

FLORA OF INDIA

VOLUME 2

PAPAVERACEAE · CARYOPHYLLACEAE

Editors

B.D. SHARMA

and

N.P. BALAKRISHNAN

with assistance from

M. Sanjappa



भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

BOTANICAL SURVEY OF INDIA

CALCUTTA

© Government of India

Date of Publication : July 12, 1993

Published by The Director, Botanical Survey of India, P-8, Brabourne Road, Calcutta-700 001; composed at Computer Unit, Botanical Survey of India, Southern Circle, Coimbatore, 641 003 and printed at Deep Printers, 3/26, Ramesh Nagar, New Delhi-110 015.

CONTENTS

Preface	i
Contributors and Editors	iv
Abbreviations	vi
List of illustrations	vii
PAPAVERACEAE	1
FUMARIACEAE	34
BRASSICACEAE	88
CAPPARACEAE	248
RESEDACEAE	336
VIOLACEAE	342
BIXACEAE	380
FLACOURTIACEAE	386
PITTOSPORACEAE	438
POLYGALACEAE	450
XANTHOPHYLLACEAE	494
FRANKENIACEAE	500
CARYOPHYLLACEAE	502
Index to scientific names	597
Index to common names	616

PREFACE

The Flora of India, Volume 1 (Ranunculaceae to Barclayaceae) containing 489 species should be in your hands before this volume. We now take pleasure in continuing the series with Volume 2 (Papaveraceae to Caryophyllaceae) containing 611 species. Thus, 1100 species of the approximately 17,000 species of Indian flora has been dealt with by now. The format as in Volume 1 is maintained and the details are repeated below for quick reference by users of individual volumes.

The Flora of India covering the present political boundaries of India is planned to be published in 32 volumes dealing with the entire Angiosperms from Ranunculaceae to Poaceae. An introductory volume to the Flora of India has been planned which will cover in general various aspects of flora and vegetation and other allied subjects. Bentham & Hooker's system of classification with delimitation and circumscription based on Cronquist's system, except for certain families, is followed in the delimitation of families. Each volume is being demarcated to accommodate 400 to 600 species on an average.

Family names are followed as per *Nomina Familiarum Conservanda* of International Code of Botanical Nomenclature (ICBN). Alternate names, if any, are given in brackets. Family descriptions are elaborate, so as to reflect the important features on world-wide basis. General distribution of the family along with total number of genera and species for the world and India are indicated in the next paragraph. If there are any important monograph, revision or works on allied subject on the family or genera covering or useful for Indian region, these are cited in the following paragraph under '*Literature*' in alphabetical sequence of authors. Keys to genera, as well as to lower categories, are strictly dichotomous and of bracketed type. For large families, viz. Annonaceae, Menispermaceae, Brassicaceae, Rutaceae, Fabaceae, Asteraceae, Orchidaceae, Poaceae, etc., it may be necessary to arrange genera and keys to genera segregated into subdivisions of the family, like subfamilies, tribes, etc.

The genera are arranged serially in alphabetical sequence. Generic descriptions incorporate important characters of the genus on world-wide basis in a condensed form. The next paragraph contains distribution followed by total number of species in the world and in India. Important selected literature on the genus, with full references form the following paragraph named '*Literature*'.

The species are arranged serially and alphabetically. The correct name of the species appears in bold letters followed by its author's name and full reference to original publication. Basionyms, if any, are given with full citations. All important synonyms, connecting to Indian flora and Indian works are given. This is followed by common names, arranged in alphabetical sequence of abbreviated language names. A detailed taxonomic description of the species is provided for proper identification of the species. Phenological data gathered from herbarium specimens and correlated with those available in literature are indicated as Flowering (*Fl.*) and Fruiting (*Fr.*). Distribution of the species is given in two paragraphs. The first paragraph gives distribution in India, including general ecology and statewise distribution. The second paragraph provides world distribution, countrywise and/or phytogeographically. Uses of the species, if any, on economic, medicinal or ethnobotanical aspects are given under 'Notes'. If there are any nomenclatural, taxonomic or phytogeographic interesting aspects these are also given under 'Notes' with literature citation, if any.

Plants which are purely cultivated are listed at the end of the family with short descriptions and notes. Those exotic species which have run wild or get propagated naturally are included in the general account.

For the sake of uniformity, author's names are mostly abbreviated as given in 'Draft Index of Author Abbreviations' compiled at Kew.

Acknowledgements

The Editors acknowledge their deep gratitude and appreciation to Dr. T.N. Khoosoo, Emeritus Scientist, and Ex-Secretary, Ministry of Environment & Forests, Govt. of India, who in 1984, initiated the process of the preparation of Flora of India in this new pattern and gave constant encouragement and facilities during the formative period. They are thankful to Mr. R. Rajamani, Secretary, Ministry of Environment & Forests, Govt. of India, for his consistent encouragement and prompt action in providing all facilities for continuation of the work. The Editors thank Dr. S.K. Jain, Ex-Director, Botanical Survey of India, who initiated the series 'Fascicles of Flora of India' and showed keen interest and encouragement during the course of this work. They appreciate the hard efforts put in by Dr. M.P. Nayar, Ex-Director, Botanical Survey of India for initiating the project and the enthusiasm shown during the preparation of guide-lines and for encouraging the contributors.

The editors express their appreciation for the hard work put in by various contributors of the families and family editors for finalisation of the manuscripts on time. They also express their gratitude to the various Artists and Photographers of the department for their efficient and prompt preparation of illustrations and photographs.

The editors record their thanks to Mr. A.R.K. Sastry, Scientist SF, Botanical Survey of India, Calcutta for his valuable help in various ways during the entire work starting from preparation of guidelines to the publication.

Special thanks are due to Mr. S.C. Pal, Publication Officer, Botanical Survey of India, Calcutta for helping us in composing and formatting the volume.

The editors acknowledge the efficient and quick work done by the Computer Unit of Botanical Survey of India at Southern Circle, Coimbatore, in typing the manuscripts on Computer and composing them in DTP by Mr. A.K. Pathak, System Analyst, Mr. N.G.R. Nair, Stenographer, Mrs. P. Sumathi and Miss G. Geethalakshmi, Data Entry Operators. The Editors express their deep appreciation and gratitude to all the present and retired staff members of Botanical Survey of India for their hardwork and whole-hearted cooperation which amply helped us to achieve this goal.

Finally the editors acknowledge the quick production of the books in final form by Mr. M.L. Jain of Deep Printers, New Delhi.

Calcutta
15.06.1993

B.D. SHARMA
and
N.P. BALAKRISHNAN

CONTRIBUTORS AND EDITORS

- BALAKRISHNAN, N.P. 13 - 14 BPC Nagar, Thondamuthur Road, Bharatiyar University P.O. , Coimbatore 641 046.
- BANERJEE, R.N. Botanical Survey of India, Central National Herbarium, P.O. Botanic Garden, Howrah 711 103.
- BANERJEE, S.P. 49 Shibtola Street, Uttarpara 712 258, West Bengal.
- BASAK, R.K. 15-B, Chidam Mudi Lane, Calcutta 700 006.
- BHAUMIK, G.H. Botanical Survey of India, Central National Herbarium, Botanic Garden, Howrah 711 103.
- CHOWDHERY, H.J. Botanical Survey of India, Arunachal Pradesh, Field Station, Itanagar 791 110.
- DANIEL, P. Botanical Survey of India, Southern Circle, TNAU Campus, Lawley Road, Coimbatore 641 003.
- DAS, G.C. Botanical Survey of India, P-8 Brabourne Road, Calcutta 700 001.
- DEBNATH, H.S. Botanical Survey of India, Flora Cell, Central National Herbarium, Botanic Garden, Howrah 711 103.
- ELLIS, J.L. 64, 4th Main, Gopalappa Layout, Lakhasandra, Bangalore 560 036.
- GIRI, G.S. Botanical Survey of India, Flora Cell, Central National Herbarium, Botanic Garden, Howrah 711 103.
- HAJRA, P.K. Ministry of Environment & Forests, Paryavaran Bhavan, C.G.O. Complex, Lodhi Road, New Delhi 110 003.
- HENRY, A.N. Botanical Survey of India, Southern Circle, TNAU Campus, Lawley Road, Coimbatore 641 003.
- JANARTHANAM, M.K. Department of Botany, Goa University, Taleigao Plateau, Goa 403 203.
- MAJUMDAR, N.C. 18/1 A, Chetla Hat Road, Alipore, Calcutta 700 027.

MITRA, R.L. Botanical Survey of India, Industrial Section, Indian Museum, Botanical Survey of India, 1-Sudder Street, Calcutta 700 016.

NAYAR, M.P. TC-19/315, "The Greens", Vattavila, Thirumala, Thiruvananthapuram, 695 006.

PREMANATH, R.K. Botanical Survey of India, National Orchidarium & Experimental Garden, Yercaud 636 001.

SANJAPPA, M. Botanical Survey of India, Flora Cell, Central National Herbarium, Botanic Garden, Howrah 711 103.

SUNDARARAGHAVAN, R. We regretfully state that he expired on 4 March 1991.

VERMA, D.M. Botanical Survey of India, P-8 Brabourne Road, Calcutta 700 001.

VIVEKANANTHAN, K. Botanical Survey of India, Southern Circle, TNAU Campus, Lawley Road, Coimbatore 641 003.

ABBREVIATIONS

of

INDIAN LANGUAGES

Abhor	: Abhor	Kum.	: Kumaonese
And.	: Andaman	Lep.	: Lepcha
Asm.	: Assamese	Lus.	: Lushai
Beng.	: Bengali	Mal.	: Malayalam
Bhoj.	: Bhojpuri	Mani.	: Manipuri
Bhut.	: Bhutia	Mar.	: Marathi
Cachar	: Cachar	Mikir	: Mikir
Coorgi	: Coorgi	Miri	: Miri
Eng.	: English	Naga	: Naga
Garo	: Garo	Nep.	: Nepali
Garh.	: Garhwali	Or.	: Oriya
Goa.	: Goanese	Port.	: Portugese
Guj.	: Gujarati	Punj.	: Punjabi
Hindi	: Hindi	Raj.	: Rajasthani
Jain.	: Jaintea	Sans.	: Sanskrit
Jaun.	: Jaunsar	Sant.	: Santal
Kang.	: Kangri	Sind.	: Sindhi
Kan.	: Kannada	Tam.	: Tamil
Kash.	: Kashmiri	Tel.	: Tclugu
Kh.	: Khasi	Tipp.	: Tipperra (Tripura)
Kon.	: Konkani	Urdu	: Urdu

LIST OF ILLUSTRATIONS

PAPAVERACEAE

1.	Argemone mexicana L. forma mexicana	4
2.	Argemone ochroleuca Sweet	6
3.	Eschscholtzia californica Cham.	9
4.	Meconopsis aculeata Royle	12
5.	Meconopsis discigera Prain	15
6.	Meconopsis grandis Prain	16
7.a.	Meconopsis horridula Hook. f. & Thomson	18
	b. Meconopsis lyrata (Prain) Prain	18
8.a.	Meconopsis robusta Hook. f. & Thomson	23
	b. Meconopsis simplicifolia (D. Don) Walp.	23
9.	Meconopsis villosa (Hook. f.) G. Taylor	26
10.	Papaver macrostomum Boiss.	30

FUMARIACEAE

11.	Corydalis cornuta Royle	47
12.	Corydalis diphylla Wallich	51
13.	Corydalis geraniifolia Hook. f. & Thomson	58
14.	Corydalis govaniana Wallich	61
15.	Dicentra scandens (D. Don) Walp.	80

BRASSICACEAE

16.A.	Farsetia hamiltonii Royle	95
	B. Farsetia jacquemontii Hook. f. & Thomson	95
17.	Arabis nova Vill.	102
18.	Arabis pterosperma Edgew.	104
19.	Cardamine flexuosa Withering	111

20.	<i>Cardamine hirsuta</i> L.	113
21.	<i>Cardamine macrophylla</i> Willd.	116
22.	<i>Rorippa indica</i> (L.) Hiern	130
23.	<i>Brassica rapa</i> L. subsp. <i>campestris</i> (L.) Clapham	139
24.	<i>Schouwia purpurea</i> (Forsskal) Schweinf.	148
25.	<i>Sinapis alba</i> L.	150
26.	<i>Draba gracillima</i> Hook. f. & Thomson	160
27.	<i>Draba oreades</i> Schrenk.	165
28.	<i>Neslia apiculata</i> Fischer, C. Meyer & Ave-Lall.	175
29.	<i>Tauscheria lasiocarpa</i> Fischer ex DC	177
30.	<i>Erysimum altaicum</i> C. Meyer	181
31.	<i>Erysimum hieracifolium</i> L.	183
32.	<i>Dilophila salsa</i> Thomson	194
33.	<i>Isatis tinctoria</i> L.	200
34.	<i>Lepidium latifolium</i> L.	204
35.	<i>Lepidium virginicum</i> L.	208
36.	<i>Matthiola flavida</i> Boiss.	218
37.	<i>Matthiola incana</i> (L.) R. Br.	220
38.	<i>Arabidiopsis stricta</i> (Cambess.) N. Bausch	230
39.	<i>Arcyosperma primulifolium</i> (Thomson) O. Schulz	233
40.	<i>Descurainia sophia</i> (L.) Webb ex Prantl	238

CAPPARACEAE

41.	<i>Cadaba trifoliolata</i> (Roxb.) Wight & Arn.	251
42.	<i>Capparis assamica</i> Hook. f. & Thomson	259
43.	<i>Capparis brevispina</i> DC.	261
44.	<i>Capparis cleghornii</i> Dunn	264
45.	<i>Capparis diversifolia</i> Wight & Arn.	268
46.	<i>Capparis floribunda</i> Wight	270
47.	<i>Capparis fusifera</i> Dunn	272
48.	<i>Capparis micrantha</i> DC.	276

49.	<i>Capparis moonii</i> Wight	278
50.	<i>Capparis multiflora</i> Hook. f. & Thomson	280
51.	<i>Capparis nilgiriensis</i> Subbarao et al.	282
52.	<i>Capparis pachyphylla</i> Jacobs	284
53.	<i>Capparis rheedii</i> DC.	286
54.	<i>Capparis shevaroyensis</i> Sund.-Ragh.	291
55.	<i>Capparis sikkimensis</i> Kurz	293
56.	Capsules and seeds of <i>Cleome</i> L.	300
57.	<i>Cleome burmanii</i> Wight & Arn.	305
58.	<i>Cleome chelidonii</i> L. f.	307
59.	<i>Cleome gynandra</i> L. var. <i>gynandra</i>	311
60.	<i>Cleome viscosa</i> L. var. <i>nagarjunakondensis</i> Sund.-Ragh.	319
61.	<i>Dipterygium glaucum</i> Decsne	328
62.	<i>Maerua apetala</i> (Roxb.) Jacobs	330
63.	<i>Stixis suaveolens</i> (Roxb.) Pierre	334

VIOLACEAE

64.	<i>Hybanthus enneaspermus</i> (L.) F. Muell.	344
65.	<i>Hybanthus travancoricus</i> (Beddome) Melchior	346
66.	<i>Rinorea bengalensis</i> (Wallich) O. Ktze	349
67.	Style and stigma of Indian <i>Violas</i>	352
68.	<i>Viola betonicifolia</i> J. Smith subsp. <i>jaunsarensis</i> (W. Becker) Hara	356
69.	<i>Viola sikkimensis</i> W. Becker	375

BIXACEAE

70.	<i>Bixa orellana</i> L.	382
71.	<i>Cochlospermum religiosum</i> (L.) Alston	384

FLACOURTIACEAE

72.	<i>Casearia andamanica</i> King	392
73.	<i>Flacourtia jangomas</i> (Lour.) Raeusch.	404

74.	<i>Gyncardia odorata</i> R. Br.	408
75.	<i>Homalium travancoricum</i> Beddome	416
76.	<i>Hydnocarpus alpina</i> Wight (male)	419
77.	<i>Hydnocarpus alpina</i> Wight (female)	420
78.	<i>Scolopia acuminata</i> Clos	429
79.	<i>Scolopia spinosa</i> (Roxb.) Warb.	432
80.	<i>Xylosma controversum</i> Clos	435
81.	<i>Xylosma longifolium</i> Clos	437

PITTOSPORACEAE

82. *	<i>Pittosporum anamallayense</i> Nayar & Giri	440
83.	<i>Pittosporum dasycaulon</i> Miq.	443
84.	<i>Pittosporum viridulum</i> Nayar et al.	448

POLYGALACEAE

85.	<i>Epirixanthes elongata</i> Blume	452
86.	<i>Polygala arillata</i> D. Don	458
87.	<i>Polygala arvensis</i> Willd.	461
88.	<i>Polygala chinensis</i> L.	465
89.	<i>Polygala crioptera</i> DC.	468
90.	<i>Polygala globulifera</i> Dunn	471
91.	<i>Polygala karensium</i> Kurz	475
92.	<i>Polygala linarifolia</i> Willd	477
93.	<i>Polygala mariesii</i> Hemsley	479
94.	<i>Polygala sibirica</i> L.	482
95.	<i>Polygala tartarinowii</i> Regel.	484
96.	<i>Polygala tricholopha</i> Chodat	486
97.	<i>Salomonina ciliata</i> (L.) DC.	491
98.	<i>Securidaca inappendiculata</i> Hassk	493

XANTHOPHYLLACEAE

- | | | |
|------|--|-----|
| 99. | <i>Xanthophyllum andamanicum</i> King | 496 |
| 100. | <i>Xanthophyllum flavescens</i> Roxb. var. <i>flavescens</i> | 498 |

CARYOPHYLLACEAE

- | | | |
|------|---|-----|
| 101. | <i>Arenaria curviflora</i> Majumdar | 508 |
| 102. | <i>Arenaria serpyllifolia</i> L. | 516 |
| 103. | <i>Arenaria thangoensis</i> W. Smith | 518 |
| 104. | <i>Brachystemma calycinum</i> d. Don | 520 |
| 105. | <i>Cerastium cerastoides</i> (L.) Britton | 522 |
| 106. | <i>Cucubalus baccifer</i> L. | 526 |
| 107. | <i>Dianthus chinensis</i> L. | 529 |
| 108. | <i>Drymaria diandra</i> Blume | 534 |
| 109. | <i>Gypsophila cerastioides</i> D. Don | 536 |
| 110. | <i>Lepyrodiclis holosteoides</i> (C. Meyer) Fischer & C. Meyer | 541 |
| 111. | <i>Lychnis coronaria</i> (L.) Desr. | 543 |
| 112. | <i>Minuartia ebracteolata</i> Majumdar & Giri | 546 |
| 113. | <i>Petrorhagia alpina</i> (Habl.) Ball & Heywood | 550 |
| 114. | <i>Polycarpon prostratum</i> (Forsskal) Aschers. & Schweinf. | 554 |
| 115. | <i>Pseudostellaria heterantha</i> (Maxim.) Pax var. <i>himalaica</i> Ohwi | 556 |
| 116. | <i>Silene songarica</i> (Fischer, C. Meyer & Ave-Lall.) Bocq. | 575 |
| 117. | <i>Spergula arvensis</i> L. | 579 |
| 118. | <i>Vaccaria pyramidata</i> Medikus | 594 |



1. *Argemone mexicana* L. (BSI, W.C., Pune)



2. *Bixa orellana* L. (BSI, W.C., Pune)



3. *Cadaba trifoliata* (Roxb.) Wight & Arn. - Mundanthurai, Tirunelveli Distr., Tamil Nadu. Photo : K. Ravikumar (MH)



4. *Capparis decidua* (Forsskal) Edgew. - Tree with orange-red flowers (BSI, W.C., Pune)



5. *Capparis decidua* (Forsskal) Edgew. - with pink red flowers
(BSI, W.C., Pune)



6. *Capparis divaricata* Lam. - flowers (BSI, W.C., Pune)



7. *Capparis divaricata* Lam. - fruits (BSI, W.C., Pune)



8. *Capparis grandis* L. (BSI, W.C., Pune)



9. *Capparis zeylanica* L. (BSI, W.C., Pune)



10. *Casearia graveolens* Dalz. - Eastern Ghats, Andhra Pradesh,
N. Rama Rao (BSI, S.C., Coimbatore)



11. *Casearia grewiaefolia* Vent. var. *gelonoides* (Blume) Sleumer -
Andaman & Nicobar Islands (BSI, A.N.C., Port Blair)



12. *Cleome viscosa* L. (BSI, W.C., Pune)



13. *Cochlospermum religiosum* (L.) Alston - Bodi hills, Madurai Dist., Tamil Nadu. Photo : K. Ravikumar (MH)



14. *Hydnocarpus pentandra* (Buch.-Ham.) Oken - High Wavy's Mountains, Madurai Dist., Tamil Nadu. Photo : K. Ravikumar (MH)



15. *Maerua oblongifolia* (Forsskal) A. Rich. (BSI, W.C., Pune)



16. *Polygala arillata* D. Don - High Wavy's Mountains, Madurai Dist., Tamil Nadu. Photo : K. Ravikumar (MH)

PAPAVERACEAE

(H. S. Debnath and M. P. Nayar)

Herbs or shrubs with milky latex or yellowish juice, annual, biennial or perennial; hairs simple, barbellate or stellate. Leaves exstipulate, mostly basal in a rosette, simple, pinnatifid, pinnatisect or palmately lobed; stem leaves usually few, alternate, rarely opposite. Flowers on leafless scapes or in leafy racemes or panicles, bisexual, actinomorphic, nodding in bud, showy. Sepals 2 (-3), free or rarely united at base, imbricate, caducous. Petals 4 - 6 (rarely 8 - 12 or absent), in 1 - 2 (-3) whorls, free, imbricate, often crumpled at first. Stamens many, free; anthers longitudinally dehiscent; filaments filiform or winged. Ovary superior, 1-loculed or apparently 2 - 10 -loculed by intrusive placentae; ovules many on parietal placentae, rarely solitary and basal; style usually 1 or absent; stigmas of different forms, usually connate, capitate, rarely free or sessile on ovary as lobed disc. Fruit a capsule, dehiscent by 2 - 10 pores or valves; seeds small, numerous.

Temperate and subtropical N. America, Europe, Asia and a few in Australia and South Africa; 26 genera and about 200 species; 5 genera and 27 species in India.

Literature. DEBNATH, H. S. & M. P. NAYAR (1984) Papaveraceae & Hycoceae. In: *Fasc. Fl. India* 17: 1 - 48, ff. 1 - 18. DEBNATH, H. S. & M. P. NAYAR (1986) The Poppies of Indian Region, pp. 1 - 192, ff. 1 - 42. FEDDE, F. (1909) Papaveraceae, Hycoceae & Papaveroideae. In: *Engler, Pflanzenr.* 40 (IV, 104): 1 - 430, ff. 1 - 43. JAFFRI, S. M. H. & M. QAISER (1974) Papaveraceae. In: *Fl. W. Pakistan* 61: 1 - 32, ff. 1 - 6. STEENIS, C. G. G. J. van (1954) Papaveraceae. In: *Fl. Males.* 1, 5: 114 - 117, ff. 1 - 2.

KEY TO THE GENERA

- 1a. Stigmatic lobes alternate to placentae; capsules opening throughout its length 2
- b. Stigmatic lobes opposite to placentae; capsules usually opening by pores or by short valves, rarely throughout its length 3
- 2a. Leaves ternately dissected into narrow segments; sepals forming a hood or calytra-like cap; stigmas 4 - 6 3. *Eschscholzia*
- b. Leaves pinnatifid or pinnatifid; sepals not forming any hood or calytra-like cap; stigmas bifurcate 2. *Dicranostigma*
- 3a. Styles present or inconspicuous; stigmas not discoid; capsules opening usually by short valves 4
- b. Styles absent; stigmas sessile, discoid; capsules opening by pores or by short valves, rarely throughout its length 5. *Papaver*

4a. Styles distinct, conspicuously broad and large; stigmas forming a globular mass over ovary

4. Meconopsis

b. Styles inconspicuous (rarely very short); stigmas not forming a globular mass over ovary

1. Argemone

1. Argemone L.

Herbs, erect, prickly or often glabrous, annual or perennial, with yellowish juice. Leaves sessile, pinnatifid or sinuate-lobulate, glaucous; middle and upper ones elliptic-oblong; lower obovate or oblanceolate, toothed along margins, each tooth ending in a prickle. Flowers solitary, terminal or axillary, pedunculate, white, yellow or orange; flower-buds spherical, elliptic or oblong. Sepals 3, caducous, bearing a horn below apex. Petals 6 in 2 whorls, obovate. Stamens many, 2-loculed; filaments filiform; anthers linear, basifixed. Ovary ovate-oblong or subfusiform, unilocular; placentae 3 - 5, parietal; ovules numerous; styles very short or obsolete; stigmas sessile, radiating, 3 - 7-lobed; lobes opposite to placental strands. Capsules ellipsoid to oblong, 4 - 6-ribbed, prickly or not, dehiscent along sutures by 3 - 6 short valves in upper part; seeds numerous, subspherical or spherical, pitted.

American genus; ca 22 species, 3 species in India, introduced as weeds.

Literature. KSHETRAPAL, S., JAIN, U. & T. C. TANWAR (1984) Anatomical studies in the genus *Argemone*. Bull. Bot. Surv. India 26: 164 - 166. LAYKA, S. (1976) Le polymorphisme pollinique dans le genre *Argemone* (Papaveraceae). Pollen et Spores 18(3): 351 - 375. MARY, T. N., GROVER, I. S. & C. P. MALICK (1974) The genus *Argemone*: 3. Cytological studies in some autotetraploids. Chromosome Inform. Serv. No. 16: 11 - 12. OWNBEY, G. B. (1958) Monograph of the genus *Argemone* for North America and the West Indies. Mem. Torrey Bot. Club 21(1): 1 - 149.

KEY TO THE SPECIES

- 1a. Flowers bright yellow; stigmatic lobes closely crowded together and appressed to styles at anthesis; styles inconspicuous, up to 1 mm long in fruit **1. A. mexicana**
- b. Flowers white, turning to pale yellowish with age; stigmatic lobes divergent and not appressed; styles conspicuous in fruits, 1 - 3 mm long **2**
- 2a. Capsules lanceolate or ovate-lanceolate; sepal horns 6 - 8 mm long; leaves whitish green with prominent whitish tinge along midribs and veins **2. A. ochroleuca**
- b. Capsules subellipsoid to subfusiform; sepal horns 10 - 14 mm long; leaves pale green **3. A. subfusiformis**

1. *Argemone mexicana* L., Sp. Pl. 508. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 117. 1872.

Annuals, 30 - 125 cm high, divaricately branched, spinescent or devoid of spines (in *f. leiocarpa*), with yellow latex. Leaves sessile, elliptic-obovate, cordate or semi-amplexicaul at base, pinnatifid, sinuate-lobulate, 3 - 22 x 2 - 8 cm; segments inciso-dentate, acute

or spiny along margins, glaucous-green with pale markings on veins, often prickly on lower surface, smooth above or on both surfaces (in *f. leiocarpa*). Flower buds 9 - 24 x 6 - 12 mm, sparingly or totally smooth (in *f. leiocarpa*); flowers bright yellow, 4 - 7 cm in diam., sessile, subtended by 2 - 3 foliaceous bracts. Sepals elliptic, 8 - 15 x 5 - 10 mm, each with 6 - 9 mm long acute terete horn, sparsely prickly outside. Petals 4 - 6, imbricate, obovate, cuneiform, crumpled in aestivation, 2 - 3 x 1.5 - 2.5 cm. Stamens many 8 - 10 mm long; filaments yellow; anthers ca 2 mm long, yellow. Ovary ovoid, 8 - 15 x 3 - 6 mm. Capsules ellipsoid to oblong, 10 - 38 x 8 - 21 mm, larger spines 4 - 9 mm long or the surface totally smooth (in *f. leiocarpa*); seeds many, 1.6 - 2 mm long, deeply reticulate, suborbiculate, blackish brown to deep brown.

KEY TO THE FORMA

- | | |
|--|-----------------------------|
| 1a. Plants glabrous, devoid of any spines, except leaf margins | 1.1. forma <i>leiocarpa</i> |
| b. Plants spinescent | 1.2. forma <i>mexicana</i> |

1.1. forma *leiocarpa* (E. Greene) Ownbey in Mem. Torrey Bot. Club 21(1): 37. 1958. *A. leiocarpa* E. Greene in Pittonia 3: 345. 1898.

Distrib. India: Rajasthan (Udaipur).

USA (Southern Florida), Brazil and West Africa.

Notes. Reported by Malik & Grover (in Indian For. 95(2): 123 - 124. 1969) from Udaipur.

Chromosome no. = $n = 14, 28$ (Mary et al., l. c.).

1.2. forma *mexicana*

Fig. 1.

Beng.: *Barosial-kanta*, *Sial-kanta*; Guj.: *Darudi*; Hindi: *Bhar-bhand*, *Farangi-dhutura*, *Pila-dhutura*, *Shial-kanta*; Ladakhi: *Gailshe*; Mal.: *Brahmadanti*; Or.: *Kantukusam*; Punj.: *Bhat-kateya*, *Bhatmil*, *Bher-bhandi*, *Kandiari*, *Katei*, *Satyanasa*, *Sial-kanta*; Sans.: *Brahma-dandi*, *Srigala-kanta*; Tam.: *Birma-dandu*, *Kurukkum-chedi*; Tel.: *Brahma-dandi-chettu*; Urdu.: *Brama-dandi*.

Fl. & Fr. Feb. - May

Distrib. India: Throughout, from sea level to 1500 m.

Native of Tropical America.

Notes. The yellow juice of the plant is used as a medicine for dropsy, jaundice and cutaneous infections. It is also used as diuretic, to relieve blisters and ulcers. The seed

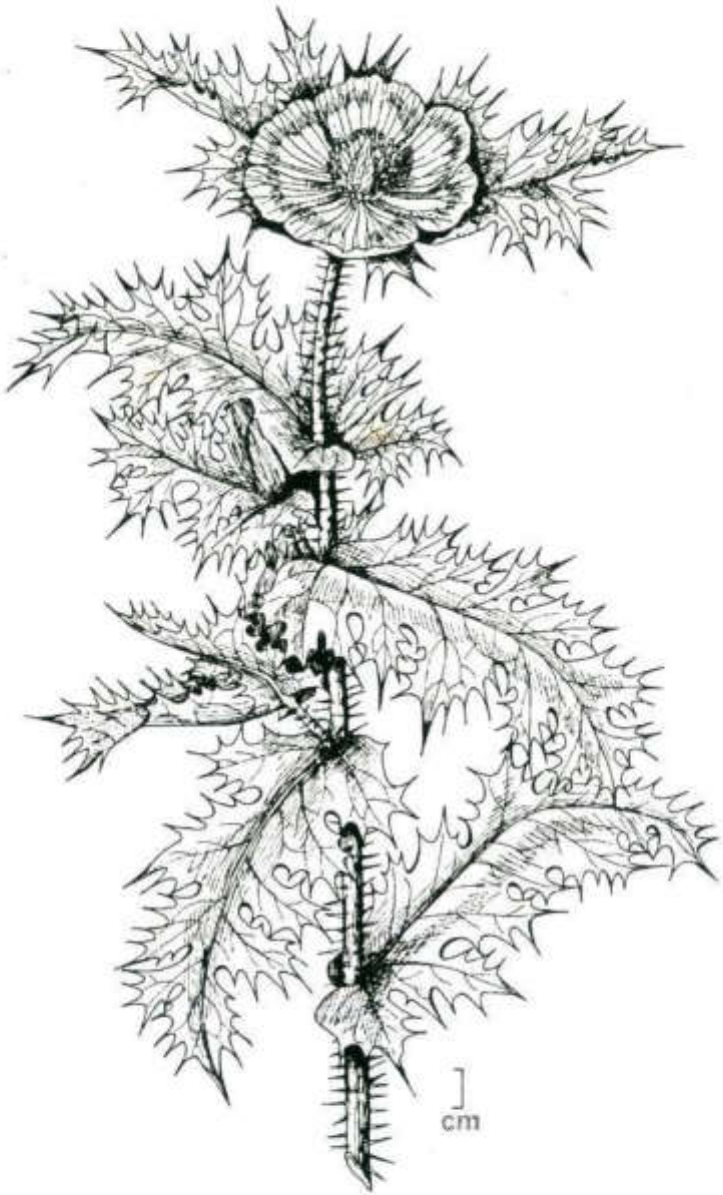


Fig. 1. *Argemone mexicana* L. forma mexicana

oil is used as a medicine for ulcers and eruptions and also for burning in lamps. In Ladakh an aqueous extract of the powdered leaves is used externally to treat eczema and eye diseases.

Chromosome no. $n = 28$ (Kaul in Sci. & Cult. 462 - 463, 1966); $n = 14, 28$ (Mary et al., l. c.).

2. *Argemone ochroleuca* Sweet, Brit. Fl. Gard. 3: t. 242. 1829; Nair in Rec. Bot. Surv. India 21(1): 7 - 8. 1978. Fig. 2.

Shrubs, annual or perennial, up to 1 m tall; young stems whitish purple or violaceous. Leaves oblanceolate, semi-amplexicaul, sessile at base, sinuate to pinnatifid, basal leaves deeply lobed; lobes oblong, glaucous. Flower buds oblong, 8 - 15 x 4 - 9 mm; flowers whitish or pale lemon yellow, 2.5 - 3.5 cm across, sessile, subtended by 2 - 3 foliaceous 2 - 5 cm long, ca 5 mm broad bracts. Sepals 3, 8 - 12 x 5 - 7 mm. Petals 6, obcuneate-ovovate, 28 - 30 x 16 - 19 mm. Stamens many, 8 - 10 mm long; filaments pale yellow; anthers oblong, recurved, dark yellow. Ovary 8 - 10 x ca 5 mm; stigmas 5-lobed, deeply dissected, dark red. Capsules ovoid or lanceolate-ovoid, 1 - 4 cm long excluding style, 4 - 17 mm thick, with 12 - 26 erecto-patent spines per valve, the largest spine up to 10 mm long; seeds 1.5 - 2 mm in diam., finely reticulate, black.

Fl. & Fr. Feb. - June.

Distrib. India. A common weed in cultivated fields and embankments. Punjab, Delhi and Uttar Pradesh.

Native of Mexico.

Notes. Chromosome no. $n = 14$ (Ernst in Contr. Dudley Herb. 5, 5: 137 - 139. 1959); $2n = 28, 56$ (Ownbey, l. c. 1958).

3. *Argemone subfusiformis* Ownbey in Brittonia 13: 102, ff. 12 - 14. 1961.

Herbs or shrubs, annual or subperennial, prickly, 40 - 100 cm high, with perpendicular or reflexed prickles on stems. Leaves glaucous, lobed, with equal sinuses, dentate along margins with acute teeth, prickly on lower surface, smooth on upper surface. Flower buds oblong, 15 - 20 x 8 - 12 mm, prickly; flowers 2.8 - 4.6 cm across. Sepals 10 - 14 mm long, with terete horns. Petals cuneate, suborbicular, lemon-yellow. Stamens 25 - 30, yellow. Stigmas 2 - 3 mm broad, 1.5 - 2 mm long, purple; lobes narrow, spreading. Capsules subellipsoid or subfusiform, 29 - 45 x 14 - 15 mm, 3 - 4 (-5)-carpellate; styles 0.5 - 3 mm long, armed with patent subequal spines; seeds many, more or less rounded, 18 - 25 mm long, blackish brown.

Fl. & Fr. April - Nov.

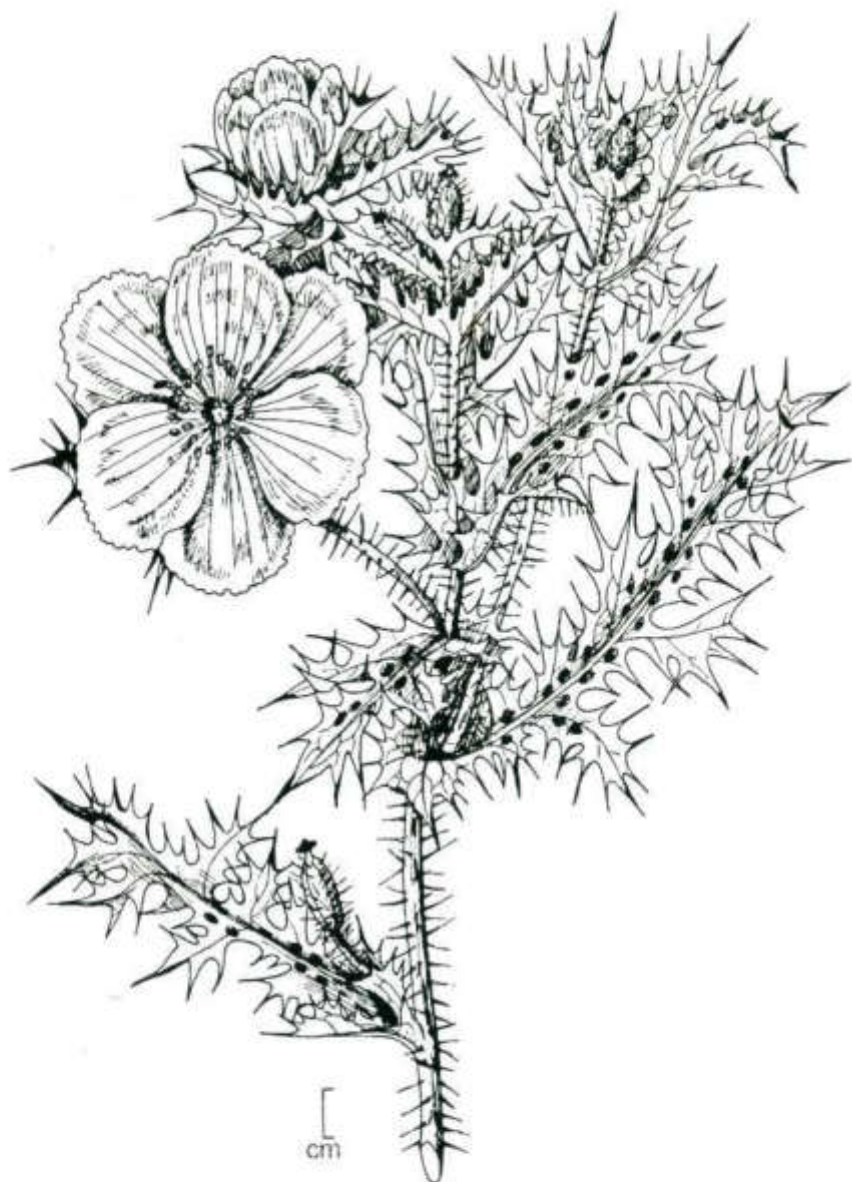


Fig. 2. *Argemone ochroleuca* Sweet

Distrib. India: Rajasthan (Udaipur).

Native of S. America.

Notes. Malik & Grover (in Indian For. 95(7): 480 - 481. 1969 & in Sci. & Cult. 41(5): 220 - 223. 1975) report this for India from Udaipur. It is distinguishable by the larger flowers and subclipsoid to subfusiform capsules.

Chromosome no. $n = 14, 28$ (Mary et al., l. c.).

2. *Dicranostigma* Hook. f. & Thomson

Herbs, annual or perennial, glaucous, with yellow juice and stout woody taproot; stems many, leafless and branched at lower part with alternate leafy bracts above. Leaves mainly radical, petioled, pinnatifid or pinnately partite, with distant rhomboid acute sharply cut segments and trifid terminal segments; stem leaves few, sessile, alternate. Flowers few on slender ebracteate pedicel, terminal and in axils of stem leaves. Sepals 2, ovate, 2-horned at apex, early caducous. Petals 4, in 2 whorls, orange or yellow. Stamens many. Ovary narrowly ellipsoid, 1-loculed with 2 parietal placentae; style stout, erect; stigmatic lobes alternate to placentae, ascending. Capsules narrowly cylindrical or linear, acute, dehiscent up to base by 2 valves, softly hairy or glabrous; seeds not cristate.

Himalayas and W. China; 3 species, one in India.

Dicranostigma lactucoides Hook. f. & Thomson, Fl. Ind. 255. 1855. *Stylopodium lactucoides* (Hook. f. & Thomson) Benth. & Hook. f., Gen. Pl. 1: 53. 1862 & Fl. Brit. India 1: 119. 1872.

Herbs decumbent, 20 - 60 cm long, puberulous; flowering stems 3 - 4, slender, subglabrous, erect, branched above, each branch with a terminal flower. Leaves pinnatifid or partite with 4 - 6 pairs of segments; basal leaves elliptic-oblongate, irregularly dentate along margins, deeply pinnatifid with 4 - 7 pairs of oblong squarish lobes, 10 - 25 x 3 - 7 cm; petioles 1 - 6 cm long, winged; cauline leaves sessile, smaller, ca 2 cm long, with 1 - 3 pairs of lobes. Pedicels 5 - 7.5 cm long, slender. Sepals broadly elliptic, 1.5 - 2 cm long with stout blunt horns, acute, puberulous. Petals obovate, 1.5 - 2.5 x 2 cm, orange. Stamens many; anthers linear or linear-oblong. Ovary narrowly ovate, ca 1 cm long, puberulous; styles distinct, ca 5 mm long; stigmas mitriform, crowned. Capsules slightly curved, on up to 20 cm long pedicels, 5 - 6 x 0.5 cm, hairy; seeds numerous, small, punctate.

Fl. & Fr. June - Oct.

Distrib. India: W. Himalayas, 2700 - 4700 m. Uttar Pradesh (Garhwal).

Nepal.

3. *Eschscholzia* Cham.

Herbs, annual or perennial, glaucous, with watery sap. Leaves alternate, radical or cauline, ternately dissected into narrow segments, petioled. Flowers solitary, terminal or axillary, long-pedicelled, large, showy. Torus turbinate with a broad, flat or recurved border surrounding the base of pistil and on inner edge of which the calyx, corolla and stamens are inserted showing a perigynous appearance. Sepals 2, oblong, deciduous, connate, forming a hood or calyptra-like cap, which is pushed off by the expanding petals. Petals 4, free, whitish or yellowish. Stamens many, inserted at base of petals; anthers linear-lanceolate or oblong, basifixed, ditheous; filaments shorter than anthers, dilated at base. Ovary linear, ribbed; styles very short; stigmas 4 - 6, filiform, unequal. Capsules linear, with a narrow base, dehiscent by 2 valves from base to apex, ribbed; seeds numerous, globose, reticulate.

Native to North America; ca 10 species, one introduced into India as a garden plant.

Eschscholzia californica Cham. in Nees, *Horae Phys. Berol.* 74, t. 15. 1820; Nair in *Rec. Bot. Surv. India* 21(1): 8. 1978. Fig. 3.

Perennial, erect to diffuse herbs; stems 30 - 50 cm high, quadrangular, scapose to leafy, dichotomously branched, glabrous or subglabrous. Leaves 10 - 30 cm long, ternately dissected into narrow ca 1 mm broad acute or subobtuse segments; petioles 5 - 20 cm long, becoming shorter in upper leaves. Flower-buds ovate, 2 - 2.5 x 1 - 1.5 cm; pedicels 6 - 20 cm long; flowers 4 - 8 cm in diam., showy. Sepals united into a calyptra, caducous, leaving 2 rims at base of ovary, conical, ca 2 cm long; outer rim spreading, 3 - 4 mm broad, with parallel striations; inner rim erect, short. Petals broadly obovate, 5 - 6 x 1 - 4 cm, yellow, shortly clawed. Anthers linear-lanceolate, 4 - 6 mm long; filaments short, 3 - 5 mm long. Ovary ca 8 - 10 mm long; styles short; stigmas 4, 3 - 4 mm long. Capsules 7 - 10 cm long, 3 - 4 mm broad, straight, longitudinally ribbed, glabrous; seeds globose, reticulate, ca 2 mm in diam., black.

Fl. & Fr. Feb. - Aug.

Distrib. India: Cultivated in gardens as ornamental plant and often runs wild in W. Himalayan region.

Native of North America.



Fig. 3. *Eschscholzia californica* Cham.

4. *Meconopsis* Viguiet

Herbs, erect, biennial or perennial, monocarpic or polycarpic, with yellow juice, often woody at base; stems scapose or leafy, usually simple, often branched; indumentum often of barbellate bristles or hairs. Leaves mostly radical, some cauline, entire to bipinnatifid or partite, rarely palmatifid. Flowers solitary, terminal on leafless scapose stems or on pedicels arising all along the central flowering axis forming leafy racemes or in axillary cymes forming leafy panicles. Sepals 2, ovate, elliptic, early caducous. Petals 4, more often 5 - 9 (-10), obovate or suborbicular, variously coloured, showy. Stamens many; filaments filiform, linear, mostly coloured like petals. Ovary sessile, ellipsoid to oblong-ellipsoid, ovoid, obovoid or rarely subglobose, often bristly; style conspicuous, elongate; stigmas 2 - 12, free or united with more or less decurrent lobes. Capsules cylindrical to subglobose or ellipsoid-oblong or obovoid, 4 - 10-valved, usually dehiscent by interplacental subapical pores or long slits at apex only or rarely to the base; seeds many, subreniform or ellipsoid-oblong, smooth or rugose, often papillose.

Himalayas and south-central Asia; ca 47 species, 16 species in India.

Literature. HENDERSON, D. M. (1965) Pollen morphology of *Meconopsis*. *Grana Palynologia* 6(2): 191 - 209. TAYLOR, G. & E. H. M. COX (1934) An account of the genus *Meconopsis*. pp. 1 - 130, tt. 1 - 29.

Notes. *Cathcartia* Hook. f. treated as an independent genus by Hook. f. & Thomson (in *Fl. Brit. India* 1: 119. 1872) is included here in this genus.

KEY TO THE SPECIES

- | | | |
|-----|--|-------------------------------|
| 1a | Ovary and capsule flat-topped, bearing a lobed epigynous disc formed by expanded disc of stylar base | |
| | | 4. <i>M. discigera</i> |
| b. | Ovary and capsule tapering at apex into a long style without expanded epigynous disc of stylar base | 2 |
| 2a | Indumentum of prickly rigid bristles | 3 |
| b. | Indumentum of soft hairs, if present | 8 |
| 3a. | Flowering stems scapose or leafy at base only | 4 |
| b. | Flowering stems leafy throughout | 5 |
| 4a. | Leaves deeply pinnatifid; style ca 1 cm long | 10. <i>M. neglecta</i> |
| b. | Leaves entire to sinuate-toothed; styles 2 - 5 mm long | 6. <i>M. horridula</i> |
| 5a. | Leaves imperfectly 1 - 2 pinnatipartite | 1. <i>M. aculeata</i> |
| b. | Leaves entire or sinuate-lobed | 6 |
| 6a. | Polycarpic herbs; stem leaves ovate-cordate; flowers solitary or in 1 - 7-flowered lax leafless racemes, yellow; ovary glabrous | 16. <i>M. villosa</i> |
| b. | Monocarpic herbs; stem leaves narrowly oblanceolate or oblong-lanceolate or ovate-oblong; flowers in dense leafy racemes, blue, purple, violet or white; ovary bristly | 7 |

- 7a. Stem leaves oblong to ovate or broadly lanceolate, 2 - 6 cm broad; upper flowers ebracteate; petals pale blue or white; ovary glabrous; capsules 1 - 1.5 cm long (excl. beak) 7. *M. latifolia*
- b. Stem leaves narrowly oblanceolate or oblong, 1 - 3 cm broad; upper flowers bracteate; petals blue, purple or violet; ovary bristly; capsules 4 - 5 cm long (excl. beak) 14. *M. sinuata*
- 8a. Plants softly golden yellowish villous, mixed with minute stellate hairs throughout; petals yellowish 11. *M. paniculata*
- b. Plants brownish yellow villous, without stellate hairs; flowers blue, purple, pink, red or white, never yellow 9
- 9a. Hairs, if present, non-barbellate 10
- b. Hairs, if present, barbellate 11
- 10a. Flowering stems leafy; leaves entire to lyrato-pinnatifid; flowers borne in axils of upper cauline leaves; petals 7 - 20 mm long; capsules oblong 8. *M. lyrata*
- b. Flowering stems scapose; leaves 2-pinnatifid or partite; flowers borne singly on leafless scapes in axils of basal leaves; petals 20 - 30 mm long; capsules obovoid, pear-shaped 2. *M. bella*
- 11a. Indumentum of long hairs mixed with short much branched hairs 12
- b. Indumentum of only long hairs 13
- 12a. Leaves shallowly serrate; flowers white, petals 4 - 6 cm long; styles 3 - 5 mm long 15. *M. superba*
- b. Leaves deeply pinnatifid or partite; flowers red purple or blue; petals 2 - 4 cm long; styles 2 - 10 mm long 9. *M. napaulensis*
- 13a. Leaves imperfectly 1 - 2 pinnatifid or partite; plants of Western Himalayas 12. *M. robusta*
- b. Leaves entire to sinuate-dentate; plants of Eastern Himalayas 14
- 14a. Flowers on leafless scapes; petals (2-) 3 - 5 cm long 13. *M. simplicifolia*
- b. Flowers on leafy stems; petals (4-) 5 - 9 cm long 15
- 15a. Stems 1 - 1.5 m long; lower cauline leaves truncate or cordate at base 3. *M. betonicifolia*
- b. Stems 0.5 - 1 m long; lower cauline leaves cuneate or attenuate at base 5. *M. grandis*

1. *Meconopsis aculeata* Royle, Illus. Bot. Himal. 67, t.15, 183. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 118. 1872. *M. bikramii* Aswal in Indian J. For. 8(1): 84. 1985.

Fig. 4.

Herbs, monocarpic, prickly; stems up to 60 cm high, leafy throughout, covered with 2 - 7 mm long bristles; taproots ca 12 cm long, narrowly elongated, fusiform. Leaves oblong, imperfectly irregularly pinnatifid, rarely bipinnate-partite, up to 30 cm long (incl. petiole); upper cauline leaves sessile, smaller; segments oblong or obovate or ovate-triangular, obtuse or rounded at apex, bristly on both sides; petioles 3 - 10 (-15) cm long, expanded at base; higher leaves sessile, smaller. Flowers on long spiny 1 - 15 cm long pedicels. Sepals broadly oblong-orbicular, 1 - 2 cm long. Petals 4, rarely 6, blue, purplish blue or red, obovate to suborbicular, ca 3.5 x 3.5 cm. Filaments 5 - 10 mm long; anthers 1 - 1.5 mm long, golden yellow. Ovary subglobose or ellipsoid, densely spiny; styles 2 - 10 mm long. Capsules dehiscent by 4 - 6 valves, 10 - 15 mm long; seeds subreniform, ca 1 mm long.

Fl. & Fr. July - Oct.



Fig. 4. *Meconopsis aculeata* Royle

Distrib. India: W. Himalayas, 2400 - 4700 m. Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh.

Pakistan.

Notes. This species is very variable in habit, size, dissection of leaves, nature of inflorescence and size and colour of petals. It is closely allied to *M. horridula*, but can be easily recognised by leafy stems, globose flower buds and pinnatifid or pinnatipartite leaves.

The roots are used as narcotic in Kashmir.

Chromosome no. $n = 28$ (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200. 1967).

Pollen grains 3-colpate, spheroidal, 20 - 24 μ in diam. included in *Horridula* type (Henderson in Grana Palynol. 6(2): 196, 200. 1965)

2. *Meconopsis bella* Prain in J. Asiat. Soc. Bengal 63(2): 82. 1894.

Herbs, polycarpic, with up to 17 cm long stout narrow elongated perennial taproot; caudex ca 2.5 cm long, covered by a rosette of numerous withered petiole-bases. Leaves numerous, crowded, 1.5 - 6 cm long, all basal, variable, simple, elliptic-lanceolate or oblong, attenuate at base, obtuse at apex, deeply pinnatisect or bipinnatisect, 1.5 - 6 x 0.5 - 1 cm, glabrous or sparsely bristly; ultimate segments usually 3-fid, obovate or obovate-oblong; petioles 2.5 - 10 cm long, slender, glabrous or sparsely bristly with expanded persistent bases. Flowers solitary on leafless 4 - 15 cm long bristly erect scape stems; scapes 1 - 25, recurved and up to 20 cm long in fruits. Sepals 2, oblong, 7 - 10 mm long, glabrous or sparsely hairy. Petals 4, rarely 5 - 6, pale blue or purple, obovate-suborbicular, entire or denticulate, 2 - 3 x 2.5 cm. Filaments 5 - 7 mm long, dark purple; anthers ca 2 mm long, golden yellow. Ovary ellipsoid, glabrous or sparsely bristly; styles 2 - 5 mm long, stout, swollen at base. Capsules narrowly obovoid, pear-shaped, 15 - 20 x 6 - 8 mm, dehiscing by 4 - 7 valves only near apex; seeds ellipsoid, ca 1.3 mm long, ribbed.

Fl. & Fr. June - Oct.

Distrib. India: Eastern Himalayas, on alpine steep grassy slopes, 3700 - 4800 m. Sikkim.

Bhutan and Nepal.

3. *Meconopsis betonicifolia* Franchet, Pl. Delav. 1: 42, t. 12. 1889; Debnath & Nayar in Fasc. Fl. India 17: 14, f.3. 1984.

Herbs, monocarpic or polycarpic; stems glabrous or scattered rufous hairy, 1 - 1.5 m tall; rootstocks short, clothed with dark brown bristly membranous leaf-sheaths. Leaves oblong to elongate, truncate or auriculate at base, subacute, obtuse or rounded at apex, incised or crenate along margins, sometimes coarsely or irregularly serrate or even lobed, 10 - 15 x 5 - 7 cm; basal cauline leaves on ca 20 cm long sheathed petiole; upper cauline leaves sessile. Flowers ca 6 cm in diam., on 25 - 30 cm long axillary pedicels. Petals 4 - 6, blue-violet, purple, broadly ovate, slightly sinuate-lobed, ca 5 x 5 cm. Filaments white, anthers deep yellow. Ovary ellipsoid, oblong, covered by rufous bristles; styles green, ca 1 cm long; stigmas green, 4 - 7-lobed. Capsules oblong to oblong-ellipsoid, splitting by 4 - 7 valves; seeds reniform with longitudinal rows of shallow pits.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas from 3000 - 4000 m. Arunachal Pradesh.

Myanmar and China.

4. *Meconopsis discigera* Prain in Ann. Bot. 20: 356, t. 24, f. 12. 1906. **Fig. 5.**

Monocarpic herbs with slender taproot; stems 30 - 70 cm high, stout, sulcate, clothed with golden brown barbellate patent or deflexed bristles or their persistent bases. Leaves entire or 3-lobed, oblanceolate or elliptic-oblanceolate, subacute or rounded at apex; basal leaves ca 15 cm long (incl. petiole); upper ones sessile. Flowering stem solitary, ribbed, forming leafy 10 - 15-flowered racemes; pedicels 2 - 5 cm long, hairy, decurrent on stem, swollen at apex. Petals 4, obovate, 4 - 5 x 3 - 4 cm, red, purple or pale blue. Filaments filiform, dark coloured. Ovary oblong, truncate, densely yellow bristly; styles slender, elongate, 5 - 6 mm long, bearing 6 - 10 linear erect lobes. Capsules oblong, 6-ribbed, 2 - 3 cm long, appressed bristly, dehiscing by 6 - 10 valves, crowned with ovate lacinate reflexed 5 - 7 mm long persistent stylar disc; seeds reniform, ribbed and reticulate.

Fl. & Fr. June - Sept.

Distrib. India: Alpine cliffs and rocky ravines, 3400 - 4800 m. Sikkim.

Bhutan, Nepal, China (Tibet).

Notes. Chromosome no. $n = 40$ (Ernst in Madrono 18: 122 - 126. 1965; $n = 41, c. 40$ (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200. 1967).



Fig. 5. *Meconopsis discigera* Prain



Fig. 6. *Meconopsis grandis* Prain

5. *Meconopsis grandis* Prain in J. Asiat. Soc. Bengal 64(2): 320. 1895. **Fig. 6.**

Herbs, polycarpic, up to 1.5 m high; roots short, fibrous; stems covered with appressed 5 - 8 mm long bristles. Leaves all basal, oblanceolate or elliptic-oblong, acute at apex, cuneate at base, 10 - 25 x 2 - 8 cm, with several shallow broad teeth along margins; basal leaves sessile, becoming bract-like at top, sometimes cordate; petioles 10 - 30 cm long, bristly, sheathing at base. Flowers 1 - 4 per stem, on 10 - 15 cm long pedicels, becoming elongated up to 60 cm in fruit. Sepals broadly oblong-ovate, obtuse, 3 - 3.5 cm long, appressed bristly. Petals 4 - 5 (-9), purple or blue tinged with purple, 4 - 7 cm long. Filaments filiform, 1 - 1.5 cm long, white; anthers ca 2 mm long, yellow. Ovary oblong or ellipsoid, patently or appressed bristly; styles 5 - 15 mm long; stigmas globose, 4 - 6-lobed. Capsules ellipsoid-oblong, dehiscent by 4 - 6 valves, 3.5 - 4.5 cm long, glabrous or patently bristly; seeds reniform.

Fl. & Fr. June - Sept.

Distrib. India: E. Himalayas, between 3400 - 4600 m. Sikkim.

Bhutan, Nepal and China (Tibet).

Notes. Chromosome no. $n = 28$, $2n = 56$ (Ratter & Milne in Notes R. Bot. Gard. Edinb. 32: 429 - 438. 1973).

6. *Meconopsis horridula* Hook. f. & Thomson, Fl. Ind. 252. 1855 & Fl. Brit. India 1: 118. 1872. *M. racemosa* Maxim. in Bull. Acad. Imp. Sci. St. Petersb. 23: 310. 1877.

Fig. 7 a.

Herbs, monocarpic, with up to 25 cm long slender taproot; stems subscapose, 15 - 30 (-80) cm long, with dense pale, spreading or deflexed, 3 - 7 mm long prickles throughout. Leaves mostly basal, rosetted, oblanceolate, obovate-elliptic, decurrent at base, acute or rounded at apex, entire to sinuate-lobed, 5 - 15 x 1 - 4 cm; petioles 2 - 6 cm long; stem leaves absent or a few only. Flowers 3 - 10, on 2 - 15 cm long pedicels, borne in a raceme on stout erect stem, often surrounded by 3 - 15 single-flowered leafless 5 - 20 cm long scapes, arising from axils of basal leaves. Sepals oblong, obtuse, 1 - 2 cm long, bristly. Petals 4 - 8, obovate, denticulate at top, 2 - 3 cm long, usually blue, rarely white. Ovary ellipsoid, densely prickly, bearing 2 - 5 mm long style; stigma capitate or clavate. Capsules broadly ellipsoid, oblong, 1 - 2 x 1 cm, prickly, 5 - 6-valved, dehiscent only near apex; seeds subreniform, ca 8 mm long.

Fl. & Fr. July - Sept.

Distrib. India: Eastern Himalayas, alpine cliffs and meadows, 3800 - 4700 m. Sikkim.

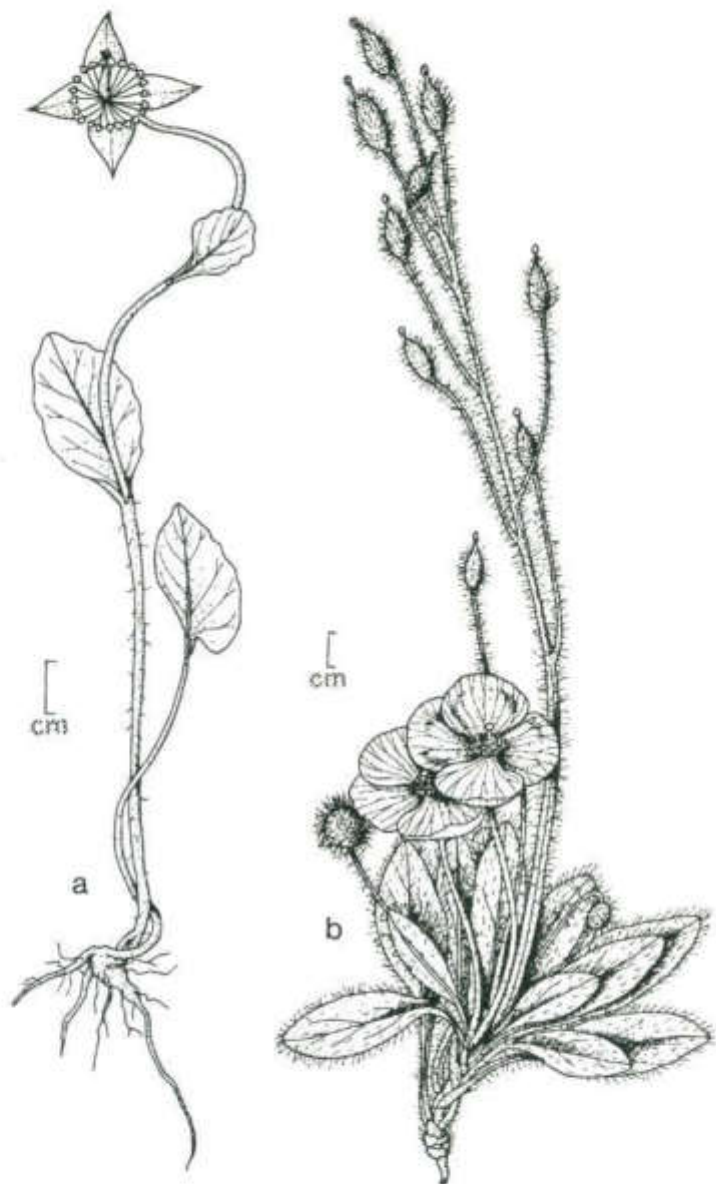


Fig. 7. a. *Meconopsis horridula* Hook. f. & Thomson; b. *Meconopsis lyrata* (Prain) Prain

Nepal, Bhutan, Myanmar and China (Tibet).

Notes. Chromosome no. $n = 28$ (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200. 1967).

7. *Meconopsis latifolia* (Prain) Prain in Bull. Misc. Inf. Kew 1915: 146. 1915. *M. sinuata* Prain var. *latifolia* Prain in Curtis, Bot. Mag. 134: t. 8223. 1908.

Herbs, monocarpic, with stout elongated taproots; stems 30 - 100 cm high, simple, leafy, covered with yellowish brown or golden brown 2 - 8 mm long bristles. Leaves oblong or ovate-lanceolate, acute or obtuse, sinuate-lobed or deeply incised-serrate, rarely pinnatilobed; basal leaves 6 - 22 x 2 - 6 cm, on 2 - 8 cm long bristly petioles; upper ones sessile. Flowers axillary or terminal, forming leafy racemes; uppermost flowers usually ebracteate; pedicels 2 - 8 cm long, hairy as on stems. Sepals broadly oblong, 1 - 1.5 cm long. Petals 4, pale blue or white, obovate or suborbicular, 2 - 3 cm long. Filaments 8 - 10 mm long. Ovary ovoid, bristly; styles 1.5 - 3 mm long. Capsules ellipsoid, oblong, bristly, dehiscent by 4 - 7 valves, 1 - 1.5 cm long (excl. stylar beak); seeds subreniform and plano-convex.

Fl. & Fr. July - Oct.

Distrib. India: N.W. Himalayas, 2100 - 4600 m. Jammu & Kashmir.

Endemic.

Notes. Chromosome no. $n = 28$ (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200. 1967).

8. *Meconopsis lyrata* (Prain) Prain in Bull. Misc. Inf. Kew 1915: 142. 1915. *Cathcartia lyrata* Prain in J. Asiat. Soc. Bengal 64(2): 325. 1896. *M. polygonoides* Prain, l. c. 326. 1896. *M. compta* Prain in Bull. Misc. Inf. Kew 1918: 212. 1918. **Fig. 7 b.**

Herbs, monocarpic, with stout swollen up to 6.5 cm long napiform often elongated taproots; stems 5 - 30 cm high, slender, leafy, simple or often branched at base, clothed with persistent glabrous membranous leafy sheaths at base, glabrous or sparsely bristly with golden-brown hairs. Leaves ovate, oblong, spatulate or oblanceolate with a hastate or subcordate rounded base, acute or rounded at apex, entire or lyrate-pinnatifid along margins; basal leaves on 5 - 50 mm long petioles, often with bulbils in their axils, soon withering, usually pinnatifid or partite; lateral lobes 2 - 4, elliptic, smaller than terminal lobe; stem leaves 2 - 5, distant, uppermost sessile. Flowers up to 5, terminal and in axils of upper leaves on slender curved 3 - 8 cm long pedicels. Sepals oblong-obovate, 8 - 10 mm long. Petals 4 (-6), obovate-suborbicular, 7 - 20 x 10 - 20 mm, pale pink, blue or white. Stamens 12 - 36; filaments filiform, 4 - 5 mm long; anthers ca 2 mm long, golden yellow. Ovary narrowly oblong or oblong-ellipsoid, glabrous; styles 2 - 4

mm long; stigmas 2 - 4-lobed. Capsules narrowly oblong or obovoid, glabrous, dehiscing by 3 - 4 valves, ca 2.5 cm long (incl. beak); seeds falcate-ellipsoid, pitted.

Fl. & Fr. July - Oct.

Distrib. India: Eastern Himalayas, on rocky alpine slopes and cliffs, 2800 - 4500 m. West Bengal and Sikkim.

Nepal and China.

Notes. Very variable in leaf and petal shapes and number of stamens. Based on these variable characters Prain recognised *M. polygonoides* Prain (in *J. Asiat. Soc. Bengal* 64, 2: 326. 1896) and *M. compta* Prain (in *Bull. Misc. Inf. Kew* 1918: 212. 1918), which cannot be maintained as distinct from *M. lyrata*.

The presence of bulbils in leaf axils is characteristic of this species, a character also reported by Taylor & Cox (l. c.) in *M. chelidonifolia*.

9. *Meconopsis napaulensis* DC., *Prodr.* 1: 121. 1824. *M. wallichii* Hook. f. in Curtis, *Bot. Mag.* 78: t. 4668. 1852; Hook. f. & Thomson in *Fl. Brit. India* 1: 119. 1872.

Herbs, monocarpic; stems 0.5 - 2 m high, covered with ca 7 mm long stiff brownish bristles throughout. Leaves elliptic-oblong, imperfectly 1 - 2 pinnatisect or partite; segments ovate-oblong, sinuate-pinnatilobed; basal leaves ca 45 cm long, on 5 - 20 cm long petioles, often more strongly pinnatisect; segments oblong with large rounded teeth; upper most ones often entire. Flowers axillary on 2.5 - 6 (-10) cm long brownish bristly pedicels. Sepals ovate-oblong, obtuse, 1.5 - 2 cm long. Petals 4, obovate-suborbicular, 2 - 4 cm long, red to purple or blue, often white with yellow nerves. Filaments filiform, 8 - 10 mm long; anthers ca 2 mm long. Ovary ellipsoid-oblong or ovoid, clothed with same hairs as on stem; styles distinct, 2 - 10 mm long, becoming slightly swollen at base in fruit; stigmas capitate or subclavate, 5 - 8-lobed. Capsules oblong-ellipsoid, 15 - 35 x 10 mm, hairy, dehiscing by 5 - 8 valves; seeds ovoid, oblong, 1 - 1.2 mm long, papillose.

Fl. & Fr. July - Oct.

Distrib. India: C. & E. Himalayas, common in fir forests and near mountain streams, 2700 - 4300 m. Uttar Pradesh, West Bengal, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China.

Notes. Very variable in colour of flowers, degree and density of indumentum and size and shape of leaves.

Chromosome no. $n = 28$ (Ratter in *Notes R. Bot. Gard. Edinb.* 28: 191 - 200. 1967).

The specific epithet is often spelled as '*nepalensis*' and '*nipalensis*', but the original spelling is '*napaulensis*'.

10. *Meconopsis neglecta* G. Taylor, Acc. *Meconopsis* 102. 1934; Dhar & Kachroo in *Geobios*, New Rep. 2: 132. 1983.

Herbs, monocarpic, 15 - 20 cm high; taproots dauciform, up to 14 cm long, ca 1 cm broad, passing upwards into short stem, covered with persistent leaf-bases. Leaves radical, ca 3.5 x 1 cm, on 3 - 3.5 cm long petioles, deeply pinnatifid, densely covered on both surfaces with pungent spines; lobes oblong, rounded at apex. Scapes up to 12, sparsely spiny, up to 15 cm long. Petals 4, broadly obovate or suborbicular, 1.5 - 2 cm across. Stamens many; filaments filiform; anthers yellow. Ovary ellipsoid, densely covered with pungent spines; styles distinct, ca 1 cm long; stigma capitate.

Fl. & Fr. not known.

Distrib. India: N.W. Himalayas, 3350 - 4000 m. Jammu & Kashmir.

Pakistan.

Notes. The roots are medicinal, used as a narcotic in Kashmir.

11. *Meconopsis paniculata* Prain in *J. Asiat. Soc. Bengal* 64(2): 316. 1896. *M. nipalensis* sensu Hook. f. & Thomson in *Fl. Brit. India* 1: 118. 1872 (non DC. 1824).

Herbs, monocarpic, with stout elongated taproots, often split into several rootlets; stems up to 2.5 m long, leafy, stout, fistular, sparsely or densely clothed with patent or deflexed golden yellow soft hairs, mixed with minute stellate hairs throughout. Leaves linear-oblong in outline, often entire or deeply pinnatifid, or sometimes pinnatisect near base, 30 - 60 x 8 - 20 cm; lobes ovate or oblong, acute or obtuse, coarsely crenate or serrate; basal leaves in rosette, larger, petiolate; stem leaves smaller, becoming sessile; petioles 15 - 25 cm long. Flowering stems solitary, shortly branched; flowers numerous, pendulous, borne singly in upper part and in 2 - 6-flowered lateral cymes in lower part; pedicels 2 - 15 cm long, pendulous, hairy as on stem. Sepals ovate-oblong, obtuse-rounded, golden yellowish hairy. Petals 4 (-5), obovate to suborbicular, entire or subentire, rarely denticulate, 3 - 5 cm long, yellow. Filaments filiform, 7 - 15 mm long; anthers ca 2 mm long. Ovary subglobose, ellipsoid or ovoid, densely covered with appressed golden-yellow hairs; styles 5 - 15 mm long, with capitate 6 - 12-lobed stigmas. Capsules oblong-ellipsoid, 1.5 - 3.5 x 1.2 - 1.5 cm, hairy as on stems, 6 - 10-valved, dehiscent only near apex, borne on elongated up to 15 cm long pedicels; seeds subreniform, ca 1 mm long, minutely papillose.

Fl. & Fr. June - Oct.

Distrib. India: Central and Eastern Himalayas, in grassy and rocky alpine hillsides and temperate forests, between 2200 - 4500 m. Uttar Pradesh, West Bengal (Darjeeling), Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China (Tibet).

Notes. Giri & Lal (in *J. Econ. Tax. Bot.* 12: 365 - 366. 1988) report it from Arunachal Pradesh.

Very similar to and was previously confused with *M. napaulensis* DC., but is easily recognised by their yellow flowers, pinnatifid to pinnatipartite leaves and minute papillose seeds.

The rootstock has sweet taste and is used as salad by sherpas in E. Nepal. The root has narcotic properties (Banerjee in *J. Bombay Nat. Hist. Soc.* 53: 153. 1955-56).

Chromosome no. $n = 28$ (Ratter in *Notes R. Bot. Gard. Edinb.* 28: 200. 1967).

12. *Meconopsis robusta* Hook. f. & Thomson, *Fl. Ind.* 253. 1855 & in *Fl. Brit. India* 1: 119. 1872. **Fig. 8 a.**

Herbs, monocarpic; stems 1 - 2 m long, leafy, stout, fistular, sparsely clothed with patent ferruginous or yellowish-brown 5 - 6 mm long bristles or with their persistent bases. Leaves imperfectly 1 - 2-pinnatifid to pinnatipartite, often uppermost entire, sparsely bristly; segments ovate or ovate-oblong, acute or obtuse at apex; basal leaves on 10 - 15 mm long petioles; upper ones sessile. Flowers solitary on 5 - 20 cm long pedicels, in axillary or terminal leafy racemes. Sepals broadly ovate-oblong, 1.5 - 2 cm long, bristly. Petals 4, obovate, yellow to sulphur yellow. Filaments 10 - 15 mm long, filiform. Ovary ellipsoid or oblong, bristly; styles 2 - 10 mm long; stigmas capitate, 6 - 9-lobed. Capsules obovoid-oblong or ellipsoid, dehiscent by 6 - 9 valves, 2 - 3 cm long; seeds subreniform, papillose.

Fl. & Fr. July - Oct.

Distrib. India: N.W. Himalayas, 2400 - 4000 m. Uttar Pradesh.

Endemic to Garhwal Himalayas.

Notes. Chromosome no. $2n = 28$ (Sugiura in *Cytologia* 13: 352 - 359. 1944).

13. *Meconopsis simplicifolia* (D. Don) Walp., *Repert. Bot. Syst.* 1: 110. 1842; Hook. f. & Thomson in *Fl. Brit. India* 1: 118. 1872. *Papaver simplicifolium* D. Don, *Prodr. Fl. Nepal.* 197. 1825. **Fig. 8 b.**

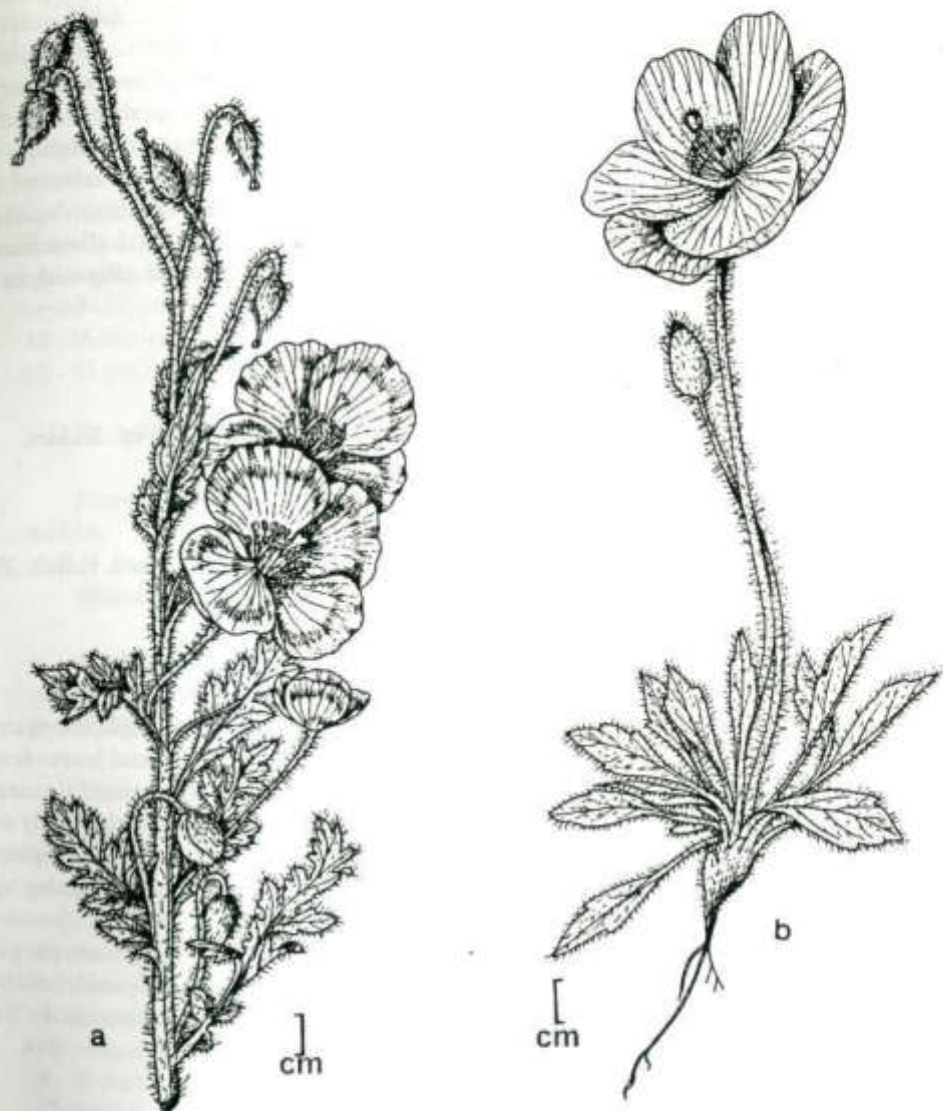


Fig. 8. a. *Meconopsis robusta* Hook. f. & Thomson; b. *Meconopsis simplicifolia* (D. Don) Walp.

Herbs, polycarpic or sometimes monocarpic, 30 - 70 cm high, brownish bristly throughout; stem bases clothed with rufous-bristly persistent leaf sheaths; taproots slender, elongated. Leaves all basal, oblanceolate, spatulate, or elliptic-lanceolate, long-attenuate at base, obtuse or subacute at apex, 4 - 15 x 1 - 3 cm, entire or with a few teeth or shallow rounded lobes on margins; petioles 0.5 - 25 cm long. Flowers solitary, nodding on 5 - 70 cm long, 1 - 5 scapes arising from rosette leaves; pedicels densely bristly. Sepals broadly oblong, obtuse, 20 - 25 x 10 - 12 mm, rufous bristly. Petals 5 - 9, obovate, 25 - 50 x 15 - 30 mm, blue or purple. Filaments 8 - 20 mm long, coloured as petals; anthers ca 2 mm long. Ovary ellipsoid or oblong; styles slender with stout capitate stigmas. Capsules oblong-ellipsoid, 3 - 7 x 1 - 1.5 cm, slightly constricted above base, thinly bristly, with 4 - 9 valves dehiscing in upper one-third; seeds ovoid-ellipsoid, ca 3 mm long, densely papillose.

Fl. & Fr. May - Oct.

Distrib. India: E. Himalayas, on rocky alpine hillsides, 3000 - 4800 m. Sikkim.

Nepal, Bhutan and China (Tibet only).

Notes. Chromosome no. $n = 41$ or 42 (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200, 1967).

14. *Meconopsis sinuata* Prain in *J. Asiat. Soc. Bengal* 64(2): 314. 1896.

Herbs, monocarpic, with stout elongated taproots; stems slender, single, elongate, leafy, 15 - 50 cm high, covered with 2 - 5 (-7) mm long prickly bristles. Basal leaves few; stem leaves numerous, obovate, oblanceolate, often linear, strongly crenate sinuate-lobed along margins or sometimes entire, 4 - 12 x 1 - 3 cm, glaucous beneath, bristly on both surfaces; petioles 2 - 5 cm long, often absent on upper leaves. Flowers 4 - 8, axillary or terminal, forming leafy racemes; pedicels all bracteate, 2 - 5 cm long, elongating up to 15 cm in fruit. Sepals broadly oblong, acute, ca 1.5 cm long, bristly. Petals 4, obovate, suborbicular, rounded at apex, slightly irregularly notched, 1.5 - 3 cm long, blue, purple or violet. Filaments 8 - 10 mm long; anthers ca 3.5 mm long. Ovary ellipsoid, bristly; styles slender, 1.5 - 3 mm long; stigmas capitate. Capsules narrowly obovoid, 4 - 5 x 0.7 - 0.9 cm, 3 - 4-valved; seeds falcate-oblong with longitudinal rows of shallow pits.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, rocky alpine hillsides and Rhododendron forests, 3600 - 4500 m. Sikkim.

Nepal and Bhutan.

15. *Meconopsis superba* Prain in J. Asiat. Soc. Bengal 64 (2): 317. 1896.

Herbs, monocarpic, with stout elongated taproots; stems up to 1.5 m tall, stout, leafy, tomentose with appressed golden-brown, 5 - 8 mm long bristly hairs, mixed with short much-branched hairs. Basal leaves simple, unlobed, obovate, ca 40 x 8.5 cm, shallowly serrate, on ca 5 cm long petioles, densely sericeous; stem leaves sessile, oblanceolate, elliptic-oblong, semiamplexicaul at base, acute at apex, incised-serrate along margins, smaller than basal leaves. Flowers borne singly at axils of uppermost leaves, forming leafy racemes of 6 - 20 flowers; pedicels stout, clothed with golden-brown hairs. Sepals broadly ovate-oblong, obtuse, 4 - 6 cm long, tomentose. Petals 4, ovate-orbicular, 3.5 - 5 cm across, white. Filaments 12 - 15 mm long; anthers ca 2 mm long. Ovary globose or ovoid-ellipsoid, tomentose; styles distinct and stout, 3 - 5 mm long; stigmas capitate with 12 - 16 distinct lobes. Capsules ellipsoid, 4 - 5 x 1.5 - 2 cm, borne on very stout elongated 12 - 25 cm long pedicels, dehiscing by 7 - 11 valves; seeds subreniform, papillose.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, among shrubs on alpine slopes, 3900 - 4200 m. Sikkim.

Bhutan and China (Tibet).

16. *Meconopsis villosa* (Hook. f.) G. Taylor, Acc. Meconopsis 28. 1934. *Cathcartia villosa* Hook. in Curtis, Bot. Mag. 77: t. 4596. 1851; Hook. f. & Thomson in Fl. Brit. India 1: 119. 1872. Fig. 9.

Herbs, polycarpic, perennial; rootstock stout, short, clothed with rufous bristly membranous persistent leaf sheaths; stems up to 60 cm long, erect, usually unbranched, patently bristly with rufous barbellate 3 - 5 mm long bristles. Leaves broadly ovate-cordate or orbicular, cuneate or cordate at base, palmately 3 - 5-lobed with palmatilobed segments, 4 - 12 x 6 - 15 cm, appressed hairy, 3 - 5-veined; lobes coarsely or bluntly toothed; basal leaves shorter, petioled or sessile, passing into bracts. Flowers solitary, terminal or axillary, 1 - 7 per stem; pedicels slender, 5 - 12 cm long, hairy. Sepals ovate-oblong, subacute or obtuse, 1.5 - 2 cm long, appressed bristly, yellow. Petals 4, obovate, suborbicular, obtuse to rounded at apex, 2.5 - 3.5 x 3.5 - 4 cm, yellow. Filaments 8 - 10 mm long, filiform, yellow; anthers yellow to dark brown, ca 2 mm long, basifixed. Ovary cylindrical or narrowly oblong, 1.5 - 2 cm, glabrous; stigma sessile, with 4 - 7 radiate lobes. Capsules narrowly oblong, cylindrical, with 4 - 7 prominent ribs alternating with faint ribs, 4 - 8 x 0.5 - 0.7 cm, dehiscing by 4 - 7 valves to more than half way down its length; seeds subreniform, dark.

Fl. & Fr. May - Sept.



Fig. 9. *Meconopsis villosa* (Hook. f.) G. Taylor

Distrib. India: Endemic to Eastern Himalayas, rocky streamsides and forests, 2700 - 4200 m. West Bengal (Darjeeling) and Sikkim.

Nepal and Bhutan.

Notes. Horticulturally valued as an ornamental woodland garden plant for temperate regions.

Chromosome no. $n = 16$ (Ratter in Notes R. Bot. Gard. Edinb. 28: 191 - 200. 1967).

5. *Papaver* L.

Herbs, annual, biennial or perennial, with milky, yellowish or orange-coloured juice; stems erect, ascending, mostly bristly, rarely glabrous. Leaves mostly on stems, sometimes in a rosette at base, mostly pinnatifid or pinnatilobed or pinnatipartite, entire or mostly incised, dentate or serrate; segments variously incised; lower leaves petioled, upper sessile. Flowers solitary, terminal and axillary on long leafless scapes, ebracteate, sometimes paniculate, mostly patent or appressed-setose; flower buds ovate or subglobose. Sepals 2 (-3), free, early caducous, ovate-orbicular, minutely setose. Petals 4 (-6), in 2 whorls, obovate-orbicular with little or no claw, mostly red, yellow, orange, lilac or white. Stamens many; filaments filiform or dilated; anthers small, orbicular to linear. Ovary mostly ovoid, rarely cylindrical-oblong, glabrous, or setose; ovules many on parietal placentae; stigmas sessile, 4 - 20, radiating on a lobed disc. Capsules oblong, globular, obovate or subcylindrical, dehiscent by subapical pores under lobes of persistent disc; seeds very small, kidney-shaped, alveolate-reticulate, brown, black, dark-grey or white, without appendage.

Temperate Europe, Africa and Asia; about 50 species, 6 in India.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1a. Stems very short; leaves all radical; flowers borne on leafless scapes | 4. <i>P. nudicaule</i> |
| b. Stems long or rarely short; leaves both radical and cauline; flowers on leafy scapes | 2 |
| 2a. Plants glabrous, glaucous; cauline leaves sessile, amplexicaul, unlobed or shallowly pinnatifid; flowers one or few | 6. <i>P. somniferum</i> |
| b. Plants usually densely hispid or stiff hairy; cauline leaves shortly petioled, not amplexicaul, deeply pinnatisect; flowers many | 3 |
| 3a. Stigmatic segments keeled, with deeply dissected marginal lobes; disc of capsules hemispherical | 3. <i>P. macrostomum</i> |
| b. Stigmatic segments not keeled, with shallow marginal lobes; disc of capsules flat | 4 |
| 4a. Terminal segments of leaves narrow, linear, awned; capsules subglobose, hispid-setose, with 4 - 8 stigmatic rays | 2. <i>P. hybridum</i> |
| b. Terminal segments of leaves broader, not awned; capsules campanulate, oblong-ovoid or clavate-cylindrical, glabrous, with 6 - 15 stigmatic rays | 5 |

- 5a. Terminal segments of leaves almost equal to lateral segments; capsules oblong-ovate or clavate-cylindrical; number of rays of stigmatic disc 6 - 8 (-9) **1. *P. dubium***
- b. Terminal segments of leaves much longer than the lateral segments; capsules campanulate; number of rays of stigmatic disc 9 - 13 (-15) **5. *P. rhoeas***

1. *Papaver dubium* L., Sp. Pl. 1196. 1753; Hook. f. & Thomson in Fl. Brit India 1: 117. 1872.

Herbs, annual, caulescent or subscapose, hispid or bristly, 14 - 40 cm high. Leaves pinnatisect, sometimes pinnatifid, oblong-ovate, entire or often dentate, obtuse or acute, 2 - 10 x 2 - 3 cm; upper leaves pinnatifid into linear or oblong-linear or lanceolate 4 - 10 mm broad, entire or dentate with bristly acute segments. Peduncles 5 - 33 cm long, erect, large, with enlarged summit, hairy; flower buds ovoid, tapering to a more acute apex, hornless, 8 - 16 x 4 - 8 mm, roughly tubercular, white and silky hairy; flowers 3 - 7 cm across, terminal. Sepals 2, ovate, caducous, glabrous or bristly. Petals ovate, 2.4 - 2.8 x 3 - 3.6 cm, brick red to red in colour, not overlapping, caducous. Stamens few, as long as ovary; filaments slender, up to 9 mm long; anthers broad-elliptic, ca 1 mm long. Rays of stigmatic disc yellow in colour, 6 - 8 in number. Capsules sessile, oblong, ovate, clavate, cylindrical, 10 - 20 x 3 - 9 mm, glabrous; stigmatic rays 6 - 8 (-9); seeds reniform, ca 0.6 mm in diam., purplish black.

Fl. & Fr. April - Aug.

Distrib. India: N.W. Himalayas, 1000 - 3000 m. Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh.

Nepal, Pakistan, Afghanistan and Iran to Europe.

Notes. A very variable and complex species, and as a result several varieties have been recognised, which are collectively referred under the single polymorphic species *P. dubium*.

Chromosome no. $n = 14$ (Koul et al. in Nucleus 15: 117 - 123. 1972); $2n = 28, 42$ (Koopmans in New Phytol. 69: 1121 - 1130. 1970).

Bahl & Tyagi (in Curr. Sci. 58: 1384 - 1385. 1989) analysed the karyotype of this species.

2. *Papaver hybridum* L., Sp. Pl. 506. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 117. 1872.

Annual, sparingly branched, hispid herbs, 19 - 40 cm high; hairs on branches and stems appressed and with bulbous bases, caducous with age. Radical leaves long petioled, 3 - 30 cm long; cauline leaves alternate, subsessile to sessile, pinnatifid to

pinnatisect, 3 - 5.5 cm long; terminal segments linear-lanceolate, awned at apex. Flowers 2.5 - 4 cm across, scarlet with a blackish blotch at base; pedicels 8 - 13 cm long. Sepals 2, caducous, obtuse, sparingly hispid. Petals 4, overlapping and crumpled in bud, obovate, 1 - 1.3 cm long. Stamens numerous; filaments dilated upwards. Capsules subglobose, 8 - 13 mm long, bristly hispid; stigma convex; stigmatic rays 4 - 8, reaching the edge of disc.

Fl. & Fr. March - May.

Distrib. India: Naturalised weed in wheat fields and wastelands. Jammu & Kashmir (Poonch and Rajouri Districts).

Pakistan, Afghanistan, West Asia, N. Africa and Europe.

3. *Papaver macrostomum* Boiss., *Fl. Orient.* 1: 115. 1867; Singh & Kachroo, *For. Fl. Srinagar* 25, 27. 1976. **Fig. 10.**

Herbs, annual, erect; stems 20 - 40 cm long, with soft scattered spreading bristles except peduncles which are appressed-hairy. Basal leaves 1 - 2-pinnatisect or deeply incised, 5 - 10 cm long; segments linear-lanceolate or oblong-lanceolate, entire or coarsely dentate, acute, terminating in a bristle, 1 - 4 cm long, hairy on both surfaces or glabrous above; lower leaves petioled; upper ones usually sessile or subsessile, becoming smaller upwards. Peduncles 10 - 22 cm long, stout, often flexuous, appressed bristly; flower buds ovoid-oblong, rounded at apex, 10 - 25 x 6 - 11 mm, with spreading hairs; flowers up to 6 cm in diam. Sepals caducous. Petals broadly obovate-orbicular, 2 - 3 cm long, bright red or crimson with or without a basal black blotch. Stamens numerous; filaments almost black, slender; anthers broadly ellipsoid, 1 - 1.5 mm long; connective bearing a small orange capitate apical appendage. Capsules oblong-ellipsoid, narrow at base, broad at apex, 9 - 20 x 4 - 10 mm, glabrous, smooth or faintly ribbed; stigmatic rays 5 - 10, keeled with disc teeth ascending and recurved at edges; seeds reniform, up to 1 mm long, dark brown, reticulate.

Fl. & Fr. April - Aug.

Distrib. India: N.W. Himalayas, open fields and grasslands, 1500 - 3000 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, Afghanistan, Iran, Turkey and Russia.

Notes. Chromosome no. $n = 7$ (Koul et al. in *Nucleus* 15: 117 - 123. 1972); $2n = 14$ (Kawatani & Ohno in *Bull Nat. Inst. Hyg. Sci.* 83: 127 - 133. 1965).



Fig. 10. *Papaver macrostomum* Boiss.

4. *Papaver nudicaule* L., Sp. Pl. 507. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 117. 1872.

Herbs, perennial, with simple somewhat stiff setose hairs; rootstock scaly, covered with somewhat sheathing persistent leaf bases; scapes 1 - 5, erect, 10 - 58 cm long, 1-flowered, covered with 1.5 - 3.5 mm long dense hairs. Leaves all basal in rosette, pinnately 3-lobed, 2 - 6 x 1 - 3 cm, somewhat glaucous, bristly or ciliate; lobes usually pinnatifid; terminal lobe larger than lateral ones, often 3-lobulate; secondary lobes oblong-acute, up to 11 mm long and 5 mm broad; petioles 2 - 12 cm long, widened at base, ending in a leaf-sheath. Flower buds ovoid-orbicular or suborbicular, blunt at apex, 8 - 12 x 5 - 9 mm, appressed hairy, dark brown; flowers 1.5 - 3 cm in diam. Sepals concave, caducous, hispid with stiff brown hairs. Petals 4, obovate, suborbicular, 10 - 18 mm across, yellowish-orange, purple or yellow. Stamens many, linear; filaments as long as ovary; anthers 1 - 2 mm long. Capsules oblong, obovoid to subglobose, 8 - 15 x 5 - 10 mm, roughly setose; stigmatic disc as broad as capsule with 7 - 8 ridges, dehiscing by 7 - 8 pores alternating ridges; seeds reniform, ca 0.5 mm in diam.

Fl. & Fr. May - Aug.

Distrib. India: Western Himalayas, between 3000 - 5000 m. Kashmir and Himachal Pradesh.

Pakistan, Afghanistan, Russia, Mongolia and China (Tibet).

Notes. Very variable in size and colour of flowers, varying from pale yellowish to yellow, orange and saffron.

Chromosome no. $n = 14$ (Koul et al. in Nucleus 15: 117 - 123. 1972); $2n = 42$ (Hanelt in Kulturpflanze 18: 73 - 88. 1970).

5. *Papaver rhoeas* L., Sp. Pl. 507. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 117. 1872.

Beng.: *Lalposht*; Guj.: *Lala, Lalkhaskhas*; Hindi: *Lalpost, Post, Postekheya*; Mal.: *Chovanna-kashakhasa*; Sans.: *Rakta-posta-vrikshaka*; Tam.: *Sigippu-postaka, Sigappu-gashagasha*; Tel.: *Eva-gassa-gassa-la, Eva-postakaya*; Urdu: *Gulela-kebija, Khashashiyah*.

Herbs, annual, erect, caulescent, hispid, 30 - 50 cm high; stems simple or sparsely branched, covered with rigid horizontally spreading 1 - 3 mm long bristles. Basal leaves ovate, sinuate, pinnatisect, 6 - 18 x 3 - 9 cm; segments linear, acute, dentate, bristly hairy, hispid or glabrous; terminal segments much larger than lateral segments; basal and lower leaves petioled, larger, less dissected; upper cauline leaves sessile, smaller, much dissected, with amplexicaul bases. Peduncles erect, dilated at summit, 10 - 25 cm long,

patently hairy, yellowish; flower buds obovoid, blunt at apex, hornless, 1.5 - 3 x 1 - 2 cm, coarsely tuberculately hairy; flowers solitary, terminal, ca 7.5 cm in diam., bristly hairy. Sepals 2, bristly hairy. Petals obovate, suborbicular, 3 - 4 x 3 - 6 cm, red with black basal blotch. Stamens numerous; filaments linear, filiform; anthers oblong, ca 1 mm long. Capsules campanulate, 1 - 2 cm long, glabrous; stigmatic rays 9 - 13 (-15); seeds dark brown.

Fl. & Fr. April - Sept.

Distrib. India: Usually under cultivation, sometimes run wild. Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

Nepal, Europe and N. Africa.

Notes. The latex from the capsules is narcotic and has slight sedative properties.

Chromosome no. $n = 7$ (Koul et al. in *Nucleus* 15 : 117 - 123, 1972); $2n = 14$ (Mitra in *Sci & cult.* 30(7): 344 - 345, 1964).

6. *Papaver somniferum* L., Sp. Pl. 1: 508. 1753; Hook. f. & Thomson in *Fl. Brit. India* 1: 117. 1872.

Beng.: *Posto*; Hindi: *Afim, Afyum, Khas-khas, Postehij*; Guj.: *Aphina, Khus-khus, Posta*; Mal.: *Aveen, Afium, Khasha-khasha*; Mar.: *Aphu, Khus-khus, Posta*; Punj.: *Afim, Doda, Khas-khas, Khishshash*; Sans.: *Ahifen, Chosa, Khasa, Khakasa, Ullasata*; Tam.: *Abini, Gasha-gasha, Kasa-kasa, Postaka*; Tel.: *Abhini, Gasagasala, Gasalu, Khasakasa*; Urdu: *Khash-khasu-faid*.

Herbs, annual, robust, erect, glaucous, glabrous or nearly so, 0.5 - 1 m high, little branched. Basal leaves ovate-oblong, shallowly pinnatifid, rounded or cordate at base, acute at apex, 15 - 25 x 8 - 15 cm; lobes triangular, coarsely dentate, glaucous green; petioles short, 1 - 2 cm long; upper cauline leaves smaller, more shallowly lobed or unlobed, sessile, cordate-amplexicaul at base. Flower buds ovoid-oblong, obtuse, 1.5 - 3 x 1 - 2 cm; pedicels 3 - 20 cm long, leafless; flowers 2 - 10 cm across. Sepals glabrous, early caducous. Petals obovate, orbicular, wavy-margined, 3 - 9 cm across, white, or pale purple, sometimes with a dark basal blotch. Stamens as long as ovary; filaments yellowish, 5 - 10 mm long; anthers oblong, 1 - 1.5 mm long. Ovary globose, with 5 - 12-lobed apical disc bearing sessile stigmas. Capsules globose, subglobose or ovoid, rounded at base, flat-topped, 2 - 7 x 5 - 6 cm, glabrous; stigmatic disc enlarged, scarious, with 7 - 18 rays; seeds globose, ca 3 mm in diam., white or grey-brown or grey black.

Fl. & Fr. April - Aug.

Distrib. India: Widely cultivated in several parts of north India, up to 3000 m in Himalayas, possibly also naturalised. Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Manipur, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Nepal, Bhutan, Pakistan to Europe and Central Asia.

Notes. The latex from fruits yields the narcotic alkaloids (Morphine, Narcotine, Papaverine, Codeine and Thebaine) widely used in medicine.

Opium is used in diarrhoea, diabetes and rheumatism and also as an antidote to snake poison and scorpion sting.

Also cultivated for the poppy-seeds used as food and to produce an oil, which is used for making candles, soap, medicine and as food.

Javeid (in Indian Forester 99: 629. 1973), reports this from Srinagar in Kashmir.

Chromosome no. $n = 11$ (Koul et al. in Nucleus 15: 117 - 123. 1972); $2n = 22$ (Mary & Malik in Chromosome Inf. Serv. 15: 27 - 29. 1973).

FUMARIACEAE

(J. L. Ellis and N. P. Balakrishnan)

Herbs, annual or perennial, erect or ascending, decumbent, or straggling, sometimes scandent, glabrous, often glaucous, containing watery sap; roots often tuberous. Leaves usually alternate, radical or upper ones sometimes opposite or subopposite, exstipulate; radical leaves in rosettes, rarely simple or pinnate, 1 - 3 pinnatisect or 1 - 3 ternatisect; cauline leaves much divided or dissected. Flowers bisexual, zygomorphic, hypogynous, generally pedicellate and bracteate, usually in terminal leaf-opposed racemes or spikes or in dichasial cymes (*Hypecoum*) or corymbs (*Dicentra*). Sepals 2, free, small, scarious, scale-like, caducous. Petals 4, erect, imbricate, biscriate, coherent in dimorphic pairs; outer pair larger, convex or apically cucullate, one or both saccate or spurred at base, often crested outside; inner pair smaller, narrower, crested outside, sometimes apically connate and hooded over stigma; petal-spur enclosing a nectariferous gland. Stamens 4, free and opposite to petal or 6, diadelphous, connate in 2 bundles (phalanges) opposite to outer petals with filaments connate almost from base to top; anthers small, linear, bilocular or dimorphic with central anther of each bundle 2-loculed and two lateral ones 1-loculed, covering stigma. Ovary superior, 1-loculed with 2 carpels; ovules 1 - many on 2 parietal placentae, bitegmic, crassinucellar, anatropous or campylotropous; style 1, slender; stigmas 2, apical, capitate or flattened with 2, 4 or 8 stigmatic surfaces. Fruits usually capsular, 2-valved, often with transverse septa (replum), ellipsoid or linear, valvately dehiscent or breaking into 1-seeded indehiscent segments or a 1-seeded indehiscent nutlet. Seeds 1 - many, sometimes with arillate raphe, attached to style, reniform, orbicular, black or grey, shiny; embryo small, linear, straight or curved; cotyledons twice as wide as radicle; endosperm copious.

Temperate, alpine and warm regions of northern hemisphere and highlands of S. Africa and Asia; ca 16 genera and 450 species, 4 genera and 65 species in India.

Literature. JAFRI, S. M. H. (1974) *Fumariaceae*. In: Nasir, E. & S.I. Ali (ed.) *Fl. W. Pakistan* 73: 1 - 43. RYDBERG, M. (1960) A morphological study of the *Fumariaceae* and the taxonomic significance of the characters examined. *Act. Hort. Berg.* 19: 121 - 248, tt. 1 - 12. WENDELBO, P. (1974) *Fumariaceae*. In: K.H. Rechinger (ed.) *Flora Iranica* 110: 1 - 32, tt. 1 - 22.

Notes. *Hypecoum* is included in *Fumariaceae* following the delimitation of the families as adopted by Cronquist (1981).

KEY TO THE GENERA

- 1a. Petals not spurred or gibbous; stamens 4, free; fruit breaking into 1-seeded indehiscent segments 4. *Hypecoum*
- b. Petals one or both outer ones gibbous or spurred at base; stamens 6, united in two bundles of 3 each; fruit a dehiscent capsule not breaking into 1-seeded segments or a 1-seeded indehiscent nutlet 2
- 2a. Herbs climbing extensively; leaves often tendrillar; outer petals both gibbous at base 2. *Dicentra*
- b. Herbs bushy, diffuse, scrambling, erect or prostrate; leaves never tendrillar, one of outer pair of petals spurred at base 3
- 3a. Herbs bushy or scrambling, usually a weedy annual; leaves 2 - 4 pinnatisect; fruits 1-seeded nutlets 3. *Fumaria*
- b. Herbs erect or diffuse, mostly perennials, rarely weeds; leaves usually 2 - 3 (-4) ternate; fruits few to many-seeded capsules 1. *Corydalis*

1. *Corydalis* DC., nom. cons.

Herbs, usually perennial, erect, decumbent or diffuse, glabrous, glaucous or subglabrous; rootstock rhizomatous, tuberous or bulbous. Leaves often with a radical whorl and mostly with many cauline leaves, alternate or often cauline ones opposite, 1 - 3 pinnatisect or (1-) 2 - 3 (-4) ternatisect; basal and lower cauline leaves usually petiolate and sheathing at base. Inflorescence terminal, simple or branched racemes or sometimes condensed subumbellate, often elongating and becoming lax in fruit. Flowers bracteate, pedicellate, zygomorphic with upper petal usually spurred, mostly yellow or purplish, rarely pink, blue or bluish violet, or very rarely white. Sepals 2, small, scarious or white-membranous, caducous. Petals 4; outer pair dissimilar, with upper (posterior) one spurred or gibbous at base or below and lower (anterior) one flat or concave at base, smaller and more or less equalling lamina of upper petal, both often winged at back and expanded at margins; inner pair clawed, often cohering, narrower than and about as long as lower petal. Stamens 6 in 2 bundles of 3 each; upper bundle with a basal tail-like nectariferous gland projecting into and adnate to petal spur; anthers dimorphic with midanthers of each bundle dithecous and lateral ones monothealous. Ovary 1-loculed, usually many-ovuled; style filiform with 2, often dilated stigmas, becoming curved at tip. Capsules ovoid, oblong, elliptic or linear, dehiscent when ripe by somewhat membranous tumid or inflated valves, falling apart and leaving seed-bearing placentae attached to style; seeds suborbicular or reniform, sometimes arillate, usually shiny black.

Northern temperate regions, mostly Eurasian; about 300 species, 53 species in India.

Literature. BRUCKNER, C. (1985) Zur Samenmorphologie in *Corydalis* Vent. (Fumariaceae DC.). *Gelditschia* 13: 53 - 67. LIDEN, M. (1989) *Corydalis* (Papaveraceae: Fumarioideae) in Nepal. *Bull. Brit. Mus. (Nat. Hist.) Botany* 18: 479 - 538, ff. 1 - 26. LONG, D.G. (1984) Notes relating to the flora of Bhutan IX. Notes R. Bot. Gard. Edinb. 42: 87 - 106. LUDLOW, F. & W. T. STERN (1975) New Himalayan and Tibetan species of *Corydalis*. *Bull. Brit. Mus. (Nat. Hist.) Botany* 5: 47 - 69, ff. 1 - 14, tt. 1 - 15.

Notes. A very complex genus showing a high degree of variability. Species delimitation has always caused considerable hurdles for taxonomists. Only a comprehensive worldwide revision with sufficient field observations in the entire range of the genus can produce a satisfactory account.

Corydalis DC. in Lam. & DC., Fl. France ed. 3, 4: 637. 1805 has been conserved against Medikus 1789 and Ventenat (1803).

KEY TO THE SPECIES

- 1a. Flowers with blue, pink or purple as main colour 2
 b. Flowers with yellow or rarely orange or white as main colour 11
- 2a. Spur shorter than limb of upper petal 3
 b. Spur equal to or longer than limb of upper petal 5
- 3a. Plants 50 - 130 cm high, stiff, erect; capsules linear, 20 - 30 mm long; racemes 8 - 20-flowered, overtopping leaves 25. *C. flaccida*
 b. Plants less than 30 cm high, slender, flexuous; capsules obovoid, 6 - 10 mm long; racemes 2 - 10-flowered, not overtopping leaves 4
- 4a. Plants with greyish-purple hue; ultimate lobes of leaves obovate, obtuse; flowers spongy; spur 1.5 - 3 x 2 - 3.5 mm, broader than long 34. *C. latiflora*
 b. Plants without greyish-purple hue; ultimate lobes of leaves narrow, acute; flowers not spongy; spur 4.5 - 8 x 2 - 3 mm, longer than broad 38. *C. nana*
- 5a. Cauline leaves 2 - 4 or more 6
 b. Cauline leaves solitary or rarely 2 or absent 9
- 6a. Flowers 22 - 28 mm long; sepals minute, less than 0.5 mm long 7
 b. Flowers 15 - 20 mm long; sepals larger, 1 - 2 mm long 8
- 7a. Plants decumbent, branched; roots fibrous; leaves biternate with crenately lobed segments; bracts 6 - 10 mm long, lower ones toothed; pedicels 5 - 8 mm long; upper petal distinctly crested; capsules linear, up to 35 mm long 35. *C. leptocarpa*
 b. Plants erect, scarcely branched; roots tuberous; leaves triternate with entire segments; bracts 3 - 6 mm long, entire; pedicels 1 - 3 mm long; upper petal narrowly crested at apex; capsules ellipsoid, up to 15 mm long 16. *C. dorjii*
- 8a. Radical leaves absent; cauline leaves 2, usually opposite; pedicels ca 10 mm long; petals pink with purplish face 15. *C. diphylla*
 b. Radical leaves present; cauline leaves 2 - 4, alternate, scattered; pedicels 3 - 5 mm long; petals blue violet or white 2. *C. alpestris*
- 9a. Radical leaves absent; bracts entire 52. *C. trifoliata*
 b. Radical leaves present; bracts divided 10
- 10a. Roots fibrous; cauline leaf on 5 - 10 mm long petioles; lip of lower petal boat-shaped 39. *C. oligantha*
 b. Roots tuberous; cauline leaf sessile; lip of lower petal broad, almost flat 5. *C. cashmeriana*
- 11a. Cauline leaves 1 - 3, verticillate at apex of stem below inflorescence, simple, reniform or suborbicular, somewhat shortly dissected or dentate, fleshy 12. *C. crassifolia*
 b. Cauline leaves not so, not fleshy 12

- 12a. Bracts all entire 13
 b. Bracts at least some, dissected, dentate, lacinate, lobed or leafy 22
- 13a. Stems simple, unbranched 14
 b. Stems usually branched 16
- 14a. Tuberos storage roots present; cauline leaves alternate, simple 31. *C. juncea*
 b. Tuberos storage roots absent; cauline leaves opposite or subopposite, lobed or pinnate 15
- 15a. Cauline leaves 4, in 2 subopposite pairs; bracts 5 - 10 mm broad; flowers yellow without purplish tips 10. *C. clarkii*
 b. Cauline leaves 0 - 2, opposite or subopposite; bracts 2 - 5 mm broad; flowers pale yellow with purplish tips 14. *C. crithimifolia*
- 16a. Plants robust, stout, 50 - 130 cm high 17
 b. Plants slender, up to 50 cm high 20
- 17a. Capsules strongly undulate-tortuous 40. *C. ophiocarpa*
 b. Capsules not undulate-tortuous 18
- 18a. Leaves simple pinnate with flabellate-reniform pinnae; spur saccate or gibbous; capsules pendulous, linear 24. *C. flabellata*
 b. Leaves pinnate, bipinnate or tripinnate; pinnae not flabellate or reniform; spur long slender; capsules erect, obovoid or narrowly oblanceolate 19
- 19a. Flowers pale or golden yellow with brownish veins; corolla including spur 16 - 20 mm long; spur 8 - 9 mm long; capsules ellipsoid-obovoid, ca 8 mm long, 2 - 5-seeded 8. *C. chaerophylla*
 b. Flowers orange-brown; corolla including spur 20 - 25 mm long; spur 14 - 15 mm long; capsules narrowly oblanceolate, 9 - 13 mm long, 8 - 10-seeded 3. *C. borli*
- 20a. Pedicels 5 - 20 mm long; bracts shorter than pedicels; racemes 3 - 8-flowered 33. *C. lathyroides*
 b. Pedicels up to 5 mm long; bracts exceeding pedicels; racemes more than 10-flowered 21
- 21a. Leaves simply pinnate; pinnae fan-shaped, ovate to suborbicular; capsules sometimes dimorphic 1. *C. adiantifolia*
 b. Leaves 2 - 3 pinnatisect; pinnae elongated, much dissected with ovate to sublinear segments; capsules never dimorphic 49. *C. stricta*
- 22a. Cauline leaves absent, or if present 1 or 2 and highly reduced 23
 b. Cauline leaves present, well-developed 24
- 23a. Racemes 10 - 15-flowered, 10 - 14 cm long, visible above and exceeding radical leaves 43. *C. pseudocrithmifolia*
 b. Racemes 3 - 10-flowered, 8 - 10 cm long, hardly exceeding radical leaves 50. *C. tibetica*
- 24a. Plants 60 - 130 cm high; upper petal without crest on back 26. *C. geraniifolia*
 b. Plants less than 60 cm high; upper petal usually crested on back, rarely minutely so 25
- 25a. Stems zig-zag at nodes; leaves 3 - 4 times ternate; ultimate lobes less than 1 mm broad 45. *C. shan-ae*
 b. Stems not zig-zag at nodes; leaves 2 - 3 times pinnate; ultimate lobes more than 1 mm broad 26
- 26a. Cauline leaves usually 2, opposite, rarely 1 or 3, opposite or subopposite 27
 b. Cauline leaves usually several, alternate 29
- 27a. Plants small, cushion-forming, less than 8 cm high; racemes 3 - 10-flowered 29. *C. hendersonii*
 b. Plants not cushion-forming, more than 10 cm high; racemes 10 - 40-flowered 28
- 28a. Bracts wedge-shaped or oblong, pectinate-incised, 8 - 20 mm wide; flowers 20 - 25 mm long; spur conical, straight or slightly curved downwards 28. *C. govaniana*

- b. Bracts not wedge-shaped, linear-lanceolate, entire or lower ones dissected, 2 - 5 mm wide; flowers 12 - 18 mm long; spur cylindrical, slightly hooked at apex **21. C. falconeri**
- 29a. Leaves primarily ternately divided and subdivided into equal or unequal pinnately or ternately subdivided leaflets 30
- b. Leaves primarily pinnately divided and subdivided into equal or unequal pinnately subdivided leaflets 41
- 30a. Erect robust little-branched herbs, up to 60 cm high; roots numerous, densely fascicled **32. C. laelia**
- b. Diffuse or suberect weak much-branched herbs, mostly less than 50 cm high; rootstock a simple rhizome, not consisting of fascicled roots 31
- 31a. Rootstock almost absent or very short, with a taproot and branched roots; capsules subtorulose **47. C. stewartii**
- b. Rootstock present, long, slender or thickened, fusiform, often branched and covered with sheathing withered leaf-bases; capsules not torulose 32
- 32a. Terminal leaflet usually larger than lateral ones; racemes rounded, densely flowered 33
- b. Terminal leaflets similar to lateral ones; racemes elongated, laxly flowered 34
- 33a. Leaf segments obovate, mucronate; racemes 10 - 20-flowered; bracts equal to pedicels; crests of outer petals not projecting beyond lips **13. C. crispa**
- b. Leaf segments linear-lanceolate, acute; racemes 6 - 12 -flowered; upper bracts longer than pedicels; crests of outer petals projecting beyond lips **17. C. drepanantha**
- 34a. Lower petal not spurred, nor gibbous or pouched at base 35
- b. Lower petal with a short broad spur or basal pouch or gibbous at base 38
- 35a. Tuberous storage roots present on short rhizome; stem leafless towards underground portion; basal rosette of withered leaf sheaths and scales absent; cauline leaves 1 - 3; capsules obovoid-oblong, 5 - 8 mm long, 2 - 3 mm thick **42. C. polygalina**
- b. Tuberous storage roots absent; stem originating from a basal rosette of withered leaf-sheath bases and scales; cauline leaves usually more than 3; capsules linear, 8 - 15 mm long, ca 1 mm thick 36
- 36a. Racemes 1.5 - 3 cm long; flowers ca 1 cm or less long; sepals less than 1 mm across; nectariferous gland coherent entirely to spur wall, not upcurved at apex **6. C. casimiriensis**
- b. Racemes 3 - 7 cm long; flowers ca 1.5 cm or more long; sepals ca 2 mm across; nectariferous gland coherent partially to wall, upcurved at apex 37
- 37a. Pedicels much longer than bracts; upper petal acute; spur as long as limb **22. C. filicina**
- b. Pedicels as long as or shorter than bracts; upper petal with a broad blunt crest; spur shorter than limb **7. C. cavei**
- 38a. Densely tufted cushion-forming herbs, 2 - 5 cm high; radical leaves ca 1 cm long; bracts large, exceeding flowers; capsules 2-seeded **37. C. mucronifera**
- b. Erect or diffuse herbs, not cushion-forming; radical leaves, if present, longer; bracts not exceeding flowers, usually smaller than pedicels; capsules 8 - 18 -seeded 39
- 39a. Crest of upper petal extending only up to tip of spur; lower petal with a short spur at base; nectariferous gland two-third to three-fourth the length of spur **9. C. changuensis**
- b. Crest of upper petal extending only up to half the length of spur; lower petal with a short pouch at base; nectariferous gland up to half the length of spur 40
- 40a. Plants bluish green; sepals large, deeply fimbriate, 2 - 3 x 1.5 - 2 mm; spur 9 - 10 mm long; nectariferous gland more than 2.5 mm long, partly without a median constriction **23. C. filiformis**

- b. Plants not bluish green; sepals small, minutely divided or entire, ca 1 mm across; spur 5 - 6 mm long; nectariferous gland less than 1 mm long, not fused with spur; lower petal with a median constriction
44. *C. pseudolongipes*
- 41a. Pedicels much longer than or almost double the length of bracts
22. *C. filicina*
- b. Pedicels almost equal to or shorter than bracts 42
- 42a. Spur of upper petal shorter or much shorter than limb 43
- b. Spur of upper petal equal to or longer than limb 45
- 43a. Stems ascending, branched; racemes lax; pedicels 2 - 8 mm long; seeds minutely papillate
48. *C. stracheyi*
- b. Stems erect, not or slightly branched; pedicels 10 - 15 mm long; racemes dense; seeds smooth 44
- 44a. Robust herbs; basal leaf remnants with persistent fibres; racemes 12 - 35-flowered; upper petal 12 - 13 mm long; spur 1.5 - 5 mm long
36. *C. meifolia*
- b. Weak herbs; basal leaf remnants membranous; racemes 5 - 15-flowered; upper petal 15 - 19 mm long; spur 6 - 8 mm long
46. *C. sikkimensis*
- 45a. Leaves rather thick, crisped; ultimate segments of leaves linear, less than 1 mm wide; pedicels 10 - 13 mm long; seeds minutely papillate
18. *C. dubia*
- b. Leaves thin, not crisped; ultimate segments of leaves oblanceolate to lanceolate, more than 1 mm wide; pedicels 2 - 12 mm long 46
- 46a. Leaves 1-pinnate; leaflets lobed, pinnatisect or ternatisect 47
- b. Leaves mainly 2 - 3 pinnate; leaflets lobed, pinnatisect or ternatisect 49
- 47a. Leaves lacinate; ultimate segments white mucronate at apex; flowers ca 8 mm long; upper petal faintly crested; capsules up to 5 mm long
4. *C. boweri*
- b. Leaflets deeply lobed; ultimate segments obtuse or acute, not white mucronate; flowers more than 14 mm long; upper petal distinctly crested; capsules 8 - 16 mm long 48
- 48a. Rootstock with a rosette of scales and withered sheathing leaf bases at apex; ultimate segments of leaflets obtuse; flowers 20 - 22 mm long; capsules obovoid, 13 - 16 mm long
20. *C. elegans*
- b. Rootstock without such scales; ultimate segments of leaflets acute; flowers 14 - 16 mm long; capsules oblong, 8 - 10 mm long
30. *C. hookeri*
- 49a. Plants tufted, up to 14 cm high; stems absent or very much shortened, unbranched
19. *C. duthiei*
- b. Plants diffuse, 15 - 60 cm high; stems present, elongated, usually branched 50
- 50a. Rootstock spindle-shaped; plants glaucous, often glandular pilose; branches few, confined to region of inflorescence only; leaf segments obovate, oblong, suborbicular, obtuse at apex
27. *C. gortschakovii*
- b. Rootstock slender or thickened, not spindle-shaped; plants subglaucous or green; branches several, scattered; leaf segments linear-oblong, linear-ovate, acute or mucronate at apex 51
- 51a. Petiole-bases broadly winged and sheathing at base; inflorescence simple racemes; unbranched 52
- b. Petiole-bases sometimes very narrowly winged not sheathing at base; inflorescence thyrsoid, often branched below 53
- 52a. Rootstock almost absent; stems angular; pedicels 2 - 5 mm long; flowers yellow with purplish tips on inner petals; crest of upper petal entire; seeds opaque, mucronulate or punctulate
11. *C. cornuta*
- b. Rootstock present; stems not angular; pedicels 4 - 10 mm long; flowers yellow with brownish veins, not purple-tipped; crest of upper petal dentate or denticulate; seeds shiny, smooth
53. *C. vaginans*
- 53a. Racemes 30 - 40-flowered, 5 - 12 cm long; flowers with purple tips; spur robust, broad, straight; capsules ellipsoid, 5 - 7 mm long, ca 4 mm broad, 3 - 4-seeded
51. *C. thyrsiflora*

- b. Racemes 15 - 20-flowered, 3 - 6 cm long; flowers without purple tips; spur slender, down-curved; capsules oblong, 8 - 10 mm long, 2.5 - 3 mm broad, 6 - 8-seeded

41. *C. pakistanica*

1. *Corydalis adiantifolia* Hook. f. & Thomson, Fl. Ind. 271. 1855; Hook. f., Fl. Brit. India 1: 127. 1872.

Herbs, perennial, stout, 20 - 30 (-40) cm high, glabrous, glaucous, sparsely branched above or simple, erect, rigid; rootstock thick, woody, often shortly branched above, densely covered with withered leaf bases. Radical leaves pinnate with (2-) 3 - 6 distant pairs of lateral and one terminal pinnae, somewhat fleshy; pinnae often kidney-shaped, broader than long, 1 - 2 cm in diam., often 3 - 5-lobulate along margins; terminal segments often with 2 lateral segments at base; petioles hardly sheathing at base. Racemes simple, terminal, 5 - 10 cm long, somewhat dense, becoming lax in fruits; bracts much exceeding the flower buds; lower ones about as long as pedicels; upper ones longer, linear-subulate, setaceous, 4 - 5 (-6) mm long, ca 1 mm wide; pedicels 2 - 4 mm long, deflexed in fruit; flowers yellow, tipped brown, 12 - 18 mm long. Sepals lanceolate, denticulate below, 3 - 4 mm long, ca 1 mm broad, membranous. Upper petal hooded near apex, acute, minutely mucronate, slightly membranaceous, subentire; spur saccate or gibbous and down-curved at base; lower petal similar to upper petal. Capsules usually linear or rarely dimorphic with linear or broad-elliptic fruits, present on same plant on different branches, 15 - 22 mm long, 2 - 3 or 6 - 7 mm broad; style straight; seeds 8 - 10, biseriate, ca 2 mm in diam., shiny black.

KEY TO THE VARIETIES

- 1a. Capsules always linear, 15 - 22 mm long, 2 - 3 mm broad 1.1. var. *adiantifolia*
 b. Capsules heteromorphic, linear, 15 - 22 mm long and 2 - 3 mm broad on some branches and elliptic, 15 - 20 mm long and 6 - 7 mm broad on some other branches 1.2. var. *heterocarpa*

1.1. var. *adiantifolia*

Fl. & Fr. June - Aug.

Distrib. India: Alpine and temperate regions in Western Himalayas, 3000 - 5000 m. Jammu & Kashmir.

China (Tibet).

1.2. var. *heterocarpa* Jafri in Fl. W. Pakistan 73: 36, f. 10 A-B. 1974.

Fl. & Fr. June - Aug.

Distrib. India: Temperate and subalpine regions of Himalayas, 3000 - 3100 m. Jammu & Kashmir.

Pakistan.

2. *Corydalis alpestris* C. Meyer, Verz. Pfl. Cauc. 176. 1831; Prain in J. Asiat. Soc. Bengal II, 65(2): 21. 1896.

Herbs, perennial, 5 - 16 cm high, glabrous, glaucous; stems simple; rootstock a short conical scaly tuber, dividing below with 2 - 3 short lanceolate scales between tuber and last basal leaf; underground part of stem branched. Leaves radical and cauline; radical leaves 1 - 2 only at base of stem almost below ground, ternate, suborbicular, similar but smaller than cauline leaves, 1.5 - 5 cm across; petioles 5 - 15 cm long; cauline leaves 2 - 4, scattered and alternate, ternate with sessile deeply 3-partite pinnae; pinnae ca 2 cm across; leaflets orbicular or obovate, 3 - 5-lobed; lobules oblong, minute, mucronate, entire or 2 - 3 dentate, 7 - 12 x 2 - 3 mm; petioles 5 - 8 cm long, sheathing at base. Inflorescence terminal, 4 - 8-flowered, congested, bracteate, umbellate, borne at same level as leaves; bracts obovate or ovate, acute, entire, 5 - 10 x 3 - 6 mm, equal to pedicels. Flowers 15 - 18 mm long, bluish violet, rarely white. Sepals 1 (-2) mm long, squarish or oblong with short toothed margins; petals 15 - 20 mm long; spur shortly acuminate, 10 - 13 x 3 - 4 mm; upper lip hooded, erect. Capsules ellipsoid or narrowly obovoid, 10 - 15 mm long, ca 5 mm thick; style 3 - 4 mm long with dilated curved stigma; seeds ca 1.5 mm in diam.

Fl. & Fr. June - Aug.

Distrib. India: Alpine and temperate meadows, 3500 - 4200 m. Jammu & Kashmir.

China (Tibet), Bhutan, Nepal, Pakistan, Central Asia, Caucasus and Turkey.

3. *Corydalis borii* C. Fischer in Bull. Misc. Inf. Kew 1940: 31. 1940.

Herbs, glabrous. Radical leaves not seen. Culine leaves several, sessile or nearly so, ovate in outline 4 - 14 x 2 - 10 cm, pale beneath, pinnatisect; lobes 3 - 4 on each side, more or less decurrent on midrib, elliptic; terminal lobe lanceolate, lobulate; lobules unequally 2 - 4 toothed with acute or rounded teeth; uppermost cauline leaves small, stipule-like. Racemes terminal or terminal and lateral, few-flowered, rarely many-flowered, 4 - 6 cm long in flower, up to 17 cm long in fruit; lateral usually shorter; bracts lanceolate, broad and embracing the pedicel at base, acute at apex, 4 - 5 mm long; pedicels 2.5 - 3 mm long, elongating in fruit. Sepals suborbicular or broader than long, 0.75 - 1 mm long, 1 - 1.5 mm wide, erose-denticulate along margins, delicate. Corolla orange or brownish orange, 2 - 2.5 cm long; outer petal oblanceolate, obtuse, more or less boat-shaped, 9 - 10 mm long; upper petal cucullate, 8 - 9 mm long, with nearly straight 14 - 15 mm long spur; inner petals oblong, obtuse, 5 - 5.5 x 2.5 mm, cohering by their

apices and joined at base to sides of upper petals, winged on back along mid-nerve and with a thick broadly conical wing or fold along lower 2/3 of the lateral nerves. Ovary narrowly fusiform, 4 - 5 mm long; ovules 8 - 10. Capsules narrowly oblanceolate, 9 - 13 mm long, 8 - 10-seeded.

Fl. & Fr. May - Dec.

Distrib. India: Evergreen forests, 1500 - 2500 m. Nagaland.

Endemic.

4. *Corydalis boweri* Hemsley in J. Linn. Soc. 30: 108. 1894.

Herbs, diffuse, up to 10 cm high; branches rather woody, covered at base with scales and petiole bases; scales ca 15 x 3 mm, scarious near margins; rootstock rather woody. Leaves up to 8 cm long, pinnately branched with laciniate leaflets; ultimate segments elliptic-oblong, cuneate at base, abruptly white mucronate, ca 1 mm long, coriaceous; petioles up to 3 cm long, winged, glabrous. Racemes simple, ca 1.8 cm long; bracts ca 16 mm long, obcuneate, laciniate towards apex with linear ciliate segments; pedicels ca 12 mm long, prominently bent and looped at top; flowers golden yellow, ca 8 mm long. Sepals laciniate, ca 1.5 mm long, persistent. Petals ca 1 cm long; upper petal faintly crested; spur linear, ca 5 mm long, equal to limb. Ovary glabrous with expanded faintly angled stigma. Capsules ellipsoid, ca 5 mm long; seeds about 2, ovoid-orbicular, ca 2 mm across, finely punctulate, shiny black.

Fl. & Fr. July - Aug.

Distrib. India: Uttar Pradesh (Kumaon).

Endemic.

5. *Corydalis cashmeriana* Royle, *Illus. Bot. Himal.* 69 (1834), t. 16, f. 1. 1833; Hook. f., *Fl. Brit. India* 1: 128. 1872. *C. cashmeriana* var. *ecristata* Prain in J. Asiat. Soc. Bengal II, 65(2): 22. 1896. *C. ecristata* (Prain) D. Long in Notes R. Bot. Gard. Edinb. 42: 91. 1984. *C. ecristata* var. *longicalcarata* D. Long, l. c. 93.

Herbs, perennial, erect, 5 - 20 (-30) cm high; stems one to many, simple, arising from axils of fleshy scales forming small bulbils at top of vertical rhizome; rootstock tuberous, rather woody, branched below. Radical leaves few, 2 - 3 cm long, stalked, obcuneate, palmately 3 (-5)-parted or 3 (-5) pinnate, 10 - 15 cm long, glaucous; petioles up to 17 cm long, filiform, sheathing at base; pinnae obovate, deeply ternate; petiolules 1 - 2 cm long; ultimate leaflets linear or linear-oblanceolate or obovate, 1 - 2.5 cm long, (0.7-) 1 - 1.7 (-2.5) mm broad; nerves parallel, prominent. Cauline leaves sometimes absent or 1 - 2, if 2 then subopposite or alternate, placed at middle of the stem, sessile or subsessile,

elliptic to oblong-lanceolate, more deeply lobed or pinnatisect; lobules linear or oblanceolate, acute and minutely mucronate at apex, ca 1 mm broad. Flowers deeply sky blue with darker tips, turning pale when dry, 1.5 - 2.2 cm long with spur, in terminal simple or subumbellate 2 - 3 cm long (1 - 3) 5 - 8 (-9)-flowered racemes; pedicels 1 - 2.5 cm long; bracts foliaceous, laciniately 2 - 7-lobed, as long as pedicels or up to 1 mm across. Upper petal concave, broad, clawed at base, acute or minutely acuminate at apex, 11 - 22 mm long including spur, prominently or narrowly winged, glabrous; spur slightly curved downwards, strongly deflexed at tip, 4 - 16 mm long, 2.5 - 3 mm broad; lower petal 7 - 14 x 4 - 6 mm, with rhombic-ovate acute or obtuse-truncate limb, distinctly keeled, shortly crested beyond the upper lip by 1 - 4 mm. Ovary glabrous; style 2 - 4 mm long, with curved dilated flattened bilobed stigma. Capsules linear-oblong, 11 - 18 mm long, 2.5 - 3 mm thick, pendent, on up to 1.5 cm long erect spreading elongated pedicels; seeds 8 - 20, biseriate, ca 1.5 mm in diam.

Fl. & Fr. April - Sept.

Distrib. India: Temperate and subalpine Himalayas, on grassy slopes and Rhododendron forests, 2800 - 5500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China (E. Tibet).

Notes. Ellis (in Bull. Bot. Surv. India 27: 261 - 263. 1985) discusses the status of *C. ecristata* and var. *longicalcarata* and concludes that they all fall within the range of variation exhibited by *C. cashmeriana* and hence merges with it.

6. *Corydalis casimiriana* Duthie & Prain in J. Asiat. Soc. Bengal II, 65(2): 27. 1896. *C. sibirica* auct. non (L. f.) Persoon; Hook. f., Fl. Brit. India 1: 125. 1872, p.p. *C. prainiana* Kanodia & Mukerjee in Rec. Bot. Surv. India 20(2): 32. 1973.

Herbs, erect, decumbent or prostrate, 15 - 45 cm high; branches many, diffuse, grooved, glabrous; rootstock rather slender. Leaves numerous, mostly cauline, alternate, broadly ovate, deeply and equally biternatisect, 1 - 7 x 1 - 5 cm; ultimate segments oblong-cuneate or obovate or oblanceolate, 1.5 - 3 mm broad; nerves rather prominent beneath; petioles channelled above, slightly sheathing at base, 3 - 6 cm long. Racemes terminal, laxly 4 - 11-flowered, 1.5 - 3 cm long, elongating up to 6 cm in fruits; pedicels 5 - 10 mm long; bracts 2 - 4 mm long, lower ones ternately lobed, middle and upper ones entire; flowers yellow, sometimes tinged with purple, ca 1 cm or less long. Sepals suborbicular, dentate or faintly erose along margins, 0.5 - 1 cm across. Corolla 8 - 10 mm long, slender, narrowly winged; upper petals acute or shortly acuminate at apex, 10 - 12 mm long; spur equal to or longer than inner petals, 5 - 7 mm long, 1 - 1.5 mm broad at base, often curved upwards, obtuse; nectariferous gland 2 - 3 mm long, fused to spur for one-third to one-half of its length; upper lip with low entire crest not decurrent on spur; lower lip equal to upper lip; lower petal 5 - 6 mm long, not saccate at base,

constricted at middle; inner petals usually tipped with blackish purple. Style 1.5 - 2 mm long, expanded; stigma with 4 stalked papillae. Capsules linear, 8 - 15 x 1 (-2) mm; seeds 6 - 13, uniseriate, ca 1 mm across, shiny.

Fl. & Fr. July - Sept.

Distrib. India: Open grassy slopes and streamsides in temperate and alpine Himalayas, 2200 - 4700 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Meghalaya.

Nepal and Bhutan.

7. *Corydalis cavei* D. Long in Notes R. Bot. Gard. Edinb. 42(1): 104, f. 5F. 1984.

Herbs, perennial, 15 - 30 cm high; stems diffuse, slender, weak, much-branched from base; rootstock narrow, slender. Leaves numerous, mostly cauline, alternate, broadly ovate, 2 - 3 x 1.5 - 2 cm, bipinnate or biternate with deeply divided segments, glaucous beneath; ultimate segments broadly obovate, obtuse, 1.5 - 3 mm broad; petioles of lower leaves 3 - 9 cm long, upper shorter, 1 - 1.5 cm long; petiolules 6 - 13 mm long. Racemes 8 - 16-flowered, rarely with a basal branch, 4 - 7 cm long, elongate, rather dense at anthesis; bracts 3 - 6 mm long, leaf-like below, dentate to entire above, usually shorter than slender 5 - 15 mm long pedicels which are downwardly arcuate in fruit; flowers 16 - 20 mm long, yellow to orange with tips of inner petals dark. Sepals suborbicular, dentate, 1.8 - 2 mm in diam. Upper petal 13 - 15 mm long with a broad crest reaching apex and terminating abruptly, narrowly decurrent on spur; lower petal broadly winged, not spurred or gibbous, acute-acuminate, shortly cristate; spur 7 - 9 mm long, 2.5 - 3 mm broad; nectariferous gland 4 - 6 mm long, about one half to two-third the length of spur, upwardly curved. Nectariferous gland 4 - 6 mm long. Capsules linear, 10 - 13 mm long; style ca 2.5 mm long; seeds 5 - 7, uniseriate.

Fl. & Fr. June - Oct.

Distrib. India: Grassy meadows, 2700 - 4300 m. Sikkim.

Endemic.

Notes. Related to *C. crispa*, but has less branched stems, larger flowers, broader spurs and more seeded fruits.

8. *Corydalis chaerophylla* DC., Prodr. 1: 128. 1824; Hook. f., Fl. Brit. India 1: 126. 1872.

