Floristic report from Upper Dibang (Arunachal Pradesh) with several species new to India

Magnus Lidén² and Alister Adhikari¹

Uppsala university, Evolutionary Biology Centre, Dept. of Organismal Biology, Norbyvägen 18D, 75236 Uppsala, Sweden. *E-mail:* magnus.liden@ebc.uu.se

¹Dr. Graham's Homes, Kalimpong 734301, West Bengal. *E-mail:* naturehimalaya@yahoo.com

²Corresponding author

[Received 06.01.2019; Revised 16.06.2019; Accepted 20.06.2019; Published 30.06.2019]

Abstract

Huperzia bucahwangensis, *H. tibetica*, *Hymenidium davidii*, *Synotis yui*, *Cremanthodium phyllodium*, *C. wardii*, *Leontopodium aurantiacum*, *L. forrestianum*, *Melanoseris ciliata*, *Impatiens medogensis*, *I. microcentra*, *I. nyimana*, *Hackelia brachytuba*, *Odontostemma monilifera*, *Parnassia yui*, *Gaultheria albiflora*, *G. ovata*, *G. eciliata*, *Crawfordia tsangshanensis*, *Gentiana subtilis*, *Swertia tibetica*, *S. verticillifolia*, *Veronica chayuensis*, *V. yunnanensis*, *Potentilla dumosa*, *Patrinia speciosa* and *Paris rugosa* are recorded from Upper Dibang, East of Anini in Arunachal Pradesh, India. From the "Pemako trail" closer to the Tibetan border, we report *Rhodiola primuloides* subsp. *kongboensis*. Most of these species we believe to be new records for India. The flora (in particular of alpine and subalpine zones) is similar to that of SE Tibet, N Myanmar and NW Yunnan (Gaoligongshan), and it is not unexpected to find many common species.

Key words: Flora, Upper Dibang, Arunachal Pradesh, New records, India

INTRODUCTION

During an explorative excursion to alpine levels East of Anini (Upper Dibang) in autumn 2017, we found several plants that we believe have not, or very rarely, been recorded from India. To our knowledge, few botanical collections have been made from this part of Arunachal Pradesh. An ongoing inventory of the Mayudia pass area, Lower Dibang (V. H. Hareesh), is at lower altitudes. The vast collections from Upper Siang and Upper Dibang by Mithilesh Pathak (CAL) mainly cover subalpine zones, although there are also alpine samples. These have only partially been worked on, and overlap with our list is to be expected.

For eight records (*Hymenidium davidii*, *Synotis yui*, *Cremanthodium phyllodium*, *Melanoseris ciliata*, *Hackelia brachytuba*, *Rhodiola primuloides* subsp. *kongboensis*, *Gaultheria eciliata* and *Paris rugosa*) we have only photographic evidence, but none of these can be confused with other species. A further seven species, not reported here, are probably new to science and will be treated elsewhere, together with taxonomic specialists (*Gentiana*, *Stellaria*, *Corydalis*, *Koenigia s.l.*, *Anemone*). A couple of *Platanthera* species are also treated separately (Lidén & Bharali 2019).

Floristically there are strong similarities between Upper Dibang and neighbouring parts of SE Tibet (Medog), N Myanmar and N Gaoligongshan (Yunnan/Myanmar border mountains). Indeed, for some species, it appears as if the only previous specimens were collected by Yu Te-Tsun (T.T.Yü) in the Gongshan district in NW Yunnan during 1930 to 1940.

This is but a small contribution to the knowledge of the extraordinary biodiversity of the alpine parts of Eastern Arunachal Pradesh (part of Eastern Himalaya), but we hope it can be of value. Future systematic field work will undoubtedly uncover much more, with equipment for large scale comprehensive collecting in the spirit of the late Mithilesh Pathak at BSI Kolkata, to whom we dedicate this report.

ENUMERATION

Abbreviations used: AP = Arunachal Pradesh; eFI = e-Flora of India (www); FoC = Flora of China (www); CoM: Checklist of the trees, shrubs, herbs and climbers of Myanmar (Kress & al. 2003)

Specimens are deposited in ASSAM.

