FASCICLES
OF
FLORA OF INDIA

FASCICLE 21

LEGUMINOSAE - PAPILIONOIDEAE : TRIBE - INDIGOFEREAE

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BOTANICAL SURVEY OF INDIA
CONTENTS

LEGUMINOSAE - PAPILIONOIDEAE :
TRIBE - INDIGOFERAE (M. SANJAPPA ) 1 - 160

INDEX OF BOTANICAL NAMES 161 - 164

INDEX OF LOCAL NAMES 165 - 167
Indigofera trifoliata L.
Indigofera cassioides
Rottler ex DC.

Indigofera hendecaphylla
Jacq.
LEGUMINOSAE - PAPILIONOIDEAE

TRIBE: INDIGOFEREAE

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INDIGOFEREAE

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Herbs or shrubs, rarely small trees or treelets (sometimes with cladodes or even leafless branches as in Madagascan genus Phylloxylon). Indumentum characteristically biramous, sometimes mixed with multicellular gland-tipped hairs and more often with pearl bodies. Leaves generally imparipinnate, sometimes 3-foliate, or 1-foliate or simple; stipellae present or absent; leaflets opposite or alternate, entire or toothed along margins, usually hairy on both surfaces or rarely glabrous adaxially, sometimes gland-dotted beneath; bracteoles absent except in Phylloxylon. Flowers generally in axillary racemes, rarely solitary or in panicles. Corolla generally red or pinkish-red, sometimes purple, rarely white, caducent. Stamens 10, all united or with vexillary stamen free, anthers uniform, apiculate, gland-tipped or with an expanded connective, sometimes a tuft of hairs present at base and/or tip; pollen tricolporate, generally with thickened endexine, columnellae granular. Pods 2-valved, usually dehiscent, rarely indehiscent; endocarp sepaate between the seeds, often spotted with tannin deposits. Seeds spherical to subtetragonal; endosperm usually rather copious. Seedlings mostly epigal, usually with 1-foliate, opposite eophyll, occasionally with adventitious cladodes from hypocotyl (as in Phylloxylon). Chromosome numbers are 2n = 14,16,32,48. Free aminoacid canvanine generally present in seeds, sometimes with Indospicine.

Type: Indigofera Linn.

4 genera viz., Indigofera, Cyamopsis, Rhynochotropis, Phylloxylon, principally in tropical Africa, South Africa, Madagascar and Asia. The genus Indigofera is widely distributed in tropical and subtropical regions of the world. Indigofera and Cyamopsis are represented in India.
Key to the Genera

1a. Vexillary stamen lightly attached to others forming a closed tube; leaflets often dentate; pods broad, flat, longitudinally ridged
   1. Cyamopsis

b. Vexillary stamen free or attached to others at base only; leaflets entire; pods subcylindric to globose
   2. Indigofera

1. CYAMOPSIS


Type species: C. tetragonoloba (Linn.) Taub.

Annual, erect herbs; hairs biramous. Leaves imparipinnate, 3 - 7-foliolate, rarely 1-foliolate; leaflets opposite, entire or dentate to crenate along margins, extipellate; stipules small, setaceous. Flowers small, pink to purplish in axillary racemes; bracts caducous; bracteoles absent. Calyx broad, oblique, 5-toothed, ventral tooth the longest. Petals caducous; standard obovate, sessile, glabrous, distinctly veined; wing petals oblong, free from keel petals; keel petals erect, slightly incurved, obtuse, shortly spurred on sides. Stamens 10, monadelphous, all connate into a closed tube; anthers uniform, apiculate; Pollen spheroidal to subprolate, P/E 1.1 1.18, size: P 35 (39.5) 44, E 30 (34) - 39 in, coarsely rugulate, perforate; exine stratification somewhat complex. Ovary sessile, many-ovuled; style incurved at apex; stigma capitate. Pods flat, linear, ascending, longitudinally ridged, often faintly torulose, beaked, 2-valved, 3 - many-seeded, septate between seeds, somewhat compressed, minutely tuberculate, estrophiolate.

**Distrib.**: Arabia, India and drier parts of Africa, 3 species; one in India.

Local names: Bilati sim (Beng.), Cluster bean, Gur (Eng.), Gowar (Hindi), Gawar, Guwar (Guj.), Chavalikayi, Gorikayi (Kan.), Barachi, Gavari, Makti (Mar.), Kulti, Guar, Kuwara (Punj.), Dridhabija, Nishandhyagni, Sushka, Vakrasimb, Gorani, Gorakshapalani, Bakuchi (Sans.), Koth-avery (Tam.), Gorchikurkai (Tel.).

Annual, erect herbs, 10 - 120 cm high; branches angular or grooved, adpressed with biramous hairs when young, glabrous when mature. Leaves 2 - 15 cm long including 0.8 - 4 cm long petiole; stipules 3 - 10 mm long, setaceous, glabrous or with few hairs outside; rachis 4 - 12 cm long, flat above; petiolules 1 - 4 mm long; leaflet 1 7 x 0.5 - 4 cm, ovate to ovate-lanceolate, cuneate to rounded at base, obtuse to acute at apex, dentate to crenate with lateral veins ending in teeth along margins, sparsely to somewhat densely hairy on both surfaces, sometimes glabrous. Racemes 5 - 15 cm long including 3 - 5 mm long peduncle; rachis adpressed hairy, 6 - many-flowered. Flowers pinkish-white to purplish, 4 - 5.5 mm long; bracts 3 - 5 mm long, setaceous, hairy outside, subpersistent; pedicels ca 1.3 mm long, hairy, stout in fruits. Calyx ca 4.5 mm long, oblique, adpressed hairy outside, glabrous inside, 5-toothed, teeth 2 - 2.5 mm long, narrowly triangular, cup 1.5 - 2 cm long. Standard 3 - 5 x 1.5 - 3 mm, ovate to rotund, cuneate and clawed at base, rounded at apex, vinced, glabrous; wing petals 2 - 4 mm long, glabrous; keel petals 2.5 - 4.5 mm long, glabrous. Stamens 10, 2.5 - 4.2 mm long, monadelphous; anthers less than 1 mm long, apiculate. Ovary 1.8 - 3.5 mm long, channeled on vexillary side, glabrous, 3 - 8-ovuled; style 1.5 - 2.3 mm long, glabrous; stigma capitulate. Pods 2 - 6 x 0.6 - 1.3 cm, linear, slightly oblique at base, abruptly apiculate; sutures broad, valves longitudinally ridged (usually 3-ridged), somewhat torulose, adpressed hairy. Seeds 3 - 4 x 3 - 4 mm, greyish, flat, nearly spherical, minutely tuberculate, black spot present below micropyle.

Type: India, Suratte, Herb. Linn. 928. 23(LINN !)


Distrib.: India (cultivated throughout and is known from very ancient period; several cultivars are recorded from different parts of India). In wild state it is collected from Kutch (Gujarat) and Etawah (Uttar Pradesh); cultivated throughout tropics.

Exsicc.: In wild: Gujarat : Kutch, Dr. Stoliczka s.n. (CAL Acc. No. 109526); Uttar Pradesh: Etawah, Herb. Kurz. (CAL Acc. No. 109529); In Cultivation: Andaman & Nicobar Islands, Car Nicobar, Agricultural farm, 23 Sept. 1976

*Specimens cited in this work unless indicated are represented in CAL.


**Uses**: Young tender pods eaten as vegetable, seeds and whole plant (green fodder) are relished by cattle and horses. The seed flour is the commercial source of 'Guar gum' and is used in food, paper and textile industries. It is cultivated on commercial scale in Gujarat, Punjab and Uttar Pradesh.

