

Tropical Forages

Indigofera zollingeriana

Scientific name

Indigofera zollingeriana Miq.



Synonyms

Indigofera teysmannii Miq.

Family/tribe

Family: *Fabaceae* (alt. *Leguminosae*) subfamily:

Faboideae tribe: *Indigofereae*.

Morphological description

Erect shrub or small tree, 2–3 (–12) m tall. Branches horizontal and drooping, subsericeous with minute brown or white, biramous, appressed hairs. Leaves alternate, imparipinnate, 15–30 cm long; rachis 9.5–16 (–25) cm long, flattened and adaxially grooved; petioles 1.5–3 cm long, stipules linear, 5–6 (–8) mm long, deciduous. Leaflets opposite or sub-opposite, (7–) 11–23 in number, lanceolate to elliptic-ovate; (2–) 3–6.5 (–8) cm × 1–3 cm, obtuse-rounded at base, acute and mucronate at apex, sparsely adpressed pubescent on both surfaces, petiolules 1–2 mm long; stipels c. 1.5 mm long. Inflorescence an erect, axillary, many-flowered raceme, 10–20 cm long, including peduncle 1–1.5 cm long; rachis dark brown pubescent. Flowers 5–8 mm long, buds ferruginous-brown outside; bracts narrowly triangular, brown-pubescent outside; pedicels 2–3 mm long, pubescent; calyx brown-sericeous, 2 mm long; corolla whitish, pink, red or dark purple; standard ovate, up to 5 mm × 4 mm, dorsally sericeous. Pods spreading, cylindrical, straight or slightly curved, 25–45 mm × 3–6 mm, glabrous, beak 3–5 mm, surface becoming transversely cracked and fissured, brown, indehiscent. Seeds 10–16/pod, discoid, 2.5–3 mm diameter, 1.4 mm thick, brown. 230,000–250,000 seeds/kg

Common names

Asia: □□□□; □□□□ jian ye mu lan (China); marmojo gunung, tom pantai (Indonesia); □□□□□□□□□□ □ ryūkyū-komatsunagi (Japan); ■■■■■■■■,

■■■■■■■ kham 'louang (Laos); balabalatong, tina-tinaan (Tagalog), balabalatangan (Bikol), vanatnid (Ivatan)(Philippines); □□□□ (Taiwan); ครามช้าง kham-chang (Mae Hong Son), ครามหลวง kham-luang (Lampang), ชะคราม cha kham (Nong Khai), นอคอมี no-kho-mi (Karen-Mae Hong Son), nao kao; ครามใหญ่ kram yai (Thailand); cây keo lá chàm, chàm cánh rảnh, chàm lá nhọn, chàm quả trụ, đậu chàm, muồng cánh rảnh, muồng lá nhọn (Vietnam)

English: Zollinger's indigo, Lanyu indigo, large indigo, Assam Shade, Tasmania (from the synonym, *I. teysmannii*)

French: indigotier de Zollinger

Distribution

Native:

Asia-Subtropical/Temperate: China (Guangdong, Yunnan, Guangxi); Japan (Ryukyu Islands); Taiwan

Asia-Tropical: Bhutan; India (Andaman and Nicobar, Andhra Pradesh, Gujarat, Karnataka, Kerala, Tamil Nadu, West Bengal); Indonesia;



Erect inflorescences



Erect shrub or small tree mostly to 2-3m tall



Leaves imparipinnate comprising 7-23 leaflets



Inflorescence a many-flowered axillary raceme



Inflorescences with immature pods developing



Pods 25-45 mm long with pronounced beak



Discoid, brown seed

Laos; Philippines; Sri Lanka; Thailand; Vietnam

Naturalized:

Caribbean: Lesser Antilles (Barbados)

Cultivated:

Asia: India; Indonesia; Philippines

Uses/applications

Forage

I. zollingeriana can be used as a source of high protein forage.

Environment

A shade plant for young tea, cocoa, coconut and coffee, and as a green manure; also as a pioneer species for reforestation of degraded land, and in suppressing/shading out the weed grass, *Imperata cylindrica*.

Other

It has a role in ethno-medicine possibly due to the presence of various organic substances found in the leaves, including flavonol glycosides, tannins, saponin. It has been used to some extent in fabric dyeing, and can also provide useful fuel wood that burns with little smoke or ash.

Ecology

Note: With such a wide range of indigineity, it is probable that considerable ecotypic variation exists in *Indigofera zollingeriana* in relation to adaptation to the environmental conditions.

Soil requirements

I. zollingeriana is adapted over a range of soil textures from sandy coralline strands to clays (ultisol), probably representing a pH range of 4.5–8.5. It is more tolerant of high levels of exchangeable aluminium than *Calliandra calothyrsus* and *Gliricidia sepium*. It is tolerant of low fertility.

Moisture

While *I. zollingeriana* grows best with good moisture and is largely recommended in higher rainfall environments (to 3,000 mm/year), it is said to be adapted to areas with rainfall as low as 600 mm/year. Although it does not have a deep root system like *Leucaena leucocephala*, it is moderately tolerant of dry conditions, shedding leaves during extended or severe droughts to conserve moisture.

Temperature

I. zollingeriana has been commercialized in the humid tropics of Indonesia, Philippines and India, but does extend to about 27° N in Bhutan and southern China, and has been grown at altitudes to 2,200 m asl, suggesting there might be types that are subtropically adapted.

Light

As with other members of the genus, it appears to have some degree of shade tolerance, but grows most effectively in full light.

