

**FASCICLES
OF
FLORA OF INDIA**

FASCICLE 12

VIOLACEAE

S. P. BANERJEE AND B. B. PRAMANIK

**BOTANICAL SURVEY OF INDIA
P. O. BOTANIC GARDEN
HOWRAH-711 103**

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VIOLACEAE †

Batsch. Tab. Aff. Reg. Veg. 57. 1802 (*Violarie*).

S. P. BANERJEE AND B. B. PRAMANIK*

Annual or perennial herbs, shrubs or undershrubs or rarely trees. Leaves alternate, rarely opposite, simple, entire or lobed, stipulate. Flowers bisexual, hypogynous or slightly perigynous, medianly zygomorphic or actinomorphic, solitary or inflorescence various. Sepals 5, free or slightly connate, usually persistent, imbricate. Petals 5, free, imbricate, usually the lower most spurred and larger than others. Stamens 5, alternate with petals, closely connivent around the pistil, anthers 2-celled, introrse, one of them often spurred. Ovary superior, unilocular, carpels 3-5, placentas parietal with 1-2 or numerous ovules on each; style 1 with stigma of varying shapes. Fruit usually a loculicidal capsule. Seeds with copious fleshy endosperm, embryo straight.

16 genera and about 900 species. Cosmopolitan, tropical and temperate in distribution. Three genera and 40 species are reported from India.

1a. Herbs, sometimes suffruticose. Flowers irregular :

2a. Sepals produced at base; anthers connate ... 3. *Viola*

2b. Sepals not produced at base; anthers free ... 1. *Hybanthus*

1b. Shrubs or small trees. Flowers regular ... 2. *Rinorea*

1. HYBANTHUS

Jacq. Enum. Plant Carib. 2. 1760; Melchior in Engl. & Prantl. Nat. Pflanzenfam. ed. 2. 21 : 357. 1925; Tennant in Kew Bull. 16 : 430. 1963; Hutchinson, Gen. Fl. Pl. 2 : 334. 1967; Jacobs et D. M. Moore in Fl. Males. 7 : 194. 1971. *Ionidium* Vent. Jard. Malm. t. 27. 1803; Bentham in Benth. et Hook. f. Gen. Pl. 1 : 117. 1862; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872.

Herbs or undershrubs. Leaves alternate or rarely sub-opposite to opposite. Stipules persistent, rarely deciduous. Peduncles articulate.

† Editor for the family Violaceae : G. Panigrahi, Botanical Survey of India, Howrah-711 103.

* Botanical Survey of India, Howrah-711 103.

Flowers white to orange or purple, single or several in the leaf axil or racemose. Sepals sub-equal. Petals unequal, the anterior petal sometime small or much enlarged than the rest with prolongation beyond the base, umbonate or somewhat pouch-like, spurred. Stamens free or coherent, anthers free or more or less united, 2 (rarely 4) of them gibbous or spurred. Style clavate, incurved; stigma oblique, anteriorly directed. Capsules elastic, 3-valved.

Distrib. : ca. 150 species, distributed chiefly in the tropical or sub-tropical areas of America, Africa, Asia and Australia. 2 species in India.

- 1a. Seeds conspicuously longitudinally ribbed. Capsules about 5 mm long. Sepals keeled ... 1. *H. enneaspermus*
- 1b. Seeds obscurely ribbed. Capsules about 10 mm long. Sepals not keeled ... 2. *H. travancoricus*

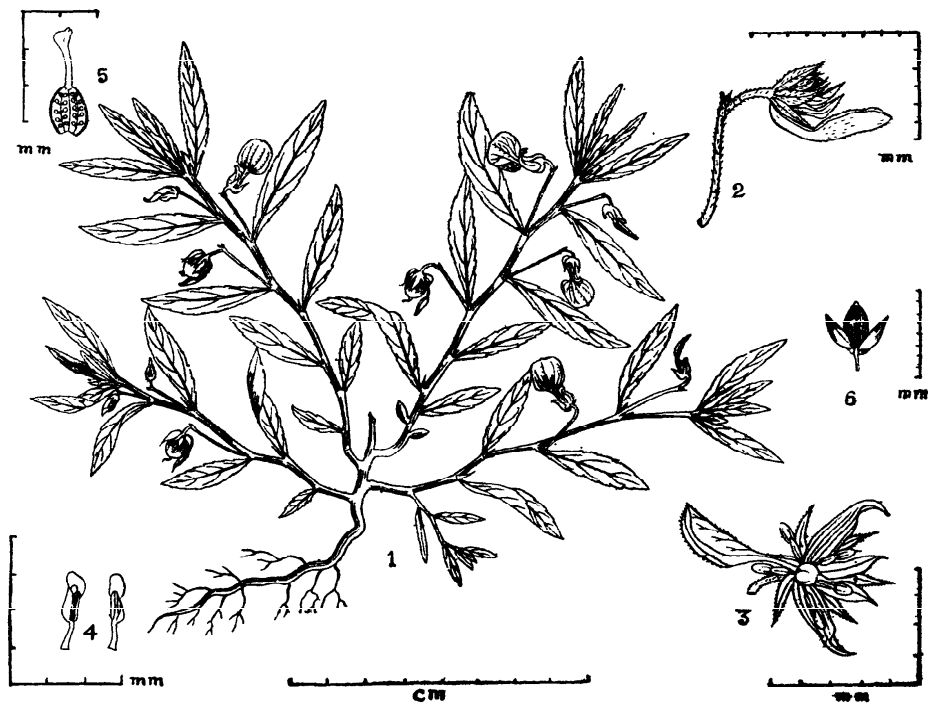
1. *H. enneaspermus* (L.) F. v. Muell. Fragm. 10 : 81. 1876; Tennant in Kew Bull. 16 : 431. 1963; Grey-Wilson in Kew Bull. 36(1) : 103. t. 1. 1981. *Viola enneasperma* L. Sp. Pl. 2 : 937. 1753. *V. suffruticosa* L. Sp. Pl. 2 : 937. 1753. *Ionidium enneaspermum* (L.) Vent. Jard. Malm. Sub. t. 27. 1803; Dalz. et Gibson, Bomb. Fl. 12. 1861 (Repr. ed. 12. 1973). *I. heterophyllum* Vent. Jard. Malm. in addn. sub. t. 27. 1803; Cooke, Fl. Pres. Bomb. 1 : 52. 1901 (Repr. ed. 1 : 55. 1958); Duthie, Fl. Upper Gang. Pl. 1 : 56. 1905 (Repr. ed. 1 : 54. 1960). *I. suffruticosum* (L.) Roem. et Schult. Syst. Veg. 5 : 394. 1819; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872. *I. hexaspermum* Dalz. in Hook. Kew Journ. Bot. 4. 342. 1852; Dalz. et Gibs., Bomb. Fl. 12. 1861 (Repr. ed. 12. 1973).

Figs. 1-6

Ratnapuras (Hind.); *Nunbora* (Beng.); *Tondi-sol*, *Bir-Surajmukhi* (Sant.).

Annual or perennial herbs, spreading or half erect, very variable in habits and in leaf form. Stems pubescent, branched near the base, branches nearly simple. Leaves 2.5-5 (-7) cm × 0.3-0.8 (-1.2) cm, variable, sub-sessile, oblong-lanceolate, mucronate, crenate or serrate, lower leaves broader than upper ones. Stipules 1-2 mm, subulate, peduncles 1-2.5 cm, shorter than the leaves, bi-bracteolate. Flowers red, axillary, solitary. Sepals 2-4 mm, sub-equal, triangular, acuminate. Petals variable, 4 oblong acute or mucronate 2-4 mm the lower petal nearly orbicular, obtuse, reticulate 6-18 mm.

Type : Sri Lanka, *Hermann* s. n. in Vol. 1 : 19 of Hb. Hermann (BM-holo, Photo !).



Hybanthus enneaspermus (L.) F. v. Muell.

Figs. 1-6 : 1. Habit of the plant, 2. Flower, 3. Flower split open.
4. Stamens, 5. Gynoecium, 6. Capsule after dehiscence.

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Andhra Pradesh, Assam, Bihar, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal ; TROPICAL ASIA, AFRICA, AUSTRALIA, AMERICA.

Chr. No. : $n = 16$ (Gupta & Srivastava in Taxon 20 : 609-614. 1971) ; $2n = 32$ (Magenot & Magenot in Rev. Cytol et Biol. Veg. 25 : 411-447. 1962).

Notes : Tennant (*l.c.*) pointed out that Dalzell and Gibson (1861) were the first to unite *V. enneasperma* L. and *V. suffruticosa* L. and adopted the epithet *enneasperma* for the combined species. Grey-Wilson (1981) who recognises 6 varieties in East Africa, considers it as a polymorphic species.

2. *H. travancoricus* (Bedd.) Melchior in Engl. & Prantl. Nat. Pflanzenfam. ed. 2. 21 : 360. 1925. *Ionidium travancoricum* Bedd. Ic. Pl. Ind. Or. 1 : 55. t. 230. 1874 ; Gamble, Fl. Pres. Madr. 1 : 49. 1915 (Repr. ed. 1 : 35. 1957).

Shrubs, up to 1.5 m high. Branches erect, woody, glabrous, terete below, angled towards the apex. Leaves 6-9 cm $\times$ 1.2-2.5 cm, linear lanceolate, sub-sessile, distantly serrated, acuminate, glabrous. Stipules subulate, glandular-puberulous. Peduncles 1-2 cm long, bi-bracteolate towards the apex. Sepals long subulate, recurved. Petals 5, variable, the lower petal with long claw, saccate and furnished with 2-spurs, the others falcate, the upper 2 only ciliate. Stamens 5, the 2 anthers nearest the large petal furnished with a round gibbous spur at the base.

Type : India : Hills of Tinnevely, Travancore, *Beddome* s. n. (Kholo, MH-iso !).

Fls. & Frts. : Aug.-Sept.

Distrib. : INDIA : Kerala (endemic).

Chr. No. : $2n = 32$ (Gadella, Kliphus *et al.* in Acta. Bot. Neerl. 18 : 74-83. 1969).

2. RINOREA

Aubl. Hist. Pl. Guain. Franc. 1 : 235. t. 93. 1775 ; Tennant in Kew Bull. 16 : 409. 1963 ; Hutchinson Gen. Fl. Pl. 2 : 330. 1967 ; Jacobs in Blumea 15(1) : 127. 1967 ; Jacobs et D. M. Moore in Fl. Males. 7 : 181. 1971. *Alsodeia* Thou. Hist. Veg. Austr. Afr. 2 : 55. t. 17-18. 1806 ; Bentham in

Benth. et Hook. f. Gen. Pl. 1 : 118. 1862 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 186, 1872.

Shrubs or small trees. Leaves alternate or rarely opposite, entire or serrate ; stipules deciduous. Peduncles articulate. Flowers regular, solitary or usually racemose, cymose or paniculate, rarely arranged in axillary or terminal cymes. Sepals almost equal, rigid, ciliate. Petals, isomorphic or sub-equal, free, sessile. Stamens inserted on the margin of an annular disc ; connective produced into a long or short, often broad membranous appendage. Ovary tricarpellary ; ovules 1-3, rarely numerous ; style straight ; stigma terminal. Capsules 3-valved, few seeded. Seeds glabrous, rarely woolly with leather like testa.

ca. 200 species, distributed in Sri Lanka, Bangladesh, Burma, Malaysia, Indonesia to N. Australia, Tropical America, Africa, Malagasy. 4 species in India.

