

A taxonomic revision of caulescent tuberous *Sonerila* (Melastomataceae) in India

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Abstract: *Sonerila* Roxb. (Melastomataceae) is represented by 49 species and one variety in India, of which seven species are caulescent and tuberous, and endemic to the southern Western Ghats. The caulescent, tuberous species of the genus are revisited here based on field and herbarium studies. *Sonerila kanjilasseriensis* Arunraj, R.Reshma & Vishnupr. and *S. keralensis* Deepthikum. & Pandur. are reduced to synonymy of *S. rheedei* Wall. ex Wight & Arn. Since no type has so far been indicated for the genus, a lectotype is designated here. Detailed descriptions, illustration/photographic images and a key for the identification of the caulescent tuberous species in India are provided.

Keywords: Endemism, India, Paleotropics, Sonerileae, Taxonomy.

Introduction

Sonerila Roxb., a species-rich taxonomically complex tropical Old World genus of the family Melastomataceae (tribe Sonerileae), is represented by around 180 taxa (Cellinese, 1997; Resmi & Nampy, 2021a, b; Resmi *et al.*, 2018, 2021). The genus includes caulescent and acaulescent herbs, and is incredibly diverse, not surprisingly taxonomically difficult. It is distributed mainly across Sri Lanka, India, Nepal, Bhutan, South China, Taiwan, Indo-China and the Malay Archipelago. It is the largest genus in the tribe Sonerileae in India, with 49 species and one variety, and exhibits high percentage of endemism. Greater diversity of *Sonerila* occurs in the Western Ghats, where 43 species and one variety are found with 86 % of endemics (Resmi, 2022).

The name *Sonerila* was first used by Roxburgh (1814) in *Hortus Bengalensis* and included three species from the Garrow hills, namely, *Sonerila maculata* Roxb., *S. emaculata* Roxb. and *S. augustifolia* Roxb. The genus was validly published by Roxburgh six years later (Roxburgh, 1820). The name *Sonerila* was originally taken from the Malayalam name *Soneri-Ila*, which has been cited by Van Rheedee in *Hortus Malabaricus* (1689, vol. 9. t. 65.). In Malayalam ‘*Suwarna*’ means beautifully coloured and ‘*ila*’, leaf; ‘an allusion to the shining leaves’ (Nayar, 1985).

Dennstedt (1818) proposed the name *Cassebeeria* and cited “*Cassebeeria maculata*, IX, 65” in his *Schlüssel zum Hortus Indicus Malabaricus* while Kaulfuss (1824) proposed the name *Cassebeera* to name a Pteridophyte. Sprengel (1827) while treating Kaulfuss’s name, *Cassebeera* changed its spelling to *Cassebeeria*. Kuntze (1891) validated *Cassebeeria* Dennst. (*Schlüssel Hortus Malab.* p. 35 ex *Sonneri Ila* Rheedee IX t. 65 = *Sonerila* Roxb. 1820).

In the early 1900s, it was thought that *Cassebeeria* Dennst. was valid and had priority over *Sonerila* Roxb. However, *Sonerila* was conserved over *Cassebeeria* Dennst. (Harms, 1904 p. 29), and *Cassebeeria* Dennst. a later homonym (non *Cassebeera* Kaulfuss, 1824) and therefore a superfluous illegitimate name for *Sonerila* Roxb. and that the proposal was not necessary. Nevertheless, once a name is conserved, the name remains permanent and presently *Sonerila* is a conserved name, but not against any other name (Art. 14.13, Turland *et al.*, 2018).

The genus represents caulescent and acaulescent herbs thriving in shady habitats, and many have tubers. The tubers are perennial and undergo

a dormant period coinciding with the end of the monsoon season, surviving within humus-rich soil or rock crevices. The plants are usually herbaceous or suffrutescent woody herbs with simple or branched stems. The stems and branches are terete to quadrangular and glabrous to hairy (Lundin, 1983). The genus displays an array of morphological diversity and many species show variation in leaf shape and hair pattern. Members of the genus are easily recognized by generally trimerous flowers, mostly uniparous (scorpioid) cymes, and a 3-locular, inferior ovary. Diversity in leaf variegation and pigmentation, and the occurrence of occasionally both, tetramerous or pentamerous, flowers are also found within the same plant or within the same population. Many species of *Sonerila* are capable of growing as lithophytes or facultative epiphytes. Most of the species are known to be local endemics.

As a part of ongoing systematic studies, *Sonerila* in India is revised based on field studies and herbarium specimens and data. Based on the habit, four groups can be recognized in Indian *Sonerila*. The acaulescent to sub-acaulous group of 14 species, which are more or less stemless with tubers or with tubers and/or stolons or with rhizomes and radical rosette leaves. The second group (caulescent tuberous) has species with tubers and a distinct stem, and includes seven species. In the third group, plant height varies from species to species and it ranges from 3 to 150 cm. They possess a much thicker main stem than those of species in the second group, and these plants are repeatedly branched distally. This group includes 27 species and one variety. The last group includes only a single species, *Sonerila lundinii* Resmi & Nampy, which possess creeping or prostrate stems with roots at nodes (Resmi *et al.*, this issue). The present work highlights the taxonomy of caulescent tuberous species in India, discusses its diversity, including a key for their identification, detailed descriptions, and notes on infraspecific variations, geographical distributions and conservation assessments. Taxonomic problems relevant to the study are also resolved resulting in typification and subsequent synonymy.

Materials and Methods

The present study is based primarily on the authors' collections and field observations of all taxa,

supported by herbarium specimens housed in the following herbaria: BLAT, BSI, CAL, CALI, DD, E, herbarium of Goa University, JCB, K, KFRI, MH, TBGT (acronyms as per Thiers, continuously updated). Herbarium specimens were prepared using the wet method (De Vogel, 1987; Forman & Bridson, 1989). Live materials were maintained in the Calicut University Botanical Garden (CUBG) in order to observe variation under cultivation. Detailed morphological observations were recorded using descriptive terms following Stearn (1992) and Beentje (2016). Habitat and distributional data were collected during field studies and were also recorded from herbarium labels. Morphological studies and measurements were taken with an EZ4 HD stereo microscope with a 3.0 megapixel digital camera (Leica, Heerbrugg, Switzerland) and Stemi 508 stereo microscope (Zeiss, Oberkochen, Germany) outfitted with an Axiocam 105 color camera (Zeiss). Synonyms given were based on a critical examination of relevant protologues, types and synonymy lists from the taxonomic literature (Dennstedt, 1818; Clarke, 1879; Wight & Arn. 1834; Kuntz, 1891; Yoganarasimhan *et al.*, 1976; Deepthikumari & Pandurangan, 2014; Arunraj *et al.*, 2021). The distribution maps were created using QGIS 3.28.2 (QGIS, 2022). The Area of Occupancy (AOO) and Extend of Occurrence (EOO) were estimated using GeoCAT (Bachman *et al.*, 2011). Conservation assessments were prepared according to the IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Taxonomic Treatment

Sonerila Roxb., Fl. Ind. (Carey & Wallich eds.) 1: 180. 1820, *nom. cons.*; Jack, Malayan Misc. 1(5): 7. 1820; Blume, Flora 14: 490. 1831; Wall., Numer. List. 4089–4099. 1831; Wight & Arn., Prodr. Fl. Ind. Orient. 321. 1834; Wight, Icon. Pl. Ind. Orient. 3: t. 995. 1846; Naudin, Ann. Sci. Nat. Bot. Ser. 3, 15: 319. 1851; Hook.f., Curtis Bot. Mag. 83: t. 4978. 1857; Triana, Trans. Linn. Soc. London 28: 75. 1872; C.B. Clarke in Hook.f., Fl. Brit. Ind. 2(6): 529. 1879; Cogn. in A.D.C. & C.D.C., Monogr. Phan. 7: 507. 1891; Stapf, Ann. Bot. (Oxford) 6: 293. 1892; Gamble, Fl. Madras 1: 497. 1919; R.A. Clement in D.G. Long & Grierson, Fl. Bhutan 2(1): 297. 1984; Lundin, Nord. J. Bot. 3: 635. 1986; M. Ahmedullah & M.P. Nayar, Endemic

Pl. Indian Region 1: 111. 1987; Renner *et al.* in Santisuk & Larsen, Fl. Thailand 7(3): 482. 2001; C.Chen & S.S.Renner in Wu *et al.*, Fl. China 13: 390. 2007; T.S.Nayar *et al.*, Fl. Pl. Western Ghats 1: 637. 2014; V.S.Murthy & V.J.Nair, Fl. Kerala 2: 417. 2016. *Lectotype* (designated here): *Sonerila maculata* Roxb.

Cassebeeria Dennst., Schlüssel Hortus Malab. 35. 1818, *nom. inval.*; *Cassebeeria* Dennst. ex Kuntze, Revis. Gen. Pl. 1: 245. 1891, *nom. illeg.*

Annual or perennial herbs or sub-shrubs. Stem reduced (rosette forming with a subterranean globose tuber or horizontally running rhizome) or erect, rarely creeping. Leaves simple, opposite-decussate, radical or whorled; petiolate or sessile or sessile; laminae size and shape variable; green or vinaceous or claret coloured adaxially and abaxially, obtuse or sub rounded or deeply cordate at base with overlapping or non-overlapping margins, obtuse or acute or acuminate or rounded at apex, glabrous or densely or sparsely covered by eglandular trichomes adaxially and glabrous or sparsely covered by glandular trichomes abaxially, crenate to serrate or serrulate at margins; veins palmate, 2–3 pairs from the base, less branched, impressed adaxially, conspicuous abaxially. Inflorescence branched or unbranched scorpioid cyme or pseudo-umbel; peduncles terete or quadrangular, glabrous or sparsely to densely pubescent. Flowers trimerous (sometimes tetramerous or pentamerous), pale or dark pink or pale rose; pedicels terete or quadrangular, green or vinaceous or claret, glabrous or pubescent. Hypanthia campanulate or urceolate or cylindrical, 3-lobed, 3 or 6-ribbed, vinaceous or claret, glabrous or pubescent. Petals 3, ovate or elliptic or lanceolate or obovate acute to mucronate at apex, glabrous or pubescent abaxially. Stamens 3, alternate to petals; filaments pale to dark pink, glabrous, slightly flattened and twisted downwards; anthers sagittate to cordate at base, yellow, acute to acuminate or rostrate at apex, dehiscing through apical pores. Ovary 3-locular, inferior; style filiform, pale to dark pink; stigma capitate, pale to dark pink, rugose, glabrous. Capsules campanulate or urceolate or obconic or cupuliform, vinaceous or claret coloured, 3–6-ribbed, glabrous or pubescent. Seeds numerous, ellipsoid or obovoid, tuberculate or pusticulate.

Distribution: Sri Lanka, India, Nepal, Bhutan, South China, Taiwan, Indo-China and the Malay Archipelago.

Typification: *Sonerila maculata* is one of the three species included by Roxburgh (1814) while establishing the genus *Sonerila*. However, the name was not validly published. Later he validated the name in his *Flora Indica* (Roxburgh, 1820). The name was also cited in Wallich's catalogue (1828–1849) against *Numer. List* 4099 and quoted "4099 *Sonerila maculata* Roxb., a. Nepalens 1821, B. Sillet FD, *Sonerila emaculata*...Golpara". According to TL-2 (Staffeu & Cowan, 1983), the herbarium and type material of William Roxburgh (1751–1815) are at K, BM, BR, E, G and LIV. We have traced three relevant collections at K (K001038115, K001038116, K001038117 digital images!) and four at BM [BM000793166, BM000944458, BM000793165, BM000793167 digital images!]. The sheet BM000793166 bears an annotation of Roxburgh "1087, *Sonerila maculata*, Soneri-ila, Rheed. Mal. ix, 127 t. 65, E Sylhet-Sept 1817", while BM000944458 has the annotation *Sonerila maculata* Roxb., India Orientalis - Dr. Roxburgh (1815)". The other two sheets, BM000793165 and BM000793167, are annotated *Sonerila emaculata* and *Sonerila augustifolia*, India Orientalis, Dr. Roxburgh 1815 respectively. The sheet K001038115 bears annotation of Roxburgh and a label of Wallich, but is collected in 1821. K001038116 bears an annotation "*Sonerila maculata* Roxb., E. Silhet", while K001038117 has a label "*Sonerila immaculata*, Golpara, 18 June 1808". Among them, the specimen BM000793166 is selected here as the lectotype, which is collected before the publication of *S. maculata* and has a clear annotation by Roxburgh.

