

## NEW ADDITIONS TO THE FLORA OF UTTARAKHAND, INDIA

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Uttarakhand is one of the Himalayan states in India and its area is about 53,483km<sup>2</sup>, mainly made up of mountainous terrain. The state hardly covers 1.69% of the land area of India but hosts more than 27.96% flowering plant diversity (Karthikeyan 2000; Uniyal et al. 2007) which speaks of the richness of flora here. This area has been a focus of plant collections as far back as 1796 when Thomas Hardwicke collected plants from the Alaknanda Valley of Garhwal. Since then, a large number of plant collectors have explored the area and a great deal of information was available about the flowering plants of this area by the beginning of the 21<sup>st</sup> century. Based on these collections, floristic reports and their own collections, Uniyal et al. (2007) compiled a checklist of flowering plants of Uttarakhand as a baseline data for writing the flora of Uttarakhand. This valuable document indicates the presence of nearly 4,700 species of flowering plants (including 32 species of Gymnosperms and a few cultivated species).

In routine botanical explorations in different parts of Uttarakhand a few interesting specimens were collected and identified with the help of relevant taxonomic literature and by comparing them with authentic specimens housed at the herbaria of Botanical Survey of India (BSI) and Forest Research Institute (DD) at Dehradun. These species proved as additions to the flora

of Uttarakhand as these were not mentioned in Uniyal et al. (2007). Considering it, these species are being reported here for the first time from Uttarakhand. Their description including correct name, basionym (based on The Plant List 2010, International Plant Name Index 2012 or other recent literature), name in Flora of British India (Hooker 1872–97), and photographs of their natural state and their flowering/ fruiting times are provided here in this communication for future reference and further correct identification. The species are arranged in the sequence of families as per Uniyal et al. (2007).

Plant specimens processed following standard taxonomic procedures (Rao & Sharma 1990) are deposited and being maintained at G.B. Pant University Herbarium, Department of Biological Sciences, CBSH Pantnagar, Uttarakhand, India (GBPUH).

**1. *Tiliacora acuminata*** (Lam.) Miers in Ann. Mag. Nat. Hist. ser. 2, 7(37): 39. 1851; Pramanik, Flora of India 1:343. 1993. *Menispermum acuminatum* Lam., Encycl. 4:101. 1797. *T. racemosa* Colebr. in Trans. Linn. Soc. Lond. 13: 67. 1822; Hook.f. et Thomson, Fl. Brit. India 1: 99. 1872. (Menispermaceae).

Specimen examined: GBPUH 603/30.1.2013, 21.ix.2011, Haldi near Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 1,2)

Large, woody stemmed evergreen climbers. Stem striate, glabrous, young branches pubescent. Leaves petiolate, petiole up to 4cm, often curved at upper end, lamina ovate to elliptic-lanceolate, cordate, rounded or truncate at base, entire, apex rounded, acute or acuminate, 7–20x6–11 cm, glabrous, first two pairs of lateral nerves close to lamina base, nerves free at



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Image 1. *Tiliacora acuminata* (Lam.) Miers

outer sepals smaller, triangular to ovate, hairy on abaxial side, innermost three largest, elliptic to ovate, acute or rounded, glabrous, 5x2.5 mm, erect, upper ¼ curved outward, yellow. Petals 6, free, in one whorl, obovate, concave, 1–1.5 mm, glabrous, emarginated. In male flowers stamens 6, antipetalous, longer than petals but shorter to inner sepals, up to 4.5mm long, filament thick, anthers small, opening lengthwise, carpellodes few (1–2), on 1mm long gynophores, or absent. Female flowers with up to 8 carpels, on gynophores, 2mm long, glabrous, one ovuled, style curved outward, subapical, as long as ovary. Fruit a drupe, drupes obovoid, subcompressed, shining red, glabrous, 8–12x6–10 mm, styler scar subbasal, embryo curved. In forests and along road sides, climbing over smaller trees up to 6–7 m.

**Flowering and Fruiting:** June–October

This species is previously known to occur in Uttar Pradesh, Bihar, West Bengal, Orissa, Tamil Nadu and Kerala in India (Sharma et al. 1993) and now being reported for the first time from Uttarakhand.

