

# Taxonomy, typification and distribution of *Hygrophila phlomoides* (Acanthaceae) in India

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**Abstract:** *Hygrophila phlomoides* Nees is recorded here for the first time from southern India. A detailed description and information about habitat, phenology, and distribution are provided. A morphological comparison between its allied species *H. ringens* (L.) R.Br. ex Steud. is given, and a lectotype is designated for *H. phlomoides*.

**Keywords:** *Hygrophila ringens*, Identity, Lectotype, Southern India.

## Introduction

*Hygrophila* R.Br. (Acanthaceae: Ruellieae) is one of the major cosmopolitan moisture-loving genera and is widely distributed in tropical and subtropical regions of the world (Hu & Daniel, 2011). The genus includes c. 77 species globally (POWO, 2023), of which, 16 species and one variety are reported in India (Arisdason *et al.*, 2020).

The present paper is a part of a systematic study on the genus *Hygrophila* in India, which is primarily based on the analysis of the relevant literature, field explorations and critical examination of live and herbarium specimens. During field exploration near a canal at Karwar, Uttara Kannada district of Karnataka, the authors came across a population of *Hygrophila*. After critical examination of the specimens using pertinent taxonomic literature (Clarke, 1884; Cook, 1996) and consultation of herbarium specimens (AHU, ASSAM, ARUN, CAL, MH, NBU and digital images from C, E, G, GZU, K, O, P, PH, UPS), it was identified as *Hygrophila phlomoides* Nees. Perusal of literature (Gamble, 1924; Matthew, 1983; Sharma *et al.*, 1984; Pullaiah & Moulali, 1997; Pullaiah, 2015; Ansari *et al.*, 2016; Sanjappa and Sringeswara, 2019; Narasimhan and Irwin, 2021; Ravikumar *et al.*, 2021) revealed that the species was so far not reported from southern

India. Hence the occurrence of this plant in Karnataka forms a new distributional record for southern India. It was also noticed that most authors (*viz.*, Clarke, 1884; Prain, 1903; Karthikeyan *et al.*, 2009) treated *H. phlomoides* as a distinct species except Arisdason *et al.* (2020). They treated the name as a heterotypic synonym of the highly variable species, *H. ringens* (L.) R.Br. ex Steud. However, the present study shows that it is very distinct from the latter. Therefore, we recognize both species as distinct from one another and provide a detailed taxonomic account along with an identification key, photo plate, distribution map, a comparison table, and images showing morphological differences between *H. phlomoides* and the allied species *H. ringens*, to delineate them accurately. A lectotype of the name *H. phlomoides* is also designated here.

## Key to the species of *Hygrophila* in southern India

1. Plants homophyllous ..... 2
1. Plants heterophyllous ..... 3
2. Flowers in axillary whorls ..... 4
2. Flowers in terminal spikes ..... 5
3. Stem diffuse; leaves viscid; flowers pedicellate ..... *H. triflora*
3. Stem erect; leaves not viscid; flowers sessile ..... 6
4. Plants armed with prominent axillary spines; calyx 4-partite; seeds 4–8 ..... *H. auriculata*
4. Plants unarmed; calyx 5-partite; seeds more than 8 ..... 7
5. Plants succulent; leaf base sub-amplexicaul; bracts orbicular ..... *H. heinei*
5. Plants not succulent; leaf base cuneate; bracts ovate-elliptic ..... 8

