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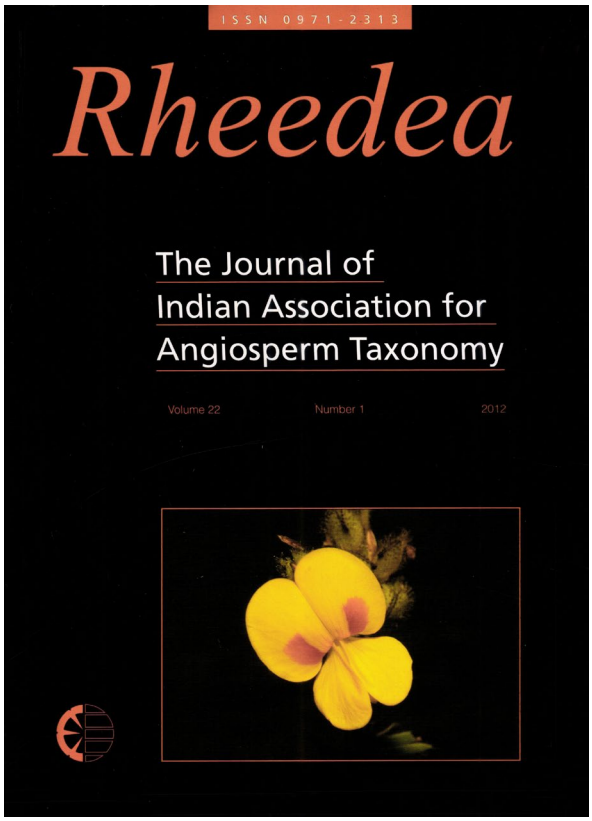

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Section *Ceratotropis* of subgenus *Ceratotropis* of *Vigna* (Leguminosae – Papilionoideae) in India with a new species from northern Western Ghats

M.M. Aitawade*, S.P. Sutar, S.R. Rao[1], S.K. Malik[2], S.R. Yadav and K.V. Bhat[3]
Department of Botany, Shivaji University, Kolhapur – 416 004, Maharashtra, India.
[1]Department of Biotechnology and Bioinformatics, North-Eastern Hill University, Maykynroh, Umshing, Shillong – 793 022, Meghalaya, India.
[2]Tissue culture and Cryopreservation Unit, National Bureau of Plant Genetic Resources, Pusa, New Delhi – 110 012, India.
[3]National Research Centre on DNA Fingerprinting, National Bureau of Plant Genetic Resources, Pusa, New Delhi – 110 012, India.
*E-mail: meetmh@rediffmail.com

Abstract

Section Ceratotropis of subgenus Ceratotropis of the genus *Vigna* Savi in India, along with comparison of selected characters and an artificial key to the species of the section is given. A new species of *Vigna* belonging to the section from northern Western Ghats is described and illustrated. In addition, *V. mungo* var. *silvestris* is raised to species level.

Keywords: India, New Species, Northern Western Ghats, Section Ceratotropis, *Vigna*

Introduction

Vigna Savi is a large pantropical genus with 104 species (Lewis *et al.*, 2005) distributed among 7 subgenera (Maréchal *et al.*, 1978). An excellent account of the Asian *Vigna* subgenus Ceratotropis has been published by Tomooka *et al.* (2002). India, with 24 species of *Vigna* (Sanjappa, 1992), represents secondary centre of species diversity for all the three sections of subgenus Ceratotropis and are also known as Asian *Vigna*. Babu *et al.* (1987) revised Tribe Phaseoleae for India in which 23 species of *Vigna* are described. *Vigna* is considered as a morphologically homogenous group with highly specialized complex floral characters.

The important diagnostic characters in determination of species are the keel pocket size, stigma beak length and shape, flower colour (various shades of yellow); number, size, orientation and surface of pods; seed size, shape, surface, number per pod and aril development and seedling characters (Table 1). In the present study critical observations and analyses of characters of the species belonging to section Ceratotropis resulted in discovery of a new species allied to *V. silvestris* (comb. & stat. nov.) which is described and illustrated here. All the species belonging to section Ceratotropis of subgenus Ceratotropis were grown under identical conditions and it is observed that all taxa maintained their distinct characteristic features.

Vigna sahyadriana Aitawade, K.V. Bhat *et* S.R. Yadav, **sp. nov.** **Fig. 1, 4Aa – d**

Vignae silvestri similis, inflorescentiae maturate leguminibus 7 – 12 (contra 2 – 6) 6 – 6.5 cm longis (contra 3.7 – 4.5) seminibus 10 – 15 (contra 6 – 8) differt. Species ceterae sectionis Ceratotropis (*V. hainiania*, *V. radiata*, *V. subramaniana*) stipulis anguste falcatis (contra late ovatis) seminibus arillatis (contra non-arillatis) differt.

