



RESEARCH ARTICLE

Diversity and distribution of the genus *Rhynchocheum* Blume (Gesneriaceae) in Arunachal Pradesh, India

Momang Taram and Hui Tag*

Plant Systematics and Ethnobotanical Research Laboratory, Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh-791112, Arunachal Pradesh, India

Corresponding author email: hui.tag@rgu.ac.in; momang.taram@rgu.ac.in

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Abstract

A taxonomic investigation on the genus *Rhynchocheum* Blume (Gesneriaceae) in the state of Arunachal Pradesh, India was carried out during 2018–2022. The present revisionary studies have reported 7 taxa from Arunachal Pradesh. All the recorded species are enumerated here with taxonomic keys and notes based on morphological characters of living plants, along with the distributional ranges and colored photographs.

Keywords: *Rhynchocheum*, Gesneriaceae, Diversity, Arunachal Pradesh, India

1. Introduction

State of Arunachal Pradesh is reported as richest botanical province in India, which harbors about 50% of the India's flora, and 4% of them are reported to be endemic to the region (Taram et al., 2020c; Borah et al., 2019). Wide range of agro-climatic conditions and altitudinal variations found in the region confers ideal habitat for the proliferation of phyto-diversity in different vegetation types found in the state of Arunachal Pradesh (Taram et al., 2020b). Arunachal Pradesh harbors highest number of Gesneriad members among the states of North Eastern India. Gesneriaceae is one of the flowering plant families in the order Lamiales which comprises around 3400 species and roughly a one-third of its total species are distributed in the New world and two-third in Old world in tropical and subtropical moist forest (Taram et al., 2021). In India, Gesneriaceae shows maximum diversity of genera in Northeastern Region of India while maximum species diversity have been reported from states of Assam and Arunachal Pradesh (Roy 2017).

The genus *Rhynchocheum* Blume is an important genus of the Gesneriaceae, which belonging to sub-family *Didymocarpoideae*, tribe *Trichosporeae* and sub-tribe *Leptoboeinae* (Weber et al., 2013; Moller et al., 2017). The genus was described by Blume in 1826, and it comprises a group of understory shrubs, cymose inflorescences with relatively small flowers (white to pink) with short corolla tube and indehiscent white berries. They are found to be distributed in tropical and subtropical Asia from India to China, north to the Ryukyus in Japan, south through the Philippines and the Malay Peninsula to Sumatra and east to Papua New Guinea (Anderson and Middleton, 2013). *Rhynchocheum* Blume has been revised recently by Anderson and Middleton (2013) who recognized a total of 16 species, excluding the recently described species: *R. nirijuliense* Taram & D. Borah (Taram and Borah, 2020) and *R. lalashanense* S.S. Ying vide POWO (2020); <https://padme.rbge.org.uk/GRC>.

In India, a total of ten species of *Rhynchocheum* have been reported which include: *R. alternifolium* C.B. Clarke, *R. calycinum* C.B. Clarke, *R. ellipticum* (Wall. ex D. Dietr.) A.D.C., *R. gracile* B.M. Anderson, *R. hookeri* (C.B. Clarke) B.M. Anderson, *R. nirijuliense* Taram & D. Borah, *R. obovatum* (Griff.) B.L. Burtt, *R. parviflorum* Blume, *R.*

permolle (Nees) B.L. Burtt and *R. vestitum* Wall. ex C.B. Clarke (Anderson and Middleton, 2013; Sinha and Datta, 2016; Möller et al., 2017; Roy, 2017; Roy et al., 2019; Taram et al., 2020; Taram & Borah 2020) from which nine species (with the exception of *R. permolle*) are distributed in North East India while *R. nirijuliense* and *R. calycinum* are reported to be endemic to Northeast India. Among the ten species, eight species of *Rhynchocheum* have been reported from Arunachal Pradesh (Anderson and Middleton, 2013; Sinha and Dutta, 2016; Roy et al., 2019; Taram and Borah, 2020; Taram et al., 2020a) but the present field investigation has recorded seven *Rhynchocheum* species with immense foliar and floral diversity found in the state of Arunachal Pradesh.

Although Gesneriaceae is economically less important but many Gesneriads are reported as ethno-botanically significant for some tribal communities (Roy 2017). Taram et al (2021) have reported 21 ethno-botanically significant Gesneriads of Arunachal Pradesh which includes the seven *Rhynchocheum* species. The present field investigation has reported taxonomic diversity of *Rhynchocheum* species of Arunachal Himalaya along with their current taxonomic status, distribution and endemism range.