## 2. INDIGOFERA


Annual or perennial herbs on shrubs, rarely small trees or treelets (*I. heterantha* Wallich ex Brandis, *I. zollingeriana* Miq.); branches spreading or ascending, hairs adpressed to spreading medifixed, biramous with equally or unequal arms, often with pearl bodies, in some species mixed with stiff, erect, multicellular often gland-tipped hairs or with sessile, yellowish to reddish-brown disc-shaped glands. Leaves alternate, usually imparipinnate, pinnately or digitately trifoliate, or unifoliate or simple; stipules usually small, persistent; petioles pulvinate, hairy; rachis canalicate above, hairy, leaflets opposite or alternate, linear to orbicular, the terminal one larger than the lateral ones, rounded to cuneate at base, acute or obtuse to retuse and mucronate at apex, entire, usually adpressed pubescent on both surfaces, rarely glabrous above, midrib sunken above and raised beneath, lateral nerves inconspicuous, form marginal arches when distinct. Flowers usually in axillary racemes, sometimes in pseudo panicles or very rarely solitary; pedicelled or subsessile, always single in the axil of a setaceous, caducous bract; bracteoles absent. Calyx campanulate, pubescent outside, usually glabrous inside, rarely pubescent (*I. myorensis*), teeth 5, subequal, the lowest the longest. Corolla usually red or pink, rarely white, caducous; standard sessile or shortly clawed, blade elliptic to orbicular, strigose to tomentose or rarely glabrous on the back, sometimes glandular, usually glabrous inside, very rarely with a tuft of hairs (*I. nigrescens* Kurz ex King & Prain); wing petals shortly clawed, free or adnate to keel petals, shorter or as long as keel petals, oblong to spatulate, glabrous or sometimes ciliate,
veined, upper auricle well developed; keel petals shortly clawed, falcate, valvately connate along lower margin from about middle to apex, upper auricle well developed, lateral spur present or absent, usually hairy towards apex and along margins to the base outside, sometimes glandular, ciliate along upper margins. Stamens diadelphous (9 + 1), filaments persistent, vexillary (upper) filament free, the other 9 connate, alternately shorter and longer, gradually longer towards the lowerside; anthers uniform, basifixed, connective apiculate, sometimes with a tuft of hairs at its base and apex. Ovary sessile or sub-sessile, linear to spherical, glabrous or hairy, in some species with glands at the tip of ovary, 1 many-ovuled; style curved upwards, glabrous or with a few hairs, sometimes with glands throughout; stigma capitate. Pods deflexed or spreading or ascending, dehiscent or indehiscent, linear to globose, straight or curved, cylindric or subtetrangular, some species with longitudinal wings or crests, rarely with curved spines, hairy or glabrous outside, beaked at apex, sometimes uncinate, disconnecting by means of a more or less distinct circumferent articulation near the base, the persistent basal articulation generally glabrous and/or paler outside; endocarp septate between seeds, often tannin-spotted. Seeds globose or cylindric or ellipsoid or quadrangular, smooth or pitted or foveolate.

Type species: I. tinctoria Linn.

Distrib.: Throughout the tropical and subtropical regions of the world, ca 700 species; ca 60 species and 10 varieties in India.

KEY TO THE SPECIES

1a. Leaves simple or unifoliolate 2
   b. Leaves compound 5

2a. Pods 1-2-seeded, sutures narrow
   b. Pods up to 7-seeded, sutures broad 3

3a. Pods 1-2-seeded, endocarp red-spotted; racemes globose
   b. Pods always 1-seeded, endocarp never spotted; racemes elongated 4

4a. Leaf blades obovate- orbicular, glabrescent; minute gland-dotted beneath; pods falcate, echinate; seeds kidney-shaped, smooth 16. I. dalzellii
   b. Leaf blades linear to obovate, densely adpressed pubescent, never gland-dotted; pods globose, not echinate; seeds globose, tuberculculate 39. I. nummulariifolia

5a. Leaves trifoliolate, if rarely multifoliolate then mixed with trifoliolate ones
   (as in I. angulosa, I. aspalathoides, I. trita var. marginulata and var. seabra) 6
   b. Leaves multifoliolate 18

6a. Leaflets gland-dotted beneath (except I. thothathrii); styles and pods covered with glands 7
   b. Leaflets not gland-dotted beneath; styles and pods without glands 15

7a. Leaves pinnately trifoliolate 8
   b. Leaves digitately trifoliolate 12
8a. Leaflets stipellate
b. Leaflets exstipellate

9a. Leaflets gland-dotted beneath; pods obscurely constricted between seeds, distinctly beaked
   7. I. barberi
   b. Leaflets not gland-dotted beneath; pods neither constricted between seeds nor beaked
      52. I. thothathri

10a. Pods 3 - 4-seeded, constricted between seeds
   b. Pods 1 - 2-seeded, not constricted between seeds
   45. I. santapanii
   11a. Pods prominently winged, wings fringed, valves not veined
      24. I. glandulosa
   b. Pods obscurely winged, wings entire, valves veined
      54. I. tirunelvelica

12a. Racemes longer than leaves; flowers distinctly long pedicelled
   b. Racemes much shorter than leaves; flowers short pedicelled or subsessile
      42. I. pedicellata

13a. Plants densely spreading pubescent
   b. Plants sparsely adpressed pubescent
      14. I. karuppiana

14a. Pods 1 - 1.5 mm broad, obscurely winged; terminal petioloole as long as lateral ones
   43. I. prostrata
   b. Pods more than 1.5 mm broad, prominently winged; terminal petioloole slightly longer than the lateral ones
      55. I. trifoliata

15a. Pods constricted between seeds
   b. Pods not constricted between seeds
      17. I. deccanensis
   16a. Leaves always tritfoliate; pods straight, narrowly constricted
   b. Leaves trifoliolate but always mixed with 5-foliolate ones; pods curved, deeply constricted
      1. I. angulosa

17a. Leaves digitately trifoliolate mixed with 5-foliolate ones; flowers solitary or rarely in pairs;
   leaflets narrow with a tubular glands at apex beneath
   4. I. aspalathoides
   b. Leaves pinnately trifoliolate mixed with 5 - 7-foliolate ones; flowers many in racemes;
      leaflets broad without glands at apex
   56. I. trita

18a. Standard glabrous; keel petals rostrate never laterally spurred; pods always 2 or more-
   seeded
   b. Standard pubescent, sometimes only at tips and margins; keel petals not rostrate, laterally
      spurred; pods 1 - many-seeded
      4. I. parviflora

19a. Pods flat, curved, papery, endocarp never spotted; fruiting pedicels reflexed
   30. I. hochstetteri
   b. Pods subcylindrical or subcircular, endocarp often spotted; fruiting pedicels variable