Typus: India, Maharashtra, Satara, Pasarani Ghat, 21 October 2011, *S.P. Sutar* SUKV-156 (Holotypus, CAL; Isotypii, K, BSI, SUK).

A twining herb. Stem slender, 2 – 3 m long, densely covered with 3.5 – 4 mm long, more or less retrorse yellowish brown hairs. Leaves 3-foliolate, 15 – 30 cm long including 9 – 14 cm long petiole; petioles densely covered with 2.5 – 3 mm long yellowish brown hairs; rachis 2 – 2.3

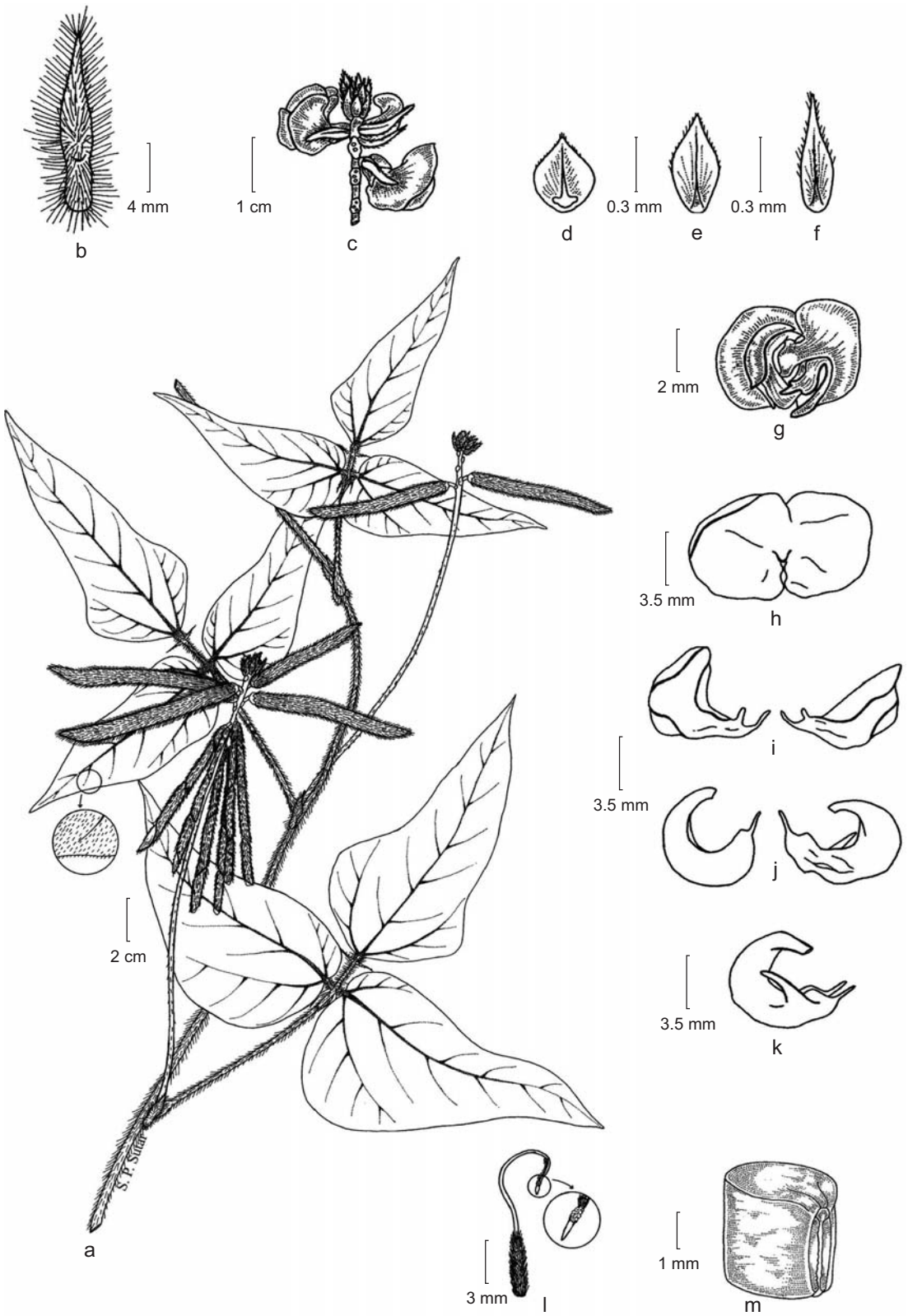

Fig. 1. *Vigna sahyadriana* Aitawade, K.V. Bhat & S.R. Yadav sp. nov.: **a.** Fruiting twig; **b.** Stipule; **c.** Part of inflorescence; **d.** Primary bract; **e.** Secondary bract; **f.** Bracteole; **g.** Flower; **h.** Standard; **i.** Wings; **j, k.** Keel; **l.** Gynoecium; **m.** Seed.

