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continued on the back inside cover

**Cover: A digital art of water birds of Noyyal River and its wetlands in Coimbatore District by Megha A. Kashyap.**

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# Notes on the extended distribution of *Ceropegia gardneri* Thwaites and other rare species of *Ceropegia* from southern Western Ghats, India

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**Abstract:** The extended distributional record of a threatened species of *Ceropegia* namely *Ceropegia gardneri* from Kerala is provided. This species exhibits a narrow range of distribution along the Western Ghats and in Sri Lanka. Details of four other rare species of *Ceropegia* are also given. Notes on taxonomy, phenology, distribution and conservation status are also provided for the better understanding of the species.

**Keywords:** *Ceropegia candelabrum*, *Ceropegia decaisneana*, *Ceropegia elegans*, *Ceropegia fimbriifera*, *Ceropegia hirsuta*, endemic, grasslands, Kerala, new record, Paithalmala.

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**Author contributions:** EJJ collected the specimens and identified it based on the morphological characters. PB and JA helped in taking the photographs, arranging the colour plate and preparation of the manuscript. All authors read and approved the final manuscript.

**Competing interests:** The authors declare no competing interests.

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## INTRODUCTION

The genus *Ceropegia* L.(s.l.) is represented by 740 species (Bruyns et al. 2020) which are distributed in the tropical regions of the world from Macaronesia and Africa to northern Australia (Huber 1957). Among these, 160 species with erect stem and radiate flowers were delimited to the Genus *Brachystelma* (Prasad & Venu 2015, 2020). In India, the genus *Ceropegia* s.s. is represented by 64 species (Kamble & Yadav 2019) mostly from the Western Ghats. *C. gardneri* Thwaites, often considered as a synonym of *C. elegans* Wall. is mostly distributed in Sri Lanka, was distinguished as a distinct species and was recorded from Baba Budan Giri hills of Chikmagalur District of Karnataka State for the first time from India (Kamble & Yadav 2012, 2013). No other records for this taxon are found anywhere from India. During the exploration of flowering plants of Paithalmala Hills of southern Western Ghats of Kerala, the authors encountered this species along with five other species of *Ceropegia* most of which belong to rare or threatened category. *C. gardneri* is recorded here as a new record to Kerala and also provided the details of five other rare species of *Ceropegia* from the locality.

## MATERIALS AND METHODS

The current study is based on seasonal plant explorations in Paithalmala of southern Western Ghats. The authors found species of *Ceropegia* growing in different habitats like rock crevices, grassland thickettes, and margins of evergreen forests. The specimens are collected and dissected under Zoom Stereo Microscope M 125. Photographs of the specimens were taken using Nikon 530 D camera. The specimens were then pressed and herbaria were prepared using the standard methods (Bridson & Forman 1991) and deposited in the herbarium of St. Thomas College, Palai for further studies. The specimens were identified using pertinent literature (Hooker 1885; Gamble 1921; Manilal & Sivarajan 1982; Ramachandran & Nair 1988; Murthy & Yoganarasimhan 1990; Kambale & Yadav 2014) and by comparing with the specimens available in various herbaria (K! K000305478 Brutt B.D. 14.05.1930; K000857808 Wight R 27.03.1844; K000894295 Gamble J.S. date not supplied; KFRI! 936 Sasidharan N. 11.10.1979; 932 Sasidharan N. 29.09.1978; 2485 Nambiar & Sasidharan 26.10.1982).

## RESULTS AND DISCUSSION

The present study showed the existence of six species of *Ceropegia* from Paithalmala hills of southern Western Ghats. The species identified include *C. fimbriifera*, *C. hirsuta*, *C. elegans*, *C. candelabrum*, *C. gardneri* and *C. decaisneana.* Most of these species fail to set fruit and seeds and survive only by means of underground rhizomes. Moreover they exhibit narrow microclimatic conditions in the Western Ghats.