1a. Leaves 2-5 cm long ; sub-sessile. Stamens exserted, anthers cohering into a cone ... 2. **R. heteroclita**

1b. Leaves 5-25 cm long ; petiole. Stamens inserted, anthers free :

2a. Flowers fascicled :

3a. Stipules 4-16 mm, distinctly striate. Fruits glabrous ... 1. **R. bengalensis**

3b. Stipules 1.5-6 mm, scarcely striate. Fruits sparsely hairy ... 4. **R. macrophylla**

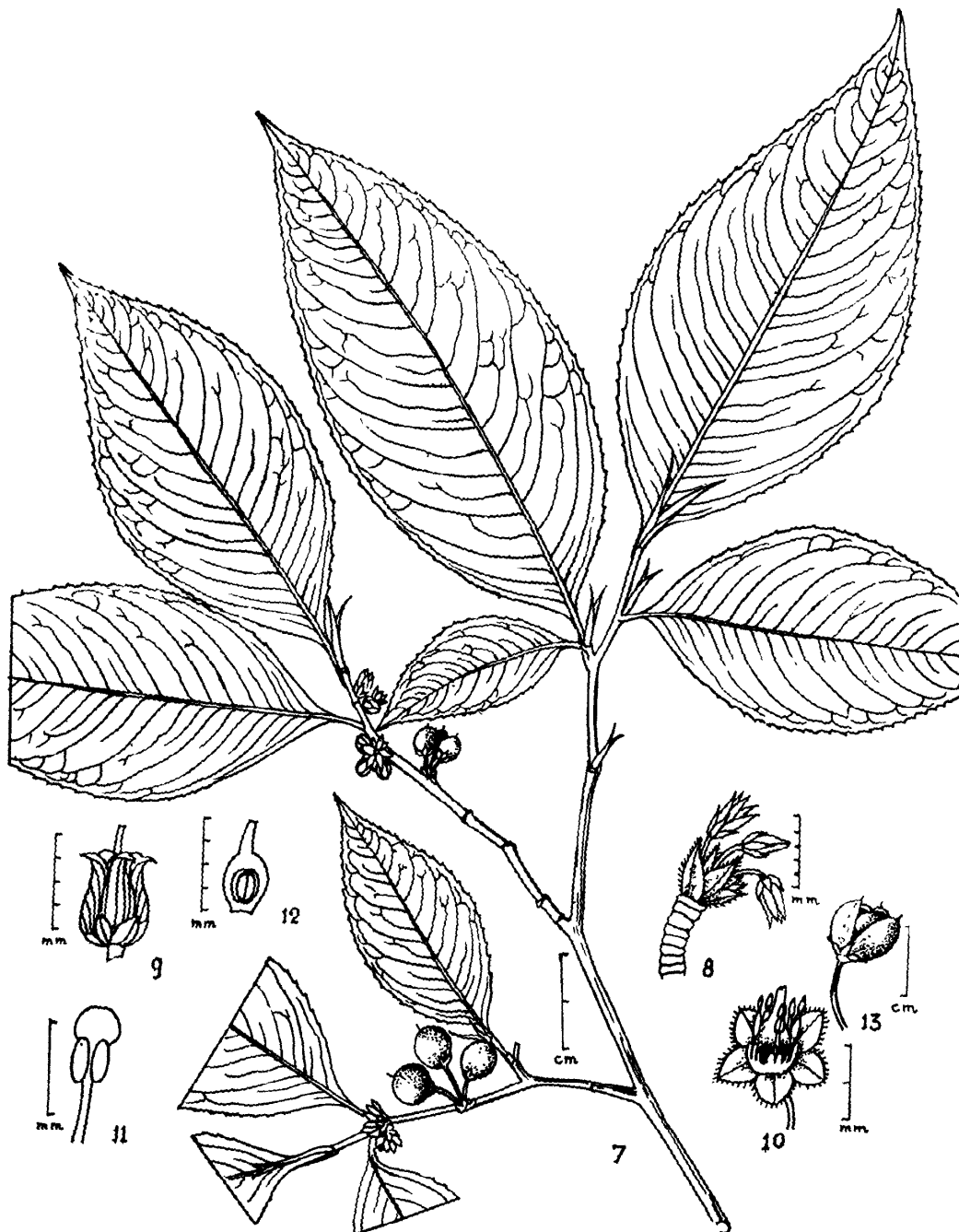
2b. Flowers racemose ... 3. **R. longiracemosa**

1. **R. bengalensis** (Wall.) O. Ktze. Rev. Gen. Pl. 1 : 42. 1891 ; Jacobs in Blumea 15 : 128. 1967 ; Jacobs et D. M. Moore in Fl. Males. 7 : 184. 1971. *Alsodeia bengalensis* Wall. Trans. Med. Phys. Soc. Calc. 7 : 224. 1835 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 186. 1872 ; Kanjilal *et al.* Fl. Assam 1 : 82. 1934. *R. zeylanica* (Arn.) O. Ktze. Rev. Gen. Pl. 1 : 42. 1891. *Pentaloba zeylanica* Arn. Mag. Zool. Bot. 2 : 543. 1837. *Alsodeia zeylanica* (Arn.) Thw. Enum. Pl. Zeyl. 21. 1858 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 187. 1872 ; Gamble, Fl. Pres. Madr. 1 : 49. 1915 (Repr. ed. 1 : 35. 1957).

Figs. 7-13

Branchlets glabrous to puberulous. Leaves elliptic-lanceolate, serrate to somewhat crenate, glabrous except bearded nerve axils beneath, obtuse ; petioles up to 1 cm long. Stipules lanceolate to subulate, 1 cm long. Peduncles up to 1 cm long, bracts basal, acute. Flowers 3 mm in

diam., white. Sepals 2 mm long, broadly ovate, sub-equal. Petals 5 mm long, oblong. Stamens on a thick 5-lobed disc; filaments short expanded at the base, cohering into a tube; anthers oblong, appendage sub-apical, broad hooded. Capsule up to 1 cm in diam., globose.



Rinorea bengalensis (Wall.) O. Ktze.

Figs. 7-13 : 7. A fertile branch. 8. Inflorescence. 9. & 10. Fertile flowers showing the large ovary, style and stigma, and the attachment of the stamens. 11. Stamen. 12. Ovary cut vertically. 13. Capsule after dehiscence.

Type : Bangladesh : Silhet, *Wallich* Num. List. no. 4896 (K-holo, Photo 1).

Fls. & Frts. : Apr.-Nov.

Distrib. : INDIA : Andaman & Nicobar Islands, Assam, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh (Saharanpore, cult.), West Bengal (H. B. C. cult.); SRI LANKA, BANGLADESH, BURMA TO MALAYSIA, AUSTRALIA AND PACIFIC ISLANDS.

Notes : Abundant in the leaf-shedding forests of the Andamans. The leaves, which somewhat resemble those of the tea plant, are said to be used to adulterate tea.

2. *R. heteroclita* (Roxb.) Craib, Fl. Siam. Enum. 89. 1925; Jacobs in Blumea 15 : 136. 1967. *Vareca heteroclita* Roxb. Fl. Ind. 2 : 446. 1824. *Pentaloba roxburghii* Wall. ex Arn. in Mag. Zool. & Bot. 2 : 543. 1837. *Alsodeia roxburghii* Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 186. 1872; Kanjilal *et al.* Fl. Assam 1 : 82. 1934.

Branchlets fulvous-puberulous. Leaves 2.5-6 × 1.5-2 cm, sub-sessile, elliptic lanceolate, cuneate at base, obtuse to apiculate, more or less crenate, glabrous, perforate at nerve axils beneath, tertiary nerves obsolete. Stipules 2-4 mm, subulate, keeled, acute. Flowers 2-3 mm, white, subsessile, axillary, fascicled. Sepals 2 mm, unequal, obtuse. Petals 4-5 mm, lanceolate, revolute above. Capsules 5 mm long, sub-globose, tapering towards apex.

Type : India : Lucknow, *Martin* s. n. [Grown in Calcutta Botanic Garden—(?)]

Fls. & Frts. : Mar.-Apr., extending up to October.

Distrib. : INDIA : Andaman & Nicobar Islands, Assam, Bihar, Uttar Pradesh, West Bengal; BANGLADESH, BURMA, THAILAND, INDONESIA.

Notes : The occurrence of this species in different localities could not be confirmed due to scanty materials. Kanjilal *et al.* (*l. c.*) noted it from Bihar although not mentioned in Haine's work. They say : "appears to have spread from Bengal into South Sylhet, *Wallich*" In *Wallich's* Numerical list the place of collection is not mentioned. On a sheet in Cambridge, Jacobs (*l. c.*) found *W. Gr.* (*W. Griffith*), Serampore. No other collection is available in K & BM except the type.

3. *R. longiracemosa* (Kurz) Craib, Fl. Siam. Enum. 90. 1925; Jacobs *et al.* D. M. Moore in Fl. Males. 7 : 189. 1971; Banerjee *et al.* Pramanik in Bull. bot. Surv. India 21 : 201. 1979 (1981). *Alsodeia longiracemosa*

Kurz in J. As. Soc. Beng. 39(2) : 63. 1870. *A. racemosa* Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 187. 1872; Kanjilal *et al.* Fl. Assam 1 : 83. 1934, *non* Mart. & Zucc. 1824.

Branchlets glabrous. Leaves 5-16 cm × 2.5-5 cm, oblong-lanceolate to elliptic-obovate, acuminate, serrate, glabrous; petioles up to 7 mm, puberulous. Stipules 5 mm, subulate, scariose. Peduncles up to 5 mm bi-bracteolate at the base. Flowers yellowish-white, 3-4 mm in diam. Sepals about 2 mm, ovate, puberulous. Petals 2-3 mm, oblong-obtuse. Stamens : filaments connate at the base, forming a cup with the disc. Capsules up to 1.5 cm long, sub-globose.

Type : Martaban, S. Kurz 41, (NEOTYPE-CAL!).

Fls. : Feb.-Apr.; *Frts.* : Apr.-May.

Distrib. : INDIA : Andaman & Nicobar Islands, Assam; BURMA, MALAYSIA, THAILAND, CAMBODIA, VIETNAM.

Notes : The type of *R. longiracemosa* Kurz viz. *Brandis s. n.* from Martaban could not be traced in K, BM or in any of the Indian Herbaria, although Jacobs (*l. c.*, 1967) suspected its presence in CAL. However, in CAL there is a collection (S. Kurz 41) from Martaban annotated by Kurz. Hence, in absence of the original material this has been designated as the NEOTYPE. (Banerjee & Pramanik, *l. c.*). We could trace no other herbarium specimen from Assam, the type locality of *A. racemosa*. Recently, this species has been collected from Katchal Island in Nicobar (*Chakraborty* 2548 CAL, PBL).

4. *R. macrophylla* (Decne) O. Ktze. Rev. Gen. Pl. 1 : 42. 1891; Jacobs in Blumea 15 : 135. 1967; Jacobs et D. M. Moore in Fl. Males. 7 : 190. 1971; Chakraborty in J. Bombay nat. Hist. Soc. 76 : 212. 1979. *A'sodeia macrophylla* Decne, Ann. Mus. Hist. Nat. Paris 3 : 468, t. 9. 1834.

Branchlets velvety brown to sparsely puberulous. Leaves : obovate, ellipsoid oblong, glabrous to sparsely hairy on the midrib and veins mainly beneath; petiole up to 2 cm long. Stipules up to 6 mm, subulate. Peduncles up to 1 cm, bracts minute triangular. Flowers 2-4 mm in diam., greenish yellow. Sepals sub-equal 2-3 mm bluntly triangular to elliptic. Petals 3-5 mm long, ± hairy outside. Stamens 3-4 mm; filaments cohering into a tube; anthers with broad dorsal appendage. Ovary hairy; style glabrous. Capsule up to 1.5 cm, sub-globose, purplish brown.

Type : Lesser Sunda Islands, Timor, *Riedle* (P).

Fls. & Frts. : Apr.-Nov.

Distrib. : INDIA : Andaman & Nicobar Islands; THAILAND, MALAYSIA.

3. VIOLA

L. Sp. Pl. 933. 1753 ; Gen. Pl. ed. 5 : 402. 1754 ; Bentham in Benth. et Hook. f. Gen. Pl. 1 : 117. 1862 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 182. 1872 ; Hutchinson Gen. Fl. Pl. 2 : 334. 1967 ; Jacobs et D. M. Moore in Fl. Males. 7 : 199. 1971 ; Hara in Fl. East Himal. 3rd report 8 : 82. 1975.

Herbs, often suffruticose, rarely shrubby. Leaves alternate, entire to pinnatisect. Stipules persistent, free or adnate to petiole. Flowers irregular, 1-2 on long axillary bi-bracteolate, non-articulate peduncles, often dimorphic, normal and cleistogamous. Sepals persistent. Petals erect or spreading, the lowest usually largest, spurred, the other 4 flat, sub-equal. Anthers 2-celled, sub-sessile, connivent around the gynoecium, each tipped with a small triangular appendage, the connectives of the lower 2 often produced into spurs within the spur of the corolla. Style straight or curved, often geniculate at base, filiform to clavate. Stigma obtuse, lobed or triangular marginate, $\pm$ truncate, often $\pm$ beaked. Fruit 3-valved loculicidal capsule.

Figs. 14-31

ca. 500 species, distributed chiefly in the temperate regions throughout the world. 35 species in India.

Pollen grains : Spheroidal, furrow generally three, occasionally 4 to 6, long tapering to pointed ends ; furrow membrane smooth, easily ruptured ; germ pore circular or more or less irregular. Exine nearly or quite smooth. (Wodehouse, R. P. in Pollen Grains, 442-444. 1959).

