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DISCOVERY
SCIENTIFIC SOCIETY

Eriocaulon ravii (Eriocaulaceae), a new species from Agasthyamala Biosphere Reserve, Kerala region, India

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ABSTRACT

A new species of *Eriocaulon*, *E. ravii* (Eriocaulaceae), is described and illustrated from the Kerala region of Agasthyamala Biosphere Reserve (ABR), southern Western Ghats, India. Morphologically the species is similar to *E. ensiforme*, but differs by creeping rhizome, strictly 7-ribbed peduncle, broadly keeled sepals and shortly clawed petals of female flowers, 3-5 curved and straight appendages in cells of the seed coat.

Keywords: India, Eriocaulaceae, Agasthyamala Biosphere Reserve, Endemic, Kerala.

1. INTRODUCTION

The genus *Eriocaulon* (Eriocaulaceae) was originally described by Carl Linnaeus, (1753) with four species, of which three were from India. Species of the genus are considered to be exceptionally difficult to distinguish from each other due to uniformity in vegetative parts and minute differences in floral parts (Fyson, 1919). The genus, comprises of about 479 species (POWO, 2020), is mainly distributed throughout the tropics and subtropics, with a few species growing in temperate regions. The majority are found in the New World. The family Eriocaulaceae is represented in India by a single genus *Eriocaulon* L. Significant original work on the family Eriocaulaceae in India include that of Hooker, (1893), Fyson, (1919), Fischer, (1931), Cooke, (1903).

Ansari and Balakrishnan, (2009) introduced a new classification system for the species of Indian *Eriocaulon* and established 12 informal sections. They recognized 80 species, of which 68 are from the Peninsular Indian region, showing the area's greatest species diversity and endemism. In recent years more than 100 species were newly described by different workers from India (Yadav et al., 2008; Shimpale et al., 2009; Shimpale et al., 2010; Nampy et al., 2011; Biju et al., 2012; Swapna et al., 2012; Sunil et al., 2013; Rashmi and Krishnakumar, 2014; Sunil et al., 2014; Sunil and Kumar, 2015; Manudev et al., 2017; Naveen et al., 2017; Sunil et al., 2017; Sunil et al., 2018; Chandore et al., 2019; Darshetkar et al., 2017; Khanna

and Kumar, 2019; Francis et al., 2020; Anoop and Robi, 2021; Aswini et al., 2021; Nampy et al., 2021; Shaju et al., 2022; Harishma et al., 2022).

During a recent floristic survey in the Agasthyamala Biosphere Reserve (ABR), situated at the southernmost end of the Western Ghats and stretching to the southern states of Kerala and Tamil Nadu, an interesting specimen of *Eriocaulon* was collected from Vattapara River basin in Ponmudi hills at an altitude of ± 1120m MSL. The collection site in Thiruvananthapuram district falls on the western slopes of the Western Ghats towards the interstate border of Kerala and Tamil Nadu. The specimen could not be identified at the species level as it failed to match the ones described/published. Critical examination of the specimen and detailed studies with available literature and authentic herbarium specimens revealed its novelty and distinctiveness from the hitherto known species. A detailed description, illustration, photographs, distribution map, and critical notes are provided to facilitate easy identification.

***Eriocaulon ravii* Shaju, Rajendraprasad, Reghu, Rijuraj & Ashi. sp. nov. (Figure 1-3)**

Type: INDIA: Kerala State, Thiruvananthapuram district, Agasthyamala Biosphere Reserve (ABR), Ponmudi hills, Vattapara riparian belt ($8^0$44'43'' N & $77^0$10'26'' E, ±1120m), 11th March 2022, M. Rajendraprasad, A.V Raghu & T. Shaju, 97598 (Holotype TBGT!, isotype TBGT!, MH!,).

Etymology

The new species is named in honor of Prof Ravi, former Professor of Botany Sree Narayana College, Kollam, Kerala, and Emeritus Scientist of JNTBGRI, a dedicated teacher of taxonomy and a renowned environmentalist committed to biodiversity conservation.

2. DIAGNOSIS

Eriocaulon ravii is related to *E. ensiforme* C. E. C. Fisch., another endemic species of the southern Western Ghats, by the overall similarity of the habit and leaf shape, but differs by creeping rhizome, strictly 7-ribbed peduncle, unequal and glabrous sheath, broadly keeled sepals and shortly clawed petals of female flowers, 3-5 curved and straight appendages in cells of the seed coat.