1. Plants erect herbs ..... *C. fimbriifera*
1. Plants twiners ..... 2
2. Stem hirsute ..... *C. hirsuta*
2. Stem glabrous ..... 3
3. Inner and outer lobes of corona equal ..... *C. elegans*
3. Inner and outer lobes of corona unequal ..... 4
4. Corolla lobes up to 1 cm long ..... *C. candelabrum*
4. Corolla lobes more than 1 cm long ..... 5
5. Rounded pouches between corolla lobes present ..... *C. gardneri*
5. Rounded pouches between corolla lobes absent ..... *C. decaisneana*

### Taxonomic treatment

***Ceropegia gardneri*** Thwaites, Enum. Pl. Zeyl. 3: 199. 1860; Kambale & Yadav, Asklepios 114. 2012. Typus: C.P. 2838 PDA! Sri Lanka.

Twiners; roots tuberous, fascicled; stem terete, glabrous; internodes c. 8 cm long. Leaves opposite, petiolate; lamina lanceolate, 4–7 × 2–3.5 cm, apex acuminate, base rounded, margin entire, ciliate, nerves indistinct above, ciliate beneath; petiole c. 2 cm long, glabrous, canaliculate above. Flowers in axillary few flowered cymes, purplish, c. 4.5 cm long; peduncle short, c. 5 mm long, glabrous; bracts subulate, c. 2 mm long; pedicel c. 1.5 cm long, glabrous. Calyx lobes 5, free, linear, 4–6 mm long and glabrous. Corolla tube 2.5–3 cm long, white with purple blotches, glabrous; base swollen, purplish spotted; mouth funnel-shaped, purplish lines within, with a ring of downwardly pointed hairs, c. 3 mm long, purplish; lobes 1.4–1.7 cm long, connivent, spreading, purplish, apex greenish, hairy within and ciliate at apex. Corona 2-seriate, outer 2-fid, connate, c. 3 mm long hispid, shorter than inner lobes, hairy within; inner c. 2 mm long, connate, glabrous. Pollinaria ovoid, c. 0.2 x 0. 2.5 mm and reddish. Ovary oblong, carpels 2, free; style 2, c. 3 mm long; glabrous, stylar dome 5 sided.

**Specimens examined**: India, Kerala, Kannur District, Paithalmala, 1,208 m. 12.1039 °N, 75.3221 °E, JEJ 1712.

**Distribution**: India (Karnataka, Kerala) & Sri Lanka.

**Habitat**: Margins of evergreen forests.

**Notes**: *C. gardneri* Thwaites was reported from India for the first time from Hassan District of Karnataka. The species show restricted distribution in India and Sri Lanka along the margins of rainforests and associated streams. Poor fruit formation and seed setting are likely reasons for restricted distribution of the species. Further studies are necessary to assess the distribution and possible threats to the species (NE).

***Ceropegia candelabrum*** L., Sp. Pl. 1: 211. 1753, var. *candelabrum*; Hook.f., Fl. Brit. India 4: 66. 1883; Gamble, Fl. Pres. Madras 856. 1923. Manilal & Sivar., Fl. Calicut 150. 1982; V.S. Ramach. & V.J. Nair, Fl. Cannanore 283. 1988; Murthy & Yoganarasimhan, Fl. Coorg 280. 1990. Typus: Plate of Rheede, Hor. Mal. 9: 27. t. 16, 1763.

Twiners; stem terete, glabrous; internodes 3–8 cm long. Leaves opposite, decussate; elliptic-ovate, 2.5–8 × 2–4.5 cm, apex apiculate, glabrous, membranous; lateral veins 3 or 4 pairs; petiole 1–2 cm long, glabrous, slender. Inflorescence axillary few-flowered cymes. Flowers 3–6, purplish-yellow, c. 2.5 cm long; pedicel c. 0.8 cm long. Sepals 5, linear-lanceolate, c. 2.5 × 0.5 mm, acute. Corolla tube c. 2.5 cm long, swollen below, yellowish with purple lines; lobes 5, oblong, 3–4 × 2.5–3 mm, apiculate, yellow, hispid at apex and inside, with purplish beaks. Corona 2-seriate, outer corona c. 3 × 2 mm, hispid; inner corona erect, c. 2.5 × 1.5 mm, linear, connivent. Pollinia 5, yellow, oblong. Ovary ellipsoid, carpels free; stigma dome shaped.