Key to the species of caulescent tuberous *Sonerila* species in India

1. Stems pubescent only at nodes; leaves sessile to sub-sessile..... **1. S. malabarica**
1. Stems sparsely to densely pubescent throughout; leaves distinctly petiolate 2
2. Anthers ovate, acute at apex..... 3
2. Anthers lanceolate, acuminate to rostrate at apex 4
3. Leaves more or less fascicled; petioles 0.5–1 cm long; peduncles 3–7 cm long **2. S. sahyadrica**

3. Leaves decussate; petioles 5–9 cm long; peduncles 10–16 cm long **3. *S. longipedunculata***
4. Laminae ovate to elliptic **5**
4. Laminae ovate or lanceolate **6**
5. Laminae acute to acuminate at apex; bracts leaf-like, ovate to elliptic, persistent; petals ovate to oblong **4. *S. konkanensis***
5. Laminae acute at apex; bracts apparently absent; petals ovate to elliptic **5. *S. rheedei***
6. Laminae ovate, 1–2 cm long, cordate at base, obtuse to rounded at apex **6. *S. lateritica***
6. Laminae lanceolate, 4–7 cm long, acute to sub-rounded at base, acute to acuminate at apex **7. *S. talbotii***

1. *Sonerila malabarica* Robi, Dantas & Sujanalap, *Webbia* 72(1): 93. 2016. *Type*: INDIA, Kerala, Kozhikode district, Malabar Wildlife Sanctuary, way to Kakkayam Damsite, 950 m, 19.07.2013, *A.J. Robi & K.J. Dantas* 23302 (holo KFRI!). **Fig. 1**

Perennating, tuberous, caulescent, succulent, erect or procumbent herbs, 20–53 cm tall. Tubers up to 1.5 cm in diam. Stems quadrangular, 0.2–0.6 cm thick, green or vinaceous or claret, fleshy, simple or branched, glabrous; internodes 2–5 cm long; with prominent leaf scars and gland-tipped trichomes sparsely at nodes, less so with age. Leaves decussate, sessile or sub-sessile; petiole to 0.2 cm long; laminae ovate to lanceolate, 2.5–3.5 × 1.2–1.9 cm, green, coriaceous, glabrous, cordate or rounded at base with non-overlapping margins, acute at apex, serrate at margins; veins pinnate, 3 pairs from the base, less branched, impressed adaxially, conspicuous abaxially. Cymes scorpioid, unbranched, usually 1 from the distal node, sometimes two, 5–13-flowered, terminal; peduncles quadrangular, 2–4 × 0.15–0.2 cm, green, longer than the petiole, glabrous; bracts caducous or apparently absent. Flowers trimerous, 1.5–2 × 1.5–2 cm; pedicels quadrangular, 3–5 × 0.1–0.15 mm, longer in fruit, green with a vinaceous or claret tinge, sparsely covered with glandular trichomes. Hypanthia campanulate, 5–6 × 2–3 mm, 3-lobed, 3-ribbed, green with vinaceous or claret tinge towards the lobes, sparsely covered with glandular trichomes; lobes triangular, 1–1.5 × 1–1.5 mm, acute at apex. Petals 3, ovate to obovate, 9–10 × 6–9 mm, dark pink, obtuse to

rounded at base, mucronate at apex, glabrous adaxially, glandular pubescent abaxially. Stamens 3; filaments 5–6.5 mm long, pink, pale towards apex, glabrous; anthers lanceolate, 5–6 mm long, yellow, acuminate at apex. Ovary 4–5 × 3–3.5 mm; style 9–10 mm long, pink, pale towards apex, as long as the stamens; stigma capitate, pink, rugose, glabrous. Capsules campanulate, 6–10 × 3–4 mm, green with a vinaceous or claret tinge when young and brown at maturity, 3-ribbed, glabrous. Seeds numerous, obovoid, 0.45–0.6 × 0.2–0.3 mm, dark brown.

Flowering & fruiting: Flowering from July to August and fruiting from August to September.

Habitat: *Sonerila malabarica* grows on soil pockets of dripping rocks at the margins of evergreen forests, at elevations 600–1100 m above sea level. It is found in association with *Sonerila wallichii* Benn. (Melastomataceae), *Henckelia humboldtiana* (Gardner) A. Weber & B.L. Burtt (Gesneriaceae), *Chlorophytum malabaricum* Baker (Asparagaceae), *Impatiens scapiflora* B. Heyne (Balsaminaceae), *Eriocaulon eurypeplon* Korn. (Eriocaulaceae), *Kleinia grandiflora* (Wall. ex DC) N. Rani (Asteraceae), *Themeda triandra* Forssk., *Tripogon malabarica* Thoiba & Pradeep, *Panicum* sp. (all Poaceae) and many bryophytes.

Distribution: Endemic to southern Western Ghats, India (Fig. 4).

Specimens examined: INDIA, Kerala, Kozhikode district, Malabar Wildlife Sanctuary, Kakkayam, *s.d.*, *A.J. Robi* 27921 (KFRI); way to Kakkayam dam, on rocks, 10.09.2016, *S. Resmi, Manu Philip & K. Jithin* 143881; *Ibid.*, 03.10.2016, *S. Resmi & A.P. Janeesha* 143886; *Ibid.*, 28.07.2018, *S. Resmi & S. Nampy* 151280 (CALI); Vayalada, 08.07.2019, *S. Jaismon, S. Resmi & S. Nampy* 168293 (CALI).

Conservation status: The species occurs only in two populations in the Kozhikode district of Kerala. Hence it is not possible to calculate the Extent of Occurrence. The species has a calculated Area of Occupancy of 8 km². We studied the individuals in the two locations, where we found in total 100 mature plants. One population is located in the Malabar Wildlife Sanctuary with less threat, while the plants in the other location, Vayalada, are vulnerable to tourism activities, a decline in plant number is likely. Considering these facts

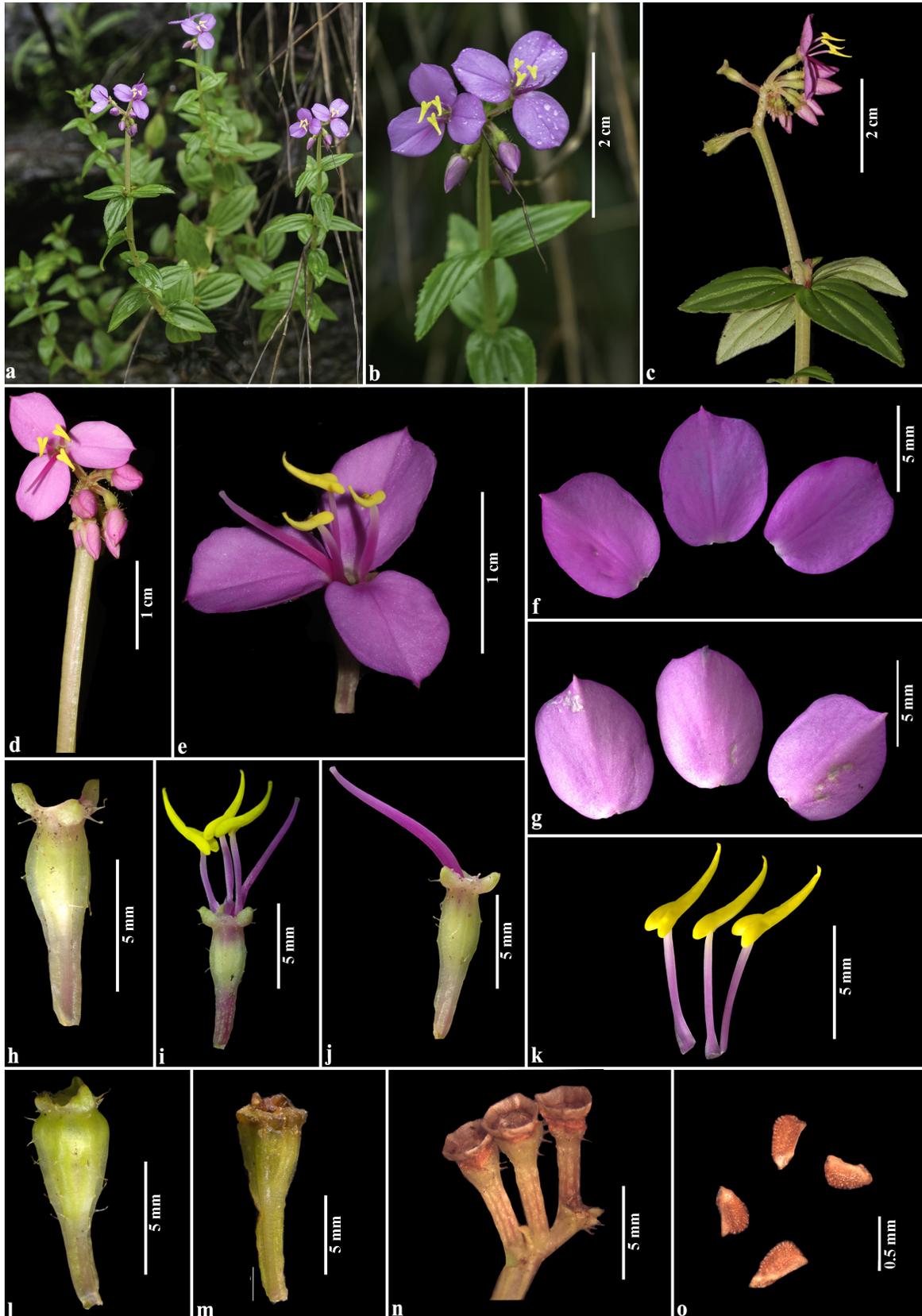


Fig. 1. *Sonerila malabarica* Robi, Dantas & Sujanapal: **a.** Habit; **b–d.** Cymes; **e.** Flower; **f.** Petals—adaxial view; **g.** Petals—abaxial view; **h.** Hypanthium; **i.** Hypanthium with stamens and pistil; **j.** Pistil; **k.** Stamens; **l.** Immature capsule; **m & n.** Dehiscent capsules; **o.** Seeds (from *S. Resmi* & *S. Nampy* 151280; photos by S. Resmi).

and the small size of the populations, the species is thus assessed here as Critically Endangered (CR), B2ab(ii,iii,v) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: *Sonerila malabarica* is a delicate tuberous plant with sessile or sub-sessile leaves and is morphologically allied to *S. kanniyakumariana* Gopalan & A.N.Henry. It differs from the latter by its tubers, quadrangular, glabrous stems (pubescent at nodes), small, ovate to lanceolate leaves, quadrangular peduncles, 3-ribbed sparsely pubescent hypanthia and the abaxially glandular pubescent petals.

2. *Sonerila sahyadrica* G.S.Giri & M.P.Nayar, Bull. Bot. Surv. India 26(3-4): 175. 1986; Sasidh., Biodiv. Doc. Kerala Part 6: Fl. Pl. 186. 2004; T.S.Nayar *et al.*, Fl. Pl. Kerala 1: 418. 2006, Fl. Pl. Western Ghats 1: 636. 2014; G.V.S.Murthy & V.J.Nair, Fl. Kerala 2: 416. 2016. *Type:* INDIA, Kerala, Kollam district, Pamba to Anathode, 1050 m, 30.09.1976, Vivekananthan 48344 (holo CAL [CAL0000015620!]; iso MH [MH00000415!]). **Figs. 2 & 3**

Perennating, tuberous, caulescent, erect herbs, 5–10 cm tall. Tubers globose, 0.3–0.5 cm thick, pale green to white. Stems quadrangular, 0.2–0.3 cm thick, green or vinaceous or claret, fleshy, simple, densely covered with gland-tipped trichomes, less so with age; internodes 0.5–1 cm long, short towards apex. Leaves more or less fascicled; petioles adaxially grooved or canaliculated, 0.5–2 × 0.1–0.2 cm, green to vinaceous or claret or with white dots or patches, densely covered with gland-tipped trichomes, less so with age; laminae ovate, 2–7 × 1–3 cm, pale to dark green or purple or vinaceous or claret adaxially and abaxially or with white dots or patches adaxially, rounded at base with overlapping or non-overlapping margins, acute at apex, membranous, sparsely to densely eglandular pubescent adaxially but only on veins abaxially, finely serrate at margins with each tooth ending in a terminal eglandular trichome; veins pinnate, 1–2 pairs from the base and 2–3 pairs from the midrib above, less branched, impressed adaxially, conspicuous and green or vinaceous or claret abaxially. Cymes unbranched, scorpioid, 3–8-flowered, terminal; peduncles quadrangular, 3–7 × 0.1–0.2 cm, longer than petiole, green or vinaceous or claret, densely covered with gland

tipped trichomes; bracts apparently absent. Flowers trimerous (occasionally tetramerous), 1–1.7 × 1–1.5 cm; pedicels quadrangular, 3–4 × 1–1.5 mm, longer in fruit, green or vinaceous or claret, densely covered with gland-tipped trichomes. Hypanthia campanulate, 3-lobed, obscurely 3-ribbed, 2.5–3.5 × 2–3 mm, green or vinaceous or claret, sparsely covered with gland-tipped trichomes; lobes triangular, 0.5–0.75 × 0.5–0.75 mm, acute at apex. Petals 3, elliptic to ovate, 5–6 × 2–2.5 mm, pale rose, rarely white with a pinkish tinge, rounded at base, acute to mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 2–3 mm long, pale pink or white, glabrous; anthers narrowly ovate, 1–2.5 mm long, yellow, acute at apex with prolonged connective. Ovary 2–3 × 2–3 mm; style 4–5 mm long, dark pink, pale towards apex; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 3–4 × 3–4 mm, green to vinaceous or claret when young and brown at maturity, 3-ribbed, sparsely covered with gland-tipped trichomes, less so with age. Seeds many, ellipsoid, 0.5–0.6 × 0.2–0.3 mm, blackish brown; raphe prominent, excurrent; testa sparsely tuberculate at dorsal angle.