Key to the species of *Eriocaulon* occurring in Agasthyamala Biosphere Reserve, Kerala region, India

1. Robust herbs; rootstock present…….....2
1. Slender herbs; root stock absent…….....3
2. Rootstock ca. 8 mm long, pseudostem absent; plants with inflorescence to 10-30 cm high; heads globose, 1-1.5 cm across……...*E. ensiforme*
2. Root stock up to 10 cm long, pseudostem up to 3cm; plants with inflorescence 40-60 cm high; head hemispherical, 0.5-0.8 cm across ……. ……...*E. ravii*
3. Spathe of male flowers not distinctly lobed.....…...*E. sexangulare*
3. Spathe of male flowers distinctly lobed…….....……4
4. Spathe 2-lobed……5
4. Spathe 3-lobed……6
5. Petals of male flowers unequal; cells of seed coat vertically elongated….....*E. truncatum*
5. Petals of male flowers equal; cells of seed coat transversely elongated ….....*E. thwaitesii*
6. Seed surface with appendages……...……..……7
6. Seed surface without appendages…….……9
7. Heads hemispherical, straw coloured; floral bracts cuneate, truncate.....….*E. xeranthemum*
7. Heads globose, black or gray; floral bracts oblanceolate-cuneate, acuminate ……8
8. Seeds oblong-ovoid, purple or pink …….....…….*E. odoratum*
8. Seeds oblong-ellipsoid, reddish yellow …….....……..*E. trilobatum*
9. Floral bracts linear-elliptic; petals of female flowers absent. ……..……...*E. cinereum*
9. Floral bracts oblanceolate; petals of female flowers present……..… *E. leucomeles*

3. DESCRIPTION

Amphibious, rhizomatous creeping perennial herbs, 40-60cm tall, caespitose. Rhizome branched; pseudostem ca. 3cm. Leaves ensiform, 10-30 x 2-2.5cm, base gradually broadening up to 4cm wide, thick, glabrous, acuminate, parallel veins prominent. Scapes

1-3, stout, straight, up to 55cm long, glabrous, strictly 7 ribbed; sheaths 14-20cm long, limb lanceolate, acuminate. Capitulum hemispherical, 0.5cm long and 0.8cm wide, greyish white; receptacle pilose; involucral bracts spreading, ca. 3-3.5 x 2.2-2.7mm, obovate, coriaceous, long hairy outside and glabrous inside, straw-colored; floral bracts oblong-cuneate, ca. 3.5 x 2.5mm, densely papillose towards apex; black tinged.

Male flowers: pedicel ca. 1.2mm long, sepals 2, free, shortly keeled, obliquely truncate, ca. 2,5 x 1mm, hoary at the tip, black colored; petals 3, equal, ca. 1.2 x 0.8-1mm, white-villous with black glands; anthers 6, black. Female flowers: pedicel absent; sepals 2, free, similar, obovate-elliptic, conduplicate, broadly keeled, 4 x 2.5mm, hoary along keel towards apex; petals 3, equal, 3.4 x 0.6mm, linear or spathulate, shortly clawed, hyaline, densely villous except basal portion, gland black, hoary at apex, not stipitate between sepals and petals. Ovary sessile, ovoid; style 3-fid. Seeds oblong-ellipsoid, obtuse or acute, brownish; cells of seed coat transversely elongate, aligned in vertical rows; appendages curved and straight, 3-5 from transverse radial walls, setiform, minutely dilated at the apex.

Flowering & Fruiting

January to March

Distribution

Endemic to Kerala, it is found to be narrowly distributed in the area with a significantly small population.

Habitat & Ecology

The species was found associated with the Vattapara riverine belt at an altitude of ±1120m MSL. It grows in sandy soil, among rocks in river beds. The associated species in the community include members of Poaceae such as *Arundinaria walkeriana* Munro, *Ischaemum nilagiricum* Hack., *Isachne miliacea* Roth., *Didymocarpus sp.* (Gesneriaceae), *Carex* sp. (Cyperaceae). Vegetative reproduction seems to be the primary means of propagation; new individuals arise from the stoloniferous branched rhizome. The riverine belt housing the above population forms a part of the region's evergreen/ semievergreen forest tract, which gradually merges with the semievergreen vegetation of Tamil Nadu.