**Specimens examined**: India, Kerala, Kannur District, Paithalmala, 920 m. 12.1042 °N, 75.3215 °E, JEJ 2663.

**Distribution**: India & Sri Lanka.

**Habitat**: Thickets in grasslands.

**Notes**: It is the most common species found in the lower altitudes and can survive in dry habitats.

***Ceropegia decaisneana*** Wight, Icon. Pl. Ind. Orient. 4: t. 1259 1848; Gamble, Fl. Pres. Madras 859, 1924; Murthy & Yoganarasimhan, Fl. Coorg 269. 1990. *Ceropegia brevicollis* Hook.f., Fl. Brit. India 4: 74 1883. Lectotype: K! 000857806 Kambale & Yadav, INDIA.

Twiners; stem terete, glabrous, herbaceous; internodes 5–20 cm long. Leaves opposite; lamina lanceolate, 10–14 × 4–6 cm, apex acute, membranous, hispid above, veins sparsely hispid below, lateral veins 4–6 pairs. Inflorescence axillary, umbellate cymes; peduncle c. 4 cm long and glabrous. Flowers 4–6, c. 4 cm long, purplish; bracts lanceolate, c. 2.5 × 0.5 mm, acute. Sepals 5, linear lanceolate, c. 6 × 1 mm, acute. Corolla tube c. 3 cm long, base swollen, c. 5–8 mm long; middle tubular, c. 1.2 cm long, puberulent, dark purplish inside; lobes 5, c. 2 cm long, midrib prominent, apex connate, ciliate at the tips and inside. Outer corona lobes bifid, base connate, c. 3 mm long, hispid along the margins; inner lobes longer c. 3 mm long, spathulate. Pollinaria 5, elliptic, 0.2 mm long, caudicle short, c. 0.5 mm long. Ovary linear-oblong, c. 0.8 mm long; style 2, c. 4 mm long; stylar dome 5-sided.

**Specimens examined**: India, Kerala, Kannur District, Paithalmala, 920 m, 12.1042 °N, 075.3215 °E, JEJ 2668.

**Distribution**: Endemic to the Western Ghats: Vulnerable (V)

**Habitat**: Margins of evergreen forests.

**Notes**: This species survives by means of underground tubers and has restricted distribution in the Western Ghats where it is found in the interiors of rain forests. Its leaves are edible and used by tribal communities

***Ceropegia elegans*** Wall. in Curtis, Bot. Mag. 57: t. 3015 1830; Hook.f., Fl. Brit. India 4:68.1883, Gamble, Fl. Pres. Madras 857, 1923; V.S.Ramach &V.J.Nair, Fl. Cannanore 282. 1988. *Ceropegia mysorensis* Wight, Icon. Pl. Ind. Orient. 3: t. 846. 1844; Hook.f., Fl. Brit. India 4: 69. 1883; Gamble, Fl. Pres. Madras 857.1924. *Ceropegia walkerae* Wight, Icon. Pl. Ind. Orient. 4: t. 1266 1848; Hook.f., Fl. Brit. India 4: 69. 1883; Gamble, Fl. Pres. Madras 857.1923.Lectotype: Wallich 1830: t. 3, 1930.

Twiners; roots fasciculated, tuberous; stem terete, purplish, glabrous, herbaceous; internodes c. 10 cm long. Leaves opposite; lamina lanceolate, 6–9 × 2.5–3.5 cm, apex acute-acuminate, base rounded, margins entire, leathery, glabrous; lateral veins 5 pairs; petiole c. 1.5 cm long, sparsely hispid, pubescent. Inflorescence axillary, umbellate cymes, few flowered. Flowers c. 3.5 cm long, purplish; peduncle light purplish, c. 2 cm long; pedicel c. 1 cm long. Sepals 5, linear 1–2 mm long, acute. Corolla purplish; tube 3–3.5 cm long, base swollen, c. 5 mm long, with purplish dots outside; lobes 5, ovate-elliptic, 1–1.5 × 0.5–1 cm, bent inwardly, purplish, apiculate, purplish ciliate, involute. Outer corona lobes 5, c. 2 mm long, light purplish, 2-fid, hispid inside; inner corona c. 2 mm long, linear, purplish. Pollinaria 5, ovoid, yellow; caudicle c. 0.5 mm, ovary c. 1 mm long, oblong, carpels free; styles 2, c. 2 mm long; stigmatic dome 5-sided.

