

SOME ADDITION TO THE FLORA OF ARUNACHAL PRADESH AND INDIA

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Abstract

The paper highlighted the six species which are having new distributional records for the state of Arunachal Pradesh, viz. *Cardamine trifoliolata*, *Elatostema cyrtandrifolium*, *Pilea medogensis*, *Salvia campanulata* var. *codonantha* (new record for India), *Strobilanthes mastersii* and *Strobilanthes oxycalycina*. The scrutiny of literature ascertained that the occurrence of these species in the state was not known.

Keywords: Distribution, Diversity, New records.

INTRODUCTION

Arunachal Pradesh, by virtue of its geographical position, climate conditions and altitudinal variations, is a biodiversity rich region in North East India, with large zone of tropical wet evergreen, subtropical, temperate and alpine forests. The state is recognized as one among the 200 globally important regions (Olson and Dinerstein, 1998). The flora of Arunachal Himalaya comprises well over 4500 species of flowering plants (Hajra et al., 1996). During the course of floristic exploration under the project 'Flora of East Kameng District' (2015-2019) of Botanical Survey of India, the senior author had made collection from the district. These specimens were identified with the help of existing floras for the region and also consulted with the various herbaria representing the collection of plants for the North East Indian region such as SIKKIM (Gangtok), ASSAM (Shillong), ARUN (Itanagar) and CAL (Howrah). A critical examination of the literature revealed that so far these plants species were not been reported from the state of Arunachal Pradesh, total of 6 species comes as a new distributional record for the state and including one species as a new record for the India (Hooker, 1882, 1885 & 1897; His-wen and Hegade, 1994; Giri et al.,

2009; Das and Mao, 2011; Pal, 2013; Bhaumik and Satyanarayana 2014a&b, Tiwari, 2015-16, 2016; Tiwari and Mao, 2016; Kanwal et al., 2019; Tiwari, 2019). Therefore, these plants are reported here with complete description, photographs of the species and relevant notes based on collector's information for provided to facilitate easy identification.

Taxonomic Enumerations

1. *Cardamine trifoliolata* J.D.Hooker & Thomson, J. Proc. Linn. Soc., Bot. 5: 145. 1861 (Family: Brassicaceae) (Fig. 1a).

Prostrate or procumbent herb, minutely pilose. Stem thick at base with slender rhizomes. Stems decumbent, slender, simple or few branched. Basal leaves 1–3, foliolate, rarely simple; petiole upto 4 cm; terminal leaflet obovate or ovate, 2–10 × 2–11 mm, petiolule 1–7 mm, base subtruncate to cordate, or rounded, entire margin and obscurely 5-lobed, apically subtruncate or obtusely 3-lobed; lateral leaflets 1–3 pairs, subsessile or petiolulate, terminal leaflets not lobed, small, ovate. Cauline leaves 1–5-foliolate; petiole 4–14 mm; terminal and lateral leaflets ovate; petiolule 0.5–3 mm. Racemes lax, 2–8-flowered, rachis straight. Sepals oblong, 2–3 × 1–2 mm, glabrous, lateral pair subsaccate.

Petals white, spatulate, 4–9 × 2–4 mm, not clawed, apex rounded. Ovules 8–12 per ovary. Young fruit glabrous. Fruiting pedicels ascending or divaricate, 5–20 mm, straight, glabrous. Mature fruit and seeds not seen.

Flowering and fruiting: July–November.

Specimen examined: 47649 (ARUN!), 23.vii.2016, India: East Kameng district, Meechi Sawa block, 27.504°N & 92.572°E, 3384m, Coll. U.L. Tiwari.

Distribution: Found in alpine meadows and near streams; India (Arunachal Pradesh, Sikkim); Bhutan, Nepal, China.

2. *Elatostema cyrtandrifolium* (Zoll. & Moritzi) Miq, Pl. Jungh. 1: 21. 1851 (Family: Urticaceae) (Fig. 1b).

