

# Taxonomic reassessment of *Impatiens verecunda* (Balsaminaceae) and its synonymization with *I. cordata* in the Western Ghats, India

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**Abstract:** Historical records, such as those by J.D. Hooker and subsequent studies, have noted taxonomic complexities in *Impatiens verecunda* Hook. f. and its relationship with *I. cordata* Wight and *I. anaimudica* C.E.C.Fisch. Field surveys in Devikulam, Kerala, discovered specimens resembling *I. verecunda*, prompting detailed morphological comparisons with *I. cordata* and *I. anaimudica*. The plants exhibited similarities to *I. cordata*, differing only in habitat-driven traits like short stature and short floral spurs, confirmed the synonymization of *I. verecunda* under *I. cordata*. Conversely, *I. anaimudica* remains distinct due to its lenticelled stems, crimson flowers, and unique spur morphology. Further studies on *I. cordata* populations revealed variations in life history, habit, flower colour, spur length, and floral morphology, influenced by environmental conditions. A revised description of *I. cordata* is presented to account for these variations and clarify its distinction from closely related taxa like *I. elegans* Bedd.

**Keywords:** Anamalai hills, Devikulam, Idukki, *Impatiens anaimudica*, Kerala

## Introduction

*Impatiens* L. is represented by about 1167 species (POWO, 2026) mainly distributed in the tropical and subtropical regions of the Old World (Grey-Wilson, 1980; Yuan *et al.*, 2004; Janssens *et al.*, 2009). Approximately 280 species are reported from India, which are confined to the moist and humid regions of India such as North-Eastern states, Eastern Himalayas, and the Western Ghats (Gogoi

*et al.*, 2020). Among these, more than 120 species are endemic to the Western Ghats (Bhaskar, 2012; Mani *et al.*, 2020; Anirudhan *et al.*, 2023). Hooker (1875, 1904, 1905 & 1906) described a considerable number of Indian *Impatiens*, including collections made by Meebold from the Travancore, such as *I. herbicola* Hook.f., *I. verecunda* Hook.f. The latter plants were originally collected from the steep embankments in Periakanal [Periyakanal] and Devicolam [Devikulam] in Idukki, Kerala.

Bhaskar (2012) provided an account of *Impatiens* of the Western Ghats, wherein he expressed uncertainty about the identity of *I. verecunda*. Despite this, he treated it as a distinct species. He speculated that *I. anaimudica* C.E.C.Fisch. (Fischer, 1935) might be conspecific with *I. verecunda*, but the absence of collections beyond the type material left him uncertain. Consequently, he retained *I. anaimudica* as a separate species. Bhaskar concluded that if the basal lobe of the lateral united petal in *I. verecunda* does not form a vault over the stamens, then *I. anaimudica* could be merged under *I. verecunda*.

During the field survey in Devikulam, the authors collected interesting specimens of *Impatiens* from open rocky embankments. The material was studied and found similar to the type specimens of *I. verecunda*. The plants were growing as small erect succulent herbs without profuse branching from the base. In vegetative and floral morphology, the specimen is much closer to *I. cordata* Wight. Some

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of the differences between these specimens from *I. cordata* are the short stature of the plant and the flower with a short spur. In all other aspects, this specimen perfectly matches *I. cordata*.

We thoroughly analyzed the type specimen of *I. verecunda* collected by Meebold. The type material has flowering and fruiting plants and separated floral parts. The floral parts were illustrated on the type sheet by J.D. Hooker. This helped us to extract its morphological characters and was very helpful in reaching the exact identity of the type specimen of *I. verecunda*. The characters derived from the type specimen include stem morphology; leaf arrangement (alternate), shape, and lamina margins; inflorescence type (sub-umbellate); floral structure; shapes of the lateral sepals, lip with spur, standard petal, and lateral united petals with a vaulted basal lobe around the stamens and distal lobes; spur length (short); and fruit shape, whereas the presence of a purple spot at the base of the wing (lateral united petal) was mentioned in the protologue also agree with collections from Devikulam (Fig. 1e–h). The characteristics such as the short stature of the plant and short spur alone do not satisfy to retain *I. verecunda* as a distinct species. It might be due to the conditions in which the plants are exposed such as open rocky habitats, where they grow as annuals. Often *I. cordata* occurs in stream sides or moist places under shade and grows as a perennial decumbent-erect succulent with profuse branching from the base. Considering the above facts, we synonymize *I. verecunda* under *I. cordata* Wight. At the same time *I. anaimudica* could easily be set apart from *I. cordata* (= *I. verecunda*) by its lenticelled and pubescent stem, crimson flowers, rounded boss-like spur and basal lobe of wing petals not forming a vault over stamens (Fig. 2c–d).

