ISSN: 2287-688X

Annals of
Plant Sciences

Volume 11, Issue 02 (2022) pp. 4820-4826

Research Article

A New Species of *Eriocaulon* L. (Eriocaulaceae) from Lateritic Plateaus of Northern Kerala, India

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Abstract

A new species, *Eriocaulon sunilii* Shaju, Rijuraj, Rajendraprasad, Rasiya Beegam & Ratheesh, from lateritic plain of Vypirium in Kasaragod district of Kerala, India, is described and illustrated. It is morphologically allied to *E. periyarense* and *E. tuberiferum*. Information on habitat, distribution, phenology, and conservation status are provided.

Keywords: *Eriocaulon, laterite, endemic, Kasaragod, Kerala, Vypirium*

Introduction

The genus *Eriocaulon* (*Eriocaulaceae*) was described by Linnaeus (Linnaeus, C. *et al*., 1753).Species of the genus is considered to be very difficult to distinguish due to uniformity in vegetative parts and difference in floral parts (Fyson, P. F. 1919-1922). It is mainly distributed in North West Europe, tropical and sub tropical Old World to Russia, Far East and America with about 476 species (POWO. 2019). In India the genus is represented by ca. 80 species grouped under 12 sections (Ansari, R. and Balakrishnan, N.P., 2009) and the main centre of distribution is Peninsular regions. In recent years several new species have been described from India by different workers (Yadav, S. R. et al., 2008; Shimpale, V.B. et al., 2009; Shimpale, V.B. and Yadav, S.R., 2010; Vivek, C.P. et al., 2010; Nampy. S., et al., 2011; Biju, P. et al., 2012; ; Swapna, M.M. et al., 2012; Sunil, C.N. et al., 2013; Rashmi, K.and Krishnakumar, G., 2014; Sunil, C.N. et al., 2014; Sunil, C.N. and Kumar, V.N., 2015; Manudev, K. M. et al., 2017; Naveen, K. V. et al., 2017;Sunil, C.N. et al., 2017 & 2018).

During a recent floristic survey on the lateritic plateaus of northern Kerala, a tuberous specimen of the genus *Eriocaulon* was collected from a fragmented lateritic plain of Vypirium in Kasaragod district of Kerala. Critical examinations and detailed studies with available literature and authentic specimens revealed its novelty and distinctness from the hitherto known species, and is described and illustrated here as a new species. The species is allied to *E. periyarense* Naveen *et al.* and *E. tuberiferum* Kulkarni & Desai, two endemic species of Peninsular India. Key to the species, detailed description, illustration, photographs and important notes are provided to facilitate easy identification.

Taxonomic Treatement

Eriocaulon sunilii Shaju, Rijuraj, Rajendraprasad, Rasiya Beegam & Ratheesh sp. ***nov***. (Fig 1–2). *Type:* India: Kerala State, Kasaragod District, Vypirium, open areas in lateritic plateau, (12°10‟16.8''N 75°4‟30.1''E ± 78 m),, 24 November 2017, *T. Shaju, M.P. Rijuraj & M.K. Ratheesh Narayanan 91778* (Holotype TBGT!; Isotypes MH!).

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DOI: http://dx.doi.org/10.21746/aps.2022.11.2.14

Eriocaulon sunilii belongs to section XI of Ansari and Balakrishnan (Ansari, R. *et al*., 2009), which is characterized by the transversely elongated seed coat cells with ribbon-like appendages. Presently this section possesses only two species, *Eriocaulon tuberiferum* and *E. periyarense*. Based on the above mentioned characters *E. sunilii* coming under this section, but it is easily distinguished by the free sepals in male flowers, white papillose towards apex with a black gland in petals of male flowers, pale yellow stamens, and 3 lobed limbs.

Diagnostic morphological characters of the three species are given in Table 1.

Key to the species based on floral characters of section XI proposed by Ansari and Balakrishnan (Ansari, R. *et al*., 2009).