1a. Style globose at top. Lateral petals directed towards the top of the flower. Stipules pinnatifid to palmatifid. Sect. *Melanium* DC.

... 33 *V. tricolor*

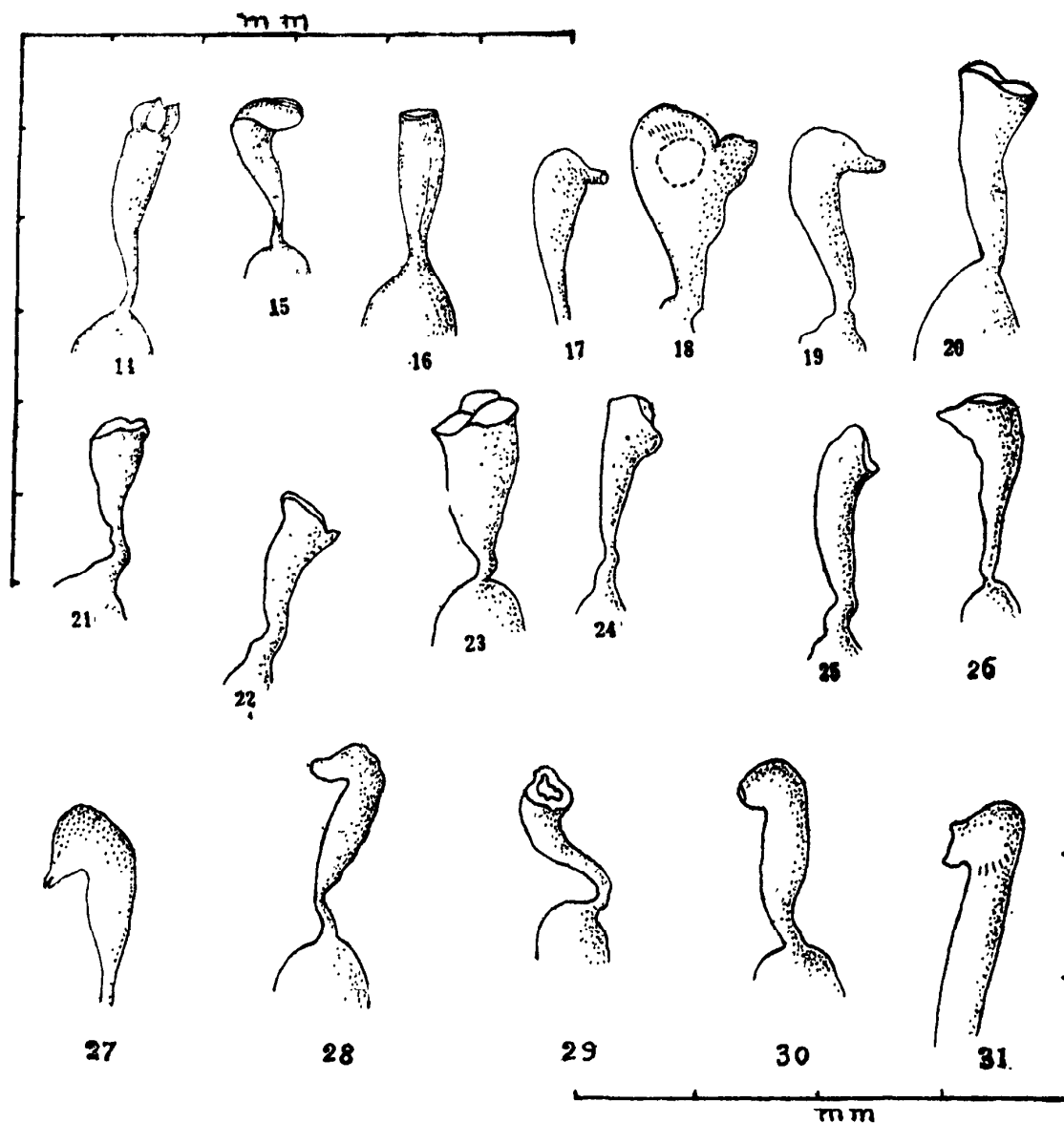
1b. Style not as above. Lateral petals spreading horizontally. Stipules entire to fimbriate :

2a. Stigma beaked, triangular marginate, truncate or sub-truncate. Sect. *Viola* (Syn. *Nomimium* Ging.)

3a. Plants with superterranean, decumbent or ascending stems or stolons. Stipules free from petioles :

4a. Stipules entire or with a few short teeth. Top of style with two laterally patent lobes :

5a. Leaves cordate-reniform, petioles not or scarcely winged :



Style and stigma of Indian taxa of *Viola*.

Figs. 14-31 : 14. *V. biflora*. 15. *V. cinerea* var. *stocksii*. 16. *V. canescens*. 17. *V. sylvatica*. 18. *V. tricolor*. 19. *V. odorata*. 20. *V. macroceras*. 21. *V. diffusa*. 22. *V. betonicifolia*. 23. *V. philippica*. 24. *V. inconspicua*. 25. *V. hamiltoniana*. 26. *V. pilosa*. 27. *V. indica*. 28. *V. hookeri*. 29. *V. glaucescens*. 30. *V. kunawarensis*. 31. *V. fedtschenkoana*.

- 6a. Stems with underground tubers ... 3. *V. bulbosa*
ssp. *tuberifera*
- 6b. Stems without underground tubers
... 10. *V. hamiltoniana*
- 5b. Leaves elliptic-ovate to oblanceolate, petioles conspicuously winged :
 - 7a. Peduncles bi-bracteolate at the middle
... 7. *V. diffusa*
 - 7b. Peduncles bi-bracteolate at the top
... 6. *V. cinerea* var. *stocksii*
- 4b. Stipules with long acute teeth or fimbriate. Top of style without laterally patent lobes :
 - 8a. Leaves ovate or ovate-oblong, from a deeply cordate base :
 - 9a. Flowers up to 1 cm in diam. Stipules foliaceous, up to 3.5 cm long ... 17. *V. jordani* var. *falconeri*
 - 9b. Flowers up to 2 cm in diam. Stipules membranaceous, up to 1.5 cm long :
 - 10a. Style swollen upwards, erect :
 - 11a. Peduncles bi-bracteolate at or below the middle :
 - 12a. Sepals acute :
 - 13a. Leaves canescent, obtuse
... 5. *V. canescens*
 - 13b. Leaves pilose or glabrous, acute to prolonged acuminate :
 - 14a. Spur 5 mm. Leaves acute to acuminate, deeply cordate at base
.. 24. *V. pilosa*
 - 14b. Spur 2-3 mm. Leaves prolonged acuminate, widely cordate at base
... 26. *V. pogonantha*

- 12b. Sepals obtuse . . . 30. *V. suavis*
- 11b. Peduncles bi-bracteolate above the middle :
 - 15a. Spur up to 2 mm :
 - 16a. Lateral petals bearded at base . . . 25. *V. placida*
 - 16b. Lateral petals not bearded at base :
 - 17a. Petioles shorter than the lamina . . . 35. *V. yunnanensis*
 - 17b. Petioles more than twice longer than the lamina . . . 13. *V. hossei*
 - 15b. Spur 3-5 mm :
 - 18a. Stigma marginate, not papillose hairy . . . 32. *V. thomsonii*
 - 18b. Stigma beaked, not marginate, papillose hairy . . . 27. *V. reichenbachiana*
- 10b. Styles not swollen upwards, decurved :
 - 19a. Sepals acute . . . 15. *V. indica*
 - 19b. Sepals obtuse . . . 21. *V. odorata*
- 8b. Leaves ovate-orbicular, base weakly cordate :
 - 20a. Peduncles bi-bracteolate at or below the middle :
 - 21a. Sepals acute . . . 9. *V. glaucescens*
 - 21b. Sepals obtuse . . . 20. *V. moupinensis*
 - 20b. Peduncles bi-bracteolate above the middle :
 - 22a. Spur 3-5 mm :
 - 23a. Stipules fimbriate . . . 31. *V. sylvatica*

- 23b. Stipules $\pm$ lobed at the apex with
a few lateral narrow teeth
... 28. *V. rupestris*
- 22b. Spur 1-2 mm :
 - 24a. Lamina silvery white beneath, veins
raised below ... 29. *V. sikkimensis*
 - 24b. Lamina not silvery white beneath,
veins not raised below
... 12. *V. hookeri*
- 3b. Plant without superterranean stems or stolons. Stipules
 $\pm$ adnate to the petioles :
 - 25a. Leaves deltoid or deltoid-ovate, rather acute usually
with a truncate, shallowly cordate base and widely
divergent basal lobes :
 - 26a. Flowers up to 1.5 cm across :
 - 27a. Calycine appendages up to 5 mm, incised,
often $\frac{1}{2}$ as long as sepals
... 14. *V. inconspicua*
 - 27b. Calycine appendages up to 2 mm, rounded,
nearly $\frac{1}{3}$ as long as sepals
... 1. *V. betonicifolia*
 - 26b. Flowers up to 6 mm across ... 16. *V. jangiensis*
 - 25b. Leaves ovate-oblong to orbicular, often broadly
rounded at apex with $\pm$ deeply cordate base and little
divergent or sub-converging basal lobes :
 - 28a. Sepals ovate, ovate-lanceolate, obtuse :
 - 29a. Capsules 1 cm long :
 - 30a. Lateral petals bearded at base
... 19. *V. macroceras*
 - 30b. Lateral petals not bearded at base :
 - 31a. Spur curving downwards
... 23. *V. philippica*
 - 31b. Spur curving upwards
... 22. *V. paravaginata*

- 29b. Capsules 3 mm long
... 18. *V. kunawarensis*
- 28b. Sepals linear-lanceolate, acute to acuminate
... 8. *V. fedtschenkoana*
- 2b. Stigma not beaked, of two laterally patent lobes. Sect. *Dischidium*
Ging. :
- 32a. Leaves reniform to rotundate :
- 33a. Spur 2 mm. Sepals linear-oblong, obtuse
... 2. *V. biflora*
- 33b. Spur 5-6 mm. Sepals subulate, acute
... 34. *V. wallichiana*
- 32b. Leaves ovate-lanceolate :
- 34a. Sepals 3 mm, linear, obtuse
... 4. *V. cameleo*
- 34b. Sepals 5 mm, ovate-oblong, acute
... 11. *V. hediniana*

1. *V. betonicifolia* J. Sm. in Rees. Cyclop. 37 : *Viola* n. 7. 1819.

Leaves in rosette, variable : lamina 1.5-8 × 0.5-3 cm, roundish obtuse to ± sub-acuminate, crenate with rounded or blunt teeth or rarely ± serrate ; petioles 2-10.5 cm, ± winged above. Stipules 0.5-1.5 cm, ovate-lanceolate, acuminate, adnate up to the middle point. Peduncles equalling or exceeding leaves. Flowers white to purple with darker veins. Sepals 4-8 mm, ovate to ovate-lanceolate, acute or acuminate. Petals up to 1.5 cm, obovate-oblong, laterals usually bearded at the base ; spur 2-6 mm, cylindrical, straight or slightly upcurved. Style 3 mm, ± geniculate at base, clavate above. Capsules up to 1 cm, ellipsoid to oblong, glabrous.

Notes : The holotype of *V. patrinii* DC. from Siberia (G) has been examined. It is restricted to Siberia, Manchuria and N. Japan and is distinguished from *V. betonicifolia* by its deep violet to dark coloured rhizomes, fairly small, white to yellowish flowers with purple striations and smaller spurs.

The plant occurring in the Western Himalayas with larger flowers, longer spurs and ovate-oblong to lanceolate leaves is *V. betonicifolia* ssp.

jaunsarensis (W. Beck.) Hara. It may be distinguished from *ssp. betonicifolia* as follows :

- 1a. Lamina linear-lanceolate to triangular-ovate. Flowers up to 1.5 cm across. Sepals 8 mm, oblong. Spur 2-4 mm ... *ssp. betonicifolia*
- 1b. Lamina ovate-oblong to broadly lanceolate. Flowers 2 cm across. Sepals 4-6 mm, lanceolate. Spur 5-6 mm ... *ssp. jaunsarensis*

ssp. betonicifolia. *V. betonicifolia* J. Sm.; Jacobs et D. M. Moore in Fl. Males. 7 : 202. 1971; Hara in Univ. Mus. Univ. Tokyo 8 : 82. 1975. *V. betonicifolia* J. Sm. *ssp. nepalensis* (Ging.) W. Beck. in Engl. Bot. Jahrb. Beibl. 120, 54 : 167. 1917. *V. patrinii* DC. var. *nepalensis* Ging. in DC. Prodr. 1 : 293. 1824. *V. patrinii* sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872, *pro max: p.*, non DC. (1824).