In the description of *I. verecunda*, Hooker compared it with *I. elegans* Bedd., a species closely related to *I. cordata*, the latter has long spur (Fig. 1a) and it is absent in the former (Figure 2a). The short spur observed in *I. verecunda* (Fig. 1e & g) may account for its comparison to *I. elegans*. Based on our study,

we propose that flowers with a spur, regardless of its length (Fig. 1), along with the presence of a small purple-red spot (*vs.* large crimson eye-spot extend beyond the basal lobe in *I. elegans*) at the claw of the lateral united petals (observed in some, but not all cases), are distinguishing characteristics that differentiate *I. cordata* from *I. elegans*.

Different populations of *I. cordata* were studied and observed notable variations in them. The major differences observed were differences in life history strategy (annual *vs.* perennial), habit (slender decumbent-erect *vs.* somewhat stout upright), shape of the lamina base (cordate *vs.* round), number of flowers in peduncle (3–7), flower colour (pink to white), shape of the dorsal petal (oblong or elliptic) and length of the spur (exceeding the wing petals *vs.* minute). In light of these observations, we present an amended description of *I. cordata*, despite its existing documentation in the literature (Wight, 1837; Bhaskar, 2012).

## Materials and Methods

Field surveys were conducted in the Western Ghats, during the flowering and fruiting seasons between 2018 and 2024. Plant specimens of *I. verecunda*, *I. cordata*, and *I. anaimudica* were collected, and preserved using both dry and wet methods (Jain & Rao, 1977). Voucher specimens were deposited at the herbarium of Carmel College (Autonomous), Thrissur (CCMT) for future reference. Relevant taxonomic literature, including protologues, historical descriptions, and regional flora, were reviewed for species identification and synonymization (Hooker, 1875, 1904, 1905, 1906, 1911; Beddome, 1859; Bhaskar 2012; Fischer, 1935; Wight, 1837). Morphological traits were compared across populations of *I. cordata* and *I. anaimudica*. Observations were noted for variations in life history, growth habit, lamina base shape, flower color, spur length, and other floral traits. Environmental conditions of the habitats, such as moisture availability and light exposure, were documented to assess their influence on morphological variability.

## Taxonomic Treatment

***Impatiens cordata*** Wight, Madras J. Lit. Sci. Ser. I, 5: 10. 1837. *Lectotype* (designated by Singh, 2016); INDIA, **Tamil Nadu**, Tenkasi district, Shevagerry (Sivagiri) hills, 08.1836, *Wight* 338 (K digital image!).

*Impatiens verecunda* Hook.f., Bull. Misc. Inform. Kew, 9: 356. 1911. **syn. nov.** *Lectotype* (designated by Singh, 2016): INDIA, **Kerala**, Travancore, Idukki district, Periakanal (Periyakanal), 1372 m, 12.1910, *Meebold* 13125 (K digital image!). **Fig. 1**