Flowering & fruiting: Flowering from August to September and fruiting from September to November.

Habitat: This species grows on wet humus in moist rock crevices in grassland and moist hill slopes, at 200–1000 m elevation above sea level. It is found in association with *Sonerila brunonis* Wight & Arn., *S. tinneveliense* C.E.C.Fisch. (Melastomataceae), *Henckelia repens* (Bedd.) A.Weber & B.L.Burt (Gesneriaceae), *Justicia brittonica* Wall. ex J.Agardh (Acanthaceae), *Arachniodes aristata* (G.Forst) Tindale (Dryopteridaceae) and many bryophytes.

Distribution: Endemic to southern Western Ghats, India (Fig. 4).

Specimens examined: INDIA, Karnataka, Coorg district, Kadamakkal Reserve Forest, Sambaje, 300 m, 30.10.1981, Srinivasan 68085 (MH). Kerala, Idukki district, Pachakkanam, 1000 m, 09.11.1993, Jomy Augustin 12660 (KFRI); Periyar Tiger Reserve, Koruthode, 07.09.1994, N. Sasidharan & Jomy Augustin 14092 (MH); Kannur district, Tellichery (Thalasseri), November 1910, Meebold 12117 (MH); Kollam district, Below Moozhiyar,

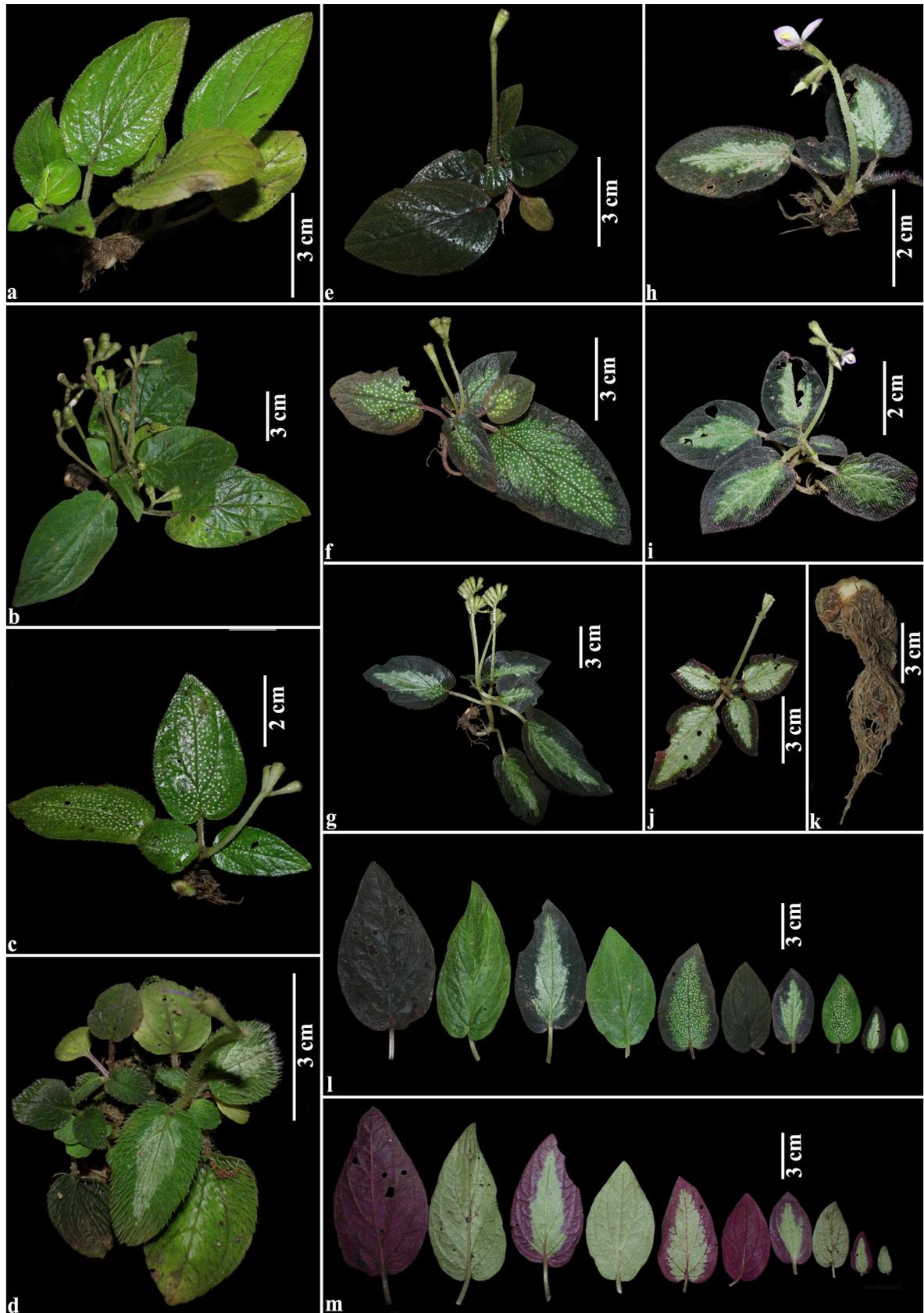


Fig. 2. *Sonerila sahyadraca* G.S.Giri & M.P.Nayar: **a–j.** Habit, note variations in leaf shape and colouration; **k.** Tuber with tuft of roots; **l.** Selection of leaves from different plants—adaxial view; **m.** and abaxial view (from *S. Resmi* & *S. Nampy* 164427; photos by S. Resmi).

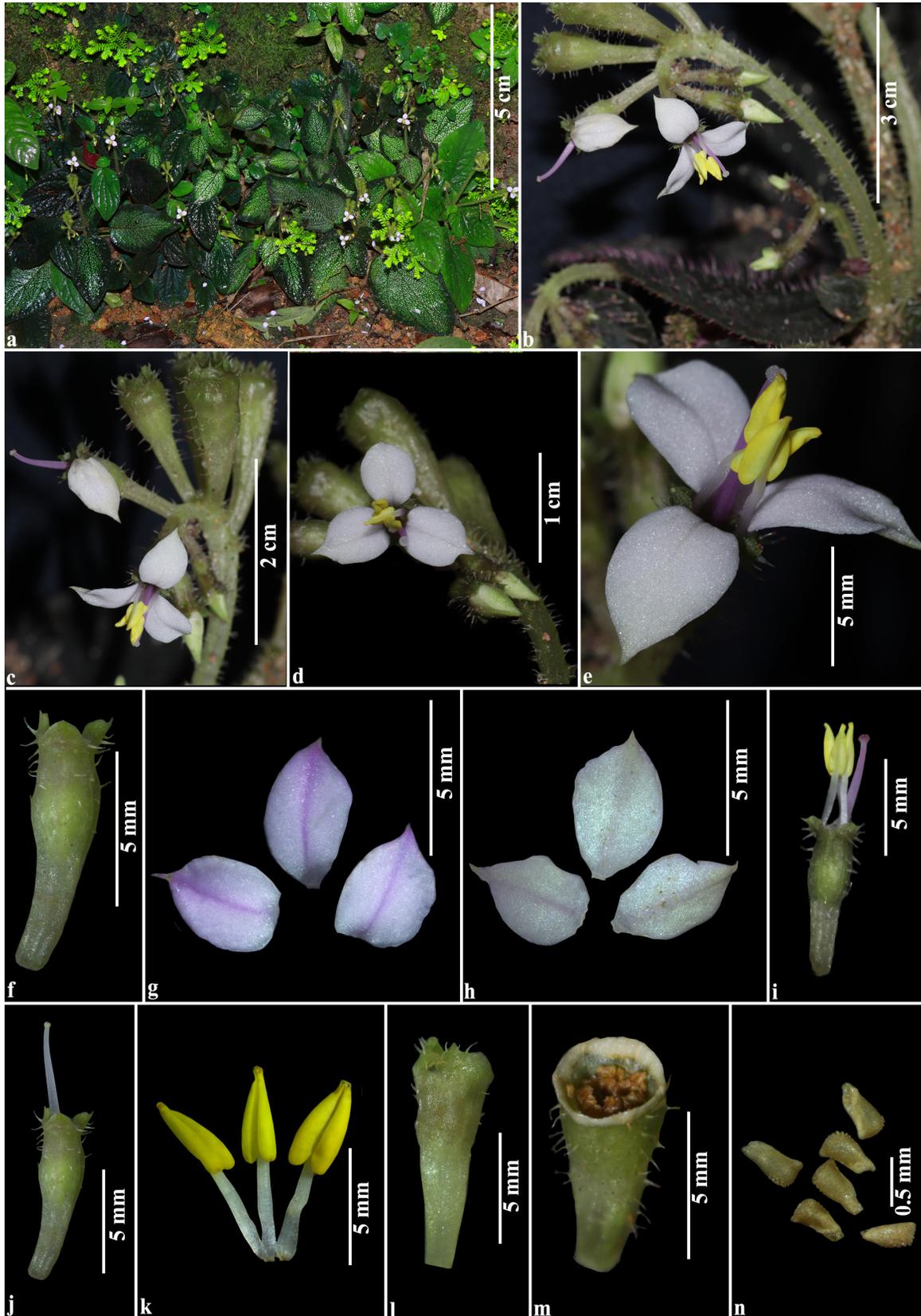


Fig. 3. *Sonerila sahyadrica* G.S.Giri & M.P.Nayar: **a.** Habitat and habit; **b & c.** Cymes; **d & e.** Flowers; **f.** Hypanthium; **g.** Petals—axial view; **h.** Petals—abaxial view; **i.** Hypanthium with stamens and pistil; **j.** Pistil; **k.** Stamens; **l.** Immature capsule; **m.** Dehiscent capsule; **n.** Seeds (from *S. Resmi* & *S. Nampy* 164427; photos a, f–n by S. Resmi; b–e by M.P. Krishnapriya).



Fig. 4. Distribution points of *Sonerila malabarica* Robi, Dantas & Sujanapal, *S. sahyadrica* G.S.Giri & M.P.Nayar, *S. longipedunculata* Resmi & Nampy and *S. konkanensis* Resmi & Nampy in India (drawn using QGIS ver. 3.28.2).

1000 m, 03.09.1977, *Nair* 50868 (MH); Moozhiyar, 1700 m, 03.09.1977, *Nair* 50872 (MH); Mukkadavu (Travancore), 24.08.1917, *Rama Rao* 1415, 1416 (MH); Kottayam, *Ibid.*, *Rama Rao* 1416 (MH); Kottayam district, Bharananganam, *V.T. Antony* 599 (JCB); Palakkad district, Attappadi hills (South Malabar), c. 850 m, 28.10.1910, *Fischer* 2263 (MH). Thiruvananthapuram district, Attayar, 700 m, 26.08.1990, *N. Mohanan* 8186 (CALI); between Palode and Kulathupuzha, November 1984, *s.coll. s.n.* (CALI); Kallar, c. 200 m, 22.11.1979, *Mohanan* 69241; *Ibid.*, *Mohanan* 65171 (CALI); Ponnudi, c. 400 m, 04.12.1977, *Mohanan* 52800 (CALI); Ponnudi estate, 950 m, 14.09.1977, *Nair* 51086; *Ibid.*, *s.d.*, *Nair* 51087 (CALI); way to Ponnudi hill top, near Kallar checkpoint, 10.10.2019, *S. Resmi & S. Nampy* 164427 (CALI).

Conservation status: The species occurs as fragmented populations in a narrow band of distribution over 800 km in Kerala and Karnataka with twelve locations. The estimated Extent of Occurrence is c. 16,433 km² and the calculated

Area of Occupancy 52 km². The areas might be subjected to tourist pressure and microclimate changes due to surrounding agricultural activities. It does not qualify for any of the 'threatened' categories presently but is close to qualifying for or is likely to qualify for a threatened category in the near future. Thus it is assessed here as Near Threatened (NT) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: *Sonerila sahyadrica* is closely allied to *S. rheedei* Wall. ex Wight & Arn., but can be easily distinguished by its short erect stems, more or less fascicled leaves, 0.5–2 cm long petioles, very short (2–3 mm long) filaments and 1–2.5 mm long narrowly ovate anthers with acute apices. The species shows notable variations in size, colour, pubescence and variegation of leaves; green to purple, vinaceous or claret leaves, sometimes with white dots or patches are observed in the same population. It sometimes produces tetramerous flowers. The ciliate margins of the petals are one

of the key characters used by Giri and Nayar (1986) to distinguish *S. sahyadraca* from *S. rheedei* and *S. wallichii*. However, we could not see this character either in type material or in live specimens. Moreover, ciliate petals are so far recorded only in *S. anaimudica* Lundin & B.Nord. and is very rare in this genus.