2. Materials and methods

The present taxonomic revisionary study was carried out during the year 2018–2022 along different altitudinal ranges in the state of Arunachal Pradesh. Extensive field surveys were conducted in different districts of Arunachal Pradesh during different seasons of the year. Flowering and fruiting seasons were recorded and flowering twigs were collected from the field and photographed using a digital camera (Nikon COOLPIX B600, Nikon India Pvt. Ltd). GPS coordinates were recorded using Garmin GPS (Etrex 10 device, Asim Navigation India Pvt. Ltd). The specimens collected from each field visits were processed using standard herbarium methods (Jain and Rao, 1977) and voucher specimens were deposited in ARUN, ASSAM, CAL, E and Herbarium of Arunachal University (RGUH/HAU), Department of Botany, Rajiv Gandhi University, Itanagar, Arunachal Pradesh for future reference. Morphological observations were made

on both fresh and dried specimens. Morphological characters were compared with those reported in the literatures: Wang et al (1998), Giri et al (2008), Anderson and Middleton (2013), Sinha and Dutta (2016), Roy (2017), Roy et al. (2019), Taram and Borah 2020, Taram

et al. (2020a) and digital images of type specimens housed in K, E, PE, ASSAM, ARUN and CAL ([http://apps.kew.org>herbcat](http://apps.kew.org/herbcat); <https://www.rbge.org.uk>; <http://pe.incas.ac.cn>>).

3. Results

3.1. Taxonomic treatment

Rhynchosyche Blume, Bijdr. Fl. Ned. Ind. 775. 1826. Synonym: *Isanthera* Nees. In Trans. Linn. Soc. London xvii: 82. 1834; *Corysanthera* [Wall ex] Endl. Gen. Pl. 719. 1839; *Cheilosandra* [Griff ex] Lindley, veg. Kingd. 672. 1847; *Chiliandra* Griff. Notulae, iv, 150. 1854 et Ic. Pl. Asiat. T 438. 1854. **Type:** *Rhynchosyche parviflorum* Blume.

Key to the *Rhynchosyche* species of Arunachal Pradesh

- 1a. Inflorescence often with solitary peduncles from leaf axils; leaves whorl of 3 or alternate.....2
- 1b. Inflorescence with a reduced/absent peduncle so that the branches appear fascicled from leaf axils; leaves opposite.....3
- 2a. Leaves and peduncles opposite or whorled; leaves abaxially sub-glabrous between the veins.....*R. obovatum*
- 2b. Leaves and peduncles alternate; leaves abaxially woolly between the veins.....*R. alternifolium*
- 3a. Plants hispid, hairs stiff; calyx lobes distinctly caudate.....*R. vestitum*
- 3b. Plants woolly pubescent, sub-glabrous at maturity, hairs not stiff; calyx lobes triangular to linear acuminate, only rarely somewhat caudate.....4
- 4a. Compact inflorescences; calyx segments glabrous, fruits globose.....*R. calycinum*
- 4b. Inflorescence and calyx segments scabrous or villous/sericeous, fruit ovoid to ellipsoid.....5
- 5a. Inflorescence spreading, pedicels and calyx lobes often scabrous, the hairs conspicuously multicellular; ovary glabrous*R. ellipticum*
- 5b. Inflorescence pendulous, pedicels and calyx lobes sericeous or sub-glabrous; ovary glabrous to short pubescent.....6
- 6a. Lateral veins of lamina more than 30, berry ovoid.....*R. nirjuliense*
- 6b. Lateral veins of lamina less than 30; berry ellipsoid or broadly ovoid.....*R. parviflorum*