Lamina 2-8 × 1-3 cm, glabrous to more or less pubescent; petioles 4-10 cm, usually winged above. Stipules 0.5-1 cm, ovate-lanceolate, acuminate, sparsely short-fimbriate. Peduncles 5-15 cm, bi-bracteolate at the middle. Flowers lilac. Petals up to 1 cm.

Type : Australia, Botany Bay, Port Jackson, N. S. Wales, *Dr. White ?* (*n. v.*).

Fls. : Jan.-Apr.; *Frts.* : Mar.-June; often extending throughout the year.

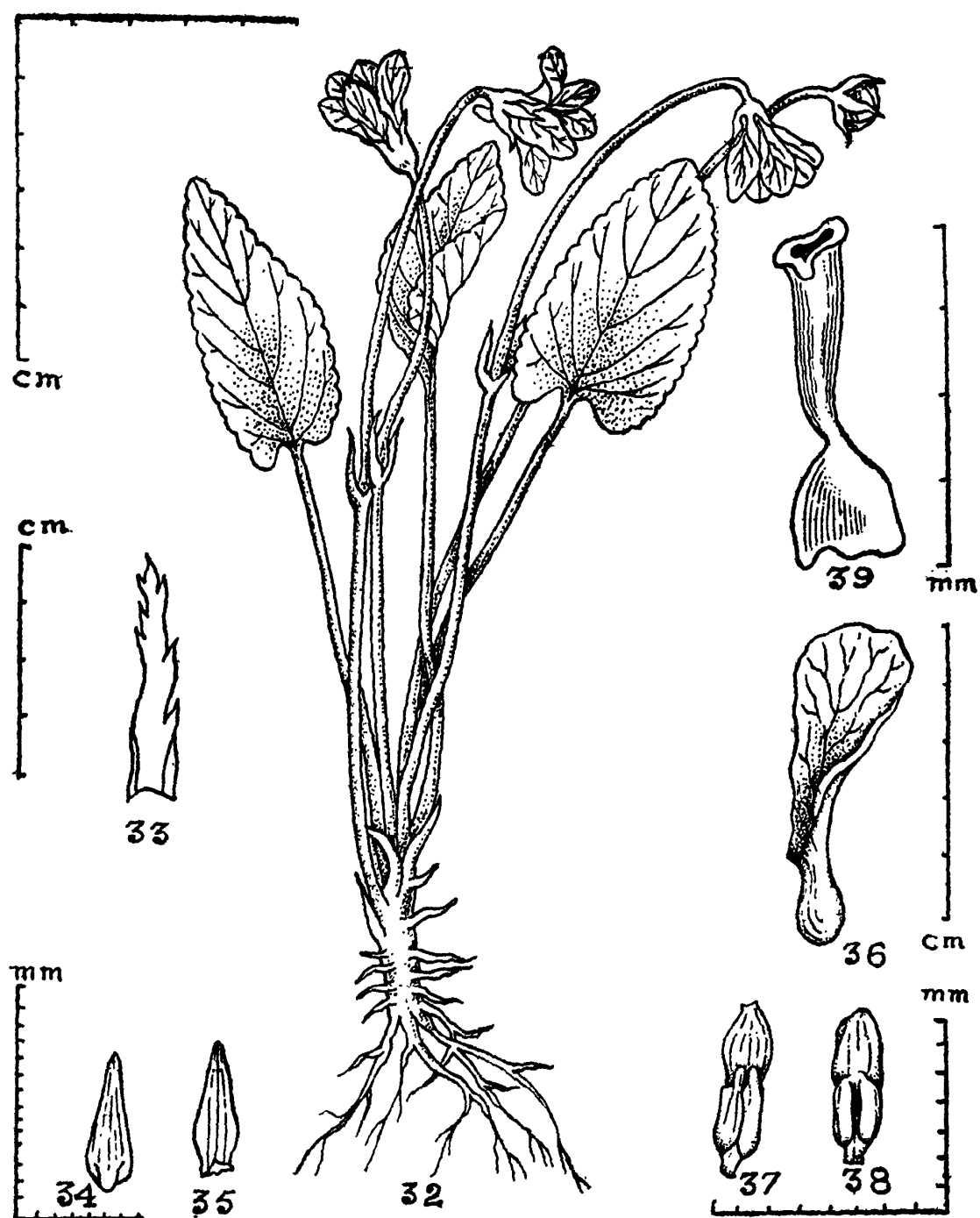
Distrib. : INDIA : Arunachal Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and W. Bengal; AFGHANISTAN, PAKISTAN, SRI LANKA, NEPAL, BHUTAN, BANGLADESH, CHINA to S. JAPAN, BURMA, MALAYSIA to AUSTRALIA.

Uses : Plants bruised and applied to ulcers and foul sores. Flowers—in China, Indo-China and Malaya are said to purify blood.

Chr. No. : $2n = 48, 72$ (Moore in Fedde, Rep. 68 : 84. 1963); $2n = 24$ (Miyaji in Cytologia 1 : 28-58. 1929).

ssp. jaunsarensis (W. Beck.) Hara in J. Jap. Bot. 49(5) : 133. 1974. *V. prionantha* Bunge. *ssp. jaunsarensis* W. Beck. in Engl. Bot. Jahrb. Beibl. 120. 54 : 181. 1917. *V. patrinii* DC. var. *suaveolens* Watt in J. Linn. Soc. 18 : 379. 1881. *V. kashmiriana* W. Beck. l. c. 120. 54 : 182. 1917, *nomen illegit.*

Figs. 32-39



Viola betonicifolia J. Sm. ssp. *jaunsarensis*
(W. Beck.) Hara

Figs. 32-39 : 32. Habit of the plant. 33. Stipule. 34 & 35. Dorsal and ventral view of the calyx. 36. Spur. 37 & 38. Dorsal and ventral views of stamen. 39. Gynoecium.

Lamina $2.5.5 \times 1.3$ cm, $\pm$ hirsute, petiole 2-8 (-12) cm. Stipules 1-1.5 cm, oblong-acuminate, shortly dentate. Peduncles up to 8(-12) cm, bi-bracteolate at or slightly below the middle. Petals 1.5 cm.

Type : India : Konain, Jaunsar, J. F. Duthie 12963 (CAL-holo !, BM-iso !).

Fls. & Frts. : Apr.-July.

Distrib. : INDIA : Himachal Pradesh, Jammu & Kashmir and Uttar Pradesh ; AFGHANISTAN, PAKISTAN.

Notes : The type sheet of *V. patrinii* var. *suaveolens* Watt in Herb. BSIS Calcutta with G. Watt's annotations consists of specimens under three different field numbers—686, 970 & 2097, collected at different times from Nag Konda forests, Chamba, N. W. Himalaya mounted on single sheet. Of these, G. Watt 2097 with field notes is chosen here as the lecto-type of var. *suaveolens*. This same specimen (viz. Watt 2097) was described as *V. kashmiriana* by W. Becker.

2. *V. biflora* L. Sp. Pl. 2 : 936. 1753 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 182. 1872 (excl. syn. *V. wallichiana* Ging. et *V. reniformis* Wall.) ; Jacobs et D. M. Moore Fl. Males. 7 : 201. 1971. *V. biflora* var. *platyphylla* Franchet Pl. Delavay 73. 1889 ; W. Beck. in Beih. Bot. Centralbl. Abt. 2. 36 : 42. 1918, syn. nov. *V. biflora* var. *hirsuta* W. Beck. l. c. syn. nov.

Herbs, glabrous or pubescent. Stem 6-30 cm, erect or decumbent. Leaves : lamina $1.6 \times 0.8-4$ cm, reniform to broadly ovate cordate, crenate, glabrous to hirsute ; petioles 1-6 (-10) cm, slender. Stipules up to 8 mm, ovate denticulate, sometimes leafy. Peduncles 1-10 cm, bi-bracteolate above the middle. Flowers 1.5 cm across, spreading, yellow. Sepals up to 7 mm. Petals 1.5 cm long, elliptic-obovate, the lower petal streaked with black and brown purple nerves. Capsules up to 1 cm, oblong.

Type : Lappd. 1052. 16/17 (LINN-holo, photo !)

Fls. : Apr.-Aug. ; *Frts.* : July-Oct.

Distrib. : INDIA : Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Uttar Pradesh, West Bengal ; PAKISTAN, NEPAL, BHUTAN, AFGHANISTAN, EASTERN & NORTHERN ASIA, U.S.S.R., TEMPERATE EUROPE, N. AMERICA.

Uses : Plant medicinal : roots emetic, flowers antiseptic, leaves laxative (Chopra et al. in Gloss. Med. Pl. 255. 1956).

Chr. No. : $2n = 12$ (Clausen in *Hereditas* 8 : 1. 1926); $2n = 48$ (Taylor & Mulligan, Queen's Printer, Ottawa : 148. 1968); $2n = 12$ Miyaji in *Cytologia* 1 : 28-58. 1929); $2n = 12$ (Kobayashi in *J. Jap. Bot.* (47 : 171-179. 1972); $2n = 12, 20$ (Chatterjee & Sharma in *J. Genet.* 61 : 52-63. 1973).

Pollen grains : 3(4) zonocolporate, prolate spheroidal ($34 \times 32\mu$). Endocolpium very faintly demarcated. Exine 1μ thick, psilate. (Nair, P. K. K. in *Pollen grains*, Bombay : 13. 1965).

Notes : W. Becker (1918) included most of the himalayan materials having reniform leaves, much broader than long under *V. biflora* var. *platyphylla*. We have examined these materials and also materials from type locality and considered this as intergrading character of the species and does not warrant the erection of a varietal status.

3. *V. bulbosa* Maxim. ssp. *tuberifera* (Franch.) W. Beck. in *Beih. Bot. Centralbl.* Abt. 2, 34 : 418. 1917. *V. tuberifera* Franch. in *Bull. Soc. Bot. France* 33 : 410. 1886 et in *Pl. Dalavay.* : 70 t. 19a. 1889; Hara in *Fl. East. Himal.* 2 : 82. 1971.

Stems 1-6 cm, stoloniferous. Leaves : lamina 1-3 cm broad, orbicular reniform, rounded obtuse, or broadly ovate-cordate, crenate : petioles 1-4 cm long, $\pm$ winged above. Stipules up to 1 cm, oblong-acuminate, entire, $\pm$ adnate at base. Peduncles up to 6 cm, bi-bracteolate above the middle. Flowers 7 mm, across, white with purple veins. Sepals 4 mm, acute, lanceolate. Petals 7 mm, lower spurred, spur 2 mm. Style clavate, narrowed downwards from a shortly winged, minutely beaked stigma. Capsules 4 mm in diam., sub-globose.

Type : China : Mount Hee-chan-men, Yunnan, *Delavay* 40, 249, 1095 (P-syntype).

Fls. & Frts. : May-June.

Distrib. : INDIA : Himachal Pradesh, Sikkim; NEPAL, BHUTAN, CHINA.

Notes : An examination of the iso-type of *V. bulbosa* Maxim. ssp. *bulbosa* in CAL, collected from Kansu, China by *Przewalski* reveals that ssp. *bulbosa* is distinguished from ssp. *tuberifera* by its ovate-cordate leaves with leaf-base attenuated to a wing $\pm$ as long as the petiole.

The unique feature of both the sub-species is production of small bulbs and suprabulbous 1-5 cm long stems.

4. *V. cameleo* Boiss. in Bull. Herb. Boiss. ser. 2, 1 : 1074. 1901 ; W. Beck, in Beih. Bot. Centralbl. Abt. 2, 36 : 45. 1918 ; Hara in Fl. East. Himal. 1 : 212. 1966.

Rhizome slender, scaly. Stolons 20-40 cm long. Leaves : lamina 1.5-2.5 cm $\times$ 1-2.3 cm, ovate-cordate, crenate-serrate, prolonged acute to $\pm$ acuminate, sparsely strigose above. Petioles up to 7 cm in basal, leaves, much smaller in upper cauline ones. Stipules 3 mm long, ovate-acute, $\pm$ foliaceous. Peduncles 2.5 cm, bi-bracteolate above the middle. Flowers 1.5-2 cm across, deep or pale yellow with slight violet tinge or entirely violet. Petals 1 cm, obovate-oblong, striate ; spur 4 mm, erect. Stigma bi-lamellate $\pm$ oblique, lobes dilated. Fruit not seen.

