

A new species of *Indigofera* (Fabaceae) from India

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Abstract

Indigofera jodhpurens sp. nov. (Fabaceae), which grows in arid places and wasteland near to the edge of Jodhpur in the direction of Pali, Rajasthan, India, is described. Although the species is similar to *Indigofera cordifolia* and *I. jaisalmerica*, it differs from these in having profusely hairy juvenile twigs, various types of trichomes on leaf surfaces, and sub-sessile flowers, straightened mucro at the tips of the leaves, and pods that are often single-seeded but can also be bi-seeded. The current communication includes a key to species, a comparative morphological analysis, and some photographs.

Introduction

Indigofera L. (Fabaceae) comprises of 700-800 species (Schrire 2005, Schrire 2009, Chauhan et al. 2013) confined to tropical and subtropical regions of the world particularly Asia, Africa, Australia and new world (Clarke et al. 2015, Wilson and Rowe, 2015). The predominant centre of diversity of *Indigofera* is considered in South Africa and Madagascar (Schrire 2005). In India, the genus is represented by 60 species (Sheetty and Singh 1987, Hajra et al, 1995, Sanjappa 1995) which includes 23 from Rajasthan (Bhandari 1978) and 17 from Jammu and Kashmir. Schrire (2005) while carried out phylogenetic analysis of the tribe Indigofereae from Africa and Madagascar, recognised seven species of and compared with four species of as accepted by Polhill (1981a, 1981b). Thereafter, phenetic analysis and pollen features were examined in species of tribe Indigofereae from Africa and Madagascar (Schrire and Sim 1997). The genus is characterised by a combination of medifixed, T-shaped hair, pulvinate leaves, axillary simple racemes, anthers with apiculate connective and flowers with explosive pollen display (Hutchinson 1964, de Kort and Thijsse 1984, Lievens, 1992).

Some fascinating specimens were gathered from the wasteland and along the roadsides of periphery of Jodhpur in 2022 in the direction of Pali (Rajasthan). On critical examination of the species in the Life Sciences Lab. of Govt. College for Women, Parade, Jammu and perusal of relevant floristic literature revealed that the species is quite different from the so far discovered species of the tribe Indigofereae and yet to be named on account of trichomes which are of three types on both the surfaces of leaves, such as such as centrifixed or subcentrifixed, having two arms (bi-ramous) equally or unequally armed (Lievens, 1992, Schrire 2005) three (tri-ramous), four arms (tetra-ramous), unequal and (penta-arms) antler shaped. All these hair type are found in our specimens but the most common type of the hairs in the genus *Indigofera* are bi-ramous. The leaves and stem particularly juvenile twigs are densely pubescent. The number of seeds are strictly one in *I. jaisalmerica* (Purohit and Kulloli 2021), usually one per pod but two seeds per pod are also present in the new species. Furthermore, the seeds are heteromorphic in our specimens when the seeds per pod is two. Since this specimens are different from the hitherto known species of *Indigofera* L. Therefore, a new name is proposed to this species as *Indigofera jodhpurens*. The most closely allied species to the new species are *I. cordifolia* and *I. jaisalmerica*. The accuracy of the species has further been verified by consulting floristic literature (Polhill 1981, Sheetty and Singh 1987, Sanjappa 1984, 1995, Schrire (2005).

Some additional corroboration was obtained with herbarium specimens kept in different herbaria of the world. It is further established that the species has gone unreported probably as a result of close similarity with its allied species in the field.

Material and Methods

In the late summer of 2022, the field data was gathered by one of the senior researchers who undertook a field investigation in the vicinity of Jodhpur along Pali roadsides, wastelands, and they observed unusual *Indigofera* species. being persuaded of the importance of the morphology of fruits, flowers, and seeds. The specimens of the species were gathered from natural populations that were growing along the roadsides and on wastelands and in arid conditions, at a distance of around three to five kilometres. The specimens were investigated in the Life Sciences, Research Lab, Govt. College for Women, Parade, Jammu, Jammu & Kashmir conducted research to ascertain the identity of the species. The closely related species of Jammu & Kashmir and Rajasthan were investigated in particular, along with comparative accounts and other morphological characteristics. The stereomicroscopic studies showed various characteristics that are impressively unique from those of the genus *Indigofera* 's previously identified species. The flower components were boiled in water for a minute to make it easier to assess their features before the stereoscopic observations. A MagCam - DC Camera was used in the lab to capture several microphotographs. To determine its correct identify, the pertinent literature (Polhill 1981a, Hutchinson 1964, Sharma and Kachroo 1981, Sheetty and Singh 1987, Philipson 1992, Sanjappa 1995, Wilson and Rowe 2004, 2010, 2015, Purohit and Kulloli, 2021) was consulted. The following is the recommended process for creating herbarium sheets (Jain and Rao 1977, Bridson and Foreman 1999). The following description employs the terminology: (Stearn 1966, Berger 1972, Hickey 1973, and Vogel 1980). The Institute of Integrative Medicine (IIIM) Jammu, Department of Botany, University of Jammu has the new species' vouchers on record in its herbaria. Different herbaria's closely related species were consulted, including the Department of Botany at the University of Jammu, the Janaki Ammal Herbarium (RRLH), and the Royal Botanic Gardens at Kew (K) (HBJU). The Indian Institute of Integrative Medicine, often known as RRLH, indexed in Thiers 2018 is where new species' vouchers are deposited.

