

Polygala idukkiana (Polygalaceae), a new species from the southern Western Ghats, India

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Abstract. *Polygala idukkiana* (Polygalaceae) is described as a new species from the Idukki district of Kerala in the southern Western Ghats. Detailed description along with colour photographs, distribution map, and key to the identification of *Polygala* species occurring in Kerala are provided. The new species is compared with the morphologically allied *P. sibirica*, *P. rosmarinifolia*, and *P. chinensis*. The conservation status of the new species is assessed provisionally as Data Deficient (DD) according to IUCN Red List Categories and Criteria.

Keywords. Biodiversity, conservation, flora, Kattadikkadavu, Kottappara, taxonomy.

Resumen. Se describe *Polygala idukkiana* (Polygalaceae) como una nueva especie del distrito de Idukki de Kerala en el sur de los Ghats occidentales. Se proporciona una descripción detallada junto con fotografías en color, un mapa de distribución y una clave para la identificación de las especies de *Polygala* presentes en Kerala. La nueva especie se compara con las especies morfológicamente afines *P. sibirica*, *P. rosmarinifolia* y *P. chinensis*. El estado de conservación de la nueva especie se evalúa provisionalmente como Datos Insuficientes (DD) de acuerdo con las Categorías y Criterios de la Lista Roja de la UICN.

Palabras clave. Biodiversidad, conservación, flora, Kattadikkadavu, Kottappara, taxonomía.

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INTRODUCTION

Polygala L. is the largest genus in the family Polygalaceae, but the estimates of the number of species vary widely. Paiva (1998) recognized 725 species while Eriksen & Persson (2007) included 300–350 species and Pastore (2018a) about 580 species. The genus is widely distributed throughout the world except in the Arctic, Antarctic, and New Zealand (Paiva 1998). The main centres of diversity are known from South Africa and the Americas (Kerrigan 2012). Pastore & al. (2017) and Mota & al. (2019) considered *Polygala* as a non-monophyletic genus. Based on Abbott (2009), Pastore & al. (2019) recognized two clades in *Polygala s.str.*, namely, New World clade comprising 213 species under three sections and the Old World clade with 349 species in 11 sections. *Polygala* is characterized by the presence of 8 (rarely 6) monadelphous stamens (in a single semi-circular ring), two petaloid inner and three smaller outer sepals, and the dehiscent capsules containing two pubescent caruncular seeds (Chodat 1891; Eriksen 1993; Paiva 1998; Uđurlu 2020). Chandrabose & Nair (1981) reported 15 species from South India while 27 species were

reported in India by Banerjee (1993). Kerrigan (2008, 2012) in a treatment of *Polygala* from northern Australia, recognized 45 species, of which 26 species and four varieties were newly described. A key for the identification of all the 50 species found in Australia were also provided in this work. Recently several new taxa of *Polygala* have been described: *P. azizsancarii* Dönmez from Turkey (Dönmez & Aydin 2018); *P. mazandaranica* Sarvi & Faghir and *P. guilanica* Sarvi & Faghir from North Iran (Sarvi & al. 2020, 2021); *P. bringelii* J.F.B.Pastore & Antar, *P. capitulensis* J.F.B.Pastore, *P. herbiola* var. *minensis* J.F.B.Pastore, *P. jardimii* J.F.B.Pastore, *P. kalunga* J.F.B.Pastore, *P. michelliana* J.F.B.Pastore, *P. paganuccii* J.F.B.Pastore, *P. petricola* J.F.B.Pastore, *P. tocantinensis* J.F.B.Pastore & Antar and *P. veadeiroensis* J.F.B.Pastore from Brazil (Pastore 2018a, 2018b; Pastore & al. 2021a, 2021b; Pastore & Antar 2021; Pastore 2022) and *P. sandiaochiaoensis* S.S.Ying from Taiwan (Ying 2020).

During field work in the floristically rich Idukki district of Kerala in the southern Western Ghats, we found an unrecognized species of *Polygala* resembling *P. sibirica* L.

and *P. rosmarinifolia* Wight & Arn. After careful comparison of morphological characters in living and herbarium specimens (CALI), and after consulting relevant literature (Adema 1966; Chandrabose & Nair 1981; Banerjee 1993; Banerjee & Balakrishnan 2005; Chen & al. 2008; Ranjan 2009; Kerrigan 2008, 2012; Yang & Chen 2013; Dönmez & Aydin 2018; Pastore 2018a, 2018b; Pastore & al. 2019; Sarvi & al. 2020; Ying 2020; Pastore & al. 2021a, 2021b; Pastore & Antar 2021; Sarvi & al. 2021; Pastore 2022) we found that the entity in question is consistently distinct from all other species of the genus and is described here as new. The new species falls under *Polygala* subgenus *Polygala*.