Type : China, Tachen-Keou-lin. *R. P. Farges* s. n. (P-holo !).

Fls. : Apr.-May.

Distrib. : INDIA : Sikkim ; CHINA.

Notes : This species allied to *V. hediniana* W. Beck. is first recorded from Eastern Himalaya by Hara (*l. c.*) but there is a collection from Lachen, Sikkim in May 1885 by King's Collector s. n. Acc. no. 31233 in CAL.

5. *V. canescens* Wall. in Roxb. Fl. Ind. 2 : 450. 1824 ; Hara in Bull. Univ. Mus. Univ. Tokyo 8 : 83. 1975. *V. serpens* Wall. var. *canescens* Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 184. 1872.

Stems often none, or producing runners instead of leafy stolons. Leaves : lamina 1.5-4 $\times$ 1.5-5 cm, ovate-cordate to sub-reniform, obtuse, serrate-crenate, petioles 2-10 cm, retrorse-pubescent. Stipules up to 1 cm, lanceolate, deeply fimbriate. Peduncles up to 10 cm, bi-bracteolate at about the middle. Flowers 1.5 cm in diam., pale violet. Sepals 6 mm, oblong-acute, pubescent, trinerved. Petals up to 1.6 cm, obovate-oblong, the lowermost shorter than the rest, terminating in a 3 mm long spur. Ovary villous ; style clavate ; stigma truncate, oblique. Capsule 4 mm in diam., sub-globose, pubescent.

Type : Nepal, Wallich Num. List. no. 1442 (K-holo, CAL-iso !).

Fls. & Frts. : Mar.-June, extending up to Sept.-Oct.

Distrib. : INDIA : Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal ; NEPAL, BHUTAN. BURMA, EASTERN ASIA.

Notes : This taxon is readily distinguished from *V. serpens* Wall.

(= *V. pilosa* Bl.) by its glaucous pubescence, broadly ovate-cordate to sub-reniform obtuse leaves and deeply fimbriate stipules.

6. *V. cinerea* Boiss. var. *stocksii* (Boiss.) W. Beck. in Beih. Bot. Centralbl. Abt. 2, 36 : 37. 1918. *V. stocksii* Boiss. Fl. Orient. 1 : 453. 1867 ; Cooke, Fl. Pres. Bombay 1 : 51. 1901. *V. cinerea* sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872. *non* Boiss., 1867. *V. cinerea* ssp. *kathiawarensis* W. Beck. l.c. 34 : 245. 1916. *V. cinerea* var. *stocksii* f. *kathiawarensis* W. Beck. l.c. 36 : 37. 1918. Santapau in Fl. Saur. 20. 1962.

Banafsha, *Zinkobanaphsha* (Punj. & Guj.).

Herbs, suffruticose. Stems 3-15 cm, much branched. Leaves including petioles 1-3.5 × 0.5-11 cm, ovate, oblong-obovate to elliptic lanceolate or ± spathulate, acute, apiculate, lamina decurrent into the petiole, glabrous, crenulate to sub-dentate. Stipules 2-6 (-10) mm, subulate, mostly denticulate to more or less fimbriate. Peduncles up to 4.5 cm long. Flowers 5 mm in diam., pale violet or white. Sepals 4 mm, lanceolate, aristate, glabrous. Petals 6 mm long, the lower petal spurred, spur very short, rounded. Style clavate, compressed ; stigma lateral, of 2 oblong parallel discs. Capsules 4-6 mm long, cylindric, acute. Seeds 1 mm in diam., ovoid, white, shining.

Type : Afghanistan : Bolan Pass, *Griffith* s. n. and Pakistan : Baluchistan, *Stocks* 468, (syntypes K, photo !).

Fls. & Frts. : Apr.-Oct.

Distrib. : INDIA : Gujarat, Punjab, Rajasthan ; PAKISTAN, AFGHANISTAN.

Uses : The root is a powerful emetic ; the flowers are emollient and demulcent ; the whole plant is considered as an useful febrifuge.

Notes : *V. cinerea* var. *cinerea* differs from var. *stocksii* in its cinerescence habit, smaller, more or less shortly dentate stipules ; shortly cartilagineo-acuminate leaves and tomentulose capsules.

Since forma *stocksii* and f. *kathiawarensis* show overlapping characters, they are merged here.

7. *V. diffusa* Ging. in DC. Prodr. 1 : 298. 1824 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872 ; Jacobs et D. M. Moore in Fl. Males. 7 : 202. 1971.

Rhizome fibrillose. Stolons up to 15 cm long, producing dense rosettes of leaves and flowers. Leaves : lamina 1.5-5 cm × 0.8-2 cm, hirsute, obtuse to acute, decurrent ; petioles 1.5-7 cm long ; stipules 6-10 mm long, lanceolate, acute, dentate to fimbriate. Peduncles 1.5-6 cm long. Flowers 0.8 cm across, pale-purple to nearly white. Sepals 5 mm long, lanceolate, sparsely hairy. Petals ± 1 cm long, ovate-oblong, laterals not bearded, spurs 1-2 mm. Style clavate, geniculate at base ; stigma with two lateral lobes. Capsules 4-6 mm, ellipsoid.

Type : Nepal, Wallich Num. List no. 1444 (K-holo, photo !).

Fls. & Frts. : Feb.-Aug.

Distrib. : INDIA : Arunachal Pradesh, Assam, Meghalaya, Nagaland, Sikkim ; NEPAL, BHUTAN, BURMA, CHINA, INDO-CHINA, JAPAN, FORMOSA, PHILIPPINES, NEW GUINEA.

Uses : Flowers medicinal : applied in chest diseases (Chopra *et al.* in Gloss. Med. Pl. 255. 1956).

Chr. No. $2n = 26$ (Miyaji in Cytologia 1 : 28. 1929).

8. *V. fedtschenkoana* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 237. 1916. et *l. c.* 40 : 59. 1923.

Branches few, decumbent. Stolons absent. Leaves : lamina 1.5-2.5 × 1.5-2 cm, sub-cordate at base, margin entire below, crenate-serrate upwards, obtuse, glandular-punctate ; petioles 2-4 cm glabrous. Stipules ovate-lanceolate, glandulose ciliate. Peduncles 2-6 (-8) cm, bi-bracteolate little above the middle or near the tip. Flowers up to 2 cm in diam, pale-violet, much above the leaves. Sepals up to 8 mm, appendage elongated. Petals up to 1.5 cm, obovate-oblong, lateral petals bearded at base ; spurs up to 6 mm, slender, slightly curved upwards. Style swollen upwards, hooked above ; stigma ± papillose hairy. Fruit not seen.

- 1a. Root-stock non-articulated. Peduncles bi-bracteolate little above the middle. Spur elongated up to 6 mm. Style papillose hairy above
... var. *fedtschenkoana*
- 1b. Root-stock articulated. Peduncles bi-bracteolate near the tip. Spur short, up to 3 mm. Style non-papillose hairy
... var. *muzaffarabadensis*

var. *fedtschenkoana*

Type : U.S.S.R. : Buchar, 11.5.1913, B. A. Fedtschenko 1536 (LE-holo !).

Fls. : May-July.

Distrib. : INDIA : Himachal Pradesh, Jammu & Kashmir; CENTRAL ASIA.

var. *muzaffarabadensis* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 40 : 59. 1923.

Lamina 1-2 × 1-1.5 cm, ovate-orbicular. Stipules 8 mm, scarcely fimbriate. Peduncles up to 7 cm. Flowers 1.5 cm across. Style-swollen upwards, hooked above, stigma sub-truncate, obscurely beaked. Fruit not seen.

Type : India : Jammu & Kashmir, Muzaffarabad, *Inayat* 21166 (CAL-holo !).

Fls. : July.

Distrib. : INDIA : Jammu & Kashmir.

9. *V. glaucescens* Oudem. in Miq. Ann. Mus. Bot. Lugd. Bat. 3 : 74. 1867 ; W. Beck. in Beih. Bot. Centralbl. Abt. 2, 40 : 109. 1923 ; Hara in Bull. Univ. Mus. Univ. Tokyo 8 : 84. 1975. *V. glaucescens* var. *rubella* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 259. 1916 ; l.c. 40 : 110. 1923, syn. nov. *V. glaucescens* f. *rubella* (W. Beck.) Hara in Fl. East. Himal. 213. 1966, *V. distans* var. *fimbriata* Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 184. 1872.

Root stock articulated. Stolons up to 20 cm long. Leaves : lamina 2-4.5 × 1.3-3.5 cm, acute to sub-acuminate, basal sinus moderately wide, margin broadly and evenly crenate, glabrous or sparsely hispid above ; petioles up to 10 cm long. Stipules up to 1.5 cm long, ovate-oblong, lacerate or fimbriate. Peduncles up to 8 cm long. Flowers 1-1.5 cm across, white or rose-purple. Sepals 5 mm long lanceolate. Petals 1 cm long, orbicular-obovate, laterals barbate ; spur 3 mm, saccate. Capsules 8 mm oblong, apiculate. Seeds globose, light brown.

Type : India : Sikkim, *J. D. Hooker* s. n. (Herb. Ind. Or. Hook. f. et Thoms. sub n. 8—L-holo, photo ! CAL-iso !).

Fls. & Frts. : Throughout the year.

Distrib. : INDIA : Arunachal Pradesh, Assam, Manipur, Mizoram, Nagaland, Sikkim, West Bengal ; NEPAL, BHUTAN, MALAYSIA.

Notes : This species is distinguished from *V. pilosa* Bl. by its orbicular-cordate, acute, more or less glabrous leaves, marginate and shortly beaked stigma and elongate-oblong capsules. The purple-flowered

materials have been described as a variety (var. *rubella*) by W. Becker, subsequently reduced to a forma by Hara. In all other essential characters they are similar. Authentic sheets of *V. distans* var. *fimbriata* in CAL, verified at Kew also lead to the same conclusion.

10. *V. hamiltoniana* D. Don, Prodr. Pl. Nep. 206. 1825 (Feb.); W. Beck. in Beih. Bot. Centralbl. Abt. 2, 40 : 170. 1923; Hara in Enum. Fl. Pl. Nep. 2 : 47. 1979. *V. arcuata* Bl. Bijdr. 58. 1825 (June-Dec.); Kanjilal *et al.* Fl. Assam. 1 : 81. 1934; Jacobs *et al.* D. M. Moore in Fl. Males 7 : 205. 1971. *V. distans* Wall. in Trans. Med. Phys. Soc. Cal. 7 : 227. 1835; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872. *V. distans* var. *acaulis* Hook. f. & Thoms. l. c. 184.

Stems or stolons trailing up to 30 cm. Leaves : lamina 1.5 × 1.4.5 (-6) cm, usually as broad as long, ovate to reniform-cordate, basal sinus broad, obtuse or rather acute, crenate-serrate, glabrous to hirsute; petioles 1-8 cm long, glabrous. Stipules up to 2 cm, sub-entire to fimbriate. Peduncles 1-8 (-12) cm, bi-bracteolate above the middle. Flowers 1-1.5 cm in diam., white to light violet. Sepals 5 mm, ovate-lanceolate, acute. Petals 1 cm, obovate-oblong; spur 4 mm, saccate. Style more or less geniculate at base, sub-clavate; stigma of 2 small laterally patent lobes. Capsules 1 cm long.

Type : Java, *Blume* s. n. (L-holo, photo!).

Fls. & Frts. : Mar.-June, often throughout the year.

Distrib. : INDIA : Arunachal Pradesh, Himachal Pradesh (BM), Manipur, Meghalaya, Nagaland, Sikkim, Tamil Nadu, West Bengal; NEPAL, BHUTAN, BANGLADESH, BURMA, CHINA, MALAYSIA, PHILIPPINES.

Chr. No. : $2n = 24$ (Borgmann in Zeitschr. Bot. 17 : 1-27. 1964).

11. *V. hediniana* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 262. 1916; Spare *et al.* Fischer in Kew Bull. 1929 : 252. 1929.

Herbs pubescent to glabrous. Rhizomes slender, horizontal. Stolons up to 20 cm long, ascending. Leaves : lamina 3-7 cm × 1.8-2.5 cm, smaller above, cordate at base, remotely crenate, sub-acuminate, sparsely pubescent above to glabrous; up to 1 cm long in basal leaves, shorter to sessile in upper cauline leaves. Stipules 5 mm long, ovate-lanceolate. Peduncles 7 cm long, bi-bracteolate at or above the middle. Flowers 1 cm across, yellow. Sepals 3-nervate, shortly appendiculate. Petals oblong-ovate, 1 cm long, laterals ebarbate, spur 5 mm long. Stigma bilobed. Fruit not seen.