1a. Male sepals free, stamens pale yellow .....*E. sunilii*
1b. Male sepals connate in to a spathe, stamens white 2
2a. Root tuber present, petals of male and
Female flowers with black glands .....*E. tuberiferum*
2b. Root tuber absent, petals of male and
Female flowers with yellow glands .....*E. periyarense*

Annual acaulescent submerged or terrestrial herb. Root stock 1–1.7 cm long, thick. Leaves rosulate, 3.5–4 cm long, linear, broad up to 3 mm at base, tapering upwards, acuminate at apex, spongy, glabrous. Peduncle 5–10, 5–15 cm long, striate, twisted, glabrous. Sheath 2.5–3 cm long, striate, glabrous; limb 3 lobed, lobes triangular. Head hemispherical, ca. 8 mm across, gray to black. Involucral bract spreading or reflexed, oblong-obovate, acute or subacute at apex, entire or lacerate, chartaceous, black, glabrous, 2.75–3 x 1.5 mm. Floral bracts hood-like, oblanceolate, broadly cuneate at base, obtuse to acuteat apex, 2–2.6 × 0.8–1.2 mm, brownish black, chartaceous, densely white-papillose above from middle towards apex. *Male flowers*: Pedicels ca.0.5 mm long. Sepals three, free, oblong-oblanceolate, conduplicate, 1.5–75 mm long, hyaline to black, densely white-villous around obtuse apex. Stipe of corolla ca. 2 mm long. Petals 3, unequal, odd petal slightly larger, ca. 1 mm long than lateral ones with ca. 0.5 mm long, oblanceolate, white-papillose towards apex with a black gland. Anthers 6, pale yellow, warty. *Female flowers*: Pedicels ca.0.4 mm long. Sepals 3, free, similar, equal to petals, hyaline to pale black, oblong–oblanceolate or obovate,1.4–1.8 × 0.4–0.6 mm, conduplicate, slightly keeled at back, densely white-papillose along magins above middle to obtuse apex. Petals 3, similar, white, linear-oblanceolate, 1.5–1.75 × 0.3–0.4 mm, densely white-papillose along margins towards obtuse apex with a black gland, stipitate between sepals and petals. Ovary sub-sessile, ovoid, trigonous, ca. 0.75 x 0.75 mm; style ca. 1.2 mm long; stigmas 3, ca.1.3 mm long, scabrid. Seed ellipsoid, ca. 0.6 x 0.4 mm, pale brown; seed coat cells transversely elongated, aligned in vertical rows.

Table 1: Morphological difference between ***Eriocaulon sunilii***, ***E. periyarense*** and ***E. tuberiferum***

Character	***E. sunilii***	***E. periyarense***	***E. tuberiferum***
Root stock	Present, 1–1.7 cm long	Present, 2–9.5 cm long	Absent
Leaves	Rosulate, linear, abruptly broadening ca. 3 mm at base, 3.5–4 cm long,	Linear-lanceolate, not abruptly broadening at base, 1.5–17 cm long	Rosulate, linear-lanceolate, not abruptly broadening at base, ca. 5 cm long
Peduncle	Up to 10, 5–15 cm long	Up to 7, 7–50 cm long	Many, 10–20 cm long
Sheath	2.5–3 cm long, glabrous, limb 3 lobed, lobes triangular	2–8 cm long, limb lanceolate, acute at apex	Ca.10 cm long, limb ovate, acute, glabrous.

Sepals of male flower	Free, equal	Connate into a spathe with 3 obscure lobes or truncate and not lobed at apex	Connate into a spathe with 3 obtuse lobes
Anthers	Pale yellow	White	White
Petals of male flower	White-papillose towards apex with a black gland	Hairy towards apex with an yellow gland	Hairy with a black gland at apex
Sepals of female flower	Similar, oblong–oblanceolate or obovate, slightly keeled at back, densely white-papillose along margins above middle to obtuse apex	Subsimilar, minutely keeled at back, obtuse or acute or unequally bi-lobed at apex, sparsely hairy on abaxial and hairy towards apex	Not keeled at back, obtuse or obscure at apex, hairy towards apex
Petals of female flower	1.5–1.75 mm long, pilose at the middle upwards, hairy towards apex with a black gland, slightly clawed	1.6–2 mm long, sparsely hairy along margins and adaxial side, hairy towards apex with an yellow gland	1.75–2-225 mm long, pilose at the middle, hairy towards apex with a black gland.
Seed coat	Cells with appendages in the form of ribbon like bands from the transverse radial walls and conforming to the length of cells	Cells with appendages in the form of ribbon like bands from the transverse radial walls and conforming to its length	Cells with appendages in the form of continuous ribbon like bands from longitudinal and transverse walls