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6. Flowers solitary; upper leaves lanceolate entire to serrate, lower leaves deeply lobed ..... *H. pinnatifida*
6. Flowers many; upper leaves orbicular crenate to serrate, lower leaves dissected ..... *H. balsamica*
7. Herbs up to 100 cm high; stem thick; retinacula hard, curved ..... 9
7. Herbs up to 30 cm high; stem slender; retinacula soft, straight ..... 10
8. Leaves glabrous or puberulous; stamens 2, fertile, posterior pair reduced to teeth; seeds 20 or more ..... *H. polysperma*
8. Leaves hispid; stamens 4, fertile, anthers of the posterior half as long as those of the anterior; seeds 8–10 ..... *H. serpyllum*
9. Stem glabrous; leaves ovate, obovate or lanceolate, apex acute, lamina glabrous or slightly pubescent at base; petiolete; bracts glabrous ..... *H. ringens*
9. Stem strigose; leaves obovate or oblong, elliptic-oblong, apex obtuse to sub-acute, lamina hirsute on both surfaces, sessile to sub-sessile; bracts hirsute ..... *H. phlomoides*
10. Pyramidally branching herbs; flowers in axillary dichasial cymes becoming sympodial and unilateral ..... *H. madurensis*
10. Simple branching herbs; flowers in axillary cymes ..... *H. thymus*

## Taxonomic Treatment

**Hygrophila phlomoides** Nees in Wall., Pl. Asiat. Rar. 3: 80. 1832, in DC., Prodr. 11: 90. 1847; C.B. Clarke in Hook.f., Fl. Brit. India. 4: 408. 1884; Karthik. et al., Fl. Pl. India 1: 22. 2009. *Lectotype* (designated here): BANGLADESH, Sillet, G. Gomez, Wall Cat n. 2376 [GZU [GZU000250031 digital image!]; isolecto GZU [GZU000250880 digital image!], K [K001115798, K001115799, K000882379 digital images!], E [E00881581, E00881582, E00881587, E00881590, E00885439 digital images!], P [P00650240, P00650241 digital images!], PH [PH00008111 digital image!], G-DC [G-DC00676169 digital image!], C [C10004911 digital image!], CAL [CAL0000072375!, CAL0000072376!, CAL0000072377!].

Fig. 1

Perennial erect or decumbent unarmed herbs up to 1 m high. Stem thick, quadrangular, branched, striate, green to reddish brown, strigose, hirsute upwards; internodes 4–6 cm long; nodes swollen,

hairy. Leaves sessile to sub-sessile, homophyllous, decussate, elliptic, obovate or elliptic-oblong, 2.5–5 × 1.5–2 cm, base cuneate, margins entire or undulate, apex obtuse or sub-acute; hirsute on both surfaces; midrib broad at base, conspicuous beneath; lateral nerves 8–13 pairs; cystoliths dense; petiole 0–0.4 cm long, hirsute. Flowers axillary in dense villous whorls, 10–12; bracts in three ranks; outer bracts large, foliaceous, obovate, 1.5–1.8 × 0.5–0.8 cm, base cuneate, margins entire, apex obtuse, green, hirsute; bracts in the second rank ovate-lanceolate, 1.1–1.3 × 0.4–0.5 cm, base cuneate, margins entire, apex sub-acute, green hirsute on both surfaces; inner bracts 0.8–1 × 0.25–0.3 cm, hirsute on both surfaces, green, margins entire, base cuneate, apex sub-acute; bracteoles linear to linear oblong, c. 5 × 2 mm, as long as the calyx tube, hirsute, margins entire, base cuneate, apex obtuse. Calyx tubular, 5-lobed, c. 1.1 cm long, reddish brown, white hirsute, divided halfway down; teeth linear, hispid, one segment larger than others. Corolla bilabiate, 1.8–2 cm long, pink-purple with dark dots or patches on palate, glandular pubescent without; tube 0.7–0.8 cm long, ventricose, glabrous; upper lip triangular, 2-lobed, margins entire, glabrous inside, glandular-pubescent outside; lower lip oblong, 3-lobed, middle lobe broader than the lateral lobes, sub-orbicular, margins entire, apex obtuse, glabrous inside except at centre of middle lobe, glandular-pubescent outside, dark purple-stripes at centre. Stamens 4, didynamous, adnate to the base of the ventricose portion of corolla tube; filaments white, glabrous above, retrorsely pilose below; anterior filaments c. 10 mm long, posterior filaments c. 4 mm long; anthers elliptic-oblong, dorsifixed, divergent; thecae c. 2 mm long, purple with white tinge, pubescent at the base of slit, longitudinally dehiscent. Ovary oblong, c. 3 mm long, glabrous, green, 2-loculed; ovules many in each locule, nectariferous disc cupulate; style filiform, 1.3–1.5 cm long, white, antrorsely bristled-hairy with glands at base; stigma white, entire. Capsule linear-oblong, c. 1.5 cm long, green, slightly compressed, exceeding the calyx. Seeds 15–20, orbicular ovoid, compressed, c. 2 × 1.5 mm, brownish, whitish woolly, supported on prominent, hard, curved retinacula.

