

1 **Revealing *Euploca wightiana* sp. nov., a new species of Heliotropiaceae from South**
2 **India.**

3 **Abstract**

4 *Euploca wightiana* P. Javad & A. A. Ancy sp. nov., a new species of the family
5 Heliotropiaceae is described from Coimbatore district of South India. Morphologically it is
6 similar to *Euploca marifolia* but differs in being perennial; erect woody stem with dense
7 hirsute hairs; oblong leaves with obtuse apex; inflorescence with distantly placed flowers;
8 long, cylindrical style with unifid, capitate stigma and densely hirsute nutlets. The species
9 remained misidentified in herbaria for long. Detailed description, photo plates and
10 distribution maps are provided. Morphological differences with relevant species are
11 discussed. The status of the new species is provisionally assessed here as ‘endangered’
12 according to IUCN Red List Categories and Criteria.

13 **Keywords:** Heliotropiaceae; Coimbatore district; woody stem; inflorescence; capitate stigma.

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23 **Introduction**

24 Recent phylogenetic studies recommend the recognition of eleven well defined monophyletic
25 families within Boraginales (Luebert 2016). The family Heliotropiaceae Schard. consists of 4
26 genera and ca. 450 species all over the world and are largely confined to the tropics and
27 subtropics. The members are mostly annual or perennial; herbs, under shrubs or rarely trees.
28 The species are characterized by their terminal or axillary scorpioid inflorescence and conical
29 stigmatic head with sterile apex and a basal receptive ring. In India the family is represented
30 by two genera *Heliotropium* L. and *Euploca* Nutt.

31 Hilger and Diane reinstated the genus *Euploca* in 2003. The genus *Euploca* Nutt. includes
32 species belonging to *Heliotropium* sect. orthostachys (1810) of Robert Brown along with
33 *Hilgeria* Forthner (1998) and *Schleidenia* Endl. (1839). The distribution of genus *Euploca*
34 extends from subtropical to temperate regions of the world (Frohlich *et al.* 2020). It consists
35 of 164 species all over the world of which 9 species occur in India. The genus *Euploca* could
36 be separated from the genus *Heliotropium* in having bracteate inflorescence, anthers coherent
37 at the apex and schizocarps separating into four one-seeded mericarps.

38 As part of the revisionary studies of genus *Heliotropium* L. in India, field explorations were
39 conducted to different parts of the country during past four years. We collected an interesting
40 material from 3 localities in Coimbatore district of Tamilnadu. Upon detailed examination of
41 the specimen, following literature survey and herbarium review we conclude it as a species
42 new to science. The specimen is characterized by its prominent bracts and anthers coherent at
43 their apices as in genus *Euploca*. The new species *Euploca wightiana* P. Javad & A. A. Ancy
44 is described here and compared with *E. marifolia* (J. Koenig ex Retz.) Ancy & P. Javad.

45 While studying specimens deposited at various herbaria, we found five collections (*R. Wight*
46 *P03513402* P!, *C. B. Clarke 11513* CAL!, *J. S. Gamble 13023* CAL!, *C. E. C. Fischer 2675*
47 CAL! and *K. Subramanyam 629* CAL!) similar to *Euploca wightiana* sp. nov. .These

collections were also from different localities of Coimbatore district but labelled as *H. Rottleri* Lehm. Detailed studies on type at MEL (ex Herbarium J.G.C. Lehman; Herbarium O.W. Sonder) and protologue confirmed that these materials are different from *H. rottleri* described by Lehmann from India (1817). Further in 1993 lectotypified *H. rottleri* Lehm. *Euploca wightiana* sp. nov. differs from *H. Rottleri* Lehm. in having flowers that are distantly placed on inflorescence axis, stiff curved branches and inflorescence, oblong leaves with obtuse apex and long style with capitate stigma. Robert Wight in his *Icones Pl. Indiae Orient.*, (1850) has described a material similar to *Euploca wightiana* sp. nov. Under *H. rottleri*, but it is much distinct from the type specimen of *H. Rottleri* Lehm.. Wight has mentioned it as a ‘very distinct but not easily described or represented species’. Antony & Javad 2020 made the recombination *Euploca marifolia* var. *rottleri* (Lehm.) Ancy & P. Javad