LYCOPODIACEAE

Huperzia bucahwangensis Ching, Acta Bot. Yunnan. 3: 301. 1981. [Figure 1].

Mayudia pass, 28°14'32"N; 95°55'29"E, 2640 m, shaded roadside slope. 15 September 2017. AA & ML 2017-162.

Distribution: FoC: NW Yunnan.

Recognised by broad-based subulate basally reflexed leaves.

Huperzia tibetica (Ching) Ching, Acta Bot. Yunnan. 3: 304. 1981 (*Lycopodium t.*).

E Anini (28° 48' 44" N; 96° 02' 50" E), 3900 m, on moss-covered rock (dwarf form). 10 September 2017. AA & ML 2017-160.

Mayudia pass (28°14'32"N; 95°55'29" E), 2640 m, shaded roadside slope. 15 September 2017. AA & ML 2017-161.

FoC: NW Yunnan (Gongshan).

Small plant with ascending flat acute leaves.

EUDICOTYLEDONS

APIACEAE

Hymenidium davidii (Franch.) Pimenov et Kljuykov, Feddes Repert. 111(7–8): 542. 2000. (*Pleurospermum d.*). [Figure 24].

[= *Pleurospermum benthamii* sensu FoC, non (DC.) C.B. Clarke, fide Pimenov (2017)]

Pimenov (2017): W and SW China, N Myanmar.

E Anini (28°49'03"N; 96°02'59"E), 3850 m, wet alpine meadow. 10 September 2017.

A stocky plant with a short thick rhizome and a large terminal umbel surrounded by smaller apparently sterile umbels (as in *Hymenidium astringioides*); fruit wings consisting of rows of large vesicles. Note that *H. benthamii* (DC.) Pimenov & Kljuykov is a very different much taller and branched plant and lacks, for example, lateral umbels crowded below the terminal one.

ASTERACEAE

Cremanthodium phyllodinum S.W.Liu, Acta Biol. Plateau Sin. 3: 60. 1984. [Figure 2].

E Anini (28°48'43"N; 96°03'03"E), rich meadows 3800 to 3950 m, common.

FoC: NW Yunnan, SE Tibet.

PLATE – I. *Huperzia bucahwangensis*; **2.** *Cremanthodium phyllodinium*; **3.** *Cremanthodium wardii*; **4a.** *Leontopodium aurantiacum*; **4b.** *Leontopodium forrestianum*; **5.** *Melanoseris ciliata*; **6.** *Synotis yui*

Easily recognised by its robust habit, leaves with numerous teeth, adaxially with a dense network of impressed veins, broad nodding single capitula, broadly elliptic acute coarsely black-pilose involucre bracts, and large deeply lobed ray-florets. Unlike most of its congeners, it usually forms wide dense stands rather than isolated plants, suggesting rhizomatous growth, but this needs to be confirmed.

Cremanthodium wardii W.W.Sm., Notes Roy. Bot. Gard. Edinb. 10: 27. 1919. [Figure 3]. E Anini (28°49'02"N; 96°02'32"E), 3900 m, by water seeping over rock. 10 September 2017. AA & ML 2017-111.

NE Myanmar.

Differs from *C. campanulatum* Diels in pale leaves, elliptic capitula with whitish, pale yellow or straw-coloured only slightly hairy involucre bracts with translucent fringed margin, shorter flowers and much shorter pappus.

Leontopodium aurantiacum Hand.-Mazz., Beih. Bot. Centralbl., Abt. 2. 44: 83. 1927. [Figure 4a].

E Anini (28°48'44"N; 96°02'58"E), 3950m, rock crevice. 10 Sep 2017. AA & ML 2017-112.

FoC: NW Yunnan, N Myanmar.

Recognised by the minute size, leaves subtending the single capitulum not enlarged and pappus golden brown.

Leontopodium forrestianum Hand.-Mazz., Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 61: 112. 1924. [Figure 4b].

E Anini (28°49'02"N; 96°02'32"E), 3900 m, flat rock. 10 September 2017. AA & ML 2017-114.

FoC: NW Yunnan, N Myanmar.

