.

Vernacular name: Caucasian Elecampane.

Flowering & Fruiting: July to September.

Distribution: India: Himachal Pradesh (Chamba, Chenab, Kinnaur, Pangi, Jaunsar, Lahul, Keylong), Jammu & Kashmir (Gulmarg, Sonmarg, Sheshnag near Pissu Ghati), Uttarakhand (Badrinath, Kedarnath, Gangotri Yamunotri in Garhwal Himalaya) and Semi-arid regions of Punjab, Nepal, Pakistan and Caucasus.

Habitat: Grows on damp places along the steep edges of the torrents up to 2000-3600 m.

Uses: The aromatic roots, also used to control high blood pressure and stimulate the peristaltic movement of the intestine, skin treatment (Grossheim 1949; Gogoladze & Gventsadze 1985; Mamedov *et al.*, 2005).

Specimens examined: INDIA, **Himachal Pradesh**, Leppa valley, upper Chenab, 17.8.1879, B.H. Baden-Powell 200; Chamba, 12.8.1880, Robert Ellis 416; Pangi, 5.8.1890, J.H. Lace 475; Phulga, 12.10.1894, Jaunsar, 10.11.1894, J.S. Gamble 15084; Pangi, 18.9.1895, J.H. Lace 1256 (CAL); Urni, 30.8.1963, N.C. Nair 62492; Pangi village, Kinnaur district, 3.9.1963, N.C. Nair 37400; Sang La, 22.9.1964, N.C. Nair 36552; Trilokinath, upper Chenab, 20.8.1971, U.C. Bhattacharyya 45383; Rakcham hill slope, 13.8.1973, K.P. Janardhanan 75358; near stream, 9.9.1973, K.P. Janardhanan 70962; on the way to Lahul and Keylong, 24.9.1974, M.V. Vishwanathan 61675 (BSD); Pangi, Chamba, 15.8.1999, Harakh 236894 (CAL). **Jammu & Kashmir**, Tilail valley, 4.9.1893, J.F. Duthie 13969; Sonmarg, 25.8.1913, F.E. Kaebel 119 (CAL); Kistwar, 22.9.1958, T.A. Rao 9453, 9798, 9799, 9800 (BSD); Sheshnag, near Pissughati, 26.9.1961, J.N. Vohra & B.M. Wadhwa 254 (CAL); Gulmarg, 5.6.1971, Gurucharan Singh 2609; Gulmarg, 7.6.1976, U. Dhar 4318; Kashmir, 10.8.1989, Naqshi, Shaikat & Kachroo 10284. Kashmir, 13.8.1989, Naqshi, Shaikat & Kachroo 9808 (KASH); Zozi La, 8.9.2005, B.M. Sharma 16567, 16568 (RRLH). **Uttarakhand**, Tihri-Garhwal, 2.10.1881, J.F. Duthie 236902; Nila valley, Tihri Garhwal, 14.8.1883, J.F. Duthie 809 (CAL); Tihri-Garhwal, 2.10.1891, J.F. Duthie 1713 (DD); Jeolikot, Kumaun, 17.9.1912, N. Eill 437 (CAL); Kumaun, 21.9.1957, T.A. Rao 5254, 5255, 5256; Dwali, Kumaun, 22.9.1957, T.A. Rao 1980; Gaurikund, Rambara, 25.9.1958, M.A. Rau 9267 (BSD); Gaurikund, Rambara, 25.9.1958, M.A. Rau 8609 (CAL); Valley of Flowers, Garhwal Himalaya, 13.10.1962, U.C. Bhattacharyya 25646, 25647; Garhwal, 1.10.1964, B.V. Shetty 36461; Gangotri, near Tehri Garhwal, 5.10.1967, B.D. Naithani 41757; Ralam valley, Kumaun, 17.9.1969, Naithani 45031; Ghangaria, near Chamoli district,