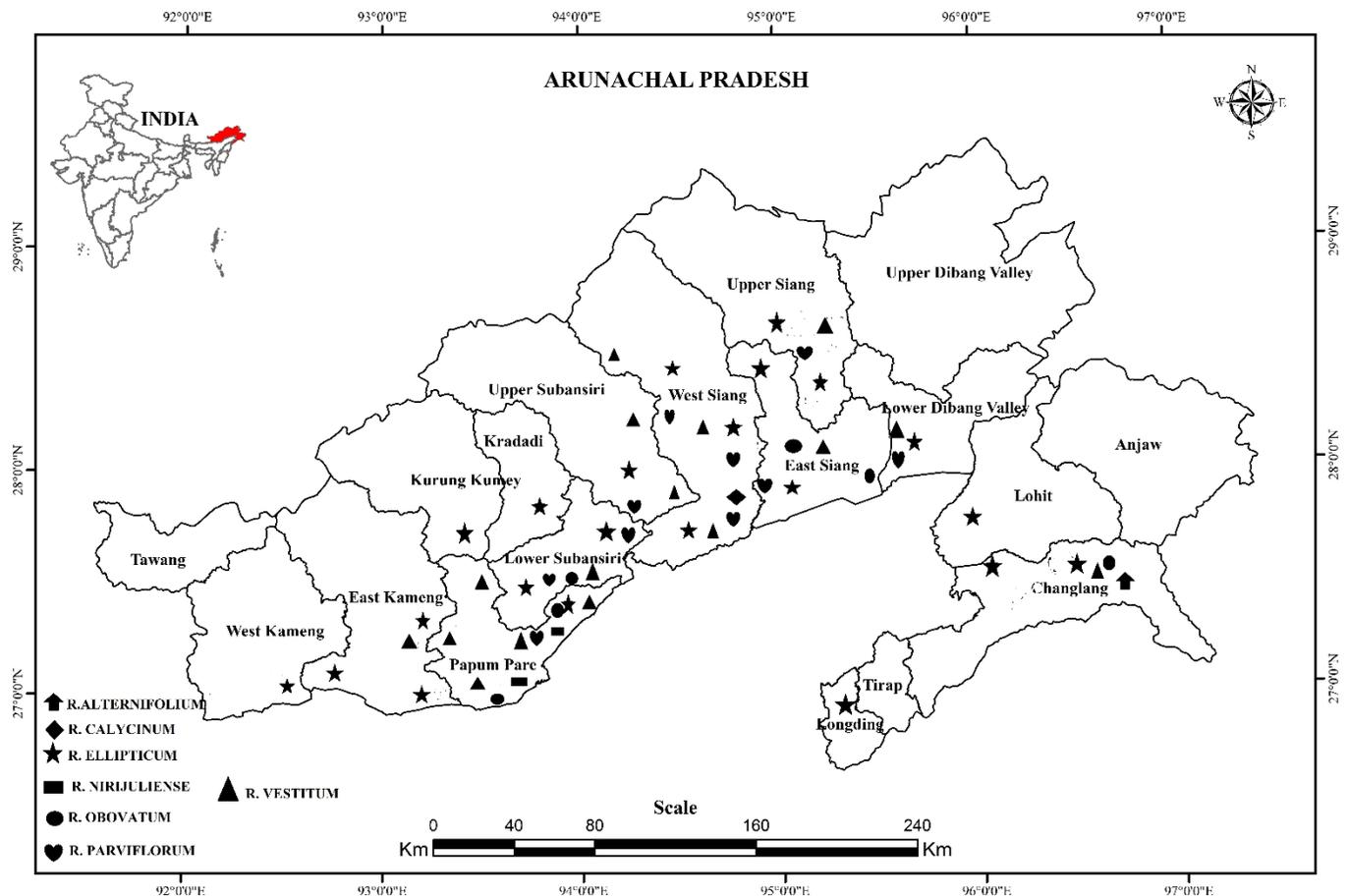


Figure 1. Distribution of *Rhynchosyche* species in Arunachal Pradesh.