**2. *Dunbaria glandulosa* (Dalz.) Prain**, J. Asiat. Soc. Bengal 66: 433. 1897; Sanjappa, Leg. India 169. 1992. *Cajanus glandulosus* Dalz. In Dalz. & Gibs., Bombay Fl. 73. 1861. *Atylosia glandulosa* Dalz., J. Linn. Soc. 13: 185. 1873. *Atylosia rostrata* Baker in Hook.f., Fl. Brit. India 2: 216. 1876. (Fabaceae).

**Specimen examined:** GBPUH 604/30.1.2013, 30.vii.2012, near Tata Motors, along road, Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 3,4).

Large vines, up to 5m long, copiously branched. Stem with glandular and simple hairs, with many obscure lines of hairs in internodal region on branches. Leaves estipulate, petiole up to 14cm, densely hairy, exceeding base of lateral leaflet joints by up to 3.5cm, petiolule 3–5



Image 2. Herbarium specimen of *Tiliacora acuminata* (Lam.) Miers

margin. Inflorescence axillary raceme like panicles or of a few flowered pedunculate cymes in raceme, borne on younger branches, 5–15 cm long, peduncle tomentulose. Flowers sessile, yellow, 3–4 mm across. Sepals 9, in three whorls of three each, or one missing in outermost, six



Image 3. *Dunbaria glandulosa* (Dalz.) Prain



Image 4. Herbarium specimen of *Dunbaria glandulosa* (Dalz.) Prain

mm; leaves pinnately trifoliate, lateral obliquely rounded, rounded at base, apex acute, 5-nerved at base of which two outermost very close to margins, mid nerve closer to upper margin, adpressed hairy, mainly on nerves on either side, densely hairy on margins, terminal leaflet rhombic with rounded lateral angles, equilateral, 5-nerved, outermost two marginal or submarginal, base rounded, apex acute, appressed hairy, mainly on nerves on either side, densely hairy on margins, with numerous brown glands abaxially. Racemes axillary, few (up to 16) flowered, exceeding leaf, peduncle with scattered bulbous based long hairs, flowers solitary or paired at nodes. Flowers ebracteate, pedicel up to 1.5cm. Calyx tube campanulate, densely covered with bulbous based hairs, 5-lobed, lobes densely hairy on margins, lowermost longest, acuminate, rest smaller, triangular, acute. Corolla three times or more longer than calyx, standard largest, 2.2x3.0 cm, orbicular, auricled and clawed; wing 2.2x1.0 cm, auricled and clawed, elliptic to obovate; keel 2.0x1.3 cm, half rounded, beaked. Stamen (9)+1, vexillary free, unequal. Ovary base covered with yellowish nectar ring, ovary sessile, orange, densely

covered with long bulbous based golden hairs, style long, slender, incurved, upper half glabrous, stigma glabrous. Fruit 5–6.5x0.7–0.9 cm, linear-oblong, acuminate, blackish-brown, with indistinctly depressed lines between seeds, densely covered with bulbous based long hairs, 6–8 seeded. Seeds brown, mottled with black, rounded, compressed, hilum black,  $\frac{1}{4}$  of circumference.

**Flowering and Fruiting:** September–November.

Along road sides, inside forest climbing over shrubs.

This species was known from the Western Ghats, central India, Assam and West Bengal in India (Sanjappa 1992). Here it is being reported for the first time from Uttarakhand.

**3. *Flemingia lineata* (L.) Roxb. ex Ait.f., Hort. Kew ed.2, 4:350. 1812; Baker in Hook.f., Fl. Brit. India 2: 228. 1876; Sanjappa, Leg. India 176. 1992. *Hedysarum lineatum* L., Sp. Pl. 1054. 1753. (Fabaceae).**

**Specimen examined:** GBPUH 605/30.1.2013, 11.iv.2009, near Petrol Pump, Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 5,6).