**Flowering & fruiting:** Flowering from October to December, fruiting from December to March.

**Habitat:** The species is seen mostly in marshes, swamps, near streams, ponds, and canals.



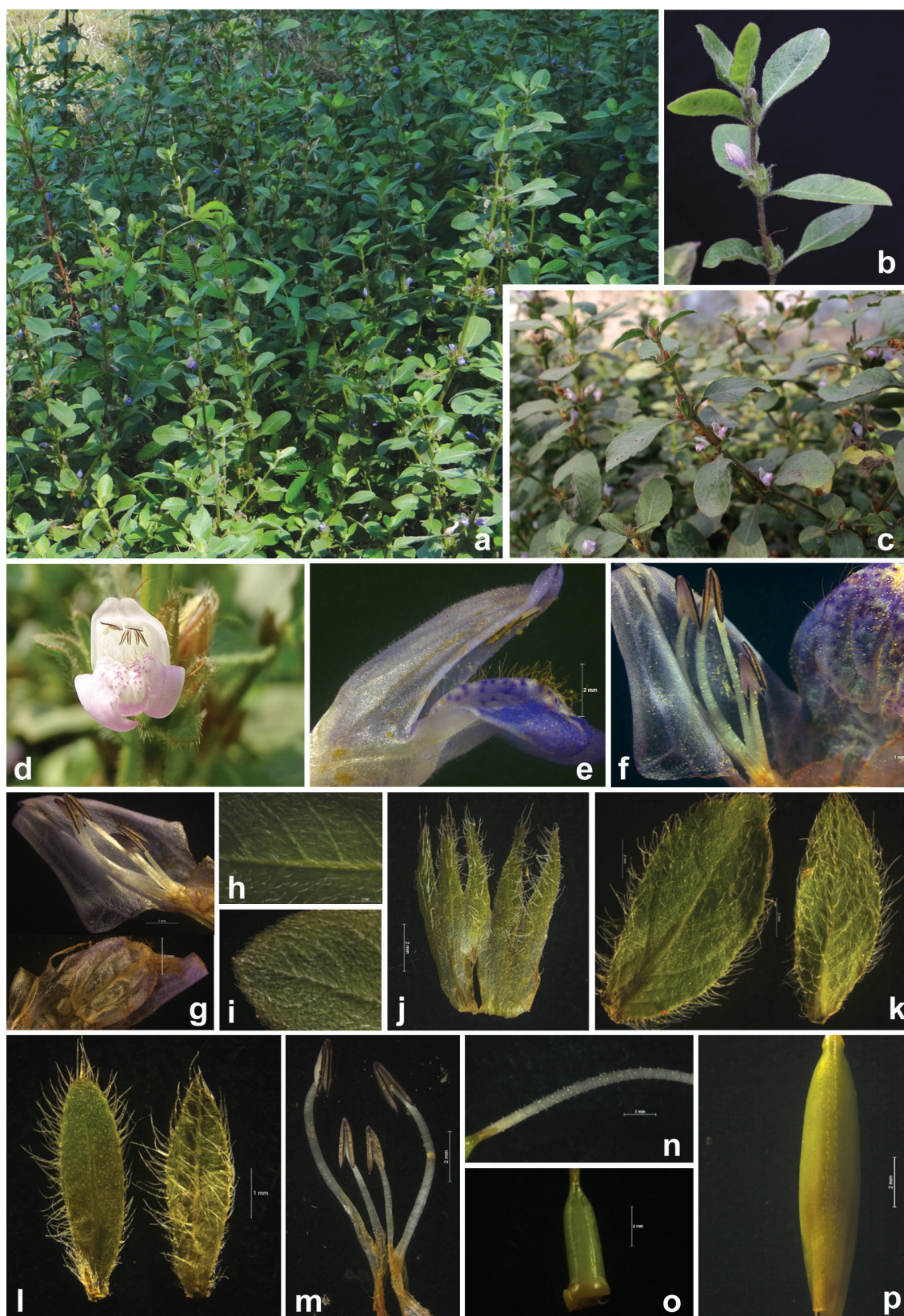


Fig. 1. *Hygrophila phlomoides* Nees: a. Habitat; b & c. Habit; d. Flower close-up; e. Corolla; f. Corolla opened; g. Upper & lower lip; h. Leaf adaxial view; i. Leaf abaxial view; j. Calyx; k. Bract adaxial (left) & abaxial (right) view; l. Bracteole adaxial (left) & abaxial (right) view; m. Androecium; n. Style; o. Ovary; p. Capsule (from V.T. Jaseela & E.K. Sinisha 18412; photos by V.T. Jaseela).



**Distribution:** Bangladesh, Cambodia, China South-Central, East Himalaya, India (Fig. 2 showing distribution in Karnataka), Laos, Malaya, Myanmar, Philippines, Thailand, and Vietnam.

**Specimens examined:** INDIA, **Arunachal Pradesh**, Darrang district, Aka hills, *s.d.*, *N.L. Bor s.n.* Acc. No.21215 (ASSAM); Papum Pare district, Naharlagun, 00.04.1978, *G.D. Pal* 74639 (ARUN). **Assam**, Kamrup district, Rajapara Chandubhi Lake, 21.10.1965, *A.S. Rao* 42435 (ASSAM); Jarasal forest on way from Rajapara to Rani, 23.10.1965, *A.S. Rao* 42499 (ASSAM); Kokrajhar district, Chakrasila WLS, 04.11.2006, *R. Daimary* 111911 (ASSAM); Gorhatty hills, 00.10.1850, *Simons* 405 (CAL); Jaboea: Yongali Bam garden, 11.10.1898, *Hoex* 75 (CAL); Lakhimpur district, Satajan beel, 21.08.2018, *P. Gogoi, V. S. Ayam & A. P. Das* 027 (AHU); North Lakhimpur district, Naharbari, 17.05.1966, *D.M. Verma* 46404 (ASSAM); Sadiya district, On the way from Tinsukia to Digboi, 23.10.1960, *G. Panigrahi* 22105 (ASSAM); Sibsagar district, Nrigriting, 11.10.1885, *C.B. Clarke* 40737 (CAL); Southern range, 15.10.1941, 20683 (ASSAM); *s.l., s.d.*, *Jenkins s.n.* (CAL); *s.l., s.d.*, *Jenkins* 5438 (P03580844, image). **Karnataka**, Karwar, 140 48.6760 N, 740 9.2420 E, 25.11.2021,