20a. Flowers solitary or in pairs; leaflets and calyx teeth with a tubular gland at apex beneath
   21a. Flowers many in racemes; leaflets and calyx teeth never with tubular glands at apex beneath
   (except I. glabra which has capitulate stalked glands)
   23. I. mysorensis
   b. Leaves digitate or obscurely pinnate, 3 - 5-foliolate; bracts minute; calyx glabrous inside
   22a. Stiffly erect shrublets with woody branches, often with very short internodes; pedicels stout;
      pods 6 - 8-seeded
      4. I. aspalathoides
   b. Prostrate herbs with slender stems and branches, internodes distinctly longer; pedicels
      slender, filiform; pods 3 - 5-seeded
      57. I. uniflora
23a. Stems and branches glabrous
   b. Stems and branches pubescent
24a. Leaflets opposite or subopposite
   b. Leaflets alternate
25a. Plants with gland-tipped hairs
   b. Plants without gland-tipped hairs
26a. Pods 4 - 6-seeded; seeds punctate; racemes 1.5 - 3 cm long
   b. Pods more than 6-seeded; seeds foveolate; racemes more than 3 cm long
27a. Racemes laxly 4 - 8-flowered
   b. Racemes compactly more than 8-flowered
28a. Young leaflets and calyx teeth tipped with capitate stalked glands; flower bearing part of rachis glabrous
   b. Young leaflets and calyx teeth without glands at tips; flower bearing part of rachis pubescent
29a. Leaflets glabrous adaxially; pods 1 - 1.5 cm long, densely spreading pubescent; obliquely depressed between seeds; seeds foveolate except at ends
   b. Leaflets pubescent on both surfaces; pods more than 1.5 cm long, sparsely adpressed pubescent, never obliquely depressed between seeds; seeds foveolate all over
30a. Corolla (except for margins) and pods glabrous
   b. Corolla and pods pubescent, if glabrous then bracts minute and pedicels slender
31a. Bracts cymbiform, membranous, abruptly secalaceous at apex
   b. Bracts linear to ovate, gradually narrowed towards apex
32a. Bracts 2 - 3 mm broad; anthers always with hairs at base; racemes often with sterile bracts at base
   b. Bracts 1 - 1.5 mm broad; anthers without hairs at base; racemes without bracts at base
33a. Leaflets usually 3 - 5, rarely up to 11, smaller (15 - 25 x 8 - 12 mm)
   b. Leaflets more than 11, larger (25 - 35 x 15 - 25 mm)
34a. Standard with a tuft hairs at base inside; calyx and bracts bluish black-spotted
   b. Standard glabrous inside; calyx and bracts never bluish black-spotted
35a. Racemes velvety or hispid with densely spreading soft or stiff hairs
   b. Racemes adpressed pubescent
36a. Calyx lobes linear, much longer than the cup; endocarp spotted; seeds pitted-punctate; leaflets 5 - 7, 10 - 20 mm broad
   b. Calyx lobes deltoid, much shorter than the cup; endocarp not spotted; seeds smooth; leaflets 13 - 51, 3 - 6 mm broad
37a. Peduncles up to 2.5 cm long; pods 3 - 6-seeded, 3 - 3.5 mm broad; leaflets 7 - 11, rarely up to 15
   b. Peduncles 4.5 - 6.5 cm long; pods 5 - 9-seeded, 1.5 - 2.5 mm broad; leaflets (3 -) 5 - 7
38a. Corolla (except for margins) and pods glabrous
   b. Corolla and pods pubescent, if glabrous then bracts minute and pedicels slender
39a. Bracts cymbiform, membranous, abruptly secalaceous at apex
   b. Bracts linear to ovate, gradually narrowed towards apex
40a. Bracts 2 - 3 mm broad; anthers always with hairs at base; racemes often with sterile bracts at base
   b. Bracts 1 - 1.5 mm broad; anthers without hairs at base; racemes without bracts at base
41a. Leaflets usually 3 - 5, rarely up to 11, smaller (15 - 25 x 8 - 12 mm)
   b. Leaflets more than 11, larger (25 - 35 x 15 - 25 mm)
42a. Standard with a tuft hairs at base inside; calyx and bracts bluish black-spotted
   b. Standard glabrous inside; calyx and bracts never bluish black-spotted
43a. Racemes velvety or hispid with densely spreading soft or stiff hairs
   b. Racemes adpressed pubescent
44a. Calyx lobes linear, much longer than the cup; endocarp spotted; seeds pitted-punctate; leaflets 5 - 7, 10 - 20 mm broad
   b. Calyx lobes deltoid, much shorter than the cup; endocarp not spotted; seeds smooth; leaflets 13 - 51, 3 - 6 mm broad
45a. Peduncles up to 2.5 cm long; pods 3 - 6-seeded, 3 - 3.5 mm broad; leaflets 7 - 11, rarely up to 15
   b. Peduncles 4.5 - 6.5 cm long; pods 5 - 9-seeded, 1.5 - 2.5 mm broad; leaflets (3 -) 5 - 7
46a. Corolla (except for margins) and pods glabrous
   b. Corolla and pods pubescent, if glabrous then bracts minute and pedicels slender
47a. Bracts cymbiform, membranous, abruptly secalaceous at apex
   b. Bracts linear to ovate, gradually narrowed towards apex
48a. Bracts 2 - 3 mm broad; anthers always with hairs at base; racemes often with sterile bracts at base
   b. Bracts 1 - 1.5 mm broad; anthers without hairs at base; racemes without bracts at base
49a. Leaflets usually 3 - 5, rarely up to 11, smaller (15 - 25 x 8 - 12 mm)
   b. Leaflets more than 11, larger (25 - 35 x 15 - 25 mm)
50a. Standard with a tuft hairs at base inside; calyx and bracts bluish black-spotted
   b. Standard glabrous inside; calyx and bracts never bluish black-spotted
51a. Racemes velvety or hispid with densely spreading soft or stiff hairs
   b. Racemes adpressed pubescent
52a. Calyx lobes linear, much longer than the cup; endocarp spotted; seeds pitted-punctate; leaflets 5 - 7, 10 - 20 mm broad
   b. Calyx lobes deltoid, much shorter than the cup; endocarp not spotted; seeds smooth; leaflets 13 - 51, 3 - 6 mm broad
53a. Peduncles up to 2.5 cm long; pods 3 - 6-seeded, 3 - 3.5 mm broad; leaflets 7 - 11, rarely up to 15
   b. Peduncles 4.5 - 6.5 cm long; pods 5 - 9-seeded, 1.5 - 2.5 mm broad; leaflets (3 -) 5 - 7
54a. Corolla (except for margins) and pods glabrous
   b. Corolla and pods pubescent, if glabrous then bracts minute and pedicels slender
55a. Bracts cymbiform, membranous, abruptly secalaceous at apex
   b. Bracts linear to ovate, gradually narrowed towards apex
56a. Bracts 2 - 3 mm broad; anthers always with hairs at base; racemes often with sterile bracts at base
   b. Bracts 1 - 1.5 mm broad; anthers without hairs at base; racemes without bracts at base
57a. Leaflets usually 3 - 5, rarely up to 11, smaller (15 - 25 x 8 - 12 mm)
   b. Leaflets more than 11, larger (25 - 35 x 15 - 25 mm)
58a. Standard with a tuft hairs at base inside; calyx and bracts bluish black-spotted
   b. Standard glabrous inside; calyx and bracts never bluish black-spotted
59a. Racemes velvety or hispid with densely spreading soft or stiff hairs
   b. Racemes adpressed pubescent
60a. Calyx lobes linear, much longer than the cup; endocarp spotted; seeds pitted-punctate; leaflets 5 - 7, 10 - 20 mm broad
   b. Calyx lobes deltoid, much shorter than the cup; endocarp not spotted; seeds smooth; leaflets 13 - 51, 3 - 6 mm broad
61a. Peduncles up to 2.5 cm long; pods 3 - 6-seeded, 3 - 3.5 mm broad; leaflets 7 - 11, rarely up to 15
   b. Peduncles 4.5 - 6.5 cm long; pods 5 - 9-seeded, 1.5 - 2.5 mm broad; leaflets (3 -) 5 - 7
38a. Shrubs; racemes up to 8 cm long; pods quadrangular, spreading, rarely a few lower ones deflexed
   b. Large shrubs or treelets; racemes more than 8 cm long; pods subcylindrical, deflexed
      18a. I. dosua
      50a. I. stachyodes

39a. Seeds discoid, arranged like a pile of coins in ca 5 mm broad pods
   b. Seeds cylindrical to angular, arranged differently in 1.5 - 2.5 mm broad pods
      60a. I. zollingeriana

40a. Pods straight, never turulose or constricted
   b. Pods curved, if straight then pods somewhat sparsely adpressed pubescent
      54a. I. sesquipedalis

41a. Pods fastigate grouped with apices pointing towards tip of rachis; endocarp red-spotted;
   seeds punctate to shallowly foveolate (species restricted to NE and SW India)
   b. Pods spreading or deflexed; endocarp not spotted; seeds smooth (species restricted to
      Himalayas except I. sesquipedalis and I. lancel of Khasi and Naga hills in NE India)
      42a. I. galegooides

42a. Leaflets large (2 - 3 x 0.3 - 1.7 cm); calyx cup longer than teeth; pods 6 - 7.5 cm long including
   a beak of 4 - 8 mm, glabrescent, 15 - 18-seeded; seeds 2.5 - 3 x 1.5 mm
      21a. I. wightii

43a. Racemes up to 5 cm long
   b. Racemes more than 5 cm long
      44a. Pedicels 2 - 3 mm long; branches rusty brown pubescent
          b. Pedicels ca 1 mm long; branches grey pubescent
      19a. I. emmae

45a. Branches and pods densely spreading pubescent
   b. Branches and pods adpressed pubescent
      22a. I. gangetica

46a. Stipellae 1 between pairs of leaflets; racemes stiffly erect; leaflets glabrous to adpressed
   pubescent adaxially
   b. Stipellae 2 between pairs of leaflets; racemes not stiffly; leaflets always adpressed pubescent adaxially
      48a. I. silvestrii

47a. Pods glabrous
   b. Pods adpressed pubescent
      49a. Pods ascending
      50a. Pods reflexed-spreading

49a. Stipules 5 - 10 mm long, persistent; leaves 21 - 31-foliolate; young branches and calyx grey
   pubescent; biramous hairs slender on abaxial surface of leaflets
   b. Stipules 3 - 4 mm long, deciduous; leaves 9 - 19-foliolate; young branches and calyx brown
      pubescent; biramous hairs stout on abaxial surface of leaflets
      33a. I. lacel

50a. Leaves 7 - 11-foliolate; standard and keel petals glabrescent; calyx teeth narrowly triangular,
   longer than the cup
   b. Leaves 13 - 23-foliolate; standard and keel petals densely adpressed pubescent; calyx teeth
      deltoid, shorter than the cup
      28a. I. himalayensis

51a. Calyx rusty brown tomentose; trailing or prostrate shrubs; hairs grey and brown mixed on
   abaxial surface of leaflets
   b. Calyx grey tomentose; erect shrubs; hairs grey on abaxial surface of leaflets
      44a. I. pseudoreticulata

52a. I. exiles
Fig. 2. *Indigofera angulosa* Edgew.: a. Habit, b. Calyx, c. Leaflet-abaxial surface, d. Leaflet-adaxial surface, e. Pod, f. Seed-hilar view, g. Seed-side view, (a-g: Sunjappa 9257)
52a. Leaflets large (15 - 25 x 5 - 10 mm); calyx densely adpressed pubescent, teeth shorter than the cup  

10. I. cedrorum  

b. Leaflets small (5 - 15 x 3 - 5 mm); calyx sparsely pubescent, teeth equal to or longer than the cup  

53a. Tall shrubs or treeclets 2 - 5 m tall; leaves sessile or subsessile; anthers glabrous; pods 3 - 5 cm long spreading  

27. I. heterantha  

b. Shrubs up to 60 cm high; leaves distinctly petiolate; Pods 1.5 - 2 cm long, reflexed-spreading  