3. *Sonerila longipedunculata* Resmi & Nampy, Eur. J. Taxon. 733: 161, figs 1–3, 4A1–G1. 2021. *Type*: INDIA, Kerala, Wayanad district, Banasura hills, Kattukunnu, c. 1000 m, 13.08.2017, *S. Resmi* & *S. Nampy* 151222 (holo CALI!; iso MH!). **Fig. 5**

Perennating, tuberous, caulescent, erect or decumbent herbs, 10–30 cm tall. Tubers globose, 1–1.5 cm in diam., white to pale green, covered by tufts of roots. Stems sub-terete with shallow grooves on both sides arising from the axil of each pair of leaves, 0.3–0.5 cm thick, vinaceous or claret, fleshy, simple or with 2 or 3 branches occasionally from the distal nodes, sparsely covered with gland-tipped or eglandular bristles, less so with age; internodes 2–4 cm long, short towards apex; nodes with densely glandular or eglandular bristles. Leaves decussate; petioles adaxially grooved or canaliculate, 5–9 × 0.1–0.2 cm, vinaceous or claret, densely covered with gland-tipped or eglandular bristles, less so with age; laminae ovate, basal ones cordate to broadly ovate, 3–6 × 3–6 cm, dark green adaxially, vinaceous or claret abaxially, cordate to sub-rounded at base with overlapping or non-overlapping margins (basal ones), obtuse or rounded at apex, serrate at margins with each tooth ending in a terminal eglandular trichome, membranous, bullate when mature, densely eglandular bristly adaxially but only on veins abaxially; veins pinnate, 1–2 pairs from the base and 2–3 pairs from the midrib above, less branched, impressed adaxially, conspicuous and vinaceous or claret abaxially. Cymes scorpioid, unbranched, 6–14-flowered, terminal; peduncles quadrangular, 10–16 × 0.15–0.2 cm, longer than petiole, vinaceous or claret, densely covered with gland tipped bristles; bracts caducous or apparently absent. Flowers trimerous, 1–1.6 × 1–1.5 cm; pedicels terete, 4–5 × 1–2 mm, longer in fruit, vinaceous or claret, densely covered with gland-tipped trichomes. Hypanthia campanulate, 5–6 × 2–3 mm, 3-lobed, 3-ribbed, vinaceous or claret with a greenish tinge distally, densely covered with gland-tipped trichomes; lobes triangular, 1–2 × 1–2

mm, acute at apex. Petals 3, ovate to elliptic, 7–8 × 4–5 mm, pale pink with darker midrib, obtuse to rounded at base, acute to mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 4–5 mm long, pale pink, glabrous, slightly dilated and twisted downwards; anthers narrowly ovate, 4–5 mm long, yellow, acute at apex. Ovary 2–2.5 × 2–3 mm; style 8–9 mm long, pale pink, dark towards apex, longer than stamen; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 5–7 × 3–3.5 mm, green or vinaceous or claret, when young and brown at maturity, 3-ribbed, sparsely covered with gland-tipped bristles, less so with age. Seeds numerous, obovoid, 0.5–0.6 × 0.2–0.3 mm, pale brown.

Flowering & fruiting: Flowering from August to September and fruiting from September to October.

Habitat: It grows on wet rocks in grassy slopes at 1000 m elevation above sea level. Although no detailed ecological studies have been undertaken, *S. longipedunculata* appears to be restricted to shaded rocky outcrops and is likely to occur in areas where a specific combination of light intensity and moisture prevails, such as vertical, moss-covered rocks or rock crevices, as is the case for many species of *Sonerila*. It is found in association with *S. raghaviana* Ratheesh, Sunil, Nandakumar & Shaju (Melastomataceae), species of grass (Poaceae), *Mitracarpus* sp. (Rubiaceae), *Selaginella* sp. (Selaginellaceae) and several mosses.

Distribution: Endemic to southern Western Ghats, India (Fig. 4).

Conservation status: *Sonerila longipedunculata* is known only from a single population at the type locality with about 60 mature individuals. The calculated Area of Occupancy is 4 km². No anthropogenic threat was detected as the area falls in a wildlife sanctuary. However, this area is prone to landslides due to heavy rain, which has occurred in previous years. The habitat has been affected by climate-induced draught after the unexpected floods in 2018 and 2019. We suggest the status of *S. longipedunculata* as Critically Endangered (CR) B2ab(ii,iii,v) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

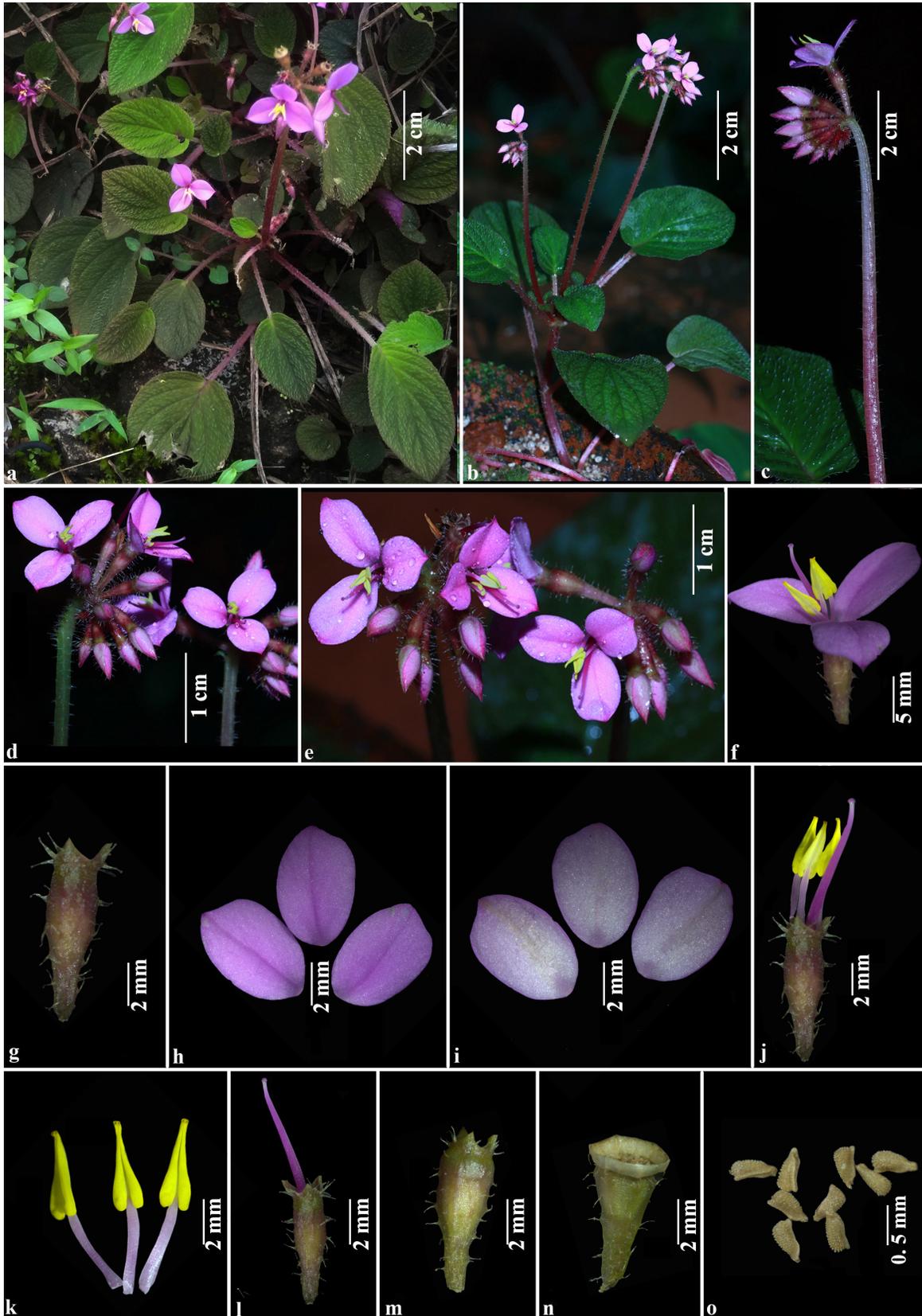


Fig. 5. *Sonerila longipedunculata* Resmi & Nampy: a. Habit; b. Plant with three cymes emerging from a distal node; c–e. Cymes; f. Flower. g. Hypanthium. h. Petals–adaxial view. i. Petals–abaxial view. j. Hypanthium with stamens and pistil. k. Stamens. l. Pistil. m. Immature capsule. n. Dehiscing capsule. o. Seeds (from *S. Resmi* & *S. Nampy* 151222; photos by S. Resmi).

Notes: *Sonerila longipedunculata* is characterised by long peduncles (10–16 cm long) and petioles (5–9 cm long), and these traits are not described in any other herbaceous caulescent tuberous species, other than the suffrutescent or woody species of Indian *Sonerila*. *Sonerila longipedunculata* has fleshy, simple stems, occasionally branched at distal nodes. *Sonerila longipedunculata* is also similar to *S. raghaviana*, which grow sympatrically and share similar hair patterns and floral features, but differs by its caulescent habit (*vs.* acaulescent), 10–16 cm long peduncles (*vs.* 4–11 cm long) and 6–14-flowered cymes (*vs.* 3–6-flowered in *S. raghaviana*).

4. *Sonerila konkanensis* Resmi & Nampy, *Candollea* 76(1): 140. 2021. *Type:* INDIA, Goa, South Goa district, Salcete taluk, Chandreshwar hills, way to Chandreshwar temple, ghat road cuttings, N 15°13'15.6", E 74°01'59.6", c. 220 m, 03.09.2019, *S. Resmi & P.F. Akshatra* 164408 (holo CALI!).

Figs. 6 & 7

Perennating, tuberous, caulescent, erect herbs, 5–30 cm tall. Tubers globose, 0.5–1.5 cm in diam., white to pale green, covered by tufts of roots. Stems quadrangular, sub-angular at the base, 0.2–0.6 cm thick, green with a vinaceous or claret tinge, corners distinctly marked dark pink or vinaceous, fleshy, simple or branched, densely covered with gland-tipped trichomes, less so with age; internodes 2–5 cm long, short towards apex; nodes with prominent leaf scars and densely covered with gland-tipped trichomes. Leaves decussate, sometimes clustered at the distal nodes; petioles adaxially grooved or canaliculate, 2–3.5 × 0.2–0.27 cm, green with a vinaceous or claret tinge, densely covered with gland-tipped trichomes, less so with age; laminae ovate to elliptic, 3–8 × 1.5–4 cm, lime green adaxially, pale green abaxially, cordate or sub-rounded at base with non-overlapping margins, acute to acuminate at apex, membranous, densely glandular pubescent adaxially but only on veins abaxially, serrate to dentate at margins with each tooth ending in a terminal glandular trichome; veins pinnate, 2 pairs from the base and 2–3 pairs from midrib above, less branched, impressed adaxially, conspicuous abaxially. Cymes scorpioid, unbranched, usually 1–2 cymes arising from the distal node of the stem and branches (sometimes 3–5); 6–20-flowered,

terminal; peduncles quadrangular, 4–7 × 0.15–0.2 cm, longer than petioles, vinaceous or claret, densely covered with gland tipped bristles; bracts leaf-like, ovate to elliptic, 0.5–2.5 × 0.5–1.5 cm, densely glandular pubescent adaxially but only on veins abaxially, persistent. Flowers trimerous (occasionally tetramerous), 1–1.6 × 1–1.5 cm, rarely tetramerous and the word rarely pedicels sub-angular, 4–10 × 1–1.8 mm, longer in fruit, vinaceous or claret, densely covered with gland-tipped trichomes. Hypanthia campanulate, 4–5 × 1.5–2.7 mm, 3-lobed, obscurely 3-ribbed, green with a vinaceous or claret tinge distally, densely covered with gland-tipped trichomes; lobes triangular, 1–2 × 1–2 mm, acute at apex. Petals 3, ovate to oblong, 8–12 × 4–5 mm, pale pink with darker midrib, obtuse at base, mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 5–6 mm long, dark pink, pale towards apex, glabrous; anthers lanceolate, 5–6 mm long, yellow, acuminate to rostrate at apex. Ovary 2–2.5 × 2–3 mm; style 8–10 mm long, dark pink, shorter or as long as the stamen; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 4–5 × 3–4 mm, green with a vinaceous or claret tinge distally when young and brown at maturity, obscurely 3-ribbed, densely covered with gland-tipped trichomes, less so with age. Seeds many, obovoid, 0.4–0.5 × 0.2–0.25 mm, pale brown.

Flowering & fruiting: Flowering from August to September and fruiting from September to October.