Annual or perennial, often grows as decumbent herbs, rarely upright; stems more or less cylindrical, branched or unbranched, slender, pale green or with salmon red pigmentation, glabrous; extra-floral nectary absent. Leaves alternate; petiole 3.5–7 cm long, rarely to 11 cm long, channeled above; blade ovate, 4–13 × 3–7 cm, base cordate or round, apex acute, margins crenate with minute cilia at crenatures, midrib distinct, lateral veins 4–6 pairs with minute hairs on both surfaces. Inflorescence 4–12 cm long, pedunculate sub-umbels. Bracts ovate, 2–3 × 4–6 mm, pale green or with salmon-red tinges. Flowers 3–7 in each peduncle, 2–2.5 cm across, pink to white; pedicels 1.5–2 cm long, pale green, glabrous; lateral sepals 2, ovate, 4–8 × 3.5–6 mm, 5-nerved, mucronate, glabrous, pale green or with salmon-red tinges; dorsal petal oblong or elliptic, 8–10 × 6–7 mm, glabrous, dorsally keeled, round or truncate at base, emarginate at apex, mucronate; lateral united petals 2-lobed, 15–20 × 10–13 mm, glabrous, pink to white; basal lobe orbicular, 3–4 × c. 3 mm, salmon-red or translucent, incurved, vaulting over stamen; distal lobe ovate, 15–20 × 10–13 mm, spreading, pink to white, clawed at point of attachment with a crimson-eye; lower sepal widely ovate to orbicular, depressed into the spur, 7–10 × 7–9 mm, mucronate at apex, glabrous, white; spur tubular, 2–35 mm long, glabrous, white; stamens 5, cohering above pistil; column c. 2.5 × c. 1.5 mm, slightly curved; filaments 5, white, connate at apex; anthers yellow. Pistil c. 2 × c. 1 mm; ovary ellipsoid, glabrous; style

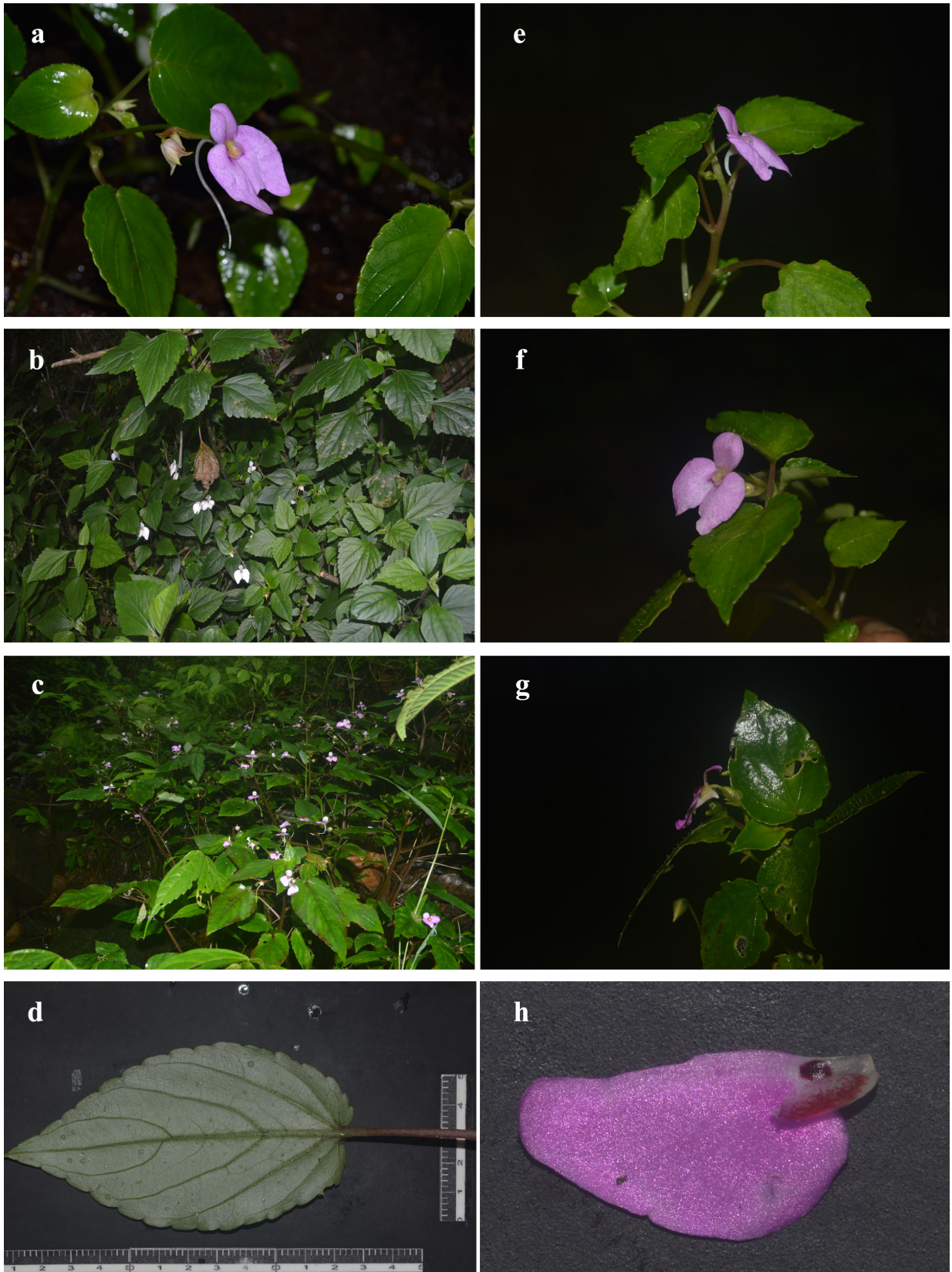
rudimentary; stigma 5-toothed. Capsule ellipsoid, 9–15 × 4–6 mm, slightly oblique, glabrous, green; seeds obovoid or globose, c. 2 × c. 2 mm, 5–20 in number, brown, long brown hairy throughout with tuft of hairs at pointed end.