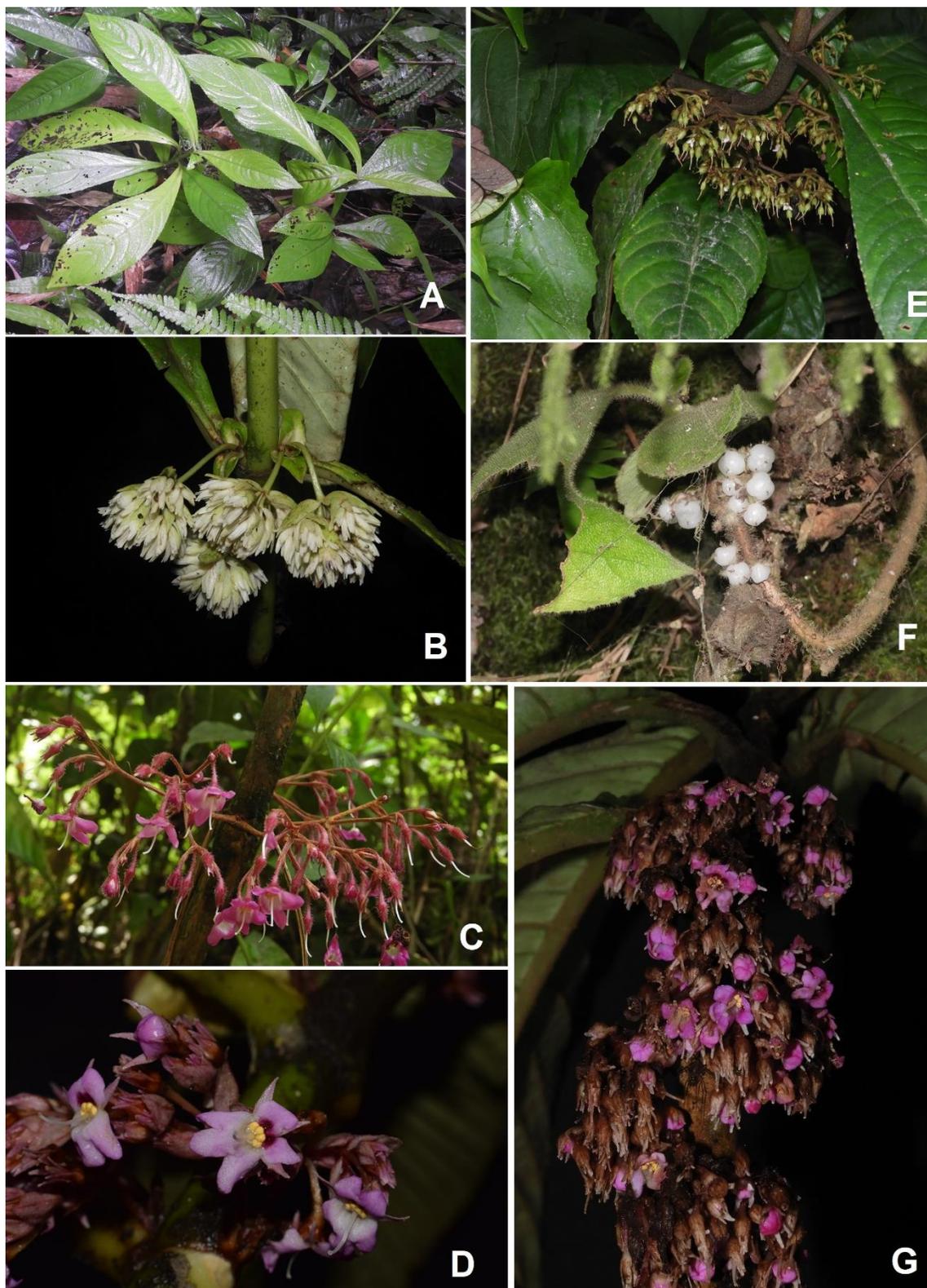


Figure 2. A-*R. alternifolium*, B- *R. calycinum*, C- *R. ellipticum*, D- *R. nirjuliense*, E- *R. obovatum*, F- *R. vestitum*, G- *R. parviflorum*

(3.1.1) *Rhynchoatechum alternifolium* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 198. 1883; C.B.Clarke in Hook.f., Fl. Brit. India 4: 374 1884; Sinha & Dutta, Nelumbo 58:39.2016.

Synonym: None

Type: India, Upper Assam, by lake Brahmakoondo [Brahmakund], Griffith 3850 (K).

Stems glabrescent. Leaves alternate to sub-opposite. Inflorescence spreading, 5–20 cm long, 4–5-branched; peduncle 2.5–11.5 cm long; bracts linear to triangular. Calyx lobes oblong to ovate-elliptic, glabrous to sparsely sericeous. Corolla white, exterior glabrous; upper lip with darker patch, 3–3.5 × 5 mm, apices obtuse; lower lip 4.5–5 × 7 mm; lower lobes 2.25–2.5 × 2–2.5 mm, apices rounded to obtuse; tube 1.5 mm long. Stamens inserted near the base of the corolla tube; filaments c.1 mm long. Ovary slightly puberulent; style 5–7 mm long; stigma apex globose to truncate. Fruit ovoid, glabrous.

Flowering and fruiting: February, August and November.

Habitat and ecology: Growing in evergreen and mixed forests at an elevation from 350 – 800 m msl in association with *Rhynchoatechum obovatum*, *Boeica fulva*, *Begonia burkillii*, *Begonia dicrasine*, *Thladiantha* species, *Polygala arillata*, *Urtica* species and many more.

Distribution: India (Arunachal Pradesh) and Myanmar

Specimen examined: India, Arunachal Pradesh, Changlang, Namdhapa National Park, 450 m msl, 12 August 2021

(3.1.2) *Rhynchoatechum calycinum* C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 199. 1883; C.B.Clarke in Hook.f., Fl. Brit. India 4: 374. 1884; Burkill, Rec. Bot. Surv. India 10: 330. 1925; G.D.Pal & Thoth., Bull. Bot. Surv. India 30: 173. 1988; Giri et al., Mat. Fl. Arunachal Pradesh 2: 234. 2008; Kumar, A., Floristic Diversity of Arunachal Pradesh (Upper Subansiri District) 343. 2013; G. D. Pal, Fl. Lower Subansiri District, Arunachal Pradesh 2: 176. 2013; Sinha and Datta, Nelumbo 58: 40. 2016

Synonym: None

Type: India, Upper Assam, on the banks of the river Soondra, Unknown s.n. (holo K).

Stem glabrous. Leaves opposite; petiole sessile. Inflorescence axillary, pendulous compact, 1 - 4 cyme per axil, 2-4 -branched; peduncle 2-4 cm long, glabrous; bracts elliptic to lanceolate, acute, sub entire; first bract 1.8–2.5 cm × 0.7 - 1 cm, second bract 1.3-2 cm × 0.4-0.8 cm; pedicels sub-glabrous. Calyx creamy white, lobes triangular or oblong to linear, apices acute to obtuse, 0.5–0.8 × 0.2-0.3 cm, glabrous, margin entire. Corolla white, exterior glabrous. Stamens yellow inserted near the base of the corolla tube, didynamous; filaments 1–2 mm long. Disk annular. Ovary glabrous; style 0.3 - 0.4 cm long. Fruit ellipsoid to globose, 2.5–2.75 × 2–2.25 mm, glabrous.

Flowering and fruiting: June - August.

Distribution: Endemic to Northeast India (Arunachal Pradesh, Assam)

Habitat and ecology: Growing on the margins of primary forest, often in moist and shady conditions, along streams side or road sides at an elevation from 300 -700 m msl. It grows with an association with *Musa* species, *Begonia burkillii*, *Strobilanthes* species, *Elatostemma* species, *Urtica* species, *Calocasia* species, Ferns, *Alpinia* species, *Amomum* species etc.