19.9.1977, B.M. Wadhwa 84488; on the way to Khating, Tehri district, 19.9.1979, A.K. Goel 70674; Chamoli district, 11.9.1980, B.D. Naithani 70990; Ghangheria, Chamoli district, 15.9.1982, D. Basu 96744; Chirbasa, Gangotri, 5.9.1983, U.C. Bhattacharyya 78106, 80808; on the way to Bundhi, Pithoragarh district, 14.9.1986, C.L. Malhotra & Bipin Balodi 83302; Chamoli district, 4.10.1986, P.C. Pant & B.P. Uniyal 90683; Harki Dhun, Uttarkashi, 21.8.1987, Dev Raj Agarwal 79768; Chamoli district, 7.9.1989, P.K. Hajra 90716; Tehri district, 1.10.1991, S.C. Majumdar & Bipin Balodi 92862; Uttarkashi, 4.10.1993, Majumdar & Surendra Singh 88006; Uttarkashi district, 20.9.1995, Bipin Balodi 98459; Bungling to Sela, Pithoragarh district, 5.8.1998, B.P. Uniyal & Bipin Balodi 103522; (BSD); On the way to Badrinath, Garhwal Himalaya, 21.9.2009, S. Shekhar & A.K. Pandey 1051, 1052, 1053; Near Gaurikund and Rambara, Garhwal Himalaya, 24.9.2009, S. Shekhar & A.K. Pandey 1055, 1058, 1059; On the way to Triyuginarayan, Rudraprayag, Garhwal Himalaya, 25.9.2009, S. Shekhar 1060, 1062; On the way to Kedarnath temple, 20.9.2010, S. Shekhar 1096, 1097; Near Gaurikund and Rambara, Kedarnath, 20.9.2010, S. Shekhar 1099, 1100 (DUH).

10. *Inula racemosa* Hook. f., Fl. Brit. India 3: 292. 1881; E. Blatt., Beaut. Fl. Kashmir 1: 158-161. 1927; Stewart in Nasir & Ali, Ann. Cat. Vas. Pl. W. Pakistan & Kashmir 752, 1972; Rech. f., Fl. Iranica 96. 1980a; Kitamura & Gould in Hara *et al.*, Enum. Fl. Pl. Nepal 3: 31. 1982; Sarv. Kumar & Pant in Hajra *et al.*, Fl. India 13: 22. 1995. **Fig. 10**

Type: INDIA, **Kashmir**, 5000 - 7000', Falconer *et al.* s.n. (K).

Perennial herb, 130-180 cm tall. Stem, branched, furrowed, rough, young parts densely hairy. Leaves 16.5-31.0 × 4.0-12.0 cm, elliptic-oblong to lanceolate, sessile to long-petiolate, coriaceous, scabrid, upper sessile, base dilated, semi-amplexicaul, lower long-petiolate, winged, beneath densely tomentose, upper surface pubescent or glabrous-scabrid, margin crenate-dentate. Capitula 3.5-7 cm, cymosely arranged on stout hairy peduncles. Involucral bracts 5-6 seriate, imbricate, densely hairy, outer bracts leafy, broad-triangular, ovate, 1.5-2.0 × 0.5-1.0 cm, apically recurved, densely woolly; inner bracts membranous with hyaline margins, linear, narrow, c. 1.3-1.5 × 0.5-0.8 cm. Ray-florets 28-30 mm long, 2-3-toothed. Disc-florets c. 15 mm long. Anther caudate, with tails, apical anther appendage acute-obtuse, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with



Fig. 10. *Inula racemosa* Hook.f.: **a.** Habit; **b-b₅.** Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e.** Anthers; **f.** Style & Stigma. (a from Clarke 236813, CAL; b, c, d from Shekhar 5410, DUH; e, f from Shekhar 5410, DUH).

acute sweeping hairs, not reaching the furcation. Cypselae 2.0–4.0 mm long, oblong, dark brown, glabrous, 16–24-ribbed. Pappus 8–9 mm long, uniseriate bristles, 30–48, reddish-brown.

Chromosome number: $2n=20$.

Vernacular name: Pohakarmul, Puskarmul

Flowering & Fruiting: July to September.