Conservation status

Eriocaulon ravii is known only from the type locality. The authors identified less than 50 bunches scattered in the rocky river bed. The area of occupancy is ca. 250m^2, which indicates its narrow endemic nature, therefore, more field explorations are essential to asses a conservation status. Fortunately, the type locality is located within the Biosphere Reserve and thus is adequately protected. According to IUCN criteria, the species comes under the category Data Deficient (IUCN Standards and Petitions Subcommittee, 2019).

Similar species

Eriocaulon ravii resembles *E. ensiforme* C. E. C. Fischer but differs in the characters detailed in Table 1.

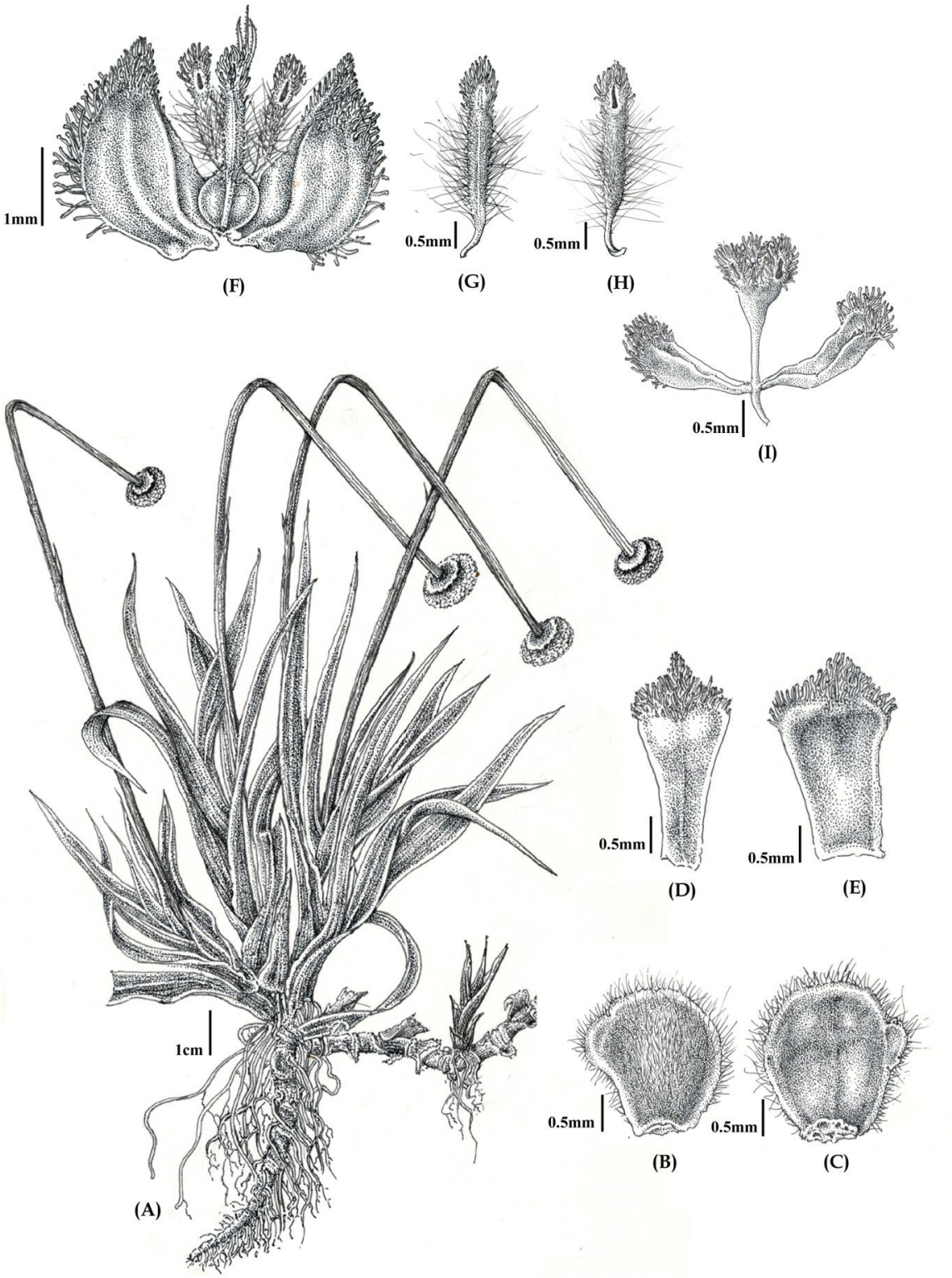

Figure 1 *Eriocaulon ravii* sp. nov. (A) habit, (B & C) involucral bract: dorsal and ventral views, (D & E) floral bract: dorsal and ventral views, (F) female flower, (G & H) female petal: dorsal and ventral views, (I) male flower (drawing by T. Shaju)

Figure 2 *Eriocaulon ravii* sp.nov. (A & B) habitat, (C & D) habit, (E) leaf: showing broadened base, (F) ridged peduncle, (G) capitulum: upper view, (H & I) involucral bract: dorsal and ventral view, (J &K) floral bract: dorsal and ventral view, (L) male flower, (M) male petal, (N) female flower, (O) light microscopic image of seed. (Photographs taken by M. Rajendraprasad & M.P. Rijuraj), (P & Q) scanning electron microscopic images of seed and enlarged view of cells showing curved and straight appendages (Central Laboratory for Instrumentation and Facilitation, University of Kerala, Karyavattom)

Table 1 Comparison between characters of *Eriocaulon ravii* sp. nov. and *E. ensiforme*

Characters	*E. ravii*	*E. ensiforme*
Branched creeping rhizome, pseudostem	Present, root stock up to 10cm long, Pseudostem up to 3cm.	Absent, rootstock ca. 8 mm long, absent
Leaves	Ensiform, acuminate, up to 30 cm long, glabrous, ca. 30 prominent nerves.	Ensiform, acute, up to 26cm long, sparsely pubescent ventrally and pilose dorsally, ca. 20 prominent nerves.
Peduncle	1 – 3, up to 55cm long, glabrous, strictly 7-ribbed.	1 or rarely 2, up to 40 cm long, sparsely pubescent, ca.10- ribbed.