Habitat: It grows in wet humus and on damp rocks along the ghat road cuttings, between 210–280 m elevations above sea level. It is found in association with *Adiantum lunulatum* Burm.f. (Adiantaceae), *Lygodium flexuosum* (L.) Sw. (Lygodiaceae), *Athyrium* sp. (Athyriaceae), *Cheilanthes* sp. (Pteridaceae), *Pteris scabripes* Wall. ex J. Agardh (Pteridaceae), *Arachniodes aristata* (G.Forst) Tindale (Dryopteridaceae), *Selaginella* sp. (Selaginellaceae), *Ixora* sp. (Rubiaceae), *Leea asiatica* (L.) Ridsdale (Vitaceae), *Exacum petiolare* Griseb. (Gentianaceae) and *Begonia integrifolia* Dalzell (Begoniaceae).

Distribution: Endemic to Konkan, India (Fig. 4).

Specimens examined: INDIA, Goa, South Goa district, Salcete taluk, Chandreshwar hills, Chandranath, 16.09.1997, *Vaishali C. Joshi &*

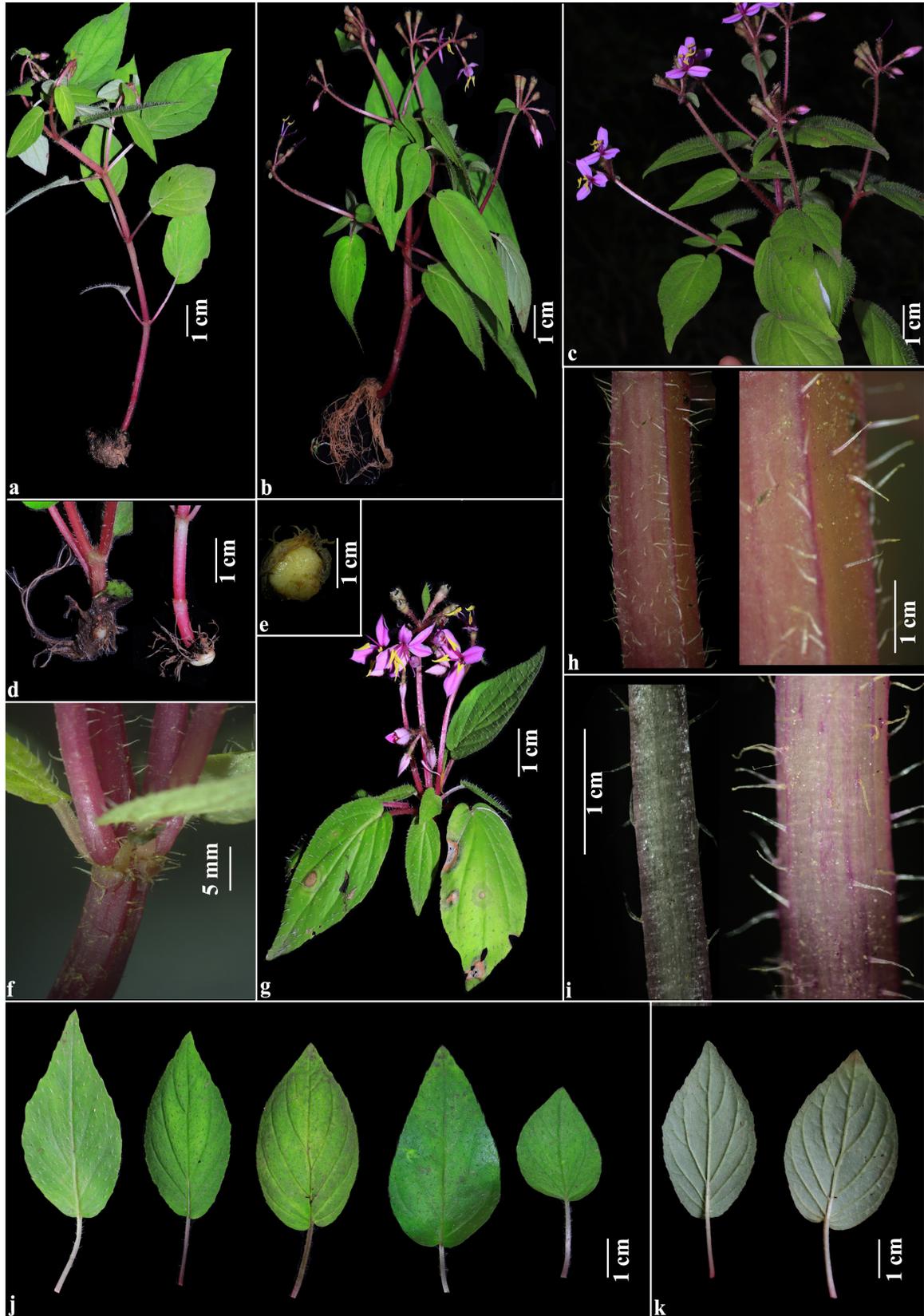


Fig. 6. *Sonerila konkanensis* Resmi & Nampy: **a & b.** Habit; **c.** Portion of stem with cymes; **d.** Base of stem with tubers; **e.** Detail of tuber; **f.** Node with leaf scar (arrow); **g.** Plant with several cymes emerging from distal node; **h & i.** Portion of stem showing its angular nature (arrow) and glandular trichomes; **j.** Leaves—adaxial view; **k.** Leaves—abaxial view (from *S. Resmi & P.F. Akshatra* 164408; photos by S. Resmi).

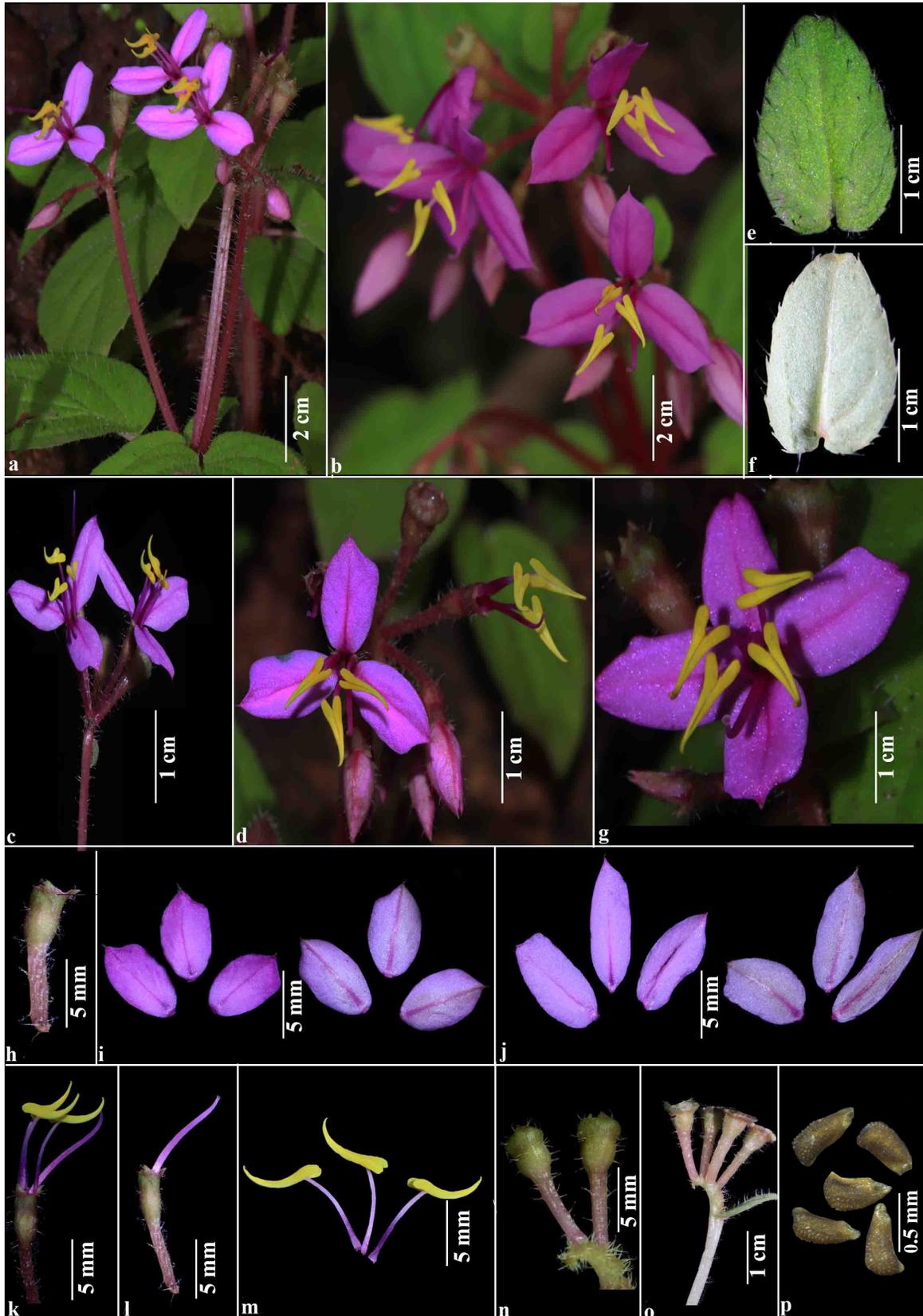


Fig. 7. *Sonerila konkanensis* Resmi & Nampy: a–c. Cymes; d. Flower; e. Bracts—adaxial view; f. Bracts—abaxial view; g. Rare tetramerous flower; h. Hypanthium; i. Ovate petals—adaxial and abaxial views; j. Oblong petals—adaxial and abaxial views; k. Hypanthium with stamens and pistil; l. Pistil; m. Stamens; n. Immature capsules; o. Dehiscent capsules; p. Seeds (from S. Resmi & P.F. Akshatra 164408; photos by S. Resmi).

S. Rajkumar 962 (Goa University Herbarium); Near Bhoothnath temple, 09.09.2007, *P. Ashish* 532 (Goa University Herbarium); on the way to Chandreshwar temple, 273 m, 03.09.2019, *S. Resmi & P.F. Akshatra* 164409 (CALI).

Conservation status: *Sonerila konkanensis* is known only from one location with two sub populations in an unprotected area, separated by a distance of 200–300 m. The calculated Area of Occupancy is c. 8 km² and 90 mature individuals were observed. Since the type locality is a tourist destination, and considering the observed ecological disturbances, we provisionally assess the species as Critically Endangered (CR), B2ab(ii,iii,v) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: *Sonerila konkanensis* is a pretty, tuberous species with quadrangular stems, lime green leaves, pale pink flowers and acuminate to rostrate anthers. This species is further characterised by its large, leaf-like, persistent bracts, not seen in any other *Sonerila* species from India. The stems are sometimes sparsely branched and occasionally with a solitary flower. It frequently produces 4-merous flowers within natural populations as well as in cultivation.

5. *Sonerila rheedei* Wall. ex Wight & Arn., Prodr. Fl. Ind. Orient. 321. 1834; Stapf, Ann. Bot. (Oxford) 6: 307. 1892; Gamble, Fl. Madras 1: 500. 1919; Vivek. in N.C.Nair & A.N.Henry, Fl. Tamil Nadu Ind., Ser I: Analysis 1: 164. 1983; B.D.Sharma *et al.*, Fl. Karnataka: analysis 2: 106. 1984; M.Ahmedullah & M.P.Nayar, Endemic Pl. Indian Region 1: 111. 1987; V.S.Ramach. & V.J.Nair, Fl. Cannanore 189. 1988; M.Mohanan & A.N.Henry, Fl. Thiruvananthapuram 200. 1994; Sasidh. & Sivar., Fl. Pl. Thrissur For. 193. 1996; C.J.Saldanha & B.R.Ramesh in C.J.Saldanha, Fl. Karnataka 2: 44. 1996; M.Mohanan & Sivad., Fl. Agasthyamala 283. 2002; Sasidh., Biodiv. Doc. Kerala Part 6: Fl. Pl.: 186. 2004; Anil Kumar *et al.*, Fl. Pathanamthitta 224. 2005; T.S.Nayar *et al.*, Fl. Pl. Kerala 1: 418. 2006 T.S.Nayar *et al.*, Fl. Pl. Western Ghats 1: 637. 2014; G.V.S.Murthy & V.J.Nair, Fl. Kerala 2: 413. 2016. *Lectotype* (designated by Giri & Nayar, 1986): Rheede. Hort. Malab. 9. t. 65. **Figs. 8 & 9**

Sonerila wallichii sensu C.B.Clarke in Hook.f., Fl. Brit. India 2: 538. 1879 *p.p.*, *non* Benn.

Sonerila pedunculosa sensu Yoganarasimhan *et al.*, in Curr. Sci. 45(14): 527. 1976, *non* Thwaites.

Sonerila keralensis Deepthikum. & Pandur., Taprobanica 6(2): 73. 2014, **syn. nov.** *Type:* INDIA, Kerala, Wayanad district, Thirunelli, c. 1000 m, 30.06.2009, *K.P. Deepthikumary & A.G. Pandurangan* 60590 (holo TBGT!).

Sonerila kanjilasseriensis Arunraj, R.Reshma & Vishnupr., Kew Bull. 76(1): 77. 2021, **syn. nov.** *Type:* INDIA, Kerala, Kozhikkod district, Chemanchery, Kanjilasseri, N 11°24'17", E 75°43'53", 13 m, 01.08.2018, *P.T. Arunraj & C.P. Vishnuprasad* 15362 (holo TBGT *n.v.*; iso TBGT, KFRI *n.v.*).