461. sesquipedalis

54a. Pods constricted between seeds  

b. Pods not constricted between seeds  

55a. Leaves 3 - 5-foliolate; pods 1 - 3-seedea  

1. I. anguosa  

b. Leaves 7 - 11-foliolate; pods 4 - 8-seedea  

13. I. consticta

56a. Leaflets glabrous adaxially; pods 1 - 4-seeded, torulose  

111. I. coerulaea  

b. Leaflets pubescent on both surfaces; pods 3 or more-seeded  

57

57a. Pods straight  

b. Pods curved  

58

58a. Leaflets 9 - 13, ovate-elliptic; pods spreading; seeds foveolate-reticulate  

361. longirracemosa  

b. Leaflets 11 - 19, elliptic to oblong; pods reflexed; seeds smooth  

3. I. arrecta

59a. Pods 1 - 2 cm long, distinctly curved, 5 - 8-seeded  

51. I. suffructicosa  

b. Pods more than 2 cm long, slightly curved, 8 - 12-seedea  

53. I. tinctoria

60a. Pods 1 - 6-seeded; racemes subglobose to ovoid, shorter than leaves  

61  

b. Pods more than 6-seeded but often mixed with less seeded pods; racemes elongated, longer than leaves  

62

61a. Pods 1 - 2-seeded, faintly torulose in 2-seeded ones; leaves subsessile  

35. I. lineae  

b. Pods 3 - 6-seeded, distinctly torulose; leaves distinctly petiolate  

47. I. sessiliflora  

62a. Shrubs; pods curved, cylindrical, constricted between seeds, endocarp red-spotted; calyx 1 - 1.5 mm long; leaves 1 - 5-foliolate  

40. I. oblongifolia  

b. Herbs; pods straight except the beak; subtetragonal, not constricted between seeds, endocarp not red-spotted; calyx 2.5 - 3 cm long; leaves 7 - 11-foliolate rarely mixed with 5-seeded ones  

49. I. spicata


Fig. 2, Map 1.

Undershrub, 1 2 m high; branches spreading; biramous hairs grey, adpressed. Leaves 2.5 - 4 cm long including 5 - 12 mm long petiole; stipules 1.5 - 2.5 mm long, subulate, adpressed pubescent outside; stipellae minute; petiolules 1 - 2 mm long; leaflets 3 - 5, 8 - 25 x 6 - 15 mm, elliptic to obovate, rounded to obtuse at base, retuse or rounded at apex, adpressed pubescent on both surfaces, biramous hairs with unequal arms above and with equal arms beneath.
Racemes 5 15 cm long, shortly peduncled, axillary, laxely many-flowered. Flowers pinkish, 5 mm long; bracts 1 - 1.5 mm long, subulate, adpressed hairy outside, caducous. Calyx ca 4.5 mm long, adpressed pubescent outside, lobes ca 3.5 mm long, setaceous; tube ca 1 mm long. Standard 4 4.5 x 2.5 mm, obovate, rounded, mucronulate at apex, strigulose without; wing petals ca 4 mm long, glabrous; keel petals 3.5 - 4 mm long, strigulose outside towards the tip, lateral spur ca 0.4 mm long. Staminode sheath ca 4 mm long. Ovary ca 2.5 mm long, linear, 3 - 5-ovuled. Pods 10 - 15 mm long, somewhat deflexed-spreading, subtetragonal, curved, constricted between seeds, abruptly beaked, strigose. Seeds 1 - 4, ca 3 x 1.5 mm, keeled on sides, yellowish-brown, smooth.

Type: India: Madhya Pradesh, Banda Dist., (‘Bundelkund’) Kurthal Hills, Edgeworth 2014 (K, holo !).


Distrib.: INDIA: Gujarat, Madhya Pradesh, Maharashtra and Rajasthan; endemic.

Habitat: Dry gravely/rocky soils on hill slopes as an undergrowth.


Chr. No.: n = 16 & 2n = 32 (Sanjappa & Bhatt, Taxon 26: 266. 1977).


Fig. 3, Map 1.

Undershrub or herb, 30 - 60 cm high, diffusely branched; branches many, angular, when young, terete and striate when mature; densely canescent, bire- mous hairs adpressed, grey, mixed with multicellular gland-tipped hairs. Leaves 1.5 - 3.5 cm long including 8 10 mm long petirole; stipules 2 - 2.5 mm long, subulate to setaceous, pubescent outside, ciliate with gland-tipped hairs; rachis obscurely canaliculate above, canescent; leaflets 3 - 9, opposite, 3.5 - 5 x 2 - 3.5 mm, orbicular or obovate, rounded at base, obtuse or rounded to emarginate and mucronulate at apex, adpressed pubescent on both surfaces, gland-tipped hairy along margin and lower surface; stipellae minute; petiolules
Fig. 3. *Indigofera argentea* Burm. f.: a. Habit, b. Leaflet-adaxial surface, c. Leaflet-abaxial surface, d. Infructescence, e. Calyx, f. Pod, g. Seed, (a-c: G.P. Roy 2011; d., f-g: Wadhwa 5167)
Fig. 4. *Indigofera arrecta* Hochst. ex A. Rich.: a. Habit, b. Calyx, c. Infructescence, d. Pod, e. Seed-hilar view (a-b: A.S. Rao 85449; c-e: Prain 6)
ca 1 mm long. Racemes 1.5 3 cm long including 5 8 mm long peduncle, axillary, up to 12-flowered. Flowers pink, ca 5 mm long; bracts ca 1 mm long, subulate, pubescent, caducous; pedicels ca 1 mm long. Calyx 1.5 - 2 mm long, adpressed grey pubescent outside, ciliate with gland-tipped hairs along margins, tube ca 0.5 mm long. Standard 4.5 5 x 4 mm, obovate or orbicular, strigulose outside, gland-tipped hairs present; wing petals ca 4 mm long, glabrous; keel petals ca 4.5 mm long, strigulose, lateral spur minute. Staminal sheath ca 4.5 mm long. Ovary ca 2.5 mm long, sparsely hairy, 4-8-ovuled. Pods 8 - 10 x 2 - 3 mm spreading, linear or slightly curved, faintly torulose, shortly apiculate, adpressed grey pubescent and gland-tipped hairy, upper suturet broad; endocarp red-spotted on septum. Seeds generally 4 - 6-seeded, sometimes 8, 1 - 1.5 mm across, orbicular or ovoid, reddish-brown, smooth.

**Type:** Persia, *Herb. Burmann f.* (G, photo !)

**Fls.:** Aug. - Dec.; **Frts.:** Dec. - Feb.

**Distrib.:** INDIA: Gujarat and Rajasthan; PAKISTAN, YEMEN, OMAN, SAUDI ARABIA, CHAD, EGYPT, ERITREA, IRAN, LIBYA, MAURITANIA, NIGERIA, SOMALILAND, SUDAN.

**Habitat:** Confined to sand dunes of deserts.


**Chr. No.:** n = 8 & 2n = 16 (Ramanathan, Curr. Sci. 24: 17. 1955).


**Local names:** Nil (Hindi, Beng.); Neeligada(Kan.); Bengal indigo, Java indigo, Natal indigo (Eng.).

Stout, woody herb or undershrub, 1 - 2 m high; stems and branches ridged, striate, sparsely strigulose, biramous hairs minute with equal arms densely adpressed. Leaves 7 12 cm long, petiole and rachis canaliculate above, adpressed strigulose; stipules ca 3 mm long, subulate to triangular, pubescent, caducous; petiolules ca 1.5 mm long; stipellae minute; leaflets 7 17, 1.8 - 3 x 0.6 - 1.3 cm, oblong to obovate-oblong, cuneate to rounded at base, rounded
and apiculate at apex, sparsely strigulose to adpressed pubescent on both surfaces, sometimes glabrous above, drying blackish. Racemes 4 - 7.5 cm long, axillary, sessile or subsessile, many-flowered. Flowers pale pink to scarlet red, 5 - 6 mm long; bracts ca 1 mm long, lanceolate, caducous. Calyx ca 1 mm long, brown strigulose outside, lobes triangular. Standard 3 - 4 x 2.5 mm, ovobate, mucronate at apex, brown strigulose outside; wing petals ca 2.5 mm long, ciliate; keel petals 3 - 4 mm long, brown strigulose outside, lateral spur ca 0.4 mm long. Staminal sheath ca 4 mm long. Ovary ca 3 mm long, linear, glabrous, 4 8-ovuled. Pods 18 - 23 x 3 - 4 mm, deflexed, straight, subcylindric to somewhat tetragonal, obscurely torulose, abruptly apiculate, thinly adpressed pubescent; sutures thick, valves faintly angular, often obliquely cracking in mature fruits; endocarp red-spotted. Seeds 4 - 8, ca 1.5 x 1 mm, oblong, cylindric, smooth.

_Type:_ N. Ethiopia, 1837, _Schimper_ 349 & 1923 (P, photo ! K !).


_Distrib._: INDIA: Andaman & Nicobar Islands, Bihar, Karnataka, Uttar Pradesh and West Bengal; SAUDI ARABIA, CAMEROON, CONGO, ERITREA, GAMBIA, NORTH YEMEN, SUDAN, S. AFRICA, TROPICAL AFRICA. Introduced in S.E. Asia including India.