TAXONOMIC TREATMENT

Indigofera jodhpurens — sp. nov. (Fig. 1–5)

Diagnosis

A species closely related to *Indigofera cordifolia* and *I. jaisalmerica* but differing from it by its taller stems (50–80 cm versus 15–35 and 40–60 cm), stem in cross section 3.2 mm versus 2.2 mm and 2.7 mm), stem (profusely branched at base and lax above versus much branched at base and above and profusely branched at base and slightly lax above), trichomes (2–5-ramous versus 2-romous and 5-ramous), inflorescence (1–6 flowered versus 2–8 and 14–17), flowers (pretty pinkish-red versus bright red and bright red), legume (1-seeded occasionally 2-seeded versus 2-seeded occasionally 1-seeded and strictly 1-seeded).

Type: India, district Jodhpur, ca 6 km from Bhagat ki Kothi towards Pali, 26.205541 N 73.106040 E, 230 m a.s.l., 16 Nov 2022, Bhellum 16925 (RRLH –).

Etymology: The specific epithet *jodhpurens* is the name of the district Jodhpur.

Description

Prostrate or ascending annual, 50–80 cm tall herbs. Stem profusely branched at the base, branches lax above, ca 3.2 mm across. Leaves simple, alternate, usually ovate or cordate, entire, nerves obscure, slightly emerginate, mucronate and intermixed with apiculate mucronate, apex, 6–20 × 5–15 mm, velvety white hairy; hairs centric or subcentric, or with equal or unequal arms, 2–5 ramous on both surfaces of leaves, margins hairy; stipule somewhat triangular, 1 – 1.6 mm long, not adnate to petiole, covered with elongate ciliate hairy, persistent. hairy. Inflorescence 1–6-flowered capitate racemes; bracts minute, hairy; flowers papilionaceous, pentamerous; pedicel minute, 1–1.5 mm long; calyx 5-lobed, tube short, cup-like,

sepals subequal, narrow, 2.8–3.2 mm long, hairy, hairs spreading, persistent; corolla pretty, pinkish-red, standard obovate or rounded above, narrow towards base, longer than width, spathulate, minutely hairy on back, persistent, wings as long as the keel, adherent to keel; keel gently curved, 1.5– 2.7 mm long, somewhat gibbus, lateral pocket like spur or pouch on outer side, minute, acute glabrous. Androecium with ten stamens, diadelphous, (nine stamens fused and the vexillary one slightly shorter, free), staminal tube ca 2.4 mm long, anthers subglobose with mucro tips, minutely glandular at apex, basifixed, light yellow. Ovary sessile, usually one rarely two ovuled, style inflexed, stigma capitate. Pods dehiscent, densely white appressed hairy, usually globose, 1-seeded, apex straight, occasionally 2-seeded, oblong, apex slightly angled, soft septa appears between the seeds; seeds dehiscent, rounded, ellipsoides or trianguar, pitted, equal or subequal, homomorphic in globose bright light yellow in 1- seeded per pod, pits smaller and heteromorphic reddish brown when the pod 2-seeded per pod, pits larger, rarely mottled.

Phenology: Flowering and fruiting from September to November

Habitat and distribution, Ecology and conservation

Indigofera jodhpurens has been found in Jodhpur district of Rajasthan, India, on sandy and dry places between Bhagat Ki Kothi and Pali. The species has been found abundantly on grey and reddish soil, in association of *Acacia modesta* Wall., *Aristida reducta* Stapf, *Calotropis gigantea* (L.) Dryand., *Chenopodium album* L., *Coccinea indica* Wight & Arn., *Dactyloctenium scindicus* Boiss., *Evolvulus alsinoides* L., *Euphorbia hirta* L., *E. serpens* Kunth, *Boerhavia diffusa* L., *Indigofera linifolia* (L. f.) L., *Ipomoea pes-tigridis* L., *Ricinus communis* L., *Tephrosia purpurea* Pers. Since the species is abundant in the area therefore, no any threat to this species.