**Specimens examined**: India, Kerala, Kannur District, Paithalmala, 920 m, 12.1136 °N, 075.3121 °E, JEJ 3771.

**Distribution**: India & Sri Lanka.

**Habitat**: Evergreen forests.

**Notes**: This species collected from different parts of peninsular India showed variation in its morphology and it is well represented in many parts of the Western

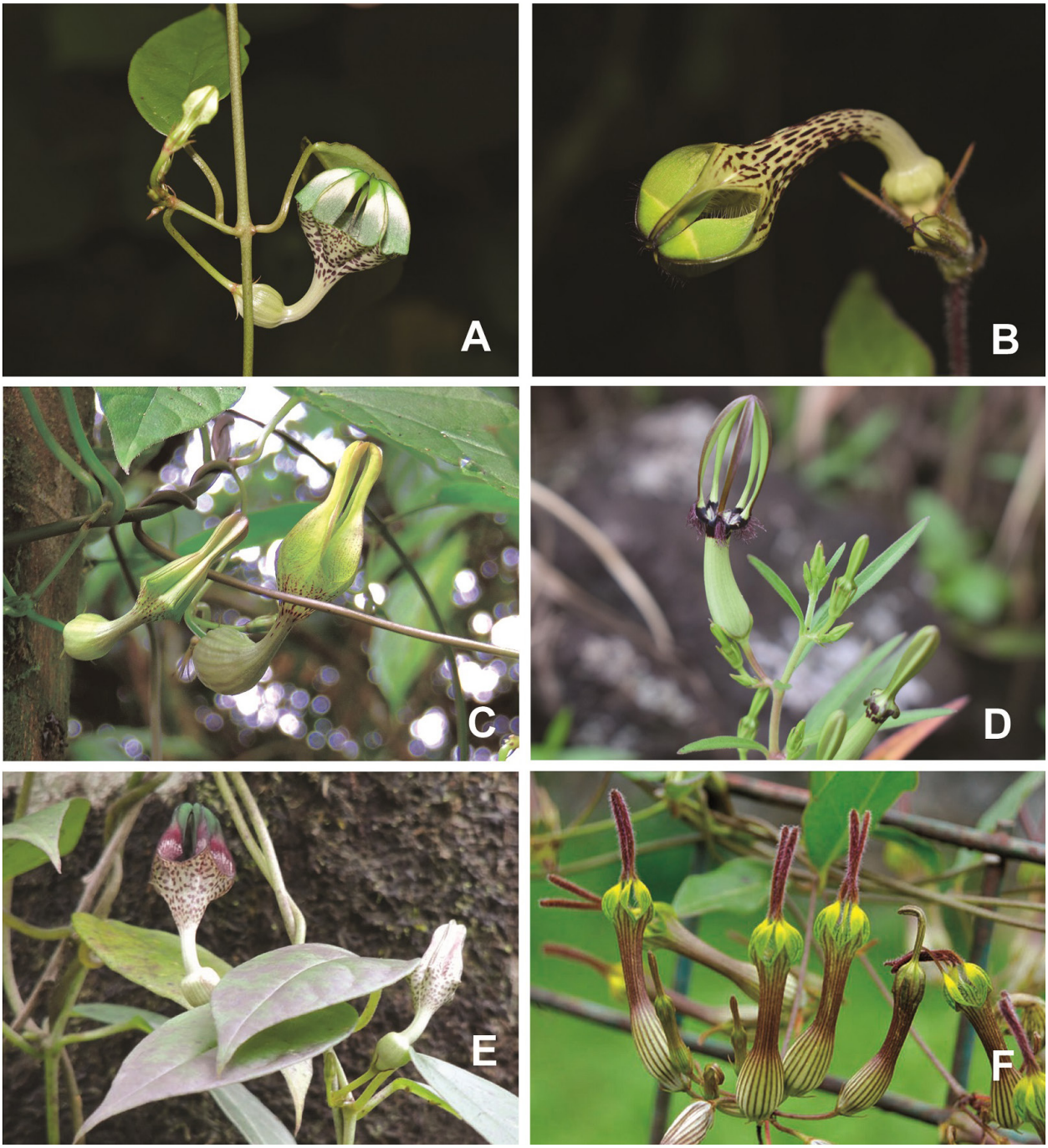


**Image 1. A—*Ceropegia gardneri* | B—*C. hirsuta* | C—*C. decaisneana* | D—*C. fimbriifera* | E—*C. elegans* | F—*C. candelabrum*. © E.J. Josekutty.**

Ghats. Further studies are necessary for the delimitation of this taxon.