MATERIALS AND METHODS

Specimens collected were preserved in 4% formalin and 70% ethanol for detailed study. Photographs of habitat and habit were taken with a 77D DSLR camera (Canon, Japan). Floral details were studied using stemi 508 stereo microscope equipped with axiocam 105 color camera (Zeiss, Germany). The description was prepared by examining all available specimens and the terminologies followed Simpson (2006), Kerrigan (2008, 2012), and Pastore (2018a, 2018b). Herbarium sheets were prepared by conventional methods (Bridson & Forman 1991). The identity of the species was confirmed by comparing the types and protologues of the related species. For scanning electron microscopy (SEM), the seed samples were fixed in FAA and dehydrated by passing through an ethanol series. They were then critical point dried and mounted on to stubs using double-side adhesive tape, sputter coated with gold using SPI module sputter coater and examined under Gemini SEM 300 (Zeiss, Germany).

RESULTS AND DISCUSSION

Taxonomic treatment

Polygala idukkiana Vishnu & Nampy, **sp. nov.** Type: India, Kerala, Idukki district, Kottppara-Mullaringad, 10°00'02"N, 76°47'52"E, ± 318 m, 2 Oct. 2021, Vishnu Mohan & Santhosh Nampy 176330 (holotype: CALI!; isotype: K!). Figs. 1–3.

Diagnosis.—*Polygala idukkiana* resembles *P. rosmarinifolia* by its inflorescence pattern and hairy seeds and to *P. sibirica* by its 3-lobed aril, but differs from the former, by its lavender flowers and hispid inner sepals (vs. yellow flowers and glabrous inner sepals) and from the latter by its lanceolate leaves, ciliate capsules, and non-hooded, equal sized arils (vs. elliptic leaves, glabrous capsules and hooded unequal sized arils).



Fig. 1. *Polygala idukkiana* Vishnu & Nampy sp. nov. in its natural habitat.

Description.—Erect subshrubs, 20–50 cm tall. Roots not tuberous. Stem branched from base, cylindrical, striated, tomentulose, green. Leaves alternate; lamina lanceolate, 1.5–5.5 × 0.5–2.2 cm, acute at apex and base, entire and revolute along margins, sparsely tomentose on both surfaces; petioles 1.5–2 mm long, tomentulose. Racemes axillary, erect, 3–5 mm long, 3–5-flowered. Flowers 6–9 mm diameter; pedicels 3–5 mm long, puberulous; bracts 3, elliptic, 0.9–1.4 × 0.4–0.5 mm, rounded at apex and base, ciliate at margins. Sepals 5, persistent in fruit, green; upper outer sepals 2, free, lanceolate, 2–3 × 1 mm, narrowly acute at apex, ciliate; lower outer sepals 1, lanceolate, 4 × 1.4 mm, acuminate at apex, entire; inner sepals (wings) 2, petaloid, elliptic-lanceolate, 5–6 × 2–3 mm, mucronate at apex, wider at middle, ciliate, slightly coriaceous, hispid, reddish white. Petals 3, upper petals obliquely obovate, 7–8 × 4–5 mm, lavender with violet streaks, retuse at apex, clawed, entire; lower petal, clawed, boat shaped, 6–7 × 2.5–3 mm; crest (dorsal appendages) 10–12-lobed in 2 bundles, violet; lateral lobe obliquely ovate. Stamens 8, monadelphous; fused at the base; staminal sheath 4.5–6 mm long, surrounding the style, adherent to upper petals; anthers obconical, 0.5–0.6