Perennial herb, plant dioecious, 8–80 cm tall. Stems branched erect, glabrous. Leaves alternate; nanophylls absent; stipules narrowly lanceolate, 2–5 × 0.5–1 mm, glabrous, with cystoliths; petiolate, petiole 0.5–5 mm; leaf blade obliquely elliptic, 4–15 × 2–5.5 cm, membranous, abaxial puberulent along veins, adaxial strigillose, cystoliths conspicuous, dense; base broadly cuneate or rounded, margin serrate, apex acuminate. Male inflorescences solitary, simple, 4–13 mm in diam.; peduncle ca. 7 mm; receptacle 5–12 mm in diam.; bracts connate, ca. 3 mm; bracteoles cymbiform. Male flowers 4-merous. Female inflorescences solitary or in pairs, 3–14 mm in diam.; peduncle 0.5–2 mm; receptacle 2–10 mm in diam.; bracts ovate; bracteoles spatulate or linear-lanceolate. Achenes ovoid or ellipsoid, 6–9-ribbed.

Flowering and fruiting: July–November.

Specimen examined: 47303 (ARUN!), 6.vii.2016, India: East Kameng district, Hill top-Yashing Rhichukurung block, 27.2092°N & 92.7882°E, 1065m, Coll. U.L. Tiwari.

Distribution: Subtropical evergreen forest along stream side; India (Arunachal Pradesh, Sikkim); Bhutan, Nepal, China.

3. *Pilea medogensis* C. J. Chen, Bull. Bot. Res., Harbin 2(3): 109. 1982 (Family: Urticaceae) (Fig. 1c).

Perennial herb, stoloniferous, dioecious or monoecious. Stems erect, branched. Stipules deciduous, brownish, oblong-lanceolate, membranous. Leaves elliptic or ovate-elliptic, unequal in size, 1.9 × 1.4 cm, submembranous, 3-veined, lateral veins 9–13 each side, inconspicuous, abaxial pubescent, adaxial multicellular pilose, cystoliths minute, shortly fusiform or punctate, base broadly cuneate or obtuse, margin dentate, apex caudate-acuminate. Inflorescence glomerules several, in moniliform spikes, branched, rarely capitate, peduncle 4–26 mm; bracts ovate-oblong, ca. 0.6 mm. Male flowers purplish, ovoid, ca. 1 mm; perianth lobes 4, subapically inconspicuously corniculate; stamens 4; rudimentary ovary minute. Female perianth lobes unequal, abaxial lobe somewhat hooded, half as long as achene, lateral 2 lobes triangular-ovate, shorter, membranous. Achene ovoid, ca. 1 mm, slightly compressed, slightly oblique, verrucose, enclosed by persistent perianth.

Flowering and fruiting: July–November.

Specimen examined: 47193b (ARUN!), 19.xi.2015, India: East Kameng district, Pipu block, 27.6672°N & 93.1241°E, 980m, Coll. U.L. Tiwari.

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

4. *Salvia campanulata* var. *codonantha* (E. Peter) E. Peter, Repert. Spec. Nov. Regni Veg. 39: 180. 1936 (Family: Lamiaceae) (Fig. 1d).

Perennial herbs; stems erect, 35–90 cm, strigose or villous, 4 angular. Leaves cordate to ovate-truncate, subglabrous, adaxially densely pilose on veins, margin ciliate, 2.5–19 × 3.5–18 cm, base acuminate, margin incised-crenate, acuminate apex, petiolate, 3–26 cm. Inflorescences densely villous, glandular pilose; verticillasters 8–30 flowered, in terminal raceme-panicles; bracts ovate, 3–10 mm. Pedicel 3–7 mm. Calyx campanulate, ca. 1.5 cm, shallowly 2-cleft, villous, glandular pilose, margin ciliolate; upper lip broadly ovate, ca. 2–3 × 10–13 mm, acute apex; lower lip as long as upper, ca. 6–10 mm wide, apex with 2 triangular acute teeth. Corolla Yellow, ca. 3.5 cm, white hairs outside; tube pilose annulate inside, gradually curved; upper lip ovate, ca. 4–6 mm, slightly arcuate; lower lip 1–1.5 × 1.5 cm, obliquely spreading; middle lobe obcordate, ca. 4 × 8 mm, constricted at base; lateral lobes triangular-ovate, ca. 4 mm wide. Stamens exserted or nearly included; filaments ca. 6.5 mm; connectives ca. 1 cm, upper arms ca. 5 mm, lower arms ca. 3 mm. Style slightly exserted. Nutlets brown, narrowly obovoid.