***Ceropegia fimbriifera*** Bedd., Madras J. Lit. Sci. III, 1: 53 1864; Hook.f., Fl. Brit. India 4: 66. 1883; Gamble, Fl. Pres. Madras 856. 1923. Lectotype: R.H. Beddome BM001014217, INDIA.

Tuberous, erect herbs, c. 25 cm high; tuber depressed globose, brownish, c. 1.5 cm across; stem purplish, puberulent, nodes close. Leaves alternate; lamina linear-lanceolate, 3–5 × 0.4–0.5 cm, apex and base acute, entire, ciliate, puberulent; lateral veins indistinct; petiole 4–6 mm long, glabrous, grooved. Flowers axillary, solitary or few flowered cymes; peduncle c. 3 mm long, terete; bract linear-lanceolate, c. 2 mm long, acute, puberulent; pedicel c. 8 mm long, hispid. Sepals 5, linear-lanceolate,

acuminate, puberulent above, ciliate. Corolla tube swollen near the base, grooved, tubular above, c. 2.2 cm long, purplish; lobes 5, confluent above, purplish, linear-lanceolate, with purplish gland tipped hairs in between. Corona 2-seriate, outer 2-lobed, smaller c. 1.5 mm long, obtuse with purplish hairs; inner longer c. 3 mm long, purplish. Pollinia 5, yellow, oblong. Ovary oblong, 2-locular, free; style short, stigma dome shaped.

**Specimens examined**: India, Kerala, Kannur District, Paithalmala, 920 m, 12.1104 °N, 75.3131 °E, JEJ 1496.

**Distribution**: Endemic to southern Western Ghats.

**Habitat**: Rock crevices in grasslands.

**Notes**: This species is rare and survives by its depressed spherical tubers. It is found in the grasslands. Wild fires and conversion of grasslands forming monoculture plantations and tourism are considered to be threats to this rare species.

***Ceropegia hirsuta*** Wight & Arn. in Wight, Contrib. 30. 1834; Hook.f., Fl. Brit. India 4: 7. 1883; Gamble, Fl. Pres. Madras 562. 1922. *Ceropegia hirsuta* var. *stenophylla* Hook.f., Fl. Brit. India 4: 71. 1983; Gamble, Fl. Pres. Madras 859. 1923. Lectotype: R. Wight K000894263, INDIA.

Twiners; stem terete, purplish, hirsute; internodes 5–10 cm long. Leaves opposite; lamina ovate-lanceolate, 4–10 × 3–4.5 cm, apex acuminate, chartaceous; lateral veins 3–5 pairs; petiole 4–7 mm long, hirsute. Inflorescence axillary, few-flowered cymes. Flowers purplish, c. 2.8 cm long. Calyx tube short; lobes linear, 5–6 mm long, hispid. Corolla tube c. 2.2 cm long, base swollen, hispid within; lobes oblong, c. 6 mm long, acute, hispid inside; corona 2-seriate; outer corona c. 5 mm long; lobes triangular, bifid, densely hispid; inner corona linear, c. 2 mm long, bent, base hispid. Pollinaria 5, ellipsoid, yellow. Ovary oblong, carpels 2, free, hispid; style 2, c. 4 mm long, thick, stylar dome 5 sided, truncate.

Specimens examined: India, Kerala, Kannur District, Paithalmala, 450 m, 12.1128 °N, 75.3142 °E, JEJ 1499.

**Distribution**: Endemic to India; Vulnerable (V).

**Habitat**: Slopes in grasslands.

**Notes**: Even though restricted to India, this species has wide representation in peninsular India and Indo-gangetic plains. The species is well adapted to survive in drier habitats as well as along the high altitudes of the Western Ghats.

## CONCLUSION

The present study documents six species of Ceropegia from Paithalmala in Kannur District of Kerala. Among these *C. gardneri* is a new report to Kerala as it is reported only from Karnataka so far from India. *C. fimbriifera* is very rare and there is no recent report for this species from Kerala and was mentioned only in the Flora of British India and Flora of the Presidency of Madras, which were published about a century ago. *C. decaisneana* Wight and *C. hirsuta* Wight & Arn. are endemic and vulnerable species.

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