Recognised by the small size, a single capitulum per stem and pale brownish pappus.

Melanoseris ciliata (C. Shih) N. Kilian, Fl. China 20-21: 219. 2011 (*Chaetoseris c.*). [Figure 5].

E Anini (28°49'N; 96°02'E), 3700 m, wet meadow. 10 September 2017.

FoC: W & NW Yunnan.

The involucre bracts with whitish erose-ciliate margin are distinctive.

Synotis yui C. Jeffrey & Y.L. Chen, Kew Bull. 39: use 308. 1984. [Figure 6].

E Anini (28°49'34"N; 96°01'46"E), 2900 m, forest. 10 September 2017.

FoC: Yunnan (Dongshan), SE Tibet; CoM: Burma.

Not similar to any other Indian species of *Synotis*. It shares with *S. saluenensis* (Diels) C. Jeffrey & Y.L. Chen the small filiform outer female florets, but is widely different in other characters.

BALSAMINACEAE

Impatiens medogensis Y.L. Chen, Acta Phytotax. Sin. 18: 381. 1980. [Figure 7].

E Anini, fairly common from 3200 to 3650 m, mostly in forest; (28°49'02"N; 96°02'32"E), shaded gravelly slope. 10 September 2017. AA & ML 2017-146.

FoC: SE Tibet (Medog).

A small rhizomatous plant, incorrectly described as annual in FoC.

Impatiens microcentra Hand.-Mazz., Symb. Sin. 7: 653. 1933. [Figure 8].

E Anini (28°50'43"N; 95°59'50"E), forest, 3350 m, a few scattered individuals. Flowers purple to dark purple. 10 September 2017. *AA & ML 2017-145*.

FoC: NW Yunnan (Nu Jiang).

We have compared our plant with the type specimens at WU on www.

Impatiens nyimana C.Marquand & Airy Shaw, J. Linn. Soc., Bot. 48. 167. 1929.

[Figure 9].

E Anini (28°49'03"N; 96°02'59"E), 3850m, wet alpine meadow. 10 Sep 2017. *AA & ML 2017-147*.

FoC: E Tibet.

Flowers pale yellow, lower sepal and lower petals with small red freckles, auricles of lower petals very long and narrow.

BORAGINACEAE

Hackelia brachytuba (Diels) I.M.Johnston, (*H. uncinata* v. *brachytuba*). [Figure 10].

E Anini (28°49'04"N; 96°02'28"E), 3750m. 10 September 2017.

FoC: Nepal, Tibet, W China.

Well distinguished from *H. uncinata* i. a. by the long style.

CARYOPHYLLACEAE

Odontostemma monilifera Mattfeld, Notizbl. Bot. Gart. Berlin-Dahlem. 11: 334. 1932.

E Anini (28°49'02"N; 96°02'32"E), 3650 m, open gravelly slope. 10 September 2017. *AA & ML 2017-156*.

FoC: W Sichuan, E Tibet.

Very similar to *O. trichophora* (Franch.) Sadeghian & Zarre, reported from Arunachal Pradesh (Se La) by Bharali & al. (2018), but rhizome moniliform, i.e. narrow between swollen nodes.

Silene* aff. *indica Otth. in DC. Prodr. 1: 368. 1824. [Figure 11].

E Anini (28°49'34"N; 96°01'46"E), meadow slope with tall herbs and grass, 2100 m. 10 September 2017. *AA & ML 2017-149*.

Lidén (2018): Nepal, Chumbi.

Our find differs from *S. indica* sensu stricto in shorter pedicels, shorter petals and shorter hairs on the anthophore. Further research is needed to establish its status (Lidén 2018).

CELASTRACEAE

Parnassia yui Z.P.Jien, Acta Phytotax. Sin. 8(3): 256. 1963.[Figure 12].

E Anini: (28°49'34"N; 96°01'46"E), wet place in forest by torrent, 3000 m. 10 September 2017. *AA & ML 2017-142*.

Mayudia pass, wet forest, 2600 m.

FoC: NW Yunnan (Gongshan).

A very distinct and peculiar species with its small cauline leaf, long narrow green petal claw, narrowly elliptic fimbriate petal limb with two green patches at base, and obtriangular apically dentate staminodes..