Herbs, erect, robust, 50 - 130 cm high; stems grooved, glabrous to crispate pubescent below; rootstock woody, stout, rather elongated, up to 30 cm long, with persistent stem

and petiole bases. Radical leaves few, broadly ovate, 9 - 15 x 7 - 14 cm, pale beneath, long-petiolate; primary divisions ternate into 3 petiolulate bipinnatisect major divisions; pinnae of each major division sessile, decurrent; ultimate segments oblong, obtuse; nerves raised and prominent below; cauline leaves confined to upper part of stem, similar but smaller, becoming sessile upwards; petiolules 15 - 25 cm long, sheathing at base. Racemes terminal, simple and few-flowered or dichotomously branched panicles, elongating in fruits, 10 - 20 cm long; flowers 6 - 40, golden yellow; pedicels 2 - 3 mm long; bracts linear to narrowly ovate or lanceolate, entire, 3 - 4 mm long, equalling pedicels. Sepals ovate-orbicular, faintly serrulate, ca 1 mm long. Outer pair of petals apiculate, very narrowly crested; upper petal 11 - 13 mm long; spur slender, usually straight, 8 - 9 mm long; nectariferous gland up to three-fourth the spur; lower petal without a prominent basal pouch. Ovary glabrous; style rather flattened and grooved. Capsules obovoid or ellipsoid, ca 8 mm long, ca 3 mm thick, spreading; seeds 2 - 5, ca 1 mm across, black, shiny.

Fl. & Fr. May - Nov.

Distrib. India: Himalayas from Kumaon to Bhutan, clearings in forests, mostly near streams, 2100 - 4200 m. Himachal Pradesh, Uttar Pradesh, Sikkim and Nagaland.

Nepal and Bhutan.

Notes. The leaves somewhat resemble a fern frond. A very variable species.

9. *Corydalis changuensis* D. Long in Notes R. Bot. Gard. Edinb. 42(1): 102, f. 4E. 1984.

Herbs, diffuse, much-branched, 15 - 30 cm high; rootstock slender, woody. Leaves many, mostly cauline, alternate, broadly ovate in outline, 1.5 - 2.5 x 1.7 - 3 cm, deeply and equally biternatisect; ultimate segments subequal, ovate, obovate to oblanceolate, cuneate at base, 1.5 - 3 mm broad; petioles 3 - 9 cm long; lateral petiolules 3 - 5 mm long, terminal ones up to 11 mm long. Racemes lax, few-flowered, 1.5 - 3 cm long; flowers yellow; lower bracts deeply lobed into 3 linear segments; upper bracts smaller, lanceolate, entire. Sepals suborbicular, dentate, less than 1 mm across. Petals yellow, tipped black; upper petal 13 - 15 mm long including spur, slightly curved upwards; spur 7 - 9 x 2 - 3.5 mm, with crest extending almost to tip of spur; lower petal equalling upper, near insertion with pedicel bearing short obtuse 1.2 - 1.4 mm long spur; nectariferous gland 4.5 - 5.5 mm long, extending up to two-third to three-fourth the length of spur. Capsules (immature) ellipsoid, 6 - 7 mm long.

Fl. & Fr. Sept.

Distrib. India: Gravelly moist slopes, 3600 - 3900 m. Sikkim (Changu district).

Endemic.

Notes. The most striking feature of this species is that in addition to the upper petal bearing a long spur, the lower petal also bears a short spur at base.

10. *Corydalis clarkei* Prain in J. Asiat. Soc. Bengal II, 65(2): 34. 1896. *C. moorcroftiana* Wallich ex Hook. f. & Thomson, Fl. Ind. 266. 1855, p. p.; Hook. f., Fl. Brit. India 1: 125. 1872, p. p. *C. elegans* sensu Hook. f., l. c. 124, p. p., non Wallich ex Hook. f. & Thomson, l. c.

Herbs, perennial, tufted and diffuse, robust, 15-30 cm high; branches terete, striate, glabrous, subglaucous; rootstock thick, densely covered with 2-5 cm long sheathing bases of leaves, branched below with elongated and intertwined branches. Radical leaves 4-7-jugately pinnate, up to 6 cm long, petiolate; pinnae sessile to shortly petiolulate, ovate, often deeply 3-lobed, 15-30 mm long; lobes elliptic-ovate, deeply to shallowly 1-3 lobuled; ultimate segments oblong to lanceolate, often decurrent, acute, apiculate, 3-20 mm long, 3-5 mm broad. Cauline leaves 4 in 2 subopposite pairs (sometimes alternate or opposite), similar to radical leaves but smaller, less lobed, shortly petioled to sessile; nerves prominent below. Racemes densely 20-30-flowered, simple or branched below, 6-8 cm long; bracts conspicuous, lanceolate to linear-elliptic, acute, entire, 15-30 x 5-10 mm, distinctly veined; pedicels 10-15 mm long, stout, deflexed in fruit; flowers yellow, ca 2.2 cm long. Sepals suborbicular, ovate, erose or much-dissected at margins, ca 2 mm in diam. Upper petal with broad dorsal wing and blunt apex; spur robust, straight or slightly falcate, blunt, 7-12 mm long; lower petal saccate at base. Style 3-5 mm long, curved at apex with broad faintly dentate stigma. Capsules obovate or broadly ellipsoid, 6-10 mm long, ca 4 mm broad; seeds 6-8, biseriate, 1.5-2 mm across, faintly striate, shiny black.

Fl. & Fr. Oct. - Nov.

Distrib. India: Alpine and subalpine regions, 3500-4500 m. Jammu & Kashmir.

Pakistan and China (Tibet).

11. *Corydalis cornuta* Royle, Illus. Bot. Himal. 69. 1834; Hook. f., Fl. Brit. India 1: 126. 1872. Fig. 11.

Herbs, annual or biennial, sometimes perennial; stems stout, erect or decumbent, densely branched from base, 15-60 cm long, angular, grooved, usually straggling; roots fusiform, up to 10 cm long. Leaves mostly cauline, triangular-oblong, subternate or bipinnate with opposite pinnae, 6-16 cm long, 3-5 cm broad, glaucous beneath; petioles (3-) 5-8 (-10) cm long, grooved above, sheathed and winged at base; pinnae oblong, orbicular, ca 1.2 cm long, variously lobed; ultimate segments oblong, obovate, cuneate at base, broadly obtuse-apiculate at apex, ca 6 mm wide. Racemes terminal, simple or



Fig. 11. *Corydalis cornuta* Royle

branched at base 7 - 20 cm long, 10 - 15-flowered; pedicels 2 - 6 mm long; bracts 2 - 8 cm long, usually divided or uppermost entire; flowers yellow with blackish purple tips on inner petals, 14 - 16 mm long, slender. Sepals minute, serrate or erose along margins. Corolla (10-) 12 - 18 mm long; upper petals with entire crests; spur straight or curved, obtuse, ca 8 mm long; lower petal with a conspicuous basal pouch. Capsules on deflexed pedicels, oblong, narrowly obovoid or linear-ellipsoid, 8 - 14 mm long, 2 - 3.5 mm thick, recurved, pointing downwards; style 2 - 3 mm long; seeds 8 - 16, minutely muriculate or punctulate, ca 1 mm across, dull, black.

Fl. & Fr. April - Oct.

Distrib. India: Hillsides and streamsides in forests, 2300 - 4000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Pakistan and Afghanistan.

12. *Corydalis crassifolia* Royle, *Illus. Bot. Himal.* 68. 1834; Hook. f., *Fl. Brit. India* 1: 127. 1872.

Herbs, erect, robust, perennial, 10 - 30 cm high; stems simple, thick, glabrous, glaucous, grooved; rootstock rather stout, prostrate, covered above with withered leaf bases. Radical leaves ternate, fan-shaped or reniform, cuneate at base, deeply divided into 3 - 5 lobes, 5 - 10 cm in diam., fleshy; lobes suborbicular, narrowed below, crenulate to shortly lobulate; petioles 7 - 12 cm long, weak. Cauline leaves 1 - 3-verticillate, sessile or shortly up to 15 mm long, petiolate, otherwise similar to radical leaves. Racemes simple or rarely branched below, densely 20 - 25 -flowered, 3 - 5 cm long, slightly elongating to 8 cm in fruits; pedicels spreading, 5 - 10 mm long, stout, elongated and deflexed in fruits; bracts spatulate, oblanceolate to obovate-lanceolate, cuneate at base, entire or lower ones often lobed, 10 - 15 mm long, 4 - 6 mm broad, becoming smaller upwards, green or leafy; flowers white or yellowish with purple spots, 18 - 25 mm long. Sepals slightly peltate, ovate, cordate at base, acute or acuminate at apex, erose along margins, ca 2 mm long. Upper petal broad, obtuse, slightly expanded at margins with short narrow, entire or 1 - 2-denticulate dorsal keel; lower petal slightly saccate at base, narrow, as long as upper petal, slightly deflexed. Capsules ellipsoid or subglobose, inflated, 15 - 35 mm long, 10 - 25 mm thick, with papery valves; seeds 7 - 9, ca 1 mm across, with small aril, shiny.

Fl. & Fr. July - Oct.

Distrib. India: W. & N.W. Himalayas, 3000 - 5500 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan and China (Tibet).

Notes. Wendelbo (in Bot. Notis. 119: 243 - 248. 1966) treats *C. crassissima* Cambess. as distinct from *C. crassifolia*. More field studies are required to test this assessment.

13. *Corydalis crispa* Prain in J. Asiat. Soc. Bengal II, 65: 30. 1896. *C. stacheyoides* Fedde, Repert. Spec. Nov. 18: 29. 1922.

Herbs, diffusely much branched, decumbent, 10 - 22 cm high; branches grooved, glabrous; rootstock woody, robust. Leaves numerous, all cauline, alternate, ovate, 3 - 6 x 2 - 2.5 cm, finely biternatisect; petioles 1 - 2.5 cm long, winged along margins and sheathed at base; terminal leaflet larger than laterals and leaf appearing somewhat pinnate, ca 1 cm long; ultimate segments oblong, obovate, apiculate, 1 - 2 mm broad, glabrous; nerves rather prominent below. Racemes rounded, densely 10 - 20-flowered, 2 - 4 cm long; pedicels slender, 4 - 10 mm long; lower bracts pinnatisect, 4 - 7 mm long; upper ones linear, entire, 2 - 4 mm long; flowers yellow or white, ca 1 mm long. Sepals suborbicular, arose along margins, ca 1 mm across; upper petal prominently winged, 10 - 14 mm long; spur ca 7 mm long, upwardly curved; nectariferous gland about three-fourth the length of spur. Filaments expanded at base. Ovary glabrous with a star-shaped stigma. Capsules ovoid, ca 7 mm long; seeds 3 - 4, dull black, smooth.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, 3500 - 4600 m. Sikkim.

W. Bhutan.

Notes. Closely similar to *C. filicina* and *C. cavei* in habit.

14. *Corydalis crithmifolia* Royle, Illus. Bot. Himal. 68. 1834; Hook. f., Fl. Brit. India 1: 123. 1872.

Herbs, erect or suberect, perennial, 10 - 25 cm high, glabrous, subglaucous, simple or unbranched; rootstock thick, covered with withered sheathing leaf bases. Radical leaves 2 - 3-ternate, long-stalked, 10 - 18 cm long; leaflets dichotomously pectinate, 1 - 2 cm in diam., each with 2 deeply dissected lobes; each lobe again deeply 3 - 4 lobed to the base; ultimate segments linear to elliptic-oblong, acute-mucronate at apex, 8 - 15 x 2 - 3 mm. Cauline leaves absent or often 2, opposite or subopposite, few-lobed or pinnatisect to almost entire. Racemes 10 - 20-flowered, lax in fruits, 6 - 10 cm long, not exceeding radical leaves; peduncles up to 8 cm long, grooved; pedicels 1 - 2 cm long, deflexed in fruit; bracts sessile, entire, linear-elliptic, 1.5 - 3 cm long, 2 - 5 mm wide; flowers pale yellow with purplish tips, 1.8 - 2.3 cm long. Sepals ca 1 mm across, irregularly serrate along margins. Upper petal winged above behind the acute crested apex; spur slender, subfalcate, down-curved below, ca 1 cm long; lower petal similarly winged, somewhat serrate at base. Ovary glabrous, 2 - 3 mm long; stigma orbicular, curved

downwards. Capsules linear-ellipsoid, 1 - 1.5 cm long, 2 - 2.5 mm thick, with 3 - 3.5 mm long persistent style; seeds 6 - 8, sub-biseriate, ca 1.5 mm in diam.

Fl. & Fr. June - Sept.

Distrib. India: Alpine and subalpine regions of W. Himalayas, 4000 - 6000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh (Garhwal).

Pakistan and China (W. Tibet).

Notes. Easily recognisable by its long linear bracts and long slender spur about twice as long as lamina.

15. *Corydalis diphylla* Wallich, Tent. Fl. Nap. 54. 1826. *C. rutifolia* auct. non Sibth. & Smith; Hook. f., Fl. Brit. India 1: 122. 1872 (as *rutaefolia*). **Fig. 12.**

Herbs, perennial, erect or slightly decumbent, 10 - 30 (-40) cm high, glabrous or subglaucous; rootstock deeply underground with 2 - 5 cm long irregularly rounded tubers; stems slender, simple, grooved, becoming thinner and tapering towards base. Radical leaves absent. Cauline leaves 2, usually opposite or 3 whorled, 2 - 3 times ternate, 10 - 20 (-25) cm long; petioles 1 - 5 cm long; leaflets oblong or ovate, 2 - 3 cm long, entire or pedately lobed; ultimate segments usually elliptic-oblong or obovate, obtuse, entire or subentire, subfleshy, unequal to subequal in size; middle lobe of each group consisting of 3 (-5) lobes, the largest (10-) 15 - 40 (-45) mm long and 5 - 10 mm broad, sometimes almost sessile, with 3 - 5 parallel inconspicuous veins; petiolules longer than petioles. Racemes laxly 3 - 8-flowered, axillary and terminal, 10 - 15 cm long, longer than leaves; pedicels 8 - 18 mm long, slender, spreading, elongating to 15 - 30 mm and deflexed in fruits; bracts sessile with broad base, leaf-like, ovate-lanceolate, acute, 6 - 14 mm long, 3 - 5 mm wide, entire or subentire; flowers showy, purple or bright orange-red with violet-pink or darker tips, 15 - 20 mm long. Sepals suborbicular, denticulate, crose-margined, 1 - 1.5 mm in diam. Corolla 18 - 19 mm long; upper petal broad, upcurved, with winged margins, emarginate at apex, 7 - 10 mm wide; spur subcylindric to infundibuliform, usually upcurved, obtuse, ca 12 mm long, as long as or a little longer than lamina of upper petal; lower petal similar to upper petal, ca 1 cm long. Capsules ellipsoid or oblong-ovoid, abruptly narrowed at apex into 3 - 5 mm long curved persistent style, 10 - 15 mm long, 4 - 5 mm thick; valves tumid, parallel-veined, slightly brownish; seeds 5 - 8, biseriate, orbicular, flattened, ca 2 mm in diam., shiny black.

Fl. & Fr. March - July.

Distrib. India: N. W. and W. Himalayas in temperate forests, 2500 - 3200 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal and Afghanistan.



Fig. 12. *Corydalis diphylla* Wallich

16. *Corydalis dorjii* D. Long in Notes R. Bot. Gard. Edinb. 42: 93 - 96, f. 3A. 1984.

Herbs, slender, erect, 30 - 50 cm long, arising from a cluster of spindle-shaped 1.5 - 2 cm long tuberous roots; stems with 1 - 3 short axillary branches. Basal leaves 2 - 3, sometimes absent or early withering, triternate, broadly triangular in outline, 7 - 11 cm long and broad; ultimate segments elliptic-obovate, attenuate at base, obtuse at apex, entire, 12 - 22 x 5 - 13 mm, glabrous, whitish beneath; petioles of basal leaves 10 - 14 cm long; primary petiolules 2.5 - 4.5 cm long; secondary petiolules 0.5 - 2 cm long. Cauline leaves 2 - 3, alternate, distant, 2 - 6 cm long, similar to basal leaves but with shorter petioles. Flowers 2 - 4 in short terminal 2 - 4 cm long racemes; peduncles 3 - 20 cm long; bracts elliptic, acute, 3 - 6 x 1 - 3 mm, entire; pedicels 1.5 - 3 mm long. Sepals minute, rim-like, ca 0.1 mm long, subentire. Petals pale blue, lilac or pale mauve; outer pair with a short low crest in apical 3 - 3.5 mm length; upper petal 25 - 28 mm long, including the slender deflexed 16 - 18 mm long spur; lower lip equalling upper, boat-shaped, gibbous near insertion with pedicel. Nectariferous gland 7 - 8 mm long, less than half the length of spur. Capsules narrowly compressed-ellipsoid, ca 15 x 3 mm, becoming torulose.

Fl. & Fr. April - May.

Distrib. India: Subtropical and temperate forests, 1600 - 2500 m. Manipur.

Bhutan and China (S.E. Tibet).

Notes. The report from Manipur is based on a sterile collection by George Watt (Ching Sow, 2560 m, April 1882, *Watt* 6537 in K & E). No further collection seen. The disjunct distribution needs confirmation with fresh fertile specimens from Manipur.

17. *Corydalis drepanantha* D. Long in Notes R. Bot. Gard. Edinb. 42(1): 101, f. 4D. 1984.

Herbs, erect, 12 - 30 cm high; stems branched at base on slender rootstock. Lower cauline leaves broadly ovate, ternatisect, 3.5 - 5 x 4 - 5.5 cm; secondary divisions ovate, ternately dissected; ultimate segments and teeth linear-oblongate, acute, 0.5 - 1.5 mm broad; petioles 5 - 9 cm long; upper leaves smaller and shortly petiolate. Racemes 3 - 5 cm long, 6 - 12-flowered; pedicels 3 - 10 mm long; lower bracts leaf-like, 1 - 2 cm long; upper bracts linear, 4 - 6 mm long, longer than pedicels; flowers yellow, sickle-shaped, secund. Sepals ovate, broadly crested, with apex of crest irregularly dentate and projecting forwards beyond lips; upper petal 10 - 13 mm long, including upcurved 6 - 9 mm long spur; nectariferous gland about half as long as spur; lower lip boat-shaped, equalling upper, not gibbous at base. Capsules obovate-elliptic, obtuse, ca 9 mm long, ca 3 mm thick.

Fl. & Fr. April - July.

Distrib. India: Streamsides on damp grassy banks, in cool broad leaved forests, 2000 - 2300 m. Arunachal Pradesh (Kameng Dist.).

Bhutan.

18. *Corydalis dubia* Prain in J. Asiat. Soc. Bengal II, 65(2): 36. 1896.

Herbs, weakly much-branched, 10 - 20 cm high. Radical leaves few; lower cauline leaves oblong, pinnately divided into 5 or more equal or unequal pinnately dissected leaflets, 3 - 7 x 2 - 2.5 cm, finely dissected; ultimate segments linear, acute, 2 - 5 x 0.5 - 1 mm. Racemes terminal, 2 - 5 cm long, few to many-flowered; lower bracts 10 - 12 x 5 - 7 mm, deeply pinnatisect; upper bracts shorter with fewer teeth; pedicels 10 - 13 mm long; flowers yellow. Upper petal 15 - 18 mm long, with a low crest; spur 7 - 9 mm long, equal to limb. Capsules narrowly obovoid, 7 - 10 mm long, ca 3 mm thick; seeds glossy but minutely papillate.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayan slopes, 3800 - 4800 m. Sikkim.

Bhutan.

19. *Corydalis duthiei* Maxim., Fl. Tangut. 49 (in obs.), t. 25, ff. 12 - 17. 1889.

Herbs, tufted, ca 14 cm high, glabrous; stems absent or very much shortened; roots rather thick. Radical leaves ca 14 cm long; petioles ca 4 cm long, broadly winged and clasping stems to form a column, prominently nerved. Cauline leaves ca 2 cm long; leaflets 7 - 10 mm long, alternate, laciniate; ultimate segments ca 5 mm long, linear, elliptic-obovate with inconspicuous nerves. Racemes 4 - 5 cm long; peduncles ca 3 cm long; bracts ovate to elliptic-ovate, entire and shortly laciniate along margins at top, ca 15 x 8 mm; flowers yellow, 15 - 17 mm long. Sepals small, dentately erose along margins. Outer petals prominently crested, ventral petal generally bent downwards; spur straight or slightly falcate. Ovary glabrous with flattened and slightly basally spurred stigma. Capsules not seen.

Fl. Aug. - Sept.

Distrib. India: W. Himalayas, 3000 - 4000 m. Himachal Pradesh and Uttar Pradesh.

Endemic.

20. *Corydalis elegans* Hook. f. & Thomson, Fl. Ind. 265, 1855; Hook. f., Fl. Brit. India 1: 124. 1872.

Herbs, erect or decumbent, 10 - 30 cm high; stems slender, grooved, glabrous; rootstock thick, woody, elongated, crowned by glumaceous scales and withered leaf bases; roots rather thick. Leaves mostly basal, 6 - 20 cm long, 1-pinnate with deeply divided leaflets, very glaucous; petioles 6 - 16 cm long, expanded and sheathed at base; leaflets up to 3.5 x 1 cm, deeply ternately lobed; ultimate lobules broadly obovate, oblong, even orbicular, attenuate at base, obtuse at apex, with rather parallel and prominent reticulations below; petioles short. Racemes densely 10 - 16-flowered, 5 - 8 cm long, elongating in fruit; bracts broadly lanceolate to ovate-elliptic, acute, ca 2 x 1 cm, parallel-nerved, glabrous; the lower ones longer, somewhat divided; upper ones shorter; pedicels arcuate, reaching 3 - 5 cm long in fruit; flowers 2 - 2.2 cm long, yellow with red spots. Sepals ca 1 x 1 mm, deeply dentate. Upper petal ca 2 cm long, prominently winged from about the middle to top; inner petals tipped dark purplish brown; lower petal divergent, conspicuously saccate at base, winged on back. Ovary glabrous; style 3 - 4 mm long, bent near flattened stigma. Capsules ovoid or obovoid, ca 15 mm long, ca 5 mm thick; seeds many, shiny, dark brown.

Fl. & Fr. July - Aug.

Distrib. India: Open slopes, 3600 - 4600 m. Himachal Pradesh and Uttar Pradesh.

Nepal.

21. *Corydalis falconeri* Hook. f. & Thomson in Fl. Brit. India 1: 124. 1872.

Ladakh: *Ralchat*.

Herbs, perennial, erect, 15 - 40 cm high; rootstock slender, tuberous, fusiform at end of narrow curved underground portion of stem; stems simple with scale leaves and withered sheathing petiole-bases at base. Radical leaves 10 - 20 cm long, ternate, bipinnatisect with 1 - 2 pairs of lateral pinnae and a terminal one; petioles usually 2 - 3 times as long as lamina; pinnae ternately deeply dissected, oblong or narrowly obovate, acute and mucronate at apex, 10 - 20 x 2 - 4 mm, 3-nerved. Cauline leaves 2, usually opposite, a little below the inflorescence or above middle of stem, sessile or subsessile, similar to radical leaves. Racemes 15 - 30-flowered, 3 - 10 cm long, much exceeding radical leaves; bracts linear-lanceolate, tapering at apex, entire, rarely lower ones dissected, 10 - 25 x 2 - 5 mm; pedicels up to 1.5 cm long and deflexed in fruit; flowers yellow with purple tips and reddish brown streaks, 12 - 18 mm long. Sepals obscure. Upper petal vaulted, slightly winged at back, acute; spur cylindrical, slightly hooked at apex, half as long as flower; lower petal winged, somewhat gibbous at base, slightly longer than other petals. Capsules oblong, narrowed at base, with 3 - 4 mm long curved style, 12 - 20 mm long, 2.5 - 3.5 mm thick; seeds 5 - 8, biseriate, ca 2 mm in diam., shiny black.

Fl. & Fr. June - Sept.

Distrib. India: Western Himalayas, 3000 - 4000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh (Tunganath).

China (W. Tibet).

Notes. In Ladakh powdered shoots are eaten for fever and colds.

22. *Corydalis filicina* Prain in J. Asiat. Soc. Bengal II, 65(2): 30. 1896.

Herbs, slender, erect or decumbent, 10 - 18 cm high; branches diffuse, terete, grooved; rootstock elongate, thin, wiry. Leaves cauline, alternate, triangular, bipinnate to usually bi- or triternate, ca 8 cm long; petioles ca 8 cm long; leaflets much divided, 5 - 8 cm across, often smaller; ultimate segments linear-lanceolate or broadly obovate, apiculate or not; nerves not prominent. Racemes laxly 3 - 10(-15)-flowered, 3 - 5 cm long; bracts divided into linear segments or oblanceolate, dentate or entire; pedicels 10 - 20 mm long, winged at base, much longer than bracts; flowers yellow with darker veins, rarely white, 16 - 20 mm long. Sepals ca 1.5 mm across, crose or irregularly serrulate along margins. Outer petals broadly auriculate, acute at apex, ca 18 mm long, crested on back; spur ca 6 mm long, straight or faintly falcate; nectariferous gland about half the length of spur. Ovary glabrous; stigma expanded, sagittate at base. Capsules (immature ones) linear, 8 - 15 mm long, ca 1 mm thick, 10-seeded; style ca 3.5 mm long. Seeds not seen.

Fl. & Fr. April - Sept.

Distrib. India: Grasslands, pastures, 3000 - 4500 m. Sikkim.

Nepal and Bhutan.

23. *Corydalis filiformis* Royle, Illus. Bot. Himal. Pl. 65, 1834. *C. longipes* auct. non DC.; Prain in J. Asiat. Soc. Bengal II, 65(2): 35. 1896.

Herbs, annual or short perennials, glabrous, bluish green, almost glaucous; stems weak, slender, trailing, branched; rootstock thin, often branched. Leaves all cauline, ternate or biternate, thin, submembranous; lower petioles long, upper ones shorter; pinnae ovate to suborbicular, deeply lobed; lobes narrowly oblong, obovate, obtuse, 4 - 15 x 1 - 4 mm; petiolules up to 1 cm long. Racemes subcorymbose, 3 - 11-flowered, lax, 2 - 5 cm long, elongating in fruit; lower bracts leaf-like, upper ones often clavate, entire; pedicels slender, 1 - 2 cm long, elongating in fruit; flowers pale yellow, 10 - 12 mm long, erect. Sepals large, ovate-orbicular, deeply fimbriate, 2 - 3 x 1.5 - 2 mm, reddish tinted. Upper petal cristate, long-acuminate, hooded and often long-aristate at apex, without dorsal wing; spur short, conical, upcurved or straight, 9 - 10 mm long; lower petal with a prominent basal pouch, without median constriction, 8 - 10 mm long; inner petals with dorsal wings, often tipped with blackish purple; nectariferous gland half as long as spur,

partially fused to it. Style ca 3 mm long; stigma with 6 apical papillae, of which the 4 central ones are longer than others. Capsules oblong, 8 - 10 mm long; seeds 8 - 18, biseriate, ca 1.2 mm across, shiny black.

Fl. & Fr. June - Aug.

Distrib. India: Alpine meadows of N.W. Himalayas, 2500 - 4000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal.

24. *Corydalis flabellata* Edgew. in Trans. Linn. Soc., Bot. 20: 30. 1851; Hook. f., Fl. Brit. India 1: 127. 1872.

Herbs, perennial, erect, rigid, much-branched, (15-) 20 - 60 (-90) cm high, glabrous, glaucous; rootstock thick, stout, woody, slender, simple or branched, ca 6 cm long, covered at base by ca 8 mm long glutinous scales. Radical leaves pinnate with 2 - 6 distant pairs of lateral flabellate pinnae and a terminal one, fleshy, glaucous, 10 - 15 cm long; pinnae sessile or subsessile, fan-shaped or obovate-suborbicular, cuneate below, 1 - 3 cm across, often 3-pinnuled or deeply lobed; lobules denticulate above, coriaceous. Cauline leaves distant, similar, but gradually becoming smaller above. Racemes usually simple, spicate, terminal on branches, 5 - 18 cm long, 10 - 30-flowered, somewhat dense, but becoming lax and elongated in fruit; bracts linear, ca 4 mm long, not longer than flower buds, about half as long as pedicel in fruit, curved downwards; pedicels 2 - 4 mm long in flower, 7 - 9 mm long in fruit; flowers yellow, 12 - 18 mm long. Sepals ovate or suborbicular, often caudate at apex, lacerate with hair-like projections at basal margins, 3 - 4 mm across. Upper petal hooded or cucullate near the apex, acute, subacuminate or mucronate at apex, membranous along margins; spur saccate or gibbous, curved downwards; lower petal similar to upper petal. Capsules pendent, linear, 12 - 25 mm long, ca 2.5 mm wide, somewhat deflexed, glabrous, with a distinct midvein on valves; style 3 - 5 mm long, curved at apex with broad stigma; seeds 5 - 9, biseriate with a short beak, ca 1.3 mm in diam., shiny black or dark brown.

Fl. & Fr. May - Sept.

Distrib. India: N.W. Himalayas, usually on dry gravelly soil, 2500 - 3500 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal and China (S.W. Tibet).

Notes. The plants are self-fertile.

25. *Corydalis flaccida* Hook. f. & Thomson, Fl. Ind. 260. 1855; Hook. f., Fl. Brit. India 1: 122. 1872.

Herbs, robust, 65 - 130 cm high; stems stiff, erect, leafy throughout; branches grooved, glabrous; rootstock robust, long, stout, with elongate fibrous roots. Radical leaves few, up to 40 cm long, 3 - 4 pinnatisect with opposite pinnae; leaflets ca 2 cm long, deeply incised; ultimate segments ovate, rounded, crenate, mucronate, thin, green above, glaucous beneath; terminal segments the largest; petioles 5 - 15 cm long. Cauline leaves many, sessile or shortly petiolate, similar to radical leaves, becoming smaller, less divided and sessile upwards. Racemes terminal, densely 8 - 20-flowered, 3 - 8 cm long; lower bracts pinnatifid, usually similar to upper leaves but smaller, 20 - 25 mm long; upper bracts linear to lanceolate, 5 - 15 mm long, often with a distinct stalk, entire to dentate; pedicels slender, equal to bracts, up to 25 mm long; upper ones 5 - 15 mm long; flowers red, mauve, purple or bluish purple, 17 - 18 mm long. Sepals ovate-orbicular, cordate at base, acute at apex, 1.5 - 2.5 mm across, slightly erose or irregularly serrulate along margins. Outer petals broadly crested, with narrow base and broad blunt apex, 14 - 16 mm long; spur 6 - 7 mm long, ca 2 mm broad at base, attenuate towards apex, slightly upcurved. Ovary glabrous; stigma stellately expanded. Capsules linear, flattened dorso-ventrally, 20 - 30 cm long, ca 2 mm wide; seeds 8 - 15, uniseriate, finely wrinkled with elaisomes, 1.9 - 2 cm long.

Fl. & Fr. June - Aug.

Distrib. India: Clearings in Rhododendron forests, 3100 - 5700 m. Sikkim.

Nepal, Bhutan, Myanmar and S.W. China.

26. *Corydalis geraniifolia* Hook. f. & Thomson, Fl. Ind. 269. 1855; Hook. f., Fl. Brit. India 1: 126. 1972, p. p. *C. chaerophylla* var. *geraniifolia* (Hook. f. & Thomson) Hara, Fl. E. Himalaya 103. 1966. Fig. 13.

Herbs, 60 - 100 (-130) cm high, glabrous to crispate puberulent below; stems solitary or few, naked below, leafy and branched above; rootstock stout, rather woody, covered with persistent petiole bases, reddish when dry. Radical leaves few, rather large, broadly ovate to triangular in outline, 10 - 15 x 6 - 12 cm, primarily ternately divided into 3 petiolulate bipinnatisect divisions; petioles 15 - 25 cm long; pinnae sessile or decurrent on rachis, up to 3 cm long, attenuate along rachis forming wings; ultimate segments oblong, acuminate, rather sharply pointed, glabrous, pale beneath; nerves raised and prominent. Cauline leaves smaller, becoming sessile upwards, confined to middle and upper parts of stem. Racemes simple to frequently branched below, terminal, lax, 10 - 15-flowered, 6 - 13 cm long; bracts obovate, 8 - 10 (-15) mm long, usually deeply 3 - 5-fid or upper ovate and entire; pedicels 3 - 5 mm long; flowers golden yellow, usually with brownish veins, 22 - 23 mm long. Sepals orbicular, cordate, ca 1 mm across. Upper petal 14 - 17 mm long, ecristate, apiculate; spur 9 - 11 mm long, apically recurved; lower petal with prominent basal pouch. Capsules cylindric, linear, ca 10 mm long, ca 2 mm thick; style ca 2 mm long; seeds 6 - 7, 0.9 - 1.4 mm in diam., dark brown or black, shiny.



Fig. 13. *Corydalis geraniifolia* Hook. f. & Thomson

Fl. & Fr. Aug. - Nov.

Distrib. India: Margins of clearings in forests, 2400 - 3350 m. Sikkim.

Nepal and Bhutan.

Notes. Closely allied to *C. chaerophylla* DC., but differing in lax 10 - 15-flowered, sometimes basally branched racemes, usually deeply 3 - 5 times divided lower bracts and ovate entire upper bracts which are larger, 7 - 10 (-15) mm long, the larger (22 - 23 mm long) flowers, cristate corolla, apically curved spur and linear-cylindric capsules.

27. *Corydalis gortschakovii* Schrenk, Enum. Pl. Nov. 1: 100. 1841. *C. moorcroftiana* Hook. f. & Thomson, Fl. Ind. 266. 1855; Hook. f., Fl. Brit. India 1: 125. 1872, p. p.

Herbs, perennial, erect to diffuse, 15 - 35 (-60) cm high; stems tufted, simple to sparingly branched, angular, ridged, glaucous, often minutely or obscurely glandular-pilose; rootstock spindle-shaped, often stout, woody, branched, densely crowned with withered brown sheathing leaf bases. Radical leaves bi- or subtripinnatisect, sometimes 4 - 5-jugate with terminal lobe often larger and densely lobulate, lower or lateral pinnae distant and smaller; pinnae ovate to suborbicular, 10 - 25 mm long, lobed into many lobules, often in threes; ultimate segments oblong-obovate to suborbicular, 4 - 10 x 1.5 - 4 mm, obtuse and minutely mucronate at apex, scabrid-pilose. Cauline leaves reduced, sessile, pinnatisect with narrow lobules. Racemes often dense and congested, but becoming lax in fruit, 3 - 10 cm long, 15 - 30-flowered, rarely branched below; peduncles scabrid papillose; bracts entire to segmented, oblong-elliptic; ovate-cuneate to broad-lanceolate, 10 - 15 x 2 - 8 mm, often covering flower buds; pedicels (5-) 10 - 15 mm long in fruit and deflexed; flowers yellow, usually with dark purple tips, 15 - 20 mm long. Sepals 1 - 2 mm in diam., denticulate along margins, white, membranaceous. Corolla 18 - 25 mm long; upper petal conspicuously dorsally broad-winged, obtuse, expanded and membranaceous along margins; wings sparsely denticulate to entire; spur straight or slightly downcurved at apex, blunt, 8 - 10 mm long; lower petal similar to upper, saccate at base. Capsules oblong, cuneate below, obtuse at apex, 12 - 15 mm long, 2.5 - 3 mm broad, on elongated recurved pedicels; style 2 - 4 mm long, curved at apex; seeds 8 - 10, subbiseriate, ca 1.5 mm in diam., shiny black.

Fl. & Fr. June - Sept.

Distrib. India: N.W. Himalayas, 3600 - 5500 m. Jammu & Kashmir.

Pakistan and Afghanistan to Central Asia.

28. *Corydalis govaniana* Wallich, Tent. Fl. Nap. 55. 1826; Hook. f., Fl. Brit. India 1: 124. 1872. Fig. 14.

Ladakh: *Ralchatnakpo*.

Herbs, perennial, erect, tufted, 15 - 60 cm high; rootstock thick, fibrous, densely crowned with remnants of sheathing leaf-bases and cataphylls, slender, elongated, often a few twisted together; stems stout, woody, simple, rarely branched, 15 - 35 cm long, subglaucous, glabrous. Radical leaves few to many, ovate to triangular-ovate, ca 30 cm long, bi- (or tri-) pinnate, nearly as long as stem; petioles ca 15 cm long, as long as lamina, 4.5 x 1 cm, sheathed at base; pinnae ovate, oblong-ovate to suborbicular, 1 - 6 cm long, 3 - 5-pinnuled; petiolules very short; pinnules shortly stalked to sessile, up to 3 cm long, deeply dissected and variously cut into narrow segments; ultimate segments oblong-ovate, attenuate at base, rounded at apex, minutely mucronate, prominently nerved. Cauline leaves usually 2, opposite or subopposite at or below middle of stem, up to 20 cm long, smaller than radical leaves, dentate to almost entire and lanceolate; petioles up to 15 cm long, simple, often dense, 5 - 15 cm long; peduncles up to 25 cm long, grooved; bracts wedge-shaped or oblong and pectinate-incised, 1 - 3 (-5) x 0.8 - 2 cm, upper ones subentire and lower ones dissected; pedicels arcuate, 5 - 20 mm long, elongated to 30 cm and deflexed in fruits; flowers bright yellow, 2 - 2.5 cm long. Sepals ca 1 mm in diam., dentate, whitish. Upper petal dorsally crested; spur conical, straight or somewhat down-curved, subobtuse, ca 1 cm long, equal to limb; lower petal subsaccate at base. Style curved at apex, 2 - 4 mm long; stigma broad, usually with basal papillae. Capsules oblong or obovoid, narrowed at base, subobtuse at apex, 10 - 15 mm long, 3 - 4 mm wide; seeds 4 - 8, biscriate, 1.5 - 2 mm in diam., shiny black, covered at base with persistent raphe.

Fl. & Fr. April - Aug.

Distrib. India: N.W. Himalayas, usually above the tree-line on moist open slopes, 3200 - 5600 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan and Nepal.

Notes. In Ladakh roots and seeds are eaten as carminative.

29. *Corydalis hendersonii* Hemsley in J. Linn. Soc., Bot. 30: 108. 1894.

Herbs, perennial, short, cushion plants, densely tufted, 5 - 8 cm high; rootstock stout, cylindrical, densely crowned by withered sheathing leaf bases; stems 3 - 5 cm long, somewhat fleshy, glaucous, glabrous. Radical leaves tufted, 2.5 - 5 cm long, bi- or tripinnatisect, fleshy; petioles broadly sheathing, minutely glandular pilose along margins of sheaths, 1.5 - 3 cm long; pinnae usually bipinnatisect, 1.5 - 3 cm long; ultimate segments many, narrowly linear or lanceolate, acute to subobtuse and mucronulate at



Fig. 14. *Corydalis govaniana* Wallich

apex, 1 - 3 x 1 - 1.5 mm. Cauline leaves 1 - 2 (-3), similar to radical ones, but smaller. Racemes condensed, corymbose, hardly exceeding leaves, 3 - 10-flowered; bracts leafy, much divided, becoming shorter above; pedicels 12 - 18 mm long, erect, apically deflexed in fruit; flowers yellow, 16 - 20 mm long, almost erect with only apices visible above leaves and bracts. Sepals narrowly linear. Upper petal rhombic, acute or subobtusate, with expanded margins, dorsally cristate, not winged; spur slender, ca 1 cm long; lower petal slightly saccate at base, similar to lamina of upper petal. Capsules hidden among bracts, oblong, 5 - 11 mm long; style 5 - 6 mm long; seeds 1 - 9, ca 1.8 mm long, shiny black.

Fl. & Fr. June - Sept.

Distrib. India: Alpine areas of N.W. Himalayas, 3800 - 6000 m. Jammu & Kashmir.

Pakistan, Nepal and China (Tibet).

30. *Corydalis hookeri* Prain in J. Asiat. Soc., Bengal II, 65(2): 34. 1896. *C. denticulato-bracteata* Fedde, Repert. Spec. Nov. 25: 219. 1928.

Herbs, perennial, 10 - 50 cm high, much-branched; rootstock slender, woody. Leaves somewhat fleshy, very glaucous, scabrid on nerves beneath, oblong in outline, 1-pinnate; leaflets coarsely pinnatisect to ternatisect; ultimate segments often imbricate, obovate to lanceolate, acuminate and shortly mucronate, 3 - 5 mm broad; lowermost pair of leaflets often smaller; basal petioles 5 - 10 cm long, winged, upper ones smaller. Racemes dense, branched, 10 - 30-flowered, 5 - 8 cm long; pedicels 3 - 8 mm long, deflexed in fruit; bracts narrowly linear, entire or lower ones smaller and divided, faintly denticulate-glandular along margins, 2 - 8 mm long, slightly glandular on midrib beneath; flowers 14 - 16 mm long, yellow, tinged brown with dark purple tips. Outer petals broadly crested up to tip, along margin. Upper petal 18 - 20 mm long, acute to short-acuminate at apex; spur 7 - 10 mm long with rather broad crests which reach the tips, strongly recurved at apex; inner petals pale, rarely tipped with brownish purple. Ovary flattened at top, elongated at base. Capsules linear-ovoid, 8 - 10 mm long, with 3 - 4 mm long persistent style; seeds 2 - 4, ca 1.8 mm across, shiny.

Fl. & Fr. May - Sept.

Distrib. India: Roadsides, hillsides and edges of fields in temperate and alpine Central Himalayas, 3000 - 5000 m. Sikkim.

Nepal and China (S. Tibet).

Notes. The plants are self-fertile.

31. *Corydalis juncea* Wallich, Tent. Fl. Nap. 54, t. 42, f. dextra. 1826; Hook. f., Fl. Brit. India 1: 123. 1872.

Herbs, erect or decumbent; stems simple, 8 - 50 cm high; branches terete, striate, glabrous; rootstock woody with a dense cluster of tuberous fusiform unbranched up to 3.5 cm long storage roots. Radical leaves usually solitary, biternate or rarely triternate with deeply cut leaflets; petioles very long, slender, sheathed at base, up to 20 cm long; leaflets simple or often pedately divided, ovate-oblong to elliptic, oblanceolate, cuneate at base, acute at apex, 20 - 30 x 6 - 8 mm, glabrous, with prominent nerves; petiolules 1 - 3 cm long. Cauline leaves absent or up to 2, entire, linear-lanceolate, 3 - 5-nerved from base, 1 - 6 x 0.2 - 1 cm, rarely ternate. Racemes spicate, 10 - 30 (-40)-flowered, 5 - 25 cm long; bracts linear to broadly lanceolate, 5 - 20 (-40) mm long; pedicels 5 - 15 (-20) mm long; flowers yellow with black spots, up to 1.5 cm long. Sepals minute, arose along margins. Upper petal broadly crested, 9 - 10 (-12) mm long; spur straight or slightly upcurved, ca 3.5 x 2 mm long; lower petal crested, similar to upper; inner petals almost always tipped with blackish purple. Stamens with prominently expanded filaments. Ovary ovoid, glabrous; stigma expanded, sharply angled. Capsules obovoid or ellipsoid, ca 13 mm long with up to 3 mm long style; seeds ca 10, ca 1 mm in diam., shiny.

Fl. & Fr. April - Oct.

Distrib. India: Alpine meadows, grasslands and almost low scrubs, 2600 - 5100 m. Sikkim.

Nepal and Bhutan.

32. *Corydalis laelia* Prain in J. Asiat. Soc. Bengal II, 65(2): 25. 1896.

Herbs, robust, erect, 30 - 50 (-60) cm high; stems stout, shiny, grooved, little-branched, arising from a dense cluster of slender fibrous fascicled roots; stem base surrounded by old petiole remains and scales. Radical leaves ovate in outline, biternatisect, 10 - 14 x 8 - 14 cm, glaucous beneath, glabrous; petioles 15 - 25 cm long, winged and sheathing at base; leaflets up to 4 cm long, deeply divided into linear or elliptic, acute or subacute segments or 2 - 5 mm broad teeth; nerves prominent below; petioles ca 5 mm long. Cauline leaves on shorter 1 - 3 cm long petioles. Racemes stout, many-flowered, forming branched panicles; lower bracts ovate, deeply pinnatisect into linear teeth, 1 - 2 cm long; upper shorter, linear-ovate, entire; flowers yellow, ca 1.8 cm long. Sepals ca 2 mm across, faintly lacinate along margins. Outer pair of petals with very broad dorsal crests projecting forwards beyond lips; upper petal 20 - 25 mm long, including 8 - 11 mm long straight spur with somewhat deflexed tip. Capsules cylindrical to obovoid-cylindric, ca 12 mm long, ca 2 mm thick.

Fl. & Fr. May - Sept.

Distrib. India: Streamsides in temperate forests, 2600 - 4000 m. Sikkim.

Pakistan, Bhutan and China (S. Tibet - Chumbi Valley).

33. *Corydalis lathyroides* Prain in J. Asiat. Soc. Bengal II, 65(2): 23. 1896.

Herbs, erect, delicate, branched from base, sparingly leafy, 10 - 20 cm high. Rootstock and radical leaves unknown. Cauline leaves narrowly oblong, 3 - 6 x 1 - 2 cm, once pinnate; lower pinnae with 1 - 3 cm long petioles; upper ones sessile, purplish beneath; leaflets in 3 - 5 pairs, if entire broadly ovate or suborbicular, obtuse and mucronate or if divided, as usual, then 2 - 5-segmented, which are obovate-obtuse. Racemes terminal and from upper leaf axils, 3 - 8-flowered, lax on slender peduncles, 1.5 - 7 cm long; bracts linear or 3-fid, 3 - 6 mm long; pedicels erecto-patent, 5 - 15 mm in flower, 15 - 20 mm in fruit; flowers yellow, 8 - 10 mm long. Sepals shallowly dentate, 1 - 1.5 mm long. Upper petal acute, 10 - 15 mm long, not or very narrowly cristate; spur 3.5 - 7 mm long, slightly curved upwards; lower petal spatulate, acute, ca 7 mm long, exerted beyond upper petal, without a basal pouch; nectariferous gland very slender, about two-third as long as spur. Style ca 2 mm long; stigma with 4 stalked papillae. Capsules narrowly obovoid, 6 - 8 mm long, 1.5 - 2 mm wide; seeds biseriate, ca 15, with very long elaiosomes, ca 0.7 mm across, glossy.

Fl. & Fr. July - Aug.

Distrib. India: Cliff edges, amidst moss on dripping rocks, 3000 - 4100 m. Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal and Bhutan.

34. *Corydalis latiflora* Hook. f. & Thomson, Fl. Ind. 270. 1855; Hook. f., Fl. Brit. India 1: 126. 1872. *C. gerdae* Fedde, Repert. Spec. Nov. 18: 30. 1922.

Herbs, erect, 7 - 15 cm high with a greyish purple hue; stems surrounded by persistent petiole bases, diffusely branched; young branches striate, glabrous, older ones robust with scales at base; rootstock slender, long, scaly, woody, often very long. Radical leaves 2 - 5 x 1.5 - 2 cm, biternate or bipinnate with ternately finely divided leaflets; petioles 4 - 8 cm long, sheathed at base; leaflets broadly ovate or orbicular, deeply dissected into obovate obtuse teeth, ca 1.5 cm long; ultimate lobules linear to oblong-obovate, obtuse or acute at apex, rather chartaceous, glabrous. Cauline leaves subopposite, similar to radical leaves, or sometimes smaller, rarely absent, often with 2 opposite leaves below inflorescence. Racemes 2 - 8-flowered, corymbose or subumbellate with 3 - 6 horizontal flowers, sometimes scarcely exerted above bracts, 2 - 2.5 cm long; bracts linear-ovate to broadly flabellately divided, 6 - 25 cm long; lower ones 2 - 3-fid; pedicels 5 - 20 mm long, slightly shorter than bracts, erect, apically hooked in fruit; flowers 14 - 20 mm long, greyish blue or pale violet with yellow tips, scented. Sepals

minute, slightly laciniate. Upper petal 13 - 19 mm long including spur, notched behind hooded apex, broadly cristate, often with crest decurrent to apex of spur, making the profile of flower very broad; spur 1.5 - 6 x 2 - 3.5 mm, downwardly curved; inner petals tipped dark green or blackish; lower petal almost straight, often with deflexed tip. Capsules ellipsoid or obovoid, 6 - 10 mm long, 2 - 4 mm thick, pendent on erect apically hooked pedicels; style ca 3 mm long; seeds 3 - 5, ca 1.5 mm, smooth or minutely papillose, dull.

Fl. & Fr. July - Oct.

Distrib. India: Rocky slopes and streamsides, often forming cushions between boulders, 4200 - 5500 m. Sikkim.

Nepal, Bhutan and China (S.W. Tibet).

35. *Corydalis leptocarpa* Hook. f. & Thomson, Fl. Ind. 260. 1855; Hook. f., Fl. Brit. India 1: 122. 1872.

Herbs, annual or perennial, 10 - 30 cm high, diffuse, decumbent; stems several, branched, delicate, arising from a cluster of slender fibrous roots; branches dense, slender, striate, glabrous; roots simple with a main root and lateral fibrous ones. Radical leaves biternate, oblong-triangular, 5 - 8 x 3 - 5 cm; petioles 5 - 9 cm long, slightly sheathed at base; leaflets ternate, broad, obtuse, often trilobed, glaucous beneath; terminal and lateral segments ovate-elliptic, oblong-obovate, crenately dentate along margins or deeply lobed, finely attenuate at base, ca 2 x 1 cm, glabrous; nerves prominent; petioles short. Cauline leaves 2 or more, alternate. Racemes axillary or terminal, 2 - 6 cm long, laxly (2-) 4 - 8-flowered; bracts obovate, narrowly ovate-lanceolate, 6 - 12 mm long, lower ones toothed or lobed, upper ones narrow, entire; pedicels 5 - 8 mm long, deflexed in fruit; flowers pink or purple or sometimes white, 2.2 - 2.8 cm long. Sepals minute, orbicular, slightly lacerate along margin. Outer pair crested; upper petal 25 - 30 mm long, winged on dorsal and ventral lobes; spur slightly falcate, 13 - 15 x 3 - 3.5 mm; nectariferous gland 6 - 7 mm long. Capsules linear, (2-) 2.5 - 3 (-3.5) cm long, 1.5 - 2 mm thick, torulose; style alternate, ca 4 mm long; seeds 16 - 20, ca 1.2 mm across, black, shiny.

Fl. & Fr. March - Aug.

Distrib. India: Damp streamsides or cliffs, in temperate and subtropical forests, 1900 - 2800 m. Sikkim, Arunachal Pradesh, Nagaland and Manipur.

Nepal, Bhutan, Myanmar and S.E. China (Yunnan).

36. *Corydalis meifolia* Wallich, Tent. Fl. Nap. 55, t. 41. 1826; Hook. f., Fl. Brit. India 1: 126. 1872. *C. meifolia* var. *sikkimensis* Prain in J. Asiat. Soc. Bengal II, 65(2): 40. 1896. *C. meifolia* var. *violacea* Prain, l. c.

Herbs, erect, often robust, showy, 10 - 45 cm high; stems tufted, stout, striate, glabrous, covered at base by up to 10 cm long persistent leaf bases and cataphylls; rootstock with several thick twisted subfusiform rope-like, ca 14 cm long strands. Radical leaves large, deeply finely bipinnatisect, 8 - 35 x 6 - 15 cm, as long as stems; petioles 8 - 15 cm long, flattened, sheathing at base; lamina triangular to oblong, tripinnate with numerous oblong or filiform, 5 - 10 mm long and 0.5 - 1 mm wide segments. Cauline leaves several, subopposite, 15 - 18 cm long; lowermost one situated near middle of stem, becoming shorter and sessile upwards; petioles winged and sheathed at base, 10 - 18 cm long; leaflets ca 3 cm long, both alternate and opposite, finely lacinate; ultimate segments linear, capillary, often circinnate, glabrous, rather coriaceous. Racemes terminal, corymbose, densely 12 - 30-flowered, rounded, up to 8 cm long, elongating in fruit; pedicels erecto-patent, 1 - 3 cm long, apically arcuate in fruit; lower bracts leaf-like, oblong or flabellate, 1.5 - 3 cm long, with flattened linear bases and deeply divided linear segments; flowers yellow with purple tips, rarely orange, sometimes marked with purplish brown at base, ca 1.8 cm long. Sepals oblong, ovate, irregularly serrate-lacinate, 1.5 - 3 x 1 - 1.5 mm. Upper petal with prominent rounded crest at tip, 12 - 16 mm long, with up to 2.5 mm long slightly curved spur; lower petals broadly 3 - 4 mm long; stigma flattened, bifid, projecting at base. Capsules narrowly obovoid, broadly elliptic, clavate, 6 - 8 x 3.5 - 4 mm; seeds ca 10, smooth or faintly foveolate, ca 1.5 mm across, shiny black.

Fl. & Fr. June - Oct.

Distrib. India: Alpine Himalayas, on damp streamsides and moist slopes, 3900 - 5200 m. Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (S.E. Tibet).

37. *Corydalis mucronifera* Maxim., Fl. Tangut. 1: 51, t. 24, ff. 19 - 21. 1889.

Herbs, stunted, diffusely branched, erect, 3 - 6 cm high; main stem rather woody, grooved, branching from base, often covered with triangular scales just below branches; rootstock rather thick with fibrous roots. Basal leaves ternatisect, 1 - 4 cm long; petioles 1 - 3 cm long, winged and sparsely pectinate-hirsute along margins, sheathed at base; leaflets 3 at ends of petioles, entire or often lobed or lacinate; ultimate segments linear to linear-spathulate, denticulate along margins, bluntly 3-fid. Cauline leaves smaller. Flowers yellow, in simple few-flowered bracteate racemes; bracts obovate, lacinate, ca 12 x 8 mm, exceeding and hiding flowers. Sepals reniform, shortly lacinate along margin, ca 1 mm across. Upper petal 6 - 8 mm long; including ca 3 mm long spur, denticulate along margin from half way down, not crested; spur of lower petal ca 4 mm long; outer

petals keeled or narrowly crested. Ovary with style bent near ridged stigma. Capsules oblong, ca 3 mm long; seeds 2, ca 2 mm across, blackish-brown, reticulate.

Fl. & Fr. July - Aug.

Distrib. India: Sikkim.

China (S. Tibet).

38. *Corydalis nana* Royle, *Illus. Bot. Himal.* 68. 1834. *C. ramosa* Hook. f. & Thomson var. *nana* Hook. f., *Fl. Brit. India* 1: 125. 1872.

Herbs, erect, dwarf, 5 - 15 cm high; stems simple or branched above, ascending, glabrous; rootstock stout, often slender. Leaves spongy. Radical leaves bipinnate, ca 5 cm long; petioles 8 - 10 mm long, winged along margins; leaflets subopposite, ca 2 cm long, variously lobed; ultimate lobules obovate, linear-oblong or lanceolate, acute, glabrous. Cauline leaves 3 - 4, the lower often subopposite, situated near middle of stem. Racemes corymbose, densely 5 - 10-flowered, not overtopping leaves, ca 4 cm long; bracts broadly flabellate, much dissected into linear segments, 14 - 25 mm long, glabrous; pedicels 12 - 23 mm long, apically thickened and hooked in fruit; flowers greyish or bluish grey, tipped green, ca 13 mm long. Sepals broadly ovate, ca 13 mm long. Sepals broadly ovate, apically dentate, ca 1 mm across. Upper petals cristate, 15 - 16 mm long; spur 4.5 - 6 mm long, somewhat down-curved; lower petal boat-shaped except for cristate deflexed apex; inner petals dark tipped. Ovary placed at an angle to the top of slightly thickened pedicel, ovoid or obovoid; stigma flattened, slightly bilobed, each simply papillate at top. Capsules narrowly obovoid, ca 6 mm long; style 3 - 3.5 mm long, sharply bent below stigma; seeds up to 10, ca 0.8 mm in diam., smooth, shiny.

Fl. & Fr. Aug. - Sept.

Distrib. India: Alpine N.W. and W. Himalayas, 4200 - 6000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal.

39. *Corydalis oligantha* Ludlow in *Bull. Brit. Mus. (Nat. Hist.) Botany* 5: 60, t. 9, f. 8. 1975.

Herbs, slender, 8 - 12 cm high; stems simple, arising from a cluster of fibrous roots. Radical leaves several, ovate, bipinnatisect, 1 - 2 cm long, deeply divided into oblong or obovate lobes; petioles 1.5 - 3 cm long. Cauline leaves solitary, similar, bipinnatisect with toothed segments; petioles smaller, 5 - 10 mm long, subtending small axillary bulbils. Flowers 2 - 3, subtended by sessile leaf-like bracts, blue or white. Upper petals 14 - 15

mm long, including the slender 8 - 10 mm long spur; lower lip boat-shaped, acute. Capsules not seen.

Fl. May.

Distrib. India: Temperate forest clearings, 2800 - 3100 m. Arunachal Pradesh.

N.E. Bhutan.

40. *Corydalis ophiocarpa* Hook. f. & Thomson, Fl. Ind. 259. 1855; Hook. f., Fl. Brit. India 1: 122. 1872.

Herbs, robust, erect, 50 - 110 cm high; stems grooved, glabrous; rootstock woody. Radical leaves numerous, ovate-triangular, 10 - 25 x 7 - 12 cm, bipinnatisect; petioles prominently flattened and winged along margins, 6 - 15 cm long; pinnae ca 6 cm long; leaflets alternate, up to 3.5 cm long; terminal one the largest, deeply lobed; ultimate segments oblong, apiculate, glabrous; nerves rather prominent below. Cauline leaves numerous, smaller, on 1 - 2 cm long petioles. Racemes terminal, 5 - 15 cm long, many-flowered; bracts entire, lanceolate to linear-acuminate, finely pointed, 2 - 5 mm long; flowers yellow, slender, 10 - 12 mm long, ca 2 mm wide. Sepals ovate, erose along margins, ca 1 mm long, scarious. Petals uncrested; upper petal 10 - 12 mm long, including short rounded ca 2.5 mm long spur; lip winged, but not crested; lower lip equal to upper. Ovary glabrous, tortuous; style glabrous; stigma reversely bifid. Capsules strongly undulate, linear-tortuous, 20 - 25 mm long, ca 2 mm thick; seeds ca 1 mm across, finely foveolate, black, shiny.

Fl. & Fr. May - July.

Distrib. India: Temperate forests, 3000 - 3300 m. Sikkim.

Bhutan and China (S.E. Tibet).

41. *Corydalis pakistanica* Jafri in Fl. W. Pakistan 73: 26, ff. 8 D-F. 1974.

Herbs, perennial, diffuse or ascending, (15-) 20 - 40 cm high, glabrous, green or subglaucous, branched above; rootstock slender, covered with withered sheathing leaf bases. Radical leaves reaching base of inflorescence, 10 - 20 (-25) cm long, 2 - 3-pinnatisect; pinnae (3-) 4 - 5, subopposite or in alternate pairs and a terminal one, (10-) 15 - 30 (-40) mm long, 10 - 20 (-25) mm broad with 3 - 5 lobes as pinnules; pinnules sessile or very shortly petioluled, 6 - 12 (-15) mm in diam., deeply 4 - 5-lobed; lobules oblong-ovate, acute, minutely mucronate, 3 - 10 (-15) mm long, 2 - 4 (-7) mm broad. Lower cauline leaves similar to radical leaves but somewhat smaller; upper cauline leaves small, sessile, deeply dissected with a few contiguous lobes or lobules. Racemes short, dense, terminal, subthyrsiform, usually on short branches, 3 - 6 cm long, densely

15 - 20-flowered, becoming lax later on; bracts linear-lanceolate to foliaceous, 1 - 3 cm long, lower dissected and similar to upper cauline leaves; upper ones entire, acute, slightly exceeding pedicels; flowers yellow, 1.5 - 1.7 cm long. Sepals ca 1 mm in diam., denticulate, white, membranaceous. Upper petal dorsally winged with the wing reaching lamina base and tips of spur, rounded or obtuse at apex; spur slightly down-curved, slender; lower petal similarly winged, slightly saccate at base. Capsules oblong, 8 - 10 mm long, 2.5 - 3 mm thick, acute or subobtuse, deflexed on elongated pedicels; style 2 - 3 mm long, curved above with broad stigmas; seeds 6 - 8, biseriate, ca 1.5 mm in diam., shiny black.

Fl. & Fr. June - Sept.

Distrib. India: N.W. Himalayas, 3500 - 4500 m. Jammu & Kashmir.

Pakistan.

42. *Corydalis polygalina* Hook. f. & Thomson, *Fl. Ind.* 263. 1855; Hook. f., *Fl. Brit. India* 1: 123. 1872. *C. graminea* Prain in *J. Asiat. Soc. Bengal* II, 65(2): 23. 1896.

Herbs, erect or decumbent, 12 - 25 cm high; branches diffuse, obscurely quadrangular, grooved, glabrous; rootstock rather woody with long attenuate and often branched tuberous roots. Radical leaves ternate to biternate or subpinnate, up to 18 cm long, with narrowly lanceolate segments; petioles up to 15 cm long, channelled above; leaflets dissected or linear-ovate, obtuse or acute and apiculate at apex, ca 2 x 0.4 cm, glabrous, obscurely 3-nerved from base. Cauline leaves 1 - 3 (-5)-pinnate with 2 - 3 pairs of linear-lanceolate leaflets, ca 4 cm long, upper leaves less divided; petioles ca 1.5 cm long. Racemes terminal, 5 - 15-flowered, 3 - 5 cm long; bracts ca 7 mm long, dissected; lower ones leaf-like, upper ones shorter and entire, 6 - 12 mm long; pedicels 1.5 - 2.2 cm long, deflexed in fruit; flowers yellow, 14 - 19 mm long. Sepals orbicular, ca 1 mm across, irregularly serrulate along margins. Upper petal ca 16 mm long, crests on back almost to the entire length of spur, winged along margins; spur up to 8 mm long, straight; lower petal without a spur or pouch at base, acute, woody at margins; inner petals dark brownish purple at tip. Ovary ovoid, glabrous; stigma ovate, expanded and slightly hastate at base. Capsules obovoid to linear-oblong, 5 - 8 mm long; seeds 6 - 9, shiny black.

Fl. & Fr. June - Sept.

Distrib. India: Alpine grasslands, 3600 - 4900 m. Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (S.E. Tibet).

43. *Corydalis pseudocrithmifolia* Jafri in Fl. W. Pakistan 73: 12, f. 3 D-F. 1974.

Herbs, perennial, glaucous or pilose; rootstock thick, divided at apex. Radical leaves 6 - 15 cm long, equal to stem, often unifoliolate, bipinnatisect, 3 - 5-paired, long-petiolate; pinnae ovate-orbicular, shortly petiolulate, 1 - 2 cm diam., often 3-lobulate; lobules sessile or subsessile, often further 1 - 3-lobulate; ultimate segments ovate-oblong, rounded-mucronate at apex, 2 - 5 mm long, 1 - 2 mm wide, glaucous, thin; cauline leaves absent. Racemes laxly 10 - 15-flowered, 10 - 13 cm long; pedicels 1 - 2.5 cm long, deflexed and filiform in fruits; bracts 1 - 2 cm long, entire or much dissected into linear 1.5 - 3 mm long segments; flowers greenish yellow, purple at apex, ca 2 cm long. Sepals very minute. Upper petal keeled at back, minutely mucronate at apex, irregularly dentate; spur cylindrical, curved at base, 1.2 - 1.5 cm long; lower petal keeled behind, not saccate at base. Capsules deflexed, oblong, cuneate at base, rounded at apex, 1.2 - 1.5 cm long, 2 - 2.5 mm thick, with 3 - 3.5 mm long persistent style bearing dilated stigma at apex; valves minutely pilose with distinct midnerve; seeds biseriate, ca 1.5 mm in diam.

Fl. & Fr. May - Aug.

Distrib. India: Alpine Himalayas, in dry pastures, 4000 - 5500 m. Jammu & Kashmir.

Pakistan.

44. *Corydalis pseudolongipes* Liden in Bull. Brit. Mus. (Nat. Hist.) Botany 18: 532, ff. 22D & 23D. 1989. *C. longipes* auct. non DC.; D. Long in Notes R. Bot. Gard. Edinb. 42: 87 - 106. 1984. *C. longipes* vars. *burkillii*, *phallutiana* and *smithii* Fedde, Repert. Spec. Nov. 16: 314 - 315. 1920. *C. sibirica* auct. non (L. f.) Persoon; Hook. f., Fl. Brit. India 1: 125. 1872, p. p.

Herbs, decumbent, 15 - 25 cm high; stems slender, much branched, weak, glabrous; rootstock thinly fibrous. Leaves cauline, ca 3 cm long, ternate; each segment cuneately 2 - 3 lobate; lobules narrowly obovate, obtuse, 1 - 4 mm broad. Racemes terminal, simple, 4 - 8 cm long, 3 - 10-flowered; bracts linear, deeply dissected along margins, rarely upper ones entire, ca 2.5 mm long; pedicels 5 - 10 (-15) mm long; flowers yellow, 8 - 12 mm long. Sepals broadly ovate, often deeply divided or lacerate along margins, rarely entire, minute, ca 1 mm long. Upper petal concave, hooded, acute or shortly acuminate, with broad often crenately toothed dorsal crest, decurrent along spur; nectariferous gland prominent, not fused with spur, ca 1 mm long; spur 5 - 6 mm long, curved upwards, slender, longer than short inner petals which are blackish purple-tipped; nectariferous gland 0.7 - 1.4 mm long, one-sixth to one-fifth of the length of spur; lower petal 5 - 6 mm, with rounded basal pouch and a constriction in the middle. Ovary glabrous, with incurved style; stigma slightly flattened, with stalked papillae. Capsules deflexed, obovoid, 5 - 7 x 2 - 3 mm, minutely papillose all over surface; seeds ca 10, biseriate, ca 1.2 mm across, shiny.

Fl. & Fr. June - Oct.

Distrib. India: Streamsides, sometimes as weed of cultivation, 2800 - 4000 m. Sikkim and Arunachal Pradesh.

Nepal and Bhutan.

Notes. According to Liden (l. c.), *C. longipes* DC. is endemic to Central Nepal. Eastern Himalayan plants, so far known as *C. longipes* are *C. pseudolongipes* Liden and Western Himalayan plants, so far known as *C. longipes*, are either *C. filiformis* Royle or *C. casimiriana* Prain. *C. pseudolongipes* Liden is distinguishable from these by acute outer petals, blackish purple-tipped inner petals, lower petal lacking a pouch and stigma with 4 stalked apical papillae.

45. *Corydalis shakya* Liden in Bull. Brit. Mus. (Nat. Hist.) Botany 18: 519, ff. 11 C-D, 12 C-D. 1989.

Herbs, up to 40 cm high; stems somewhat flexuous, leafy, zig-zag branched. Leaves 3 - 4 times ternate to subpinnate with divided leaflets; lower petiole often longer than lamina; upper much shorter; ultimate segments narrowly oblanceolate to oblong with acuminate apices. Racemes 5 - 14-flowered, 2 - 6 cm long with usually short peduncles; bracts deeply divided with narrow irregularly divided or dentate segments, progressively smaller upwards, glabrous; pedicels 7 - 10 mm long, about as long as bracts, arcuate, more recurved in fruit; flowers 18 - 22 mm long, yellow with brownish green keel on the upper petal and dark apices to inner petals. Sepals reniform, dentate, ca 1.5 mm long. Outer petals with broad eroded crests; spur of upper petal 10 - 11 mm long, tapering, slightly down-curved; nectariferous gland about two-fifth as long as spur. Stigma with distinct horns. Capsules obovoid, abruptly narrowed into 3.5 - 4 mm long style; seeds 2 - 6, glossy, 1.5 - 2 mm in diam.

Fl. & Fr. July - Aug.

Distrib. India: Open subalpine slopes on rock crevices, 3600 - 3900 m. Uttar Pradesh (Kumaon).

Nepal.

Notes. Closely allied to *C. thyrsoflora* Prain and *C. pakistanica* Jafri.

46. *Corydalis sikkimensis* (Prain) Fedde, Repert. Spec. Nov. 17: 201. 1921. *C. duthiei* Maxim. var. *sikkimensis* Prain in J. Asiat. Soc. Bengal II, 65(2): 33. 1896.

Herbs, erect or diffuse with numerous decumbent stems, 10 - 25 cm high, glabrous or subglabrous; rootstock slender, thicker towards apex, crowned with withered mem-

branous sheathing leaf bases and cataphylls, often branched. Radical leaves 8 - 20 x 1.5 - 4 cm, 2 - 3-pinnatisect with 4 - 5 pairs of lateral and one terminal pinnae; petioles 7 - 15 cm long; pinnae sessile or subsessile, deeply 3-lobed with each lobe again 2 - 3-lobuled; ultimate segments linear to oblong or obovate, acute, pointed or rounded at apex, 3 - 5 mm long, 1 - 1.5 mm wide. Cauline leaves 2 - 4, rarely 1, often in subopposite pairs, similar but smaller than radical leaves. Racemes simple, (5-) 10 - 15-flowered, short, dense, subcorymbose, 3 - 5 cm long, slightly lax, elongating in fruit; pedicels 5 - 12 mm long; bracts 1 - 2 cm long, 5 - 12 mm broad; lower ones broadly ovate, laciniately linear-lobed; upper ones becoming smaller, less divided and ultimately entire, lanceolate to elliptic; flowers yellow, 15 - 18 mm long, crowded, suberect to horizontal, lower ones becoming subvertical. Upper petal 15 - 19 mm long, including spur, dorsally winged up to base of lamina or tips of spur, obtuse or rounded at apex; spur straight to subfalcate, conical with crest decurrent almost to tip, 5 - 8 mm long, yellow; lower petal similarly broadly winged and crested, subsaccate at base. Ovary oblong-obovoid, ca 4 mm long, ca 1.5 mm thick, with 3 - 4 mm long style and apically curved broad bifid stigma. Capsules narrowly obovoid to oblong, ca 15 mm long, ca 5 mm thick; seeds 3 - 8, ca 1 mm across, shiny, smooth.

Fl. & Fr. July - Sept.

Distrib. India: Moist rocky places, near streamsides in Himalayas, 3800 - 4500 m. Uttar Pradesh and Sikkim.

Pakistan, Nepal, Bhutan and China (S. Tibet).

47. *Corydalis stewartii* Fedde, Repert. Spec. Nov. 19: 119. 1923.

Herbs, annual or biennial, weakly branched, sparsely leafy, 10 - 30 (-50) cm long, glabrous, subglaucous, sometimes slightly succulent; rootstock usually absent, rarely present and very stout. Leaves ternate, 10 - 15 x 3 - 5 cm, lower and basal ones long-petioled; pinnae suborbicular, ovate, cuneate, 5 - 10 (-15) mm long, 3-lobulate, with slender petioles; lobules obovate-oblong, cuneate at base, somewhat rounded and obscurely mucronate at apex, 3 - 10 mm long. Racemes many, simple, terminating the branches, laxly 5 - 10-flowered, 3 - 5 cm long; bracts foliaceous, small, upper ones gradually becoming entire, linear and much smaller; pedicels 2 - 5 mm long and deflexed in fruit; flowers pale yellow with dark tips, 6 - 10 mm long. Sepals minute. Upper petal narrow, acute to subacuminate at apex, sometimes with an obscure dorsal wing; spur slender, slightly curved and blunt at apex; lower petal not saccate at base, simple. Capsules linear, 12 - 15 mm long, 1.5 - 2 mm thick, subtorulose, narrowed and seedless at base, slightly rounded at apex; style slightly curved at apex with broad stigma, 2 - 3 mm long; seeds 6 - 8, uni- or biseriate, ca 1.5 mm in diam., minutely tubercled, black.

Fl. & Fr. May - Sept.

Distrib. India: Damp places in temperate and subalpine areas of N.W. Himalayas, 2800 - 3800 m. Jammu & Kashmir.

Pakistan.

Notes. Wendelbo (Fl. Iranica 110: 4 - 5, 1974) reduces this to a synonym of *C. cornuta* Royle but here leaves are primarily ternate and not pinnate as in *C. cornuta*.

48. *Corydalis stracheyi* Prain in J. Asiat. Soc. Bengal II, 65(2): 37, 1896. *C. nana* var. *jacquemontii* Fedde, Repert. Spec. Nov. 18: 29, 1922.

Herbs, weak, diffuse, ascending, (10-) 15 - 40 cm high, glaucous; stems leafy, branched, grooved, glabrous; rootstock very long, rather robust, split into several firm fibrous strands, crowned by withered remnants of leaf-sheaths and scales. Radical leaves few or absent. Cauline leaves oblong in outline, bipinnate, 5 - 7 cm long; leaflets lacinate, ca 1.5 cm long; lobules lanceolate to linear-lanceolate, oblanceolate or narrowly obovate, acute and shortly apiculate, 2 - 5 x 0.5 - 1 mm, glabrous with midrib prominent beneath; petioles 3 - 6 cm long, sheathing at base, winged along margins; upper leaves with shorter petioles. Racemes terminal and axillary, 2 - 10-flowered; upper bracts narrowly oblanceolate, ca 4 mm long, entire; lower bracts linear-spathulate, 7 - 10 x 5 - 7 mm, longer and often much divided; pedicels (2-) 7 - 15 (-18) mm long, recurved in fruit; flowers often solitary, ca 13 mm long, yellow, sometimes orange with purplish brown and green markings on keel and sometimes also on spur. Sepals orbicular, ca 1.5 mm across, erose along margins. Upper petal winged on back, 12 - 14 mm long; spur ca 5 mm long, rather straight; inner petals clawed at base. Ovary glabrous; stigma expanded, pointed at base. Capsules broadly ovoid or narrowly obovoid, 6 - 10 mm long, ca 3 mm thick; seeds 5 - 10, biseriate, 1 - 1.2 mm across, minutely papillose, dull or subglossy.

Fl. & Fr. June - Oct.

Distrib. India: Deeply rooted among boulders in alpine slopes, 3800 - 5000 m. Uttar Pradesh and Sikkim.

Nepal and China (S. Tibet).

49. *Corydalis stricta* DC., Syst. Nat. 2: 123, 1821; Hook. f., Fl. Brit. India 1: 126, 1872. *C. astragalina* Hook. f. & Thomson, Fl. Ind. 270, 1855.

Herbs, erect or decumbent at base, tufted, perennial, (15-) 20 - 50 (-60) cm high; stems stout, fleshy, simple or sparsely branched, striated, much exceeding radical leaves, glabrous, glaucous; rootstock thick, spindle-shaped, simple or shortly branched, dark brown, densely crowned with rigid often shiny sheathing leaf bases and scales. Leaves fleshy, thick; radical leaves many, congested, pinnate or bipinnate or 2 - 3-pinnatisect,

7 - 15 x (1.5-) 2 - 4 cm; petiole as long as lamina; pinnae shortly petioled, or sessile with 3 - 5 lateral pinnae and a terminal one, 1.5 - 3 x 1 - 1.5 cm, 3 - 4-lobed with each lobe again ternately divided; ultimate lobules ovate, triangular-ovate to linear-oblong or oblanceolate, acute or minutely acuminate and shortly mucronate at apex, (1-)3 - 6 (-8) x 1 - 3 mm. Cauline leaves alternate, subopposite, few to many, becoming smaller and subsessile upwards; petioles absent or short, with or without sheathing bases. Racemes terminal, simple, rarely branched below, densely 20 - 60-flowered, oblong, 3 - 5 cm long, 2 - 4 cm broad; bracts hyaline, membranaceous, subulate, linear or elliptic, entire or rarely minutely denticulate, acute to acuminate, 5 - 9 mm long, scarious along margins; pedicels 3 - 6 mm long; flowers yellow, 12 - 17 mm long. Sepals ovate, lanceolate, dentate, fimbriate at base, 2 - 4 x 1.5 mm. Upper petals slender, abruptly subglobose near apex, somewhat upcurved, sharply acuminate or mucronate at tip, dorsally very narrowly winged, slightly expanded and fimbriate at margins; spur subglobose or gibbous at base, 2.5 - 4 mm long; lower petal similar to the lamina of upper petal, slender, narrow below, hardly saccate at base. Capsules linear, straight, often pendulous on somewhat thickened pedicel, (15-) 20 - 30 mm long, 2.5 - 3.5 mm thick; style 3 - 5 mm long, upcurved at apex; seeds 6 - 9, uniseriate, ca 2 mm in diam., shiny black.

Fl. & Fr. May - Aug.

Distrib. India: Among dry rocks in N.W. Himalayas, 3500 - 5400 m. Jammu & Kashmir.

Nepal, China (W. Tibet), Pakistan to Central Asia.

Notes. A very polymorphic species in habit, leaf segmentation and flower size, but constant in its long linear fruits.

50. *Corydalis tibetica* Hook. f. & Thomson, *Fl. Ind.* 265. 1855; Hook. f., *Fl. Brit. India* 1: 124. 1872.

Herbs, perennial, slender, diffuse, 5 - 16 (-20) cm long, glabrous or subpilose-glandular, glaucous; stems usually leafless, rarely 1-leaved, often developing a shoot in its axil. Radical leaves (5-) 8 - 20 cm long, including petiole, bi- or sub-tripinnatisect, sometimes 4 - 5-jugate with terminal lobe often slightly larger and densely lobulate; petioles 3 - 4 cm long; pinnae ovate to suborbicular, 1 - 2.5 cm long; sessile or subsessile, shallowly to deeply dissected into pinnules or lobes; each pinnule or lobe again divided in threes; ultimate segments narrowly oblanceolate or oblong-linear, (2-) 4 - 10 mm long, 1 - 1.5 (-2) mm broad. Cauline leaves, if present, smaller and reduced. Racemes simple, hardly exceeding radical leaves, laxly 3 - 10-flowered; flowers yellow with brown or green tips, 1.5 - 2 cm long. Sepals minute, denticulate. Upper petal with dorsal wing reaching up to tip of spur and slightly denticulate, expanded and cristate or entire along margins, acute or acuminate at apex; spur slender, straight or slightly down curved, 8 - 10 mm long; lower petal winged as in upper petal, subsaccate at base. Capsules oblong-ovoid,

7 - 9 mm long, ca 2.5 mm thick; style 4 - 5 mm long, curved at apex; seeds 4 - 6, biseriate, 1.5 - 2 mm in diam., shiny black.

Fl. & Fr. June - Sept.

Distrib. India: Alpine N.W. Himalayas, 4000 - 5000 m. Jammu & Kashmir.

China (W. Tibet).

51. *Corydalis thyrsoiflora* Prain in J. Asiat. Soc. Bengal II, 65(2): 35. 1896. *C. gortschakovii* auct. non Schrenk.; Hook. f., Fl. Brit. India 1: 125. 1872.

Herbs, erect or ascending, diffuse, perennial, (10-) 15 - 40 (-60) cm high; stems usually branched above, striate, subsucculent, glabrous, subglaucous; rootstock woody, thickened. Radical leaves 2 - 3-pinnatisect, often reaching up to base of inflorescence, glaucous; petioles long, slightly sheathing at base; pinnae 5 - 10 on each side and a terminal one, alternate or subopposite, 1 - 3 (-4) cm long, 1 - 2 cm broad, shortly petioluled to sessile, 3 - 7-pinnuled; each pinnule deeply 3 - 5-lobuled, 5 - 10 (-15) mm across; ultimate segments obovate, oblong to linear, acute, acuminate, minutely mucronulate, (3-) 5 - 10 x 1 - 3 mm. Cauline leaves many, similar, gradually becoming smaller upwards, petiolate to sessile, alternate to subopposite. Racemes terminal or on short apical branches, densely 20 - 40-flowered, thyrsoform, tapering above, (3-) 5 - 12 cm long; upper bracts linear, entire, 8 - 12 (-15) mm long; lower bracts pinnatisect with ca 1 mm broad lobes; pedicels up to 10 mm long, shorter than bracts, deflexed and up to 12 mm long in fruits; flowers yellow or orange-yellow, with purple tips, 13 - 18 mm long, 3 - 5 mm broad, lower ones usually inverted. Sepals minute, orbicular, much dissected along margins, ca 1.5 mm in diam., membranaceous. Corolla 15 - 18 mm long; upper petal with broad dorsal wing near apex, obtuse; spur broad, obtuse, straight or slightly downcurved, 6 - 7 mm long; lower petal saccate at base, winged like upper petal. Capsules ellipsoid, 5 - 10 mm long, 3 - 3.5 mm broad, on recurved elongated pedicels; valves 3 - 4-veined; style 3 - 3.5 mm long, curved at apex; seeds 3 - 6, biseriate, ca 2 mm in diam., shiny, black.

Fl. & Fr. June - Sept.

Distrib. India: N.W. Himalayas, 3500 - 5000 m. Jammu & Kashmir and Uttar Pradesh (Nanda Devi sanctuary).

Pakistan.

52. *Corydalis trifoliata* Franchet in Bull. Soc. Bot. France 33: 392. 1886; D. Long in Grierson & Long, Fl. Bhutan 1(2): 392. 1984. *C. trifoliolata* auct. plur.

Herbs, 8 - 25 cm high; stems simple, grooved, glabrous; flowering stems leafless below, arising from axils of fleshy scales forming small bulbils; tubers napiform, sessile, simple, fibrous. Radical leaves small or absent. Cauline leaves solitary or rarely few, trifoliolate, up to 8 cm long; petioles 5 - 15 mm long, sheathed at base; leaflets sessile, elliptic, broadly obovate, acute, entire, 1.5 - 2 cm long, ca 1 cm wide, chartaceous, with obscure nerves. Racemes densely 2 - 5-flowered; bracts broadly ovate to elliptic or oblong, acute, entire, 1 - 2 x 0.5 - 1 cm; pedicels 5 - 8 mm long; flowers light purple or blue, rarely white, 11 - 16 mm long. Sepals ovate, laciniate, ca 1 mm long. Upper petal 10 - 15 mm long, not crested; spur narrowly cristate, 4 - 8 mm long, rather thick; lower petal boat-shaped, shortly exerted beyond upper petal. Stigma expanded, angled. Capsules linear-oblong.

Fl. June - July.

Distrib. India: Damp ground in temperate forests, 3500 - 4300 m. Sikkim.

Nepal, Bhutan, S. & S.E. China (Tibet and Yunnan).

53. *Corydalis vaginans* Royle, *Illus. Bot. Himal.* 69. 1834. *C. ramosa* Hook. f. & Thomson, *Fl. Ind.* 267. 1855. *C. ramosa* var. *vaginans* Hook. f., *Fl. Brit. India* 1: 125. 1872.

Kash.: *Mamiran, Mamiri.*

Herbs, perennial, procumbent, weak, (10-) 20 - 60 cm high; stems simple or much branched, leafy, glabrous, subglaucous; branches often long and straggling; rootstock slender, simple or branched, often short-noded. Leaves usually tripinnate or bipinnate, 7 - 12 x 3 - 4 cm; petioles sheathing at base, becoming smaller upwards; pinnae and pinnules petioled; pinnules deeply lobed into a number of ultimate lobules, ovate to suborbicular in outline, 1 - 2 cm in diam., ultimate lobules variable, lanceolate, linear-oblong to obovate-oblong, acute or rounded at apex, 2 - 12 x 1 - 4 mm. Racemes simple, many, terminal on branches, 3 - 12 cm long, 8 - 20-flowered, lax in fruit; bracts usually deeply dissected, upper ones linear, subentire or entire, lower ones trisect, leafy, 1 - 2 cm long, shortly stalked or sessile, often papillose-scabrid on nerves beneath; flowers yellow, often with brownish veins, 1 - 1.5 cm long. Sepals minutely dissected along margins, 1 - 1.5 mm long. Upper petal hooded, dorsally winged with lacerate, denticulate or subentire crest; spur straight, obtuse, 6 - 8 mm long; lower petal winged like upper one, saccate at base. Capsules obovoid or oblong-ovoid, 7 - 12 mm long, 3.5 - 5 mm thick, on 6 - 13 mm long deflexed pedicels, explosively dehiscent; valves finely striated; style curved at apex, 1.5 - 2 mm long; seeds 6 - 11, biseriate, 1.5 - 2 mm in diam., smooth, shiny black.

Fl. & Fr. May - Oct.

Distrib. India: W. & N.W. Himalayas, in open slopes, 2800 - 4500 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Pakistan and Afghanistan.

2. *Dicentra Bernhardi*, nom. cons.

Herbs, climbing or erect; stems grooved, glabrous; rootstock stout, often tuberous, perennial. Leaves alternate, repeatedly ternate, petiolate, exstipulate; leaflets entire, ovate, spatulate, sometimes orbicular, equally or unequally acute or rounded, sometimes cordate at base, petiolulate; terminal leaflets often replaced by a branched tendril; nerves 3 - 4 from or slightly above base. Flowers in lateral leaf-opposed pendulous corymbs or umbels, pedicellate, bracteate. Sepals 2, small, caducous. Petals 4; outer pair coherent and keeled, forming a compressed tube, spurred or gibbous at base, hooded and divergent at tip; inner pair rather linear, crested, unguiculate, exposed at mouth, with long slender claw and connivent hooded limb enclosing anthers and stigma. Stamens 6, in 2 bundles of 3 each; filaments adherent to outer petals, middle anthers of each bundle 2-loculed; lateral anthers 1-loculed; each bundle expanded at base into 1 - 2 nectar glands, enclosed by swollen base of outer petal. Ovary elongate, 1-loculed, few to many-ovuled; style slender, stigmas flattened with 2 apical horns. Fruits capsular, linear, cylindric, ellipsoid, ovoid, rotund, dehiscent by 2 valves, leaving placentae attached to persistent style. Seeds reniform, rather flattened, papillate, beaked on one side, often bulged on either side at beak, arillate or not.

Western to Eastern Himalayas, Meghalaya, China, Siberia, Japan and N. America; ca 20 species, 6 in India.

KEY TO THE SPECIES

- 1a. Racemes mostly 2 - 8-flowered; bracts and sepals fimbriate or toothed at base; fruits linear, more than 3.5 cm long, less than 5 mm long 2
- b. Racemes mostly 8 - 14-flowered; bracts and sepals entire at base; fruits ovoid, less than 3.5 cm long, more than 5 mm thick 3
- 2a. Stout herbs, up to 3 m high; leaflets up to 4 x 1 cm; racemes 6 - 8-flowered; fruits torulose; seeds 1-seriate, opaque 5. *D. torulosa*
- b. Slender herbs, up to 1.5 m high; leaflets about 1.5 x 0.5 cm; racemes 2 - 4-flowered; fruits not torulose; seeds 2-seriate, shiny 3. *D. roylei*
- 3a. Leaflets broadly ovate, 2.5 - 6 x 2 - 3 cm, prominently 3 - 6-nerved from base; nectar glands short, thick, up to 1.7 mm thick, not hooked at apex 2. *D. paucinervia*
- b. Leaflets ovate-elliptic or lanceolate, up to 3.5 x 2.5 cm, not prominently 5 - 7-nerved from base; nectar gland long, slender, less than 1 mm thick, hooked or not at apex 4
- 4a. Leaves ovate-elliptic; nectar glands 4 - 5 mm long, deflexed and strongly hooked at apex; fruits ovoid, ellipsoid with long persistent style 4. *D. scandens*

- b. Leaves narrowly ovate-lanceolate; nectar glands ca 3.5 mm long, deflexed but not hooked at apex; fruits narrowly ellipsoid, acute at both ends, rather elongated 5
- 5a. Leaflets greyish when dry, about 1.5 - 3 x 0.6 - 1.4 cm; petals ca 6 mm long; capsules generally rounded at base 6. *D. ventii*
- b. Leaflets greenish when dry, about 3 - 3.5 x 1 - 2 cm; petals ca 22 mm long; capsules acute at both ends 1. *D. macrocapnos*

1. *Dicentra macrocapnos* Prain in J. Asiat. Soc. Bengal 65: 12. 1896. *Dicentra scandens* auct. non (D. Don) Walp.; Hook. f. & Thomson, Fl. Ind. 273. 1855, p. p.; Hook. f. Fl. Brit. India 1: 121. 1872, p. p. *Dactylicapnos macrocapnos* (Prain) Hutch. in Bull. Misc. Inf. Kew 1921: 104. 1921.

Herbs, climbing, ca 1 m long; stems grooved, glabrous. Leaves decompose, exstipulate, ca 8 cm long; petioles ca 3 cm long; basal leaves often modified into branched tendrils; lateral leaflets slightly smaller, broadly ovate, entire, equally or unequally acute, rounded or truncate at base, obtuse, apiculate at apex, glabrous; main nerves 3 from base; lateral nerves further branched to form 4 - 5 nerves, each joining at margin; terminal petioles longest, ca 1.6 cm long; lateral petioles shorter. Flowers yellow, ca 2.2 cm long, in leaf-opposed racemes, ca 6 cm long, bracteate; pedicels ca 2 cm long; peduncles ca 8 cm long. Sepals 2, ca 2 mm long. Petals ca 22 mm long, crested at back. Stamen bundles connate at top. Stigma slightly flattened. Capsules linear-ovoid, acute at base, attenuate at apex; seeds several, bulged at base, papillate above, not papillate near hilum, black.

Fl. & Fr. Jan. - Dec.

Distrib. India: Himachal Pradesh and Uttar Pradesh (Garhwal Himalayas).

Nepal and Myanmar.

2. *Dicentra paucinervia* K. Stern in Brittonia 13: 45. 1961.

Herbs, scandent or climbing, 4 - 5 m long; stems 5-angular, grooved, glabrous; rootstock stout. Leaves trifoliate, exstipulate, ca 8 cm long; petioles ca 3 cm long, angled, slightly vaginate at base; leaflets broadly ovate, acute or acuminate, 2.5 - 6 x 2 - 3 cm; terminal leaflet ovate, rounded or acute at base; laterals slightly unequally cordate at base, entire, glabrous; nerves 3 - 6 from base, lowest pair comparatively inconspicuous; petiolules grooved above, terminal ones up to 8 mm long; terminal leaflets often tendrillar. Flowers orange, ca 2 cm long, in leaf-opposed 7 - 14-flowered ca 22 cm long racemes; pedicels up to 2.5 cm long; bracteoles ca 3 mm long. Sepals ovate-acuminate, ca 2 mm long. Petals yellow, ca 2 cm long, faintly reflexed, slightly spurred; inner with filiform ca 1.5 cm long claw, crested; filaments connate up to anthers; nectariferous glands short, 4 - 5 mm long, ca 1.7 mm wide, not hooked, often producing a waxy secretion. Style filiform, ca 8 mm long. Capsules ovoid, 12 - 20 mm long, 4 - 8 mm thick; seeds many, reniform, papillate, arillate.

Fl. & Fr. May - Nov.

Distrib. India: Warm broad-leaved forests, 900 - 1500 m. Sikkim and West Bengal (Darjeeling District).

Bhutan.

Notes. Stern (l. c.) speaks of the similarity of *D. grandifoliolata* Merrill and *D. paucinervia* to an extent, but the leaflets of the former are membranaceous, veins not prominent beneath and spur shorter.

3. *Dicentra roylei* Hook. f. & Thomson, Fl. Ind. 273. 1855; Hook. f., Fl. Brit. India 1: 121. 1872. *Dactylicapnos roylei* (Hook. f. & Thomson) Hutch. in Bull. Misc. Inf. Kew 1921: 104. 1921.

Herbs, slender, climbing, ca 1 m long; stems sulcate, glabrous. Leaves biternate, exstipulate; petioles ca 2 cm long; leaflets ovate-spathulate, rounded or acute, often unequally so at base, obtuse or acute at apex, 8 - 14 x 4 - 7 mm; lateral leaflets smaller; nerves 3 - 5 from base, rather inconspicuous; terminal leaflets modified into tendrils. Flowers yellow, often tinged purple, ca 1.5 cm long, in leaf-opposed, ca 3 cm long 2 - 3-flowered corymbs; pedicels ca 1.2 cm long; bracts linear, 8 - 12 mm long, ca 2 mm wide. Sepals similar to bracts, but smaller, linear to linear-lanceolate, 7 - 9 mm long, ca 2 mm wide. Petals 15 - 18 cm long; outer petals broadly shortly spurred, 14 - 18 mm long, 2 - 4 mm broad at insertion, auricled at base, acuminate at apex; inner petals broadly spathulate-orbicular, narrowly clawed at base, bifid at apex. Nectariferous glands slender, curved, 2 - 3 mm long. Ovary with stigma half-moon shaped. Capsules linear-cylindric, tapering upwards with persistent quadrangular stigmas, 3.5 - 5 cm; seeds ca 10 - 12, biseriate, orbicular, compressed, striate, shiny, arillate at back.

Fl. & Fr. June - Sept.

Distrib. India: 1200 - 1600 m. Himachal Pradesh, Sikkim and Meghalaya.

Bhutan.

4. *Dicentra scandens* (D. Don) Walp., Repert. 1: 118. 1842; Hook. f., Fl. Brit. India 1: 121. 1872, p. p. *Dielytra scandens* D. Don, Prodr. Fl. Nep. 198. 1825. *Dactylicapnos thalictrifolia* Wallich, Tent. Fl. Nep. 51, t. 89. 1826. *Dicentra thalictrifolia* (Wallich) Hook. f. & Thomson, Fl. Ind. 272. 1855; Hook. f., l. c. Fig. 15.

Herbs, climbing, ca 3 m long; stems grooved. Leaves 2 - 3 times ternately compound, exstipulate, ca 5 cm long; petioles ca 3 cm long; leaflets ovate-elliptic or ovate-spathulate, obtuse, apiculate, abruptly acute or cuneate at base, sometimes unequally so, 1 - 3.5 x 0.5 - 2 cm; veins 5 - 7 from base; terminal petiolules ca 1 cm long. Flowers yellow or



Fig. 15. *Dicentra scandens* (D. Don) Walp.

rarely purple, ca 2 cm long, in leaf-opposed 7 - 10-flowered 2 - 7 cm long racemes; bracts lanceolate, 4 - 10 mm long, entire; pedicels filiform, up to 2.5 cm long. Sepals triangular, ovate, acuminate, entire, 2 - 3 mm long, glabrous, caducous. Petals yellow, acute, spurred; outer pair 1.8 - 2 cm long; inner pair unguiculate with crested lower lobe; nectariferous glands 4 - 5 x 0.8 - 1 mm, strongly hooked at apex. Ovary oblong, with slender style and quadrangular flattened stigma. Capsules ovoid-ellipsoid with persistent style and stigma, 14 - 20 x 6 - 8 mm, more or less fleshy; seeds numerous, in 4 rows, reniform, papillate, black, often with a small white aril.

Fl. & Fr. June - Dec.

Distrib. India: Climbing on shrubs in forests, 2000 - 2750 m. West Bengal, Sikkim and Meghalaya.

Bhutan.

5. *Dicentra torulosa* Hook. f. & Thomson, Fl. Ind. 272. 1855; Hook. f., Fl. Brit. India 1: 121. 1872. *Dactylicapnos torulosa* (Hook. f. & Thomson) Hutch. in Bull. Misc. Inf. Kew 1921: 104. 1921.

Herbs, slender, trailing or climbing, glabrous; stems sulcate, 2 - 3 m long, whitish or yellowish. Leaves biternately decompose, 4 - 10 cm long, exstipulate; petioles 4 - 12 cm long, ending in a branched tendril; leaflets ovate, obovate or elliptic to linear-lanceolate, cuneate at base, acute at apex, 10 - 20 x 6 - 10 mm, membranous; terminal leaflets ovate, ovate-spathulate, elliptic-ovate, acute at base, apiculate at apex, 1.5 x 0.8 cm, sometimes up to 2.5 x 1.2 cm; nerves palmately 3 - 5, rather indistinct; terminal petiolules longer than lateral ones. Flowers golden yellow, cylindrical, ca 6 - 8 mm long, in leaf-opposed ca 4 cm long corymbose racemes or subumbels; peduncles 1 - 2 cm long; pedicels slender, ca 8 mm long; bracts linear, fimbriate, 6 - 8 mm long. Sepals linear-subulate, scale-like, ca 2 mm long, lacerate along margins. Petals connivent, ca 8 mm long; outer two oblong, concave, saccate at base, acute at apex; inner two keeled, briefly clawed at base, cohering at apex. Stamens diadelphous from base; filaments with short basal spurs. Ovary linear, style slender; stigma quadrately bilobed. Capsules pod-like, linear, curved, torulose with persistent narrowed style, 2 - 5 cm long, 2 - 4 mm thick, dehiscing by 2 membranous longitudinal valves; seeds many, uniseriate, strophiolate at base, striated, beaked with 2-lobed aril, 1 - 1.5 mm broad, granulate, opaque, brownish.

Fl. June - Aug.; *Fr.* Sept. - Nov.

Distrib. India: Meghalaya.

Endemic.

6. *Dicentra ventii* Khanh in Fedde, Repert. Spec. Nov. 83: 540. 1972 (1973). *D. scandens* (D. Don) Walp., Repert. 1: 118. 1842, p. p.

Herbs, climbing, ca 45 cm long; stems slender, grooved, glabrous. Leaves alternate, biternate, exstipulate, ca 8 cm long; leaflets ovate, elliptic, narrowly lanceolate, spatulate, unequally acute or obtuse at base, 2.2 - 4 x 1 - 1.5 cm, drying grey, 3-nerved from base; ultimate leaflets tendrillar; petiolules slender, 1.5 - 2 cm long. Flowers yellow, ca 2 cm long, in 6 - 8-flowered leaf-opposed ca 8 cm long racemes, bracteate; peduncles ca 5 cm long; pedicels ca 3 cm long, slender, increasing in length in fruits. Sepals minute, ca 2 mm long. Petals unequal, ca 6 mm long; inner unguiculate, obcordate, panduriform, appendiculate at apex, dorsally cristate; spur ca 3 mm long, incurved; nectar glands 3 - 5 x 0.8 - 1 mm, deflexed but not hooked at apex. Ovary with slender style and quadrangular flattened stigma. Capsules linear-oblong or narrowly ellipsoid, attenuate at apex, abruptly rounded at base, 17 - 20 x 4 - 5 mm; style and stigma persistent; seeds numerous, papillate.

Fl. & Fr. July - Oct.

Distrib. India: Among scrubs, 1500 - 2700 m. West Bengal (Darjeeling) and Sikkim.

Endemic.

Notes. This species is quite distinct from *D. scandens*, especially in the shape of leaflets and capsules and in the greyish colour when dry.

3. *Fumaria* L.

Herbs, usually annuals, rarely perennials, erect, or diffuse, scrambling or sometimes scandent, usually with long stems, glabrous or subglabrous. Leaves cauline, irregularly 2 - 4-pinnatisect; segments usually narrow. Flowers small, white or pink, short pedicellate, in terminal or leaf-opposed bracteate racemes; bracts linear, short, rarely as long as pedicels. Sepals 2, lateral, small or obsolete. Corolla zygomorphic; petals erect or connivent, outer pair dissimilar, upper one gibbous or spurred at base and hooded at apex, lower one shorter, not spurred, flat or concave; inner pair clawed, keeled, free or coherent at tip. Stamens 6, in 2 bundles, upper bundle produced into a basal nectariferous gland enclosed in spur of petal; anthers dimorphic. Ovary subglobose, 1-loculed; ovules 1 (-2); style filiform, articulate at base; stigma entire or shortly 2-lobed. Fruit a 1-seeded nutlet, indehiscent, subglobose, rugulose or smooth when dry with 2 apical pits due to clefts in the mesocarp; seeds not arillate, brownish.

Europe, extratropical Africa, Central Asia, Himalayas, plains of N. India, up to Myanmar; ca 50 species, 4 species in India.

Notes. The species of this genus show high amount of variability. There is much discord among various authors on the delimitation of species. The variability largely depends on light and shade conditions. The genus needs a careful revision on its whole range coupled with field observations. Cleistogamous flowers are known in plants growing under shade. Often they grow as weeds in cultivated fields.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1a. Peduncles 2 - 6 cm long; sepals more than 1.5 mm long; corolla more than 7 mm long | 2 |
| b. Peduncles 0.5 - 1.5 cm long; sepals 1 mm or less long; corolla less than 7 mm long | 3 |
| 2a. Pedicels erect in fruit; sepals 1.5 - 3.5 mm long; corolla 7 - 9 mm long, dark purple; wings of upper petal not prominently upturned; nutlets rugose when dry | 3. <i>F. officinalis</i> |
| b. Pedicels recurved-arcuate in fruit; sepals 4 - 6 mm long; corolla 10 - 14 mm long, creamy-white or light pink; wings of upper petal prominently upturned; nutlets smooth when dry | 1. <i>F. capreolata</i> |
| 3a. Bracts equal or slightly longer than fruiting pedicels; corolla pale pink or white, 6 - 7 mm long; leaf segments obscurely channelled or not; nutlets obtuse at apex | 2. <i>F. indica</i> |
| b. Bracts shorter than fruiting pedicels; petals pinkish violet or purple, 5 - 6 mm long; leaf segments flat; nutlets minutely apiculate at apex | 4. <i>F. vaillantii</i> |

1. *Fumaria capreolata* L., Sp. Pl. 701. 1753; D. Long in Grierson & Long, Fl. Bhutan 1(2): 384. 1984.

Extensive scramblers, up to 1 m long. Leaves much dissected; lobes elliptic to oblong, 2 - 4 mm broad. Racemes up to 20-flowered; peduncles 2 - 5 cm long, shorter than racemes; pedicels often rigidly arcuate-recurved in fruits; bracts equal to or shorter than fruiting pedicels. Sepals more or less dentate, obtuse, 4 - 6 x 2 - 3 mm. Petals 10 - 14 mm long, creamy white or pinkish, rarely deeply red, often with blackish red tips on wings of upper petal and on apex of inner petal; upper petal narrow, laterally compressed, with upturned wings; lower petal with very narrow erect margin. Nutlets subglobose, obtuse, obscurely keeled, ca 2 x 2 mm, smooth when dry.

Fl. Sept.

Distrib. India: Introduced from Europe and run wild, as a weed in cultivation, 4000 to 4500 m. Sikkim.

Europe.

Notes. Inclusion of this species is based on the report by D. Long (l. c.) from Sikkim.

Chromosome number reported from Europe is $2n = 56$.

2. *Fumaria indica* (Haussk.) Pugsley in J. Linn. Soc., Bot. 44: 313. 1919. *F. vaillantii* Loisel. var. *indica* Haussk. in Flora 56: 443. 1873. *F. parviflora* Lam. subsp. *vaillantii* (Loisel) Hook. f. & Thomson in Fl. Brit. India 1: 128. 1872, p. p.

Beng.: *Ban-saaphla*; Hindi: *Pit-papra*; Mar.: *Pitpada*.

Herbs, erect or decumbent, diffuse, 15 - 60 cm long; stems glabrous or faintly puberulous, much-branched, grooved. Leaves multifid, decomposed, ca 6 cm long, glaucous; pinnæ ca 3 x 2.4 cm, laciniate; ultimate lobules flat, narrowly linear-lanceolate, entire, acute-mucronate, ca 5 x 1 mm. Flowers whitish or pinkish-red, ca 8 - 15 mm long, in ca 2 cm long 15 - 20-flowered racemes; bracts lanceolate, acuminate, equal, generally longer than fruiting pedicels, membranous; pedicels ca 3 mm long. Sepals lanceolate, minute, ca 1 mm long, caducous. Petals ca 7 mm long, crested at back with ascending spur; upper petal emarginate. Filaments of each bundle connate up to top. Ovary glabrous; style slender; stigma rather small. Nutlets globose, slightly pointed or not, ca 3 mm across, pale brown, polished, verrucose or rugose and with 2 pits at top when dry.

Fl. & Fr. Dec. - Mar.

Distrib. India: Weed in cultivated fields, up to 2000 m. Jammu & Kashmir, Himachal Pradesh, Haryana, Punjab, Uttar Pradesh, Rajasthan, Bihar, West Bengal, Orissa, Maharashtra, Karnataka and Tamil Nadu (above 1500 m only).

Bhutan, Nepal, Pakistan and Afghanistan, extending to West Asia.

Notes. Used as fodder.

The differences between *F. parviflora* Lam., *F. vaillantii* Loisel. and *F. indica* (Haussk.) Pugsley are rather obscure and not clear-cut. There is difference of opinion among authors of various floras. Probably they are varieties of a complex widespread species. This needs detailed investigation.

3. *Fumaria officinale* L., Sp. Pl. 700. 1753; Sharma *et al.* in Biol. Mem. 2(1 & 2): 13. 1977.

Herbs, erect or decumbent; ca 45 cm long; stems glabrous, very faintly grooved; roots rather thick. Leaves laciniately dissected, ca 5 cm long; each segment slightly obovate, apiculate; nerves rather inconspicuous. Flowers purplish pink, ca 5 mm long, in terminal or lateral ca 11 cm long racemes; peduncles shorter than racemes; bracts linear-ovate, ca 1.5 mm long, scarious; pedicels as long as bracts in flower or longer, up to 3 mm long and erect in fruits. Sepals ovate, faintly serrulate, ca 2 mm long, scarious. Petals linear-ovate, 7 - 8 mm long, dark purple; upper petal rather thickened at top with lateral scarious blackish red wings, spurred at base; lower petal spatulate, with patent margins. Stamen bundles as long as petals; filaments dilated at base. Ovary glabrous;

style slightly falcate; stigma small. Nutlets globose to obreniform in profile, obscurely keeled or slightly emarginate at apex, 2 - 3 mm across, faintly rugulose when dry; seed single, purplish brown, striate.

Fl. & Fr. June - Oct.

Distrib. India: Tamil Nadu (Yercaud and Niligiri hills), above 1200 m. Introduced and run wild.

Europe, Africa and USA.

4. *Fumaria vaillantii* Loisel. in Desv. *J. Bot.* 2: 358. 1809. *F. parviflora* Lam. subsp. *vaillantii* (Loisel.) Hook. f., *Fl. Brit. India* 1: 128. 1872, p. p.

Herbs, small, delicate, much-branched, diffuse, 10 - 20 (-30) cm high. Leaves subsessile or petiolate, much dissected, 2 - 3-pinnatisect, 3 - 9 x 1.5 - 5 cm; segments flat, up to 2 cm broad, often finely lobed. Racemes short, generally 6- to 12-flowered; peduncles shorter than racemes; pedicels erect, up to 3 mm in fruit; bracts about half to three-fourth as long as the fruiting pedicels. Sepals lanceolate to obovate, laciniate-dentate, minute, 0.8 - 1 x 0.4 - 0.5 mm. Petals 5 - 6 mm, pinkish violet or pale pink, often tinted with black red at apex of inner petals and wings of upper petal; lower petal with patent margins, spatulate. Nutlets subglobose, obscurely keeled at one side, obtuse and apiculate at apex, ca 2 x 2 mm, granular-rugose when dry.

Fl. & Fr. April - June.

Distrib. India: Weed in cultivated fields. Jammu & Kashmir and Sikkim.

Nepal, Pakistan to Europe and N. Africa.

Notes. Chromosome number reported from Europe is $2n = 32$.

4. *Hypocoum* L.

Herbs, annual, erect, ascending or prostrate, glabrous, often glaucous, with watery sap, with several stems and scapes. Leaves short-petiolate, exstipulate, 2 - 4 pinnatisect into linear to narrowly obovate lobules. Inflorescences dichasial cymes, spreading; floral leaves much reduced and thinly dissected. Sepals 2, free, ovate-triangular or oblong, much smaller than petals, deciduous. Petals 4, in 2 whorls; outer pair not gibbous or spurred, obovate, entire; inner pair 3-lobed. Stamens 4, free, opposite to petals; filaments winged or dilated, scarious, sometimes with a stipitate gland at the base; anthers linear, bilocular. Ovary superior, bicarpellary, syncarpous, unilocular, linear; ovules numerous on two parietal placentae; style short, stigmas bipartite, glandular at tip, often curved. Capsules linear, siliquiform, many-seeded, transversely septate, lomentoid,

fragmenting into 1-seeded segments, rarely dehiscent by 2 valves; seeds small, grey, compound, without aril, rough or smooth.

Temperate and alpine Himalayas, eastwards to N. China and Japan and westwards to West Asia, N. Africa and Central Europe; ca 15 species, 2 in India.

Notes. In India the genus occurs in cultivated land, fallow fields, weed infested places, rocky foothills and intermountain terrains, up to 5000 m.

Literature. DEBNATH, H. S. & M. P. NAYAR (1984) Papaveraceae and Hypecoaceae. In Fasc. Fl. India 17: 42 - 46, f. 1. DEBNATH, H. S. & M. P. NAYAR (1985) A reappraisal of *Hypecoum pendulum* and *H. parviflorum* (Hypecoaceae). Bull. Bot. Surv. India 27: 109 - 112, ff. 1 - 4.

KEY TO THE SPECIES

- 1a. Flowers white or slightly pinkish violet; middle lobe of inner petals not fringed; siliquas erect, with erect or horizontal pedicels **1. *H. leptocarpum***
- b. Flowers yellow; middle lobe of inner petals with fringed margins; siliquas pendulous on incurved pedicels **2. *H. pendulum***

1. *Hypecoum leptocarpum* Hook. f. & Thomson, Fl. Ind. 1: 276. 1855; Hook. f., Fl. Brit. India 1: 120. 1872.

Ladakh: *Parpapata*.

Herbs, 15 - 35 cm high. Leaves rosulate, 2 - 3 pinnatisect; upper leaves sessile or subsessile; basal leaves 7 - 17 x 1 - 2 cm; pinnae 4 - 8 pairs, sessile, distant, deeply divided into elliptic acute lobes; petiole base winged. Flowering stems slender, 15 - 35 cm long, branched; pedicels slender, ascending; bracteoles filiform; flowers purple, pinkish or white with purple streaks, often yellow inside, 0.8 - 1.5 cm across. Sepals entire, 2.5 - 3 x 1.5 - 2 mm. Outer 2 petals entire, not lobed, obtuse, keeled at apex, 9 - 10 x 5 - 6 mm; inner 2 deeply 3-lobed, 5 - 6 x 4 - 4.5 mm; middle lobes spatulate, hooded; outer lobes obtuse. Stamens 5 - 6 mm long; filaments ca 3.5 mm long, ca 1 mm thick; anthers ca 1.5 mm long, basifixed, linear-oblong, each locule with a minute apical projection and with 2 glands at base of filament. Ovary ca 8 mm long; style very short; stigmas 2, slender, recurved, ca 1.5 mm long. Capsules narrowly linear, fragmenting into 8 - 18 segments, 2.5 - 3.5 cm long, 2 - 3 mm thick; seeds brown, oblong.

Fl. & Fr. June - Oct.

Distrib. India: Temperate and alpine Himalayas, hillsides and riverbanks, 2700 - 5000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, Bhutan, China, Mongolia, Japan and Afghanistan to Russia.

Notes. The latex contains the alkaloid protopine which has narcotic action. The species varies much in size and form, those growing at low elevations are usually taller than those at higher elevations.

2. *Hypocoum pendulum* L., Sp. Pl. 124. 1753. *H. procumbens* auct. non L.; Hook. f. & Thomson, Fl. Ind. 276. 1855; Hook. f., Fl. Brit. India 1: 120. 1872.

Herbs, 5 - 25 cm high, slender, procumbent; stems many, slender. Leaves 2 - 3-pinnatisect with linear segments; cauline leaves palmatisect, subopposite, 5 - 10 cm long. Flowers yellow, 8 - 12 mm across, few, pedicellate. Sepals entire or shallowly incised along margin. Outer petals entire or obscurely 3-lobed, 7 - 10 x 4 - 6 mm, the two lateral lobes a little broader than median lobe and projecting laterally like teeth; inner 2 deeply 3-lobed, dentate or fimbriate, obtuse, 4 - 7 mm long; middle lobe shorter or longer than lateral lobes, emarginate and recurved, spatulate. Stamens 5 - 6 mm long; filaments ca 4.5 mm long; glands 2 at the base of filaments; anthers ca 2 mm long, basifixed, linear with 2 projections at apex on locules. Ovary ca 5 mm long; style slender, ca 3.5 mm long; stigmas 2, divergent, ca 1.5 mm long. Capsules pendulous, terete, subcylindrical, 3 - 7.5 x 1.5 - 3 mm, indehiscent or pseudodehiscent and breaking into 1-seeded segments. Seeds obliquely semicircular, ca 2 x 1.5 mm, grey.

KEY TO THE VARIETIES

- | | |
|---|------------------------------|
| 1a. Capsules disarticulating; epidermis not peeling off | 2.1. var. <i>parviflorum</i> |
| b. Capsules not disarticulating; epidermis peeling off | 2.2. var. <i>pendulum</i> |

2.1. var. *parviflorum* (Karelin & Kir.) Cullen in Rech. f., Fl. Iran. 34: 25, t. 7, f. 1. & 2. 1966. *H. parviflorum* Karelin & Kir. in Bull. Soc. Nat. Mosc. 15: 141. 1842.

Fl. & Fr. Mar. - July.

Distrib. India: N.W. Himalayas. Jammu & Kashmir.

Pakistan, Afghanistan, Iran, Turkey and Russia.

2.2. var. *pendulum*

Fl. & Fr. Jan. - July.

Distrib. India: Jammu & Kashmir and Rajasthan (Ganganagar). Rare.

Pakistan, West Asia to Europe.

BRASSICACEAE

(Cruciferae, nom. alt.)

Herbs or rarely shrubs with pungent watery juice, terrestrial or aquatic, glabrous or with simple or variously branched unicellular trichomes or rarely with multicellular, glandular trichomes. Leaves alternate or sometimes confined to a basal rosette, exstipulate, simple or very rarely pinnate or palmate, rarely reduced to scales. Inflorescence terminal or axillary, racemose, corymbose or paniculate, rarely flowers solitary, usually ebracteate. Flowers bisexual, hypogynous, mostly actinomorphic, rarely zygomorphic. Sepals 4, usually free, in decussate pairs, erect or spreading, usually caducous, the laterals often saccate at base. Petals 4, decussate, cruciform, alternating with the sepals, usually clawed, entire or rarely lobed, rarely absent. Stamens 6, sometimes 2, 4 or rarely more than 6, tetradynamous in 2 rows or 2-dynamous, rarely all of equal length; filaments filiform, sometimes winged or appendaged at base, free or the median pair connate; anthers mostly sagittate, 2 (-1)-loculed, longitudinally dehiscent. Nectar glands receptacular, subtending or surrounding the bases of some or all filaments. Ovary superior, bicarpellate, syncarpous, 2-locular by a false septum connecting the 2-parietal placentae; style distinct, persistent or obsolete; stigma entire or 2-lobed, capitate or discoid; ovules 1-many, anatropous or campylotropous. Fruit a dry bivalvately dehiscent siliqua, schizocarp or indehiscent and becoming lomentaceous or achene-like or samaroid, usually beakless or rarely with seedless or 1 - few-seeded beak; replum persistent; septum complete or incomplete, usually membranaceous. Seeds uniseriate or biseriata, usually wingless, often mucilaginous when wet; endosperm absent; embryo large, usually strongly curved or folded; germination epigeal.

Throughout the world, primarily in temperate regions; ca 340 genera and 3350 species, 64 genera and 207 species in India.

Literature. AL-SHEHBAZ, ISHAN A. (1984) The tribes of Cruciferae (Brassicaceae) in South-eastern United States. *J. Arn. Arb.* 65: 343 - 374. JAFRI, S. M. H. (1973) Brassicaceae. In: Nasir & Ali, Fl. W. Pakistan 55: 1 - 308. JONSELL, B. (1988) Cruciferae. In: Fl. Males. I, 10: 541 - 560, ff. 1 - 5. SARKAR, A. K. & J. N. MITRA (1969) The order Rhoeadales in Eastern India, I. Cruciferae. *Bull. Bot. Soc. Bengal* 23: 93 - 107. SCHULZ, O. E. (1919) Cruciferae-Brassicaceae. Pars prima. In: Engler, A. Pflanzenreich 70 (IV-105): 1 - 290. SCHULZ, O. E. (1923) Cruciferae-Brassicaceae. Pars secunda. In: Engler, A., l. c. 84: 1 - 100. SCHULZ, O. E. (1927) Beiträge zur Kenntnis der Cruciferen des nordwestlichen Himalayan Gebirges. *Notizbl.* 9: 1057 - 1095. SCHULZ, O. E. (1936) Brassicaceae in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 17b: 227 - 658.

KEY TO THE TRIBES

- 1a. Fruits beaked, beak one or few-seeded; sometimes transversely jointed; cotyledons conduplicate 3. Brassiceae
- b. Fruits not beaked or rarely with a seedless stylar beak; never jointed; cotyledons accumbent or incumbent 2
- 2a. Fruits compressed at right angles to the septum; replum much narrower than the width of fruit 7. Lepidieae
- b. Fruits terete, angular, inflated or compressed parallel to septum; replum equalling the width of fruit 3
- 3a. Fruits indehiscent, nut-like; valves generally thick or spongy 5. Euclidieae
- b. Fruits dehiscent or transversely breaking into seed-bearing segments; valves generally thin and not spongy 4
- 4a. Fruits usually less than 3 times longer than broad (except a few *Draba* and *Farsetia* spp.) 5
- b. Fruits usually more than 8 times longer than broad (sometimes short in *Rorippa*) 6
- 5a. Septal cells with parallel walls 4. Drabeae
- b. Septal cells with polygonal walls 1. Alysseae
- 6a. Calyx closed at anthesis, sepals erect; multicellular glandular trichomes commonly present; fruits tardily dehiscent or sometimes breaking transversely 7
- b. Calyx open at anthesis, sepals spreading or ascending; multicellular glands always absent; fruits readily dehiscent 8
- 7a. Cotyledons usually accumbent 8. Matthioleae
- b. Cotyledons usually incumbent 6. Hesperideae
- 8a. Cotyledons mostly accumbent 2. Arabideae
- b. Cotyledons mostly incumbent 9. Sisymbrieae

KEY TO THE GENERA IN TRIBES

Tribe 1. ALYSSEAE

- 1a. Wings absent on seeds 4. Ptilotrichum
- b. Wings present on seeds 2
- 2a. Seeds broadly winged 2. Farsetia
- b. Seeds narrowly winged 3
- 3a. Hairs uniformly bipartite, medifixed, sessile, appressed 3. Lobularia
- b. Hairs stellate or branched, stalked or sessile, subappressed or appressed when stellate 1. Alyssum

Tribe 2. ARABIDEAE

- 1a. Flowers usually yellow (sometimes turning white when old) 2
- b. Flowers usually purple or white 4
- 2a. Petals twice as long as sepals 6. Barbaraea
- b. Petals almost equalling sepals 3
- 3a. Leaves usually simple; flowers in leafless scapes 10. Drabopsis

- | | |
|---|-------------------------|
| b. Leaves usually pinnate or pinnatifid; flowers in leafy scapes | 15. <i>Rorippa</i> |
| 4a. Scapes 1-flowered | 13. <i>Pegaeophyton</i> |
| b. Racemes few to many-flowered | 5 |
| 5a. Filaments often dentate-appendaged | 9. <i>Dontostemon</i> |
| b. Filaments not dentate-appendaged | 6 |
| 6a. Herbs glabrous or very sparsely hairy; hairs simple | 7 |
| b. Herbs usually densely hairy; hairs forked or stellate | 10 |
| 7a. Cauline leaves sagittate-amplexicaul | 16. <i>Turritis</i> |
| b. Cauline leaves not sagittate-amplexicaul | 8 |
| 8a. Plants aquatic, rooting below nodes | 12. <i>Nasturtium</i> |
| b. Plants terrestrial, not rooting at nodes | 9 |
| 9a. Racemes few-flowered; filaments broadened and toothed above | 11. <i>Loxostemon</i> |
| b. Racemes many-flowered; filaments not toothed above | 7. <i>Cardamine</i> |
| 10a. Basal leaves short, spatulate to obovate, usually toothed above | 8. <i>Christolea</i> |
| b. Basal leaves elongated, oblanceolate or oblong-obovate, entire, dentate or sinuate-dentate | 11 |
| 11a. Fruits densely covered with hairs | 14. <i>Phaconyrium</i> |
| b. Fruits usually glabrous | 5. <i>Arabis</i> |

Tribe 3. BRASSICEAE

- | | |
|---|----------------------|
| 1a. Fruits ovate or suborbicular, less than 2 times as long as wide, up to 3 cm across | 2 |
| b. Fruits elongated, linear, cylindrical or oblong-ovoid, more than 2 times as long as wide, usually 3 - 10 cm long | 3 |
| 2a. Leaves shortly petioled, not amplexicaul at base; flowers white or golden yellow; fruits narrowed at base forming a stalk with gynophore; seed 1, pendulous | 19. <i>Crambe</i> |
| b. Leaves sessile and amplexicaul at base; flowers violet or rose-purple; fruits cordate at base; seeds many, biseriata | 23. <i>Schouwia</i> |
| 3a. Seeds in 2 rows in each loculus | 4 |
| b. Seeds in 1 row in each loculus | 5 |
| 4a. Sepals erect (calyx closed); pedicels elongated and pendulous in fruit; upper part of fruit with a short beak | 20. <i>Diploaxis</i> |
| b. Sepals erecto-patent (calyx spreading); pedicels short and erect in fruit; upper part of fruit with long ensiform beak | 21. <i>Eruca</i> |
| 5a. Leaves simple; sepals erect (calyx closed); fruits compressed or acutely tetragonal with obscure beak | 18. <i>Coringia</i> |
| b. Leaves pinnatisect; sepals erecto-patent (calyx spreading); fruits subcylindrical with distinct beak | 6 |
| 6a. Fruit a lomentum, transversely articulate with 2 or more 1-seeded segments; upper part with 2 - 3 cm long beak | 22. <i>Raphanus</i> |
| b. Fruit a siliqua-capsule, dehiscent along two longitudinal sutures having a persistent partition (replum) inside; upper part with 1 - 2 cm long beak | 7 |
| 7a. Lateral nectaries of flowers prismatic, intense green; valves of fruits one-nerved | 17. <i>Brassica</i> |
| b. Lateral nectaries of flowers not prismatic; valves of fruits 3 - 7-nerved | 24. <i>Sinapis</i> |

Tribe 4. DRABEAE

- | | |
|--|---------------------|
| 1a. Petals usually entire or subemarginate | 25. <i>Draba</i> |
| b. Petals deeply bifid to almost half their length | 26. <i>Erophila</i> |

Tribe 5. EUCLIDIEAE

- | | |
|---|-----------------------|
| 1a. Pods 1-loculed | 2 |
| b. Pods 2 - 3-loculed | 3 |
| 2a. Stems glabrous; pods winged | 30. <i>Tauscheria</i> |
| b. Stems pubescent; pods not winged | 29. <i>Neslia</i> |
| 3a. Fruits obliquely ovate-globose, 2-loculed | 27. <i>Euclidium</i> |
| b. Fruits obpyramidate-sublyrate, 3-loculed | 28. <i>Myagrum</i> |

Tribe 6. HESPERIDEAE

- | | |
|--|-------------------------|
| 1a. Racemes usually 1 - 5-flowered | 2 |
| b. Racemes 10 - 50-flowered | 3 |
| 2a. Aerial stem usually 3 - 8 cm high; racemes 2 - 6-flowered | 31. <i>Atelanthera</i> |
| b. Aerial stem absent; scapes 1-flowered | 36. <i>Pycnoplithus</i> |
| 3a. Flowers white, pale-pink or purple | 4 |
| b. Flowers yellow or orange | 5 |
| 4a. Sepals 4 - 5 mm long; mature pods up to 8 cm long | 35. <i>Malcolmia</i> |
| b. Sepals ca 2 mm long; mature pods up to 1 cm long | 34. <i>Goldbachia</i> |
| 5a. Flowers large; sepals 10 - 15 mm long; middle nectar glands absent | 32. <i>Cheiranthus</i> |
| b. Flowers small; sepals usually 4 - 8 mm long; middle nectar glands present | 33. <i>Erysimum</i> |

Tribe 7. LEPIDIEAE

- | | |
|--|------------------------|
| 1a. Racemes condensed, subumbellate or corymbose in fruit | 2 |
| b. Racemes elongated in fruit | 3 |
| 2a. Plants glabrous; valves of pod gibbous, double-crested at the back | 41. <i>Dilophila</i> |
| b. Plants pubescent; valves of pod neither gibbous nor double-crested | 42. <i>Hedinia</i> |
| 3a. Fruits indehiscent or breaking into 1-seeded halves | 4 |
| b. Fruits dehiscent, liberating the seeds free | 7 |
| 4a. Fruits unilocular, pendent | 45. <i>Isatis</i> |
| b. Fruits bilocular, erect or spreading | 5 |
| 5a. Valves of the pod reticulately pitted or tubercled | 40. <i>Coronopus</i> |
| b. Valves of the pod neither pitted nor tubercled | 6 |
| 6a. Stamens 6 | 38. <i>Cardaria</i> |
| b. Stamens more than 6, up to 16 | 47. <i>Megacarpaea</i> |
| 7a. Seeds 1 in each locule | 8 |
| b. Seeds 2-many in each locule | 9 |

- 8a. Petals when present, usually equal in size; style short or inconspicuous or absent; cotyledons incumbent 46. *Lepidium*
- b. Petals unequal in size, outer larger than inner; style prominent; cotyledons accumbent 44. *Iberis*
- 9a. Valves of fruits winged or shortly keeled 48. *Thlaspi*
- b. Valves of fruits neither winged, nor keeled 10
- 10a. Fruits triangular-obcordate 37. *Capsella*
- b. Fruits ellipsoid to globose 11
- 11a. Valves of fruits convex, not strongly compressed 39. *Cochlearia*
- b. Valves of fruits flat, strongly compressed 43. *Hymenolobus*

Tribe 8. MATTHIOLEAE

- 1a. Pods with 2 apical appendages 51. *Notoceras*
- b. Pods without appendages 2
- 2a. Scapes usually leafless 52. *Parrya*
- b. Scapes usually with leaves 3
- 3a. Pods usually transversely breaking into several 2-seeded parts; seeds not winged 49. *Chorispora*
- b. Pods usually not breaking into 2-seeded parts; seeds often narrowly winged 50. *Matthiola*

Tribe 9. SISYMBRIEAE

- 1a. Leaves usually bipinnatisect 2
- b. Leaves simple or lyrate-pinnatifid 3
- 2a. Fruits 6 - 8 mm long 63. *Smelowskia*
- b. Fruits 15 - 30 mm long 59. *Descurainia*
- 3a. Seeds not mucilaginous when wet 4
- b. Seeds mucilaginous when wet 11
- 4a. Seeds large, longitudinally striated; basal leaves more or less cordate 53. *Alliaria*
- b. Seeds small, granulated or reticulate; basal leaves not cordate 5
- 5a. Lateral nectar glands annular; middle glands joining laterals 6
- b. Lateral nectar glands in pairs; middle glands absent 10
- 6a. Fruits elongated, linear 7
- b. Fruits small, oblong, terete or elliptic-oblong 8
- 7a. Flowers white or pink; valves 1-veined 60. *Guillenia*
- b. Flowers yellow; valves 3-veined 62. *Sisymbrium*
- 8a. Fruits oblong, terete, 15 - 20 mm long 56. *Arcyosperma*
- b. Fruits elliptic-oblong, flattened, 5 - 10 mm long 9
- 9a. Sepals not saccate at base 54. *Aphragmus*
- b. Sepals saccate at base 61. *Lignariella*
- 10a. Sepals caducous; seeds uniseriate 64. *Torularia*
- b. Sepals persistent; seeds usually biseriate 57. *Braya*
- 11a. Seeds uniseriate 55. *Arabidiopsis*
- b. Seeds biseriate 58. *Camelina*

Tribe 1. A L Y S S E A E Grenier & Godron

(H. S. Debnath)

Annual or perennial herbs or undershrubs; hairs appressed or subappressed, forked, branched or stellate. Lateral nectar glands in pairs or rarely one; middle ones absent. Staminal filaments toothed, appendaged or entire and linear. Ovary sessile or rarely on a short gynophore; stigma usually shortly bilobed. Fruit a silicula or sometimes a siliqua, broadly septate, 2 or 1-locular, generally dehiscent.

Four genera and 7 species in India.

Literature. AL-SHEHBAS, T. A. (1987) The genera of Alyssaceae (Cruciferae, Brassicaceae) in Southeastern United States. *J. Arn. Arb.* 68: 185 - 240.

I. *Alyssum* L.

Herbs, or often suffrutescent, annual or perennial, often decumbent, branched, clothed with short stellate hairs, sometimes heterotrichous. Leaves linear, entire. Inflorescence racemose, ebracteate, simple or branched, elongating in fruit. Flowers small, generally yellow, often dull white. Sepals free, erect, not saccate at base. Petals spatulate-oblong, clawed at base, emarginate at apex, about twice as long as sepals. Stamens 6, free; filaments filiform or sometimes winged at base; anthers blunt at apex. Lateral nectar glands in pairs. Ovary suborbicular to elliptic, bilocular, 1 - 8-ovuled in each locule; style short; stigma slightly bilobed. Fruit a silicula, suborbicular, broadly ovate or elliptic, discoid, bilocular, dehiscent, rarely subdehiscent or indehiscent, slightly emarginate or entire at apex; septum membranous, broad. Seeds 1 - 2 or more in each cell, suborbicular, more or less compressed.

S.E. Europe, N. Africa, C. & W. Asia, Pakistan and N.W. Himalayas; ca 100 species, 1 in India.

Alyssum desertorum Stapf in Denkschr. Akad. Wiss. Wien, Math.- Nat. Kl. (Wein) 51: 302. 1886. *A. minimum* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 141. 1872.

Herbs, greyish green, annual, erect, spreading or ascending, branched from base, 4 - 20 cm high, densely covered with stellate hairs. Leaves oblanceolate or linear-lanceolate, sessile, 10 - 25 x 1 - 5 mm. Racemes 30 - 40-flowered, ebracteate. Flowers pale yellow or dull white, 1.8 - 2 mm across; pedicels up to 3 mm long in fruit. Sepals ca 1.5 mm long, caducous. Petals broad at middle, entire or obscurely emarginate at apex, ca 2.5 mm long, sparsely hairy outside. Stamens 1.5 - 2 mm long; filaments smaller and scale-like in outer two stamens. Style ca 0.5 mm long. Fruiting racemes long, dense; pedicels 2 - 5 mm long; fruits more or less orbicular, emarginate, 2.5 - 3.5 mm in diam.,

glabrous; valves uniformly tumid with flat, narrow margin; seeds 2 in each locule, ovate-orbicular, brown, ca 1 mm long.

Fl. & Fr. March - Sept.

Distrib. India. N.W. Himalayas. Jammu & Kashmir and Himachal Pradesh.

S.E. Europe, N. Africa, C. & S.W. Asia.

2. *Farsetia Turra*

Herbs or undershrubs, open with woody base, erect or spreading, much-branched, annual or perennial, hoary with stiff bipartite, appressed white hairs. Leaves linear-oblong, tapering to base, sessile. Racemes lax, ebracteate. Flowers small or large, pale yellow, orange or whitish; pedicels short. Sepals erect, linear-oblong, more or less equal at base. Petals oblong-linear, clawed, often crimped along margins, rounded at apex, slightly longer to about twice as long as sepals. Stamens 6; filaments linear; anthers oblong-linear. Ovary oblong, 10 - 40-ovuled, hairy; style short and thick; stigma capitate. Fruits linear-oblong, erect, compressed, bilocular, nearly rounded at both ends, covered with bipartite appressed hairs; valves with distinct midvein, often slightly torulose; septum membranous. Seeds uniseriate to biseriate, orbicular, winged.

S.W. Asia, Central and North America; about 10 species, 4 in India.

Literature. JAFRI, S. M. H. (1957) The genus *Farsetia* in Pakistan, India and Afghanistan. Notes R. Bot. Gard. Edinb. 22: 209 - 216.

KEY TO THE SPECIES

- | | |
|--|----------------------------------|
| 1a. Seeds uniseriate | 2 |
| b. Seeds biseriate | 3 |
| 2a. Flowers 3 - 5 mm in diam.; sepals usually less than 5 mm (3 - 4 mm) long; petals slightly exceeding the sepals | 1. <i>F. hamiltonii</i> |
| b. Flowers 10 - 12 mm in diam.; sepals usually more than 5 mm (6 - 9 mm) long; petals much exceeding the sepals | 2. <i>F. heliophila</i> |
| 3a. Leaves linear-oblong or linear, 3 - 40 x 2 - 8 mm, sessile; flowers 5 - 10 mm across; petals oblong-linear | 3. <i>F. Jacquemontii</i> |
| b. Leaves lanceolate, 40 - 70 x 15 - 22 mm, petiolate; flowers 12 - 15 mm across; petals spatulate | 4. <i>F. macrantha</i> |

1. *Farsetia hamiltonii* Royle, *Illus. Bot. Himal.* 1: 71. 1834; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 140. 1872. **Fig. 16 A.**

Hindi: *Hiram-chabba*.