Type : West China, *E. H. Wilson* 3220 (HBG-holo ! & K-iso, photo !).

Fls. : May.

Distrib. : INDIA : Arunachal Pradesh ; CHINA.

Notes : This species, originally described from China is reported from Arunachal Pradesh, India based on a collection from Mishmi, Delei Valley by Kingdon Ward (Cf. Spare and Fischer, *l. c.*), but we have however not seen this collection.

12. *V. hookeri* Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872, *pr. max.* p., emend. W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 259. 1916 ; Spare et Fischer in Kew Bull. 1929 : 251. 1929.

Herbs glabrous or younger parts pilose. Root stock warted. Stems and stolons short. Leaves : lamina 1.5-4 cm $\times$ 1.5-3.5 cm, apex rounded rarely sub-acute, broadly crenate, basal sinus deep, lobes touching or overlapping, glabrous ; petioles up to 10 cm, not winged. Stipules up to 1.2 cm, lanceolate, acuminate, toothed or lacerate, tips glandular. Peduncles up to 7 cm. Flowers 1 cm across, white with purple veins. Sepals 5 mm, lanceolate, obtuse. Petals 1 cm oblong-ovate, minutely puberulous. Style sub-clavate, narrowed downwards from the obscurely beaked stigma. Capsules 5 mm long, valves apiculate, glandular.

Type : At Kew a sheet (*V. griffithii* Hook. f. et Thoms. *nomen*) from Bhutan,—*Griffith* EIC 233 is labelled as type specimen of *V. hookeri* Thoms.

Fls. : Apr.-June ; *Frts.* : July-Aug.

Distrib. : INDIA : Arunachal Pradesh, Sikkim, West Bengal ; BHUTAN, CHINA.

Chr. No. $n=9$ (Sharma & Sarkar in Research Bulletin 2 : 39. 1967-68) ; $n=9$, 36 (Chatterjee & Sharma in J. Genet. 61 : 52-63. 1973).

Thomson described *V. hookeri* based on two collections (i) from Bhutan *Griffith* and (ii) from Sikkim *J. D. Hooker*, as mentioned in the protologue, although he was not un-aware of there being two species mixed up and if so they occur in both Sikkim and Bhutan collections.

The one with ovate-rotundate, deeply cordate, or overlapping basal auricles, rounded, crenate, glabrous, obtuse, silvery grey beneath and minutely gland-dotted leaves and acute sepals has been described as *V. sikkimensis* by W. Becker (1916).

13. *V. hossei* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 257. 1916. Stoloniferous, stolons up to 18 cm long. Leaves : lamina 2-4(-5) × 1.5-3 cm, crenate-serrate, acute, sparsely white hispid to glabrous. Stipules up to 1 cm, lanceolate, reddish brown. Peduncles 2.5-3.5 cm. Flowers violet, wide open. Sepals up to 5 mm, linear, acute, glabrous. Petals ± 1 cm long, obovate-oblong. Style clavate, slightly curved. Capsules up to 8 mm, sub-globose, ± papillose.

Type : China : Yunnan, *Henry* 11768 (K-holo, photo ! CAL-iso !).

Fls. & Frts. : Mar.-Oct.

Distrib. : INDIA : Meghalaya ; BURMA, S. W. CHINA, MALAYAN PENINSULA, MALESIA, ISLANDS, THAILAND.

14. *V. inconspicua* Bl. Cat. Buitenz. 57. 1823 ; Hara in Fl. East. Himal. 212. 1966 ; Jacobs et D. M. Moore in Fl. Males. 7 : 203. 1971. *V. apetala* Roxb. Fl. Ind. 2 : 449. 1824, *non* Schmidt. 1791 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872.

Root-stock densely articulated. Leaves in rosette ; lamina 1.5-6 × 1-4.5 cm, crenulate or serrate, apex acute or roundish obtuse. Petioles 1-10(-13) cm. Stipules 7-9 mm, lanceolate, acuminate, sparsely dentate. Peduncles 1-10(-15) cm, 1-flowered bi-bracteolate above the middle. Flowers generally apetalous and cleistogamous, rarely perfect, pale purple. Sepals 5 mm, ovate-lanceolate, acuminate, glabrous. Petals when present up to 1.2 cm long ; obovate-oblong, laterals bearded at the base ; spur 3 mm, cylindrical, obtuse. Style geniculate at base, clavate. Capsules up to 1 cm, ellipsoid to oblong glabrous.

Type : Java, *Blume* (L-photo !).

Fls. & Frts. : Jan.-June.

Distrib. : INDIA : Arunachal Pradesh, Assam, Himachal Pradesh, Meghalaya, Nagaland, Sikkim, West Bengal ; S. W. CHINA, BURMA, MALAYSIA, INDONESIA, PHILIPPINES.

Notes : This species is often confused with *V. betonicifolia*. However, it can be distinguished by its triangular hastate leaves, sub-cordate and attenuated at the base, and generally apetalous flowers.

15. *V. indica* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 20 : 126. 1906 et l. c. 40 : 134. 1923.

Root-stock long up to 12 cm., densely articulated. Stoloniferous, stolons up to 20 cm, leafy and flowering. Leaves : lamina 2-6 × 1.5-4 cm.

crenate-serrate, sub-acuminate; petioles up to 10 cm, retrose-hispid. Stipules ovate-lanceolate, acute, ciliate. Peduncles 3-10 cm, bi-bracteolate at about the middle. Flowers lilac, sweet scented. Sepals 6 mm, lanceolate, glabrous, appendage shortly triangular. Petals 1.5 cm, obovate-oblong, lateral petals smooth, $\pm$ bearded; spur stout, up to 8 mm, curved upwards. Stigma shortly beaked. Fruit not seen.

Showing similarities with *V. pilosa* Bl. but distinguished by its densely articulated root stock, larger flowers and curved style.

1a. Lateral petals not bearded at base ... f. *indica*

1b. Lateral petals bearded at base ... f. *barbata*

f. *indica*

Type : India : Kishtewar et Kashmir, reg. temp. Herb. Ind. Or., *Hook. f. et Thoms.* s. n. (sub *V. odorata*)—B (n. v.).

Fls. : Mar.-July.

Distrib. : INDIA : Himachal Pradesh, Jammu & Kashmir, Meghalaya, Punjab, Uttar Pradesh; PAKISTAN, AFGHANISTAN.

f. *barbata* W. Beck.) Banerjee et Pramanik comb. et stat. nov. *V. indica* var. *barbata* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 40 : 135. 1923.

Type : India : Matiana, 2700 m, Simla Hill State, *I. H. Burkill* 28658 (CAL-holo!).

Fls. : Apr.

Distrib. : INDIA : Himachal Pradesh.

16. *V. jangiensis* W. Beck. in Kew Bull. 1929 : 201. 1929.

Rhizome ascending, 2-3 mm thick, shortly articulated. Acaulescent. Leaves : lamina 1-2 $\times$ 1-2 cm obtuse, entire or remotely crenate to partly repand-crenate, $\pm$ pubescent, specially on the lower surface; young leaves narrower; petioles up to 8 cm. Stipules about 1 cm long. Peduncles 5-7 cm long, bi-bracteolate at the middle. Flowers pale violet; sepals 2 mm, ovate-lanceolate, lateral sepals 3 mm, narrower, shortly appendiculate. Lateral petals minutely hairy at the base; spur acute, 1 mm. Ovary conical; style geniculate at base, $\pm$ clavate, not curved at apex, passing directly upwards to a $\pm$ uncovered orifice.

Type : India : Jangi, Kunawar, 3350 m, Punjab, *Nanah* 2003 (K-holo, photo!).

Fls. : July.

Distrib. : INDIA : Punjab.

17. *V. jordani* Hanry [Cat. Pl. Var. 169. 1853] var. *falconeri* (Hook. f. & Thoms.) W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 380. 1917. *V. falconeri* Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872.

Stems or branches 15-30 cm, erect, internodes long. Leaves : lamina 2-4.5 × 3-6.5 cm, very broadly crenate, obtuse, gland-dotted, glabrate to sparsely strigose ; petioles up to 5 cm. Stipules 1-3 cm, foliaceous, smaller below, gland-dotted. Peduncles 5-7 cm, bi-bracteolate above the middle. Flowers blue throat with white markings. Sepals up to 8 mm, subulate-lanceolate, appendage elongate. Petals orbicular-obovate ; spur saccate. Style inflated above ; stigma decurved, oblique. Capsules 1 cm, glabrous, apiculate.

Type : India : Kashmir, *Falconer* s. n. EIC 193 (K-holo, CAL-iso !).

Fls. & Frts. : May-Oct.

Distrib. : INDIA : Jammu & Kashmir.

18. *V. kunawarensis* Royle Ill. Himal. Bot. 74. t. 18. f. 3, 1839 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872 ; W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 396. 1917. *V. kunawarensis* var. *angustifolia* W. Beck. l. c. 397, syn. nov.

Herbs up to 7 cm tall, glabrous. Root-stock slender, branched. Acaulescent, stolons absent. Leaves tufted : lamina 1-2 × 0.5-1 cm, sub-entire, base cuneate attenuated into the petiole, glabrous ; petioles 2-6 cm. Stipules 2-3 mm, adnate up to a point above the middle, lanceolate, acuminate, shortly glandulose-fimbriate, membranaceous. Peduncles up to 8 cm, bi-bracteolate at the middle. Flowers spreading, 1 cm in diam., purple. Sepals 3 mm. Petals up to 1 cm, obovate-oblong, spur short, 2 mm, obtuse. Style clavate, shortly incurved ; stigma sub-horizontal, hardly beaked. Capsule elliptic, acute, glabrous.

Type : N. W. India, Hb. Royle s. n. (K-holo, photo ! CAL-iso !).

Fls. & Frts. : May-Sept.

Distrib. : INDIA : Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttar Pradesh ; NEPAL, AFGHANISTAN, PAKISTAN, CHINA.

Notes : W. Becker (l. c. 397) described *V. kunawarensis* var. *angus-*

tifolia from Khambajong in Tibet, based on oblong-lanceolate leaves, long attenuated at the base. This is not a distinctive feature and found in materials from the area under study.

19. *V. macroceras* Bunge in Ledeb. Fl. Altaic. 1 : 256. 1829 ; Ledeb. Icon. Pl. Ross. 3 : t. 219. 1831 ; W. Beck. in Engl. Bot. Jahrb. 120, 54 : 183. 1917. *V. patrinii* sensu Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872, *p. p.*

Rhizome short, indistinctly articulated at apex. Leaves in rosette : lamina 2.5-5 × 2-4 cm, obtuse, basal parts entire, crenate above, glabrous to pubescent ; petioles 5-16 cm, ± winged above. Stipules 1 cm, adnate to a point above the middle, fimbriate. Peduncles 12 cm bi-bracteolate above the middle. Flowers ± 1 cm across, purple to white. Sepals 4 mm, appendage short, rotundate. Petals 1 cm, obovate-oblong, spur 4-6 mm. Ovary glabrous, style clavate ; stigma marginate and shortly beaked. Seeds purple.

Type : Bucktorminsk, Altai, *Ledebour* s. n. (LE-holo !).

Fls. & Frts. : Apr.-Sept.

Distrib. : INDIA : Uttar Pradesh ; EUROPE, RUSSIA, CHINA.

20. *V. moupinensis* (Franch.) Franch. in Bull. Soc. Bot. France 33 : 412. 1886 ; Spare et Fischer in Kew Bull. 1929 ; 252. 1929. *V. palustris* L. var. *moupinensis* Franch. Pl. David. 2. in Arch. du Mus. Sr. 2. 6 : 202.

Rhizomes thick, articulated, giving rise to a few ascending floriferous stolons. Leaves radical and cauline : lamina 2-3.5 × 2-4 cm, ± broader than length, crenate-serrate, acute ; petioles up to 10 cm. Stipules up to 1 cm ovate-acuminate, sub-entire to shortly glandulose-fimbriate. Peduncles ± equaling the leaves in the flowering stage, bi-bracteolate below the middle. Flowers 1 cm across, white or pale-violet, striate. Sepals up to 5 mm, ovate-oblong. Petals up to 1 cm, obovate-oblong, laterals hairy at the base, lower petal conspicuously striate, spur saccate, 2-3 mm. Style sub-clavate, stigma marginate, shortly beaked. Capsules 1.5 cm, ovate-oblong.

Type : China : Moupin, *M. A. David* (P-holo ! K-iso).