*Flowering & fruiting:* Flowering and fruiting from July to January.

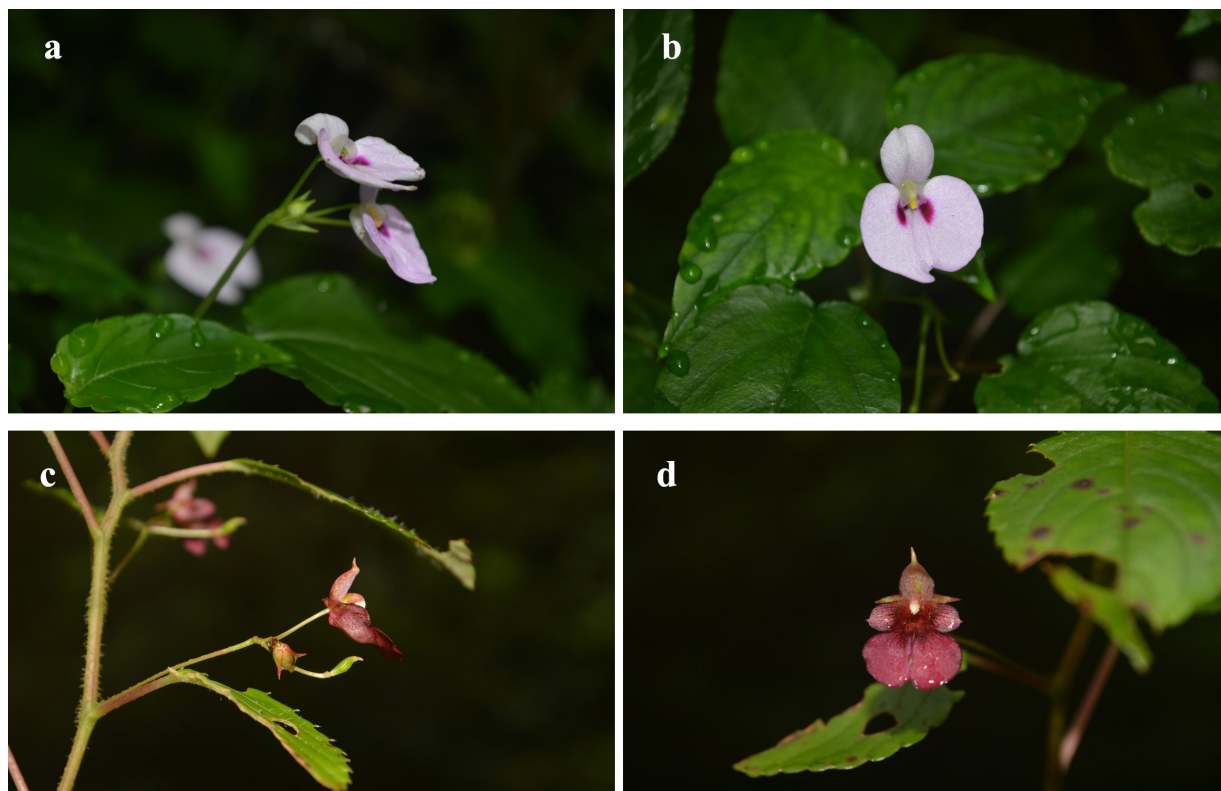
*Habitat:* It grows in moist and shady places, streams and riverbanks in the shola forests at an elevation of 1400–2000 m. Rarely, it grows on open rocky embankments, moist places and water courses in evergreen forests at an elevation of 1200–1500 m.