cm long; stipules elliptic, 1.3 – 1.5 × 0.35 – 0.45 cm, peltate, sub-medifixed, prolonged below the point of insertion, obtuse to rounded at base, densely pubescent and ciliate at margins with 2.5 – 3 mm long yellowish white hairs, acute at apex, 8 – 10-nerved. Leaflets membranous, pubescent especially on nerves and at margins with 1 – 2 mm long white hairs; terminal leaflet narrowly ovate to rhomboidal, 11.5 − 12.5 × 6.5 − 7.5 cm, obtuse or rounded at base, acute at apex; lateral leaflets obliquely ovate, 10 − 11 × 6 − 7 cm; stipels narrowly elliptic or linear, 10 − 10.5 × 1 − 1.1 mm with cirrhose apex, ciliate at margins with *c.* 1 mm long yellowish white hairs, glabrous; petiolules *c.* 6.5 mm long, pubescence as on petiole. Racemes axillary, 20 – 22-flowered; peduncles slender, 15 – 21 cm long, sparsely to densely covered with *c.* 2 mm long retrorse yellowish white hairs; rachis 2 – 2.5 cm long. Primary bracts basifixed, ovate, *c.* 4.5 × 2.8 mm, obtuse to cordate at base, ciliate at margins with *c.* 0.4 mm long white hairs, acute at apex, glabrous; secondary bracts basifixed, narrowly ovate to lanceolate, *c.* 5.5 × 2 mm, truncate at base, ciliate at margins with 0.4 – 0.5 mm long white hairs, acute at apex glabrous; bracteoles lanceolate, *c.* 7 × 1.8 mm, ciliate at margins with *c.* 2 mm long yellowish brown hairs, hairy outside; pedicels ascending, 1 – 1.5 mm long in flowers; 2 – 3 mm in fruits. Flowers creamy to yellow. Calyx campanulate, 2.5 – 3 mm long; tube 2 – 2.5 mm long; lobes ciliate at margins with 0.1 – 0.15 mm long white hairs, glabrous. Standard asymmetric, obliquely and transversely broadly elliptic, 6 − 8 × 11 − 13 mm, emarginate at apex; claw *c.* 0.4 mm long; auricle *c.* 12 mm long; right wing petal concealing the upper portion of the keel petals; lamina obliquely obovate, 8 − 10 × 5 − 7 mm; claw 2.2 – 2.5 mm long; auricle 1 – 1.4 mm long; left wing petal spreading; lamina obliquely obovate to elliptic, 8 − 10 × 5 − 6 mm; claw 1.8 – 2 mm long; auricle 1 – 1.2 mm long; keel petals spirally incurved to left; 1.8 – 2 cm long; horn-like pocket on the left keel petal 3.5 – 4.5 mm long. Pistil 15 – 17 mm long; ovary linear, 4.5 − 5 × 1.1 − 1.4 mm, clothed with 0.4 – 0.5 mm long white hairs; ovules 10 – 15, marginal; style filiform, 11 – 12 mm long, very shortly beaked beyond stigma; beak 0.6 – 0.8 mm long; stigma capitate, 0.4 – 0.5 mm. Pods linear, cylindrical, 6 − 6.5 × 0.4 − 0.5 cm, covered with 1.8 – 2 mm long brown hairs when young and turning brownish white or white when mature; seeds 10 – 15, rectangular, *c.* 3 × 2.5 × 2 mm; testa rough, dark brown to maroon; hilum elliptic to linear, *c.* 1.4 × 0.7 mm, protruding; aril well developed, *c.* 1.8 × 0.8 × 0.4 mm, whitish yellow. Germination epigeal; the first and second foliage leaves simple, sessile to sub-sessile, narrowly long-elliptic, 3 − 3.4 × 0.8 – 1 cm, pubescent.

Flowering & Fruiting: August – November.

Habitat: Common in Ghats.

Distribution: India: Maharashtra, Northern Western Ghats.