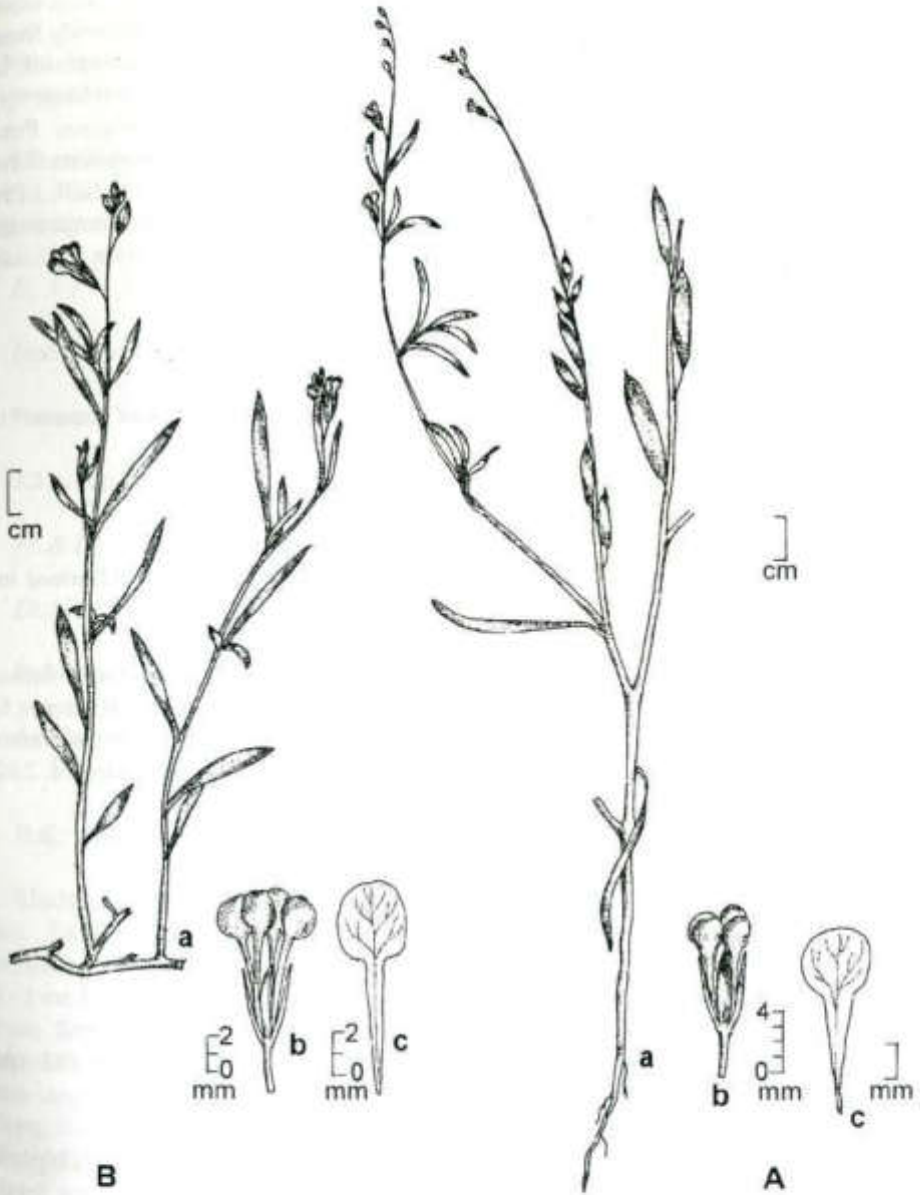


Fig. 16 A. *Farsetia hamiltonii* Royle : a. habit; b. flower; c. petal.

Fig. 16 B. *Farsetia jacquemontii* Hook. f. & Thomson : a. flowering branch; b. flower; c. petal.

Undershrubs, annual or perennial, erect or spreading, 10 - 50 cm high, often woody at base, densely hoary with bipartite appressed white hairs. Leaves narrowly linear, entire, sessile, 10 - 40 (-80) x 1 - 3 (-8) mm, strigose. Racemes 5 - 20-flowered, lax, ebracteate. Flowers white or pale pink, 2.5 - 4 mm across; pedicels 1 - 3 mm long, up to 6 mm long in fruit. Sepals oblong, subobtusate at apex, 3.5 - 4 x 1 mm, strigose. Petals oblong, cuneate, rounded at apex, 5 - 6 mm long. Stamens 3 - 4 mm long; anthers obtuse at apex, ca 1 mm long. Style thin, ca 1.5 (-2.5) mm long; stigma bilobed. Fruit linear-oblong, compressed, nearly rounded at both ends, 10 - 47 x 2 - 4.5 mm, covered with bipartite appressed hairs; valves often slightly torulose; seeds uniseriate, orbicular, ca 3 mm in diam. (including ca 1 mm wide wing).

Fl. & Fr. Feb. - Nov.

Distrib. India: Throughout the Indian desert to the western banks of Jamuna (the type locality) in the east.

Pakistan.

2. *Farsetia heliophila* Bunge ex Cosson, *Comp. Fl. Alt.* 2: 227. 1884; Parmar in *J. Econ. Tax. Bot.* 4: 639. 1983.

Undershrubs, perennial, erect; branches rigid, wiry. Leaves linear to linear-lanceolate, attenuate at base, rotundate or obtuse at apex, sessile, ca 20 x 2 mm. Racemes few flowered, lax. Sepals 6 - 9 mm long. Petals light violet, 10 - 12 mm long. Fruits narrow, erect, compressed, 25 - 30 x 2 - 3 mm; seeds uniseriate, nearly orbicular, winged, 2 - 2.5 mm in diam.

Fl. & Fr. Oct. - Jan.

Distrib. India: Rajasthan.

Pakistan and Iran.

3. *Farsetia jacquemontii* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 148. 1861; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 140. 1872.

Shrubs, erect or spreading, 15 - 45 cm high, woody at base, hoary with bipartite appressed hairs. Leaves linear-oblong or linear, acute or subobtusate at apex, sessile, 10 - 60 x 1 - 7 (-12) mm. Petals oblong-linear, often clawed, rounded at apex, 10 - 15 (-20) x 1.5 - 2.5 mm. Stamens 7 - 8 mm long; anthers ca 3 mm long. Style 0.7 - 1 mm long, slightly thickened; stigma conical, bilobed. Fruits oblong, compressed, 15 - 48 x 2.5 - 7 mm; valves membranous; seeds 1 - 2-seriate, orbicular, winged, 2.5 - 3 mm in diam.; wing 0.7 - 0.9 mm wide.

KEY TO THE SUBSPECIES

- 1a. Fruits broadly oblong, 15 - 21 x 5 - 7 mm
 b. Fruits narrowly oblong, 17 - 48 x 2.5 - 4.5 mm

- 3.1. subsp. *edgeworthii*
 3.2. subsp. *jacquemontii*

3.1. subsp. *edgeworthii* (Hook. f. & Thomson) Jafri in Notes R. Bot. Gard. Edinb. 22: 213. 1957. *F. edgeworthii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 147. 1861. *F. aegyptiaca* auct. non Turra 1765; Hook. f. & T. Anderson in Fl. Brit. India 1: 140. 1872.

Fl. & Fr. Apr. - July.

Distrib. India. Rajasthan.

Pakistan and Afghanistan.

3.2. subsp. *jacquemontii*

Fig. 16 B.

Fl. & Fr. April - Dec.

Distrib. India: W. & N.W. regions.

Pakistan, Afghanistan and Iran.

4. *Farsetia macrantha* Blatter & Hallberg in J. Bombay Nat. Hist. Soc. 26: 220. 1918.

Raj.: *Motio-hiran-chabbo*.

Undershrubs, rigid, up to 80 cm high, covered with appressed, medifixed, scabrous hairs. Leaves alternate, except a lower few which are supposite, broadly linear-lanceolate, attenuate at base, acute at apex, 4 - 7 x 1.5 - 2 cm, subcoriaceous; petioles 0.5 - 1 cm long, grooved. Flowers 5 - 10 in racemes, white or creamy white, 12 - 15 mm across. Sepals linear, subobtusate at apex, 9 - 10 x 1 - 1.5 mm. Petals spatulate, rounded at apex, 15 - 16 x 5 mm. Stamens ca 6 mm long; anthers linear, ca 4 mm long. Ovary 5 - 6 mm long, densely strigose; style stout, ca 1 mm long; stigma obscurely bilobed. Fruits oblong, compressed, narrow at both ends, 3 - 3.5 x 0.5 - 0.6 cm, densely strigose; valves indistinctly 1-ribbed; seeds biseriate, winged, 4 - 6 mm in diam.; wing ca 1 mm wide.

Fl. & Fr. Aug. - Dec.

Distrib. India. Rajasthan.

Endemic.

Notes. Bhandari (in J. Bombay Nat. Hist. Soc. 72: 604 - 606, ff. 1 - 4, 1975) has discussed typification of this species.

3. *Lobularia* Desv.

Herbs, annual or perennial, erect or suberect, branched, clothed with bipartite, medifixed appressed hairs. Leaves linear or narrowly oblanceolate, sessile, entire or obscurely toothed along margins, usually acute at apex. Flowers small, white or pinkish in lax ebracteate racemes; pedicels filiform, spreading. Sepals patent, not saccate at base. Petals broadly obovate or suborbicular, clawed, white. Stamens 6; filaments linear, without appendages. Lateral nectar glands in pairs, short, stalk-like, middle ones rudimentary. Ovary suborbicular or ovate, 2 - 10 - ovuled. Fruit a latiseptate silicula, suborbicular or ovate, bilocular, compressed, dehiscent; valves slightly inflated, with a distinct midvein; septum obscurely veined; style distinct; seeds suborbicular, compressed, narrowly winged, 1 - 5 in each locule.

Mostly in Mediterranean region; 5 species, 1 in India.

Lobularia maritima (L.) Desv. in J. Bot. Appl. 3: 162. 1814. *Clypeola maritima* L., Sp. Pl. 652. 1753.

Herbs, perennial, erect or suberect, 10 - 40 cm high, branched mostly from base, greyish-white pubescent with bipartite appressed hairs. Leaves sessile, linear or narrowly oblanceolate, entire or obscurely toothed along margins, acute at apex, 20 - 35 x 3 - 8 mm. Racemes 20 - 30 flowered, lax. Flowers white or pinkish, bracteate, ca 5 mm across; pedicels 8 - 10 mm long in fruit. Sepals ca 2 mm long. Petals 3 - 4 x 2.5 mm. Stamens ca 2 mm long; anthers ca 0.3 mm long. Style ca 1 mm long. Fruits suborbicular, oblong or obovate, 2.5 - 4 x 2 - 2.5 mm, appressed pubescent to almost glabrous; valves convex with a distinct midvein; seeds 1 in each locule, suborbicular, reddish-brown, 1 - 1.5 mm in diam.

Fl. & Fr. Mar. - June.

Distrib. Native of Mediterranean and Macronesian regions; widely cultivated for ornamental purposes.

4. *Ptilotrichum* C. Meyer

Herbs, perennial often laxly caespitose, somewhat woody at base, clothed with stellate or branched hairs or indumentum sometimes lepidote. Leaves linear or narrowly oblanceolate. Inflorescence ebracteate, simple or branched raceme. Flowers small, white or pinkish; pedicels filiform, flexuous, somewhat erect. Sepals erecto-patent, not saccate at base, linear to oblong. Petals oblong-linear, entire, white to purple. Stamens 6; filaments usually not toothed. Lateral nectar glands somewhat projected outwards.

Ovary ovoid to subglobose, 1 - 2-ovuled in each locule; style short, distinct. Fruit a latiseptate silicula, ovoid to subglobose, dehiscent, rarely subdehiscent or indehiscent; valves flat or uniformly turgid or inflated, acute or obtuse at apex; septum broad, membranous; seeds 1 - 2 in each locule, oblong-ovate.

Mostly in Central Asia; ca 12 species, 1 in India.

Ptilotrichum canescens (DC.) C. Meyer in Ledeb., Fl. Alt. 3: 66. 1831. *Alyssum canescens* DC., Syst. Nat. 2: 322. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 141. 1872.

Perennials, suberect, laxly caespitose, 5 - 10 cm high, covered with stellate and branched appressed dimorphic hairs. Leaves linear, sessile, 5 - 15 x 0.8 - 2.5 mm. Racemes 10 - 20-flowered, ebracteate. Flowers 4 - 5 mm across, white or pinkish; pedicels up to 8 mm long in fruit. Sepals linear to oblong, ca 2.5 x 1.5 mm. Petals ca 3.5 x 2.5 mm. Stamens 2 - 3 mm long. Style 1 - 1.5 mm long; stigma capitate. Fruits ovate-oblong, 3 - 5 x 2 - 3 mm, densely pubescent; valves uniformly inflated, septum not veined; seeds ovate-oblong, brown, ca 2 mm long.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan, China (Tibet) and Altai.

Tribe 2. ARABIDEAE DC.

(P. K. Hajra and H. J. Chowdhery)

Herbs, annual, biennial or perennial, glabrous or pubescent; hairs simple, forked or stellately branched; stem simple or branched. Leaves in basal rosette and cauline. Flowers in racemes or in scapes, yellow, white or purple. Lateral nectar glands simple or lobed; middle glands present or absent. Filaments usually without appendages, rarely toothed. Fruits usually narrow, long, compressed; seeds many, 1 - 2-seriate.

12 genera and 51 species in India.

5. *Arabis* L.

Herbs, annual, biennial or perennial, glabrous or pubescent; hairs simple, median, forked or stellately branched; stems erect, often simple. Basal leaves in a rosette, spatulate, stalked and hairy; cauline sessile, amplexicaul, entire or toothed. Racemes usually lax (in fruit), bracteate or ebracteate. Flowers white, purple or rose-coloured. Sepals erect or spreading, short, often slightly saccate at base. Petals obovate-oblong,

entire, usually clawed, longer than sepals. Stamens 6; filaments not appendaged; anthers oblong-linear. Ovary linear, many-ovuled; style distinct; stigma capitate or emarginate. Fruits linear-oblong, usually compressed; valves veiny with weak midrib; style short; seeds usually ovate, compressed, more or less winged.

Chiefly in Northern temperate zone and S. America; about 100 species, 9 in India.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Cauline leaves either auricled or amplexicaul to subamplexicaul at base | 2 |
| b. Cauline leaves neither auricled nor amplexicaul at base | 7 |
| 2a. Seeds either margined or narrowly winged | 3 |
| b. Seeds neither margined nor winged | 5 |
| 3a. Fruits pubescent | 3. <i>A. nova</i> |
| b. Fruits glabrous | 4 |
| 4a. Flowers ca 10 mm across | 2. <i>A. bijuga</i> |
| b. Flowers ca 5 mm across | 5. <i>A. pterosperma</i> |
| 5a. Basal leaves entire | 6. <i>A. recta</i> |
| b. Basal leaves toothed or crenate-serrate | 6 |
| 6a. Basal leaves 3 - 4 cm long; flowers ca 5 mm across | 4. <i>A. pangiensis</i> |
| b. Basal leaves 5 - 15 cm long; flowers ca 9 mm across | 1. <i>A. amplexicaulis</i> |
| 7a. Cauline leaves ca 0.5 cm long, linear or absent | 7. <i>A. saxicola</i> |
| b. Cauline leaves 0.8 - 2 cm long, usually oblong-obovate, toothed or lobulate | 8 |
| 8a. Fruits ca 8 cm long; style ca 2 mm long | 8. <i>A. tenuirostris</i> |
| b. Fruits ca 6 cm long; style ca 1.5 mm long | 9. <i>A. tibetica</i> |

1. *Arabis amplexicaulis* Edgew. in Trans. Linn. Soc., Lond. 20: 31. 1846; Hook. f. & T. Anderson in Fl. Brit. India 1: 136. 1872. *A. alticola* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1062. 1927.

Herbs, annual or biennial, suberect, up to 65 cm high, simple or branched, hispidly pilose. Basal leaves in rosette, ovate-oblong, oblanceolate, coarsely toothed, attenuate at base, subacute or rounded at apex, 3.5 - 15 x 1 - 3 cm; cauline leaves sessile, amplexicaul, rounded or rounded-auricled at base, ovate, oblong, acute or obtuse, toothed or entire, 1.5 - 6.5 x 0.5 - 3.5 cm. Racemes 10 - 25 cm long, laxly 15 - 35-flowered. Flowers ca 1 cm across, white; pedicels ca 1.5 cm long, glabrous. Sepals ovate, ca 5 mm long, 0.5 - 1 mm wide, with white margins. Petals ca 1 cm long, white. Stamens ca 5 mm long. Fruits linear, horizontal or drooping, acute, 3 - 6 cm long, ca 1 mm thick, glabrous; seeds many in each locule, not winged.

Fl. & Fr. April - May.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Bhutan, Nepal, Pakistan, and Afghanistan.

2. *Arabis bijuga* G. Watt in J. Linn. Soc., Bot. 18: 378. 1881. *A. pangiensis* O. Schulz in Notzbl. Bot. Gart. Berlin 9: 1063. 1927, p. p.; Chowdhery & Wadhwa, Fl. Himachal Pradesh 1: 56. 1984, non G. Watt 1881.

Herbs, perennial, up to 40 cm high, subglabrous or stellate hairy. Basal leaves rosulate, ovate-oblong or oblanceolate, often dentate with short obtuse teeth, 5 - 15 x 1 - 2 cm. Cauline leaves oblong, narrow, semiamplexicaul, sessile, 1 - 2.5 x 0.3 - 0.6 cm. Flowers ca 1 cm across. Petals ca 1.5 cm long. Fruits 3 - 6 cm long, glabrous; seeds many in each locule.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan and Iran.

3. *Arabis nova* Vill., Prosp. Pl. Dauph. 39. 1779. *A. auriculata* Lam., Encycl. Meth. Bot. 1: 219. 1783; Hook. f. & T. Anderson in Fl. Brit. India 1: 135. 1872, p. p. *A. montbretiana* Boiss. in Ann. Sci. Nat. ser. 2, 17: 53. 1842. Fig. 17.

Herbs, annual or biennial, up to 40 cm high, erect, stellately hairy. Basal leaves oblong-spathulate or oblong-obovate, sinuate, toothed or subentire, obtuse at apex, 0.5 - 3 x 0.5 - 2 cm, pubescent. Cauline leaves ovate or ovate-oblong, toothed, 0.5 - 2 x 0.2 - 1.5 cm, with obtuse or apiculate basal lobes. Racemes up to 10-flowered, lax. Flowers ca 4 mm across, white; pedicels up to 5 mm long in fruit. Sepals ca 2 mm long. Petals ca 4 mm long. Stamens ca 2 mm long. Stigma small. Fruits linear-oblong, compressed, 2 - 3 cm long, usually minutely pubescent; seeds narrowly winged.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Arunachal Pradesh.

Pakistan, Afghanistan, W. Asia and Mediterranean.

4. *Arabis pangiensis* G. Watt in J. Linn. Soc., Bot. 18: 378, t. 10. 1881.

Herbs, perennial, up to 20 cm high, densely hispid below, with short branched or stellate hairs. Basal leaves densely rosulate, spathulate-oblong, coarsely 3 - 4-dentate towards apex, obtuse or acute at apex, 3 - 4 x 0.4 - 1 cm, densely stellate hairy; cauline leaves usually 1 - 2, oblong-linear, almost entire, 1.5 - 3 x 0.2 - 0.4 cm, sessile. Racemes 15 - 30-flowered. Flowers ca 5 mm across; pedicels 1 - 2 cm long in fruit. Sepals ca 3 mm long. Petals ca 5 mm long. Stamens ca 4 mm long. Style ca 1 mm long; stigma

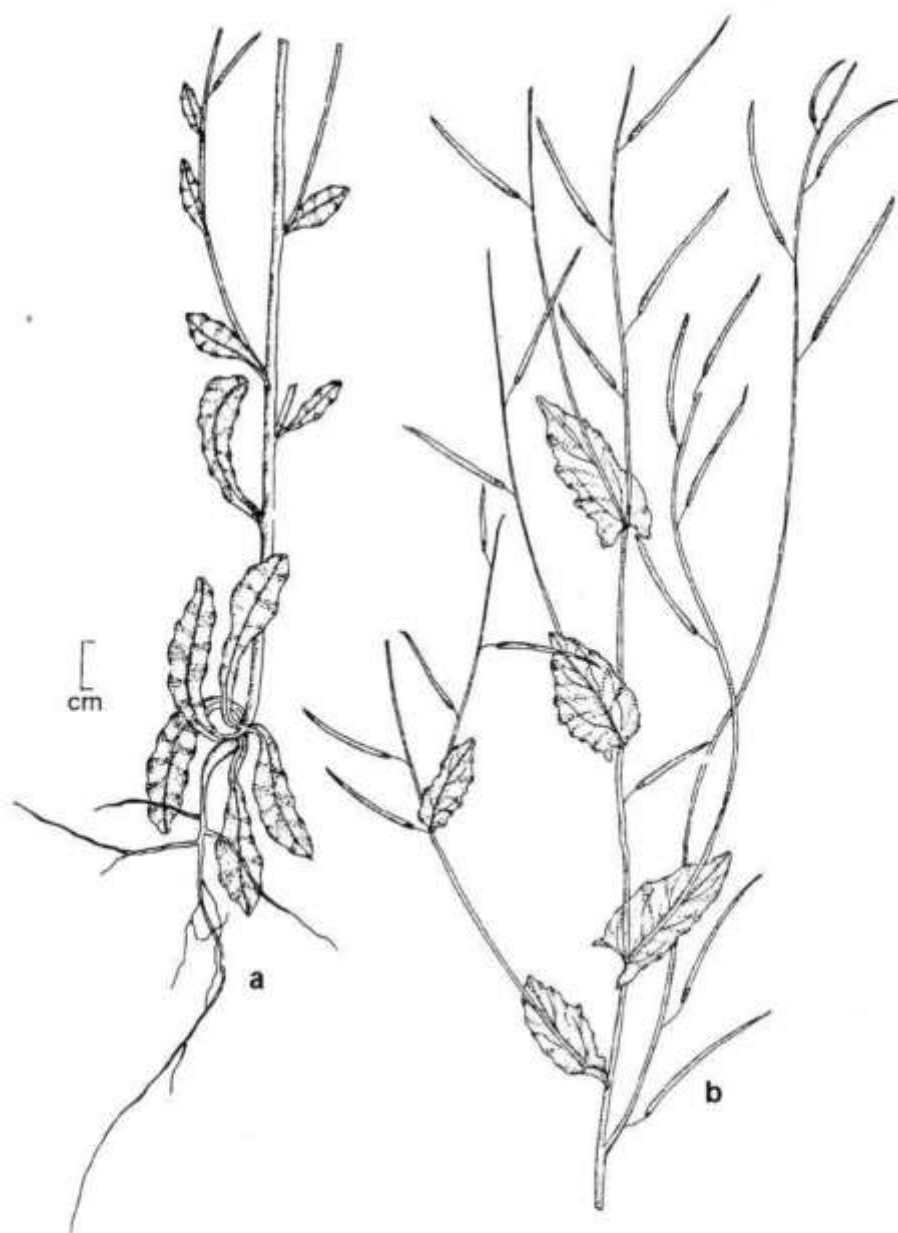


Fig. 17. *Arabis nova* Vill. : a. plant, lower portion; b. fruiting branch.

depressed, short. Fruits linear-oblong, 3 - 5 cm long, glabrous; seeds many, oblong.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan and Nepal.

5. *Arabis pterosperma* Edgew. in Trans. Linn. Soc., Lond. 20: 33. 1846. *A. alpina* auct. non L.; Hook. f. & T. Anderson in Fl. Brit. India 1: 135. 1872. *Arabidiopsis mollissima* auct. non N. Busch.; Hara, Fl. E. Himal. 2: 42. 1971. **Fig. 18.**

Herbs, biennial or rarely perennial, erect, up to 45 cm high, simple or branched, hoary with forked or stellate hairs. Basal leaves in rosette, oblong-lanceolate to spatulate, shallowly crenate-serrate along margins, obtuse or subacute, 2 - 4.5 x 2.5 - 1.5 cm, petioled; cauline leaves oblong, with obtuse basal lobes, 1 - 2 x 0.3 - 0.8 cm, sessile. Racemes 20 - 30-flowered, up to 12 cm long in fruit. Flowers ca 5 mm across, white; pedicels slender, 8 - 10 mm in fruit. Sepals elliptic-oblong, 3 - 4 mm long, glabrous, white-margined. Petals spatulate with long claws, 6 - 7 mm long, ca 1.5 mm wide. Stamens ca 3 mm long. Fruits erect or ascending at first, later spreading, compressed, 3.5 - 6 cm long, glabrous; valves 1-nerved; seeds 25 - 30 in each locule, margined.

Fl. & Fr. May - Sept.

Distrib. India: Alpine grasslands, 3000 - 4000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan, Nepal and Bhutan.

6. *Arabis recta* Vill., Prosp. Pl. Dauph. 3: 319. 1788. *A. auriculata* auct. non Lam. 1783; Hook. f. & T. Anderson in Fl. Brit. India 1: 135. 1872, p. p.

Herbs, annual, up to 30 cm high, simple or branched, pubescent. Basal leaves ovate or obovate, entire, petiolate; cauline leaves ovate to oblong, auriculate, rounded at apex, 0.6 - 2 cm long, sessile. Racemes flexuous, 7 - 40-flowered; pedicels up to 5 mm long. Petals ca 3 mm long, white. Fruits 1 - 3.5 cm long, glabrous or pubescent, patent; seeds ca 1 mm long, brown.

Fl. & Fr. July - Aug.

Distrib. India: Himachal Pradesh.

Europe.



Fig. 18. *Arabis pterosperma* Edgew. : a. habit.

7. *Arabis saxicola* Edgew. in Trans. Linn. Soc., Lond. 20: 32. 1846; Jafri in Fl. W. Pakistan 55: 173. 1973. *A. scaposa* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1965. 1927.

Herbs, perennial, up to 30 cm high; hairs branched. Basal leaves oblanceolate or oblong-obovate, entire or toothed at apex, 1.5 - 5 x 0.2 - 1.5 cm, sparsely hairy. Cauline leaves minute, linear, entire. Racemes 5 - 10-flowered, lax, up to 8 cm long in fruit. Flowers ca 4 mm across, white; pedicels up to 1 cm long in fruit. Sepals ca 3 mm long. Petals linear, cuneate, ca 6 mm long. Stamens ca 3 mm long. Fruits linear to linear-oblong, compressed, erect, acute, 2 - 6 cm long, glabrous; valves 1-nerved. Seeds 12 - 15 in each locule, ca 1 cm long.

KEY TO THE VARIETIES

- | | |
|---|---------------------------|
| 1a. Herbs up to 30 cm high; pedicels ca 1 cm long | 7.1. var. <i>elatior</i> |
| b. Herbs up to 15 cm high; pedicels ca 5 mm long | 7.2. var. <i>saxicola</i> |

7. 1. var. *elatior* (O. Schulz) Jafri in Notes R. Bot. Gard. Edinb. 22 (2): 100. 1956. *A. scaposa* O. Schulz var. *elatior* O. Schulz in Notizbl. Bot. Gart. Berlin-Dahlem 9: 1066. 1927.

Basal leaves oblong-obovate, 2 - 5 x 1 - 1.5 cm. Fruits linear-oblong, 4 - 6 cm long, ca 2 cm broad.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan.

7. 2. var. *saxicola*

Fl. & Fr. April - July.

Distrib. India: Jammu & Kashmir and Uttar Pradesh.

Pakistan and Afghanistan.

8. *Arabis tenuirostris* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1066. 1927.

Herbs, biennial up to 30 cm high, much-branched with simple or forked hairs. Basal leaves obovate-spathulate, narrowed at base, coarsely 2 - 4-dentate or lobate, obtuse at apex, ca 3.5 cm long; cauline leaves much narrower, linear, obtuse; lower ones remotely 2 - 3-dentate, hairy; upper ones entire, glabrous. Racemes 8 - 20-flowered. Flowers ca 3 mm across. Sepals oblong, ca 2 mm long. Petals obovate, cuneate, ca 5 mm long, white

or pale-lilac. Seeds 20 - 30 in each locule.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan.

9. *Arabis tibetica* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 143. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 136. 1872. *A. thomsonii* Hook. f. in J. Linn. Soc., Bot. 5: 143. 1861.

Herbs, perennial, up to 20 cm high, much-branched; stems leafy, stellately hairy. Basal leaves obovate or spatulate, sinuate-dentate to almost entire, 10 - 40 x 3 - 10 mm, usually densely pubescent. Cauline leaves sessile, lanceolate or narrowly spatulate, coarsely toothed or entire, 8 - 18 x 2 - 5 mm. Racemes 10 - 20-flowered, up to 10 cm long in fruit. Flowers ca 5 mm across, white or pale pink. Sepals ca 4 mm long, acute, sparsely stellately hairy. Petals 5 - 6 mm long. Fruits erect, narrow-linear, falcate, 3.5 - 6 cm long, glabrous; valves veined; midrib distinct; seeds usually ca 16 in each locule.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir (Ladakh).

Pakistan, Afghanistan and Central Asia.

6. *Barbarea* R. Br., nom. cons.

Herbs, biennial or perennial; stems erect, branched, angular, glabrous or with sparse simple hairs. Basal leaves rosulate, lyrate pinnatifid or entire, petiolate; cauline leaves amplexicaul, entire or irregularly sinuate-dentate to pinnatifid. Racemes lax in fruit. Flowers yellow, ebracteate. Sepals suberect, often saccate at base; inner sepals not pouched at base. Petals spatulate, clawed, yellow, longer than sepals. Stamens 6. Ovary linear to oblong-linear, many-ovuled; style short with subretuse stigma. Fruits linear, compressed, 4-angled, many-seeded; valves with prominent midribs. Seeds small, 1-seriate, ca 10, ovoid.

Asia, Europe, Africa and Australia; about 15 species, 3 in India.

KEY TO THE SPECIES

1a. Cauline leaves deeply 2 - 5-jugate

b. Cauline leaves entire or sinuate lobed or closely toothed

2. *B. intermedia*

- 2a. Pedicels 10 - 15 mm long; style persistent
 b. Pedicels 5 - 9 mm long; style caducous

1. *B. elata*3. *B. vulgaris*

1. **Barbaraea elata** Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 140. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 135. 1872.

Herbs, 30 - 100 cm high; stems usually simple, striated. Basal leaves with 1 - 3 pairs of lateral lobes; terminal lobes oblong-obtuse, sinuate. Cauline leaves obovate, auricled at base, entire or sinuate-lobed or closely toothed, 4 - 7 x 1 - 3 cm. Racemes up to 20-flowered. Flowers bright yellow; pedicels thick, erect, 10 - 15 mm long. Fruits 8 - 20 mm long, ca 3 mm thick, turgid, faintly 1-nerved; style persistent, 2 - 3 mm long.

Fl. & Fr. Aug. - Sept.

Distrib. India: Sandy soil, 3000 - 3800 m. Sikkim.

Bhutan.

Notes. Some authors treat this species under the genus *Rorippa* Scop.

2. **Barbaraea intermedia** Boreau, Fl. Cent. France 2: 48. 1840. *B. vulgaris* R. Br. var. *sicula* Hook. f. & T. Anderson in Fl. Brit. India 1: 134. 1872, non *B. sicula* Presl 1819.

Herbs, up to 60 cm high, branched. Basal leaves 2 - 19 x 1 - 4.5 cm; lateral lobes 3 - 8-paired, elliptic or obovate; terminal lobe rounded. Cauline leaves usually 2 - 5-jugate, 2 - 5 x 1.5 - 3 cm, deeply lobed with linear-oblong or oblanceolate segments. Racemes up to 18 cm long, 10 - 20-flowered. Flowers ca 5 mm across; pedicels 4 - 5 mm long in fruit. Sepals ovate-elliptic, ca 3 mm long, ca 1 mm wide. Petals obovate, ca 5 mm long, ca 1.5 mm wide. Stamens ca 4 mm long. Fruits linear-oblong, terete or terete-compressed, 10 - 30 mm long, ca 1.5 mm thick, glabrous; style not persistent. Seeds many, ovate.

Fl. & Fr. June - July.

Distrib. India: Temperate Himalayas, open grassy slopes, 2000 - 5500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Bhutan, Nepal, C. Asia, Europe and N. Africa.

3. **Barbaraea vulgaris** R. Br. in Aiton, Hort. Kew. ed. 2, 4: 109. 1812. *Erysimum barbaraea* L., Sp. Pl. 60. 1753. *Barbaraea vulgaris* R. Br. var. *taurica* Hook. f. & T. Anderson in Fl. Brit. India 1: 134. 1872, non *B. taurica* DC. 1821.

Herbs, up to 50 cm high, branched. Basal leaves 3 - 5-jugate, 4 - 12 x 1.5 - 3.5 cm; terminal lobes ovate-oblong, cordate at base, 2.5 - 5 x 2 - 3 mm; cauline leaves ovate, amplexicaul at base, entire or toothed, 1 - 5 x 0.5 - 2.5 cm. Racemes 10 - 35-flowered, up to 20 cm long in fruit. Flowers ca 6 mm across; pedicels 5 - 9 mm long. Sepals ca 3 mm long. Petals 6 - 8 mm long, clawed. Stamens ca 3 mm long. Fruits 1 - 3 cm long, ca 3 mm thick, glabrous; valves with a distinct midvein; seeds brown, many.

Fl. & Fr. April - June.

Distrib. India: 2000 - 4000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal Pradesh and Tamil Nadu.

Pakistan, most of Asia, Europe, Africa and Australia.

7. *Cardamine* L.

Herbs, annual, biennial or perennial; stems erect, diffuse or flaccid, simple or branched, glaucous, pubescent or with a few simple hairs. Leaves simple, ternate, pinnate or pinnatisect, alternate or rarely verticillate. Racemes usually many-flowered, ebracteate. Flowers white, pale-purple, mauve, pale-violet or pale-yellow; pedicels filiform, erect or upcurved. Sepals nearly equal at base, oblong or ovate; inner sepals somewhat pouched at base. Petals 4, clawed, obovate or subspathulate, rounded or emarginate, rarely absent. Stamens 4 - 6; filaments subulate, not broadened at base, erect; anthers oblong. Ovary cylindrical, 4 - 40-ovulate; ovules uniseriate, oval or orbicular; style often filiform; stigma simple, more or less bilobed. Fruits laterally compressed, narrow or broadly linear, tapering at both ends; valves rounded, with indistinct venation, dehiscent explosively and becoming coiled; style short. Seeds compressed, finely tuberculate, 1-seriate, few to many; cotyledons accumbent.

Cosmopolitan; about 150 species, 14 in India.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Leaves simple or cauline, sometimes 3-foliolate, not deeply lobed or pinnatisect | 2 |
| b. Leaves compound | 3 |
| 2a. Leaves sessile, lanceolate, half-amplexicaul; flowers violet | 13. <i>C. violacea</i> |
| b. Leaves petioled, cordate or subcordate; flowers white | 2. <i>C. circaeoides</i> |
| 3a. Leaves trifoliolate or bifoliolate, irregularly lobed, minutely or deeply toothed | 4 |
| b. Leaves many-jugate, pinnatisect | 6 |
| 4a. Plants robust, generally up to 100 cm high; leaflets acuminate at apex; flowers pink | 10. <i>C. scoriarum</i> |
| b. Plants not robust, usually up to 45 cm high; leaflets obtuse or acute at apex; flowers dull white or pale-lilac | 5 |
| 5a. Flowers dull white or greenish yellow, 2 - 5 mm across | 1. <i>C. africana</i> |
| b. Flowers pale-lilac, ca 8 mm across | 12. <i>C. trifoliolata</i> |

- | | |
|--|-----------------------------|
| 6a. Plants robust, usually 45 - 100 cm high | 9. <i>C. macrophylla</i> |
| b. Plants slender, stems up to 40 cm (rarely 60 cm) high | 7 |
| 7a. Leaves auricled at base | 8 |
| b. Leaves not auricled at base | 9 |
| 8a. Flowers white; sepals ca 1.5 mm long | 7. <i>C. impatiens</i> |
| b. Flowers lilac or purple; sepals 3 - 3.5 mm long | 5. <i>C. griffithii</i> |
| 9a. Leaflets irregularly lobed or crenately toothed at margin | 10 |
| b. Leaflets entire or irregularly sinuate or lobed at margin | 11 |
| 10a. Petals oblong, ca 2 mm long or sometimes absent | 11. <i>C. trichocarpa</i> |
| b. Petals obovate-cuneate, ca 4 mm long | 14. <i>C. yunnanensis</i> |
| 11a. Flowers usually 7 - 13 mm across | 8. <i>C. loxotemonoides</i> |
| b. Flowers usually 3 - 6 mm across | 12 |
| 12a. Stem flexuose, usually with several branches from below; leaflets 2 - 4 pairs | 4. <i>C. flexuosa</i> |
| b. Stem erect or ascending, usually not branched from below; leaflets 5 - 13 pairs | 13 |
| 13a. Basal leaves many, densely rosetted, hairy on upper surface | 6. <i>C. hirsuta</i> |
| b. Basal leaves few, not rosetted, glabrous on upper surface | 3. <i>C. elegantula</i> |

1. *Cardamine africana* L., Sp. Pl. 655. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 137. 1872.

Stems erect or decumbent, up to 60 cm long; stems often rooting at nodes, sparsely hispid or glabrous. Leaves mostly radical, trifoliolate; petioles 2 - 16 cm long; leaflets broadly ovate; lateral ones oblique at base, crenate-serrate along margins, acute or obtuse at apex, 2 - 7 x 1 - 3 cm, sessile or petiolulate; petiolules up to 2 cm long. Racemes few-flowered. Flowers dull-white or greenish yellow, 2 - 5 mm across. Sepals suberect, oblong, ca 3 x 1.5 mm. Petals oblong to obovate, cuneate, ca 5 x 1.5 mm. Filaments 3 - 5 mm long. Ovary 8 - 16-ovuled; style ca 1 mm long; stigma globose. Fruits crowded or subclax, erect or ascending, tapering at both ends, 2.5 - 4 cm long. Seeds 8 - 10, flattened-ellipsoid, brownish.

Fl. & Fr. Oct. - Dec.

Distrib. India: Humid localities in open borders or forest floors of evergreen and semievergreen forests, 1500 - 2500 m. Arunachal Pradesh, Karnataka and Tamil Nadu.

Temperate and subtropical Africa, Sri Lanka and Indonesia.

2. *Cardamine circaeoides* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 144. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 137. 1872.

Herbs, erect, up to 45 cm high; stems more or less branched, sparsely pubescent or nearly glabrous. Leaves cordate, sinuate-toothed, obtuse at apex, 1.5 - 4 x 1 - 3.5 cm, lower lobes rounded; terminal leaflet ovate, acuminate, 2 - 4 x 1 - 2.5 cm; petioles slender, in upper leaves ca 1 cm long, in lower ones ca 7 mm long. Racemes subcorymbose.

few-flowered. Flowers white, ca 5 mm across; pedicels ca 5 mm long. Sepals oblong, ca 3 mm long. Petals oblanceolate, cuneate, 4 - 5 mm long, white. Inner stamens as long as or slightly longer than petals. Style equal to or slightly longer than petals; stigma broad, globose. Fruits linear, 1.5 - 2.5 cm long, ca 1.5 mm thick. Seeds oblong, ca 1 x 0.5 mm, brown.

Fl. & Fr. April - Oct.

Distrib. India: Moist forests, 1500 - 2400 m. Sikkim and Arunachal Pradesh.

Bhutan, Upper Myanmar and W. China.

3. *Cardamine elegantula* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 146. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 139. 1872.

Stems slender, branched, up to 15 cm long. Leaves pinnate, 3 - 4.5 cm long, glabrous; leaflets 3 - 7 pairs, more or less opposite, ovate, oblong, linear-oblong or lanceolate, entire, 3 - 7 x 1 - 2 mm, lower petiolate, upper sessile. Racemes 2 - 9-flowered. Flowers 5 - 7 mm across, white or rose-coloured. Sepals narrowly ovate, glabrous, ca 2 mm long. Petals obovate or obovate-cuneate or more or less spatulate, ca 5 mm long, white or purplish. Stamens 6, inner ca 9 mm long, outer ca 2 mm long. Fruits narrow, linear, horizontal or recurved, more or less pendulous, 12 - 15 x 1 - 2 mm. Seeds ca 0.8 x 0.4 mm.

Fl. & Fr. April - May.

Distrib. India: Moist places, 1000 - 3000 m. West Bengal, Sikkim and Meghalaya.

Nepal and Bhutan.

4. *Cardamine flexuosa* Withering, Bot. Arr. Brit. Pl. ed. 3, 3: 578. 1976. *C. hirsuta* var. *sylvatica* auct. non Link; Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872, p. p. *C. scutata* Thunb. subsp. *flexuosa* (Withering) Hara in J. Fac. Sci. Univ. Tokyo, B. 6: 59. 1952. **Fig. 19.**

Herbs, annual or biennial, flexuose, simple or sparsely branched, 10 - 40 cm high; roots fibrous on a short rootstock. Basal leaves 7 - 12, scarcely rosulate, orbicular, sinuate-dentate to lobed. Cauline leaves 4 - 10, ovate to lanceolate, pinnate, 2.5 - 5 cm long; lateral leaflets 2 - 4 pairs, orbicular-ovate, obtuse or subacute at apex, 3 - 7 x 2 - 5 mm; terminal leaflet obovate, suborbicular, toothed. Racemes 2 - 15 cm long; flowers few to many, ca 3 mm across. Sepals erecto-patent, oblong to oblong-elliptic, acute, ca 2 mm long. Petals ca 4 mm long, white. Stamens usually 4 or 6 with 2 outer staminodes. Fruits elliptic-oblong, obtuse, 1.2 - 2.5 cm long, less than 1 mm thick, with elastic valves. Seeds ovoid-compressed, ca 1 mm long, yellow.

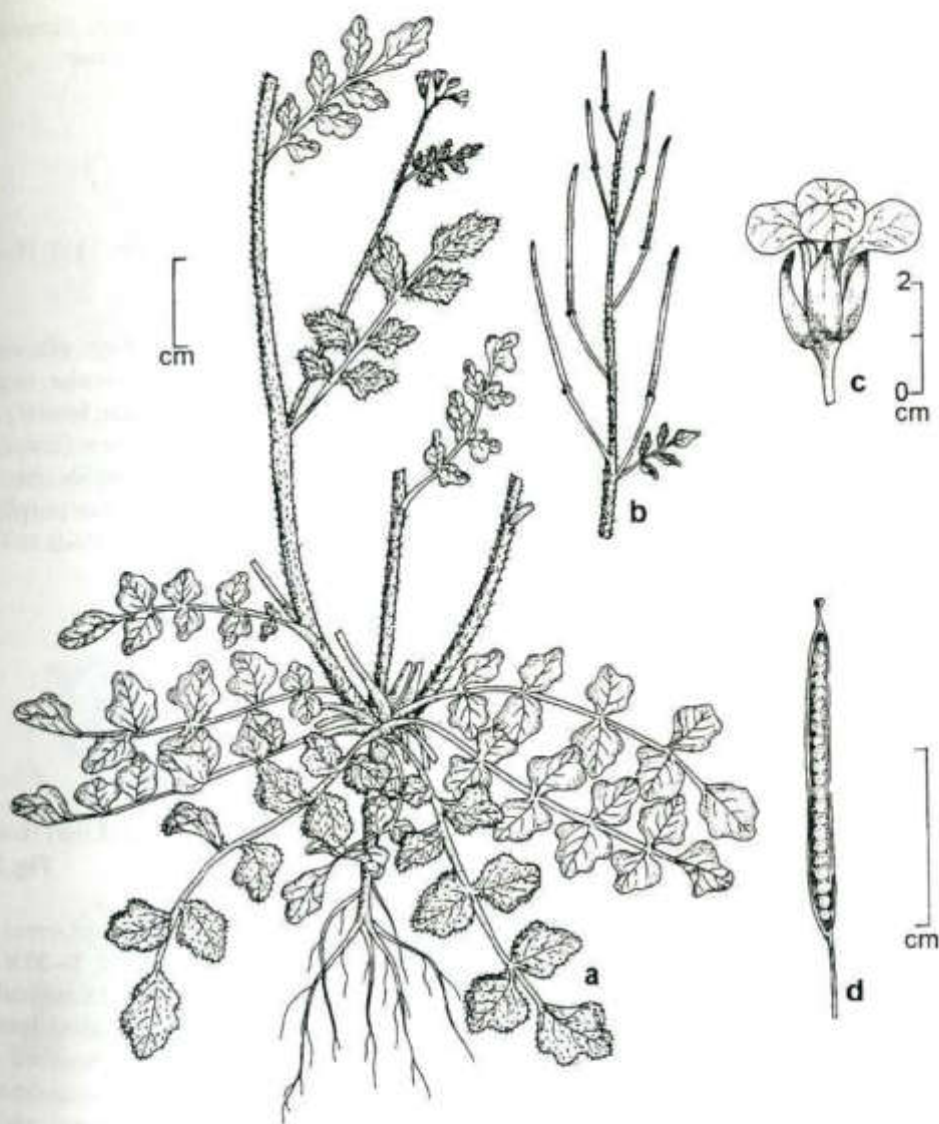


Fig. 19. *Cardamine flexuosa* Withering : a. plant, lower portion; b. fruiting twig; c. flower; d. fruit.

Fl. & Fr. Jan. - Aug.

Distrib. India: Moist streamsides, 500 - 2500 m. Himachal Pradesh, Jammu & Kashmir, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Assam and Manipur.

Bhutan, Temperate Eurasia and Canada.

Notes. Leaves and seeds used in skin diseases in Uttar Pradesh.

5. *Cardamine griffithii* Hook. f & Thomson in J. Linn. Soc., Bot. 5: 146. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 139. 1872.

Stems angled or grooved, sparsely branched above, up to 60 cm high, glabrous. Leaves 2 - 9 cm long; lateral leaflets 3 - 6 pairs, sessile or subsessile, orbicular, ovate, rounded at base, entire or irregularly sinuate along margins, 3 - 10 x 2 - 8 mm; lowest pair auriculate; terminal leaflet suborbicular, up to 1.3 cm across. Racemes few-flowered, somewhat crowded at apex. Flowers lilac or purple, ca 6 mm across. Sepals oblong-elliptic, obtuse at apex, ca 3 x 2 mm. Petals obovate, 4 - 10 x 3 - 5 mm, white or purplish. Stamens 6, the 4 inner ones larger, ca 6 mm long, the 2 outer ones smaller. Pods 10 - 15 mm long.

Fl. & Fr. May - July.

Distrib. India: Streamsides, along shady places, 2000 - 4000 m. Sikkim.

Nepal, Bhutan and China.

6. *Cardamine hirsuta* L., Sp. Pl. 655. 1753. *C. hirsuta* L. var. *sylvatica* (Link) Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872, p. p. **Fig. 20.**

Herbs, annual, up to 50 cm high; stems simple, diffuse or much-branched, erect or creeping at base, glabrous or hairy. Leaves very variable, glabrous or hairy, 3 - 25 x 1 - 20 mm; basal leaves forming a rosette, imparipinnate, petioled; leaflets 5 - 13, orbicular or ovate, irregularly toothed or irregularly lobed, 5 - 15 mm across. Cauline leaves petioled or subsessile; leaflets lanceolate, narrowly oblong or obovate, toothed or irregularly lobed, obtusely rounded at apex, 5 - 25 x 1 - 15 mm. Inflorescence racemose or subcorymbose, 10 - 20-flowered, up to 20 cm long. Flowers 3 - 5 mm across, white. Sepals oblong, obtuse at apex, ca 2 mm long. Petals obovate-cuneate, rounded at apex, 2.5 - 5 mm long. Stamens 4 or rarely 6, rarely outer two abortive, 2 - 3 mm long. Ovary many-ovuled. Fruits cylindric, somewhat compressed, 15 - 25 mm long, ca 1 mm thick. Seeds 6 - 12 on either side of septum, ca 1 mm long.

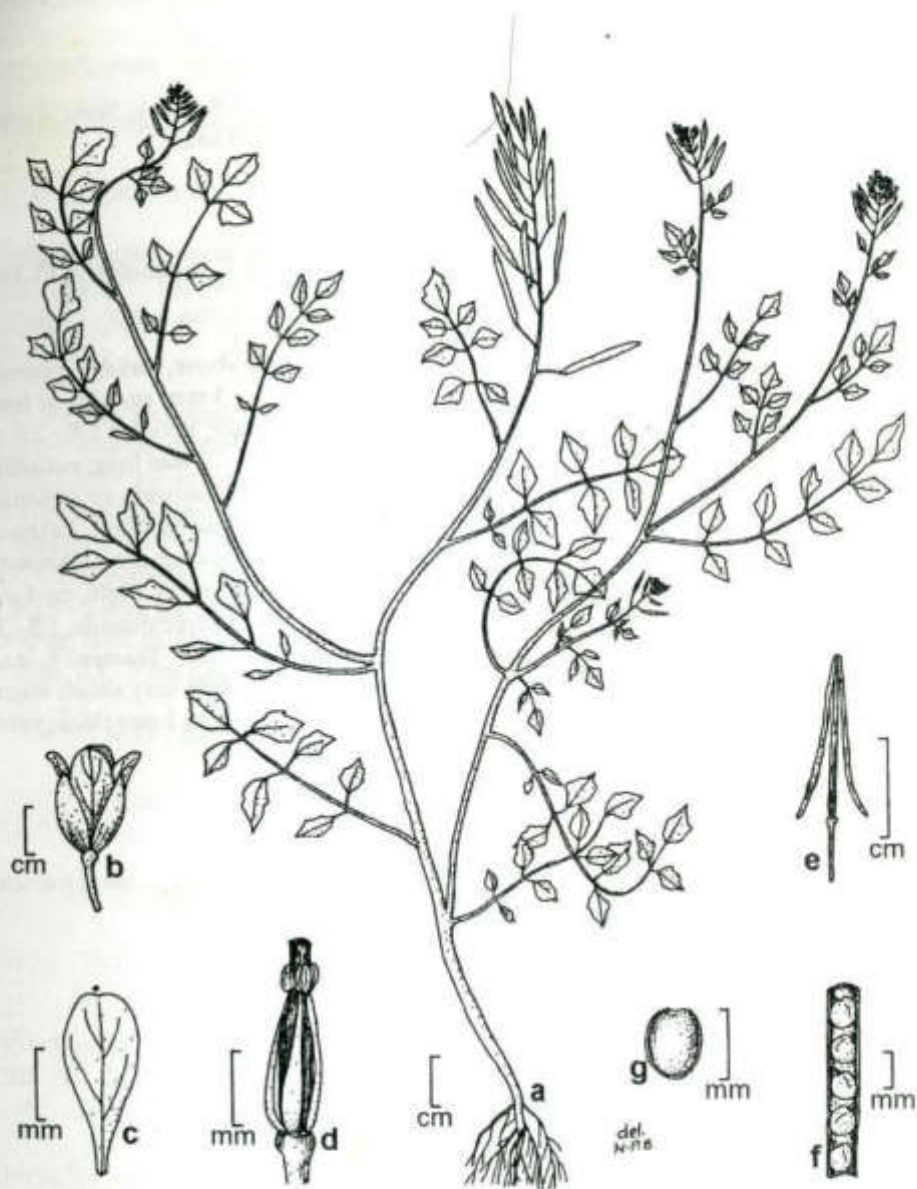


Fig. 20. *Cardamine hirsuta* L. : a. plant; b. flower; c. petal; d. stamens adhering to ovary; e. dehiscent fruit; f. seeds attached to septum; g. seed.

Fl. & Fr. March - May (Feb. - Sept.).

Distrib. India: Humid wet localities, 700 - 2500 m. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Meghalaya and Tamil Nadu.

Cosmopolitan.

7. *Cardamine impatiens* L., Sp. Pl. 655. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872.

Herbs, up to 60 cm high. Leaves crowded at base, alternate above, variable, pinnate, many-jugate, 5 - 17 or more in each, with narrow sagittate 2 - 3 mm auricles at base, sparsely hairy or fringed with white bristles; apical leaflets larger; petioles 1.5 - 2.5 cm long. Leaflets of basal leaves entire, wavy or deeply 2 - 5-lobed, 4 - 20 mm long; petiolules up to 10 mm long. Leaflets of upper leaves narrower, elliptic, obovate or obliquely cuneate, lanceolate or linear-lanceolate, entire, incised or irregularly lobed, attenuate at base, rounded, obtuse or acute at apex, ca 5.5 x 1.5 mm. Inflorescence erect, racemose or somewhat subcorymbose, many-flowered, 5 - 15 cm long. Flowers white, ca 4 mm across; pedicels 4 - 7 mm long. Sepals oblong, sometimes pale-purple outside, 1.5 - 3 x 0.5 - 0.8 mm. Petals oblanceolate or oblong-linear, ca 4 x 1 mm, white. Stamens 6, inner 4 longer, outer 2 smaller. Ovary shorter than inner stamens; style very short; stigma globose. Fruits erect, slender, linear, flat, stalked, 1.5 - 3 cm long, ca 1 mm thick; valves with distinct midrib. Seeds many, oval or ellipsoid, reddish-brown.

Fl. & Fr. May - July.

Distrib. India: Moist shaded places, 1500 - 4000 m. Jammu & Kashmir, Himachal Pradesh, Rajasthan, Uttar Pradesh, Sikkim and Tamil Nadu.

Asia and Europe.

8. *Cardamine loxostemonoides* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1069. 1927. *C. pratensis* auct. non L.; Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872. *C. pratensis* forma *luxuriana* Jafri in Notes R. Bot. Gard. Edinb. 22: 104. 1956.

Perennials, up to 30 cm high, glabrous, with a creeping rhizome, bearing several ovoid 2 - 3 mm long bulbils at ground level. Leaves pinnate, petioled; leaflets of basal leaves orbicular, 3 - 12 mm across in equidistant pairs; terminal leaflet larger, ovate or rounded at base, shortly petioluled; leaflets of cauline leaves ovate, oblong-ovate to lanceolate or linear, 5 - 15 x 1 - 3 mm. Racemes 5 - 15-flowered, elongate, lax, subcorymbose. Flowers 10 - 20 mm across, lilac or pinkish; pedicels 10 - 20 mm long in fruit. Sepals ca 3 mm long. Petals obovate-oblong, ca 2 x 1 cm. Stamens ca 5 mm long. Fruits erect, compressed, 2.5 - 5 cm long. Seeds oblong, brown.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.
Nepal, Bhutan and China (Tibet).

9. *Cardamine macrophylla* Willd., Sp. Pl. 3: 484. 1800; Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872. *C. polyphylla* D. Don, Prodr. Fl. Nep. 201. 1825. *C. macrophylla* Willd. subsp. *polyphylla* (D. Don) O. Schulz in Notizbl. Bot. Gart. Berlin 9:1071. 1927. **Fig.21.**

Perennials, rootstock creeping; stems simple, stout, erect, up to 90 cm high, usually glabrous. Leaves pinnate, petioled; leaflets 2 - 7 pairs, ovate, obovate-cuneate or lanceolate, crenate-serrate or coarsely irregularly lobed or pinnatifid, acute or acuminate at apex, subsessile, 1.2 - 8 x 0.5 - 4 cm. Racemes erect, many-flowered, subcorymbose; pedicels 1 - 2 cm long. Flowers purple, deep violet or white, 8 - 15 mm across. Sepals oblong-elliptic, ca 4 x 2 mm long, glabrous. Petals narrowly obovate, cuneate, 10 - 15 x 3 - 5 mm, purplish. Inner stamens ca 6 mm long, outer ca 4 mm long. Ovary ca 5 mm long; style ca 2 mm long; stigma large, globose. Fruits erect, smooth, tapering at both ends, 2.5 - 5 cm long; pedicels ca 2 cm long. Seeds oblong, brown, ca 2 mm long.

Fl. & Fr. May - July.

Distrib. India: Damp shaded places, 2400 - 4100 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Bhutan, China and Korea.

Notes. A much variable, polymorphic species.

10. *Cardamine scoriarum* W. Smith in Notes R. Bot. Gard. Edinb. 11: 203. 1920. *C. smithiana* Biswas in J. Bot. 46: 22. 1938.

Stems up to 1 m long, glabrous. Leaflets elliptic to ovate-elliptic, rounded or cuneate at base, irregularly crenate-serrate along margins, acuminate at apex, (3.5-) 5 - 10 x 2 - 4 cm; petioles 2 - 4 cm long. Flowers many in corymbose racemes. Sepals oblong or elliptic, ca 3 x 2 mm, with 3 - 4 veins converging below the apex. Petals pink, ca 6 x 4 mm. Pods ca 5 mm long.

Fl. & Fr. June - July.

Distrib. India: Shaded streamsides, 2300 - 3000 m. Arunachal Pradesh.



Fig. 21. *Cardamine macrophylla* Willd. : a. twig; b. flower.

Bhutan.

11. *Cardamine trichocarpa* Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 18. 1847. *C. subumbellata* Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872.

Herbs, perennial or annual, slender, diffuse, up to 30 cm high, young parts with spreading hairs. Leaves 4 - 7 cm long; petioles 0.6 - 2.2 cm long; leaflets 5 - 7, ovate or suborbicular, irregularly crenate or lobed, subsessile, 2 - 2.5 x 0.8 - 1.2 cm, sparingly hairy. Inflorescence corymbose, few-flowered. Flowers yellowish white, ca 2 mm across; pedicels slender, ca 2 mm long. Sepals 4, oblong, obtuse at apex, ca 1.5 mm long, purplish, with long bristly hairs. Petals oblong, ca 2 mm long, yellowish white. Stamens 4, filaments up to 1.5 mm long. Ovary linear-elongate; style short; stigma globose. Fruits linear-lanceolate, compressed, 0.8 - 2.5 cm long, pubescent. Seeds 6 - 10, suborbicular to broadly oblong.

Fl. & Fr. (Jan.-) July - Sept.

Distrib. India: Moist shaded places above 1200 m. Maharashtra, Karnataka and Tamil Nadu.

Sri Lanka.

12. *Cardamine trifoliolata* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 145. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872.

Herbs, succulent, up to 45 cm high, simple or branched at base with creeping rootstocks. Leaves trifoliolate; petioles 0.8 - 8 cm long; leaflets oblanceolate to usually obovate; terminal ones often 3-lobed; lateral ones narrowly ovate or oblong, bilobed, rarely entire; lobes rounded or obtusely pointed at apex, sparsely hairy above, glabrous beneath. Racemes subcorymbose, short, few-flowered. Flowers pale-lilac, ca 8 mm across; pedicels ca 5 mm long. Sepals oblong, obovate, 2 - 4 mm long. Petals obovate-cuneate, rarely clawed, subtruncate at apex, 5 - 8 mm long. Inner stamens ca 5 mm long, outer ca 3 mm long. Ovary 8 - 12-ovuled; style thick; stigma subulate or globose. Fruits erect, 12 - 20 mm long, ca 1 mm thick. Seeds minute, ovoid, ca 1 mm across.

Fl. & Fr. April - July.

Distrib. India: 2500 - 4000 m. Uttar Pradesh, West Bengal and Sikkim.

Nepal and Bhutan.

13. *Cardamine violacea* (D. Don) Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 144. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 137. 1872. *Erysimum violaceum* D. Don, Prodr. Fl. Nep. 202. 1825.

Herbs, perennial; stems simple, erect, up to 50 cm high. Leaves narrowly ovate, lanceolate or oblanceolate, sessile and half-amplexicaul at base with sagittate auricles, dentate along margins, acuminate at apex, 3 - 15 x 0.8 - 2 cm, sparsely puberulous. Racemes 5 - 12-flowered. Flowers deep violet, pedicellate, 1.5 - 2.5 cm across; pedicels 8 - 12 mm long. Sepals ovate-oblong, subacute, hyaline along margins, ca 8 mm long, 5-nerved. Petals obovate-cuneate, submarginate at apex, ca 10 x 4 mm, purple. Stamens linear, ca 11 mm long, outer ca 9 mm long; anthers oblong, ca 2 mm long; glands distinct. Style elongate, ca 6 mm long; stigma broad. Fruits borne on thickened pedicels, 2 - 6 cm long, ca 2 mm thick. Seeds ovate or oblong, 2 - 3 mm long, brown.

Fl. & Fr. May - June.

Distrib. India: Streamsides and open forest edges, 2500 - 3600 m. Sikkim.

Nepal and Bhutan.

14. *Cardamine yunnanensis* Franchet in Bull. Soc. Bot. Fr. 33: 398. 1886. *C. hirsuta* var. *oxycarpa* Hook. f. & T. Anderson in Fl. Brit. India 1: 138. 1872, p. p. *C. inayatii* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1069. 1927. *C. sikkimensis* Hara in J. Jap. Bot. 37: 97. 1962.

Stems up to 35 cm long. Leaves (including petiole) 5 - 9 cm long, sparsely pubescent; lateral leaflets 2 - 3 pairs, ovate, crenately toothed along margins, obtuse at apex, 1 - 2.5 x 0.75 - 1.5 cm; terminal leaflets larger, up to 5.5 x 2.5 cm. Flowers few, white or pink. Sepals oblong-ovate, 2.5 - 3 x 1.5 mm. Petals obovate, cuneate at base, ca 4 x 2 mm. Fruits 2.5 - 3 cm long.

Fl. & Fr. May - Sept.

Distrib. India: Moist shaded places, 2000 - 2700 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Tamil Nadu.

Nepal, Bhutan and W. China.

8. *Christolea* Cambess.

Herbs, tufted, perennial, rhizomatous, suberect or procumbent, pilose or rarely glabrous. Leaves obovate or spatulate, toothed or lobulate above, sessile or subsessile; radical leaves rosulate. Racemes usually many-flowered; bracts linear. Flowers white or purplish, rarely mauve or yellowish. Sepals oblong, obtuse, inner pair sometimes pouched. Petals spatulate or obovate. Stamens 6. Ovary linear or elliptic-ovate, few to many ovuled; stigma usually depressed. Fruits oblong, cylindrical. Seeds 12 - 15, 1 - 2-seriate.

Central Asia, China (Tibet) and Himalayas; about 20 species, 7 in India.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Racemes ca 3-flowered | 5. <i>C. pumila</i> |
| b. Racemes 6 - 25-flowered | 2 |
| 2a. Pedicels ca 6 mm long in fruit | 3 |
| b. Pedicels 8 - 10 mm long in fruit | 4 |
| 3a. Fruits ca 20 mm long, 5 - 8 mm broad | 3. <i>C. lanuginosa</i> |
| b. Fruits 25 - 35 mm long, 2 - 4 cm broad | 7. <i>C. stewartii</i> |
| 4a. Leaves spatulate-orbicular to more or less orbicular, usually with 8 - 10 marginal lobules or blunt teeth | 6. <i>C. scaposa</i> |
| b. Leaves spatulate-ovate to obovate-oblong or narrowly spatulate, usually up to 3-toothed | 5 |
| 5a. Fruits linear, ca 1 mm broad; ovules ca 8 in each locule | 4. <i>C. parkeri</i> |
| b. Fruits oblong-obovate or oblong, 2 - 4 mm broad; ovules many in each locule | 6 |
| 6a. Plants usually more than 15 cm long; leaves broad, up to 2 cm wide | 1. <i>C. crassifolia</i> |
| b. Plants up to 15 cm long; leaves narrow, up to 1 cm wide | 2. <i>C. himalayensis</i> |

1. *Christolea crassifolia* Cambess. in Jacquem. Voy. 4 (Bot.) 17: t. 17. 1835; Hook. f. & T. Anderson in Fl. Brit. India 1: 154. 1872.

Herbs, suberect, much-branched, up to 40 cm high, usually densely villous. Leaves cuneate-obovate, acute or obtuse and deeply toothed towards apex, 1 - 5 x 0.5 - 2 cm. Racemes 10 - 20-flowered, up to ca 7 cm long in fruit. Flowers white with lilac or purple base, ca 6 mm across; pedicels ca 1 cm long in fruit. Sepals ca 3 mm long. Petals ca 6 mm long. Stamens ca 3.5 mm long. Stigma depressed, subsessile. Fruits oblong-obovate, erect, flat, acute at both ends, 1 - 3.5 cm long, ca 4 mm broad, nearly glabrous or hairy; valves with a distinct midvein. Seeds 5 - 10 in each locule, flattened.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan, China (Tibet) and C. Asia.

2. *Christolea himalayensis* (Cambess.) Jafri in Notes R. Bot. Gard. Edinb. 22: 3. f. 1, F. 1955. *Cheiranthus himalayensis* Cambess. in Jacquem., Voy. Bot. 14. 1844; Hook. f. & T. Anderson in Fl. Brit. India 1: 132. 1872. *C. himalaicus* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 137. 1861. *Ermania himalayensis* (Cambess.) O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1080. 1927.

Herbs, densely greyish pilose; rootstock much-divided; stems suberect, leafy, 3 - 15 cm long. Leaves obovate or spatulate-obovate, subfleshy, cuneate at base, 3 - 5-toothed above, 7 - 15 x 3 - 8 mm. Flowers ca 5 mm across in terminal dense racemose heads,

violet or purplish, fragrant; pedicels ca 1 cm long in fruit, pilose. Sepals ca 3 mm long, usually tinged dark purple. Petals ca 4 mm long, purplish, distinctly veined. Stamens ca 3 mm long. Ovary ca 4 mm long; stigma stout, bilobed. Fruits oblong, compressed, 2 - 3.5 cm long; valves with thickened margins. Seeds many, partially 2-seriate.

Fl. & Fr. June - July.

Distrib. India: 4000 - 5600 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan, Bhutan, Afghanistan and China (W. Tibet).

3. *Christolea lanuginosa* (Hook. f. & Thomson) Ovcz. in Sov. Etsk. Bot. 151. 1941. *Parrya lanuginosa* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 136. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 132. 1872.

Herbs, low, densely woolly. Leaves spatulate, coarsely toothed towards apex, 0.6 - 1.5 x 0.2 - 0.5 cm. Racemes scapose, 8 - 12-flowered, ca 5 mm long. Flowers ca 5 mm across; pedicels ca 5 mm long in fruit. Sepals spreading, ca 3 mm long, woolly. Petals broadly spatulate, undulate, ca 5 mm long. Stamens ca 4 mm long. Fruits flattened, acute, ca 1.8 cm long; valves with distinct mid-vein. Seeds not winged, 4 - 6 in each locule.

Fl. & Fr. June - July.

Distrib. India: Himalayas at 5000 m and above. Jammu & Kashmir (Ladakh).

China (S.W. Tibet).

4. *Christolea parkeri* (O. Schulz) Jafri in Notes R. Bot. Gard. Edinb. 22: 52. 1955. *Ermania parkeri* O. Schulz in Fedde, Repert. Spec. Nov. 31: 333. 1933.

Herbs, erect or suberect, up to 10 cm high, hairy. Basal leaves narrowly spatulate, rounded or 1 - 3-dentate at apex, 1 - 1.5 x 0.3 - 0.5 cm; upper leaves oblanceolate to linear. Racemes 10 - 15-flowered, bracteate. Flowers white with purple tinge at base, ca 5 mm across; pedicels ca 8 mm long in fruit. Sepals ca 3 mm long. Petals 5 - 8 mm long. Stamens ca 3 mm long. Stigma depressed, shortly bilobed. Fruits linear, ca 10 x 1 mm, pilose. Seeds ca 8 in each locule.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Nepal.

5. *Christolea pumila* (Kurz) Jafri in Fl. W. Pakistan 55: 157. 1973. *Parrya pumila* Kurz in Flora 55, 18: 285. 1872. *Ermania koelzii* O. Schulz in Fedde, Repert. Spec. Nov. 31: 332. 1933. *Vyedenskiella pumila* (Kurz) Botsch. in Nov. Syst. Leningrad 17: 176. 1955.

Leaves spatulate, almost entire or obscurely 1-3-toothed above, as long or slightly exceeding the inflorescence. Racemes ca 3-flowered. Sepals 4-5 mm long. Petals ca 9 mm long. Fruits oblong-obovate, short, flattened with pilose margins; style ca 1 mm long, somewhat broad.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan.

6. *Christolea scaposa* Jafri in Notes R. Bot. Gard. Edinb. 22: 38, f. 2. 1955. *Ermania scaposa* (Jafri) Botsch. in Bot. J. U.R.S.S. 41: 731. 1956.

Herbs, up to 10 cm high, densely pilose, hairs usually simple. Basal leaves orbicular, with blunt teeth, subcoriaceous, 5-15 mm broad, pilose. Racemes ca 20-flowered, ebracteate, erect-ascending, up to 1 cm long in fruit, pilose. Sepals 3-4 mm long. Petals 5-6 x 2 mm. Stamens 3.5-4.5 cm long. Fruits oblong-linear, compressed, ca 1.2 cm long, pilose; valves with a distinct mid-vein. Seeds biseriate.

Fl. & Fr. June - July.

Distrib. India: Kashmir.

Endemic.

7. *Christolea stewartii* (T. Anderson) Jafri in Notes R. Bot. Gard. Edinb. 22(1): 53. f. I, E. 1955. *Cheiranthus stewartii* T. Anderson in Hook. f., Fl. Brit. India 1: 132. 1872. *Ermania stewartii* (T. Anderson) O. Schulz in Bot. Jahrb. 66: 98. 1933.

Stems slender, erect, up to 15 cm high. Basal leaves spatulate, subcoriaceous, toothed at tip, 1.2-2.5 x 0.5-1 cm, woolly; upper linear, entire, smaller. Racemes 6-12-flowered, bracteate, up to 7.5 cm long in fruit. Flowers ca 5 mm across, purple; pedicels ca 5 mm long in fruit. Sepals oblong, ca 2 mm long. Petals broadly spatulate, ca 5 mm long. Stamens ca 2 mm long. Stigma sessile. Fruits linear, tapering at both ends, 2.5-3.5 cm long, ca 4 mm broad; valves flat. Seeds small, ovate-oblong, somewhat 2-seriate.

Fl. & Fr. July - Aug.

Distrib. India: Alpine W. Himalayas, 4500 - 5500 m. Jammu & Kashmir and Himachal Pradesh.

Endemic.

9. *Dontostemon* Andr. ex Ledeb., nom. cons.

Herbs, annual, caespitose or subprostrate, branched, with simple or branched glandular hairs. Leaves linear or spathulate, sinuate-toothed, pinnatifid or entire; lower stalked; upper sessile or subsessile. Racemes ebracteate. Flowers white to lilac; pedicels flexuous in fruit, glandular. Sepals erect, slightly saccate at base. Petals spathulate, nearly twice as long as sepals. Stamens 6; filaments often dentate-appendaged; anthers short, blunt. Lateral nectar glands present in pairs. Ovary cylindrical or linear, many-ovuled; style short with broad depressed capitate stigma. Fruits linear to cylindrical, bilocular, dehiscent. Seeds uniserial.

Mostly in C. Asia; about 10 species, 2 in India.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1a. Leaves narrowly spathulate or linear; filaments not dentate | 1. <i>D. glandulosus</i> |
| b. Leaves pectinate; filaments dentate | 2. <i>D. pectinatus</i> |

1. *Dontostemon glandulosus* (Karelin & Kir.) O. Schulz in Notizbl. Bot. Gart. Berlin 10: 554. 1929. *Arabis glandulosa* Karelin & Kir. in Bull. Soc. Nat. Mosc. 15: 146. 1842; Hook. f. & T. Anderson in Fl. Brit. India 1: 136. 1872.

Herbs, erect to suberect, spreading or prostrate, up to 15 cm high. Basal leaves rosulate, elliptic-lanceolate to narrowly spathulate, entire to sinuate-toothed, petioled, 10 - 20 x 3 - 5 mm; segments linear, 2 - 3 mm broad; upper leaves linear, entire, sessile, 5 - 10 mm long. Racemes 10 - 30-flowered, up to 7 cm long in fruit. Flowers 2 - 4 mm across, pinkish-white to white; pedicels up to 7 mm long in fruit, glandular. Sepals oblong, 2 - 3 mm long, ca 0.5 mm broad, sparsely hairy. Petals subrounded at apex, 3 - 5 x 1 - 2 mm, pink or white. Stamens up to 3 mm long; anthers ca 0.5 mm long. Fruits linear, subtorulose, glandular, 1.5 - 2.5 cm long, ca 1 mm thick; valves concave, veined, with faint midrib. Seeds 10 - 15 in each locule, oblong-ellipsoid, slightly flattened, brown.

Fl. & Fr. May - July.

Distrib. India: 3500 - 5500 m. Jammu & Kashmir and Sikkim.

Pakistan, Bhutan and W. China.

2. *Dontostemon pectinatus* (DC.) Ledeb., Fl. Ross. 1: 175. 1841. *Sisymbrium pectinatum* DC., Syst. Nat. 2: 485. 1821.

Herbs, erect. Leaves pectinate. Flowers white. Staminal filaments dentate.

Fl. & Fr. June - Aug.

Distrib. India: Uttar Pradesh.

Pakistan, Nepal, China and Russia (E. Siberia).

10. *Drabopsis* C. Koch

Monotypic; description and distribution as for the species below.

Drabopsis verna C. Koch in Linnaea 15: 253. 1841. *Arabis nuda* Bel. ex Boiss. in Ann. Sci. Nat. ser. 2, 17: 54. 1842; Hook. f. & T. Anderson in Fl. Brit. India 1: 137. 1872. *Arabis scapigera* Boiss., l. c. *Sisymbrium nudum* (Bel. ex Boiss.) Boiss., Fl. Orient. 1: 214. 1867. *Arabidopsis nuda* (Bel. ex Boiss.) Bornm. in Beih. Bot. Centrbl. 28(2): 535. 1911.

Herbs, annual, up to 12 cm high. Leaves radical, obovate-oblong, sessile or subsessile, entire or toothed, 0.5 - 1.5 x 0.2 - 0.5 cm, slightly hairy. Scapes several, erect, rigid, many-flowered, 2.5 - 12.5 cm long, glabrous or slightly hairy at base. Flowers ca 3 mm across; pedicels ca 4 mm long in fruit. Sepals equal, obtuse at apex, ca 3 mm long, green, glabrous. Petals ca 4 mm long. Stamens ca 2 mm long. Middle nectar glands absent or rudimentary. Stigma minute. Fruits on very short thick pedicels, straight or curved above, linear, much flattened, obtuse at apex, 2.5 - 3.5 cm long; valves with a distant midrib and prominent veins. Seeds 7 - 12 in each locule; cotyledons incumbent.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir.

Pakistan, Turkey and Central Asia.

11. *Loxostemon* Hook. f. & Thomson

Monotypic; description and distribution as for the species below.

Loxostemon pulchellus Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 147. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 139. 1872.

Herbs, annual or perennial, with thin bulbiferous rhizomes; stems slender, filiform, flexuous, 5 - 25 cm high; bulbils in a cluster, ovoid, ca 2 x 1 mm at base. Leaves 3 - 5-foliolate, simple hairy; petioles 3 - 8 mm long; leaflets elliptic, oblanceolate or linear, acute at apex, entire, ciliate, 4 - 8 x 1 - 3 mm, subsessile. Corymbs 3 - 6-flowered, ebracteate; flowers small, lilac; pedicels 5 - 10 mm long. Sepals spreading, ovate, ca 2 x 1 mm. Petals obovate to broadly spatulate, clawed at base, ca 4 x 3 mm, pink. Filaments broad and toothed above. Stigma sessile, 2-lobed. Fruits linear to ovoid, 5 - 6 mm long.

Fl. & Fr. June - July.

Distrib. India: Rocky places, 4000 - 4200 m. West Bengal and Sikkim.

Nepal, Bhutan and China.

12. *Nasturtium* R. Br., nom. cons.

Herbs, terrestrial or aquatic, branched, glabrous or hairy. Leaves entire, lobed or pinnate. Racemes lax in fruit, ebracteate. Flowers small, white. Sepals short. Petals spatulate. Stamens 6. Ovary oblong, many ovuled. Fruits subcylindrical, bilocular, dehiscent; valves membranous, faintly 1-nerved, glabrous. Seeds 1 - 2-seriate.

Widespread in the Northern Hemisphere; 2 species, both in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Fruits ca 1 mm broad; seeds uniseriate | 1. <i>N. microphyllum</i> |
| b. Fruits ca 2 mm broad; seeds biseriata | 2. <i>N. officinale</i> |

1. *Nasturtium microphyllum* Boenn. ex Reichb., Fl. Ger. Exc. 683. 1832; Jafri in Fl. W. Pakistan 55: 185. 1973.

Herbs, procumbent or erect, up to 75 cm high. Leaves lyrate-pinnate, lower stalked with 5 - 7 leaflets; upper sessile with 5 - 9 leaflets. Inflorescence up to 23 cm long in fruit. Flowers ca 5 mm across, white; pedicels spreading, ca 2 cm long. Fruits slender, 1.5 - 2 cm long, ca 1 mm broad; valves smooth, glabrous. Seeds uniseriate, each side with ca 100 depressions.

Fl. & Fr. April - July.

Distrib. India: Himachal Pradesh and Uttar Pradesh.

Pakistan, C. Europe, W. Asia, Africa and America.

2. *Nasturtium officinale* R. Br. in Aiton, Hort. Kew. ed. 2, 4: 110. 1812; Hook. f. & T. Anderson in Fl. Brit. India 1: 133. 1872. *Sisymbrium nasturtium-aquaticum* L., Sp. Pl. 657. 1753. *Rorippa nasturtium-aquaticum* (L.) Hayek, Sched. Fl. Stir. Exs. 3-4: 22. 1905.

Eng.: *Water-cress*.

Herbs, perennial; stems much-branched, creeping or floating, rooting below at nodes, usually up to 40 cm long, rarely up to 100 cm long. Leaves lyrate-pinnate, 1 - 12 cm long; lower with 1 - 7 leaflets, petioled; upper with 5 - 9 leaflets; terminal leaflets suborbicular or broadly ovate-cordate, acute or obtuse, 5 - 20 x 5 - 15 mm; lateral leaflets elliptic, entire or sinuate-toothed, 3 - 20 x 2 - 10 mm. Racemes 5 - 20-flowered, 4 - 10 cm long. Flowers ca 3 mm across, white; pedicels up to 1 cm long in fruit. Sepals oblong, 1 - 2 mm long, ca 1 mm wide. Petals obovate, 3 - 5 mm long, ca 2 mm wide. Stamens 6, ca 3 mm long. Fruits spreading, slightly upcurved, 0.8 - 2.5 cm long, on 6 - 12 mm long pedicels. Seeds 2-seriate, ovoid-rounded, lenticular, 0.7 - 1 x 0.5 mm, red, muriculate.

Fl. & Fr. March - July.

Distrib. India: Throughout, up to 3000 m, mostly along water courses.

Temperate and subtropical Africa, Asia and Europe.

Notes. Eaten as salad.

13. *Pegaeophyton* Hayek & Hand.-Mazz.

Herbs, perennial with thick or thin rootstocks, glabrous or with simple hairs. Leaves rosulate, spatulate, linear-lanceolate, obovate or ovate. Flowers solitary on slender scapes, variable in size, white or purplish. Sepals spreading, rounded at apex, not pouched at base. Petals about twice as long as sepals with broad limb. Stamens 6. Ovary narrowly ovoid, glabrous, ca 10-ovuled; stigma sessile or subsessile. Fruits ovoid, ellipsoid or suborbicular; valves with faint midrib and veins; septum incomplete. Seeds biseriate, few.

C. Asia and Himalayas; 3 species, 2 in India.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1a. Rootstock slender, ca 1 mm thick; scapes minutely pubescent on one side | 1. <i>P. minutum</i> |
| b. Rootstock stout, ca 10 mm thick; scapes glabrous | 2. <i>P. scapiflorum</i> |

1. *Pegaeophyton minutum* Hara in J. Jap. Bot. 47: 270. 1972; Grierson in Grierson & Long, Fl. Bhutan 1(2): 433. 1984.

Rootstock slender, ca 1 mm thick, branching. Leaves obovate, spatulate, ovate or linear, 1 - 4 x 1 - 2 mm; petioles up to 2 cm long. Scapes minutely pubescent, up to 2.5 cm long. Sepals white or purplish, ca 2 x 1 mm. Fruits ellipsoid, up to 1.5 cm long; style 1 - 2 mm long.

Fl. & Fr. May - Aug.

Distrib. India: 3900 - 4900 m. Sikkim.

Nepal, Bhutan and China (S. Tibet).

2. *Pegaeophyton scapiflorum* (Hook. f. & Thomson) Marquand & Shaw in *J. Linn. Soc., Bot.* 48: 229. 1929. *Cochlearia scapiflora* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 154. 1861; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 145. 1872.

Rootstock branching above, ca 10 mm thick; aerial stem absent. Leaves spatulate or linear-lanceolate, tapering at base into a long flat petiole, entire or with a few broad sharp teeth along margins, rounded, obtuse or acute at apex, 1 - 7 x 0.1 - 0.6 cm, glabrous or sparsely hairy. Flowers ca 5 mm across. Sepals ca 3 x 2 mm. Petals 3 - 6 x 2 - 4 mm. Stamens ca 3.5 mm long. Fruits ellipsoid-oblong, slightly compressed, unilocular, 6 - 10 x 3 - 8 mm, glabrous. Seeds small, few.

Fl. & Fr. May - Aug.

Distrib. India: Alpine streamsides, 3900 - 4900 m. Jammu & Kashmir and Sikkim.

Nepal and Bhutan.

14. *Phaeonychium* O. Schulz

Herbs, perennial with woody rootstocks; stems densely hairy. Leaves in basal rosette, oblong-linear or spatulate-oblong, entire or minutely dentate above, bearing stellately branched hairs. Flowers several or few, on ebracteate scapes, white or with lilac tinge. Sepals erect or somewhat spreading. Petals obovate, clawed, about twice as long as sepals. Stamens 6. Lateral nectar glands horse-shoe shaped. Ovary oblong-linear, 3 - 7-ovuled in each locule, densely hairy. Fruits linear-elliptic, compressed, bilocular. Seeds 3 - 6, irregularly 1-seriate.

Himalayas, Pamir-Altai and Afghanistan; 3 species, 2 in India.

KEY TO THE SPECIES

- 1a. Basal leaves 1 - 2 cm long
b. Basal leaves 5 - 8 cm long

1. *P. albiflorum*
2. *P. parryoides*

1. *Phaeonychium albiflorum* (T. Anderson) Jafri in Fl. W. Pakistan 55: 162. 1973. *Cheiranthus albiflorus* T. Anderson in Hook. f., Fl. Brit. India 1: 133. 1872. *Ermania albiflora* (T. Anderson) O. Schulz in Bot. Jahrb. 66: 98. 1933. *Christolea albiflora* (T. Anderson) Jafri in Notes R. Bot. Gard. Edinb. 22: 52. 1955.

Herbs, minutely tomentose, hoary, up to 8 cm high. Basal leaves linear-lanceolate or subspathulate, entire or sub-lobed, 1 - 2 cm long, ca 3 mm broad; cauline ones linear-lanceolate, entire or rarely toothed. Racemes 10 - 12-flowered. Flowers white, ca 5 mm across; pedicels ca 5 mm long in fruit. Sepals linear, ca 2 mm long, tomentose. Petals spathulate, obtuse or slightly retuse at apex, ca 7 mm long. Stamens ca 3 mm long. Style short, glabrous, with sub-bilobed stigma. Fruits ca 5 mm long when young, densely pubescent.

Fl. & Fr. June - July.

Distrib. India: 3600 - 5300 m. Jammu & Kashmir.

China (W. Tibet).

2. *Phaeonychium parryoides* (Hook. f. & T. Anderson) O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1092. 1927. *Cheiranthus parryoides* Hook. f. & T. Anderson in Hook. f., Fl. Brit. India 1: 132. 1872.

Herbs, erect or suberect; rootstock up to 15 mm thick, densely covered with withered petiole bases; stems 5 - 15 cm long, white pubescent. Basal leaves linear-oblong to elliptic, entire, attenuate at base, acute or rounded at apex, 5 - 8 x 0.4 - 2.6 cm, densely tomentose. Racemes many-flowered, lax, up to 22 cm long in fruit. Flowers white or mauve with lilac base, ca 6 mm across; pedicels erect, 1.5 - 2.5 cm long in fruit, tomentose. Sepals elliptic, 3.5 - 4 x 1 - 1.5 mm, pubescent. Petals 7 - 8 x 3 - 4 mm, white with dark purple claw. Stamens ca 5 mm long. Style ca 1 mm long with bilobed stigma. Fruits linear, flattened, ca 2 cm long, stellately ca 2 mm thick, grey-pubescent; valve with a distinct midvein.

Fl. & Fr. June - July.

Distrib. India: Rocky cliffs, 3000 - 3700 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, Bhutan and China (W. Tibet).

15. *Rorippa* Scop.

Herbs, annual or perennial, erect, branching, glabrous or with simple hairs; taproot slender. Leaves simple to deeply lyrate-pinnate, glabrous or sparsely pilose. Flowers in

bracteate or ebracteate racemes, yellow. Sepals scarcely saccate at base; inner sepals pouched at base. Petals yellow, as long as or longer than sepals or absent. Stamens 6 or sometimes 4. Ovary oblong to suborbicular, many-ovuled; stigma slightly bilobed. Fruits linear, cylindrical or ellipsoid, bilocular, dehiscent; valves with indistinct midrib; style short; stigma rounded. Seeds suborbicular, few to numerous, more or less biseriate, reddish-brown.

Mostly in northern temperate zone; about 90 species, 7 in India.

Notes. Sometimes considered congeneric with *Nasturtium* R. Br. In that case the correct name for the combined genus would be *Rorippa* Scop.

KEY TO THE SPECIES

- | | |
|--|-------------------------------|
| 1a. Mature fruits up to 10 mm long, 2 - 2.5 mm broad | 6. <i>R. palustris</i> |
| b. Mature fruits usually 10 - 35 mm long, 1 - 1.5 mm broad | 2 |
| 2a. Flowers bracteate | 1. <i>R. benghalensis</i> |
| b. Flowers usually ebracteate | 3 |
| 3a. Petals much longer than sepals | 7. <i>R. sylvestris</i> |
| b. Petals more or less equalling the sepals or absent | 4 |
| 4a. Mature fruits 1 - 2 cm long | 5 |
| b. Mature fruits 2.5 - 3.5 cm long | 6 |
| 5a. Pedicels ca 3 mm long in fruit | 4. <i>R. madagascariensis</i> |
| b. Pedicels 5 - 7 mm long in fruit | 3. <i>R. indica</i> |
| 6a. Petals always present | 5. <i>R. montana</i> |
| b. Petals usually absent | 2. <i>R. dubia</i> |

1. *Rorippa benghalensis* (DC.) Hara in J. Jap. Bot. 49: 132. 1974. *Nasturtium benghalensis* DC., Syst. Nat. 2: 198. 1821. *N. indicum* (L.) DC. var. *benghalensis* (DC.) Hook. f. & T. Anderson in Fl. Brit. India 1: 134. 1872. *R. indica* (L.) Hiern var. *benghalensis* (DC.) Deb in Taxon 14: 111. 1965.

Beng.: *Bil-rai*.

Herbs, 15 - 25 cm high, branched. Lower leaves pinnatifid, petioled; upper coarsely toothed, sessile. Racemes many-flowered, bracteate; bracts linear-lanceolate, leaf-like, variously toothed or entire, sessile, 0.5 - 2 cm long. Fruits 1 - 1.5 cm long, 1 - 1.5 mm thick, on 3 - 7 mm long pedicels.

Fl. & Fr. March - May.

Distrib. India: 270 - 600 m. West Bengal, Sikkim, Assam and Meghalaya.

Nepal, Bangladesh, Myanmar, Indo-China and Java.

2. *Rorippa dubia* (Pers.) Hara in J. Jap. Bot. 30: 196. 1955. *Sisymbrium dubium* Pers., Synop. Pl. 2: 199. 1806. *Nasturtium indicum* auct. non (L.) DC. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 132. 1872, p. p.

Herbs, annual or biennial, slender, up to 20 cm tall, creeping at base, usually glabrous, young parts hairy. Leaves serrate-dentate, 2-7 x 1-2.5 cm; basal leaves densely crowded, lyrate-pinnatifid, long-petioled; upper ones obovate-oblong, entire or irregularly serrate-dentate, sessile or subsessile. Racemes 6-10 cm long; pedicels erect or erecto-patent, ca 2 mm long (3-4 mm long in fruit). Sepals erect, ca 2 mm long, green. Petals often absent. Stamens ca 2 mm long. Stigma subsessile. Pods thin, straight or slightly curved, 2.5-3 cm long, 0.6-0.8 mm thick; pedicels 4-8 mm long. Seeds uniseriate.

Fl. & Fr. Nov. - May (-July).

Distrib. India: Humid stony localities, up to 1500 m. Uttar Pradesh and Sikkim.

Nepal, Bhutan, China, Japan, Malaysia and Indonesia.

3. *Rorippa indica* (L.) Hieron, Cat. Afr. Pl. Welw. 1: 26. add. et corr. 1896 et 2: 481, errata 1899. *Sisymbrium indicum* L., Mant. Pl. 1: 93. 1767. *Nasturtium indicum* (L.) DC., Syst. Nat. 2: 199. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 134. 1872.

Fig. 22.

Tam.: *Kattu-kadugu*.

Herbs, annual, erect, slender, simple or branched, up to 60 cm high, glabrous or hairy. Lower leaves deeply lyrate-pinnatifid to pinnatifid with 1-4 segments on either side, 6-10 x 2.5 cm; upper ones sessile, ovate-lanceolate to lanceolate-oblong, entire, lyrate-pinnatifid or dentate above base. Racemes terminal, 7-30 cm long, many-flowered. Flowers bright yellow, ca 2.5 mm across; pedicels 5-7 mm long in fruit. Sepals 2-3 mm long. Petals 3-4 mm long. Stamens ca 2 mm long. Stigma subsessile. Fruits on patent or erecto-patent 4-8 mm long stalks, slightly curved, beaked, 10-20 x 1.5 mm. Seeds biseriate or sub-biseriate, minute, rugose, spherical, red-brown.

Fl. & Fr. April - June (Aug. - Jan.)

Distrib. India: Mostly along agricultural fields, roadsides and streamsides, up to 2000 m. Throughout India.

Pakistan, Sri Lanka, China, S.E. Asia and Africa.

4. *Rorippa madagascariensis* (DC.) Hara in J. Jap. Bot. 30: 198. 1955. *Nasturtium madagascariensis* DC., Syst. Nat. 2: 192. 1821. *N. indicum* auct. non (L.) DC.; Hook.



Fig. 22. *Rorippa indica* (L.) Hiern : a. plant; b. flower; c. flower with perianth removed; d. stamen; e. ovary; f. fruit; g. seeds attached to septum; h. seed.

f. & T. Anderson in FL. Brit. India 1: 134. 1872. *Rorippa pseudoislandica* H. J. Chowdhery & R. R. Rao in Indian J. For. 8: 150. 1985.

Herbs, glabrous, up to 35 cm high. Leaves sessile, obovate, oblong, deeply pinnatifid, auriculate-amplexicaul at base, toothed along margins, 5 - 12 cm long, sparsely hairy. Flowers yellow, small; pedicels up to 3 mm long in fruit. Sepals oblong, 1.5 - 2 x 1 mm. Petals narrowly oblong, 2 - 2.5 x 0.7 - 0.8 mm. Stamens 6; filaments 1.6 - 2 mm long; anthers ca 0.5 mm long. Ovary ellipsoid, 1.5 x 0.8 mm with a stout style and capitate stigma. Fruits cylindric, glabrous, upcurved, 7 - 14 x 1 - 2 mm, on 2 - 4 mm long pedicels and up to 1 mm long persistent style. Seeds 2-seriate, lenticular, ca 0.7 mm in diam.

Fl. & Fr. Feb. - May.

Distrib. India: 200 - 2400 m. Orissa, Andhra Pradesh and Tamil Nadu.

Bhutan, Pakistan, tropical Africa and Madagascar.

5. *Rorippa montana* (Hook. f. & Thomson) Small, Fl. SE. United States, ed. 2: 1336. 1913. *Nasturtium montanum* Hook. f. & Thomson in J. Proc. Linn. Soc., Bot. 5: 139. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 134. 1872

Herbs, erect, up to 45 cm high, usually glabrous or sometimes slightly villous. Basal leaves petiolate, obovate-oblong, sinuate-pinnatifid, 4 - 10 x 1 - 3 cm; upper leaves very variable, ovate, entire or minutely toothed, sessile or subsessile, 1 - 6 x 0.5 - 2 cm. Racemes 8 - 15-flowered, up to 10 cm long. Flowers small; pedicels spreading, ca 5 mm long. Petals almost equalling sepals. Fruits slender, cylindric, not beaked, 2.5 - 3.5 cm long. Seeds 60 - 80, uniseriate, pitted, brown.

Fl. & Fr. Dec. - March.

Distrib. India: Weed in wet and shaded places in cultivated fields. Himachal Pradesh, Rajasthan, Uttar Pradesh, West Bengal, Sikkim, Nagaland, Meghalaya and Maharashtra.

Pakistan, Myanmar, Java, China and E. Asia.

6. *Rorippa palustris* (L.) Besser, Enum. Pl. Volhyn. 27. 1822. *Sisymbrium amphibium* L. var. *palustre* L., Sp. Pl. 657. 1753. *Rorippa islandica* auct. non (Deder) Borbas 1900. *Nasturtium palustre* (L.) DC., Syst. Nat. 2: 191. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 133. 1872.

Herbs, annual or biennial, up to 80 cm high, suberect to ascending, glabrous or with a few simple hairs. Leaves lyrate-pinnatifid or toothed, 5 - 18 x 1 - 5 cm; lateral segments 3 - 5-jugate, oblong, elliptic; terminal segments ovate, obtuse at apex, crenately sinuate-

toothed at margins, glabrous. Racemes ebracteate, 10 - 30-flowered, up to 25 cm long in fruit. Flowers ca 2 mm across; pedicels horizontal, ca 1 cm long in fruit. Sepals erecto-patent, ovate, 2 - 2.5 mm long, green or yellowish. Petals spatulate, 2 - 2.5 x 0.5 - 1.5 cm, yellow. Filaments dilated at base, ca 2 mm long. Fruits oblong, slightly curved when ripe, 5 - 10 x 2 - 2.5 mm; valves convex, glabrous. Seeds crowded, 2-seriate, many, suborbicular, not winged, ca 0.5 mm in diam., pale brown.

Fl. & Fr. April - July.

Distrib. India: Humid marshy localities, 2000 - 3300 m. Jammu & Kashmir, Himachal Pradesh, Bihar, West Bengal and Assam.

Europe and temperate Asia.

Notes. Naqshi & Javeid (in *Geobios* 3: 165 - 166. 1976) discuss the nomenclature of this species.

7. *Rorippa sylvestris* (L.) Besser, Enum. Pl. Volhyn 27. 1822; Javeid in Indian For. 99: 629. 1973. *Sisymbrium sylvestre* L., Sp. Pl. 657. 1753. *Nasturtium sylvestre* (L.) R. Br. in Aiton, Hort. Kew. ed.2. 4: 110. 1812.

Herbs, perennial, stoloniferous, erect or decumbent, 15 - 45 cm high, more or less glabrous. Leaves pinnate or pinnatifid, 3 - 10 cm long; lower petiolate, upper sessile or sessile; lobes obovate to oblong, cuneate at base, sinuate-toothed or subentire, rounded at apex. Racemes (10-) 25 - 50-flowered, up to 15 cm long in fruit. Flowers 5 - 8 mm across. Sepals spreading or suberect, ca 2 mm long. Petals ovate, ca 5 mm long, yellow. Stamens ca 3 mm long. Fruits linear-oblong to cylindrical, slightly curved, 1 - 1.6 cm long, glabrous. Seeds many, biseriate.

Fl. & Fr. May - Aug.

Distrib. India: Common in waste places in Srinagar. Jammu & Kashmir.

Eurasia.

16. *Turritis* L.

Herbs, annual or perennial. Basal leaves in rosette, stalked; cauline many, sagittate-amplexicaul. Racemes many-flowered. Flowers small; pedicels erect, somewhat appressed in fruit. Fruits long, erect, slender, terete or somewhat quadrangular, compressed, usually with biseriate seeds.

Mostly in Europe, Asia and Africa; introduced in N. America and Australia; probably 3 species, 1 in India.

Turritis glabra L., Sp. Pl. 666. 1753. *Arabis glabra* (L.) Bernh., Syst. Verz Erfurt. 1: 195. 1800; Hook. f. & T. Anderson in Fl. Brit. India 1: 135. 1872.

Herbs, erect, up to 1 m high, glabrous or slightly hairy at base. Basal leaves obovate-oblong, spreading, entire or sinuate-toothed or pinnately lobed, 5 - 15 x 1.5 - 3.5 cm, rough on both surfaces; cauline oblong-lanceolate, entire, auricled at base, 2 - 8 x 0.5 - 3 cm, glabrous. Racemes up to 30 cm long in fruit. Flowers ca 5 mm across, white or straw-coloured. Sepals 3 - 4 mm long. Petals ca 5 mm long. Stamens ca 4 mm long. Fruits linear, crowded, pedicelled, 5 - 9 cm long; valves flat, 1-nerved; septum with depressions. Seeds biseriate.

Fl. & Fr. May - Aug.

Distrib. India: 2000 - 3500 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Europe, Asia, introduced elsewhere.

Tribe 3. BRASSICEAE Hayek

(P. K. Hajra, H. J. Chowdhery and G. H. Bhaumik)

Herbs, glabrous or hispid. Leaves pinnatifid or entire. Filaments of stamens very rarely appendaged. Lateral nectar glands of different shapes, truncated at apex; middle glands often long, subglobose or stalk-like. Stigma capitate or bilobed. Fruit siliqua, silicle or lomentum with distinct closed beak containing a few or no seeds.

8 genera and 15 species in India.

Literature. NAQSHI, A.R. & G.N. JAVEID (1987) Tribe Brassiceae (Brassicaceae) in Kashmir Himalayas. J. Econ. Tax. Bot. 9: 89 - 96. SCHULZ, O. E. (1919) Cruciferae - Brassiceae I. in Engler, Pflanzenreich 70 (IV. 105): 1 - 290, ff. 1 - 35. SCHULZ, O. E. (1919) Cruciferae - Brassiceae II. ibid. 84 (IV. 105): 1 - 100, ff. 1 - 26.

17. Brassica L.

Herbs, glabrous, sparsely hirsute or hispid; rootstock slender or tuberous. Leaves alternate, petiolate or sessile, often amplexicaul, lower sometimes rosulate, pinnatifid or lyrate, rarely entire. Racemes usually short, corymbose. Flowers yellow or white. Sepals subequal, erect or spreading, inner larger, usually pouched. Petals yellow or white, clawed. Stamens 6. Ovary cylindrical, 5 - 45-ovuled; style distinct; stigma capitate or 2-lobed. Fruit a siliqua with long or short seedless or 1 - 2-seeded narrow beak, linear or oblong, terete or angular; valves convex with prominent median vein. Seeds few to many, uniseriate or rarely biseriate (in some extra-Indian species).

Mostly Mediterranean; about 40 species, 6 in India.

Notes. Most of the species are cultivated, as these include many vegetables and oil seed plants. There is considerable confusion regarding the identity and nomenclature of several species and infraspecific taxa.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Upper leaves stalked or narrowed at base | 2 |
| b. Upper leaves usually amplexicaul, rounded or deeply cordate at base | 4 |
| 2a. Beak of fruits 10 - 15 mm long | 6. <i>B. tournefortii</i> |
| b. Beak of fruits 4 - 10 mm long | 3 |
| 3a. Beak of fruits 4 mm long | 3. <i>B. nigra</i> |
| b. Beak of fruits 5 - 10 mm long | 1. <i>B. juncea</i> |
| 4a. All leaves glabrous | 4. <i>B. oleracea</i> |
| b. Lower leaves always bristly or ciliate hairy | 5 |
| 5a. All leaves glaucous | 2. <i>B. napus</i> |
| b. Lower leaves usually green, not glaucous | 5. <i>B. rapa</i> |

1. *Brassica juncea* (L.) Czern., Consp. Fl. Chark. 8. 1859; Hook. f. & T. Anderson in Fl. Brit. India 1: 157. 1872. *Sinapis juncea* L., Sp. Pl. 668. 1753.

Asm.: *Lai, Lahi*; Beng. & Hindi: *Rai*.

Herbs, annual, erect, branched, 20 - 100 cm high, glabrous, sometimes glaucous or hispid. Basal leaves oblong-lanceolate, lyrate-pinnatifid, toothed, petioled, 6 - 10 x 2 - 5 cm; middle leaves oblong-ovate, dentate; upper narrow-lanceolate, toothed, subsessile. Racemes many-flowered. Flowers ca 7 mm across, bright yellow. Sepals ca 5 mm long. Petals obovate, clawed, rounded at apex, ca 8 mm long. Stamens ca 5 mm long. Fruits suberect, torulose, 2 - 5 cm long; beak long, seedless; valves with a prominent midrib. Seeds globose, reddish-brown, 10 - 20 in each locule.

Fl. & Fr. March - May.

Distrib. India: Cultivated throughout.

C. & E. Asia and Europe.

Notes. A number of infra-specific taxa have been recognised under this species. As most of them are cultivated forms, they are not easily distinguishable.

Usually cultivated for its oil-yielding seeds. Sometimes leaves are taken as vegetable or salad.

2. *Brassica napus* L., Sp. Pl. 666. 1753. *B. campestris* L. subsp. *napus* (L.) Hook. f. & T. Anderson in Hook. f., Fl. Brit. India 1: 156. 1872.

Herbs, annual or biennial, erect, 50 - 150 cm high; taproot fusiform, tuberous, slender or stout. Leaves glaucous; basal leaves petiolate, lyrato-pinnatifid or not, 5 - 22 x 1 - 70 cm, glabrous or sparingly pubescent; upper leaves sessile, shallowly cordate at base, clasping the stem, entire or dentate. Racemes 5 - 50 cm long; pedicels 1 - 2 cm long, up to 3 cm in fruit. Sepals erecto-patent, 6 - 8 mm long. Petals clawed, 10 - 20 mm long, deep or light yellow. Basal stamens shorter and erecto-patent. Fruits 4 - 11 cm long, 3 - 4 mm thick, suberect, attenuate to a long slender up to 3 cm long beak. Seeds obscurely dentate.

KEY TO THE SUBSPECIES

- | | |
|----------------------------------|---------------------------------|
| 1a. Roots and stem base tuberous | 2.1. subsp. <i>napobrassica</i> |
| b. Roots and stem base slender | 2.2. subsp. <i>napus</i> |

2. 1. subsp. *napobrassica* (L.) Jafri in Fl. W. Pakistan 55: 24. 1973. *B. oleracea* L. var. *napobrassica* L., Sp. Pl. 667. 1753.

Roots tuberous; lower leaves lyrate-pinnatifid, 5 - 22 x 1 - 7 cm.

Distrib. India: N.W. Himalayas.

2. 2. subsp. *napus*

Herbs, annual or biennial, erect, branched, up to 1.5 m high, glabrous, glaucous, taproot slender. Basal leaves lyrate-pinnatisect, 4 - 20 x 2 - 5 cm; upper leaves cauline, lanceolate, amplexicaul, more or less entire, sessile. Racemes 10 - 40-flowered. Sepals erect, ca 6 mm long. Petals obovate, 1 - 1.5 cm long. Stamens ca 8 mm long. Fruits linear, subtorulose, 4 - 8 cm long. Seeds globose, ca 1.5 mm across, yellowish-brown, 10 - 20 in each locule.

KEY TO THE VARIETIES

- | | |
|---|-----------------------------------|
| 1a. Fruits erect, 4-loculed; beak flattened | 2.2.1. var. <i>quadrivalvis</i> |
| b. Fruits pendulous, 3 - 4-loculed; beak terete | 2.2.2. var. <i>trifolocularis</i> |

2. 2.1. subsp. *napus* var. *quadrivalvis* (Hook. f. & Thomson) O. Schulz in Engler, Pflanzenr. 70: 42. 1919. *B. quadrivalvis* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 170. 1861.

Distrib. India: Cultivated fields in Uttar Pradesh and Bihar.

Nepal.

2. 2.2. subsp. *napus* var. *trilocularis* (Roxb.) O. Schulz in Engler, Pflanzenr. 70: 42. 1919. *Sinapis trilocularis* Roxb., Fl. Ind. 3: 121. 1832. *Brassica trilocularis* (Roxb.) Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 170. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 156. 1872.

Distrib. India: Cultivated in Sikkim and Assam.

Throughout the temperate regions of the world.

3. *Brassica nigra* (L.) Koch in Roehling, Deuts. Fl. ed. 3, 4: 713. 1833; Hook. f. & T. Anderson in Fl. Brit. India 1: 156. 1872. *Sinapis nigra* L., Sp. Pl. 668. 1753. *S. erysimoides* Roxb., Fl. Ind. 3: 123. 1832.

Beng.: *Benarisi-rai*; Eng.: *Mustard*; Hindi: *Kali-sarson*; Kan.: *Sasive*; Mal.: *Kadugu*; Mar.: *Mohari*; Tam.: *Kadugu*; Tel.: *Avalu*.

Herbs, annual, erect, rigid, 40 - 90 (-120) cm high, branched, more or less hispid. Lower leaves lyrate, deeply pinnatifid or pinnatisect, 6 - 20 x 4 - 12 cm; upper smaller, narrowly elliptic or lanceolate, entire, sessile or shortly stalked. Inflorescence a branched raceme, densely 40 - 50-flowered, naked. Flowers ca 1.2 cm across, bright yellow; pedicels 3 - 5 mm long, ebracteate. Sepals erect-spreading, oblong, obtuse at apex, 4 - 5 mm long, glabrous. Petals obovate, long-clawed, 8 - 10 mm long. Stamens ca 4 mm long. Fruits oblong, 1 - 2 cm long, 1 - 2.5 mm thick; beak 2 - 3 mm long, seedless; valves keeled, torulose, 3 - 5-seeded in each locule; seeds globular, ca 1 mm in diam., dark-brown.

Fl. & Fr. March - May.

Distrib. India: Introduced and widely cultivated in northern parts.

Throughout Europe, N. Africa, S.W. Asia and in most temperate parts of the world.

Notes. Cultivated for its seeds which yield Mustard oil.

4. *Brassica oleracea* L., Sp. Pl. 667. 1753.

Herbs, glabrous; stems 30 - 100 cm high. Leaves fleshy; lower leaves petioled, lyrate pinnatifid, 15 - 40 cm long; terminal lobe broadly ovate or suborbicular, cordate at base, broadly dentate or crenate at margins, rounded at apex; lateral lobes 2 - 3 (-5) pairs, smaller than terminal. Upper leaves sessile, simple, lanceolate to oblong-lanceolate, rounded-cordate or often subamplexicaul at base. Racemes simple or often paniced, ebracteate, elongating to 30 cm in fruit; pedicels 1.5 - 2 cm long, up

to 2.5 cm in fruit. Sepals erect, oblong, obtuse, 8 - 12 x 2 - 3 mm. Petals obovate, clawed, 15 - 20 x 4 - 6 cm. Stamens erect. Fruits erect or on erecto-patent pedicels, 6 - 10 cm long including 1 - 2 cm long often 1-seeded beak. Seeds reticulate.

The following varieties are cultivated for vegetable:

4. 1. *Brassica oleracea* L. var. *botrytis* L., Sp. Pl. 667. 1753.

Eng.: *Cauliflower*; Hindi: *Phulgobhi*.

Stems moderately tall; leaves usually shallowly lobed, the higher leaves usually enclosing inflorescence; rachises of young inflorescences and pedicels thickened forming a dense yellowish white mass with the flowers and buds.

Extensively cultivated in different parts of India and used as vegetable.

4. 2. *Brassica oleracea* L. var. *capitata* L., Sp. Pl. 667. 1753.

Eng.: *Cabbage*; Asm., Beng., Guj. & Hindi: *Bandha-gobhi*; Kan.: *Kolu-gadde*; Mal. & Tam.: *Mootaghos, Muttakhoos*.

Stems short until flowering; leaves very densely packed and overlapping into a subglobose or ellipsoid head with very stout nerves forming the "Cabbage" used as vegetable.

Abundantly cultivated all over India.

Notes. Apart from being used as vegetable, it is reported to be a remedy for bleeding piles. Half a cup of fresh juice of leaves is given to the person with bleeding piles daily in the morning, followed by a glass of water. This is said to cure piles (Goel & Aswal in J. Econ. Tax. Bot. 14: 186. 1990).

4. 3. *Brassica oleracea* L. var. *gemmifera* Zenker, Fl. Thuringen 15: 2. 1836.

Stems long with numerous lateral, semi-closed lateral sprouts, called the "Brussels sprouts".

Often cultivated in cold hill stations.

4. 4. *Brassica oleracea* L. var. *gongylodes* L., Sp. Pl. 667. 1753.

Eng.: *Knol-khol*; Hindi & Beng.: *Ganth-gobi, Ol-gobhi*.

Cultivated throughout India, for the swollen and subglobose thickened fleshy stem, used as vegetable.

5. *Brassica rapa* L., Sp. Pl. 666. 1753. *B. campestris* subsp. *rapa* Hook. f. & T. Anderson in Hook. f., Fl. Brit. India 1: 156. 1872.

Herbs, annual or biennial; taproot slender, stout or tuberous. Basal leaves short petioled, lyrate, bright green, hispid or with setiform hairs; upper cauline leaves sessile, amplexicaul, glaucous and glabrous. Flowers yellow, in terminal racemes, overtopping buds. Sepals patent. Petals 4, 5 - 10 mm long. Stamens 6. Fruits glabrous, 3.5 - 10.5 cm long. Seeds small, smooth, pale or dark.

KEY TO THE SUBSPECIES

- | | |
|---|-------------------------------|
| 1a. Roots slender | 5.1. subsp. <i>campestris</i> |
| b. Roots tuberous, globose or nearly so | 5.2. var. <i>rapa</i> |

5.1. subsp. *campestris* (L.) Clapham in Fl. Brit. Isles, ed. 2: 124. 1962. *B. campestris* L., Sp. Pl. 666. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 156. 1872. *B. rapa* L. var. *campestris* (L.) Peterm., Fl. Lips. 491. 1838. **Fig. 23.**

Herbs, annual, simple or branched, 30 - 100 cm high, glabrous or slightly hispid. Basal leaves pinnatifid or more or less so, often auricled, petioled; upper oblong or lanceolate. Flowers yellow. Pods up to 10.5 cm long. Seeds ca 1.5 mm across.

Fl. & Fr. Jan. - March.

Distrib. India: Cultivated and found as an escape.

C. Asia and Europe.

5.2. subsp. *rapa*

B. campestris L. subsp. *rapa* (L.) Hook. f. & T. Anderson, l. c.

Eng.: *Common Turnip*; *Hindi:* *Shalgam*.

Biennial; roots tuberous; stems branched, up to 1 m high, hairy below, glabrous above. Basal leaves 5-jugate, lyrate-pinnatifid, 10 - 30 x 5 - 10 cm; middle and upper leaves oblong to oblong-lanceolate, clasping stem with cordate base, glabrous, glaucous. Racemes 30 - 40-flowered. Flowers ca 1 cm across, yellow. Fruits linear, subtorulose, 3.5 - 8 cm long. Seeds 8 - 12 in each locule, yellow-brown.

Fl. & Fr. Oct. - Dec.

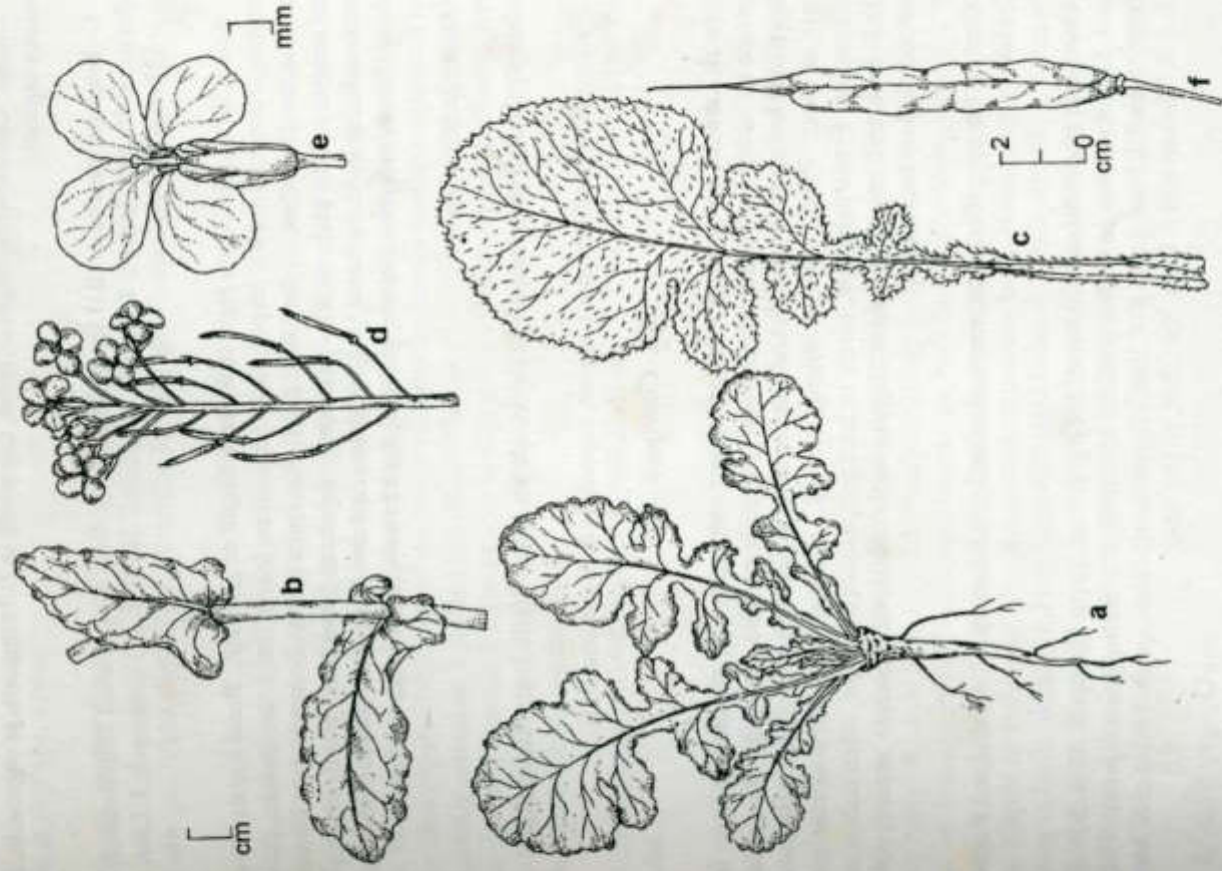


Fig. 23. *Brassica rapa* L. subsp. *campestris* (L.) Clapham : a. & b. habit; c. basal leaf; d. inflorescence; e. flower; f. fruit.

Distrib. Cultivated throughout India, especially in hilly regions, as vegetable, for its tuberous taproot.

6. *Brassica tournefortii* Gouan, *Illus. Obs. Bot.* 44. t. 20A. 1773; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 156. 1872. *B. stocksii* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 171. 1861.

Herbs, erect, 30 - 70 cm high, branched, hispid or glabrate. Basal leaves crowded, spreading, runcinate-lyrate, hispid, toothed; cauline leaves linear-lanceolate, entire or pinnatifid, acute at apex, 1 - 3 x 0.4 - 0.8 cm. Racemes 15 - 20-flowered, lax. Flowers ca 6 mm across, yellow; pedicels 0.5 - 3 cm long. Sepals ca 3 mm long. Petals oblong-obovate, rounded at apex, ca 5 mm long. Stamens ca 4 mm long. Fruits linear-oblong, 4 - 6 cm long. Seeds uniseriate, many, globose, dark brown, finely tuberculated.

Fl. & Fr. May - June.

Distrib. India: Near cultivated fields. Delhi, Uttar Pradesh and Rajasthan.

Native of the Mediterranean region, especially in Spain and Italy.

18. *Conringia* Fabr.

Herbs, annual, glabrous, glaucous. Leaves oblong, entire, auricled at base; lower subsessile or shortly petioled; upper sessile, usually cordate-clasping. Racemes lax, ebracteate. Flowers pale yellow, short-pedicelled. Sepals elongate, equal or lateral ones saccate at base. Petals obovate-oblong, clawed. Stamens 6. Lateral nectar glands semi-annular. Fruits dehiscent, terete or tetragonous siliqua, linear, often compressed; valves 1 - 3-nerved, smooth, torulose; stigma simple or bilobed. Seeds 1 - seriate, oblong, brown; cotyledons incumbent.

Central Europe, Mediterranean region and central and S.W. Asia; about 8 species, 1 in India.

Conringia planisiliqua Fischer & Meyer in *Sem. Hort. Petrop.* 3: 32. n. 564. 1837; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 152. 1872. *Erysimum planisiliquum* (Fischer & Meyer) Steudel, *Nom. ed.* 2. 394. 1840. *Sisymbrium planisiliquum* (Fischer & Meyer) Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 159. 1861.

Herbs, erect, 30 - 60 cm high. Leaves oblong-ovate, entire or obscurely toothed, 5 - 8.5 x 1 - 3 cm; basal leaves petiolate; cauline sessile. Racemes many-flowered, up to 15 cm long. Flowers ca 5 mm across; pedicels slender, up to 1 cm long. Sepals ca 4 mm long. Petals ca 6 mm long. Stamens ca 5 mm long. Fruits linear, 7.5 - 10 cm long; valves convex. Seeds 12 - 20 in each locule.

Fl. & Fr. Apr. - June.

Distrib. India: Jammu & Kashmir (Gilgit, Baltistan).

Pakistan, Afghanistan, Iran, Anatolia, C. Asia and Trans-Caspian region.

19. *Crambe* L.

Herbs or undershrubs, annual or perennial, glabrous or with unbranched hairs. Basal leaves large, entire or pinnatifid, lyrate or toothed, glabrous or simple hairy; cauline leaves much smaller. Racemes elongate, usually paniced. Flowers conspicuous, white, rarely golden yellow. Sepals oblong, spreading. Petals obovate, cuneate at base, longer than sepals. Filaments of the larger stamens frequently toothed at apex. Fruit a transversely articulate 2-jointed indehiscent silicula; the lower joint short, cylindrical, sterile or rarely 1-seeded, forming a stalk with gynophore; the upper globose or ovoid, 1-seeded, at first fleshy, later becomes dry and thick, indehiscent; seed pendent, globose, cotyledons 2-lobed, conduplicate.

Europe, North Atlantic Islands, Tropical Africa, C. & W. Asia; about 25 species, 1 in India.

Crambe cordifolia Steven subsp. *kotschyana* (Boiss.) Jafri in Fl. W. Pakistan 55: 37. 1973; Chowdhery & Wadhwa, Fl. Himachal Pradesh 1: 63. 1984. *C. kotschyana* Boiss., Diagn. ser. 1, 6: 19. 1845. *C. cordifolia* Steven var. *kotschyana* (Boiss.) O. Schulz in Engler, Pflanzenr. 70: 236. 1919.

Perennials; rootstock thick, fleshy; stems 1 - 2 m high, branched, striated, sparsely bristly hairy. Radical leaves cordate-reniform, irregularly crenate, 10 - 25 x 15 - 40 cm, more or less coriaceous, scabrous, hirsute on both surfaces; petioles dilated at base, 10 - 40 cm long, striated, strigose, hairy; cauline leaves much smaller, on shorter petioles, ovate-elliptic or rhomboid, sharply toothed. Racemes large, ebracteate; pedicels 2 - 4 cm long in fruit. Sepals 3 - 4 mm long with rigid bristles. Petals obovate-oblong, white, cuneate at base, rounded at apex, 6 - 10 x 3 - 5 mm. Fruits biarticulated; lower part stalk-like, ca 2 mm long, sterile; upper ovate-suborbicular, 4 - 5 mm in diam., 1-seeded; valves thick, reticulately veined. Seeds subglobose, 3 - 4 mm in diam., pale brown.

Fl. & Fr. Apr. - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

W. Tibet and C. & S.W. Asia.

Notes. Leaves and roots are eaten as vegetable. The plant as a whole is a good fodder.

Can be distinguished from var. *cordifolia* by its comparatively thicker and less incised leaves, and larger and more rounded fruit.

20. *Diploaxis* DC.

Annuals, erect, branched, hairy to subglabrous. Leaves lyrate-pinnate, dentate or rarely pinnatisect, lower shortly stalked, upper subsessile or sessile. Racemes corymbose, becoming lax and elongated in fruit. Flowers often large, yellow, purple, or pink-white; pedicels often elongated and pendulous in fruit. Sepals oblong, erect, spreading, subequal. Petals broadly obovate, shortly clawed or not, submarginate at apex. Stamens 6; filaments free, linear; anthers oblong, subacute, yellow. Ovary subcylindrical, many-ovuled; style short; stigma more or less 2-lobed. Fruits siliculae, slender, oblong or linear, compressed, erect or pendulous; shortly beaked. Seeds numerous, biseriate, ovoid or ellipsoid, light brown.

Mostly in Central Europe, Mediterranean region and Western and Central Asia; 19 species, 2 in India.

KEY TO THE SPECIES

- | | |
|-------------------------------|-------------------------|
| 1a. Flowers purplish to white | 1. <i>D. griffithii</i> |
| b. Flowers yellow | 2. <i>D. muralis</i> |

1. *Diploaxis griffithii* (Hook. f. & Thomson) Boiss., Fl. Orient. 1: 388. 1867; Hook. f. & T. Anderson in Fl. Brit. India 1: 157. 1872. *Brassica griffithii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 171. 1861.

Herbs, 30 - 90 cm high. Lower leaves oblong or oblong-lanceolate or lyrate-pinnatifid, 2 - 15 x 1 - 1.5 cm, lobes short, obtuse, roughly 2 - 3-toothed; upper few, oblong-elliptic to linear, 1 - 3 x 0.5 - 1 cm, entire or faintly toothed, sessile. Racemes corymbose, 15 - 60-flowered, up to 45 cm long in fruit. Sepals oblong, 5 - 7 x 1 - 2 mm, hairy. Petals obovate, 10 - 15 x 4 - 6 mm. Stamens 8 - 10 mm long; anthers 2 - 2.5 mm long, oblong-linear, 25 - 70 x 1 - 3 mm; valves with a distinct midvein, thin; beak up to 1 mm long with a large, bilobed stigma. Seeds numerous, biseriate, ovoid, pale brown.

Fl. & Fr. Apr. - June.

Distrib. India: Punjab (?).

Pakistan, Afghanistan and Bangladesh.

Notes. No specimen seen in Indian herbaria; included on the authority of Hook. f. & T. Anderson (l. c.).

2. *Diplotaxis muralis* (L.) DC., Reg. Veg. Syst. Nat. 2: 634. 1981; Siddique et al. in *Geobios* 7: 166, ff. 1 - 6. 1988. *Sisymbrium murale* L., Sp. Pl. 658. 1753. *Brassica muralis* (L.) Huds., Fl. Angl. ed. 2. 291. 1778.

Herbs, stems ascending, 12 - 42 cm high. Basal leaves rosette-forming, spatulate, lyrate-pinnatifid, ca 35 x 12 mm; petioles 3 - 20 mm long; cauline leaves when present sessile, toothed. Racemes lax. Flowers 5 - 10 mm across. Sepals ovate-lanceolate, acute at apex, ca 3 mm long, hirtellous. Petals ovate-obovate, ca 6 mm long, yellow, fading brownish on drying. Fruits beaked, glabrous; pedicels up to 4 cm long, sparsely hairy; beak somewhat conical, 2 mm long, seedless. Seeds ovoid, finely reticulate, ca 1.3 x 0.3 mm, yellowish brown.

Fl. June - Sept.

Distrib. India: Jammu & Kashmir.

C. & S. Europe, N.W. Africa.

21. *Eruca* Miller

Herbs, annual or rhizomatous perennial, with pilose simple spreading or retrorse trichomes, sometimes glabrous. Leaves lyrate-pinnatisect. Flowers yellow, cream-coloured or purplish, in elongating bractless racemes; pedicels short, erect in fruit. Sepals oblong, erect, subequal, lateral ones saccate at base. Petals obovate, long-clawed, usually yellowish with brown or violet nerves, rarely full violet. Staminal filaments linear; anthers oblong. Nectar glands minute. Ovary cylindrical, up to 50-ovuled; style as long as or longer than ovary; stigma small or inconspicuous. Fruits ovoid-oblong, somewhat turgid, dorsally compressed, beaked; valves concave, 3-nerved; replum hyaline, not pitted. Seeds many, globose or ovoid, biseriate; cotyledons longitudinally conduplicate.

Chiefly distributed in Mediterranean region and North Africa; 6 species, 1 in India.

Eruca sativa Miller, Gard. Diet., ed. 8, no. 1. 1768; Hook. f. & T. Anderson in Fl. Brit. India 1: 158. 1872. *Brassica eruca* L., Sp. Pl. 667. 1753. *B. eruroides* Roxb., Fl. Ind. 3: 117. 1832. *Eruca vesicaria* (L.) Cav. var. *sativa* (Miller) Thell. in Hegi, Fl. Mittelur. 4(1): 201. 1918.

Beng.: *Swet-sarisha*, *Taramoni*; Hindi: *Duan*, *Gohawa*, *Sebuwa*, *Taranuri*; Punj.: *Taramira*.

Herbs, annual, erect, 25 - 90 (-100) cm high, glaucous with slender taproot; stems simple or branched, stiff, hispid below, glabrous upwards. Basal leaves lyrate-pinnatifid, 7 - 15 x 3 - 5 cm, petiolate; upper ones lyrate-pinnatifid with entire to subulate-dentate segments, sessile or subsessile. Racemes 15 - 40-flowered, up to 30 cm long in fruit. Flowers yellow with violet veins, turning to white, 1.5 - 2 cm across; pedicels 2 - 4 mm long. Sepals oblong, often pale violet, ca 1 cm long. Petals obovate-cuneate, with dark-purplish veins, 1.5 - 2.5 cm long. Stamens 1 - 1.5 cm long; anthers ca 3 mm long. Fruits erect, up to 3 cm long, appressed to axis, setose-hairy; beak flattened, broad, ensiform, glabrous. Seeds subglobose, flattened, 2-seriate, brownish.

Fl. & Fr. Jan. - Sept.

Distrib. India: Weed of cultivated fields, roadsides and wastelands. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Rajasthan and Maharashtra.

Pakistan, S.W. Asia, N. Africa and S. Europe.

Notes. The oil extracted from the seed is used as illuminant, lubricant, hair oil, vesicant and also used in massage and pickling. The whole plant is considered to be an aphrodisiac, and electuary preparations have been used to cure indurations of liver.

22. *Raphanus* L.

Herbs, annual or biennial or rarely short-lived perennial, more or less with stiff simple hairs; tap roots sometimes fleshy, fusiform; stems erect, branched. Leaves pinnatisect, lyrate, uppermost often simply toothed. Racemes corymbose, becoming lax in fruit, ebracteate. Flowers large, ebracteate, pedicellate. Sepals usually erect, oblong, the outer ones slightly hooded below the tips; inner ones a little broader, somewhat saccate at base. Petals oblanceolate or obovate, abruptly long-clawed, white, yellow or violet, reticulately veined. Stamens 6, filaments not appendaged. Ovary awl-shaped, transversely bipartite; the lower portions shorter than upper, 2 - 12-ovuled; stigma small, more or less bilobed. Fruits elongated, cylindric lomentum, biarticulated; lower portion very short, inconspicuous, stalk-like, usually empty, rarely 1 or 2-seeded, persistent; upper portion 1-many seeded, cylindrical and indehiscent or breaking into 1-seeded segments, sometimes curved or constricted between the seeds; beak long. Seeds pendulous from short funicle; cotyledons conduplicate.

Chiefly Euro-Siberian, Mediterranean and N.E. African regions; 8 species, 2 in India.

KEY TO THE SPECIES

- 1a. Taproot not tuberous; fruits torulose, markedly constricted between seeds, breaking into 1-seeded parts
1. *R. raphanistrum*
- b. Taproot tuberous; fruits hardly constricted between seeds, not breaking into 1-seeded parts
2. *R. sativus*

1. *Raphanus raphanistrum* L., Sp. Pl. 669. 1753; Jafri in Fl. W. Pakistan 55: 34. 1973.

Eng.: *Wild Radish*; Hindi: *Jungli-mooli*.

Herbs, annual, 20 - 70 cm (-1 m) tall; taproot slender; stems erect, branched or simple, densely covered with coarse hairs at base, sparsely so above. Lower leaves lyrate-pinnatisect, 15 - 20 x 1 - 2 cm; lateral lobes 4 - 7 pairs, rounded at base and apex, shallowly toothed along margins, terminal lobes broadly obovate, up to 5.5 cm long; upper leaves smaller, up to 10 cm long, oblong, pinnately lobed or toothed; uppermost smaller, simple, elliptic or oblanceolate, hirsute. Racemes many-flowered, up to 30 cm long in fruit; pedicels up to 2.5 cm long in fruit. Sepals oblong, subequal, 7 - 8 x 1.5 - 2 mm, inner pair somewhat saccate at base. Petals obovate, long-clawed, submarginate at apex, 12 - 20 x 5 mm, white or yellow, brown-veined. Fruits cylindrical, torulose, constricted between 3 - 8 seeds, 3 - 8 x 0.3 - 0.4 cm; beak slender, 1 - 3 cm long; valves hard, strongly veined, breaking into separate 1-seeded joints at maturity. Seeds ovoid or subglobose, 1.5 - 2.5 mm in diameter.

Fl. & Fr. Jan. - June.

Distrib. India: Weed around cultivated fields, roadsides and wastelands, 2000 - 2300 m. Sikkim.

S.W. Asia, Europe and N. Africa. Introduced elsewhere.

Notes. Roots and leaves are used as vegetable.

2. *Raphanus sativus* L., Sp. Pl. 669. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 166. 1872.

Herbs, annual or biennial; taproot thick, tuberous; stems erect, up to 1 m high, branched, hispid below and glabrous above. Lower leaves lyrate-pinnatifid, ovate-oblong in general outline, long-stalked, 3 - 5-jugate, terminal lobes suborbicular, rounded at apex, crenate along margins; lateral lobes much shorter, oblong-ovate, obtuse at apex, dentate along margins; upper leaves much smaller, oblong to lanceolate, entire, dentate or few-lobed, sessile or subsessile. Racemes many flowered, up to 40 cm long in fruit; pedicels 1 - 2 cm long in fruit. Sepals oblong, subequal, 5 - 8 x 1.5 - 2

mm, inner pair somewhat saccate at base. Petals obovate, long-clawed, subemarginate at apex, 12 - 25 x 5 - 7 mm. Fruits lanceolate-oblong or oblong-ellipsoid, terete, 2 - 6 x 0.4 - 0.5 cm; beak conical, seedless, 1 - 2 cm long; valves spongy, scarcely ribbed, often obscurely constricted between seeds; lower part of siliqua stalk-like, bilocular with a complete septum, sterile, 1 - 3.5 mm long. Seeds ovoid to subglobose, 6 - 12, uniseriate, ca 2 mm in diam., brown, reticulated.

KEY TO THE VARIETIES

- 1a. Petals ca 2.5 cm long; ovules 15 - 20; siliqua 20 - 60 cm long, including whip-like long beak 2.1. var. *caudatus*
 b. Petals 1.2 - 2 cm long; ovules 10 - 12; siliqua 2 - 6 (-8) cm long 2.2. var. *sativus*

2. 1. var. *caudatus* (L.) Hook. f. & T. Anderson in Fl. Brit. India 1: 166. 1872. *R. caudatus* L., Mant. Pl. 1: 95. 1767.

Hindi: *Singri*; Punj.: *Mougri, Mugra*.

Fl. & Fr. Jan. - Apr.

Distrib. India: Cultivated in Punjab, Uttar Pradesh and Rajasthan.

Notes. The pods are eaten.

2. 2. var. *sativus*

Beng.: *Mula*; Hindi: *Muli*; Tel., Tam., Kan. & Mal.: *Mullangi*; Eng.: *Radish*.

Fl. & Fr. Jan. - Apr.

Distrib. Widely cultivated throughout the World.

Notes. The roots, leaves, flower tops and young fruits are eaten as salad. In Eastern Asia, the roots are preserved by canning, drying and pickling in brine and rice hull. The seed oil is edible and used in soup-making, illuminating and cryon manufacturing; also cultivated as fodder. It has also several medicinal properties and used in the treatment of burns, fevers, pain, coughs, tumours, cholera and paralysis.

The palynology of this species has been described by Premnath & Mehta (in J. Palynol. 6: 78. 1970).

23. *Schouwia* DC.

Herbs, annual, glabrous; stems woody, diffusely branched. Leaves simple, alternate; basal ones shortly pedicelled to sessile; upper ones amplexicaul. Racemes both terminal and lateral. Flowers violet or rose-purple. Sepals erect; outer 2 linear; inner 2 oblong-ovate, more or less saccate at base. Fruits oval or ovate-suborbicular, laterally compressed with a cordate base, terminated by a retuse style; valves membranous, reticulate, broadly winged. Seeds many, 2-seriate; cotyledons conduplicate; radicle accumbent.

Chiefly distributed in Southwest Asia and Northeast Tropical Africa; 2 species, 1 in India.

Schouwia purpurea (Forsskal) Schweinf. in Bull. Herb. Boissier 4. App. 2: 183. n. 486. 1896; Thombre in J. Bombay Nat. Hist. Soc. 60: 289. 1963. *Subularia purpurea* Forsskal, Fl. Aeg.-Arab. 117. 1775. *Thlaspi arabicum* Vahl, Symb. Bot. 2: 76. 1791. *Schouwia arabicum* (Vahl) DC., Syst. Nat. 2: 644. 1821; A. S. Rao in Bull. Bot. Surv. India 5: 261, t. 1. 1963. Fig. 24.