Small shrub, up to 60cm tall. Stem copiously branched, branches appressed hairy. Stipules leaf opposed, lanceolate, entire or bifid with long hairy acumen at apices, persistent, striate, up to 1cm long, brown. Leaves digitately trifoliate, petiole hairy, up to 4cm long, petiolules equal, densely hairy; leaflets thinly leathery, 3-nerved at base, nerves raised on abaxial side, central leaflet obovate to oblanceolate, dorsally glabrescent at maturity, with numerous, minute, white glands on abaxial side, cuneate at base, apex acute, 2–6x0.8–2.0 cm; lateral leaflets smaller, obliquely elliptic-lanceolate. Inflorescence axillary, up to 5cm long panicle, peduncle glandular hairy. Bracts linear, glandular hairy, up to 2mm long. Flowers 5–7 mm, pedicel slender, 1–3 mm, glandular



Image 5. *Flemingia lineata* (L.) Roxb. ex Ait.f.



Image 6. Herbarium specimen of *Flemingia lineata* (L.) Roxb. ex Ait.f.

hairy. Calyx pubescent, 5-lobed, lobes linear, longer than tube, lowermost longest. Corolla little exceeding calyx; standard 5–6x2.5–4 mm, clawed, rounded with two auricles; wing oblong, auricled, clawed, apex acute; keel falcate, clawed, apex acute. Stamens (9)+1, vexillary free, equal. Carpel densely hairy, style long, slender, glabrous in upper half, stigma capitate, glabrous. Fruit oblong-ovate, 8–12x6–8 mm, glandular pubescent, yellowish-brown. Seeds 2, black, rounded, 2–2.5x2–2.5 mm, little compressed, hilum small, white.

**Flowering and Fruiting:** December–February.

Along road sides in moist areas in Pantnagar.

Sanjappa (1992) has mentioned the occurrence of *Flemingia lineata* from throughout India southward of Himalaya but Uniyal et al. (2007) lacking specimens have not mentioned it from Uttarakhand. Thus, it is the first report of its occurrence in Uttarakhand.

**4. *Saxifraga minutissima*** D.S. Rawat, Gornall et al. in Edinb. J. Bot. 69(2): 211–217. 20012. (Saxifragaceae).

**Specimen examined:** GBPUH 442/20.12.2009, 10.Ix.2001, Vasuki Tal area Kedarnath, Uttarakhand, coll. D.S. Rawat (Image 7).

Loose cushion forming perennial herbs, 8–15 mm tall, branched at ground level, cushions up to 5cm across. Proximal axillary shoots leafy, prostrate, with small, distal leaf rosettes. Leaves in rosette, sessile, linear to oblong-lanceolate, entire, glabrous or with sparse eglandular hairs on dorsal side, acute or obtuse at apex, 1.5–2.5x0.5–1 mm; leaves on prostrate stems sessile, linear to oblong-lanceolate, margin entire, glabrous or rarely with eglandular hairs, apex acute or obtuse, 1.5–2x0.5 mm, somewhat fleshy. Flowering stem terminal, leafless, ebracteate with solitary flower; pedicel 3–6 mm long, brown glandular hairy. Flowers minute, 2–3 mm across, greenish. Sepals 5, erect, 1–1.2x0.6–1 mm, reddish at apex, ovate to oblong, acute or subacute, adaxial surface and margins glabrous, or rarely with a few brown-glandular hairs; veins 3, obscure. Petals absent. Stamens 5, or 6 (rarely), opposite to sepals, equal to sepals, filaments linear, ca. 0.7mm, anthers 0.3mm, yellow, thecae parallel on dehiscence. Ovary semi-inferior at anthesis, ovoid to oblong, to 2.5mm long in fruit; carpels tapered to short conical styles, styles 0.2–0.3 mm long, exceeding sepals, stigmas capitate. Seeds spherical to ovoid, shining brown,



Image 7. Herbarium specimen of *Saxifraga minutissima* D.S. Rawat

smooth, 0.3–0.4 mm.

**Flowering and Fruiting:** July–October.

On steep slopes in high alpine zones with mosses.

This alpine plant species is a newly described species from Uttarakhand (Gornall et al. 2012) and considered, till date, an endemic to Kedarnath area in Uttarakhand.

**5. *Oxystelma esculentum* (L.f.) Sm.** in Rees, Cycl. 1. 25. 1813; Hook.f., Fl. Brit. India 4: 17. 1893; Karthikeyan et al., Fl. Pl. India 1: 177. 2009. *Periploca esculenta* L.f., Supl. Pl. 168. 1782. (Asclepiadaceae).