_Uses:_ Once cultivated in Bihar and Bengal as one of the major Indigo producing species. Presently the species is cultivated as a green manure plant in coffee estates in Karnataka.


_Chr. No._: 2n = 16 (Frahm-Leliveld, Euphytica 2: 47. 1953) 2n = 16 + 2B (Sanjappa & Bhatt, Taxon 26: 266. 1977).

Map 1. Indigofera angulosa Edgew. (♦); I. argentea Burm. f. (★); I. aspalathoides Vahl ex DC. (⊙); I. barberi Gamble (■); I. bracteata var. bracteata (★), var. khasiana Sanjappa (Θ); I. cedrorum Dunn (♦); I. coerulea var. monosperma (Santapau) Santapau (●).
Local names: Neela, Shiva malli (Kan.); Wiry indigo (Eng.), Manneli (Mal.); Ratakamba, Sivanimba, Shevaniarba (Sans.); Shivanarivembo, Iraivanavembo (Tam.).

Erect, copiously branched, undershrub, 30 - 40 cm high; stems and branches rigid, spreading, terete, internodes very short, white canascent when young, glabrous or sparsely hairy and reddish when mature. Leaves digitate, sessile; stipules 0.8 - 1.1 mm long, scentuous, glabrous; stipellae 1 mm long, scentuous, glabrous; petiolules 1 mm long, brown; leaflets 1 - 6, fleshy, 3 - 5 x 0.5 - 2 mm, linear or obovate-oblong, cuneate at base, obtuse or rounded at apex, minutely apiculate with a tubular gland, glabrous above, sparsely adpressed hairy beneath; Flowers dark pink, 3 - 4 mm long, solitary or sometimes paired, axillary; pedicels 4 - 6 mm long, erecto-patent, jointed, glabrescent; bracts minute, caducous. Calyx 1.5 - 2 mm long, thinly pubescent outside; lobes 1.5 mm long, subulate with a tubular gland on the midrib at tip outside; standard 3.5 x 1.5 mm, elliptic, strigulose outside; wings 3 mm long, glabrous; keels 3 - 3.5 mm long, strigulose without, lateral spur 0.3 mm long. Ovary 1.5 - 2 mm long, linear, glabrous; 5 - 8-ovuled. Pods 12 - 18 x 1 - 2 mm, longer than pedicels, linear, straight, subcylindric or flattened, apiculate, faintly torulose, sparsely adpressed hairy; endocarp spotted. Seeds 3 - 6(-8), 1 x 1 mm, cubical or subcylindric, truncate at both ends, reddish-brown, smooth.

Type: Sri Lanka, Herb. De Candolle 2: 231. 95 (G-DC, seen on microfiche).

Fls. & Frts.: June - Dec.

Distrib.: INDIA: Andhra Pradesh, Karnataka, Kerala, Orissa and Tamil Nadu; SRI LANKA.

Habitat: Common on sandy coastal areas.


Uses: The decoction of leaves, flowers and tender shoots is employed in leprosy and cancerous affections.
**Pollen:** 3-zonocolporate, spheroidal, rarely subprolate, 37-40 x 30-36 μm, rugulate, perforate (Ferguson & Strachan, Pollen et Spores 24: 171-210. 1982).

**Notes:** This species was erroneously recorded from Darjeeling, West Bengal (K.K.N. Nair in Jour. Indian Bot. Soc. 60: 182-183. 1981) based on a collection probably made from Orissa as this is a coastal species especially on sandy soils but also found on other types of soils in interior parts towards southern most tip of peninsular India.


**Fig. 6.**

**Local name:** Dagadia (Hindi).

Annual, erect herb, 1 - 1.5 m high; stems and branches angular when young, terete and reddish when mature, biramous hairs stiffly, usually white, sometimes brownish. Leaves 8 - 15 cm long including 2 - 3 cm long petioles; stipules 1.6 cm long, linear to filiform, brown plumose; rachis prolonged beyond lateral leaflets, hirsute; petiolules 2 - 3 mm long, stipellae 2 - 3 mm long, brown pilose; leaflets 7 - 9, sometimes up to 15, opposite, 1 - 4 x 1 - 2 cm, obovate, elliptic or elliptic-oblong, mucronate at apex, pilose on both surfaces, hairs brownish on midrib and along margins, green above, pale beneath. Racemes 8 - 20 cm long including 1 - 2.5 cm long peduncle; rachis hirsute, densely many-flowered. Flowers light pink to brick red; pedicels 2 - 3 mm long, pilose, reflexed in fruits; bracts 3 - 4 mm long pilose, caducous. Calyx 3.5 - 4 mm long, plumose; lobes linear, setaceous, divided almost to the base. Standard 3 - 4.5 x 2.5 mm, elliptic or obovate, obtuse or retuse at apex, pubescent outside; wing petals 3 - 3.5 mm long, ciliate; keel petals 3 - 4.5 mm long, pubescent outside, lateral spur ca 0.4 mm long. Staminode sheath ca 4 mm long. Ovary 1 - 2 mm long, glabrous, 5 6-ovuled. Pods 10 - 19 x 3 - 3.5 mm, straight, reflexed, subquadrangular, abruptly short apiculate, hisrate, up to 6-seeded; endocarp spotted. Seeds 3 - 6, 2 - 5 x 1.5 mm, tetragonal, strongly pitted, brown.

**Type:** Senegal, Perrottet 143 (G, photo !).
Fig. 7. Indigofera atropurpurea Buch.-Ham. ex Hornem.: a. Habit, b. Calyx, c. Infructescence, d. Pod, e. Seed (a-b: Inayat 24340; c-e: Lace 5517).

Distrib.: INDIA (throughout up to 900 m in Sikkim); PAKISTAN, AUSTRALIA, CHINA, S.E. ASIA, S.AFRICA, TROPICAL AFRICA, introduced in West Indies.


Pollen: 3-zonocolporate, spheroidal, rarely subprolate, 37 - 40 x 30 - 36μm, rugulate, perforate (Ferguson & Strachan, Pollen et spores 24: 171 - 210. 1982).

Notes: In almost all Indian floras this species was merged with its closely allied I. hirsuta Linn. until Gillett (1960) exclusively discussed the differences to retain them as separate species. Gillett's (op. cit) view is accepted here after studying all the Indian materials. So far no intermediates between the species are recorded in India.


Fig. 7.

Local names: Bankati, Kala, Sakena, Sakana (Hindi), Kathi, Gorkatri (Kashm.).

Shrub, 2 - 3 m high; stems and branches erect, biramous hairs adpressed with equal arms. Leaves 12 - 24 cm long; stipules ca 5 mm long, narrowly triangular, caducous; rachis 10 - 20 cm long including 2 - 4 cm long petioles; stipellae 1 - 1.5 mm long, linear; petiolules 2 - 3 mm long; leaflets (9-)11 - 17, opposite, 3 - 5 x 1.5 - 3.5 cm, obovate, sometimes elliptic, obtuse to rounded at base, acute to rounded apex, rarely retuse and mucronate, adpressed pubescent on both surfaces, green above, pale beneath, venation distinctly reticulate, lateral nerves 9 - 11 pairs, alternate. Racemes 10 - 20 cm long including 2 - 4 cm long angular peduncle, many-flowered, often bear flowers near to the base of rachis. Flowers purplish-red, 6 - 10 mm long; bracts 3 - 6 x 1 - 1.5 mm,
triangular, subpersistent; pedicels ca 1.5 mm long. Calyx 3 4 mm long, obliquely campanulate, cup ca 1.5 mm long, teeth 1-1.5 mm long, deltoid. Standard 8-9 x 5-6 mm, elliptic, dark purple glabrous; wing petals 6-8 x 2-2.5 mm, obovate, pink, ciliate along margins, keel petals 8 8.5 x 2-2.5 mm, purple, ciliate along upper margins, lateral spur 1 1.2 mm long. Staminal sheath 6-7 mm long; anthers ca 0.5 mm long. Ovary ca 5 mm long, linear, glabrous, 9 11-ovuled; style ca 3 mm long, glabrous. Pods 30 45 x 4 mm, straight, spreading or deflexed cylindric, abruptly short beaked, glabrous, dehiscent, 6-10-seeded. Seeds 2.5 x 2-2.5 mm, cylindric, rounded at both ends, smooth, dark brown.

**Type:** Cultivated in the Botanic garden at Copenhagen, *Hornemann s.n.* (C, photo !).

**Fls.:** July - Sept.; **Frts.:** Oct. - Dec.

**Distrib.:** INDIA: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Punjab, Tripura and Uttar Pradesh; NEPAL, BHUTAN, BANGLADESH, MYANMAR, CHINA, VIETNAM.