Materials and methods

Collection trips were conducted to different parts of India, photographs and habitat information were obtained. All measurements and thorough morphological assessments were performed using live specimens. Repeated visits to type localities were made. Materials were pressed and preserved. Detailed literature survey was done (Akhani & Förther 1994; Brown 1810; Diane et al 2016; Diane 2003; Förther 1998; De Candolle 1845; Frohlich 2020; Hilger and Diane 2003; Nuttall 1837; Naggar 2015; Luebert et al. 2016; Weigend et al 2014; Kazmi 1970). All available specimens of *Euploca* and *Heliotropium*, including types, were examined in the following herbaria: ARUN, ASSAM, BSI, BSJO, BARO, BM, CAL, FRC, G, GH, MH, BM, K, MEL, P, SUK. Acronyms used follow Index Herbariorum (Thiers, continuously updated). Specimen images were retrieved from JSTOR Global Plants (<http://plants.jstor.org>). Nomenclature was checked in Tropicos (<http://www.tropicos.org>), the International Plant Names Index (<http://www.ipni.org>) and WFO (<http://www.worldfloraonline.org>). The terminology used in description follows Beentje (2010). Photographs were taken with a Leica EZ4E stereo zoom microscope with a 3.0

74 megapixel digital camera (Leica, Switzerland) and a Canon DSLR 77 D 18-55 Camera.
75 Ecological and geographic distribution data were collected from herbarium labels; the
76 distribution map was created using QGIS ver. 3.24.3 (QGIS 2022). Provisional conservation
77 status assessments were based on guidelines published by the IUCN Standards and Petitions
78 Subcommittee (2019).

79 **Results and discussion**

80 *Euploca wightiana* P. Javad & A.A. Ancy sp. nov.

81 **Diagnosis**

82 Morphologically similar to *Euploca marifolia* in having bracteate inflorescence, white
83 flowers, stamens inserted below the middle of corolla tube, anthers coherent at apex and four
84 equal sized nutlets, but differs in having woody erect habit (procumbent in *E. marifolia*); stiff,
85 curved branches and inflorescence (spreading branches and inflorescence in *E. marifolia*);
86 stiff, oblong leaves with obtuse apex (lanceolate leaves with acute apex in *E. marifolia*);
87 distantly placed flowers on the inflorescence axis, distance between first and second flower 5
88 to 7mm (closely placed on the inflorescence axis, 1mm apart in *E. marifolia*); style stout,
89 long (0.6mm) with stigma unifid and capitate (style thin, short (0.2mm); stigma bifid, conical
90 in *E. marifolia*).

91 **Etymology**

92 The specific epithet '*wightiana*' commemorates Robert Wight, who first collected and
93 illustrated the specimen.

94 **Distribution**

95 India

96 **Specimens examined**

97 **Type**

98 INDIA, Tamilnadu, Coimbatore district, Salem-Ernakulam Highway, Echanari; 10°54'30.6"
99 N, 76°58'37.2" E; 23 Oct. 2018; P. Javad & Anna Ancy Antony ECR002; holotype: SAC!.

100 **Additional material**

101 INDIA, Tamilnadu, Coimbatore district, Madukkarai, Chettipalayam pirivu; 10°53'43.1" N,
102 76°56'00.1" E; 30 Sept. 2019; *P. Javad & Anna Ancy Antony ECR027*; SAC!.

103 **Paratypes**

104 INDIA, Tamilnadu, Coimbatore district; 1847; *R. Wight P03513402*; P!. 1000 m a.s.l.; 5 April
105 1870; *C. B. Clarke 11513* CAL!. 1000 m a.s.l.; October 1883; *J. S. Gamble 13023*; CAL!.
106 Jadagam; 1900 m a.s.l.; 23 April 1911; *C. E. C. Fischer 2675*; CAL!. Foot of Kuridimalai;
107 600 m a.s.l.; 27 August 1956; *K. Subramanyam 629*; CAL!.

108 **Description**

109 Perennial erect herb, branching from the base. Branches spreading, 5–35cm long. Stem
110 woody, covered with dense hirsute hairs. Leaves entire, 7–8.5 × 2.3–3mm, stiff, oblong with
111 obtuse apex, alternate and spirally arranged (dextrose); margin incurved towards ventral
112 surface; base subcordate; lamina hirsute dorsally and ventrally, with stiff trichomes usually
113 arising from tubercles, canaliculate dorsally, shortly petiolate; petiole 0.7 to 1.1 mm long.
114 Inflorescence scorpioid cyme, 2–5cm long; flowers distantly placed on the inflorescence axis,
115 distance between first and second flower 5–7 mm. Flower white with greenish yellow throat,
116 3.5–5 × 2–2.5mm, hirsute. Bracts prominent, spreading, lanceolate, 2–2.7 × 1–1.45mm,
117 scabrid inside, hirsute outside. Calyx persistent, base connate; sepals 5, lanceolate, hirsute
118 outside, minutely scabrid towards apex inside, 1.4–1.6 × 1–1.3mm, more or less equal lobes.
119 Corolla 5 lobed, fused, 3–4.5 × 2–2.5mm; tube cylindrical, greenish, hirsute at throat; lobes
120 spreading, equal. Intercalary lobes prominent at the sinus; hirsute outside, puberulous inside
121 on the neck region around stamens. Stamens 5, epipetalous, inserted below the middle of the
122 corolla tube above the stigmatic head; anthers pale yellow, inverted obcordate, 0.6–0.8 mm;
123 filaments 0.2 mm long; apex coherent, papillate. Ovary glabrous, ovoid, brown, 0.4 × 0.5
124 mm, 4 ovuled; style 0.6 mm long, pale brown, stigmatic ring prominent; stigma minutely