Distribution: India (Jammu & Kashmir, Himachal Pradesh: Manali) and rarely some parts of Assam; Hindu-Kush-Himalayan region across Afghanistan, Pakistan, Nepal.

Habitat: Grows in between 1500–3100 m high altitudes.

Uses: A reputed medicinal plant frequently cultivated. Roots are aromatic and used as an anthelmintic, antimicrobial, diuretic, aphrodisiac, repellent, antispasmodic, anti-asthmatic, insecticidal, strengthens and prevents hair-loss. It is also used to treat chest pain, supports blood sugar metabolism, cardio-protective and anti-obesity, and in veterinary medicines (Jamma *et al.*, 2012).

Specimens examined. INDIA, **Himachal Pradesh**, Lahul, 16.8.1838, *N.L. Bor* 153; Keylong, 14.7.1841, *N.L. Bor* 9933; Near Sissu, Lahul, 28.7.1841, *N.L. Bor* 92389 (DD); Lahul, Kangra, 17.8.1916, *R.E. Cooper* 5517 (CAL); Kamring, upper Chenab, Lahul, 18.8.1971, *U.C. Bhattacharyya* 45370; Koksar, Lahul, 5.9.1985, *P.K. Hajra* 76996; on the way to Trilokinath, 6.8.1994, *S.K. Murti & Surendra Singh* 88113 (BSD); Sisso, 20.8.1995, *T.N. Srivastava* 17071 (RRLH); On the way to Manali, 9.8.2009, *S. Shekhar* 1078, 1095 (DUH). **Jammu & Kashmir**, Barzallia, Srinagar, 22.6.1961, *A.K. Dutta* 7400; Jammu, 18.5.1963, 5981; Yatika form, 12.5.1965, *Y.K. Sarin* 10935; Jammu, 17.9.1971, *D.R. Sharma* 11752 a & b (RRLH); Sind valley, 3.9.1876, *C.B. Clarke* 31026 (CAL); Gilgit expedition, Kashmir, 1887, *J.F. Duthie* 718; Hirpur, Pir Panjal, 16.8.1891, *C.B. Clarke* 236813, 236814, 25657; Liddar valley, above Pahalgam, 3.8.1893, *J.F. Duthie* 13456; Kangra, Lahul, 14.8.1916, *R.E. Cooper* 5517; Kashmir, 29.1.1962, *T.A. Rao* 2979, 2980 (DD); Dachingham, 11.8.1968, GNJ1064; Harwan, Kashmir, 10.7.1970, *Gurucharan Singh* 215 (KASH); Gond La, 14.9.1990, *B.K. Kapahi* 17981; Kashmir, 5.6.2006, *M.A. Youb* 53038 (RRLH); Local Amchi, Leh-Ladakh, 26.6.2011, *S. Shekhar* 1128; Garhwal Himalaya, *A.K. Pandey* 10028 (DUH).

11. *Inula rhizocephala* Schrenk., Enum. Pl. Nov. 51. 1841; Boiss., Fl. Orient. 3: 196. 1875; Gorschkova in Shishkin, Fl. USSR, 25: 472. 1959. *I. rhizocephaloides* C.B. Clarke, In Compos. Indicae. 124. 1876. Hook. f., Fl. Brit. India 3: 295. 1881. Stewart in Nasir & Ali, Ann. Cat. Vasc. Pl. W. Pakistan & Kashmir 755. 1972; Kumar & Pant in Hajra *et al.*, Fl. India 13: 23. 1995; Abid & Qaiser. Candollea 56: 317. 2002; Chen & A. Anderb., Fl. China 20: 839. 2011. **Fig. 11**

Type: East Kazakhstan, Tarbagatai mountain, Schrenk *s.n.* (LE, BR0000005267897).