Specimen examined: India, Arunachal Pradesh, Lower Siang district, on the way to Koyu, 530 m amsl, 12 July 2019, Momang Taram (982, 983) (ARUN, RGHU/HAU)

(3.1.3) *Rhynchoatechum ellipticum* (Wall. ex D.Dietr.) A.DC. in DC., Prodr. 9:285.1845; C.B.Clarke, Commelyn. Cyrtandr. Bengal. 131, pl. 41. 1874; in A.DC. & C.DC., Monogr. Phan. 5(1): 196.1883; in Hook.f., Fl. Brit. India 4: 373. 1884; Kumar A., Floristic Diversity of Arunachal Pradesh (Upper Subansiri District) 343. 2013; G. D. Pal, Fl. Lower Subansiri District, Arunachal Pradesh 2:178. 2013; Sinha and Datta, Nelumbo 58: 39. 2016

Synonym: *Chiliandra obovata* Griff. Not Pl. Asiat 4: 150. 1854. *Corysanthera elliptica* Wall. ex D. Dietr Syn. Pl. 3: 582. 1843.

Rhynchoatechum latifolius Hook. f., et Thomson ex C. B. Clarke Commelyn. Cyrtandr. Bengal. t. 94.1874.

Type: Mts Sylhet, F. de Silva, W. Gomez & H. Bruce in Wallich 6411 (K)

Stems 60–180 cm tall. Leaves opposite; petiole 1–4 cm long; lamina elliptic to narrowly elliptic. Inflorescence spreading, pink, 1.2–13.5 cm long, 2–6 branched; peduncle reduced; axes short yellow-rusty villous becoming scabrous to sub-glabrous higher up; bracts linear to triangular, first bract 3–6 mm long, second bract 3–5 mm long; pedicels, scabrous to sub-glabrous. Calyx pink to pale pink, lobes triangular to linear acuminate with apices rounded, 3–4.5 × c.1–1.5 mm. Corolla red-purple, exterior scabrous with glandular hairs. Stamens inserted near the base of the corolla tube; filaments c.1 mm long; anthers purple, c.1–1.5 mm diameter, slightly puberulent. Ovary 1–1.5 × 1–1.75 mm, glabrous to rarely puberulent with glandular hairs; style 6–7 mm long; stigma apex globose to truncate. Fruit broadly ovoid, 3–4.5 × 3–4.5 mm, glabrous.

Flowering & Fruiting: July to November

Distribution: India, Bhutan, Bangladesh, Nepal and Burma.

Habitat and ecology: Growing in primary and secondary forests, typically in shady and moist conditions along road side, stream side and on rocky places.

Specimen examined: India, Arunachal Pradesh, Papum Pare district, Jote road, 19 September 2019, Momang Taram 1020 (ARUN); India, Arunachal Pradesh, Papum Pare district, 430 m amsl, 19 September 2018, Momang Taram 813 (RGUH/HAU)

(3.1.4) *Rhynchoatechum nirijuliense* Taram & D. Borah in Gardens' Bulletin Singapore 72(1): 125–129. 2020. **Type:** India, Arunachal Pradesh, Papum Pare district, Nirjuli, Bage Hills, tropical bamboo forest, 27°7'19"N, 93°43'56"E, 166 m, 1 May 2019, M. Taram & D. Borah 0157 (holotype CAL; isotypes ASSAM, ARUN, E).

Stems to 2 m tall. Leaves opposite; almost sessile, petiole if present 0.5–1.2 cm long. Inflorescence axillary, pendulous; peduncle reduced or absent, branches 4–6 from each node, axes densely villous; bracts ovate to ovate lanceolate, navicular, undulate, deeply grooved along the midvein, paired, each at the axil of the first branches, 10–12 × 4–6 mm; bracteoles paired, one per branch, pale pink, ovate, entire, membranous, midvein prominent, 1–1.2 × 0.8–1 cm; pedicels 0.3–1.5 cm long, silky villous. Calyx divided to near the base, tube 1–2 mm long, lobes ovate lanceolate, with broadly acuminate apices, 7–10 × 1.8–2.2 mm, equal to or longer than the corolla, villous outside, glabrous inside. Corolla pink, exterior glabrous; tube 2–3 mm long. Stamens inserted near the base of the corolla tube; filaments c. 1 mm long; anthers c. 1.5 mm diameter, glabrous; staminate inconspicuous. Ovary ovoid, 1–1.5 × 1–1.2 mm, glabrous; Fruits ovoid, 1.2–1.5 × 0.7–0.9 cm, glabrous.

Flowering and fruiting: flowers from April to May, fruiting is from May onwards.

Distribution: India (Arunachal Pradesh).

Habitat and ecology: It occurs in damp and shady areas alongside streams and grows in association with *Begonia aborensis*, *Impatiens laevigata*, *Impatiens marianae*, *Impatiens porrecta*, *Litsea lancifolia*, *Pseuderanthemum latifolium*, *Strobilanthes secunda* etc.

Specimen examined: India, Arunachal Pradesh, Papum Pare district, Nirijuli, Bage Hills, 27°7'19"N, 93°43'56"E, 166 m, 1 May 2019, M. Taram & D. Borah 0157.