Herbs, 25 - 75 cm high. Leaves subfleshy when green, turning membranous to chartaceous and yellow on drying, 1.5 - 9 x 1 - 4 cm; basal leaves obovate or oblanceolate, tapering towards base, more or less acute at apex, mostly entire, sometimes crenate or distantly wavy-dentate along margins; upper ovate or ovate-oblong, deeply cordate to cordate-auricled at base, acute or obtuse at apex. Inflorescence at first congested, corymbose, elongating up to 30 cm long in fruit; pedicels 5 - 7 mm long in fruit. Sepals 4 - 5 mm long. Petals unguiculate, 7 - 9 x 2 - 3 mm, purple. Fruits ovate or subelliptic to ovate-suborbicular, 1.5 - 2 cm across; beak 5 - 7 mm long; replum linear, membranous. Seeds biseriate, many, globose, reddish-brown, mucilaginous.

Fl. & Fr. Jan. - Nov.

Distrib. India: Maharashtra, Andhra Pradesh and Karnataka.

S.W. Asia, N.E. Tropical Africa.

Notes. Occurs as a weed along the edges of cultivated fields and dry sandy soil, (vide Bhaumik & Banerjee in J. Bombay Nat. Hist. Soc. 82: 237 - 238. 1985).

24. *Sinapis* L.

Herbs, annual or rarely perennial, branched, hispid with simple hairs; stems erect, often branched. Leaves pinnatisect, lower shortly petioled, upper sessile or nearly so, divided or entire. Racemes many-flowered, ebracteate. Flowers yellow. Sepals subequal, erect-spreading. Petals obovate, clawed. Stamens 6, free, without appendages.

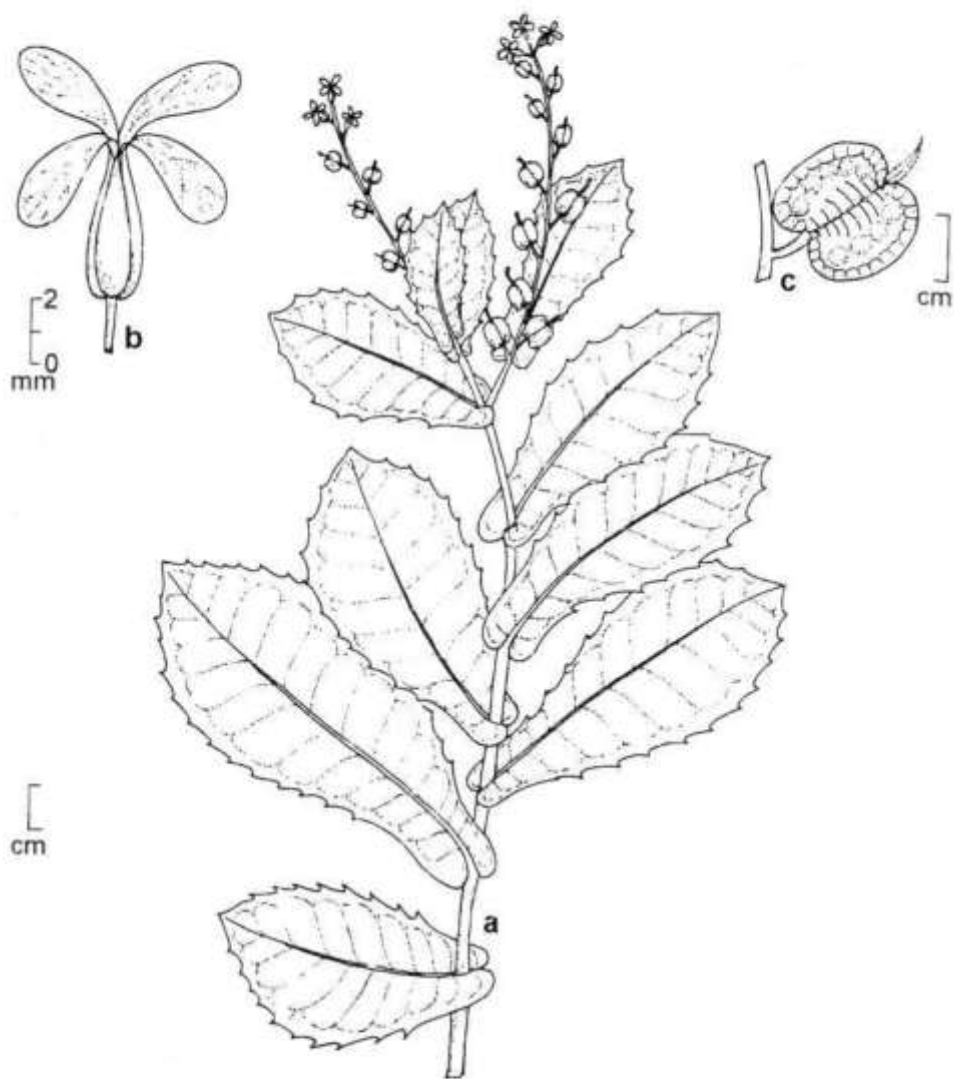


Fig. 24. *Schouwia purpurea* (Forsskal) Schweinf. : a. plant, upper portion; b. flower; c. fruit.

Ovary cylindrical, 15 - 17-ovuled; stigma truncate, somewhat 2-lobed. Fruits subcylindrical, few-seeded siliqua, dehiscent by 2 convex distinctly 3 - 7-nerved valves; beak indehiscent, containing 1 - 2 seeds, conical. Seeds subspherical uniseriate, pendulous or erect; cotyledons conduplicate.

Mediterranean region; 10 species, 1 in India.

Sinapis alba L., Sp. Pl. 668. 1753. *Brassica alba* (L.) Rabenh., Fl. Lusatica 1: 154. 1839; Hook. f. & T. Anderson in Fl. Brit. India 1: 157. 1872. **Fig. 25.**

Hindi: *Safed-sarson*.

Herbs, annual, erect, retrorsely hispid, 25 - 70 m high. Lower leaves lyrate-pinnatifid, 5 - 20 cm long, petiolate, terminal lobe larger than laterals, coarsely lobed and toothed. Racemes densely many-flowered, ca 25 cm long in fruit; pedicels 5 - 8 mm long; flowers conspicuous, aromatic, ca 1 cm across. Sepals ca 5 mm long, spreading. Petals obovate, short-clawed, 8 - 15 mm long, yellow; limb obovate. Stamens 4 - 5, ca 6 mm long. Fruits 2-torulose, on spreading pedicels, 2 - 4 cm long, 3 - 4 mm thick, usually hirsute; beak long, ca 1-seeded; valves 3 - 5-nerved, hispid with antrorse bristles; beak 1-seeded, compressed, ensiform. Seeds 1 - 4 in each locule, globose, pale brownish.

Fl. & Fr. Aug. - Dec.

Distrib. India: Roadsides and wastelands. Uttar Pradesh.

S.W. Asia, Europe and N. Africa.

Notes. Introduced and often cultivated for its seeds.

Tribe 4. DRABEA E O. Schulz

(R. K. Basak)

Annual or perennial herbs or dwarf shrubs; stems scapose or leafy, simple, furcate or stellate hairy or rarely glabrous. Flowers in ebracteate racemes or corymbs. Ovary sessile, often ellipsoid; style with shortly bilobed or capitate stigma. Fruits usually ovoid-lanceolate, rarely elongated, broadly septate; valves easily detachable, flat to subconvex, median vein distinct up to middle; style mostly persistent. Seeds biseriate or rarely sub-biseriate and slightly winged, pendulous.

Two genera and 34 species in India.

Literature. SCHULZ, O. E. (1927) Cruciferae - Draba et Erophila in Engler, Pflanzenreich 89 (IV. 105): 1 - 396.

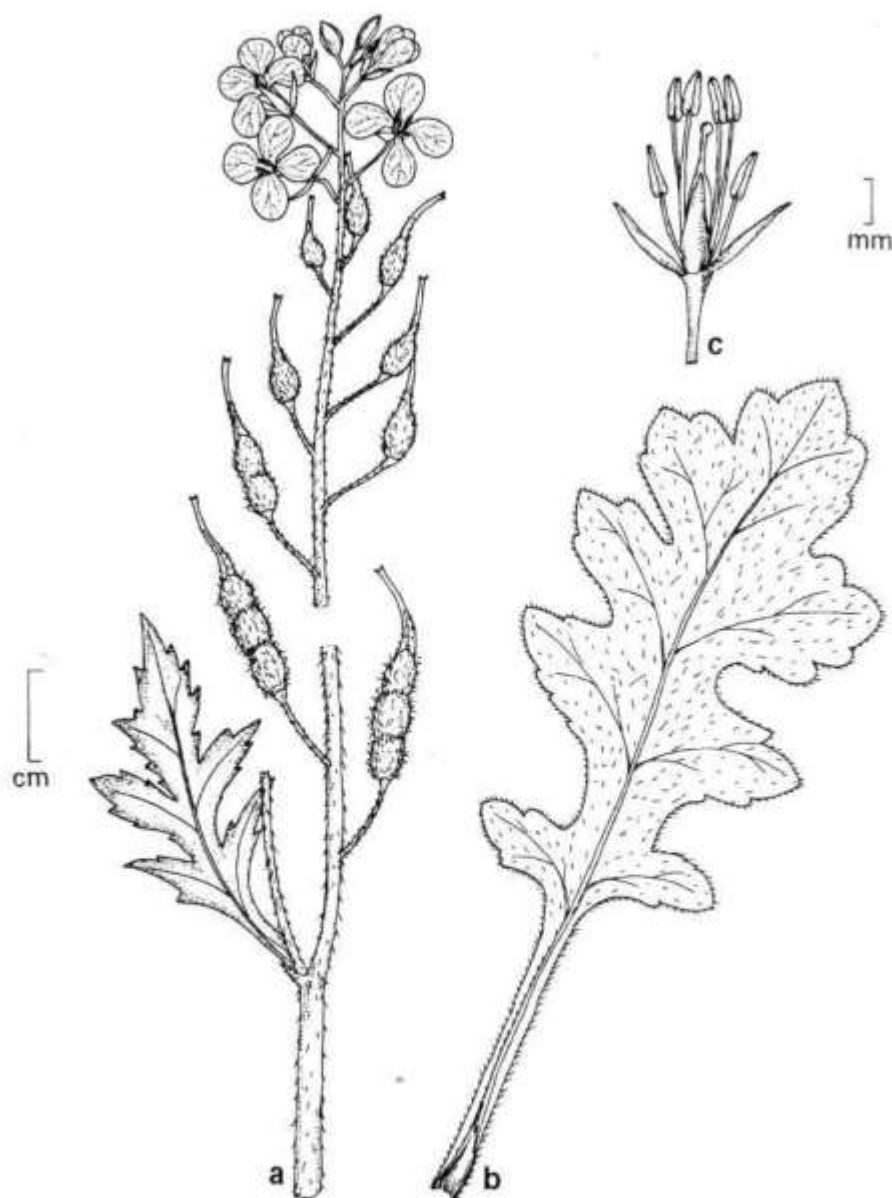


Fig. 25. *Sinapis alba* L. : a. plant, upper portion; b. basal leaf; c. flower, petals removed.

25. *Draba* L.

Annual, perennial or rarely biennial herbs or dwarf shrubs, sometimes with woody rootstocks; stems scapose or leafy, often elongating after flowering, usually beset with stellate, furcate or simple hairs, rarely glabrous. Leaves simple, entire or shortly dentate, ciliate; basal leaves usually rosulate, sessile or short-stalked; cauline leaves when present amplexicaul, mostly sessile, rarely shortly petiolate. Flowers in ebracteate racemes or corymbs, occasionally bracteate, yellow or white, rarely purple, lilac or rose-coloured. Sepals subequal, erect; inner ones broadly ovate, rarely slightly saccate at base, rounded or blunt at apex; outer ones longer, elliptic, thin along margins. Petals obovate-cuneate, entire or subemarginate, rarely absent. Stamens 6, or 4 with 2 outer abortive ones; filaments linear, often broadened towards base, rarely outer ones 1-dentate; anthers ovoid or oblong. Nectar glands various, laterals usually 2- or 4-lobed, often joining to form a horse-shoe shaped structure; middle glands mostly absent. Ovary sessile, flat and ellipsoid or rarely cylindrical; ovules 4 to many; style distinct, persistent; stigma bilobed or depressed capitate. Fruits ovoid-suborbicular to ellipsoid, rarely siliquiform or linear, broadly septate, bilocular, straight or twisted, pilose or smooth; valves flat to subconvex, reticulately nerved with a distinct median vein at base or obscurely veined; septum of the replum membranous with small irregular polygonal cells. Seeds 2-many in 2 rows in each locule, ovoid or ellipsoid, rarely slightly winged, pendulous, radicle accumbent.

In Arctic, temperate and high altitudes of tropical zones; about 300 species, 33 in India.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Flowering stem scapose, rarely 1 - 2-leaved | 2 |
| b. Flowering stem leafy | 10 |
| 2a. Petals absent | 30. <i>D. tenerrima</i> |
| b. Petals present | 3 |
| 3a. Dried basal leaves usually 3 (-5)-nerved | 32. <i>D. trinervis</i> |
| b. Dried basal leaves mostly 1-nerved | 4 |
| 4a. Leaves sparsely white tomentose | 5 |
| b. Leaves densely white tomentose | 9 |
| 5a. Fruits oblong-ellipsoid, compressed | 26. <i>D. setosa</i> |
| b. Fruits ovoid, inflated | 6 |
| 6a. Ovary 24-ovuled; fruits obtuse at apex | 14. <i>D. humillima</i> |
| b. Ovary 4 - 12-ovuled; fruits acute at apex | 7 |
| 7a. Fruits rounded at base; leaves greenish beneath, with simple or branched hairs | 8 |
| b. Fruits sub-bisaccate at base; leaves whitish beneath with dense stellate hairs | 15. <i>D. korschinskyi</i> |
| 8a. Leaves oblong-linear, 3 - 4 (-5) mm long, rigid, mid-vein prominent; fruits 3 - 4 x 2 - 2.5 mm | 5. <i>D. cachemirica</i> |

- b. Leaves oblong or elliptic-obovate, 6 - 12 (-15) mm long, chartaceous, mid-vein not prominent; fruits (3-) 4 - 6 x 3 - 5 mm **23. D. oreades**
- 9a. Stems radical, 1 - 5 cm long; ovary 4 - 8-ovuled; style 1 - 2 mm long **1. D. affghanica**
- b. Stems erect, 3 - 10 cm long; ovary (8-) 10 - 14-ovuled; style 0.5 - 0.75 mm long **22. D. olgae**
- 10a. Scape with 4 - 14 or more leaves, uniformly arranged throughout 11
- b. Scape with (1-) 2 - 3 (-5) leaves, usually below the middle 14
- 11a. Leaves sessile, often semi-amplexicaul **25. D. radicans**
- b. Leaves shortly petioled 12
- 12a. Flowers yellow; fruits ovoid to ellipsoid **3. D. amoena**
- b. Flowers violet; fruits oblong 13
- 13a. Stem 6 - 8-foliolate; fruits slightly acute, pilose **8. D. elata**
- b. Stem 14-foliolate or more; fruits obtuse, glabrous **24. D. polyphylla**
- 14a. Plants annual, rarely perennial; flowers yellow (white in *D. ellipsoidea*); fruits usually with rudimentary styles, rarely styliferous 15
- b. Plants perennial; petals white (yellowish white or yellow in *D. tibetica*); fruits styliferous 22
- 15a. Seeds sub-biseriate, ca 2 mm long; margins slightly winged **4. D. aubrietoides**
- b. Seeds biseriate, 0.5 - 1 mm long; margins not winged 16
- 16a. Flowers yellow; petals 2 mm long or more **9. D. ellipsoidea**
- b. Flowers white; petals ca 1 mm long 17
- 17a. Plants flaccid, diffuse; racemes lax, few-flowered 18
- b. Plants erect or ascending; racemes usually many-flowered 19
- 18a. Racemes 1 - 3 (-5)-flowered; petals 7 - 8 mm long; style ca 1.5 mm long **6. D. cholaensis**
- b. Racemes usually (1-) 3 - 10-flowered; petals ca 3 mm long; style ca 0.5 mm long or obscure **13. D. gracillima**
- 19a. Petals less than 3 mm long 20
- b. Petals 3 mm long or more 21
- 20a. Racemes 25 or more flowered; petals ca 2 mm long; fruits oblong-ellipsoid, 5 - 8 x 2.5 (-3) mm; pedicels stout, longer than fruits **20. D. nemorosa**
- b. Racemes (5-) 12 (-16)-flowered; petals ca 2.5 mm long; fruits sublinear or oblong-ellipsoid, 4 - 7 x 1 mm; pedicels slender, equal to or shorter than fruit **19. D. melanopus**
- 21a. Pedicels filiform; fruits linear, slightly obtuse, pilose, 8 - 20 x 2 mm **29. D. stenocarpa**
- b. Pedicels stout; fruits ovoid or oblong-ovoid, acute, glabrous, 5 - 10 x 2 - 2.5 mm **10. D. eriopoda**
- 22a. Flowers mostly white **31. D. tibetica**
- b. Flowers yellowish white or yellow 23
- 23a. Fruiting scapes 4 - 8 cm long; fruits 3 - 4 x 1.5 (-2) mm 24
- b. Fruiting scapes 6 - 20 cm long; fruits 5 - 10 x 1.5 (-2) mm 25
- 24a. Basal leaves largely ciliate with simple or furcate hairs; fruiting scapes ca 4 (-6) cm long; fruits ovoid-oblong, straight, glabrous; pedicels 4 - 6 mm long **2. D. altaica**
- b. Basal leaves densely tomentose with short and stellate white hairs; fruiting scapes ca 8 cm long, tomentose; fruits ellipsoid-oblong, often twisted, puberulous; pedicels 2 - 4 mm long **12. D. glomerata**
- 25a. Fruits ovoid or oblong-ellipsoid, mostly twisted **17. D. lasiophylla**
- b. Fruits linear-oblong or ellipsoid-lanceolate, flattened, rarely twisted 26
- 26a. Racemes conspicuously bracteate **16. D. lanceolata**
- b. Racemes rarely bracteate below 27

- | | |
|---|------------------------------|
| 27a. Leaves densely white tomentose | 28 |
| b. Leaves not as above | 30 |
| 28a. Basal leaves petioled | 33. <i>D. winterbottomii</i> |
| b. Basal leaves sessile or subsessile | 29 |
| 29a. Leaves 5 - 10 mm long; racemes 6 - 12-flowered; fruits tomentose | 27. <i>D. sikkimensis</i> |
| b. Leaves 2 - 3 mm long; racemes 2 - 5-flowered; fruits glabrous | 7. <i>D. dasyastra</i> |
| 30a. Stems few-leaved, all parts substellately woolly | 21. <i>D. oariocarpa</i> |
| b. Stems many-leaved, all parts not substellately woolly | 31 |
| 31a. Fruits up to 20 x 3 mm, linear-oblong | 11. <i>D. falconeri</i> |
| b. Fruits up to 5 x 3 mm, oblong-ovoid to ovoid-orbicular | 32 |
| 32a. Scapes erect, 15 - 20-flowered; fruits glabrous, 6 - 10-seeded | 18. <i>D. ludlowiana</i> |
| b. Scapes serpentine-flexuous, 30 - 50-flowered; fruits pubescent, 12 - 16-seeded | 28. <i>D. stenobotrys</i> |

1. *Draba affghanica* Boiss., Fl. Orient. Suppl. 55. 1888. *D. rostrata* Pohle in Fedde, Repert. Spec. Nov. 32: 136. 1925. *D. affghanica* Boiss. var. *rostrata* (Pohle) O. Schulz. in Engler, Pflanzenr. 89: 118. 1927. *D. alpina* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 42. 1872, p. p.

Herbs, perennial, caespitose; rootstocks often long and branched; stems filiform, ascending, mostly aphyllous or 1-leaved, with dried leaves persisting at base, up to 5 cm long, beset with bifurcate and stellate hairs. Basal leaves rosulate, oblanceolate or lanceolate, entire or obscurely dentate, 5 - 15 (-18) x (1.5-) 2.5 - 5 mm, 1-nerved, hairy. Flowers yellow, 5 - 12 in corymbose racemes; pedicels 2 - 5 mm long, erect, becoming 3 - 10 mm long in fruit. Sepals oblong-elliptic, rounded at apex, 2 - 2.5 mm long. Petals obovate, submarginate at apex, 4 - 5 x 2 mm. Stamens up to 3.5 mm long; anthers ca 0.5 mm long. Ovary ovoid with simple and furcate hairs; style 1 - 2 mm long; stigma depressed. Fruits ovoid, inflated, 3 - 8 x 2 - 4 mm, hairy or rarely glabrous; septum not veined. Seeds 2 - 4 in each locule, ovoid-oblong, ca 1 mm long, dull brown.

Fl. & Fr. May - Aug.

Distrib. India: Jammu & Kashmir and Uttar Pradesh.

Nepal, Pakistan, Afghanistan and Iran.

2. *Draba altaica* (C. Meyer) Bunge in Delect. Sem. Hort. Dorpat. 8. 1841. *D. rupestris* R. Br. var. *altaica* C. Meyer in Ledeb. Fl. Alt. 3: 72. 1831. *D. fladnitzensis* var. *homotricha* (Ledeb.) Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872, p. p. *D. wahlenbergii* Schur. var. *homotricha* Ledeb., Fl. Ross. 1: 150. 1841.

Herbs, small, perennial; stems often much branched, erect, 2 - 6 cm high, basally covered with remains of dried leaves of previous year; hairs simple or forked. Leaves hairy or rarely glabrous, ciliate along margins; basal leaves rosulate, lanceolate or oblong-elliptic, tapering at base, acute at apex, with 1 - 2-dentate or entire margins, 5 -

20 x 1 - 2 (-5) mm; cauline leaves oblong-ovate or lanceolate, with 1 - 2-dentate or entire margins. Flowers white, 4 - 8 (-15) in 2 - 5 cm long racemose corymbs, often bracteate at base; pedicels spreading, 3 - 6 mm long, glabrous or hairy. Sepals oblong-elliptic, ca 1 mm long, pubescent. Petals 2 - 2.5 x 1 mm, slightly emarginate at apex. Stamens up to 1.5 mm long. Fruits ovoid-oblong or elliptic, rounded at base, acute at apex, 3 - 4 (-6) x 1.5 - 2 mm, usually glabrous or rarely with short simple hairs along margins of valves; style short, ca 0.5 mm long; stigma depressed. Seeds 4 - 6 in each locule, ovoid, brown.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim (ca 5600 m).

Pakistan, Nepal, Bhutan, China, Afghanistan, Central Asia and W. Siberia.

3. *Draba amoena* O. Schulz in Engler, Pflanzcnr. 89: 188, f.2. 1927; Hara in Hara & Williams, Enum. Fl. Pl. Nepal 2: 42. 1979.

Herbs, perennial; rootstock 4 - 6 cm long; stems erect, fistulose, much-branched, 50 - 60 (-70) cm high, 3 - 4 mm in diam., stellate hairy. Basal leaves rosulate; upper ones spatulate, acute at apex, dentate along margins, 40 - 70 x 9 - 15 mm; petioles 3 - 4 mm broad; cauline leaves smaller, 3 - 7 in number, oblong-lanceolate, sessile, semi-amplexicaul, gradually transformed into linear bracts, 1 - 1.5 cm long, stellate or simple hairy. Flowers pale violet, bracteate, 25 - 40 in lax, corymbose racemes; pedicels 6 - 15 mm long. Sepals oblong-elliptic in outer row, ovate in inner row, saccate at base, obtuse at apex, ca 4.5 mm long. Petals oblong-elliptic, clawed, cuneate at base, subemarginate at apex, 8 - 9 mm long. Stamens up to 5 mm long; anthers oblong, ca 1 mm long. Ovary oblong, pilose; style ca 0.75 mm long; stigma capitate. Fruits oblong, compressed, twisted, obtuse at base, acute at apex, 12 - 20 x 3 - 3.5 mm; style coronate, contorted or undulate along margins, 1 - 1.5 mm long; valves reticulately nerved, stellate or simple hairy near margins. Seeds ovoid, biscriate, ca 0.3 mm long.

Fl. & Fr. July - Sept.

Distrib. India: Uttar Pradesh (Kumaon).

Nepal.

4. *Draba aubrietoides* Jafri in Notes R. Bot. Gard. Edinb. 22: 106. 1956 & in Fl. W. Pakistan 55: 146. 1973.

Herbs, perennial or biennial; stem-branches numerous, prostrate to suberect, filiform, 15 - 20 cm high, with dense minute branched hairs. Leaves many, elliptic-obovate or oblong-elliptic, subsessile, cuneate at base, acute or obtuse at apex, mostly

entire, rarely 1 - 3-subdentate, pubescent. Flowers yellow, 6 - 10 (-16) in lax racemes; pedicels suberect, glabrous, 8 - 12 mm long, 10 - 20 (-25) mm long in fruit. Petals obovate, attenuate at base, subemarginate at apex, 5 - 6 x 2 - 3 mm. Stamens up to 2 mm long. Ovary oblong-ellipsoid, ca 3.5 mm long; style ca 0.5 mm long. Fruits variously curved, compressed, 12 - 25 x 2.5 mm, glabrous; valves membranous with a mid-vein and obscure reticulations; style with depressed capitate stigma, ca 1 mm long; septum membranous with an obscure mid-vein. Seeds usually 4 - 6 in each locule, sub-biseriate, oblong, compressed, slightly winged, ca 1.5 mm long.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Endemic.

5. *Draba cachemirica* Gandoger in Bull. Soc. Bot. France 46: 418. 1889. *D. glacialis* auct. non Adams 1817; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Herbs, perennial, densely caespitose; rootstock woody; stems tufted, erect, covered with dried leaf bases below, aphyllous above, 2 - 5 (-8) cm long. Basal leaves rosulate, oblong-linear, obtuse at apex, entire and ciliate along margins, prominently 1-veined beneath, 3 - 4 (-6) x 1 - 1.5 mm, simple or branched hairy. Flowers yellow, 8 - 15 in congested corymbose racemes; pedicels ascending, 1 - 5 (-7) mm long in fruit. Sepals oblong-ovate, 2 - 3 mm long with a few simple hairs below. Petals narrowly obovate, cuncate at base, subemarginate at apex, 4 - 6 x 2.5 - 3 mm. Stamens up to 3 mm long; anthers ca 0.5 mm long. Ovary flask-shaped, 4 - 8-ovuled; style 0.5 - 1 mm long, glabrous with depressed stigma. Fruits ovoid, subinflated to inflated, rounded at base, acute at apex, (2-) 3 - 4 (-5) x 1 - 3 mm; valves obscurely nerved; septum not veined. Seeds ovoid, 2 - 4 in each locule, ca 1 mm long, brown.

Fl. May - July; *Fr.* July - Sept.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

China (Tibet).

6. *Draba cholaensis* W. Smith in Rec. Bot. Surv. India 4(7): 352. 1913; Hara in Hara & Williams, Fl. Pl. Nepal 2: 42. 1979. *D. cholaensis* W. Smith var. *leiocarpa* Hara in J. Jap. Bot. 49: 131. 1974.

Herbs, annual or perennial, slender; stem branches numerous, filiform, flexuous, leafy below, 10 - 20 cm long, with simple or bifurcate, white spreading hairs at base, glabrous above; flowering scapes 5 - 8 cm long, aphyllous above. Basal leaves few; cauline leaves obovate to elliptic, acute at apex, entire or dentate along margins,

subsessile, 8 - 11 x 3 - 4 mm, with sparse white mostly simple hairs above, intermixed with furcate or stellate hairs beneath; nerves obscure. Flowers yellow, 1 - 3 in lax racemes; pedicels filiform, divergent, 5 - 15 mm long, becoming 10 - 25 mm long in fruit. Sepals oblong-ovate, ca 3 mm long, glabrous or subglabrous. Petals oblong, slightly clawed at base, emarginate at apex, 7 - 8 x 3 mm. Stamens up to 5 mm long; anthers ovoid, ca 0.5 mm long. Ovary ca 8 mm long, with simple hairs; style 1.5 - 2 mm long, with capitate stigma. Fruits siliquiform, linearly compressed, styliferous, 15 - 22 x 2 mm, white hairy or glabrous. Seeds ca 20 in number, biseriate, oblong-ellipsoid, ca 0.5 mm long.

Fl. & Fr. July - Aug.

Distrib. India: Sikkim (ca 4300 m).

Nepal and Bhutan.

7. ***Draba dasyastra*** O. Schulz in Engler, Pflanzenr. 89 (IV.105): 265. 1927.

Herbs, perennial; stems branched, crowded, suberect, 1 - 2 cm long, aphyllous, with dried persistent leaf bases below, densely hairy. Basal leaves congested, oblong-elliptic, obtuse at apex, entire, 2 - 3 x 1 mm, white stellate hairy. Flowers white, 2 - 5 in lax racemes; pedicels 2 - 5 mm long in fruit. Sepals oblong-elliptic, ca 2 mm long. Petals obovate, cuneate at base, ca 3.5 mm long. Filaments ciliate at base. Ovary 12-ovuled. Fruits oblong, suberect, contorted, 6 - 8 x 1.5 mm; style ca 0.4 mm long, glabrous.

Fl. July - Aug.; *Fr.* Aug. - Sept.

Distrib. India: Sikkim.

China (Tibet, adjoining Sikkim).

8. ***Draba elata*** Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 150. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Herbs, perennial, erect, up to 60 cm high; stems simple or branched, pubescent. Basal leaves rosulate, oblanceolate or spatulate, attenuate at base, acute at apex; margins obscurely dentate or entire with stellate forked and simple hairs; cauline leaves (2-) 6 - 8 (-10), rather remote, similar to basal leaves, oblong-ovate, amplexicaul, often 4-dentate. Flowers yellow, 10 - 30 in subcapitate corymbs, ebracteate or with 1 - 3 narrowly ovate bracts, 5 - 10 x 2 - 3 mm; pedicels 4 - 8 mm long, becoming 6 - 20 mm long in fruit. Sepals oblong-elliptic, rounded at apex, scarious along margins, 2.5 - 3 x 1.5 mm. Petals obovate, emarginate at apex, 5 (-7) x 2.5 (-4) mm. Stamens up to 3 mm long. Ovary flask-shaped, 12 - 16-ovuled, simple hairy; style 0.5 - 2 mm long in fruit, subincrassate. Fruits ovoid or ellipsoid, sometimes contorted, erecto-patent or ascending, acute at apex, 7 - 12 (-15) x 2 - 3 mm, pubescent or glabrous. Seeds ovoid, compressed, brown.

Fl. July - Aug.; *Fr.* Aug. - Sept.

Distrib. India: E. Himalayas in moist places, 3300 - 4600 m. Sikkim and Assam.

Nepal, Bhutan and China (Tibet).

9. *Draba ellipsoidea* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 153. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 144. 1872.

Herbs, annual, prostrate; stems slender, 0.5 - 1 cm long, basally branched, with stellate hairs. Leaves obovate to oblanceolate, attenuate at base, acute or obtuse at apex, entire or shallowly 1 - 3-dentate along margins, short stellate hairy. Flowers white, 3 - 8 in a raceme; pedicels filiform, 3 - 8 mm long. Sepals oblong, 1 - 1.5 mm long. Petals narrowly spatulate, 1-veined, ca 1 x 0.5 mm. Stamens up to 1.5 mm long; filaments thin; anthers ovoid. Ovary ovoid, densely hirsute, 22-ovuled; style absent or minute. Fruits ellipsoid, flat, erecto-patent, rounded at apex, (4-) 5 - 8 x 3 - 4, pubescent with minute, substellate hairs. Seeds ovoid.

Fl. & Fr. July - Sept.

Distrib. India: A weed of cultivation. Jammu & Kashmir and Sikkim (ca 4250 m).

Nepal and China.

10. *Draba eriopoda* Turcz. in Bull. Soc. Nat. Mosc. 15: 260. 1842 & Fl. Baic.-dahur. 1: 142. 1842; Hara in Hara & Williams, Enum. Fl. Pl. Nepal 2: 42. 1979.

Herbs, annual to biennial; stems 6 - 30 (-50) cm high, stellate hairy. Basal leaves rosulate, lanceolate, acute at apex, entire, 7 - 20 x 1.5 - 6 mm; cauline leaves longer, numerous, lower ones oblong-ovate, upper ones shorter, ovate, sessile or amplexicaul, acute at apex, all leaves hairy. Flowers yellow, 20 - 50 in corymbose racemes; pedicels 2 - 5 mm long, 3 - 10 mm long in fruit, densely hairy. Sepals elliptic with simple and furcate hairs, 1.5 - 2 mm long. Petals obovate, submarginate at apex, 3 - 4 mm long. Stamens ca 2 mm long; filaments dilated at base; anthers ovoid, ca 0.3 mm long. Ovary ovoid, 12 - 24-ovuled, glabrous; stigma sessile. Fruits ovoid-elliptic or oblong-obovoid, flattened, erecto-patent, acute at apex, glabrous, 5 - 10 x 2 - 2.5 mm; style rudimentary. Seeds ovoid, 0.3 - 0.75 mm long.

Fl. & Fr. June - Sept.

Distrib. India: E. Himalayas, ca 4100 m. Sikkim.

Nepal, Bhutan and China.

11. *Draba falconeri* O. Schulz in Engler, Pflanzenr. 89: 300. 1927; Jafri in Fl. W. Pakistan 55: 142. 1973.

Herbs, perennial; stems simple or sparsely branched, decumbent, up to 60 cm high, beset with branched and simple hairs. Basal leaves rosulate, oblong-obovate, acute at apex, entire or 1-dentate, 10 - 20 (-25) x 2 - 6 mm; cauline leaves sessile, oblong-ovate, acute at apex, 6 - 35 x 5 - 10 mm; upper ones 1 - 5-dentate or entire; all leaves with stellate and simple hairs, ciliate along margins. Flowers white, 15 - 30 (-40) in corymbose racemes, ebracteate; pedicels 4 - 8 mm long, 6 - 20 mm long in fruit, ascending or spreading, hairy. Sepals 2 - 3 x 1 mm, simple hairy. Petals obovate, cuneate at base, submarginate at apex, 4 - 6 x 1.5 - 2 mm. Stamens up to 2.5 mm long; anthers ca 0.5 mm long. Ovary linear, densely hirsute. Fruits linear-oblong, contorted, obtuse at apex, pubescent with rigid, short, branched and stellate hairs; style 0.75 - 1 mm long with depressed stigma. Seeds 10 - 14 in each locule, ovoid, ca 1 mm long.

Fl. & Fr. July - Sept.

Distrib. India: Kashmir.

Pakistan.

12. *Draba glomerata* Royle, Illus. Bot. Himal. 1: 71. 1834. *D. glomerata* Royle var. *dasycarpa* O. Schulz in Engler, Pflanzenr. 89: 220. 1927. *D. tibetica* var. *winterbottomii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 152. 1861, p. p. *D. lasiophylla* auct. non Royle 1834; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1972, p. p.

Herbs, perennial, caespitose; stems erect, 1 - 4-leaved, up to 8 cm high, tomentose with dense short soft stellate hairs. Basal leaves rosulate, narrowly oblong, narrowed towards base, obtuse at apex, 5 - 15 x 1 - 2.5 mm, densely hairy; cauline leaves oblong-ovate, entire or 1-denticulate, sessile, uppermost bract-like. Flowers white, 10 - 15 in corymbose racemes; pedicels 2 - 4 mm long in fruit, tomentose. Sepals ca 1.5 mm long. Petals obovate, cuneate at base, ca 2 x 1 mm. Stamens up to 1.5 mm long. Fruits subumbellate, compact, ellipsoid-oblong or oblong-ovoid, flattened, often twisted, 3 - 3.5 (-5) x 1.5 (-2) mm, minute hairy or glabrous; style ca 0.5 mm long, with depressed stigma. Seeds ovoid-oblong, 3 - 6 in each locule, ca 0.7 mm long.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal and China (Tibet).

13. *Draba gracillima* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 153. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 144. 1872. *D. wardii* W. Smith in Notes R. Bot. Gard. Edinb. 55: 210. 1919. Fig. 26.

Herbs, annual or perennial, slender, short-lived; stems filiform, ascending, diffusely branched, up to 30 cm high, covered with persistent dried leaf bases below, beset with short, simple and branched hairs, rarely glabrous. Basal leaves rosulate, oblanceolate, ovate or spatulate, attenuate at base, acute at apex, dentate to entire along margins, 10 - 15 x 4 - 5 mm, pubescent with simple hairs; cauline leaves ovate, acute at apex, often 2-dentate, 5 - 8 x 2 - 3 mm, covered with simple hairs above and stellate hairs beneath. Flowers yellow, 3 - 12 in lax racemes; pedicels 5 - 15 mm long, becoming 6 - 30 mm long in fruit. Sepals ovate-elliptic, ca 2 mm long. Petals obovate, cuneate at base, emarginate at apex, ca 2.5 - 3 x 1 mm. Stamens up to 2 mm long. Ovary oblong or ovoid, glabrous; stigma subsessile. Fruits often erect, linear-elliptic, elongated, compressed, recurved or subcontorted, obtuse at apex, 6 - 12 (-15) x 1.5 - 2.5 mm; style ca 0.5 mm long. Seeds ovoid, 6 - 10 in each locule, ca 1 mm long, brown.

Fl. & Fr. May - July.

Distrib. India: Moist open places, 3000 - 4200 m. Himachal Pradesh, Uttar Pradesh, West Bengal and Sikkim.

Pakistan, Nepal, Bhutan and China.

14. *Draba humillima* O. Schulz in Engler, Pflanzenr. 89: 114. 1927. *D. alpina* auct. non. L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Herbs, annual, densely caespitose; stems 1 - 2 cm long, covered with persistent scaly lanceolate leaves at base; scapes ca 5 mm long with stellate hairs. Basal leaves oblong-elliptic, cuneate at base, obtuse at apex, entire and ciliate along margins, 5 - 8 x 2.5 - 3 mm, subglabrous or glabrous above and with numerous minute stellate hairs below. Flowers yellow, 3 - 6 in lax racemes; pedicels 2 - 3 mm long, 3 - 4 (-8) mm long in fruit. Sepals oblong, ca 2.5 mm long, with simple hairs. Petals obovate, ca 4 x 2 mm. Stamens up to 3 mm long; anthers obtuse, ca 0.5 mm long. Ovary oblong-obovoid, 24-ovuled; style ca 0.3 mm long; stigma capitate. Fruits oblong-ellipsoid, inflated, obtuse or rounded at both ends, 5 - 7 x 3 - 4 mm, glabrous; style short, ca 0.5 mm long, coronate. Seeds, ca 24.

Fl. & Fr. July - Aug.

Distrib. India: 4500 - 5000 m. Sikkim.

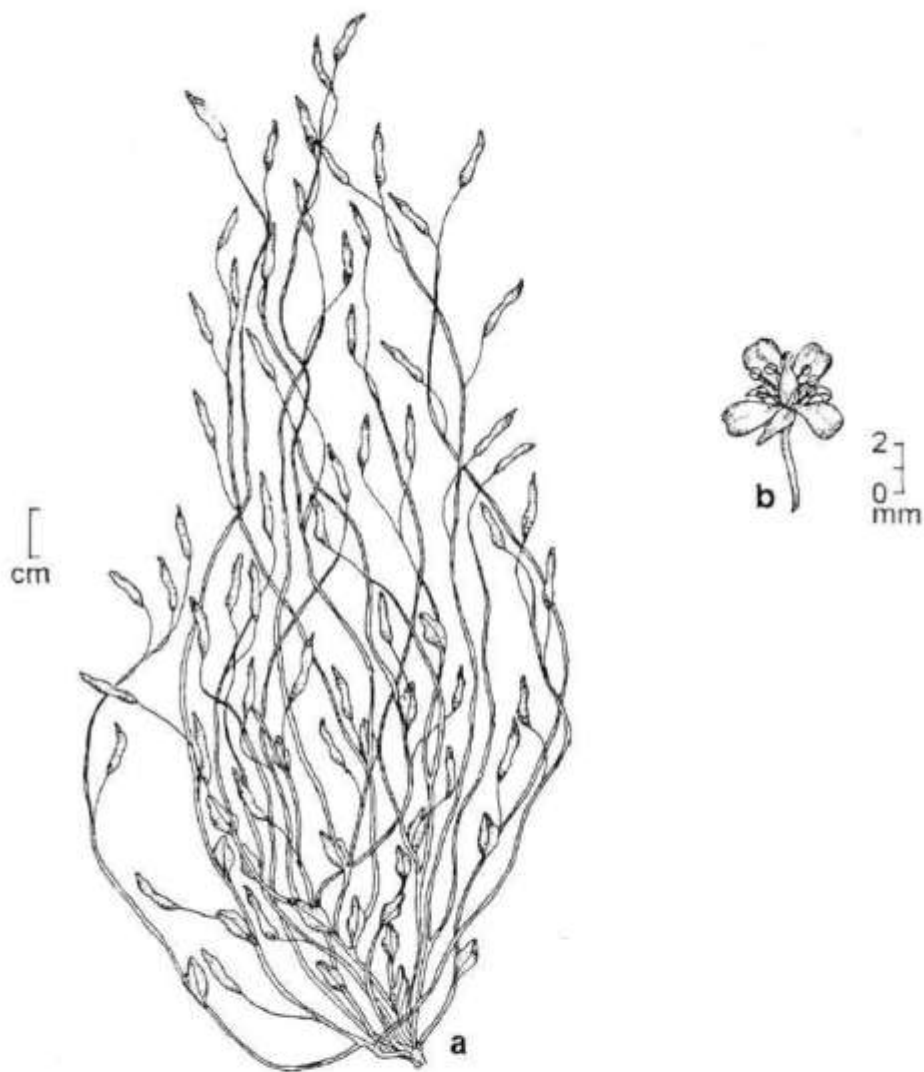


Fig. 26. *Draba gracillima* Hook. f. & Thomson : a. habit; b. flower.

15. *Draba korschinskyi* (O. Fedtsch.) Pohle in Act. Hort. Petrop. 31: 484. 1914; Jafri in Fl. W. Pakistan 55: 132. 1973. *D. alpina* var. *korschinskyi* O. Fedtsch. in Act. Hort. Petrop. 21: 266. 1903.

Herbs, perennial, compact, caespitose; rootstock much branched; stems slender, aphyllous, up to 5 cm long in fruit, covered with minute stellate hairs. Basal leaves rosulate, oblong, spatulate, obtuse at apex, 3 - 5 x 1 - 1.5 mm, often incurved, glabrous above and hairy beneath. Flowers yellow, 5 - 10 in corymbose racemes; pedicels spreading, 2 - 5 mm long, glabrous. Sepals oblong-obovate to ovate-oblong, ca 2 x 1 mm. Petals obovate, subemarginate at apex, 3 - 3.5 x 1.5 mm. Stamens up to 2.5 mm long; anthers ca 0.5 mm long. Fruits ovoid to suborbicular, inflated at base, acute at apex, 3 - 4 x 2 - 2.5 mm, usually glabrous, rarely hairy; style ca 0.5 mm long; stigma capitate. Seeds 4 - 6 in each locule, oblong-ovoid, brown, ca 0.75 mm long.

Fl. June - July; *Fr.* July - Aug.

Distrib. India: Jammu & Kashmir.

Pakistan, Nepal, China, Afghanistan and Russia.

16. *Draba lanceolata* Royle, Illus. Bot. Himal. 1: 72. 1834. *D. lanceolata* Royle var. *leiocarpa* O. Schulz in Engler, Pflanzenr. 89: 297. 1927. *D. incana* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872, p. p.

Herbs, perennial, compact, caespitose; stems much branched, erect, up to 25 cm high, covered with persistent dried leaves at base, hairy. Basal leaves rosulate, oblanceolate or spatulate, attenuate at base, subacuminate at apex, dentate or entire along margins, 10 - 15 x 1.5 mm, hairy; cauline leaves oblong-ovate or ovate-lanceolate, sessile, subacuminate at apex, distinctly dentate, rarely entire, 4 - 15 (-20) x 1.5 - 3.5 mm, pubescent. Flowers white, up to 35 in lax, often bracteate racemes; pedicels erect, ascending, 4 - 5 mm long in fruit. Sepals narrowly oblong, ca 2 mm long. Petals oblong-ovate, obtuse or emarginate at apex, 2.5 - 3.5 mm long. Stamens ca 1.5 - 2 mm long. Style ca 0.7 mm long. Fruits linear-oblong or ellipsoid-lanceolate, flattened, rarely twisted, 6 - 12 (-14) x 1.5 (-2) mm, minutely stellately hairy or rarely glabrous. Seeds 16 - 20 in each locule, ca 0.7 mm long.

Fl. June - July; *Fr.* July - Sept.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan, China, Afghanistan, Central Asia, Russia (Siberia) and N. America.

17. *Draba lasiophylla* Royle, Illus. Bot. Himal. 1: 71. 1834; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872, p. p. *D. nubigena* O. Schulz in Engler, Pflanzenr. 89: 291.

1927. *D. incana* auct. non L. 1753; Hook. f. & T. Anderson, l. c., p. p.

Herbs, perennial, small, caespitose; stems erect or ascending, slender, up to 25 cm high, sparsely leafy, hairy. Basal leaves rosulate, lanceolate or oblong, attenuate at base, acute at apex, entire or 2-denticulate, 10 - 15 (-20) x 2 - 5 mm, densely covered with branched hairs mixed with long, simple or forked hairs; cauline leaves ovate-oblong, sessile, acute at apex, denticulate along margins, 4 - 12 x 2 - 5 mm, pubescent. Flowers white, up to 20 in lax, subcapitate racemes, elongating up to 10 cm long; pedicels (2-) 4 - 6 mm long in fruit, densely covered with short, branched and simple hairs. Sepals oblong-elliptic, 2 - 2.5 mm long. Petals oblong-obovate, 2.5 - 3 x 1 mm. Stamens up to 2.5 mm long. Ovary 10 - 18-ovuled. Fruits ovoid or oblong-ellipsoid, acute at apex, (4-) 6 - 10 x 1.5 (-2) mm, often pubescent with short, whitish, branched hairs or glabrous; style ca 0.5 mm long, coronate. Seeds ca 0.7 mm long, brown.

Fl. & Fr. June - Aug.

Distrib. India: Between 3700 and 5500 m along streamsides. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal and China.

18. *Draba ludlowiana* Jafri in Notes R. Bot. Gard. Edinb. 22: 105. 1956.

Herbs, perennial, caespitose; stems erect, up to 18 cm long with 1 - 3 cauline leaves, tomentose. Basal leaves densely rosulate, linear-lanceolate, acute at apex, entire, 16 x 1 - 2 (-3) mm, tomentose; cauline leaves 1 - 4, elliptic or oblong, obovate, amplexicaul at base, acute at apex, entire, 2 - 8 x 1 - 3 mm. Flowers white, 15 - 20 in lax racemes up to 10 cm long, ebracteate; pedicels ascending, 2.5 - 7 mm long in fruit. Sepals oblong-elliptic, obtuse at apex, 1 - 1.5 x 0.7 mm, persistent, pubescent. Petals emarginate at apex, 2.5 - 3 x 1.5 mm. Stamens up to 1.5 mm long. Fruits ovoid-orbicular, compressed, 3 - 4 x 2.5 - 3, glabrous; stigma minute, sessile or subsessile; septum obscurely veined. Seeds 3 - 5 in each locule, suborbicular, ca 1 mm long, brown.

Fl. & Fr. June - Aug.

Distrib. India: Kashmir (Ladak).

Endemic.

19. *Draba melanopus* Komarov in Trav. Soc. Nat. Petersb. Bot. 26: 102. no. 179. 1896; Jafri in Fl. W. Pakistan 55: 143. 1973.

Herbs, perennial or biennial; stems much branched at base, aphyllous or rarely 1-leaved, (4-) 5 - 8 (-12) cm long, sparsely hairy below, almost glabrous above. Basal

leaves rosulate, oblong-elliptic or oblong-spathulate, entire, 5 - 10 (-12) x 1.5 - 3 mm, ciliate hairy along margins. Flowers light yellow, 5 - 12 (-16) in loose racemes; pedicels 1 - 4 mm long, becoming 3 - 6 mm long in fruit. Sepals 1 - 1.5 mm long. Petals spathulate, submarginate at apex, 2.5 x 1 mm. Stamens up to 1.5 mm long. Fruits oblong-ellipsoid or sublinear, 4 - 7 x 1 mm, hairy or glabrous; style minute or obscure. Seeds oblong-ovoid, 6 - 12 in each locule, ca 0.5 mm long, brown.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan, Iran and C. Asia.

20. *Draba nemorosa* L., Sp. Pl. 643. 1753. *D. muralis* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 144. 1872.

Herbs, slender, annual; stems erect, simple or branched, up to 25 cm high, leafy with stellate, furcate or simple hairs, glabrescent above. Basal leaves rosulate, oblong-obovate or elliptic-ovate, sessile, obtuse at apex, remotely dentate or subentire, 8 - 30 x 3 - 15 mm; cauline leaves few, often remote or absent, clasping, ovate or oblong-ovate, sessile, cuneate at base, acute at apex, 3 - 6-dentate, 5 - 25 x 2.5 - 12 mm; all leaves covered with rather long furcate or simple hairs. Flowers yellow, 25 or more, in ebracteate racemes; pedicels filiform, 5 - 10 mm long, 10 - 20 mm long in fruit, usually widely spreading or slightly recurved and ascending. Sepals oblong or ovate, obtuse at apex, ca 1.5 mm long, glabrous or slightly pubescent. Petals submarginate at apex, ca 2 mm long. Stamens up to 1.7 mm long. Fruits ellipsoid-oblong, compressed, 5 - 8 x 2 - 2.5 mm, with short, simple and forked hairs, rarely glabrous or sparsely pubescent; stigma minute, sessile. Seeds 16 - 20 in each locule, ovoid, ca 0.7 mm long, brown.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Iran, Turkey, China, Japan, Asia, Europe and N. America.

21. *Draba oariocarpa* O. Schulz in Engler, Pflanzenr. 89: 279. 1927. *D. lasiophylla* auct. non Royle 1834; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872, p. p.

Herbs, perennial, caespitose; stems slender, up to 20 cm high, with persistent, dried, linear-lanceolate, 3 - 4 mm long leaves at base and with rosulate, congested leaves above, all parts substellate-woolly. Basal leaves densely crowded, oblong-lanceolate, narrowed towards base, entire, acute at apex, 1 - 1.5 x 1 mm; cauline leaves few, remote, oblong-ovate, sessile, tomentose; hairs furcate and stellate on both sides. Flowers white, 6 - 12 in lax racemes; pedicels erecto-patent, filiform, 1 - 3 mm long, 3 - 6 mm long in fruit.

Sepals outer oblong, inner elliptic, obtuse at apex, ca 1.5 mm long. Petals obovate, cuneate at base, emarginate at apex, ca 2 mm long. Stamens ca 1.8 mm long, filaments filiform; anthers ovoid, ca 0.25 mm long. Ovary ovoid, pilose, 10-ovuled; style ca 1 mm long; stigma bilobed. Fruits ovoid, ca 3 x 2 - 2.5 mm; style ca 1 mm long, coronate; valves simple, hairy.

Fl. & Fr. June - Aug.

Distrib. India: 4500 - 4700 m. Sikkim.

Bhutan.

22. *Draba olgae* Regel & Schmalh. in Regel, Descr. Pl. Nov. in Fedtsch., Reise Nach Turkest. Lief. 18: 8. 1882; Jafri in Fl. W. Pakistan 55: 134. 1973.

Herbs, perennial, caespitose; stems erect, aphyllous, 3 - 10 (-15) cm high, glabrous in upper parts, pubescent below. Basal leaves rosulate, lanceolate, oblong or oblanceolate, entire or rarely 1 - 2-dentate along margins, acute at apex, 5 - 10 (-15) x 2 - 3 mm, hairy. Flowers yellow or yellowish white, (10-) 15 - 30 in compact corymbs, elongating in fruit; pedicels thread-like, erecto-patent, (3-) 5 - 10 (-14) mm long in fruit, glabrous. Sepals oblong-ovate, 2 - 2.5 mm long, hairy or sparsely pilose. Petals obovate, cuneate at base, subemarginate at apex, 4.5 - 6 (-7) x 1.5 - 4 mm. Stamens up to 2.5 mm long; anthers ca 0.5 mm long. Ovary ellipsoid, (8-) 10 - 14-ovuled, covered with minute, simple hairs. Fruits ellipsoid or oblong-ellipsoid, inflated, often incurved, 4 - 6 (-8) x 2 - 2.5 (-3) mm; style 0.5 - 0.75 mm long. Seeds (4-) 5 - 7 in each locule, ca 0.5 mm long.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan and Central Asia.

23. *Draba oreades* Schrenk in Fischer & Meyer, Enum. Pl. Nov. 2: 56. 1842. *D. alpina* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Fig. 27.

Herbs, perennial, caespitose; rootstock thin, covered with dried leaf-bases; stem-branches and branchlets numerous from the base, compact, 2 - 5 (-8) cm long in fruit, covered mostly with dense long slender simple or sometimes mixed with short, branched hairs. Basal leaves rosulate, oblong, oblanceolate or elliptic-obovate, chartaceous, attenuate at base, entire or obscurely 1-dentate along margins, obtuse or acute at apex. Flowers yellow to yellowish white, 4 - 12 (-15) in ebracteate, corymbose racemes; peduncles 1 - 10 cm long; pedicels 1 - 2 mm long, becoming 2 - 4 mm long in fruit. Sepals oblong, obtuse, 1.5 - 2.5 mm long, persistent, usually glabrous. Petals oblanceolate or



Fig. 27. *Draba oreades* Schrenk : a. flowering twig; b. fruiting twig; c. flower.

obovate, subemarginate at apex, 3 - 4 x 1 - 1.5 mm. Ovary 6 - 12-ovuled. Fruits shortly ovoid, acute, flattened, inflated below, rounded at base, mostly straight, rarely subcontorted, (3-) 4 - 6 (-8) x 3 - 4 (-5) mm, glabrous, rarely sparsely hairy; style 0.5 - 1 mm long. Seeds 3 - 6 in each locule, ovoid, 1 mm long.

Fl. June - July; *Fr.* July - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim (3900 - 4700 m).

Pakistan, Nepal, Bhutan, China and Central & Western Asia.

24. *Draba polyphylla* O. Schulz in Engler, Pflanzenr. 89: 180. 1927. *D. elata* auct. non Hook. f. & Thomson 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Herbs, perennial, robust; stems often simple, 20 - 60 cm in flower, up to 90 cm high in fruit. Basal leaves oblanceolate, often semiamplexicaul or sessile, (10-) 15 - 25 (-35) x 3.5 - 8 mm; cauline leaves oblong or oblong-elliptic, semiamplexicaul at base, dentate along margins, (5-) 15 - 20 (-40) x (-2) 3 - 8 (-12) mm, gradually transformed into bracts. Flowers yellow, bracteate, 20 - 40 in subcapitate racemes; pedicels 5 - 20 mm long in fruit. Sepals ovate, 2.5 - 3 x 1.5 - 2 mm. Petals obovate or oblanceolate, emarginate at apex, 3.5 - 4 x 1.5 - 2 mm. Ovary glabrous. Fruits oblong-ellipsoid or ovoid, often twisted, obtuse at apex, 7 - 12 (-14) x 4 - 6 mm, glabrous.

Fl. May - July; *Fr.* Aug. - Oct.

Distrib. India: 3600 - 5000 m. Sikkim.

Endemic.

25. *Draba radicans* Royle, Illus. Bot. Himal. 1: 71. 1834. *D. alpina* auct. non L. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872, p. p.

Herbs, perennial; stems branched at base; each branch 4 - 12 (-15) leaved, flaccid, 8 - 25 cm high, hairy. Cauline leaves: lower ones obovate, shortly narrowed to petiole at base, entire or subdentate along margins, acute at apex, 15 - 35 (-45) x 6 - 15 mm; upper ovate, sessile or shortly petioled, acute at apex; hairs simple, adpressed on upper surface, stellate or scabrous, dispersed on lower surface. Flowers yellow, ebracteate, 15 - 20 (-32) in lax racemes; pedicels 4 - 15 mm long, 12 - 20 mm long in fruit. Sepals: exterior ones oblong; interior ones oblong-ovate, obtuse at apex, 2.5 - 3 x 1 - 1.5 mm, pilose. Petals obovate, cuneate at base, emarginate at apex, 6 - 7 x 1.5 mm. Stamens up to 5 mm long;

filaments narrowed; anthers oblong, ca 1 mm long. Ovary narrow, flask-shaped, 18 - 20-ovuled; style ca 2 mm long, slender; stigma depressed, capitate. Fruits oblong, acute at apex, 10 - 15 x 2.5 - 3 mm, glabrous or with simple, dispersed hairs; style coronate, ca 3 mm long.

Fl. May - July; *Fr.* July - Aug.

Distrib. India: Uttar Pradesh.

Nepal.

26. *Draba setosa* Royle, *Illus. Bot. Himal.* 1: 71. 1884. *D. pyriformis* Pohle in Fedde, *Repert. Spec. Nov.* 32: 54. 1925. *D. glacialis* auct. non Adams 1817; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 142. 1872, p. p.

Herbs, perennial, caespitose; stems filiform, aphyllous, erect or ascending, 4 - 10 (-15) cm high, ciliate pilose. Basal leaves densely rosulate, linear, narrowed towards base, entire, 10 - 15 x 1 - 1.5 mm, rigid with a stout midrib beneath, setose along margins. Flowers yellow, 5 - 10 in corymbose racemes; pedicels 1.5 - 4 mm long, up to 6 mm long in fruit. Sepals oblong-obovate to oblong-ovate, ca 2 mm long. Petals narrowly obovate, cuneate at base, submarginate at apex, 3.5 - 4 mm long, densely veined. Stamens up to 2.5 mm long; filaments dilated at base; anthers ca 0.3 mm long. Ovary flask-shaped, 16-ovuled; style ca 0.5 mm long; stigma depressed. Fruits oblong-ellipsoid or linear, compressed, somewhat twisted or straight, acute at apex, 5 - 10 x 3 mm, glabrous; style 0.5 - 1 mm long. Seeds 6 - 8 in each locule, oblong-ovoid, brown, ca 1 mm long.

Fl. June - July; *Fr.* July - Aug.

Distrib. India: In alpine regions. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, China, Russia and Arctic Asia.

27. *Draba sikkimensis* (Hook. f. & Thomson) Pohle in Fedde, *Repert. Spec. Nov.* 32: 144. 1925. *D. tibetica* var. *sikkimensis* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 152. 1861; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 144. 1872.

Herbs, perennial, densely caespitose; stems simple, ascending, 1 - 2-leaved, rarely aphyllous, 3 - 20 cm high, hairy. Basal leaves rosulate or laxly imbricate, often forming columns, spatulate or oblanceolate, attenuate at base, entire or obscurely 1-dentate along margins, subacute at apex, 5 - 10 (-12) x 2 - 4 mm, hairs often woolly. Flowers white, 6 - 12 in lax corymbose racemes; pedicels suberect, 4 - 6 mm long, up to 12 mm

long in fruit. Sepals oblong, subsaccate at base, rounded at apex, ca 2.5 x 1 mm. Petals obovate, 4.5 - 6 x 2.5 - 3 mm. Ovary flask-shaped, densely woolly, 12-ovuled; stigma peltate. Fruits oblong-ellipsoid, often curved, sometimes twisted, acute at both ends, 6 - 12 x 2 - 3 mm, glabrous or pubescent; style coronate, 0.75 - 1 mm long. Seeds biseriate, ellipsoid, compressed, brown, 1 - 1.5 x 1 mm.

Fl. June - July; *Fr.* Aug. - Sept.

Distrib. India: Sikkim.

Bhutan.

28. *Draba stenobotrys* Gilg & O. Schulz in Engler, Pflanzenr. 89: 291. 1927. *D. stenobotrys* Gilg & O. Schulz var. *leiocarpa* O. Schulz in Engler, Pflanzenr. 89: 291. 1927. *D. lasiophylla* auct. non Royle 1834; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872, p. p.

Herbs, perennial; stems simple or often much-branched with 5 - 10 remote leaves, erect, ascending, flexuous, up to 30 cm high, covered with persistent dried leaves at base. Basal leaves rosulate, narrowly lanceolate, entire or obscurely 1-dentate, acute at apex, 10 - 15 x 1 - 1.5 mm, densely tomentose; cauline leaves ovate, broadly sessile, entire or obscurely denticulate along margins, acute at apex, 5 - 8 x 1 mm. Flowers white, 30 - 50 in elongated racemes, 4 - 6 bracteate below; pedicels 0.5 - 1 mm long, becoming 1 - 3 mm long in fruit. Sepals ca 1.5 mm long. Petals ca 2.5 mm long. Stamens up to 1.8 mm long. Ovary 12 - 16-ovuled, pilose; style ca 0.5 mm long. Fruits oblong-ovoid, suberect, acute at apex, 4 - 5 x 1.5 mm with furcate hairs or glabrous; septum prominently nerved. Seeds ca 0.75 mm long.

Fl. & Fr. July - Sept.

Distrib. India: Sikkim.

Endemic.

29. *Draba stenocarpa* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 153. 1861. *D. linearis* auct. non Boiss. 1842; Hook. f. & T. Anderson in Fl. Brit. India 1: 144. 1872.

Herbs, annual or biennial, rather stout; stems erect, simple or branched from base, bearing 2 - 5 leaves, rarely aphyllous, up to 30 (-40) cm high in fruit, densely hairy in lower parts, usually glabrous in upper parts. Basal leaves oblong-elliptic or oblong-obovate, subsessile, entire or subdentate along margins, acute at apex, 15 - 22 (-25) x 3 - 5 mm, strigose on upper surface, stellate or furcate hairy beneath; cauline leaves 2 - 5, lanceolate or oblong-ovate, obscurely few-denticulate or subentire, 5 - 20 x 2 - 7 mm. Flowers yellow or white, 20 - 30 (-40) in lax corymbose racemes; pedicels filiform,

spreading, 5 - 15 mm long in fruit. Sepals oblong, obtuse at apex, ca 2 mm long. Petals obcuneate, emarginate at apex, 3 - 4 x 1 mm. Stamens up to 2 mm long. Fruits linear or ellipsoid-lanceolate, tapering at both ends, flat, compressed, erect on spreading pedicels, (8-) 10 - 15 (-18) x 2 mm, hairy, rarely glabrous; style very short or obscure. Seeds biseriate, 14 - 20 in each locule, ca 1 mm long, brown.

Fl. May - July; *Fr.* June - Aug.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Central Asia, Pakistan, Afghanistan and China.

30. *Draba tenerrima* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 640. 1932 (incl. var. *trichocarpa* O. Schulz). *Erophila tenerrima* (O. Schulz) Jafri in Fl. W. Pakistan 55: 149. 1973.

Herbs, annual, delicate; stems erect simple, filiform, aphyllous, up to 4.5 cm high. Basal leaves rosulate, obovate or oblong-elliptic, narrowed at base, sessile, 1-denticulate or subentire, obtuse at apex, 2 - 8 x 1.5 - 4 mm, sparsely hairy. Flowers green, 2 - 6 in lax racemes; pedicels erect, ascending, filiform, 2 - 4 mm long in fruit, glabrous. Sepals 4, oblong, obtuse at apex, persistent in young fruits, ca 1 mm long. Petals absent. Stamens 4, ca 1 mm long; filaments slender, very short; anthers minute. Fruits obovate-ellipsoid, compressed, acute at base, rounded at apex, 2.5 - 4 x 1.5 - 2 mm; valves membranous, obscurely veined, glabrous or sparsely hairy; septum white. Seeds 3 - 5 (-6) in each locule, ovoid, compressed, ca 0.75 mm long.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Endemic.

31. *Draba tibetica* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 152. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 143. 1872. (incl. var. *thomsonii* Hook. f. & T. Anderson & var. *duthiei* O. Schulz).

Herbs, perennial, caespitose; stems erect or suberect, slender, simple, 1 - 2-leaved or leafless, 6 - 18 (-22) cm high, floccose. Basal leaves rosulate, oblong, sessile, slightly narrowed at base, entire, rarely toothed, subacuminate at apex, 8 - 20 x 1.5 - 3 mm; cauline leaves similar to basal leaves, rather small. Flowers yellowish white or yellow, 5 - 7 (-10) in lax corymbose racemes, elongating up to 10 cm in fruit; pedicels filiform, erect, ascending, 8 - 15 mm long in fruit. Sepals ovate-oblong, ca 2.5 mm long. Petals subemarginate at apex, 4 - 5 x 2 mm, hairy. Stamens up to 2.5 mm long. Fruits oblong-linear or narrowly lanceolate, flat, often acute at apex, 6 - 18 x (1-) 1.5 - 2 mm,

pubescent with short, branched hairs, rarely glabrous; style stout, ca 1 mm long; stigma capitate. Seeds oblong-ovoid, 8 - 12 in each locule, ca 1 mm long.

Fl. June - July; *Fr.* July - Aug.

Distrib. India: Jammu & Kashmir.

Pakistan, Nepal, China (W. Tibet), Afghanistan and Central Asia.

32. *Draba trinervis* O. Schulz in Engler, Pflanzenr. 89: 131. 1927; Jafri in Fl. W. Pakistan 55: 136. 1973.

Herbs, perennial, caespitose; rootstock much-branched; stems slender, ascending, aphyllous, 1 - 4 (-6) cm high, glabrous. Basal leaves linear-elliptic or lanceolate, entire, acute at apex, 3 - 8 x 1.5 - 2.5 mm, membranous, prominently 3 (-5)-nerved, ciliate-hairy. Flowers yellow, 5 - 10 in loose racemes; pedicels erect, 3 - 6 mm long, elongating up to 10 mm in fruit. Sepals oblong-ovate to ovate, ca 2.5 mm long, glabrous. Petals obovate, slightly oblique, rounded at apex, 4 - 5 mm long. Stamens 2.5 - 3 mm long; anthers ca 0.5 mm long. Ovary flask-shaped, 10-ovuled; style ca 0.75 - 1 mm long; stigma depressed. Fruits ovoid, 3.5 - 6 x 3 mm, glabrous; valves obscurely veined, subundulate on margins. Seeds 4 - 5 in each locule, ca 1 mm long.

Fl. May - Oct.; *Fr.* July - Oct.

Distrib. India: Jammu & Kashmir.

Pakistan and Afghanistan.

33. *Draba winterbottomii* (Hook. f. & Thomson) Pohle in Fedde, Repert. Spcc. Nov. Beih. 32: 138. 1925. *D. tibetica* Hook. f. & Thomson var. *winterbottomii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 152. 1861. *D. incompecta* auct. non Steven 1812; Hook. f. & T. Anderson in Fl. Brit. India 1: 142. 1872.

Herbs, perennial, caespitose; rootstock much-branched, covered below with persistent dried leaves and leaf-bases; stem branches decumbent below, suberect above, aphyllous or 1-leaved, 2 - 6 cm high. Basal leaves numerous, subrosulate, oblong, spatulate or narrowly obovate, almost sessile, cuneate at base, entire, obtuse at apex, 3 - 5 x 1 - 2 mm, floccose; cauline leaves when present oblong. Flowers white, 6 - 10 in lax racemes; pedicels 2 - 8 mm long in fruit. Sepals oblong-elliptic, ca 2.5 mm long. Petals obovate-cuneate, subemarginate at apex, ca 4 x 2 mm. Stamens up to 2.5 mm long. Fruits oblong-ellipsoid or lanceolate, slightly contorted, often recurved, flattened, acute at apex, 5 - 7 x 1.5 - 2 mm, glabrous or sparsely hairy near margins; style 1 - 1.5 mm long; stigma depressed. Seeds 5 - 8 in each locule, ca 1 mm long.

Fl. June - Aug.; *Fr.* July - Aug.

Distrib. India: Jammu & Kashmir.

China.

26. *Erophila* DC., nom. cons.

Herbs, annual, small, delicate, loosely tufted; stems scapose, slender, aphyllous; scapes arising from basal rosette. Basal leaves rosulate, simple, oblong-ovate or elliptic, broadly petioled, entire, simple or furcate hairy. Flowers white, rarely pinkish, in loose corymbose racemes. Sepals erect, obovate to ovate. Petals obovate or elliptic, emarginate or deeply bifid. Stamens 6; filaments slender, free. Ovary 10 - 60-ovuled, narrowly or broadly ellipsoid, sessile, glabrous. Fruit a silicula, oblong-ellipsoid, obovoid or linear, flattened, dorsally compressed, rounded at apex; valves flat or slightly convex, 1-veined; pedicels filiform; style short or obscure; stigma flat; septum membranous. Seeds numerous, small, ovoid, biseriate in each locule; funicles filiform.

Chiefly in Mediterranean region and in various parts of Europe, W. Asia, N. Africa and Temperate N.E. America; 10 species, 1 in India.

Erophila verna (L.) Besser, Enum. Pl. Volhyn. 22. 1822. *Draba verna* L., Sp. Pl. 642. 1753. *Erophila vulgaris* DC., Syst. Nat. 2: 356. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 145. 1872.

Herbs, annual; stems solitary or branched, erect or spreading, aphyllous, rarely 1-leaved, 3 - 10 (-20) cm high in fruit, hairy at base with simple or forked hairs and glabrous above. Leaves basal, in rosette, spatulate or broadly lanceolate or elliptic, attenuate at base, entire or remotely few dentate along margins, slightly acute at apex, hairy with simple and forked hairs. Flowers white, rarely pinkish, 10 - 20 in dense corymbose racemes; pedicels filiform, erect, glabrous, up to 10 mm long in fruit. Sepals 1.5 - 2 mm long, glabrous or pilose, white-margined. Petals deeply bifid at apex, 2.5-3.5 mm long. Stamens up to 2 mm long. Fruits erect-spreading, oblong-ellipsoid to almost orbicular, with short style at apex, variable, 5 - 8 (-10) x (1.5-) 2 - 3 (-4) mm. Seeds 10 - 20 in each locule, ca 0.5 mm long.

Fl. & Fr. Mar. - June.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan, Iran, C. & W. Asia, Europe, N. Africa and N.E. America.

Notes. A very polymorphic species showing extreme phenotypic plasticity. Several varieties have been described from Europe, Central and W. Asia.

Tribe 5. EUCLIDIEAE DC.

(G. H. Bhaumik)

Herbs, annual, usually pubescent with simple, branched or stellate-appressed hairs or sometimes sparsely papillose or glabrous. Sepals oblong or narrowly oblong, erect, not saccate at base. Petals spatulate or oblong, not clawed, yellow or white. Stamens 6, tetradynamous; filaments linear, free or the inner four connate in pairs at base, appendages absent. Ovary sessile, often subglobose; stigma capitate or slightly bilobed. Fruit an indehiscent, unilocular to trilocular, short-hemispherical silicula; valves hard, often variously appendaged; radicle incumbent or accumbent.

4 genera and 5 species in India.

27. *Euclidium* R. Br., nom. cons.

Herbs, annual, erect or suberect, dichotomously branched, pubescent throughout with branched and unbranched hairs. Leaves simple, lanceolate to linear, more or less stalked, sinuate-dentate to almost entire. Inflorescence spicate, often arising opposite to leaves, lax and elongated in fruit; pedicels very short, erect, appressed in fruit. Sepals erecto-patent, not saccate, pubescent. Petals narrowly linear-oblong or spatulate, not clawed, slightly emarginate at apex, white. Fruit an indehiscent silicula, ovoid, 2-seeded, longitudinally 4-veined, clearly septate, beaked. Seeds one in each locule; cotyledons accumbent or obliquely incumbent in juvenile state.

Europe, C. & S.W. Asia; 2 species, both in India.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1a. Cauline leaves petioled; fruits hairy; style subulate, obliquely bent, persistent | 1. <i>E. syriacum</i> |
| b. Cauline leaves sessile; fruits glabrous; style cylindrical, straight, deciduous | 2. <i>E. tenuissimum</i> |

1. *Euclidium syriacum* (L.) R. Br. in Aiton, Hort. Kew., ed. 2, 4: 74. 1812; Hook. f. & T. Anderson in Fl. Brit. India 1: 165. 1872. *Anastatica syriaca* L., Sp. Pl. ed. 2. 895. 1763.

Herbs, annual, diffuse, 10 - 20 cm high; stems spreading from base, cineraceous green, densely grey-pubescent, covered with simple, short and rigid stalked hairs. Radical leaves pinnatifid; cauline leaves oblong or oblong-lanceolate, gradually tapering towards base into petiole, sinuate-dentate or irregularly toothed along margins, sub-acute at apex, hairy along margins and on both surfaces. Racemes lax, up to 10 cm long in fruit; pedicels ca 1 mm long, thickened and appressed to stem. Sepals ovate-oblong, spreading, obtuse at apex, ca 1 mm long, pubescent. Petals spatulate, emarginate at apex, a little longer than sepals. Fruits obliquely ellipsoid or ovoid, tetragonous,

torulose, rugose, 3 - 4 x 2 - 2.5 mm, densely covered with short hairs; style persistent, conical-subulate, 1.5 - 2 mm long, usually bent or recurved. Seeds ovoid, compressed, brown, 2 x 1.25 mm.

Fl. & Fr. May - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

C. & S.W. Asia and Europe.

2. *Euclidium tenuissimum* (Pallas) O. Fedtsch. in Bull. Herb. Boiss. 2(4): 915. 1904; Nair in J. Bombay Nat. Hist. Soc. 64: 133. 1967 & Fl. Bashahr Himal. 28. 1977. *Vella tenuissima* Pallas, Reise 5: 506. 1793. *Bunias tatarica* Willd., Sp. Pl. 3: 43. 1800. *Euclidium tataricum* (Willd.) DC., Syst. Nat. 2: 422. 1821.

Herbs, annual, erect, branched, 10 - 40 cm high. Radical leaves more or less sinuate-dentate to lyrate-pinnatifid, with small lanceolate lateral lobes and larger oblong-lanceolate apical lobe, 3 - 10 x 0.5 - 2 cm; cauline leaves linear-oblong to linear-lanceolate, entire or rarely irregularly toothed, 1 - 6 x 0.5 - 1 cm, simple hairy on mid-veins below, upper surface usually glabrous, rarely hairy on both surfaces. Inflorescence spicate, up to 25 cm long in fruit; pedicels ca 1 mm long in fruit, ascending or subappressed. Sepals ovate-lanceolate, cuneate, 1.75 - 2 mm long, glabrous. Petals 2.5 - 4 x 1 mm, pinkish white. Fruits broadly ovate with 6 prominent longitudinal ribs, 1.75 - 2.25 x 2 mm, glabrous, bilocular; style ca 2 mm long. Seeds orbicular, brown, ca 1.25 mm in diameter.

Fl. & Fr. Apr. - May.

Distrib. India: Himachal Pradesh.

C. & S.W. Asia and Europe.

28. *Myagrum* L.

Monotypic; description and distribution as for the species below.

Myagrum perfoliatum L., Sp. Pl. 640. 1753; Naithani et al. in Indian For. 104: 171, f.1. 1978.

Herbs, erect, annual, 20 - 100 cm high; stems branched from base and above the middle, glabrous, glaucous. Leaves 2 - 4 cm long, entire; basal leaves oblong-oblong-lanceolate, obtuse, sinuate-dentate to pinnatifid, petiolate; cauline leaves oblong to lanceolate, sessile and sagittate to cordate-amplexicaul at base, entire to denticulate along margins, acute at apex. Racemes ebracteate, erect. Flowers ca 6 mm long, yellow; fruiting pedicels

clavately thickened, tightly appressed to stem, 4 - 5.5 mm long, very sturdy, hollow. Sepals ovate, erect or suberect, slightly saccate at base, ca 2 mm long. Petals oblong, not clawed, truncate or rounded at apex, 3 - 4.5 x 1.5 mm, yellow or cream-coloured. Stamens 6, the longer ones sometimes connate at base in pairs. Fruit an indehiscent silicula, clavate, compressed, more or less tuberculate-rugose, 3-loculed, 5 - 8 x 5 mm; upper 2 locules sterile, the lower one fertile with one or rarely two seeds; beak small, conical. Seed solitary, oblong or obovoid, pendulous, ca 3 mm long; cotyledons slightly incumbent.

Fl. & Fr. April - June.

Distrib. India: Uttar Pradesh.

C. & S. Europe and C. & S.W. Asia.

29. *Neslia* Desv., nom. cons.

Herbs, annual, erect, branched with simple and branched hairs. Basal leaves petiolate; cauline leaves sessile, oblong-lanceolate, auricled, amplexicaul, entire to toothed, pubescent. Racemes corymbose, ebracteate, dense in flower, elongated in fruit; flowers small, yellow; pedicels filiform, spreading or ascending, elongated in fruit. Sepals erect, not saccate. Petals entire, spatulate, about twice as long as sepals, yellow. Stamens edentate. Fruit an indehiscent latiseptate silicula, subglobose, dorsally compressed, bilocular, 1-loculed, 1-seeded, wrinkled; style distinct, jointed; stigma minute, slightly 2-lobed; seed 1, pendulous, ovoid, suborbicular, brown; cotyledons incumbent.

Europe and Asia; 2 species, 1 in India.

Neslia apiculata Fischer, C. Meyer & Ave-Lall in Ind. Sem. Hort. Petrop. 8: 68. 1842. *N. paniculata* (L.) Desv. subsp. *thracica* (Velent.) Bornm. in Ostter Bot. Zeitschr. 44: 125. 1894. *N. thracia* Velent. in Osterr. Bot. Zeitschr. 41: 122. 1891. *N. paniculata* auct. non. Desv. 1814; Hook. f. & T. Anderson in Fl. Brit. India 1: 164. 1872. **Fig. 28.**

Herbs, annual, erect, 20 - 80 cm high; stems branched, ascending, pubescent. Radical leaves subsessile or petiolate, oblong or oblong-lanceolate, entire or dentate, sagittate at base, acute at apex, 3 - 10 x 1 - 2 cm; cauline leaves sessile, linear to linear-oblong, sagittate-auricled at base, 1 - 8 x 0.3 - 1.5 cm. Racemes corymbose paniculate, 30 - 50-flowered, up to 30 cm long in fruit; pedicels up to 1 cm long in fruit, spreading. Sepals erect-spreading ca 2 mm long, yellowish with membranous margins. Petals linear-oblong, truncate, tapering at base, 2 - 3 x 1 mm. Fruits lentiform-subspherical, glabrous, alveolate and finely granular, ca 2 - 5 mm in diam; valves with a distinct midnerve, reticulately veined; style ca 1 mm long. Seeds brown, ca 1.5 mm in diam.

Fl. & Fr. March - Apr.

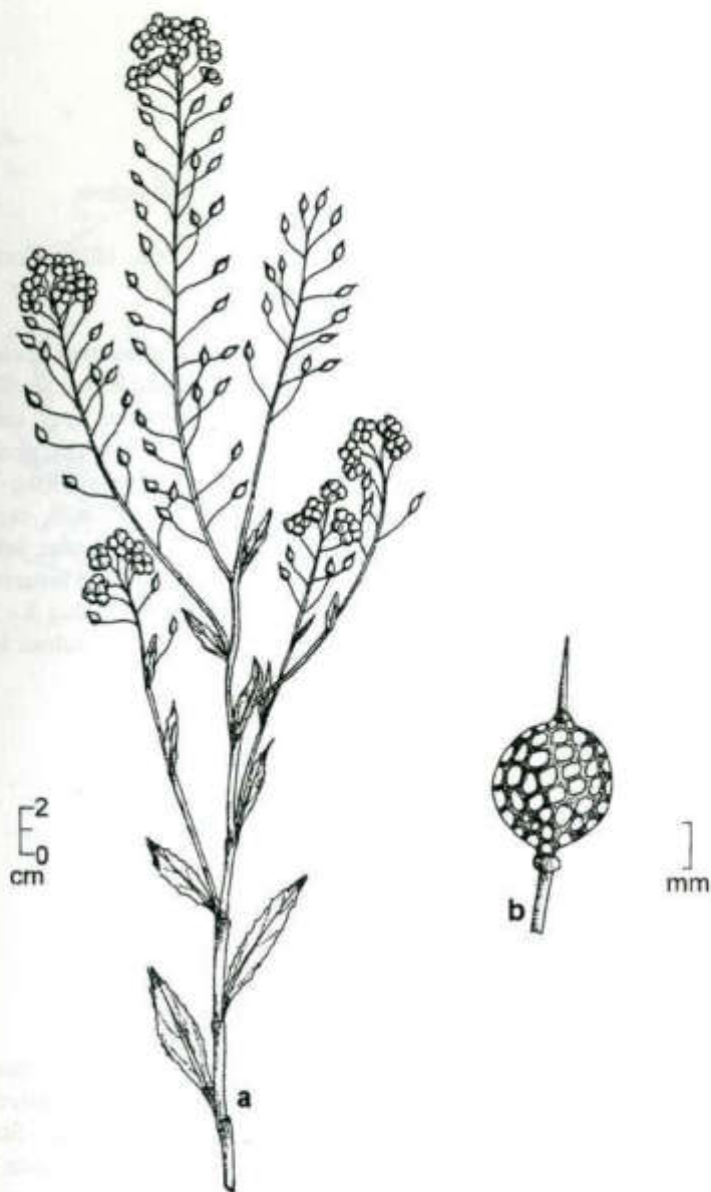


Fig. 28. *Neslia apiculata* Fischer, C. Meyer & Ave-Lall. : a. plant, upper portion; b. fruit.

Distrib. India: Jammu & Kashmir.

C. & S.W. Asia, S. Europe and N.W. Africa.

30. *Tauscheria* Fischer ex DC.

Monotypic; description and distribution as for the species below.

Tauscheria lasiocarpa Fischer ex DC. Syst. Nat. 2: 563. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 164. 1872. **Fig. 29.**

Herbs, annual, 15 - 30 cm high, erect, branched, glabrous, glaucous. Leaves simple, entire. Radical leaves cuneate, mostly drying up early. Cauline leaves sessile, amplexicaul, ovate-lanceolate, cordate-auricled at base, acute or obtuse at apex, entire, 2 - 6.5 x 0.75 - 1 cm, glabrous. Racemes lax, in loose panicles, elongated in fruits; pedicels erect, afterwards spreading, up to 3.5 mm long and recurved in fruit. Sepals oblong-lanceolate, more or less concave, acute or obtuse at apex, 1.25 x 0.5 - 0.75 mm, erect. Petals spatulate, obtuse or subretuse, sinuate along margins, 1.5 - 2 x 0.5 mm, yellow. Fruit an indehiscent silicula, boat-shaped, concave and deeply grooved with incurved margins above, convex below, winged, 1-loculed, 5 - 6 x 2.75 - 3 mm (including 2 - 3 mm long beak), thickly glandular hairy; beak curving upwards. Seeds 2, pendulous from top of locule, ca 2.25 x 1 mm, blackish brown; cotyledons incumbent.

Fl. & Fr. July - Aug.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

C. & S.W. Asia.

Tribe 6. HESPERIDEAE Prantl

(P. K. Hajra, H. J. Chowdhery & G. H. Bhaumik)

Herbs, usually with simple or 2 - 3-forked appressed hairs, sometimes glabrous. Racemes few to many-flowered, sometimes scape 1-flowered. Sepals usually erect, inner often saccate or subsaccate at base. Petals usually twice as long as sepals. Stamens free or inner four connate in pairs; anthers usually ditheous. Ovary sessile or shortly stipitate; stigma bilobed. Fruits long or rarely short, dehiscent or indehiscent.

6 genera and 18 species in India.

31. *Atelantha* Hook. f. & Thomson

Monotypic; description and distribution as for the species below.

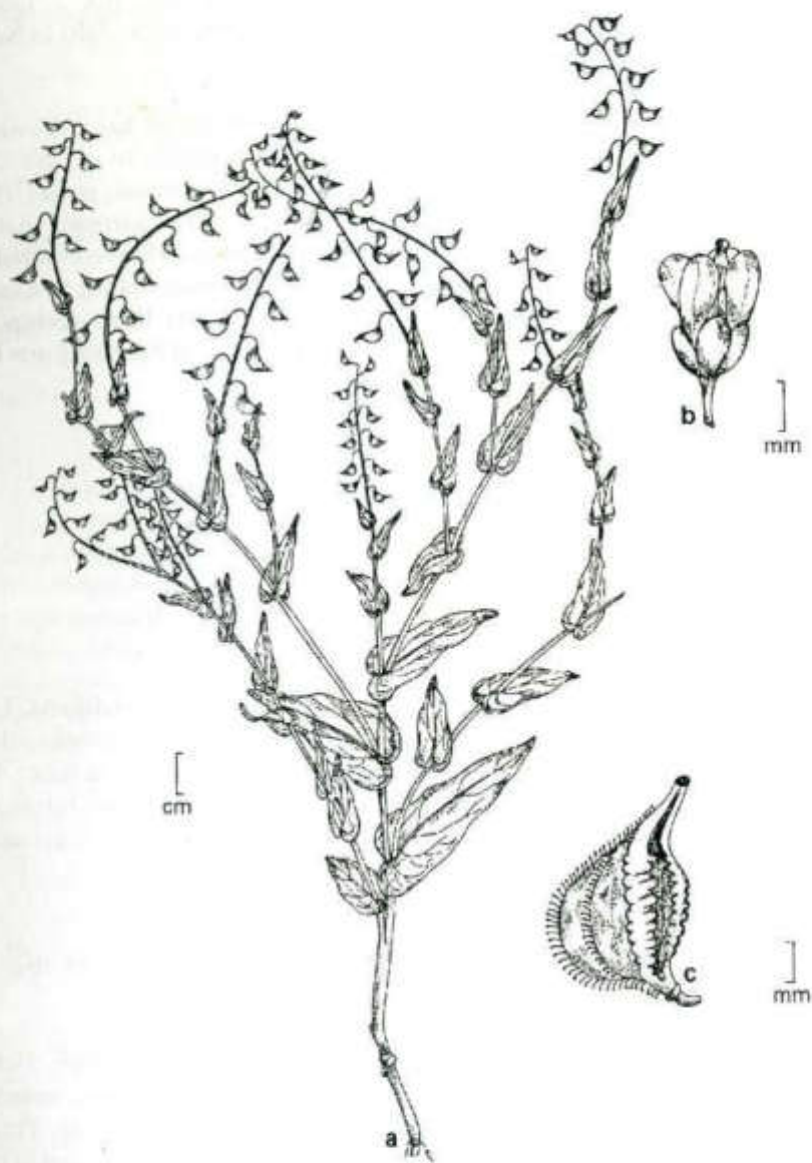


Fig. 29. *Tauscheria lasiocarpa* Fischer ex DC. : a. plant; b. flower; c. fruit.

Atelanthera perpusilla Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 138. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 133. 1872. *A. pentandra* Jafri in Notes R. Bot. Gard. Edinb. 22: 101. 1956.

Herbs, annual, 3 - 8 cm high, with appressed bipartite rough hairs; stems erect, simple, filiform. Leaves few, sessile, distant, linear-oblong, entire, 10 - 15 x 1 - 3 mm. Racemes 2 - 6-flowered. Flowers white, subsessile, ca 2.5 mm across; pedicels inconspicuous, ca 1 mm long in fruit. Sepals ca 2 mm long, erect. Petals narrowly spatulate or oblong, ca 3 mm long. Stamens 6, dimorphic, ca 2 mm long; anthers with short claw at tip. Lateral nectar glands in pairs, oblong-terete. Ovary linear-oblong to somewhat cylindrical, 14 - 24-ovuled; style short, stigma 2-lobed. Fruits linear, compressed, bilocular, dehiscent, straight or twisted, appressed hairy, ca 2 cm long, ca 1 mm broad. Seeds 6 - 12 in each locule, 1-seriate, oblong.

Fl. & Fr. Apr. - June.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan and China.

32. *Cheiranthus* L.

Herbs, perennial; stems leafy, appressed hairy; hairs branched, medifixed. Leaves elliptic to linear-oblong; basal rosulate, cauline crowded. Racemes 10 - 30-flowered. Flowers bright orange-yellow. Sepals erect, inner saccate at base. Petals long-clawed, yellow; median nectaries absent. Fruit a silique, compressed, terete, erect, appressed hairy; valves with a distinct midvein. Seeds 1 - 2-seriate; radicle accumbent.

Eurasia; about 10 species, 1 cultivated in India.

Cheiranthus cheiri L., Sp. Pl. 661. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 132. 1872.

Stems up to 80 cm high, woody at base. Basal leaves oblong-lanceolate, 5 - 10 cm long, entire or minutely denticulate, shortly petioled; cauline smaller, subsessile. Flowers ca 2 cm across; pedicels 5 - 15 mm long in fruit. Sepals ca 1 cm long. Petals ca 2 cm long. Fruits 4 - 7 cm long, 3 - 5 mm broad. Seeds suborbicular, ca 3 mm in diam.

Cultivated in India; native of Europe, called Wall Flower.

33. *Erysimum* L.

Herbs, often pubescent with 2 - 3-branched medifixed appressed hairs; stems leafy, branched mostly from base. Leaves simple, linear, elliptic or oblong, attenuate at base,

entire or sinuate-toothed. Flowers in corymbose racemes, usually ebracteate, or bracteate only at base, orange, yellow or rarely purple. Sepals erect, inner ones pouched or saccate at base. Petals clawed. Stamens 6; filaments simple; anthers linear-oblong. Ovary pubescent, many-ovuled; stigma 2-lobed, capitate. Fruit a siliqua, linear, elongate-narrow, compressed, tetragonal or terete; valves 1-nerved, rounded or keeled. Seeds many, 1-seriate.

Chiefly Eurasian; about 100 species, 11 in India.

KEY TO THE SPECIES

- | | |
|---|----------------------------|
| 1a. Plants usually dwarf, 3 - 12 cm high, branches crowded | 2 |
| b. Plants usually 15 - 75 cm high; branches not crowded | 3 |
| 2a. Plants ca 3 cm high; pods 1.5 - 2 cm long; seeds with slender funicle | 5. <i>E. funiculosum</i> |
| b. Plants 7 - 12 cm high; pods 3.5 - 5 cm long; seeds with short funicle | 4. <i>E. deflexum</i> |
| 3a. Plants diffusely branched; mature pods horizontal | 10. <i>E. repandum</i> |
| b. Plants not diffusely branched; mature pods usually erect and stout | 4 |
| 4a. Pods usually 10 - 11 cm long | 7. <i>E. longisiliquum</i> |
| b. Pods usually 3 - 8 cm long | 5 |
| 5a. Flowers ca 6 mm across | 11. <i>E. thomsonii</i> |
| b. Flowers usually 8 - 15 mm across | 6 |
| 6a. Pedicels up to 5 mm long | 1. <i>E. aitchisonii</i> |
| b. Pedicels more than 5 mm long | 7 |
| 7a. Leaves usually linear, 2 - 3 mm broad | 2. <i>E. altaicum</i> |
| b. Leaves usually oblong-elliptic or lanceolate, 5 - 10 mm broad | 8 |
| 8a. Mature pods usually 1.5 mm broad | 9 |
| b. Mature pods usually 2.5 - 3 mm broad | 10 |
| 9a. Sepals ca 5 mm long | 6. <i>E. hieracifolium</i> |
| b. Sepals ca 8 mm long | 8. <i>E. melicentae</i> |
| 10a. Flowers ca 8 mm across | 9. <i>E. pachycarpum</i> |
| b. Flowers ca 12 mm | 3. <i>E. cachemiricum</i> |

1. *Erysimum aitchisonii* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1080. 1927; Jafri in Fl. W. Pakistan 55: 239. 1973.

Herbs, erect, much-branched, up to 60 cm high. Basal leaves entire or shortly toothed, acute at apex, petioled, 5 - 8 x 0.5 - 1 cm. Racemes 25 - 45-flowered, up to 25 cm long in fruit. Flowers ca 1 cm across, yellow; pedicels 2 - 3 mm long in fruit. Sepals lanceolate, ca 5 mm long. Petals ca 1.5 cm long. Pods linear to subcylindrical, 2 - 4 cm long; valves with distinct midrib. Seeds brown.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Afghanistan.

2. **Erysimum altaicum** C. Meyer in Ledeb., Fl. Alt. 3: 153. 1831; Hook. f. & T. Anderson in Fl. Brit. India 1: 154. 1872. **Fig. 30.**

Herbs, perennial, erect, up to 25 cm high. Radical leaves linear-oblong, entire or sinuate-toothed, sometimes runcinate, petioled, 3-5 x 0.2-0.3 cm; cauline leaves smaller, linear, sessile. Racemes 15-45-flowered. Flowers 0.8-1.2 cm across; pedicels 0.5-1 cm long in fruit. Sepals ca 8 mm long. Petals ca 1 cm long. Stamens ca 8 mm long. Fruits linear-oblong, terete, ca 5 cm long; valves with prominent midrib. Seeds minute, oblong-ellipsoid.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan and Central Asia.

3. **Erysimum cachemicum** O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1080. 1927; Jafri in Fl. W. Pakistan 55: 237. 1973.

Herbs, erect, robust, up to 50 cm high. Leaves both basal-rosulate and cauline, oblong-elliptic to lanceolate, sparsely dentate, acute at apex, petioled, 5-10 x 0.5 cm. Racemes 20-35-flowered, 15-20 cm long in fruit. Flowers ca 1.2 cm across; pedicels ca 8 mm long in fruit, spreading. Sepals ca 5 mm long. Petals ca 1 cm long. Fruits 3-5 cm long; style thickened with capitate subbilobed stigma. Seeds oblong.

Fl. & Fr. May - July.

Distrib. India: Kashmir.

Endemic.

4. **Erysimum deflexum** Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 165. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 153. 1872.

Herbs, 8-12 cm high, ascending or decumbent or deflexed in fruit; rootstock thick, woody, much branched. Leaves linear-spathulate, minutely toothed, 0.8-3 cm long, 1.5-3 mm wide, appressed-pubescent with 2-branched hairs. Flowers 0.8-1 cm across, orange-yellow; pedicels ca 8 mm long, equalling sepals. Fruits linear, erect, tetragonal, 3.5-5 cm long, acute at apex. Seeds with very short funicles, ellipsoid, ca 1.5 mm long, ca 0.7 mm wide; funicles ca 1 mm long.

Fl. & Fr. July - Aug.

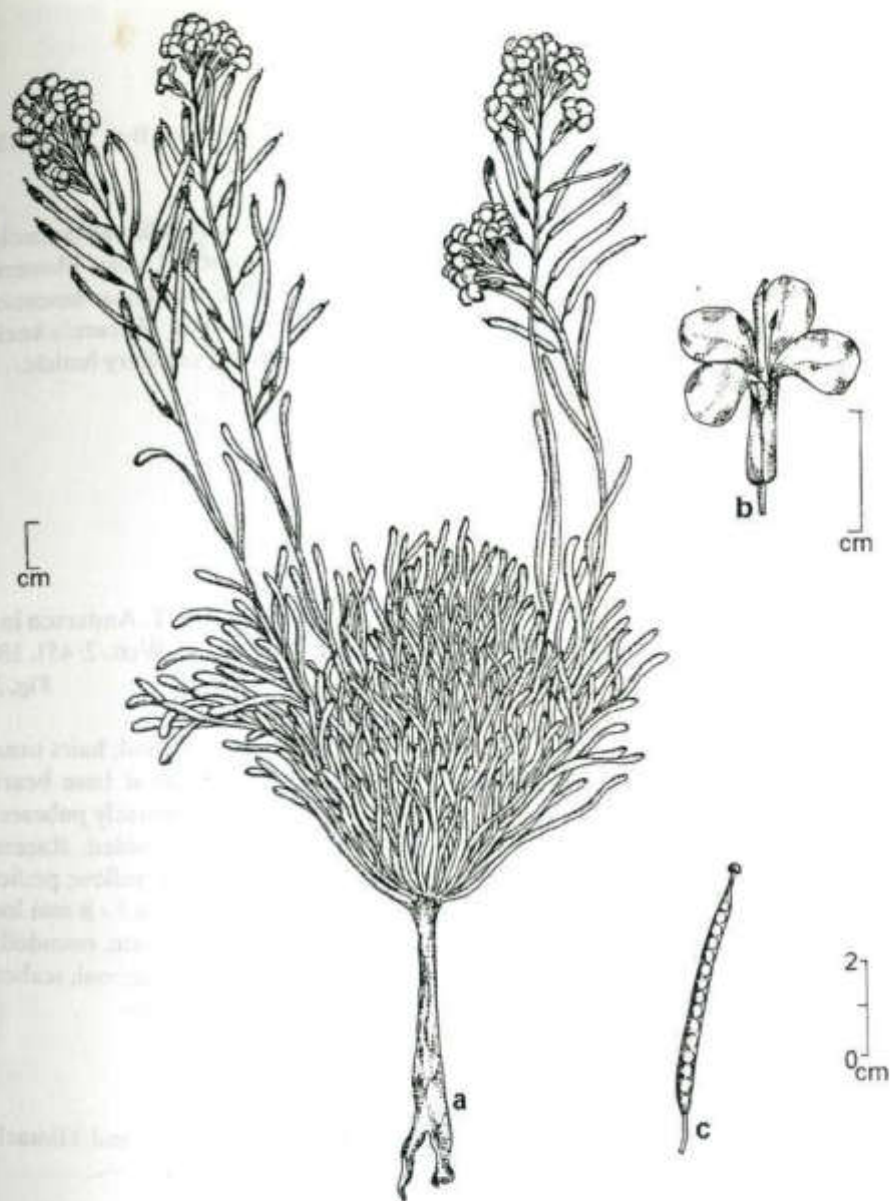


Fig. 30. *Erysimum altaicum* C. Meyer : a. habit; b. flower; c. fruit.

Distrib. India: E. Himalayas, 3950 - 5250 m. Sikkim.

Bhutan.

5. *Erysimum funiculosum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 165. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 153. 1872.

Rootstock much divided; branches erect, ca 3 cm high. Leaves linear-lanceolate, oblanceolate, 1 - 2 cm long, 2 - 3 mm wide, entire, bearing 2-branched hairs. Flowers ca 1 cm across; pedicels ca 8 mm long in fruit. Fruits fascicled, erect, linear-lanceolate, compressed, 1.5 - 2 cm long, 2 - 2.5 mm wide; valves membranous, obscurely keeled; style short, conical. Seeds ellipsoid, ca 2 x 0.7 mm, with slender, capillary funicle.

Fl. & Fr. Aug.

Distrib. India: Sikkim (4265 - 4570 m).

Endemic.

6. *Erysimum hieraciifolium* L., Cent. Pl. 1: 18. 1755; Hook. f. & T. Anderson in Fl. Brit. India 1: 153. 1872. *E. strictum* Gaertner f. in Mey. & Schreb., Pl. Wett. 2: 451. 1800. *E. bhutanicum* W. Smith in Notes R. Bot. Gard. Edinb. 10: 31. 1917. **Fig. 31.**

Herbs, erect, stout or slender, up to 75 cm high, simple or branched; hairs usually 2-forked, appressed. Leaves elliptic-oblong to oblanceolate, attenuate at base bearing 3 - 5 small teeth on either side, acute at apex, 3 - 10 x 0.5 - 1.5 cm, sparsely pubescent, mostly with 2-branched hairs; upper ones sessile or subsessile, basal petioled. Racemes 10 - 50-flowered, up to 40 cm long in fruit. Flowers 0.8 - 1 cm across, yellow; pedicels up to 1 cm long, upcurved, stout. Sepals narrowly oblong or ovate, ca 5 - 8 mm long. Petals orange, ca 1 cm long, 5 - 9 mm long, clawed; limb oblong, obovate, rounded or emarginate. Stamens ca 6 mm long. Fruits slender, erect, narrow, tetragonal, scaberulous, 3 - 8 cm long; style short, stout or slender. Seeds 1.7 - 2 mm across.

Fl. & Fr. May - Aug.

Distrib. India: River banks and hillsides. Jammu & Kashmir and Himachal Pradesh.

Nepal, Bhutan, Pakistan, China, S.E. Tibet, Temperate Asia and Northern Europe.

7. *Erysimum longisiliquum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 166. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 154. 1872.

Herbs, robust, erect, up to 80 cm high, glabrous; stems acutely angled. Leaves

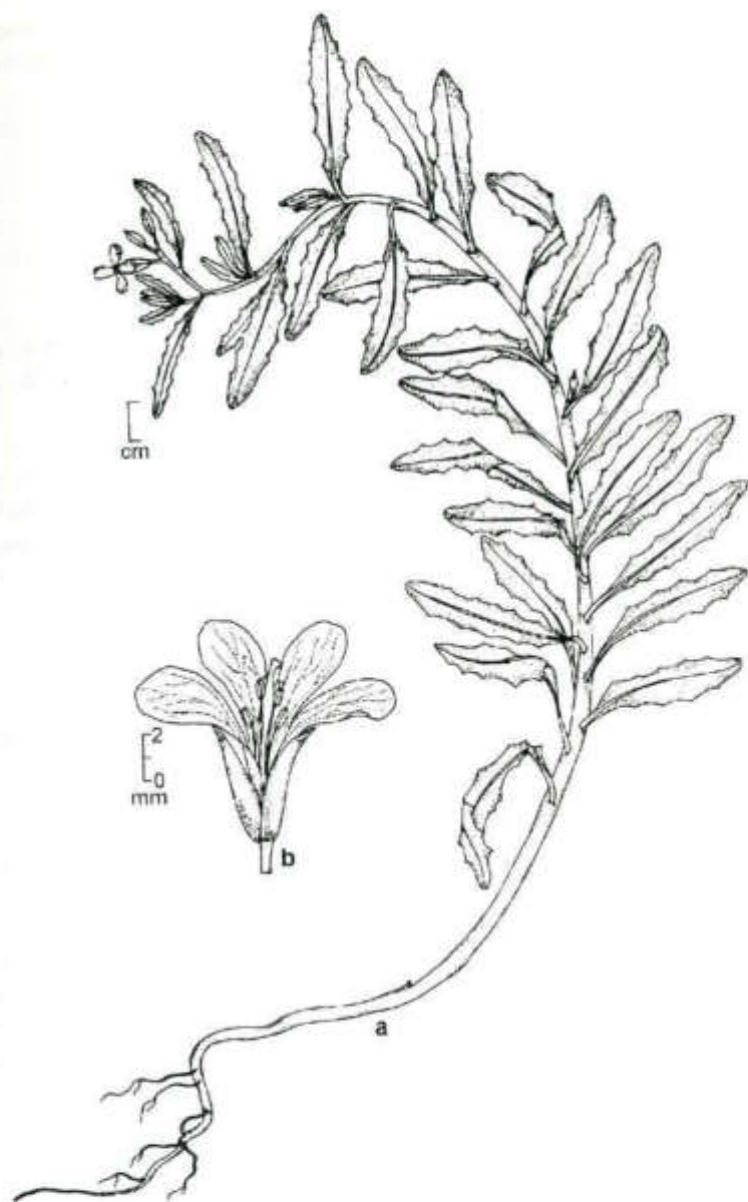


Fig. 31. *Erysimum hieraciifolium* L. : a. habit; b. flower.

lanceolate or oblanceolate, obscurely toothed. Flowers ca 1 cm across; pedicels 0.5 - 1.5 cm long in fruit. Style 2 - 3 mm long, stout. Fruits spreading, linear, 8 - 12 x 0.3 cm; valves with prominent keel.

Fl. & Fr. May - June.

Distrib. India: In Eastern Himalayas, 3050 - 3950 m. Sikkim.

Bhutan.

8. *Erysimum melicentae* Dunn in Bull. Misc. Inf. Kew 1920: 366. 1920. *E. odoratum* auct. non Ehrh. 1792; Hook. f. & T. Anderson in Fl. Brit. India 1: 154. 1872. *E. parkeri* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1083. 1927.

Herbs, up to 75 cm high. Leaves oblong to lanceolate or linear-lanceolate, sinuate-toothed or entire, scaberulous, petioled, 3 - 10 x 0.5 - 1 cm. Racemes 20 - 40-flowered. Flowers 0.8 - 1.5 cm across; pedicels ca 1 cm long in fruit. Sepals ca 8 mm long. Petals 1 - 1.5 cm long. Stamens ca 1 cm long. Fruits linear-terete, 3 - 7 cm long, densely hairy; valves with prominent midrib. Seeds oblong-terete.

Fl. & Fr. May - Sept.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal and China (Tibet).

9. *Erysimum pachycarpum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 167. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 153. 1872.

Herbs, robust, branched, up to 60 cm high with scattered hairs. Leaves lanceolate or oblanceolate, sinuate-toothed, 8 - 9 x 1 cm. Flowers orange-yellow, ca 8 mm across; pedicels 3 - 6 mm long, minutely hairy. Petals obovate-spathulate. Style ca 2 mm thick; stigma large, capitate. Fruits 5 - 6.5 x 0.3 cm; valves obtusely keeled. Seeds minute.

Fl. & Fr. June - Aug.

Distrib. India: Sikkim (3000 - 4000m).

Nepal and Bhutan.

10. *Erysimum repandum* L., Demonstr. Pl. 17. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 153. 1872.

Herbs, annual, erect, diffusely branched, up to 40 cm high, hoary with close

appressed hairs; hairs mostly medifixed, 2-partite or rarely trifid. Leaves lanceolate, oblanceolate or elliptic-oblong, sinuate-dentate to almost entire along margins, 1 - 6.5 x 0.2 - 1 cm, lower ones petioled, upper sessile. Racemes densely 15 - 25-flowered, elongating to 25 cm in fruit. Flowers ca 6 mm across, yellow; pedicels up to 5 mm long in fruit. Sepals 3 - 6 mm long, not or slightly saccate at base. Petals ca 6 mm long, pubescent on back. Stamens ca 5 mm long. Fruits rigid or flexuous, torulose, obtusely 4-angled, glabrous, 2 - 8 cm long, 1 - 1.5 mm thick; style 2 - 5 mm long. Seeds oblong-ellipsoid, ca 1.5 mm across.

Fl. & Fr. Apr. - June.

Distrib. India: Jammu & Kashmir.

Europe, N. Africa and S.W. Asia.

11. *Erysimum thomsonii* Hook. f. in J. Linn. Soc., Bot. 5: 165. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 154. 1872.

Herbs, up to 35 cm high, stout, erect, with 3-furcate hairs. Leaves rosulate, linear-lanceolate, obscurely toothed, acute at apex, 2.5 - 3.5 x 0.4 - 0.2 cm. Flowers ca 6 mm across; pedicels 8 - 12 mm long, stout. Sepals ca 5 mm long. Petals ca 1 cm long, ca 3 mm broad. Fruits 7.5 - 8 cm long, ca 2 mm broad; valves acutely keeled; style long. Seeds many, ca 3 mm long.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Afghanistan and China (Tibet).

34. *Goldbachia* DC., nom. cons.

Herbs, annual or biennial, glabrous. Leaves oblong-elliptic or oblanceolate, sinuate-dentate to subentire; basal leaves petioled; upper sessile. Racemes few to many flowered, lax in fruit. Sepals erect, not saccate. Petals white or pink, not clawed. Stamens 6. Ovary elliptic-ovate, 2 - 4-ovuled; style short, thick; stigma capitate or shortly 2-lobed. Fruits erect or erecto-patent at the end of pendent pedicel, indehiscent, coriaceous, tetragonous, slightly constricted between seeds, curved, tapering above into a broad flattened beak; segments (1-) 2 - 3, superimposed in one row, each 1-seeded. Seeds oblong, pendulous; cotyledons incumbent.

Europe, Central and S.W. Asia; about 16 species, 1 in India.

Goldbachia laevigata (M. Bieb.) DC., Syst. Nat. 2: 577. 1821; Hook. f. & T.

Anderson in Fl. Brit. India 1: 166. 1872. *Raphanus laevigatus* M. Bieb., Fl. Taur.-Cauc. 2: 129. 1808. *Goldbachia hispida* Blatter & Hallberg in J. Indian Bot. Soc. 1: 156. 1919.

Herbs, up to 40 cm high. Radical leaves rosulate, oblong or obovate to oblanceolate or spatulate, obtuse at apex, sinuate-dentate, rarely entire, 2.5 - 18 x 0.5 - 3.5 cm; cauline leaves gradually smaller, lanceolate to linear-oblong, auricled at base, dentate to entire at margins. Racemes in axils of leaves, elongating up to 25 cm long in fruit. Flowers faintly purple; pedicels of flowers erect, 7 - 12 mm long and recurved in fruit. Sepals erect, lanceolate, 1.5 - 2 x 0.4 - 0.75 mm. Petals oblanceolate, obtuse at apex, 3 - 4 mm long. Fruit a silicula, cylindrical, 4-angled, attenuate at base and apex, smooth or wrinkled, reticulately veined, 10 - 12 x 2 - 4 mm; beak conical, compressed. Seeds 2 or rarely 1 or 3, 2.5 - 3 x 1 mm, black.

Fl. & Fr. May - June.

Distrib. India: Jammu & Kashmir and Punjab.

Most of Asia, rare in Europe.

35. *Malcolmia* R. Br., nom. cons.

Herbs, usually annual, or rarely perennial, branched, pubescent; hairs branched, rarely unbranched. Leaves entire or pinnatifid. Racemes lax, ebracteate. Flowers white or purple. Sepals equal, erect; the inner usually saccate at base. Petals linear or narrowly oblanceolate, long-clawed, white or pink to violet. Stamens usually 6; longer stamens connate in pairs; filaments free or united below in pairs. Ovary oblong, many-ovuled. Fruit a siliqua, cylindrical; valves 3-nerved, somewhat rigid; style absent; stigma deeply 2 fid. Seeds 1 - 2-seriate, ovoid or oblong, rarely globular.

Asian and Mediterranean regions; about 30 species, 3 in India.

KEY TO THE SPECIES

- | | |
|--|-------------------------|
| 1a. Plants short, few-flowered; siliqua almost glabrous | 2. <i>M. intermedia</i> |
| b. Plants tall, many-flowered; siliqua with strigose or forked hairs | 2 |
| 2a. Petals white; siliqua with strigose hairs, 2 - 3 cm long | 3. <i>M. strigosa</i> |
| b. Petals violet; siliqua with short forked hairs, 3.5 - 8 cm long | 1. <i>M. africana</i> |

1. *Malcolmia africana* (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4: 121. 1812; Hook. f. & T. Anderson in Fl. Brit. India 1: 146. 1872. *Hesperis africana* L., Sp. Pl. 663. 1753.

Herbs, 15 - 45 cm high, stout with stiff forked hairs; branches many, long, but shorter than main stem, spreading. Leaves oblanceolate, oblong or subelliptic, entire or sinuate-dentate, sessile or petioled, 2.5 - 15 x 0.5 - 2 cm. Racemes 10 - 20-flowered, lax,

10 - 15 cm long in fruit; pedicels 1 - 2 mm long in fruit. Flowers subsessile, ca 6 mm across, pink to purple. Sepals ca 5 mm long not saccate. Petals ca 1 cm long, violet. Stamens ca 5 mm long. Fruits linear, more or less 4-angled, 3.5 - 8 cm long, 1 - 2 mm wide, patent, rigid, with short forked hairs. Seeds many, oblong.

Fl. & Fr. Jan. - June.

Distrib. India: Weed of cultivated fields. Jammu & Kashmir, Punjab and Rajasthan.

S.W. Asia, S. Europe and N. Africa.

2. *Malcolmia intermedia* C. A. Mey., Verz. Pfl. Cauc. 186. 1831. *M. taraxacifolia* Balbis ex Vass. in Kom., Fl. U.R.S.S. ed. 2, 8: 283. 1939; Naqshi & Javeid in J. Bombay Nat. Hist. Soc. 74: 394. 1977.

Herbs, annual, dwarf, spreading or subterete, 5 - 10 cm high, glabrous or sparsely hairy with branched hairs. Leaves variable oblong or oblanceolate, sinuate-dentate to almost entire; basal leaves stalked, rosulate, 2 - 6 x 0.5 - 1.5 mm broad. Racemes 5 - 8-flowered, lax in fruit; pedicels ca 1 mm long in fruit. Flowers ca 5 mm across, usually whitish. Sepals 2.5 - 3 mm long, saccate at base. Petals 4 - 5 mm long, pinkish. Stamens ca 3 mm long. Fruits linear-oblong, quadrangular, 3.5 - 6 cm long, 1 mm wide. Seeds oblong, brown, up to 35 in each locule.

Fl. & Fr. Feb. - May.

Distrib. India: Jammu & Kashmir.

Trans-Caspian region, Iraq, Iran, Afghanistan and Pakistan.

3. *Malcolmia strigosa* Boiss. in Ann. Sci. Nat. ser. 2, 17: 70. 1842; Hook. f. & T. Anderson in Fl. Brit. India 1: 146. 1872.

Herbs, annual, suberect or spreading, 10 - 20 cm high, branched from base. Leaves oblanceolate, oblong or subelliptic, subentire to sinuate toothed, shortly petioled, 1 - 3 x 0.5 - 1.2 cm. Flowers ca 4 mm across, numerous in racemes; pedicels ca 1 mm long in fruit. Sepals ca 3 mm long. Petals ca 6 mm long, whitish. Stamens ca 3 mm long. Fruits subquadrate or terete, tapering towards the apex, often slightly curved, spreading straight, ca 30 mm long, 2 mm wide. Seeds ca 1 mm long, pale brown.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir.

Afghanistan, Iran and Pakistan.

Notes. Aswal et al. (in Indian J. For. 11(2): 172. 1988) reports this from Ladakh in Kashmir.

36. *Pycnolinthus* O. Schulz

Monotypic; description and distribution as for the species below.

Pycnolinthus uniflorus (Hook. f. & Thomson) O. Schulz in Engler, Pflanzenr. 86: 199. 1924. *Braya uniflora* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 168. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 155. 1872.

Herbs, densely tufted, glabrous; rootstock stout, branched, ca 6 mm thick. Leaves mostly radical, sessile, linear to linear-spathulate, entire, 1 - 2.5 x 0.2 cm, fleshy. Scapes many, filiform, ca 2.5 cm long, each 1-flowered. Flowers white, ca 7 mm across. Sepals suberect, ca 3 mm long; inner ones saccate at base. Petals obovate, short-clawed, ca 5 mm long. Stamens 6, ca 4 mm long. Ovary sessile, oblong. Fruits oblong, 8 - 12 mm long, glabrous, bilocular, dehiscent; septum 2-nerved; style short. Seeds 5 - 6 in each locule, 1-seriate, brownish, finely reticulated.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan and China (Tibet).

Tribe 7. LEPIDIEAE DC.

(G. H. Bhaumik)

Herbs, sometimes subshrubs or shrubs, usually pubescent with simple or rarely branched hairs, or rarely glabrous. Sepals erect or spreading, equal or unequal at base; lateral ones more or less saccate and sometimes broader at base. Petals equal or unequal, often slightly differentiated into blade and claw. Stamens 6, tetradynamous or reduced to 4 or 2, or very rarely 8 - 24; appendages on filaments present or absent. Stigma capitate, often shortly bilobed. Siliculae usually with a narrowly elliptic septum, laterally compressed, sometimes inflated, or unilocular without septum, dehiscent, or sometimes indehiscent and breaking longitudinally into 1-seeded halves. Seeds often mucilaginous when wet, winged or wingless; cotyledons incumbent or accumbent.

12 genera and 32 species in India.

37. *Capsella* Medikus, nom. cons.

Herbs, annual or biennial, glabrous or with simple or branched and often stellate hairs on stems and leaves; stems mostly erect, simple or branched. Basal leaves mostly rosulate, entire or lobed; cauline leaves subentire, sessile, amplexicaul and sagittate at base. Inflorescence racemose; pedicels slender. Sepals erect, not saccate, equal at base. Petals white, pink or yellowish, obovate, rounded or truncate at base. Stamens free; filaments linear, edentate. Fruit an angustiseptate silicula, obcordate-triangular, laterally compressed; valves boat-shaped, keeled, reticulately veined; septum narrow, membranous; style short; stigma minute, capitate. Seeds biseriolate, many in each locule, ellipsoid; cotyledons incumbent.

Temperate regions of both hemispheres; about 5 species, 1 in India.

Literature. ALMQUIST, E. (1907-1923) Studies über die *Capsella bursa-pastoris* (L.) Medikus. Acta Hort. Berg. 4 (6): 3 - 91. 1907; *ibid.* 7 (2): 41 - 95. 1923.

Capsella bursa-pastoris (L.) Medikus, Pflanzengatt. 1: 85. 1792; Hook. f & T. Anderson in Fl. Brit. India 1: 159. 1872. *Thlaspi bursa-pastoris* L., Sp. Pl. 647. 1753.

Eng.: *Shepherd's purse*; Kash.: *Drati, Kral-mund*.

Herbs, annual, erect, sparsely branched, up to 45 cm high, glabrous. Basal leaves rosulate, oblong-lanceolate, pinnati-partite, sometimes runcinate, rarely entire, shortly stalked, 2 - 14 x 0.5 - 3.5 cm; lobes triangular or oblong-triangular and acute; cauline leaves ovate-lanceolate to linear, auricled and clasping at base, entire or denticulate, acute at apex, serrate-dentate or entire, 1 - 7 x 0.2 - 2 cm. Racemes congested at anthesis, much elongated at maturity reaching up to 30 cm long in fruit; pedicels spreading to horizontal. Sepals oblong, obtuse at apex, ca 1.5 x 1 mm, usually green, pubescent or not. Petals white, oblanceolate, 2 - 2.5 x 0.5 - 1 mm. Fruits obcordate to obtriangular, 5 - 9 x 3.5 - 6 mm, scarcely attenuate at base, straight or convex at lateral margins, slightly emarginate at apex, with wide apical notch; apical lobes subacute. Seeds up to 12 in each locule, ellipsoid, ca 1 mm long, reddish brown to black.

Fl. & Fr. March - Oct.

Distrib. India: Weed of roadsides and alpine meadows, 1600 - 4000 m. Throughout the temperate regions of Himalayas and Nilgiris.

Cosmopolitan except in the tropics.

Notes. Plants used as an astringent in diarrhoea and as a diuretic in dropsy. Fruits eaten raw. Leaves used as greens.

38. *Cardaria* Desv.

Herbs, perennial glabrous to canescent with short simple hairs; stems erect, leafy, branched. Flowers in corymbose racemes, small, white. Fruiting racemes elongated or shortened and crowded forming a compact corymb. Sepals diverging, outer oblong, inner ovate, not saccate. Petals white, with notched limb. Ovary elliptic to suborbicular, bilocular, 2 - 4-ovuled; style 1 - 2 mm long; stigma capitate. Fruit an indehiscent, somewhat inflated to subglobose silicula, compressed and rarely emarginate at apex, 2 - 4-seeded, glabrous or pubescent; cotyledons incumbent.

Chiefly distributed in Central and Southeast Asia, Europe and Africa; 5 species, 1 in India.

Cardaria chalepense (L.) Hand.-Mazz., Ann. Nat. Hofmus., Wein 27: 55. 1913. *Lepidium chalepense* L., Cent. Pl. 2: 23. 1756. *L. draba* L. subsp. *chalepense* (L.) O. Schulz in Engler & Prantl, Pflanzenf. ed.2, 17b: 417. 1936.

Eng.: *Lens-podded hoary cress*.

Herbs, erect, up to 60 cm high, mostly branched from base. Basal leaves obovate, elliptic-oblong or lanceolate, attenuate at base, irregularly toothed to entire along margins, 3 - 7 x 1 - 2 cm, sparingly to densely pubescent; middle and upper leaves oblong or oblong-lanceolate, sessile, sagittate-aureoled at base, sparsely to densely pubescent or almost glabrous. Flowers in corymbose panicles; pedicels erect, ascending, 1 - 1.5 cm long in fruit. Sepals obovate or oblong, 2-2.5 mm long, white margined, glabrous. Petals obovate, 3 - 3.25 mm long. Fruits ovate to broadly obovate, cuneate at base, 4 - 6 x 3.5 - 4.5 mm, glabrous or minutely pubescent when young; valves obscurely veined. Seeds ovoid, slightly compressed, brown to black, 1.5 - 2 mm long.

Fl. & Fr. April - July.

Distrib. India: Jammu & Kashmir.

Europe, Central & South-west Asia and Africa.

39. *Cochlearia* L.

Herbs, annual, biennial or perennial, with slender taproot, erect or prostrate, subglabrous or with simple hairs; stems simple, leafy, branched from base. Leaves simple or pinnatifid. Racemes short, corymbose, bracteate or not; flowers small, greenish white or yellow. Sepals erecto-patent or spreading. Petals obovate-oblong or oblanceolate, shortly clawed. Stamens 6; filaments linear. Fruit a laterally compressed silicula, ovoid-oblong or ellipsoid, somewhat inflated, bilocular, dehiscent; valves convex, turgid, not winged. Seeds biseriate, few to many, subcompressed, verrucose or

papillose.

Chiefly distributed in the northern hemisphere; about 25 species, 2 in India.

KEY TO THE SPECIES

- | | |
|---|-----------------------------|
| 1a. Leaves lanceolate, pinnatifid; fruits globose | 1. <i>C. cochlearioides</i> |
| b. Leaves ovate, not pinnatifid; fruits ellipsoid | 2. <i>C. himalaica</i> |

1. *Cochlearia cochlearioides* (Roth) Santapau & Maheshw. in J. Bombay Nat. Hist. Soc. 54: 804. 1957. *Alyssum cochlearioides* Roth, Nov. Pl. Sp. 322. 1821. *Cochlearia flava* Roxb. ex Hook. f. & T. Anderson in Fl. Brit. India 1: 145. 1872.

Herbs, annual, erect, diffusely branched, glabrous. Leaves lanceolate, pinnatifid, auricled at base, up to 12 cm long. Racemes numerous. Flowers small, yellow. Fruits globose, smooth; valves membranous, nerveless; style short, thick. Seeds numerous, rugose, funicles filiform.

Fl. & Fr. Aug. - Oct.

Distrib. India: Upper and lower Gangetic Plains and Gujarat.

2. *Cochlearia himalaica* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 154. 1861; Grierson & Long, Fl. Bhutan 1(2): 63. 1984.

Herbs, biennial or perennial, subglabrous or with simple hairs. Leaves ovate, obtuse at apex, rounded at base, irregularly crenate along margins, 5 - 12 x 3 - 7 mm; petioles 1 - 2.5 mm long. Flowers up to 3 x 1 mm, greenish white, in corymbose racemes. Sepals oblong, ca 1.5 x 0.75 mm. Fruits ellipsoid, 3 - 5-seeded, 5 - 6 x 2 - 3 mm; valves slightly swollen; style ca 1 mm long.

Fl. & Fr. June - Aug.

Distrib. India: In moist places, 4500 - 4600 m. Sikkim.

Bhutan.

40. *Coronopus* Zinn., nom. cons.

Herbs, annual or biennial, foetid-scented, glabrous or pubescent with branched hairs. Leaves entire, irregularly lobed or deeply pinnatifid. Racemes usually short, apparently leaf-opposed. Sepals short, patent, not saccate. Petals white, minute, scarcely exceeding the calyx or absent. Stamens 6, 5, 4 or 2, free, edentate. Ovary with 2 ovules; style very short; stigma capitate. Fruits didymous, more or less laterally compressed

silicula; valves 2, rugose or tubercled, separating into closed indehiscent 1-seeded nutlets; style pyramidal; seed globose.

Chiefly Eurasian; about 10 species, one in India.

Coronopus didymus (L.) Smith, Fl. Britain 2: 691. 1800. *Lepidium didymum* L., Mant. Pl. 1: 92, 1767. *Senebiera pinnatifida* DC. in Mem. Soc. Hist. Nat. Paris 144, t. 9. 1799. *S. didyma* (L.) Pers., Syn. Pl. 2: 185. 1807.

Eng.: Lesser-wart cress; Kash.: Taribad; Punj.: Hurwal, Maloone.

Herbs, foetid, annual or biennial, 10 - 40 cm high with slender taproot and diffuse or procumbent branches; stems angular, sulcate, much-branched from base, spreading and ascending, clothed with unbranched or 2-fid hairs. Lower leaves oblong in general outline, long-petioled, deeply pinnatifid, 7 - 10 x 1.5 - 2 cm, often glabrous, segments usually pinnatifid; lobes with a few teeth; cauline leaves much smaller. Racemes 30 - 60-flowered, dense, 3 - 5 cm long in fruit; pedicels 1.5 - 3 mm in flower, 3 - 5 mm long and spreading in fruit. Sepals ovate-rounded, 0.5 - 0.75 mm long. Petals linear, ca 0.5 mm long. Stamens 4 - 6, fertile stamens 2. Fruits emarginate at base and notched at apex, netted rugose, 1.5 - 1.7 x 2 - 2.5 mm, reticulate-pitted, greyish, divided into 2 one-seeded nutlets; style much included within the notch. Seeds reniform, flattened punctate-striate, ca 1 mm long, light brown.

Fl. & Fr. Almost throughout the year.

Distrib. India: Almost in all the states.

Native of South America, naturalised widely in Western and Central Europe, Africa, Iran, Afghanistan and Pakistan.

Notes. A good fodder. In Kashmir the young fruits are used in salad preparations.

41. *Dilophila* Thomson

Herbs, small, dwarf, biennial or perennial; branches prostrate. Leaves spatulate; basal ones densely rosulate; cauline ones often involucrate below the inflorescence. Racemes condensed, many-flowered, subumbellate, or corymbose. Flowers white, small; pedicels short, slightly thickened in fruit. Sepals equal, spreading, persistent. Petals longer than sepals. Stamens 6; filaments linear. Ovary sessile; style thick; stigma truncate. Fruit a silicula, cordate-orbicular, slightly compressed with persistent style. Seeds 2 - 4 in each locule, cotyledons incumbent.

Chiefly confined to the high mountainous regions of C. Asia, Himalayas, Nepal, Bhutan and China (Tibet); 5 species, 1 in India.

Dilophila salsa Thomson in Hooker's J. Bot. Kew Gard. Misc. IV, 5: 20. t. 12. 1853; Hook. f. & T. Anderson in Fl. Brit. India 1: 161. 1872. **Fig. 32.**

Herbs, procumbent, glabrous; stems 2 - 3 cm high; branches up to 12 cm long. Leaves oblanceolate or spatulate, entire or sinuate-dentate, 7 - 25 x 1 - 5 mm, fleshy. Flowers crowded in dense umbellate racemes in axils of leafy bracts. Sepals broadly elliptic or ovate, 1.5 - 2 mm long. Petals obovate, 2 - 3 mm long, retuse at apex. Fruits subcordate in outline, ca 2.5 mm across with 2 wing-like crests on valves. Seeds brown, 0.75 x 0.5 mm.

Fl. & Fr. June - Sept.

Distrib. India: In saline marshes, 3000 - 4400 m. Jammu & Kashmir, Himachal Pradesh and Sikkim.

Pakistan, Nepal, Bhutan and China (Tibet).

42. *Hedinia* Ostenf.

Monotypic; description and distribution as for the species below.

Hedinia tibetica (Thomson) Ostenf. in S. Hedin, S. Tibet 6(3): 76. f. 2. 1922. *Hutchinsia tibetica* Thomson in Hook. f., Ic. Pl. 9: t. 900. 1852. *Capsella thomsonii* Hook. f. & T. Anderson in Hook. f., Fl. Brit. India 1: 159. 1872.

Herbs, perennial, procumbent, prostrate, grey-pubescent with simple and branched hairs; branches up to 25 cm long, profusely spreading from base. Leaves elliptic to ovate-lanceolate, pinnatifid, many-jugate; segments deeply lobed, the terminal lobes usually ovate; radical leaves shortly stalked; cauline ones sessile. Racemes lax, many-flowered, corymbose, bracteate, somewhat lax in fruit. Flowers white, small, subsessile, crowded in axils of deeply lobed leafy bracts; pedicels 3 - 5 mm long in fruit. Sepals oblong-elliptic, not pouched at base, ca 2 mm long, pilose. Petals obovate, spatulate, clawed at base, obtuse at apex, ca 3 x 1 mm, white. Style minute, ca 1 mm long. Fruit a silicula, broadly elliptic or oblong, laterally compressed, retuse at apex, often subtortured, 6 - 10 x 3 - 4 mm, glabrous; valves not keeled, nor winged, membranous, glabrous to sparsely hairy, obscurely veined. Seeds 10 - 16 in each locule, elliptic-oblong, ca 1 x 0.5 mm, brown or blackish brown; cotyledons incumbent.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, 4000 - 4800 m. Jammu & Kashmir and Sikkim.

Pakistan, Nepal, Bhutan, China (Tibet) and Central Asia.

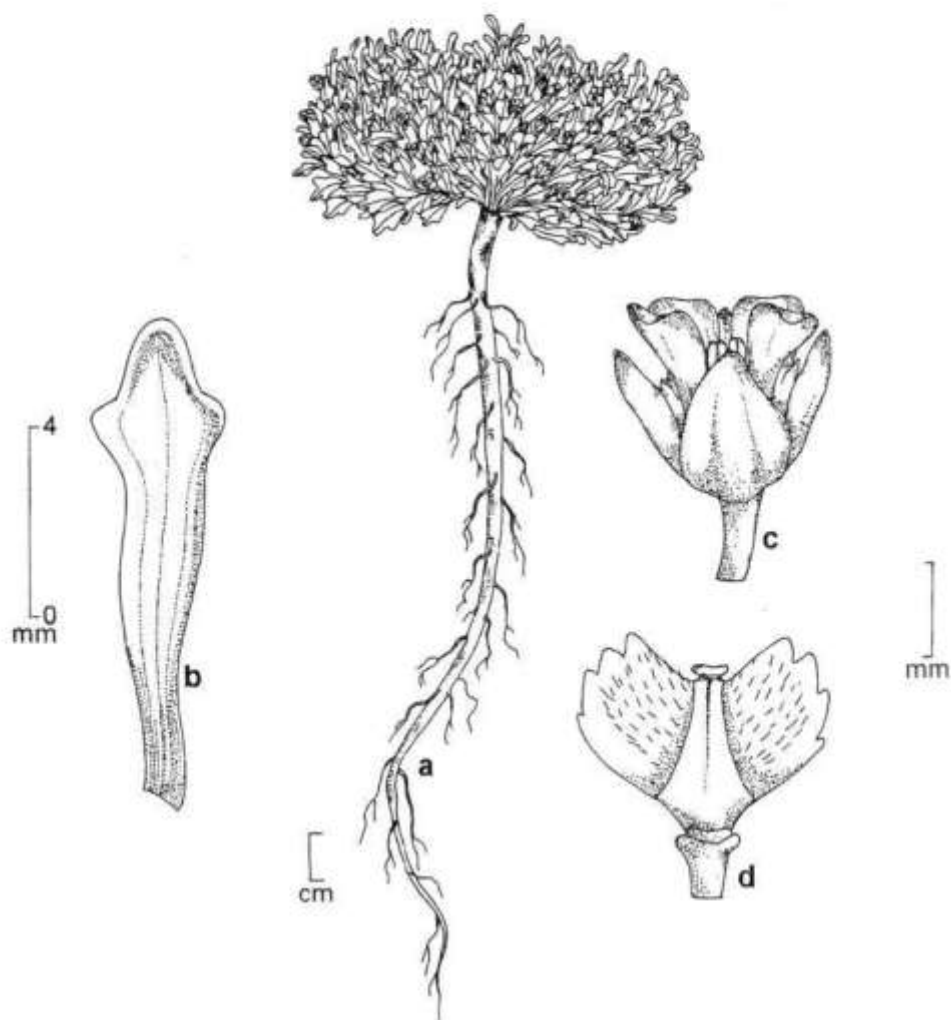


Fig. 32. *Dilophila salsa* Thomson : a. habit; b. leaf; c. flower; d. fruit.

43. *Hymenolobus* Nutt. ex Torrey & Gray

Herbs, annual or biennial, glabrous or rarely sparsely hairy with simple hairs. Leaves simple, distant, spathulate or elliptic-oblong or oblanceolate, pinnatifid to entire, shortly stalked to sessile. Inflorescence racemose; pedicels slender. Sepals equal at base, divergent, not saccate. Petals spathulate, white. Fruit a silicula, ellipsoid or orbicular, rounded or truncate at apex, laterally compressed; valves boat-shaped, keeled, netted-veined; style very short; stigma capitate, slightly bilobed. Seeds few to many in each locule; cotyledons incumbent.

Mostly distributed in Europe, N. America, C. & S.W. Asia and Australia; about 5 species, 1 in India.

Hymenolobus procumbens (L.) Nutt. ex Torrey & Gray, Fl. N. America 1: 117. 1838. *Lepidium procumbens* L., Sp. Pl. 2: 643. 1753. *Capsella elliptica* C. Meyer in Ledeb., Fl. Ross. 1: 199. 1841; Hook. f. & T. Anderson in Fl. Brit. India 1: 159. 1872.

Herbs, dwarf, weak, procumbent, up to 30 cm long; stems simple or profusely branched from base. Basal leaves usually rosulate, spathulate, deeply lyrate-pinnatifid to entire, shortly stalked to sessile, 10 - 40 x 2.5 - 10 mm, glabrous or sparsely pubescent; lobes elliptic or lanceolate, retuse; upper leaves smaller, linear, toothed to entire, sessile, cuneate at base. Racemes lax, many-flowered, elongating up to 10 cm long in fruit; flowers minute, ca 1 mm long; pedicels 3 - 8 mm long in fruit, spreading. Petals spathulate, as long as or slightly longer than oblong, hairy sepals. Fruits ovoid or ellipsoid, obtuse or slightly emarginate, 3 - 4 mm long; valves translucent, reticulate-veined. Seeds 2 - 4 in each locule.

Fl. & Fr. April - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Mostly in N. temperate regions, extremely variable.

44. *Iberis* L.