CRASSULACEAE

Rhodiola primuloides* subsp. *kongboensis, H. Ohba, J. Jap.Bot. 53: 329. 1978. [Figure 22].

Upper Siang, along Pemako trail. 29 September 2014. Photo: Alister Adhikari.

FoC: previously known from the type locality, quite close on the Tibetan side of the border: SE Tibet, Kongbo, Deyang La, 13,500 feet. 10 Aug 1947. *Ludlow, Sherriff & Elliot 14299* (BM, P).

Rhodiola primuloides subsp. *primuloides* differs in fimbriate petals. *R. sedoides* have similar flowers, but is very different in its scale-like caudex leaves, apiculate anthers and slightly erose-dentate petals.

ERICACEAE

The monograph (Fritsch & al. 2015) of *Gaultheria* ser. *Trichophyllae* recognises several similar species from East Himalaya, that often grow close together or even intermingled. The three species recorded below are known from neighbouring areas, and their occurrence in AP is not unexpected. They all differ from *Gaultheria trichophylla* Royle by their wide open fruiting calyx.

Gaultheria albiflora (T.Z.Xu) P.W.Fritsch & Lu Lu, Phytotaxa 201: 1. 2015 (*G. suborbicularis* var. *a.*). [Figure 13].

E Anini (28°49'02"N; 96°02'32"E), 3900 m, rocky meadow slope. 10 September 2017. *AA & ML 2017-134*.

Fritsch & al. 2015: Bhutan, SE Tibet, NW Yunnan.

Recognised by very small leaves with few teeth and minute marginal bristles.

Gaultheria eciliata (S.J.Rae & D.G.Long) P.W.Fritsch & L.H.Zhou, Proc. Cal. Acad. Sci. 59 :165. 2008 (*G. trichophylla* var. *e.*). [Figure 14].

West Siang, Domjee La ca 13 km N Mechuka (28°42'N; 94°05'E), 3900 m. 24 August 2014.

Fritsch & al. 2015: SE Tibet, NW Yunnan.

Distinguished by ± revolute leaf margin without bristles.

Gaultheria obovata (Airy Shaw) P.W.Fritsch & Lu Lu, Phytotaxa 201:17, 2015 (*G. trichophylla* var. *o.*). [Figure 15].

E Anini (28°49'02"N; 96°02'32"E), 3900 m, rocky meadow slope. 10 September 2017. *AA & ML 2017-133*.

Fritsch & al. 2015: SE Tibet, NW Yunnan, N Myanmar.

Recognised from the two above by leaves with prominent marginal bristles.

GENTIANACEAE

Crawfordia tsangshanensis C.J.Wu, Bull. Bot. Res., Harbin. 4(3): 135. 1984.

E Anini (28°49'02"N; 96°02'32"E), 3650 m, gravelly slope. 10 September 2017. *AA & ML 2017-109*.

PLATE – II. 7. *Impatiens medogensis*; 8. *Impatiens microcentra*; 9. *Impatiens nyimana*; 10. *Hackelia brachytuba*; 11. *Silene* aff. *indica*; 12. *Parnassia yui*

FoC: NW Yunnan.

Distinguished from *C. campanulacea* C.B. Clarke i. a. by the short and narrow calyx lobes.

Gentiana subtilis Harry Sm., Anz. Akad. Wiss. Wien, Math.-Naturwiss. 63: 103. 1926. [Figure 16].

[*Gentiana pluviarum* ssp. *subtilis* (Harry Sm.) T.N. Ho]

E Anini (28°48'44"N; 96°02'50"E), 3850 m, moss-covered rock. 10 September 2017. AA & ML 2017-123.

Ho & Liu 2001: NW Yunnan.

Probably related to *G. pluviarum* C.B. Clarke, but with broadly spatulate to elliptic (not linear) leaves and calyx lobes.

Swertia tibetica Batalin, Mém. Acad. Imp. Sci. Saint Pétersbourg. 14: 175. 1895.

[Figure 17].