Flowering and fruiting: July–September.

Specimen examined: 47641 (ARUN!), 23.vii.2016, India: East Kameng district, Meechi Sawa block, 27.504°N & 92.572°E, 3384m, Coll. U.L. Tiwari.

Distribution: Found in alpine meadows along rocky slopes; India (Arunachal Pradesh); China and Myanmar.

5. *Strobilanthes mastersii* T. Anderson, J. Linn. Soc., Bot. 9: 481. 1867 (Family: Acanthaceae) (Fig. 1e).

Perennial herbs 1.5–2.5 m tall; stems 4-angled, erect, sulcate, glabrous to gland-tipped pilose. Leaves ovate to ovate-lanceolate, base cuneate on basal leaves and rounded on apical

leaves, margin serrate, apex acuminate, 8–16 × 3–8.5 cm, petiole 0–2 cm with apical leaves sessile. Inflorescences terminal, panicles of spikes, narrowly ovoid, to 35 cm; densely gland-tipped pilose; sterile bracts leaflike, lanceolate to ovate, 5–13 × 3–9 mm, caducous, acuminate apex; floral bracts elliptic, 5–6 × 2–3 mm, caducous, obtuse apex; bracteoles oblong, ca. 3 × 1 mm, caducous, abaxially glabrous. Calyx 0.6–1.8 cm, densely gland-tipped pilose and accrescent, 5-lobed almost to base; lobes lanceolate, with 3 lobes slightly longer than other 2, acuminate apex. Corolla purple, 2.5–3.9 cm, straight, ventricose, outside glabrous, inside glabrous except for trichomes retaining style; tube basally cylindrical and ca. 2 mm wide for 1–1.5 cm then widened to ca. 1 cm at mouth; lobes orbicular, ca. 6 mm in diam. Stamens 4, included; filaments glabrous, didynamous, 3–6 mm. Ovary slightly pilose at tip. Capsule clavate, ca. 1.5 cm, apically gland-tipped pilose, 4-seeded.

Flowering and fruiting: September–January.

Specimen examined: 47165 (ARUN!), 17.xi.2015, India: East Kameng district, Chiyangtajo to Yangfo basti, 27.6911°N & 92.1402°E, 1400m, Coll. U.L. Tiwari.

Distribution: Forests on mountain slopes; between 1300–1800m; India (Arunachal Pradesh); China and Myanmar.

6. *Strobilanthes oxycalycina* J. R. I. Wood, Edinburgh J. Bot. 51: 250. 1994 (Family: Acanthaceae) (Fig. 1f).

Sub-shrubs 1–3 m tall; stems rounded, glabrous, covered with cystoliths. Leaves oblong-elliptic, 5–15 × 2.5–8 cm, both surfaces glabrous with prominent cystoliths, secondary veins 5–9 on each side of midvein, base cuneate, margin serrate, acuminate apex; petiole 0.5–1.9 cm, glabrous; Inflorescences terminal, headlike spikes, simple or 3-furcate

branched; peduncle 2.5–6.5 cm, glabrous; bracts ovate, ca. 6 × 4 mm, caducous, thinly pubescent, apex shortly acuminate; bracteoles oblong-obovate, ca. 3 × 1–2 mm, acute apex. Calyx ca. 10 mm, accrescent to ca. 1.1 cm in fruit, 5-lobed almost to base; lobes linear to oblong-elliptic, equal, outside pubescent with gland-tipped trichomes, inside glabrous, acute apex. Corolla blue, 3–4.5 cm, slightly curved, outside gland-tipped pubescent, inside glabrous except for trichomes retaining style; tube basally cylindrical and ca. 1 mm wide for ca. 1.2 cm then gradually widened to 7–9 mm at mouth; lobes ovate, ca. 5 × 5 mm, apex obtuse. Stamens 4; filaments finely pubescent, didynamous, 4–8 mm, unequal, and slightly exerted. Ovary gland-tipped pilose at tip. Capsule oblong, 1.1–1.5 cm, gland-tipped pubescent, 4-seeded.