Annual or perennial, glabrous or hairy, dwarf herbs or undershrubs with simple or branched, angular, leafy stems. Leaves simple, somewhat fleshy, linear or broader, entire or dentate to pinnatifid; radical leaves petioled; cauline sessile. Flowers in cbracteate corymbs or racemes, elongating in fruits; pedicels filiform, horizontal or horizontal-ascending. Sepals oblique, erect, with wide membranous margins, not saccate. Petals white, rose, red or violet, outer two larger, obovate, shortly clawed, 2 outer usually larger than inner. Fruit an angustiseptate silicula, ovate, bilocular, often notched at apex; valves boat-shaped, netted-veined, keeled, winged at apex; style distinct; stigma capitate, sometimes bilobed. Seed 1 in each locule, ovate, often winged; cotyledons

accumbent.

Chiefly in the Mediterranean region; about 40 species, 4 in India, commonly grown as popular garden plants.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Perennials, usually with non-flowering rosettes; leaves persistent | 3. <i>I. sempervirens</i> |
| b. Annuals, without non-flowering rosettes; leaves mostly deciduous | 2 |
| 2a. Flowers rose-coloured, in umbellate racemes | 4. <i>I. umbellata</i> |
| b. Flowers white, in elongating racemes | 3 |
| 3a. Siliculae in racemes; lobes of pod erect | 1. <i>I. amara</i> |
| b. Siliculae in corymbs; lobes of pod spreading, divergent | 2. <i>I. odorata</i> |

1. *Iberis amara* L., Sp. Pl. 649. 1753; Jafri in Fl. W. Pakistan 55: 79. 1973.

Eng.: *Rocket-candytuft*.

Herbs, annual, erect, glabrous or sparsely pubescent, up to 30 cm high. Leaves oblanceolate to spatulate, obtuse, 3 - 10 cm long, mostly with a few teeth, mainly at apex. Flowers white, fragrant, forming globular terminal clusters, which elongate up to 15 cm long in fruit; pedicels filiform, spreading or ascending, divergent, ca 2.5 cm long in fruit. Sepals ca 2.5 mm long. Petals obovate-oblong, cuneate below, 4 - 8 mm long. Fruits suborbicular, broadly emarginate with divergent, acute, triangular wings, 5 - 7 mm in diam.; valves reticulately veined; style exceeding the apical notch. Seeds broadly ovate, slightly winged below, reddish-brown, ca 3 mm long.

Fl. & Fr. June - July.

Distrib. India: Cultivated throughout as a garden plant.

Native of Europe, introduced and cultivated throughout the world.

2. *Iberis odorata* L., Sp. Pl. 649. 1753.

Eng.: *Sweet-scented-candytufts*.

Herbs, annual, erect or ascending, glabrous or sparsely short-hairy, up to 30 cm high. Leaves spatulate-linear, up to 3 cm long, tapering to base, wider towards apex, more or less toothed, ciliate towards base, pinnatifid or coarsely dentate towards apex. Racemes corymbose, elongating up to 12 cm in fruit. Flowers fragrant, white; pedicels filiform, horizontally spreading, ca 5 mm long in flower, ca 2 cm long in fruit. Sepals ca 2.25 mm long, persistent, not saccate, becoming purple. Petals obovate-oblong, clawed towards base, 4 - 8 mm long. Fruits suborbicular, broadly notched at apex, with style

shorter than 1 mm in the notch, 5 - 6 mm in diam.; valves winged; wings acute at apex. Seeds compressed, narrowly margined.

Fl. & Fr. June - Aug.

Distrib. India: Cultivated as a garden plant, often run wild.

E. Mediterranean and S.W. Asia regions.

Notes. Fruiting pedicels of mature fruits spread apart when moistened.

3. *Iberis sempervirens* L., Sp. Pl. 648. 1753.

Eng.: *Edging-candytuft*.

Perennial, erect, glabrous, evergreen herbs or undershrubs, up to 30 cm high or even more; stems branched and woody at base. Leaves oblong to oblong-spathulate, narrowed at base, sessile, entire, obtuse at apex, 1.5 - 4 cm long, glabrous. Flowers in elongating racemes, white, sometimes tinged-lilac; pedicels 6 - 9 mm long in fruit. Petals: outer ones 7 - 11 x 2.5 mm, inner ones 5 - 7 x 2 - 4 mm. Fruits ovate to obovate, emarginate and deeply notched at apex, 8 - 10 x 6 - 9 mm; wings 1.5 - 2 mm broad; style 1.5 - 3 mm long. Seeds 1 - 2.

Fl. & Fr. May - July.

Distrib. India: Introduced and cultivated.

S. Europe (Mediterranean region), introduced and cultivated throughout the world.

4. *Iberis umbellata* L., Sp. Pl. 649. 1753.

Eng.: *Globe-candytuft*.

Herbs, annual, erect, subglabrous, branched, up to 40 cm high. Leaves elliptic-lanceolate, acuminate at apex, 3 - 8 cm long, lower ones serrate; upper entire or sometimes with very few small teeth. Inflorescence an umbellate raceme, terminal; flowers rose-coloured, shades of rose or purple. Fruits obovate with a deep wide sinus at the top; valves with apiculate spreading points; style very slender.

Fl. & Fr. May - July.

Distrib. India: Cultivated in gardens.

Cultivated widely as an ornamental plant throughout the world.

45. *Isatis* L.

Herbs, annual, biennial or sometimes perennial usually glabrous and glaucous or rarely hairy. Radical leaves petiolate or sessile, attenuated into petiole; cauline leaves sessile, auriculate at base. Flowers yellow or white in corymbose panicles, ebracteate, often elongating and becoming lax in fruit; pedicels often thickened above, deflexed in fruit. Sepals suberect, equal at base. Petals shortly clawed, entire, rounded at apex, exserted. Stamens free, edentate. Stigma 2-lobed, subsessile. Fruits indehiscent, linear to suborbicular, laterally flattened, slightly to conspicuously winged, unilocular, 1-seeded; valves usually with a distinct midvein, more or less winged, glabrescent or pubescent. Seeds pendulous; cotyledons mostly incumbent.

Chiefly distributed in the Mediterranean, Saharo-Arabian and Irano-Turanian regions; about 50 species, 2 in India.

KEY TO THE SPECIES

- 1a. Fruits rounded at both ends, ca 3 times as long as wide, central rib wide and distinctly 3-ridged 1. *I. costata*
 b. Fruits tapering towards base, rounded at apex, ca 3 - 5 times as long as wide, central rib slender and simple 2. *I. tinctoria*

1. *Isatis costata* C. Meyer in Ledeb., Fl. Alt. 3: 204. 1831; Hook. f. & T. Anderson in Fl. Brit. India 1: 163. 1872; Jafri in Fl. W. Pakistan 55: 76. 1973.

Herbs, annual or biennial, erect, glabrous, subglobose, much-branched, up to 1 m high. Radical leaves rosulate, obovate-oblong, subsessile, entire or sinuate-dentate, 7 - 12.5 x 2 - 3 cm; cauline leaves gradually smaller, lanceolate, acutely auricled and amplexicaul at base, entire. Inflorescence paniculate, elongating up to 10 cm long in fruit; pedicels 5 - 7.5 mm long in fruit, often deflexed. Sepals 1.5 - 1.75 mm long. Petals 2.5 - 3 mm long, yellowish. Fruits oblong-obovate, 9 - 15 x 3 - 5 mm, rounded at both ends, glabrous or minutely pubescent; wings thick; mid-vein of locules 3-ridged. Seeds oblong-ovoid to ellipsoid, brown, 3 x 1 mm.

Fl. & Fr. May - Aug.

Distrib. India: Jammu & Kashmir.

Europe, Central and S.W. Asia.

2. *Isatis tinctoria* L., Sp. Pl. 670. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 163. 1872. Fig. 33.

Eng.: *Dyer's wood*.

Herbs, biennial or rarely perennial, erect, much-branched, glabrous or hirsute, subglaucous, up to 1 m high. Basal leaves rosulate, oblong-lanceolate or oblanceolate, shortly stalked, entire or weakly dentate, 5 - 15 x 1 - 3 cm; cauline leaves gradually smaller, linear or linear-lanceolate, acutely auricled and amplexicaul at base, entire. Inflorescence a loose panicle elongating up to 12 cm long in fruit; pedicels filiform, 5 - 8 mm long in fruit, more or less deflexed. Sepals 2 - 2.5 mm long, glabrous. Petals oblong-obovate, cuneate towards base, yellow, 3 - 5 mm long. Fruit oblong, elliptic-obovate, cuneate towards base, obtuse or emarginate at apex, 10 - 25 x 2 - 5 (-9) mm, glabrous or puberulent; wings thick, midrib usually slender. Seeds oblong to ellipsoid, brown, 3 - 4 x 1 mm.

Fl. & Fr. May - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Cultivated in Europe, N. and E. Asia.

Notes. The blue and green pigments extracted from the leaves are used as dye in textile industry.

A highly polymorphic species.

46. *Lepidium* L.

Herbs, annual or perennial, or subshrubs, erect, prostrate or spreading, glabrous, or pubescent with simple or branched hairs, sometimes glandular hairy. Leaves entire or bi- or tri-pinnatifid, sessile or the lower petiolate. Flowers small, inconspicuous, usually in elongating ebracteate racemes. Sepals oblique, long or ovate, orbicular, slightly concave, not saccate. Petals up to 3 mm long, scarcely longer than sepals, sometimes lacking or mere vestiges, white, pink or sulphur yellow. Stamens 6, 4 or 2; filaments free, edentate; anthers nearly orbicular. Ovary sessile, flat, 2-ovuled with distinct short style and capitate stigma. Fruit a silicula, strongly flattened, 2-valved; valves winged, usually rounded or keeled at back, glabrous to hirsute; apex scarcely notched and barely winged to deeply notched and prominently winged; septum narrow. Seeds usually 1 or rarely 2 in each locule, pendulous; cotyledons mostly incumbent.

Nearly cosmopolitan; about 150 species, 10 in India.



Fig. 33. *Isatis tinctoria* L. : a. plant, lower portion; b. flowering twig; c. fruiting twig; d. flower.

Literature. THELLUNG, A. (1907) Die Gattung *Lepidium* (L.) R. Br. Eine monographische Studie. Mitt. Bot. Mus. Univ. Zurich 28: 1 - 340.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Stamens 6 | 2 |
| b. Stamens 4 or 2 | 5 |
| 2a. Upper cauline leaves perfoliate | 6. <i>L. perfoliatum</i> |
| b. Upper cauline leaves not perfoliate | 3 |
| 3a. Fruits 5 - 6 mm long, prominently winged and broadly notched at apex | 9. <i>L. sativum</i> |
| b. Fruits 2 - 3.5 mm long, neither winged not notched at apex | 4 |
| 4a. Leaves oblong-lanceolate, acute at apex; racemes corymbose; calyx deciduous | 4. <i>L. latifolium</i> |
| b. Leaves oblong, obtuse at base; racemes densely capitate; calyx persistent | 5. <i>L. obtusum</i> |
| 5a. Stems glabrous or with a few smooth hairs | 6 |
| b. Stems distinctly puberulous | 7 |
| 6a. Stems usually glabrous; upper cauline leaves oblanceolate or spatulate | 7. <i>L. pinnatifidum</i> |
| b. Stems often with a few unbranched hairs; upper cauline leaves linear | 8. <i>L. ruderales</i> |
| 7a. Hairs on stems capitate or glandular | 8 |
| b. Hairs on stems terete | 9 |
| 8a. Herbs erect; hairs capitate; racemes elongated in fruit | 2. <i>L. apetalum</i> |
| b. Herbs procumbent; hairs glandular; racemes capitate in fruit | 3. <i>L. capitatum</i> |
| 9a. Petals longer than sepals; pedicels divaricate, straight | 10. <i>L. virginicum</i> |
| b. Petals shorter than sepals; pedicels arcuately patent | 1. <i>L. africanum</i> |

1. *Lepidium africanum* (Burm. f.) DC., Syst. Nat. 2: 552. 1821, quoad basionym, excl. specim. et descr. *Thlaspi africanum* Burm. f., Prodr. Fl. Cap. 17. 1768. *Lepidium divaricatum* auct. non Soland. 1789; Bhattacharyya & Majumdar in Bull. Bot. Surv. India 18: 214, f. 1 - 3. 1976.

Eng.: *Rubble-pepper-ress, Common-pepper-ress.*

Herbs, annual or biennial; stems one to many from base, ascending and spreading, densely puberulent with very short retrose or straight hairs. Basal leaves short-lived, oblanceolate, subpinnate; cauline leaves not distinctly petioled, oblong-lanceolate, acute, dentate, up to 4 cm long, attenuate at base, acute at apex. Racemes terminal and axillary, dense in fruit, up to 6 cm long; pedicels arcuately patent, 2.5 - 4 mm long, puberulent. Sepals ovate with membranous margins, 0.5 - 0.75 mm long. Petals narrowly spatulate or linear, 0.25 - 0.5 mm long. Fruits on 4 - 6 cm long racemes, elliptic to ovate, distinctly emarginate and notched, 1.8 - 3 x 1.5 - 2 mm, with shallow and narrow apical notch; style very short; stigma included within the notch. Seeds ovoid, slightly compressed, reddish brown, 1.25 x 0.7 mm; cotyledons incumbent.

Fl. & Fr. Aug.

Distrib. India: Himachal Pradesh.

S. Africa and Australia.

Notes. For a discussion on the correct identity and nomenclature of this species, see Bhaumik & Thothathri in Bull. Bot. Surv. India 24: 214 - 215. 1982.

2. *Lepidium apetalum* Willd., Sp. Pl. 3. 439. 1800. *L. ruderale* auct. non L.; Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 175. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 160. 1872, p. p.

Herbs, annual or biennial, up to 30 cm high; stems branched, sparsely to densely hairy with thick capitate hairs; branches and branchlets in raceme-like patterns, always terminating in a short raceme. Radical leaves long-petioled, oblong, subpinnate or pinnatifid, ca 3.5 x 1 cm, lobes very frequently narrow and entire; cauline leaves sessile, broad, semiauricled and semiamplexicaul at base; lower lanceolate or oblong, deeply or coarsely dentate or lobed, lobes entire and acute; upper linear, nearly obtuse at apex, entire or remotely serrate. Flowers in both axillary and terminal racemes; terminal racemes elongating up to 5 mm long in fruit, minutely capitate-hairy. Sepals ovate, 0.75 - 1 mm long, white-margined. Petals oblong or triangular to triangular-obovate, narrowed to base, retuse or subemarginate at apex, ca 0.5 mm long, membranous. Stamens 2 or 4, 0.75 mm long. Fruits elliptic or ovate, distinctly notched and very narrowly winged in upper part, 2.5 - 3 x 2 - 2.5 mm; stigma sessile. Seeds elliptic, ca 1 mm long, reddish brown; cotyledons incumbent.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal and C. & S.W. Asia.

3. *Lepidium capitatum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 175. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 160. 1872.

Herbs, annual, procumbent or suberect up to 30 cm long; stems profusely branched, more or less glandular hairy; branches spreading from base. Leaves simple, tubercled, glabrous or rarely very minutely capitate-hairy along margins and on ventral mid-vein; radical leaves short-petioled, pinnatisect, gradually narrowed to base, with narrow, oblong, acute lobes, 3 - 6 x 1 - 2 cm; cauline leaves gradually smaller, sessile, more or less similar, cuneate-oblong, pinnatifid or coarsely dentate-laciniate, mostly above the middle; uppermost linear, entire. Flowers white, in dense compact racemes forming capitulum on lateral and terminal branches; pedicels thick, minutely capitate, hairy, up to 2 mm long in flower, ca 5 mm long in fruit. Sepals ovate or elliptic-oblong, concave, white-margined, ca 1 x 0.5 mm, glabrous. Petals broader and shorter than sepals,

obovate, spatulate, narrowed at base, obtuse or retuse at apex. Stamens 4, ca 1 mm long, 2 laterals rudimentary or absent. Fruits ovate, emarginate, narrowly winged, 2 - 2.5 x 1.75 - 2 mm, glabrous; stigma sessile, equalling the notch or a little shorter. Seeds ovate, pale brown, ca 1.25 x 0.6 mm; cotyledons incumbent.

Fl. & Fr. July - Oct.

Distrib. India: Damp grassy slopes, 3200 - 4000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and West Bengal.

Nepal, Bhutan and China (Tibet).

4. *Lepidium latifolium* L., Sp. Pl. 644. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 160. 1872. Fig. 34.

Eng.: *Perennial-pepper-grass*, *Broad-leaved-pepper-grass*, *Dittander*; Ladakh: *Gonyach*.

Herbs or subshrubs, perennial, up to 1 m tall; stems erect, much-branched, arising from a branched rootstock, glabrous or sparsely simple hairy. Leaves oblong-lanceolate or ovate, acute, more or less serrate, glabrous; basal leaves long-petioled, ovate, elliptic, spatulate to oblong-lanceolate, simple to pinnately lobed, serrate along margins, up to 30 x 6 cm; upper leaves subsessile to sessile, lanceolate, tapering at base, acute to apiculate at apex; uppermost leaves reduced, narrowly elliptical to linear, bract-like. Flowers white, up to 1.5 mm long, in short densely paniced bracteate corymbs; pedicels spreading, 3 - 5 mm long in fruit, glabrous or minutely hairy. Sepals suborbicular, 1 - 2.25 mm long, whitish at margins, finely hairy, caducous. Petals suborbicular, distinctly or obscurely clawed, white, rarely pink at base, 2 - 3 mm long. Fruits ellipsoid to ovoid, terminating in very short style, 2.5 - 2.75 x 1.75 mm, glabrous or finely pubescent; valves pilose, sometimes glabrous, not winged. Seeds elliptical, ca 1.25 x 0.75 mm; cotyledons incumbent.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Bhutan, C. & S.W. Asia, Europe, N. Africa and Australia.

Notes. Leaves are edible and used as salad or spice.

5. *Lepidium obtusum* Basiner in Bull. Cl. Phys.-Math. Acad. Imp. Sci. St.-Petersb. 2: 203. 1844. *L. latifolium* L. var. *platycarpum* Trautv. in A. H. P. 1: 170. 1872. *L. latifolium* L. subsp. *obtusum* (Basiner) Thell. in Mitt. Bot. Mus. Univ. Zurich 28: 162. 1906.



Fig. 34. *Lepidium latifolium* L. : a. fruiting twig; b. flower; c. fruit.

Herbs, perennial, glabrous, glaucous, up to 1 m high, densely and corymbosely branched. Leaves oblong, entire or obscurely sinuate, thick coriaceous, indistinctly 3-nerved; lower leaves attenuate at base; upper sessile, gradually tapering towards apex and abruptly towards base. Racemes densely capitate even in fruit; pedicels filiform, up to 4 mm long in fruit, pilose. Calyx long persistent; sepals suborbicular, broadly white margined, ca 1 mm long. Petals suborbicular, clawed, up to 2 mm long, white. Fruits oval, subcordate at base, subobtusate at apex, ca 2 mm across, slightly pilose and reticulate; stigma sessile, capitate. Seeds elliptic-obovate, somewhat flattened, emarginate, smooth; cotyledons incumbent.

Fl. & Fr. May - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

C. & S.W. Asia, Europe and N. Africa.

6. *Lepidium perfoliatum* L., Sp. Pl. 643. 1753; Babu, Herb. Fl. Dehra Dun 59. 1977.

Eng.: *Clasping-leaved pepper-grass, Shield-cress.*

Herbs, annual or biennial, up to 40 cm high; stems erect, unbranched, sparsely pubescent with simple setose hairs. Leaves distinctly dimorphic; basal leaves long-petioled, bipinnately dissected into narrow, linear lobes, 10 - 15 cm long, pubescent; lower cauline leaves more or less similar, but gradually smaller, sessile with expanded wing-like auricles on both sides; upper cauline leaves broadly ovate or suborbicular, sessile, entire, deeply cordate and usually overtopping, with rounded auricles at base, subacute at apex, glabrous. Racemes terminal, elongating in fruit, up to 10 cm long; pedicels filiform, glabrous, divergent, 7 - 8 mm long in fruit. Sepals spreading, pubescent, ca 1 mm long. Petals oblong-spathulate, clawed, rounded at apex, ca 1.7 mm long. Stamens 6 with minute anthers. Fruits broad-elliptic, minutely notched and narrowly winged, 3.5 - 4 x 2.5 - 3 mm, glabrous; style short, shortly protruding out of the notch. Seeds laterally compressed and distinctly winged, 1.5 - 1.75 x 1 mm; cotyledons incumbent.

Fl. & Fr. Feb. - July.

Distrib. India: Uttar Pradesh.

Southern Asia, Europe and North America.

7. *Lepidium pinnatifidum* Ledeb., Fl. Ross. 1: 206. 1841; Chowdhery & Wadhwa, Fl. Himachal Pradesh 1: 70. 1984.

Herbs, annual or biennial, up to 50 cm high, glabrous. Basal leaves pinnatifid,

narrowly oblong, short-petioled, drying early; cauline leaves oblanceolate-spathulate, irregularly dentate, 3 - 5 cm long; the upper linear or narrowly oblanceolate, entire. Racemes both terminal and lateral, elongating in fruit up to 12 cm long; pedicels filiform, up to 4 mm long in fruit, covered with long spreading hairs. Sepals ovate or elliptic-lanceolate, white-margined, ca 1 mm long. Petals rudimentary, linear-spathulate, usually shorter than calyx or sometimes absent. Fruit broadly elliptic silicula, obscurely notched at apex, 2 - 2.75 x 1.75 - 2.25 mm, sparsely pubescent. Seeds narrowly ovate-ellipsoid, flattened, 1 - 1.25 x 0.5 - 0.75 mm; cotyledons incumbent.

Fl. & Fr. April - June.

Distrib. India: Himachal Pradesh.

C. & SW. Asia, Europe and Australia.

8. *Lepidium ruderales* L., Sp. Pl. 645. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 160. 1872, p. p.

Eng.: *Roadside-pepper-grass*.

Herbs, annual or biennial, up to 40 cm high; stems erect, ascending, diffusely branched, glabrous or finely hairy. Basal leaves rosulate, elliptic-ovate, or oblong-linear, long-petioled, 5 - 7 x 1 - 2 cm, bipinnately lobed with an oblanceolate, serrulate-dentate and subacute terminal lobe; lower cauline leaves lanceolate to narrowly oblong, gradually narrowed towards base, sessile, entire, obtuse or subacute at apex, 1.5 - 3 cm long; upper leaves linear-oblong, entire. Racemes lateral and terminal, elongating up to 15 cm long in fruit, glabrous or hairy; pedicels filiform, spreading, 2.5 - 3 mm long in fruit, minutely hairy. Sepals oblong-elliptic to narrowly ovate-lanceolate, ca 1 mm long, white-margined. Petals absent or very reduced. Stamens 2. Fruit ovate or elliptic-ovate silicula, emarginate at apex, 2.2 - 3 x 2 - 2.8 mm, minutely hairy; style very short, included within notch. Seeds ovoid, reddish brown, ca 1.25 x 0.75 mm; cotyledons incumbent.

Fl. & Fr. April - Aug.

Distrib. India: Jammu & Kashmir and Tamil Nadu.

C. & S.W. Asia and Europe.

9. *Lepidium sativum* L., Sp. Pl. 644. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 159. 1872.

Beng.: *Halim*; Eng.: *Garden-cress*, *Curled-cress*; Hindi: *Halim*; Mar.: *Assalia*; Nep.: *Chum-sue*; Raj.: *Ahlya*; Tam.: *Aliverai*; Tel.: *Adalavithulu*, *Adeli*.

Herbs, annual, up to 50 cm high; stems erect, unbranched, glabrous. Basal leaves long-petioled, irregularly pinnate or bipinnate or lyrate-lobate, with toothed obovate lobes, drying early; cauline leaves sessile, pinnate, less incised with oblong-linear segments, sparsely pubescent with simple hairs; upper leaves linear, entire. Flowers white or pinkish in elongating racemes; pedicels cylindrical, ascending or subappressed, up to 3.5 mm long in fruit, glabrous. Sepals 1.5 - 1.75 mm long, sparsely pubescent outside. Petals spathulate, somewhat clawed, 2.5 - 2.75 mm long, sometimes reddish and distinctly veined. Fruits broadly elliptic to suborbicular silicula, narrowly winged at lower part and broadly winged at top, deeply notched at apex, 4.5 - 6 x 3.5 - 5 mm, glabrous; style short and included within the notch. Seeds ovoid, ca 3 x 1.5 mm, reddish brown; cotyledons incumbent, deeply trifid.

Fl. & Fr. Almost throughout the year.

Distrib. India: Cultivated and also found as an escape.

Introduced and naturalised, also cultivated throughout the world.

Notes. Used as pot herb; leaves are edible and used as salad.

10. *Lepidium virginicum* L., Sp. Pl. 645. 1753; Maheshwari & Paul in J. Bombay Nat. Hist. Soc. 70: 575. 1973.

Fig. 35.

Eng.: *Pepper-grass, Virginian-pepper-cress.*

Herbs, erect, annual or biennial up to 50 cm high; stems scarcely branched above, minutely pubescent to hirsute, with appressed curved hairs. Basal leaves oblanceolate, lyrate pinnatifid, attenuate at base, acute at apex, 4 - 9 cm long, 0.75 - 1.5 cm wide, hairy; cauline leaves more or less sessile, oblanceolate to linear-lanceolate, attenuate at base, serrate to entire along margins, acute at apex, 10 - 25 x 0.5 - 4 mm, mostly glabrous above and pilose below, rarely pilose hairy on both surfaces, often ciliate along margins; uppermost leaves linear, ca 1 cm long, ca 1 mm wide. Racemes many-flowered, up to 12.5 mm long in fruit, very minutely hairy; pedicels 4 - 5 mm in fruit spreading. Sepals elliptic, concave, ca 1 mm long, glabrous or puberulent on adaxial surface. Petals obovate-spathulate, 1 - 2 mm long, white. Stamens 2 or 4, ca 1.25 mm long. Fruits broadly ovate to suborbicular, rounded-emarginate, narrowly winged and broadly notched at apex, 3 - 4 mm across, glabrous; valves shiny, reticulately veined; style short; stigma capitate, completely contained within the sinus. Seeds ovoid, narrowly winged, ca 2 mm long, brown; cotyledons obliquely accumbent, entire.

Fl. & Fr. June - Oct.

Distrib. India: Weed of roadsides and farms, up to 2500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal and Tamil Nadu.

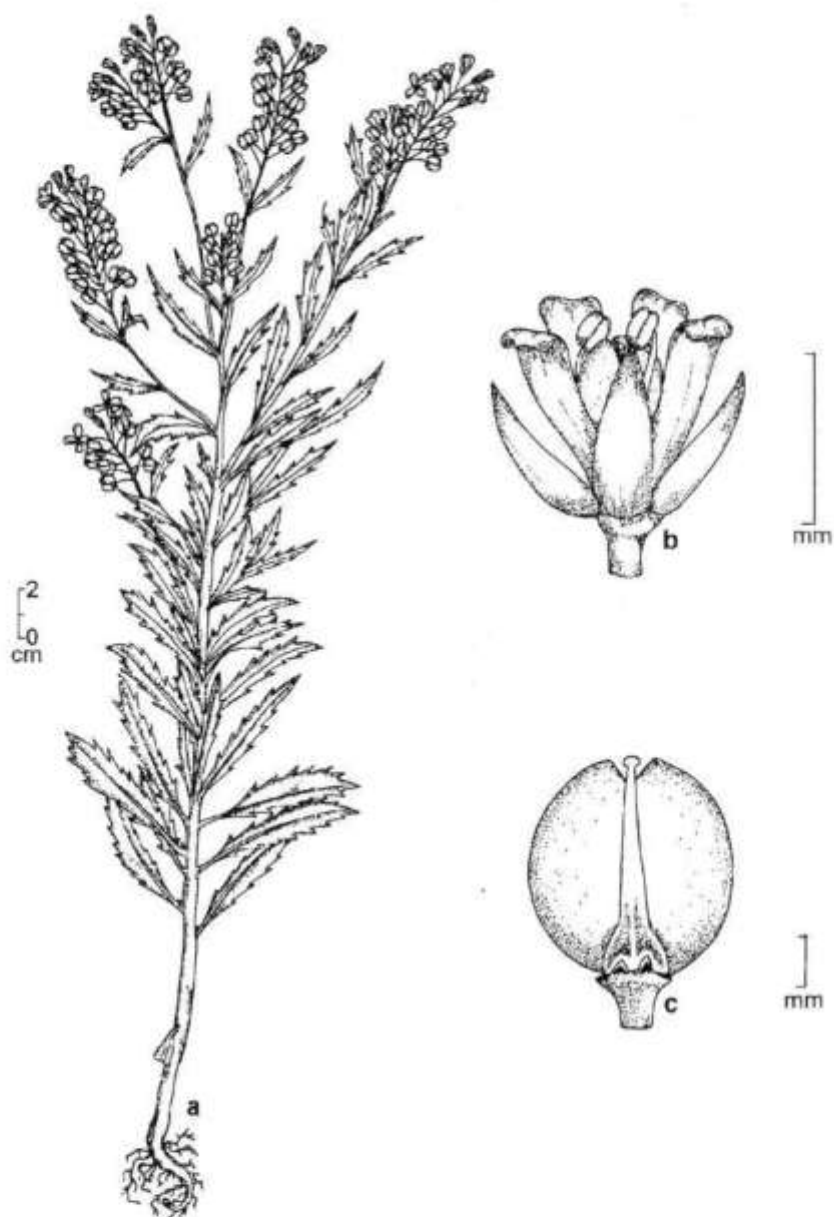


Fig. 35. *Lepidium virginicum* L. : a. habit; b. flower; c. fruit.

Pakistan, Bhutan, Europe and North America.

Notes. The young spring shoots are used as salad and seeds in seasoning and meat dressing.

Naqshi & Javeid (in J. Bombay Nat. Hist. Soc. 74: 392. 1977) report it from Kashmir.

47. *Megacarpaea* DC.

Herbs or undershrubs, perennial, robust with thick fleshy root; stem with stiff crisped hairs. Leaves large, pinnately or palmately lobed. Inflorescence panicate, increasing length in fruit. Flowers large, white or creamy yellow. Sepals equal, not saccate. Petals pink or white, obovate or oblong, entire. Stamens 6 - 16, subequal. Style very short or absent; stigma disciform, obscurely 2-lobed. Fruits large, didymous, indehiscent silicula, much-flattened, broadly winged; cotyledons accumbent.

Chiefly in C. Asia, Himalayas and China; about 7 species, 2 in India.

KEY TO THE SPECIES

- 1a. Leaf segments entire; fruits obcordate, very deeply notched at apex; lobes obovate; wings about half as broad as the locule 1. *M. bifida*
- b. Leaf segments serrate or irregularly toothed; fruits suborbicular; lobes suborbicular; wings as broad as the locule 2. *M. polyandra*

1. *Megacarpaea bifida* Benth. in Hooker's J. Bot. Kew Garden Misc. 7: 357. 1855; Hook. f. & T. Anderson in Fl. Brit. India 1: 161. 1872.

Herbs, perennial, robust, much branched, up to 60 cm high glabrous or subhairy. Cauline leaves petiolate, pinnately lobed, 20 - 30 x 5 - 20 cm; lobes lanceolate, more or less glabrous. Racemes much-branched, paniced, reaching up to 50 cm long in fruit; pedicels linear, recurved, glabrous, 2 - 2.5 cm long in fruit. Sepals obovate to elliptic-obovate, 3 - 5 x 3 - 3.5 mm, distinctly veined. Petals obovate or elliptic-oblong, attenuate at base, sometimes expanded and obtuse at apex, 3.5 - 5.5 x 2 - 4 mm. Stamens 7 - 11. Fruits conspicuously bifid; lobes diverging, obovate-oblong, 3 - 4.25 x 2 - 2.7 cm along with the wing; wing about half as broad as the locule. Seeds obovate, black, ca 1.5 x 0.75 cm.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir.

Pakistan and China (W. Tibet).

2. *Megacarpaea polyandra* Benth. in Hooker's J. Bot. Kew Garden Misc. 7: 356, t. 7. 1855; Hook. f. & T. Anderson in Fl. Brit. India 1: 161. 1872.

Kash.: *Chach, Chatri, Chattarhak.*

Robust herbs or undershrubs, up to 60 cm high, glabrous or subhairy, much-branched. Basal leaves long-petioled, bipinnately dissected, 30 - 60 x 15 - 25 cm; lobes lanceolate, sharply serrate along margins, acuminate at apex, 10 - 20 x 2.5 cm. Cauline leaves pinnately lobed, 10 - 30 x 5 - 25 cm; lobes lanceolate, irregularly serrate; petioles often flattened and auricled at base, sometimes spongy in nature. Racemes paniced, many-flowered, dense, elongating up to 25 cm long in fruit, densely capitate hairy. Sepals obovate or elliptic-obovate, concave, 3.7 - 5 x 3.5 mm, prominently veined. Petals obovate or oblong, attenuate at base, 3.5 - 5.5 x 2 - 3 mm, white or creamy yellow. Fruits suborbicular, bilobed, 3 - 3.5 cm across; lobes unequal in size, rarely one lobe abortive; wings about as broad as the locule. Seeds reniform, black, ca 1 x 0.8 cm.

Fl. & Fr. May - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Pakistan and China (W. Tibet).

48. *Thlaspi* L.

Herbs, annual, biennial or perennial, glabrous or glaucous, more rarely pilose, with unbranched hairs. Radical leaves rosulate, rarely not, entire or shallowly dentate; cauline leaves oblong, entire or toothed, sessile or subsessile with auriculate base. Inflorescence an ebracteate elongating raceme or sometimes corymbose or scapose. Flowers white or pink, rarely yellow. Sepals oblique, erect, not scapose, broad-membranous along margins. Petals entire, obovate or spatulate, shortly clawed at base. Stamens free, edentate. Fruit a dehiscent silicula, oblong to elliptic, obcordate or orbicular, laterally compressed, acuminate or acute at apex, with or without apical notch; style erect, more or less elongated, apex stigmatose, emarginate; valves boat-shaped, dorsally sharply keeled, sometimes more or less winged or rarely wingless; septum narrow, membranous. Seeds 2 - several in each locule; cotyledons accumbent.

Mostly in Europe and Asia; about 60 species, 6 in India.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Fruits orbicular to broadly obcordate, winged throughout the length | 2 |
| b. Fruits usually oblong, winged only in the upper 2/3 or wingless | 3 |
| 2a. Fruits orbicular, seeds striated | 2. <i>T. arvense</i> |
| b. Fruits obcordate, seeds not striated | 4. <i>T. kotschyannum</i> |

- 3a. Flowers 6 - 7 mm across; fruits oblong-elliptic, more or less entire at apex, wingless 1. *T. andersonii*
 b. Flowers 3 - 5 mm across; fruits oblong or obtriangular, slightly or distinctly retuse at apex, wings
 obscure or sharp 4
 4a. Fruits obtriangular to oblong, straight; plants usually 15 - 30 cm high 5. *T. montanum*
 b. Fruits oblong, subcontorted; plants short up to 15 cm high 5
 5a. Fruits 2 - 2.5 mm broad 3. *T. cochlearioides*
 b. Fruits ca 1.5 mm broad 6. *T. septigerum*

1. *Thlaspi andersonii* (Hook. f. & Thomson) O. Schulz in Ann. Akad. Wiss. Wien, Math.-Nat. 63: 98. 1926, in obs. *Iberidella andersonii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 177. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 163. 1872.

Herbs, procumbent or ascending, up to 20 cm high; stems mostly branched from the base; flowerless shoots weak, decumbent. Radical leaves spatulate, stalked, indistinctly toothed, 1 - 4 x 0.3 - 3 cm; cauline leaves ovate-oblong, auricled and amplexicaul at base, more or less entire or serrate-dentate along margins, 0.5 - 2.5 x 0.4 - 1.5 cm; leaves on barren shoots broadly ovate to more or less orbicular, shortly clawed. Racemes 4 - 5 (-8) cm long in fruit. Flowers white or pale rose; pedicels 5 (-10) mm long in fruit, ascending and spreading. Sepals ovate, 2 - 2.5 x 1 - 1.5 mm, papery margined. Petals oblong-ovate, often veined, clawed, 5 - 6 x 2 - 2.5 mm. Fruits narrowly lanceolate to oblong-lanceolate, curved, entire, acute at apex, 6 - 10 x 2 - 3 mm; style 1.5 - 2 mm long. Seeds 2 - 6 in each locule.

Fl. & Fr. March - July.

Distrib. India: Open hillsides amidst grass, 3400 - 4600 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (S.Tibet).

2. *Thlaspi arvense* L., Sp. Pl. 646. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 162. 1872.

Eng.: Field Penny-cress; *Hindi*: Maula (Jaunsar); *Nep.*: Cheka-chumu.

Herbs, annual, glabrous up to 50 cm high; stems erect, simple or corymbosely branched. Radical leaves not rosulate, ovate-oblong, obovate, petioled, usually obtuse at apex, 2 - 8 x 1 - 2 cm; cauline leaves oblong-lanceolate, sessile, acute-sagittate and amplexicaul at base, acute to subacute at apex; all leaves more or less dentate or toothed. Racemes elongating up to 25 cm long in fruit; pedicels erect-spreading, up to 15 mm long in fruit. Sepals oblong-lanceolate, 2 - 2.5 mm long. Petals white, obovate or obtriangular, clawed, obtuse at apex, 3 - 5 mm long. Stamens shorter than petals; anthers yellow. Fruits orbicular-obovate or orbicular-ovate, much flattened, broadly winged, deeply notched at apex, 12 - 18 x 10 - 15 mm; wings 2 - 5 mm broad, prominently reticulate;

style short; stigma capitate. Seeds 5 - 7 in each locule, ellipsoid or ovoid, 1.75 - 2.25 x 1.25 - 1.5 mm, concentrically ridged and grooved.

Fl. & Fr. April - Aug.

Distrib. India: Weeds of roadsides and farm lands, 2200 - 4000 m. Jammu & Kashmir, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Orissa, Maharashtra and Tamil Nadu.

Nepal, Bhutan, S.W. Asia, Europe and America.

Notes. Tender leaves are eaten as vegetable.

3. *Thlaspi cochlearioides* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 177. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 162. 1872.

Herbs, erect or decumbent, glabrous, up to 15 cm long; stems mostly branched from base. Basal leaves rosulate, more or less ovate or orbicular, rounded at base, obscurely toothed, rounded at apex, 1.5 - 3 x 0.4 - 0.8 cm; petioles up to 5 cm long; upper leaves elliptic-ovate or oblong-ovate, sessile, distinctly or obscurely acutely auricled at base, toothed or entire along margins, 5 - 20 x 3 - 8 mm. Flowers in decumbent, corymbose racemes; pedicels spreading or ascending, up to 3 mm long in fruit, glabrous. Sepals oblong-ovate, 1.75 - 2.25 x 0.75 - 1 mm. Petals white, tinged with purple, obovate, cuneate at base, 3 - 5 x 1 - 2 mm. Fruits oblong, often slightly curved, obtuse at base, retuse or submarginate at apex, sometimes twisted, 7 - 11 x 2.5 - 3 mm; style 0.5 - 1 mm long. Seeds oblong-ovate, 3 - 5 in each locule, pale brown, ca 1.25 mm long.

Fl. & Fr. June - Aug.

Distrib. India: Alpine slopes, 4200 - 4600 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal and Bhutan.

4. *Thlaspi kotschyannum* Boiss. & Hohen in Boiss., Diagn. Ser. 1, 8: 39. 1849. *T. cardiocarpum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 176. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 162. 1872.

Herbs, erect, glabrous, up to 40 cm high; stems usually branched from base. Basal leaves ovate, shortly stalked, 1 - 3 x 0.5 cm, dry up early; cauline leaves ovate or oblong, broadly sagittate at base, obtuse at apex, 1 - 5 x 0.5 - 2 cm. Racemes elongating up to 10 (-20) cm long in fruit; pedicels ca 0.5 mm long in fruit. Sepals ovate, white-margined, ca 1 mm long. Petals linear-oblong, cuneate at base, rounded at apex, 1.5 - 1.75 mm long. Fruits orbicular-obcordate, broadly winged, 6 - 10 x 9 - 12 mm, rounded and broadly

notched at apex, netted-veined; stigma sessile, included within the sinus. Seeds 4 - 5 in each locule, reddish-brown, ca 1.5 mm long.

Fl. & Fr. April - May.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

C. & S.W. Asia.

5. *Thlaspi montanum* L., Sp. Pl. 647. 1753. *T. cochleariforme* auct. non DC.; Singh & Kachroo, Fl. Srinagar 169. 1976. *T. cochleariforme* DC. subsp. *griffithianum* (Boiss.) Jafri in Notes R. Bot. Gard. Edinb. 22: 119. 1956; Nair, Fl. Bashahr Himal. 30. 1977. *T. alpestre* auct. non L.; Hook. f. & T. Anderson in Fl. Brit. India 1: 162. 1872.

Herbs, perennial, mat-forming, up to 30 cm high; stems many from short or elongated branched caudex, glabrous, mostly glaucous. Basal leaves in rosettes, spatulate or oblong-obovate, narrowed and stalked at base, mostly rounded at apex, 1.5 - 7 x 0.3 - 2 cm; cauline leaves ovate-cordate, sessile, auriculate and clasping at base, obtuse to acute at apex, 1 - 3 x 0.4 - 1.5 cm; all entire or sinuate-denticulate, subcoriaceous, glabrous. Racemes up to 10 (- 15) cm long in fruit; pedicels usually horizontal to horizontal-ascending or sometimes obscurely deflexed up to 8 mm long in fruit. Sepals ovate or oblong-ovate, greenish to purplish with a narrow hyaline border, 2.5 - 3 mm long. Petals spatulate, white or pinkish purple, cuneate at base, 4 - 7 mm long, ca 3 mm wide. Fruits obovate or obcordate, obtuse to truncate or subemarginate to distinctly emarginate at apex, obscurely to slightly winged above, 4 - 8 x 2 - 3.5 mm; style 1 - 2 mm long. Seeds ovate, pale brown, 2 - 4 in each locule, ovate, ca 1.5 mm long, pale brown.

Fl. & Fr. April - Aug.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

S.W. Asia, Europe and America.

Notes. See Bhaumik (in J. Econ. Tax. Bot. 3: 237 - 239. 1982) for discussion about the identity of this species.

6. *Thlaspi septigerum* (Bunge) Jafri in Notes R. Bot. Gard. Edinb. 22: 119. 1956; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 86. 1983. *Eutrema septigerum* Bunge, Verz. Pfl. Ostl. Alt. 73. 1836.

Herbs, perennial, erect, glabrous, up to 15 cm high. Basal leaves suborbicular, entire, 2.5 - 3.5 x 0.5 - 1 cm (including 1 - 1.5 cm long petiole); upper leaves sessile, narrowly lanceolate or oblong, entire, acute at apex, 10 - 20 x 3 - 5 mm. Racemes 10 - 15-flowered, ascending, up to 7 cm long in fruit, glabrous. Fruits oblong, laterally

compressed, truncate to slightly emarginate at apex, 6 - 12 x 1.5 - 2 mm; style 0.5 mm long. Seeds ellipsoid, dark brown, 4 - 6 in each locule, ca 1.5 mm long.

Fr. Sept.

Distrib. India: Jammu & Kashmir.

Pakistan and C. Asia.

Tribe 8. MATTHIOLEAE O. Schulz

(P. K. Hajra, H. J. Chowdhery and G. H. Bhaumik)

Annual or perennial herbs or small undershrubs, hoary or stellate pubescent, subglabrous or rarely glabrous. Leaves rosulate or cauline or both. Flowers white, purple or pink, rarely yellow. Sepals usually erect, inner pair often broad and saccate at base. Filaments usually linear; anthers often oblong, retuse at apex. Lateral nectar glands various, often semiannular, with or without basal process; middle glands present or absent. Ovary sessile or with short gynophore; stigma short or long. Pods short or long, bilocular. Seeds usually 2 in each locule, winged or without wings.

4 genera and 13 species in India.

49. *Chorispora* R. Br. ex DC., nom cons.

Herbs, annual or perennial. Stems erect, branched mostly from base; hairs branched or unbranched, glandular or sometimes eglandular. Leaves deeply pinnatifid to entire; basal leaves rosulate, petiolate; upper subsessile to sessile. Racemes lax; flowers showy. Sepals erect, the laterals slightly saccate at base. Petals spatulate, long-clawed, emarginate at apex, about twice as long as sepals, purple. Stamens 6. Ovary linear, bilocular; style long; stigma short, bilobed. Fruit an indehiscent articulated siliqua, linear, torulose or moniliform, breaking into 2-seeded segments; style at least half as long as fruit, more or less beaked. Seeds few to many, 1 in each locule, cotyledons accumbent.

Chiefly distributed in Eastern mediterranean region and C. Asia; about 10 species, 5 in India.

KEY TO THE SPECIES

- | | |
|--|-----------------------|
| 1a. Annual or biennial herbs | 2 |
| b. Perennial herbs | 3 |
| 2a. Flowers pink, lilac or violet; beak as long as the body of siliqua, thickened | 5. <i>C. tenella</i> |
| b. Flowers yellow; beak half or less than half the length of the body of siliqua, thin | 4. <i>C. sibirica</i> |

- 3a. Flowers yellow; siliqua ca 10 mm long 2. *C. macropoda*
 b. Flowers pink or violet; siliqua 15 - 30 mm long 4
 4a. Flowering stem short or absent; pedicels up to 30 mm long in fruit; petals 14 - 16 mm long
1. *C. bungeana*
 b. Flowering stem conspicuously present; pedicels up to 15 mm long in fruit; petals 6 - 10 mm
3. *C. sabulosa*

1. *Chorispora bungeana* Fischer & Meyer in Shrenk, Enum. Pl. Nov. 1: 96. 1841; Dhar & Naqshi in Geobios 3: 65, f.1. 1976.

Herbs, perennial, glabrous, 5 - 8 cm high; rootstock thick, inconspicuous or suppressed. Radical leaves rosulate, oblanceolate, pinnatifid or sinuate-dentate, long-stalked, 20 - 50 x 3 - 10 mm. Scape slender, glabrous, 1-flowered, sometimes 2 - 5-flowered racemes, embedded in leaves. Flowers solitary, ca 1 cm across, bluish-pink; pedicels slender, glabrous, up to 3 cm long in fruit. Sepals erect, oblong, more or less pilose, usually violet, 5 - 8 mm long. Petals spreading, tapering into a long claw, dilated and deeply emarginate at apex, 15 - 20 x 5 - 7 mm. Fruits cylindrical, torulose or moniliform, 20 - 30 x 1.5 - 2 mm; style 5 mm long. Seeds ellipsoid, compressed, 1.5 x 1 mm, reddish brown.

Fl. & Fr. May - July.

Distrib. India: On dry gravelly and rocky slopes and moraines, ca 3100 m. Jammu & Kashmir.

Pakistan, Afghanistan, C. & S.W. Asia and Russia.

Notes. Pods eaten raw or cooked as vegetable.

Dhar & Naqshi (l. c.) reports it from Meenamarg in Kashmir.

2. *Chorispora macropoda* Trautv. in Bull. Soc. Nat. Mosc. 33: t. 109. 1860; Jafri in Fl. W. Pakistan 55: 205. 1973.

Herbs, perennial, suberect, 5 - 10 cm high; stems slender, branched from base forming compact tufts, finely pubescent with both glandular and eglandular simple hairs. Leaves mostly radical, congested at base, stalked, oblanceolate or oblong-spathulate, more or less dentate to pinnatifid, 20 - 30 x 4 - 7 mm; lobes small, lanceolate, glabrous to sparsely hairy along margins. Racemes dense, up to 7 cm long in fruit; pedicels ascending, 8 - 10 mm long in fruit. Sepals 2 - 3 mm long, sparsely hairy. Petals linear-spathulate, clawed at base, dilated and emarginate at apex, 5 - 7 mm long. Fruits irregularly flattened and torulose, 10 - 15 x 2 - 2.5 mm, finely glandular hairy; style 2.5 - 4 mm long.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Central and S.W. Asia.

3. *Chorispora sabulosa* Cambess. in Jacquem., *Voy. Bot.* 15, t. 15. 1844; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 167. 1872. *C. elegans* Cambess. in Jacquem., *Voy. Bot.* 15, t. 14. 1844. *C. elegans* Cambess. var. *sabulosa* (Cambess.) O. Schulz in *Notizbl. Bot. Gart. Berlin* 9: 1071. 1927.

Herbs, perennial, 3 - 20 cm high; stems slender, much-branched, forming compact tufts at base, glandular hairy or rarely glabrous. Leaves radical, rosette, oblanceolate or spatulate, deeply pinnatifid to irregularly dentate, rarely entire, petiolate, 1 - 8 x 0.2 - 1 cm, hairy; lobes lanceolate, terminal larger, laterals smaller. Racemes many-flowered, compact at first, elongating up to 18 cm long in fruit. Flowers showy; pedicels up to 20 mm long in fruit. Sepals elliptic-oblong, 3 - 5 mm long, pilose. Petals 6 - 12 mm long. Fruits cylindrical, torulose or moniliform, 10 - 15 (-20) x 2 - 5 mm; hairs glandular or eglandular; valves usually breaking into 1-seeded parts on each side; locules biseriate, opposite or almost alternate, tubercled; style subulate, 3 - 4 mm long. Seeds 6 - 10, ca 1.5 mm across.

KEY TO THE VARIETIES

- 1a. Fruits eglandular hairy
b. Fruits glandular hairy

- 3.1. var. *eglandulosa*
3.2. var. *sabulosa*

3.1. var. *eglandulosa* Naray. ex Naithani & Uniyal in *Indian J. For.* 5(3): 245. 1982.

Fl. & Fr. June - Sept.

Distrib. India: Along rocky slopes. Himachal Pradesh.

3.2. var. *sabulosa*

Fl. & Fr. June - Sept.

Distrib. India: Common in dry places and along rocky hill slopes. Jammu & Kashmir and Himachal Pradesh.

Central & S.W. Asia.

Notes. Fruits are edible.

4. *Chorispora sibirica* (L.) DC. Syst. Nat. 2: 437. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 167. 1872. *Raphanus sibiricus* L., Sp. Pl. 669. 1753.

Herbs, annual, 5 - 20 cm high; stems erect, slender, branched from base; hairs glandular and eglandular. Basal leaves rosulate, stalked, oblanceolate, more or less sinuate-dentate to pinnatifid, 2 - 5 x 0.3 - 0.5 cm, finely glandular hairy; lobes narrowly lanceolate; cauline leaves gradually smaller, sessile. Racemes up to 15 cm long in fruit; pedicels spreading or ascending, slightly thickened, sometimes reflexed or subhorizontally declinate. Sepals oblong, ca 3.5 mm long, pilose. Petals dilated above, emarginate at apex, 5 - 8 mm long. Fruits cylindrical, finely torulose, often curved or subreflexed, glandular hairy, 15 - 20 x 1.5 - 2 mm; beak ca 5 mm long. Seeds oval, compressed, brown, ca 1.5 x 1 mm.

Fl. & Fr. June - July.

Distrib. India: On dry hill slopes. Jammu & Kashmir.

Central and S.W. Asia.

5. *Chorispora tenella* (Pallas) DC., Syst. Nat. 2: 435. 1821; Hook. f. & T. Anderson in Fl. Brit. India 1: 166. 1872. *Raphanus tenellus* Pallas, Reise 3(2): 741. 1776.

Eng.: Blue-mustard.

Herbs, annual, 15 - 50 cm high; stem and leaves glandular hairy. Basal leaves rosulate, oblanceolate, sinuate-toothed, petioled, 4 - 7 x 1.5 - 1.75 cm; upper leaves lanceolate to linear-lanceolate, shortly stalked to sessile, irregularly dentate to subentire, 2 - 8 x 0.3 - 2 cm. Racemes lax, up to 20 cm long in fruit; flowers distant, light purple; pedicels 3 - 4 mm long in fruit. Sepals oblong, 5 - 6 mm long, hairy outside near apex. Petals entire, 10 - 11 x 2 mm. Fruits cylindrical, more or less torulose, 20 - 30 x 1.5 - 2 mm, spreading, gradually tapering towards apex, breaking transversely into several 2-seeded parts, sparsely glandular hairy; stylar beak subulate, 15 - 25 mm long; stigma bilobed. Seeds 1.5 - 1.75 x 0.3 mm, brown.

Fl. & Fr. May - Aug.

Distrib. India: On dry hill slopes, roadsides, waste places, fields and open range lands. Jammu & Kashmir and Himachal Pradesh.

Central and S.W. Asia, Europe and America.

50. *Matthiola* R. Br., nom. cons.

Herbs or often small undershrubs, annual or perennial, hoary or stellate pubescent,



Fig. 36. *Matthiola flava* Boiss. : a. habit; b. inflorescence; c. flower.

rarely glandular or subglabrous. Leaves entire or sinuate; basal leaves petioled; upper ones sessile or shortly petioled. Racemes lax, bracteate. Flowers white or purple, large; bracts absent; pedicels erect or ascending. Sepals erect, inner ones saccate at base. Petals long-clawed, linear, spreading, purple, white or yellowish. Stamens 6. Ovary oblong, many-ovuled; stigma of 2 erect connivent lobes. Fruits cylindrical or flattened; valves 1-veined; style absent. Seeds 1-seriate, flattened with broad membranous wing.

S.W. Asia, Europe and South Africa; about 60 species, 2 cultivated in India.

KEY TO THE SPECIES

- | | |
|--|----------------------|
| 1a. Leaves sinuate or pinnatisect; flowers 5 - 8 mm across | 1. <i>M. flavida</i> |
| b. Leaves entire; flowers ca 15 mm across | 2. <i>M. incana</i> |

1. *Matthiola flavida* Boiss., Diagn. Pl. Nov. Or. 1, 6: 9. 1845. *M. odoratissima* auct. non (Pallas) R. Br. (1812); Hook. f. & T. Anderson in Fl. Brit. India 1: 131. 1872.

Fig. 36.

Perennials, 30 - 60 cm high, hoary with stellate pubescence. Lower leaves obovate; upper lanceolate, sinuate or pinnatisect, rarely entire, 1.5 - 4 x 1 - 2 cm; petioles 0.5 - 2 cm long. Racemes lax, 5 - 15-flowered, 20 - 40 cm long. Flowers 5 - 8 mm across, purplish, often fragrant. Sepals ca 1 cm long. Petals oblong-linear, entire, ca 2 cm long. Stamens ca 8 mm long; anthers ca 2 mm long. Fruits linear-oblong, compressed, erect, rigid, stellate-pubescent, 7 - 13 cm long. Seeds ca 2 x 1 mm, broad with marginal wing.

Fl. & Fr. April - July.

Distrib. India: Jammu & Kashmir.

S.W. Asia.

2. *Matthiola incana* (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4: 120. 1812; Jafri in Fl. W. Pakistan 55: 200. 1973. *Cheiranthus incanus* L., Sp. Pl. 662. 1753.

Fig. 37.

Herbs, perennial, woody at base, 25 - 75 cm high, densely white-canescens. Leaves oblanceolate, usually entire, rarely sinuate-pinnatifid, 3 - 9 x 0.5 - 1.5 cm. Racemes 15 - 30-flowered, 5 - 30 cm long; pedicels 10 - 15 mm long; lower pedicels 7 - 25 mm in fruit. Flowers purplish, ca 1.5 cm across. Sepals 9 - 15 mm long. Petals 20 - 30 x 4 - 12 mm. Fruits 10 - 15 cm long, erecto-patent, compressed, glandular-pubescent; stigma narrower than silique, without conspicuous horns.

Fl. & Fr. March - May.

Distrib. India: Cultivated as an ornamental.

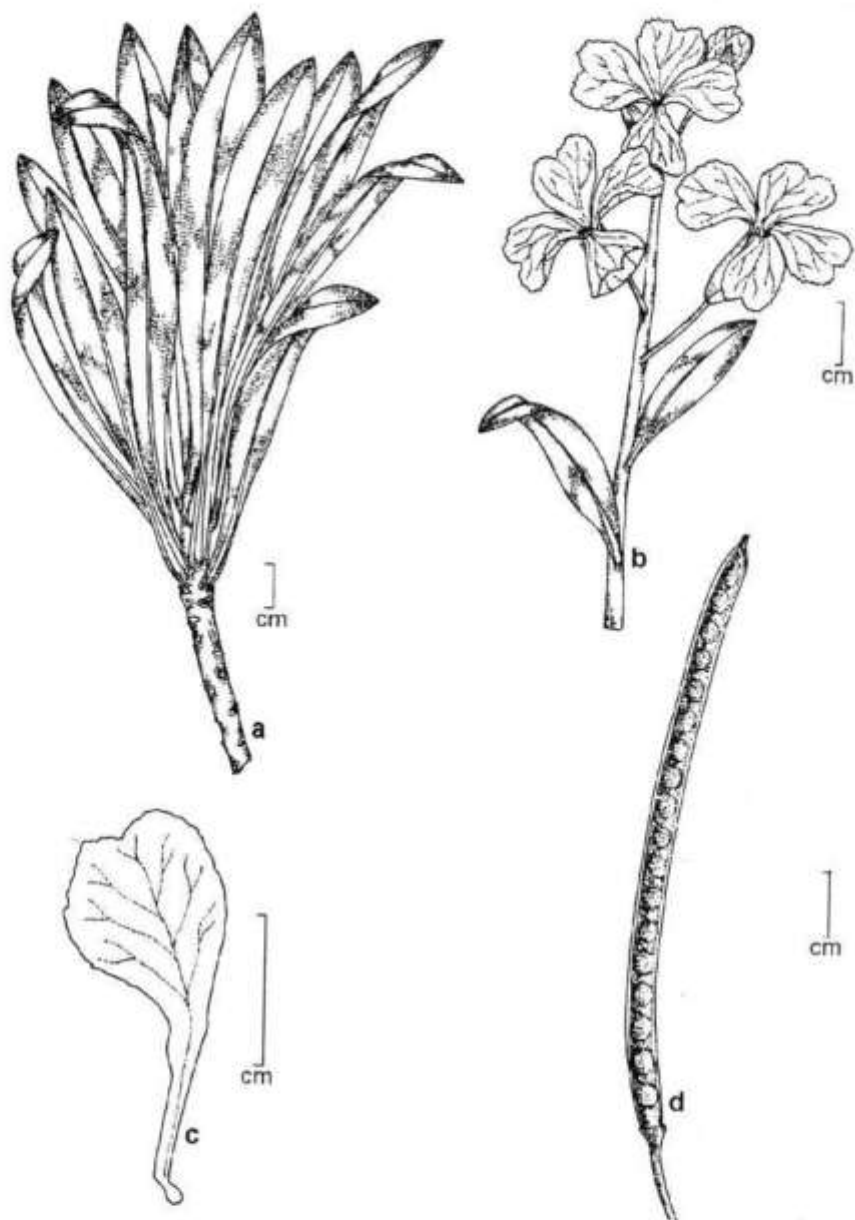


Fig. 37. *Matthiola incana* (L.) R. Br. : a. habit; b. flowering twig; c. petal; d. fruit.

Coasts of South and Western Europe, Cyprus, Turkey, Arabia and Egypt.

EXCLUDED SPECIES

1. *Matthiola tenera* Rech. f. in Fl. Iran. 57: 235. 1968.

Rechinger (l. c.) reports this species from Jammu & Kashmir. However, there is no specimen in Indian herbaria.

2. *Matthiola tristis* (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4: 120. 1812. *Cheiranthus tristis* L., Sp. Pl. ed. 2: 925. 1759.

According to Hook.f. & T. Anderson (1872) this species is cultivated in the gardens of Northern India. There are no specimens in Indian herbaria.

51. *Notoceras* R. Br.

Herbs, small, depressed, branched, hoary with bipartite medifixed appressed hairs. Leaves linear to oblanceolate, entire, sessile or subsessile. Racemes leaf-opposed. Flowers white, linear-oblong, not clawed, white. Sepals equal at base, erecto-patent, not saccate. Petals small, linear to oblong, not clawed, white. Stamens 6; filaments linear. Lateral nectar glands in pairs, minute; middle glands absent. Ovary subquadrate with 2 apical horns, 6 - 8-ovuled; style short; stigma minute, capitate. Fruit a short tardily dehiscent siliqua, rigid, linear to oblong, with 2 horns at apex; valves narrowly winged and keeled; style distinct; stigma capitate. Seeds 1-seriate, compressed, wingless; cotyledons accumbent.

Mediterranean region, eastwards to India; 2 species, one in India.

Notoceras bicornis (Aiton) Amo, Fl. Iber. 6: 536. 1873. *Erysimum bicornis* Aiton, Hort. Kew. ed.1, 2: 394. 1789. *Notoceras canariense* R. Br. in Aiton, Hort. Kew. ed. 2, 4: 117, 1812; Hook. f. & T. Anderson in Fl. Brit. India 1: 140. 1872. *N. hispanicum* DC., Syst. Nat. 2: 204. 1821.

Herbs, 15 - 30 cm long; branches procumbent, ascending, spreading from base. Leaves lanceolate, linear-lanceolate, entire, 1 - 5 x 0.5 - 1 cm. Racemes 15 - 25-flowered, short, dense, leaf-opposed. Flowers ca 2 mm across; pedicels up to 2 mm long in fruit, stout, thickened. Sepals ca 2 mm long. Petals ca 2 mm long. Stamens ca 2 mm long. Fruits tetragonous, 5 - 8 mm long, ca 1.5 mm thick; valves torulose, 1-nerved, hairy. Seeds 2 - 5 in each locule, compressed.

Fl. & Fr. April - May.

Distrib. India: Jammu & Kashmir and Punjab.

Pakistan, S.W. Asia and Mediterranean regions of Europe.

Notes. Jafri (in Fl. W. Pakistan 55: 193, 1973) has quoted a collection (Falconer s.n. in K) from Kashmir without any precise locality. Except for a single specimen from Punjab (Herb. Sulp. Kurz., CAL Acc. No. 22253) there is no collection from India.

52. *Parrya* R. Br., sensu lato

Herbs, perennial, tufted; rootstock thick; hairs unbranched, sometimes glandular. Basal leaves rosulate, linear or spatulate, entire, pinnatifid or sinuate-dentate, often stalked with sheathing bases. Scapes 1-many-flowered, usually leafless. Flowers large, white or purple. Sepals erect, inner saccate at base. Petals spatulate, clawed, white or purplish. Stamens usually 6; anthers linear, oblong. Ovary linear, many-ovuled; style with bilobed, erect stigmas. Fruit a siliqua linear-oblong, compressed or much flattened; valves with distinct median vein; style very short; stigma 2-lobed. Seeds 1 - 2-seriate, compressed, winged.

Mostly in Central Asia; about 30 species, 5 in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Leaves entire | 5. <i>P. platycarpa</i> |
| b. Leaves pinnatisect, irregularly toothed or pinnatifid | 2 |
| 2a. Flowers ca 2 cm across | 3 |
| b. Flowers up to 1 cm across | 4 |
| 3a. Scapes 1-flowered | 2. <i>P. exscapa</i> |
| b. Scapes many-flowered | 4. <i>P. nudicaulis</i> |
| 4a. Leaves deeply pinnatisect; lobes narrowly oblong | 1. <i>P. chitralensis</i> |
| b. Leaves pinnatifid to subpinnatisect; lobes triangular | 3. <i>P. minjanensis</i> |

1. *Parrya chitralensis* Jafri in Notes R. Bot. Gard. Edinb. 22(2): 115. 1956 & in Fl. W. Pakistan 55: 212. 1973.

Herbs, 10 - 20 cm high, glabrous; rootstock woody, 4 - 5 cm thick. Leaves deeply pinnatisect, 5 - 7-jugate, 3 - 7 x 1 - 1.6 cm; terminal lobes acute at apex, 5 - 10 x 1.5 - 5 mm; lateral lobes 4 - 10 x 1 - 2.5 mm. Scapes erect, glabrous, 8 - 20 cm long. Racemes 3 - 4-flowered. Flowers ca 7 mm across; pedicels erect, glabrous, 1 - 9 mm long. Sepals oblong, erect, saccate at base, obtuse at apex, glabrous, white-margined, 7 - 10 x 2 - 3 mm. Petals spatulate, long unguiculate, 15 - 18 x 3 - 5 mm. Stamens 7 - 9, ca 10 mm long; anthers linear-oblong, ca 3 mm long. Style ca 2 mm long. Fruits 5 - 8 cm long, 2 - 3 mm broad. Seeds many.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan.

2. *Parrya exscapa* Ledeb., Icon. Pl. Ross. 1: 21, t. 86. 1829; Hook. f. & T. Anderson in Fl. Brit. India 1: 131. 1872.

Herbs, tufted, glabrous or puberulous; rootstock woody, slender. Leaves rosulate, spatulate, entire or irregularly toothed, 15 - 40 x 3 - 8 mm. Flowers purple, ca 2 mm across; pedicels 1.5 - 3.5 cm long. Sepals ca 8 mm long. Petals 15 - 20 mm long. Stamens ca 7, ca 8 mm long; anthers ca 3 mm long. Fruits oblong, compressed, drooping, 4.5 - 5.5 x 0.5 cm. Seeds 1 - 2-seriate, ovate-orbicular, brown with broad membranous wing.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan and Central Asia.

3. *Parrya minjanensis* Rech. f. in Phytion 3: 62. 1951. *P. stenocarpa* Karelin & Kir. var. *pinnatisecta* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1092. 1927, p. p. *P. stenocarpa* Karelin & Kir. subsp. *gilgitica* Jafri in Notes R. Bot. Gard. Edinb. 22(2): 115. 1956.

Herbs, 10 - 25 cm high, densely hispid or glabrous. Leaves pinnatifid to pinnatipartite, usually 5 - 7-toothed, 3 - 6 cm long, densely hispid. Scapes 8 - 22 cm long; racemes 5 - 6-flowered at apex. Flowers white or lilac, ca 1 cm across; pedicels ca 5 mm long in fruit. Sepals ca 8 mm long. Petals ca 1.5 cm long. Stamens 7, ca 8 mm long. Pods 6 - 8 x 0.4 cm. Seeds many, oblong-ovate.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir.

Pakistan and Afghanistan.

4. *Parrya nudicaulis* (L.) Regel in Bull. Soc. Nat. Mosc. 34(3): 176. 1861. *Cardamine nudicaulis* L., Sp. Pl. 654. 1753. *Arabis nudicaulis* (L.) DC., Syst. Nat. 2: 240. 1821. *Neurotoma nudicaule* (L.) DC., Prodr. 1: 156. 1824. *Parrya macrocarpa* R. Br. in Parry's Voy., app. 11: 270. 1824; Hook. f. & T. Anderson in Fl. Brit. India 131. 1872.

Herbs, 7 - 40 cm high, sparsely glandular-tomentose or rarely subglabrous; rhizome stout, long. Basal leaves rosulate, lanceolate, sinuate-toothed or entire, 5 - 15 cm long, glandular, long-petioled. Scapes up to 38 cm long in fruit; racemes 10 - 15-flowered. Flowers ca 2 cm across; pedicels 1 - 3 (-5) cm long in fruit. Sepals 5 - 10 mm long. Petals

obovate, 10 - 20 mm long. Stamens ca 1 cm long; anthers ca 2 mm long. Fruits compressed, attenuate at base and apex, undulate along margins, 3 - 6 x 0.4 - 0.5 cm. Seeds many, suborbicular, broadly winged, ca 4 mm across.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan, C. & N. Asia and Arctic Europe.

5. *Parrya platycarpa* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 136. 1861; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 131. 1872.

Rootstock covered with old spongy petioles. Leaves spatulate or obovate, entire, leathery, 2 - 4 x 0.5 - 1 cm, glabrous or with hairy margins; petioles 2 - 4 cm long, sheathing at base. Scapes short, thick, few-flowered, pilose, sometimes with 1 or 2 leaves. Fruits ovate, 1.5 - 3 x 0.5 - 1 cm, tapering into short, thick style; valves thin, convex, not veined, midrib distinct. Seeds few, not winged.

Fl. & Fr. June - Aug.

Distrib. India: Sikkim.

Endemic.

Tribe 9. SISYMBRIAE DC.

(P. K. Hajra, H. J. Chowdhery and G. C. Das)

Herbs, annual, biennial or perennial. Leaves lyrate-pinnatifid or pinnatisect. Flowers white, pink or yellow. Lateral nectar glands semiannular or annular; middle glands often joining laterals. Staminal filaments not appendaged; anthers usually oblong, obtuse. Fruits usually long; valves often convex; style usually short or absent; stigma usually depressed, capitate. Seeds usually oblong or suborbicular.

12 genera and 32 species in India.

53. *Alliaria* Scop.

Herbs, annual or biennial. Basal leaves long-petioled; cauline leaves shortly stalked. Racemes many-flowered, lax, elongated in fruit. Flowers small, white. Petals oblong-obovate, about twice as long as sepals. Stamens 6; anthers short, obtuse. Lateral nectar glands annular; middle glands broadly conical. Fruits bilocular, dehiscent. Seeds 1-seriate.

Asia, Europe and North Africa; 2 species, 1 in India.

Alliaria petiolata (M. Bieb.) Cavara & Grande in Boll. Orto Bot. Regia Univ. Napoli 3: 418. 1913; Chowdhery & Wadhwa, Fl. Himachal Pradesh 1: 52. 1984. *Arabis petiolata* M. Bieb., Fl. Taur.-Cauc. 2: 126. 1808. *Erysimum alliaria* L., Sp. Pl. 660. 1753. *Sisymbrium alliaria* (L.) Scop., Fl. Carn. 2: 26. 1772; Hook. f. & T. Anderson in Fl. Brit. India 1: 151. 1872. *Alliaria officinalis* Andr. ex M. Bieb., Fl. Taur.-Cauc. 3: 445. 1819.

Herbs, branched or simple, 30 - 95 cm high. Basal leaves reniform, 5 - 12 x 2 - 6 cm, dentate; petioles 3 - 5 cm long. Upper leaves ovate-cordate or deltoid, crenate, 1.5 - 7.5 x 0.8 - 5.5 cm, membranous; petioles 1 - 2 cm long. Racemes 10 - 30-flowered, up to 20 cm long in fruit. Flowers white, ca 4 mm across; pedicels up to 6 mm long in fruit. Sepals ca 2 mm long. Petals ca 6 mm long. Stamens 2 - 3 mm long. Fruits 3.5 - 5.5 cm long; valves 3-nerved, with slot midrib. Seeds oblong, striate and dotted, dark brown.

Fl. & Fr. May - July.

Distrib. India: On rocky hill slopes at 2300 - 3000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Pakistan, Asia, Europe and N. America.

54. *Aphragmus* Andr. ex DC.

Herbs, perennial, branching from base, more or less glabrous or slightly hairy below. Leaves simple, rosulate, linear-spathulate to oblong, stalked, entire, subacute at apex, fleshy, glabrous; cauline leaves several. Racemes short, axillary, lax, mostly bracteate. Flowers small, mostly white or lilac; pedicels thin, suberect in fruit. Sepals ascending, deciduous. Petals obovate-oblong, subacute at apex, about twice as long as sepals, or more. Stamens 6; filaments slender; anthers ovoid. Lateral nectariferous glands semicircular, opening inside, connate with narrow middle glands. Ovary sessile, elliptic to oblong-elliptic, 6 - 10-ovuled; style short with compressed capitate stigma. Fruits elliptic-oblong, subcompressed, acuminate at both ends, glabrous; valves distinctly midveined; septum usually absent, if present hyaline. Seeds 2-seriate, ovate, smooth, radicle incumbent.

C. Asia, Tibet and Himalayas; 3 - 4 species, 1 in India.

Aphragmus oxycarpus (Hook. f. & Thomson) Jafri in Notes R. Bot. Gard. Edinb. 22: 96. 1956. *Braya oxycarpa* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 169. 1861. *Lignariella duthiei* Naqshi in J. Econ. Tax. Bot. 3: 976. 1982 (1983). *Brya alpina* auct. non Sternb. & Hoppe; Hook. f. & T. Anderson in Fl. Brit. India 1: 155. 1872.

Herbs dwarf, 3 - 8.5 (-10) cm high, glabrous or somewhat hairy below and glabrous above, purple. Radicle leaves 4 - 20 (-25) x 1 - 3 (-4) mm, shortly petioled or sessile; cauline leaves distant, oblong-elliptic to oblong-linear, entire, (5-) 7 - 12 (-15) x 2 - 3 mm, sessile; all leaves glabrous or sparsely hairy, subfleshy. Racemes 5 - 10-flowered, up to 5 cm long in fruit. Flowers white or pinkish, ca 3 mm across; pedicels ascending, 4 - 6 mm long in fruit, puberulous. Sepals ovate-elliptic, ca 2 mm long, 3-nerved, glabrous. Petals 3 - 3.5 x 1.5 mm, tapering below. Stamens up to 2.5 mm long, bright yellow; anthers ca 0.3 mm long. Fruits erect, linear, terete or subcompressed, 5 - 10 x 0.5 - 2 mm, glabrous; valves with curved veins; septum complete or incomplete; style thick, up to 0.5 mm long. Seeds 8 - 10 in each locule, ellipsoid, brown, ca 1 mm long.

KEY TO THE VARIETIES

- | | |
|---|-----------------------------|
| 1a. Fruits 1.5 - 2 mm broad, terete | 1.1. var. <i>oxycarpus</i> |
| b. Fruits 0.5 - 0.8 mm broad, subcompressed | 1.2. var. <i>stenocarpa</i> |

1. 1. var. *oxycarpus*

Fl. & Fr. June - Aug.

Distrib. India: Open grassy slopes, 4000 - 4700 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan, China, Afghanistan and C. Asia.

1. 2. var. *stenocarpa* (O. Schulz) G. C. Das, *comb. nov.* *Braya oxycarpa* Hook. f. & Thomson var. *stenocarpa* O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1068. 1927.

Fl. & Fr. not known.

Distrib. India: Uttar Pradesh.

Endemic.

55. *Arabidopsis* Heynh.

Herbs, annual, biennial or perennial, erect or suberect, branched from base, usually densely simple or branched hairy. Radical leaves usually rosulate, often petiolate, narrowed at base, rarely auriculate, ovate-oblong, entire or toothed; cauline leaves often sagittate, entire or toothed. Racemes elongate, usually bracteate at base, lax in fruit. Flowers white, purple or rose-coloured. Sepals spreading. Petals obovate or spatulate, rounded, almost twice as long as sepals, pink, white or purple. Stamens usually 6. Lateral nectar glands usually annular or semiannular; middle often torulose. Ovary linear, many-ovuled; stigma depressed. Fruits linear, often curved, compressed or

terete, glabrous or hairy; valves usually weakly 1-nerved. Seeds few to many, 1-2-seriate.

Mainly Asian; about 15 species, 9 in India.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Cauline leaves cuneate at base | 2 |
| b. Cauline leaves usually sagittate-amplexicaul or broad at base | 5 |
| 2a. Fruits usually 0.5 - 1.5 cm long | 8. <i>A. thaliana</i> |
| b. Fruits usually 4 - 8 cm long | 3 |
| 3a. Flowers ca 3 mm across | 9. <i>A. wallichii</i> |
| b. Flowers ca 5 mm across | 4 |
| 4a. Basal leaves not rosulate; fruits blunt at apex with subsessile stigma | 5. <i>A. russelliana</i> |
| b. Basal leaves rosulate; fruits acute at apex with ca 2 mm long style | 7. <i>A. taraxacifolia</i> |
| 5a. Flowers yellow | 4. <i>A. pumila</i> |
| b. Flowers white or pink | 6 |
| 6a. Racemes bracteate mostly up to the apex | 1. <i>A. himalaica</i> |
| b. Racemes ebracteate or rarely few bracteate below | 7 |
| 7a. Fruits densely pubescent | 2. <i>A. lasiocarpa</i> |
| b. Fruits glabrous | 8 |
| 8a. Cauline leaves sagittate-amplexicaul at base | 3. <i>A. mollissima</i> |
| b. Cauline leaves narrowed at base | 6. <i>A. stricta</i> |

1. *Arabidopsis himalaica* (Edgew.) O. Schulz in Engler, Pflanzenr. 86 (IV.105): 283. 1924. *Arabis himalaica* Edgew. in Trans. Linn. Soc. 20: 31. 1846. *Sisymbrium himalaicum* (Edgew.) Hook. f. & Thomson in J. Linn. Soc., Bot. 160. 1862; Hook. f. & T. Anderson in Fl. Brit. India 1: 147. 1872.

Herbs, biennial or perennial, 10 - 45 cm high, erect with spreading or ascending branches, hirsute; hairs simple and stellate. Leaves oblong or spatulate, acute or obtuse, 1 - 5 x 0.3 - 1.5 cm; basal ones petioled; upper ones clasping stem, auricled at base, sagittate, sinuate-toothed along margins. Racemes 15 - 30-flowered, with leaf-like bracts, up to 15 cm long in fruit. Flowers pink; pedicels ca 1 cm long in fruit. Sepals ovate-oblong, ca 2.5 x 1 mm; petals ca 4 x 1.5 mm. Fruits 1.5 - 3.5 cm long, erect or spreading, terete to linear, glabrous or sparsely pubescent; valves 1-veined, striate. Seeds many in each locule.

Fl. & Fr. May - July.

Distrib. India: Rocky hillsides and shaded or open forests, 3000 - 4500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Afghanistan, Pakistan, Nepal, Bhutan and China (Tibet).

2. *Arabidopsis lasiocarpa* O. Schulz in Engler, Pflanzenr. 86(IV.105): 282. 1924. *Sisymbrium lasiocarpum* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 662. 1861. (non F. Mueller 1858); Hook. f. & T. Anderson in Fl. Brit. India 1: 348. 1872. *S. bhutanicum* Balakr. in J. Bombay Nat. Hist. Soc. 67: 57. 1970.

Herbs, annual, 10 - 45 cm high, slender, erect, hispidly greyish pubescent; hairs mixed, simple and stellate. Radical leaves ovate-spathulate, 8 - 25 x 4 - 6 mm, few, shortly petioled, sinuate-toothed; cauline leaves sessile, obovate, 5 - 12 x 2 - 4 mm, toothed to subentire. Racemes 10 - 30-flowered, up to ca 15 cm long in fruit, often bracteate below. Flowers ca 2 mm across, white or lilac; pedicels ca 2 mm long. Sepals oblong, ca 2 mm long, pubescent. Petals 2 - 3 x 1 mm. Stamens ca 2 mm long. Fruits straight, terete, ca 16 mm long, densely pubescent; valves convex. Seeds ca 15 in each locule.

Fl. & Fr. April - June.

Distrib. India: 2400 - 2800 m. Jammu & Kashmir.

Pakistan, Nepal and Bhutan.

3. *Arabidopsis mollissima* (C. Meyer) N. Busch, Fl. Sib. & Or. Extr. 1: 136. 1913. *Sisymbrium mollissimum* C. Meyer in Ledeb., Fl. Alt. 3: 140. 1831; Hook. f. & T. Anderson in Fl. Brit. India 1: 39. 1872. *S. thomsonii* Hook. f. in J. Linn. Soc., Bot. 5: 161. 1861.

Herbs, biennial or perennial, 7 - 45 cm high, erect, simple or branched, glabrous or hairy. Basal leaves rosulate, spatulate or oblong-obovate, 2.5 - 5 x 0.5 - 1.5 cm, entire or toothed, obtuse; cauline leaves lanceolate or oblong-ovate, entire or shallowly dentate, 0.8 - 1 x 0.3 - 0.4 cm, sessile, auricled at base, amplexicaul, densely pubescent or canescent. Racemes 15 - 35-flowered, up to 15 cm long in fruit, ebracteate, rarely bracteate at base only. Flowers ca 4 mm across, white or pinkish; pedicels spreading, filiform, 1 - 1.5 cm long. Sepals ca 2 mm long. Petals ca 4 mm long, ca 1 mm broad. Stamens ca 2 mm long. Fruits usually erect, 2.5 - 5 cm long; valves convex, glabrous. Seeds 20 - 40 in each locule.

Fl. & Fr. May - July.

Distrib. India: On north facing slopes of Himalayas, 3000 - 4000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, Bhutan, Pakistan, Afghanistan, C. Asia, Russia (Siberia) and W. China (Tibet).

4. *Arabidopsis pumila* (Stephan) N. Busch, Fl. Cauc. Crite. 3, 4: 457 & 465. 1909. *Sisymbrium pumilum* Stephan in Willd., Sp. Pl. ed. 4, 3 (1): 507. 1800. *S. foliosum* Hook.

f. & Thomson in J. Linn. Soc., Bot. 5: 160. 1862; Hook. f. & T. Anderson in Fl. Brit. India 1: 148. 1872.

Herbs, 8 - 30 cm high, suberect or decumbent, much-branched, scabrous, stellate hairy. Radical leaves oblong-obovate, spatulate, toothed, 2 - 4 x 0.5 - 3 cm, shortly petioled; cauline leaves oblong or obovate, sagittate, sessile and stem-clasping at base, coarsely toothed, 2.5 - 8 x 0.5 - 1.5 cm. Racemes 15 - 30-flowered, up to 15 cm long in fruit. Flowers ca 2 mm across, yellow, turning white, ebracteate; pedicels ca 2 mm long in fruit. Sepals oblong, ca 2 mm long, glabrous. Petals ca 2 mm long, cream-coloured. Stamens ca 2 mm long. Fruits 15 - 30 mm long, ca 1 mm broad, slender, curved, glabrous or with a few stellate hairs; valves 1-nerved, thin, flattened, striate. Seeds 15 - 30 in each locule, oblong, ca 0.5 mm.

Fl. & Fr. March - June.

Distrib. India: Old mud walls and house tops, 1000 - 2000 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, Iran, Central Asia and East Mediterranean, E. Europe.

5. *Arabidopsis russelliana* Jafri in Notes R. Bot. Gard. Edinb. 22: 97. 1956; R. R. Rao & H.J. Chowdhery in Indian J. For. 7: 257. 1984.

Herbs, annual, up to 65 cm high, erect, branched, sparsely hairy. Lower leaves sessile or subsessile, 5 - 7-jugate, runcinate-pinnatifid, 7 - 8 x 1.5 - 2 cm; upper cauline leaves linear-oblong, 1.5 - 3 cm long, pubescent, sessile. Racemes 9 - 12-flowered, up to 10 cm long, ebracteate. Flowers ca 3 mm across; pedicels ca 5 mm long. Sepals ca 2 mm long. Petals ca 4 mm long, white. Stamens ca 3 mm long. Fruits subcylindrical, 5 - 6 cm long, obtuse, glabrous. Seeds ca 25 in each locule.

Fl. & Fr. June - July.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan.

6. *Arabidopsis stricta* (Cambess.) N. Busch, Fl. Cauc. Crite. 3, 4: 457. 1909. *Malcolmia stricta* Cambess. in Jacquem., Voy. Bot. Ind. 4: 16. 1844. *Sisymbrium strictum* (Cambess.) Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 161. 1862; Hook. f. & T. Anderson in Fl. Brit. India 1: 149. 1872.

Fig. 38.

Annuals, 24 - 60 cm high, erect, simple, rigid, scabrid or hairy. Lower leaves linear-oblong to oblong-spathulate, 2.5 - 5.5 x 5 - 15 cm, narrowed into short petiole, sinuate-toothed or entire; upper cauline leaves lanceolate, 1 - 3 x 0.3 - 0.6 cm, sessile or

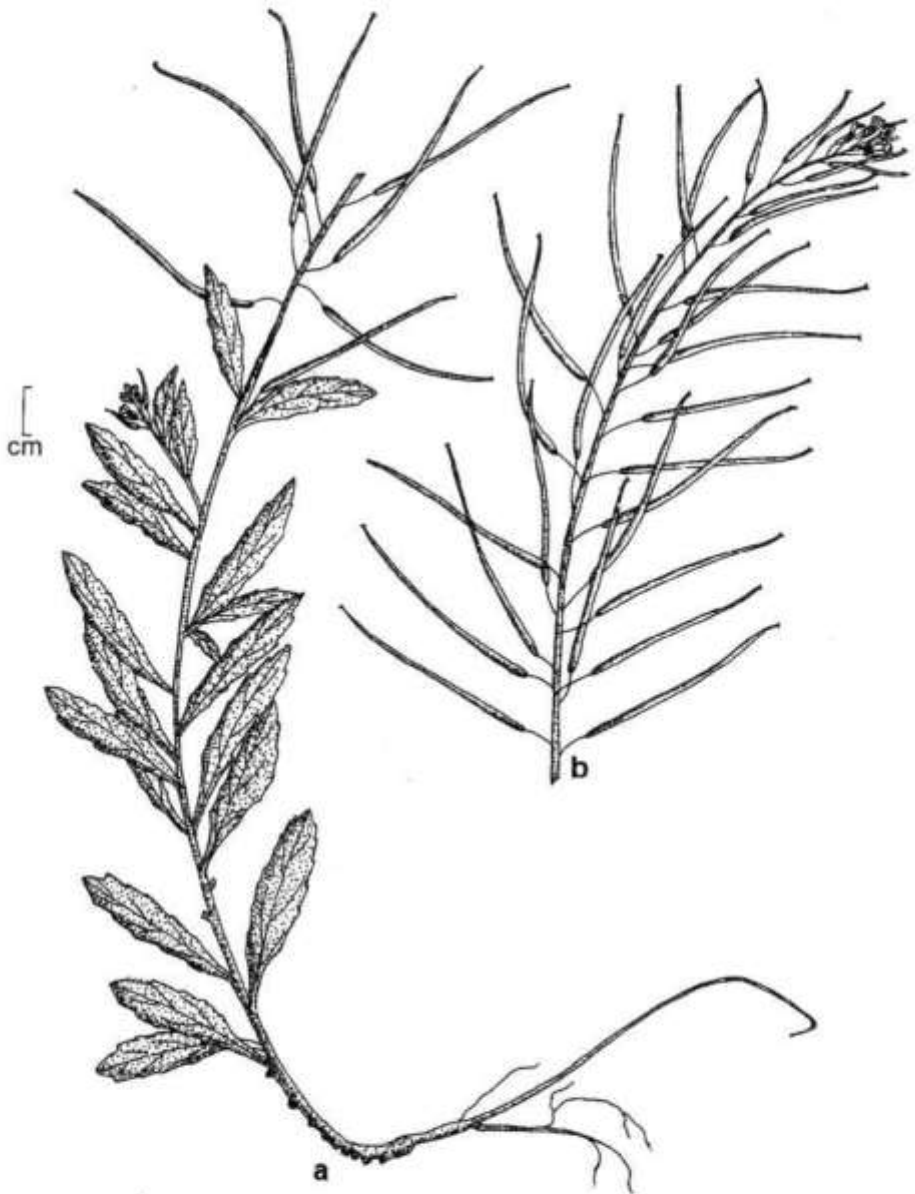


Fig. 38. *Arabidopsis stricta* (Cambess.) N. Busch : a. habit; b. inflorescence.

subsessile, subentire. Racemes 25 - 50-flowered, up to 25 cm long. Flowers ca 2 mm across, pale rose-coloured; pedicels 5 - 8 cm long. Sepals ca 2 mm long. Petals ca 3 mm long. Stamens ca 2 mm long. Fruits erect, curved, terete, 2.5 - 5 cm long, glabrous; valves convex with prominent midrib; style short, tapering. Seeds 20 - 25 in each locule.

Fl. & Fr. April - Aug.

Distrib. India: Open west-facing slopes, 1800 - 3300 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Afghanistan and China (Tibet).

7. *Arabidopsis taraxacifolia* (T. Anderson) Jafri in Fl. W. Pakistan 55: 274. 1973. *Arabis taraxacifolia* T. Anderson in Fl. Brit. India 1: 136. 1872.

Herbs, annual, 15 - 20 cm high, spreading, much-branched, hairy. Radical leaves lyrate-pinnatifid or lobed, 4 - 6-jugate, 4 - 8 x 0.5 - 1.5 cm, hairy; terminal lobes large, rounded, entire, rarely toothed; laterals short, narrow, entire, obtuse. Cauline leaves few, lanceolate, oblong-lanceolate, entire or sinuate, sessile. Racemes 10 - 20-flowered, up to 15 cm long in fruit. Flowers ca 4 mm across; pedicels slender, suberect, 1.2 - 2.5 cm long. Sepals pubescent or glabrous. Petals narrowly oblong, ca 5 mm long, pale rose or white. Fruits linear, flattened, 3.5 - 6 cm long, suberect, horizontal or decurved, glabrous; style long, acute; valves thin, veinless. Seeds ca 1 mm long.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan.

8. *Arabidopsis thaliana* (L.) Heynh. in Holl. & Heynh., Fl. Sachs. 1: 538. 1842. *Arabis thaliana* L., Sp. Pl. 665. 1753. *Sisymbrium thalianum* (L.) Gay & Monnard in Gandin, Fl. Helv. 4: 348. 1829; Hook. f. & T. Anderson in Fl. Brit. India 1: 148. 1872.

Herbs, 7 - 30 cm high, erect, branched, hispid with simple or forked hairs, or glabrous. Radical leaves rosulate, obovate, petiolate, 1.5 - 7.5 x 0.5 - 0.8 cm; cauline leaves oblong or linear, remote, cuneate below, entire, sessile, 0.5 - 1.2 x 0.1 - 0.2 cm. Racemes 10 - 20 cm long in fruit, slender. Flowers white, ca 2 mm across; pedicels 6 - 7 mm long, spreading or descending. Sepals ca 2 mm long. Petals white, ca 3 mm long. Stamens 1 - 2 mm long. Fruits narrow, linear, glabrous, 0.8 - 2 cm long; valves 1-nerved, convex. Seeds ca 20 in each locule.

Fl. & Fr. April - June.

Distrib. India: Shady moist grassy slopes along stream sides, 1400 - 3800 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Bhutan, Nepal, Pakistan, temperate Asia and Mediterranean region of Europe.

9. *Arabidopsis wallichii* (Hook. f. & Thomson) N. Busch, Fl. Cauc. Crite 3, 4: 457. 1909. *Sisymbrium wallichii* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 158. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 149. 1872.

Herbs, perennial, simple or branched, hispidly hairy, 15 - 45 cm high. Radical leaves crowded, runcinately lyrate, 2.5 - 8 x 1 - 2 cm, terminal lobes large; cauline leaves few, linear-lanceolate, pinnatifid or almost entire, 1.5 - 3 cm long. Racemes up to 15-flowered, ca 15 cm long. Flowers white or pale pinkish, ca 3 mm across; pedicels 1 - 2.5 cm long in fruit, spreading. Sepals ca 2 mm long. Petals ca 3 mm long. Stamens ca 3 mm long. Fruits spreading, curved, glabrous, 2 - 8.5 cm long; valves more or less convex, midrib distinct; style short, tapering. Seeds ca 20 in each locule.

Fl. & Fr. March - July.

Distrib. India: Open marshy grass slopes, 800 - 3500 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Pakistan, Afghanistan, Iran and Central Asia.

56. *Arcyosperma* O. Schulz

Monotypic; description and distribution as for the species below.

Arcyosperma primulifolium (Thomson) O. Schulz in Engler, Pflanzenr. 86 (IV.105): 182. 1924. *Sisymbrium primulifolium* Thomson in Hooker's J. Bot. 5: 18. 1853. *Eutrema primulifolium* (Thomson) Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 164. 1862.

Fig. 39.

Herbs, perennial, low, 4 - 15 cm high, glabrous or sparsely hairy; rootstock covered with leaf bases. Basal leaves rosulate, ovate-oblong, oblanceolate or broadly spatulate, attenuate at base, acute or obtuse at apex, denticulate, sinuous or entire along margins, 3 - 14 x 1 - 3 cm, sparsely pilose with simple hairs. Cauline leaves sessile, ovate-oblong to oblong-elliptic, up to 3 x 1 cm. Racemes ebracteate; scapes bracteate, 3 - 10 cm long, many; bracts leaf-like, obovate, 1.2 - 2.5 cm long. Flowers white or pink, ca 5 mm across; pedicels filiform, 0.5 - 1 cm long in fruit, spreading, glabrous. Sepals suberect, ovate or oblong-ovate, not pouched at base, 3 - 4 x 1 - 1.5 mm long. Petals obovate, clawed at base, submarginate at apex, ca 6 x 1 mm, white or purplish. Stamens ca 4 mm long. Lateral nectar glands horse-shoe shaped; middle glands torulose, joining laterals. Ovary sessile, oblong; ovules ca 35; stigma depressed, subsessile. Fruits linear-oblong, often



Fig. 39. *Arcyosperma primulifolium* (Thomson) O. Schulz : a. plant, upper portion.

curved, dehiscent, 1.5 - 2.5 cm long, 1.5 - 2 mm thick; valves submembranous with distinct midrib. Seeds minute, few to numerous in 2 rows.

Fl. & Fr. May - July.

Distrib. India: Open rocky soil and partially shaded places, 3100 - 4500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan, Bhutan and Nepal.

57. *Braya* Sternh. & Hoppe

Herbs, small, perennial, dwarf, caespitose, branched from base; rootstock many-branched; stems erect, often scapose, glabrous or greyish-white tomentose or pilose with simple or 2-branched hairs. Leaves mostly radical, simple, linear-lanceolate or narrow-oblong, narrowed at base, sessile or subsessile, entire or faintly denticulate along margins, basal ones densely rosulate; cauline leaves usually absent, rarely 1 or 2. Racemes short or elongated, sometimes corymbose, many-flowered, ebracteate or rarely bracteate. Flowers small, pink, bluish or white or sometimes pale yellowish; pedicels erect, short, thickened in fruit. Sepals persistent, divergent, oblong, not pouched at base, tinged with purple, with hyaline margins. Petals obovate, cuneate at base, truncate at apex, exceeding sepals, white or purplish. Stamens 6; filaments free; anthers short, ovoid, obtuse at apex. Nectar glands small, pyramidal, on either side of the shorter stamens. Ovary sessile, oblong or subcylindrical, 4 - 20-ovuled; style very short; stigma depressed-capitate, shortly subbilobate. Fruit a siliqua or silicule, ovoid or subcylindric, glabrous; valves convex, 1-nerved; septum hyaline, entire, 1-veined with many stout parallel walls of the epidermal cells; style slender. Seeds 2-seriate, rarely 1-seriate, few to many, ovoid.

Chiefly in high alpine regions of Arctic, Europe, C. Asia and Sino-Himalayas; about 13 species, 3 in India.

KEY TO THE SPECIES

- | | |
|--|-------------------------------|
| 1a. Leaves absent or 1-leaved, narrowly linear, 1 - 2 mm broad; sepals 1.5 - 2 mm long; petals 2 - 2.5 mm long | 3. <i>B. tibetica</i> |
| b. Leaves spatulate or oblong-linear, (2-) 3 (-4) mm broad; sepals ca 2.5 mm long; petals 3.5 - 4.5 mm long | 2 |
| 2a. Fruits 6 - 8 x 1 - 1.5 mm, with recurved attenuate apex; pedicels 4 - 6 mm long | 2. <i>B. thomsonii</i> |
| b. Fruits 4 - 6 x 1.5 - 2 mm, with rounded apex; pedicels up to 4 mm long | 1. <i>B. rosea</i> |

1. *Braya rosea* (Turcz.) Bunge in Del. Sem. Hort. Dorpat 7. 1839; Hook. f. & T. Anderson in Fl. Brit. India 1: 155. 1872. *Draba rosea* Turcz. in Bull. Soc. Nat. Mosc. 87. 1838.

Herbs, erect, branched, 3 - 5 (-10) cm high; roots stout, fleshy. Radical leaves numerous, entire, 10 - 30 x 2 - 4 mm, petiolate, glabrous or sparsely hairy, fleshy; cauline leaves 5 - 7 x 2 - 3 mm, glabrous. Racemes 10 - 20-flowered, short, thick, somewhat capitate, hairy or subglabrous, ebracteate. Flowers pale purple, rose or rarely white, ca 3 mm across; pedicels erect, spreading, thick, slightly swollen in fruit. Sepals narrowly scarious along margins, minutely pilose. Petals ca 1.5 mm broad. Stamens up to 2 mm long; anthers ca 0.2 mm long. Fruits ellipsoid or oblongoid, often obscurely torulose, rounded at apex, minutely pilose; valves subconvex; style thick, 0.2 - 0.5 mm long with depressed short stigma. Seeds 8 - 15, ovate, yellowish-brown, ca 0.8 mm long.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir and Sikkim.

C. Asia.

2. *Braya thomsonii* Hook. f. in J. Linn. Soc., Bot. 5: 168. 1861. *B. alpina* auct. non Sternb. & Hoppe 1815; Hook. f. & T. Anderson in Fl. Brit. India 1: 155. 1872.

Herbs, 2 - 3 (-6) cm high; stems pilose with long simple hairs. Radical leaves erect, 7 - 14 (-25) mm long, usually glabrous, rarely ciliate; cauline leaves 8 - 10 x 1.5 mm. Racemes 10 - 15-flowered, erect, up to 2.5 cm long. Flowers white, ca 3 mm across; pedicels erect, rigid, thickened in fruit. Sepals oblong. Petals spatulate, ca 1 mm broad. Stamens up to 3 mm long; anthers ca 0.3 mm long. Fruits linear, subtorulose, recurved-attenuate at apex, glabrous; valves erect, 1-nerved; style 0.5 - 0.8 mm long with faintly bilobate stigma; septum obscurely veined; seeds 8 - 10, 1-seriate, ovoid-oblong, brownish, ca 0.8 mm long.

Fl. & Fr. June - Aug.

Distrib. India: 3600 - 5000 m. Uttar Pradesh.

China (Tibet).

3. *Braya tibetica* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 168. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 155. 1872.

Herbs, much-branched, erect, 4 - 8 cm high; roots slender. Leaves absent, sometimes one-leaved, narrowly oblanceolate, attenuate at base, acute at apex, entire or rarely faintly toothed along margins, 10 - 15 x 1 - 2 mm, thick, subglabrous. Racemes 15 - 20-flowered, corymbose-capitate, bracteate. Flowers ca 2.5 mm across, white or pinkish; pedicels subspreading, 3 - 4 mm long in fruit. Sepals ca 2 x 1 mm, minutely hairy above, membranous. Petals oblong, cuneate, ca 3 x 1 mm, purplish. Stamens up to 1.8 mm long; anthers ovoid, ca 0.2 mm long. Fruits ellipsoid, attenuate at apex, 3.5 - 4 x

1.5 - 2 mm, puberulous; valves oblong, obscurely 1-veined; style 0.2-0.5 mm long, with minute depressed stigma; septum hyaline. Seeds 4 - 6, ovoid, brownish, ca 1 mm long.

Fl. & Fr. July - Aug.

Distrib. India: 3500 - 5600 m. Jammu & Kashmir.

China (Tibet).

58. *Camelina* Crantz

Herbs, annuals or biennials, simple or branched. Cauline leaves sessile, often auriculate. Inflorescence ebracteate. Sepals erect. Petals yellow or white. Fruits more or less inflated; style distinct. Seeds numerous.

C. Europe, Mediterranean region and C. Asia; about 10 species, one in India.

Camelina sativa (L.) Crantz, *Stirp. Austr.* 1: 17. 1762; Jafri in *Fl. W. Pakistan* 55: 280. 1973. *Myagrum sativum* L., *Sp. Pl.* 641. 1753.

Herbs, up to 80 cm high, branched mostly from base, glabrous or sometimes sparsely hairy. Basal leaves oblong-lanceolate, sessile, cuneate at base, entire or irregularly toothed along margins, 15 - 50 x 5 - 10 (-15) mm; upper leaves lanceolate or linear, sagittate-amplexicaul at base, entire or toothed along margins. Racemes 30 - 70-flowered, up to 30 cm long in fruit. Flowers yellow, ca 3.5 mm across; pedicels ascending, 10 - 20 (-25) mm long in fruit. Sepals ca 2.5 mm long. Petals ca 5 mm long. Fruits obovoid, rounded at apex, 7 - 9 x 4 - 5 mm; valves convex, glabrous with a distinct midrib; style 1.5 - 2 mm long with capitate stigma. Seeds 9 - 10 in each locule, ovoid, ca 1.5 mm long, brown.

Fl. & Fr. March - May.

Distrib. India: Jammu & Kashmir.

C. & S.W. Asia and Europe.

59. *Descurainia* Webb & Berth., nom. cons.

Herbs, annual or biennial, erect, pubescent with simple or branched hairs. Leaves 2 - 3-pinnatisect, sessile or petioled. Racemes many-flowered, ebracteate. Flowers small, yellow or cream-coloured; pedicels filiform. Sepals and petals more or less equal. Stamens 6. Lateral nectar glands semiannular or almost annular; middle nectar glands joining the laterals. Ovary linear, many-ovuled. Fruits linear, cylindrical, often up-curved; valves 1-veined. Seeds 1 - 2-seriate.

Chiefly American; about 40 species, 1 in India.

Descurainia sophia (L.) Webb ex Prantl in Engler & Prantl, Pflanzenf. 3, 2: 192. 1891. *Sisymbrium sophia* L., Sp. Pl. 659. 1753; Hook. f. & T. Anderson in Fl. Brit. India 1: 150. 1872. **Fig. 40.**

Herbs, 25 - 80 cm high, erect, branched, glabrous or sparsely pubescent; branches ascending. Leaves numerous, 5 - 16 cm long; lobes narrowly linear or oblong, ca 2 mm broad. Racemes up to 50-flowered, up to 25 cm long in fruit. Flowers ca 2 mm across; pedicels ca 1.5 cm long in fruit, glabrous. Sepals oblong, ca 2 x 0.5 mm. Petals ca 2 mm long. Stamens ca 2 mm long. Fruits spreading or erect, subtorulose, 1.5 - 3 cm long, ca 1 mm wide, glabrous; valves 1-veined; stigma subsessile. Seeds ca 20, reddish brown.

Fl. & Fr. April - Aug.

Distrib. India: Near cultivated fields or dry open places, 1500 - 4500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, Pakistan, C. Asia, Europe and N. Africa.

60. *Guillenia* E. Greene

Herbs, annual, erect or prostrate, branched, hairy. Leaves usually basal, lyrate-pinnate or deeply dissected; cauline, if present, few, variable. Racemes few-flowered, bracteate, lax in fruit. Flowers small, white or pinkish; pedicels usually elongated. Sepals suberect, not pouched. Petals usually longer than sepals. Nectar glands minute. Ovary cylindrical with 10 - 40 ovules. Fruits linear, on slender curved pedicels; valves weakly 1-nerved, subconvex; style short, slender; stigma short. Seeds numerous, uniseriate.

Himalayas to Central Asia; 4 species, all in India.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Plants diffuse; branches 7.5 - 15 cm long | 1. <i>G. axillare</i> |
| b. Plants erect, 10 - 100 cm high | 2 |
| 2a. Pods 1.2 - 1.5 cm long | 4. <i>G. minutiflorum</i> |
| b. Pods 3.5 - 6 cm long | 3 |
| 3a. Pods ca 3.5 cm long | 2. <i>G. duthiei</i> |
| b. Pods 4 - 6 cm long | 3. <i>G. flaccidum</i> |

1. ***Guillenia axillare*** (Hook. f. & Thomson) Bennet in J. Econ. Tax. Bot. 4 (2): 593. 1983. *Sisymbrium axillare* Hook. f. & Thomson in J. Linn. Soc., Bot. 5: 102. 1861; Hook. f. & T. Anderson in Fl. Brit. India 1: 149. 1872. *Microsisymbrium axillare* (Hook. f. &



Fig. 40. *Descurainia sophia* (L.) Webb ex Prantl : a. habit; b. plant, upper portion.

Thomson) O. Schulz in Engler, Pflanzenr. 86: 160. 1924.

Diffuse annuals; branches spreading, 7.5 - 15 cm long, pubescent with simple and branched hairs. Basal leaves spatulate, ca 2.5 cm long, lobed or toothed, shortly petioled; cauline leaves ovate or oblong, 0.6 - 1.5 cm long, rounded at apex, sessile. Racemes elongate, lax, 6 - 10 flowered, leafy. Flowers bracteate, large, solitary in axils of upper leaves, white; pedicels slender, spreading or ascending. Sepals oblong, ca 2.5 mm long. Petals 3 - 5 mm long, white. Fruits very slender, terete, straight or slightly curved, subtorulose, ca 0.6 cm long, glabrous; style short.

Fl. & Fr. April - Aug.

Distrib. India: Roadsides in evergreen forests, 2500 - 5000 m. Sikkim.

Nepal and Bhutan.

2. **Guillenia duthiei** (O. Schulz) Bennet in J. Econ. Tax. Bot. 4 (2): 593. 1983.
Microsisymbrium duthiei O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1089. 1927.

Herbs, annual, up to 1 m high; stems erect, hollow; hairs simple, patent, ca 1 mm long, mixed with shorter bifurcate and stellate hairs. Lower cauline leaves obovate-cuneate, dentate-lobulate, rounded at apex, narrowed to a short petiole; upper leaves oblong, sessile, minutely denticulate, subacute, gradually smaller; topmost floral leaves linear, ca 3 mm long, all membranous, both sides clothed with simple and stellate hairs. Racemes ca 40-flowered, up to 50 cm long in fruit, bracteate. Flowers minute; pedicels 1 - 2 mm long. Sepals oblong, ca 1.5 mm long, hirsute. Petals spatulate, ca 2 mm long, white. Stamens 1.5 - 1.8 mm long; anthers oblong, ca 0.4 mm long. Ovary hairy. Fruits erect, narrowly linear, subterete; valves with stellate hairs; septum slender, 1-nerved. Seeds biseriate, numerous, oblong, ca 0.5 mm long, brown.

Fl. & Fr. July - Aug.

Distrib. India: Uttar Pradesh (Kumaon).

Endemic.

3. **Guillenia flaccidum** (O. Schulz) Bennet in J. Econ. Tax. Bot. 4 (2): 593. 1983.
Microsisymbrium flaccidum O. Schulz in Notizbl. Bot. Gart. Berlin 9: 1090. 1927.

Herbs, 10 - 45 cm high, branched, suberect or ascending, hairy below, glabrous or subglabrous above. Basal leaves lyrate, pinnatipartite or obovate, 1 - 2-jugate, 2 - 5 x 1 - 2 cm; terminal lobes large, obovate-orbicular or suborbicular, sparsely denticulate; lateral lobes minute; cauline leaves absent or a few. Racemes 10 - 20-flowered, ebracteate, lax, up to 25 cm long in fruit. Flowers ca 5 mm across, white; pedicels filiform,

glabrous, ascending or upcurved, 1.2 - 2.5 cm long in fruit. Sepals ca 2 mm long. Petals ca 5 mm long. Stamens ca 3 mm long. Fruits linear, 4 - 6 cm long, glabrous; valves with a distinct midvein; style ca 1 mm long. Seeds ca 20 in each locule, brown.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir.

Pakistan.

4. *Guillenia minutiflorum* (Hook. f. & Thomson) Bennet in *J. Econ. Tax. Bot.* 4 (2): 593. 1983. *Sisymbrium minutiflorum* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 5: 158. 1861; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 149. 1872. *Microsisymbrium minutiflorum* (Hook. f. & Thomson) O. Schulz in *Engler, Pflanzenr.* 86: 160. 1924.

Herbs, annual, 5 - 22 cm high, branched, stellately hairy. Leaves pinnatisect, 1 - 2-jugate, petioled; lobes narrowly oblong or linear, 3 - 5 mm long, entire, thick. Racemes 5 - 10-flowered, lax, up to 10 cm long. Flowers ca 2 mm across, white; pedicels filiform, spreading. Sepals ca 1 mm long. Petals ca 2 mm long. Stamens ca 1 mm long. Fruits linear, straight or slightly curved, 1.2 - 1.5 cm long; valves glabrous or hairy. Seeds 5 - 10 in each locule, minute, brown.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan, Afghanistan and China (Tibet).

61. *Lignariella* Bakhni

Herbs, annual, slender, flexuous, subspreading, prostrate, glabrous, or with simple hairs. Leaves deeply trilobed or tripartite, upper ones sometimes entire. Flowers axillary, solitary or few in bracteate racemes, blue, pinkish or white; pedicels thin, flexuous, elongated in fruit. Sepals ovate, equal; inner sepals pouched or saccate at base, cochleate at apex. Petals showy, purplish, usually twice as long as sepals. Stamens 6, equal, straight; filaments somewhat winged; anthers ovate. Lateral glands semilunar, encircling the base of stamens, converging with transverse glands. Ovary ovoid, shortly stipitate, 1-locular, 2 - 8-ovuled; style short, reflexed, slightly dilated at apex. Fruits ellipsoid to oblong-ellipsoid, subterete, more or less falcate or crowned with reflexed style, glabrous; valves convex, membranous; septum absent or rudimentary. Seeds (-1) 2 - 5, 1-seriate, oblong-ovoid; cotyledons accumbent.

Himalayas in between 3000 and 4700 m, Pakistan, Nepal, Bhutan, Tibet and India; 2 species, both in India.

KEY TO THE SPECIES

- 1a. Leaves petiolate, 1.5 - 2 mm broad; pedicels 10 - 15 mm long in fruit; petals ca 4 mm long
1. *L. hobsonii*
- b. Leaves sessile or subsessile, 2 - 8 mm broad; pedicels 6 - 10 mm long in fruit; petals 2.5 - 3 mm long
2. *L. obscura*

1. *Lignariella hobsonii* (Pearson) Baehni in Candollea 15: 57. 1955. *Cochlearia hobsonii* Pearson in Hook., Icon. Pl. t. 2643. 1900.

Herbs accumbent, 3 - 7 (-30) cm high, branched. Leaves marcescent, broadly ovate or oblong-suborbicular, attenuate at base, acute at apex, 3 - 6 x 1.5 - 2 mm, deeply trilobed, often tripartite, rarely entire or 5-lobed; stipules conical, at base of cauline leaves, glandular, ca 0.3 mm long; petioles 2 - 15 mm long. Flowers solitary, axillary, 5 - 6 mm long, ebracteate; pedicels glandular, 10 - 15 mm long, accrescent. Sepals cymbiform, forming a pouch at base, narrowly scarious along margins, glabrous, ca 2.2 mm long. Petals ovate or nearly orbicular, rounded at apex, abruptly narrowed, blue, occasionally white, rarely mauve. Stamens 2.8 - 3 mm long; filaments flat, subwinged; anthers ca 0.5 mm long. Ovary attenuate at apex; ovules 2 (or 6, rarely 11 or 12) with thick funicle. Fruits unilocular, often curved or sickle-shaped, flat, 10 - 13 mm long, 1.5 - 2 mm thick; style 1 - 4 mm long. Seeds 1 - 6, with smooth testa.

Fl. & Fr. June - Aug.

Distrib. India: Streamsides, 2600 - 3600 m. Sikkim.

Nepal, Bhutan and China (Tibet).

Notes. Smaller forms with shorter styles are referable to subsp. *serpens* (W. Smith) Hara, which seems to be the common one in Sikkim Himalayas.

2. *Lignariella obscura* (Dunn) Jafri in Candollea 134. 1957. *Draba obscura* Dunn in Bull. Misc. Inf. Kew 1924: 383. 1924.

Herbs, prostrate, 4 - 8 (-10) cm high, much-branched, distantly leafy, glabrous above, sparsely hairy below. Leaves rosulate, elliptic, elliptic-oblong or spatulate, entire or faintly trilobed, 7 - 20 x 2 - 6 mm, rarely stalked. Racemes 3 - 10-flowered. Flowers bracteate, white, ca 2.5 mm across; pedicels filiform, spreading. Sepals oblong, obtuse at apex, 1.8 - 2 mm long. Petals somewhat orbicular, obtuse at apex, ca 1.2 mm broad. Stamens 1.5 - 2 mm long; anthers ca 0.5 mm long. Fruits subtorulose, (5-) 8 - 15 x 1 - 2 mm; style 1 - 1.3 mm long, with minute depressed stigma; septum absent. Seeds ovoid, 5 - 6, brown, ca 1 mm long.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir.

Pakistan.

62. *Sisymbrium* L.

Herbs, annual, biennial or perennial, glabrous or hairy. Leaves entire, pinnatifid or pinnatisect, lower petiolate, upper sessile or subsessile. Racemes many-flowered, elongated in fruit. Flowers usually yellow; pedicels more or less thickened. Sepals erect. Petals 4, unguiculate with long claws, usually oblong-obovate. Stamens 6, free; filaments simple; anthers oblong or obtuse. Lateral nectar glands annular, quadrate or hexangular. Ovary linear-subcylindrical, sessile, many-ovuled; style short. Fruits linear-subcylindrical, erect or spreading; valves 3-nerved, usually glabrous; septum hyaline. Seeds 1-seriate, many, ovoid; cotyledons incumbent.

Mostly temperate; about 70 species, 7 in India.

Literature. KHOSHOO, T. (1967) Biosystematics of *Sisymbrium irio* complex XIII: Taxonomic considerations. Bull. Bot. Surv. India 9: 49 - 55, f. 1.

KEY TO THE SPECIES

- | | |
|---|----------------------------|
| 1a. Fruits usually 1 - 4.5 (-5) cm long | 2 |
| b. Fruits 5 - 10 cm long | 4 |
| 2a. Pedicels 2 - 4 mm long in fruit | 6. <i>S. officinale</i> |
| b. Pedicels 6 - 15 mm long in fruit | 3 |
| 3a. Flowers ca 3 mm across | 4. <i>S. irio</i> |
| b. Flowers ca 6 - 8 mm across | 5. <i>S. loeselii</i> |
| 4a. Flowers ca 3 mm across; pedicels 0.5 - 1.5 cm long | 3. <i>S. heteromalum</i> |
| b. Flowers 5 - 6 mm across; pedicels 3 - 12 mm long | 5 |
| 5a. Lower leaves runcinate-pinnatifid, lateral lobes 6 - 8 paired | 1. <i>S. altissimum</i> |
| b. Lower leaves 1 - 5-jugate | 6 |
| 6a. Lower leaves 1 - 2-jugate | 2. <i>S. brassiciforme</i> |
| b. Lower leaves 4 - 5-jugate | 7. <i>S. orientale</i> |

1. *Sisymbrium altissimum* L., Sp. Pl. 659. 1753. *S. panonicum* Jacq., Icon. Pl. Rar. 1: 12, t. 123. 1786; Hook. f. & T. Anderson in Fl. Brit. India 1: 150. 1872.

Herbs, annual or biennial, 15 - 55 cm high, erect, divaricately branched above, hispid or glabrate. Basal leaves runcinate-pinnatifid, 5 - 17 x 3 - 7.5 cm, shortly petioled; upper leaves narrowly linear, 5 - 7-jugate, toothed or entire. Racemes many-flowered, up to 30 cm long in fruit. Flowers ca 5 mm across, pale yellow; pedicels ca 1 cm long in fruit, spreading or ascending. Sepals ca 5 mm long. Petals ca 1 cm long. Stamens ca 6 mm long. Fruits linear-subcylindrical, straight, 7.5 - 10 cm long, glabrous; style subelongate,

thick; stigma large, 2-lobed; valves 3-nerved. Seeds ca 50 in each locule.

Fl. & Fr. April - July.

Distrib. India: Jammu & Kashmir.

C. & S.W. Asia and Europe.

2. *Sisymbrium brassiciforme* C. Meyer in Ledeb., *Fl. Alt.* 3: 129. 1831. *S. columnae* auct. non. Jacq. 1776; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 150. 1872, p. p.

Annuals, 50 - 90 cm high, erect, slightly branched, glabrous or hairy below; hairs spreading or reflexed. Lower leaves ovate-oblong to lanceolate, runcinate; segments toothed; terminal lobe angled; upper leaves linear, hastate, subsessile to sessile. Racemes 25 - 45-flowered, up to 20 cm long in fruit. Flowers ca 4 mm across, pale yellow; pedicels 4 - 8 mm long. Sepals ca 3 mm long. Petals ca 6 mm long. Stamens ca 5 mm long. Fruits 5 - 9 cm long, spreading, very slender, curved, glabrous or hairy; valves striated, indistinctly costate; style thickened, ca 1 mm long. Seeds oblong, brown.

Fl. & Fr. May - July.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Maharashtra.

Nepal, Pakistan, Afghanistan, C. Asia and China (Tibet).

3. *Sisymbrium heteromallum* C. Meyer in Ledeb. *Fl. Alt.* 3: 132. 1831; Jafri in *Fl. W. Pakistan* 55: 252. 1973.

Herbs, annual or biennial, 30 - 90 cm high, erect, branched above, hairy or subglabrous below. Leaves lyrate-pinnatifid, petioled; terminal lobe much larger than laterals; lateral lobes 2 - 3-paired, shortly toothed. Racemes 25 - 40-flowered, up to 20 cm long in fruit. Flowers ca 2 mm across, pale yellow. Sepals ca 3 mm long. Petals ca 4 mm long. Stamens ca 4 mm long. Fruits 5 - 7 cm long, glabrous; valves convex, 3-nerved. Seeds many, oblong-ellipsoid.

Fl. & Fr. April - June.

Distrib. India: Jammu & Kashmir.

Nepal, Pakistan, China (Tibet), C. Asia, Russia (Siberia) and Mongolia.

4. *Sisymbrium irio* L., *Sp. Pl.* 659. 1753; Hook. f. & T. Anderson in *Fl. Brit. India* 1: 150. 1872. *S. irioides* Boiss. in *Ann. Sci. Nat. ser.2*, 17: 76. 1842.

Hindi: *Asalio, Khub-khala.*

Herbs, annual or biennial, erect, 15 - 85 cm high, branched, glabrous or sparsely hairy or pubescent at base. Radical leaves petioled, numerous in rosette, pinnatifid; cauline leaves runcinate-pinnatifid; segments remote, spreading, toothed; terminal lobes large, sometimes hastate. Racemes 40 - 80 or sometimes more flowered, up to 25 cm long in fruit. Flowers ca 3 mm across, yellow; pedicels slender, ascending, 0.6 - 1.5 cm long in fruit. Sepals ca 2 mm long. Petals ca 3 mm long. Stamens ca 3 mm long. Fruit siliqua, ascending, slender, subtorulose, 3 - 5 cm long, young ones overtopping raceme, mature ones 3-nerved; stigma sessile. Seeds 20 - 40 in each locule, oblong, minutely granulate, light brown.

Fl. & Fr. Nov. - May.

Distrib. India: Plains to hills. Jammu & Kashmir, Himachal Pradesh, Rajasthan, Punjab and Rajasthan.

Pakistan, Afghanistan, most of Asia, Europe and North Africa.

Notes. Seeds containing isorhamnetin are expectorant and stimulating. Leaves contain Vitamin A and C.

5. *Sisymbrium loeselii* L., Cent. Pl. 1: 18. no. 49. 1755; Hook. f. & T. Anderson in Fl. Brit. India 1: 151. 1872.

Herbs, annual or biennial, 25 - 100 cm high, erect, branched, hairy or rarely glabrous. Basal leaves sublyrately runcinate; terminal lobes elongated, triangular or hastate; lateral lobes 2 - 4-paired; all lobes dentate; upper leaves smaller, shortly petioled or subsessile. Racemes many-flowered, up to 25 cm long in fruit. Flowers ca 7 mm across, yellow; pedicels ca 1 cm long in fruit, ascending or upcurved. Sepals ca 3 mm long. Petals ca 6 mm long. Stamens ca 4 mm long. Fruits linear-subcylindrical, erect, upcurved, 1.5 - 4.5 cm long; valves 3-nerved. Seeds oblong-ellipsoid, somewhat papillose, brown, ca 25 in each locule.

Fl. & Fr. May - Aug.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Europe and most of Asia.

6. *Sisymbrium officinale* (L.) Scop., Fl. Carn. 2: 26. 1772; Naqshi in Geobios 2: 164. 1975. *Erysimum officinale* L., Sp. Pl. 660. 1753.

Herbs, annual, 20 - 50 cm high, erect, densely branched, with simple rigid reflexed hairs. Radical leaves rosulate, lyrate deeply pinnatisect, 5 - 8 x 3 - 4 cm; terminal lobes more or less rounded or subtriangular, irregularly toothed; cauline leaves smaller with a narrow, often hastate terminal lobe. Racemes branched, 15 - 25-flowered. Flowers 3 - 4 mm across, yellow; pedicels erect, thickened, ca 3 mm long, erect. Sepals erect, slightly saccate at base, ca 2 mm long. Petals spatulate, spreading, clawed at base, obtuse at apex, ca 4 mm long. Stamens ca 3 mm long. Fruits 1 - 1.5 cm long, hispid or glabrous; valves rigid, 2 - 3-nerved, rigid. Seeds 10 - 11 in each locule, ellipsoid, reddish-brown.

Fl. & Fr. April - July.

Distrib. India: An undergrowth in Deodar forests, at ca 1800 m. Kashmir and Himachal Pradesh.

Europe, Asia and N. Africa.

Notes. Naqshi (l. c.) reports it from Uri in Kashmir with detailed description.

7. *Sisymbrium orientale* L., Cent. Pl. 2: 24. 1756. *S. columnae* Jacq., Fl. Austr. t. 323. 1776; Hook. f. & T. Anderson in Fl. Brit. India 1: 150. 1872, p. p.

Herbs, annual or biennial; stems stout, erect, branched, glabrous or hairy below, up to 75 cm high. Basal leaves in a rosette, runcinate or entire, usually 4 - 5-jugate; segments ovate-oblong to lanceolate, toothed; terminal lobe angled, oblong or lanceolate, often hastate. Racemes 15 - 20-flowered, ebracteate, up to 15 cm long in fruit; pedicels 4 - 7 mm long. Flowers ca 5 mm across, pale yellow. Sepals ca 5 x 1 mm, glabrous. Petals obovate, 5 - 8 mm long. Stamens ca 5 mm long. Fruits 7 - 10 cm long, spreading, very slender, curved, glabrous or hairy; valves not ribbed; style thickened, ca 2 mm long. Seeds 40 - 50 in each locule, ellipsoid or narrowly ovoid, yellowish brown.

Fl. & Fr. April - Aug.

Distrib. India: Wastelands in rock crevices, 2700 - 3200 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

S.W. & C. Asia, Africa and Europe.

63. *Smelowskia* C. Meyer

Herbs, perennial, erect, caespitose, branched mostly from base, often densely hairy with simple and branched hairs; rootstock often thick and covered with withered leaf-bases. Leaves pinnatisect; lower ones rosulate, petiolate; upper few distant, shortly stalked; lobes narrowly oblong to linear. Racemes corymbose above, often lax below,

bracteate. Flowers small, whitish or pinkish; pedicels filiform, ascending, short. Sepals not saccate at base. Petals suborbicular, narrowed below, about twice as long as sepals. Stamens 6; anthers oblong, obtuse. Lateral nectariferous glands annular, emarginate or open inside; median glands cylindrical, on outer side of long stamens, united with laterals to form a closed ring. Ovary ellipsoid, subcylindrical, usually 6 - 10-ovuled; style short with depressed, capitate, subretuse stigma. Fruit a bivalved, lanceolate silicula or a short siliqua, 4 to 5 times longer than broad, tapering towards base; valves slightly coriaceous, flat or somewhat keeled, midrib distinct; septum thin, often obscurely 1-veined, as broad as siliculae. Seeds few, usually uniseriate, oblong-ellipsoid; radicle incumbent.

C. Asia and N. America; about 7 species, 1 in India.

Smelowskia calycina (Stephan ex Willd.) C. Meyer in Ledeb., Fl. Alt. 3: 170. 1831; Jafri in Fl. W. Pakistan 55: 282. 1973. *Lepidium calycinum* Stephan ex Willd., Sp. Pl. 3: 433. 1800.

Herbs, up to 30 cm high. Radical leaves 30 - 60 x 5 - 12 mm. Racemes 15 - 30-flowered, up to 10 (-15) cm long in fruit. Flowers pale yellow or whitish, ca 5 mm across; pedicels erect, 5 - 8 mm long in fruit. Sepals 3 - 3.5 mm long. Petals 5 - 6 x 3 mm. Stamens up to 3.5 mm long; anthers ca 0.7 mm long. Fruits ellipsoid, subterete, 6 - 8 x 1.5 - 2 mm, glabrous; valves convex; style 0.75 - 1 mm long; septum obscurely 1-veined. Seeds 4 - 5 in each locule, ellipsoid, oblong, ca 1.5 mm long.

Fl. & Fr. June - Aug.

Distrib. India: Jammu & Kashmir.

Pakistan, Afghanistan, Asia and America.

Notes. This species is included on the authority of Jafri (in Notes R. Bot. Gard. Edinb. 22: 117. 1956).

64. *Torularia* (Coss.) O. Schulz

Herbs, annual or perennial, hairy with shortly stalked 2-branched and simple hairs. Leaves pinnatifid or toothed, rarely entire; basal ones rosulate; cauline petioled or sessile. Racemes bracteate, lax in fruit. Flowers small, violet, pink or white; pedicels short, often thickened. Sepals erect or spreading, inner pair not pouched at base. Petals almost twice as long as sepals, spatulate, or obovate. Stamens 6. Lateral nectar glands in pairs, semiglobose or ovoid, free or connate at base; middle glands absent. Ovary linear to cylindrical, sessile. Fruits subcylindrical or subterete, bilocular, often torulose and variously curved, usually hairy; styles short. Seeds 1-seriate.

Mostly Asian; about 15 species, 1 in India.

Torularia humilis (C. Meyer) O. Schulz ex Limpricht in Fedde, Repert. Spec. Nov. Beih. 12: 390. 1922. *Sisymbrium humile* C. Meyer in Ledeb., Icon. Pl. Ross. 2: 16, t. 147. 1830; Hook. f. & T. Anderson in Fl. Brit. India 1: 148. 1872.

Herbs, 2.5 - 20 cm high, decumbent or spreading, simple or branched, subhispid, hoary or rarely glabrous. Basal leaves oblong, sinuate-toothed or entire, 0.6 - 3 x 0.5 - 0.8 cm; cauline leaves smaller. Racemes ca 15-flowered, up to 10 cm long in fruit. Flowers ca 4 mm long. Sepals elliptic, obtuse, ca 3 mm long, pubescent or glabrous. Petals ca 4 mm long, 1.5 - 3 mm wide, purplish. Stamens ca 2 mm long. Fruits torulose, 1.2 - 2.5 cm long, ca 1.5 mm thick, appressed-pubescent. Seeds 10 - 15 in each locule, minute.

Fl. & Fr. May - July.

Distrib. India: Rocky slopes, 3600 - 4200 m. Jammu & Kashmir, Himachal Pradesh and Sikkim.

Bhutan, Nepal, Pakistan, Afghanistan, C. & N. Asia, N. America (introduced), W. & N. China, Mongolia and Russia (Siberia).

CAPPARACEAE

(R. Sundara Raghavan)

Herbs, shrubs or trees. Leaves alternate, subopposite or rarely opposite, occasionally crowded on abbreviated shoots, simple or digitately 1-several foliolate, rarely poorly developed and caducous, entire, penninerved; stipules 1 - 2, setaceous or spinescent. Inflorescence axillary or terminal, racemose, corymbose or paniculate, sometimes flowers solitary or in fascicles on short shoots. Flowers bisexual (rarely unisexual and plants dioecious), actinomorphic to slightly zygomorphic, pedicellate, bracteate; receptacle cupular, infundibuliform, campanulate or cylindrical with entire, undulate or fimbriate margin; disc various or absent. Sepals 4, sometimes 6 or reduced to 3, biseriate, free or connate below, equal or unequal, valvate or imbricate. Petals 4 (rarely 0, 2 or 8), sessile or clawed. Stamens 4-many, usually borne on a short or elongated androphore; filaments free, sometimes coherent at base or adherent to gynophore; anthers ditheous, basifixed, longitudinally dehiscent. Ovary superior, sessile or supported by a short or long gynophore, unilocular (or by spurious dissipiments divided into 2 or more loculi); ovules few to many, on 2 - 6 parietal placentae, if trilocular then with axile placentation; style short or absent, if present simple or split into 3 arms; stigma simple or capitate. Fruits capsular or baccate and of various shapes, oblong-cylindrical, sometimes torulose or lobed, 1 - many-seeded; seeds orbicular to reniform, embedded in pulp or free; endosperm none or scanty; embryo arcuate or incurved; cotyledons folded or convolute.

America, S. Europe, Africa, Asia and Australia, mostly in tropical and subtropical regions; ca 48 genera and 700 species, 7 genera and 55 species in India.

Literature. DANIEL, M. & S. D. SABNIS (1977) Chemotaxonomical studies on Capparidaceae & Cleomaceae. *Curr. Sci.* 46(14): 472 - 474. HEDGE, IAN C. & J. LAMMOND (1970) Capparidaceae. In: K. H. Rechinger, *Fl. Iranica* 68: 1 - 32. JACOBS, M. (1960) Capparaceae. In: van Steenis, *Fl. Males.* I, 6(1): 61 - 105, ff. 1 - 33. JAFRI, S. M. H. (1973) Capparidaceae. In: *Fl. West Pakistan* 34: 1 - 35, ff. 1 - 9. MITRA, K. (1978) Contribution to the pollen morphology of the family Capparaceae. *Bull. Bot. Surv. India* 17: 7 - 31. 1975.

Notes. *Steriphoma* Spreng., a native of America, is occasionally cultivated in gardens.

KEY TO THE GENERA

- | | |
|--|---|
| 1a. Herbs or woody undershrubs with non-baccate fruits | 2 |
| b. Shrubs or trees with baccate fruits | 3 |

- | | |
|---|-----------------------|
| 2a. Herbs; fruits siliqua with 4 or more seeds | 3. <i>Cleome</i> |
| b. Undershrubs, woody; fruits dry, indehiscent, winged nutlets, 1 (or rarely 2)-seeded | 5. <i>Dipterygium</i> |
| 3a. Sepals 6; ovary 3-loculed, with axile placentation | 7. <i>Stixis</i> |
| b. Sepals 4 (3); ovary mostly unilocular, rarely by false dissipiments, 2 or more locular, with parietal placentation | 4 |
| 4a. Sepals fused, forming a distinct tube | 6. <i>Maerua</i> |
| b. Sepals mostly free, rarely slightly connate at base, but never forming a tube | 5 |
| 5a. Disc large, tubular, trumpet-shaped, petaloid; stamens 4 - 6, inserted halfway on gynophore | 1. <i>Cadaba</i> |
| b. Disc otherwise; stamens numerous, at any rate more than 8, inserted at base of gynophore | 6 |
| 6a. Shrubs with simple leaves | 2. <i>Capparis</i> |
| b. Trees with trifoliolate leaves | 4. <i>Crateva</i> |

1. *Cadaba* Forsskal

Scandent shrubs to small trees, unarmed; branches sharply tapering, thorn-like; twigs hoary pubescent or glandular hairy, often covered with waxy scales. Leaves simple to 2 - 5-foliolate; stipules small, inconspicuous. Flowers zygomorphic, in axillary or terminal racemes or corymbs, rarely solitary or fascicled. Sepals 4, biseriata, unequal; outer pair enclosing the inner. Petals 4, rarely 0 or 2, clawed. Disc spatulate, infundibular or trumpet-shaped, nectary often petaloid and toothed. Stamens 4 - 8, exerted; filaments unilateral, almost verticillate, on a short androphore or connate with androgynophore. Ovary cylindrical on elongated androgynophore, 1 (-2) locular; stigma sessile, capitate; ovules numerous, 2-seriate on 2 (-4) parietal placentae. Fruit indehiscent or tardily dehiscent, oblong-cylindric; seeds many, subglobose, embedded in scarlet pulp.

Africa, Middle East, South Asia extending to Malesia and Australia; ca 30 species, 2 in India.

Notes. Pollen longiaxis, 3-colporate, size ranging from 20 - 40 μ (polar axis) and 12 - 13 μ (equatorial diam.). Endoaperture circular or longate with well-developed or diffused operculum. Exine scabrate, striate or reticulate (Krishna Mitra in Bull. Bot. Surv. India 17: 14, t.1, f. 10 - 11. 1975).

Literature. JAFRI, S. M. H. (1953) A note on the taxonomy and distribution of some species of *Cadaba*. Pak. J. Forestry 8(2): 204 - 205. SAKHARAM RAO, J. (1955) Leaf variation within a species *Cadaba trifoliata* W. & A. J. Bombay Nat. Hist. Soc. 53(2): 288 - 289.

KEY TO THE SPECIES

- | | |
|----------------------------------|-------------------------|
| 1a. Leaves simple; petals 4 | 1. <i>C. fruticosa</i> |
| b. Leaves trifoliolate; petals 2 | 2. <i>C. trifoliata</i> |

1. *Cadaba fruticosa* (L.) Druce in Bot. Exch. Cl. Soc. Brit. Isles 3: 415. 1914, *Cieome fruticosa* L., Sp. Pl. 671. 1753. *Cadaba indica* Lam., Encycl. 1: 544. 1785; Hook. f. & Thomson in Fl. Brit. India 1: 171. 1872.

Guj.: Bhatkani, Katikial, Telichemkand; Hindi: Kodhab; Kan.: Kagnika, Maragacha, Maragadhachoppu; Mar.: Kalasakal, Kalitaka; Raj.: Dabi; Tam.: Kadagathi, izhudhi; Tel.: Addamorinika, Chekmadi. Chimurudi, Yenuka-parika (Chenchu tribes).