Etymology

The specific epithet is proposed in honour of Prof. (Dr.) C.N. Sunil, Former Assistant professor, Department of Botany, SNM College, Maliankara, Kerala, for his contribution to the field of plant taxonomy especially in systematic studies of the family Eriocaulaceae.

Flowering & Fruiting

Flowering and fruiting observed from October to December.

Ecology and Distribution

The species has a restricted distribution in mud flat ephemeral pools in association with *Eriocaulon cuspidatum* Dalz., *Xyris indica* L., *Utricularia reticulata* Sm., *Dopartium junceum* (Roxb.) Buch.-Ham. ex Benth., and *Weisneria triandra* (Dalz.) Mich.

Conservation Status

There were only less than 100 mature individuals restricted to few ephemeral pools in Vypirium lateritic plain, Kasaragod District, Kerala. The present habitat is highly disturbed due to urban developmental activities. Further field explorations are essential to have in-depth knowledge on range of distribution and assessment of status of the species; and hence as per IUCN categories and criteria (2012) it is herein categorized as 'Data Deficient' (DD).

Notes

Remarkable occurrence of the genus *Ericaulon* L. in the lateritic plateaus of Peninsular India emphatically shows its evolutionary significance with high degree of endemism and species richness. The restriction of endemic plants to nutritionally imbalanced substrata (laterite/serpentine) is a widespread phenomenon in endemic rich areas. There is much evidence to suggest that these nutritionally uneven substrata provide a strong selective force for the evolution of endemic plants. Isolation in marginal habitats owing to climate change has given rise to plants with certain adaptive traits, in which sediment or soil seed banks offer a natural mechanism for preservation and evolution of ephemeral endemic taxa. With this strategy, the genus *Eriocaulon* L. preserved species diversity and endemism in the lateritic area. Altogether, there are about 17 species identified from the lateritic plateaus of northern Kerala, of which 10 are endemics

including 4 exclusive endemic species. This highest degree of endemism of the genus is mostly represented from these habitats with very narrow distributional range. They may have closely related taxa occurring in the same area, which also might have developed through speciation, and hence the lateritic plateau is considered as one of the active centres of speciation of the genus.