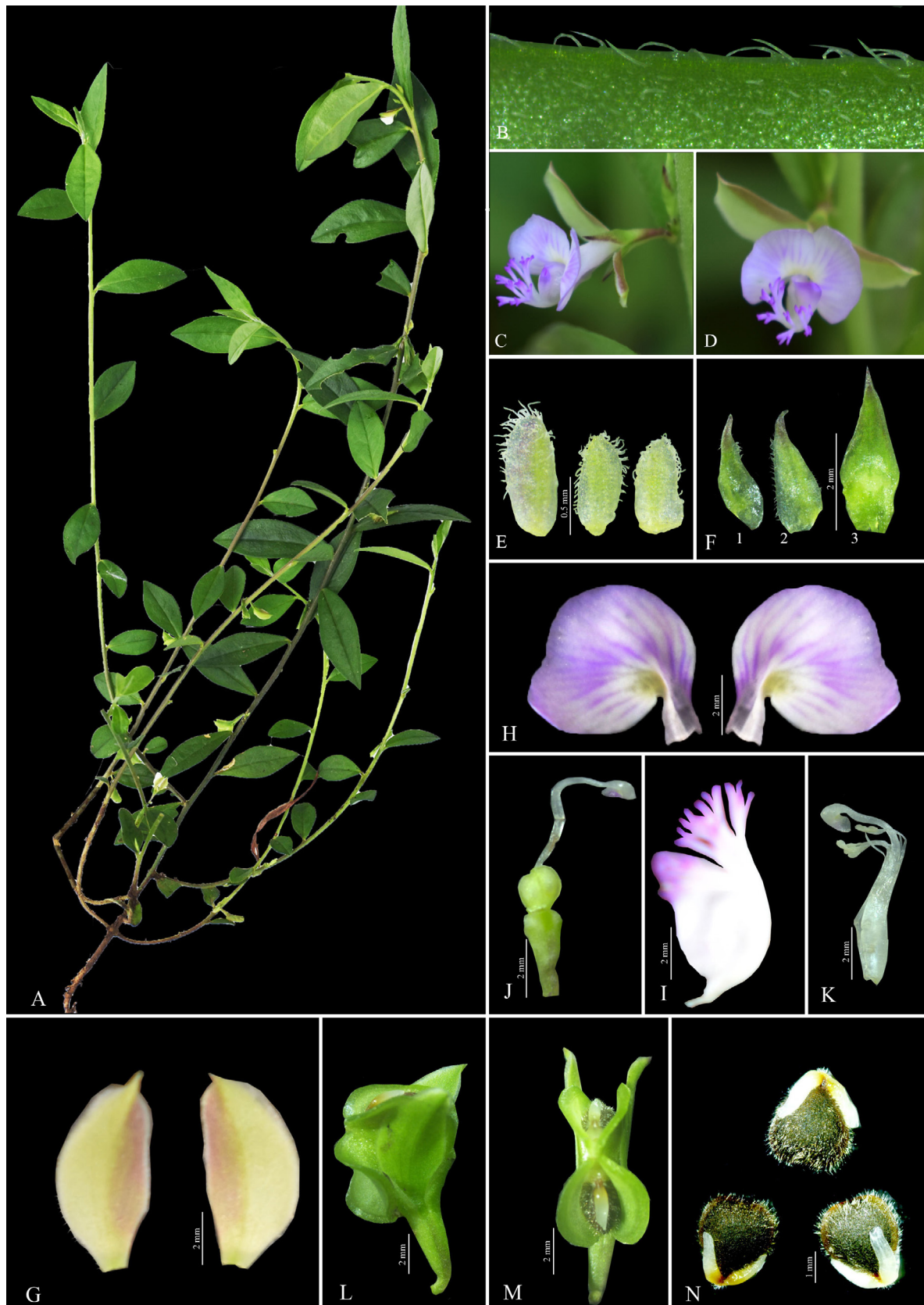


Fig. 2. *Polygala idukkiana* Vishnu & Nampy sp. nov.: **a**, habit; **b**, leaf margin; **c**, flower lateral view; **d**, flower front view; **e**, bracts; **f**, outer sepals (1 and 2: upper, 3: lower); **g**, inner sepals; **h**, upper petals; **i**, lower petal; **j**, gynoecium; **k**, androecium; **l-m**, fruits; **n**, seeds.