Shrubs, low straggling among bushes, 1.5 - 3 m tall; stems much-branched, terete; old twigs glabrescent, smooth; young ones mealy farinaceous, with glandular mixed hairs. Leaves simple, entire, elliptic, ovate or obovate, rounded at base, acute or obtuse or emarginate and mucronate at apex, 2.5 - 5 x 0.5 - 2.5 cm, glaucous, chartaceous or coriaceous; petioles 2 - 8 mm long, mealy. Inflorescence terminal, one-sided corymbose racemes, few-flowered. Flowers greenish to creamy-white, ca 1.5 cm across; pedicels 6 - 12 mm long, mealy, pubescent; bracts subulate, 5 - 6 mm long, mealy. Sepals greenish; outer sepals ovate or obovate, boat-shaped, acute, 10 - 14 x 3 - 6 mm; inner ones elliptic-lanceolate or oblong-ovate, acute, 10 - 12 mm long, ca 3 mm wide, glandular pubescent outside. Petals white, spatulate, 10 - 16 x 3 - 4 mm; claw very narrow, as long as the limb. Disc prolonged into a 6 - 9 mm long trumpet-shaped process, expanded, toothed-fimbriate and about 2.5 mm wide at apex, pinkish. Stamens 4 - 6, spreading, inserted half way up on gynophore, rarely at different levels producing up to 1 cm long androphore. Gynophore 1 - 1.7 cm long; ovary 3 - 5 mm long, ca 1 mm thick; style absent; stigma sessile, blunt, glandular-pubescent, mealy when dry. Fruits narrowly cylindrical, irregularly torulose, 2 - 5.5 cm long, ca 4 mm thick; pericarp fleshy, thick, densely glandular pubescent, greenish brown when fresh; seeds many, striate, black, ca 2.5 mm long, ca 2 mm thick, surrounded by an orange-red aril, embedded in orange pulp.

Fl. & Fr. Throughout the year, peak being in November and February.

Distrib. India: Common in arid regions in scrub jungles from sea level to 150 m. Throughout, except Himachal Pradesh, Jammu & Kashmir, hill states of N. E. India and Andaman & Nicobar Islands.

Pakistan, Bangladesh, Myanmar, Sri Lanka and extending to Africa and Arabia.

Notes. Chenchu tribes of Andhra Pradesh use leaves for treating indigestion. Leaves are crushed and 3 spoonfuls of the filtrate taken daily for 3 days.

Pollination is through butterflies. The diploid plants have $2n = 16$ (Miege in Rev. Cytol. Biol. Veg. 24: 149-164. 1962) and tetraploids $n = 16$ (Baquar & Reese in Teil de Pharmazie 20: 159 - 168. 1965).

2. *Cadaba trifoliata* (Roxb.) Wight & Arn., Prodr. 1: 24. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 171. 1872. *Stroemia trifoliata* Roxb., Fl. Ind. 2: 79. 1824 (as *Stroemia*).

Fig. 41.

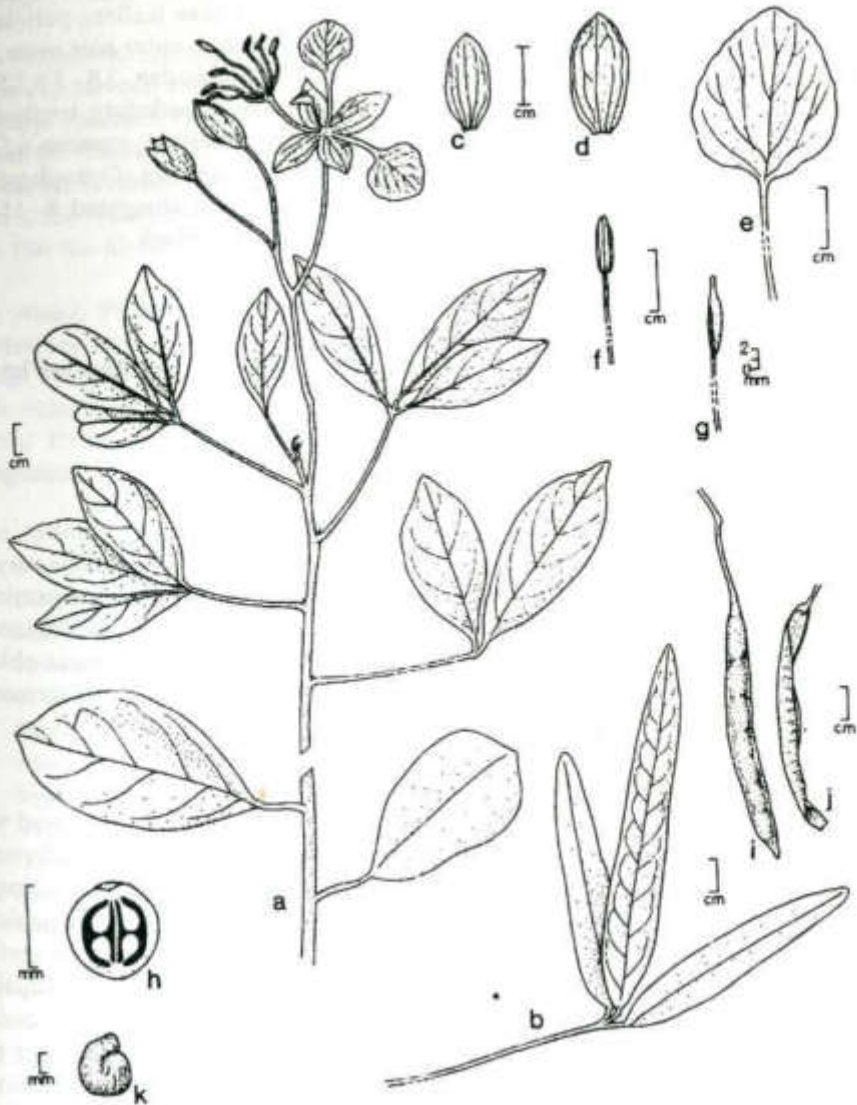


Fig. 41. *Cadaba trifoliata* (Roxb.) Wight & Arn.: a. flowering shoot showing variations in leaflets; b. leaf with oblong-lanceolate leaflets; c. outer sepal; d. inner sepal; e. petal; f. stamen; g. pistil; h. t. s. of ovary; i. fruit; j. dehiscent fruit; k. seed.

Tam.: *Karunkurichi, Manudu-kkurundu, Neelachedi, Odhaperali, Purna, Viluti.*

Shrubs, unarmed, branched, erect or straggling, 2 - 3 m tall; stem white-tubercled, scabrous on young parts. Leaves mostly 3-foliolate; leaflets elliptic or oblong-lanceolate, ovate-elliptic or obovate, cuneate at base, acuminate at apex, 4 - 9 (-13) x 1.3 - 4.8 cm, distinctly reticulate veined; petioles 1 - 4 cm long, but shorter than leaflets; petiolules 1.5 - 3 mm long. Racemes corymbose, 4 - 10-flowered. Sepals 4, outer pair ovate, 2 - 2.5 x 0.8 - 1 cm; inner pair elliptic, ca 15 x 6 mm. Petals 2, suborbicular, 3.8 - 5 x 2.5 - 3 cm, white or creamy; claw equalling the limb. Disc appendage spatulate, toothed at apex, ca 15 mm long, shorter than claw, yellow. Androphore absent; stamens 6 (-7), inserted at middle of gynophore, reflexed; filaments up to 2.5 cm long. Gynophore 4 - 5 cm long; ovary linear, 7 - 8 mm long, ca 1 mm thick. Fruits terete, elongated, 8 - 11 cm long, 6 - 8 mm thick, black; seeds many, reniform, ca 3.5 x 3 mm, black.

Fl. & Fr. Oct. - Nov.

Distrib. India: Deciduous and semideciduous forests of Eastern Ghats at low levels. Andhra Pradesh, Karnataka and Tamil Nadu.

Endemic.

Notes. Sakharam Rao (l. c.) mentions many aberrations in leaflet number, size, shape, etc. in specimens collected from Tirunelveli, with the number of leaflets varying from 2 to 5 and the middle leaflets being either largest or smallest and petiole sometimes being as long as lamina. In *Fischer* 4267 (CAL) and 4407 (CAL, FRC) from Mamander in Andhra Pradesh, the leaves are 3 - 5-foliolate, with leaflets rarely linear-oblong (exceptionally 7 - 8 times as long as broad) and flowers having 3 petals and 7 stamens.

2. *Capparis* L.

Shrubs or rarely trees, erect, scandent or sprawling; shoots generally armed with stipular spines, infrequently unarmed; base of shoots sometimes surrounded by cataphylls; indumentum simple or with stellate hairs. Leaves petiolate, alternate, simple, entire, rarely reduced and apparently leafless. Flowers bisexual, arranged in panicles, racemes, corymbs or umbels, sometimes solitary, axillary or supraaxillary in vertical series or 3 - 4 conferted on condensed lateral shoots; bracts early caducous. Sepals 4, mostly caducous after anthesis, in two unequal whorls of two each; the outer concave and overlapping inner ones, imbricate or valvate, free or almost so, rarely outer pair connate in bud; inner pair always free and flat. Petals 4, caducous after anthesis, mostly unequal, oblong or obovate, not clawed; the upper pair cohering around disc, but not connate; lower pair free. Receptacle flat with small adaxial disc. Stamens 8 to many, inserted on torus; androphore absent. Ovary ovoid or spherical on a gynophore not much elongating but often incrassate in fruit, unilocular, 4 - many-ovuled; placentae 2 - 6; style short; stigma obscure to capitate. Berry on a slender or thickened stipe, globose,

elongate or ovoid; pericarp leathery, corky or smooth, ribbed or sculptured, indehiscent or tardily dehiscent; seeds 1 - many, reniform, embedded in pulp; embryo convolute.

Pantropic in America, Africa, Asia, Australia, sometimes in temperate regions of Europe, China, Australia, S. Africa and S. America; ca 240 species, 29 species in India.

Literature. JACOBS, M. (1965) The genus *Capparis* (Capparaceae) from Indus to the Pacific. *Blumea* 12: 385 - 541. JAFRI, S. M. H. (1956) The genus *Capparis* in West Pakistan, Afghanistan and N.W. Himalaya. *Pakistan J. Forestry* 6: 191 - 192. NICOLSON, D. H. (1975) The reinstatement of *Capparis rheedii* DC. (Capparaceae). *Bull. Bot. Surv. India* 17: 160 - 161. ST. JOHN, H. (1965). Revision of *Capparis spinosa* and its African, Asian and Pacific relatives. *Micronesia* 2: 25 - 44. SUNDARA RAGHAVAN, R. & R. S. RAO (1965) Critical notes on three species of *Capparis* Linn. from peninsular India. *J. Bombay Nat. Hist. Soc.* 62: 412 - 424.

Notes. Plants usually noctiflorous, with flowers opening at dusk and pollinated by butterflies, moths or other nocturnal insects. Seed dispersal is effected by mammals or birds. Sterility is prevalent in both sexes. Pollen longiaxis, oval, 3-colporate. Ectoaperture colpi long extending to pole. Ectoaperture more or less circular, with granular teeth. Exine ornamentation psillate, reticulate, rugose or perforate. Pollen quite homogenous.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Leaves small, only on young twigs, early caducous; plants apparently leafless | 7. <i>C. decidua</i> |
| b. Leaves large, persistent, plants prominently leafy | 2 |
| 2a. Flowers solitary, axillary (rarely 2 - 4 conferted together on lateral axis as in <i>C. brevispina</i> or <i>C. nilgiriensis</i>) | 3 |
| b. Flowers generally not solitary and axillary, but variously arranged, (rarely a few flowers axillary if inflorescence is a corymb or in supra-axillary series) | 9 |
| 3a. Upper petals with a yellow or purplish blotch; ovary densely hairy | 4 |
| b. Upper petals not blotched as above; ovary glabrous | 7 |
| 4a. Leaves with basal two pairs of nerves conferted towards base | 5 |
| b. Leaves with arching nerves, never conferted towards base | 6 |
| 5a. Leaves with prominent reticulation and acute apex; flowers 8 - 10 cm across; gynophore glabrous during anthesis | 21. <i>C. rheedel</i> |
| b. Leaves with obscure reticulation and obtuse apex; flowers 1.5 - 1.8 cm across, gynophore hairy during anthesis | 10. <i>C. flavicans</i> |
| 6a. Leaves stiff, recurved at margins, mucronate at tip; fruits beaked, with smooth pericarp | 3. <i>C. brevispina</i> |
| b. Leaves flexuous, not recurved at margins, not mucronate at tip; fruits not beaked, with warted or corrugated pericarp | 18. <i>C. nilgiriensis</i> |
| 7a. Outer sepals connate in bud with free tip; inner sepals petaloid; fruits with sculptured pericarp | 8. <i>C. divaricata</i> |
| b. All sepals free, none petaloid; fruits with ribbed pericarp | 8 |

- 8a. Twigs with brownish stellate indumentum; petioles 2 - 3 mm long; pedicels 1 - 1.5 cm long 13. *C. grandiflora*
- b. Twigs with cobweb-like tomentum, at length glabrescent; petioles more than 5 mm long; pedicels 3 - 8 cm long 27. *C. spinosa*
- 9a. Flowers in supra-axillary vertical series of 2 - 10 or even more (rarely solitary, axillary) 10
- b. Flowers otherwise, never in supra-axillary vertical series 15
- 10a. Flowers appearing before leaves, hence flowering shoots apparently leafless 11
- b. Flowers not developing before leaves, hence flowering shoots always leafy 12
- 11a. Flowers 2 - 4-stichous, many, extending for 10 - 15 cm or more, small, hardly 4 - 6 mm across; sepals less than 5 mm long; fruits 8 - 10 mm across 17. *C. multiflora*
- b. Flowers not 2 - 4-stichous, 2 - 6 (10) together, large, 2.5 - 4 cm across; sepals more than 7 mm long; fruits 4 - 6 mm across 29. *C. zeylanica*
- 12a. Cataphylls present, at least at base 13
- b. Cataphylls absent 14
- 13a. Leaves drying glaucous, prominently reticulate; ovary 3 mm or less long, glabrous; fruits large, exceeding 3 cm across, many-seeded 15. *C. micracantha*
- b. Leaves drying brown, indistinctly reticulate; ovary 4 - 6 mm long, densely tomentose; fruits small, under 1 cm across, 1 (-3)-seeded 19. *C. olacifolia*
- 14a. Shoots with recurved spines; stamens 16 - 20 28. *C. tenera*
- b. Shoots generally unarmed, if armed, spines straight; stamens exceeding 20 1. *C. acutifolia*
- 15a. Inflorescence racemose or paniculate, if umbellate, the umbels arranged to form a panicle 16
- b. Inflorescence neither racemose, nor paniculate; flowers either in solitary umbels, subumbels or in corymbs 20
- 16a. Inflorescence a terminal or subterminal raceme 2. *C. assamica*
- b. Inflorescence variously paniculate 17
- 17a. Cataphylls prominent; flowers in axillary racemose bundles, arranged in the form of a panicle 20. *C. pachyphylla*
- b. Cataphylls absent; flowers in axillary subumbels or corymbs, arranged in the form of a panicle 18
- 18a. Gynophore exceeding 3 cm in length; fruits exceeding 2.5 cm across 26. *C. sikkimensis*
- b. Gynophore under 1.5 cm in length; fruits under 2.5 cm across 19
- 19a. Midrib of leaves flattish or raised at basal part; panicles dense-flowered; stamens 8 - 12; placentae 2; fruits 1.8 - 2 cm across with a leathery pericarp 11. *C. floribunda*
- b. Midrib of leaves sunken at basal part; panicles lax-flowered; stamens 18 - 22; placentae 4; fruits under 1.8 cm with thin pericarp 4. *C. cantoniensis*
- 20a. Flowers in corymbs (with a few subterminal solitary flowers intermixed at base) 21
- b. Flowers umbellate or subumbellate 24
- 21a. Leaves with olive green velvety indumentum; veins close, more or less parallel, mostly without intermediary nerves 14. *C. grandis*
- b. Leaves otherwise, neither velvety pubescent, nor with close parallel nerves 22
- 22a. Flowers large, 10 - 12 cm across; stamens 80 - 120; fruits 10 cm or more across when fully mature 16. *C. moonii*
- b. Flowers medium-sized, 3 - 6 cm across; stamens under 60; fruits up to 6 cm across when fully mature

- 23a. Sepals and petals glabrous; gynophore 3.5 - 5.5 cm long; fruits orange-yellow, globose, 5 - 6 cm across, many-seeded 23. *C. roxburghii*
- b. Sepals and petals pubescent; gynophore 2.5 - 3.5 cm long; fruits deep purple, umbonate, 2.5 - 3 cm across, 1 - 4-seeded 6. *C. cleghornii*
- 24a. Cataphylls conspicuous, at least at base 25
- b. Cataphylls absent 27
- 25a. Gynophore 20 - 25 mm long 5. *C. cinerea*
- b. Gynophore under 15 mm long 26
- 26a. Leaves linear to oblong-lanceolate; flowers purple or violet; fruits ellipsoid, 6 or more seeded 9. *C. diversifolia*
- b. Leaves elliptic to oblong; flowers greenish white; fruits spindle-shaped, 1 - 2-seeded 12. *C. fusifera*
- 27a. Mostly unarmed, if armed spines few, straight and short 25. *C. shevaroyensis*
- b. Densely armed, spines otherwise 28
- 28a. Erect shrubs; leaves with cordate base; spines dimorphic, either long and acicular or sharply recurved or both in the same plant 22. *C. rotundifolia*
- b. Scandent shrubs; leaves cuneate, rounded or rarely subcordate at base; spines uniform, recurved 24. *C. sepiaria*

1. *Capparis acutifolia* Sweet, Hort. Brit. ed. 2. 585. 1830. *C. sabiaefolia* Hook. f. & Thomson in Fl. Brit. India 1: 179. 1872. *C. bodinieri* A. Leveille in Fedde, Repert. Nov. Spec. 9: 450. 1911. *C. viminea* auct. non Oliver, 1868; Hook. f. & Thomson, l. c. *C. membranifolia* Kurz in J. Asiat. Soc. Bengal 43(2): 70. 1874.

Nep.: *Chila-pati*.

Climbing shrubs or small trees; branches unarmed or with short 2 - 5 mm long straight stipular thorns; shoots floccose with brownish stellate hairs at first, soon glabrescent; cataphylls absent. Leaves highly variable in size and shape, ovate-elliptic to lanceolate, rounded or cuneate at base, abruptly acute or acuminate at apex, 5 - 12 x 2 - 4 cm, thinly herbaceous, glabrous or minutely stellate-pubescent at first; midrib slightly sunken above; lateral nerves 7 - 10 pairs, thin with fairly distinct reticulations; petioles (4-) 5 - 7 (-11) mm long, channelled above. Flowers 2 - 4 (-6) in vertical supraaxillary rows, sometimes solitary, axillary, 1 - 1.8 cm across, white; pedicels 1 - 2 (-4) cm long, not thickened in fruit. Sepals subequal, broadly elliptic, rounded or obovate, obtuse, concave, (4-) 5 - 8 (-9) x 3 - 4 mm; outer pair somewhat covering the inner ones in bud, boat-shaped, ovate; inner pair elliptic with tomentose margins. Petals white, rounded, obovate, (6-) 9 - 12 (-14) x 3 - 5 mm, glabrous outside, tomentose along margins and mostly on inner surfaces. Stamens (20-) 28 - 35; filaments white, 2.2 - 3 cm long, equalling gynophore or up to 5 mm longer. Gynophore (1.2-) 1.7 - 2.7 (-3.2) cm long, filiform, not thickened in fruit, glabrous; ovary ovoid, ca 2 x 1 mm, glabrous; placentae 2 (-3). Fruits globose or subglobose, often pointed or apiculate at apex, (0.8-) 1 - 1.5 cm across; pericarp thin, blackish when ripe; seeds obliquely reniform, 1 - 3 (-8), embedded in yellow pulp, ca 7 mm long, ca 6 mm wide, ca 3 mm thick.

Distrib. India, Myanmar, China, Taiwan, Hainan, Laos, Cambodia, Vietnam and Thailand.

Notes. The subsp. *acutifolia* is confined to S.E. China, Taiwan, Laos and Vietnam. It does not occur in India.

KEY TO THE SUBSPECIES

- | | |
|---|--------------------------------|
| 1a. Leaves 2.5 times as long as wide; lateral nerves more than 7 pairs | 1.2. subsp. <i>sabiaefolia</i> |
| b. Leaves 1.5 - 2.4 times as long as wide; lateral nerves under 7 pairs | 2 |
| 2a. Stipular thorns present; flowers greenish white | 1.1. subsp. <i>bodinieri</i> |
| b. Stipular thorns small or wanting; flowers white with greenish striations | 1.3. subsp. <i>viminea</i> |

1.1. subsp. *bodinieri* (A. Leveille) Jacobs in *Blumea* 12: 431 - 432, ff. 22 a-c. 1965.
C. bodinieri A. Leveille, in Fedde, *Repert. Nov. Spec.* 9: 450. 1911.

Nep.: *Chila-pati*.

Shrubs or trees, erect, up to 4 m tall; young shoots greyish or brown tomentose, later glabrescent; stipular thorns straight, 2 - 4 mm long. Leaves ovate, acute to subobtusate at base, gradually to abruptly acuminate at apex, 5 - 6 x 3 - 4 cm, broadest below the middle, herbaceous to subcoriaceous, glabrous; lateral nerves 5 - 6 pairs with obscure reticulations; petioles ca 4 mm long. Flowers 3 - 4 in vertical supra-axillary rows, 1.2 - 1.5 cm across, greenish white or dull white with brown spots; pedicels filiform, 1.5 - 1.8 cm long. Sepals subequal, 7 - 8 x 3 - 4 mm, pale green, tomentose; outer sepals concave, obtuse; inner ones elliptic. Petals obovate, 10 - 12 x 3 - 4 mm, pubescent. Stamens 28 - 32; filaments white; anthers black. Ovary as in subsp. *sabiaefolia*. Fruits globose, apiculate, 8 - 10 mm across, 1 - 3-seeded, blackish when dry.

Fl. Feb. - March; *Fr.* April - May.

Distrib. India: In open subtropical forests, 300 - 1700 m. Sikkim.

Bhutan, Myanmar and China.

Notes. Kuhn (in *Ber. disch. bot. Ges.* 4b: 682. 1938) reports $2n = ca\ 84$ for the Chinese plants, possibly representing subsp. *bodinieri*.

1.2. subsp. *sabiaefolia* (Hook. f. & Thomson) Jacobs in *Blumea* 12: 432 - 433, ff. 22 d - f. 1965. *C. sabiaefolia* Hook. f. & Thomson in *Fl. Brit. India* 1: 179. 1872.

Kh.: *Dieng-sning-sning*.

Shrubs, often subsucculent or trees up to 10 m tall, glabrous; stipular thorns ca 1 mm long, exceptionally up to 4 - 5 mm long on older branches, but mostly minute or wanting in young twigs. Leaves lanceolate or sometimes oblong-lanceolate, tapering or acute at base, abruptly long-acuminate at apex, widest at or below the middle, glabrous, dark green; midrib slightly sunken above, sometimes in basal part only; lateral nerves paired, arching and forming intramarginal loops, with distinct reticulations. Flowers fragrant, 10 - 15 mm across, 2 - 4 (-6) in vertical supraaxillary rows. Sepals greenish-white, broadly obovate, glabrous, puberulous along margins. Petals densely tomentose inside. Stamens 20 - 25. Gynophore up to 4 cm in fruit, filiform, not thickened in fruit; ovary pear-shaped, acute at apex. Fruits subglobose or pear-shaped; stipes 4 - 5.5 cm long; seeds ca 6 x 3.5 mm.

Fl. March - May; *Fr.* Aug. - Oct.

Distrib. India: In open thickets or primary forests between 1200 - 1800 m. Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram and Meghalaya.

Myanmar, extending to China, Laos, Vietnam and Thailand.

Notes. Plants collected from Jowai, Meghalaya (Balakrishnan, *Fl. Jowai* 1: 74, 1981) belong to subsp. *sabiaefolia*.

13. subsp. *viminea* Jacobs in *Blumea* 12: 429 - 437, f. 22 j-i. 1965. *C. membranifolia* Kurz, l. c. *C. viminea* auct. non Oliver, 1869; sensu Hook. f. & Thomson, l. c.

Nep.: *Chila-pati*.

Shrubs, erect or scandent, weak, 2 - 3 m tall; twigs whitish; innovations brownish pubescent, but soon glabrescent; stipular thorns mostly absent, often present in old shoots, 2 - 3 mm long, straight or curved at tip. Leaves elliptic or oblong, acute to decurrent at base, abruptly 7 - 12 mm long acuminate at apex; reticulations conspicuous; petioles 5 - 6 mm long. Flowers 1 - 7 in supraaxillary vertical rows, 1.4 - 1.8 cm across, white with green striations and purple spots, fragrant; pedicels up to 2.5 cm long. Sepals equal, ciliate along margins; outer pair boat-shaped; inner ones elliptic, 5 - 6 x 2 mm. Petals obovate-oblong, 8 - 10 x 2.5 - 3.5 mm, densely tomentose. Stamens 28 - 30; filaments white; anthers dark coloured. Ovary ovoid, ca 1.5 x 0.8 mm, glabrous, on filiform up to 2.2 cm long gynophore. Fruits globose, slightly compressed laterally, 1.5 - 1.8 cm across, purple; seeds 3 - 5, ca 6 x 5 mm.

Fl. March - April; *Fr.* May - July.

Distrib. India: Common between 600 - 1500 m altitudes in subtropical scrub forests. Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Bhutan, Myanmar, China, Laos, Vietnam and Thailand.

Notes. *Capparis viminea* Oliver and *C. viminea* Hook. f. & Thomson belong to two different species based entirely on different types, the former conspecific to *C. tenera* Dalz., also occurring in India. However, *C. viminea* Hook. f. & Thomson being a later homonym cannot be maintained as a species, but Jacobs retains it as a new name for the subspecies under *C. acutifolia*.

2. *Capparis assamica* Hook. f. & Thomson in Fl. Brit. India 1: 177. 1872. Fig. 42.

Kh.: *Diangsh-sah-saw*.

Shrubs or small trees, 1.5 - 3 m, erect, often subscandent; young shoots sparsely appressed pubescent with medifixed hairs, glabrescent; stipular thorns few, straight or slightly recurved, minute, 0.5 - 1 mm long, often absent; cataphylls profuse near base, ca 1 mm long. Leaves elliptic, oblong-lanceolate, attenuate to cuneate at base, acute or abruptly acuminate and mucronate at apex, 16 - 24 x 5 - 8 cm, 3.5 - 5.5 times as long as broad, subcoriaceous, dull, glabrous, pale glaucous beneath; midrib sunken above; lateral nerves 8 - 12 pairs, arched and looping, subdepressed with distinct reticulations; petioles 6 - 9 mm long, grooved above. Racemes terminal or subterminal, dense-flowered, 12 - 40 cm long, pendent; peduncles short or none, surrounded by empty bracts at base; rachis glabrescent; pedicels 1.5 - 2 cm long, filiform, puberulous; bracts subulate, ca 2 mm long, glabrous. Flowers white, fragrant, 8 - 10 mm across. Sepals imbricate, subequal, concave, ovate-elliptic to lanceolate, 4 - 5 x 1.5 - 1.8 mm, ciliate, pubescent. Petals ovate or obovate-oblong, subtruncate, 4 - 5 x 1.5 - 2 mm, white, puberulous along margins and towards base. Stamens 16 - 24; filaments filiform, 8 - 10 mm long. Gynophore 6 - 9 (-14) mm long, glabrous, hardly thickened in fruits; ovary glabrous, ovoid or subglobose, ca 1.5 x 1 mm; placentae 2, few-ovuled. Fruits globose, wrinkled, 8 - 10 mm across, reddish-brown, one-seeded; stipes up to 2.5 cm long, not thickened.

Fl. April - May; *Fr.* June - Oct.

Distrib. India: In dense subtropical evergreen forests, up to 1000 m. Arunachal Pradesh, Assam and Meghalaya.

Bangladesh, Myanmar, China, Laos and Thailand.

Notes. A charming bushy plant with white fragrant flowers and red fruits in pendulous festoons, worth cultivating as an ornamental garden plant.



Fig. 42. *Capparis assamica* Hook. f. & Thomson : a. flowering twig; b. fruiting twig; c. flower; d. outer sepal; e. inner sepal; f. outer petal; g. inner petal; h. stamen; i. pistil.

3. *Capparis brevispina* DC., Prodr. 1: 246. 1824. *C. zeylanica* auct. non. L. 1762; Hook. f. & Thomson, in Fl. Brit. India 1: 174. 1872, p.p. Fig. 43.

Beng.: *Kelu-kira*; Mar.: *Govind-phal, Wagati*; Or.: *Lephra, Niphera*; Tam.: *Adan-da, Kattukanji*.

Shrubs or small slender trees, up to 4 m tall; innovations more or less densely stellate hairy, soon glabrescent; branches low, radiating; stipular thorns 2 - 4 mm long, straight or slightly curved at tip; cataphylls conspicuous. Leaves elliptic to oblong, acute or cuneate at base, obtuse or subacute at apex, recurved along margins, 3 - 6 (-12) x 1.5 - 2.5 (-3.6) cm, stiff, coriaceous, glossy above, dull below, drying brown; lateral nerves 4 - 6 pairs; midrib shallowly sunken above; reticulations distinct; petioles 2 - 7 mm long. Flowers showy, white or pale creamy, drying pink, 3.5 - 4 cm across, solitary and axillary or 2 - 4 conferted on lateral axes; buds obovoid, only half covered by sepals at anthesis; pedicels 1.5 - 4 cm long, puberulous. Sepals subequal, tomentose to villose; outer pair orbicular, boat-shaped, 6 - 10 x 3 - 5 mm; inner pair ovate, slightly larger. Petals oblong or obovate, 2 - 2.5 x 0.7 - 1 cm, sparsely pubescent, creamy or white, upper pair with yellow or brownish blotch at base. Torus ca 2 mm wide. Stamens 25 - 35; filaments ca 2.5 cm long, exserted. Gynophore glabrous, 1.8 - 2.5 cm long, slightly thickened in fruits; ovary ovoid, angular, long-beaked, 5 - 6 x 1.5 - 1.8 mm, tomentose during anthesis; placentae 4; ovules many. Fruits ovoid or ellipsoid, apiculate, 3 - 4.5 cm long, 1.5 - 2.5 cm thick, orange-red to purple, tardily dehiscent; pericarp thin, smooth; stipes 4.5 - 5.5 cm long, ca 1.5 mm thick; seeds up to 15, immersed in foetid white creamy pulp, 6 - 8 mm long, 3 - 6 mm thick, brown.

Fl. Feb. - April (peak), Oct. - Nov.; *Fr.* June - Sept.

Distrib. India: Along dry inland scrub forests of low elevations and coastal belts. Orissa, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka.

Notes. The green fruits are sliced, dried, cooked and eaten in Sri Lanka (Trimen, Handb. Fl. Ceylon 1: 61. 1893).

In juvenile specimens stipular thorns are straight, up to 1 cm long. In a collection by Ananthakrishnan from Mannarkad in Kerala (RHT), cataphylls are absent and leaves are chartaceous and gynophore puberulous.

4. *Capparis cantoniensis* Lour., Fl. Cochinch. 331. 1790; *ibid.* ed. Willd. 404. 1793; DC., Prodr. 1: 253. 1824 (as *cantonensis*). *C. pumila* Benth. in Hooker's J. Bot. Kew. Misc. 3: 260. 1851; Hook. f. & Thomson in Fl. Brit. India 1: 177. 1872.

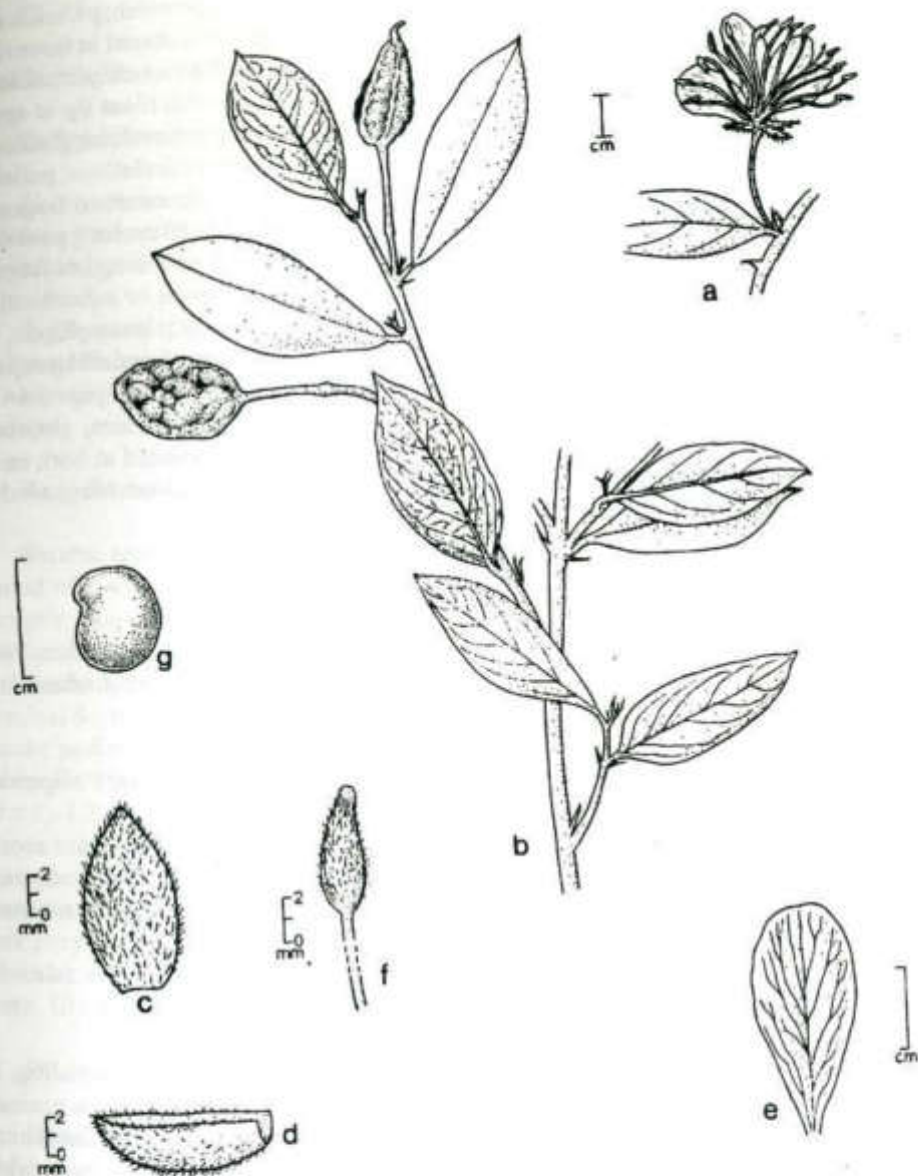


Fig. 43. *Capparis brevispina* DC.: a. solitary axillary flower; b. fruiting twig; c. outer sepal; d. inner sepal; e. petal; f. pistil; g. seed.

Shrubs, 2 - 10 (-20) m tall, scandent or rarely erect; branchlets greenish, puberulous, early glabrescent; stipular thorns minute, straight or recurved, often absent in flowering twigs, but 2 - 4 mm long in older branchlets; cataphylls absent. Leaves elliptic, oblong or lanceolate, rounded, cuneate or attenuate at base, acuminate with blunt tip at apex, 6 - 9 (-16) x 1.5 - 3.2 (-4.8) cm, subcoriaceous, glabrous or minutely puberulous, glaucous, often drying brownish; lateral nerves 6 - 10 pairs, faint with obscure reticulations; petioles 6 - 8 mm long. Flowers greenish white, fading to pink, 1.2 - 1.5 cm across, fragrant, arranged in 6 - 8 (-12)-flowered subumbels grouped in terminal 12 - 20 cm long panicles; peduncles 1.5 - 2.2 cm long, puberulous; bracts subulate, 1 - 2 mm long, caducous; pedicels 1.2 - 2 cm long, brown-pubescent. Sepals imbricate, ovate or suborbicular, concave, sparsely puberulous; outer pair orbicular, 5 - 6 mm across; inner elliptic, 4 - 7 x 3 - 5 mm. Petals white, obovate or oblong, 5 - 8 x 2 - 5 mm, almost equalling sepals. Stamens 18 - 32; filaments 1.8 - 2.5 cm long, exceeding gynoecium. Gynophore 4 - 10 (-12) mm long, slightly thickened in fruits; ovary ellipsoid, 1.5 x 0.8 mm, glabrous; placentae 2, few-ovuled. Fruits subglobose, oblong or ellipsoid, pointed at both ends, faintly ribbed, 1.5 - 1.8 x 0.8 - 1.2 cm, glabrous, reddish; stipe 2 - 2.5 cm long; seeds 1 (-2) globular or elliptic, 8 - 10 x 6 - 8 mm, brown.

Fl. Feb. - March, July - Aug.; *Fr.* Nov. - Dec., Feb. - June.

Distrib. India: In tropical rain forests, from sea level (Andamans) to 1800 m. West Bengal, Sikkim, Assam, Nagaland, Mizoram, Tripura, Meghalaya and Andaman & Nicobar Islands.

Myanmar, extending to China, Vietnam, Laos, Malaysia, Indonesia and Philippines.

Notes. When erect, the species is hardly 2 m tall, but in forests, they are mostly scandent-ascending, often attaining a height of up to 20 m. Unlike in mainland where the leaves hardly exceed 8 x 3 cm, in Andaman & Nicobar Islands, the leaves are much larger, up to 10 - 15 x 3.5 - 4.5 cm.

5. *Capparis cinerea* Jacobs in *Blumea* 12: 444 - 445. 1965.

Shrubs, densely fulvous tomentose; stipular spines straight, conical, ascending, 1 - 2 mm long; cataphylls profuse at base. Leaves elliptic, obtuse at base, acute to acuminate at apex, 7 - 10 x 2.8 - 3.2 cm, coriaceous, glabrous, except along midrib and veins; lateral nerves 7 - 8 pairs, obscure; reticulations indistinct; petioles 3 - 5 mm long. Flowers white with a tinge of pink, arranged in up to 5-flowered umbels, on 1 - 2 cm long axillary or lateral peduncles; pedicels 1 - 2.2 cm long, puberulous; bracts subulate, 1 - 2 mm long. Sepals subequal, elliptic, outer pair partially covering inner, ca 6 x 4 mm, ciliate. Petals obovate, ca 9 x 4 mm, tomentose on both sides. Torus ca 1.5 mm across. Stamens 30 - 35; filaments exerted, ca 2.5 mm long. Gynophore glabrous, ca 2.5 cm long; ovary ellipsoid, glabrous, 1.5 x 0.5 mm; style indistinct; placentae 2. Fruits unknown.

Fl. May.

Distrib. India: Open hillslopes at 1800 m. alt. Manipur.

Endemic and probably already extinct.

Notes. Never recollected since the type collections. It is allied to *C. cataphyllosa* Jacobs, a Burmese species but differing from it in the lax few-flowered inflorescence and greyish indumentum.

6. *Capparis cleghornii* Dunn in Bull. Misc. Inf. Kew 1916: 61. 1916, descr.; Gamble, Fl. Pres. Madras 1: 46. 1915, nomen; Rao & Sund.-Ragh. in Blumea 12: 313 - 316. 1964. *C. roxburghii* auct. non DC.; Hook. f. & Thomson in Fl. Brit. India 1: 175. 1872, p.p., excl.syn. Fig.44.

Kan.: Badumungri, Baduhugli, Navi-karemanjahanu, Malaithothikai.

Shrubs, scandent, ca 2 m tall; twigs purplish, flagellate, fulvous pubescent, densely armed with sharp recurved stipular thorns. Leaves elliptic or obovate, acute at base, abruptly blunt acuminate at apex, 3.5 - 10 x 2 - 4.5 cm, subcoriaceous, pinkish when tender, dull greenish when dry; lateral nerves 4 - 6 pairs with obscure reticulations; petioles 6 - 10 mm long. Flowers showy, white, purple on ageing, 3.5 - 4.5 cm across, in terminal 6 - 10-flowered corymbs or rarely solitary, axillary or conferted in subterminal shoots; pedicels 2.5 - 4 cm long, pubescent. Sepals subequal, concave, 10 - 12 x 7 - 8 cm, pubescent outside, glabrous inside. Petals obovate or oblong, unequal; upper pair 2.2 - 2.5 x 1 - 1.2 cm; lower pair 1.6 - 1.8 x 1.2 - 1.4 cm, puberulous at base. Torus 2.5 - 3 mm across. Stamens 65 - 80, white turning to pink or scarlet; filaments 2.5 - 2.8 cm long. Gynophore 2.5 - 3.5 cm long, glabrous; ovary ovoid, 3 - 3.5 x 2 mm, purple, glabrous; placentae 3 - 4. Fruits on slender stalks, ovoid or subglobose, umbonate, 6 - 8.5 cm long, dark purplish to violet, 3 - 4 x 2 - 3 cm. Seeds 1 - 4, dorsally compressed, obovoid, or orbicular, embedded in scarlet pulp, 1.5 - 1.8 x 1.4 - 1.5 cm; cotyledons foliaceous, elliptic, acute, 10 - 20 x 7 - 8 mm; radicle thick.

Fl. Feb. - April; *Fr.* April - Oct.

Distrib. India: Outskirts of evergreen forests at altitudes of 600 - 1400 m along laterite slopes associated with *Moullava spicata*, *Mezoneuron cucullatum* etc. Karnataka and Kerala.

Endemic.

Notes. Fruits are edible and consumed in Coorg.

The chromosome number is $n = 20$ (R. Sundara Raghavan, unpublished).



Fig. 44. *Capparis cleghornii* Dunn: a. fruiting twig; b. flowering twig; c. outer sepal; d. inner sepal; e. outer petal; f. inner petal; g. stamens; h. pistil; i. t. s. of ovary; j. seed; k. seed with testa partially removed, showing embryo; l. embryo, taken out.

Refer to Rolla S. Rao & R.S. Raghavan (in *Blumea* 12: 313 - 315, f. 142. 1962) for discussions on taxonomy and nomenclature of the species.

Once thought to be extinct, it has now been rediscovered from Shimoga, Chickmagalur, Hassan, N. & S. Kanara of Karnataka and Kannur Dist. of Kerala. It is threatened due to habitat disturbances.

7. *Capparis decidua* (Forsskal) Edgew. in *J. Linn. Soc. Lond.*, Bot. 6: 184. 1862. *Sodada decidua* Forsskal, *Fl. Aegypt.-Arab.* 81. 1775. *Capparis aphylla* Roth, *Nov. Sp. Pl. Ind. Or.* 238. 1821; Hook. f. & Thomson in *Fl. Brit. India* 1: 174. 1872.

Guj.: *Kera-guj, Kerdo*; Hindi: *Dela, Karil, Karir, Ker*; Kan.: *Karina, Kariuppugida*; Tam.: *Sengam*.

Shrubs or small trees, up to 7 m tall; branches scrambling or suffruticose; twigs zig-zag, glabrous to glabrescent; stipular thorns yellowish, straight, 3 - 6 mm long, rarely absent; cataphylls confined to base. Leaves confined to young twigs, early caducous, fleshy, subsessile, linear to spatulate, 3 - 18 x 1 - 3 mm, spinous-tipped; petioles obscure. Racemes from older branches or on short lateral shoots, ebracteate, 10 - 30-flowered; buds ovoid, pointed, tomentose. Flowers showy, coral-pink, brick-red, orange-red, or yellowish, 1.5 - 2.5 cm across; pedicels slender, 1 - 1.5 cm long, fulvous tomentose to glabrescent. Sepals unequal, tomentose, floccose-ciliate along margins, 7 - 10 x 3 - 5 mm; adaxial sepal ovate-oblong, saccate, hooded, others petaloid, elliptic to linear-lanceolate. Petals almost equalling sepals, puberulous; anterior pair triangular-ovate, included within hooded sepal, posterior pair slightly smaller, oblong-lanceolate. Stamens 10 - 16; filaments 1 - 1.8 cm long, reddish. Gynophore 1.2 - 1.6 cm long, slender, glabrous; ovary glabrous, globose, beaked, 2.5 x 2 mm, faintly 4-grooved; placentae 4. Fruits berries, on thin stalk, globose to ovoid, beaked, 14 - 20 mm across, scarlet red, smooth with thin pericarp; seeds 1 - 4, reniform, 2 - 5 x 2 - 4 mm.

Fl. Feb. - May; *Fr.* Sept. - Nov. (Jan.)

Distrib. India: In semi-arid scrub forests, mostly at lower elevations, up to 800 m, often associated with *Prosopis spicigera*, *Salvadora oleoides*, *Salvadora persica*, *Acacia sp.* and *Maerua oblongifolia*. Throughout the country, except Jammu & Kashmir, N. E. hill states, Andaman & Nicobar Islands and other high humid regions.

Pakistan, extending to Middle East, West Asia and N.E. tropical Africa.

Notes. Flower buds and fruits are used as vegetables and pickles. Young shoots, leaves, roots and fruits are powdered and used in treating boils, skin eruptions, rheumatism, etc. Wood resistant to white ants and hence utilised for rafters, beams, ploughs and country boats. Often planted as a sand binder to arrest spread of deserts. A showy

ornamental plant when in bloom or in fruits. Fasciation of twigs is common and vegetative propagation is by root suckers.

Chromosome number reported is $2n = 22$ (Panikar in Curr. Sci. 31 : 32. 1962).

8. *Capparis divaricata* Lam., Encyl. Meth. Bot. 1: 606. 1785; Hook. f. & Thomson in Fl. Brit. India 1: 174. 1872. *C. stylosa* DC., Prodr. 1: 246. 1824; Dunn in Gamble, Fl. Pres. Madras 1: 32. 1957 (repr. ed.).

Kan.: Revdi, Thottala; Mar.: Pachunda; Tam.: Athandi, Chorakazhita-chedi, Sengathali, Toratti; Tel.: Badreni.

Shrubs or small trees, erect, much-branched, 2 - 6 m tall; innovations whitish or fulvous tomentose with stellate hairs; twigs green, slender, zig-zag, stellate-pubescent; stipular thorns variable, divaricate, straight or curved upwards or downwards; cataphylls absent. Leaves variable, dimorphic, either linear to linear-oblong or elliptic to oblong-lanceolate, cuneate or rounded at base, acute-mucronate at apex, 4 - 7 x 0.1 - 2.5 cm, dull coriaceous, pubescent; midrib somewhat raised; lateral nerves 3 - 5 pairs, more or less confluent towards base; reticulations obscure; petioles 2 - 4 (-8) mm long. Flowers solitary, axillary, 3 - 5.5 cm across, odorous, green or red; buds ovoid, beaked, greyish to brown-pubescent; pedicels 1.8 - 2 cm long. Sepals elliptic-orbicular, thick, pubescent on both sides; outer pair boat-shaped, 11 - 16 x 4 - 7 mm, connate in bud, splitting irregularly; inner pair petaloid, equalling petals, 15 - 27 x 3 - 9 mm. Petals greenish-yellow, creamy or white, linear, oblong, obovate-spathulate or strap-shaped, acute to rounded at apex, 2.5 - 3.8 x 0.8 - 1.2 cm, tomentose along margins and tip. Stamens 45 - 65; filaments yellowish, purplish-red at base, longer than petals. Gynophore 2 - 2.2 cm long, thickened in fruit; ovary ovoid, beaked, 5 - 6 x 1.5 - 1.7 mm, 6 - 8-ribbed, reddish, glabrous. Fruits globose or ellipsoid, beaked with 6 - 10 longitudinal ribs and many small knobs, warted and tubercled in between, 3.5 - 5 x 2.5 - 4 cm, reddish; stipe woody, 3 - 4.5 cm long, 3 - 6 mm thick; seeds 6 - 8, embedded in white or creamy pulp, 8 - 10 x 5 - 6 mm.

Fl. March - April; Fr. June - Sept.

Distrib. India: Scrubs or deciduous forests, on black cotton or laterite soil at 300 - 600 m. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka.

Notes. As a tree, it often attains a girth of 60 - 75 cm and branches are seen drooping from the rounded top of the crown. Leaves are dimorphic, some twigs bearing exclusively linear to linear-oblong leaves, while in others they are elliptic or oblong-lanceolate.

Flowers are borne in both types of twigs but comparatively a lesser number of narrow-leaved twigs bear flowers.

This species is the only Indian representative of the section *Busbeckea* (mainly Australian, characterised by connate outer sepals and leaf dimorphism), serving as a connecting link between section *Monostichocalyx* (common in India) and section *Busbeckea*. In its stellate indumentum and ovary features, it is allied to "Brevispina" group of section *Monostichocalyx*. Sculptured berries are common in both sections but petaloid inner sepals are known only in the Australian *C. loranthifolia* Lindley of section *Busbeckea*.

9. *Capparis diversifolia* Wight & Arn., Prodr. 1: 27. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 175. 1872. Fig. 45.

Shrubs, erect, ca 2 m tall; twigs flexuous; indumentum stellate hairy, early glabrescent; stipular thorns few, straight or slightly curved, 2 - 2.5 mm long. Leaves dimorphic; if linear, linear-oblong or oblong-lanceolate and 2.5 - 3.8 x 0.3 - 0.6 cm; if elliptic-ovate, acute to rounded at base, acute-mucronate at apex and 5.6 - 9 x 2 - 3.5 cm; lateral nerves 5 - 7 pairs, with distinct reticulations; petioles 2 - 6 mm long. Flowers showy, reddish-purple to violet, 3.5 - 4.5 cm across, conferted in 3 - 8-flowered subumbels; pedicels 6 - 8 mm long, puberulous but early glabrescent. Sepals subequal, ovate, 7 - 8 x 3.5 - 4 cm, minutely puberulous outside, densely tomentose inside. Petals ovate or obovate, subequal, 1.8 - 2 x 0.6 - 0.9 cm, glabrous but tomentellous at base. Stamens 40 - 60, much exceeding gynoecium. Gynophore bent, 5 - 9 mm long, up to 11 mm in fruits, hardly thickened; ovary fusiform, ca 6 x 2 mm (including beak), smooth, glabrous, often abortive; placentae 4. Fruits ovoid or ellipsoid, 3 - 3.5 x 2 cm, smooth, apiculate on a thin stipe; pericarp thin, 8 - 10-seeded; seeds 6.5 - 7 x 6 mm.

Fl. Sept. - Dec., April - July; Fr. July - Sept.

Distrib. India: Rare in moist forests along rocky slopes, between 600 - 800 m. Tamil Nadu, Pondicherry and Kerala.

Endemic and endangered.

Notes. It is often confused with *C. divaricata* but can be easily distinguished from it either in flower or in fruits. Even in vegetative state it can be easily differentiated by the distinct reticulation and veins not conferting towards base. Sometimes an entire twig bears linear or linear-oblong leaves; however other twigs in the same plant bear ovate or lanceolate leaves and they are never so narrowly linear as in *C. divaricata*. Sterility is correlated to abortive ovaries only and not to narrow or broad leaves. Gynoecium is often vestigial and in view of abortive ovaries, hardly 1 - 2 fruits ever mature in an umbel.



Fig. 45. *Capparis diversifolia* Wight & Arn. : a. twig with buds and young fruits; b. flower; c. immature fruit.

Hook. f. & Thomson (l. c.) mentions the distribution as extending to Kerala. Rama Rao (in *Fl. Pl. of Travancore* 20. 1914) includes it for Kerala without mentioning any precise locality. Except for a vegetative specimen at CAL, there are no recent collections from Kerala proper. Its occurrence in Pondicherry is equally doubtful, as Pierre on way to Pondicherry, probably had collected it from Tamil Nadu only.

10. *Capparis flavicans* Kurz in *J. Asiat. Soc. Bengal* 39(2): 62. 1870. *C. flavicans* Hook. f. & Thomson in *Fl. Brit. India* 1: 179. 1872.

Tel.: *Pula-tiga*.

Shrubs or small trees, 1.5 - 8 m tall; twigs tawny pubescent with fulvous brown stellate hairs; stipular thorns minute or lacking in flowering twigs, but in older branches ca 1 - 2 mm long, straight or slightly curved; cataphylls absent. Leaves suborbicular, elliptic-obovate or oblong, cuneate or rounded at base, obtuse or retuse and mucronate at apex, 2.2 - 4 x 1.2 - 1.6 cm, subcoriaceous, drying dull green, at length glabrescent, lateral nerves 3 - 5 pairs; basal 1 - 2 pairs confluent towards base; reticulation obscure; petioles 2 - 5 mm long, puberulous. Flowers 1 (rarely 2) in axils of leaves on young twigs, yellow or rosy pink, 1.5 - 1.8 cm across; pedicels slender, 1 - 3 cm long, puberulous, much thickened in fruits. Sepals tawny pubescent, 6 - 8 x 3 - 5 mm, outer boat-shaped, inner ovate or obovate. Petals yellow, obovate, 6 - 9 x 3 - 4.5 mm, densely woolly; upper petal with a golden yellow or brownish blotch. Stamens 6 - 8 (-12); filaments greenish, 1.4 - 1.8 cm long. Gynophore 1.5 - 2 cm long, densely hairy, much thickened in fruit; ovary ovoid, 2.5 - 3 x 2 - 2.5 mm, pointed, densely pubescent, often abortive; stigma knob-shaped; placentae 4. Fruits subglobose to ovoid or ellipsoid, umbonate, 3.5 - 4 x 2.5 - 3 cm, pale yellow, orange or reddish brown, hoary pubescent; stalk 3 - 4.5 cm long, 4 - 7 mm thick; pericarp thick, warted, beset with longitudinally arranged knob-like protuberances; seeds 2 - 8, embedded in yellow pulp, ca 6 x 4 mm.

Fl. Jan. - Mar.; *Fr.* July - Sept.

Distrib. India: At low elevations, or rocky soils, in dry scrubland or deciduous forests. Andhra Pradesh (rare).

Laos, Vietnam, Cambodia and Thailand.

Notes. Leaves are eaten as curry and also as galactogene.

The only authentic collection from India is by Brandis from Sriharikota, coastal Andhra Pradesh deposited in CAL herbarium. In its sculptured and ribbed fruits, it superficially resembles *C. divaricata* of section *Busbeckea*. However, it is allied to section *Brevispina* in its solitary flowers, free sepals and anterior petal blotched with yellow.

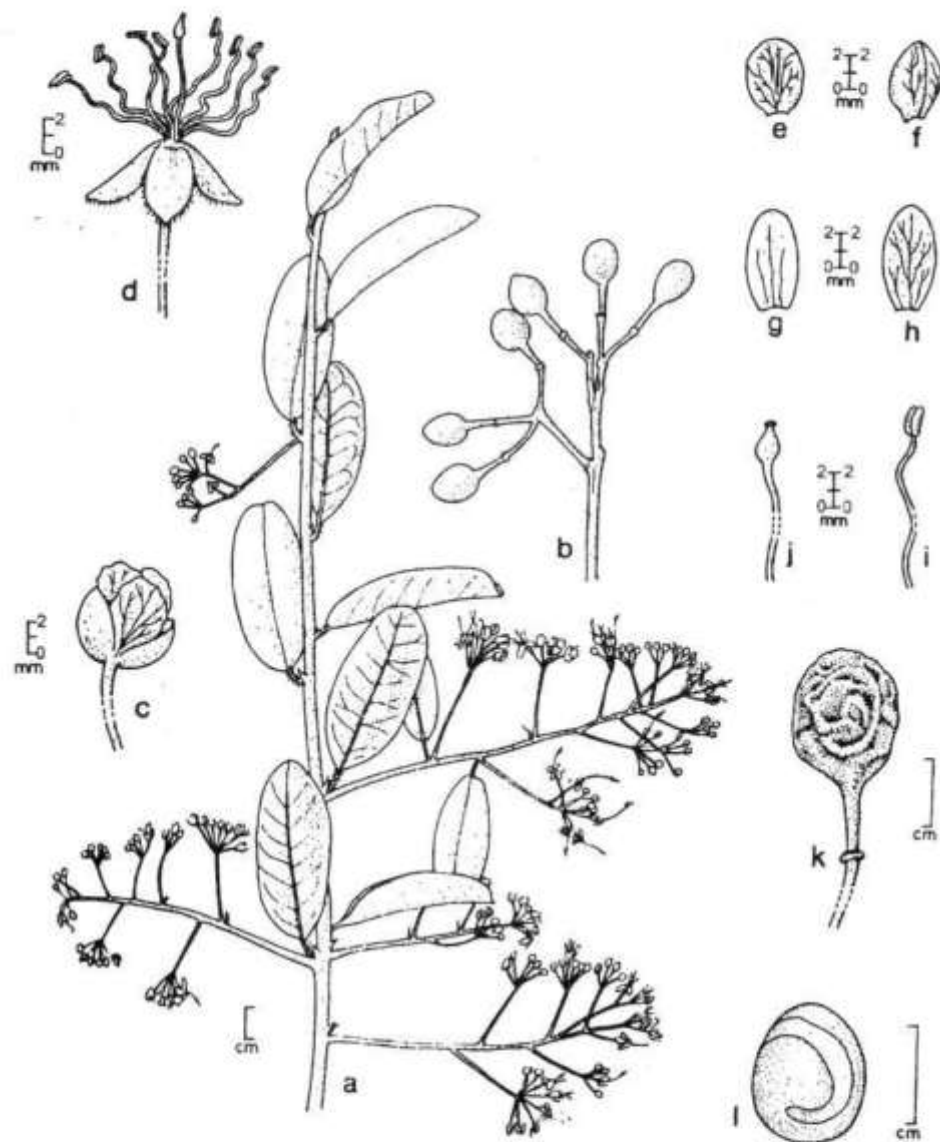


Fig. 46. *Capparis floribunda* Wight: **a.** flowering twig; **b.** fruiting twig; **c.** flower bud before anthesis; **d.** flower after anthesis; **e.** outer sepal; **f.** inner sepal; **g.** outer petal; **h.** inner petal; **i.** stamen; **j.** pistil; **k.** fruit; **l.** seed cut open, showing embryo.

11. *Capparis floribunda* Wight, *Illus.* 1: 33, t. 14. 1840; Hook. f. & Thomson in *Fl. Brit. India* 1: 177. 1872. *C. andamanica* King in *Ann. R. Bot. Gard. Calc.* 5: 119, t. 137. 1896. **Fig. 46.**

Shrubs, scandent, woody, 2-4 m tall; twigs straight, glabrous, rarely puberulous with simple fulvous hairs; stipular thorns small, recurved, often absent. Leaves oblong or elliptic, tapering at base, rounded to obtuse at apex, entire, recurved or rarely crenate along margins, 4-8 (-13) x 3.5-5 (-5.5) cm, subcoriaceous to coriaceous, glossy, glabrous, drying greyish to brown; midrib slightly grooved above; lateral nerves 7-10 pairs, faint with obscure reticulations; petioles 8-12 (-15) mm long. Flowers white, fragrant, 6-10 mm across, 8-25 on subumbels on 1-1.5 cm long stalks, these in turn often arranged in large terminal 12-18 cm long panicles; buds globose, ca 2.5 mm across; bracts linear, 3-4 mm long, caducous; pedicels 6-10 mm long, slender, not thickened in fruit, glabrous. Sepals subequal, deflexed, persistent; outer pair valvate, ovate, concave, 3-3.5 x 1.5-2 mm; inner imbricate, orbicular, ca 4.2 x 2.5 mm. Gynophore 4-6 (-10) mm long, glabrous, not thickened in fruits; ovary ovoid, apiculate, ca 1.5 x 1 mm, glabrous; placentae 4. Fruits globose, shortly beaked at apex, 1.8-2 cm across; pericarp leathery, smooth, orange-red, fleshy; stipe thin, 1.2-2 cm long; seeds 1-3, ca 12 x 10 x 6 mm.

Fl. Jan. - April (-Oct.); *Fr.* May - June (-Oct.).

Distrib. India: Evergreen lowland forests along coastal belts, on sandy loam, from sea level to 600 m altitude. Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands.

Sri Lanka, Myanmar, extending to S.E. Asia.

Notes. Specimens from Andaman & Nicobar Islands show larger leaves (8-13 x 4-5.5 cm) and bigger fruits, as in other species of the genus from these islands. In the collections from Andhra Pradesh and Sri Lanka, the gynophore is longer (up to 1 cm long). There are earlier collections from Andhra Pradesh, Kerala and Tamil Nadu, but the species has not been subsequently recollected from these States during the last 50 years. Interestingly enough, in Malpe Islands, off South Kanara Coast in Karnataka, this species is quite common and denotes a new distributional record as well as its first record from the State of Karnataka.

12. *Capparis fusifera* Dunn in *Bull. Misc. Inf. Kew* 1914: 377. 1914; Joseph & Chandras. in *Bull. Bot. Surv. India* 20: 156-158, ff. 1-7. 1978 (1979). *C. tomentella* Dunn in *Gamble, Fl. Pres. Madras* 46. 1915. *C. parviflora* sensu Beddome, *Icon.* t. 276. 1868-1874 (excl. fruits) 1874, non Boiss. 1843, non Hook. f. & Thomson. **Fig. 47.**

Shrubs, much-branched, spreading, up to 3 m tall; stipular thorns mostly lacking, if present short, 1-1.5 mm long; cataphylls confined to base. Leaves elliptic-oblong or

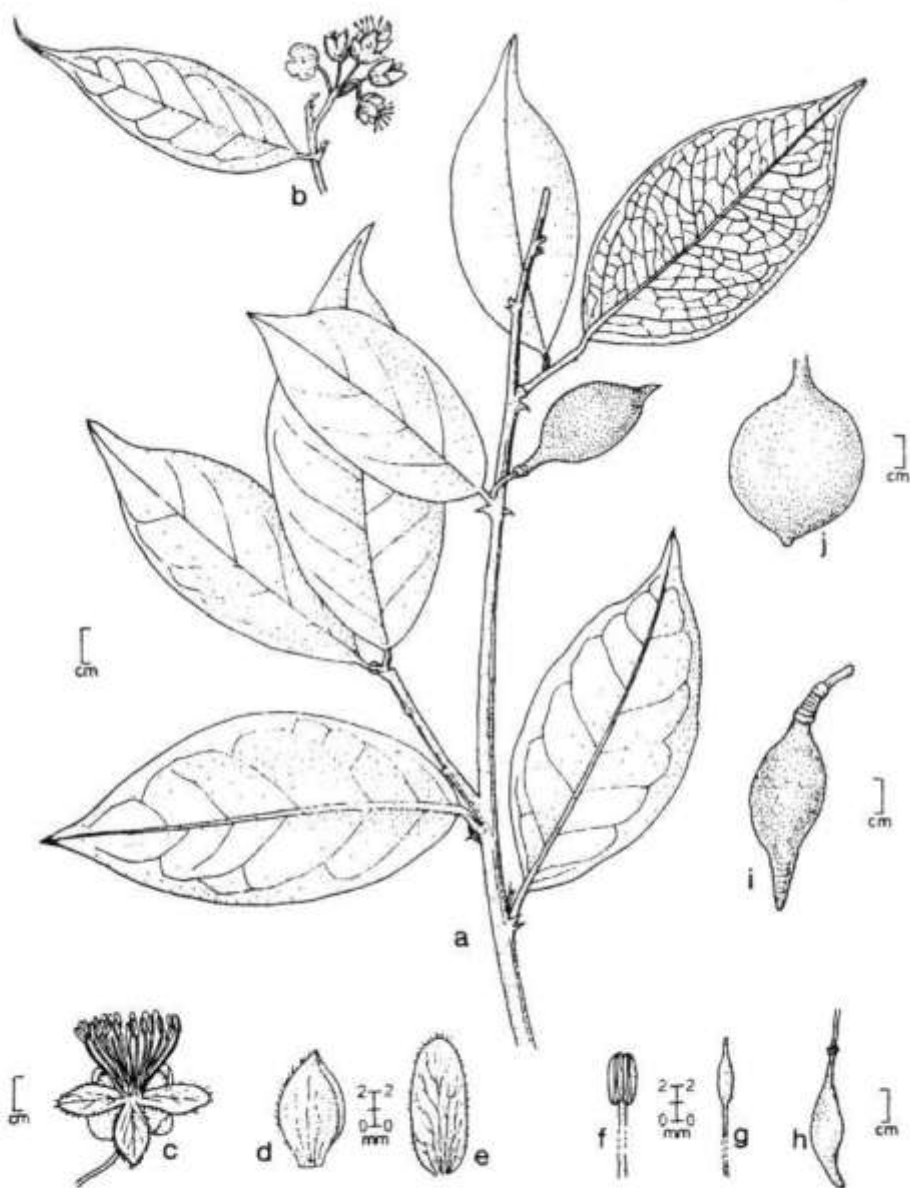


Fig. 47. *Capparis fusifera* Dunn: a. fruiting twig; b. flowering twig; c. flower; d. sepal; e. petal; f. stamen; g. pistil; h, i & j. immature and mature fruits showing variation in size and shape.

ovate, acute or obtuse at base, abruptly acuminate at apex, 11 - 16 x 4.5 - 7.5 cm, chartaceous, glabrous, drying greenish-yellow; midrib grooved above; lateral nerves 8 - 11 pairs, looped along margins; petioles 4 - 6 mm long, puberulous. Inflorescence umbellate on condensed, 3 - 6-flowered, axillary or subterminal, on 4 - 6 cm long peduncle, puberulous; bracts setaceous, 1.5 - 2 mm long, persistent. Flowers greenish-white, fragrant, 1.2 - 1.5 cm across; pedicels filiform, up to 1.6 cm long, puberulous. Sepals subequal, ovate, deeply concave, 6 - 8 x 3.5 - 5 mm, thick, membranous towards tip, glabrous except for puberulous margins. Petals oblong, gradually attenuate at base, obtuse at apex, 8 - 10 x 3.5 - 4 mm, veined, sparsely puberulous at base and along margins. Torus 1.5 - 2 mm wide. Stamens 42- 48, exserted; filaments 10 - 14 mm long, exceeding gynoeceum; anthers 1 - 1.5 mm long. Gynophore 6 - 7 mm long, much thickened in fruits; ovary glabrous, unilocular, rarely 2-locular through false septum, ellipsoid to ovoid, 1.7-2.2 x 0.6 mm; stigma terete; placentae 2. Fruits fusiform to spindle-shaped, beaked, 4 - 4.5 x 2.2 - 2.5 cm, warty on surface; stipe 1 - 1.4 cm long, ca 3 mm thick, not callose at tip; seeds 1 (-2), 1.8 - 2 x 0.8 - 1.2 cm.

Fl. Oct. - Dec.; *Fr.* Nov. - Jan., April.

Distrib. India: Semievergreen forests at 800 - 1000 m, scattered, nowhere abundant. Tamil Nadu and Kerala.

Endemic and restricted to a few localities in Anamalais and Silent Valley.

Notes. A specimen from Silent Valley in Kerala (N.C. Nair 64314 in MH) differs from the description in certain minor details. Here the stipular thorns are curved (not straight); lateral nerves are alternate (not opposite or subopposite); umbels 7 - 9-flowered (not 3 - 5 or solitary); pedicels up to 1 - 6 cm long (as against 8 - 11 mm) and gynophore 8.5 - 10 mm long (as against ca 6 mm). Fruits are not available for this specimen.

13. *Capparis grandiflora* Hook. f. & Thomson in *Fl. Brit. India* 1: 174. 1872. *C. pyrifolia* Wight & Arn., *Prodr.* 25. 1834, non Lam. 1785.

Kan.: Thottimara.

Shrubs, erect or low scrambling and spreading, 0.5 - 2 m tall; twigs with coarse stellate brown pubescence; spines copious, recurved, 2 - 3 mm long; cataphylls absent. Leaves elliptic-ovate to suborbicular, subcordate to rounded at base, acute or obtuse-mucronate at apex, 1.5 - 3.5 x 1.2 - 2 cm, subcoriaceous, lustrous glabrous above, pubescent beneath; midrib sunken; lateral nerves 3 - 4 pairs; reticulations distinct; petioles 1.5 - 3 mm long. Flowers solitary, axillary, showy, 4 - 5 cm across, faintly odorous, white with orange throat; pedicels 1 - 1.5 cm long, puberulous. Sepals subequal, 12 - 18 x 5 - 8 mm, tomentose; outer pair boat-shaped, glabrous outside and villous inside towards margins; inner pair ovate to obovate, villous outside, glabrous inside. Petals

obovate-triangular, subtruncate, 2.5 - 3 x 0.9 - 1.4 cm, white, glabrous. Torus 1.5 - 2 mm wide. Stamens 67 - 101, exceeding gynoecium; filaments white; anthers blue to pinkish. Gynophore 2 - 2.5 cm, glabrous; ovary beaked, glabrous, 4 - 5-furrowed, oblong to ovoid-cylindric, 6 - 8 x 1.2 mm; stigma puberulous, cushion-shaped, 1.5 - 2 mm across; placentae 4 - 5. Fruits ellipsoid or ovoid, beaked, 5 - 7.5 x 2.2 - 4 cm, 5 - 6-ribbed, red; stalk 3.5 - 4 cm long, ca 2 mm thick; pericarp adhering to seeds; seeds many, 5 - 7 x 5.5 - 6.5 mm.

Fl. Feb. - Aug.; *Fr.* July - Oct.

Distrib. India: Scrub jungles or deciduous forests, 500 - 1000 m, frequently associated with *Capparis roxburghii* and *C. sepiaria*. Karnataka, Kerala and Tamil Nadu.

Endemic to slopes of Nilgiri and Coorg hills.

Notes. At Thekkumalai hills in Coimbatore District of Tamil Nadu, a few clumps had flowers with 8 petals arranged in two series of four each, outer petals strap-shaped, 2 - 2.2 x 0.6 cm, inner ones obovate-elliptic, ca 2.5 - 1.3 cm and both ovary and stigmas tomentose.

14. *Capparis grandis* L. f., Suppl. 263. 1781; Hook. f. & Thomson in Fl. Brit. India 1: 176. 1872.

Guj.: Dumra, Dumrejohod, Thikari; *Mar.:* Pachara, Pachundi; *Tam.:* Mudkondai, Nakkulijam, Kattukoiya, Turatta.

Erect shrubs or crooked trees, 5 - 10 m tall; bole almost unbranched, up to 45 cm in girth with fissured bark; indumentum with olive green velvety tomentum; stipular thorns straight or rarely recurved, 5 - 6 (-9) mm long in older branches, but often lacking in flowering or tender shoots. Leaves obovate, suborbicular or elliptic-ovate, cuneate or acute at base, acute, retuse, obtuse, mucronate at apex, 4 - 7 (-9) x 2.5 - 5.5 cm, subcoriaceous, dull green above, pale and grey-pubescent beneath; midrib usually flat or rarely sunken at base; lateral nerves 5 - 9 (-12) pairs, close together, parallel and with distinct reticulations; petioles 8 - 14 mm long. Flowers white to creamy, fragrant, 2.2 - 2.8 cm across, in terminal 25 - 30-flowered corymbs or subumbels; pedicels 10 - 25 mm long, densely pubescent. Sepals sparsely puberulous; outer pair boat-shaped, orbicular, ca 8 x 6 mm; inner pair linear-oblong or obovate, 10 - 11 x 6 - 8 mm. Petals oblong to narrowly obovate, 9 - 16 x 3 - 10 mm. Stamens 35 - 50 (rarely 12 - 15). Gynophore 1.3 - 2.8 cm, hairy towards base, thickened in fruit; ovary ovoid, 1.8 - 2.2 x 1.5 mm, glabrous; placentae 2. Fruits subglobose, somewhat umbonate, 2.2 - 2.8 cm across; stipe thickened, 3 - 4.5 cm long, 3 - 4 mm thick; pericarp coriaceous, smooth, orange-red to purple; seeds 2 - 6, embedded in pink pulp, 10 - 12 x 8 - 12 mm.

Fl. Throughout the year, with peak period in Feb. - July and Nov. - Dec.;

Fr. July - Jan.

Distrib. India: On rocky soil in open country and dry forests, from plains up to 1100 m. Rajasthan, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka, Myanmar, extends to Laos, Vietnam and Thailand.

Notes. Chromosome number reported is $n = 21$ (Raman & Kesavan in Curr. Sci. 29: 413. 1963).

Leaves and stipular thorns are highly variable. In Santapau 13764 from Junagadh, Gujarat (BLAT), leaves are nearly triangular and almost truncate at base.

In Barber 7430 from Kodai Road, Tamil Nadu (MH), the leaves are wider than long, being transversely elliptic. In juvenile twigs of specimens from Mt. Abu, Rajasthan (Santapau 17609 in BLAT), thorns are straight, measuring 6 - 9 mm long. Specimens from Sri Lanka at Leiden have leaves opposite and glabrous, which is unusual. In Vajravelu 22402 (MH) from Salem District of Tamil Nadu, the fruiting gynophore is short, hardly 3 mm long.

15. *Capparis micracantha* DC., Prodr. 1: 247. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 179. 1872. *C. roydsiaefolia* Kurz in J. Asiat. Soc. Bengal 39(2): 62. 1870.

Fig. 48.

Scandent shrubs or erect trees, 4 - 5 m tall; young branchlets sparsely pubescent; stipular thorns conical, 2 - 4 mm long, straight or slightly curved at tip; cataphylls conspicuous at base. Leaves oblong to broadly lanceolate, rounded to subcordate at base, acute or occasionally retuse with a callous mucro at tip, 10 - 24 x 5 - 8 cm, coriaceous, glabrous, glossy above, dull beneath, glaucous when dry; lateral nerves 8 - 10 pairs, with distinct reticulations; petioles 6 - 10 mm long. Flowers in supraaxillary serial rows with 1 - 6 flowers, 2.5 - 3 cm across, showy, white or creamy with blue to lavender centre, odorous; pedicels 8 - 12 (-15) mm long. Sepals subequal, oblong, acute, 8 - 12 x 2 - 4.5 mm, hairy along margins, firmly herbaceous. Petals oblong to lanceolate, 1.5 - 2.2 x 0.4 - 0.9 cm, white or creamy, turning to purple or dark red or dark violet on ageing. Stamens 20 - 35 (-75); filaments white, 1.5 - 2.5 cm long. Gynophore 1.8 - 2.5 (-3.5) cm long, thickened in fruits; ovary ovoid to ellipsoid, 3 - 3.5 x 1.4 - 2 mm, glabrous; placentae 4. Fruits globose to ovoid with 4 longitudinal sutures, 5 - 7 x 3 - 4 cm, orange red or orange-yellow; stalk 3.2 - 3.5 cm long, 2 - 4 mm thick; pericarp smooth, ca 2 mm thick, woody-coriaceous when dry; seeds many, embedded in juicy pulp, ca 8 x 5.5 mm.

Fl. Feb. - March; *Fr.* April - May.

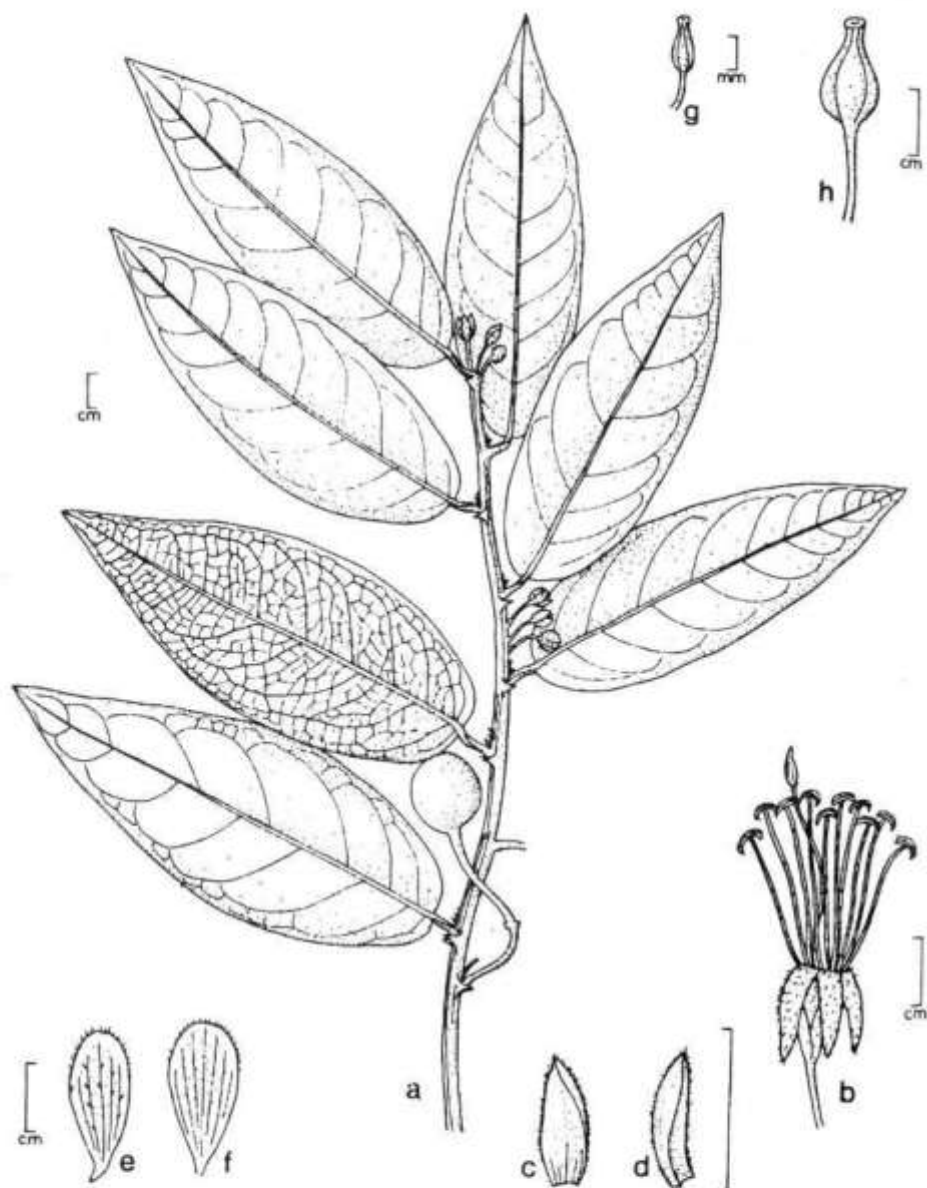


Fig. 48. *Capparis micracantha* DC. : a. twig with flowers and fruits; b. flower with petals removed; c. outer sepal; d. inner sepal; e. outer petal; f. inner petal; g. pistil; h. young fruit.

Distrib. India: Along water courses, in evergreen forests at low elevations. Andaman & Nicobar Islands.

Myanmar, S. China and S.E. Asia.

Notes. A showy plant whether in flowers or in fruits. At Kew there is a solitary specimen labelled "Herb. Rottler, Pen. Ind. Or." which is referable to this species. However as Jacobs (l.c.) pointed out this label seems to have been wrongly affixed. The species has not been known to occur in peninsular India.

16. *Capparis moonii* Wight, *Illus.* 1: 35. 1840; Hook. f. & Thomson in *Fl. Brit. India* 1: 175. 1872. Fig. 49.

Kon.: *Luthikai*; Mar.: *Poorwi*, *Wagati*.

Shrubs, woody, erect or scandent, armed, ascending up to 10 m; twigs flagellate, innovations brown-puberulous, later glabrescent; stipular thorns recurved, 2 - 3 mm long, absent in young twigs. Leaves elliptic-oblong, rounded at base, with a twisted acumen at apex, 5 - 18 x 3 - 5.5 cm, coriaceous, glabrous, lustrous; midrib shallowly sunken; lateral nerves 6 - 16 pairs with indistinct reticulations; petioles 1 - 1.8 cm long. Flowers white, purplish on ageing, showy, fragrant, 6 - 12-flowered on terminal or subterminal corymbs; buds 2 - 3 cm across; pedicels up to 5.5 cm long. Sepals subequal, 15 - 18 x 12 - 16 mm; outer pair concave, cup-shaped, smaller than inner, glabrous, inner pair flattish, fulvous-puberulous outside. Petals white, obovate or oblong, truncate at apex, unequal, veined; upper pair 3 - 3.5 x 2 - 2.5 cm; lower 2.8 - 3 x 2.2 - 2.5 cm, puberulous outside. Torus 5 - 8 mm across. Stamens 100 - 170; filaments white, turning rosy or brick red, 5.5 - 7 cm long. Gynophore 5 - 8 cm long, much thickened to 5 - 6 mm in fruits; ovary ovoid or ellipsoid, 3.5 - 5 x 2 - 3.5 mm, glabrous, green with purple tinge, stigma discoid; placentae 4. Fruits only 1 - 4 maturing in one inflorescence, pendent, subglobose or spindle-shaped, up to 16 x 12 cm; pericarp woody, green, turning reddish brown; endocarp viscous pulpy, lemon-yellow, turning scarlet; seeds 50 - 60, obovoid, 1.6 - 1.8 x 1.2 - 1.5 cm, pink; cotyledons ovate, acuminate, foliaceous, 1.8 - 2 x 1 - 2 cm.

Fl. Oct. - Dec., Feb. - April; *Fr.* Dec., March - Oct.

Distrib. India: Along rocky slopes on laterite soil in moist deciduous or semievergreen forests, from sea level to 1300 m, associated with *C. rheedii* and *C. zeylanica*. Maharashtra, Goa, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka.

Notes. The berries are used in treating skin ailments, jaundice, etc. and are also reported to be useful against tuberculosis. Laboratory trials proved that they have antitubercular properties *in vitro*, but clinical trials yielded negative results.

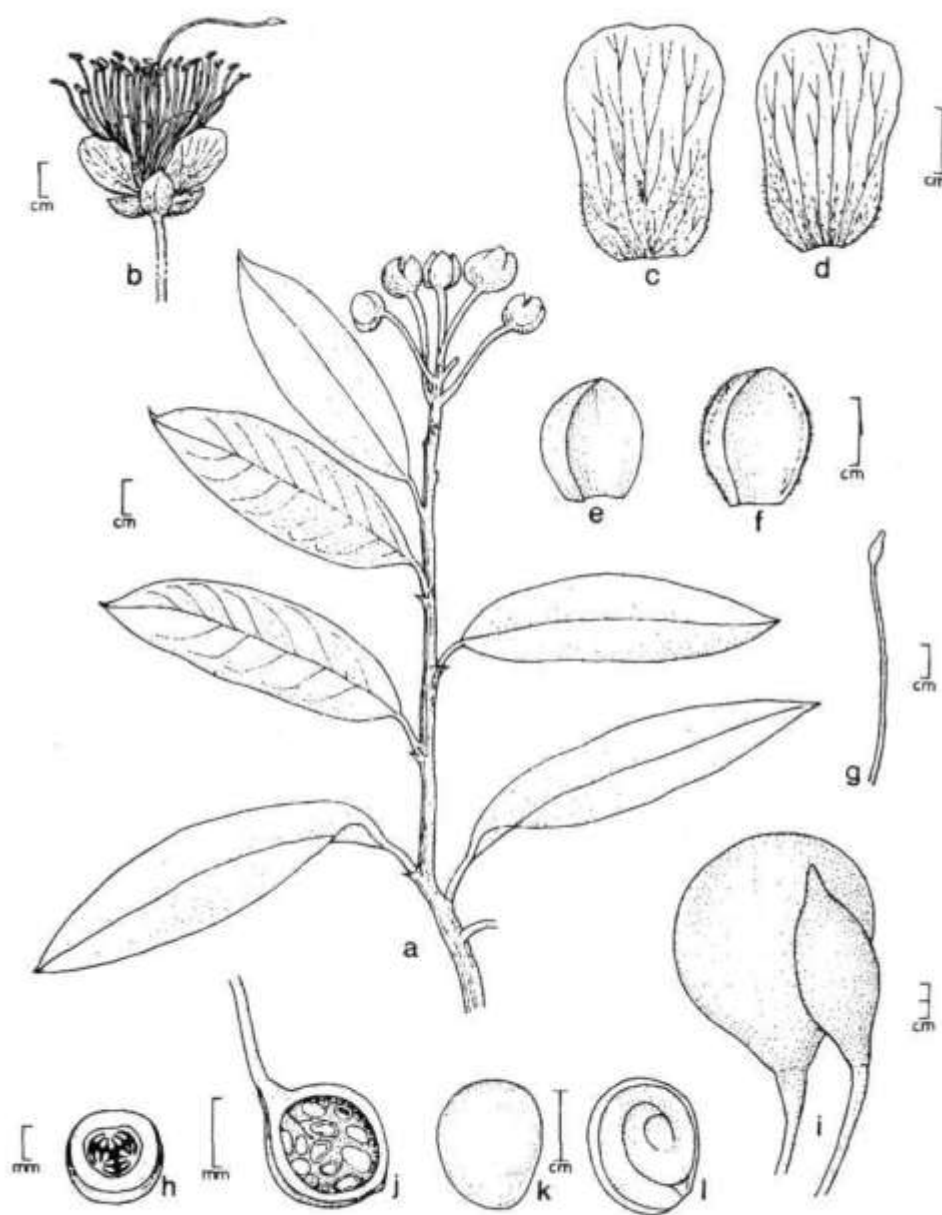


Fig. 49. *Capparis moonii* Wight: a. flowering twig; b. flower; c. outer sepal; d. inner sepal; e. outer petal; f. inner petal; g. pistil; h. t. s. of ovary; i. mature and immature fruits; j. l. s. of immature fruit; k. seed; l. seed opened, showing embryo.

It has a chromosome number of $n = 20$ (R. Sundara Raghavan, unpublished)

In exposed hillocks it is an erect bushy shrub, but when support is available it is a scandent shrub with a woody base up to 15 cm in circumference.

Female sterility is much pronounced in *C. moonii* and the allied species, *C. roxburghii* and *C. cleghornii*.

17. *Capparis multiflora* Hook. f. & Thomson in Fl. Brit. India 1: 178. 1872.
Fig. 50.

Asm.: *Thanim-niu-tre*.

Shrubs or trees, 3 - 6 m tall, sparingly branched; shoots slender, whitish pubescent at first with medifixed hairs, soon glabrate; stipular thorns ca 1 mm long, weak, straight, often absent; cataphylls subulate, 2 - 3 mm wide at base. Leaves elliptic-oblong, lanceolate or oblanceolate, broadest above the middle, attenuate or cuneate at base, gradually and abruptly acuminate with 5 - 15 mm long tip at apex, 12 - 30 x 4 - 10 cm; membranous, glabrous, dull-greenish when dry; lateral nerves 8 - 10 pairs, forming intra-marginal loop; reticulations distinct; petioles 8 - 11 mm long. Flowers white or greenish-white, fragrant, 4 - 6 mm across, numerous, arranged in supraaxillary vertical rows of 6 - 10 flowers subtended by bract-like leaf, on 8 - 25 (-40) cm long leafless parts of shoots between old and new leaves; pedicels filiform, 6 - 23 mm long, slightly thickened while fruiting. Sepals deflexed, imbricate, subequal, sparsely appressed hairy to glabrate; outer pair boat-shaped, ovate-obtuse; inner pair obovate, rounded at apex, 3 - 4.5 x 1.5 - 2.5 mm. Petals broadly elliptic or suborbicular, 5.5 - 6.5 x 3 - 4 mm, white. Stamens (8-) 10 - 12; filaments exceeding ovary. Gynophore 5 - 12 mm long, not thickened; ovary ovoid, 1.2 - 1.5 x 1 mm, glabrous or minutely pubescent; placentae 2, few-ovuled. Fruits 1 - 3 in a row, subglobose, 8 - 10 mm across; pericarp thin, reddish-purple, turning blackish; stipe slender, 2.2 - 2.5 x 0.5 mm; seeds 1 - 3, ca 6 x 4 mm.

Fl. Feb. - June; Fr. Sept. - Dec. (-March).

Distrib. India: In moist subtropical forests, between 500 - 1800 m. West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram and Meghalaya.

Nepal, Bhutan, Myanmar and China (Yunnan).

Notes. Leaves are often dimorphic, those subtending flowers are small and bract-like but flowers are also borne in axils of normal leaves. Normally flowers are densely crowded and seemingly racemose between two flushes of leaves. Female sterility is pronounced, linked to the length of gynophore. Ovaries with longer gynophores are invariably abortive.



Fig. 50. *Capparis multiflora* Hook. f. & Thomson: a. flowering twig; b. flower buds in extra-axillary serial rows; c. fruiting twig; d. inner and outer sepals; e. inner and outer petals; f. stamen; g. pistil.

Pollination is by butterflies. Honey is situated at base of posterior sepals. The denser the flowers, the more intense is the fragrance. The two posterior sepals overlap, leaving a narrow slit which in turn opens into the posterior boat-shaped sepal. Butterflies probing for nectar through the slit cross pollinate the ovary which is much shorter than the stamens.

18. *Capparis nilgiriensis* Subbarao, Kumari & Chandras. in J. Bombay Nat. Hist. Soc. 78: 146 - 148, f. 1 - 9. 1981. **Fig. 51.**

Tam.: *Karipandal-chedi*.

Shrubs or trees, 3 - 15 m tall; branches clustered, flexuous, indumentum stellate-pubescent, glabrescent at length; stipular thorns small, 1 - 2 mm long, straight, often lacking in flowering twigs but few on older branches; cataphylls linear, 3 - 5 mm long, conspicuous. Leaves ovate-elliptic or oblong-lanceolate, rounded at base, acute to obtuse at apex, not incurved along margins, chartaceous to subcoriaceous, dark green, drying glaucous to pale brown, lustrous, glabrescent; lateral nerves 5 - 7 (-9) with indistinct reticulations; petioles 5 - 13 mm long, channelled, glabrescent. Flowers showy, white, 3.5 - 4 cm across, axillary, solitary or 2 - 4 conferted on lateral shoots; bracts subulate, 2 - 3 cm long, caducous; pedicels 1.5 - 2.5 cm long, puberulous. Sepals almost equal, imbricate, puberulous; outer pair concave, ovate, obtuse, 6 - 8 x 3.5 - 4 mm; inner pair elliptic to obovate, narrowed at base. Petals tomentose, white; upper pair obovate-oblong, 1.8 - 2.2 x 0.7 - 1 cm, yellow with reddish blotch; lower pair elliptic-obovate, rounded at apex, 1.5 - 1.8 x 0.6 - 0.8 cm. Torus ca 1 mm wide. Stamens 16 - 24; filaments 2 - 3 cm long, elongating up to 4 cm and slightly thickened in fruits; ovary densely pubescent, spindle-shaped or oblong, 3.5 - 5 x 1.4 - 1.8 mm, furrowed with obscure beak; stigma sessile, glabrous; placentae 4, many-ovuled. Fruits pendulous, ovoid-oblong, obtuse, 4 - 6 x 2 - 3 cm; pericarp uneven, warty or corrugated; stipe slender, 4 - 6 cm long; seeds 8 - 16, embedded in yellow pulp, reniform, ca 10 mm long, ca 8 mm across.

Fl. March - April; *Fr.* May.

Distrib. India: Deciduous or evergreen Shola forests from 350 to 1200 m. Tamil Nadu (Nilgiri & Dharmapuri Dists.).

Endemic, endangered and nowhere abundant.

Notes. During March - April, the plant is most attractive when it is laden with flowers, but in view of pronounced female sterility, most flowers wither away and hardly 1 (or 2) fruits ripen to maturity.

Closely allied to *C. brevispina* but differs in flexuous leaves with flat margins and obscure reticulations and non-beaked, warty uneven pericarp of fruits. It is also allied to *C. srilankensis* Sund.-Ragh. endemic to Sri Lanka, but differing in fruits.

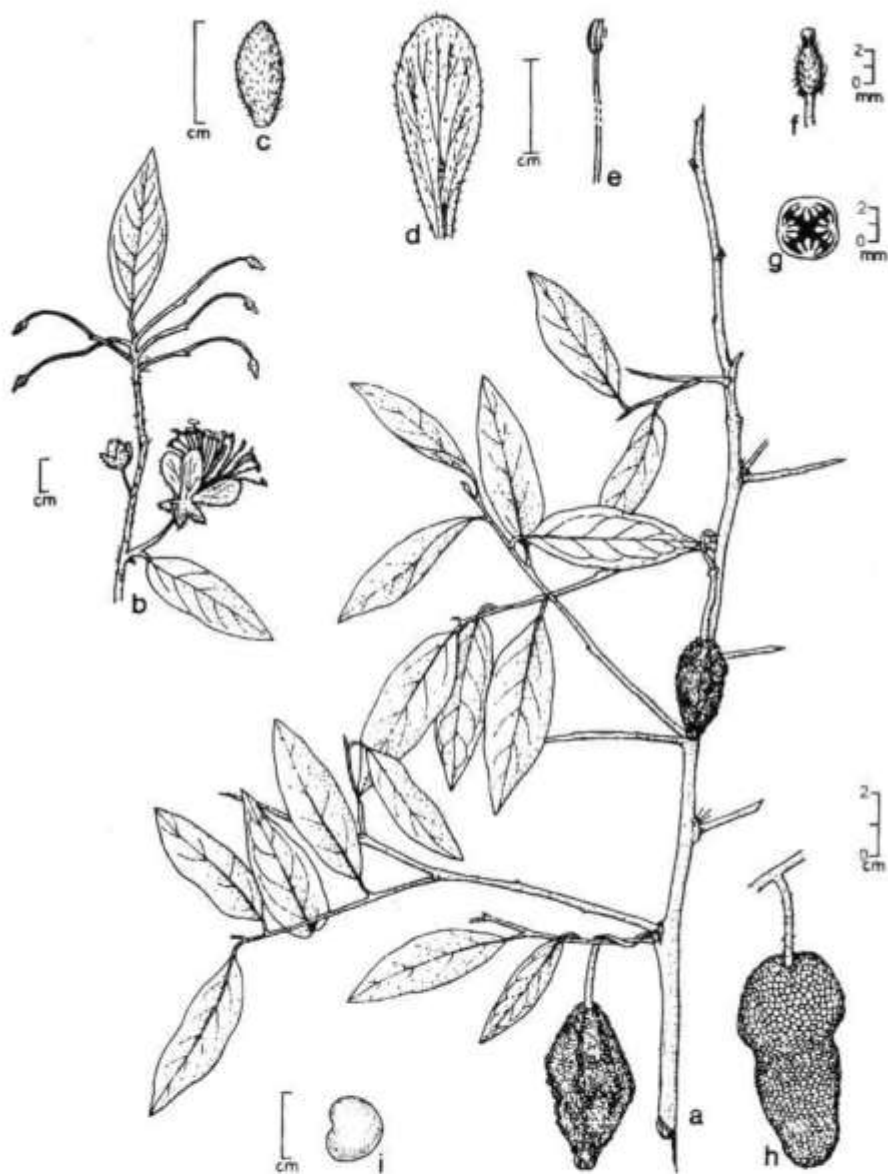


Fig. 51. *Capparis nilgiriensis* Subbarao et al. : a. fruiting twig; b. flowering twig; c. sepal; d. petal; e. stamen; f. pistil; g. t. s. of ovary; h. fruit; i. seed.

19. *Capparis olacifolia* Hook. f. & Thomson in Fl. Brit. India 1: 178. 1872.

Asm.: *Kotahar, Lokra*; Asm.(Kachari): *Borun-khosai, Philla-phang*; Kh.: *Dieng-sia*; Nep.: *Naski, Hais*.

Shrubs or small trees, ca 5 m tall; trunk 15 - 25 cm in diam. at base; twigs tomentose with brownish 5-armed stellate hairs at first, early glabrescent; cataphylls subulate, ca 1 - 1.5 mm at base; stipular thorns slender, up to 5 - 6 mm long, patent or pointing upwards. Leaves ovate-lanceolate, rounded to subacute at base, acute to acuminate and mucronulate at apex, 6 - 18 x 2.5 - 6.5 cm, chartaceous or firmly herbaceous, glabrous, lustrous, drying brownish; midrib flat; lateral nerves 5 - 8 pairs with indistinct reticulations; petioles 5 - 6 mm long, puberulous. Flowers in axillary or extra-axillary rows of 2 - 3 flowers, showy, white, 3 - 4 cm across, fetid; pedicels 6 - 12 mm long, puberulous. Sepals subequal, ovate-acute, concave, 7 - 10.5 x 2.5 - 6 mm; outer pair boat-shaped; inner pair lanceolate to elliptic, tomentose with white margins. Petals oblong or obovate to oblanceolate, 14 - 22 x 4 - 6 mm; outer pair white, inner pair with a purple or yellow blotch at base. Stamens 32 - 38, exerted, equalling gynophore; anthers ca 2 mm long, white, purple-veined, bluish when dry. Gynophore 2.5 - 3.5 cm long, not thickened; ovary ellipsoid, 4 - 5.5 mm long, ca 1.5 mm thick, beaked, tomentose; style persistent; stigma knob-shaped; placentae 2. Fruits globose to ovoid, beaked at apex, 13 - 15 x 11 - 12 mm; pericarp fairly thick, red, black when dry, glabrous; stalk thin, 3 - 3.8 cm long; seeds 1 (-3), globose, 4 - 5 mm in diam., brown.

Fl. Feb. - June; Fr. Aug. - Dec., March - April.

Distrib. India: Along grassy slopes between 300 - 1300 m, in subtropical forests. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Meghalaya, Orissa and N.E. Andhra Pradesh.

Nepal, Bhutan, Bangladesh and Myanmar.

Notes. The distribution does not extend to peninsular India and reports of its occurrence in Tamil Nadu and Kerala proved to be based on misidentifications. The flowers though white are at times described as yellow or purple due to a pair of petals being blotched yellow or purple. In Ludlow & Sherrif 1850 (BM) from Bhutan and Collett 615 (K) from Burma, the ovary is glabrous. The gynophore is invariably 3 - 5 times as long as pedicel. However, in Subbarao 47318 (MH) from Visakhapatnam District of Andhra Pradesh, the pedicel is more than half the length of the gynophore.

20. *Capparis pachyphylla* Jacobs in Blumea 12: 476 - 477. 1965.

Fig. 52.

Shrubs to small trees; branches stout, scrambling; twigs straight, brown pubescent, glabrescent at length; stipular spines patent, 1 - 3 mm long, straight or slightly curved at tip; cataphylls conspicuous at base of shoots, puberulous. Leaves elliptic-oblong, sub-

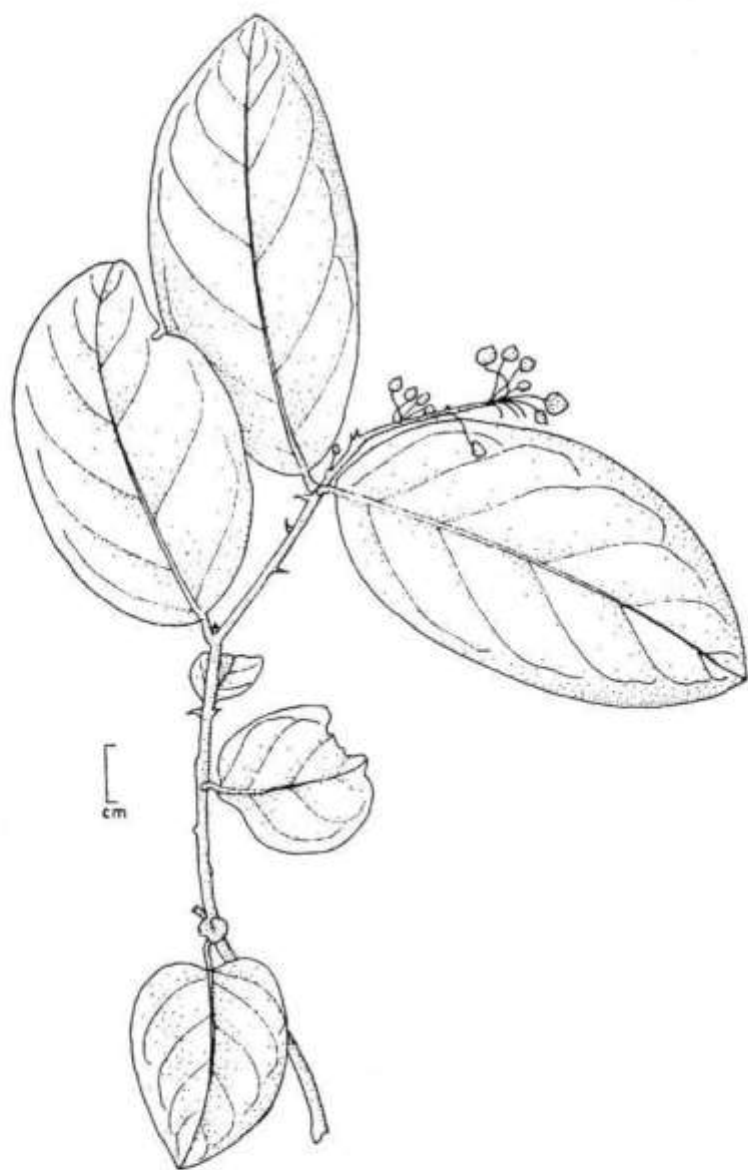


Fig. 52. *Capparis pachyphylla* Jacobs : Paratype, N.L. Bor 2866 from Aka hills, Arunachal Pradesh at 1200 m, collected on 5 March 1935.

cordate or rounded at base, obtuse or rounded and mucronate at apex, 8 - 13 x 4 - 5.5 cm, coriaceous, glabrous, dark green above, light green beneath; midrib flattish, grooved above near base; lateral nerves 5 - 6 pairs; reticulations obscure; petioles 3 - 5 mm long, glabrous. Flowers white or purple, 6 - 8 (-10) together in racemose bundles on an axillary or lateral 2 - 3 cm long puberulous stalk, sometimes in the form of a panicle; pedicels filiform, 5 - 7 mm long, subglabrous, subtended by thorn-like bracts and bracteoles. Sepals subequal, 5 - 6 x 2 - 3 mm, sparsely puberulous inside, ciliate along margins; outer pair much concave, inner pair more or less flat. Petals 6 - 7 x 2 mm, white, turning purple, puberulous inside, fringed with long hairs. Stamens 32 - 34. Gynophores glabrous; ovary small, glabrous; placentae 2. Fruits not known.

Fl. March.

Distrib. India: Subtropical evergreen forests, 600 - 1200 m. Arunachal Pradesh (Lohit & Tirap Districts).

Endemic and endangered.

Notes. The type was collected by Kingdon Ward 11183 (BM - holo, CAL, L - iso) from a gorge along Tezu river on 14 March 1935. This species has not been recollected from the area. Bor has also collected it from Aka hills, Yisi in Arunachal Pradesh in March 1935, which possibly forms the paratype though Jacobs does not designate it as such. Fruits are not known.

This species is probably threatened with extinction. However, the area of its original collection falls under the proposed Namdapha Biosphere Reserve.

21. *Capparis rheedei* DC., Prodr. 1: 246. 1824 (as *rheedii*). *C. heyneana* Wallich ex Wight & Arn., Prodr. 25. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 174. 1872. *C. baducca* auct. non L., 1753. **Fig. 53.**

Hindi & Kon.: *Chavruka*.

Shrubs, erect or scandent, much-branched, 2 - 4 m tall; twigs brown-pubescent, early glabrescent, with many cataphylls at base. Leaves elliptic-ovate to lanceolate, acute to rounded at base, acute-mucronate at apex, 8 - 19 x 4 - 7.5 cm, coriaceous, glabrous, lustrous above, drying brownish; lateral nerves 2 - 5 pairs, oblique and confluent towards base, distinctly reticulate; petioles 8 - 12 mm long. Flowers showy, 8 - 12 cm across, mostly solitary, axillary (rarely 2 - 6 arranged on a condensed leafless axillary shoot); bracts linear, reddish, pubescent; pedicels 6 - 20 mm long. Sepals elliptic, obtuse, sparsely pubescent outside, villous inside; outer pair 11 - 14 x 5 - 6 mm; inner pair 12 - 16 x 6 - 8 mm. Petals pale blue or white; upper pair with a yellowish blotch, obovate, 3.5 - 5 x 2.5 - 3.5 cm, glabrous. Stamens exceeding 80, exerted. Gynophore 2 - 4 cm long, glabrous, slightly incrassate in fruit; ovary oblong, 5 - 7 x 1.5 mm, densely



Fig. 53. *Capparis rheedii* DC.: **a.** flowering twig; **b.** leaves of lower branches; **c.** inner and outer sepals; **d.** outer and inner petals; **e.** ovary; **f.** fruits; **g.** seed; **h.** seed with testa removed, showing embryo.

pubescent, 4-angled, furrowed; placentae 4. Fruits oblong to ovoid-fusiform, beaked, 5.5 - 7 x 2 - 3.5 cm, pubescent, faintly ribbed when fresh; stipe slender, 5 - 7.5 cm long, ca 2 mm thick; seeds 18 - 22.

Fl. Feb. - Jan; *Fr.* July - Nov.

Distrib. India: Moist forests, up to 700 m, on laterite soil, associated with *Capparis moonii*, along Western Ghats. Southern Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Endemic, vulnerable and nowhere abundant.

Notes. In common with "Brevispina group", the upper petals have a yellow blotch. In *Kanodia* 96455 (BSI), two of the sepals are unusually petaloid, as in *C. divaricata*. Female sterility is high and berries seldom mature in nature. "Badukka" used by Rheede in Hort. Malab. 6: 101 (105). 1686 is not a Malayalam name for this plant. Its meaning or source is still unknown. Nicolson (in Bull. Bot. Surv. India 17: 160 - 161. 1975) contends that *C. baducca* is a New World species not occurring in India and that the Indian plant should be lectotypified by Rheede's description and plate only. Also refer to Nicolson et al., An interpretation of Van Rheede's Hortus Malabaricus p. 77. 1988.

22. *Capparis rotundifolia* Rottler, Neue. Schr. Ges. Naturf. Fr. Berl. 4: 185. 1803. *C. pedunculosa* Wallich ex Wight & Arn., Prodr. 27. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 176. 1872. *C. longispina* Hook. f. & Thomson, l. c. 1: 176. *C. orbiculata* Hook. f. & Thomson, l.c. 176.

Mar.: *Kolisna*, *Kakkaltee*.

Shrubs, erect or scandent, 2 - 5 m tall, with dense rounded crown; twigs pubescent, early glabrescent; stipular thorns reddish, dimorphic, if recurved 2 - 5 mm long, if straight and acicular, up to 18 mm long. Leaves bifarious, closely placed, suborbicular to ovate-rotundate, cordate at base, acute, obtuse, retuse or abruptly acuminate, mucronate at apex, slightly revolute along margins, 1 - 4.5 x 0.8 - 3 cm, subcoriaceous, often fleshy, glabrous above, pubescent beneath; lateral nerves 3 - 6 pairs, obscure; petioles 0.2 - 2.5 mm long. Flowers white or greenish-white, 8 - 12 mm across, in few-flowered umbels or subumbels on lateral 4 - 15 mm long peduncles or on 1-leaved 3 - 5 cm long twigs or occasionally axillary, solitary; pedicels filiform, 1 - 3.2 cm long, minutely puberulous. Sepals imbricate, reflexed, 4 - 5 x 2 - 2.5 mm, glabrous or puberulous; outer pair with narrow and inner pair with wider membranous margins. Petals 5 - 5.5 x 3 mm, very thin, puberulous. Stamens 28 - 40, exserted. Gynophore filiform, slightly thickened near tips, 12 - 18 mm long; ovary ovoid, pointed at apex, 1.8 - 2 x 1 mm; placentae 2, few-ovuled. Fruits ovoid-globose, apiculate, 9 - 15 x 8 - 10 mm; pericarp white, smooth, ca 1 mm thick; stipe slender, up to 5.5 cm long; seed solitary.

Fl. Oct. - Nov., Jan. - May; *Fr.* April - June; Oct.

Distrib. India: Along cleared forest areas on laterite soil, frequent in scrub jungles, moist deciduous or semi-evergreen forests. Maharashtra, Andhra Pradesh, Goa, Karnataka, Tamil Nadu and Pondicherry.

Sri Lanka.

Notes. Except for a solitary collection from Tanjore (Dunn 1957, MH), no other collection exists from Tamil Nadu. It is infrequent in Andhra Pradesh and has not been recorded from Kerala. Even in Karnataka, it is common only in N. Kanara District. Pierre had collected it from S. India, but due to mislabelling, erroneously noted as from "Cambodia".

The stipular thorns are highly variable, either short or recurved or long, straight and acicular. Not infrequently, out of the two thorns, one is short and recurved, whereas the other is long and acicular, the latter mostly associated with small subsessile, cordate and mucronate-tipped leaves.

23. *Capparis roxburghii* DC., Prodr. 1: 247 - 248. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 175. 1872.

Or.: Handiphuta, Kaodimi.

Shrubs, scandent, 2 - 4 m tall, 8 - 10 cm in circumference at base; branches hoary pubescent, early glabrescent; stipular thorns 1.5 - 3 mm long in old shoots, but mostly absent in young twigs. Leaves obovate-oblong, cuneate at base, rounded, acute or abruptly acuminate at apex, 4.5 - 8 x 2.5 - 3.5 cm, subcoriaceous, glabrous, lustrous, drying dull brownish; lateral nerves 5 - 6 pairs with obscure reticulations; petioles 1.3 - 2 cm long, channelled, glabrous. Flowers showy, white, fragrant, 4 - 5.5 cm across, in terminal 6 - 15-flowered corymbs or rarely subumbels; pedicels 2.5 - 3.8 cm long, glabrous or minutely puberulous. Sepals glabrous, 9 - 10 x 6 - 9 mm; outer pair much concave. Petals obovate, narrowed at base; truncate at apex, 11 - 15 x 9 - 11 mm, puberulous on both surfaces. Torus 3 - 4 mm across. Stamens 45 - 60; filaments white, rosy-purple on ageing, 2.5 - 3 cm long. Gynophore 3.5 - 5.5 cm long, thickened to 3 - 5 mm in fruit; ovary ellipsoid or ovoid, ca 3.5 x 2.5 mm; placentae 3 - 5, many-ovuled; stigma capitate. Fruits globose, umbonate, 4.5 - 6 cm across, pendent; stipes 8 - 10 cm long, 4 - 5 mm thick; seeds 35 - 40, ovoid, 1 - 1.2 x 1 cm, reddish brown; cotyledons foliaceous, coiled, elliptic with obtuse tip, 12 x 8 mm.

Fl. March - May, July - Aug.; *Fr.* May - Oct.

Distrib. India: Along rocky slopes in dry deciduous forests up to 600 m, often associated with *C. divaricata*, *C. grandiflora*, etc. Orissa, Andhra Pradesh and Tamil Nadu.

Sri Lanka.

Notes. Chromosome number is $n = 20$ (R. Sundara Raghavan, unpublished). Refer to Sundararaghavan & Rolla S. Rao in J. Bombay Nat. Hist. Soc. 63(3): 418 - 421. 1965 & Sundararaghavan in Blumea 20: 356. 1972 for further details and discussions on taxonomy of this species.

24. *Capparis sepiaria* L., Syst. Nat. ed. 10. 2: 1071. 1759; Hook. f. & Thomson in Fl. Brit. India 1: 176. 1872. *C. incanescens* DC., Prodr. 1: 247. 1824. *C. sepiaria* L. var. *incanescens* (DC.) Hook. f. & Thomson, l. c. 177. *C. glauca* Wallich ex Hook. f. & Thomson, l. c. 180.

Beng.: *Kaliakhara*; Guj.: *Kanthar*, *Kanthare*; Hindi: *Heens*; Mar.: *Kanthara*, *Kanthodi*, *Pachuda*, *Pachra*, *Pachunda*; Kan.: *Kothi*; Or.: *Hathi-ankusa*, *Kantikapala*; Tam.: *Kadukattiri*, *Serraputtai*, *Thorattai*.

Shrubs, rarely trees, erect or scandent, 2 - 6 m tall, widely much-branched, densely armed; twigs zig-zag, flexuous, hoary or appressed grey-pubescent; indumentum occasionally ash-white; stipular thorns recurved, 3 - 4 mm long, copious. Leaves ovate, ovate-elliptic, oblong to oblong-lanceolate or suborbicular, rarely exceptionally linear, acute, blunt, rounded or rarely subcordate at base, acute or often rounded and always emarginate or retuse at apex, 1.5 - 5.5 x 0.4 - 3.5 cm, herbaceous to subcoriaceous, pubescent, dull and glaucous when dry; midrib slightly sunken at base above; lateral nerves 4 - 6 (-8) pairs with obscure reticulations. Flowers white, creamy or even greenish white, fragrant, 8 - 10 mm across, in terminal 8 - 30-flowered corymbose subumbels, or on short lateral twigs; peduncles up to 1.5 cm long; pedicels 8 - 12 mm long. Sepals subequal, ovate or suborbicular, ciliate along margins; outer pair 3.5 - 4 x 2 - 3 mm, coriaceous; inner pair smaller than outer, membranous. Petals obovate or oblong-spathulate, rounded at apex, 5 - 6 x 2 - 3 mm, white, puberulous at base. Stamens 25 - 40; filaments 10 - 14 mm long, exerted; anthers brown. Gynophore 5 - 6 (-10) mm long, slender, slightly thickened in fruits, puberulous towards base; ovary ovoid, 1.5 - 2 x 0.8 - 1 mm, glabrous; ovules few; placentae 2. Fruits globose, 8 - 12 mm across, yellow turning black or dark-violet; stipe thin, 1.4 - 2 cm long; seeds 1 (-2), embedded in a sticky pulp, discoid, ca 6 x 4 mm, brown.

Fl. March - July; *Fr.* Oct. - Nov.

Distrib. India: In scrub or deciduous forests, from sea level to 350 m. Almost throughout India from Kashmir to Kanyakumari and Andaman & Nicobar Islands (except hill States of N.E. India).

Nepal, Bangladesh, Myanmar, Sri Lanka and Maldives, extending to Africa, China, Vietnam, Malesia and Australia.

Notes. As it can be raised from cuttings, can be used as a hedge plant. Berries are edible.

In some collections from Maharashtra (Santapau 28662 & Tavasari 1066 in BLAT), the peduncles are hardly 1.5 mm long.

Specimens from Andaman & Nicobar Islands show larger parts as compared to mainland Indian specimens. Leaves up to 10 x 5 cm; flowers 1.5 - 1.8 cm across, pedicels up to 2.2 cm long, sepals up to 5.2 x 2 mm, petals up to 8 x 4 mm and fruits up to 2 cm across.

The Burmese plants labelled "*C. glauca*" have narrow glaucescent leaves, smaller flowers which are arranged in a panicle of umbels, stamens varying from 12 - 18 and short hardly 2 mm long gynophore.

It has chromosome number of $2n = 40$ (T.S. Raghavan in Ann. Bot., Lond., n.s. 2: 75: 1938).

25. *Capparis shevaroyensis* Sund.-Ragh. in Kew Bull. 37: 72. 1982. *C. parviflora* Hook. f. & Thomson in Fl. Brit. India 1: 176. 1872, non Boiss. 1843. **Fig. 54.**

Shrubs, erect or scandent, irregularly profusely branched, up to 3 m tall; twigs wiry, puberulous when young, early glabrescent; stipular thorns mostly lacking, if present minute, ca 1 mm long, straight, few, pointing upwards; cataphylls absent. Leaves lanceolate or oblong-lanceolate, narrow, cordate at base, acute to caudate-acuminate at apex, with up to 1.2 cm long acumens, 5 - 12 x 1.6 - 4.8 cm, subcoriaceous, glabrous, dull green above, yellowish green beneath; lateral nerves 6 - 9 pairs, forming an intra-marginal loop; reticulations distinct above, obscure beneath; petioles 0.5 - 2.5 mm long. Flowers white or creamy white, fragrant, 6 - 8 mm across, in terminal, subterminal or upper axillary 5 - 10-flowered umbels; bracts subulate, ca 1.5 mm long; pedicels filiform, 4 - 5 mm long, glabrous. Sepals subequal, ca 3.5 mm long, 1.5 - 1.8 mm wide. Petals oblong to obovate, 3 - 4 x 2 mm, puberulous at base. Stamens 20 - 42. Gynophore filiform, 4 - 5 mm long, not thickened in fruit; ovary ovoid, ca 1.5 mm long, 0.8 - 1 mm thick, glabrous; placentae 2. Fruits yellowish-brown, globose, pisciform, 8 - 10 mm across, smooth on a slender stalk, 1.3 - 1.6 cm long, one-seeded.

Fl. March; *Fr.* Aug. - Sept.

Distrib. India: Moist forests, from 400 to 800 m. Tamil Nadu (confined to Tirunelveli Dist.), Kerala (confined to Silent Valley area in Palakkad Dist.).

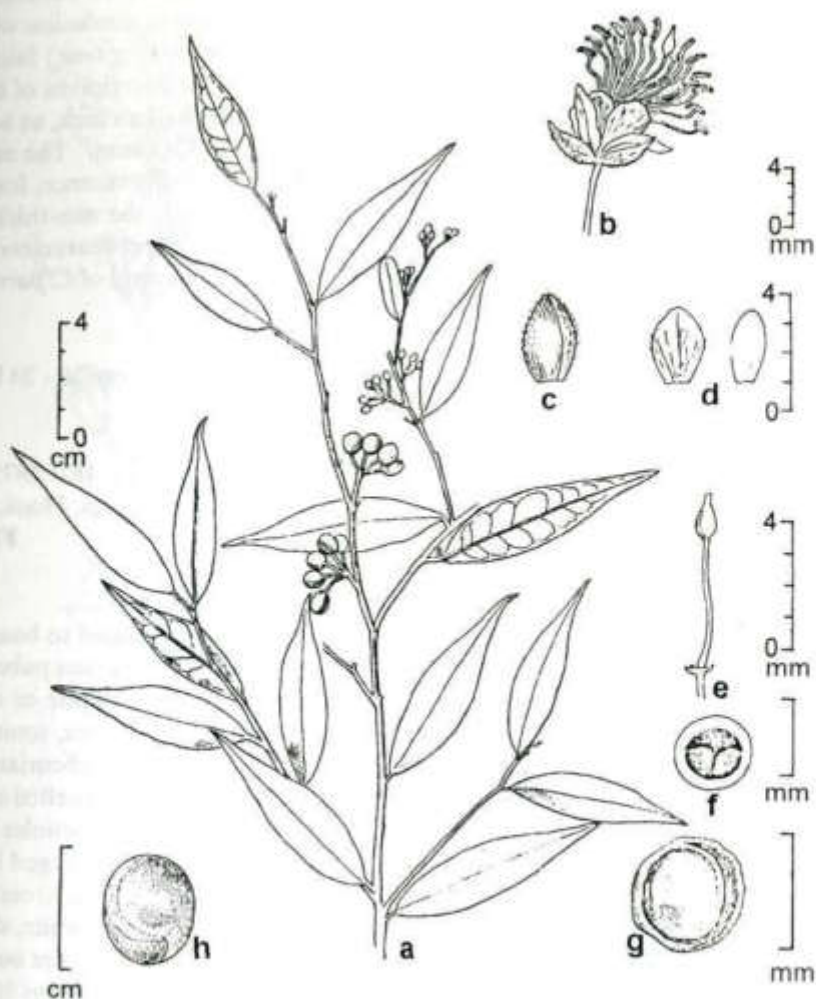


Fig. 54. *Capparis shevaroyensis* Sund.-Ragh. : a. twig with buds and immature fruits; b. flower; c. sepal; d. outer and inner petals; e. pistil; f. t.s. of ovary; g. fruit; h. seed.

Endemic and threatened.

Notes. Beddome's description and plate of *C. parviflora* Hook. f. & Thomson (in Ic. Pl. Ind. Or. 65, t. 276. 1876) are misleading, hence its apparent confusion with *C. fusifera* Dunn (= *C. tomentella* Dunn). Though his plate (excluding fruit) faithfully depicts his specimen nos. 61 and 273 (viz. *C. fusifera* Dunn) his description of leaves being "very narrow", fruits being "fusiform", scarcely exceeding half an inch, as well as his drawing of the berry, all pertain to *C. parviflora* Hook. f. & Thomson. The narrow greenish glabrous leaves with petioles of 2 mm long, nature of inflorescence, fragrant small flowers, sepals and petals hardly exceeding 4 mm in length, the non-thickened fruiting stalk and globose berries of 8 - 10 mm in diameter, all reflect characters of *C. parviflora* Hook. f. & Thomson, which happens to be a later homonym of *C. parviflora* Boiss. and hence illegitimate.

Jacobs (in Blumea 12: 477. 1965) mentions stamens as ranging from 16 - 24 but in many recent collections, it varies from 24 to 42.

26. *Capparis sikkimensis* Kurz in J. Asiat. Soc. Bengal 43(2): 181. 1875. *C. cathcartii* Hemsley ex Gamble, Darjeeling List ed.2. 1896. *Capparis* sp. Hook. f. & Thomson in Fl. Brit. India 1: 180. 1872. Fig. 55.

Shrubs, scandent, 4 - 6 m tall; stipular thorns hooked, few, confined to base, but mostly wanting in flowering shoots; twigs purple tinged; young shoots fulvous pubescent with simple hairs, but early glabrescent; cataphylls absent. Leaves elliptic or ovate, attenuate at base, rounded, often abruptly and shortly acuminate at apex, somewhat inrolled along margins, 7 - 15 x 3.5 - 7.5 cm, glabrous, chartaceous to subcoriaceous, lustrous above, dull beneath, drying brown; midrib flattish to shallowly channelled above; lateral nerves 7 - 9 pairs, prominent beneath; reticulations obscure; petioles 1 - 2 cm long. Inflorescence axillary, 8 - 20-flowered umbels, these in turn arranged in the form of a subterminal or terminal up to 18 cm long panicles; peduncles up to 10 cm long, angular; pedicels conferted towards top, 2 - 2.5 cm long, glabrous. Flowers white, showy, 2.5 - 3.5 cm across. Sepals ovate-orbicular, 7 - 12 x 4 - 5 mm, fulvous pubescent outside, greenish yellow. Petals obovate, 12 - 25 x 5 - 8 mm, white hairy inside. Stamens 28 - 40; filaments pink. Gynophore 3.5 - 4.5 cm long, reddish, much thickened in fruit; ovary ovoid or ellipsoid, apiculate, 2.5 - 4 x 1.5 - 2 mm, glabrous; placentae 4. Fruits subglobose or ovoid, umbonate, 3 - 6.5 cm across; pericarp reddish purple, up to 10 mm thick, smooth but wrinkled on drying; stipe woody, 5 - 6 cm long, 3 - 6 mm thick; seeds 4 - 8, embedded in scanty yellowish pulp, ca 1.8 x 0.8 cm.

Fl. May - June; *Fr.* Sept. - Nov.



Fig. 55. *Capparis sikkimensis* Kurz : a. flowering twig; b. twig with immature fruits; c. flower with sepals and petals removed; d. outer sepals; e. inner sepals; f. outer petals; g. inner petals; h. stamen; i. pistil.

Distrib. India: Along hilly tracts in open forests or along dense forest outskirts, often near streams, up to 1750 m. altitude. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Meghalaya.

Myanmar and China.

Notes. The Indian plants belong to subsp. *sikkimensis*. The unarmed "*Capparis*" sp. in Hook. f., Fl. Brit. India 1: 180. 1872 is referable to *C. sikkimensis* only. Kanjilal et al. do not include this species in Flora of Assam, though it is rather common in N.E. India.

Jacobs (l. c.) could not locate the type specimen. But the specimen Kurz no. 2 from Sikkim located in CAL herbarium under Accession number 29236 is designated as type, as except for this no other collection exists in CAL, K, or BM. The locality is most probably Kurseong, based on which Prain (in Ann. R. Bot. Gard. Calc. 9 (1): 8, t. 10. 1901) has depicted his plate.

27. *Capparis spinosa* L., Sp. Pl. 503. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 173. 1872.

Undershrubs, diffuse, prostrate or trailing, glabrous or pubescent with white cottony caducous tomentum; innovations with rather long white hairs; twigs appressed tomentose to glabrescent; stipular thorns divaricate, pale straw-yellow, 5 - 7 mm long, hooked; roots thick, woody. Leaves variable, 1 - 1.8 times as long as broad, ovate, obovate, elliptic or orbicular, rounded at base, retuse, obtuse or acute-mucronate or spine-tipped at apex, 1.2 - 6.5 x 1.2 - 4 cm; midrib rather obscure above; lateral nerves 3 - 4 pairs; reticulations obscure; petioles 2 - 25 (-28) mm long. Flowers solitary, axillary, sparsely scattered along twigs, showy, odorous, white suffused with red, fading rosy-pink to purple, 3 - 5 cm across; flower buds 1.5 - 2.5 cm in diam.; pedicels sturdy, 3 - 6 (-8) cm long, glabrous. Sepals subequal, nearly actinomorphic to strongly zygomorphic with the posterior sepal then being exceedingly saccate, 1.8 - 2 x 1.3 - 1.6 cm, 3 - 5 mm deep near apex; the rest 2 - 2.2 x 0.8 - 1 cm. Petals slightly exceeding sepals; posterior petal obdeltoid, 2.8 - 3.6 x 1.6 - 1.8 cm, others obovate-cuneate, often hood-shaped, 2 - 3 x 1 - 1.6 cm. Stamens exceeding 60, often up to 190; filaments longer than petals, exerted, white, fading pinkish. Gynophore 3 - 8 cm long, thickened, and much elongated in fruits, sometimes hairy towards base; ovary glabrous, ribbed, obovate, 3.5 - 4 x 2 - 2.5 mm; placentae 6 - 8. Fruits smooth, ellipsoid, ovoid or oblong-obovoid, 3 - 5 x 1 - 1.8 cm, red, 5 - 6-ribbed, splitting from apex into 4 parts; stalk 4 - 8 mm long, ca 1.5 thick; seeds 3 - 4 mm in diam., embedded in scarlet pulp.

Notes. This species is highly variable and polymorphic. As far as Indian subcontinent is concerned, three distinct varieties, including type variety, are recognisable. Following Jacobs (in Blumea 12: 416 - 420. 1965), var. *galeata* and var. *himalayensis* are treated as varieties of *C. spinosa*, although Jafri (in Fl. W. Pakistan 34: 6 - 10. 1973) prefers to treat them as distinct species. The nature of innovations, size, shape and

texture of leaves, galeate or otherwise of the posterior sepal, depth of saccate sepal, length and pubescence of gynophore are all quantitative characters and hence treated here at varietal level only, though at extremities the characters look markedly contrasting and seemingly quite distinct.

KEY TO THE VARIETIES

- 1a. Sepals nearly actinomorphic, posterior sepal shallowly galeate; petals not hooded 27.3. var. *spinosa*
 b. Sepals strongly zygomorphic, posterior sepal deeply saccate, one sepal and two petals hooded 2
 2a. Twigs glabrous to early glabrescent; leaves fleshy, cartilaginous; petioles 15 - 28 mm long; gynophore
 3 - 4 cm long 27.1. var. *galeata*
 b. Twigs appressed tomentose, later glabrescent; leaves otherwise; petioles 2 - 7 mm long; gynophore
 5 - 8 cm long 27.2. var. *himalayensis*

27. 1. var. *galeata* (Fresen.) Hook. f. & Thomson in Hook. f., Fl. Brit. India 1: 173. 1872. *C. galeata* Fresen. in Mus. Senck. 2: 111. 1837.

Guj.: Katar.

Shrubs, prostrate, straggling or erect, 1.5 - 3 m tall, glabrous, glaucous; twigs zig-zag, brittle with short internodes; stipular thorns orange-yellow, recurved, 2 - 6 mm long. Leaves ovate, elliptic or orbicular, rounded at base, emarginate at apex with a hooked yellowish or brown spine inserted below the apex, 2.5 - 6 x 1.5 - 3.5 cm, fleshy, cartilaginous, glabrous, coriaceous, drying greyish green; lateral nerves 3 - 4 pairs, obscure; petioles 15 - 28 mm long. Flowers white, tinged pink or mauve, showy, 4 - 6 cm across; pedicels 4 - 6 cm long, stout, glabrous, elongating up to 9 cm in fruits. Calyx strongly zygomorphic; posterior sepal deeply galeate, 2.8 - 5 x 1.8 - 2.8 cm with a depth of 0.9 - 1.6 cm; other sepals oblong, 2 - 2.5 x 1 - 1.5 cm. Petals not exceeding sepals, posterior petal hooded, enclosed by posterior sepal. Stamens about 100 or more. Gynophore 3.5 - 5 cm long, much thickened in fruits; placentae 8. Fruits pear-shaped or ellipsoid, 3.5 - 6 x 2 - 2.8 cm, reddish, dehiscing tardily; stipes 5 - 9 cm long, 4 - 5 mm thick.

Fl. & Fr. July - Sept.

Distrib. India: Mostly coastal areas from sea level to 300 m, often pendulous on old walls and rocky slopes. Gujarat.

Pakistan, Iran, Iraq, Israel extending to tropical N. Africa.

Notes. Chromosome number reported is $n = 10$ (Baquar et al. in Bot. Notiser 119: 24 - 32. 1966). This variety is fairly common along coastal Gujarat. It is easily distinguished from var. *spinosa* by the thick cartilaginous, fleshy leaves with a strongly

recurved mucro inserted below the apex at the end of midrib, longer petioles and strongly saccate posterior sepal. The cartilaginous leaf is probably an adaptation to the arid habitat.

27. 2. var. himalayensis (Jafri) Jacobs in Blumea 12: 419 - 420. 1965. *C. himalayensis* Jafri in Pakistan J. For. 6: 197, t.1, f.1. B, map. 1956. *C. spinosa* var. *leucophylla* sensu Hook. f. & Thomson in Fl. Brit. India 1: 173. 1872, non DC. 1824.

Hindi: *Kabra*.

Shrubs, diffuse, prostrate or hanging; twigs appressed soft pubescent; stipular thorns yellow, 4 - 6 mm long, curved at tip. Leaves rounded at base, acute or rarely obtuse and spine-tipped at apex, 2.8 - 4.5 x 2 - 3.8 cm, subcoriaceous, pubescent, drying greenish yellow; lateral nerves 3 - 6 pairs, obscure; petioles 2 - 7 mm long, pubescent. Flowers showy, mildly fragrant, white, rosy tinged, fading purplish, 3.5 - 6 cm across; pedicels 3 - 7 cm long, pubescent, elongating up to 9 cm and thickened in fruits. Sepals strongly zygomorphic, pubescent; posterior sepal 2.5 - 4.5 x 1 - 1.5 cm, 1 - 1.5 cm deep, narrowed at base, others 1.5 - 2.5 x 0.8 - 1.5 cm. Petals almost equalling outer sepals. Stamens 80 - 100; filaments mauve, turning purple. Gynophore 4 - 8 cm long, puberulous at base, thickening up to 3 mm in fruits; ovary faintly ribbed, obovoid, 6 - 8 x 2 - 3 mm; placentae 5 - 8. Fruits oblong-ellipsoid, ribbed, 3 - 5 x 1.8 - 2.3 cm, tardily dehiscent; seeds as in var. *spinosa*.

Fl. & Fr. May - Aug.

Distrib. India: On rocky cliffs, hanging from crevices at altitudes of 1500 - 2000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan and Nepal.

Notes. *C. leucophylla* DC. is altogether distinct and non-Indian. In Indian floras, *C. spinosa* var. *leucophylla* sensu Hook. f. & Thomson and sensu Collett (Fl. Siml.) represent var. *himalayensis*. In Himachal Pradesh, where both var. *spinosa* and var. *himalayensis* occur, introgressive hybridisation is common and characters intergrade so that the varieties cannot be separated. Flowers open at dusk or evening and last for one day.

27. 3. var. *spinosa*

Beng.: *Kabia*; Guj.: *Kantala, Kanthera*; Hindi: *Kabra*; Mar.: *Kabra, Kalavri, Vundri*; Punj.: *Keri, Kerail*; Sind.: *Kalvari*.

Fl. Dec. - May (Western India), July - Nov. (Northern India); *Fr.* Feb. - May (Western India), July - Dec. (Northern India).

Distrib. India: Along dry stony rocks, frequent in scrub jungles from 500 - 3500 m. Jammu & Kashmir, Punjab, Uttar Pradesh, Rajasthan, West Bengal, Gujarat, Maharashtra, Goa and Tamil Nadu.

Pakistan, Nepal, Bangladesh and eastwards to Australia and westwards to Europe and N. America.

Notes. Young and ripe fruits are edible; berries are boiled and eaten with curd. Unripe berries are pickled. Leaves used as fodder for goats, camels and sheep. Infusion of leaves used in treating gonorrhoea. In Ladakh a decoction of the leaves is drunk against hyperacidity.

There are no recent collection from peninsular India, except for a solitary collection from Madurai. On ripening, berries separate curling into 3 - 4 segments exposing seeds embedded in scarlet pulp. Dispersal of seeds is by animals.

Chromosome number reported is $2n = 38$ (Taylor in Amer. J. Bot. 12: 238. 1935).

28. *Capparis tenera* Dalz. in Hook., J. Bot. Kew Gard. Misc. 2: 41. 1850; Hook. f. & Thomson in Fl. Brit. India 1: 179. 1872.