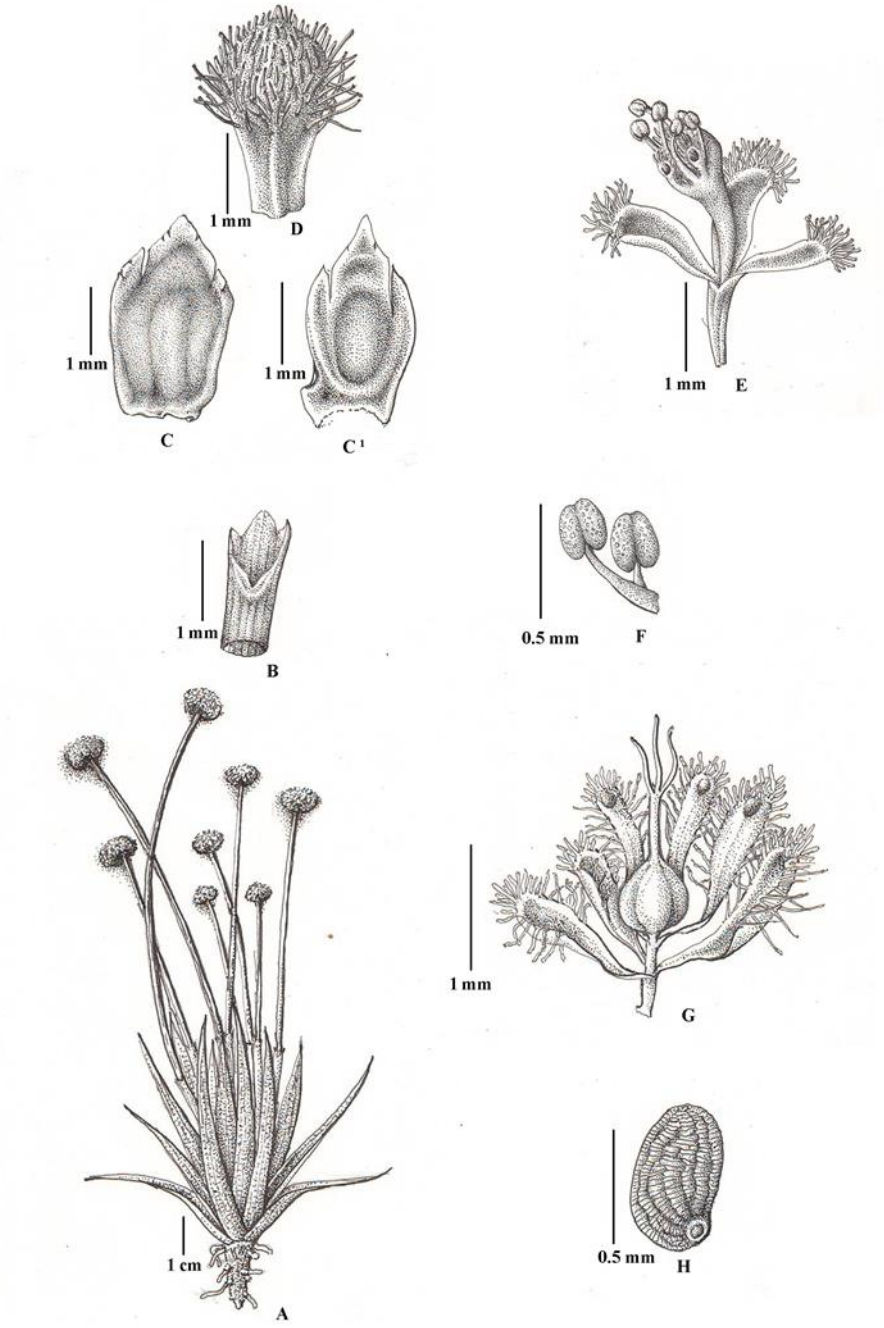

Figure 1: ***Eriocaulon sunilii*** Shaju, Rijuraj, Rajendraprasad, Rasiya Beegam & Ratheesh *sp nov.* A. Habit, B. Sheath with 3-lobed apex, C & C¹. Involucral bract(dorsal & ventral view) , D. Floral bract, E. Male flower, F. Stamens, G. Female flower, H. Seed.