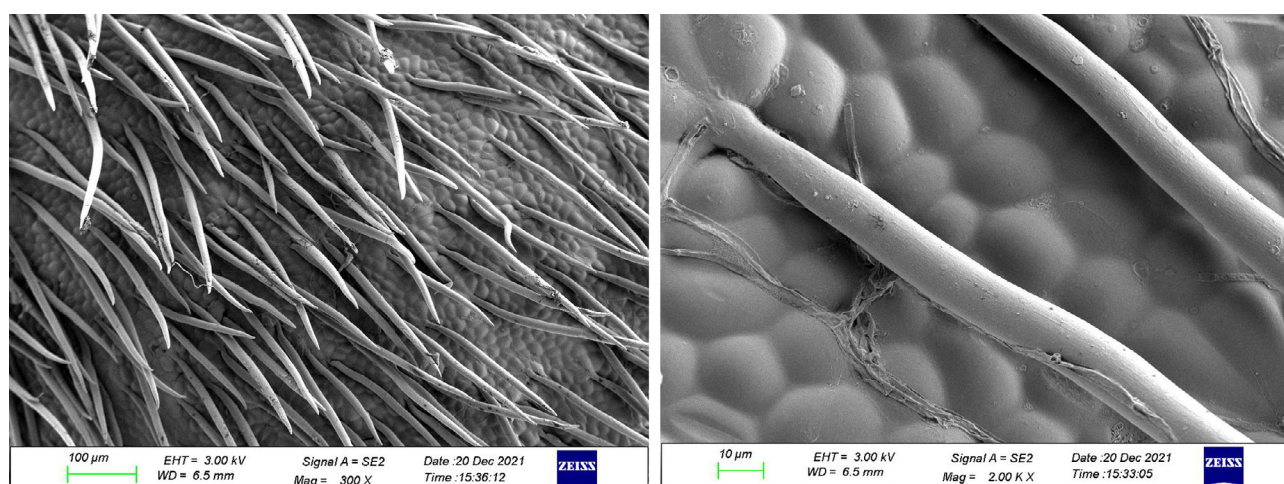


Fig. 3. Seed surface of *Polygala idukkiana* Vishnu & Nampy sp. nov. under SEM.