Perennating, tuberous, caulescent, erect or decumbent herbs, 5–30 cm tall. Tubers globose, 0.5–1 cm in diam., pale green to white. Stems quadrangular or sub-terete with shallow grooves, 0.1–0.4 cm thick, green or vinaceous or claret, fleshy, simple or repeatedly branched towards apex, densely covered with gland-tipped trichomes, less so with age; internodes 1–3 cm long, short towards apex. Leaves, decussate; petioles adaxially grooved or canaliculated, 0.5–3.5 × 0.1–0.2 cm, green or vinaceous or claret, densely covered with gland-tipped trichomes, less so with age; laminae ovate to elliptic, 3–13 × 2–6.8 cm, pale to dark green or purple to vinaceous or claret adaxially and abaxially or with white dots or patches adaxially, unequal and rounded at base with overlapping or non-overlapping margins, acute at apex, membranous, sparsely to densely eglandular pubescent adaxially but only on veins abaxially, finely serrate at margins with each tooth ending in a terminal eglandular trichome; veins pinnate, 1–2 pairs from the base and 2–3 pairs from the midrib above, less branched, impressed adaxially, conspicuous and green or vinaceous or claret abaxially. Cymes scorpioid, unbranched, 3–16-flowered, terminal and upper axillary; peduncles quadrangular, 4–10 × 0.1–0.2 cm, longer than petiole, green or vinaceous or claret, densely covered with gland tipped trichomes; bracts apparently absent. Flowers trimerous, 1–1.7 × 1–1.5 cm; pedicels quadrangular, 3–5 × 1–2 mm, longer in fruit, green or vinaceous or claret, densely covered with gland-tipped trichomes. Hypanthia campanulate, 3-lobed, obscurely 3-ribbed, 3–5 × 2–4 mm, green or vinaceous or claret, sparsely covered with gland-tipped trichomes; lobes



Fig. 8. *Sonerila rheedei* Wall. ex Wight & Arn.: a–f. Plants in their natural habitats. Note variations in leaf shape and colouration (from S. Resmi & S. Nampy 143838; photos by S. Resmi).

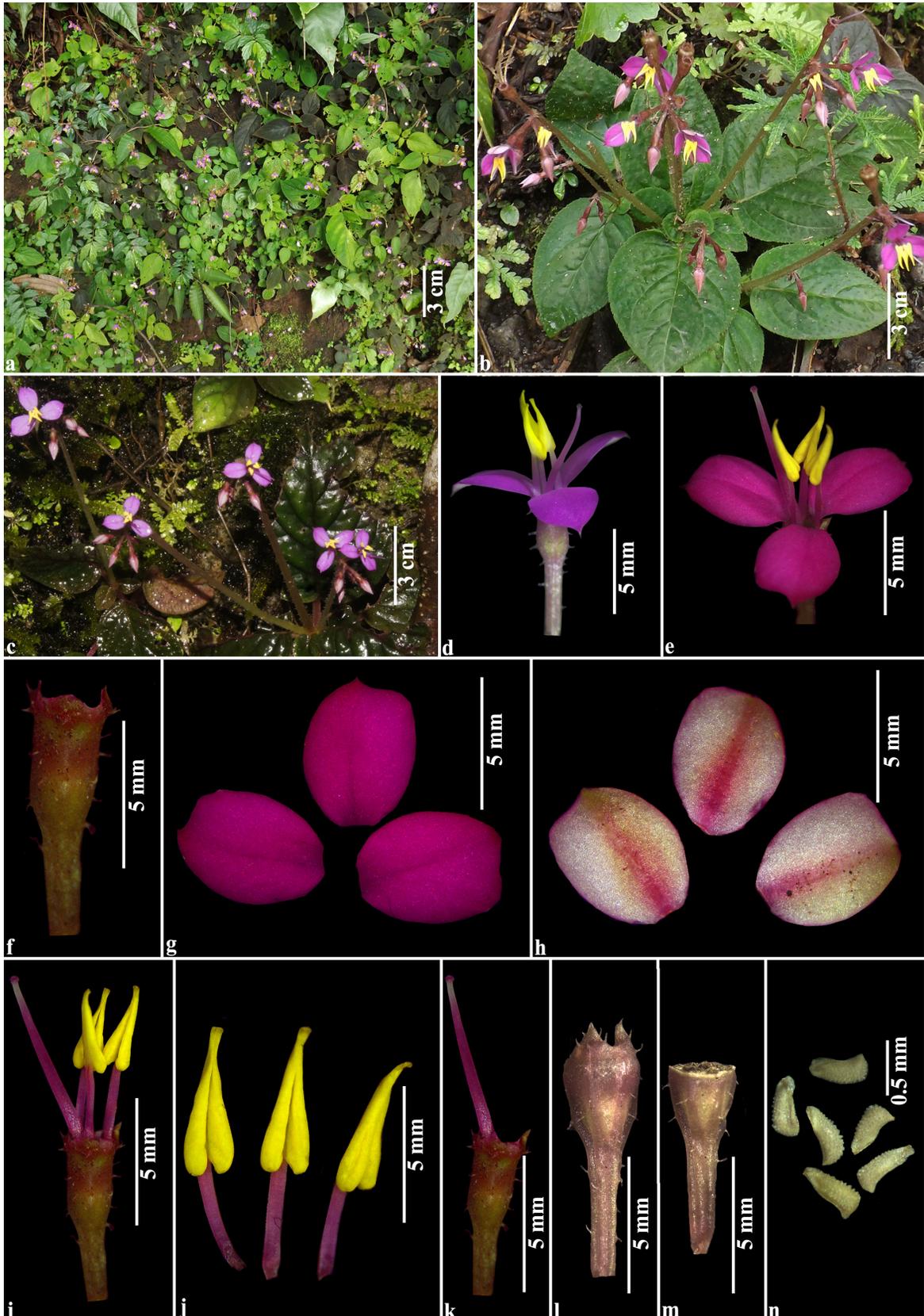


Fig. 9. *Sonerila rheedei* Wall. ex Wight & Arn.: a. Habitat; b. Habit; c. Cymes; d & e. Flowers; f. Hypanthium; g. Petals—adaxial view; h. Petals—abaxial view; i. Hypanthium with stamens and pistil; j. Stamens; k. Pistil; l. Immature capsule; m. Dehiscing capsule; n. Seeds (from S. Resmi; A.P. Janeesha & S. Nampy 143885; photos by S. Resmi).

triangular, 1–2 × 1–1.5 mm, acute at apex. Petals 3, ovate to elliptic, 5–8 × 3–4 mm, dark pink, obtuse or sub-rounded at base, acute to mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 3–4 mm long, pale pink, glabrous; anthers lanceolate, 3–4 mm long, yellow, acuminate to rostrate at apex. Ovary 3–4 × 2–3 mm; style 5–6 mm long, dark pink, pale towards apex; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 5–6 × 3–4 mm, green to vinaceous or claret when young and brown at maturity, 3-ribbed, sparsely covered with gland-tipped trichomes, less so with age. Seeds numerous, obovoid, 0.5–0.65 × 0.2–0.3 mm, pale brown to dark brown.

Flowering & fruiting: Flowering from August to September and fruiting from October to November.

Habitat: This species occurs in exposed lateritic rock crevices, between 13–1200 m elevations above sea level. It is found in association with *Sonerila wallichii*, *S. janakiana*, *S. sahyadrica* (Melastomataceae), *Utricularia striatula* Sm. (Lentibulariaceae), *Elatostemma* sp. (Urticaceae), *Canscora pauciflora* Dalzell (Gentianaceae), *Digitaria ciliaris* (Retz.) Koeler. (Poaceae), *Eriocaulon eurypeplon* Korn. (Eriocaulaceae), *Polycarpaea corymbosa* (L.) Lam. (Caryophyllaceae), *Selaginella* sp. (Selaginellaceae), *Christella* sp. (Thelypteridaceae) and many bryophytes.

Distribution: Endemic to southern Western Ghats, India (Fig. 11).

Specimens examined: INDIA, **Karnataka**, Chikmagalur district, Karadikhan Kolakhan, on shaded vertical road cuttings, 760 m, C.J. Saldanha KFP12056 (JCB); Kudramugha National Park, S. Resmi, T. Priyanka & S. Nampy 168222 (CALI); Dakshina Kannada district, Charmadi, 10.11.1962, R.K. Arora 1091 (CAL); Jog falls, 10.1919, Hallberg & McCanei 36188 (BLAT); *Ibid.*, 14.11.1900, C.A. Barber 2351; Sullia, 25.10.1900, C.A. Barber 2059 (MH); *Ibid.*, S. Resmi, T. Priyanka & S. Nampy 168230 (CALI); Hassan district, Byakarhalli, 21.08.1969, C.J. Saldanha 14551 (E); Kodagu district, Bhagamandala, 15.09.1934, E. Barnes 920 (MH); Mysore district, Hullahalli, 04.09.1969, C.J. Saldanha 17804 (JCB); Shimoga district, Agumbe, ghat route, 13.10.1962, R. Sundara Raghavan 83166

(BSI); *Ibid.*, 28.10.1980, M.R. Almeida 927 (BLAT); Agumbe to Koppa road, 30.10.1960, R. Sundara Raghavan 67947 (BSI); Hulical to Nilakal route, 25.08.1963, R. Sundara Raghavan 90213 (BSI); Ranagalgudda-Tirthahalli, 19.08.1963, R. Sundara Raghavan 90023 (BSI); Tirthahalli, 30.09.1962, R. Sundara Raghavan 82841 (BSI); Varahi forest, 08.10.1962, R. Sundara Raghavan 83045 (BSI); Yedur, 17.10.1964, R. Sundara Raghavan 90479, 90479A (BSI); Udupi district, Mookambika Wildlife Sanctuary, Goli forest, 21.07.2009, P.G. Diwakar & R. Kr. Singh 185124 (BSI); Mavinakatte forest, 14.10.2008, P.G. Diwakar & R. Kr. Singh 184460 (BSI); Uttara Kannada district, near Ankola, 20 m, 16.09.2018, S. Resmi, T. Priyanka & S. Nampy 168231 (CALI). **Kerala**, Ernakulam district, Kothamangalam, 23.07.2015, S. Resmi & V. Drishya 143804 (CALI); Neriampalam to Valara forest, 20.08.1965, K.M. Sebastine 25082 (MH); Pindimedu, 10.09.1985, K.K.N. Nair 3506 (KFRI); Idukki district, Kalverymount, 1200 m, 11.11.1981, B. Ramanujan 72462 (CAL, MH); Kulamav, 700 m, 23.09.1984, C.N. Mohanan 80158 (CAL, MH); Meenmutti, 800 m, 27.09.1981, C.N. Mohanan & B. Ramanujan 72129; *Ibid.*, 02.10.1983, C.N. Mohanan 79912, 79913 (CAL, MH); Kuttikkanam to Peermade, 21.09.1964, K. Vivekananthan 20307 (MH); On the hill between Cheruthoni & Idukki dam, 24.08.1981, V.S. Raju 71171 (MH); Pachakanam, 22.09.1972, B.D. Sharma 40834; Peermade, *s.d.*, *s.coll.*, *s.n.* (MH); Periyar Tiger Reserve, 13.10.2017, S. Resmi, Dani Francis, Divya Venugopal & S. Nampy 151240 (CALI); Way side, Neriampalam, 110 m, 11.09.2018, Vishnu Mohan & S. Nampy 159467 (CALI); Kannur district, Chandanathode, 12.07.1978, V.S. Ramachandran 57564 (MH); Chandanathode- way to Mananthavady, 24.06.1965, J.L. Ellis 25103 (MH); Kalliasseri, 20.07.1981, R. Ansari 70955 (MH); way to Chandanathode, 800 m, 14.08.1979, V.S. Ramachandran 63949 (MH); Panathur, 500 m, 10.10.1929, R. Ansari 64857 (MH); Kasaragod district, Konnakadu, 700 m, 30.09.1982, R. Ansari 74386 (CAL, MH); Kozhikode district, Kakkayam, 10.09.2016, S. Resmi, A.P. Janeesha & S. Nampy 143885 (CALI); Kuttyadi, 11.10.19984, Jolly Jacob 3812 (MH); Kuttyadi irrigation project, 25.06.1965, B.D. Naithani 24616 (MH); *Ibid.*, 13.10.1984, K. Leela 4228; *Ibid.*, 15.07.1984, A.R. Sheela 3484 (CALI); Olichuchattam, 760