*Distribution:* *Impatiens cordata* grows luxuriantly in Anamalai hills (Kerala and Tamil Nadu). It also found in Nilgiris (Kerala and Tamil Nadu), Elappara, Megamalai hills, Courtallam hill ranges and Agasthyamalai hill ranges.

*Specimens examined:* *Impatiens cordata*–INDIA, *s.loc.* 1841, *Wight* 307 (E); *s.loc.*, August 1836, *Wight* 338 (CAL); **Tamil Nadu**, Madurai district, Aruna Estate–Pachakumatchi, 22.10.1959, *Subramanyam* 9478 (CAL); Tinnavelly, Naterikal to Sengalteri, 14.02.1913, *Hooper & Ramaswami* 38598 (CAL); *ibid.*, *Hooper & Ramaswami* 38611 (CAL), Manjanampara, 30.05.1968, *Henry* 16372 (CAL); Kanyakumary, Muthukuzhivayal, 27.07.1977, *Henry* 49413 (CAL); Devikulam Taluk, Kannan Devan Hills, 04.07.1944, *Sinclair* 3627 (E); Munnar, 23.03.1980, *Ramamurthy* 66292 (CAL); Eravikulam, Varayadu Mali, 20.10.1989, *Bhargavan* 91868 (BSID); Devikulam, 05.10.2019, *B. Mani* 2617 (CCMT); Munnar, 08.09.2021, *Anitha et al.* 2740 (CCMT); Elappara, 25.09.2018, *B. Mani* 2240 (CCMT); Thiruvananthapuram district, 12.12.2021, Athirumala, *Anitha et al.* 2850 (CCMT). *Impatiens elegans*–INDIA, **Tamil Nadu**, Coimbatore district, Valparai, 02.10.2013, *B. Mani* 1800 (CCMT); **Kerala**, Idukki district, Rajamala, 26.08.2021, *Anitha et al.* 2730 (CCMT); Marayur, 24.08.2024, *B. Mani* 3245 (CCMT). *Impatiens anaimudica*–INDIA, **Kerala**, Idukki district, Eravikulam National park, 04.09.2021, *Anitha et al.* 2738 (CCMT).



**Fig. 1.** *Impatiens cordata* Wight. **a.** Flower with long spur and vaulted basal lobe of lateral united petals; **b.** Population having white flowers; **c-d.** A population with stout plants having large leaves and long spurred flowers; **e & g.** Plants having short or minute spurred flowers; **f.** Flower showing vaulted basal lobe of lateral united petals. **h.** Lateral united petal having small crimson eye-spot on the claw.



**Fig. 2.** Morphological comparison of *Impatiens elegans* Bedd. (a–b) and *I. anaimudica* C.E.C.Fisch.(c–d): **a.** Inflorescence with flowers (spur absent); **b.** A flower showing large crimson eye-spot extend beyond the basal lobe; **c.** Salmon red flower showing boss-like spur; **d.** Flower showing winged and non-vaulting basal lobe of lateral united petals.

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