**Specimen examined:** GBPUH 606/30.1.2013, 16.ix.2012, at University boundary, Masjid Colony, Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 8,9).

Twinning herbaceous climbers, up to 5m long. Stem glabrous except the younger parts, green. Leaves opposite, petiolate, petiole up to 2cm, pubescent, blade linear-lanceolate, entire, acuminate, cuneate or rounded at base, 5–15x0.5–2.0 cm, pilose on either surfaces, marginal veins distinct. Inflorescence axillary 1-few (5) flowered raceme or subumbellate cyme, as long as or longer than subtending leaf; peduncle pilose. Pedicel slender, up to 2.5cm long, pubescent. Flower drooping, 1.5–2.5 cm across. Sepal ovate-lanceolate, 1x3 mm, divided to base, hairy outside. Corolla white, purple veined on inner side, veins ending before corolla lobe apices, 5-lobed, lobes triangular, densely white hairy on the margins, corona densely pubescent at base, hoods linear, erect, glabrous, incurved at apex, white. Pollinia up to 2mm long, with dark brown carpusculum. Ovary glabrous. Fruit elliptic-ovate, inflated, 6x2 cm, glabrous, rounded at apex.

**Flowering and Fruiting:** September–December.

Along streams, climbing over grasses, shrubs.



Image 8. *Oxystelma esculentum* (L.f.) Sm.



Image 9. Herbarium specimen of *Oxystelma esculentum* (L.f.) Sm.

*Oxystelma esculentum* is considered as a widespread species and Karthikeyan et al. (2009) have reported it from throughout the plains and lower hills of India. However, it is being reported for the first time from Uttarakhand as it is not mentioned in Uniyal et al. (2007).

**6. *Hygrophila ringens* (L.) R. Br. ex Steud., Nomencl. Bot. ed.1. 1:418. 1821; Karthikeyan et al., Fl. Pl. India 1: 22. 2009. *Ruellia ringens* L., Sp.Pl. 635. 1753. *Hygrophila salicifolia* (Vahl) Nees, C.B.Clarke in Hook.f., Fl. Brit. India 4: 407. 1884. (Acanthaceae).**

**Specimen examined:** GBPUH 607/30.1.2013, 4.xii.2012, near CIMAP Station in marshy area, Nagla, Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 10,11).

Marshy herbs, perennial, up to 70cm tall, copiously branched. Stem decumbent at base, ultimately erect, rectangular, sparsely pubescent, hairy at nodes. Leaves opposite, elliptic to lanceolate, blade gradually narrowed to petiole, appressed hairy on both surfaces, more so on margins and nerves, entire, obtuse or rounded. Flowers few (2–6) in axillary clusters, sessile; bracteoles elliptic-ovate, up to 5mm long, densely long hairy on margins.



Image 10. *Hygrophila ringens* (L.) R.Br. ex Steud.

Calyx up to 1.2cm long, lobes linear-lanceolate, shorter than calyx tube, sparsely hairy outside, densely so on margins, pubescent inside. Corolla purplish, up to 2.5cm long, tube to 1.2cm, exceeding calyx, biliped, upper lip shallowly 2-lobed, lower 3-lobed, lobes ovate, rounded, hairy inside below lobes. Stamen 4, filaments glabrous, anther cells equal, parallel, 2mm long, posterior pair of stamens shorter. Ovary glabrous, style slender, up to 1cm, pubescent in lower half only, stigma 2-lobed, one much enlarged, other minute. Fruit oblong to lanceolate capsule, up to 2cm long, 2–3 mm broad, glabrous, 12–16 seeded. Seeds compressed, ovate-rounded, up to 1.5mm diameter, pubescent on margins.

**Flowering and Fruiting:** September–January.

In marshy areas making dense thickets.

Karthikeyan et al. (2009) have mentioned its distribution throughout India but it is not included in Uniyal et al (2007) which makes it a new addition to the flora of Uttarakhand.