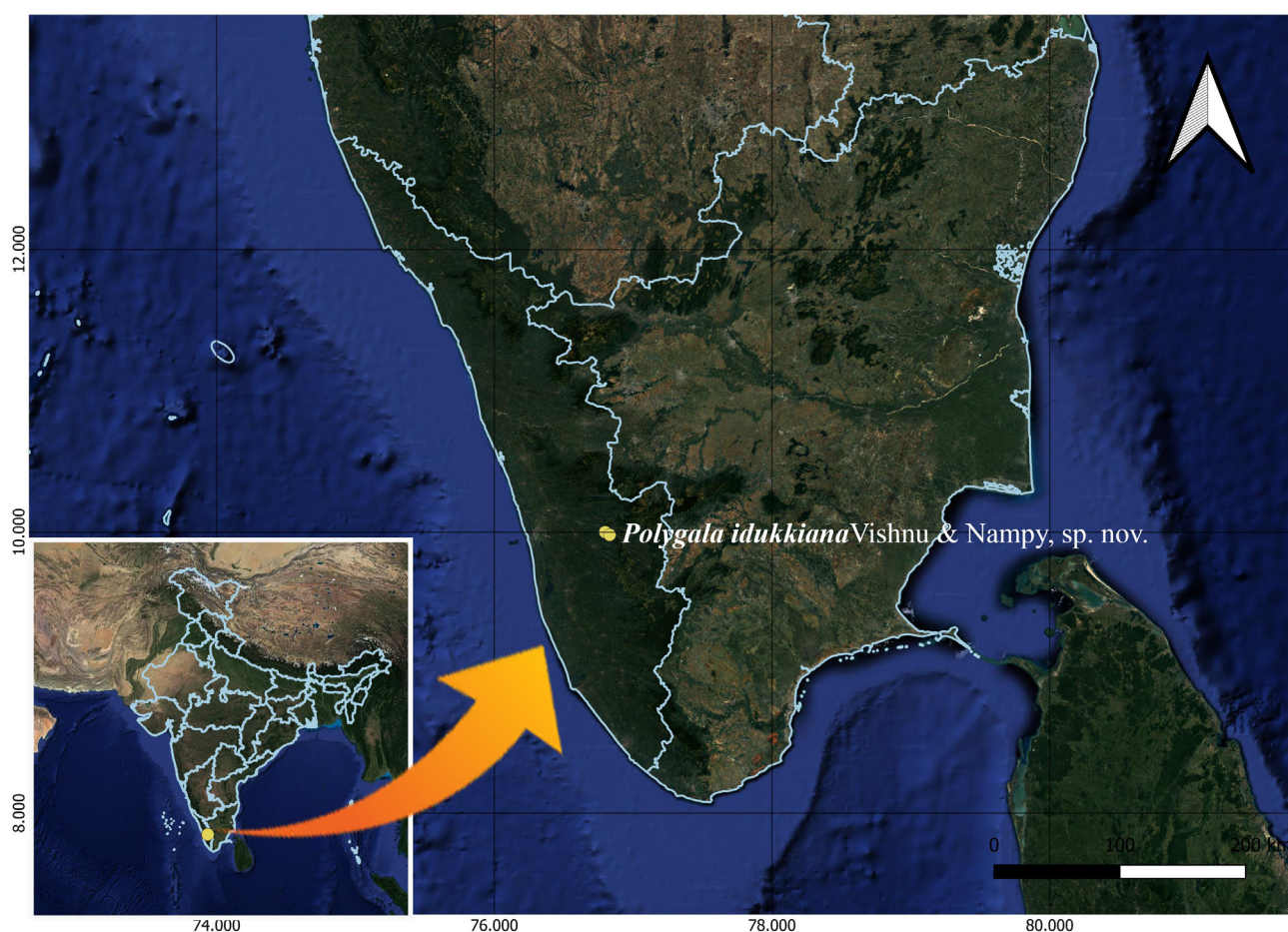


Fig. 4. Map showing the distribution of *Polygala idukkiana* Vishnu & Nampy sp. nov.

mm long. Ovary orbicular, 1.8 mm diameter, slightly oblique at apex; style strongly hooked, 6 mm long, inclined, terminated by an oblique cymbiform pre-stigmatic cavity. Capsules winged, orbicular, 6–7 × 4–5 mm, emarginated at apex, compressed, ciliate, 2-seeded; wings 2–3

mm wide. Seeds widely ovate, 3–3.7 × 2.8–3 mm, arillate, brown-black, strongly hirsute with dense silky white hairs; hairs 0.3 mm long, of equal length throughout; testa collucate. Aril head reduced; lobes 3, equal, 2–2.2 mm long, non hooded.

Table 1. Morphological comparison of *Polygala idukkiana* Vishnu & Nampy sp. nov. and related species.

Characters	<i>P. idukkiana</i>	<i>P. sibirica</i>	<i>P. rosmarinifolia</i>	<i>P. chinensis</i>
Leaf blades	Lanceolate	Elliptic	Linear, elliptic or very rarely oblong	Oblong-elliptic
Bracts	Elliptic, persistent	Linear-lanceolate, persistent	Lanceolate, caducous	Lanceolate caducous
Racemes	Axillary, 0.3–0.5 cm long	Leaf opposed or terminal, 2–10 cm long	Axillary-lateral, 0.5–1.5 cm long	Super-axillary, rarely axillary, 1 cm long
Inner sepals	Slightly coriaceous, hispid, mucronate at apex	Membranaceous, glabrous, obtuse or rounded at apex,	Membranaceous, glabrous, attenuate at apex	Petaloid, acuminate at apex
Upper petals	Lavender with violet streaks	Bluish pink-lavender with brownish red streaks	Yellow with red markings	Yellow or white with violet tips
Capsules	Ciliate	Glabrous	Ciliate	Ciliate
Seeds	Widely ovate, strongly hirsute with dense silky white hairs	Ovate, sparsely minutely white pilose	Elliptic, white pubescent	Ovoid, densely white pubescent
Aril	3-lobed	3-lobed	2-lobed	2-lobed

Etymology.—The epithet ‘idukkiana’ refers to the floristically rich Idukki district, where the type locality belongs.

Distribution and habitat.—Known from Kattadikkadavu and Kottppara in Idukki district of Kerala state (Fig. 4), in the southern Western Ghats, at 318 m elevation, where it occurs in shady areas, as undergrowth of *Gliricidia sepium* (Jacq.) Kunth, *Anacardium occidentale* L., *Artocarpus heterophyllus* Lam., *Macaranga peltata* Boiv. ex Baill., etc., and also in open lands. The associated plants include *Selaginella* sp. (Selaginellaceae), *Hyptis suaveolens* (L.) Poit. (Lamiaceae), *Microstachys chamaelea* (L.) Muell. (Euphorbiaceae), *Justicia* sp. (Acanthaceae), *Osbeckia aspera* (L.) Blume (Melastomataceae), *Chromolaena odorata* (L.) King & Robins. (Asteraceae), *Mimosa pudica* L. (Fabaceae), and *Spermocoe ocymoides* Burm.f. (Rubiaceae).