Etymology: The species is named after the Sahyadri ranges where it occurs.

Note: *Vigna sahyadriana* similar to *V. silvestris* but differs in 7 – 12 mature pods (as against 2 – 6) per infructescence, 6 – 6.5 cm (as against 3.7 – 4.5 cm) long with 10 – 15 (as against 6 – 8)-seeded pods. **Fig. 3** shows differences in the morphology and surface ornamentation of seeds between these two species using SEM. *Vigna sahyadriana* differs from rest of the species of section Ceratotropis, viz., *V. radiata, V. subramaniana* and *V. hainiana* in its narrow falcate (as against broadly ovate) stipules and arillate (as against non-arillate) seeds.

New combination in Vigna section Ceratotropis of subgenus Ceratotropis

Vigna silvestris (Lukoki, Maréchal *et* Otoul) Aitawade, K.V. Bhat *et* S.R. Yadav, **comb. et stat. nov.** **Fig. 2, 3**

V. mungo var. *silvestris* Lukoki & al., Bull. Jard. Bot. Nat. Belg. 50: 390 (1980). Holotype: INDIA, Maharashtra, Khandala, *Le Marchand & Maréchal* 3543 (BR).

This species has been considered a variety of *V. mungo* (*V. mungo* var. *silvestris*), but can readily be distinguished by its weedy twining habit, seeds with distinct rough, very porous or mesh-like surface and their size.

In Asia, the genus *Vigna* section Ceratotropis of subgenus Ceratotropis is represented by 8 species. The present study recognises 7 species (including a new species) from India. Babu *et al.* (1987) and Nayar (1994) reported absence of keel pocket in *V. hainiana*. However, critical observation on various populations of the species showed presence of very short but distinct keel pocket.

Fig. 4 shows the differences exist in the morphology of stipule, flower, pod and seeds between the seven species in section Ceratotropis in India.