- 125 papillate, unifid, capitate, 0.3×0.4 mm. Fruit globose, usually 4 equally sized nutlets,
- 126 hirsute. Seeds 1 per locule, 1.3×1.1 mm.

Characters	<i>E. wightiana</i>	<i>E. marifolia</i>	<i>E. marifolia</i> var. <i>rottleri</i>
Habit	Erect herb	Prostrate herb	Erect herb
Stem	Woody	Woody at the base	Woody
Branch length	5–35cm	5–20cm	5–20cm
Leaf shape	Oblong	Lanceolate	Lanceolate
Leaf size	$7-8.5 \times 2.3-3$ mm	$4-9 \times 1-3$ mm	$8-12 \times 2-4$ mm
Leaf apex	Obtuse	Acute	Acute
Inflorescence length	2–5cm	1–2cm	1.5–3cm
Distance between first and second flower	4–5mm	1mm	1mm
Flower	White with greenish yellow throat	White with yellow throat	White with yellow throat
Flower size	$3.5-5 \times 2-2.5$ mm	$6-9 \times 3-5$ mm	$2-3.5 \times 0.5-0.8$ mm
Calyx lobes	Equal	Unequal with one lobe large	Unequal with one lobe large
Calyx shape	Lanceolate	Linear lanceolate	Linear lanceolate
Calyx hair	Scabrid inside towards apex	Glabrous inside	Glabrous inside
Corolla lobes	5 lobed, fused, equal	5 lobed, fused, unequal with one lobe large	5 lobed, fused, unequal with one lobe large

Corolla size	3.4–5 × 2–2.5 mm	5–8 × 3–5 mm	1.7–2.2 × 0.55–0.6 mm
Corolla shape	Cylindrical	Salveriform	Cylindrical
Intercalary lobes prominent at sinus	Present	Present	Absent or less prominent
Anther colour	Pale yellow	Greenish yellow	Pale yellow
Style size	0.6 mm	0.27 mm	0.2 mm
Style colour	Pale brown	Reddish green	Base reddish apex green
Stigmatic ring	Prominent	Prominent	Absent or less prominent
Stigma	Minutely papillate, unilobed	Hairy, bifid	Hairy, unilobed
Stigma shape	Capitate	Conical	Conical
Fruit	4 equally sized nutlets, hirsute	4 nutlets, minutely hairy or glabrous outside, hair near to apex and base glabrous	4 nutlets, apex hirsute base glabrous
Habitat	Roadsides and dried cultivated lands	On exposed rocky terrains and dried ponds in India	Rocky plateaus and hillocks.

127 **Phenology**

128 *Euploca wightiana* sp. nov. was collected with flowers and fruits from July to February.