Flowering and fruiting: November-January.

Specimen examined: 47033(b) (ARUN!), 14.xi.2015, India: East Kameng district, Lagnta to Chiyang Tajo, 27.6766°N & 93.1458°E, 1735m, Coll. U.L. Tiwari.

Distribution: India (Arunachal Pradesh); China and Myanmar.

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REFERENCES

- Bhaumik, M., Satyanarayana, P., 2014a.** Nine new records for Indian flora. Indian Journal of Forestry. 37(4), 413–418.
- Bhaumik, M., Satyanarayana, P., 2014b.** *Pterygiella oliver* (Scrophulariaceae) and *Pogonia* Jussieu (Orchidaceae)- Two generic records for Indian flora. Indian Journal of Forestry. 37(3), 299–302.
- Das, S.S., Mao, A.A., 2011.** Distribution of six little known plant species from Arunachal Pradesh, India. Journal of Threatened Taxa. 3(9), 2095–2099.
- Giri, G.S., Pramanik, A., Chowdhery, H.J., 2008.** Materials for the Flora of Arunachal Pradesh, vol. 2. Botanical Survey of India, Calcutta.
- Hajra, P.K., Verma, D.M., Giri, G.S., 1996.** Materials for the Flora of Arunachal Pradesh, vol. 1. Botanical Survey of India, Kolkata.
- His-wen, L., Hegade, I.C., 1994.** Lamiaceae. Flora of China, vol. 17, 50–299.
- Hooker, J.D., 1882.** Flora of British India, vol. 3, London, pp. 308.
- Hooker, J.D., 1885.** Flora of British India, vol. 4, London, pp. 261.
- Hooker, J.D., 1885.** Flora of British India, vol. 5, London, pp. 592.
- Kanwal, K.S., Tiwari, U.L., Yama, L., Lodhi, M.S., 2019.** Extended distribution record of two bellflower species of *Codonopsis* (Campanulaceae) from the Indian state of Arunachal Pradesh. Journal of Threatened Taxa. 11(9), 14228–14231.
- Olson, D.M., Dinerstein, E., 1998.** The Global 200: A representation approach to conserving the earth's most biologically valuable ecoregions. Conservation Biology. 12, 502–515.
- Pal, G.D., 2013.** Flora of Lower Subansiri District, Arunachal Pradesh (India), vol. 2. Botanical Survey of India.
- Tiwari, U.L., 2015–16.** Notes on some new distributional records of plants from state of

Arunachal Pradesh to Bulletin of Arunachal Pradesh. Bulletin of Arunachal Forest Research. 30–31(1–2), 86–94.

Tiwari, U.L., 2016. *Oxygraphis delavayi* Franchet new generic record for state and new species record for India. Journal of Threaten Taxa. 8(4), 8739–8741.

Tiwari, U.L., Mao, A.A., 2016. *Beesia calthifolia* a new generic record for India from Arunachal Pradesh. Indian Forester. 142(5), 507–508.

Tiwari, U.L., 2019. Addition to the flora of Arunachal Pradesh state, India. Journal of Threaten Taxa. 11(8), 14075–14079.

Plate plate



a. *Cardamine trifoliolata*



b. *Elatostema cyrtandrifolium*



c. *Pilea medogensis* C. J. Chen



d. *Salvia campanulata* var. *codonantha*



e. *Strobilanthes mastersii*



f. *Strobilanthes oxycalycina*