**7. *Alpinia nigra*** (Gaertn.) Burt in Notes Roy. Bot. Gard. Edinb. 35: 213. 1977; Karthikeyan et al., *Florae Indicae Enumer. Monocot.* 289. 1989. *Alpinia allughas* (Retz.) Rosc., Baker in Hook.f. *Fl. Brit. India* 6: 253. 1892. *Zingiber nigrum* Gaertn., *Fruct.* 1: 35. t.12. 1788. (Zingiberaceae).

**Specimen examined:** GBPUH 608/30.1.2013, 15.viii.2010, Along a stream near Tata Motors, Pantnagar, Uttarakhand, coll. D.S. Rawat (Images 12,13).

Perennial, rhizomatous, aromatic herbs. Pseudostems up to 3m tall. Leaves sessile to petiolate, linear-lanceolate to elliptic-lanceolate, 15–62x2–12 cm, ligule orbicular, up to 1cm large, hirsute on abaxial side, blade glabrous except sparse pubescence on the margin of upper half and apex, acute or acuminate, petiole (in lower leaves) hirsute



Image 11. Herbarium specimen of *Hygrophila ringens* (L.) R.Br. ex Steud.

on adaxial side. Inflorescence terminal, erect, up to 50cm long panicle, with a few 2–11 cm long branches producing cincinni of a few (2–6) flowers, peduncle and pedicels tomentose. Flowers pedicellate, pedicels 0.4–1.5 cm, tomentose. Calyx tubular, 1–1.2 cm, scarcely 2–3 lobed, pinkish, pubescent outside, with 1–2 distinct aumens in bud, persistent. Corolla tube 1–1.2 cm, 3-lobed, pink, lobes oblong, upto 1.2 cm, pubescent outside, posterior median lobe outside in bud, cucullate, with distinct horn in bud. Labellum obovate, up to 1.5cm long, longer than corolla lobes, 2-lobed at apex, lateral staminodes subulate, fertile stamen one, filament robust, 1.0cm, anther lobes 0.7cm, parallel, curved (straight in fresh specimens), connective apex with two projecting lobes. Ovary densely pubescent, rounded, style slender, in staminal cleft, stigma far exceeding anthers. Capsule globose, blackish, densely hirsute hairy at maturity, 1.5–2.0 cm, with persistent calyx funnel. Seed many, 5–6 mm diam.

**Flowering and Fruiting:** July–October.

Along a perennial stream in one locality.

This species is previously known to occur in the Himalaya and Eastern India (Karthikeyan et al. 1989), however, Uniyal et al. (2007) have not reported it from



Image 12. *Alpina nigra* (Gaertn.) Burt

Uttarakhand.

All these seven species described above are an addition to the flora of Uttarakhand, and their specimens collected from Uttarakhand State do not exist at the Herbarium of Botanical Survey of India Dehradun (BSD) and Herbarium of Forest Research Institute Dehradun (DD), indicating their rare nature. It is hoped that, this information will prove helpful in their further collection and identification, and when added with Uniyal et al. (2007), will make the forthcoming Flora of Uttarakhand more complete and inclusive.

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Image 13. Herbarium specimen of *Alpina nigra* (Gaertn.) Burt

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**Appendix 1. Systematic positions of the taxa reported in this communication according to APG-III (2009) system of classification**

Informal group	Order: Family	Genus	Species
Angiosperms: Eudicots	Ranunculales: Menispermaceae	<i>Tiliacora</i>	<i>acuminata</i>
Angiosperms: Eudicots: Rosids: Fabids	Fabales: Fabaceae (Leguminosae)	<i>Dunbaria</i>	<i>glandulosa</i>
Angiosperms: Eudicots: Rosids: Fabids	Fabales: Fabaceae (Leguminosae)	<i>Flemingia</i>	<i>lineata</i>
Angiosperms: Eudicots: Core Eudicots	Saxifragales: Saxifragaceae	<i>Saxifraga</i>	<i>minutissima</i>
Angiosperms: Eudicots: Asterids: Lamiids	Gentianales: Apocynaceae	<i>Oxystelma</i>	<i>esculentum</i>
Angiosperms: Eudicots: Asterids: Lamiids	Lamiales: Acanthaceae	<i>Hygrophila</i>	<i>ringens</i>
Angiosperms: Monocotyledons: Commelinids	Zingiberales: Zingiberaceae	<i>Alpina</i>	<i>nigra</i>