129 **Habitat and occurrence**

130 Roadsides and dried cultivated lands.

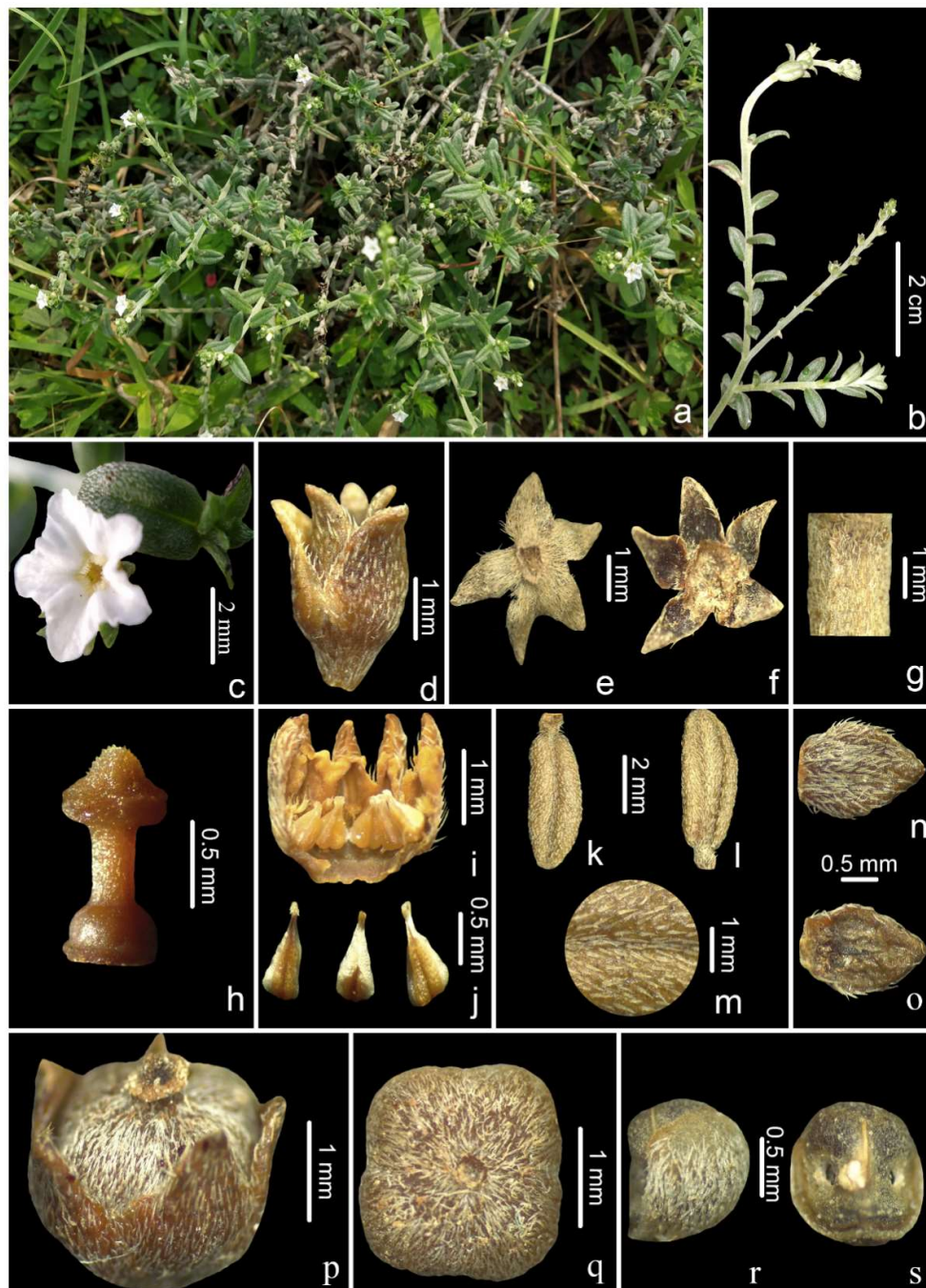
131 **Provisional conservational status**

132 *E. wightiana* sp. nov. is only reported from Coimbatore district with about 90 individuals
133 growing in different groups. The area of occupancy (AOO) is less than 15 km² and extend of
134 occurrence is less than 65 km². As the area covers National highway and too many buildings
135 and construction works, the survival of the species is extremely susceptible. We suggest the
136 status of *E. wightiana* sp. nov. as critically endangered (CR) B1 ab (iii) + B2 ab (iii)
137 according to IUCN (2019) criteria.