*V.T. Jaseela & E.K. Sinisha* 18412 (MBGH). **Manipur**, Imphal, 9.11.1907, *s.coll.* 4818 (MH); Tamenglong district: Nungba, 13.11.1907, *A. Meebold* 6304 (CAL). **Meghalaya**, East Khasi district, Khasi, *s.d.*, *s.coll.* 69466 (MH); Burni, K & J Hills, *s.d.*, *G. K. Deka* 22009 (ASSAM); Khasi hills, *s.die*, *J.D. Hooker & T. Thomson* s.n. (CAL, O-V2259613, US02854262, images). **West Bengal**, Hooghly district, Arambug, 23.11.2022, *V.T. Jaseela* 18430 (MBGH); Jalpaiguri division: Gossaihat Beel, 18.03. 2012, *A. Chowdhury, R. Biswas & A.P. Das* 0994 (NBU); South 24 Parganas district, Bahusul, 25.03.1986, *G.N. Tribedi* 1465 (CAL); North 24 Parganas district, Canning, 10.11.1983, *G.N. Tribedi & D.C. Pal* 742 (CAL); Sundarbans, Gobordhanpur village, 02.11.2021, *V.T. Jaseela & N.S. Pradeep* 18407 (MBGH); Kisorimohapur village, 02.11.2021, *V.T. Jaseela & N.S. Pradeep* 18408 (MBGH); West Dinajpur district, Islampur, 03.11.1983, *R.N. Banerjee* 16154 (CAL).

**Conservation status:** *Hygrophila phlomoides* is fairly common in its range of distribution and is widespread in many Indian states. Hence, it is evaluated here as of Least Concern (LC) using the IUCN Red List Categories and Criteria (IUCN, 2012), and IUCN guidelines (IUCN, 2022).