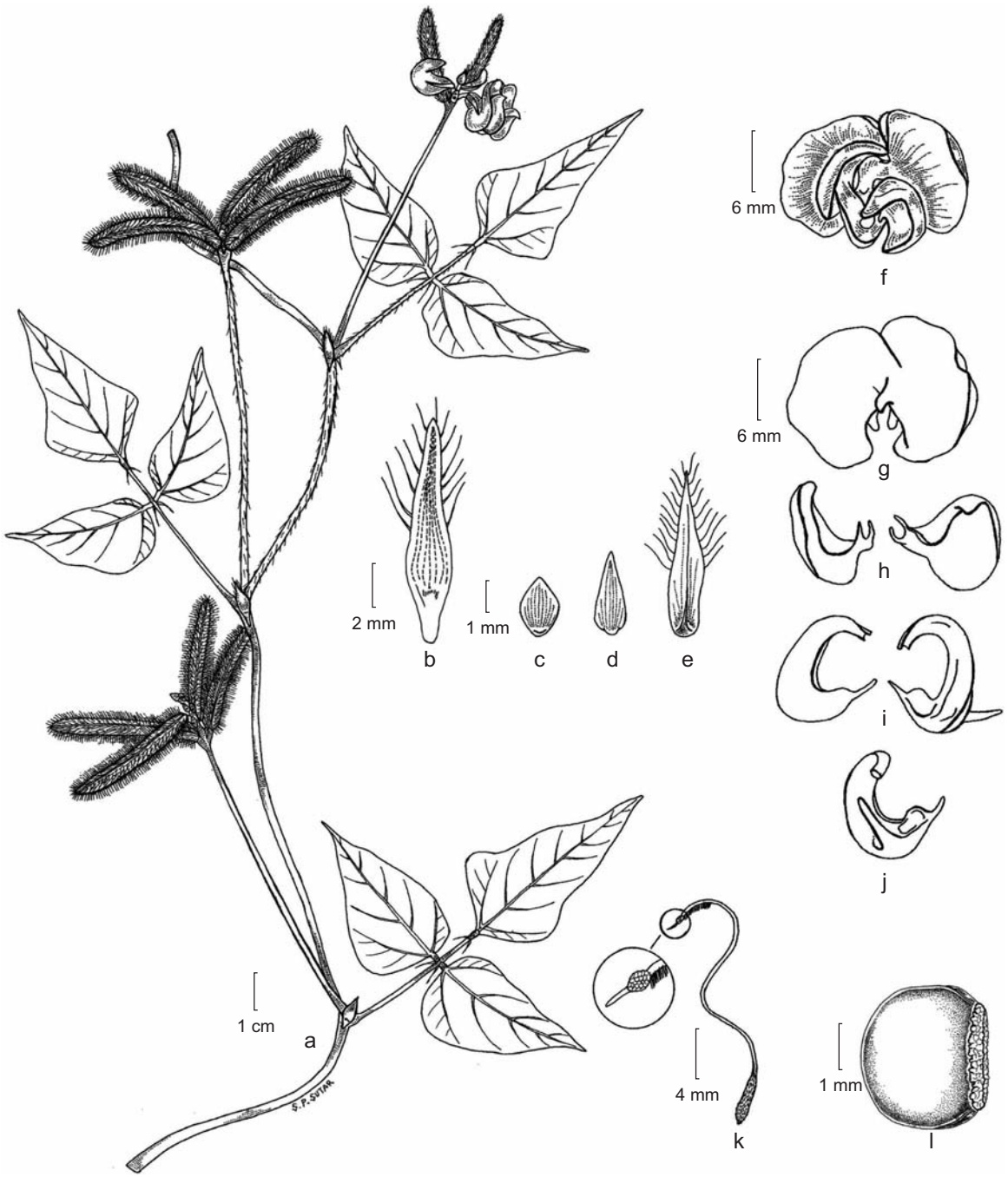

Fig. 2. *Vigna silvestris* Aitawade, K.V. Bhat & S.R. Yadav, comb. & stat. nov.: **a.** Flowering and fruiting twig; **b.** Stipule; **c.** Primary bract; **d.** Secondary bract; **e.** Bracteole; **f.** Flower; **g.** Standard; **h.** Wings; **i, j.** Keel; **k.** Gynoecium; **l.** Seed.

Key to species is given below.