Sheath	Not equal to leaves, glabrous.	Sheath equal to leaves, sparsely pilose.
Capitulum	Hemispheric, up to 1 cm across, greyish white.	Hemispheric, 1-3 cm across, grey.
Involucral bracts	Obovate, long hairy outside and glabrous inside, straw-coloured.	Obovate-orbicular, glabrous or sparsely ciliate along margins, straw coloured.
Floral bracts	Oblong-cuneate, ca. 3.5 x 2.5mm, densely papillose towards apex; black tinged.	Broadly rhomboid, acute or acuminate, ca. 4 x 3mm, white papillose-hairy towards apex, dark-grey.
Male flower	Pedicel ca. 1.2mm long; sepals 2, free, shortly keeled, obliquely truncate.	Pedicels ca. 0.75mm long; sepals connate into a spathe, deeply 2 lobed near to the base, lobes obtuse.
Female flower	Pedicel absent; sepals 2, free, obovate-elliptic, broadly keeled, 4 x 2.5mm, hoary along keel towards apex; petals 3, equal, 3.4 x 0.6mm, linear or spathulate, shortly clawed, densely villous except basal portion, not stipitate between sepals and petals.	Pedicels ca. 5mm long; sepals 2, free, similar, 2.5mm long, oblanceolate, minutely keeled at apex, hoary towards apex; petals 3, subequal, ca. 2.5mm long, oblanceolate-spathulate, not clawed, densely white-papillose towards tip, shortly stipitate between sepals and petals.
Seed coat	Seeds oblong-ellipsoid, obtuse or acute, brownish; cells of seed coat transversely elongate, aligned in vertical rows; appendages curved and straight, 3-5 from transverse radial walls, setiform, minutely dilated at apex.	Seeds oblong or ovoid, obtuse, brownish; cells of seed coat transversely elongated, appendages straight, 1-2 from middle of each transverse radial wall, so that they appear to be in vertical lines on the surface of seeds, setiform, dilated at apex.

Figure 3 Distribution map of *Eriocaulon ravii* sp. nov. in south India

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Author's contribution

All authors have contributed equally to the manuscript.

Ethical approval

The ethical guidelines for plants & plant materials are followed in the study for sample collection and identification.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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