Reproductive development

Reports on flowering in *I. zollingeriana* vary considerably from "It generally flowers at the end of the rainy season and fruits in the cold season, with seed ready to harvest near the beginning of the hot season (February in Thailand and Vietnam)" to flowering May or June to September in India and China.

Defoliation

I. zollingeriana coppices readily and can be maintained at 1–1.5 m, cutting every 60 days for maximum leaf production.

Fire

No information.

Agronomy

Guidelines for establishment and management of sown forages.

Establishment

Hardseededness in *I. zollingeriana* seed often exceeds 90%, making scarification necessary prior to sowing. This can be achieved with mechanical (sandpaper abrasion or scalpel nicking the seed coat), hot water treatment, or conc. sulfuric acid scarification. It can be

direct-seeded or transplanted using young plants grown from seed or cuttings. It tolerates bare-rooted planting providing there is good soil moisture and a proportion of the top is removed to minimize moisture loss. Spacing within and between rows depends on intended application and management. While effective strains of *Bradyrhizobium* have been isolated from nodules, it is probably not necessary to inoculate seed for field planting, since *Indigofera* spp. tend to be fairly promiscuous in their rhizobial requirements.

Fertilizer

I. zollingeriana is tolerant of low fertility but responds to modest applications of deficient nutrients in poorer soils.

Compatibility (with other species)

It does not compete well with grasses in the early stages of establishment, but if between-row cover is required due to erosion susceptibility of soils, rapidly-establishing legumes could be considered.

Companion species

Legumes: Species such as *Stylosanthes hamata* have been suggested. Companion species will decline as the *Indigofera* canopy develops.

Pests and diseases

The larvae of the seed beetle, *Bruchidius zollingerianae* (Coleoptera: Chrysomelidae), that develop in the pods, have been observed in Vietnam. The root rot fungus, *Ganoderma endochroum*, has been associated with plant deaths in Nepal. Leaf eating caterpillars can cause minor damage.

Ability to spread

I. zollingeriana is a pioneer species which often invades open areas or fields after burning.

Weed potential

Despite its ability to seed freely and grow on poor soils, *I. zollingeriana* does not appear to present a weed problem around the tropics. Australia is maintaining a watch to ensure it and other Indonesian *Indigofera* spp. are not inadvertently introduced to the Ashmore Islands off the NW coast.

Feeding value

Nutritive value

Laboratory analyses of *I. zollingeriana* indicate a high quality forage: CP 27–31%, protein digestibility 75–87%, NDF 49–57%, ADF 32–38%, dry matter digestibility 72–81%, and total tannin 0.09–0.65%. Other samples indicate sound mineral quality, Ca 1.16% and P 0.26%.

Palatability/acceptability

As with some other tropical forage legumes, on first exposure to *I. zollingeriana*, animals may not "acquire a taste" for the forage for the first 2 or 3 days, but intake gradually increases. Intake of a group of rams fed ad lib *I. zollingeriana* leaf has been measured at 2.17 kg DM/100 kg body weight, which suggests at least moderate palatability, but perhaps lower than that of the very palatable *I. hendecaphylla* that was measured at 4.38 kg DM/100 kg body weight in a different study.

Toxicity

In the absence of conclusive exonerating data, all *Indigofera* species should be treated with caution in developing livestock feeding systems due to the presence of the toxic, non-proteinogenic amino acid, indospicine (2,7-diamino-7-amino-heptanoic acid), in leaves and seeds of some species. In the above ram feeding experiment in India, the sheep developed a number of symptoms resembling those caused by indospicine, viz. haematuria and damage to the organs, including the liver and kidneys. Some farmers in Indonesia suspect a link between abortion in their cattle and the commencement of feeding *I. zollingeriana*, also typical of indospicine intoxication. However, no such observations have been made with dairy goats consuming a mixed ration containing 40% *I. zollingeriana* pellet, nor was indospicine found in an analysis of *I. zollingeriana* seed meal. These differences may be attributable to seasonal variation in indospicine, to the dilution effect of other feeds, to drying or wilting reducing any toxic principle, or to phenotypic variation among provenances of this widely distributed species. Screening experiments that compare a large range of ecotypes and are conducted over a range of seasonal conditions are warranted to gain a better understanding of toxicity risks.

Production potential

Dry matter

I. zollingeriana has been harvested at 8 months with a total fresh weight yield of over 50 t/ha. Elsewhere, plants had attained a height of 8.7 m, a stem diameter of 8.6 cm and a crown diameter of 5 m at 20 months after planting.

Animal production

Inclusion of up to 60% *I. zollingeriana* in the ration, either as wilted fresh material or pelleted leaf material, has had a significant beneficial effect on both liveweight gain and milk production of dairy goats and kids compared with animals fed native grass or Napier grass (*Cenchrus purpureus*) alone.

Genetics/breeding

2n = 32. No breeding or varietal selection work has been undertaken. There may well be a need for agronomic and forage merit, including determination of indospicine levels among ecotypes.

Seed production

Pods are normally collected by hand and sun-dried. They are indehiscent and need to be threshed to obtain the seed. Dried seeds can be stored in normal conditions for 2 years.

Herbicide effects

No information available.

Strengths

- easily established
- widely adapted in humid tropics
- palatable
- nutritious
- largely pest and disease free

Limitations

- Doubt regarding indospicine (toxicity) status of some provenances.
- Not particularly drought tolerant.

Selected references

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Cultivars

None released.

Promising accessions

None reported.

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