(3.1.5) *Rhynchoatechum obovatum* (Griff.) B.L.Burt, Notes Roy. Bot. Gard. Edinburgh 24: 38. 1962; Chun (ed.), Fl. Hainan. 3: 528.1974.; C.B.Clarke in A.DC. & C.DC., Monogr. Phan. 5(1): 198. 1883; in Hook.f., Fl. Brit. India 4: 374. 1884.

Synonym: *Chiliandra obovata* Griff., Not. Pl. Asiat. 4: 150.1854

Type: Griff., Icon. Pl. Asiat. 4: pl. 438 (1854) (K [K000249997])

Stems 60–100 (–120) cm tall. Leaves whorled (of 3), rarely opposite to alternate lower down; petiole 1–6 cm long. Inflorescence axillary, spreading, 5–11 cm long, up to 4 branched, branches purple tinged; peduncle 2.5–5.5 cm long, axes short yellow-rusty villous; bracts linear subulate; pedicels 0.3–1 cm. Calyx villous(outside), glabrous

(inside), green-pale pink, 0.4–0.5 × 0.10–0.12 cm, lobes triangular with rounded or slightly caudate apices; corolla white or pale pink, glabrous to slightly puberulent exteriorly; tube 1.5–2 mm long. Ovary 1.5–2.5 × 1–1.75 mm, glabrous to rarely puberulent, with glandular hairs; style 5.5–7.5 mm long; stigma apex globose/ rounded to truncate. Fruit ovoid.

Flowering and fruiting: July - September.

Distribution: Bangladesh, India, Burma, Thailand, Vietnam, Laos, Cambodia and China.

Habitat and ecology: Growing in wet to dry primary and secondary evergreen forests, sometimes disturbed areas or on gentle to steep slopes, at 197–2120 m.

Specimen examined: India, Arunachal Pradesh, Lower Subansiri District, Potin, 23 July 2019, Momang Taram 1020 (ARUN, RGUH/HAU)

(3.1.6). *Rhynchoetechum parviflorum* Blume, Bijdr. Fl. Ned. Ind. 775. 1826; C.B. Clarke in A.D.C. & C.D.C., Monogr. Phan. 5(1): 195. 1883 in Hook.f., Fl. Brit. India 4: 373. 1884; Vietnam 3(1): 25. 1993; Taram et al., in JOTT 12(1): 15208–15211. 2020

Synonym: *Cyrtandra microcarpa* C.B. Clarke in A.L.P.P. de Candolle & A.C.P. de Candolle, Monogr. Phan. 5: 195. 1883.

Type: Java, Seribu mountains, Blume s.n. [0834014]

Stems 20–180 cm tall. Leaves opposite, rarely sub-opposite; petiole 1.7–5 cm long. Inflorescence axillary, pendulous, 1.3–6 cm long, 2–4-branched; peduncle reduced/absent; axes rusty-yellow villous to sub-glabrous, rarely with glandular hairs present; bracts linear to triangular or subulate; pedicels 0.1–1.1 cm long, yellow-rusty villous. Calyx purplish red or green to pinkish brown, lobes triangular with apices rounded, rarely somewhat caudate, 0.2–0.4 cm × 0.75–1.5 mm, yellow-rusty villous to sub-glabrous or scabrous with glandular hairs. Corolla white to pale purple, exterior glabrous to slightly puberulent. Stamens inserted at 0.5–0.75 mm above the base of the corolla tube. Ovary 0.75–1.25 × 0.75–1.5 mm, short pubescent to puberulent; style white, 1.5–3.25 mm long; stigma white, apex truncate to globose. Fruit widely ellipsoid or widely ovoid, 0.3–0.4 × 0.2–0.5 cm, glabrous.

Flowering and fruiting: recorded in all months.

Distribution: India, Burma, Thailand, Vietnam, China, Sumatra, Kalimantan, Sulawesi, Indonesian New Guinea, Papua New Guinea and the Philippines.

Habitat and ecology: It usually prefers cliffs near perennial streams in primary forests as well as in secondary forests and damp groves near roadsides at an elevation from 300–800 m msl. It grows in associations with *Diplazium esculentum*, *Henckelia pumila*, *Boeica clarkei*, *Rhynchoetechum vestitum*, *Pilea insolens*, *Pilea umbrosa*, *Mycetia mukerjiana*, *Cyclosorus parasiticus*, *Strobilanthes hamiltoniana*, *Justicia* sp. Etc.

Taxonomic note: *Rhynchoetechum hookeri* can be recognised by its fairly compact and sub-glabrous inflorescences. It differs from *R. parviflorum* in its more entire leaves, its smaller inflorescence, its less puberulent ovary, and its typically longer style (Anderson and Middleton 2013). But these characteristics mentioned for *R. hookeri* has been observed in the *R. parviflorum* populations in Arunachal Pradesh. Occurrence of *R. hookeri* is doubtful in Arunachal Pradesh.