Perennial herb, 5–10 cm tall, acaulescent. Leaves numerous, all radical, rosulate, 3–5 cm long, bristly-hairy, attenuating towards base into a broad petiole. Capitula numerous (7–18), 1.5–3 cm in diameter, sessile, arranged in dense semi-spherical sessile subcapitate synflorescences. Capitula 1.8–2.5 cm in diameter, densely congested in the centre of the leaf rosette. Involucral bracts 5-seriate, narrow, linear, pointed; the outer green with recurved tips; inner purplish. Ray-florets c. 15 mm long, slightly longer than phyllaries, shortly tridentate. Disc florets yellow, c. 7–9 mm long, slightly shorter than pappus, with 5 smooth teeth. Anther caudate, apical anther appendage acute-obtuse, endothecial tissue radial; cells of filament collar generally longer than wide. Pollen spines

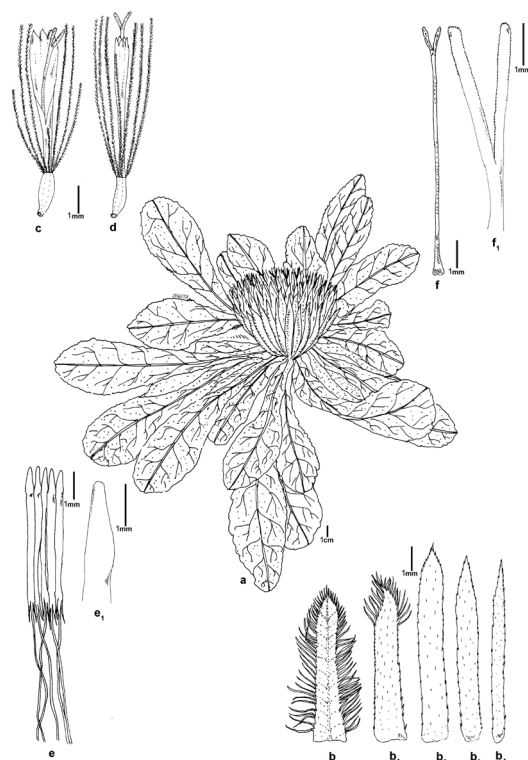


Fig. 11. *Inula rhizocephala* Schrenk.: **a.** Habit; **b-b₄**, Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e, e₁**, Anthers; **f, f₁**, Style & Stigma. (a from *Shekhar* 5404, DUH; b, c, d from *Shekhar* 5426, DUH; e, f from *Shekhar* 5440, DUH).

rounded. Style with acute sweeping hairs, not reaching the furcation. Cypselae 1.5–2 mm long, oblong-oblancoate, golden-brown, glabrous, 10–12-ribbed. Pappus 7–8 mm long, 2–3 seriate, bristles, 20–40, reddish-brown golden.

Chromosome number: 2n=16.

Vernacular name: Turzit.

Flowering & Fruiting: Late June to August.

Distribution: Afghanistan, China (Xinjiang, Xizang), India (Jammu & Kashmir, Leh-Ladakh); Iran, Kazakhstan, Pakistan, Tajikistan, Tibet, Turkmenistan, Uzbekistan.

Habitat: Occasional in moist meadows between 2500–4000 m in West Ladakh especially in Nun-Kun basin, Kargil and Suru valley. Over exploitation and habitat degradation are the major causes of population decline (Rawat, 2008).

Uses: Whole plant is used in the treatment of chest pain and common cold. In Ladakh, it is used in the

treatment of constipation, intestine infection and ulcers, throat sores, wound and inflammation by local Amchi (Khuroo *et al.*, 2007).