E Anini (28°49'03"N; 96°02'59"E), 3850 m, alpine meadow. 10 September 2017. AA & ML 2017-110.

FoC: W Sichuan, NW Yunnan.

Swertia verticillifolia T.N. Ho & S.W. Liu, Acta Phytotax. Sin. 18: 81. 1980. [Figure 18].

E Anini (28°48'56"N; 96°02'44"E), 3800 m, margin of Rhodo-thicket. 10 September 2017. AA & ML 2017-115.

FoC: SE Xizang.

The species of the *Swertia hookeri* group are possibly monocarpic rather than perennial as stated in FoC. The very broad cordate sepals readily distinguish *S. verticillifolia* from its relatives.

PLANTAGINACEAE

Veronica chayuensis D.Y. Hong, Fl. Reipubl. Popularis Sin. 67(2): 403. 1979. [Figure 19].

E Anini (28°49'02"N; 96°02'32"E), 3650 m, open gravelly slope, corolla pale purplish blue, 8 to 15 seeds per locus. 10 September 2017. AA & ML 2017-186.

FoC: S Tibet (Zayu).

Similar to *V. umbelliformis* Pennell, but lower leaves smaller and narrower. In plants seen in this locality, the corolla was 5-lobed, but that is probably of no taxonomic significance.

Veronica yunnanensis D.Y. Hong, Fl. Reipubl. Popularis Sin. 67(2): 404. 1979.

E Anini (28°49'34"N; 96°01'46"E), 3000 m, by path in forest. 10 September 2017. AA & ML 2017-140.

FoC: NW Yunnan.

Very similar to *V. cana* Benth, from which it differs mainly in the glandular hairy inflorescence.

ROSACEAE

Potentilla dumosa (Franch.) Hand.-Mazz. Symb. Sin. Pt. vii. 515. 1933 (*P. coriandrifolia* var. *d.*). [Figure 20].

E Anini (28°48'38"N; 96°02'50"E), 3950m, on rocks. 10 Sep 2017. AA & ML 2017-113.

FoC: SE Tibet, N Myanmar, NW Yunnan.

PLATE – III. 13. *Gaultheria albiflora*; 14. *Gaultheria eciliata*; 15. *Gaultheria obovata*; 16. *Gentiana subtilis*; 17. *Swertia tibetica*; 18. *Swertia verticillifolia*; 19. *Veronica chayuensis*

Like *P. coriandrifolia* D.Don, but more robust and flowers yellow.

VALERIANACEAE

Patrinia speciosa Hand.-Mazz., Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 61: 21. 1924. [Figure 21].

E Anini (28°48'56"N; 96°02'44"E), 3800 m, alpine meadow, fairly common. 10 September 2017. AA & ML 2017-119.

FoC: SE Tibet, NW Yunnan (Gongshan).

MONOCOTYLEDONS

TRILLIACEAE

Paris rugosa H.Li & Kurita, Acta Bot. Yunnan., Suppl. 5: 13. 1992. [Figure 23].

E Anini (28°49'35"N; 96°01'44"E), forest margin, 1900 m. 10 Sep 2017.

FoC: NW Yunnan.

Distinguished by its broad wrinkled leaves, broad outer tepals, very long filiform inner tepals, stamens 3 X as many as tepals and connective not prolonged.

Often, locals collect it as a substitute for the related medicinal herb *P. polyphylla* Sm.

Additional species collected from the areas E of Anini above 3000 m amsl includes:

Sinocarum sp. [Apiaceae]

Apiaceae sp. yet to determine

Cremanthodium palmatum subsp. *rhodocephalum* (Diels) D'O.Good [Asteraceae]

Balanophora polyandra Griff. [Balanophoraceae]

Codonopsis benthamii Hook.f. & Thomson [Campanulaceae]

Schizotechium paniculatum (Edgew.) Pusalkar & S.K.Srivast. [Caryophyllaceae]

Parnassia chinensis Franch. *vel aff.* [Celastraceae]

Parnassia cooperi W.E.Evans [Celastraceae]

Parnassia wightiana Wight & Arn. [Celastraceae]

Sedum trullipetalum Hook.f. & Thomson [Crassulaceae]