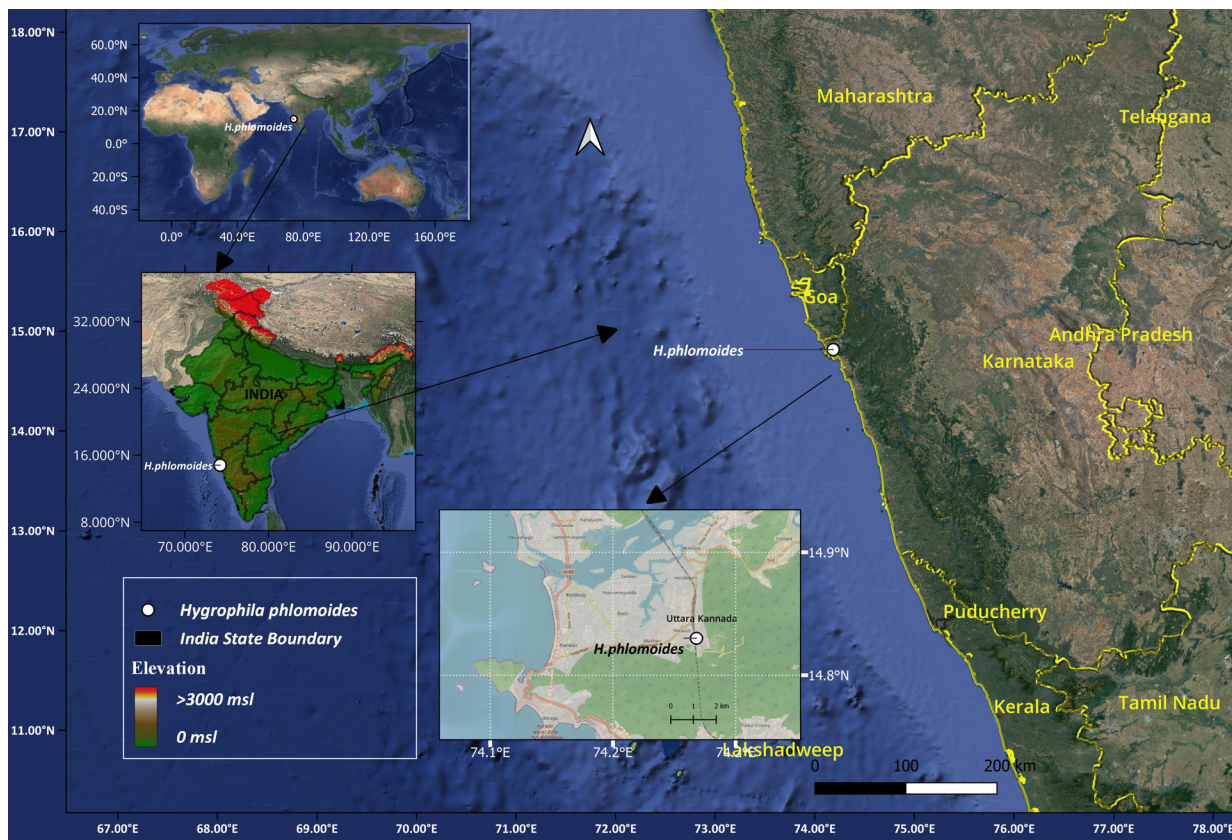


Fig. 2. Distribution of *Hygrophila phlomoides* Nees in Karnataka, India (drawn using QGIS ver. 3.28.4; QGIS.org, 2023).



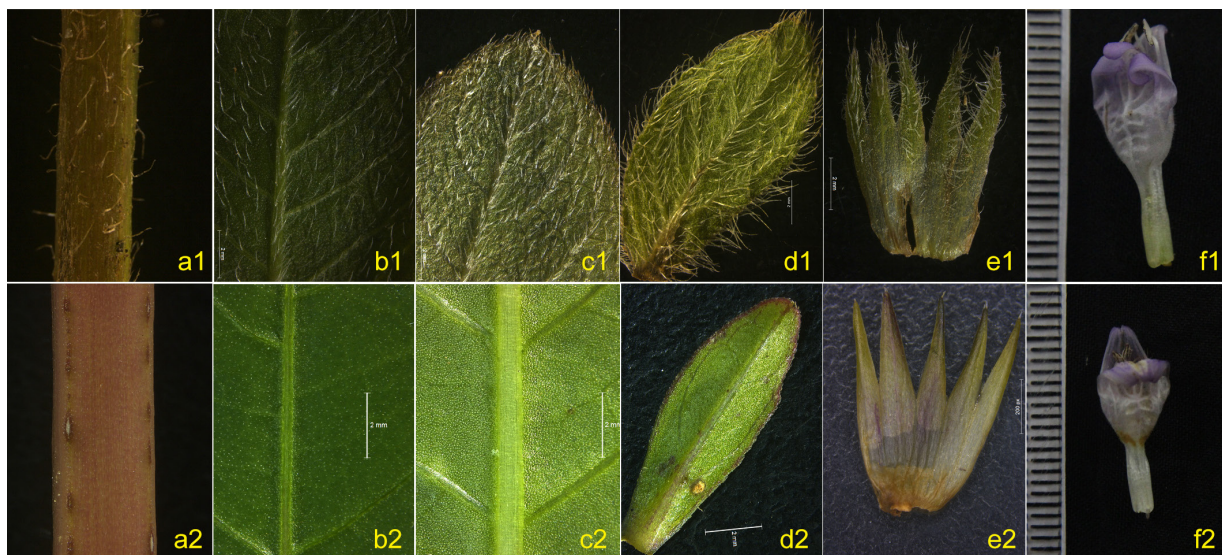


Fig. 3. Photographic images for morphological comparisons between *Hygrophila phlomoides* Nees (a1–f1), and *Hygrophila ringens* (L.) R.Br. ex Steud. (a2–f2): a. Stem; b. Leaf–adaxial view; c. Leaf–abaxial view; d. Bract; e. Calyx; f. Flower (photos by V.T. Jaseela).

**Notes:** *Hygrophila phlomoides* can be mistaken for a morphologically similar taxon, *H. ringens* which is distributed in Bangladesh, Myanmar, Sri Lanka and India. Arisdason *et al.* (2020) treated *H. phlomoides* as a heterotypic synonym of highly variable *H. ringens*. Both the species resemble each other in the nature of flowers and leaves. However, there are many characters which are useful to distinguish both the species (Table 1; Fig. 3).