m, 19.09.1997, A.K. Pradeep 56014 (CALI); Peruvannamuzhi dam site, 24.08.2015, S. Resmi & V. Veena 143819, 143821 (CALI); Vellarimala, 1500 m, 20.09.1997, E.J. Josekutty 47541 (CALI); Kollam district, Thenmala, near Kallada dam, 18.08.2016, S. Resmi, A.P. Janeesha & S. Nampy 143868, 143869 (CALI); Malappuram district, Calicut University beauty spot, 23.07.2015, S. Resmi & S. Nampy 143804; *Ibid.*, 04.08.2015, S. Resmi & V. Veena 143809 (CALI); Chettiarmadu, 04.07.1991, TP. Sheeja 3218 (CALI); Kannothe, 24.09.1913, *s.coll.*, 9389 (CALI); Olipramkadavu, 15.08.1985, M.P. Anitha 5195; *Ibid.*, 15.08.1986, A.K. Valsa 7124; *Ibid.*, 30.08.1991, C.G. Solly 4277; *Ibid.*, 26.06.1992, V.T. Smitha 3973 (CALI); Thiruvangad, 02.09.1970, V.V. Sivarajan 487 (CALI); *Ibid.*, 03.09.1983, A. Babu 37441 (CAL); Palakkad district, Silent Valley, 1000 m, 26.09.1977, R. Ansari 51490 (MH); Pathanamthitta district, Moozhiyar, 250 m, 10.09.1987, N. Anilkumar 26 (CAL, MH); way to Angamoozhy, R. Chandrasekaran 88579 (MH); Thrissur district, Vazhachal, 24.08.2016, S. Resmi & S. Nampy 143873, 143874 (CALI); Wayanad district, Near Lakkidi, 20.08.2015, S. Resmi & P.K. Dilna 143815, 143816 (CALI); Near Meenmutti waterfalls, 13.08.2017, S. Resmi & P.B. Athira 151217; Pakramthalam ghat, 14.10.2019, S. Resmi & S. Nampy 164422 (CALI); Thirunelly, 16.10.2015, S. Resmi & S. Nampy 143848, 143851 (CALI); Wayanad, *s.d.*, *s.coll.*, *s.n.* (MH). **Tamil Nadu**, Nilgiris district, Cherambadi, 820 m, 27.07.1972, E. Vajravelu 41863 (MH); Gudalur, 20.09.1928, G.V. Narayana & S.R. Raju 18485 (MH); Gudalur to Devala forest, E. Vajravelu 42815 (MH); Nadukani ghat, 11.09.2015, S. Resmi & S. Nampy 143838, 143839, 143840 (CALI).

Conservation status: This species is widely distributed in low to midlands of Kerala and in a few locations in Tamil Nadu and Karnataka. The Extend of Occurrence is estimated to be c. 57,247 km² and it is greater than the limits of any of the 'threatened' categories. Thus the species is assessed here as Least Concern (LC) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: Wight and Arnott (1834) described *Sonerila rheedei* and cited Wallich No. 4096 and Rheede's illustration (1689: t. 65). Since Wallich No. 4096 and Rheede's t. 65 are taxonomically different, Bennett

(1844) described *S. wallichii* based on Wallich 4096. Giri and Nayar (1986) also considered *S. rheedei* (as *S. rheedii*) and *S. wallichii* as quite distinct and lectotypified the former name with Rheede's illustration.

Sonerila rheedei is an erect or decumbent herb with a wide range of morphological variation. Green to purple or vinaceous or claret leaves, sometimes with white dots or patches are observed among the same population. Perusal of specimens at different herbaria and in the field revealed that the tuberous root stock of this plant did not get much attention during the collection and processing of specimens. The tuberous roots might have been lost during specimen preparation, or specimens with poorly developed tuberous roots were deposited at many Indian herbaria (BSI, BLAT, CAL, CALI, JCB, KFRI, MH and TBGT). Critical examination of the protologue and the illustration (Rheede. Hort. Malab. 9. t. 65) substantiates the above observations, and this lead to the proliferation of taxa numbers. *Sonerila rheedei* is morphologically close to *S. sahyadrica* and *S. pedunculosa* Thwaites but can be easily distinguished by its 1–4 cm long petioles, 4–10 cm long peduncles and 5–7 mm long, lanceolate acuminate or rostrate anthers.

Deepthikumari and Pandurangan (2014) described *Sonerila keralensis* based on their collections from Tirunelli in Wayanad district. According to them, *S. keralensis* differs from *S. rheedei* by having a tuberous root stock, erect apically branched stems, 3–7-flowered cymes, sparsely glandular hairy petal margins with a glabrous midrib, non-beaked anthers and sparsely hairy capsules. They also mentioned "petals glandular hairy marginally and on midrib" in *S. sahyadrica* and "petals glandular hairy marginally and midrib glandular hairy only dorsally" in *S. rheedei*. However, the illustration used for depicting the species is rather different from the description (non-beaked anthers and petals with sparsely hairy margins) and the characters given for *S. keralensis* overlap with the circumscription of *S. rheedei*.

Similarly, Arunraj *et al.* (2021) described *Sonerila kanjilasseriensis* from Kozhikode district of Kerala where they mentioned that it differs from *S. rheedei* by having a subterranean tuber, cylindrical to sub-quadrangular stems, (10–)12–24(–29)-flowered cymes, petals with acuminate apex, 4–6-ribbed

hypanthia and capsules. Recently Santhosh Kumar and Filimban (2021) synonymised *S. kanjilasseriensis* under *S. sahyadrica* without noticing its overlapping characters with *S. rheedei* and their comparison of *S. kanjilasseriensis* with *S. sahyadrica* is untenable especially in the pattern of phyllotaxy, size and shape of leaves, length of petioles and peduncles, number of flowers per cymes, shape and size of anthers, and nature of hypanthia and capsules. According to them, the plants grown on exposed vertical cuttings have short petioles, whereas longer petioles are seen on plants grown in shady humus rich soil. They also reported shorter filaments and anthers in smaller specimens from exposed vertical cuttings, but the robust plants from humus-rich soil possess longer filaments and anthers. Both *S. sahyadrica* and *S. rheedei* show considerable infraspecific variations which is very prevalent in *Sonerila*. However, the length of the peduncles, number of flowers per cymes, shape and size of anthers, and nature of hypanthia and capsules are useful characters for delimiting *S. sahyadrica* from its allied taxa if the populations are continuously observed. Overall, the critical examination of specimens and protologues of *S. rheedei*, *S. keralensis* and *S. kanjilasseriensis* revealed that the characters outlined for separating *S. keralensis* and *S. kanjilasseriensis* are intergrading with the circumscription of *S. rheedei*, and hence both are reduced to synonymy of *S. rheedei*.

6. *Sonerila lateritica* Resmi, Manudev & Nampy, Phytotaxa 333(2): 236. 2018. *Type*: INDIA, Kerala, Kozhikode district, Kakkoor, Ponkunnu hills, lateritic rock crevices, c. 200 m, 20.10.2015, *S. Resmi & K.M. Manudev* 143853 (holo CALI!; iso MH!).

Fig. 10

Perennating, tuberous, caulescent, erect herbs, 5–10(–13) cm tall. Tubers globose, 0.5–1 cm diam., white to pale green, fleshy, covered by tufts of roots. Stems quadrangular, 0.1–0.2 cm thick, green or vinaceous or claret, fleshy, simple or branched, sparsely covered with gland-tipped trichomes; internodes 0.5–1 cm long. Leaves decussate; petioles adaxially grooved or canaliculate, 0.3–0.5 × 0.1–0.2 cm, vinaceous or claret, densely covered with gland-tipped trichomes; laminae ovate, 1–2 × 0.5–1.5 cm, dark green adaxially, purple or vinaceous or claret abaxially, cordate at base with non-overlapping margins, obtuse to rounded at

apex, membranous, bullate when mature, densely eglandular pubescent adaxially but only on veins abaxially, serrate at margins with each tooth ending in a terminal eglandular trichome; veins pinnate, 2 pairs from the base and 1 pair from the midrib above, less branched, impressed adaxially, conspicuous and vinaceous or claret abaxially. Cymes scorpioid, unbranched, 3–12(–14)-flowered, terminal; peduncles quadrangular, 2–7 × 0.1–0.2 cm, longer than petiole, green with a vinaceous or claret tinge, sparsely covered with gland tipped trichomes; bracts apparently absent. Flowers 0.7–1.2 × 1–1.2 cm; pedicels narrowly angular, 1.5–6 × 1–2 mm, longer in fruit, green with a vinaceous or claret tinge, densely covered with gland-tipped trichomes. Hypanthia campanulate, 4–5 × 2–3 mm, 3-lobed, obscurely 3-ribbed, green to vinaceous or claret, densely covered with gland-tipped trichomes; lobes triangular, 2–3.5 × 2–3 mm, acute at apex. Petals 3, elliptic to broadly obovate, 3–5 × 3–4 mm, pale pink with darker midrib, cuneate to rounded at base, mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 2–5 mm long, dark pink, glabrous; anthers lanceolate, 3–4 mm long, yellow, acuminate at apex. Ovary 2–3 × 1.8–2.5 mm; style 4–5 mm long, dark pink, pale pink towards apex; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 3–5 × 3–4 mm, green to vinaceous or claret when young and brown at maturity, 3-ribbed, densely covered with gland-tipped trichomes, less so with age. Seeds numerous, ellipsoid to obovoid, 0.5–0.7 × 0.2–0.3 mm, dark brown.

Flowering & fruiting: Flowering from September to October and fruiting from October to November.

Habitat: This species occurs in exposed lateritic rock crevices at 200 m elevation above sea level. It is found in association with *Canscora pauciflora* Dalzell (Gentianaceae), *Ceropegia nampyana* Manudev, Kambale & Pramod (Apocynaceae), *Digitaria ciliaris* (Retz.) Koeler (Poaceae), *Polycarpha corymbosa* (L.) Lam. (Caryophyllaceae), *Eriocaulon eurypeplon* Korn. (Eriocaulaceae), *Selaginella* sp. (Selaginellaceae) and many bryophytes.

Distribution: Endemic to southern Western Ghats, India (Fig. 11).

Specimens examined: INDIA, Kerala, Kozhikode

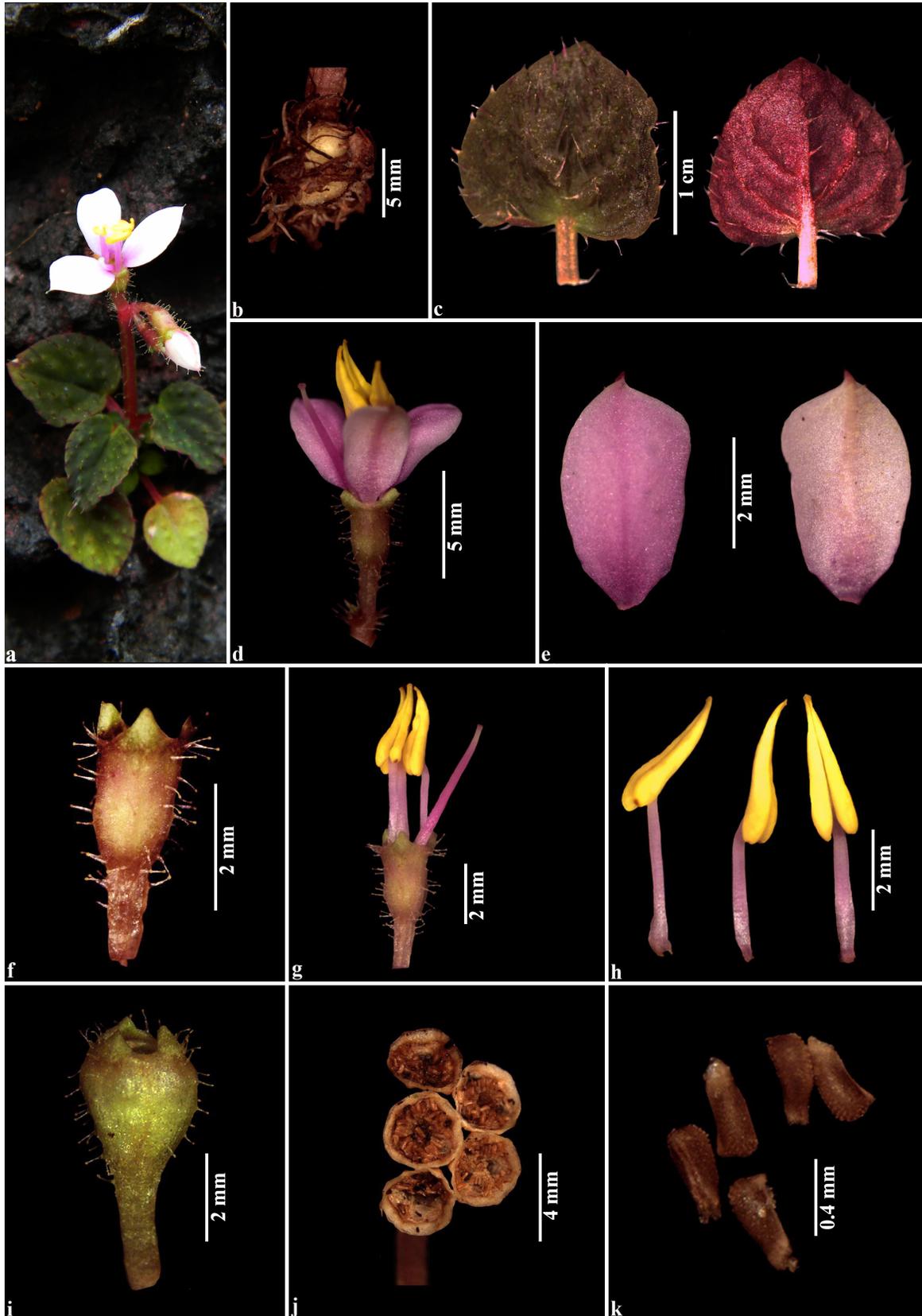


Fig. 10. *Sonerila lateritica* Resmi, Manudev & Nampy: **a.** Habit; **b.** Tuber; **c.** Leaf–adaxial and abaxial views; **d.** Flower; **e.** Petal–adaxial and abaxial views; **f.** Hypanthium; **g.** Hypanthium with stamens and pistil; **h.** Stamens; **i.** Immature capsule; **j.** Mature capsules; **k.** Seeds (from *S. Resmi* & *K.M. Manudev* 143841; photos by *S. Resmi*).