Table 1. The morphological comparison of *Indigofera jodhpurens* with its closely related *I. cordifolia* and *I. jaisalmerica*.

Characters	Characters	Indigofera jodhpurens	Indigofera jodhpurens
Plant size in cm	Plant size in cm	50 80	
Stem in cross section in mm	Stem in cross section in mm	ca 3.3	
Leaf size in cm		6 22 × 5 15	6 22 × 5 15
Leaf apex		More or less staight mucronate	More or less staight mucronate
Trichomes on leaf	Trichomes on leaf	1 5- ramous	1 5- ramous
Inflorescence	Inflorescence	1– 6 flowered raceme	1– 6 flowered raceme
Flower colour	Flower colour	Pretty, pinkish-red	Pretty, pinkish-red
Pedicel		1 – 1.5 mm long	1 – 1.5 mm long
Calyx		Longer or shorter than pods	Longer or shorter than pods
Standard		2.2 – 3.1 mm long	2.2 – 3.1 mm long
Stamens		2.0 – 2.6 mm long	2.0 – 2.6 mm long
Pod shape	Pod shape	Globose rarely oblong	Globose rarely oblong
Pod apex		Straight rarely angled	Straight rarely angled
Seed/s number/pod	Seed/s number/pod	1 occasionally 2	

Key to related species with simple leaves of *Indigofera* L.

1. + Leaves linear lanceolate —————
Indigofera linifolia
– Leaves ovate, cordate, or ovate-cordate ————— 2
2. + Pods usually 2- seeded [—————]
I. cordifolia

– Pods usually 1-seeded; seeds homomorphic or heteromorphic ————— 3

3.+ Inflorescence 14–17 flowered; trichomes on both surfaces of leaves 5-ramous (antler shaped); Pods strictly with one seed per pod, homomorphic ——— *I. jaisalmerica*

– Inflorescence 1–6 flowered; trichomes on both surfaces of leaves 1–5-ramous; pods usually with one seed per, rarely with two seeds per pod then seeds are heteromorphic —————

I. jodhpurens

Discussion and Conclusion

A morphological analysis provides evidences that the *Indigofera jodhpurens* reported here is a new species. It shares a close relationship with *I. cordifolia*, that has been found in several Indian states including Rajasthan and *I. jaisalmerica*, which grows only in the Jaisalmer area of Rajasthan. Since both of these species *I. cordifolia* and *I. jaisalmerica* are found in environments with comparable climatic conditions in the state of Rajasthan, a detailed analysis of the new species from the Jodhpur district indicated that it appears to be more prevalent. In terms of one-seeded legumes, these species are closely related to one another. *Indigofera jodhpurens* often produces one-seeded legumes, but *I. jaisalmerica* produces purely one-seeded pods and *I. jodhpurens* occasionally produces two-seeded legumes. Additionally, there is a wide range in the number of blooms per inflorescence. Both of these species of *Indigofera* (*I. jodhpurens* and *I. jaisalmerica*) branches have similar, ascending arching, which sets them apart from *I. cordifolia* which is plagiotropic, almost horizontal branching structure (Fig. 1 Table 1) contains the additional information. The vascular bundle layouts of the new species and *I. cordifolia* seem to be very different from one another (Fig. 4). Biramous hair is indeed a hair pattern that is prevalent in basically all *Indigofera* species (Gillet 1958). *Indigofera* has also been found to have various kinds of hairs. Other species with uniseriate or biseriate have also been found in other old world species (Lieven, 1992) and *I. jodhpurens* has shown comparable results.

Authors Contributions

—————: Conceptualization – lead, Investigation – lead, Methodology – equal, Resources – equal, Validation – equal, Writing original draft – lead, Writing, review and editing – equal; —————
: Conceptualization – supporting, Investigation – supporting, Methodology – equal, Resources – equal, Validation – equal, Writing original draft – supporting, Writing review and editing – equal; —————
: Conceptualization – supporting, Investigation – supporting, Methodology – equal, Resources – equal, Validation – equal, Writing original draft – supporting, Writing review and editing – equal.

Data availability statement

The article present data relevant to current investigation. There is no additional data available for this paper.

Conflict of Interest

There is no any potential conflict of interest either financial or otherwise.

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