**Habitat:** Slopes of valleys at altitudes ranging from 300 to 2000 m.


**Notes:** Although this species was first named and published without description by Roxburgh (1814) in his *Hortus Bengalensis*, it was validated by Hornemann in 1819, who described it from a plant cultivated in the Botanic garden of Copenhagen. Subsequently Roxburgh also published *I. atropurpurea* in his *Flora Indica* (1832).

de Kort and Thijsse (Blumea 30: 111.1984) included Sri Lanka in the distribution of *I. atropurpurea*. It does not grow wild in Sri Lanka but was introduced in Perdeniya garden (see Moon *A catalogue of the indigenous and exotic plants growing in Ceylon*. Colombo 54. 1824).

**Chr. No.:** 2n = 16 (Mchra & Dhawan, Taxon 20: 793. 1971).

Local name: Sinnichedi (Tam.)

Erect herb or undershrub, 30-120 cm high; branches slender, angular, ascendingly appressed canascent. Leaves pinnately trifoliolate, 3-8 cm long including 1.5-2.5 cm long petiole; stipules 2-3 mm long, subulate, caducous; stipellae 1 mm long, setaceous; petiolules 1.5-2 mm long; leaflets 2-5.5 x 1-2.5 cm, obovate or elliptic to elliptic-lanceolate, obtuse at base, obtuse to rounded and mucronate at apex, adpressed strigose on both surfaces, sparsely brown gland-dotted beneath. Racemes 5-7 mm long, axillary; rachis strigose, glandular, 10-15-flowered. Flowers solomon red, 3-3.5 mm long; bracts 2-2.5 mm, subulate, pubescent, caducous; pedicels ca 1 mm long, glandular. Calyx ca 2 mm long, strigose and gland-dotted outside, cup ca 0.5 mm long, teeth 1-1.5 mm long, triangular. Standard 2.5-3 x 1-1.5 mm, elliptic or ovate, obtuse to acute at apex, strigose and gland-dotted on the back; wing petals 2-2.5 mm long, glabrous, upper auricle prominent; keel petals 2.5-3 mm long, strigulose and gland-dotted outside towards tip, lateral spur ca 1 mm long, hyaline. Ovary ca 2 mm long, linear with a few hairs on dorsal side, 4-5-ovuled; style ca 1 mm long, sparsely covered with glands. Pods 10-20 x 3-4 mm, linear or slightly upcurved, moniliform, adpressed strigose, sparsely covered with glands, 2-4-seeded. Seeds 1.5 x 1 mm, subcylindric, brown, smooth.

Type: India: Tamil Nadu, S. Arcot Dist., Melpat, 28 Sept. 1899, C.A. Barber 1076 (K, lecto! MH isolecito!). Lectotype selected here.


Distrib.: INDIA: Andhra Pradesh and Tamil Nadu; endemic.

Habitat: Open areas of deciduous forests along slopes of hills and in scrub jungles, on rocky soils at altitudes ranging from 300 to 700 m.

Exsicc.: Andhra Pradesh: Kurnool Dist, Nallamalais, near Bairani falls Diguvametta, 325 m, 10 Nov. 1969, J.L. Ellis 32470; Chittoor Dist., Talakona Forest, 9 Sept. 1971, B.K. Vijay kumar 622; Cuddapah, locality? 19 Oct. 1938, E.K. Krishnan s.n. (DD).


Note: de Kort and Thijsse (1984) have merged I. barberi Gamble under I. trifoliata L. subsp. trifoliata without assigning any reason. I. barberi differs greatly from I. trifoliata in habit, leaves, flowers and pods. Therefore, it is treated here as a distinct species.

**KEY TO THE VARIETIES**

1a. Leaflets hairy adaxially; pods 2 - 2.5 cm long, sutures, obscurely winged, valves smooth
   
   8.1. var. bracteata

b. Leaflets glabrous adaxially; pods 3 - 3.5 cm long, sutures prominently winged, rugulose
   
   8.2. var. khasiana

8.1. var. bracteata

**Type**: Graham in Wallich, Cat. No. 5477 (CAL, lecto ! K-W isolecto !).

**Fls.**: July - Nov.; **Frts.**: Nov. - Dec.

**Distrib.**: INDIA: Arunachal Pradesh; NEPAL, BHUTAN, CHINA.

**Exciss.**: Arunachal Pradesh: Jumbesi-Singhone, 10,000 ft., 1 June 1958, **R.S. Rao** 17211.

Undershrub, 30 90 cm high; stems and branches slender, prostrate or trailing, glabrous. Leaves 4 10 cm long; 3 5 x 1 1.2 mm, membranous, lanccolate, acuminate, glabrous, persistent; rachis 4 - 7 cm long including 1.5 - 2.5 cm long petiole. Stipellae 2 2.5 mm long, linear, acuminate, persistent; petiolules 1 - 1.5 mm long, glabrous; leaflets 5 - 7, opposite, 1.2 - 2.8 x 0.6 - 1 cm, elliptic or obovate, cuneate at base, obtuse to rounded or rarely retuse and mucronate at apex, sparsely adpressed pubescent on both surfaces. Racemes 8 13 cm long including 3 5 cm long, glabrous peduncles, many-flowered. Flowers violet-purple, 8 - 10 mm long; bracts prominent, 4 - 4.5 x 2 - 2.2 mm, ovate, cuspidate, reticulately veined, ciliate along margins; pedicels 2 - 3 mm long, glabrous. Calyx 1 - 1.5 mm long, adpressed strigose outside; cup ca 1 mm long, teeth short, deltoid, ciliate along margins. Standard 7 9 x 4 5 mm, elliptic, rounded at base, acute and mucronate at apcx, densely strigose outside; wing petals 6 - 8 mm long, glabrous; keel petals 7 - 9 mm long, densely strigose outside, lateral spur 1.5 - 2 mm long. Staminal sheath 7 - 8 mm long; anthers 1 1.5 mm long. Ovary 4.5 6 mm long, glabrous. Pods 30 - 35 x 2 - 3 mm, spreading, glabrous, linear, cylindric, obscurely torulose, apiculate, sutures broad with or without obscure wings, valves smooth or rugulose 7 - 10-seeded; endocarp smooth. Seeds ca 2 x 1.5 mm, cylindric, truncate at both ends, smooth, brown.
Fig. 9. *Indigofera bracteata* Graham ex Baker var. khasiana Sanjappa: a. Habit, b. Calyx, c. Leaflet-adaxial surface, d. Leaflet-abaxial surface, e. Infructescence, f. Pod, g. Seed-hilar view (a-d: Kingdon-ward 9; e-g: C.B. Clarke 15310).
**Fig. 9, Map 1.**

Differs from var. *bracteata* by its adaxially glabrous leaflets, more than 3 cm long pods with a spinate apex, prominently winged sutures and rugulose valves.

**Type:** India: Meghalaya, Khasi Hills 5000 6000 ft., J.D. Hooker & T. Thomson s.n. (holo CAL, MH, iso !).

**Fls.:** July - Nov.; **Frgs.** Nov. - Dcc.

**Distrib.:** INDIA: Arunachal Pradesh and Meghalaya; endemic.


**Notes:** Baker (1876) cited *T. Thomson s.n.*, Kashmir, 5000 - 6000 ft., as an exstipellate form of *I. bracteata*. This specimen belongs to *I. heterantha* Wallich ex Brandis, a common species of W Himalaya. Further Baker (op. cit.) mentions that the number of leaflets to be 7 - 17 but they are never more than 7 in all the specimens cited by him except in the erroneously identified 'Kashmir specimen' which has 13 leaflets per leaf.


**Local names:** Jirul, Jirahul, Hutar, Uttar (Bih.); Girghol, Hakna, Kathu, Kathi, Sakena, Sakina (Hindi); Masaligida, Gogge (Kan.); Hikpi (Lepcha); Manali (Mal.); Baroli, Chimnati, Nerdi (Mar.); Sagina, Sekene (Nep.); Gibri (Or.); Narinchi (Tam.); Siralli (Tel.); Giral, Girali (Urdu).

Shrub, 1 - 5 m high; branches erect, angular, biramous hairs adpressed with equal arms. Leaves 8 - 22 cm long including 5 - 10 mm long petioles; pinnate; stipules 3 - 5 x 0.5 - 1 mm, narrowly triangular to linear, caducous; rachis 7 - 21 cm long; stipellae 1 - 1.5 mm long, linear, persistent; petiolules 1 - 2 mm long, leaflets (7 - ) 11 - 21(- 35), opposite, subopposite rarely a few alternate, 1 - 2.8 x 0.5 2 cm, ovate-elliptic, elliptic to obovate or oblong, obtuse to rounded at base, obtuse to emarginate and mucronate at apex, sparsely adpressed pubescent on both surfaces, distinctly reticulate with veins prominent below. Racemes 5 - 20(- 35) cm long, showy, often with sterile bracts at base of rachis, many-flowered. Flowers pink or pinkish-purple, 8 - 18 mm long; bracts (sterile and fertile) 3 10 x 1.5 - 3.5 mm, somewhat boat-shaped to broadly ovate, acuminate or cadulate, densely adpressed pubescent outside, caducous; pedicels ca 1 mm long. Calyx ca 5 mm long, adpressed grey pubescent outside, cup 2 5 mm long, teeth ca 0.7 mm long, triangular. Standard 5 12 x 3 6 mm, ovate or obovate, glabrous, finely ciliate along upper margins; wing petals 4 - 10 x 1.5 - 2 mm, oblong, glabrous; keel petals 5 - 10 x 2 - 3 mm, glabrous, ciliate along upper margins, lateral spur ca 2 mm long. Staminal sheath 4 - 10 long; anthers ca 1 mm long with a tuft hairs at base and tip of connective. Ovary 8 - 10 mm long, linear, glabrous, 7 -12-ovuled; style ca 2 mm long, glabrous. Pods 2.5 4 x 0.3 0.5 mm, spreading or descending, linear, subcylindric, beaked, glabrous, 7 12-seeded, dehiscent. Seeds 1.5 2 x 1 mm, ovoid, dark brown, smooth.