Fls. : Apr.-June ; *Frts.* : June-Aug.

Distrib. : INDIA : Arunachal Pradesh ; BURMA, CHINA.

Notes : This species, is also reported from Arunachal Pradesh,

based on a collection from Mishmi, Delei Valley by Kingdon Ward (et. : Spare and Fischer l. c.).

21. *V. odorata* L. Sp. Pl. 2 : 1524. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 184. 1872, *pro parte*; Ross-Craig, Draw. Brit. Pl. 4 : t. 7. 1950.

Banafsha (Hindi & Beng.); *Vayilettu* (Tel.); *Sweet Violet* (Eng.).

Root-stock stout, articulated. Stems short; stolons 15-20 cm, slender. Leaves : lamina 1.5-3.5 × 2-4 cm, broadly ovate-cordate, obtuse, crenate, glabrous to strigose; petioles 4-8 cm. Stipules subulate-lanceolate, glandular toothed. Peduncles 4-10 cm, bi-bracteolate, at the middle. Flowers violet or white, tinged with purple. Sepals up to 7 mm. Petals obovate-orbicular, spur 5 mm, cylindric-obtuse. Stamens 5, lower two spurred. Ovary strigose. Capsules 5 mm in diam., globose, hirsute.

Type : Amman, 1052.11 (LINN-holo, photo!).

Fls. : Mar.-May; *Frts.* : June-Aug.

Distrib. : INDIA : Jammu & Kashmir, often cultivated elsewhere; EUROPE, N. AFRICA, N. & W. ASIA.

Uses : Plants medicinal : root emetic, flowers used in lung troubles (Chopra *et al.* in Gloss. Med. Pl. 255. 1956).

Chr. No. $2n = 20$ (Clausen in *Hereditus* 8 : 1. 1926). $2n = 20$ (Gadella & Kliphus in *Acta Bot. Neerl.* 12 : 195-230. 1963); $2n = 20$ [Chatterjee & Sharma in *J. Genet.* 61(1) : 52-63. 1973].

Pollen grains : 29.6-31.2 μ in diameter. (Wodehouse, R. P. in *Pollen Grains*, New York : 442-444. 1959); Prolate (39 × 28 μ) (Nair, P. K. K. in *Pollen grains of Western Himalayan plants*, Bombay : 13. 1965).

22. *V. paravaginata* Hara in *J. Jap. Bot.* 43 : 47. 1968 et *Fl. East. Himal.* 2 : 82. 1971 et in *Bull. Univ. Mus. Univ. Tokyo* 8 : 83. 1975.

Root-stock 3-7 (-12) cm long, 4-7 mm thick, articulated. Stems or stolons 0. Leaves : lamina 2-5.5 (-9) cm × 2-4 (-7) cm, rotundate to ovate-cordate, deeply cordate at base, pilose above, at the nerves only beneath; petioles 3-12 (-16) cm. Stipules 6-10 mm, oblong-ovate, long-attenuate, glanduloso-ciliate, brown. Peduncles 5-8 (-13) cm, bi-bracteolate below the middle. Flowers 1 cm across, white to purplish. Sepals 3-4 mm. Petals up to 1 cm, oblong-obovate, spur 2 mm. Stigma beaked. Capsules oblong-ovate, apiculate, glabrous, purple-spotted. Seeds yellowish brown.

Type : India : Phalut-Chia Bhanjang, 3300 m, 11.5.1960, *Collector ?* 196 (TI-holo !).

Fls. : Apr.-June ; **Frts. :** June-Oct.

Distrib. : INDIA : Sikkim, West Bengal ; NEPAL, BHUTAN.

Notes : This species is related to *V. moupinensis* Franch. from which it is distinguished by ebarbate lateral petals and absence of stolons.

23. **V. philippica** Cav. Icon. Descr. 6 : 19. 1801 ; W. Beck. in Engl. Bot. Jahrb. Beibl. 120, 54 : 174. 1917 ; Jacobs et D. M. Moore in Fl. Males. 7 : 204. 1971. *V. philippica* ssp. *munda* W. Beck. l.c. 175. *V. philippica* ssp. *munda* var. *garhwalensis* W. Beck. l.c. 176, syn. nov.

Root-stock $\pm$ articulated. Stems or stolons 0. Leaves in rosette : lamina 1-4 $\times$ 0.5-3 cm, $\pm$ crenate, usually long decurrent on petiole, glabrous or puberulent beneath, petioles 1-6 cm. Stipules up to 1 cm, ovate-lanceolate, acute, shortly dentate, adnate to the petiole up to above the middle. Peduncles 5-8 cm, bi-bracteolate at the middle. Flowers 1-1.5 cm, pale to dark violet. Sepals 3-5 mm, ovate to ovate-lanceolate, acute. Petals up to 1.5 cm, spur up to 6 mm. Style geniculate at base, clavate distally ; stigma of 3-partially fused lobes with anterior beak. Capsules up to 1 cm, elliptic-oblong.

Type : Philippines, *Cavanilles* s. n. (MA-holo, photo !).

Fls. & Frts. : Oct.-July often extending throughout the year.

Distrib. : INDIA : Manipur, Uttar Pradesh ; EASTERN ASIA, BURMA, MALAYSIA.

Chr. No. : $2n = 12$ (Kishore in Ind. J. Genet. & Plt. Breed. 11 : 217. 1951).

Notes : An examination of type materials of *V. philippica* ssp. *munda* and ssp. *munda* var. *garhwalensis* reveals that they can be considered synonymous with ssp. *philippica*.

24. **V. pilosa** Bl. Cat. Gew. Buitenz. 57. 1823 et in Bijdr. 57. 1825 ; Jacobs et D. M. Moore in Fl. Males. 7 : 207, 1971 (excl. syn.—*V. glaucescens* Oud.) ; Hara in Bull. Univ. Mus. Univ. Tokyo 8 : 83. 1975. *V. serpens* Wall. ex Ging. in DC. Prodr. 1 : 296. 1824 ; Royle, Ill. Bot. Himal. 74. t. 18. f. 1. 1834 ; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 184, 1872. *V. serpens* var. *confusa* sensu Hook. f. et Thoms. l.c. 184, non Benth. 1851. *V. wightiana* Wall ex Wight et Arnott in

Prodr. Fl. Ind. Or. 1 : 32. 1834. *V. serpens* ssp. *garhwalensis* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 255. 1916, syn. nov.; *V. serpens* ssp. *serpens* var. *deltoidea* W. Beck. l. c. 40 : 105. 1923, syn. nov.

Banafsha (Hind. & Punj.); *Thungtu* (Garh.).

Stems or stolons usually long, leafy and flowering $\pm$ prostrate. Leaves : lamina 1.5-8 cm $\times$ 1-6 cm, ovate to deltoid, serrate, mostly hirsute or pilose to glabrous; petioles 2-10 cm, pubescent. Stipules 6-15 mm, ovate-acuminate, sub-entire to $\pm$ dentate. Peduncles 3-8 cm, pilose. Flowers white or pale violet. Sepals 5 mm, linear-lanceolate, appendage 3 mm, pointed. Petals 1.5 cm, obovate-oblong, laterals bearded at base. Style sub-clavate, sub-truncate and shortly beaked at the apex. Capsules 5 mm in diam., ellipsoid.

Type : Java, *Blume* (L-holo, photo!).

Fls. : Mar.-May; *Frts.* : May-July, often throughout the year.

Distrib. : INDIA : Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal; AFGHANISTAN, PAKISTAN, SRI LANKA, NEPAL, BHUTAN, BURMA, CHINA, MALAYSIA, THAILAND, JAVA.

Chr. No. : $2n = 18, 48$ [Chatterjee & Sharma in J. Genet. 61(1) : 52-63. 1973].

Uses : Plant medicinal : febrifuge, flowers used in lung troubles, petals made into a syrup used as a remedy for infantile disorders; root emetic (Chopra *et al.* in Gloss. Med. Pl. 255. 1956—as *V. serpens* Wall.)

Notes : A variable species. Taller forms grow in shady humid places and shorter forms grow in rock-crevices. *V. serpens* ssp. *serpens* var. *deltoidea* W. Beck. and *V. serpens* ssp. *garhwalensis* W. Beck. are considered synonymous with *V. pilosa*, being smaller form of the same species. This is clear from a study of the specimens from Garhwal and other places in CAL.

25. *V. placida* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 36 : 58. 1918.

Herbs, acaulescent, hispid-pilose. Rhizome thick, densely articulated. Stoloniferous. Leaves radical : lamina $\pm$ 1-1.5 cm across, rotundate-ovate, margin rotundate crenate, acuminate, densely hispid; petioles $\pm$ 3 cm long, retrorsely hispid-pilose. Stipules 6-8 mm, free, lanceolate to triangular ovate, hairy in both sides, margin glandulose-fimbriate to ciliate. Peduncles scarcely exceeding the leaves, retrorse-hispid.

Flowers small, lilac. Sepals narrow oblong, appendages sub-rotundate. Petals up to 5 mm oblong, lowest petal $\pm$ boat shaped. Ovary glabrous; style geniculate at base, sub-clavate, horizontal, passing into a sub-marginate shortly beaked stigma. Fruit not seen.

Type : India : Chiabanjai, Sikkim, *Lacaita* 26 (n. v.).

Fls. : May.

Distrib. : INDIA : Sikkim.

Notes : This species is related to *V. hookeri* Thoms. in general, in hairyness of leaves to *V. alba* Bess. and in the form of leaves to *V. odorata* L.

26. *V. pogonantha* W. W. Sm. in Notes Roy. Bot. Gard. Edin. 12 : 228. 1920; Spare et Fischer in Kew Bull. 1929. 252. 1929.

Herbs, 10-15 cm high. Root-stock articulated. Leaves : lamina 6-8 cm $\times$ 3-4 cm, margin serrate-crenate, setose with white hairs; petioles 8-12 cm. Stipules 1.5 cm, linear-lanceolate, sub-entire to glandular-fimbriate. Peduncles 6-8 cm. Flowers 1.5 cm across, white with purple striations. Sepals 7 mm, linear-oblong; spur quadrate, pilose. Petals 1 cm, oblong-obovate, laterals bearded at base, spur 3 mm, obtuse. Ovary villous, stigma terminate, truncate. Capsule globose, villous.

Type : China : Yunnan, 2135 m, *G. Forrest* 9925 (E-holo, K-iso, photo!).

Fls. : Apr.-May.

Distrib. : INDIA : Arunachal Pradesh (K-photo!); CHINA.

Notes : This species is reported from Arunachal Pradesh, India, based on a collection from Mishmi, Delei Valley by Kingdon Ward (Cf. Spare et Fischer *l. c.*).

27. *V. reichenbachiana* Jord. ex Bor., Fl. Centr. France, ed. 3, 2 : 78. 1857; Coode et Cullen in Fl. Turkey 1 : 527. 1965.

Wood Dog-Violet (Eng.).

Root-stock articulated. Caulescent. Leaves in rosette : lamina 1.5-3 cm $\times$ 1.5-2 cm, crenate, obtuse, glabrous; petioles up to 2.5 cm. Stipules 1 cm, narrowly lanceolate, fimbriate. Peduncles 5 cm. Flowers 1.5 cm across, violet. Sepals 5 mm, lanceolate, acute, appendage short truncate. Petals obovate-oblong; spur 5 mm. Stamens 5, lower two spurred. Ovary glabrous; style clavate; stigma beaked. Capsule 1 cm, ovate-acute.

Type : None designated. (Coode et Cullen *l. c.*).

Fls. & Frts. : ?

Distrib. : INDIA : Jammu & Kashmir ; EUROPE, N. W. AFRICA, CENTRAL ASIA.

Chr. No. $2n=20$ (Valentine in New Phytol. 49 : 193-212. 1950, Larsen in Bot. Tidsskr. 50 : 163-174. 1954) ; $2n = 40$ (Majovsky *et al.* in Acta Fac. Rerum Nat. Univ. Comeninae Bot 23 : 1-23. 1974).

28. *V. rupestris* F. W. Schmidt. in Neue. Abh. Bohm. Ges. 1 : 60. 1791.
V. arenaria DC. Prodr. 1 : 298. 1824.

Herbs, grey papillose hairy to $\pm$ glabrous, caulescent. Leaves : lamina 1-2 cm $\times$ 0.5-1.5 (-2) cm, truncate, obtuse, crenulate, glandular punctate, $\pm$ shortly pilose ; petioles 1.5-3 cm. Stipules up to 1 cm, lanceolate. Peduncles up to 4.5 cm, bi-bracteolate near the apex. Flowers 1.5 cm across, violet or white. Sepals 5-7 mm, oblong-lanceolate, acute. Petals 1 cm, obovate-oblong ; spur 4 mm, cylindric. Style clavate ; stigma beaked.