**Typification:** *Hygrophila phlomoides* was described with reference to Wallich’s designation “*Ruellia phlomoides*” which is a *nomen nudum*. Nees von Esenbeck (1832) cited two collections of Wallich, Wall. Cat. No. 2376a and No. 2376b. While searching for Wallich’s specimen in various herbaria, the authors traced 18 sheets with Wall. Cat. No: 2376 (a, b), i.e., two sheets at GZU (GZU000250031, GZU000250880), three at K (K001115798, K001115799, K000882379), five at E (E00881581, E00881582, E00881587, E00881590, E00885439), two at P (P00650240, P00650241), one at PH (PH00008111), one at G (G-DC00676169), one at C (C10004911), and three at CAL (CAL0000072375, CAL0000072376, CAL0000072377). All of them can be considered to be original material according to Art. 9.4 of ICN (Turland *et al.*, 2018). Since the original material studied by Nees von Esenbeck (1832) were deposited at GZU and duplicates at K (Stafleu & Cowan, 1981), we selected the specimen with barcode GZU000250031 (Fig. 4), which

completely agrees with the protologue information, as the lectotype according to Art. 9.3 & 9.12 of ICN (Turland *et al.*, 2018).



Fig. 4. Lectotype of *Hygrophila phlomoides* Nees (GZU000250031). © The Board of Trustees for the Karl-Franzens-Universität Graz (GZU), Austria. Reproduced with permission.

**Table 1.** Morphological comparison of *Hygrophila phlomoides* and *H. ringens*

Characters	<i>H. phlomoides</i> Nees	<i>H. ringens</i> (L.) R.Br. ex Steud.
Stem	Strigose, hirsute upwards	Glabrous
Leaves	Elliptic, obovate, or elliptic-oblong; 2.5–5 × 1.5–2 cm; both surfaces hirsute; base cuneate, margins entire/slightly undulate, apex obtuse to sub-acute; petiole 0–0.4 cm long, hirsute	Ovate, lanceolate or oblong lanceolate; 3–10 × 1.0–3.0 cm; both surfaces glabrous (sometimes minute hairs on lower surface); base attenuate, margins undulate, apex acute; petiole 0.5–1.0 cm long, glabrous
Bracts	Bracts in three ranks; outer bract obovate, foliaceous, 1.5–1.8 cm long, apex obtuse, margins and outer surface hirsute, inner surface with small hairs	Bracts in one rank, ovate or elliptic, not foliaceous, 0.6–0.8 cm long, apex sub-acute, both sides glabrous, margins ciliate
Bracteole	Linear to linear-oblong, c. 0.5 cm long, obtuse, margins and outer surface hirsute	Linear or lanceolate, c. 0.4 cm long, acute, margins ciliate, sparsely hairy on outer surface
Calyx	Hirsute	Glabrous
Corolla	1.8–2.0 cm long, tube 0.7–0.8 cm long	1.3–1.5 cm long, tube 0.5–0.6 cm long
Stamens	Anterior filaments c. 10 mm long, posterior filaments c. 4 mm long	Anterior filaments c. 5 mm long, posterior filaments c. 2.5 mm long
Style	1.3–1.5 cm long	0.8–1 cm long
Capsule	c. 1.5 cm long	c. 2 cm long

Nees von Esenbeck (1832) also mentioned a synonym “*H. undulata* Blume, Bijdr. P. 803. (excl. synon. Vahl.)”. Blume (1826) erected the species *H. undulata* based on Vahl’s *Ruellia undulata*. Hence exclusion of Vahl’s name is impossible as it forms the basionym of *H. undulata*. However, critical examination of the protologue (Vahl, 1794) and type specimens of *Ruellia undulata* revealed that it does not belong to the typical species, *H. phlomoides*.

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