Gaultheria nummularioides D.Don [Ericaceae]

Corydalis casimiriana ssp. *brachycarpa* Lidén [Fumariaceae]

Corydalis flaccida Hook.f. & Thomson [Fumariaceae]

Comastoma pedunculatum (Royle ex D.Don) Holub [Gentianaceae]

Gentiana altigena Harry Sm. [Gentianaceae]

Gentiana doxiongshanensis T.N.Ho [Gentianaceae]

Gentiana cf. harrowiana Diels [Gentianaceae]

Gentiana phyllocalyx C.B.Clarke [Gentianaceae]

Gentiana sp. [Gentianaceae]

Utricularia brachiata Oliv. [Lentibulariaceae]

Utricularia christopheri Taylor (cf. Lidén & Bharali 2014). A considerable eastward extension of range [Lentibulariaceae]

Utricularia multicaulis Oliv. [Lentibulariaceae]

Circaea micrantha A.K.Skvortsov [Onagraceae]

PLATE – IV. 20. *Potentilla dumosa*; 21. *Patrinia speciosa*; 22. *Rhodiola primuloides*; 23. *Paris rugosa*; 24. *Hymenidium davidii*

Epilobium spp. [Onagraceae]
Erythranthe tenella (Bunge) G.L.Nesom [Phrymaceae]
Pedicularis spp. [Orobanchaceae]
Meconopsis prainiana Kingdon-Ward [Papaveraceae]
Meconopsis sp. [Papaveraceae]
Bistorta griffithii (Hook.f.) Grierson (cf. Bharali & *al.* 2014) [Polygonaceae]
Bistorta macrophylla (D.Don) Soják [Polygonaceae]
Koenigia nepalensis D.Don [Polygonaceae]
Koenigia delicatulum [Meisn.] [Polygonaceae]
Androsace sp. [Primulaceae]
Bryocarpum himalaicum Hook.f & Thomson (possibly the Easternmost record of this species) [Primulaceae]
Asteropyrum peltatum (Franch.) J.R.Drumm. & Hutch. (common from 2700 to 3300 m; cf. Hareesh & *al.* 2016) [Ranunculaceae]
Aruncus gombalanus (Hand.-Mazz.) Hand.-Mazz. (3700 to 3900 m; cf. Pathak & Baumik 2012) [Rosaceae]
Chamaecallis perpusilloides (W.W.Sm.) Smedmark [Rosaceae]
Fragaria daltoniana J.Gay [Rosaceae]
Potentilla cuneata Lehmann [Rosaceae]
Rubus franchetianus H.Lév. [Rosaceae]
Saxifraga hispidula D.Don [Saxifragaceae]
Viola sp. [Violaceae]
Juncus perpusillus Sam. [Juncaceae]
Juncus sp. [Juncaceae]
Tofieldia himalaica Baker [Tofieldiaceae]
Neottia alternifolia (King & Pantl.) Szlach [Orchidaceae]
Neottia divaricata (Panigrahi & P.Taylor) Szlach [Orchidaceae]
Platanthera bakeriana (King & Pantling) Kraenzlin [Orchidaceae]
Platanthera contigua Tang & F.T.Wang (cf Lidén & Bharali, this volume) [Orchidaceae]
Platanthera leptocaulon (Hook.f.) Soó [Orchidaceae]
Platanthera stenantha (Hook.f.) Soó [Orchidaceae]
Platanthera uniformis Tang & F.T.Wang (cf Lidén & Bharali, this volume) [Orchidaceae]
Agrostis sp. [Poaceae]

Acknowledgements

We are grateful to our expedition partners: Jonas Bengtsson, Magnus Björlin and Larz Danielsson – for sharp eyes and shared photos. For help with determinations we thank Dirk Albach (*Veronica*), Yu Sheng-Xiang and Rajib Gogoi (*Impatiens*), Wang Qin-Er and Wang Long (*Cremanthodium*), Bernard Dickoré (*Leontopodium*) and Bertil Nordenstam (*Synotis*). The picture of flowering *Patrinia speciosa* and the upper right flower of *Impatiens nyimana* were provided by J. Bengtsson.

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