Specimens examined: INDIA, **Jammu & Kashmir**, Baghicha to Olding Industry, 23.8.1840, *R.R. Stewart* 20990 (DD); Gilgit, 1885, *G.M. Giles* 236949 (CAL); Leh-Ladakh, 10.8.1931, *Walter Koelz* 2591; Near Sabu nallah, Leh, 13.9.1970, *U.C. Bhattacharyya* 55630, 84737; Saspol, Ladakh, 28.7.1976, *B.M. Wadhwa* 65424 (BSD); Drass, 7.8.1976, *Uppeandra Dhar* 5066 (KASH); Suru valley, Leh, 19.8.1976, *B.M. Wadhwa* 65423; Saspol, Leh, 28.6.1976, *B.M. Wadhwa* 65425; Fotu La, 5.8.1980, *U.C. Bhattacharyya* 98007; Leh, 8.8.1980, *U.C. Bhattacharyya* 74092 (BSD); Pangong lake, near Leh, 20.8.1986, *Irshad A. Nawroo* 201 (KASH); Drass, Kargil, 27.7.1988, *H.J. Chaudhary & B.P. Uniyal* 88772 (BSD). Fotu La, 26.7.2000, *Naseer Aman* (KASH); Suru Valley, 24.6.2011, *S. Shekhar & A.K. Pandey* 1120, 1121, 1123, 1124, 1125; Suru Valley, 28.8.2011, *S. Shekhar & A.K. Pandey* 1150, 1172, 1186, 1195, 1200 (DUH).

12. *Inula royleana* DC., Prodr. 5: 464. 1836; C.B. Clarke in *Compos. Indicae* 118. 1876; Hook. f., *Fl. Brit. India* 3: 292. 1881; Blatt., *Beaut. Fl. Kashmir* 1: 159. 1927; Stewart in Nasir & Ali, *Ann. Cat. Vasc. Pl. W. Pakistan & Kashmir* 755. 1972; Sarv. Kumar & Pant in Hajra *et al.*, *Fl. India* 13:23. 1995. *Inula stoliczkai* C.B. Clarke in *Comp. Indicae* 118. 1876. **Fig. 12**

Type: In Indiae prov. *Royle s.n.* (Holo G-DC., IDC No. 27.908).

Perennial herb, 30–60 cm tall. Stem erect, unbranched, stout, grooved and hairy. Leaves 6–20 × 4.5–10 cm, Radical leaves petiolate, elliptic-ovate, cordate, base abruptly narrowed, obtuse, petiole winged distally, upto 18 cm long; margin irregularly dentate; cauline leaves 12–25 × 8–15 cm long, elliptic to lanceolate, often lyrate from a clasping base, acute, auricled at base, densely hairy; margin dentate. Capitula solitary, terminal 8–11 cm in diameter, peduncled. Involucral bracts 5-seriate, outer involucral bracts foliaceous, densely glandular, hairy on both surfaces, oblong-ovate, acute, outer bracts up to 12–20 × 5–10 mm, middle bracts yellow, 8 × 2 mm, scaly, appressed hairy. Ray-florets 50 mm long, 2–3-lobed, veins conspicuous. Disc-florets up to 10 mm long. Anther caudate, apical anther appendage acute, endothelial tissue radial; cells of filament collar generally longer than wide. Pollen spines acute, with a cavity. Style with acute sweeping hairs, not reaching the furcation. Stigmatic lines confluent apically but basally separate. Cypselae c. 4 mm



Fig. 12. *Inula royleana* D.C.: **a.** Habit; **b-b₄**. Phyllaries (from outer to inner); **c.** Ray floret; **d.** Disc floret; **e.** Anthers; **f.** Style & Stigma. (a from *Rau* 50212, CAL; b, c, d from *Shekhar* 10058, DUH; e, f from *Vohra & Wadhwa* 254, CAL).

long, oblong, dark brown, glabrous. Pappus 7–8 mm long, uniseriate, bristles 22–40, golden brown.

Chromosome number: 2n=20.

Vernacular name: Puskarahva, Puskarajata.

Flowering & Fruiting: July to November.

Distribution: India: Himachal Pradesh (Chamba, Lahul and Spiti), Jammu & Kashmir (Drass-Kargil), Pakistan.

Habitat: Sporadic among shrubs, especially *Juniperus*, grows in alpine meadows between 2000–3500 m, on exposed dry alpine slopes up to about 4000 m; also in forests.