1. Stipules narrow, falcate; seeds with well-developed aril 2

1. Stipules broad, non-falcate; seeds with poorly developed aril or aril absent 4

2. Pods 7 – 12 per infructescence, 6 – 6.5 cm long; seeds 10 – 15 ..... **V. sahyadriana**

2. Pods 2 – 6 per infructescence, 4 – 4.5 cm long; seeds 4 – 8 3

3. Plants cultivated, erect; seeds with obscurely or very thin mesh-like reticulation ..... **V. mungo**

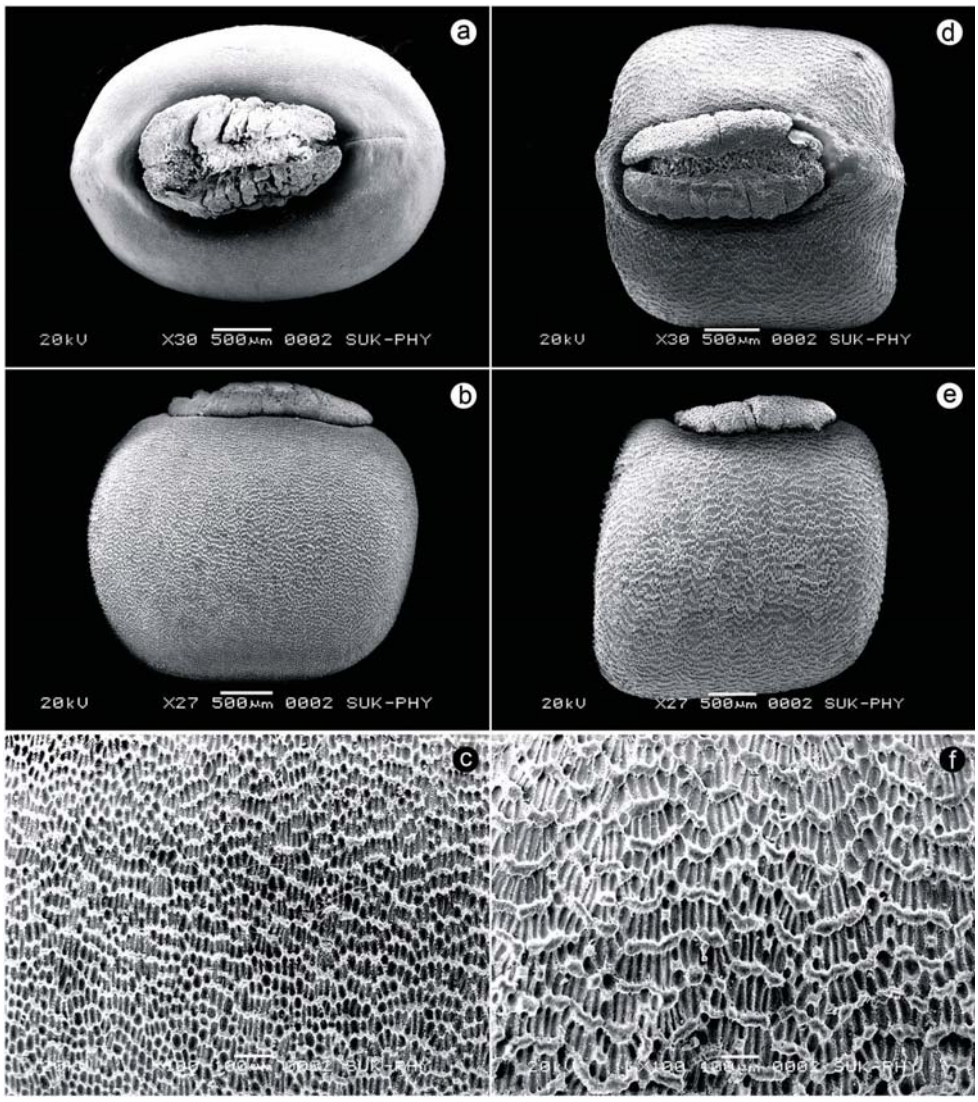

Fig. 3. SEM images of seeds and their surface ornamentation of *Vigna silvestris* (a, b, c) and *V. sahyadriana* (d, e, f).

3. Plants wild, twining; seeds with very porous or mesh-like reticulation ..... **V. silvestris**

4. Leaves velvety; flowers yellow to bright yellow; standard 6 – 6.5 × 10 – 11 mm; keel pocket 1 – 1.5 mm long ..... **V. hainiana**

4. Leaves hairy; flowers pale to greenish yellow; standard 8 – 11 × 11 – 19 mm; keel pocket 2 – 4 mm long 5

5. Flowers greenish yellow; pods 4 – 8 per infructescence, 6 – 6.5 cm long, covered with ferruginous hairs at maturity 6

5. Flowers greenish or pale yellow; pods 1 – 3 per infructescence, 4 – 4.5 cm long, covered with white hairs at maturity ..... **V. subramaniana**

6. Plants cultivated, erect; seeds green or brown-yellow; shiny with smooth surface ..... **V. radiata**

6. Plants wild, twining; seeds dark brown; rough with reticulate surface ..... **V. sublobata**

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Table 1. Comparison of selected characters to distinguish Indian species and varieties of section Ceratotropis of subgenus Ceratotropis of genus Vigna

Characters	***V. sahyadriana*** Aitawade, K.V. Bhat & S.R. Yadav	***V. mungo*** (L.) Hepper	***V. silvestris*** (Lukoki, Maréchal & Otoul) Aitawade, K.V. Bhat & S.R. Yadav	***V. radiata*** (L.) R. Wilczek	***V. sublobata*** (Roxb.) Babu & S.K. Sharma	***V. subramaniana*** (Babu ex Raizada) M. Sharma	***V. hainiana*** Babu *et al.*
Habit	Twining herb	Erect herb	Twining herb	Erect herb	Trailing or twining herb	Trailing or twining herb	Twining herb
Stem	Densely covered with 3.5 – 4 mm long brown hairs	Densely covered with *c.* 2 mm long grey hairs	Sparsely covered with 2 – 2.5 mm long grey hairs	Densely covered with 2 – 3 mm long grey hairs	Densely covered with *c.* 2.5 mm long brown hairs	Sparsely to densely covered with *c.* 2.5 mm long brown hairs	Densely covered with 3 – 3.5 mm long brown hairs
Stipule	Elliptic, 13 − 15 × 3.5 − 4.5 mm; hairs 2.5 – 3 mm long, pale yellow	Narrowly elliptic, 12 − 14 × 3 − 4 mm; hairs 2.5 – 3 mm long, grey	Elliptic, falcate, 8 − 12 × 2 − 2.5 mm; hairs *c.* 2.5 mm long, grey	Ovate, peltate, 8 − 12 × 5 − 6 mm; hairs 1.5 – 2.5 mm long, grey	Ovate, peltate, 10 − 12 × 5 − 6 mm; hairs 1 – 2.5 mm long, grey	Elliptic-ovate, 7 − 8 × 4 − 4.5 mm, hairy at margin; hairs pale 0.6 – 1.2 mm long, brown	Elliptic-ovate, 13 – 16 × 6 − 8 mm; hairs 0.4 – 1 mm long, grey
Leaves	15 – 30 cm long; leaflets covered with 1 – 2 mm long white hairs	27 – 30 cm long; leaflets covered with 0.4 – 1.4 mm long white hairs	12 – 19 cm long; leaflets covered with 0.6 – 1 mm long white hairs	13 – 18 cm long; leaflets covered with 1 – 1.5 mm long white hairs	30 – 32 cm long; leaflets covered with 0.6 mm long white hairs	12 – 16 cm long; leaflets covered with 1.6 – 1.8 mm long whitish brown hairs	10 – 37 cm long; leaflets covered with 0.6 – 1 mm long velvety white hairs
Stipel	Narrowly elliptic or linear, cirrhose, *c.* 10.5 × 1.1 mm	Narrowly elliptic, cirrhose, *c.* 5.5 × 1 mm	Narrowly elliptic, cirrhose, *c.* 5 × 0.7 mm	Linear lanceolate, or linear, *c.* 5 × 1 mm	Narrowly elliptic or linear, cirrhose, *c.* 6 × 1.4 mm	Lanceolate, cirrhose, *c.* 5.5 × 0.4 mm	Linear lanceolate, cirrhose, *c.* 7 × 0.5 mm
Flower colour	Creamy to yellow	Bright golden yellow	Bright golden yellow	Greenish yellow	Greenish yellow	Pale yellow	Yellow to bright yellow
Standard	6 − 8 × 11 − 13 mm	10 − 11 × 19 − 20 mm	10 − 11 × 18 − 19 mm	9 − 10 × 17 − 18 mm	10 − 11 × 18 − 19 mm	7 − 8 × 13 − 14 mm	6 − 6.5 × 10.5 − 11 mm