Phenology.—*Polygala idukkiana* was collected with flowers and fruits in October. Flowering may start in September and extend up to November.

Provisional conservation status.—*Polygala idukkiana* is known only from two localities with less than 25 mature individuals. The localities are separated by a distance of around 2 km and the Area of Occupancy (AOO) falls below 0.2 km². Since the localities are tourist destinations, there are chances of reduction in the number of plants in the near future. More field work is needed in similar habitats to assess the population size and full geographical extent. Hence the species is provisionally categorized here as Data Deficient (DD) as per IUCN Red List Categories and Criteria (IUCN 2022).

Notes.—The presence of crested keel places *Polygala idukkiana* in *Polygala* subgenus *Polygala*. The new species is unmistakable in the field, due to its violet streaked lavender showy flowers, fimbriate-straight floral appendages (crest) and a well developed keel pocket. The flower is white in bud stage, gradually turning lavender and finally

turns white. A morphological comparison of *P. idukkiana*, *P. sibirica*, *P. rosmarinifolia* and *P. chinensis* are provided in Table 1.

Additional specimen examined.—India. Kerala: Idukki district: Kattadikkadavu, 9°58'51.6"N 76°49'49.9"E, c. 400 m, 1 Oct. 2021, Vishnu Mohan & Santhosh Nampy 176389 (CALI).

Key to the Polygala species in Kerala (modified after Banerjee & Balakrishnan 2005)

1. Sepals caducous *P. arillata*
- Sepals (at least wing sepals) persistent in fruit 2
2. Flowers lavender; wing sepals broader at middle ..
..... *P. idukkiana*
- Flowers other than lavender; wing sepals broader above or below the middle 3
3. Wing sepals broader above middle, rounded-obtuse or subacute at apex 4
- Wing sepals broader below middle, acute-acuminate at apex 7
4. Wing sepals falcate, acute; petals lavender-bluish pink, lateral lobes linear-oblong, midlobe rounded
..... *P. sibirica*
- Wing sepals not falcate, or if falcate, obtuse; petals purple or yellow, lateral lobes obovate, midlobe acute 5
5. Stems and racemes dichotomously branched above; wing sepals symmetric, suborbicular, rounded, not mucronate at apex *P. persicariifolia*
- Stems and racemes not dichotomously branched; wing sepals asymmetric, elliptic-oblong, obtuse, mucronate at apex 6
6. Leaves revolute at margins; crest with 2 bundles of appendages *P. erioptera*
- Leaves flat at margins; crest with 1 or 3 bundles of appendages *P. telephioides*

7. Racemes longer than leaves 8
 – Racemes shorter than leaves 11
8. Ovary hairy or ciliate at apex 9
 – Ovary neither hairy nor ciliate at apex *P. javana*
9. Middle of petals distinctly auricled at base
 *P. wightiana*
 – Middle of petals not auricled at base 10
10. Racemes 10–20 cm long; capsules asymmetric,
 unequally lobed at apex *P. elongata*
 – Racemes less than 10 cm long; capsules symmetric,
 equally lobed at apex *P. bulbothrix*
11. Free portions of filaments on staminal tube differing
 much in length *P. buxiformis*
 – Free portions of filaments on staminal tube almost of
 same length 12
12. Racemes and flowers erect; outer sepals obovate-
 oblong, mucronate at apex *P. rosmarinifolia*
 – Racemes and flowers drooping; outer sepals ova-
 te-falcate, acuminate at apex 13
13. Caruncle with broad membranous winged appenda-
 ges, covering 2/3 of seed *P. jacobii*
 – Caruncle with short toothed or linear or narrowly oblong
 appendages covering less than 1/3 of seed 14
14. Leaves to 4 cm long; caruncle appendages subequal .
 *P. arvensis*
 – Leaves more than 4 cm long; caruncle appendages
 unequal, 2 large and 1 very short 15
15. Leaves linear or linear-lanceolate, to 10 mm broad;
 petals yellowish or dull orange; stigma hooded
 *P. linarifolia*
 – Leaves oblong-elliptic, 10–25 mm broad; petals white
 with purple or violet tips; stigma 2-lobed
 *P. chinensis*

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