Fig. 11. Distribution points of *Sonerila rheedei* Wall. ex Wight & Arn., *S. lateritica* Resmi, Manudev & Nampy and *S. talbotii* G.S.Giri & M.P.Nayar in India (drawn using QGIS ver. 3.28.2).

district, Kakkoor, Ponkunnu hills, lateritic rock crevices, c. 200 m, 24.09.2015, *S. Resmi & K.M. Manudev* 143841; *Ibid.*, 08.10.2015, *S. Resmi & S. Nampy* 151210; *Ibid.*, 05.10.2019, *S. Resmi & M.P. Krishnapriya* 164410 (CAL).

Conservation status: It is known from two sub-populations at the type locality with about 100 mature individuals. The Area of Occupancy is calculated with 4 km². The lateritic habitat has been affected by mining which lead to the removal of soil, vegetation and microhabitats. Thus, the status of the species is assessed here as Critically Endangered (CR), B2ab(ii,iii,v) according to IUCN Red List Categories and Criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: *Sonerila lateritica* is a small caulescent herb with stems initially unbranched but later producing short branches from the basal or apical nodes. The number of flowers varies from 3 to 12 (rarely up to 14) which are produced in terminal scorpioid cymes. The leaf apex is usually obtuse

but sometimes rounded. The species is very similar to *S. anaimudica* in having a caulescent habit, glandular trichomes, ovate leaves, subulate bracts and campanulate hypanthia, but is readily distinguished by its tuberous rootstocks (*vs.* stem with a bulbous base), quadrangular delicate stems (*vs.* terete robust stems), decussate leaves (*vs.* whorled leaves), many flowered cymes (*vs.* solitary or 2- or 3-flowered cymes) and mucronate petals with glabrous margins (*vs.* rounded or retuse petals with glandular-ciliate margins).

7. *Sonerila talbotii* G.S.Giri & M.P.Nayar, *J. Jap. Bot.* 61(11): 344. 1986; T.S.Nayar *et al.*, *Fl. Pl. Western Ghats* 1: 637. 2014. *Type:* INDIA, **Karnataka**, Uttara Kannada district, North Canara, 04.08.1883, *W.A. Talbot* 561 (holo CAL [CAL0000015623!]).

Fig. 12

Perennating, tuberous, caulescent, erect herbs, 15–30 cm tall. Tubers small, globose, 0.5–0.7 cm diam., pale green to white. Stems sub-terete with shallow grooves or quadrangular, 0.2–0.3 cm thick, green or vinaceous or claret, fleshy, woody when mature,

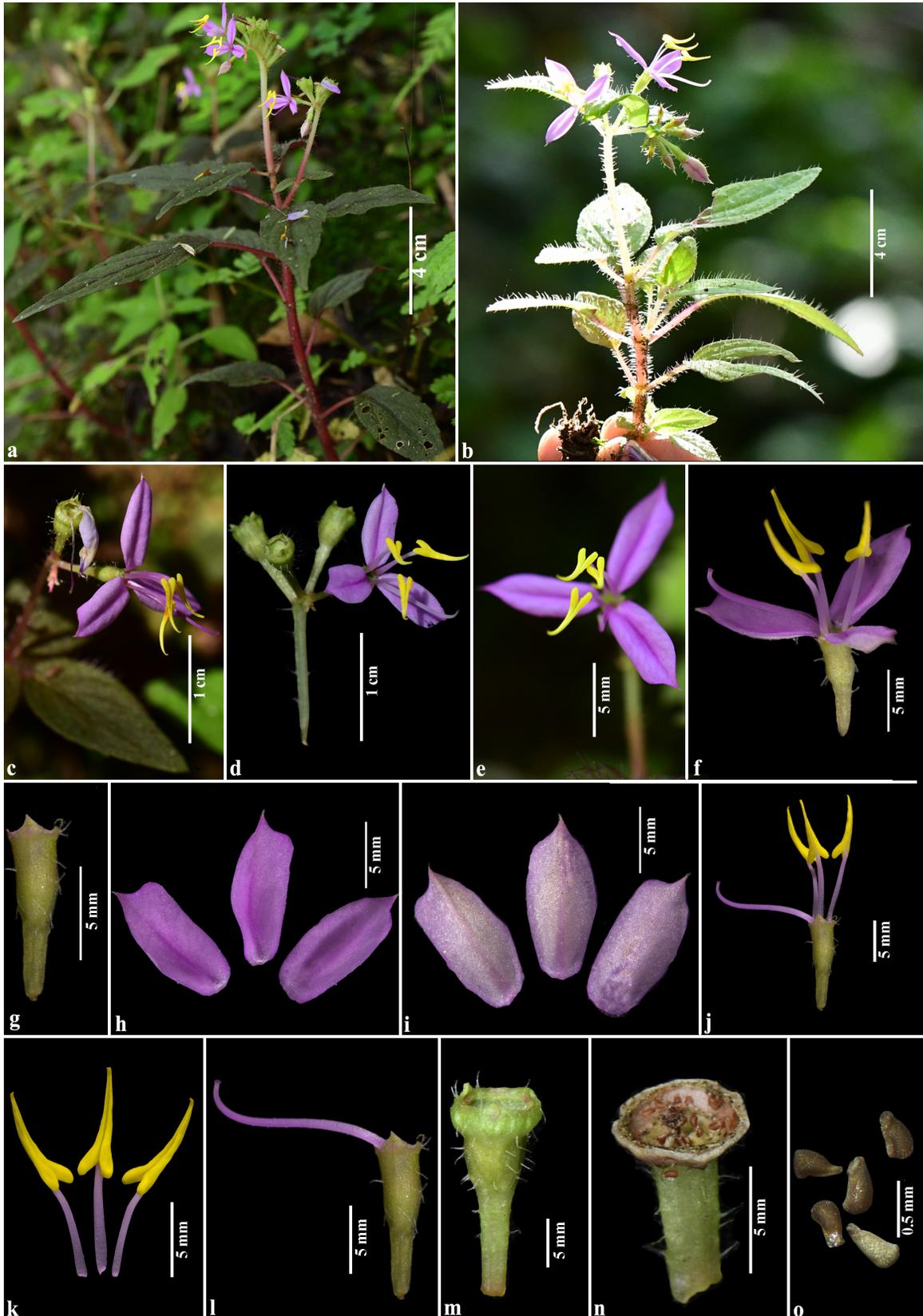


Fig. 12. *Sonerila talbotii* G.S.Giri & M.P.Nayar: **a.** Flowering twig; **b.** Habit—note dense glandular trichomes; **c & d.** Cymes—different views; **e & f.** Flower—different views; **g.** Hypanthium; **h.** Petals—adaxial view; **i.** Petals—abaxial view; **j.** Hypanthium with stamens and pistil; **k.** Stamens; **l.** Pistil; **m.** Immature capsule; **n.** Dehiscent capsule; **o.** Seeds (from *S. Resmi, T. Priyanka & S. Nampy* 168232; photos by *S. Resmi*).

simple or repeatedly branched towards apex, densely covered with gland-tipped trichomes, less so with age; internodes 2–3 cm long, short towards apex. Leaves decussate; petioles adaxially grooved or canaliculate, 1–3 × 0.1–0.2 cm, green or vinaceous or claret, densely covered with gland-tipped trichomes, less so with age; laminae lanceolate, 4–7 × 1.5–2.5 cm, pale to dark green or purple or vinaceous or claret, unequal and sub-rounded at base with non-overlapping margins, acute to acuminate at apex, membranous, sparsely glandular pubescent adaxially but only on veins abaxially, finely serrate at margins with each tooth ending in a terminal eglandular trichome; veins pinnate, 1–2 pairs from the base and 3–4 pairs from the midrib above, less branched, impressed adaxially, conspicuous and vinaceous or claret abaxially. Cymes scorpioid, unbranched, 3–8-flowered, terminal and axillary; peduncles quadrangular, 3–5 × 0.1–0.2 cm, longer than petiole, green or vinaceous or claret, densely covered with gland tipped trichomes; bracts subulate, 0.3–1.8 × 0.3–1 cm, caducous. Flowers trimerous (occasionally tetramerous), 1.2–1.4 × 1–1.2 cm; pedicels quadrangular, 4–5 × 1–2 mm, longer in fruit, vinaceous or claret, densely covered with gland-tipped trichomes. Hypanthia campanulate, 3-lobed, obscurely 3-ribbed, 4–5 × 2–3 mm, vinaceous or claret, sparsely covered with gland-tipped trichomes; lobes triangular, 1–2 × 1–1.5 mm, acute at apex. Petals 3, elliptic to oblong, 7–8 × 3–4 mm, pale pink, obtuse or sub-rounded at base, acute to mucronate at apex, glabrous adaxially, with gland-tipped trichomes on midrib abaxially. Stamens 3; filaments 5–6 mm long, pale pink, glabrous; anthers lanceolate, 5–6 mm long, yellow, acuminate to rostrate at apex. Ovary 3–4 × 2–3 mm; style 10–12 mm long, dark pink, pale towards apex; stigma capitate, dark pink, rugose, glabrous. Capsules campanulate, 4–5 × 3–3.5 mm, green to vinaceous or claret when young and brown at maturity, 3-ribbed, sparsely covered with gland-tipped trichomes, less so with age. Seeds ellipsoid to obovoid, 0.5–0.65 × 0.2–0.3 mm, dark brown.

Flowering & fruiting: Flowering from August to September and fruiting from September to November.

Habitat: This species occurs in exposed lateritic rock crevices, at c. 20 m elevation above sea level. It

is found in association with *Utricularia striatula* Sm. (Lentibulariaceae), *Elatostemma* sp. (Urticaceae), *Murdannia* sp. (Commelinaceae), *Selaginella* sp. (Selaginellaceae) and many bryophytes.

Distribution: Endemic to southern Western Ghats, India (Fig. 11).

Specimens examined: INDIA, **Karnataka**, Uttara Kannada district, Ankola, Navagadde, Near Naga temple, on dripping rocks near stream, 20 m, 17.09.2018, *S. Resmi, T. Priyanka & S. Nampy* 168232 (CALI); Karwar, 20.08.1883, *W.A. Talbot s.n.* (BSI); *Ibid.*, 25.06.1885, *W.A. Talbot* 1257 (DD).

Conservation status: It is known from two locations in Uttara Kannada district of Karnataka. The Area of Occupancy is calculated as 8 km². We were able to observe only a single location at Ankola, where we found around 400 mature individuals that are growing just about 100 m from the main road. The status of the species is assessed here as Data Deficient (DD) according to IUCN Red List Categories and criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2022).

Notes: *Sonerila talbotii* is an interesting plant with quadrangular stems, lanceolate leaves, oblong petals and acuminate to rostrate anthers. The recently described *S. konkanensis* is morphologically close to *S. talbotii* in having dense glandular trichomes on its stems, branches, petioles, laminae, peduncles, pedicels and hypanthia. However, *S. talbotii* differs from *S. konkanensis* by having 1–2 cm long petioles, elliptic to lanceolate laminae, 3–5 cm long peduncles, 3–12-flowered cymes, subulate bracts and elliptic to oblong petals. Tetramerous flowers are also noticed in the same population.

Acknowledgements

The authors are thankful to the Head of the Department of Botany, University of Calicut, for access to facilities; the curators of the herbaria at BLAT, BSI, CAL, CALI, DD, E, herbarium of Goa University, JCB, K, KFRI, MH and TBGT for permitting to consult the specimens; Goa, Karnataka, Kerala and Tamil Nadu Forest Departments for permission to conduct field studies and for various help during fieldwork. SN is thankful to the Science Engineering Research Board (SERB), New Delhi, for funding (Sanction No: EMR/2016/007346, dated 20 November 2018).

RS is grateful to the International Association for Plant Taxonomy for the IAPT Research Grant 2020; SIBBALD Trust (Royal Botanic Garden Edinburgh, UK) for a research grant 2021#3, and to the Government of Kerala for financial support. We are grateful to Dr. K.N. Gandhi (Harvard University, USA) for nomenclatural help.

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