Keel pocket	3.5 – 4.5 mm long	6 – 6.2 mm long	6.5 – 7 mm long	2 – 4 mm long	2 – 4.2 mm long	2 – 2.2 mm long	1 – 1.5 mm long
Ovary	4.5 − 5 × 1.1 − 1.4 mm	5.5 − 6.5 × 1.5 − 2 mm	3.5 − 4 × 1 − 1.3 mm	6 − 6.5 × 1 − 1.1 mm	7 − 7.5 × 1 − 1.2 mm	6 − 7 × 1 − 1.5 mm	4 − 4.5 × 1 − 1.2 mm
Beak	0.6 – 0.8 mm, slightly flattened	0.6 mm long	0.4 – 0.7 mm, linear	*c*. 0.4 mm long	*c*. 0.5 mm long	*c*. 0.6 mm long	*c*. 0.2 mm long
Pod	7 – 12 per infructescence, 6 − 6.5 × 0.4 − 0.5 cm, sparsely to densely covered with 1.8 – 2 mm long brown hairs, turning brownish white or white at maturity	2 – 6 per infructescence, 4 − 5 × 0.6 − 0.65 cm, sparsely to densely covered with 1 – 2 mm long, brownish white hairs, turning white at maturity	1 – 6 per infructescence, 3.7 − 4.5 × 0.4 − 0.6 cm, densely covered with 3 – 3.5 mm long, white hairs, turning brown at maturity	4 – 6 per infructescence, 6 − 6.5 × 0.4 − 0.45 cm, ferrugenously hairy with 0.5 – 0.9 mm long hairs	4 – 8 per infructescence, 6 − 6.5 × 0.4 − 0.5 cm, ferrugenously hairy with 0.6 – 0.7 mm long hairs	1 – 3 per infructescence, 4 − 4.5 × 0.3 − 0.35 cm, densely covered with *c*. 1 mm long white hairs	2 – 4 per infructescence, 4 − 4.5 × 0.3 − 0.35 cm, sparsely to densely covered with *c*. 0.1 mm long white hairs
Seed	10 – 15 per pod, rectangular, *c*. 3 × 2.5 × 2 mm, rough with wavy projected reticulation	4 – 6 per pod, round or oblongoid, *c*. 4.5 × 3.5 × 3.3 mm, with obscurely or very thin mesh-like reticulation	6 – 8 per pod, round, *c*. 3.2 × 3.1 × 3 mm rough with very porous or mesh-like reticulation	10 – 14 per pod, rectangular to oblongoid, *c*. 3.5 × 3 × 2.7 mm, green, shiny with very obscurely or minutely wavy reticulation	10 – 14 per pod, rectangular, *c*. 3 × 2.7 × 2.5 mm, rough with wavy projected reticulation	9 – 11 per pod, rectangular, *c*. 2.5 × 1.8 × 2 mm, rough with wavy projected reticulation	9 – 13 per pod, elliptic? or round, *c*. 2.5 × 2 × 1.8 mm, with minutely wavy projected reticulation
Aril	Well developed	Well developed	Well developed	Absent	Absent	Absent	Absent
1st and 2nd Seedling leaves	Sessile to subsessile, narrowly elliptic, 3 − 3.4 × 0.8 − 1 cm	Sessile, 3.5 − 4 × 1.3 − 1.5 cm	Sessile, elliptic - ovate, 1.5 − 2.1 × 0.7 − 1.1 cm	Sessile, narrowly elliptic, 2. 2 − 2.5 × 1 − 1.1 cm	Sessile, narrowly ovate, 2.2 − 2.4 × 1.2 − 1.4 cm	Sessile, elliptic, 1 − 1.2 − 0.6 − 0.8 cm	Sessile, narrowly ovate, 1 − 1.2 × 0.6 − 0.7 cm