Shrubs, straggling, glabrous, up to 4 m high, with spreading branches; stipular thorns strongly recurved, sharp, 2 - 4 mm long; innovations glabrous, if tomentose, early glabrescent. Leaves distichous, ovate-elliptic or obovate-oblong, rounded or subcordate at base, acute to abruptly 8 - 10 mm long caudate-acuminate with blunt tip at apex, 4 - 7 (-11) x 2.5 - 4 (-5) cm, membranous, herbaceous to subcoriaceous, glaucous; midrib shallowly sunken; lateral nerves 4 - 5 pairs with obscure reticulations; petioles 2.5 - 6 mm long. Flowers in supra-axillary serial rows of 1 - 4 flowers, white, fragrant, 8 - 12 mm across; pedicels filiform, 1.5 - 5 mm long, glabrous, not thickened in fruit. Sepals subequal, deflexed, green, purple-tinged; outer pair boat-shaped, ovate, acute, largely covering inner pair, 4.5 - 6 x 2.2 - 2.5 mm, pubescent inside, ciliate along margins; inner pair elliptic-lanceolate, puberulous at base and towards base. Petals slightly larger than sepals, oblong or ovate-oblong, acute, 5.5 - 7 x 1.8 - 2 mm, white with a red basal blotch on upper pair, tomentose at surface and margins. Stamens 8 - 15 (-18); filaments white, 14 - 20 mm long; anthers bluish. Gynophore filiform, 14 - 20 mm long, white, glabrous, not thickened; ovary pear-shaped, 1.5 - 1.8 mm long, ca 5 - 8 mm thick, purple tinged; stigma knob-shaped; placentae 2; ovules few. Fruits pisciform or subglobular, sometimes pointed, 8 - 12 mm across; pericarp thin, deep orange or red when ripe; seeds 3 - 4, ca 5 x 4 mm.

Fl. Feb. - May; *Fr.* May - June.

Distrib. India: Up to 600 m, in moderately high rainfall zones. Assam, Nagaland, Manipur, Maharashtra, Karnataka, Kerala and Andaman & Nicobar Islands.

Sri Lanka, Myanmar, Thailand and westward extending to tropical Africa.

Notes. The distribution does not extend to Sikkim and the reported collection by Thomson s.n. in 1857 is probably due to mislabelling. Bell, Blatter, Ritchie and Talbot have earlier recorded this species from North Kanara and similarly Barber and Beddome from Kerala. However, there are no recent collections from Karnataka or Kerala, except for the historical collections deposited in BLAT, CAL and K. The specimens from Andaman Islands have unusually larger leaves, flowers and fruits.

29. *Capparis zeylanica* L., Sp. Pl. ed. 2. 720. 1762. *C. horrida* L. f., Suppl. 264. 1781; Hook. f. & Thomson in Fl. Brit. India 1: 178. 1872.

Hindi: *Asaria, Bagnai, Jaginbel*; Kan.: *Anthundikai*; Mar.: *Toratti, Wagati*; Nep.: *Bagdanch*; Sans.: *Buraasaria, Hunkura*; Tam.: *Adandai, Ekkathari, Morundan, Tondai, Toratti*; Tel.: *Adandi*.

Shrubs, climbing or straggling, ascending up to 8 m, densely armed with 4 - 6 mm long recurved stipular thorns; twigs densely covered with rufous or greyish stellate scurfy deciduous tomentum; cataphylls absent. Leaves ovate, elliptic, lanceolate or obovate, rounded, subcordate or cuneate at base, acute, acuminate or obtuse, twisted with a callous recurved mucro at apex, 2 - 7 (- 11) x 1.5 - 5.5 (-8) cm, dull, coriaceous, glabrous or glabrescent; lateral nerves 4 - 8 pairs; reticulations distinct; petioles 5 - 12 (- 20) mm, pubescent. Flowers showy, white, fading to pink or purple, fragrant, 3.5 - 5 cm across, in supraaxillary rows of 2 - 6 flowers, often developing before leaves; pedicels pubescent, 0.6 - 1.8 cm long, much thickened and elongating up to 3 cm in fruits. Sepals subequal; outer pair elliptic or orbicular, 8 - 12 x 6 - 8 mm; inner pair elliptic-oblong, slightly smaller than outer. Petals white with a reddish spot within, fading to purple, oblong, rounded, 1.5 - 1.8 x 0.5 - 0.8 cm, tomentose inside, subentire, repand. Disk ca 1 mm in diam. Stamens 30 - 50; filaments 3 - 4.5 cm long, creamy white, turning to pink or purple before dusk; anthers ca 2 mm long, ca 1 mm thick. Gynophore glabrous, except at base, 3 - 5.5 cm long, thickening in fruits; ovary glabrous, ellipsoid or ovoid, 1.5 - 2.5 x 1 - 1.5 mm; placentae 4. Fruits globular or ellipsoid, pustulate, ca 5 x 4 cm; pericarp woody, leathery, up to 2 mm thick, smooth, reddish orange to purple; stipe 5 - 8 cm long, 4 - 5 mm thick; seeds many, embedded in scarlet pulp, 5 - 7 x 4 - 6 mm.

Fl. Feb. - Apr.; *Fr.* Aug. - Oct.

Distrib. India: Along hedges, roadsides, scrub forests and moist deciduous forest edges, from sea level to 1000 m. Almost throughout India, including Andaman & Nicobar Islands (except Kashmir area).

Sri Lanka, Nepal, Bangladesh, Myanmar and China to Malesia.

Notes. Unripe fruits are pickled and mature ones are edible. Pulverised fruits mixed with berries of *C. moonii* are reportedly efficacious in treating jaundice, liver ailments and even tuberculosis.

It has a diploid number of $2n = 40$ (T.S. Raghavan in Ann. Bot., Lond., n.s. 2: 75. 1938).

The leaves are highly variable, sometimes narrowly lanceolate with a pair of lateral basal lobes, hence appearing hastate. In Andamans, the leaves are very much larger than the normal ones seen in mainland. In vegetative condition it often resembles *C. micracantha* DC.

The nomenclatural problem in this species has been dealt with by Jacobs (in Blumea 12: 505 - 508. 1965). Unaware that Linnaeus had already described the species based on Hermann's collection from Sri Lanka, the younger Linnaeus described *C. horrida* based on Koenig's collection, also from Sri Lanka. Wight & Arnott (Prodr. Fl. Pen. Ind. Or. 25. 1834, excl. synonym *C. pyrifolia* Lam.) had correctly interpreted both the species but failed to recognise that both are related to one and the same species.

The description of *C. zeylanica* in Hook. f. (Fl. Brit. India 1: 174. 1872) pertains to *C. brevispina* DC., an error repeated by many other Indian botanists, except by Dunn who could distinguish *C. zeylanica* from *C. brevispina*.

3. Cleome L.

Herbs, mostly annuals, often woody at base; stems foetid, generally striate, glabrous to viscid-glandular, occasionally with scattered prickly appendages. Leaves spirally arranged, simple or digitately 3 - 13-foliolate, lower leaves petiolate, upper ones subsessile or sessile; stipules none or obsolete, rarely with stiff spine-like recurved enations. Flowers actinomorphic or slightly zygomorphic by displacement of petals, in terminal racemes or solitary, axillary, pedicellate; bracts foliaceous or membranous, persistent or caducous. Sepals 4, free or shortly united at base, equal, valvate, often glandular pubescent. Petals 4, mostly clawed at base, equal or unequal, longer than sepals. Stamens (4-) 6 to many, usually all fertile, rarely with a few staminodes, borne on a short or long androgynophore; filaments equal or subequal, declinate. Ovary sessile or mostly on a short gynophore which elongates in fruit, 1-loculed; ovules many on 2 parietal placentae; style short or absent; stigma sessile, capitate, discoid or truncate. Capsules siliquiform, linear, oblong, terete or flattened, striate, often beaked, dehiscent by 2 valves with persistent seed-bearing replum in middle; seeds glabrous or pubescent, discoid, reniform or orbicular, the ends incurving or one of them free, sometimes with funicular elaiosome, smooth, reticulate-foveolate or transversely rugose, warty, crested or ridged on surface; endosperm none or scanty; embryo straight.

Fig. 56.

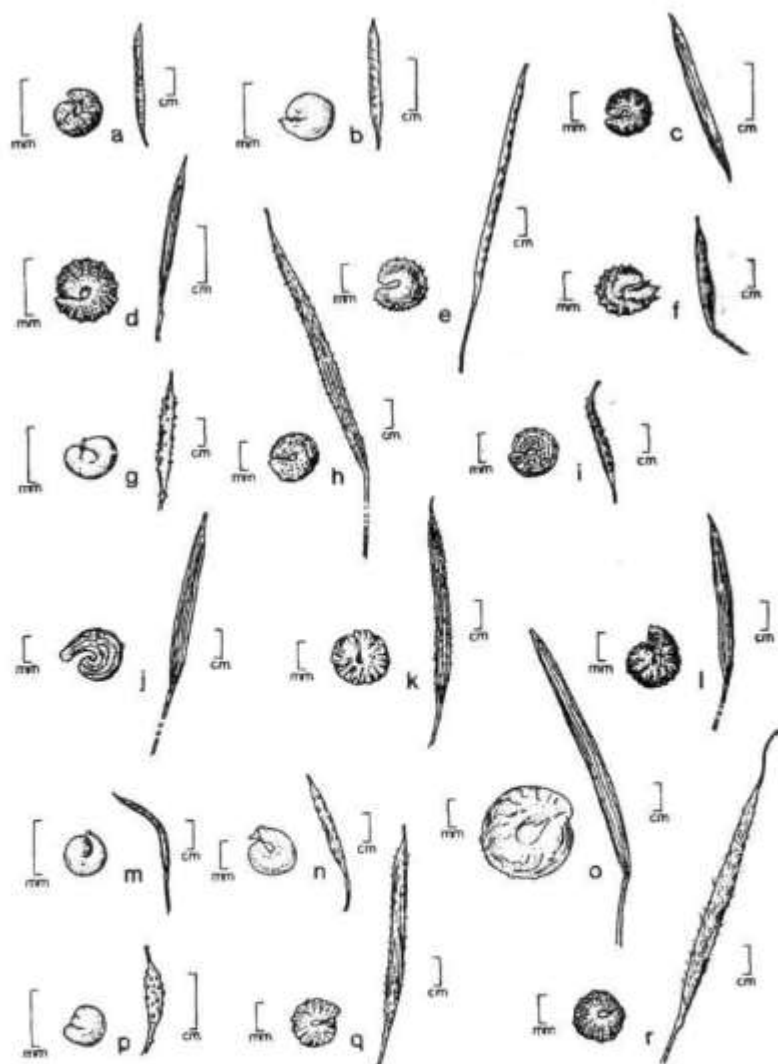


Fig. 56. Capsules and seeds of *Cleome* L.: a. *C. angustifolia*; b. *C. ariana*; c. *C. aspera*; d. *C. burmannii*; e. *C. chelidonii*; f. *C. felina*; g. *C. fimbriata*; h. *C. gynandra*; i. *C. gynandra* var. *nana*; j. *C. hassleriana*; k. *C. monopylla*; l. *C. rutidosperma*; m. *C. scaposa*; n. *C. simplicifolia*; o. *C. speciosa*; p. *C. vahliana*; q. *C. viscosa*; r. *C. viscosa* var. *nagarjunakondensis*.

America, Europe, Africa, Asia, extending to Australia in tropical areas; ca 150 species, 15 species in India.

Literature. BABU, C. R. & N. C. MAJUMDAR (1976) Taxonomical notes on *Cleome aspera* Koen. ex DC., *C. burmannii* Wight & Arn. and *C. rutidosperma* DC. (Cleomaceae). *J. Bombay Nat. Hist. Soc.* 71: 629 - 632. 1974. ILTIS, H. H. (1960) Studies in Capparidaceae vii. Old World Cleomes adventive in the New World. *Brittonia* 12: 279 - 294. KUMAR, P.V. & BIR BAHADUR (1978) Seed morphology of thirteen species of *Cleome* L. (Capparidaceae). *J. Indian Bot. Soc.* 57: 39 - 46, ff. 1 - 16. SUNDARA RAGHAVAN, R. (1984) On *Cleome burmannii* Wt. & Arn. (Capparaceae) - Its identity and distribution. *J. Econ. Tax. Bot.* 5: 463 - 465. VIJAYAKUMAR, P. & BIR BAHADUR (1978) Seed morphology of thirteen species of *Cleome* L. (Capparaceae). *J. Indian Bot. Soc.* 57: 39 - 46, ff. 1 - 16.

KEY TO THE SPECIES

- | | |
|---|-----------------------------|
| 1a. Leaves simple | 2 |
| b. Leaves compound, 3 - 9-foliolate | 5 |
| 2a. Lamina of leaves 2 or more times as long as broad | 3 |
| b. Lamina of leaves 1 - 1.5 times as long as broad | 4 |
| 3a. Stems striate, clothed with short glandular and long eglandular hairs; stamens 6; capsules 5 - 10 cm long | 9. <i>C. monophylla</i> |
| b. Stems not striate, scabrid-strigose with spinulose hairs from glandular bases; stamens 8 - 16 (-24); capsules under 4 cm long | 12. <i>C. simplicifolia</i> |
| 4a. Leaves penninerved; stamens 6; capsules ca 1 mm broad | 11. <i>C. scaposa</i> |
| b. Leaves palmately 5-nerved; stamens 4; capsules 3 - 4 mm broad | 7. <i>C. flmbriata</i> |
| 5a. Androgynophore conspicuous, 5 mm or more long | 6 |
| b. Androgynophore mostly absent, if present under 3 mm long | 7 |
| 6a. Plants pubescent with gland-tipped hairs, foetid; petals under 15 mm long, valvate in bud, white or yellowish; androgynophore 9 - 16 mm long; gynophore in fruit 5 - 10 mm long | 8. <i>C. gynandra</i> |
| b. Plants glabrous, or thinly short hairy, not glandular pubescent, not foetid; petals 25 - 35 mm long, imbricate in bud, pink or reddish violet; androgynophore 5 - 7 mm long; gynophore in fruit ca 6 cm long | 13. <i>C. speciosa</i> |
| 7a. Plants with retrorse scattered soft linear prickly appendages | 8 |
| b. Plants without retrorse or prickly appendages | 10 |
| 8a. Leaflets linear or oblong-lanceolate, scabrid with tubercle-based hairs; petioles shorter than leaflets; gynophore absent | 3. <i>C. aspera</i> |
| b. Leaflets otherwise, glabrous except for the scabrous veins; petioles equal to or longer than leaflets; gynophore short | 9 |
| 9a. Leaflets rhombate or ellipsoid-rhombate; petals 8 - 12 mm long; seeds with elaiosomes | 10. <i>C. rutidosperma</i> |
| b. Leaflets elliptic, ovate or lanceolate; petals 2 - 4 mm long; seeds without elaiosomes | 4. <i>C. burmannii</i> |
| 10a. Stamens 6 | 11 |
| b. Stamens 12 - many | 13 |
| 11a. Leaflets linear to filiform | 1. <i>C. angustifolia</i> |
| b. Leaflets various, not linear or filiform | 12 |

- 12a. Petals yellow with linear scaly appendages above claw; capsules oblong, up to 12 mm long, densely glandular-hairy 14. *C. vahliana*
 b. Petals white or pinkish without appendages; capsules linear, exceeding 15 mm long, scattered glandular-hairy 2. *C. ariana*
- 13a. Leaflets 3; capsules flat, 6 - 10 times as long as broad 6. *C. felina*
 b. Leaflets 3 - 9; capsules terete, more than 20 times as long as broad 14
- 14a. Plants pubescent with non-glandular hairs; flowers pinkish or purplish 5. *C. chelidonii*
 b. Plants viscid with stalked glandular hairs; flowers yellow 15. *C. viscosa*

1. ***Cleome angustifolia*** Forsskal, Fl. Aegypt.-Arab. 120. 1775. *C. tenella* L. f., Suppl. 300. 1781; Hook. f. & Thomson in Fl. Brit. India 1: 169. 1872.

Tam.: *Naikadugu*.

Herbs, annual, slender, much-branched, glabrous, 10 - 50 cm high; young stems filiform. Leaves 3-foliolate with 6 - 10 mm long petiole; leaflets sessile, mostly filiform, narrowly linear or oblanceolate, acute at apex, longer than petiole, 1.2 - 2 cm long, 1 - 2 mm wide; lowest leaf with oblanceolate leaflets. Flowers small, 3 - 3.5 mm across, in lax 2 - 5-flowered terminal and not clearly demarcated racemes, often solitary, axillary, yellow; pedicels up to 6 mm long; bracts simple or 3-foliolate. Sepals 4, elliptic, 1 - 1.5 mm long. Petals 3 - 4 mm long, yellow with purple veins. Stamens 6. Capsules sessile or subsessile, linear, subterete, 1.5 - 5 cm long, 1.5 - 2 mm thick, glabrous; seeds suborbicular, curved, 0.5 - 0.7 mm across, minutely rugulose with open cleft, brown.

Fl. & Fr. June - Jan.

Distrib. India: Wastelands, rocky slopes, in sandy soil from sea level to 350 m. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka, extending to Arabia and Africa.

Notes. Unlike Indian plants, the African plants are much taller (often up to 50 cm) and leaflets broader.

Though the flowers are mostly yellow with purple streaks, Matthew (in Fl. Tamil Nadu Carnatic 3(1): 49. 1983) records purple flowers.

2. ***Cleome ariana*** Hedge & Lammond in Rech. f., Fl. Iran. 68: 17, f. 2. 1970; Jafri in Fl. W. Pakistan 34: 24, f. 6A. 1973.

Herbs, annual, 20 - 40 cm high, glandular hairy; branches thin, arising from base. Leaves 3-foliolate, upper ones 1-foliolate, or apparently simple; petioles up to 10 mm in lower leaves, shorter or absent in upper leaves; leaflets linear to narrowly elliptic, 6 - 22

x 1 - 4 mm, somewhat glandular, glabrous. Racemes laxly many-flowered elongating during fruiting. Flowers 3 - 4 mm across, white or purplish-pink; pedicels thin, spreading, up to 10 mm long. Sepals ovate, obtuse, or subacute, 1 - 1.5 x 0.5 - 0.7 mm, slightly connate at base, often glandular at apex. Petals spatulate or linear-oblong, narrowly but not distinctly clawed at base, 2 - 4 x 0.5 - 1 mm. Stamens 6; filaments purple or violet, 2.5 - 6 mm long; anthers ovoid, versatile, apiculate, often violet coloured. Ovary with very short gynophore; style absent. Capsules linear-oblong, usually slightly curved or deflexed, 1.5 - 2.5 x 0.1 - 0.2 cm (including 0.5 - 3 mm long gynophore), scarcely torulose. Seeds 10 - 15, ca 1 mm across, granulate with closed cleft, glabrous, brownish black.

Fl. & Fr. July - Oct.

Distrib. India: Subtropical and temperate hillocks up to 1700 m. Jammu & Kashmir.

Pakistan, Afghanistan and Iran.

3. *Cleome aspera* Koenig ex DC., Prodr. 1: 241. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 169. 1872.

Tam.: *Malayvarinai-poondu*.

Herbs, annuals, prostrate, decumbent or ascending; stems ribbed with scattered short compressed hooked soft minute prickles. Leaves basally 3-foliolate, uppermost ones simple; petioles 2 - 10 mm long (rarely up to 2 cm long in basal leaves), almost absent in uppermost leaves; leaflets subsessile, linear-oblong or lanceolate, cuneate at base, subobtusate to retuse and mucronate at apex; central leaflets up to 2.5 x 0.5 cm, lateral leaflets up to 1.5 x 0.4 cm, scabrid and ciliate along margins with tubercle-based hairs; lateral nerves 4 - 9 pairs. Flowers ca 3 mm across, solitary, in axils of higher leaves, often forming up to 2.5 cm long leafy racemes; pedicels filiform, 3 - 5 mm long, elongating to 1.5 cm in fruits, puberulous. Sepals linear-lanceolate, obtuse, 1 - 2 mm long, thinly glandular-pubescent. Petals elliptic or oblanceolate, rounded at apex, 2.5 - 4 x 0.8 - 1.5 mm, white or creamy yellow with orange or reddish streaks. Stamens 6; filaments ca 2.5 mm long; anthers linear, ca 1 mm long. Gynophore ca 1 mm long, elongating to 3 mm in fruits; ovary linear, 2 - 2.5 mm long; styles slender, ca 1 mm long. Capsules subsessile or on up to 3 mm long stalk, terete, narrow at both ends, slightly torulose, beaked, 2 - 3 cm long, 1.5 - 2 mm thick; seeds 12 - 20, suborbicular, curved with a closed cleft, 1.7 - 2 x 1.5 mm, with prominent cross ribs and joined by obtuse concentric ribs, yellowish to dark brown.

Fl. & Fr. Throughout the year, peak period June - Oct.

Distrib. India: Wastelands, sandy or gravelly soil, up to 400 m. Orissa, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry and Kerala.

Sri Lanka.

Notes. Flowers are mostly creamy yellow or white but Gamble (in *Fl. Pres. Madras*, repr. ed. 1: 29. 1957) mentions "pink" which is reflected in the specimens, Subbarao 36252 (MH) and Sainaba 28397 (CAL). In Joesph 5219 (MH) petiole is exceptionally 1.5 - 2 cm long. The distribution does not extend to Malaysia as stated by Jacobs (*Fl. Males. Ser. I*, 6: 105. 1960) as a scrutiny of specimens at Leiden reveals that they are misidentifications of either *C. burmannii* or *C. rutidosperma*. The type, "Ind. Or. Koenig 1774" is in British Museum (BM) and not in Kew as stated by Babu (in *J. Bombay Nat. Hist. Soc.* 71: 629 - 632. 1976).

Mishra & Panigrahi (*Indian J. Forestry* 5: 153 - 154. 1982) record it from Orissa.

4. *Cleome burmannii* Wight & Arn., *Prodr.* 1: 22. 1824; Hook. f. & Thomson in *Fl. Brit. India* 1: 170. 1872. Fig. 57.

Herbs, erect, up to 50 cm high; stems much-branched, somewhat flattened, ribbed, clothed, with scattered soft 0.5 - 2.5 mm long prickles. Lower petioles 2.5 - 4 cm long, upper smaller; leaflets 3 - 5, ovate to elliptic-lanceolate, cuneate and webbed at base, acute, subacute or subrounded at apex, faintly crenate-serrulate along margins, 2 - 6 x 0.4 - 1.8 cm, membranous, glabrous; petiolules up to 1 mm long. Flowers white (rarely purple), axillary, solitary; pedicels 5 - 18 mm long, glandular hairy. Sepals lanceolate, acuminate. Petals elliptic-oblong, 2 - 4 x 0.8 - 1.2 mm. Gynophore short, 0.5 - 1.5 mm, elongating up to 4 - 7 mm after fertilisation; ovary 1.5 - 2 mm long, glabrous. Capsules linear, terete, torulose, glabrous, 3.5 - 4.5 cm long, 1 - 1.5 mm thick, narrowed at both ends, beaked; seeds 10 - 15, reddish-brown, 1.2 - 1.4 mm across, with concentric ribs and closed cleft, without elaiosome.

Fl. & Fr. May - June, Jan.

Distrib. India: In wastelands, up to 600 m, rare. Tamil Nadu and Kerala. Endangered.

Sri Lanka and Indonesia (Java).

Notes. Extremely rare and probably on way to extinction. Besides type, the only other historic collection from Peninsular India is Koenig's specimen from Ramanathapuram in Tamil Nadu. Venkobarao had collected it from Shenkotta along Kerala-Tamil Nadu border in 1914. Ellis in 1962 had collected it from Tanjavur district of Tamil Nadu. Reports of its collection from Gujarat (Shah, *Fl. Gujarat* 1: 71. 1978), Kerala (Manilal & Sivarajan, *Fl. Calicut* 34. 1983) and reports from other parts of Tamil Nadu are misidentifications of *C. rutidosperma* (Sundara Raghavan in *J. Econ. Tax. Bot.* 5: 463 - 464. 1984).

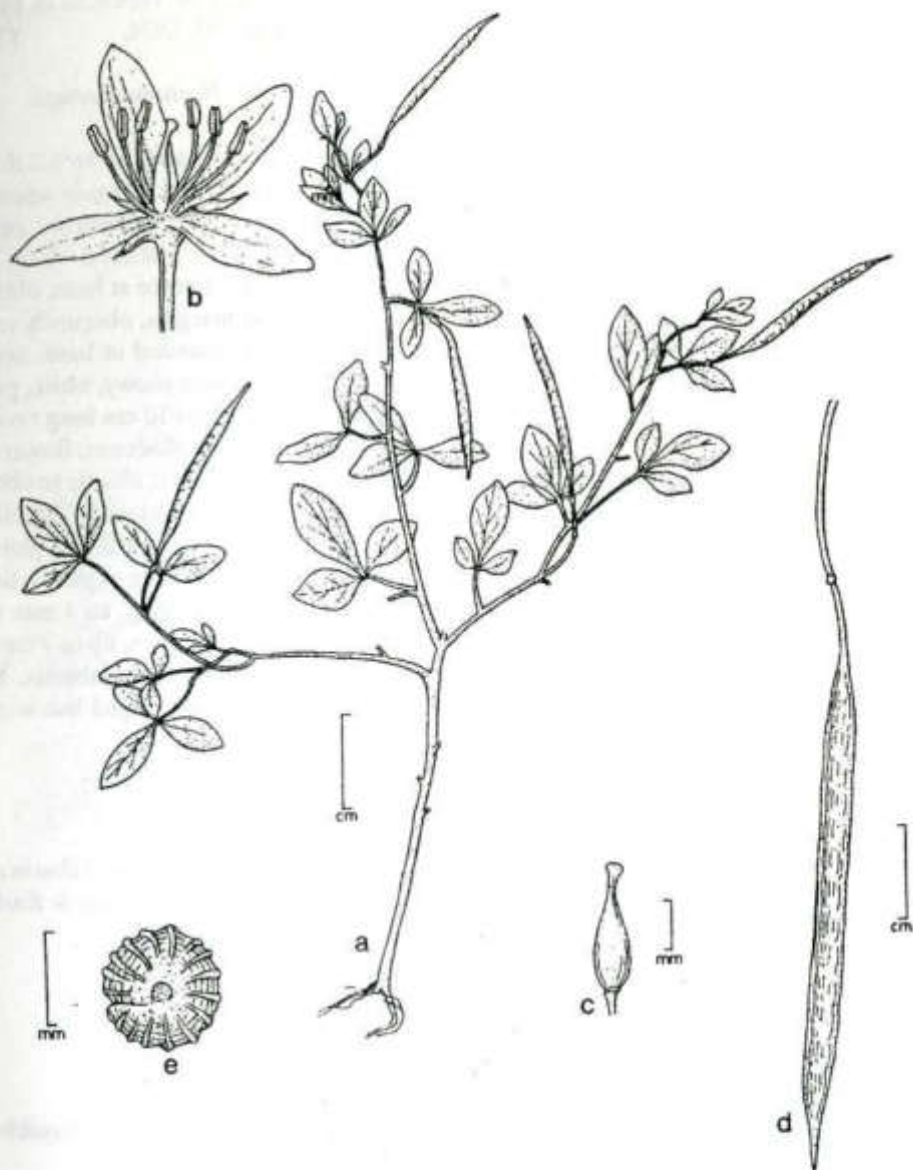


Fig. 57. *Cleome burmannii* Wight & Arn. : a. fruiting plant; b. flower; c. pistil; d. capsule; e. seed.

5. *Cleome chelidonii* L. f., Suppl. Pl. 300. 1781; Hook. f. & Thomson in Fl. Brit. India 1: 170. 1872. *Polanisia chelidonii* (L. f.) DC., Prodr. 1: 242. 1824. **Fig. 58.**

Guj.: *Ubhitaveli*; Hindi: *Jungliswas*; Kan.: *Heti*; Tam.: *Neela-naikadugu*.

Herbs, suffrutescent, woody, strigose with bulbous based hairs, up to 1.2 m high; stems subangular; taproot stout, whitish. Leaves 3 - 9-foliolate, densely appressed pubescent to glabrate, lower ones subcoriaceous, upper ones chartaceous; petioles gradually decreasing in length upwards, 8 - 10 cm to almost 0; leaflets 5 - 9 on lower leaves, 3 or rarely one in upper leaves; basal leaflets obovate, cuneate at base, obtuse to rounded at apex, 1.5 - 2 x 1.4 - 1.6 cm, strigosely hairy along margins, obscurely veined; upper leaflets elliptic-lanceolate, lanceolate or even linear, rounded at base, acute at apex, crenate to wavy along margins; lateral nerves 3 - 4. Flowers showy, white, pink or rosy purple, 1.5 - 2 cm across, in lax terminal corymbiform up to 10 cm long racemes; pedicels 2.5 - 4 cm long, elongating to 5 cm in fruit, hairy; bracts foliaceous; flower-buds ellipsoid, acute, 6 - 9 mm long. Sepals narrowly imbricate, appressed, elliptic to obovate, acuminate, 3.5 - 4.5 x 0.8 - 1.5 mm, sparsely pubescent outside. Petals 4 (-8), elliptic, ovate to obovate, narrowed at base, rounded at apex, 1 - 2 x 0.3 - 0.8 cm, glabrous. Stamens 35 - 60; filaments swollen at tips, 8 - 12 mm long, greenish-white or purple tinged; anthers ca 1 mm long, white. Ovary sessile, linear, 8 - 12 mm long, ca 1 mm thick, glabrous. Capsules linear-cylindric, narrowed at base, beaked at apex, up to 9 cm long, 2 - 3 mm thick; beak ca 3.5 mm long; valves striate, parallel-veined, glabrous. Seeds 40 - 50, orbicular with open cleft, 1.5 - 2.5 mm across; testa not ridged but warty or muriculate on dorsal side, reddish brown, drying black.

Fl. & Fr. Throughout the year, peak during premonsoon period.

Distrib. India: Paddy fields and sugarcane fields along moist areas and also in sandy semiarid soils, from sea level to 120 m. Throughout India, except in Jammu & Kashmir, Himachal Pradesh, N.E. hill states and Rajasthan.

Sri Lanka, Myanmar to Thailand, Malaysia and Indonesia.

Notes. Seeds are used as condiments.

Chromosome number reported is $2n = 34$ (T.S. Raghavan & Venkatasubban in Cytologia 11: 319. 1941).

An extremely variable plant regarding height, size, shape and texture of leaves, number of leaflets, degree of pubescence, etc. The leaves are densely appressed pubescent to almost glabrescent, with the pubescence confined to nerves only. While basal leaves are obovate, the middle and upper leaves are linear to elliptic-lanceolate. Juvenile vegetative plants growing in sandy areas have basal leaflets closely resembling

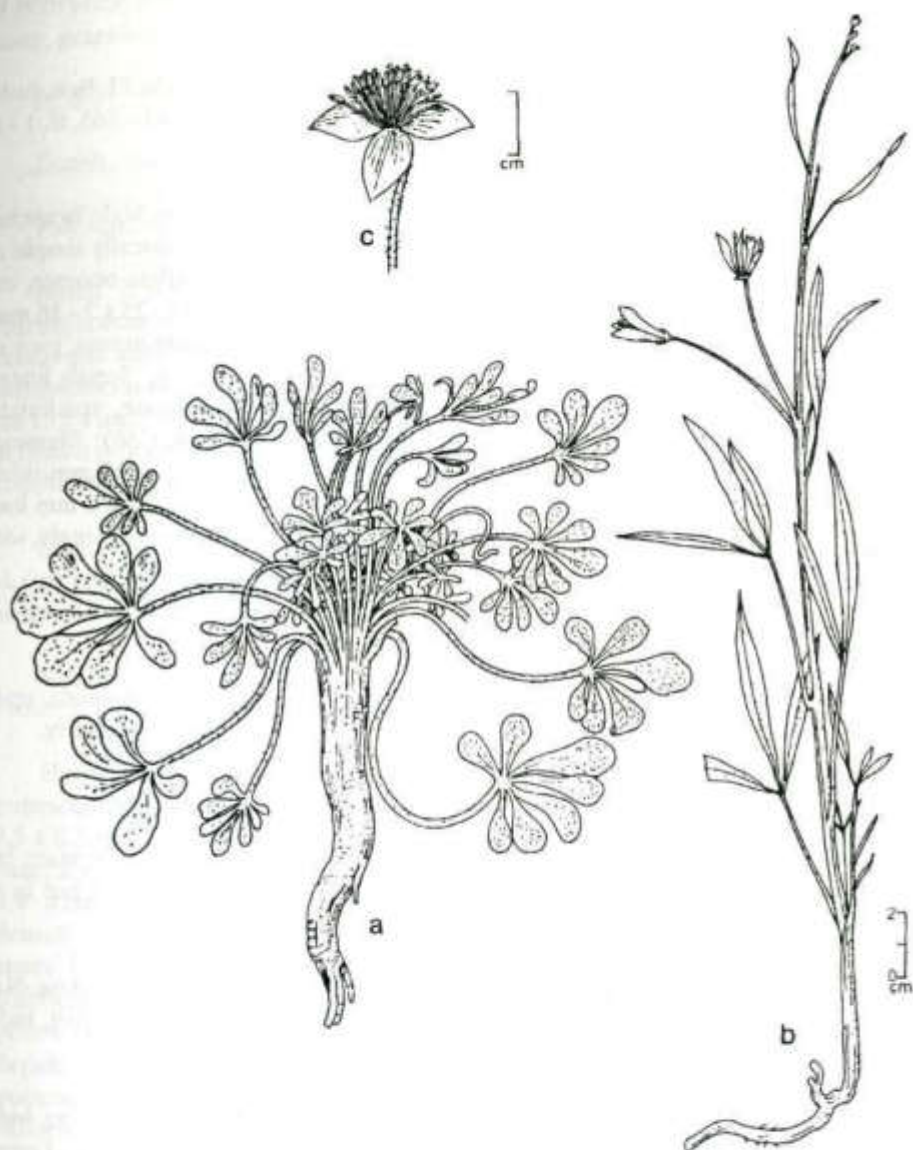


Fig. 58. *Cleome chelidonii* L. f.: a. plant with basal rosette of leaves and woody root stock; b. apical erect portion of plant with linear and lanceolate leaves; c. flower.

those of *C. felina*, but even when in flower, they can be distinguished from *C. felina* by the thick taproot and leaflets always exceeding 3 in number.

6. *Cleome felina* L. f., Suppl. Pl. 300. 1781; Hook. f. & Thomson in Fl. Brit. India 1: 170. 1872. Malhotra & Moorthy in J. Bombay Nat. Hist. Soc. 77: 361 - 363, ff. 1 - 6. 1980. *Polanisia felina* (L. f.) DC., Prodr. 1: 242. 1824.

Herbs, woody, annual, prostrate-decumbent or erect, up to 50 cm high; branches radiating from base, ascending, densely appressed-strigose. Leaves apically simple or 1-foliolate, basally 3-foliolate, clothed with rigid scale-like hairs; leaflets obovate, cuneate at base, obtuse at apex, ciliate along margins; middle leaflets 15 - 25 x 7 - 16 mm; lateral leaflets 5 - 15 x 3 - 12 mm. Flowers solitary, axillary, 5 - 8 mm across, pink or purple; pedicels 8 - 15 mm long, elongating to 22 mm while fruiting. Sepals linear, lanceolate, oblong, 4 - 1.5 x 0.5 - 1.5 mm, scabrid. Petals elliptic-obovate, spatulate, 8 - 11 x 1.5 - 3.5 mm, pink, bristly pubescent outside. Stamens 25 - 40 (-50); filaments 3 - 4 mm long, pinkish; anthers yellow. Ovary sessile, 5 - 6 mm long, 3 - 5 mm thick. Capsules flat, narrow at both ends, beaked at apex, 2 - 3 cm long, with ca 3 mm long beak; seeds many, obovoid or reniform, asymmetrical, 1.5 - 2.5 mm across, echinate, with oblique closed clefts, crested, yellowish brown.

Fl. May - Nov.; *Fr.* Aug. - Dec.

Distrib. India: Cultivated fields, fallow lands and rocky areas in wastelands, up to 500 m. Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry.

Endemic.

Notes. Often confused with *C. chelidonii* L. f., especially in vegetative state but readily distinguished when in flower and fruits. Leaflets do not exceed 3 but in *C. chelidonii* they vary from 3 to 7, often to 9.

7. *Cleome fimbriata* Vicary in J. Asiat. Soc. Bengal 16: 1158. 1847 & in Ann. Nat. Hist. ser. 2, 1: 425. 1848. *C. quinquenervia* sensu Hook. f. & Thomson in Fl. Brit. India 1: 168. 1872 (non DC. 1824).

Herbs, annual or perennial, often woody at base, aromatic, under 60 cm high; branches rigid, terete, spreading, clothed with glandular and eglandular hairs. Leaves broadly ovate or suborbicular, broadly cordate to subcordate at base, obtuse or rounded and slightly apiculate at apex, 2 - 4 x 2 - 3.5 cm, with stalked glandular hairs along margins, palmately 5-nerved. Racemes few-flowered, lax; bracts sessile, ovate, foliaceous. Flowers 6 - 7 cm across, yellow with purple or lilac veins; pedicels 5 - 6 mm long, elongating to 12 mm in fruits. Sepals ovate, 3 - 4 x 1.5 - 2 mm. Petals dimorphic, 6 - 8 x 1.5 - 2.5 mm, two of them lanceolate, the other two broadly ovate with a crested scale at junction of limb and claw, glandular at tip. Stamens 4, exerted. Ovary sessile; style

ca 1.5 mm long, elongating to 2 - 4 mm, persistent in fruit. Capsules linear-oblong, acute at both ends, slightly falcate, 2.5 - 3.5 x 0.3 - 0.4 cm, clothed with glandular hairs; seeds many, granulate, ca 1 mm across, brownish, glabrous.

Fl. & Fr. Oct. - Nov.

Distrib. India: Kashmir.

Pakistan, Afghanistan, Iran and Iraq.

Notes. It is closely related to both *C. quinquenervia* DC. and *C. dolichostyla* Jafri sharing common characters such as leaf shape, indumentum, dimorphic appendiculate petals and superficial features of capsules. Often it is treated as a synonym of *C. quinquenervia* in the floras, but the capsules in the latter are oblong, much smaller in size (ca 15 x 4 mm) with blunt or rounded apex. Moreover, *C. quinquenervia* does not occur in Indian subcontinent. The length of style (ca 1.5 mm) distinguish *C. fimbriata* from *C. dolichostyla* (8 - 12 mm long), the latter common in Iran, Afghanistan and Pakistan only.

Shetty & Singh (Fl. Rajasthan 1: 81. 1988) include this based on a report by Nair et al. (in Proc. Raj. Acad. Sci. 8: 102. 1961) from Jhunjhunu District of Rajasthan. However, no specimen was seen.

8. *Cleome gynandra* L., Sp. Pl. ed. 1. 671. 1753. *Gynandropsis pentaphylla* (L.) DC. Prodr. 1: 238. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 171. 1872.

Herbs, annual, erect, up to 1.2 m high, strongly foetid; stems branched, glandular pubescent, sparsely beset with translucent coarse hairs. Leaves 3 - 5 (-7)-foliolate, ca 7.5 x 6.5 cm; leaflets unequal, obovate-elliptic, oblanceolate or rhombate, cuneate at base, acute at apex, entire to denticulate-serrulate along margins; central leaflets 1 - 7 x 0.4 - 4 cm, lateral leaflets up to 3.5 x 1.5 cm; dry leaflets glaucous; petioles 3 - 15 cm long, densely glandular puberulous; petiolules webbed, up to 3 mm long, sulcate. Inflorescence lax, many-flowered corymbose racemes, 10 - 30 cm long; bracts foliaceous, trifoliolate, 8 - 25 mm long, much reduced and sessile upwards. Flowers white or creamy yellow (rarely pink), 1 - 2 cm across; pedicels filiform, 0.2 - 2.5 cm long, pubescent. Sepals ovate, obovate, elliptic or oblanceolate, acuminate, 1.5 - 5 x 0.5 - 1.5 mm, puberulous, caducous. Petals obovate to oblanceolate, subequal, 3 - 18 x 1 - 6 mm; claw filiform, as long as limb. Androphore 1 - 25 mm long; stamens 6, purple; filaments subequal, 1.4 - 2 cm long, stiff and somewhat spreading; anthers linear, ca 2 mm long. Gynophore 0 - 2 cm long, elongating to 3.5 cm in fruits; ovary sessile among stamens or on up to 2 cm long gynophores, oblong-cylindric, 2.5 - 4 x 0.5 mm, elongating after fertilisation, green or purplish green, shortly glandular-pubescent; style 1 - 1.2 mm long; stigma discoid, depressed at apex, purple. Capsules erecto-patent, cylindric or compressed-terete, tapering at both ends, striate, 3 - 12 cm long, 4 - 8 mm thick, sticky glandular-pubescent; stalk 2 - 4 cm long; valves papery; seeds 15 - 40, reniform,

compressed, 1 - 1.8 mm across, longitudinally and concentrically striate, with low cristate transverse ridges, rugulose to tuberculate with shallow narrow and open cleft, dark brown or black.

KEY TO THE VARIETIES

- 1a. Plants 30 - 120 cm high; androphore exceeding 6 mm long; ovary green 8.1. var. *gynandra*
 b. Plants stunted under 15 cm high; androphore less than 2 mm long; ovary purplish green 8.2. var. *nana*

8. 1. var. *gynandra*

Fig. 59.

Asm.: *Bhutmaia*; Beng.: *Ansarisha*, *Sadahurhuria*; Guj.: *Adikyakaran*, *Satitalwani*, *Talwani*; Hindi: *Churota*, *Gandhuli*, *Hulhul*, *Hulhulia*; Kan.: *Ajagandha*, *Narum-byale-soppu*, *Sirikaladide*, *Srikala*, *Suryavarta*, *Tiloni*; Mal.: *Thaivela*; Mar.: *Pandri-tilwan*; Punj.: *Kathal*; Raj.: *Bhagri*, *Kalvikhima*, *Safed-bagro*; Tam.: *Kattu-kadugu*, *Nalla-velai*, *Taiwala*, *Vellai-chedi*; Tel.: *Aayiti-kura*, *Vaita*, *Vaminka*, *Vayiti-kura*, *Vela-kura*, *Ventum*.

Fl. & Fr. Throughout the year.

Distrib. India: Throughout. Weeds of fallow or cultivated land, roadsides and wastelands, from sea level to 1800 m.

Pantropic.

Notes. Plants and tender leaves used as herbage and as vegetable after boiling and salting. Leaves used in treating rheumatism and leaf juice for headache by applying to forehead and pouring into nostrils. Seeds are anthelmintic, used as substitute for mustard and also as bird seed. Infusion and vapours from boiling seeds are used for curing cough in Rajasthan. Seed oil is efficacious in killing lice. The medicinal properties of the herb is due to Cleomine present in it.

Flowers in apical portion have almost sessile ovaries with hardly 1 - 2 mm long gynophores. About 50% of these ovaries are abortive, whereas ovaries with longer gynophores are fertile.

In Pakistan, Jafri records 10 stamens but in India it is uniformly 6 only.

It is severely attacked by *Cuscuta* as seen in Jodhpur collections (Bhagawat 23948 in BSI).

8. 2. var. *nana* (Blatter & Hallberg) Bhandari in Bull. Bot. Surv. India 6: 327. 1964 & in Fl. Indian Desert 40. 1978. *Gynandropsis pentaphylla* (L.) DC. var. *nana* Blatter & Hallberg in J. Bombay Nat. Hist. Soc. 26(1): 221. 1918.

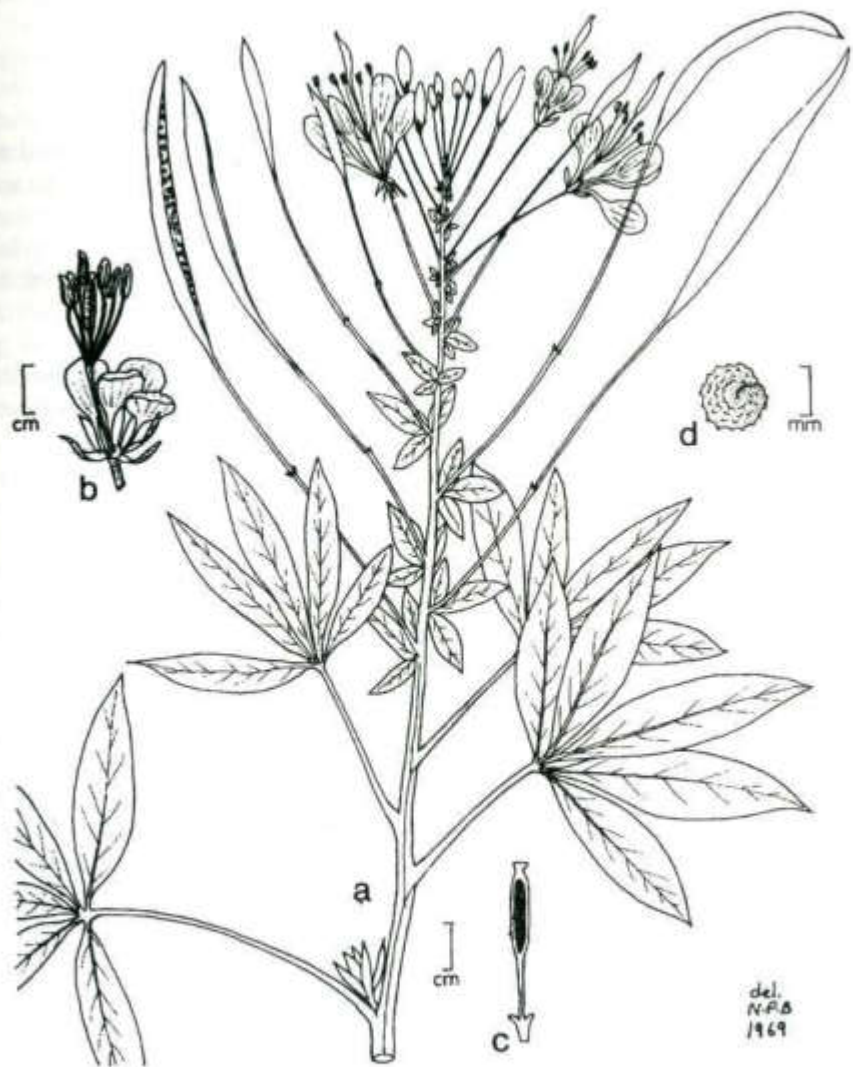


Fig. 59. *Cleome gynandra* L. var. *gynandra* : a. flowering shoot; b. flower; c. ovary, l.s.; d. seed.

Fl. & Fr. November.

Distrib. India: In dry sandy soil. Rajasthan. Rare and confined to Jaisalmer District.

Endemic.

Notes. Possibly only a dwarf form of *C. gynandra* differing in the stunted stem, almost glabrous leaves and diminished floral and capsular features adapted to severe arid conditions.

9. *Cleome monophylla* L., Sp. Pl. 672. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 168. 1872.

Beng.: *Hurhura*; Kan.: *Menasinakare*; Mar.: *Chamani, Santal, Kedar-jowar*; Tam.: *Elluku-sakkalathi*; Tel.: *Gorjuoi-saag* (Khonda-kammaras, Khonds & Porjas tribals).

Herbs, annual, erect, branched, up to 1 m high, glandular-pubescent; stems branching from base, angled, striate. Leaves simple, linear, linear-lanceolate, oblong or oblong-ovate, 2 - 10 x (0.3-) 1 - 3.5 cm, truncate at base, acute at apex, ciliate along margins; petioles up to 5 cm long, shorter than leaves, glandular-pubescent. Racemes terminal, lax, up to 30 cm long; bracts sessile, foliaceous, cordate at base. Flowers 1 - 1.5 cm across, pink, light purple, mauve or white, faintly odorous; pedicels glandular pubescent, up to 10 mm long. Sepals linear or lanceolate, acuminate, 3 - 5 mm long, ca 1 mm wide. Petals oblong, obovate or spatulate, tapering and clawed at base, rounded at apex, 6 - 10 mm long, ca 1.5 mm wide. Stamens 6; filaments unequal, 5 - 8 mm long; anthers ca 2 mm long. Ovary linear, 5 - 8 mm long, ca 1 mm thick, sessile or on a short ca 0.5 mm long gynophore. Capsules subsessile or on up to 3 mm long gynophore, subcylindric, linear, 7 - 11 cm long, up to 3 mm thick, with a flat 3 - 9 mm long beak, strongly ribbed, clothed with glandular or eglandular hairs; seeds 35 - 40, suborbicular, ridged with longitudinal striations, closed at cleft, 1.8 - 2 x 1.6 - 1.8 mm, dark brown, pubescent.

Fl. June - Nov.; *Fr.* Aug. - Feb.

Distrib. India: Common in cultivated fields, roadsides, grasslands, wastelands or sandy soil from sea level to 1300 m. Throughout the plains of the country except in Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and N.E. hill states.

Sri Lanka and Tropical Asia.

Notes. Warm leaf paste applied on breast ulcers by the tribals Khonds, Konda-kammaras and Porjas of Andhra Pradesh. Tender leaves used as vegetable and also to increase lactation by Bagatas, Nukadoras and Porjas of Andhra Pradesh.

10. *Cleome rutidosperma* DC., Prodr. 1: 241. 1824; Mukherjee in Indian For. 95: 237. 1969.

Herbs, annuals, erect or decumbent, 0.2 - 1 m high; stems weak, ribbed, subglabrous to eglandular-pilose, clothed with soft recurved deciduous up to 2 mm long prickles. Leaves 3-foliolate; lower ones long petiolate, upper ones short petiolate or sessile; leaflets subsessile, rhombate-elliptic or obovate, oblong-lanceolate, attenuate or cuneate and webbed at base, acute or acuminate at apex, obscurely crenulate-serrulate and purple along margins, 1 - 6 x 0.2 - 2 cm, glabrous; lateral nerves 6 - 8 pairs, softly setose; petioles at base up to 4 cm long, gradually diminishing upwards to nearly absent; petiolules up to 0.5 mm long. Racemes lax, few-flowered, leafy, not clearly demarcated, up to 20 cm long. Flowers in axils of leaves below and foliaceous bracts above, showy pink, magenta, bluish-violet or rarely white with pink streaks; pedicels filiform, 1 - 2 cm long, elongating to 3.5 cm in fruits, shortly glandular hairy. Sepals linear-lanceolate, acuminate, 2.5 - 4 x 0.3 - 0.8 mm, thinly clothed with short bristles. Petals oblanceolate to elliptic, attenuate-clawed at base, apiculate at apex, 8 - 12 x 1.5 - 2.5 mm; claw 2 - 3.5 mm long. Stamens 6; filaments 6 - 9 mm long; anthers linear, ca 2 mm long, recurved after anthesis. Gynophore 1.5 - 2 mm long, elongating to 8 mm in fruits; ovary linear, 7 - 12 mm long, slightly curved; stigma sessile, capitate. Capsules linear-cylindric, compressed, attenuate at both ends, ribbed, 4 - 7 cm long, 2.5 - 4 mm thick; beak 1 - 4 mm long; valves parallel-veined, glabrous; seeds many, suborbicular to reniform with prominent concentric and transverse ridges and open cleft, 1.6 - 1.9 x 1.4 - 1.7 mm, orange brown, drying black; elaiosome white or creamy, conspicuous.

Fl. & Fr. May - Nov.

Distrib. India: An African plant, introduced and naturalised in India in wastelands from sea level to 800m. Uttar Pradesh, Bihar, West Bengal, Assam, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands.

Tropical America, Trop. Africa, Maldives, Sri Lanka, Bangladesh, Myanmar, Thailand, Malaysia and Philippines.

Notes. In India, the species was first reported from Assam and West Bengal and subsequently from Andaman and Nicobar Islands. Jha and Varma (in Geobios 8: 152 - 153. 1989) reports it from Bihar. However, a careful scrutiny of herbarium specimens reveals that it is common in many parts of India, often misidentified as either "*Cleome burmannii*" or as "*C. aspera*" in several herbaria (Sundara Raghavan in J. Econ. Tax. Bot. 5: 463 - 465. 1984).

Plants exhibit dimorphism when fresh. The two middle petals have yellow transverse bands (as in *C. monophylla*) but these fade out and are indistinguishable on drying.

11. *Cleome scaposa* DC., Prodr. 1: 239. 1824. *C. papillosa* Steudel, Nomencl. Bot. ed. 2. 1: 382. 1840; Hook. f. & Thomson in Fl. Brit. India 1: 168. 1872.

Herbs, annual, erect, low, up to 60 cm high, much-branched, setose-scabrous, strongly aromatic; stems woody at base, slender, whitish, clothed with both glandular and eglandular setose-scabrous hairs. Leaves broadly ovate, elliptic or suborbicular, rounded to cordate at base, obtuse or retuse at apex, entire, 1.3 - 3 x 0.5 - 2.4 cm, scabrid or papillose-punctate; midrib impressed above; lateral nerves 2 - 4 pairs; petioles up to 2.5 cm long on basal leaves, gradually shorter above. Racemes lax, slender, 12 - 15 cm long. Flowers showy, 3.5 - 4.5 mm across; bracts foliaceous at lower flowers, absent at upper flowers; pedicels filiform, 1.5 - 4 mm long, elongating to 8 mm in fruits. Sepals lanceolate or elliptic, 1.5 - 2 mm long, glandular-pubescent and scabrous on outer surface. Petals ovate or obovate, 2.5 - 3.5 x 1 - 1.5 mm, glabrous, yellow, creamy or occasionally white or rose-pink. Stamens 6; filaments ca 2 mm long, glabrous; anthers oblong. Ovary sessile, linear-oblong, 2 - 2.5 x 0.5 mm, glabrous, narrowed into a capitate stigma. Capsules sessile, linear-falcate, striated, 20 - 30 x 0.8 - 1.2 mm, glabrous or sparsely glandular; seeds over 20, reniform, 0.5 - 0.7 mm across, minutely granulate, glabrous, blackish brown.

Fl. & Fr. Aug. - Dec.

Distrib. India: Open rocky slopes, sandy dunes or along river beds in arid or semiarid tracts, forming pure associations, up to 800 m. Himachal Pradesh, Punjab, Haryana, Rajasthan, Gujarat and Maharashtra.

Pakistan to West Asia, North and East Tropical Africa.

12. *Cleome simplicifolia* (Cambess.) Hook. f. & Thomson in Fl. Brit. India 1: 169. 1872. *Polanisia simplicifolia* Cambess. in Jacq. Voy. Bot. 20, t. 20, 1844. *C. asperima* Blatter in J. Asiat. Soc. Bengal n.s. 26: 340. 1937, *syn. nov.*

Herbs, erect, decumbent or prostrate, under 60 cm high, much-branched from base; stems angled, scabrid strigose. Leaves obovate, lanceolate, linear-oblong or oblong-elliptic, tapering at base, obtuse or subacute at apex, entire or faintly serrulate along margins, densely strigose with scaly hairs; petioles scabrid at base, up to 2 cm long but almost absent upwards. Flowers 4 - 5 mm across, showy, pink or purple, solitary in axils of leafy bracts forming lax few-flowered racemes; pedicels filiform, puberulous, up to 1.8 cm long, elongating up to 3.5 cm while fruiting. Sepals triangular or ovate, acute at apex, 1.8 - 3.5 x 0.8 - 1.5 mm, scabrid. Petals oblong, obovate, oblanceolate or spatulate, indistinctly clawed at base, rounded with a mucro at apex, 5 - 5.5 x 1.7 - 2.2 mm, pink, mauve, lilac or purplish violet, mostly glabrous, sometimes hairy along margins and midrib. Stamens 8 - 16 (-24); filaments glabrous, 3 - 5 mm long, slender throughout or slightly thickened at apex. Ovary cylindrical, 2 - 4.2 x 0.5 - 0.8 mm, elongating after anthesis. Capsules glabrous, striate, subtorulose, 25 - 35 x 2 - 2.5 mm (including 4 - 6 mm long

beak); seeds 4 - 15, reniform, 1.5 - 1.8 mm, yellowish brown, turning into black, smooth or with a few protuberances; cleft open or narrow so as to appear closed; elaiosome white.

Fl. & Fr. July - Nov.

Distrib. India: Weed of wastelands, restricted to Central, Western and Peninsular India. Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Goa, Andhra Pradesh and Karnataka.

Endemic.

Notes. According to Blatter (l. c.) *C. asperrima* is distinguished from *C. simplicifolia* as follows:-

C. asperrima

1. Sepals narrowly triangular, acuminate.
2. Petals 4 - 5 mm long, oblanceolate, strigose on back along median line.
3. Pedicels totally hispid.
4. Stamens 8 - 15; filaments uniformly thickened.
5. Seeds with closed cleft.

C. simplicifolia

- Sepals ovate, acute.
- Petals up to 5.5 mm long, oblong, glabrous.
- Pedicels apically hairy.
- Stamens 8 - 24; filaments thickened at apex only.
- Seeds with open cleft.

Study of fresh specimens reveals that the characters are variable, intergrading and not taxonomically significant. In *C. simplicifolia* sepal shape ranges from ovate to narrowly triangular; pedicels are often hispid; stamens vary from 8 - 24 and cleft of seeds is open to seemingly closed due to narrow opening. Except for the strigose petals there is no other consistent character to rely upon, but in Capparaceae indumentum and innovations are of no taxonomic value. After examining the types of both species, *C. simplicifolia* - Poonah (Pune), Jacquemont 342 & 405 (K) and *C. asperrima* - Dhulia, Maharashtra, Helene Hedberg 7670 (BLATT) and a study of populations, *C. asperrima* is relegated to the synonymy of *C. simplicifolia*. Elaiosomes are quite conspicuous in this species, but surprisingly no mention is made of this character in any of the floras.

13. *Cleome speciosa* Raf., Fl. Ludovic. 86. 1817. *Gynandropsis speciosa* (Raf.) DC., Prodr. 1: 238. 1824.

Hindi: *Hurhuria, Kalaria*.

Herbs, annuals, erect, up to 1.5 m high, hardly branched; stems smooth or with scattered spine-like protuberances, whitish, glabrous or rarely glabrescent with scattered short hairs. Leaves 3 - 7-foliolate; petioles 4 - 15 cm long; leaflets sessile, ovate-lanceolate, elliptic-lanceolate, narrowed and webbed at base, acuminate at apex, 9 - 15 x 1.5 - 4.5 cm, chartaceous; lateral nerves 7 - 20 pairs. Flowers showy, ca 2.5 cm across, on 7 - 25 cm long racemes, subtended by sessile foliaceous bracts; pedicels filiform, 2 - 3.5 cm long, ca 3 mm thick. Sepals subulate to lanceolate, 2.5 - 5 x 0.8 - 1.5 mm, ciliate, puberulous. Petals imbricate, erect, lanceolate, narrowed at base into a claw, rounded at top, 20 - 40 x 4 - 8 mm (including claw), pink, rosy or purple, rarely white. Androphore 5 - 9 mm long, slightly thickened at base and top, glabrous. Stamens 6; filaments filiform, 5 - 6 cm long, glabrous; anthers 5 - 6 mm long, greenish. Gynophore 4 - 6 cm long, elongating to 9 cm while fruiting, glabrous. Ovary linear-cylindric, 5 - 6 mm long, ca 1 mm thick, glabrous. Capsules pendent, linear-cylindric, 6 - 10 cm long, ca 3 mm thick, longitudinally striate; valves parallel-veined; seeds many, horse-shoe shaped with closed cleft, tuberculate, 2.5 - 3.5 mm across, brown, smooth with brown scales.

Fl. & Fr. April - May, Sept. - Oct.

Distrib. India: Native of tropical America, introduced and naturalised in several parts from sea level to 1500 m. Often cultivated in gardens of Meghalaya, Goa and Kerala, where it also occurs wild as a garden escape.

Pakistan, S.E. Asia, N. & S. America and W. Indies.

Notes. The species resembles *Cleome hassleriana* Chodat but in the latter androgynophore is quite short or absent. Flowers open at dusk and are pollinated by nocturnal butterflies. Flower colour varies from rose to purple and rarely to white.

14. *Cleome vahliana* Fresen. in Mus. Senck. 2: 110. 1837. *C. brachycarpa* Vahl ex DC., Prodr. 1: 240. 1824, p.p. [non *Gynandropsis brachycarpa* (Vahl) DC.]; Hook. f. & Thomson in Fl. Brit. India 1: 169. 1872. *C. brachycarpa* var. *longipetiolata* Sabnis in J. Indian Bot. Soc. 3: 178. 1924. *C. brachycarpa* var. *glauca* Blatter & Hallberg in J. Bombay Nat. Hist. Soc. 26: 221. 1918.

Guj.: *Kasturi*; Raj.: *Kasturi, Khira-mor, Madhio, Nadi, Noli, Ponwar*.

Herbs, annual or perennial, woody, erect to suberect, up to 50 cm high; stems much branched, glaucous with odour of musk or rue, glandular-pubescent with stiff hairs, at

length subglabrescent. Leaves digitately 3 - 5-foliolate at base, higher above, ternate to simple; leaflets obovate, oblanceolate or oblong, acute to subobtuse-mucronate at apex, 6 - 16 x 2 - 5 mm, glandular-pubescent, viscid, rarely glabrescent, except at margins; petioles 5 - 35 mm long; petiolules very short. Flowers yellow, 5 - 8 mm across in lax bracteate racemes; bracts sessile, simple or 3-foliolate; pedicels filiform, 9 - 15 mm long. Sepals elliptic to ovate-lanceolate, 2.5 - 3 x 1 mm, glandular hairy. Petals ovate-oblong, subacute, 6 - 8 x 2 - 2.5 mm, glabrous, yellow, with a scale-like appendage above the claw. Stamens 6, one rarely imperfect, shorter than petals. Gynophore up to 1 mm long; ovary glandular hairy; style slender, 5 - 6 mm long; stigma capitate. Capsules oblong, inflated, tipped with persistent style, 8 - 12 mm long, 2.5 - 3.5 mm thick, glandular pubescent; seeds many, minutely pitted, rugulose with closed cleft, 0.6 - 0.8 mm across, dark brown, glabrous.

Fl. & Fr. Throughout the year, peak period Oct. - Nov.

Distrib. India: Semi-arid regions from sea level to 600 m, in gravelly or rocky hillocks and sandy tracks, often associated with *Heliotropium rariflorum*, *Bouchea marrubifolia*, etc. Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan and Gujarat.

Pakistan, Iran, Saudi Arabia and tropical N.E. Africa.

Notes. Leaves used as fodder for sheep, goats, camels, etc. An infusion of leaves is reportedly efficacious for removing worms and insects from ears of camels. The plant is reported to be a snake repellent.

The plants are highly variable with regard to length of petiole; glandular pubescence, reticulation of seeds, etc. The petiole is often as long as 3.5 cm in some lower leaves. Similarly the seeds are glabrous when young, but minutely rugulose or reticulate when fully mature. As these are highly variable and fluctuating characters even for demarcation as varieties, the var. *glauca* Blatter & Hallb. and var. *longipetiolata* are treated as synonyms only.

The earliest binomial for this species is *C. omithopodioides* Forsskal (1775) which is a later homonym of *C. omithopodioides* L. (1753). The next epithet *C. parviflora* R. Br. is a nomen nudum. The specific epithet *C. brachycarpa* attributed to Vahl, refers to two different elements, one of which is Peruvian plant which De Candolle had transferred to *Gynandropsis* calling it *G. brachycarpa* (Vahl) DC. The other is an ineditus name by Vahl for an Arabic plant, described as *C. omithopodioides* by Forsskal. Since *C. brachycarpa* Vahl forms the basionym, as well as type of the Peruvian plant *G. brachycarpa* (Vahl) DC., the next available binomial, *Cleome vahliana* Fresen. is the valid and legitimate name of the Indo-arabic species.

15. *Cleome viscosa* L., Sp. Pl. 672. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 170. 1872.

Beng.: *Hade-hurhuria*; Guj.: *Tinnani*; Hindi: *Bagra*, *Karphut*, *Pilahurshur*; Kan.: *Kadusassive*, *Kanphuti*, *Nayibela*; Mar.: *Pivili-tilwan*; Punj.: *Bugra*, *Higul*; Raj.: *Bagro*, *Handi-bagro*; Tam.: *Manja-kadugu*, *Naikadugu*, *Naivelai*; Tel.: *Thirudi-bhaji* (Gonds tribals).

Herbs, annual, erect, up to 1.2 m high, viscid, clothed with glandular or non-glandular hairs, foetid; stems woody, sparsely branched from base, striated, tomentose. Leaves 3 - 5 (-7)-foliolate; petioles striated, up to 7 cm long at base, decreasing upwards, hairy; leaflets sessile, subequal, elliptic-oblong or obovate to spatulate, entire, cuneate at base, acute or rarely obtuse at apex, ciliate along margins, 6 - 45 x 2 - 25 cm, membranous, glandular pubescent; lateral nerves 3 - 8 pairs; petioles 1 - 3 mm long. Racemes lax, few-flowered, corymbiform, leafy, up to 30 cm long; flowers often solitary and axillary at lower portion of racemes, ephemeral, 1 - 1.5 cm across; bracts sessile, foliaceous; pedicels 6 - 12 mm long, elongating up to 4 cm in fruits. Sepals 4, oblong, lanceolate, acute at apex, 5 - 12 x 2 - 4 mm, reddish at base, glabrous inside, glandular hairy outside. Petals 4, subequal, obovate or oblanceolate to oblong-spathulate, cuneate with up to 6 mm long claw at base, rounded at tip, 8 - 12 (-25) x 3 - 5 (-10) mm, orange-yellow, yellow, creamy or rarely white, glabrous, distinctly veined. Stamens (8-) 12 - 40, often intermixed with staminodes, glabrous; filaments 4 - 8 (-20) mm long, distinctly broadened at tip; anthers linear, 1.5 - 2.8 mm long, bluish. Ovary sessile, oblong-cylindric or linear-oblong, beaked, 6 - 8 (-14) mm long, minutely glandular-hairy; style slender, up to 10 mm long, puberulous; stigma capitate. Capsules erect, or sometimes curved, on 2 - 3 cm long pedicels, obliquely striate, terete, linear-oblong, slightly compressed, tapering at both ends, beaked, 4 - 9 (-12) cm long, 3 - 5 mm thick; beak 4 - 20 mm long; valves centripetally nerved; seeds many, reniform, subglobose, finely centrally ribbed and transversely ridged, 1-1.5 mm across, closed at cleft with very narrow opening, glabrous, reddish brown to black.

KEY TO THE VARIETIES

- 1a. Stamens 36 - 40; styles 5 - 8 mm long in flower, elongating to 20 mm long in fruits
 15.1. var. *nagarjunakondensis*
- b. Stamens 12 - 18; styles 1 - 3.5 mm long in flower, 4 - 5 mm long in fruits
 15.2. var. *viscosa*

15. 1. var. *nagarjunakondensis* Sund.-Ragh. in Bull. Bot. Surv. India 28: 187 - 191, t. 3, f. 1 - 8. 1986 (1988). **Fig. 60.**

Herbs, erect, up to 1.2 m tall, woody and sparsely branched from base. Leaves 3 - 5 (-7)-foliolate with petiole up to 4.5 cm long; leaflets obovate, rhombate or elliptic-oblong, variable in size and shape, 0.6 - 3 x 0.2 - 1.5 cm, middle one largest; petiolule 0.5 - 2.5 mm long. Flowers cream-coloured, 2 - 2.5 cm across; pedicels up to 2.8 cm long, elongating to 4 cm in fruits. Sepals 4, elliptic-lanceolate, 8 - 12 x 2.5 - 4 mm. Petals 4, subequal; outer pair 2 - 2.5 x 0.8 - 1 cm; inner pair 1.8 - 2 x 0.6 - 0.8 cm (including 5 - 6 mm long claw). Stamens 36 - 40, intermixed with staminodes; filaments 1.5 - 2 cm long,

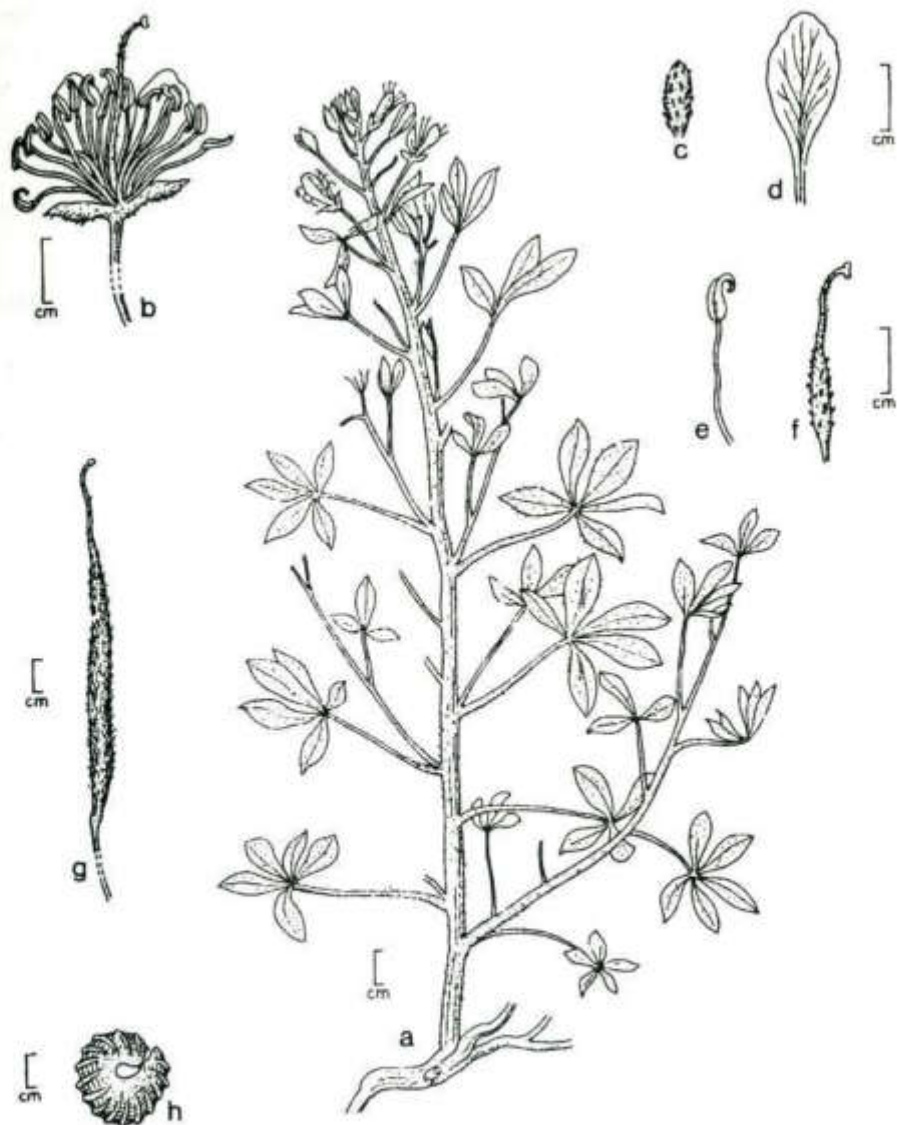


Fig. 60. *Cleome viscosa* L. var. *nagarjunakondensis* Sund.-Ragh. : a. flowering plant; b. flower; c. sepal; d. petal; e. stamen; f. pistil; g. capsule with persistent style; h. seed.

shorter than gynoeccium; anthers 2 - 2.8 mm long. Ovary 1 - 1.4 cm long, glandular hairy; style slender, puberulous, 8 - 10 mm long, elongating to 2 cm in capsules. Capsules linear to oblong, 6 - 8.5 cm long (including persistent style).

Fl. & Fr. July - Sept.

Distrib. India: Deciduous forests up to 300 m. Andhra Pradesh.

Endemic.

Notes. Differs from var. *viscosa* in the conspicuous longer style, larger flowers and more number of stamens.

15. 2. var. *viscosa*

Fl. & Fr. Throughout the year.

Distrib. India: Throughout in tropical areas up to 1000 m.

Africa, Asia, Australia and America.

Notes. Three to four drops of leaf juice poured into ears relieves ear infections as used by the tribals, Gonds and Kolams of Andhra Pradesh.

Filaments of stamens are of unequal size, the adaxial ones being shorter than the rest. The height of the plant varies from 4 cm to 1.2 m.

Chromosome numbers: $n = 10$ (Kyhos in Madrono 18: 245 - 246, 1966) and $2n = 20$ (Janaki Ammal in Curr. Sci. 1: 328, 1933; Larsen in Dansk. Bot. Ark. 23: 375 - 389, 1966).

CULTIVATED SPECIES

1. *Cleome hassleriana* Chodat in Bull. Herb. Boiss. 6 (app. 1): 12. 1898).

A native of tropical S. America, introduced and cultivated for its showy flowers, sometimes run wild. It is often misidentified as *C. heptaphylla* L. or *C. houtteana* Schlecht. in Indian floras. However, it is readily distinguished by its viscid hairy prickly stems, 5 - 7 foliolate leaves, large purple showy flowers, short or lacking androgynophore, deflexed pubescent sepals, 2 - 3 cm long and 6 - 7 mm wide sepals and 3 - 7 cm long gynophore.

Also similar to *C. gynandra* L. but the stems are up to 1 m high; leaves 5 - 7-foliolate; petioles 4 - 7 cm long, bearing a pair of short spine-like stipules at base; leaflets

oblanceolate, 2.5 - 12 x 1 - 3.5 cm, often spiny on midrib beneath; bracts simple, ovate, ca 10 x 5 mm; pedicels 2-5 cm long; sepals lanceolate, 8 - 10 cm long, reflexed; petals purplish, ca 2.5 x 1 cm; stamens sessile; filaments ca 4 cm long; gynophore at first ca 3 cm long, later 5 - 7 cm long and capsules 4.5 - 9 cm long and ca 3 mm thick.

Fl. & Fr. Aug. - Feb.

Distrib. India: Common in gardens of N.E. Indian hills, up to 2000 m, often run wild.

Tropical S. America.

2. *Cleome spinosa* Jacq., Pl. Carib. 26. 1760.

Herbs, annual or biennial, erect, 0.6 - 1.5 m high, divaricately branched, foetid, viscid; stems densely clothed with patent gland-tipped hairs, armed with minute prickles at base of leaves or unarmed. Leaves 5 - 7-foliolate; petioles of lower leaves usually longer than leaflets with 2 spiny stipules at base; leaflets oblong or lanceolate, acute, subentire to finely or slightly serrulate, 2 - 10 x 0.6 - 3 cm. Flowers large, ca 2 - 2.5 cm across, purple-pink or white, many in terminal racemes; pedicels long, shorter than gynophore, both elongated and thickened in fruit; bracts simple, ovate or oblong. Sepals reflexed during anthesis, 5 - 9 mm long. Petals long-clawed, 2 - 3.5 cm long; limb obovate, ca 1 cm broad with an equally long claw. Stamens 6; filaments much longer than petals, adnate to gynophore for 1 - 3 mm. Gynophore ca 4 cm long, about 6 - 8 cm in fruit. Capsules cylindric-linear, 3 - 8 cm long, 3 - 3.5 mm thick, on up to 7 cm long pedicels; seeds many, glabrous, smooth.

Fl. & Fr. March - Dec.

Distrib. India: West Bengal (Paria in Sci. & Cult. 46: 27 - 28. 1980).

Native of tropical S. America, cultivated as ornamental in many parts of S.E. Asia.

Notes. Similar to *C. speciosa* Raf. but less graceful; commonly known as "Spider Flower".

7. *Crateva* L.

(*Crataeva*)

Trees (rarely shrubs), unarmed, glabrous, deciduous; branches lenticellate with distinct leaf-scars. Leaves palmately trifoliolate; stipules minute, caducous; leaflets sessile to shortly stalked, often pellucid-dotted; terminal one equilateral with acuminate or caudate apex; lateral ones oblique, asymmetrical. Racemes terminal, corymbose;

rachis short or up to 25 cm long, either with arrested growth or growing through a leafy twig. Flowers showy, subtended by 3-foliolate or subulate bracts, long-pedicelled, unisexual or bisexual, often polygamous. Receptacle dish-shaped with incurved margins, nectariferous. Sepals equal, ovate-spathulate, green. Petals first white, later creamy, unguiculate, long-clawed at base, subequal; anterior pair slightly smaller, ovate to rhomboid, obtuse at top. Stamens 12 - 50, basally adnate to gynophore, longer than gynophore, infertile in female flowers. Gynophore 1.8 - 6 cm long, slender, thickened while fruiting; ovary long-stipitate, ellipsoid or subglobose, unilocular or seemingly 2-locular; placentae 2; ovules in 4 or more rows; stigma subsessile, discoid. Fruits berry-like, pendulous, globular to ellipsoid; rind spongy or hard, smooth or papillate, covered by flat whitish warts; stipe woody, thickened; seeds packed and embedded in creamy foetid pulp, reniform or horse-shoe shaped; cotyledons convolute, one longer and curved around the other.

Pantropical in Africa, Asia, Central and S. America, mostly in lowland forests near streams, up to 900 m; about 8 species, 4 species in India.

Notes. Pollen longjaxis oval. Polar axis ranges from 20 - 35 μ , equatorial diam. 15 - 27 μ , 3 - 7 colpi. Ecto-aperture colpi long extending to poles, gradually tapering. Endoaperture more or less circular to irregular with few to many teeth-like granular structure. Exine ornamentation regulo-reticulate, columella short, lumina 0.25 - 1 μ . Shape in polar view subtriangular. Sterility is common in both sexes (Krishna Mitra, l.c. 8, 1975).

Literature. JACOBS, M. (1964). The genus *Crateva* (Capparaceae). *Blumea* 12: 171 - 208, f.1 - 7.

KEY TO THE SPECIES

- 1a. Mostly leafless when flowering; fruits orange-yellow, turning to reddish on maturity
1. *C. adansonii* subsp. *odora*
 b. Mostly leaf-bearing when flowering; fruits greyish to brown on maturity 2
- 2a. Leaflets membranous, concolorous on drying; twigs mostly straw-coloured when dry 3. *C. religiosa*
 b. Leaflets subcoriaceous, discolorous on drying; twigs mostly brownish when dry 3
- 3a. Leaflets 11 - 16 (-22)-nerved; rachis of inflorescence 10 - 16 cm long; flowers up to 100; fruits ellipsoid or obovoid; seeds dorsally crested 2. *C. magna*
 b. Leaflets 5 - 10-nerved; rachis of inflorescence a few cm long; flowers up to 40; fruits globose; seeds smooth, not crested 4. *C. unilocularis*

1. *Crateva adansonii* DC. subsp. *odora* (Buch.-Ham.) Jacobs in *Blumea* 12: 198. 1964. *C. odora* Buch.-Ham. in *Trans. Linn. Soc.* 15: 118. 1827. *C. roxburghii* R. Br. in *Denh. & Clapp. Narr. Trav. Disc. Afr. App.* 224. 1826. *C. religiosa* var. *roxburghii* (R. Br.) Hook. f. & Thomson in *Fl. Brit. India* 1: 172. 1872. *C. nurvala* sensu Blatter in *J. Bombay Nat. Hist. Soc.* 35: 293. 1931, non Buch.-Ham.

Beng. & Hindi: *Barun, Barna*; Kan.: *Nirvala*; Nep.: *Chiple*; Mar.: *Vaivarna, Wairoda*; Tam.: *Kudagai, Mavilandam*; Tel.: *Mugalinga, Muvva*.

Trees, 3 - 10 m. Leaves subcoriaceous when drying, dull greyish green; petioles 7 - 10 (-12) cm, glandular at tip; leaflets 1.5 - 2 times as long as broad, ovate to elliptic-lanceolate; central leaflets up to 12 x 7 cm, with abruptly acuminate apex; lateral leaflets 6 - 8 x 3.5 - 5 cm with oblique and tapering base and acute apex; lateral nerves 4 - 6 pairs; petiolules 6 - 10 mm long. Corymbs 12 - 30-flowered, rachis 2 - 3 cm long, often growing through with a few axillary flowers. Flowers appearing before or with tender leaves, fragrant, 2.5 - 3.5 cm across; pedicels 3 - 7 cm long. Sepals petaloid, elliptic, acuminate, 3.5 - 5 x 1.5 - 2 cm. Petals initially greenish-white, turning to yellow and finally fading to pink; limb 9 - 18 x 5.5 - 10 mm; claw 3 - 6 mm long, equalling sepals. Stamens 15 - 26; filaments 3 - 4.5 cm, white, turning to lilac or purple; anthers black. Gynophore pinkish, 2.5 - 3.5 cm long; ovary ovoid or ellipsoid, ca 3 x 2 mm, often abortive; stigma small, knob-shaped. Fruits orange-yellow or reddish brown, globose, 2.5 - 4 x 2 cm; stipe 3 - 4 mm thick; seeds broadly ellipsoid, 5 - 6 x 2 mm, brown, smooth, embedded in yellow pulp.

Fl. Feb. - Apr.; *Fr.* May - Nov.

Distrib. India: In open forests or scrub jungles, from sea level to 750 m. Throughout India (except in the humid hill states of N.E. India and Kashmir).

Pakistan, Myanmar and Sri Lanka.

Notes. Wood used for agricultural implements, toys and planks. Fresh leaves and bark efficaceous in treating rheumatic and urinary complaints besides as poultices for fomentation. Fruits edible when cooked. Bark demulcent, antipyretic. Bark crushed and the filtrate administered to increase lactation by Chenchus and Lambadis of Andhra Pradesh. Bark extract with pepper used to cure chest pain and menstrual disorders by Konda-reddis of Andhra Pradesh.

The diploid chromosome number is $2n = 26$ (Raghavan & Venkatasubban in *Cytologia* 11: 319. 1936)

C. religiosa sensu Dunn (in Gamble's *Fl. Pres. Madras* 1: 47. 1915) partly reflects subsp. *odora* and partly *C. magna*, both common in peninsular India. The coloured plate by Blatter (in *J. Bombay Nat. Hist. Soc.* 35: t.14. 1931) depicts subsp. *odora* but the text figures of leaves refer to *C. magna*.

This plant does not occur in Assam or Meghalaya due to the heavy rains. The reference to "*C. roxburghii* R. Br." by Kanjilal et al. (*Fl. Assam* 1: 73 - 74. 1934) applies to *C. unilocularis* Buch.- Ham.

For detailed discussions on reasons for rejecting the earlier name *C. roxburghii* R. Br. (1826) in favour of the next epithet *C. odora* Buch.-Ham. (1827), see Jacobs, l. c. 197 - 198. 1964.

2. *Crateva magna* (Lour.) DC., Prodr. 1: 243. 1824. *Capparis magna* Lour., Fl. Cochinch. 1: 331. 1790. *Crateva nurvala* Buch.-Ham. in Trans. Linn. Soc. 15: 121. 1827. *C. lophosperma* Kurz in J. Bot. 12: 195, t. 147, ff. 4 - 6. 1874. *C. religiosa* var. *nurvala* (Buch.-Ham.) Hook. f. & Thomsomson in Fl. Brit. India 1: 172. 1872. *C. religiosa* auct. non Forster f.; Dunn in Gamble, Fl. Pres. Madras 47. 1915.

Beng.: *Tikthashak*; Guj.: *Vaivarna*, *Tripanjozadi*; Hindi: *Barna*; Kan.: *Bilepatra*, *Kadukokku*, *Neervalu*; Mal.: *Nir-mathalam*; Mar.: *Katarlingad*; Tam.: *Maralinga*; Tel.: *Uskiaman*, *Voolemara*, *Vulimiri-chettu*.

Trees, up to 10 m tall, rarely shrubs, 2 - 3 m; trunk up to 35 cm in diam.; branchlets lenticellate, greyish-brown, smooth, or verrucose. Petioles 4 - 12 cm long with glands at apex; leaflets 2 - 4 times as long as broad, 8 - 25 x 1.5 - 6 cm, chartaceous, glossy, glaucous beneath, brown tinged above; central leaflet elliptic-lanceolate or oblanceolate; laterals ovate-elliptic or rhomboidal, acute to cuneate at base, gradually long-acuminate with acute tip at apex; petiolules 3 - 7 mm long. Corymbs terminal, many-flowered; rachis 10 - 15 cm long, growing through axis. Flowers creamy, polygamous, faintly fragrant, 3 - 4 cm across; pedicels 3 - 7 cm long, leaving scars on falling off. Sepals oblong to ovate-oblong, acute, 2.5 - 3 x 1.3 - 1.5 cm. Petals obovate-obtuse, limb 2 - 2.5 x 1.5 - 1.8 cm, claw 4 - 8 mm long. Stamens exceeding 24; filaments 4.5 - 5 cm long, lilac or purple. Gynophore 4 - 6 cm long; ovary oblong-ellipsoid, 4 - 5 x 2 - 2.5 mm, often abortive. Fruits oblong-ellipsoid or oblong-ovate, 4 - 6 x 3 - 5 cm; pericarp woody, yellowish grey, with a powdery crest that soon withers off leaving it smooth; seeds dark brown, 8 - 12 x 5 - 9 mm, dorsally crested, tubercled, embedded in creamy pulp.

Fl. Jan. - Apr.; *Fr.* Apr. - Aug.

Distrib. India: In deciduous or semievergreen forests, along streams, up to 1000 m. Peninsular India, Western India, Gangetic Plains and Eastern India up to Tripura and Manipur.

Bangladesh, Myanmar, China and Sri Lanka, extending to Malaysia and Indonesia.

Notes. Young berries are edible. Leaves are bitter and used in treating skin ailments. Root bark extract administered for gastric trouble by Konda-reddis and Valmiki in Andhra Pradesh.

Kanjilal et al. (Fl. Assam 1: 74. 1934) treat this species under *Crateva lophosperma*.

In Indian plants the petioles are glandular but without distinct knobs.

3. *Crateva religiosa* Forster f., Pl. Escul. Ins. Occ. Austral. 45. 1786; Hook. f. & Thomson in Fl. Brit. India 1: 172. 1872.

Asm.: *Barun*; Hindi: *Barun*; Kachari: *Mibonji*; Naga: *Naga-sentur*.

Trees, 3 - 15 m tall, up to 1.2 m in girth; young shoots brown, bearing a few long pale lenticels. Leaves dull green, thinly membranous, concolorous; petioles 4 - 10 cm long, usually glandular-papillate at apex; leaflets 1.8 - 2.2 times as long as broad, lanceolate or elliptic, cuneate at base, tapering or abruptly acuminate at apex, 7 - 12-nerved; petiolules 3 - 7 mm long. Corymbs lax, up to 25-flowered, on short rachis, not elongating after anthesis. Flowers showy, fragrant, 3 - 4 cm across, white or creamy, orange on drying; bracts 8 - 15 mm long, caducous. Sepals ovate, acuminate, 6 - 8 x 1.5 - 3 mm, not keeled. Petals broadly ovate-elliptic, cream-coloured; limb 15 - 35 x 10 - 22 mm, claw 6 - 18 mm long. Stamens 16 - 24; filaments purple, 4 - 10 cm long. Gynophore 3 - 6.5 cm long, much thickened and elongating up to 12 cm while fruiting; ovary ovoid to subcylindric, 5 - 6 x 2.5 mm. Fruits obovoid, subglobose, 3 - 5.5 cm in diam.; rind 5 - 6 mm thick, pustular, covered with grey-yellowish crust on surface. Seeds broadly ellipsoid, somewhat compressed, dorsally keeled, 12 - 18 x 6 - 8 mm, tuberculate.

Fl. March - Apr.; Fr. Oct.

Distrib. India: Infrequent in subtropical evergreen forests, up to 1000 m. Sikkim, Arunachal Pradesh, Assam and Andaman & Nicobar Islands.

Nepal, Bhutan, Myanmar, Indo-China and Thailand, extending to S.E. Asia, up to Philippines.

Notes. Closely allied to *Crateva unilocularis* Buch.- Ham. and according to Jacobs (l. c.) the distinguishing features being thin membranous concolorous, sessile or subsessile leaflets, which are so fragile that they are invariably damaged in herbaria. However, Jacobs also remarks that in Malesia, leaflets are subcoriaceous, never so thin and petiolules often stalked and up to 13 mm long. This species needs reassessment with fresh collections for proper understanding of *C. religiosa-unilocularis* complex.

4. *Crateva unilocularis* Buch.- Ham. in Trans. Linn. Soc. 15: 121. 1827.

Asm.: *Barun*; Garo: *Jong-sia*; Nep.: *Sipligan*.

Trees, 8 - 10 (-30) m tall; branchlets greyish-brown, angular, lenticellate. Petioles 5 - 8 cm long, with distinct glands; leaflets 1.6 - 2.2 times as long as broad, ovate, elliptic or lanceolate, subacute at base, tapering with a short acumen, 6 - 12 x 3.5 - 6 cm, subcoriaceous, glossy, drying brownish; lateral leaflets slightly asymmetric; midrib reddish; lateral nerves 5 - 8 pairs with distinct reticulations; petiolules 3 - 5 mm long. Corymbs terminal, 8 - 10 cm long, 20 - 40-flowered; rachis 3 - 6 cm long, not growing

through after anthesis. Flowers white or pale creamy, drying to pale pink, 3 - 4 cm across; pedicels 4 - 6 mm long. Sepals linear or narrow-lanceolate, acuminate, keeled, 8 - 12 x 3 mm. Petals rhomboid or obovoid; limb 15 - 18 x 8 - 12 mm; claw 6 - 8 mm long. Stamens 16 - 18; filaments filiform, purplish. Gynophore 4 - 6 cm long; ovary oblong-ellipsoid, 3 - 4 x 1.5 - 2 mm; stigma subsessile, ca 1 mm wide. Fruits globose, 3 - 4 cm across; stipe 5 - 6 mm thick; pericarp 2 - 3 mm thick, greyish-papillate, lenticellate; seeds embedded in pulp, 8 - 10 x 6 - 8 mm, smooth, brown.

Fl. Jan. - Apr.; *Fr.* July - Nov.

Distrib. India: Along streams in mixed dry forests, up to 1500 m. West Bengal, Sikkim, Assam, Meghalaya and Andaman & Nicobar Islands.

Nepal, Bhutan, Bangladesh, Myanmar, extending to China and Vietnam.

Notes. Wood useful for making toys, planks and agricultural implements. Leaves used as vegetable in Assam.

This species is common in Assam and referred to as "*Crateva roxburghii* R.Br." by Kanjilal et al. (in *Fl. Assam* 1: 73, 1934). According to them the tree attains a height of over 100 ft.

Though it can be easily distinguished from *C. magna* Lour. by key characters, its affinity to *C. religiosa* needs further critical study.

5. *Dipterygium* Decsne

Monotypic; description and distribution as for the species below.

Notes. An interesting genus showing affinities to both Brassicaceae and Capparaceae. In its actinomorphic flowers, cruciform corolla, presence of 6 stamens and winged fruits it resembles Brassicaceae, especially the tribe Euclidieae. But in its bracteate racemes, non-tetradynamous stamens and presence of a very short gynophore it approaches Capparaceae. Pollen grains are akin to colpate type of *Cleome*.

Literature. BHANDARI, M. M. (1978) *Flora of Indian Deserts*, p. 43. IAN, C. HEDGE & J. LAMMOND (1970) In: Rechinger, K. H. *Flora Iranica* 68: 12 - 13. JAFRI, S.M.H. (1973) In: *Flora of West Pakistan* 34: 17, f.4. A - C. JAIN, S. K. (1960) The genus *Dipterygium* Decsne in India. *Bull. Bot. Surv. India* 2: 171.

Dipterygium glaucum Decsne in Ann. Sci. Nat. ser. 2, 4: 66, t. 3. 1835; Hook. f. & T. Anderson in Fl. Brit. India 1: 164. 1872. **Fig. 61.**

Undershrubs, woody, rigid, perennial, 10 - 60 cm high, glabrous to glandular scabrid; branches divaricate, slender, wiry, glaucous, terete, grooved. Leaves simple, sessile or subsessile, elliptic-oblong or ovate, 3 - 15 x 2 - 3 mm, fleshy; petioles ca 0.5 mm long. Flowers actinomorphic, yellow or creamy, in terminal lax few-flowered bracteate racemes. Sepals 4, free, green, glandular, ovate, acute, 0.8 - 1 mm long. Petals 4, cruciform, ovate-elliptic, clawed, obtuse at apex, 2.5 - 3.5 x 1.2 - 1.6 mm, yellow, white or lilac along margins. Stamens 6, equal, 2.5 - 3 mm long; filaments filiform. Gynophore ca 0.5 mm long. Ovary superior, obovoid, ca 2 x 1.5 mm, unilocular, 2-ovuled, 4-winged; wings membranous; style ca 0.5 mm long; stigma capitate. Fruit drooping, an indehiscent samara, ellipsoid, 2.5 - 6 x 2 - 4 mm, laterally compressed, transversely wrinkled with translucent wings; seeds solitary, rugose, ca 3.5 x 2 mm.

Fl. June - Oct.; *Fr.* July - Dec.

Distrib. India: On sand dunes or loose sandy soil, rare but it is a locally dominant species wherever it occurs. Rajasthan.

Pakistan, Middle East to Egypt and Sudan.

Notes. In India, this species is confined to Western Rajasthan, recorded from Pokran, Suratgarh, Karnisar, Barmer, Bikaner, Ganganagar and Jaisalmer.

6. *Maerua* Forsskal

Shrubs or trees, unarmed, often scandent. Leaves sessile or petiolate, sometimes clustered on abbreviated lateral shoots, simple or 1 - 3 (-5)-foliolate; stipules minute, subulate. Flowers in racemes or corymbs, sometimes 1 - 4 in axils of upper leaves. Sepals 4, rarely 3, valvate, united at base, caducous; calyx-tube funnel-shaped, sharply lined by receptacle. Petals 3 - 4, rarely absent, equal, smaller than calyx, inserted at throat of calyx-tube, mostly caducous. Receptacle cylindrical, campanulate or infundibular, inner margin produced into a lobed or toothed disc. Androphore equal or exceeding the receptacle, without appendage. Stamens many, exerted, attached to the middle of torus; filaments free, or basally connate with gynophore. Gynophore long exceeding stamens; ovary cylindrical to ellipsoid, 1 - 2-locular; stigma subsessile, capitate; ovules 4 - many on 2 (-4) parietal placentae. Fruits fleshy, ovoid, spheroid, cylindrical or moniliform, torulose or not, often transversely locular, 1- many-seeded; seeds large, subglobose to reniform, smooth or rugose; cotyledons incumbent, convolute.

Mostly in drier parts of Africa, extending to Madagascar, Middle East and Asia; ca 100 species, 2 in India.

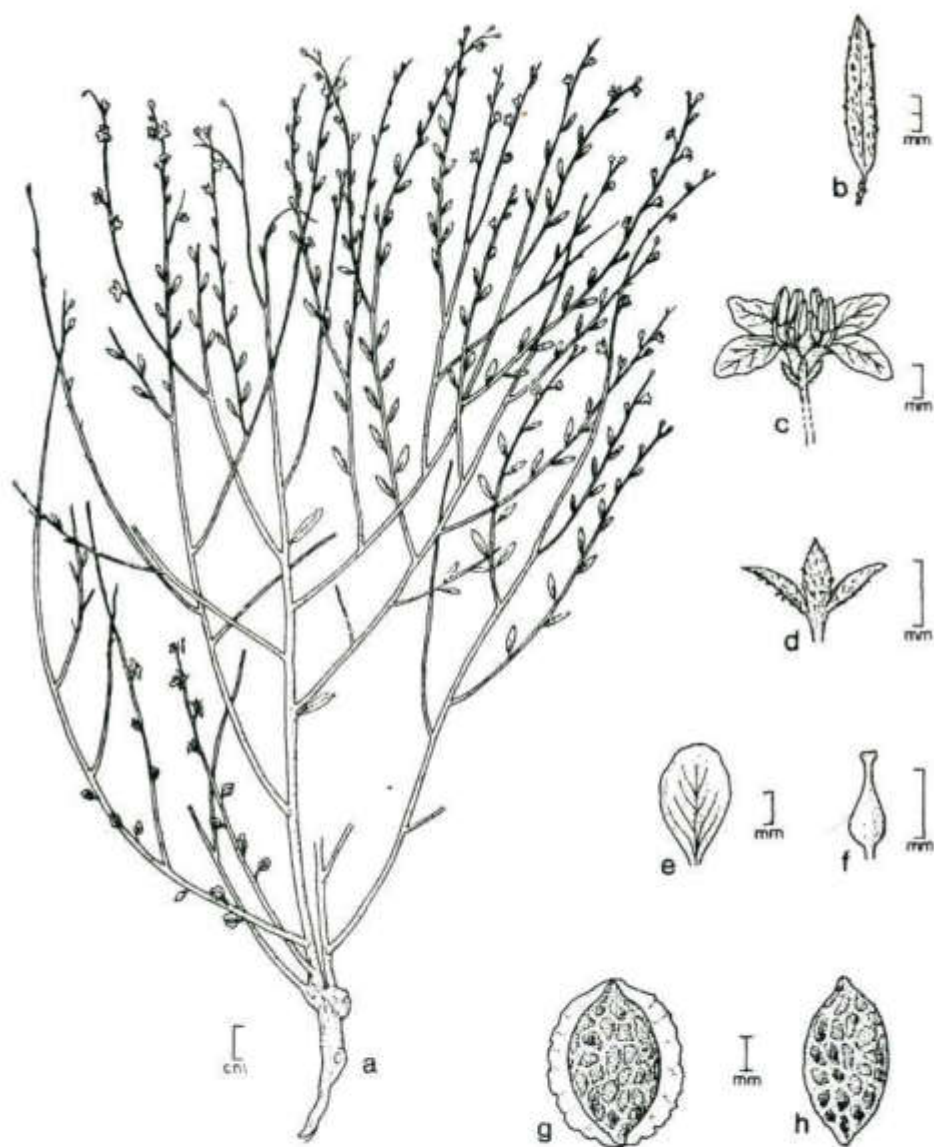


Fig. 61. *Dipterygium glaucum* Decsne : a. plant with flowers and fruits; b. leaf; c. flower; d. sepals; e. petal; f. pistil; g. samara with translucent wing; h. seed.

Notes. Pollen longiaxis, colpa long, broad, slit-like. Endoaperture circular with granules. Exine semitectate, columella in small striate groups; quite distinct from other genera. Pollen dimorphism has been noted in many species.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Trees; petals absent; berry ovoid | 1. <i>M. apetala</i> |
| b. Scandent shrubs; petals 4; berry elongated, cylindrical or moniliform | 2. <i>M. oblongifolia</i> |

1. *Maerua apetala* (Roth) Jacobs in Blumea 12(2): 207. 1964. *Capparis apetala* Roth, Nov. Pl. Sp. Ind. Or. 238. 1821. *Niebuhria linearis* DC., Prodr. 1: 244. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 171. 1872. *N. apetala* (Roth) Dunn in Gamble, Fl. Pres. Madras 41. 1915. Fig. 62.

Tam.: Iruvalli; *Tel.:* Lukki-chettu, Nemali-adugu (Chenchu & Lambadi tribals).

Trees, up to 4 m tall, glabrous. Leaves (1 - 2) 3 - 5-foliolate; leaflets ovate, elliptic-oblong, linear or linear-lanceolate, tapering at base, acute or rarely retuse and mucronate at apex, 5 - 10 x 0.3 - 3.2 cm, subcoriaceous; lateral nerves 3 - 6 pairs; secondary nerves obscure; petioles 4 - 12 cm long; petiolules 6 - 8 mm long. Racemes terminal, lax, 5 - 12 (-20)-flowered; flowers fragrant, green or white, purple tinged, on 2 - 3 cm long pedicels. Calyx-tube greenish, 1.2 - 1.5 cm long, 0.8 - 1 cm thick; lobes ovate, puberulous along margins. Petals absent. Stamens ca 30; filaments pinkish, shorter than gynophore. Gynophore 2 - 2.8 cm long, elongating up to 4 cm while fruiting, hardly incrassate. Ovary ovoid, 2.5 x 1 mm, 1-loculed with 2 placentae. Berries oblong, ovoid, 1 - 2-ridged, 1.5 - 1.8 cm long, ca 1 cm thick. Seeds 1 (3 - 5), embedded in scarlet pulp, muricate, ca 6 mm across, white.

Fl. Jan. - April; *Fr.* March - Aug.

Distrib. India: Scrub forests and dry regions, from sea level to 300 m, scattered and infrequent. Andhra Pradesh and Tamil Nadu,

Endemic.

Notes. A paste of root bark is applied for leucoderma and the extract given orally for the same by Chenchus and Lambadis of Andhra Pradesh. Tender leaves ground with spices and the paste made into pills are given orally for nervous disorders and foot pains by Chenchus.

In Vajravelu 24719 (MH) leaflets vary from 3 - 5. Though the laminae of leaflets are usually ovate, occasionally they are linear-lanceolate and up to 7 cm long and 2 - 3

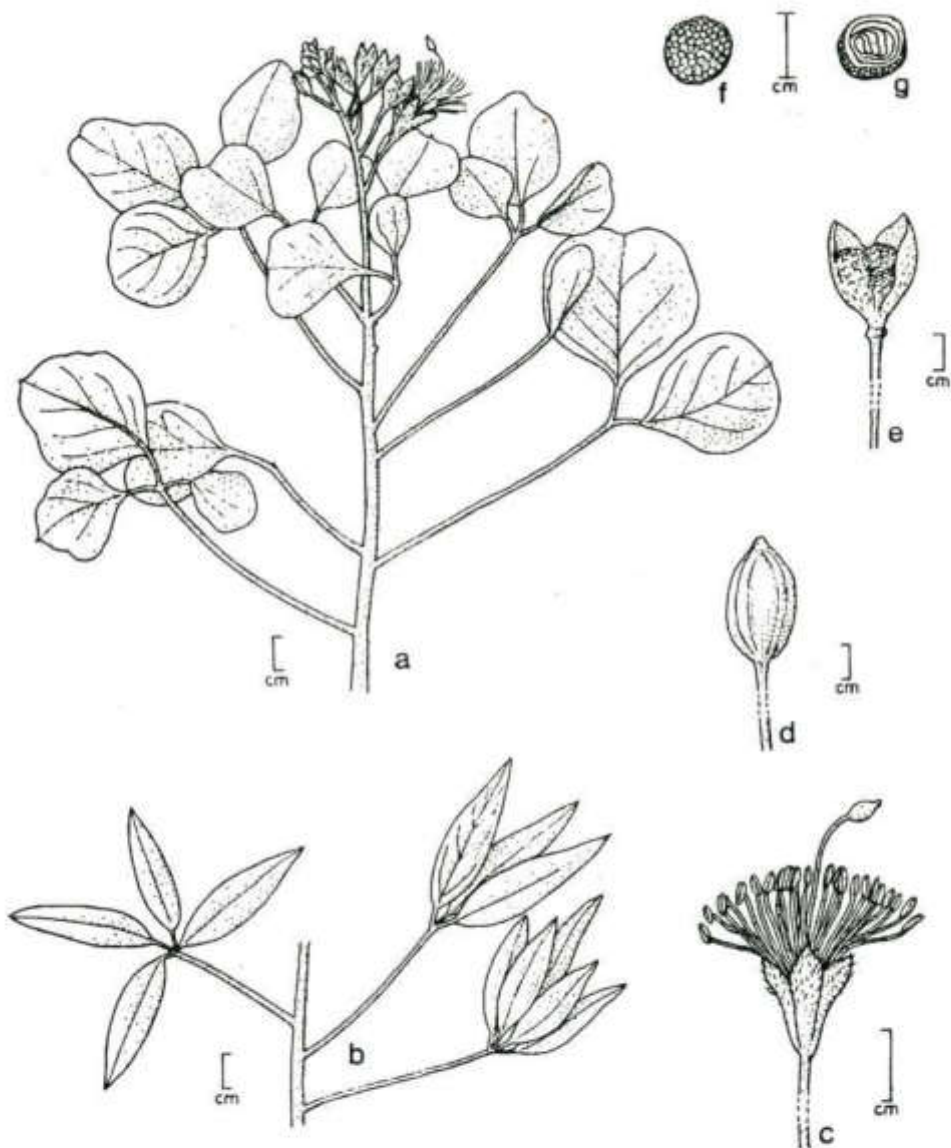


Fig. 62. *Maerua apetala* (Roxb) Jacobs : a. flowering twig; b. leaf variations; c. flower; d. fruit; e. tardily dehiscent fruit; f. seed; g. seed with testa removed, showing cotyledon.

mm wide. Fruits are generally 1-seeded, but in Ramamurthy 21000 (MH) the berries are larger, up to 3 cm long, 1.5 cm thick and 4 - 5-seeded.

2. *Maerua oblongifolia* (Forsskal) A. Rich. in Guill. & Pers., Fl. Seneg. Tent. 1: 32, t. 6. 1847. *Capparis oblongifolia* Forsskal, Fl. Aegypt.-Arab. 99. 1775. *Niebuhrnia arenaria* DC., Prodr. 1: 244. 1824. *M. arenaria* (DC.) Hook. f. & Thomson in Fl. Brit. India 1: 171. 1872 (incl. vars. *glabra* & *scabra*).

Guj.: *Hemkand*, *Kala-pinjola*, *Pinjola*; Hindi: *Potiakand*, *Wagboti*; Kan.: *Kaduthottimara*, *Nelasakregadde*; Mar.: *Kaba*, *Kalwari*; Punj.: *Pitwani*; Raj.: *Orapa*; Tam.: *Bhumichakkarai*, *Mochukkodi*, *Mulmurandai*.

Shrubs, scandent, ascending up to 4 m; twigs, leaves and inflorescence puberulous to glabrous; bark smooth, pale brown. Leaves ovate, elliptic-oblong or lanceolate, attenuate at base, obtuse, retuse and mucronate at apex, 2.5 - 8 x 0.8 - 3.5 cm, coriaceous, glaucous, drying pale green; lateral veins 5 - 6 pairs, distinct; petioles terete, 6 - 9 mm long. Corymbs dense-flowered, rarely flowers solitary, axillary. Flowers white or greenish-yellow, 2 - 2.5 cm across, mildly fragrant; pedicels 0.3 - 1.5 cm long, glabrous; bracts small, ovate, acuminate, rigid. Sepals petaloid, united near base or up to one-third from base; calyx-tube 3 - 8 mm long, lined by a tubular truncate disc; lobes elliptic-oblong, ca 1.4 x 0.6 cm, glabrous or sometimes softly pubescent outside, pubescent inside, villous along margins. Petals on cup-shaped disc, ovate-lanceolate to obovate, acuminate, undulate along margins, ca 7 x 2.5 mm, greenish yellow. Stamens 20 - 26; filaments up to 2 cm long, inserted on ca 5 mm long torus, greenish or white, brownish or purple on drying; anthers basifixed, ca 3 mm long. Gynophore 1.5 - 2.5 cm long; ovary cylindrical, 4 - 6 mm long, ca 1 mm thick, glabrous; stigma sessile. Berries 5 - 12 cm long, glabrous, pale brownish, cylindric or moniliform, often twisted and knotted, constricted with 2 - 4 alternating rows of globular 1-seeded sections; seeds globose, 5 - 6 mm across, minutely echinate-tuberculate, brown.

Fl. Jan. - March, Aug. - Oct.; Fr. Feb. - May, Sept. - Dec.

Distrib. India: Common in semiarid sandy tracts and scrub jungles from sea level to 600 m, scattered and often associated with *Capparis sepiaria*. Throughout the country, except Jammu & Kashmir and hill states of N.E. India.

Thailand, Sri Lanka, Pakistan, Arabia, Middle East and Africa.

Notes. Leaves serve as fodder for camels and goats. Ripe fruits are rarely seen, since they are eaten by birds and squirrels, which cause the seed dispersal.

An extremely variable species with reference to size, shape, texture, indumentum and venation of leaves. In Indian plants leaves are never as narrow and linear as in

African populations and besides venation in quite distinct. Though the species is common in peninsular India, no specimens could be seen from Kerala.

It has a diploid chromosome number of $2n = 20$ (T.S. Raghavan & Venkatasubban in *Cytologia* 11: 319. 1941).

7. *Stixis* Lour.

Shrubs, unarmed, scandent; branches lenticellate, verticillate. Leaves exstipulate, simple, rarely 3-foliolate, pellucid-dotted. Inflorescence axillary, many-flowered, racemose or paniculate. Flowers yellow, short-pedicelled; bracts caducous. Torus short, disc-shaped, persistent with sepals inserted along margins. Sepals 6, in two whorls of 3 each, valvate or imbricate; petaloid, outer sepals covering margins of inner ones. Petals absent (rarely petaloid appendages seen). Androphore short, subconical. Stamens many, nearly equalling sepals. Ovary shortly stipitate, 3-loculed with axile placentation, each placenta 5 - 10-ovuled; style simple or 3-armed; stigma 1 - 3, subulate. Fruit drupaceous, fleshy on a woody stalk, 3-valved; stone 1 (-2)-seeded, ovoid; cotyledons thick, fleshy, unequal, the larger embracing the other.

Nepal, Bhutan, Myanmar, China, Cambodia, Vietnam, Thailand, Malaysia, Indonesia and Philippines; 8 species, one in India.

Literature. DUTTA, R. M. & D. P. DAM (1989). The genus *Stixis* Lour. (Capparaceae) in India. *J. Econ. Tax. Bot.* 13: 17 - 21. JACOBS, M. (1963). The genus *Stixis* (Capparaceae) - a census. *Blumea* 12: 5 - 12, f. 1 a - g. SUNDARA RAGHAVAN, R. 1986 (1988) New taxa in Capparaceae. *Bull. Bot. Surv. India* 28: 185 - 192, tt. 1 - 4.

Notes. The division of *Stixis* Lour. into *Roydsia* Roxb. (style short or 0) and *Alytostylis* Hook. f. (style long with 3 stigmas) is artificial and not convincing.

KEY TO THE SPECIES

- 1a. Sepals reflexed at anthesis; androgynophore 1.5 - 2 mm long; ovary densely brown hairy; style obscurely 3-lobed or 3-dentate 1. *S. scandens*
- b. Sepals patent at anthesis; androgynophore 5 - 6 (-10) mm long; ovary glabrous; style nearly 3 - 5-fid to the base 2. *S. suaveolens*

1. *Stixis scandens* Lour., *Fl. Cochinch.* 295. 1790 & l. c. 361. 1793. *Roydsia parviflora* Griffith, *Notul. Pl. Asiat.* 4: 578. 1854; Hook. f. & Thomson in *Fl. Brit. India* 1: 180. 1872, in obs. *S. manipurensis* Deb & Rout in *J. Bombay Nat. Hist. Soc.* 86(1): 86 - 88, f. 1. 1989, *syn. nov.*

Shrubs or climbers, woody; branchlets terete, slender, greyish or reddish brown, lenticellate, puberulous when young, glabrous on maturity. Leaves alternate or subopposite, elliptic-oblong or oblong-obovate, acute or cuneate at base, abruptly acuminate at apex, entire, 7 - 16 x 2.5 - 6 cm, thinly coriaceous, glossy, minutely pustulate, glabrous, except the nerves often hairy beneath; lateral nerves 5 - 10 pairs, arching upwards and connate near periphery of margin to form an intramarginal nerve; petioles 1 - 1.5 cm long. Flowers yellowish, sweet-scented, in terminal or axillary brown tomentose racemes of 4 - 6 (-9) cm long; bracts linear, subulate, 2.5 - 3 mm long, brown-tomentose, caducous; pedicels 2 - 6 mm long, brown tomentose. Sepals obovate, obtuse, reflexed, 4 - 6 mm long, densely brown tomentose. Stamens 16 - 40 on 0.5 mm long androphore. Ovary on 1 - 1.5 mm long gynophore, brown tomentose; style 0.5 mm long, obscurely 3-lobed at apex. Drupes ellipsoid, on stout 3-angled, 3 - 6 mm long stalk, spotted with small warts, spongy. Seed embedded in pulp.

Fl. & Fr. April - Dec.

Distrib. India: Evergreen forests at 1650 m. Nagaland and Manipur.

Myanmar.

Notes. *S. manipurensis* Deb & Rout (l. c.) fits into the general description of *S. scandens* Lour. and hence reduced as a synonym.

2. *Stixis suaveolens* (Roxb.) Pierre in Bull. Soc. Linn. Paris 1: 654. 1887. *Roydsia suaveolens* Roxb., Pl. Corom. 3: 87, t. 289. 1819; Hook. f. & Thomson in Fl. Brit. India 1: 180. 1872.

Fig. 63.

Asm.: Madhumalati, Madhabimalati; *Kh.:* Madholata, Manoj; *Nep.:* Kasouli-lahara.

Shrubs, scandent, ascending up to 5 m, puberulous, later glabrescent. Leaves oblong, obovate or oblong-lanceolate, cuneate, subacute to rounded at base, abruptly acuminate at apex with 5 - 15 mm long acumen, 14 - 35 x 4 - 18 cm, glabrous, coriaceous, glossy and dark green above, pale green below; lateral nerves 5 - 12 pairs; reticulations distant; petioles 1.5 - 4 cm long. Inflorescence axillary or terminal sturdy panicles, 15 - 30 cm long, velvety pubescent; bracts linear or subulate, 2 - 4 mm long, puberulous. Flowers fragrant, pale yellow or greenish-yellow, 1.6 - 1.8 cm across; pedicels equalling bracts in length; torus ca 2.5 mm across. Sepals elliptic-oblong, 5 - 6 x 2 - 2.5 mm, olive green, pubescent, becoming reflexed on maturity. Androgynophore glabrous, ca 2 mm long; stamens 38 - 52; filaments 5 - 6 mm long, glabrous; anthers orange-yellow. Gynophore puberulous, 5 - 8 mm long, slightly elongating and incrassate in fruit; ovary ellipsoid, 2 - 2.5 x 1.6 - 1.8 mm, glabrous; styles 3 (or 4), ca 1 mm long. Drupe on a stipe of 3 - 5 mm thickness, ellipsoid or obovoid, 2.5 - 6 x 2 - 4 cm, orange-brown, scurfy,

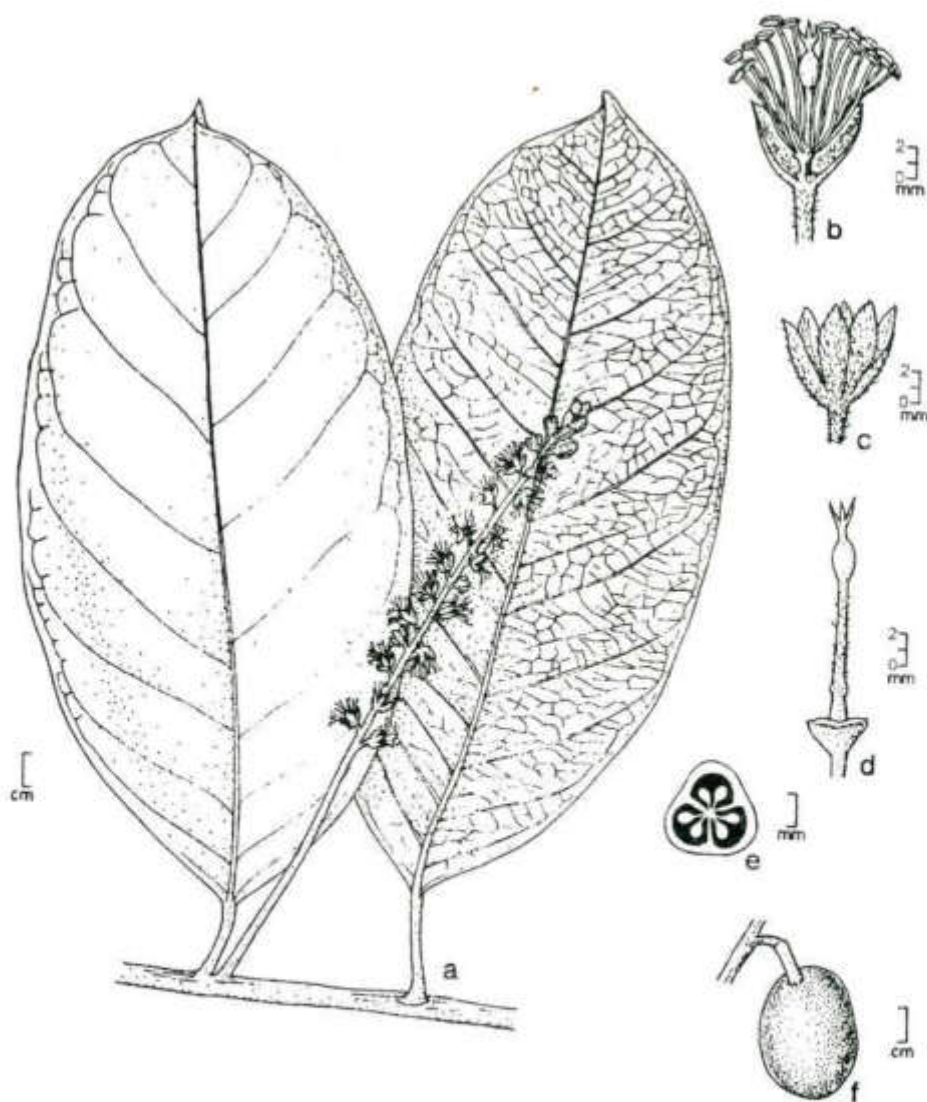


Fig. 63. *Stixis suaveolens* (Roxb.) Pierre : a. flowering twig; b. flower; c. sepals; d. androgynophore, gynophore and pistil; e. t.s. of ovary, showing axile placentation; f. fruit.

lenticellate, 3-valved; fruit wall 4 - 5 mm thick, spongy, covered with whitish warts. Seed solitary, ovoid, 1.6 - 2 x 1 - 1.2 cm; pulp aromatic, yellow, sweet.

Fl. Feb. - May; *Fr.* June - Dec.

Distrib. India: In mixed tropical and subtropical forests, often along streams, up to 1200 m. Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya.

Nepal, Bhutan, Bangladesh, Myanmar, China and S.E. Asia.

Notes. At times the plant attains a height of 10 - 12 m tall, with a girth up to 50 cm at base.

Fruits are edible.

RESEDACEAE

(N. P. Balakrishnan and R. K. Premanath)

Herbs, annual or perennial, or rarely shrubs. Leaves spiral, simple, entire or sometimes lobed or pinnatisect; stipules absent or minute and glandular. Inflorescences terminal, spikes or racemes, bracteate. Flowers solitary in axils of bracts, bisexual or unisexual, zygomorphic, 4 - 7-merous, rarely plants monoecious. Sepals 4 - 7 or more, free or sometimes basally connate, imbricate in bud, persistent, often irregular. Petals absent or 2 - 7, alternating with sepals, often with a scaly membranous appendage at base. Disc absent, or if present infundibuliform or cupular, often eccentric, hypogynous. Stamens 3-many, inserted on disc or receptacle, equal or unequal; filaments elongated, free or united at base. Ovary unilocular, of 2 - 6 connate carpels, often lobed at top, rarely free; ovules many, on 2 - 6 parietal placentas, amphitropous or campylo-tropous. Fruit usually a gaping capsule, opening at top or a berry. Seeds many, reniform to subglobose, small, carunculate, non-endospermous.

N. Africa, S. Europe, W. Asia, C. Asia to India, South Africa and Eastern U.S.A.; 6 genera and ca 70 species, 3 genera and 5 species in India.

Literature. MITRA, KRISHNA & S. N. MITRA (1976) Pollen morphology in relation to taxonomy and plant geography of Resedaceae. Bull. Bot. Surv. India 18: 194 - 202, tt. 1 - 2.

KEY TO THE GENERA

- 1a. Shrubs, with rigid branches, often straggling; petals absent or if present minute; fruit a berry 1. *Ochradenus*
- b. Herbs, with herbaceous branches, not straggling; petals present, well-developed or reduced; fruit a capsule 2
- 2a. Petals 2, reduced; disc absent; fruits sessile 2. *Oligomerus*
- b. Petals 4 - 7, well-developed; disc present; fruits pedicelled 3. *Reseda*

1. *Ochradenus* Del.

Shrubs, dioecious or polygamous, much-branched, often straggling, glabrous; branches rugose-costate, green, becoming brown. Leaves sessile, solitary or fascicled, entire, linear or oblong, often slightly dentate at base. Inflorescence terminal, dense-flowered spike or a raceme. Flowers minute, unisexual or bisexual, bracteate. Sepals 5 - 6, perigynous. Petals absent or rarely much reduced and minute. Disc unilateral, cupuliform or disciform, fleshy, yellowish. Stamens hypogynous, 10 - 15, inserted on disc; filaments filiform; anthers ovoid or ellipsoid. Ovary sessile, ovoid, closed at

top, 3 - 4-carpelled, 3- beaked; ovules many, on 3 placentas. Fruit a berry, or rarely a capsule (non-Indian). Seeds few, small, reniform or obovoid.

N.E. Africa and W. Asia to India; ca 5 species, one species in India.

Ochradenus baccatus Del., Fl. Egypte 15, 92, t. 31. 1813; Hook. f. & Thomson in Fl. Brit. India 1: 182. 1872.

Shrubs, straggling, 2 - 3 m tall; branches several, divaricate, greenish yellow when mature, brownish and leafless when old. Leaves linear, acute, 1 - 4 x 1.5 - 2 mm, fleshy; stipules minute or absent. Flowers yellowish green, in dense rigid terminal 5 - 15 cm long racemes; bracts oblong, acute, ca 2.5 mm long, early caducous; pedicels terete, 1 - 2 mm long, slightly elongating in fruits. *Bisexual flowers*: Sepals 5 (-6), ovate, ca 1 mm long. Petals absent or 2 - 3, subulate, less than 1 mm long, appendage more or less suborbicular. Disc irregularly orbicular, fleshy. Stamens 10 - 18; filaments 1 - 2 mm long, fused at base, deciduous. *Female flowers*: Petals absent or reduced. Ovary glabrous. Stamines present. Berry sessile on disc, globose, slightly contracted at apex, reniform, ca 1.5 mm long, brown, papillose. Seeds 1 - 1.5 mm across, reniform, tuberculate, yellow to brown.

Fl. & Fr. Nov. - March.

Distrib. India: Western arid zones. Rajasthan and Gujarat.

Pakistan, westwards through W. Asia to Syria, Egypt and Libya.

Notes. Fruits sweet and edible.

2. *Oligomeris* Cambess., nom. cons.

Herbs, annual or perennial, occasionally shrublets, ascending or erect. Leaves linear to obovate or spatulate, entire, sessile, fascicled. Flowers minute, in terminal spikes, white, usually bisexual. Sepals 2 - 5, persistent. Petals 2, free or connate. Disc absent. Stamens 3 - 8, free or united at base. Ovary sessile, 3 - 5-carpelled, 4-lobed, 1-locular, open at top; ovules many on 4 placentas. Capsules 1-loculed, ovoid, angled, 3 - 4-cuspidate at apex. Seeds numerous, ovoid, glossy, black or dark brown.

South-west U.S.A., N. & S. Africa, Middle East to India; about 9 species, one species in India.

Oligomeris linifolia (Vahl) Macbr. in Contr. Gray Herb. n.s. 53: 13, 1918. *Reseda subulata* Del., Fl. Egypte 15. 1813, nom. nud. *R. linifolia* Vahl in Hornem., Hort. Hafn. 2: 501. 1815. *O. glaucescens* Cambess. in Jacq., Voy. Bot. 4: 24, t. 25. 1844; Hook. f. & Thomson in Fl. Brit. India 1: 181. 1872.

Herbs, annual, glabrous, glaucous; stems many, erect to ascending, 10-35 cm high, ribbed. Leaves clustered, narrowly linear, 2.5 - 7.5 x 0.2 - 0.3 cm, glabrous to scabrid with 1 - 2 minute ca 1 mm long basal lobes; stipules minute, subulate. Flowers greenish white, bisexual, in dense terminal 2 - 25 cm long spikes; bracts 1 - 1.5 mm long, connate at base. Sepals 2 - 4, subequal, 1 - 1.5 mm long, ca 0.5 mm wide, connate at base, persistent. Petals 2, united for more than half way up or free, entire or shortly incised, acute or obtuse, ca 1.5 x 1 mm, white. Stamens 3 - 4, sometimes abortive; filaments united at base, ca 1.5 mm long. Capsules erect, sessile, subglobose, deeply 4-lobed, widely gaping at mouth, very small, 2.5 - 3.5 mm long and wide, glabrous; teeth subacute, ca 1 mm long, membranous. Seeds minute, subglobose, ca 0.5 mm long, greenish black, glaucous, shiny.

Fl. & Fr. Jan. - April.

Distrib. India: Arid and semiarid regions of Western India, in waste and saline lands, in fallow fields, from sea level to 1000 m. Punjab, Rajasthan (Ganganagar), Gujarat and Maharashtra (Concan hills).

Pakistan and westwards to Spain, N. Africa and also South-west U.S.A.

Notes. Plants growing near moist places tend to be less branched and with numerous slender leaves and shorter spikes.

3. *Reseda* L.

Herbs, annual or perennial, ascending or erect, glabrous or papillose. Leaves basal and cauline, sessile, entire or pinnatifid; stipules glandular. Inflorescence racemose, terminal, simple or branched. Flowers zygomorphic, bracteate, white or cream coloured or yellowish green. Sepals 4 - 8, shortly connate at base. Petals 4 - 7, clawed, unequal, multifid, posterior one dilated at base with a membrane above claw. Disc broad, fleshy, oblique, campanulate, dilated posticously. Stamens 10 - 40; filaments connate at base, inserted on eccentric disc, on one side of the flower. Ovary 3 - 4-carpellary, syncarpous, 1-loculed; ovules many on 3 placentas; style 3 - 4, distinct, separated. Capsules unilocular, many-sided, truncate to 3 - 4-toothed at apex, opening widely at apex; seeds reniform, inflated, papillose or scabrous.

N. Africa, W. Asia to Western India; about 26 species, 3 species in India.

KEY TO THE SPECIES

- | | |
|--|----------------------|
| 1a. Leaves always entire, rarely some upper ones divided | 2 |
| b. Leaves at least some ternate or pinnatisect | 3 |
| 2a. Sepals 5 or more; seeds reniform | 2. <i>R. aucheri</i> |
| b. Sepals 4; seeds globose | 3. <i>R. luteola</i> |

- 3a. Filaments persistent untill fruit is ripe 1. *R. alba*
 b. Filaments caducous long before fruit is ripe 4
 4a. Plants 40 - 70 cm high; sepals ca 1 mm long; capsules 3 - 5 mm long. Naturally occurring 4. *R. pruinosa*
 b. Plants up to 25 cm high; sepals 4 - 5 mm long; capsules 9 - 11 mm long. Cultivated only *R. odorata*

1. *Reseda alba* L., Sp. Pl. 449. 1753; Sharma et al. in Biol. Mem. 2 (1 & 2): 14. 1972.

Annual or perennial herbs, (10-) 30 - 80 cm high, erect, branching above, glabrous or sparingly pilose. Leaves pinnatisect into 6 or more lobes; lobes linear to oblong-lanceolate, entire, denticulate or undulate along margins; upper leaves smaller. Flowers racemose, dense; bracts acicular-linear, small, persistent; pedicels 1 - 8 mm long, white, 3-partite, the 2 upper ones with somewhat lobulate or entire lateral lobes. Stamens 10 - 13, with long persistent filaments. Capsules narrowly obovate or elliptic-ovate, constricted at apex, 8 - 15 mm long; seeds spherical-reniform, rough, tuberculate, yellow or brown.

Fl. & Fr. May - Sept.

Distrib. India: Tamil Nadu (Nilgiri hills). Introduced and naturalised.

Europe, W. Asia and Siberia.

2. *Reseda aucheri* Boiss., Diagn. ser. 1, 1: 5. 1844: Hook. f. & Thomson in Fl. Brit. India 1: 181. 1872.

Herbs, biennial or perennial, 20 - 60 cm tall; stems erect, branched, glabrous to sparsely papillose. Leaves obovate to lanceolate, tapering to a long petiole at base, acute or obtuse at apex, entire, 4 - 7 x 0.5 - 2.5 cm, sparsely pilose along margins and on veins. Flowers small, yellowish, in dense terminal 8 - 30 cm long racemes; bracts linear-lanceolate, 2 - 4 mm long. Sepals 6 - 7, obtuse or acute, 1.5 - 2 x ca 0.5 mm, caducous. Petals yellow or cream yellow, 8 - 10 (-15)-lobed; lobes linear to spatulate, rarely divided up to base; appendage suborbicular to obovate, asperulous at margins. Disc ca 1 mm high, ca 1.5 mm wide, recurved along margins. Stamens ca 15, longer than petals; filaments persistent. Capsules oblong or ovoid, contracted and with 3 acute lobes at apex, 7 - 8.5 mm long. Seeds reniform, 0.7 - 1 mm long, brown to shiny black, rugose to scrobiculate.

Fl. & Fr. Feb. - April.

Distrib. India: Western India in sandy and hilly places. Rajasthan and Gujarat.

Pakistan, Afghanistan, Iran, Iraq, Turkey and Egypt.

3. **Reseda luteola** L., Sp. Pl. 448. 1753; Gamble, Fl. Pres. Madras 1: 34. 1957 (repr. ed.).

Herbs, erect, biennial, glabrous; stems erect, 0.5 - 1.2 m high, much branched. Leaves simple, decurrent, linear or lanceolate, spatulate, entire, 2.5 - 12 x 0.4 - 1.5 cm. Racemes 30 - 60 cm long, erect, dense-flowered, spike-like; bracts persistent, 3.5 - 4.5 x 0.75 mm in flower, elongating in fruits; pedicels ca 1.5 mm long, elongating in fruits. Sepals 4, ovate-lanceolate, connate at base, ca 2 x 1 mm, persistent. Petals 4, 3 - 4 mm long, yellow; the upper one clawed, with 4 - 8-lobed obovate limb; the two laterals and lower one clawed or clawless with entire or 4-lobed limb. Disc crenate and recurved at margin, ca 0.75 mm high, ca 1.75 mm across. Stamens 20 - 40; filaments persistent, somewhat curved. Ovary 3-carpellate. Capsules erect, stipitate, obovoid, truncate, longitudinally 6-ribbed, 3 - 4 x 5 - 6 mm, glabrous, rugose; seeds reniform, obovoid, ca 1 mm long, brown.

Fl. & Fr. Oct. - Feb.

Distrib. India: Cultivated in gardens, frequently running wild in Himachal Pradesh, Punjab and Tamil Nadu (Nilgiri and Pulney hills).

Pakistan to W. Asia, S.W. & C. Europe and N. Africa.

4. **Reseda pruinosa** Del., Fl. Egypte 15. 1813; Hook. f. & Thomson in Fl. Brit. India 1: 181. 1874.

Herbs, perennial, 40 - 70 cm high; stem and branches pruinose to densely papillose. Leaves linear to lanceolate, 2 - 8 x 0.8 - 1.5 cm, upper leaves 3 - 5-partite with linear segments. Flowers small, subsessile, in dense up to 30 cm long terminal racemes; bracts subulate, 1.5 - 4 mm long, caducous; pedicels ca 2 mm long in fruit. Sepals 5 - 6, elliptic, ca 1 mm long, caducous, membranous along margins. Posterior petal with 7 - 9 (-10) linear to spatulate segments, the median petal slightly larger than laterals and often 3 - 4-fid; appendage ca 1.5 mm long, more or less the size of petal or shorter. Ovary contracted below the stigmatic lobes. Capsules erect, oblong, subglobose to obovoid, 3 - 5 mm long with 3 blunt stigmatic lobes; seeds less than 1 mm long, rugose, shiny black when mature.

Fl. & Fr. Oct. - June.

Distrib. India: Punjab and Rajasthan.

Pakistan, Afghanistan, Iran and W. Asia to Egypt.

CULTIVATED SPECIES

Reseda odorata L., Syst. Nat. ed. 10, 2: 1046. 1759.

Annual or perennial herbs, 10 - 25 cm high, with ascending branches near base. Leaves oblanceolate to obovate, usually some with 1 - 2 lateral lobes. Sepals oblong-spathulate, 4 - 5 mm long. Petals 4 - 4.5 mm long, the upper with flat claws; limb inserted near apex of claw, digitate; segments 9 - 15, spathulate. Capsules subglobose, 9 - 11 x 7 - 10 mm, nodding.

A native of N. Africa, with fragrant white or cream-coloured flowers, often cultivated as an ornamental plant, particularly in Rajasthan.

VIOLACEAE

(S. P. Banerjee and B. B. Pramanik)

Herbs, shrubs or undershrubs, small trees, rarely lianas. Leaves alternate, rarely opposite, simple, entire or toothed, rarely lobed; stipules minute or leafy. Flowers bisexual or unisexual, rarely plants polygamous or dioecious, hypogynous or slightly perigynous, medianly zygomorphic or actinomorphic, solitary or in axillary or terminal racemes, spikes or panicles, often bracteolate. Sepals 5, free or slightly connate, persistent, imbricate, often ciliate. Petals 5, free, or rarely shortly connate, generally sessile, imbricate, unequal, the lowermost often gibbous or spurred and larger than others and differentially shaped. Stamens 5, mostly hypogynous; filaments free or connate, alternate with petals, closely connivent around pistil; anthers 2-loculed, basifixed or adnate, introse, one of them often spurred, dehiscence by longitudinal slits; connective produced apically; 2 abaxial anthers sometimes spurred. Ovary superior, sessile, subglobose, unilocular with generally 3 - 5 carpels, placentae parietal with 1 - 2 or numerous ovules on each; ovules bitegmic, crassinucellar, anatropous; style simple, mostly sigmoid or thickened above; stigma various, usually truncate, lobed, beaked or simple. Fruit usually a loculicidal 3-valved capsule, or a berry or nutlet. Seeds numerous, smooth or rough, rarely tomentose, often arillate, sometimes winged in woody lianas; embryo straight; cotyledons thin, wider than radicle; endosperm moderate or copious, rarely scanty, fleshy.