(3.1.7). *Rhynchoetechum vestitum* (Griff.) Wall. ex C.B. Clarke, Commelyn. Cyrtandr. Bengal. 132, pl. 92. 1874; C.B. Clarke in A.D.C. & C.D.C., Monogr. Phan. 5(1):197. 1883; in Hook.f., Fl. Brit. India 4: 373. 1884; Kanjilal et al. in Fl. of Assam 3:399.1939; Giri et. al., Mat. Fl. Arunachal Pradesh 2: 234. 2008; A. Mukherjee et. al., Pleione 2 (2): 160. 2008; Kumar, A., Floristic Diversity of Arunachal Pradesh (Upper Subansiri District) 343. 2013; G. D. Pal, Fl. Lower Subansiri District, Arunachal Pradesh 2: 179. 2013; Sinha and Datta, Nelumbo 58: 41. 2016.

Synonym: *Corisanthera vestita* Griffith, Itin. Notes 124. 1848.

Type: Bhutan, 3300 ft, Griffith 426 [K000249996]

Stems 60–180 cm tall. Leaves opposite; petiole 2–7 cm long; blade appressed hispid. Inflorescence appressed axillary, 2–4 cymes per axil, 1.2–6 cm long, 2–4-branched; peduncle 0.5–1.5 cm long (rarely reduced; bracts triangular to linear; pedicels 0.4–1.5 cm long, densely long yellow to pink hispid. Calyx whitish to greenish, lobes triangular with apices caudate, 0.4–0.8 cm × 0.2–0.4 cm, densely long hispid. Corolla pink to white, glabrous both sides; tube 0.1–0.2 cm long.

Stamens inserted at c. 0.1 cm above the base of the corolla tube, slightly didynamous. Ovary 0.1–0.2 cm × 0.1–0.2 cm, slightly puberulent with or without glandular hairs; style 0.2–0.4 cm long; stigma apex truncate to globose. Fruit white ovoid to widely ovoid.

Flowering and fruiting: March - September.

Distribution: India, Bhutan, Bangladesh, China, Vietnam, Sumatra and Java.

Habitat and ecology: Growing in rainforests, sometimes disturbed, in damp and shady conditions, in loam on granite and limestone, sometimes in ravines, at 450–1220 m.

Specimen examined: India, Arunachal Pradesh, Upper Subansiri District, Daporijo, 27 July 2019, Momang Taram 1025 (ARUN)

4. Discussion

India has the highest number of *Rhynchoetechum* species (10 spp.) in the world, of which the distribution of 80% (8 spp.) of the species are restricted to Northeastern region of India. *R. calycinum* and *R. nirijuliense* are narrowly endemic to North East India. The number of *Rhynchoetechum* species reported from Arunachal Pradesh in present studies is much higher than Nepal, Sri Lanka, Japan, Cambodia, Malaysia, Papua New Guinea and Sri Lanka with 1 species each; Bhutan, Laos, Philippines and Thailand with 2 species each; Hongkong with 3 species; Bangladesh and Taiwan with 4 species each; Indonesia and Vietnam with 5 species each and China with 6 species. However, the number of species in Arunachal Pradesh (excluding *R. hookeri*) is equal to Myanmar (7 species each) (Vide GRC rbge). *R. ellipticum*, *R. vestitum* and *R. parviflorum* are abundantly distributed in primary and secondary forest along the stream sides and roadsides while *R. calycinum*, *R. alternifolium*, *R. nirijuliense* and *R. obovatum* have been reported to have narrow range of geographical area highly vulnerable to reduction of present population size due to habitat destruction. Therefore, natural habitat conservation and protection is necessary to conserve these rare *Rhynchoetechum* species in Arunachal Pradesh.

5. Conclusion

The present field investigation has recorded seven species of *Rhynchoetechum* from Arunachal Pradesh (India) and all the reported species are ethnobotanically significant to the tribal communities such as Adi, Galo, Tagin, Nyishi and Lisu. *Rhynchoetechum* species are locally called as Joko/Jok (Nyishi and Galo), Joku (Tagin) and Byongkot/Jongkot (Adi). These species are used in different ways: tender shoot of *R. obovatum* and *R. alternifolium* is served as vegetable, young leaves of *R. ellipticum*, *R. parviflorum* and *R. nirijuliense* are consumed as additives, fruit of *R. vestitum* is eaten raw and leaves fermented with soyabean, and twig of *R. ellipticum* and *R. parviflorum* are used in local rituals specifically perform during funeral.

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Author's contributions

First author (MT) conducted field and literature survey, developed first of the manuscript. Second author (HT) conceptualized the research, literature studies, language editing and finalized the manuscript.

Conflict of interests

Authors have no conflict of interests

References

- Anderson BM and Middleton DJ. 2013. A Revision of *Rhynchoetechum* Blume (Gesneriaceae). Edinburgh Journal of Botany 70 (1):121-176.
- Blume CL. 1826. Bijdragen tot de flora van Nederlandsch Indie. Batavia: Ter Lands Drukkerij. Pp. 759, 775–776.