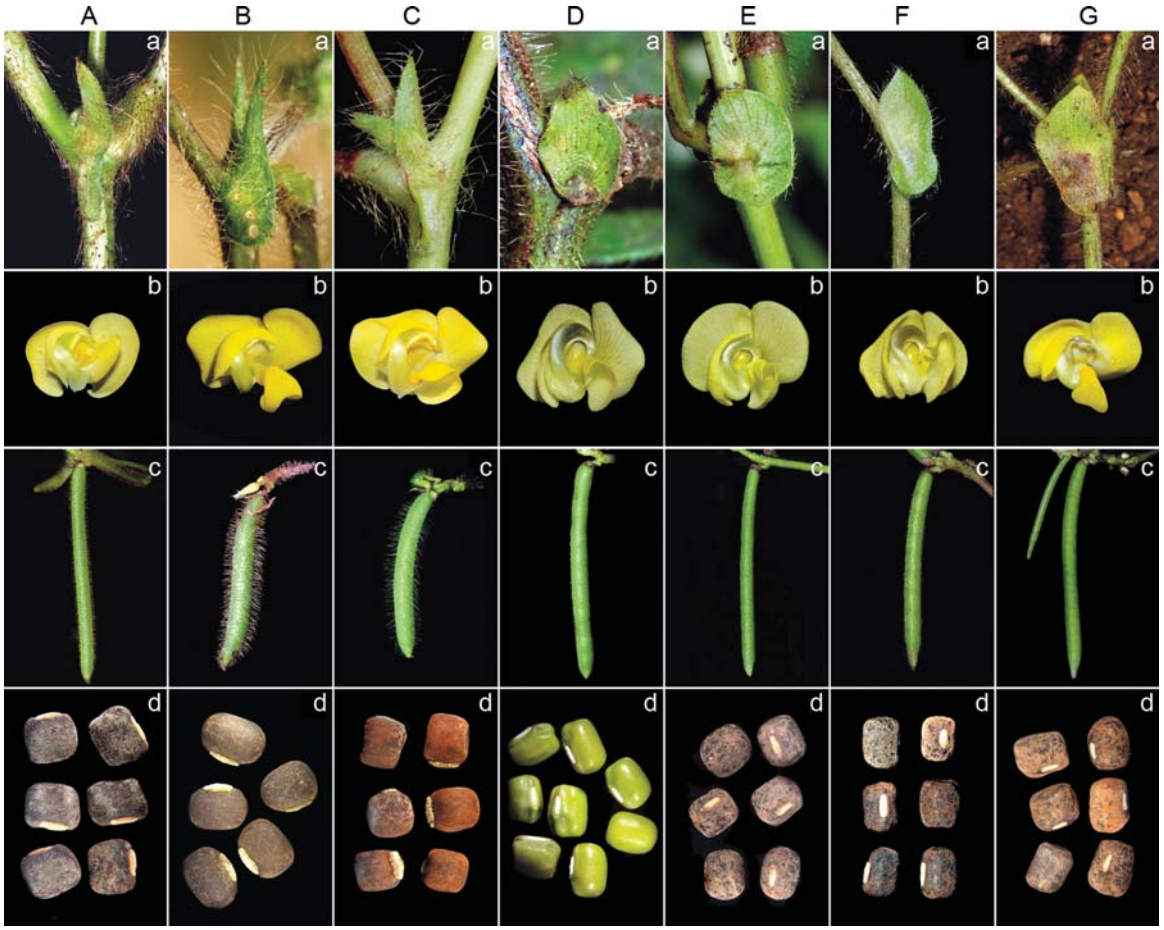

Fig. 4. Comparison of indigenous *Vigna* species of section Ceratotropis: a. Stipules; b. Flowers; c. Pods; d. Seeds.

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