1a. Plant covered all over with grey papillose hairs. Lamina ovate-orbicular, weakly cordate at base ... var. **rupestris**

1b. Plant $\pm$ glabrous. Lamina rotundate ovate, deeply cordate at base ... var. **himalayensis**

var. **rupestris**—*V. rupestris* F. W. Schmidt ; Coode et Cullen in Fl. Turkey 1 : 527. 1965.

Stems up to 4 cm, simple. Lamina 1-2 $\times$ 0.5-1.5 (-2) cm. Lateral petals bearded at base. Capsule 8 mm, elliptic-oblong, acute, hairy.

Type : "many syntypes from C. Europe"—Coode et Cullen *l. c.*

Fls. & Frts. : Apr.-Aug.

Distrib. : INDIA : Jammu & Kashmir ; ASIA, EUROPE & AMERICA.

var. **himalayensis** (W. Beck.) Banerjee et Pramanik, comb. et stat. nov.
V. himalayensis W. Beck. in Fedde. Repert. 17 : 72. 1921.

Herbs, acaulescent, caespitose. Leaves in rosette ; lamina 1-1.8 $\times$ 1-2 cm, crenulate ; petioles up to 2.5 cm ; stipules up to 1 cm, lanceolate, deeply fimbriate. Flowers 1.5 cm across. Sepals 7 mm, lanceolate. Petals 1 cm, obovate-oblong, laterals not hairy, spur 4 mm, slightly recurved. Style clavate ; stigma shortly beaked. Fruit not seen.

Type : India : Kashmir, *Falconer* s. n. sub. EIC 191, (CAL-holo!).

Fls. : ?

Distrib. : INDIA : Jammu & Kashmir.

Notes : *V. himalayensis* W. Beck. represented only by the holotype in CAL. resembles *V. rupestris* in general characters and it is difficult to maintain it as a distinct species. Therefore, it is reduced to a variety under it, differing in the characters given in the Key.

29. *V. sikkimensis* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 260. 1916; Hara in Fl. East. Himal. 213. 1966. *V. hookeri* Thoms. in Hook. f. Fl. Brit. Ind. 1 : 183. 1872, p. p. quoad Spec. Sikkim, J. D. Hook.

Root-stock densely articulated. Stolons up to 18 cm with leaves distantly placed. Leaves : lamina 1.5-5 × 1.5-3.5 cm, rotundate-crenate, glabrous; petioles up to 8 cm long, not winged. Stipules up to 1 cm, scarious, lanceolate, acuminate, long fimbriate. Peduncles up to 9 cm. Flowers 1 cm across. Sepals 5 mm lanceolate, acute. Petals 1 cm, oblong obovate, lower spurred, spur 2 mm. Style sub-clavate, narrowed downwards from the marginate, obscurely 3-lobed beaked stigma. Capsules up to 5 mm, oblong, valves apiculate.

Type : Sonada, 2500 m, J. S. Gumble 10318 (CAL!).

Fls. : Mar.-June; *Frts.* : July-Oct.

Distrib. : INDIA : Meghalaya, Nagaland, Sikkim, West Bengal; CHINA, INDONESIA.

30. *V. suavis* Beib. Fl. Taur.-Cauc. 3 : 164. 1819; Coode et Cullen in Fl. Turkey 1 : 526. 1965. *V. odorata* L. var. *suavis* (Beib.) Boiss. Fl. Or. 1 : 458. 1867. *V. pontica* W. Beck. in Beih. Bot. Centralbl. Abt. 2, 36 : 18. 1918.

Herbs, acaulescent, ± glabrous. Rhizome thick, densely articulated. Stoloniferous. Leaves radical : lamina 1-3.5 × 1.2-3 cm, rotundate crenulate ± hispid, specially on the nerves beneath; petioles up to 7 cm, retrorse-hispid. Stipules lanceolate, acuminate, glandulose fimbriate to ± ciliate. Peduncles up to 10 cm, bi-bracteolate below the middle. Flowers 1.5 cm across, violet, centre white. Sepals 5 mm. Petals 1.2 cm, laterals not hairy, spur 4 mm, saccate. Ovary glabrous; style horizontal, stigma beaked. Capsules globose, ± adpressed pubescent.

Type : none designated (Coode & Cullen l. c.).

Fls. & Frts. : Mar.-Apr.

Distrib. : INDIA : Jammu & Kashmir ; EUROPE, C. & W. ASIA.

Chr. No. n=40 (Schmidt in Österreich Bot. Zeitcher 108 : 20-88. 1961).

Notes : It differs from *V. odorata* L., in its broadly lanceolate, distinctly fimbriate stipules, ovate cordate leaves, light blue-violet flowers with a white centre and non-uncinate style.

31. *V. sylvatica* Fries ex Hartm. f. in Bot. Notiser 81. 1841 ; Blatt. Beaut. Fls. Kashmir 1 : 46, Pl. 13. f. 2. 1927. *V. canina* L. var. *syl. vatica* (Fries ex Hartm. f.) Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 185. 1872.

Root-stock short or absent. Stems arising from a short central axis. Leaves : lamina 1.5-4 × 1.5-3 cm, crenate-serrate, glabrous ; petioles 1-5.5 cm. Stipules leafy up to 1 cm, fimbriate. Peduncles 2-5 (-7) cm, equalling or exceeding the leaves, 1-flowered. Flowers up to 2 cm across, violet. Sepals lanceolate, acute, appendage 2 mm, sub-truncate. Petals orbicular, obovate ; spur 5 mm straight or curved. Style inflated above ; stigma decurved, ending in a uncovered orifice. Capsules 5 mm, ovate-acute, glabrous.

Type : Not designated.

Fls. & Frts. : June-Sept.

Distrib. : INDIA : Jammu & Kashmir ; EUROPE, CENTRAL ASIA.

Uses : Plant is used in chest troubles. Stems, leaves and flowers—bruised and applied to wounds.

32. *V. thomsonii* Oudem. in Miq. Ann. Mus. Bot. Lugd. Bat. 3 : 74. 1867 ; W. Beck. in Beih. Bot. Centralbl. Abt. 2, 34 : 257. 1916 ; Hara in Fl. East. Himal. 213. 1966.

Root-stock articulated. Stolons up to 20 cm long. Leaves : lamina 2-7 × 1.5-4 cm, acute, serrate-crenate, glabrous to ± sparsely strigose ; petioles 2-12 cm, glabrous. Stipules up to 1.5 cm, lanceolate, deeply fimbriate. Peduncles up to 13 cm, not extending leaves, bracteoles up to 1.5 cm, linear, acuminate with a few teeth at the margin. Flowers 1.5 cm long. Sepals 6 mm lanceolate, acute. Petals 1.5 cm, pale violet, obovate-oblong, lower petal spurred, spur 3-4 mm, saccate. Style geniculate at base ; shortly beaked. Capsules 1 cm, oblong, apiculate.

Type : India : Sikkim, J. D. Hooker s. n. (CAL-iso!).

Fls. & Frts. : Mar.-Sept. often throughout the year.

Distrib. : INDIA : Arunachal Pradesh, Manipur, Nagaland, Sikkim, West Bengal; NEPAL, BHUTAN, BURMA.

Notes : This species shows some similarities with *V. pilosa* Bl. but can be distinguished by its ovate cordate, acute, $\pm$ glabrous leaves, glabrous petioles, deeply fimbriated stipules and peduncles bi-bracteolate above the middle with longer bracteoles, toothed at the margin.

33. *V. tricolor* L. Sp. Pl. 2 : 1326. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 182. 1872—in Obs.; Kanjilal *et al.* Fl. Assam 1 : 81. 1934. Ross.-Craig, Draw. Brit. Pl. 4 : t. 17. 1950.

Pansy, Heartsease (Eng.).

Caulescent, annual, glabrous to $\pm$ puberulous. Root-stock nil. Stem 15-30 cm high, diffusely branched. Leaves : lamina 1.5-4 $\times$ 0.5-1.5 cm, variable, basal leaves ovate, sub-cordate, those of the stem becoming ovate, obovate-oblong or lanceolate, broadly crenate-dentate, obtuse; petiole 1-2.5 cm, often winged above. Stipules up to 2.5 cm. Peduncles up to 6 cm, bi-bracteolate above the middle. Flowers up to 4.5 cm. in diam., smaller in feral forms, violet or purplish to greenish-yellow. Sepals up to 1.5 cm, subulate, mucronate. Petals orbicular-obovate, laterals bearded at base, spur 5 mm. Style geniculate at base, stigma hairy, laterally beaked. Capsule 1 cm, ovate-acute.

Type : 1052.21 (LINN-holo, photo!).

Fls. : Feb.-May; *Frts.* : Apr.-June.

Distrib. : Cultivated in India, rarely as an escape from cultivation; EUROPE, AMERICA.

Chr. No. $2n=26$ (Love & Love in Acta Horti. Gothoburgensis 20 : 65-291. 1956, Clausen *et al.* in Rhodora 66 : 32-46, 1964, Mukherjee & Khoshoo in Nucleus 12 : 178-186. 1969); $2n = 42, 46$ (Chatterjee & Sharma in J. Genet. 61 : 52-63. 1973).

Pollen grains : Grains various in size oblately flattened, about $85 \times 63 \mu$ with furrows $\pm$ equally spaced around equator and nearly or quite meridionally arranged. Furrow long and tapering to pointed ends, furrow membrane flecked. Germ pore irregular in outline but tending to be circular. Texture finely granular. (Wodehouse, R. P. in Pollen Grains, New York : 442-444. 1959).

Uses : Plants medicinal : used in rheumatism and in skin diseases ; roots used as a substitute for Ipecacuanha.

34. *V. wallichiana* Ging. in DC. Prodr. 1 : 300. 1824 ; W. Beck. in Beih. Bot. Centralbl. 2, 34 : 262. 1916 ; Hara in Bull. Univ. Mus. Univ. Tokyo 8 : 84. 1975. *V. reniformis* Wall. in Roxb. Fl. Ind. 2 : 451. 1824 ; Ic : Royle, III. Bot. Himal. 2 : 74. t. 18. f. 2. 1839.

Stems 5-15 (-25) cm, erect or decumbent. Leaves cauline : lamina 0.7-2.5 (-4.5) $\times$ 1-3 (-5) cm, rotundate-crenate, glabrous ; petioles 0.5-6 cm. Stipules 3 mm, ovate-denticulate. Peduncles 0.8-5 cm, bi-bracteolate above the middle. Flowers 1 cm across, yellow. Sepals 5 mm subulate, acute. Petals 1 cm, elliptic-obovate, spur linear 5-6 mm, obtuse. Stigma bi-lamellate, lobes spreading. Capsules 4 mm, oblong, apiculate.

Type : Nepal, Wallich Num. List no. 1443 (G-holo !).

Fls. & Frts. : May-Sept.

Distrib. : INDIA : Sikkim, West Bengal ; NEPAL, BHUTAN.

Notes : This species is distinguished from *V. biflora* L. by its ovate-cordate rotundate-crenate leaves ; subulate, acute sepals and slender, 5-6 mm long spur.

35. *V. yunnanensis* W. Beck. et Boiss. in Bull. herb. Boiss. 8 : 740. 1908.

Root-stock $\pm$ articulated. Stolons up to 20 cm. Leaves in rosette : lamina 2.5-7 $\times$ 1-3.5 cm, crenate-serrate, acute, pilose ; petioles 1-6 cm, pilose. Stipules lanceolate, acuminate, fimbriate to sub-ciliate. Peduncles 3-6 (-11.5) cm. Flowers white. Sepals up to 1 cm, linear, acute, densely ciliate, trinervate, appendage short truncate. Petals up to 1.5 cm, obovate oblong, spur 2 mm. Ovary glabrous ; style clavate ; stigma shortly beaked above. Fruits not seen.

Type : China : Yunnan, A. Henry 10685 (K-holo & CAL-iso !).

Fls. : Apr.-May.

Distrib. : INDIA : Arunachal Pradesh (BM), Nagaland ; CHINA, BURMA.

Notes : This species is allied to *V. hossei* W. Beck. but readily distinguished by its somewhat densely pilose, ovate-oblong leaves, larger flowers and longer tri-nervate densely ciliate sepals.

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DILLENIACEAE	2	May 1979
POACEAE (TRIBE GARNOTIEAE)	3	Nov. 1979
SIMAROUBACEAE	4	April 1980
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