**Type:** India: Mount Nilgerry, 1823, Leschenault 31 (G-DC, holo, seen on microfiche).

**Fls.:** Oct. - May; **Frts.:** Nov. - May.

**Distrib.:** INDIA: Throughout on hills; SRI LANKA, PAKISTAN, NEPAL, BHUTAN, MYANMAR, CHINA, THAILAND, LAOS.

**Habitat:** Slopes of dry hills in deciduous forests, Savannahs, and scrub forests between 100 and 1200 m.
Fig. 10. *Indigofera cassoides* Rottler ex DC. (racemes with sterile bracts at base): a. Habit, b & c. Leaflets, d. Calyx, e. Pod (a,d: *Brandis s.n.*; b-c: from different collections; e. *Sanjappa 9510*).


Pollen: 3-zonocolporoidate, prolate-spheroidal, subprolate, 37 x 34 (33 - 41 x 26 - 34)µm, faint OL (Tiwari & Nair, Jour. Palynol. 15: 49 - 73. 1979)
3-zonocolporoidate, prolate spheroidal, 32 x 29 (30 - 34 x 26 - 32)µm granulate (Vishnu-Mitre & Sharma, Pollen et Spores 4: 5 - 45. 1962) sub I. pulchella.
3-zonocolporate, spheroidal, rarely subprolate 31 x 28.5 (23 - 40 x 23 - 36)µm, perforate (Ferguson & Strachan, & Pollen et Spores 24: 171 - 210. 1982.)

Notes: This species shows great variation in size of leaflets, racemes, flowers and fruits that lead Roxburgh (1832) to describe five species and recently one by Biswas (1983). Ali (1958) after studying the types of all the species involved under I. cassioideae, concluded that they fall into two groups viz., those with sterile bracts ('scales') at the base of racemes and those without sterile bracts. In Roxburgh’s Flora Indica drawings sterile bracts are drawn only in two of the four racemes on the plates of I. purpureascens and I. elliptica. On a critical examination of specimens along with field studies in different parts of India, it was found that the racemes with and without sterile bracts on the same plant or even branches are of common occurrence. However, there are a good number of collections from Maharashtra and Rajasthan (Mt. Abu) which have racemes without sterile bracts. Apart from the absence of sterile bracts no other correlative character is observed in these specimens. Therefore, all the above mentioned taxa are treated as conspecific and thus support de Kort and Thijse’s (1984) view of merging even I. pulchella Roxb., which Ali (1958) considered as a doubtful synonym of I. atropurpurea Buch.-Ham. ex Hornem. In general, this species exhibits reduction in size of different parts of the plant during dry season like majority of Indigofera species in India.


Shrub, 1 2 m high; branches woody, straight, biramous hairs adpressed with equal arms. Leaves 2.5 - 8 cm long including 8 - 12 mm long petiole; stipules 2 - 3 x 0.4 mm, narrowly triangular, adpressed hairy outside, caducous; rachis
1 - 6 cm long, canaliculate above; stipellae ca 0.5 mm long, narrowly triangular; petiolules ca 1 mm long; leaflets 5 - 23, opposite to subopposite, 5 - 25 x 3 - 10 mm, elliptic to obovate, obtuse at base, usually rounded, sometimes emarginate and mucronate at apex, adpressed strigose on both surfaces. Racemes 3.5 - 6 cm long including 5 - 10 mm long peduncle; rachis angular adpressed strigose, many-flowered. Flowers purplish to bluish-pink, 12 - 15 mm long; bracts ca 1 mm long, hairy outside, caduceous; pedicels ca 1.3 mm long, hairy. Calyx ca 3 mm long, adpressed hairy outside; cup ca 1.5 mm long; teeth 1 - 1.5 x 0.6 mm, triangular, lowest tooth the longest. Standard 12 - 15 x 7 mm, narrowly obovate, rounded to obtuse at apex, adpressed white pubescent outside especially towards the tip and middle; wing petals ca 11 x 0.4 mm, glabrous, ciliate along margin; keel petals 12 - 15 x 0.5 mm, adpressed pubescent outside towards the tip. Staminal sheath 12 - 14 mm long; anthers ca 1 mm long, hairy at base. Ovary ca 8 mm long, linear, glabrous, up to 8-ovuled; style 4 - 5 mm long, glabrous. Pods ca 55 x 6 mm, linear, spreading, cylindrical, sharply pointed, finely adpressed pubescent, 6 - 8-seeded, endocarp faintly spotted. Seeds ca 2 x 1 mm, cylindric, smooth, brownish.

Type: India: Himachal Pradesh, Chamba (state), Ravi valley, Chitrari, 6000 ft., 2 May 1920, Parker 2 (K, holo!).

Fls.: May - June; Frts.: May - July.

Distrib.: INDIA: Himachal Pradesh, Uttar Pradesh; endemic.

Habitat: Exposed slopes of the valleys and in pine forests from 1200 to 2500 m.


Note: Dunn (1920) while describing this species distinguished it from I. cassioides (I. pulchella Roxb.) but I. cedorum is more allied to I. heterantha Wallich ex Brandis and differs from it in having larger and less number leaflets, larger flowers and glabrous pods.

Fig. 12. Indigofera cedrorum Dunn: a. Habit, b. Calyx, c. Infructescence (a-b: Rogers s.n.; c: Parker 2, K).
Fig. 13. Indigofera coerulea Roxb. var. coerulea (a-g): a. Habit, b. Leaflet-adaxial surface, c. Leaflet-abaxial surface, d. Calyx, e. Inflorescence, f. Pod, g. Seed. var. monosperma (Santapau) Santapau (h-i): h. Fruiting twig, i. Pod: (a-d: Subramanyam 404; e-g: Talbot 1700; h-i: Shetty 1976).
KEY TO THE VARIETIES

1a. Pods 1 - 4-seeded
h. Pods always 1-seeded

11.1. var. coerulea


Fig. 13 a - g.

_Local names_: Surat indigo (Eng.); Surma, Surma nil (Hindi); Karu nili (Kan., Mar.); Nil (Raj.) Kalaklitaka (Sansk.); Aramuri, Iruppumuri, Katu averi (Tam.); Karu nili, Konda nili, Pedda nili (Tel.).

Shrub, 90 - 150 cm high; stems and branches woody, angular, biramous hairs adpressed white mixed with reddish-brown pearl bodies. Leaves 3 - 7.5 cm long including 1.5 - 2 cm long petioles; stipules ca 2 x 1 mm, subulate, free or connate along inner margin at base, adpressed canescent, caducous; rachis 5 - 8 cm long, adpressed canescent; leaflets 5 - 11, rarely 3, opposite, 2 - 2.7 x 1.5 - 2.5 cm, obovate or obcordate, cuneate at base, obtuse to retuse and mucronate at apex, glabrous above, adpressed pubescent beneath; stipellae ca 1 mm long, canescent, caducous; petiolule 1 - 1.5 mm long. Racemes 6 - 8 cm long, erect, axillary, sessile; rachis white canescent, densely many-flowered to the base. Flowers reddish yellow, ca 4 mm long; bracts 1 - 1.5 x 0.5 mm, ovate, acuminate, pubescent, caducous; pedicels ca 1 mm long. Calyx ca 1.5 mm long, adpressed canescent, cup ca 1 x 1 mm, teeth ca 0.5 mm long, triangular, margined with reddish-brown pearl bodies. Standard 3 3.5 x 2.5 3 mm, ovate-orbicular, rounded at base, obtuse at apex, densely adpressed pubescent outside, covered with pearl bodies at base beneath; keel petals 3 x 1.5 - 2 mm, densely adpressed pubescent outside; lateral spur 1 - 1.5 mm long. Staminal sheath 2.5 - 3 mm long; anthers ca 1 mm long with a tuft hairs on dorsal side, ovary ca 3 mm long, linear with a few hairs on dorsal side, 3 - 4-ovuled; style ca 1 mm long, glabrous. Pods 5 - 15 x 2 - 2.5 mm, divaricate, falcate, torulose, abruptly short apiculate, adpressed canescent, (1 - 2 -) 3 - 4-seeded; endocarp reddish-brown, smooth. Seeds 1.5 - 2 x 1.5 - 2 mm, smooth, truncate at both ends, reddish-brown.