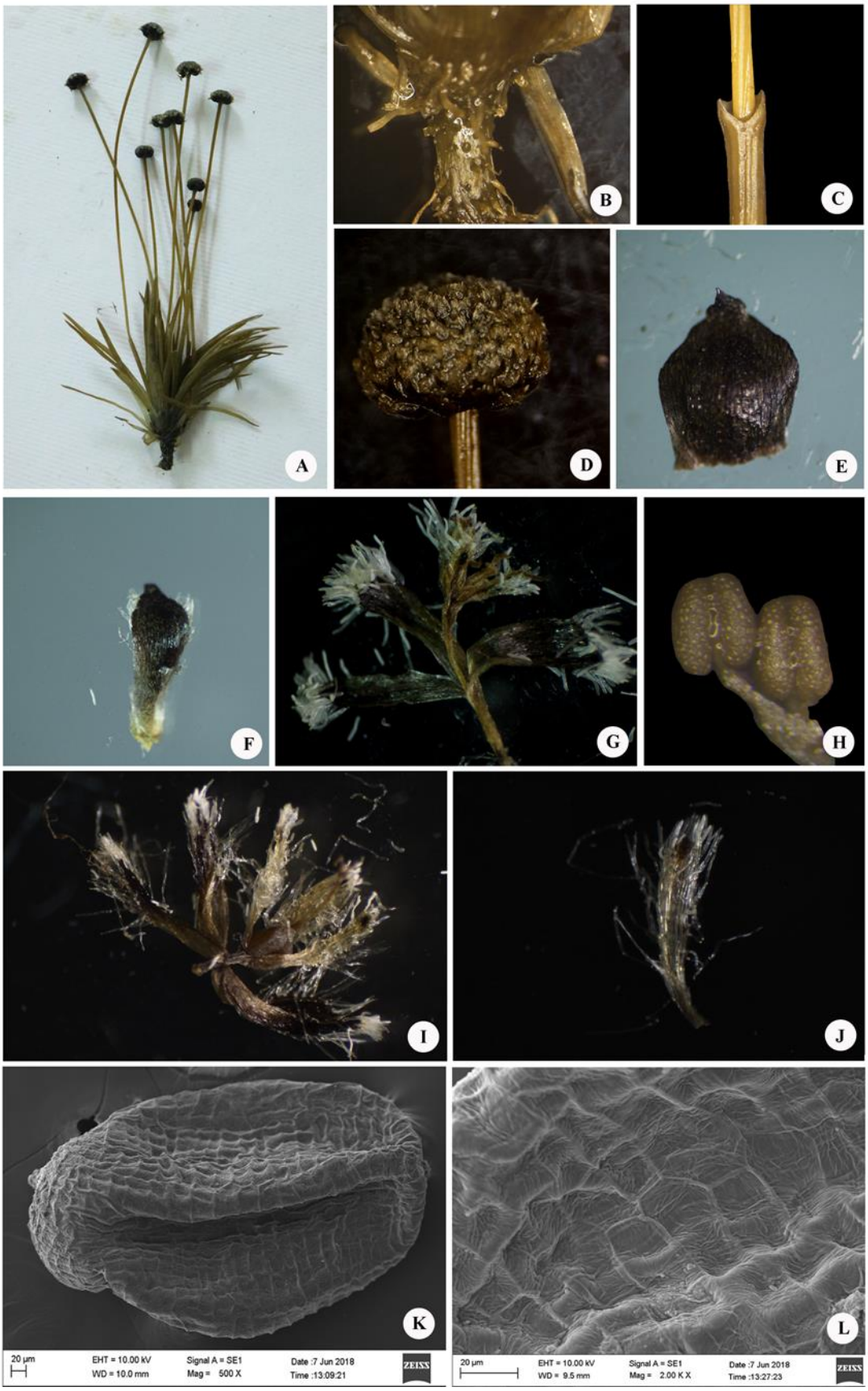

Figure 2: ***Eriocaulon sunilii*** Shaju, Rijuraj, Rajendraprasad, Rasiya Beegam & Ratheesh *sp nov*. A. Habit, B. Rootstock, C. Sheath with 3-lobed apex, D. Head, E. Involucral bract, F. Floral bract, G.

Male flower, H. Stamens, I. Female flower, J. Female corolla lobe, K. SEM Image of entire seed, L. A portion of seed showing surface cells with ribbon like appendages.

Acknowledgements

The authors are grateful to the Director, Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Palode, Thiruvananthapuram for providing constant help and encouragement in research activities. Second author is thankful to University of Kerala, Thiruvananthapuram.

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Source of support: Nil; **Conflict of interest:** Nil.

Cite this article as:
Shaju, T., Rijuraj, M. P., Rajendraprasad, M., A. R. Beegam and M. K.R. Narayanan. "A New Species of *Eriocaulon* L. (Eriocaulaceae) from Lateritic Plateaus of Northern Kerala, India." *Annals of Plant Sciences*.11.02 (2022): pp. 4820-4826.

DOI: http://dx.doi.org/10.21746/aps.2022.11.2.14