Uses: Roots are employed as an adulterant of “Kuth” (*Saussurea lappa*) and also used to control high blood pressure and peristaltic movement of intestine. Plants are poisonous, used as disinfectant, insecticidal particularly for lice, fleas, and ticks; essential oils used for intestinal

problems. The roots are stored for its aroma and used for protection of garments. Root extract is also used to cure dermatitis and allergy. Root paste is applied with leaf on swelling sprains and as an antiseptic by villagers in Kangra district (Parkash & Aggarwal, 2010).

Specimens examined: INDIA, **Himachal Pradesh**, Pangi, 22.8.1897, *J.H. Lace* 1633 (CAL); on the way to Manali, 9.8.2009, *S. Shekhar* 1094 (DUH). **Jammu & Kashmir**, Gurais, 22.7. 1876, *C.B. Clarke* 29482; Tlail, Kashmir, 27.8. 1876, *C.B. Clarke* 30783 (CAL); Sindh valley, 30.7.1891, *G.A. Gammie* (DD); Above Gaurikot, Kashmir, 26.8.1892, *J.F. Duthie* 12569; Sangam valley, 10.8.1893, *J.F. Duthie* 13528 (CAL); 17.9.1896, *G.A. Gammie* 18624 (DD); Kangi, Ladakh, 18.7.1905, *A. Meebold* 4705 (CAL); Kishanganga valley, 5.8.1906, *Keshawnand* 361; Jhelum river, 5.8.1909, *Keshwnand* 28086, 28087 (DD); Sonmarg, 10.8.1913, *Capt. F.E. Kabel* 95 (CAL); Above Gangabal, 16.8.1941 *M.V. Laurie* 89447, 89448 (DD); 5.8. 1952, 2271 (ASSAM); Kashmir, 18.7.1956, *T.A. Rao* 684 (CAL); Pir Panjal pass, 14.9.1958, *T.A. Rao* 8588, 8589, 8590, 8591 (BSD); Sheshnag lake, near Pissu Ghati, 26.9.1961, *J.N. Vohra & B.M. Wadhwa* 254; Kashmir, 29.1.1962, *T.A. Rao* 292 (CAL); Kashmir, 20.7.1970, *Gurucharan Singh* 733; Kashmir, 5.8.1970, *Gurucharan Singh* 863 (KASH); Thajiwas glaciers, 24.8.1972, *M.A. Rau* 50212 (CAL); Sonamarg, 25.8.1972, *M.A. Rau* 50266 (BSD); Khillanmarg, 14.8.1974, *Uppaendra Dhar* 1055; Sonmarg, 16.9.1975, *A.R. Azhar*, 1321 (KASH); Synthen pass, 30.8.1986, *J.N. Vohra & Naithani* 83116; Degwan, 10.9.1979, *B.M. Wadhwa* 66948 (BSD); Pranshor, 26.8.1983, *G.H. Dar* 8148; (KASH); Rajdhan, in alpine meadow, 17.9.1986, *B.M. Wadhwa & S.K. Murti* 83820; Kishanganga valley, 5.8.1987, *B.M. Wadhwa, S.K. Murti & P.C. Pant* 92137; Sonmarg, 25.7.1988, *H.J. Chaudhary & B.P. Uniyal* 85756 (BSD); Dawar, 9.8.1989, *Naqshi, Shaukat & Kachroo* 10734, 10753; Dawar, 12.8.1989, *Naqshi, Shaukat & Kachroo* 9367; Karzalwan, 13.8. 1989, *Naqshi, Shaukat & Kachroo* 10884; Gulmarg, 17.5.1998, *Tariq* **Uttarakhand**, Dhanchuli, 26.7.1963, *C.L. Malhotra & V.J. Nair* 31495 (BSD).

Acknowledgements

Grant support from University Grants Commission to SS (Rajeev Gandhi Fellowship) and AKP (Research project #40-316/2011-SR) is thankfully acknowledged. Thanks are due to the Incharge of the Herbaria (ASSAM, BSD, CAL, DD, KASH, RRLH) for allowing us to consult their respective herbaria.

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 Received: 25.02.2013

Revised and Accepted: 14.11.2013