- Borah D, Das AP, Tangiang S and Wangpan T. 2019. Flowering Plant Diversity in the Alpine Regions of Eastern Himalaya. In: Jayanta KP, Gitishree D, Sanjeet K, Hrudayanath T (Eds.) *Ethnopharmacology and Biodiversity of Medicinal Plants*. Apple Academic Press, Palm Bay, Florida, USA. DOI: [10.1201/9780429398193-8](https://doi.org/10.1201/9780429398193-8).
- Choudhary RK, Srivastava RC, Das AK and Lee J. 2012. Floristic diversity assessment and vegetation analysis of Upper Siang District of Eastern Himalaya in North East India. *Korean Journal of Plant Taxonomy* 42(3): 222-246.
- Clarke CB. 1883. *Cyrtandreae*. In: De Candolle, A. and De Candolle, C. (eds) *Monographiaephanerogamarum*, 5:1–303, Paris: Masson.
- Clarke CB. 1884. *Gesneriaceae*. In: J.D. Hooker, *Flora of British India* Vol. 4, pp. 336 – 375. L. Reeve & Co., London.
- Giri GS, Pramantik A and Chowdhery HJ. 2008. Materials for the flora of Arunachal Pradesh. Botanical Survey of India, Kolkata, India.
- Jain SK and Rao RR. 1977. A hand book of field and Herbarium Methods. Today and Tomorrow's Printer and Publishers, New Delhi.
- Möller M, Nampy S, Janeesha AP and Weber A. 2017. The Gesneriaceae of India: Consequences of updated generic concepts and new family classification. *Rheedea* 27 (1):23–41.
- POWO. 2020. Plants of the World Online. Royal Botanic Gardens, Kew. <http://www.plantsoftheworldonline.org>
- Roy S, Paul TK and Mukherjee SK. 2019. Taxonomic studies of the genus *Rhynchocheum* of Indian part of Eastern Himalaya, pp. 145 – 155. In: Agnihotri P and Khuraijam JS (Eds.) *Angiosperm Systematics: Recent Trends and Emerging Issues*. M/S Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Roy S. 2017. Taxonomic studies of the family Gesneriaceae of Indian part of Eastern Himalaya. A Ph.D thesis. University of Kalyani, Kalyani, India. <http://hdl.handle.net/10603/195852>
- Sinha BK and Datta S. 2016. Taxonomic account on the family Gesneriaceae in Northeast India. *Nelumbo* 58: 1–43.
- Taram M and Borah D. 2020. *Rhynchocheum nirijulense* (Gesneriaceae), a new species from Northeast India. *Gardens' Bulletin Singapore* 72(1): 125–129.
- Taram M, Borah D, Mipun P, Taram V and Das AP. 2020c. Evaluation of ethnobotanical knowledge in Komkar-Adi Biocultural Landscape of Eastern Himalayan Region of India. *Asian Journal of Ethnobiology* 3(2): 70-87.
- Taram M, Borah D, Tag H and Choudhery RK. 2020b. An inventory of the native flowering plants in East Siang District of Arunachal Pradesh, India. *Journal of Threatened Taxa* 12(17):17299 -17322. DOI:[10.11609/jott.6241.12.17.17299-17322](https://doi.org/10.11609/jott.6241.12.17.17299-17322)
- Taram M, Hui PK and Hui T. 2021. Ethnobotanical uses of Gesneriaceae members by the indigenous tribal communities in Arunachal Pradesh (India). *Pleione* 15(3):425-433. Doi:[10.26679/Pleione.15.3.2021.425-233](https://doi.org/10.26679/Pleione.15.3.2021.425-233).
- Taram M, Mipun P and Borah D. 2020a. *Rhynchocheum parviflorum* Blume (Gesneriaceae): a new record to mainland India. *Journal of Threatened Taxa*. 12(1): 15208–15211.
- Wang WT, Pan KY, Li ZY, Weitzman AL and Skog LE. 1998. Gesneriaceae. In: Wu, Z.Y. & Raven, P.H. (Eds) *Flora of China* Vol. 18, pp. 244–401. Beijing: Science Press; St. Louis: Missouri Botanical Garden Press.
- Weber A, Clark JL and Moller M. 2013. A new formal classification of Gesneriaceae. *Selbyana* 31(2): 68-94.

Website consulted:

BSI Herbaria (<https://archive.bsi.gov.in>) [Accessed on 27 March 2022]Flora of china @ efloras.org www.efloras.org [flora_page.floraid=2](http://www.efloras.org/flora_page.floraid=2) [Accessed on 13.03. 2019]Gesneriaceae Resource Centre. <https://padme.rbge.org.uk/GRC>. Royal Botanic Garden Edinburgh. [Accessed on 24 May 2022]Kew Herbarium Catalogue (<http://apps.kew.org>herbcat>) [Accessed on 29 March 2022]RBGE Herbarium Catalogue (<https://www.rbge.org.uk>) [Accessed on 29 March 2022]PE Herbarium (<http://pe.incas.ac.cn>>) [Accessed on 23 February 2022]