_Type_: Roxburgh, Fl. Ind. Icon 388 (ined. CAL ! K !).

Distrib.: INDIA: Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Sikkim (cultivated), Tamil Nadu and Uttar Pradesh; SRI LANKA (?), PAKISTAN, ETHIOPIA, ERITREA, SOMALILAND, SUDAN, WEST ASIA.

Habitat: Wastelands, agricultural fields, road sides and arid areas up to 900 m.


Chr. No.: 2n = 16 (Singh & Roy, Nucleus 13: 42. 1970); n = 8 (Sanjappa, Taxon 32: 668. 1983).


Notes: For a long time this species was confused with I. articulata Gouan. I. coerulea differs from it in number of leaflets, breadth of the suture and shape of the fruit segment as already pointed out by Gillett (1958).


Erect shrub, 1 - 1.5 m high. Differs from var. coerulea at once by its pods which are 1-seeded, very rarely 2-seeded.

Type: India: Gujarat, Dwaraka, near sea shore, 16 Oct. 1953, H. Santapau 16771 (BLAT, holo !).


Distrib.: INDIA: Gujarat & Rajasthan; endemic.

Habitat: On sea coasts, sandy arid lands.

Exsicc: Gujarat: Dwaraka, 17 Nov. 1953, J.C. Dhruwa 123; Dwaraka, along railway line 22 Aug. 1952, H. Santapau 14680 (BLAT); Kutch, Bhadreswar, 22

*Ch. No.:* n = 8 (Sanjappa, Taxon 32: 668. 1983).

*Uses:* Twigs are used as 'tooth brushes' and is preferred over more commonly used *Acacia nilotica* (Linn.) Delile subsp. *indica* (Benth.) Brenan or *Azadirachta indica* Linn. twigs.

*Notes:* Santapau (*op. cit.*) in his description mentioned that the flowers are ebracteate and petals glabrous except for standard. All specimens known so far under the variety showed bracteate flowers and petals glabrous except for keel petals.


*Local names:* Antu kogge (Kan.), Nai kadugu (Tam.).

Annual, erect herb or subshrub, 10 - 80 cm high; branches terete, biramous hairs adpressed with equal arms, mixed with erect, multicellular gland-tipped hairs. Leaves 10 - 35 mm long including 5 - 12 mm long petiole; stipules 5 - 8 mm long, filiform to linear, spreading, gland-tipped hairy, caducous; rachis up to 3 cm long, pubescent; stipellae absent; petiolules ca 0.5 mm long; leaflets (5 -) 7 - 11 (-15), opposite, 3 - 5.5 x 2 - 5 mm, elliptic to obovate, obtuse at base, obtuse to rounded and mucronate at apex, pale green above, glaucous beneath, medifixed hairs slender, spreading sideways above and stout, densely adpressed, almost parallel to margin beneath, gland-tipped hairy along the margins and midrib. Racemes 3 - 6 cm long; rachis gland-tipped hairy, (5 -) 8 - 12 (-15)-flowered. Flowers pinkish-red, ca 4.5 mm long; bracts ca 1 mm long, narrowly triangular; pedicels ca 1 mm long. Calyx 3 - 3.5 mm long, deeply divided, cup less than 1 mm long. teeth 2.5 - 3 mm long, linear, setaceous,
gland-tipped hairy outside the cup and along the margin of teeth. Standard 4 - 4.5 x 2 - 2.5 mm, obovate, rounded at apex, adpressed strigose, gland-tipped hairy along midrib; wing petals 3.5 - 4 mm long, glabrous; keel petals 3.5 - 4 x 1 - 1.5 mm long, sparsely adpressed strigose, short ciliate along margins; lateral spur less than 1 mm long. Ovary ca 3 mm long, linear, glabrous or sparsely strigose mixed with gland-tipped hairs, 8 - 12-ovuled; style 1 - 1.3 mm long curved. Pods spreading (nearly perpendicular to rachis), 15 - 25 x 1 - 1.5 mm, linear, subcylindric, shortly apiculate, faintly torulose, densely covered with adpressed medifixed and erect gland-tipped hairs, 5 - 12-seeded, sutures thick, endocarp reddish-brown spotted. Seeds 1 - 1.2 x 1 mm, cubical, truncate at both ends, faintly foveolate-reticulate on sides and ends, reddish-brown or brown.


Distrib.: INDIA: almost throughout plains and hills; AFRICA, AUSTRALIA, NEW ZELAND, PAKISTAN, SRI LANKA, CHINA, MYANMAR, INDONESIA, THAILAND, VIETNAM, NEW GUINEA, WEST ASIA.

Habitat: Cultivated fields, dry open areas in scrub jungles, waste lands up to 1000 m.

Exsicc.: Andhra Pradesh: Godavari Dist., Chidur, 29 Sept. 1902, C.A. Barber 4960; Kerala: Travancore, near Mekkarai, 16 Sept. 1913, C.C. Calder & M.S. Ramaswamy 637; Tamil Nadu: Madurai Dist., on way to Sornagar falls, 400 m, K. Subramanyam 8181.

Chr. No.: 2n = 16 sub I. viscosa Lam. (Hagerup, Herditas 16: 23. 1932).

Notes: There are more than 12 synonyms under this species, only those relevant to Indian floras are given here.


Fig. 15, Map 2.
Fig. 15. *Indigofera constricta* (Thwaites) Trimen: a. Habit, b. Calyx, c. Leaflet-adaxial surface, d. Leaflet-abaxial surface, e. Pod, f. Seed-hilar view, g. Seed-side view (a, c-g: Talbot 320; b. Raghavan 97429).
Map 2. Indigofera constricta (Thwaites) Trimen (●); I. cylindracea Graham ex Baker (♦); I. dalzellii T. Cooke (★); I. deccanensis Sanjappa (■); I. dosua var. simlensis (Ali) Sanjappa (★); I. emmae de Kort & Thijssc (▲); I. galegoides DC.(★); I. gangetica Sanjappa (★); I. wightii Graham ex Wight & Arn. (⊙).
Erect shrub, 60 120 cm high; branches divaricate, obscurely angular, scabrous, biramous hairs adpressed with equal arms. Leaves 7 12 cm long including 1.5 mm long petiole; stipules less than 1 mm long, triangular, scabrous, caducous; rachis 5 - 9 cm long; stipellae absent; petioles ca 1.5 mm long; leaflets 7 - 11, opposite, soon deciduous, 2 - 2.7 x 1 - 1.2 cm, elliptic, obtuse to rounded at base, rounded to rarely emarginate and mucronate at apex, dark green above, glaucous beneath, scabrous on both surfaces. Racemes 5 - 10 cm long, axillary; rachis angular, scabrous, many-flowered. Flowers pink, 6 - 8 mm long; bracts ca 1 mm long, triangular, hairy outside, caducous; pedicels ca 1.5 mm long. Calyx ca 1.5 mm long, scabrous outside, cup less than 1 mm long, teeth ca 1 mm long, triangular, acute. Standard 5 - 6.5 x 3 - 4 mm, elliptic to obovate, obtuse to rounded at apex, strigose outside; wing petals 4.5 - 6 x 1.5 mm, ciliate along margins; keel petals 5 - 6.5 x 1.5 - 2 mm, strigose outside, lateral spur 1.5 - 2 mm long. Stamina sheath 5.5 - 6 mm long; anthers ca 2 mm long with a tuft of hairs at base. Ovary 3.5 - 4.5 mm long, linear, strigulose, 6 - 8-ovuled; style 1 - 1.5 mm long, curved, glabrous. Pods 30 - 55 x 3 - 4 mm, spreading, lax, curved, subtetragonal, distinctly constricted between seeds, scabrous, (4 -)6 8-seeded. Seeds ca 2 x 1 mm, ellipsoid, subtetragonal, rounded at both ends, reddish-brown, smooth.

_Type:_ Sri Lanka: Matelle East, _Thwaites_ C.P. 3811 (K, holo ! CAL iso !).


_Distrib.:_ INDIA: Goa, Gujarat(?), Karnataka and Kerala; SRI LANKA.

_Habitat:_ Exposed slopes of hills and as an undergrowth in moist deciduous forests, from 850 - 1200 m.


_Pollen:_ 3-zonocolporoidate, oblate-spheroidal, 30 x 30 µm, granulate (Vishnu-Mittre & Sharma, Pollen et Spores 4: 5 - 45. 1962).

_Notes:_ This species is reported to occur from Nepal (Anonymous, _Fl. Langtang_ 81. 1976) but it is highly unlikely that the species grows in an altogether different habitat with a long gap between Western Ghats and foot hills of Himalayas. So far the species is not collected anywhere in between.