138 **Notes**

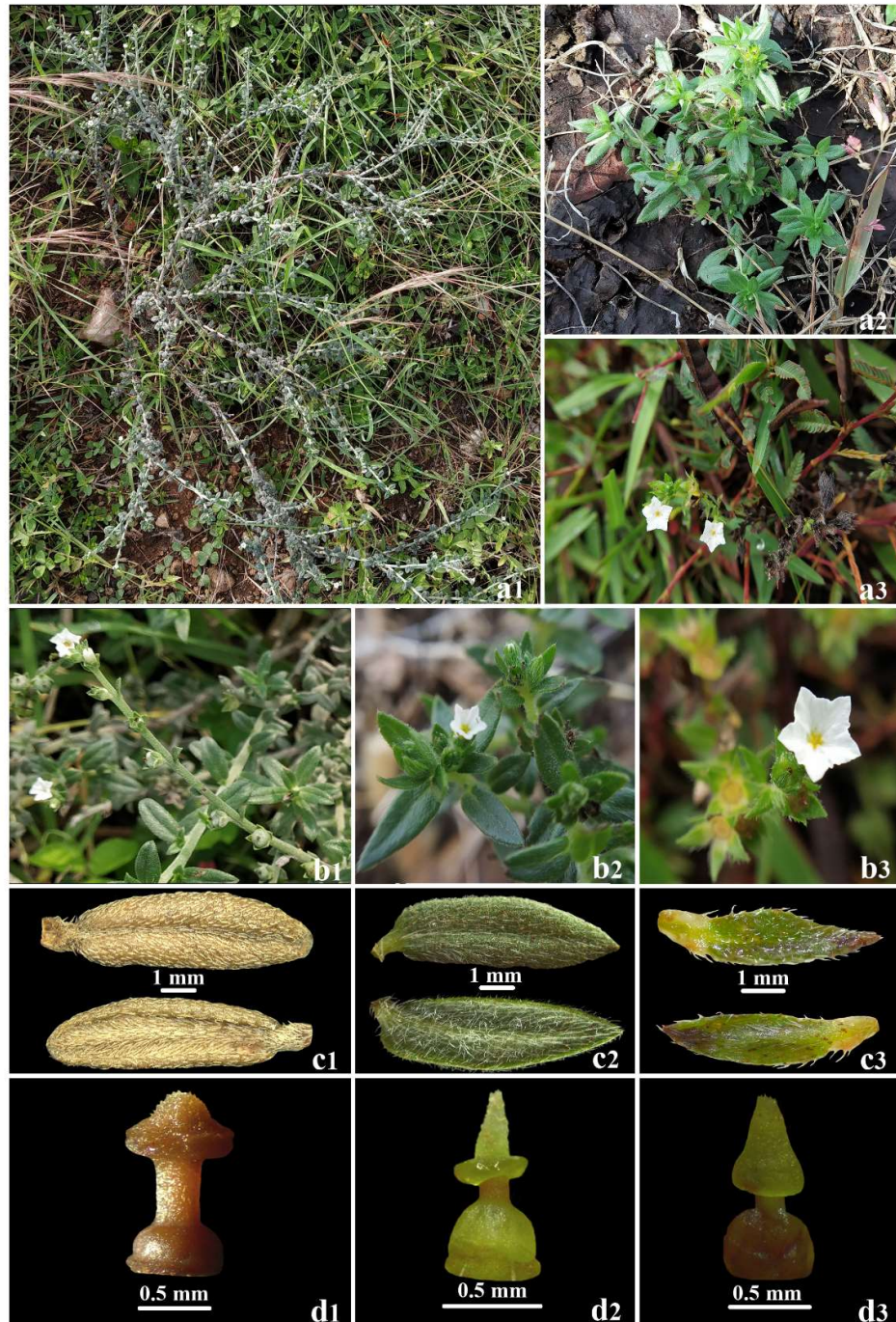
139 The curving stiff branches with flowers distantly placed on the inflorescence axis are not
140 reported in any other Indian species of *Euploca* (Fig. 1 a,b). The erect woody habit, oblong
141 leaves with obtuse apex, elongated cylindrical style with capitate stigma makes *E. wightiana*
142 sp. nov. distinct from others (Fig. 2). Repeated visits were conducted during past three years
143 to localities for collecting the specimens. A comparison of diagnostic characters between
144 species are provided in Table 1.

145 **Table 1.** Comparative description of characters of taxonomic importance.



146 **Fig.1.** *Euploca wightiana* P. Javad & A. A. Ancy sp. nov. **a.** Habit; **b.** Inflorescence; **c.**
 147 Flower; **d.** Calyx; **e.** Calyx-dorsal view; **f.** Calyx-ventral view; **g.** Stem; **h.** Gynoecium; **i.**
 148 Corolla split open; **j.** Anthers; **k.** Leaf-dorsal view; **l.** Leaf-ventral view; **m.** Trichomes on
 149 leaf enlarged; **n.** Bract-dorsal view; **o.** Bract-ventral view; **p.** Fruit with persistent calyx; **q.**
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151 Fruit with hairs; r.Nutlet-dorsal view; s. Nutlet-ventral view based on *P. Javad & Anna Ancy*
 152 *Antony ECR002 (SAC)*



153 **Fig. 2.** Comparison of species: *Euploca wightiana* P. Javad & A. A. Ancy sp. nov. (**a1**, **b1**,
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c1, d1), *Euploca marifolia* (J. Koenig ex Retz.) Ancy & P. Javad (**a2, b2, c2, d2**) & *Euploca*
marifolia var. *rottleri* (Lehm.) Ancy & P. Javad (**a3, b3, c3, d3**).



Fig. 3. Map showing the distribution of *Euploca wightiana* P. Javad & A. A. Ancy sp. nov.
 Prepared using QGIS ver. 3.24.3 (QGIS 2022).

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