Cosmopolitan, tropical and temperate regions; ca 22 genera and ca 900 species, 3 genera and 41 species in India.

Literature. BANERJEE, S. P. & B. B. PRAMANIK (1983) Violaceae. In: Fasc. Fl. India 12: 1 - 40, ff. 1 - 39. GRIERSON, A. J. C. (1991) Violaceae. In: Fl. Bhutan 2(1): 222 - 228, ff. 26 o - x. JACOBS, M. & D. M. MOORE (1972) Violaceae. In: Fl. Males. I, 7(1): 179 - 212, ff. 1 - 20. QAISER, M. & SAOOD OMER (1985) Violaceae. In: Fl. Pakistan 166: 1 - 28, ff. 1 - 8. TENNANT, J. R. (1963) Notes on Tropical African Violaceae. Kew Bull. 16(3): 409 - 435, ff. 1 - 2.

KEY TO THE GENERA

- 1a. Shrubs or small trees; flowers actinomorphic; abaxial stamens not spurred at base **2. Rinorea**
b. Herbs or sometimes suffruticose; flowers zygomorphic; abaxial stamens often spurred at base **2**
2a. Leaves sessile; sepals not produced at base; petals unequal in size; seeds longitudinally ribbed
1. Hybanthus
b. Leaves long-petioled; sepals pouched or produced at base; petals equal or subequal in size; seeds smooth **3. Viola**

1. *Hybanthus* Jacq.

Herbs or undershrubs, rarely small trees. Leaves alternate or rarely subopposite to opposite, mostly sessile, herbaceous or sometimes leathery; stipules small, persistent or mostly caducous. Flowers bisexual, irregular, rarely cleistogamous, white to orange or purple, solitary in leaf-axils, or in more or less reduced axillary cymes or dichasia or in raceme-like elongated monochasia, rarely in a terminal leafy panicle; pedicels articulate, 2-bracteolate below articulation. Sepals subequal, more or less triangular, persistent, rarely the margins with deep incisions. Petals unequal, persistent; posterior ones small and straight, middle ones longer and falcate; anterior one extended to a lip with a claw, more or less deeply saccate to shortly spurred. Filaments free or partly coherent; anthers free or more or less united, 2 or (4) of them gibbous or spurred; connective prolonged into a distinct membranous appendage. Ovary ovoid, with 3 placentae bearing 3 - 24 ovules; style clavate, incurved; stigma oblique. Capsules elastically 3-valved, subglobose; valves leathery; seeds few, ellipsoid, mostly with a small caruncula.

America, Africa, Asia and Australia in tropical and subtropical regions; about 150 species, 2 in India.

Literature. BAHADUR, B. et al. (1987) Floral biology of *Hybanthus enneaspermus* (L.) F. v. Muell. (Violaceae). *New Bot.* 14: 29 - 45, f. 42. BENNETT, E. M. (1972) A revision of the Australian species of *Hybanthus* Jacquin (Violaceae). *Nuytsia* 1: 218 - 241. GREY-WILSON, C. (1981) Notes on African Violaceae. *Kew Bull.* 36(1): 103 - 126, ff. 1 - 7.

KEY TO THE SPECIES

- 1a. Herbs with red flowers; sepals keeled; capsules ca 5 mm long; seeds conspicuously longitudinally ribbed 1. *H. enneaspermus*
- b. Shrubs with pink flowers; sepals not keeled; capsules ca 10 mm long; seeds obscurely ribbed 2. *H. travancoricus*

1. *Hybanthus enneaspermus* (L.) F. Muell., *Fragm. Phyt. Austr.* 10: 81. 1876. *Viola enneasperma* L., *Sp. Pl.* 2: 937. 1753. *V. suffruticosa* L., *Sp. Pl.* 2: 937. 1753. *Ionidium suffruticosum* (L.) Roemer & Schultes, *Syst. Veg.* 5: 394. 1819; Hook. f. & Thomson in *Fl. Brit. India* 1: 185. 1872. **Fig. 64.**

Beng.: *Nunbora*; Hindi: *Ratanpuras*; Mal.: *Orilathamara*, *Kalthamara*; Sans.: *Amburuha*, *Atichara*, *Avyata*, *Charati*, *Lakshmishreshtha-padma*, *Padmacharini*, *Padmavati*, *Padmavaha*, *Pushkama*, *Pushkaranadi*, *Pushkarini*, *Ramyra*, *Sarayda*, *Sthalapadmi*, *Sthalaruha*, *Sugandhamula*, *Supuskhara*; Sant.: *Bir-Surajmukhi*, *Tondi-sol*; Tam.: *Orilai-tamarai*, *Purusharatnam*; Tel.: *Nilakobari*.

Herbs, annual or perennial, 10 - 60 cm high; often woody at base; stems simple or moderately branched, subglabrous to densely pubescent, terete or ridged. Leaves sessile

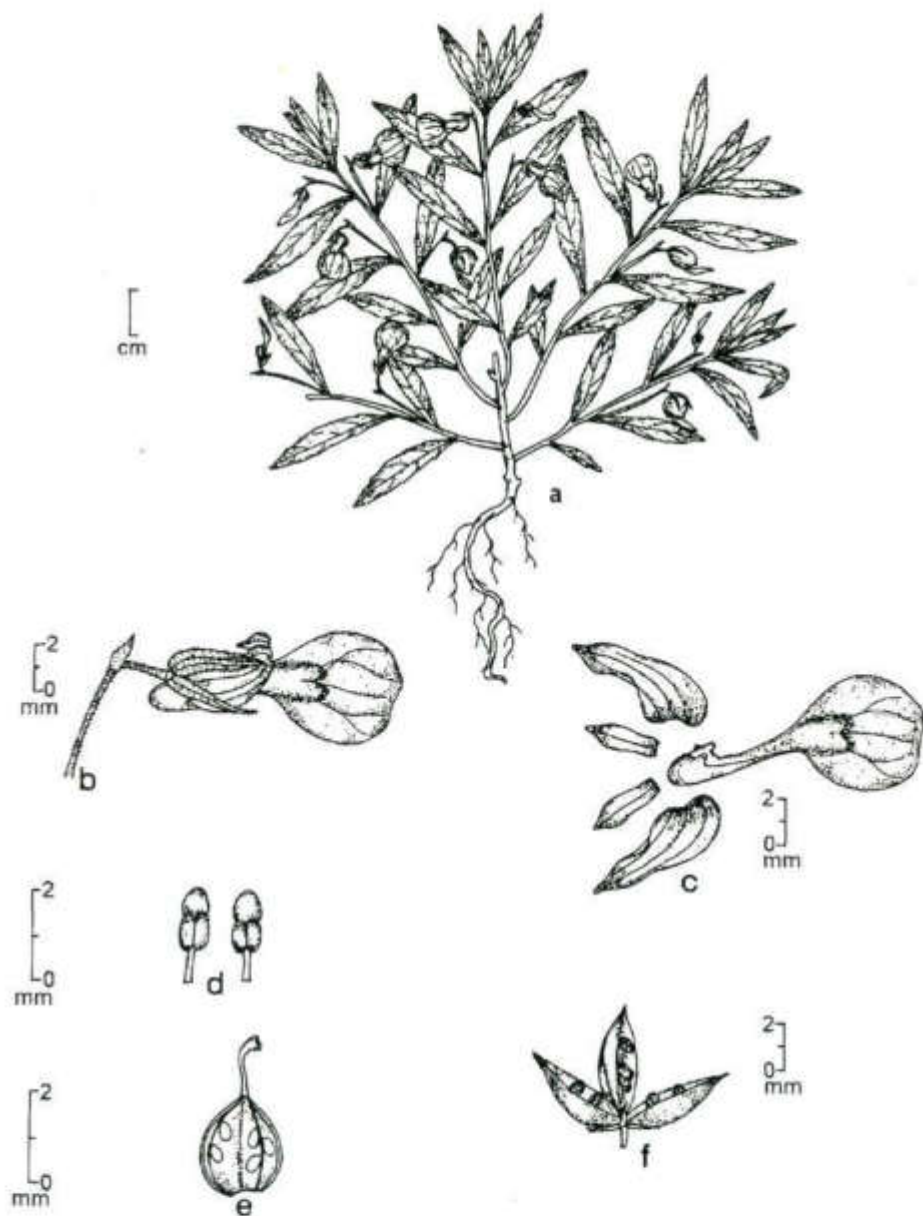


Fig. 64. *Hybanthus enneaspermus* (L.) F. Muell. : a. plant; b. flower; c. petals; d. stamens; e. pistil; f. capsule, dehisced.

to subsessile, very variable, linear to linear-lanceolate, elliptic-lanceolate or oblong-lanceolate, cuneate at base, acute to subobtusate (and often mucronate) at apex, subtentire to crenate-serrate or dentate-serrate along margins, 0.5 - 8.5 x 0.1 - 1.4 cm, glabrous to densely pubescent, hirsute or scabrid; lateral veins 4 - 7 pairs; lower leaves broader than upper ones; stipules linear-lanceolate to subulate, 1 - 4 mm long, usually ciliate along margins. Flowers axillary, solitary, red; pedicels slender, 0.6 - 2 cm long, glabrous or pubescent with a pair of subulate bracteoles. Sepals subequal, lanceolate, acute, 2 - 4 x 0.75 - 1 mm, glabrous or ciliate. Petals unequal; upper two elliptic, symmetric, acuminate, 3 - 5 mm long; lateral two triangular-oblong, 4 - 6 mm long, rather expanded and obtuse at apex; lower petal 0.8 - 1.9 cm long, suborbicular to subcordate. Stamens ca 2 mm long; anterior stamen with a small recurved fleshy appendage. Ovary globose, glabrous; style thickened towards tip. Capsules 3-lobed, glabrous; seeds ovoid-ellipsoidal.

Fl. & Fr. Throughout the year.

Distrib. India: Commonly seen in plains and coastal areas in grassy places in cultivated fields, roadsides, railway tracks, wastelands and open forest lands. Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu and Kerala.

Tropical Asia, Africa, Australia and America.

Notes. Plant is considered to possess diuretic and demulcent properties. Decoction or powder of the whole plant taken to improve memory and vitality and as a remedy in consumption, asthma, fever and leprosy. Shampoo made from this plant removes dandruff.

A polymorphic species, very variable in habit and leaf form. Grey-Wilson (l. c. 103 - 110) has recognised several distinct varieties in tropical East Africa.

Chromosome number reported: $n = 16$ (Gupta & Srivastava in Taxon 20: 609 - 614. 1971); $2n = 32$ (Mangenot & Mangenot in Rev. Cytol. Biol. Veg. 25: 411 - 447. 1962; Sanjappa, M. in Taxon 28: 265 - 279. 1979; Sarkar, A. K. et al. in Taxon 29: 347 - 367. 1980).

2. *Hybanthus travancoricus* (Beddome) Melchior in Engler & Prantl, Pflanzenfam. ed. 2. 21: 360. 1925. *Ionidium travancoricum* Beddome, Ic. Pl. Ind. Or. 1: 55, t. 230. 1868-1874.

Fig. 65.

Shrubs, up to 1.75 m high; branches erect, woody, glabrous, terete below, angled towards apex. Leaves subsessile, linear-lanceolate, distantly serrate, acuminate at apex, 1 - 9 x 0.5 - 2.5 cm, glabrous; stipules subulate, glandular-puberulous. Peduncles 1 - 2 cm long, bibracteolate towards apex. Flowers pink. Sepals equal, subulate, recurved.

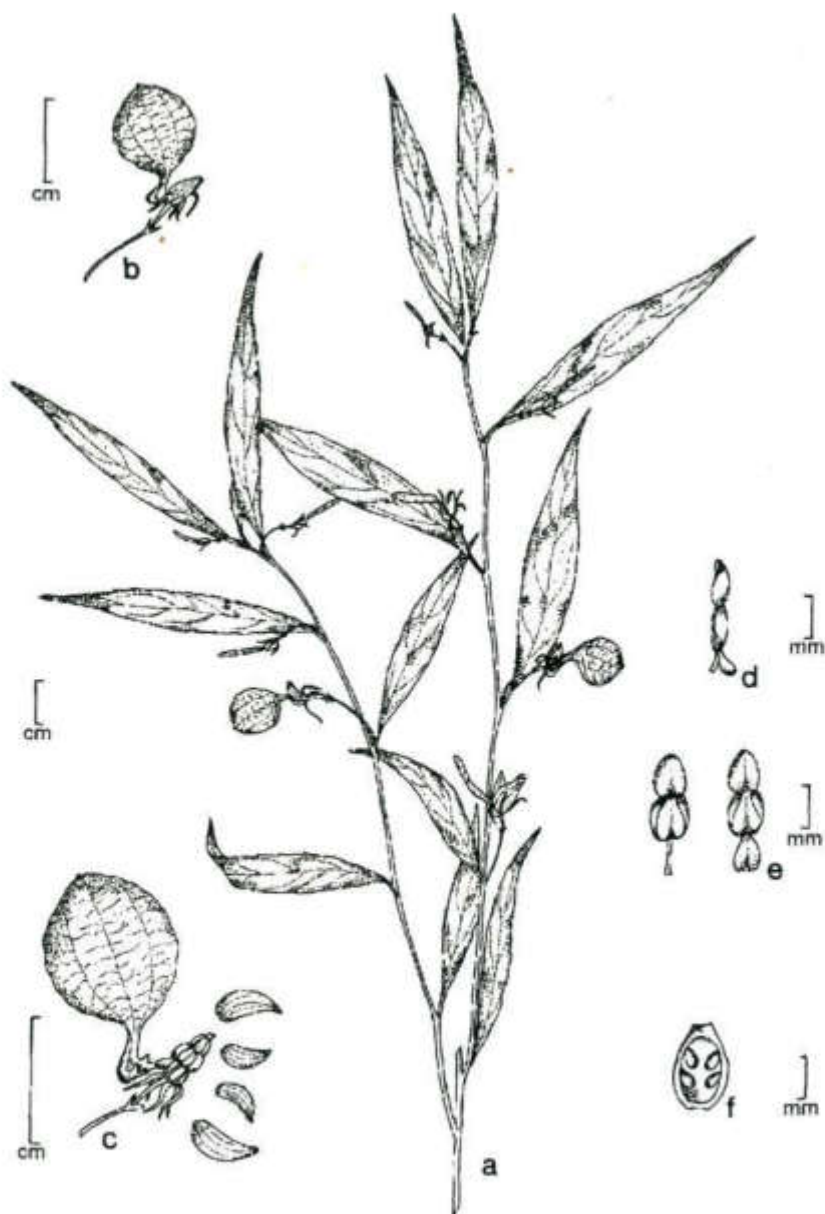


Fig. 65. *Hybanthus travancoricus* (Beddome) Melchior : a. flowering twig; b. flower, split open; d. stamen, lateral view; e. stamens, dorsal and ventral views; f. pistil.

Petals variable, lower petal with a long claw, saccate and furnished with 2 spurs, others falcate, upper 2 only ciliate. Stamens 5; anthers nearest to large petal with a round gibbous spur at base. Seeds 6 - 9, white.

Fl. & Fr. Aug. - Sept.

Distrib. India: Hills of Tirunelveli and Travancore at 650 to 1000 m. Tamil Nadu and Kerala.

Notes. Endemic to southern parts of Western Ghats.

Chromosome number reported: $2n = 32$ (Gadella, Kilphus et al. in Acta Bot. Neerl. 18: 74 - 83. 1969).

2. *Rinorea* Aublet

Shrubs or small trees. Leaves alternate or rarely opposite or spiral, distichous, entire or serrate; secondary nerves numerous and parallel; petiole short or absent; stipules caducous to persistent, often longitudinally striate. Flowers bisexual or rarely unisexual, sometimes plants dioecious, regular, solitary or usually racemose, cymose or paniculate, rarely in axillary or terminal cymes; peduncles articulate. Sepals almost equal, rigid, ciliate. Petals isomorphic or subequal, free, sessile. Stamens inserted on margin of an annular disc; connective produced into a long or short, often broad membranous appendage. Ovary trilocular, unilocular with 3 parietal placentae; ovules 1 - 3 on each placenta, rarely numerous; style straight, with a terminal more or less distinctly 3-lobed stigma. Fruits capsular, 3-valved, globose, subtended by floral parts. Seeds 3 - 6, ellipsoid, glabrous, rarely woolly with leathery testa.

America, Africa, Bangladesh, Myanmar, Sri Lanka, Malaysia, Indonesia to N. Australia, Malagasy, in tropical areas; about 200 species, 4 in India.

Literature. JACOBS, M. (1967) *Florae Malesianae Praecursores XLV*. Notes on *Rinorea* (Violaceae) from Malesia and adjacent regions. *Blumea* 15(1): 127 - 138.

Notes. *Rinorea* Aublet (1775) has long been known under its later synonym *Alsodeia* Thouars (1806).

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Leaves 2 - 5 cm long, subsessile; stamens exserted; anthers cohering into a cone | 2. <i>R. heteroclita</i> |
| b. Leaves 5 - 25 cm long, petiolate; stamens inserted; anthers free | 2 |
| 2a. Flowers in elongated racemes; anthers with a distinct ventral appendage | 3. <i>R. longiracemosa</i> |
| b. Flowers fascicled or densely set on short rachis; anthers with a dorsal appendage | 3 |

- 3a. Stipules 4 - 16 mm long, distinctly striate; leaves greenish when dry; fruits glabrous 1. *R. bengalensis*
 b. Stipules 1.5 - 6 mm long, scarcely striate; leaves dark-coloured when dry; fruits sparsely hairy

4. *R. macrophylla*

1. *Rinorea bengalensis* (Wallich) O. Ktze, Rev. Gen. Pl. 1: 42. 1891. *Alsodeia bengalensis* Wallich in Trans. Med. Phys. Soc. Calc. 7: 224. 1835; Hook. f. & Thomson in Fl. Brit. India 1: 186. 1872. *A. griffithii* Hook. f. & Thomson, l. c. 187. *A. wallichiana* Hook. f. & Thomson, l. c. 187. *A. zeylanica* (Arn.) Thwaites, Enum. Pl. Zeyl. 21. 1858; Hook. f. & Thomson, l. c. 187. Fig. 66.

And.: *Kyadoo*; Nep.: *Kalipat*.

Shrubs or trees, 5 - 20 m tall; branchlets glabrous or puberulous. Leaves elliptic-lanceolate or ovate, acute at base, obtuse at apex, crenate or serrate along margins, 6 - 18 x 2 - 9 cm, thinly coriaceous, glabrous, except for the bearded nerve axils beneath; midrib prominent; lateral nerves 10 - 12 pairs; petioles up to 1 cm long; stipules appressed, linear-lanceolate to subulate, 5 - 8 mm long, ca 1 mm wide. Peduncles up to 1 cm long; bracts basal, minute, ovate, subacute, ca 1 mm long, brown. Flowers ca 4 mm across, white. Sepals subequal, broadly ovate, ca 2 x 1 mm. Petals subequal, oblong-ovate, ca 5 x 1 mm, fleshy. Stamens on a thick 5-lobed disc, glabrous; filaments short, expanded at base, cohering into a tube; anthers oblong, appendage subapical, broad, hooded. Ovary oblong, sometimes hairy, 3-ovuled; style short, straight, glabrous. Capsules globose, up to 1 cm in diam., 3-valved, longitudinally dehiscent; seeds 3 - 4, globose, ca 5 mm in diam., glabrous.

Fl. & Fr. Jan. - Nov.

Distrib. India: Common along river-banks and as undergrowth of semievergreen forests up to 850 m. Abundant in leaf-shedding forests of the Andamans. Uttar Pradesh (cult.), West Bengal (cult.), Sikkim, Assam, Meghalaya, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands.

Bangladesh, Myanmar to Sri Lanka, Malaysia, Australia and Pacific Islands.

Notes. Leaves are said to be used to adulterate tea. Wood is white and scented.

2. *Rinorea heteroclita* (Roxb.) Craib, Fl. Siam. Enum. 1: 89. 1925. *Vareca heteroclita* Roxb., Fl. Ind. 2: 446. 1824. *Alsodeia roxburghii* Hook. f. & Thomson in Fl. Brit. India 1: 186. 1872.

Shrubs; bark grey-brown, finely striate; branchlets terete, fulvous-puberulous. Leaves elliptic or lanceolate, cuneate at base, obtuse to apiculate, often blunt, sometimes with a mucro at apex, more or less crenate, but entire near base, 2 - 6 x 1.5 - 2 cm, glabrous, perforate at nerve axils beneath; tertiary nerves obsolete; stipules subulate, keeled,

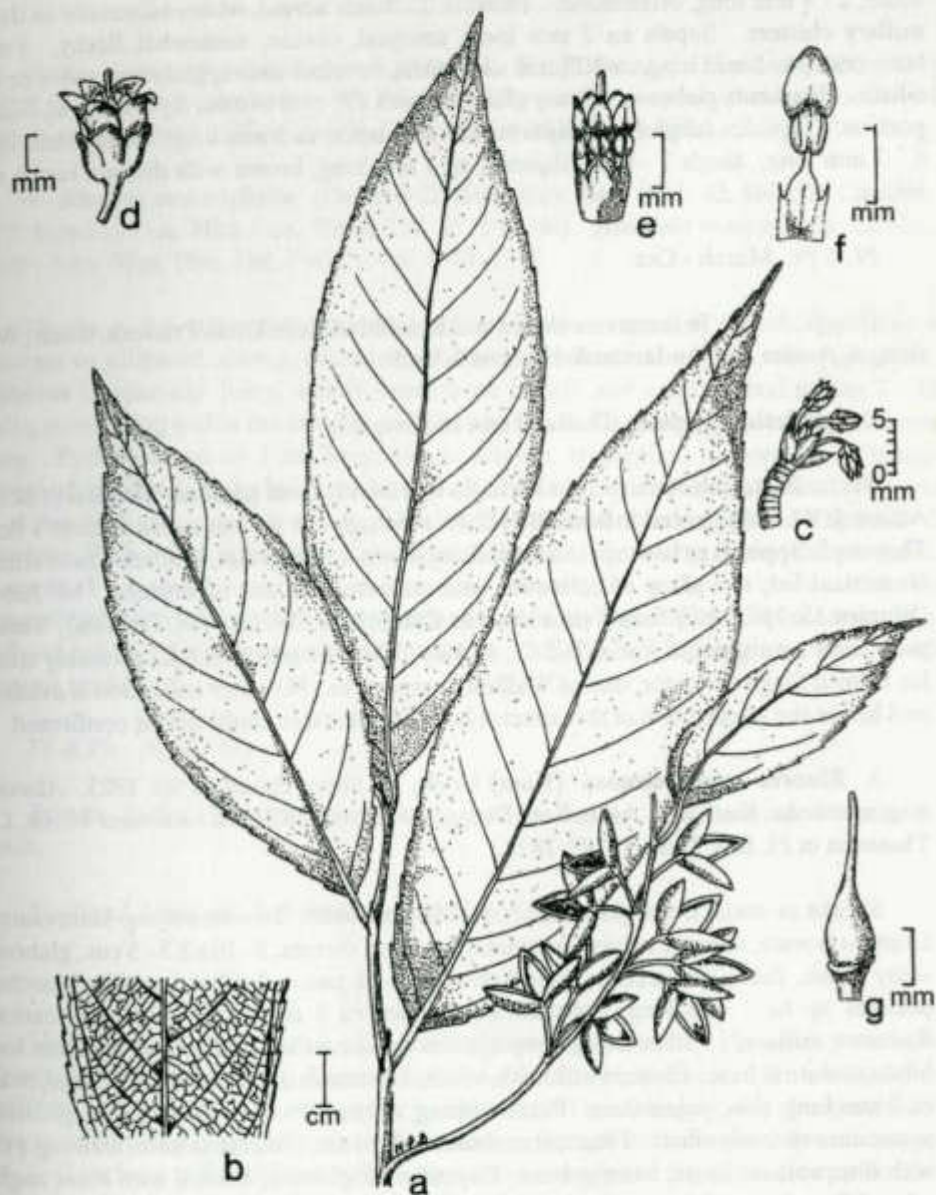


Fig. 66. *Rinorea bengalensis* (Wallich) O. Ktze : a. fruiting twig; b. leaf venation; c. inflorescence; d. flower; e. flower with sepals and petals removed; f. stamen; g. pistil.

acute, 2 - 4 mm long, often ciliate. Flowers 2 - 3 mm across, white, subsessile in dense axillary clusters. Sepals ca 2 mm long, unequal, obtuse, somewhat fleshy. Petals lanceolate, 4 - 5 mm long, ca 0.75 mm wide, thin, revolute above, glabrous, more or less ciliate. Filaments glabrous. Ovary glabrous with (3) or 6 ovules; style hairy at middle portion. Capsules subglobose, tapering towards apex, ca 5 mm long; valves when open 6 - 7 mm long; seeds 1 - few, ellipsoid, ca 3 mm long, brown with distinct raphe and hilum.

Fl. & Fr. March - Oct.

Distrib. India: In forests on slopes and bamboo-flats in Uttar Pradesh, Bihar, West Bengal, Assam and Andaman & Nicobar Islands.

Bangladesh, Myanmar, Thailand and Indonesia.

Notes. Materials are scanty in herbaria and mostly from gardens. Kanjilal et al. (Fl. Assam 1: 82. 1934) noted it from 'BEHAR' although not mentioned in Haines's flora. They say it 'appears to have spread from Bengal into South Sylhet, Wallich'. In Wallich's Numerical list, the place of collection and collector are not mentioned. M. Jacobs (Blumea 15: 136. 1967) found, on a sheet in Cambridge, 'W. Gr.' (W. Griffith), 'Serampore', and on a sheet in Paris, 'B.S.C., 14 July 1834,' the letters B.S.C. probably stands for Bhorul Singh collector, one of Wallich's employees. No other collection is available and hence the occurrence of this species in different states could not be confirmed.

3. *Rinorea longiracemosa* (Kurz) Craib, Fl. Siam. Enum. 1: 90. 1925. *Alsodeia longiracemosa* Kurz in J. Asiat. Soc. Bengal 39 (2): 63. 1870. *A. racemosa* Hook. f. & Thomson in Fl. Brit. India 1: 187. 1872.

Shrubs or small trees, glabrous; branchlets crooked. Leaves oblong-lanceolate to elliptic-obovate, cuneate at base, acuminate at apex, serrate, 5 - 16 x 2.5 - 5 cm., glabrous, shiny above, thinly coriaceous; lateral nerves 7 - 11 pairs, slender, irregularly arched; petioles up to 7 mm long, puberulous; stipules ca 5 mm long, subulate, scarious. Racemes axillary, 5 - 10 cm long, simple, erect or ascending; pedicels up to 5 mm long, bibracteolate at base. Flowers yellowish-white, 3 - 4 mm in diam. Sepals subequal, ovate, ca 2 mm long, thin, puberulous. Petals oblong, obtuse, 2 - 4 x 1 - 3 mm, thin, glabrous, sometimes sparsely ciliate. Filaments subulate, glabrous, connate at base, forming a cup with disc; anthers ovate, hairy at base. Capsules subglobose, 3-sided with blunt angles, up to 1.5 cm long, glabrous; seeds 6, obconical, with a circular depression at the place of insertion.

Fl. Feb. - April; *Fr.* April - May.

Distrib. India. Secondary and primary lowland tropical forests. Assam and Andaman & Nicobar Islands.

Myanmar, Thailand, Cambodia and Vietnam to Malesia.

Notes. Its occurrence in Assam is uncertain. Kanjilal et al. (in *Fl. Assam* 1: 83. 1934) noted, "not found it anywhere in this Province". Recently this species has been collected from Katchal Island in Nicobars (P. Chakraborty 2548 CAL, PBL).

4. *Rinorea macrophylla* (Decne.) O. Ktze, *Rev. Gen. Pl.* 1: 42. 1891; P. Chakrab. in *J. Bombay Nat. Hist. Soc.* 76(1): 212. 1979 (1980). *Alsodeia macrophylla* Decne., *Nouv. Ann. Mus. Hist. Nat. Paris* 3: 468, t. 19. 1834.

Shrubs ca 2 m tall; young branchlets velvety brown to sparsely puberulous. Leaves obovate or ellipsoid oblong, decurrent at base, acuminate at apex, 8 - 20 x 4 - 9 cm, glabrous to sparsely hairy, mainly beneath on midrib and veins; lateral nerves 7 - 10 pairs, converging within the margin; petioles up to 2 cm long; stipules subulate, 2 - 6 mm long. Peduncles up to 1 cm long; bracts minute, triangular. Inflorescence many-flowered, mostly densely hairy; pedicels 3 - 9 mm long, with a joint near base. Flowers 2 - 4 mm in diam., greenish yellow. Sepals subequal, bluntly triangular to elliptic, 2 - 3 mm long, fleshy, dark coloured, hairy outside. Petals 3 - 5 mm long, fleshy, hairy outside. Stamens 3 - 4 mm long; filaments cohering into a tube; anthers with broad dorsal appendage. Ovary hairy, each carpel with one ovule; style glabrous. Capsules trigonus-globose, up to 1.5 cm long, purplish brown; seeds 3, 6 - 7 x 5 mm, glossy brown with distinct raphe.

Fl. & Fr. April - Nov.

Distrib. India: Semievergreen and secondary forests. Andaman & Nicobar Islands.

Thailand, Malaysia, Indonesia and Philippines.

3. *Viola* L.

Herbs, annual or perennial, often suffruticose, rarely shrubby; rhizomes present or absent; stem mostly present. Leaves alternate, entire to pinnatisect, ovate-triangular or reniform, cordate, serrate or crenate; petioles sometimes winged; stipules persistent, free or adnate to petiole, lanceolate-ovate, entire, dentate or fimbriate. Flowers irregular, 1 - 2 on long axillary bibracteolate, non-articulate peduncles, often dimorphic with normal and cleistogamous flowers. Sepals persistent. Petals erect or spreading, flat, subequal; lateral ones larger than others; lowermost spurred. Anthers 2-loculed, sessile, connivent around ovary, each tipped with a small triangular appendage; connectives of lower 2 often produced into spurs within the spur of corolla. Ovary sessile; style much-variable, straight or curved, often geniculate at base, filiform to clavate; stigma variable, truncate or obtuse, lobed or triangular, straight or beaked (**Fig. 67**). Fruit 3-valved loculicidal capsule; seeds rounded-ovoid, shiny.

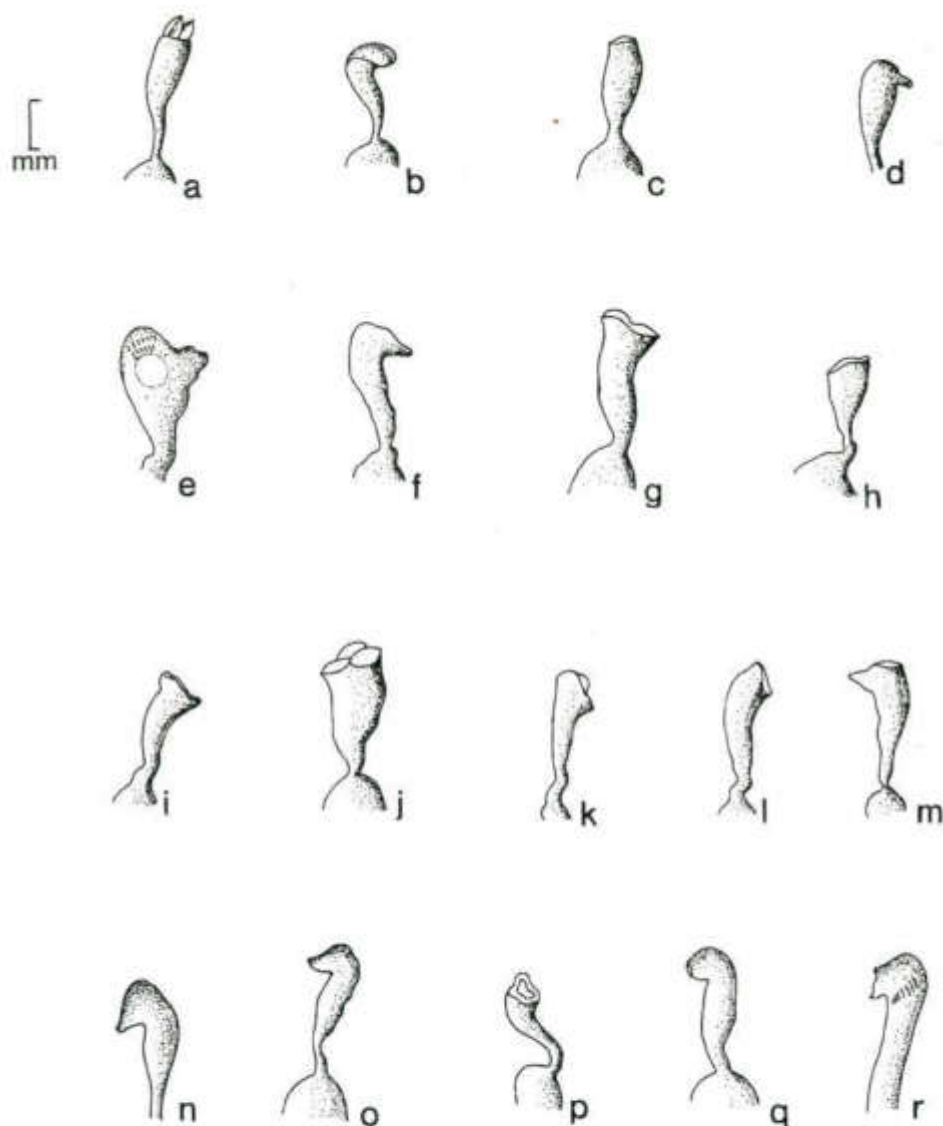


Fig. 67. Style and stigma of Indian Violas : a. *V. biflora* L.; b. *V. cinerea* Boiss. var. *stocksii* (Boiss.) W. Becker; c. *V. canescens* Wallich; d. *V. sylvatica* Fries ex Hartman f.; e. *V. tricolor* L.; f. *V. odorata* L.; g. *V. macroceros* Bunge; h. *V. diffusa* Ging.; i. *V. betonicifolia* J. Smith; j. *V. philippica* Cav.; k. *V. inconspicua* Blume; l. *V. hamiltoniana* D. Don; m. *V. pilosa* Blume; n. *V. indica* W. Becker; o. *V. hookeri* Thomson; p. *V. glaucescens* Oudem.; q. *V. kunawarensis* Royle; r. *V. fedtschenkoana* W. Becker.

Cosmopolitan, distributed chiefly in the temperate regions throughout the world; ca 500 species, 35 species in India, distributed mostly in the northern temperate and alpine areas; a few are confined to the lower hills.

Literature. CHATTERJEE, A. & A. K. SHARMA (1973) Cytological studies on Indian representatives of the genus *Viola*. *J. Genet.* 61: 52 - 63. HARA, H. (1975) *Viola*. In: H. Ohashi, *Fl. East. Himalaya* (Third Report): 82 - 85.

Notes. 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. (Wodzhouse, R.P. in *Pollen Grains*, New York 442 - 444, 1959).

KEY TO THE SPECIES

- | | |
|---|-----------------------------|
| 1a. Stipules pinnatifid or palmatifid; lateral petals directed towards the top of the flower; style expanded and globose at top | 33. <i>V. tricolor</i> |
| b. Stipules entire to long fimbriate; lateral petals spreading horizontally; style not globose at top | 2 |
| 2a. Stigma without beak, with 2 laterally patent lobes | 3 |
| b. Stigma beaked, triangular marginate, truncate or subtruncate | 6 |
| 3a. Leaves reniform to rotundate | 4 |
| b. Leaves ovate-lanceolate | 5 |
| 4a. Sepals linear-oblong, obtuse; spur ca 2 mm long | 2. <i>V. biflora</i> |
| b. Sepals subulate-acute; spur 5 - 6 mm long | 34. <i>V. wallichiana</i> |
| 5a. Sepals linear, obtuse, ca 3 mm long | 4. <i>V. cameleo</i> |
| b. Sepals ovate-oblong, acute, ca 5 mm long | 11. <i>V. hediniana</i> |
| 6a. Plants without superterranean stems or stolons; stipules more or less adnate to petioles | 7 |
| b. Plants with superterranean, decumbent or ascending stems or stolons; stipules free from petioles | 14 |
| 7a. Leaves deltoid or deltoid-ovate, rather acute, usually with a truncate or shallowly cordate base and widely divergent basal lobes | 8 |
| b. Leaves ovate-oblong to orbicular, often rounded at apex, deeply cordate at base with a little divergent or subconverging basal lobes | 10 |
| 8a. Flowers up to 6 mm across | 16. <i>V. jangiensis</i> |
| b. Flowers up to 15 mm across | 9 |
| 9a. Calycine appendages up to 5 mm long, incised, often 1/2 as long as sepals | 14. <i>V. inconspicua</i> |
| b. Calycine appendages up to 2 mm long, rounded, nearly 1/3 as long as sepals | 1. <i>V. betonicifolia</i> |
| 10a. Sepals linear-lanceolate, acute to acuminate | 8. <i>V. fedtschenkoana</i> |
| b. Sepals ovate, ovate-lanceolate, obtuse | 11 |
| 11a. Capsules ca 3 mm long | 18. <i>V. kunawarensis</i> |
| b. Capsules ca 10 mm long | 12 |
| 12a. Lateral petals bearded at base | 19. <i>V. macroceros</i> |
| b. Lateral petals not bearded at base | 13 |
| 13a. Spur curving downwards | 23. <i>V. philippica</i> |
| b. Spur curving upwards | 22. <i>V. paravaginata</i> |

- 14a. Stipules entire or with a few short teeth; top of style with 2 laterally patent lobes 15
 b. Stipules with long acute teeth or fimbriate; top of style without laterally patent lobes 18
- 15a. Leaves cordate-reniform; petioles not or scarcely winged 16
 b. Leaves elliptic-ovate to oblanceolate; petioles conspicuously winged 17
- 16a. Stems with underground tubers 3. *V. bulbosa* subsp. *tuberifera*
 b. Stems without underground tubers 10. *V. hamiltoniana*
- 17a. Peduncles bibracteolate at middle 7. *V. diffusa*
 b. Peduncles bibracteolate at top 6. *V. cinerea* var. *stocksii*
- 18a. Leaves ovate-orbicular, weakly cordate at base 19
 b. Leaves ovate-oblong, deeply cordate at base 24
- 19a. Peduncles bibracteolate at or below the middle 20
 b. Peduncles bibracteolate above the middle 21
- 20a. Sepals acute 9. *V. glaucescens*
 b. Sepals obtuse 20. *V. moupinensis*
- 21a. Spur 3 - 5 mm long 22
 b. Spur 1 - 2 mm long 23
- 22a. Stipules fimbriate 31. *V. sylvatica*
 b. Stipules more or less lobed at apex with a few lateral narrow teeth 28. *V. rupestris*
- 23a. Leaves silvery white beneath; veins raised below 29. *V. sikkimensis*
 b. Leaves not silvery white beneath; veins not raised below 12. *V. hookeri*
- 24a. Flowers up to 1 cm in diam.; stipules foliaceous, up to 3.5 cm long 17. *V. jordanii* var. *falconeri*
 b. Flowers up to 2 cm in diam.; stipules membranous up to 1.5 cm long 25
- 25a. Style not thickened upwards, decurved 26
 b. Style thickened upwards, erect 27
- 26a. Sepals acute 15. *V. indica*
 b. Sepals obtuse 21. *V. odorata*
- 27a. Peduncles bibracteolate at or below the middle 28
 b. Peduncles bibracteolate above the middle 31
- 28a. Sepals obtuse 30. *V. suavis*
 b. Sepals acute 29
- 29a. Leaves canescent, obtuse 5. *V. canescens*
 b. Leaves pilose or glabrous, acute or prolonged acuminate 30
- 30a. Leaves deeply cordate at base; spur ca 5 mm long 24. *V. pilosa*
 b. Leaves shallowly cordate at base; spur 2 - 3 mm long 26. *V. pogonantha*
- 31a. Spur 3 - 5 mm long 32
 b. Spur up to 2 mm long 33
- 32a. Stigma marginate, not papillose-hairy 32. *V. thomsonii*
 b. Stigma beaked, papillose-hairy 27. *V. reichenbachiana*
- 33a. Lateral petals bearded at base 25. *V. placida*
 b. Lateral petals not bearded at base 34
- 34a. Petioles more than twice as long as lamina 13. *V. hossei*
 b. Petioles shorter than lamina 35. *V. yunnanensis*

1. *Viola betonicifolia* J. Smith in Rees, Cyclop. 37(1): Viola no. 7. 1817. *V. betonicifolia* subsp. *nepalensis* (Ging.) W. Becker in Engler, Bot. Jahrb. 54 (Beibl. 120): 166. 1917. *V. patrinii* var. *nepalensis* Ging. in DC., Prodr. 1: 293. 1824. Fig. 67 i.

Herbs, perennial, 8 - 20 cm high; roots slender, unbranched; stem absent. Leaves in rosette, variable, linear-lanceolate to triangular-hastate or triangular-ovate, cuneate, truncate or widely shallowly cordate at base, usually decurrent on petiole, shallowly and distantly crenate, sometimes dentate on basal lobes or rarely serrate, acute or sometimes roundish obtuse at apex, 1.5 - 10 x 0.5 - 3 cm, glabrous; petioles longer than lamina, 2 - 14 cm long, winged above, glabrous; stipules ovate-lanceolate, acuminate, 2 - 15 mm long, ca 1 mm wide, short-fimbriate, adnate to petiole up to middle point. Peduncles equalling or exceeding leaves, 5 - 15 cm long, glabrous. Flowers white to purple, with darker veins; bracteoles opposite, lanceolate, acute, entire. Sepals ovate-lanceolate to oblong-lanceolate, acute or acuminate, 4 - 8 mm long, 1 - 2.5 mm wide, glabrous or ciliate, green with scarious margins. Petals oblong-ovate, up to 15 mm long; lateral ones usually bearded at base; spur cylindrical, straight or slightly upcurved, 2 - 6 mm long. Style almost geniculate at base, clavate above, up to 3 mm long. Capsules ellipsoid to oblong, up to 1 cm long, glabrous.

KEY TO THE SUBSPECIES

- 1a. Leaves linear-lanceolate to triangular-ovate; flowers up to 1.5 cm across; sepals ca 8 mm long, oblong; spur 2 - 4 mm long 1.1. subsp. *betonicifolia*
 b. Leaves ovate-oblong to broadly lanceolate; flowers ca 2 cm across; sepals 4 - 6 mm long, lanceolate; spur 5 - 6 mm long 1.2. subsp. *juansarensis*

1.1. subsp. *betonicifolia* *V. patrinii* sensu Hook. f. & Thomson in Fl. Brit. India 1: 183. 1872, pro max. parte, non DC. 1824. *V. caespitosa* D. Don, Prodr. Fl. Nep. 205. 1825.

Leaves 2 - 8 x 1 - 3 cm, glabrous to more or less pubescent; petioles 4 - 10 cm long, usually winged above; stipules ovate-lanceolate, acuminate, 5 - 10 mm long, sparsely short-fimbriate. Peduncles 5 - 15 cm long, bibracteolate at middle. Flowers lilac. Petals up to 1 cm long.

Fl. Jan. - April; *Fr.* March - June, often extending throughout the year.

Distrib. India: Usually in grasslands, river banks and damp grounds, 1400 - 2800 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka and Malaysia to Australia.

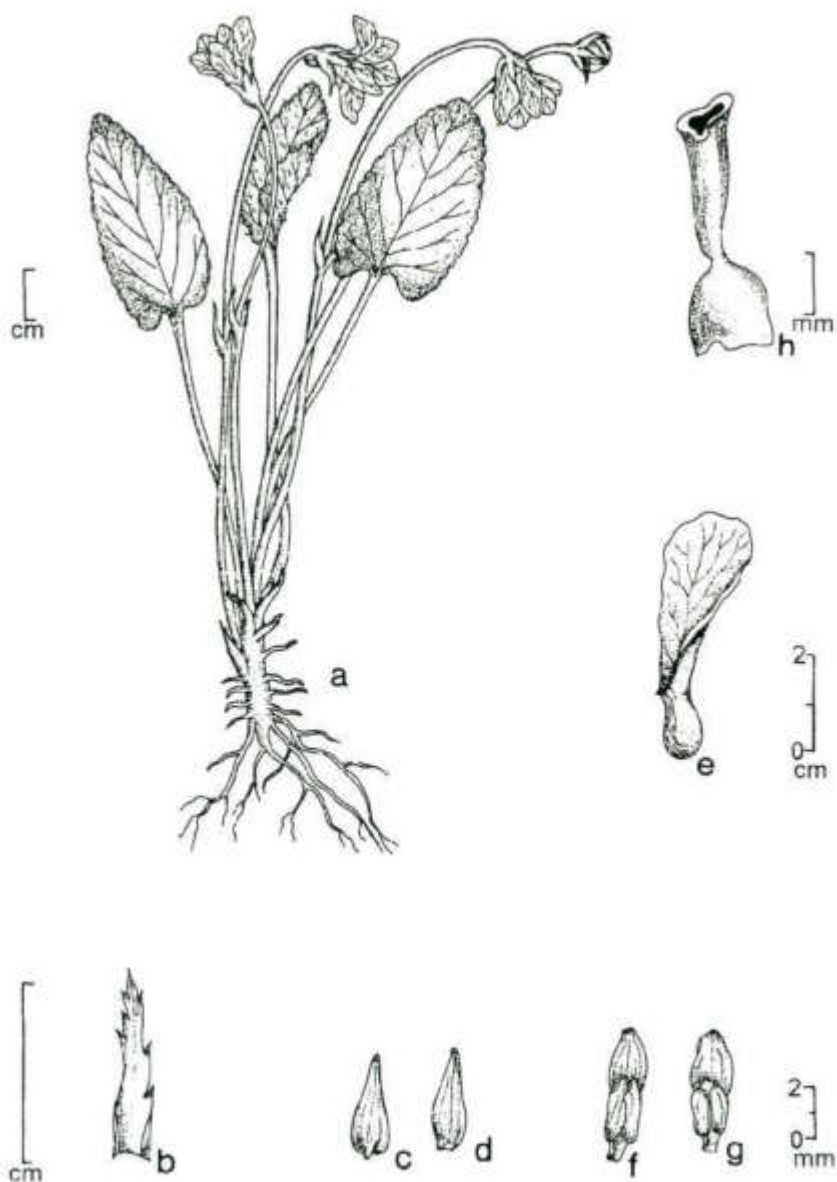


Fig. 68. *Viola betonicifolia* J. Smith subsp. *jaunsarensis* (W. Becker) Hara : a. habit; b. stipule; c. & d. dorsal and ventral views of sepals; e. spur; f. & g. dorsal and ventral views of stamens; h. pistil.

Notes. Plants bruised and applied to ulcers and foul sores. In China, Indo-China and Malaya, the flowers of this species are said to purify blood.

Chromosome numbers reported: $2n = 48, 72$ (Moore in Fedde, *Repert. Spec. Nov.* 68: 84. 1963); $2n = 24$ (Miyaji in *Cytologia* 1: 28 - 58. 1929).

1. 2. subsp. *jaunsarensis* (W. Becker) Hara in *J. Jap. Bot.* 49(5): 133. 1974. *V. prionantha* Bunge subsp. *jaunsarensis* W. Becker in *Engler, Bot. Jahrb.* 54 (Beibl. 120): 181. 1917. Fig. 68.

Leaves 2.5 - 5 x 1 - 3 cm, hirsute; petioles 2 - 8 (-12) cm long; stipules oblong-acuminate, 1 - 1.5 cm long, shortly dentate. Peduncles up to 8(-12) cm long, bibracteolate at or slightly below middle. Petals ca 1.5 cm long.

Fl. & Fr. April - July.

Distrib. India: Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan and Afghanistan.

Notes. *V. patrinii* DC. var. *suaveolens* G. Watt is a synonym of *V. betonicifolia* J. Smith subsp. *jaunsarensis* (W. Becker) Hara. The type sheet of *V. patrinii* DC. var. *suaveolens* G. Watt in Herb. BSIS, Calcutta, with G. Watt's annotations consists of specimens under three different field numbers, i.e. 686, 970 & 2097 collected at different times from Nag-konda forests, Chamba, and N.W. Himalaya, all mounted on a single sheet. Of these, G. Watt 2097 with field notes have been chosen as the lectotype of var. *suaveolens* by S. P. Banerjee & Pramanik in *Fasc. Fl. India* 12: 17. 1983. The same specimen, viz. Watt 2097 was also considered as *V. kashmiriana* by W. Becker.

2. *Viola biflora* L., *Sp. Pl.* 2: 936. 1753. Hook. f. & Thomson in *Fl. Brit. India* 1: 182. 1872, p. p. (excl. syn. *V. wallichiana* Ging. & *V. reniformis* Wallich). Fig. 67 a.

Hindi: *Banfisa*.

Herbs, annual or perennial, glabrous or pubescent, up to 30 cm high; stem slender, erect or decumbent; rhizome horizontal or oblique, more or less stout. Leaves reniform to broadly ovate, cordate at base, crenate along margins, 1 - 6 x 0.8 - 4 cm, subcoriaceous, glabrous to hirsute along margins and nerves above, 5 - 7-nerved; petioles glabrous to pubescent, slender, up to 10 cm long; stipules ovate or oblong, acute, up to 8 mm long, entire or sparsely denticulate, sometimes leafy. Peduncles slender, 1 - 10 cm long, exceeding leaves, bibracteolate above the middle; bracteoles opposite or subopposite, setaceous, membranous. Flowers solitary, 0.6 - 1.5 cm across, spreading, yellow with brownish purple veins. Sepals linear to linear-oblong, acute, up to 7 mm long, ciliate on scarious margins. Petals obovate to oblong, obtuse, entire, 7 - 15 x 3 - 5 mm; lateral petals

slightly larger and beardless, stripped with black and brown coloured nerves; spur cylindrical, straight, obtuse, ca 1.5 mm long. Ovary glabrous; style geniculate at base, clavate distally, 1.2 - 1.5 mm long, bilobed at top with no stigmatic beak. Capsules ovoid to oblong-ellipsoid, 4 - 9 mm long, glabrous.

Fl. April - Aug.; *Fr.* July - Oct.

Distrib. India: Alpine rocky grasslands and in damp Fir forest margins, 2500 - 3500 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, West Bengal, Sikkim and Arunachal Pradesh.

Bhutan, Nepal, Pakistan, Afghanistan, Eastern & Northern Asia, Russia, Europe and N. America.

Notes. Medicinal, roots emetic, flowers antiseptic and leaves laxative. Decoction of the whole plant is used for cough and acute bronchitis (Kapahi in *J. Econ. Tax. Bot.* 14: 55. 1990).

W. Becker (in *Beih. Bot. Centrabl. Abt. 2*, 36: 42. 1918) included most of the Himalayan materials, having reniform and much broader than long leaves, under *V. biflora* var. *platyphylla* and hirsute materials under *V. biflora* var. *hirsuta*. The materials from the type locality and other materials of this variety have been examined and it became clear that these are intergrading characters and do not justify distinct varietal status.

Chromosome numbers reported: $2n = 12$ (Clausen in *Hereditus* 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 x 32 u); endocolpium very faintly demarcated; exine 1 u thick, psilate. (Nair, P.K.K. in *Pollen grains of Western Himalayan plants*, Bombay 13. 1965).

3. *Viola bulbosa* Maxim. subsp. *tuberifera* (Franchet) W. Becker in *Beih. Bot. Centrabl. Abt. 2*, 34: 418. 1917. *V. tuberifera* Franchet in *Bull. Soc. Bot. France* 33: 410. 1886; Hara in *Fl. E. Himal.* 2: 82. 1971.

Herbs, perennial; stems 1 - 6 cm long, arising from underground rhizome, stoloniferous. Leaves orbicular, reniform or broadly ovate-cordate, obtuse, crenate, 1 - 3 cm broad; petioles scarcely winged above, 1 - 4 cm long; stipules oblong-acuminate, narrow, entire, almost adnate at base, up to 1 cm long, often ciliate along margins. Peduncles bibracteolate above middle, up to 6 cm long. Flowers white with red or purple veins, ca 7 mm across. Sepals lanceolate, acute, ca 4 mm long. Petals ca 7 mm long, lower one

spurred. Style clavate, narrowed downwards from a shortly winged, minutely beaked stigma. Capsules subglobose, ca 4 mm in diam.

Fl. & Fr. May - June.

Distrib. India: Temperate Himalayas, damp slopes amongst scrubs, 2000 - 4000 m. Himachal Pradesh and Sikkim.

Nepal, Bhutan and S.W. China.

Notes. *V. bulbosa* Maxim. subsp. *bulbosa* is distinguished from subsp. *tuberifera* by its ovate-cordate leaves with leaf-base attenuated to a wing almost as long as the petiole. The unique feature of both the subspecies is production of small bulbs and suprabulbous 1 - 5 cm long stems.

4. *Viola cameleo* Boiss. in Bull. Herb. Boiss. ser. 2, 1: 1074. 1901; Hara in Fl. E. Himal. 1: 212. 1966.

Rhizome slender, scaly; stolons 20 - 40 cm long. Leaves ovate-cordate, crenate-serate, prolonged acute to acuminate, 1.5 - 2.5 x 1 - 2.3 cm, sparsely strigose above; petioles up to 7 cm long in basal leaves, much smaller in upper cauline leaves; stipules ovate-acute, foliaceous, ca 3 mm long. Peduncles bibracteolate above the middle, ca 2.5 cm long. Flowers deep or pale yellow with slight violet tinge or entirely violet, 1.5 - 2 cm across. Sepals linear, obtuse, ca 3 mm long. Petals obovate-oblong, striate, ca 1 cm long; spur erect, ca 4 mm long. Stigma bilamellate, almost oblique, with dilated lobes. Fruit not seen.

Fl. April - May.

Distrib. India: Sikkim (Lachen).

China.

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

5. *Viola canescens* Wallich in Roxb., Fl. Ind. 2: 450. 1824. *V. serpens* Wallich var. *canescens* (Wallich) Hook. f. & Thomson in Fl. Brit. India 1: 184. 1872. Fig. 67 c.

Herbs, prostrate, pubescent or subglabrous; stem absent or producing runners instead of leafy stolons; roots long, cylindrical. Leaves ovate-cordate to subreniform, obtuse to acute, serrate-crenate, 1.5 - 4 x 1.5 - 5 cm, 5-nerved beneath; petioles 2 - 10 cm

long, pubescent; stipules free, lanceolate, deeply fimbriate, up to 1 cm long, reddish at base. Peduncles up to 10 cm long. Flowers ca 1.5 cm across, pale violet. Sepals oblong-acute, ca 6 mm long, trinerved; lateral sepal large, up to 10 x 2 mm, dentate near base. Petals obovate-oblong, up to 1.6 cm long, upper two cuneate, lateral two narrower, bearded at base, marked with dark coloured streaks, lowermost shortest with dark coloured stripes. Spur ca 4 mm long, compressed, obtuse, mostly straight or reflexed. Ovary villous; style clavate; stigma truncate, oblique. Capsules globose, ca 4 mm in diam., pubescent, many-seeded.

Fl. & Fr. March - June, extending up to Sept. - Oct.

Distrib. India: Temperate Himalayas, 1500 - 2000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Meghalaya and Tamil Nadu.

Pakistan, Nepal, Bhutan, Myanmar and East Asia.

Notes. This species is distinguishable from *V. pilosa* Blume by its glaucous pubescence, broadly ovate-cordate to subreniform obtuse leaves and deeply fimbriate stipules.

6. *Viola cinerea* Boiss. var. *stocksii* (Boiss.) W. Becker in Beih. Bot. Centralbl. Abt. 2, 36: 37. 1918. *V. stocksii* Boiss. Fl. Orient. 1: 453. 1867. *V. cinerea* sensu Hook. f. & Thomson in Fl. Brit. India 1: 185. 1872, non Boiss. (1867). **Fig. 67 b.**

Guj. & Punj.: *Banafsha, Zinko-banaphsha.*

Herbs, suffruticose; stem 3 - 15 cm, much-branched. Leaves ovate, oblong-ovate to elliptic-lanceolate, or almost spatulate, 1 - 3.5 x 0.5 - 11 cm, acute, apiculate; lamina decurrent into petiole, crenulate to subdentate, glabrous; stipules subulate, 2 - 6 (-10) mm long, mostly denticulate to more or less fimbriate. Peduncles up to 4.5 cm long, bibracteolate at top. Flowers pale violet or white, ca 5 mm across. Sepals lanceolate, ca 4 mm long, aristate, glabrous. Petals ca 6 mm long, lower petal spurred; spur very short, rounded. Style clavate, compressed; stigma lateral, consisting of 2 oblong parallel discs. Capsules cylindric, 4 - 6 mm long, acute; seeds ovoid, ca 1 mm in diam., white, shiny.

Fl. & Fr. April - Oct.

Distrib. India: Punjab, Rajasthan and Gujarat.

Pakistan, Afghanistan and Iran.

Notes. The root is a powerfully emetic; flowers are emollient and demulcent; the whole plant is considered useful as febrifuge.

V. cinerea var. *cinerea* differs from var. *stocksii* in its cinerous habit, smaller more or less shortly dentate stipules; shortly cartilaginous acuminate leaves and tomentulose capsules. Since forma *stocksii* and *kathiawarensis* show overlapping characters, they are considered as synonyms.

7. *Viola diffusa* Ging. in DC., Prodr. 1: 298. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 183. 1872. Fig. 67 h.

Annual or perennial, stolons up to 15 cm long, producing dense rosettes of leaves and flowers and procumbent rooting stems; rhizome vertical, fibrillose. Leaves suborbicular, elliptic-ovate to oblanceolate, obtuse to acute at apex, crenate-serrate to serrate, 1.5 - 5 x 0.8 - 2 cm, decurrent, hirsute; petioles 1.5 - 7 cm long; stipules free, lanceolate, acute, dentate to fimbriate, 6 - 10 mm long, ca 1.5 mm wide. Peduncles 1.5 - 6.5 cm long, bibracteolate at the middle. Flowers ca 8 mm across, pale purple to nearly white. Sepals ovate to lanceolate, 5 - 6 x 1 - 1.5 mm, sparsely hairy. Petals ovate-oblong, ca 1 cm long, lateral ones not bearded; spur 1 - 2 mm long, obtuse. Style clavate, slightly geniculate at base; stigma with two lateral lobes, with a small beak in between. Capsules ellipsoid, 4 - 6 mm long, glabrous.

Fl. & Fr. Feb. - Aug.

Distrib. India: Montane warm forests and grasslands, 1300 - 2500 m. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland and Meghalaya.

Nepal, Bhutan, Myanmar, China, Indo-china, Japan, Taiwan, Philippines and New Guinea.

Notes. Flowers medicinal, applied in chest diseases.

Chromosome number reported: $2n = 26$ (Miyaji in Cytologia 1: 28. 1929).

8. *Viola fedtschenkoana* W. Becker in O. Fedtsch., Fl. Az. Ross. 8: 31. 1915; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 21 - 22. 1983. Fig. 67 r.

Herbs, perennial, 6 - 16 cm high; branches few, decumbent; stolons absent. Leaves in basal rosette or on upper part of stem with the middle part of stem leafless, ovate-subreniform, cordate or subcordate at base, obtuse at apex, crenate-serrate, 1.5 - 2.5 x 0.5 - 2 cm, glandular punctate, pubescent, 4 - 5-veined; petioles 2 - 4 cm long, glabrous; stipules opposite, free, ovate-lanceolate, glandulose ciliate. Peduncles 2 - 6 (-8) cm long, bibracteolate at a little above the middle or near the tip. Flowers projecting much above leaves, pale violet, up to 2 cm in diam. Sepals linear-lanceolate, up to 8 mm

long, entire, with elongated appendage. Petals oblanceolate or obovate-oblong, up to 1.5 cm long; lateral petals bearded at base; spur slender, slightly curved upwards, up to 6 mm long. Style swollen upwards, hooked above; stigma almost papillose, hairy. Fruit not seen.

KEY TO THE VARIETIES

- 1a. Stipules distinctly fimbriate; peduncles bibracteolate at a little above the middle; spur elongated, up to 6 mm long; style papillose hairy above **8.1. var. fedtschenkoana**
 b. Stipules slightly fimbriate; peduncles bibracteolate near the tip; spur short, up to 3 mm long; style non-papillose hairy **8.2. var. muzaffarabadensis**

8. 1. var. fedtschenkoana

Fl. May - July.

Distrib. India: Jammu & Kashmir and Himachal Pradesh.

Pakistan and Central Asia.

8. 2. var. muzaffarabadensis W. Becker in Beih. Bot. Centralbl. Abt. 2, 40: 59. 1923; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 22. 1983.

Leaves ovate-orbicular, 1 - 2 x 1 - 1.5 cm; stipules ca 8 mm long. Peduncles up to 7 cm long. Flowers ca 1.5 cm across. Style swollen upwards, hooked above; stigma subtruncate, obscurely, beaked. Fruit not seen.

Fl. March - Aug.

Distrib. India: Jammu & Kashmir.

Endemic.

Notes. It is known only from the type locality Muzaffarabad in Jammu & Kashmir.

9. Viola glaucescens Oudem. in Miq. Ann. Mus. Bot. Lugd.-Bat. 3: 74. 1867. *V. distans* var. *fimbriata* Hook. f. & Thomson in Fl. Brit. India 1: 184. 1872. **Fig. 67 p.**

Rootstock articulated; stolons up to 20 cm long. Leaves orbicular-cordate, acute to subacuminate, 2 - 4.5 x 1.3 - 3.5 cm, basal sinus moderately wide, margin broadly and evenly crenate, glabrous or sparsely hispid above; petioles up to 10 cm long; stipules ovate-oblong, lacerate or fimbriate, up to 1.5 cm long. Peduncles up to 8 cm long. Flowers 1 - 1.5 cm across, white or rose purple. Sepals lanceolate, acute, ca 5 mm long.

Petals orbicular-obovate, ca 1 cm long; lateral ones barbate; spur saccate, ca 3 mm long. Capsules oblong, apiculate, ca 8 mm long. Seeds globose, light brown.

Fl. & Fr. Throughout the year.

Distrib. India: West Bengal, Arunachal Pradesh, Sikkim, Assam, Nagaland, Manipur and Mizoram.

Nepal, Bhutan and Malaysia.

Notes. This species is distinguishable from *V. pilosa* Blume 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. *Viola hamiltoniana* D. Don, Prodr. Fl. Nep. 206. Feb. 1825. *V. arcuata* Blume, Bijdr. 58, June-Dec. 1825. *V. distans* Wallich in Trans. Med. Phys. Soc. Calc. 7: 227. 1835; Hook. f. & Thomson in Fl. Brit. India 1: 183. 1872. *V. distans* Wallich var. *acaulis* Hook. f. & Thomson, l. c. 184. Fig. 67 l.

Herbs, perennial; stems or stolons trailing up to 30 cm long, slender, procumbent or ascending, rooting at lower nodes. Leaves ovate to reniform-cordate, usually as broad as long, with broad basal sinus, obtuse or rather acute at apex, crenate-serrate, 1.5 - 5 x 1 - 4.5 (-6) cm, glabrous to hirsute; petioles curved upwards, 1 - 8 cm long, glabrous; stipules lanceolate, acute, subentire to fimbriate, 5 - 15 x 1 - 4 mm, glabrous, white to purple. Peduncles 1 - 8 (-12) cm, bibracteolate above middle. Flowers 1 - 1.5 cm across, white to light violet. Sepals ovate-lanceolate, acute, entire, 2.5 - 5 x 1 - 2 mm; appendage rounded, ca 1 mm long. Petals ovate-oblong, 2 - 4 times as long as broad, ca 1 cm long; lateral ones slightly bearded; spur saccate, ca 4 mm long. Style more or less geniculate at base, subclavate distally, 1 - 2 mm long; stigma of 2 small laterally patent lobes. Capsules oblong, 0.6 - 1 cm long, glabrous.

Fl. & Fr. Feb. - June, often throughout the year.

Distrib. India: Edges of forests in grasslands and roadsides, 1000 - 2500 m. Himachal Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Meghalaya, Karnataka and Tamil Nadu.

Nepal, Bhutan, Bangladesh, Myanmar, China, Malaysia and Philippines.

Notes. Chromosome number reported: $2n = 24$ (Borgmann in Zeitschr. Bot. 17: 1 - 27. 1964).

11. *Viola hediniana* W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 262. 1916; Sparre & C. Fischer in Bull. Misc. Inf. Kew 1929: 252. 1929.

Herbs, pubescent to glabrous; rhizome slender, horizontal; stolons up to 20 cm long, ascending. Leaves ovate-lanceolate, cordate at base, remotely crenate, subacuminate at apex, 3 - 7 x 1.8 - 2.5 cm, smaller above, sparsely pubescent above to glabrous; petioles up to 1 cm long in basal leaves, shorter to sessile in upper cauline leaves; stipules ovate-lanceolate, ca 5 mm long. Peduncles ca 7 cm long, bibracteolate at or above the middle. Flowers ca 1 cm across, yellow. Sepals ovate-oblong, acute, ca 5 mm long, 3-nervate, shortly appendiculate. Petals oblong-ovate, ca 1 cm long, lateral petals ebarbate; spur ca 5 mm long. Stigma bilobed. Fruits not seen.

Fl. May.

Distrib. India: Arunachal Pradesh.

China.

Notes. This species, originally described from China has been reported from Arunachal Pradesh based on a collection from Mishmi, Delci Valley by Kingdon Ward (Sparre & C. Fischer, l. c).

12. *Viola hookeri* Thomson in Fl. Brit. India 1: 183. 1872, pro max. parte, emend. W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 259. 1916. **Fig. 67 o.**

Herbs, perennial, glabrous or younger parts pilose; root-stock warted; stems and stolons short. Leaves broadly ovate-orbicular, rounded at apex, rarely subacute, broadly crenate, 1.5 - 4 x 1.5 - 3.5 cm, basal sinus deep; lobes touching or overlapping, glabrous; petioles up to 10 cm long, not winged; stipules lanceolate, acuminate, up to 1.2 cm long, toothed or lacerate, glandular at tip. Peduncles up to 7 cm long. Flowers ca 1 cm across, white with purple veins. Sepals lanceolate, obtuse, ca 5 mm long. Petals oblong-ovate, ca 1 cm long, minutely puberulous. Style subclavate, narrowed downwards from the obscurely beaked stigma. Capsules ca 5 mm long; valves apiculate, glandular.

Fl. April - June; *Fr.* July - Aug.

Distrib. India: Moist places in shaded places of forests, 2000 - 3000 m. West Bengal, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China.

Notes. Chromosome number reported: $n = 9$ (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 by Griffith and (ii) from Sikkim by J.D. Hooker, as mentioned in the protologue, although he was not unaware 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 with 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. *Viola hossei* W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 257. 1916; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 25. 1983.

Stoloniferous herbs, stolons up to 18 cm long. Leaves ovate or ovate-oblong, crenate-serrate, acute at apex, 2 - 4 (-5) x 1.5 - 3 cm, sparsely white hispid to glabrous; petioles more than twice as long as lamina; stipules lanceolate, up to 1 cm long, reddish brown. Peduncles 2.5 - 3.5 cm long. Flowers violet, wide open. Sepals linear, acute, ca 5 mm long, glabrous. Petals obovate-oblong, ca 1 cm long. Style clavate, slightly curved. Capsules subglobose, up to 8 mm long, papillose.

Fl. & Fr. March - Oct.

Distrib. India: Meghalaya.

Myanmar, S.W. China, Thailand and Malaysia.

14. *Viola inconspicua* Blume, Cat. Gew. Buitenz. 57. 1823. *V. apetala* auct. non Schimdt 1791; Hook. f. & Thomson in Fl. Brit. India 1: 185. 1872, in obs. **Fig. 67 k.**

Herbs, perennial, acaulescent; rootstock densely articulated. Leaves in rosette, triangular-ovate to hastate, cordate at base with prominent rounded basal lobes, acute or roundish at apex, crenulate or serrate along margins, 1.5 - 6 x 1 - 4.5 cm, glabrous; petioles 1 - 10 (-13) cm long; stipules ovate-lanceolate, acute or acuminate at apex, 3 - 10 x 1 - 2 mm, sparsely dentate. Peduncles 1 - 10 (-15) cm long, 1-flowered, bibracteolate above the middle. Flowers 9 - 11 mm across, generally apetalous and cleistogamous, rarely perfect, pale purple with dark throat. Sepals ovate to ovate-lanceolate, with incised appendages, ca 5 mm long, glabrous. Petals when present up to 1.2 cm long, oblong to obovate-oblong; lateral ones bearded at base; spur ca 3 mm long, cylindrical, obtuse. Style geniculate at base, clavate. Capsules up to 1 cm long, ellipsoid to oblong, glabrous.

Fl. Jan. - June.

Distrib. India: Subtropical to temperate Himalayas, 500 - 2500 m. Himachal Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland and Meghalaya.

Myanmar, Malaysia, Indonesia, Philippines, S.W. China.

Notes. This species is often confused with *V. betonicifolia*. However, it can be distinguished by its triangular hastate leaves with subcordate and attenuate base and generally apetalous flowers.

15. *Viola indica* W. Becker in Beih. Bot. Centralbl. Abt. 2, 20: 126, 1906; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 25 - 26, 1983. **Fig. 67 n.**

Root stock densely articulated, up to 12 cm long, stoloniferous; stolons up to 20 cm long, leafy and flowering. Leaves ovate or ovate-oblong, crenate-serrate, subacuminate, 2 - 6 x 1.5 - 4 cm; petioles up to 10 cm long, retrose-hispid; stipules ovate-lanceolate, acute, up to 1.5 cm long, membranaceous, ciliate. Peduncles 3 - 10 cm long, bibracteolate at about the middle. Flowers lilac, sweet scented. Sepals lanceolate, acute, ca 6 mm long; glabrous, appendage shortly triangular. Petals obovate-oblong, ca 1.5 cm long; lateral petal smooth, more or less bearded; spur stout, up to 8 mm long, curved upwards. Stigma shortly beaked. Fruit not seen.

KEY TO THE FORMA

- | | |
|---------------------------------------|----------------------------|
| 1a. Lateral petals bearded at base | 15.1. forma barbata |
| b. Lateral petals not bearded at base | 15.2. forma indica |

15. 1. forma barbata (W. Becker) S.P. Banerjee & Pramanik in Fasc. Fl. India 12: 26, 1983. *V. indica* var. *barbata* W. Becker in Beih. Bot. Centralbl. Abt. 2, 40: 135, 1923.

Fl. April.

Distrib. India: Himachal Pradesh.

Endemic.

15. 2. forma indica

Fl. March - July.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh and Meghalaya.

Pakistan and Afghanistan.

16. *Viola jangiensis* W. Becker in Bull. Misc. Inf. Kew 1929: 201. 1929.

Herbs, acaulescent; rhizome ascending, 2 - 3 mm thick, shortly articulated. Leaves deltoid or deltoid-ovate, obtuse, entire or remotely crenate to partly repand-crenate, 1 - 2 x 1 - 2 cm, more or less pubescent, especially on lower surface; young leaves narrower; petioles up to 8 cm long; stipules about 1 cm long. Peduncles 5 - 7 cm long, bibracteolate at middle. Flowers ca 5 mm across, pale violet. Sepals ovate-lanceolate, ca 2 mm long; lateral sepals ca 3 mm long, narrower, shortly appendiculate. Lateral petals minutely hairy at base; spur acute, ca 1 mm long. Ovary conical; style geniculate at base, more or less clavate, not curved at apex, passing directly upwards to an uncovered orifice. Fruit not seen.

Fl. July.

Distrib. India: Himachal Pradesh.

Endemic.

17. *Viola jordanii* Hanry var. *falconeri* (Hook. f. & Thomson) W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 380. 1917. *V. falconeri* Hook. f. & Thomson in Fl. Brit. India 1: 185. 1872.

Herbs, glabrous; stems or branches 15 - 30 cm high, erect, with long internodes. Leaves ovate or ovate-oblong, very broadly crenate, obtuse, 2 - 4.5 x 3 - 6.5 cm, gland-dotted, glabrate to sparsely strigose; petioles up to 5 cm long; stipules foliaceous, up to 3.5 cm long, smaller below, gland-dotted. Peduncles 5 - 7 cm long, bibracteolate above middle. Flowers blue, up to 1 cm across, blue, with white markings in throat. Sepals up to 8 mm long, subulate-lanceolate, with elongate appendage. Petals orbicular-obovate; spur saccate. Style inflated above; stigma decurved, oblique. Capsules ca 1 cm long, glabrous, apiculate.

Fl. & Fr. May - Oct.

Distrib. India: Jammu & Kashmir.

Endemic.

18. *Viola kunawarensis* Royle, Illus. Bot. Himal. 74, t. 18, f. 3. 1839; Hook. f. & Thomson in Fl. Brit. India 1: 185. 1872. Fig. 67 q.

Herbs, perennial, up to 7 cm high, acaulescent, glabrous; rootstock slender, branched; stolons absent. Leaves tufted, ovate-oblong to orbicular, subentire, cuneate, attenuate at base, 1 - 2 x 0.5 - 1 cm, glabrous; petioles 2 - 6 cm long; stipules 2 - 3 mm long, adnate to a point above the middle, lanceolate, acuminate, shortly glandulose

fimbriate, membranaceous. Peduncles up to 8 cm long, bibracteolate at middle. Flowers spreading, ca 1 cm in diam., purple. Sepals ca 3 mm long. Petals up to 1 cm long, obovate-oblong; spur short, obtuse, ca 2 mm long. Style clavate, shortly incurved; stigma subhorizontal, hardly beaked. Capsule elliptic, acute, ca 3 mm long, glabrous.

Fl. & Fr. May - Sept.

Distrib. India: Alpine slopes, 4500 - 5200 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Afghanistan, Pakistan, Nepal and China (Tibet).

Notes. W. Becker (in Beih. Bot. Centralbl. Abt. 2, 34: 397. 1917) described *V. kunawarensis* var. *angustifolia* from Khambajong in Tibet based on oblong-lanceolate leaves with long attenuate base. This is not a distinctive feature found in materials from the area under study and hence it is considered as a synonym.

19. *Viola macroceros* Bunge in Ledeb., Fl. Alt. 1: 256. 1829. *V. patrinii* sensu Hook. f. & Thomson in Fl. Brit. India 1: 183. 1872, p. p Fig. 67 g.

Herbs, perennial, 5 - 14 cm high; stem absent; rhizome short, indistinctly articulated at apex. Leaves in rosette, ovate-oblong to orbicular, obtuse, 2.5 - 5 x 2 - 4 cm, basal parts entire, crenate above, glabrous to pubescent; petioles 5 - 16 cm long, almost winged above; stipules ca 1 cm long, adnate to a point above the middle, fimbriate. Peduncles ca 12 cm long, bibracteolate above the middle. Flowers ca 1 cm across, purple to white. Sepals rotundate, ca 4 mm long, with short appendage. Petals obovate-oblong, ca 1 cm long; lateral petals bearded at base; spur 4 - 6 mm long. Ovary glabrous, style clavate; stigma marginate and shortly beaked; seeds purple.

Fl. & Fr. April - Sept.

Distrib. India: Uttar Pradesh.

Pakistan, China, Afghanistan, Russia and Europe.

20. *Viola moupinensis* Franchet in Bull. Soc. Bot. France 33: 412. 1886; Sparre & C. Fischer in Bull. Misc. Inf. Kew 1929: 252. 1929.

Rhizomes thick, articulated, giving rise to a few ascending floriferous stolons. Leaves radical and cauline, ovate-orbicular, broader than long, crenate-serrate, acute, 2 - 3.5 x 2 - 4 cm; petioles up to 10 cm long; stipules ovate-acuminate, up to 1 cm long, subentire to shortly glandulose-fimbriate. Peduncles equalling leaves in flowering stage, bibracteolate below middle. Flowers ca 1 cm across, white or pale violet, striate. Sepals ovate-oblong, obtuse, up to 5 mm long. Petals obovate to oblong-obovate, up to

1 cm long; lateral ones hairy at base; lower petal conspicuously striate; spur saccate, 2 - 3 mm long. Style subclavate, stigma marginate, shortly beaked. Capsules ovate-oblong, ca 1.5 cm.

Fl. April - June; *Fr.* June - Aug.

Distrib. India: Arunachal Pradesh.

Myanmar and China.

Notes. Report from Arunachal Pradesh is based on a collection from Mishmi, Delei Valley by Kingdon Ward (Sparre & C. Fischer, l. c.).

21. *Viola odorata* L., Sp. Pl. 934. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 184. 1872, p. p. Fig. 67 f.

Beng., Guj. & Hindi: *Banafsha*; Eng.: *Sweet Violet*; Kan.: *Violethoo*; Tam.: *Vialettu*; Tel.: *Vayilettu*.

Herbs, annual or perennial, prostrate; root-stock stout, articulated; stems short; stolons 15 - 20 cm long, slender. Leaves orbicular-reniform to broadly ovate, cordate at base, rounded to obtuse at apex, crenate-serrate along margins, 1.5 - 3.5 x 2 - 4 cm, glabrous to strigose; petioles 2 - 8 cm long; stipules ovate-lanceolate to subulate-lanceolate, 8 - 12 x 3 - 5 mm, glabrous, glandular-toothed. Peduncles slender, 4 - 12 cm long, bibracteolate at middle. Flowers 1 - 1.5 cm across, violet or white, tinged with purple. Sepals ovate, obtuse, entire, up to 7 mm long, ca 2 mm wide. Petals obovate, orbicular; lateral ones bearded or not; spur cylindrical-obtuse, ca 5 mm long. Stamens 5, lower two spurred. Ovary strigose; style ca 2 mm long. Capsules globose, ca 5 mm in diam., hirsute.

Fl. March - May; *Fr.* June - Aug.

Distrib. India: Jammu & Kashmir, often cultivated elsewhere, particularly in West Bengal, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu.

N.W. Asia, Europe and N. Africa.

Notes. Plants medicinal, roots emetic, flowers used in lung troubles.

Chromosome number reported: $2n = 20$ (Clausen in Hereditus 8: 1. 1926; Gadella & Kliphuis in Acta Bot. Neerl. 12: 195 - 230. 1963; Chatterjee & Sharma in J. Genet. 61 (1): 52 - 63. 1973).

Pollen grains 29.6 - 31.2 μ in diam. (Wodehouse, R.P. in Pollen Grains, New York 442 - 444, 1959); prolate (39 x 28 μ) (Nair, P. K. K. in Pollen grains of Western Himalayan Plants, Bombay 13, 1965).

22. *Viola paravaginata* Hara in J. Jap. Bot. 43: 47, 1968 & Fl. E. Himal. 2: 82, 1971.

Herbs, perennial; rootstock 3 - 7 (-12) cm long, 4 - 7 mm thick, articulated; stems or stolons absent. Leaves rotundate to ovate-cordate, deeply cordate at base, 2 - 5.5 (-9) x 2 - 4 (-7) cm, pilose above, only on nerves beneath; petioles 3 - 12 (-16) cm long; stipules oblong-ovate, long-attenuate, 6 - 10 mm long, glandulose ciliate, brown. Peduncles 5 - 8 (-13) cm long, bibracteolate below the middle. Flowers ca 1 cm across, white to purplish or mauve with purple with purple streaks. Sepals lanceolate, 3 - 4 mm long. Petals oblong-obovate, up to 1 cm long; spur curving upwards, ca 2 mm long. Stigma beaked. Capsules oblong-ovate, apiculate, glabrous, purple-spotted; seeds yellowish brown.

Fl. April - June; *Fr.* June - Oct.

Distrib. India: Temperate E. Himalayas, often amongst bamboos, 2000 - 3500 m. West Bengal and Sikkim.

Nepal and Bhutan.

Notes. This species is allied to *V. moupinensis* Franchet from which it is distinct by the ebarbate lateral petals and absence of stolons.

23. *Viola philippica* Cav., Icon. Descr. 6: 19, 1801; W. Becker in Engler, Bot. Jahrb. 54 (Beibl.120): 174, 1917. **Fig. 67 j.**

Herbs, perennial, acaulescent; rootstock articulated, bearing rosette of leaves and flowers at apex. Leaves ovate-elliptic, ovate-oblong to triangular-hastate or orbicular, subtruncate to shallowly cordate at base and usually long-decurrent on petiole, obtuse or rounded at apex, crenate-serrate, 1 - 4 x 0.5 - 3 cm, glabrous or puberulent beneath; petioles 1 - 6 cm long; stipules ovate-lanceolate, acute, up to 1 cm long, shortly dentate, adnate to petiole up to or slightly above the middle. Peduncles 5 - 8 cm long, much exceeding leaves, bibracteolate at middle. Flowers 1 - 1.5 cm across, pale to dark violet. Sepals ovate to ovate-lanceolate, acute, 3 - 5 mm long. Petals obovate, up to 1.5 cm long; spur tapering and curved downwards, 3 - 5 mm long. Style geniculate at base, clavate distally; stigma of 3 partially fused lobes with anterior beak. Capsules ellipsoid-oblong, 5 - 10 mm long, glabrous.

Fl. & Fr. Oct. - July, often extending throughout the year.

Distrib. India: Grasslands, 300 - 1800 m. Uttar Pradesh and Manipur.

Myanmar, Malaysia, Philippines, Indonesia, China and Eastern Asia.

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

Chromosome number reported: $2n = 12$ (Kishore in Ind. J. Genet. & Pl. Breed. 11: 217. 1951).

24. *Viola pilosa* Blume, Cat. Gew. Buitenz. 57. 1823. *V. serpens* Wallich ex Ging. in DC., Prodr. 1: 296. 1824; Hook.f. & Thomson in Fl. Brit. India 1: 184. 1872. *V. serpens* var. *glabra* Hook. f. & Thomson, l. c. 184. **Fig. 67 m.**

Hindi & Punj.: *Banafsha*; Garh.: *Thungtu*.

Herbs, prostrate to subprostrate; stems or stolons usually long, leafy. Leaves ovate to deltoid, shallowly cordate at base, 1.5 - 8 x 1 - 6 cm, serrate; petioles 2 - 10 cm long, pubescent; stipules ovate-acuminate, subentire to dentate, 6 - 15 mm long. Peduncles 3 - 8 cm long, pilose; bracts 2, placed above middle, lanceolate to linear-lanceolate, entire, ca 6 mm long. Flowers white or pale violet. Sepals linear-lanceolate, acute, entire or denticulate, 4 - 8 x 1 - 2 mm; appendage ca 3 mm long, pointed. Petals obovate-oblong, 2 - 4 times as long as broad, 1 - 2 cm long; basal one obovate, slightly bearded; lateral ones oblanceolate, bearded at base; spur ca 5 mm long, obtusely cylindrical. Style subclavate, subtruncate and shortly beaked at apex, 1.5 - 3 mm long. Capsules ellipsoid, ca 5 mm in diam., glabrous.

Fl. March - May; *Fr.* May - July. Often throughout the year.

Distrib. India: Moist places around forests and margins of cultivation, in grasslands and alpine meadows, 1500 - 3500 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Meghalaya, Karnataka, Tamil Nadu and Kerala.

Pakistan, Nepal, Bhutan, Myanmar, China, Thailand and Indonesia (Sumatra and Java).

Notes. Medicinally useful as febrifuge, flowers used in lung troubles; petals made into a syrup and used as a remedy for infantile disorders; roots emetic.

A variable species. Taller forms grow in shaded humid places and shorter forms grow in rock-crevices. *V. serpens* subsp. *serpens* var. *deltioidea* W. Becker and *V. serpens* subsp. *garhwalensis* W. Becker are considered synonymous with *V. pilosa*, being a

smaller form of the same species. This is clear from a study of the specimens from Garhwal and other places.

Chromosome number reported: $2n = 18, 48$ (Chatterjee & Sharma in J. Genet. 61 (1): 52 - 63. 1973).

25. *Viola placida* W. Becker in Beih. Bot. Centralbl. Abt. 2, 36: 58. 1918; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 31. 1983.

Herbs, acaulescent, hispid-pilose; rhizome thick, densely articulated, stoloniferous. Leaves radical, rotundate-ovate, rounded-crenate along margins, acuminate at apex, 1 - 1.5 cm across, densely hispid; petioles ca 3 cm long, retorsely hispid-pilose; stipules free, lanceolate to triangular-ovate, 6 - 8 mm long, hairy on both sides, glandulose-fimbriate to ciliate along margins. Peduncles scarcely exceeding the leaves, retrorse-hispid. Flowers small, lilac. Sepals narrow, oblong, appendages sub-rotundate. Petals oblong, up to 5 mm long; lateral petals bearded at base; lowest petal almost boat-shaped. Ovary glabrous; style geniculate at base, subclavate, horizontal, passing into a submarginate shortly beaked stigma. Fruit not seen.

Fl. May.

Distrib. India: Sikkim.

Notes. This species is allied to *V. hookeri* Thomson in general, in hairyness of leaves to *V. alba* Besser and in the form of leaves to *V. odorata* L.

26. *Viola pogonantha* W. Smith in Notes R. Bot. Gard. Edinb. 12: 228. 1920; Sparre & C. Fischer in Bull. Misc. Inf. Kew 1929: 252. 1929.

Herbs, 10 - 15 cm high; rootstock articulated. Leaves ovate or ovate-oblong, 6 - 8 x 3 - 4 cm, serrate-crenate, setose with white hairs; petioles 8 - 12 cm long; stipules linear-lanceolate, ca 1.5 cm long, subentire to glandular fimbriate. Peduncles 6 - 8 cm long. Flowers ca 1.5 cm across, white with purple striations. Sepals linear-oblong, ca 7 mm long; spur quadrate, 2 - 3 mm long, pilose. Petals oblong-obovate, ca 1 cm long, lateral ones bearded at base; spur obtuse. Ovary villous; stigma terminal, truncate. Capsules globose, villous.

Fl. April - May.

Distrib. India: Arunachal Pradesh.

China.

Notes. This species is reported from Arunachal Pradesh based on a single collection from Mishmi, Delei valley by Kingdon Ward (Sparre & C. Fischer, l. c.).

27. *Viola reichenbachiana* Jordan ex Boreau, *Fl. Centr. France*, ed. 3, 2: 78. 1857; S. P. Banerjee & Pramanik in *Fasc. Fl. India* 12: 32. 1983.

Eng.: *Wood-Dog Violet*.

Herbs, caulescent; rootstock articulated. Leaves in rosette, ovate or ovate-oblong, obtuse, crenate, 1.5 - 3 x 1.5 - 2 cm, glabrous; petioles up to 2.5 cm long; stipules narrowly lanceolate, fimbriate, ca 1 cm long. Peduncles ca 5 cm long. Flowers 1.5 cm across, violet. Sepals lanceolate, acute, ca 5 mm long, appendage short, truncate. Petals obovate-oblong; spur ca 5 mm long. Stamens 5, lower two spurred. Ovary glabrous; style clavate; stigma beaked, papillose-hairy. Capsules ovate-acute, ca 1 cm long.

Fl. & Fr. not known.

Distrib. India: Jammu & Kashmir.

Central Asia, Europe and N.W. Africa.

Notes. Chromosome number reported: $2n = 20$ (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. *Viola rupestris* F. W. Schmidt in *Neue. Abh. Bohm. Ges.* 1: 60. 1791. *V. arenaria* DC., *Prodr.* 1: 298. 1824.

Herbs, grey papillose hairy to glabrous, caulescent. Leaves ovate-orbicular or rotundate-ovate, truncate at base, obtuse at apex, crenulate, 1 - 2 x 0.5 - 1.5 (2) cm, glandular punctate, shortly pilose; petioles 1.5 - 3 cm long; stipules lanceolate, more or less lobed at apex; up to 1 cm long. Peduncles up to 4.5 cm long, bibracteolate near apex. Flowers ca 1.5 cm across, violet or white. Sepals oblong-lanceolate, acute, 5 - 7 mm long. Petals oblong to obovate-oblong, ca 1 cm long; spur cylindrical, ca 4 mm long. Style clavate; stigma beaked.

KEY TO THE VARIETIES

- 1a. Plants almost glabrous; leaves rotundate ovate, deeply cordate at base 28.1. var. *himalayensis*
 b. Plants covered all over with grey papillose hairs; leaves ovate-orbicular, slightly cordate at base 28.2. var. *rupestris*

28. 1. var. himalayensis (W. Becker) S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 33 - 34. 1983. *V. himalayensis* W. Becker in Fedde, Repert. Spec. Nov. 17: 72. 1921.

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

Fl. not known.

Distrib. India: Jammu & Kashmir.

Notes. *V. himalayensis* W. Becker represented only by the type in CAL and resemble *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.

28. 2. var. rupestris

Stems up to 4 cm long, simple. Leaves 1 - 2 x 0.5 - 1.5 (-2) cm. Lateral petals bearded at base. Capsules elliptic-oblong, acute, ca 8 mm long, hairy.

Fl. & Fr. April - Aug.

Distrib. India: Jammu & Kashmir.

Asia, Europe and America.

29. Viola sikkimensis W. Becker in Beih. Bot. Centralbl. Abt. 2, 34: 260. 1916. *V. hookeri* Thomson in Fl. Brit. India 1: 183. 1872, p. p. (quoad spec. Sikkim, J.D. Hooker).

Fig. 69.

Herbs, perennial; rootstock woody, erect, densely articulated; stolons up to 18 cm long with distantly placed leaves. Leaves ovate-orbicular, cordate with broad sinus at base, acute, crenate, 1.5 - 5 x 1.5 - 3.5 cm, palmately 3 - 5-nerved at base, glabrous, silvery-white beneath; petioles up to 8 cm long, not winged; stipules lanceolate, subulate, acuminate, up to 1 cm long, long-fimbriate, scarious. Peduncles up to 9 cm long; bracts 2, medianly placed, subulate, lanceolate, laciniate along margins, ca 5 mm long. Flowers ca 1.5 cm across, creamy-white, with purplish tinge. Sepals linear-lanceolate, acute, 5 - 7 x 2 mm. Petals unequal, oblong-obovate, spatulate, ca 13 x 3 - 5 mm; lower spurred, spur ca 2 mm long. Stamens ca 3 mm long, ca 2 mm broad; filaments short, broad; connective broadly ovate with minutely ciliate margins, produced beyond anther into an ovate subacute membranous appendage of ca 1 mm long. Style subclavate, ca 1.5 mm long, narrowed downwards from the marginate obscurely 3-lobed beaked stigma. Cap-

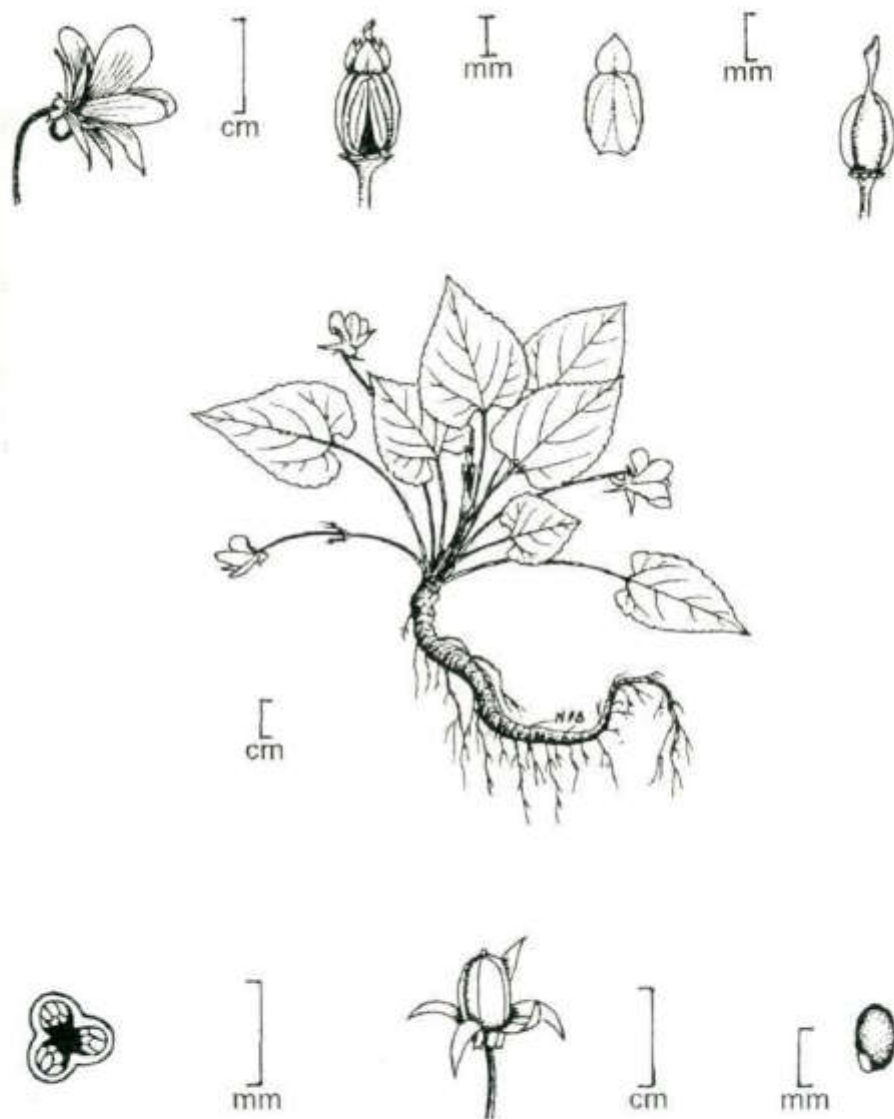


Fig. 69. *Viola sikkimensis* W. Becker : a. habit; b. flower; c. flower with sepals and petals removed; d. stamen; e. gynoeccium; f. ovary, t.s.; g. fruit; h. seed.

sules oblong-ellipsoid, beaked, 5 - 8 mm long, minutely granular, with persistent sepals; valves apiculate.

Fl. March - June; *Fr.* July - Oct.

Distrib. India: Grasslands and pine forests, 1200 - 3000 m. West Bengal, Sikkim, Arunachal Pradesh, Nagaland and Meghalaya.

China and Indonesia.

30. *Viola suavis* M. Bieb., *Fl. Taur.-Cauc.* 3: 164. 1819; É. E. Todd. in *J. R. Hort. Soc.* 55: 223. 1930.

Herbs, acaulescent, almost glabrous; rhizome thick, densely articulated, stoloniferous. Leaves radical, ovate or ovate-oblong, rotundate, crenulate, 1 - 3.5 x 1.2 - 3 cm, hispid mainly on nerves beneath; petioles up to 7 cm long, retrose-hispid; stipules lanceolate, acuminate, glandulose-fimbriate to ciliate. Peduncles up to 10 cm long. Flowers ca 1.5 cm across, violet with white centre. Sepals obtuse, ca 5 mm long. Petals ca 1.2 cm long, lateral ones not hairy; spur saccate, ca 4 mm long. Ovary glabrous; style horizontal, stigma beaked. Capsules globose, adpressed-pubescent.

Fl. & Fr. March - April.

Distrib. India: Jammu & Kashmir.

C. & W. Asia and Europe.

Notes. 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.

Chromosome number reported: $n = 40$ (Schmidt in *Osterreich Bot. Zeitcher* 108: 20 - 88. 1961).

31. *Viola sylvatica* Fries ex Hartman f. in *Bot. Notiser* 81. 1841. *V. canina* L. var. *sylvatica* (Fries ex Hartman f.) Hook. f. & Thomson in *Fl. Brit. India* 1: 185. 1872.

Fig. 67 d.

Herbs, perennial; rootstock short or absent; stem arising from a short central axis. Leaves ovate-orbicular, crenate-serrate, 1.5 - 4 x 1.5 - 3 cm, glabrous; petioles 1 - 5.5 cm long; stipules leafy, fimbriate, up to 1 cm long. Peduncles 2 - 5 (-7) cm long, equalling or exceeding leaves, 1-flowered. Flowers up to 2 cm across, violet. Sepals lanceolate, acute; appendage ca 2 mm long, subtruncate. Petals orbicular, obovate; spur ca 5 mm

long, straight or curved. Style inflated above; stigma decurved, ending in an uncurved orifice. Capsules ovate-acute, ca 5 mm long, glabrous.

Fl. & Fr. June - Sept.

Distrib. India: Jammu & Kashmir.

Central Asia and Europe.

Notes. Plant used in chest troubles; stem, leaves and flowers bruised and applied to wounds.

32. *Viola thomsonii* Oudem. in Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 74. 1867; Hara in Fl. E. Himal. 213. 1966.

Rootstock articulated; stolons up to 20 cm long. Leaves ovate-cordate, acute, 2.7 x 1.5 - 4 cm, serrate-crenate, glabrous to sparsely strigose; petioles 2 - 12 cm long, glabrous; stipules lanceolate, up to 1.5 cm long, deeply fimbriate. Peduncles up to 13 cm long, not extending above leaves; bracteoles linear, acuminate with a few teeth along the margin, up to 1.5 cm long. Flowers ca 1.5 cm long. Sepals lanceolate, acute, ca 6 mm long. Petals obovate to ovate-oblong, ca 1.5 cm long, pale violet; lower petal spurred, spur saccate. Style geniculate at base; stigma marginate, rarely shortly beaked. Capsules oblong, apiculate, ca 1 cm long.

Fl. & Fr. March - Sept. Often throughout the year.

Distrib. India: West Bengal, Sikkim, Arunachal Pradesh, Nagaland and Manipur.

Nepal, Bhutan and Myanmar.

Notes. This species shows some similarities with *V. pilosa* Blume but can be distinguished by its ovate-cordate acute glabrous leaves and petioles, deeply fimbriated stipules and peduncles bibracteolate above the middle, with longer bracteoles toothed along margins.

33. *Viola tricolor* L., Sp. Pl. 935. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 182. 1872, in obs. Fig. 67 e.

Herbs, annual, biennial or perennial, glabrous to puberulous, up to 80 cm high; stem erect, diffusely branched from base. Leaves variable, ovate-lanceolate, 1.5 - 4 x 0.5 - 1.5 cm; basal leaves ovate, subcordate, those of the stem becoming ovate-spathulate, obovate-oblong, or lanceolate, broadly crenate-dentate, obtuse; petioles 1 - 2.5 cm long, often winged above; stipules lanceolate, deeply pinnately lobed, foliaceous, up to 2.5 cm long. Flowers up to 4.5 cm across, smaller in feral forms, multicoloured or a mixture of

yellow, blue, purple and violet; peduncles 3 - 10 cm long, exceeding leaves. Sepals linear-lanceolate, subulate, mucronate, 7 - 15 x 2 - 5 mm. Petals orbicular-obovate, 1 - 2 times as long as broad; lateral ones bearded at base; spur 5 - 8 mm long, straight, obtuse. Style geniculate at base, clavate distally, ca 2 mm long; stigma laterally beaked, hairy. Capsules ellipsoid or ovoid, acute, 8 - 12 mm long.

Fl. Nov. - May; *Fr.* April - June.

Distrib. Cultivated in India as an ornamental plant with a number of horticultural varieties, rarely as an escape from cultivation.

Asia, Europe, America and Australia.

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

Chromosome number reported: $2n = 26$ (Love & Love in Acta Hort. Gothob. 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 various in size, oblately flattened, about 85 x 63 μ with furrows, more or less 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).

34. *Viola wallichiana* Ging. in DC., Prodr. 1: 300. 1824. *V. reniformis* Wallich in Roxb. Fl. Ind. 2: 457. 1824. *V. biflora* auct. non L.; Hook. f. & Thomson in Fl. Brit. India 1: 183. 1872, p. p.

Stems 5 - 15 (-25) cm, erect or decumbent. Leaves cauline, reniform to rotundate, rounded-crenate along margins, 0.7 - 2.5 (-4.5) x 1 - 3 (-5) cm long, glabrous; petioles 0.5 - 6 cm long. Stipules ovate, denticulate, ca 3 mm long. Peduncles 0.8 - 5 cm long, bibracteolate above the middle. Flowers ca 1 cm across, yellow. Sepals subulate-acute, ca 5 mm long. Petals elliptic-obovate, ca 1 cm long; spur linear, 0.5 - 6 mm long, obtuse. Stigma bilamellate, with spreading lobes. Capsules oblong, apiculate, ca 4 mm long.

Fl. & Fr. May - Sept.

Distrib. India: Temperate E. Himalayas, along margins of forests, 2000 - 3300 m. West Bengal and Sikkim.

Nepal and Bhutan.

Notes. This species is distinguished from *V. biflora* L., by its rounded-crenate leaves, subulate acute sepals, petals pure yellow outside without purple reticulations and with slender 5 - 6 mm long spur.

35. *Viola yunnanensis* W. Becker & Boiss. in Bull. Herb. Boiss. 8: 740. 1908; S. P. Banerjee & Pramanik in Fasc. Fl. India 12: 37. 1983.

Rootstock articulated; stolons up to 20 cm long. Leaves in rosette, ovate-oblong, acute, crenate-serrate, 2.5 - 7 x 1 - 3.5 cm, pilose; petioles 1 - 6 cm long, pilose; stipules lanceolate, acuminate, fimbriate to subciliate. Peduncles 3 - 6 (-11.5) cm long. Flowers white. Sepals linear, acute, up to 1 cm long, densely ciliate, trinervate, appendage shortly truncate. Petals obovate oblong, up to 1.5 cm long. Ovary glabrous; style clavate; stigma shortly beaked above. Fruits not seen.

Fl. April - May.

Distrib. India: Arunachal Pradesh (BM) and Nagaland.

Myanmar and China.

Notes. Allied to *V. hossei* W. Becker but easily distinguishable by its somewhat densely pilose, ovate-oblong leaves, larger flowers and longer trinervate densely ciliate sepals.

BIXACEAE

(N. P. Balakrishnan)

Shrubs or small trees, with mucilaginous canal producing yellow, orange or reddish sap or gum, often deciduous. Leaves spirally arranged, simple, entire or palmatipartite or digitate, serrate, palmately or pinnately nerved; stipules small, caducous. Flowers bisexual, actinomorphic, showy in terminal or axillary racemes, corymbs or panicles, often thyrsoid. Sepals 4 - 5, free, imbricate, caducous soon after anthesis leaving 5 basal glands. Petals 4 - 7, free, imbricate or contorted. Stamens many; filaments long, free or basally connate; anthers 2-loculed, basifixed or dorsifixed, dehiscent by short slit at about the middle or by 1 or 2 apical pores or short slit at apex. Disk present, annular or absent. Ovary superior, entire or 1-loculed or falsely 2-loculed or 3 - 5 loculed in lower half; ovules many, on 2 or 3 - 5 parietal placentae, bitegmic, anatropous; style 1, elongate, filiform, recurved in bud; stigma apical, bilobed or denticulate. Fruit a loculicidal 2 - 5-valved capsule; compressed; endocarp membranous, septifugal, 2 - 5-valved. Seeds many, erect or pendant, reniform or obovoid, often pilose or woolly, narrowed at base on elongated funicle, covered by red fleshy testa or long white wool; endosperm copious, oily or not; embryo straight or curved; cotyledons broad.

Tropical America, Africa, India to Malesia and N. Australia; 3 genera and ca 28 species, 2 genera and 2 species in India.

Literature. BACKER, C. A. (1951) Bixaceae. In: Fl. Males. I, 4: 239 - 241, ff. 241, tt. 1 - 2. PAUL, T. K. & M. P. NAYAR (1988) Cochlospermaceae. In: Fasc. Fl. India 19: 16 - 19, t.1, f.3. STEENIS, C. G. G. J. van (1949) Cochlospermaceae. In: Fl. Males. I, 4: 61 - 63, f. 1.

KEY TO THE GENERA

- 1a. Leaves entire, petals pink; disk annular; ovary and capsules covered densely by thick flexible bristles; ripe seeds with a thick red testa 1. *Bixa*
- b. Leaves palmatipartite, petals yellow; disk absent; ovary and capsules not covered by such bristles; ripe seeds wrapped in long white wool 2. *Cochlospermum*

1. *Bixa* L.

Shrubs or small trees with mucilaginous canals of reddish sap. Leaves simple, entire, palmately nerved. Flowers in terminal corymbs or panicles, often thyrsoid; pedicels thickened upwards. Sepals 4 - 5, free, imbricate, with 2 basal glands on outside of each sepal; all sepals caducous soon after anthesis, leaving 5 basal glands. Petals 4 - 7. Stamens inserted on hypogynous annular disk; filaments long, free, connate at base; anthers 2-loculed, dehiscent by short slit about the middle, seemingly apical. Ovary 1- or falsely 2-loculed; ovules many, on 2 opposite parietal placentae. Capsule loculicidal, compressed, 2-valved from apex downwards, mostly soft prickly; valves persistent; endocarp

membranous, separating from valves; seeds many, obovoid, impressed at apex, narrowed at base on enlarged funicle, covered by red testa; endosperm not oily; embryo straight.

Tropical America, West Indies and widely cultivated in tropics; 3 - 4 species, one in India.

Bixa orellana L., Sp. Pl. 512. 1753; Hook. f. & Thomson in Fl. Brit. India 1: 190. 1872. **Fig. 70.**

Engl.: *Anatto-tree, Amatto*; Hindi: *Sinduriva*; Kan.: *Rangamala*; Mar.: *Sendri*; Tam.: *Japhara*.

Shrubs or small trees, 2 - 9 m tall; young branches densely dark scaly; wood pale yellow, soft. Leaves ovate, subcordate or truncate at base, long-acuminate at apex, 7 - 24 x 4 - 16 cm, at first scaly beneath, afterwards glabrous, glossy above, densely red-dotted; lateral nerves 4 - 5 pairs; petioles slender, 4 - 10 cm long; stipules 5 - 6 mm long. Corymbs or panicles 8 - 50-flowered, scaly; pedicels 7 - 10 mm long; flowers 4 - 5 cm in diam. Sepals concave, broadly ovate to suborbicular, purple, scaly. Petals 5 - 7, unequal, obovate, rounded at apex, 2 - 3 x 1 - 2 cm, light red, pink to white. Filaments slender, yellow at base, red at apex; anthers purple. Ovary densely covered with thick red bristles; styles thickened upwards, 12 - 15 mm long, red. Capsules globose or broadly ovoid, nearly truncate at base, abruptly short-acuminate at apex or elongate-ovate with narrowly long-acuminate apex, 2 - 4 x 2 - 4.5 cm, with dense long stiff but soft and flexible bristles, green when young, brownish red with age. Seeds obpyramidal, ca 5 mm long, 4 - 5 mm wide, orange-red:

Fl. & Fr. Aug. - Feb.

Distrib. India: Cultivated as an ornamental, sometimes run wild, below 2000 m. Most parts of India.

Native of tropical America, now widespread in tropics.

Notes. Seeds provide a red dye used for colouring foodstuffs, butter, cheese, chocolate, cosmetics, oils, varnishes, soap and in ancient times wool and silk. Due to availability of synthetic dyes this plant is now not used commercially. The leaves and roots are used as a digestive tonic in S.E. Asia and S. America.

It occurs in two forms, one with white flowers and green capsules and another with pink flowers and red capsules.

The chromosome number reported by Mukherjee (in Bull. Bot. Soc. Bengal 29: 25. 1975) is $2n = 14$.

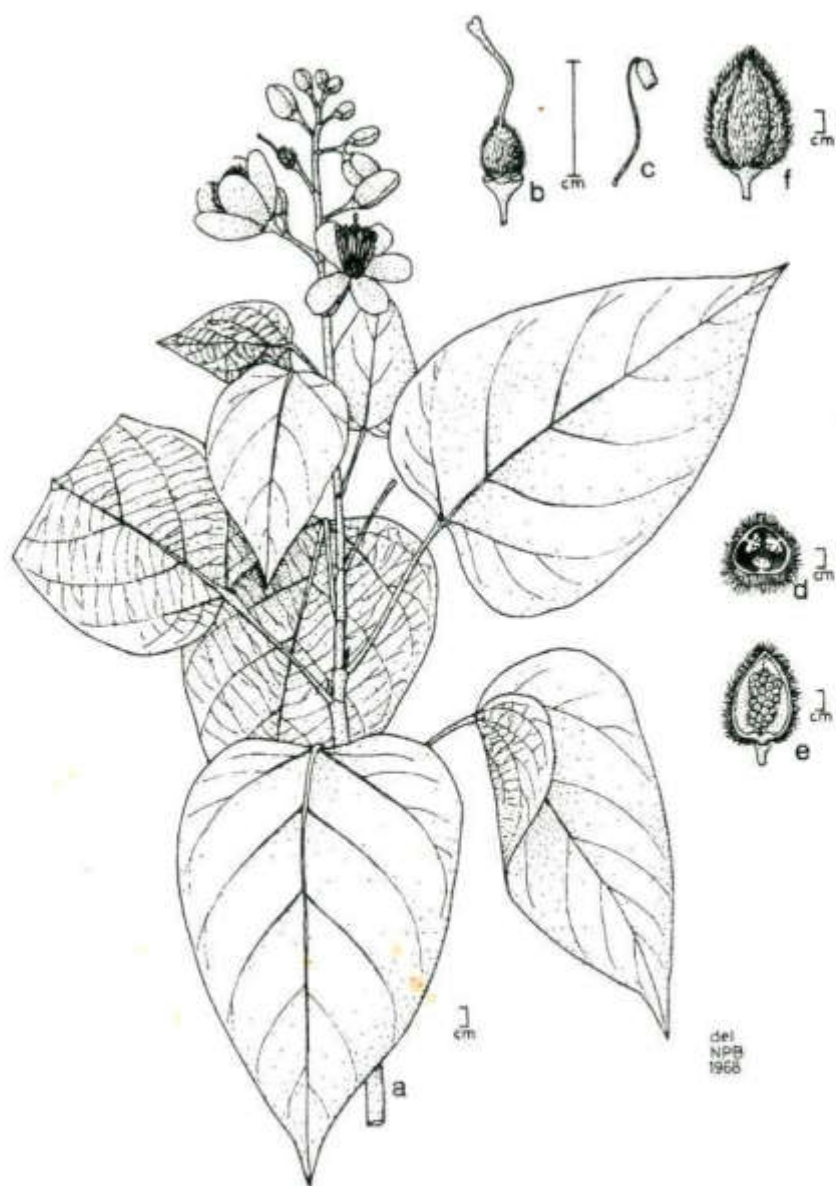


Fig. 70. *Bixa orellana* L. : a. twig; b. ovary; c. stamen; d. t.s. of ovary; e. l.s. of ovary; f. fruit.

2. *Cochlospermum* Kunth ex DC., nom. cons.

Trees or shrubs or rarely somewhat herbaceous with more or less subterranean swollen stems, often deciduous, producing gums and orange-coloured sap. Leaves spreading, palmately lobed or digitate, pubescent or glabrous, deciduous. Flowers in terminal or subterminal racemes, corymbs or panicles or these in the upper leaf axils, appearing before the leaves. Sepals 5, free, broadly ovate, obtuse, persistent or caducous. Petals 5, free, imbricate or contorted, usually emarginate, large, yellow, showy. Stamens many, equal or unequal; filaments free or shortly connate at base; anthers oblong to linear, basifixed, 2-loculed, dehiscing by confluent pore-like slits. Ovary 1-loculed above with 3 - 5 parietal laminate placentae or incompletely 3 - 5-loculed at basal half; style filiform; stigmas barely thicker than style, usually obscurely denticulate. Capsules 1-loculed, 3 - 5-valved, longitudinally dehiscing, each of the inner endocarp bearing along its centre the placentae. Seeds cochleate-reniform to somewhat horse-shoe shaped, woolly pubescent.

Mostly in tropical and subtropical America, some in Africa, and S.E. Asia; ca 11 species, one in India.

Cochlospermum religiosum (L.) Alston, Handb. Fl. Ceyl. 6: 14. 1931. *Bombax religiosum* L., Sp. Pl. 552. 1753. *C. gossypium* DC., Prodr. 1: 527. 1824; Hook. f. & Thomson in Fl. Brit. India 1: 190. 1872. Fig. 71.

Eng.: *Golden-Silk-Cotton-Tree*; Hindi: *Galgal, Kumbi*; Kan.: *Arishina-boorage*; Mal.: *Apparutakka*; Mar.: *Ganeri*; Tel.: *Kidagogu, Kindagogu*.

Shrubs or trees, up to 10 m tall, often with crooked branches, more or less deciduous. Leaves orbicular in outline, 7 - 20 cm in diam., 3 - 5-lobed to more than half-way down, cordate and 5 - 7-nerved at base, pubescent to subtomentose beneath; lobes undulate or obscurely crenate along margins, acuminate at apex; midlobe 5 - 11 x 1 - 9 cm; petioles articulate, 8 - 25 cm long; stipules linear-subulate, 5 - 10 mm long, hairy, caducous. Flowers greenish yellow, up to 8 cm across, in terminal racemes or loosely arranged panicles, short hairy, one flower opening at a time on each branch; pedicels 2 - 3 cm long; bracts triangular, acute, 4 - 5 mm broad at base, caducous. Sepals deltoid-ovate, acute, 2 - 2.5 x 1 - 2 cm, hairy, partly purplish, caducous. Petals obovate, notched at apex, 3 - 6 x 2 - 3 cm, yellow, with distinct odour, thickened at base. Stamens slightly S-curved, unequal; filaments ca 1 cm long, yellow; anthers orange, linear, falcate, ca 5 x 1 mm broad. Ovary globose, glabrous; style 1.5 - 2 cm long, glabrous. Capsules obovoid, 5 - 10 cm long, 2.5 - 8 cm broad; valves 5, striate-ribbed. Seeds reniform to cochleate, 5 - 6 mm across, brown, woolly.

Fl. Jan. - March; Fr. March - June (leafless when in flower, leaves appear in May).

Distrib. India: Tropical dry deciduous forests, in dry gravelly soil, up to 1000 m.

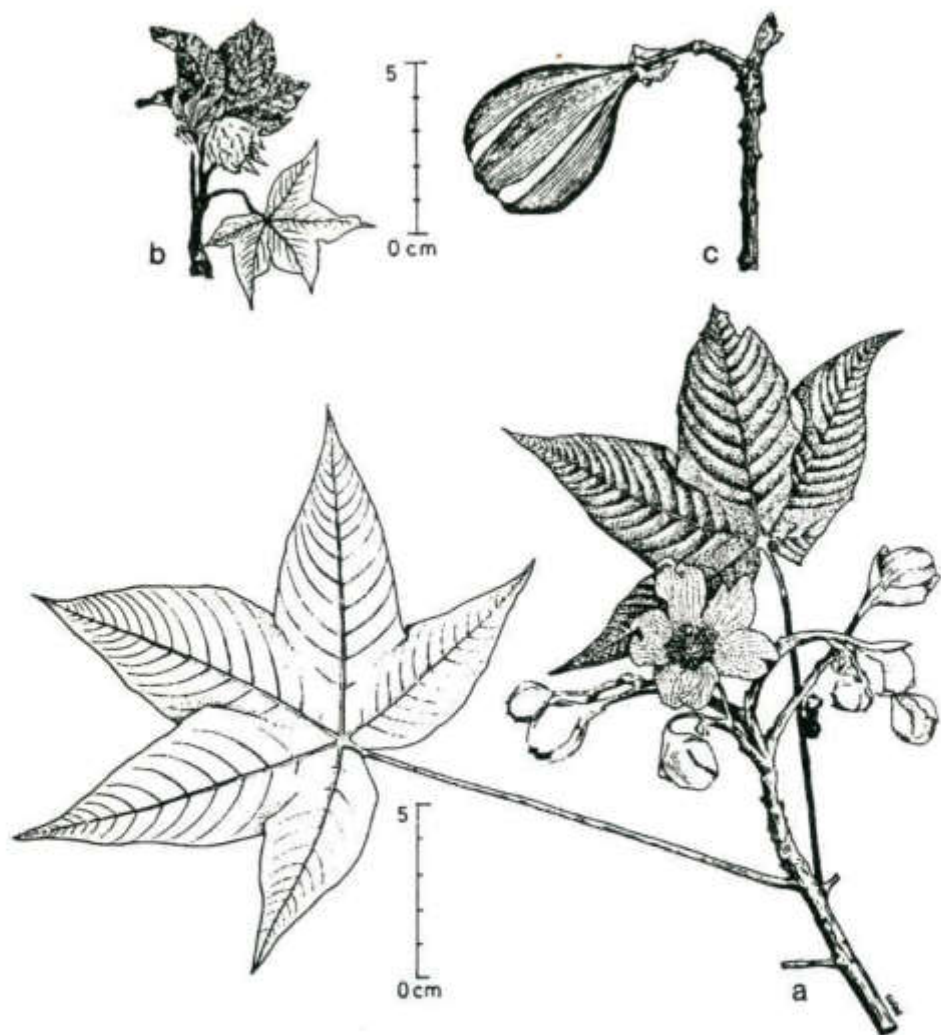


Fig. 71. *Cochlospermum religiosum* (L.) Alston : a. flowering twig; b. new shoot; c. fruit showing dehiscence.

Uttar Pradesh, Madhya Pradesh, Bihar, Orissa, Maharashtra and throughout South India.

Sri Lanka, Vietnam, Cambodia, Thailand, Malaysia, Indonesia and Philippines.

Notes. Often planted as a temple plant. Ornamental tree for gardens. Bark yields an edible gum, called 'Kutara gum'. Fibre covering seeds used for stuffing mattresses.

FLACOURTIACEAE

(R. L. Mitra)

Tress or shrubs (also scandent), sometimes armed with axillary thorns (in some genera the term spine has been used), often producing cyanogenic glycosides, and/or cyclopentenyl fatty acids. Leaves simple, mostly alternate, spirally arranged or distichous, sometimes aggregated towards apices of branchlets, entire or gland-toothed, occasionally also with glands at base, pinnately veined, often also 3-5-plinerved at base; stipules usually small and caducous, rarely absent. Flowers actinomorphic, bisexual or unisexual (plants mostly dioecious, rarely polygamous or monoecious), variously arranged in subterminal or axillary (sometimes on tubercles from old nodes) racemes, spikes, panicles, corymbs, cymes, or reduced to glomerules or fascicles, or even solitary. Sepals (2-) 3-6 (-15), connate into calyx-tube or wholly connate into a calyx closed in bud and irregularly splitting at anthesis, imbricate or valvate, mostly persistent, rarely accrescent, sometimes gradually merging into petals, rarely expanded and wing-like. Petals absent or present, 3-8 (-15), distinct and alternating with sepals, or spirally arranged and poorly differentiated from sepals, sometimes persistent and accrescent, rarely gradually transitional to stamens, occasionally with an adaxial scale at base. Torus often expanded into annular, sometimes glandular disc. Stamens as many as petals or more, or numerous, antipetalous or not arranged in relation to petals; filaments usually free or connate in antisepalous bundles or all connate into a tube or into a central column; anthers 2-loculed, basifixed or dorsifixed, dehiscent longitudinally, connective sometimes produced into an apiculate appendage; pollen tricolpate to tricolporidate or tricolporate, prolate to spheroidal, shed singly. Disc often present, extrastaminal or in between stamens, annular, lobed or composed of distinct glands. Carpels (2-) 3-6 (-10), connate into unilocular (incompletely multilocular in *Flacourtia*, because of deeply intruding placentae), superior, semiinferior or inferior ovary; ovules anatropous, amphitropous or rarely orthotropous, bitegmic, crassinucellar, 1-many in parietal placentae; styles 1-10, free or connate, sometimes absent; stigma simple or often obscurely lobed. Fruit capsular, berry or dry and indehiscent, rarely a drupe or samara, sometimes winged, prickly or spiny. Seeds 1-many, occasionally arillate, pulpy outside or covered with silky hairs; endosperm copious, oily; embryo straight; cotyledons usually broad and foliaceous.

Pantropical or subtropical, a few temperate; ca 79 genera and ca 880 species, 10 genera and 38 species in India.

Notes. Flacourtiaceae have been used in the past as a refuge for indeterminate elements, and are still relatively poorly known. Following morphological, anatomical and phytochemical studies, though a number of anomolous elements could be satisfactorily removed from the family, yet there remains much to be achieved. Thus, the family are still being distinguished from other families by a set of atypical characters. In the recent review, Lemke (1988) while recognising the family as comprising of 79 genera with approximately 880 species in 10 tribes, admitted that the family as could be circumscribed with our current state of understanding, 'are rather heterogenous assortment of more or less homogeneous tribes'.

Literature. CHAKRABARTY, T. & M. GANGOPADHYAY (1992) The Flacourtiaceae of Andaman - Nicobar Islands. *J. Econ. Tax. Bot.* 16: 715 - 722. KEATING, R. C. (1973) Pollen morphology and relationships of the Flacourtiaceae. *Ann. Missouri Bot. Gard.* 60: 273 - 305. KEATING, R. C. (1975) Trends of specialization in the pollen of Flacourtiaceae with comparative observations of Cochlospermaceae and Bixaceae. *Grana* 15: 29 - 49. LEMKE, D. E. (1983) Tribal redefinition in Flacourtiaceae. *Amer. J. Bot.* 70: 121. LEMKE, D. E. (1988) A synopsis of Flacourtiaceae. *Aliso* 12: 29 - 43. MILLER, R. B. (1975) Systematic anatomy of the xylem and comments on the relationships of the Flacourtiaceae. *J. Arn. Arb.* 56: 20 - 102. MUKHERJEE, N. (1972) Revision of the family Flacourtiaceae of India, Burma and Ceylon. *Bull. Bot. Soc. Bengal* 26: 31 - 45. SLEUMER, H. (1954) Flacourtiaceae. In: *Fl. Malesiana* 1, 5: 1 - 106. SLEUMER, H. (1980) Flacourtiaceae. In: *Fl. Neotropica* 22: 1 - 499. SPENCER, K. C. & D. S. SEIGLER (1985) Cyanogenic glycosides and systematics of the Flacourtiaceae. *Biochem. Syst. Ecol.* 13: 421 - 431.

KEY TO THE GENERA

- | | |
|--|--|
| 1a. Petals absent | 2 |
| b. Petals present | 6 |
| 2a. Flowers bisexual | 3 |
| b. Flowers unisexual (plants usually dioecious) | 4 |
| 3a. Stamens alternating with as many staminodes, connate below to form a perigynous ring adnate to calyx tube | 2. <i>Casuaria</i> |
| b. Stamens not alternating with staminodes, free | 3. <i>Flacourtia</i> p. p. (<i>F. inermis</i>) |
| 4a. Branchlets and peduncles conspicuously girdled with perular bracts at base; sepals usually 3, caducous; male flowers with pistillodes; female flowers with staminodes; disc broken up into glands between stamens in male flowers and staminodes in female flowers | 1. <i>Bennettiodendron</i> |
| b. Branchlets and peduncles not with such bracts; sepals 4 - 5, subsistent; pistillode absent in male flowers; staminodes rarely present in some female flowers (<i>Flacourtia montana</i> and <i>F. rukkam</i>); disc extra-staminal of distinct glands in male flowers, annular or lobed in female flowers | 5 |
| 5a. Anthers usually dorsifixed and versatile; ovary incompletely (2-) 3 - 6 (-10)-loculed with deeply intruding placenta; styles 3 or more, free or nearly so; berry with indurate endocarp, globose when fresh, becoming characteristically obtusely cubiform-angular and constricted in middle when dry with 2 superposed pyrenes in each locule | 3. <i>Flacourtia</i> |
| b. Anthers basifixed; ovary of 2 (-3) carpels, connate into a unilocular ovary; styles simple or branched only in upper part; berry 1-loculed, globose or ellipsoid both when fresh and dry | 10. <i>Xylosma</i> |

- 6a. Petals with a scale at base inside; flowers unisexual (plants dioecious, rarely male inflorescences with 1 - 2 bisexual but functionally female flowers, as in **Pangium**) 7
- b. Petals without a scale at base inside; flowers bisexual 10
- 7a. Sepals more or less free, imbricate **6. Hydnocarpus**
- b. Sepals wholly connate into a closed calyx in bud 8
- 8a. Calyx sheds off as an irregular calyptra, leaving a cupular calyx 5-lobed or toothed at apex **4. Gynocardia**
- b. Calyx irregularly splitting into 2 - 5 calyx lobes at anthesis, caducous or persistent 9
- 9a. Leaves crowded at apices of branches, 3 - 5-pliveined at base; stamens numerous; filaments free **7. Pangium**
- b. Leaves not crowded at apices of branches, pinnately veined from base; stamens 4 - 5; filaments connate into a column **8. Ryparosa**
- 10a. Leaves pinnately veined; sepals with an episepalous nectar gland; stamens antipetalous, solitary or in clusters; anther connectives not exerted; both ovary and fruit adnate to hypanthium below, free above; fruit a dry capsule **5. Homalium**
- b. Leaves 3 - 5-plinerved at base; episepalous nectar glands absent; stamens irregularly arranged, not in relation to petals; anther connectives produced into an apiculate appendage; hypanthium absent, both ovary and fruit free; fruit a fleshy berry **9. Scolopia**

1. *Bennettiodendron* Merr.

Trees or shrubs, dioecious; branchlets and peduncles girdled with perular bracts at base. Leaves spirally arranged, usually aggregated in distant groups, glandular-serrate, chartaceous, shiny, 3 - 5-pliveined at base, pinnately veined above, basal primary and secondary veins upturned, gradually diminishing apically to join superadjacent veins by a series of irregularly branched cross-veins and giving rise to branchlets to terminate in a gland beneath serrate teeth; petioles rather long, sometimes with two glands at apex; stipules minute. Flowers apetalous, small; bracteoles arranged in umbellate clusters on axillary and terminal divaricately branched panicles. Sepals 3 (-5), imbricate, caducous. Disc broken up into numerous small fleshy glabrous glands between stamens and staminodes. *Male flowers*: Stamens numerous; filaments filiform, pilose to about middle from base; anthers dorsifixed; pollen tricolporate, reticulate, subprolate. Ovary rudimentary. *Female flowers*: Staminodes numerous, about half as long as stamens, pilose at base. Carpels 3, connate into unilocular ovary with deeply intruding placentae; ovules 2 - 3, parietal; styles 3, diverging, caducous; stigma bilobed. Berry small, globose or subglobose, minutely reticulate.

Tropical rain forests of N.E. India, Bangladesh, Myanmar, S. China and Indonesia; ca 3 species, one in India.

Bennettiodendron leprosipes (Clos) Merr. in J. Arn. Arb. 8: 11. 1927; Sleumer in Fl. Males. 1, 5: 64. 1954. *Xylosma leprosipes* Clos in Ann. Sci. Nat. 4, 8: 230. 1857. *Bennettia longipes* Oliver in Hook., Icon. Pl. 16: t.1596. 1887; Burkill in Rec. Bot. Surv. India 10: 238. 1925.

Shrubs or trees, 3 - 6 m tall; branchlets scabridulous in younger parts; perular bracts triangular-ovate, concave, ca 2 mm long, pubescent. Leaves oblanceolate or elliptic-oblong, narrowed but obtuse (at very base) and 3 - 5-pliveined at base, short acuminate at apex, remotely glandular-serrate, 4.5 - 18 (-35) x 1.5 - 7 (-14) cm, chartaceous, shiny and glabrous or scabridulous along midrib near base; basal primary and secondary veins together 7 - 9 pairs; tertiary veins randomly reticulate and giving rise to branched quaternary veins forming incomplete meshes apparent on both surfaces; petioles (0.3-) 1.5 - 2 (-4) cm long, densely scabridulous. *Male flowers* greenish yellow, fragrant, ca 7 mm across, 3 - 5 (-9) each in subumbellate clusters and several such arranged in divaricately branched panicles, 5 - 12 (-21) cm long; rachis and rachiules densely scabridulous, at length glabrescent; peduncles 3 - 7 mm long, thickened at apex, densely scabridulous; pedicels 3 - 4 mm long, densely scabridulous. *Sépals* ovate-elliptic or ovate-rotund, ciliolate along margins, ca 3 mm long. *Stamens* numerous, yellowish, ca 1.5 mm long. *Female flowers*: *Sépals* similar to but smaller than in male flowers. *Staminodes* ca 1.5 mm long. *Ovary* ovoid, ca 3 x 2 mm; *styles* 3, divergent, 1 - 1.5 mm long; *stigma* obscurely bilobed. *Berries* subglobose, 6 - 9 mm across, reddish when ripe.

Fl. Jan.

Distrib. India: Evergreen rain forests at ca 450 m. Arunachal Pradesh (Pasighat, Yumbung). Rare.

Bangladesh (Sylhet), Myanmar, S. China, Thailand and Indonesia.

2. *Casearia* Jacq.

Shrubs or small trees. Leaves alternate, distichous, often pellucid-punctate and lineolate, serrato-crenate or entire, pinnately veined, rarely also 3 - 5-pliveined at base; secondary veins upturned, gradually diminishing apically to join superadjacent veins by a series of cross-veinules and giving rise to branchlets to terminate in a gland below serrate-crenate teeth or at margins; stipules minute, caducous. Flowers bisexual, mostly clustered in axillary fascicles (sometimes reduced to a solitary flower); pedicels articulated above base, surrounded at base by scale-like bracts. Calyx 5-lobed, imbricate, persistent. *Stamens* usually 8 - 10, alternating with as many *staminodes*, connate below to form a perigynous ring adnate to calyx-tube; *staminodes* well-developed, usually tufted hairy at top; pollen grains tricolporate, subprolate to suboblate. *Carpels* 3, connate into unilocular superior ovary; ovules few to many; style short; stigma capitate, sometimes obscurely 3-lobed. *Fruits* capsular, (2-) 3-valved, succulent, 3-angled when fresh, usually 6-ribbed when dry. *Seeds* usually numerous and bright red, arillate.

Pantropical; ca 160 species, 12 in India.

Notes. In *Casearia*, the flowers are minute and usually uniform in gross morphology except for minor details. The species are therefore primarily distinguished on vegetative

characters. But the variability in leaf shape and indumentum often make the task of recognising peripheral elements of some population extremely difficult. The pattern of leaf venation evident under a hand lens has however often proved very useful and helped in delimiting some of the taxa satisfactorily.

In general, however, more stress has been given on the characters of typical elements of a population while formulating the key characters.

KEY TO THE SPECIES

- 1a. Mature leaves conspicuously hairy, at least along midrib and veins beneath 2
 b. Mature leaves apparently glabrous 5
- 2a. Leaves at least 3 times longer than broad; calyx glabrous 10. *C. vareca*
 b. Leaves not 3 times longer than broad 3
- 3a. Mature leaves chartaceous, long acuminate at apex, attenuate at base 11. *C. wynadenis*
 b. Mature leaves subcoriaceous, obtuse or shortly acuminate at apex, usually obliquely rounded at base 4
- 4a. Indumentum along midrib and veins beneath spreading pilose; pedicels 5 - 12 mm long; stamens 10
 6. *C. kurzii*
 b. Indumentum along midrib and veins soft or velutinous tomentose; pedicels 4 - 5 mm long; stamens 8
 9. *C. tomentosa*
- 5a. Young shoots pubescent; immature leaves puberulous along midrib and secondary veins; mature leaves sometimes very minutely puberulent along midrib and veins near base 6
 b. Young shoots and both immature and mature leaves completely glabrous 8
- 6a. Leaves 3 - 5-pliveined at base 5. *C. grewiaefolia* var. *gelonoides*
 b. Leaves pinnately veined from base 7
- 7a. Leaves subcoriaceous, shiny, acute at apex, closely arranged; nodes usually 5 - 7 (-10) mm apart; pedicels ca 1 mm long; calyx hairy on both sides; ovary hirsute at least towards apex 12. *C. zeylanica*
 b. Leaves chartaceous, acuminate at apex, not shiny, not closely arranged; nodes 10 - 20 mm or more apart; pedicels 4 - 6 mm long; calyx hairy outside; ovary glabrous 3. *C. glomerata*
- 8a. Pedicels (at least below articulations) and calyx hairy 9
 b. Pedicels and calyx glabrous 10
- 9a. Leaves usually broadly elliptic to elliptic-oblong, rounded at base, shallowly crenate along margins, prominently reticulate, especially beneath when mature; reticulum coarse to touch 4. *C. graveolens*
 b. Leaves usually narrowly elliptic-oblong or elliptic-lanceolate, usually cuneate or attenuate and unequal sided at base, entire and revolute along margins, indistinctly reticulate even when mature; reticulum smooth to touch 7. *C. rubens*
- 10a. Leaves coriaceous or subcoriaceous, never membranous, usually obovate, obtuse or rounded at apex, entire and revolute along margins 8. *C. thwaitesii*
 b. Leaves membranous, chartaceous when mature, never obovate, acute or acuminate at apex, crenato-repand to subentire along margins 11
- 11a. Leaves 7 - 16.5 cm long, attenuate at base, acutely acuminate at apex; acumen often twisted; secondary veins 6 - 8 pairs; petioles 4 - 7 mm long; pedicels 2 - 4 mm long 2. *C. championii*

- b. Leaves 15 - 32 cm long, obtuse or cuneate and usually inequilateral at base, not acutely acuminate at apex; acumen never twisted; secondary veins 10 - 13 pairs; petioles 10 - 25 mm long; pedicels ca 6 mm long

1. *C. andamanica*

1. *Casearia andamanica* King in J. Asiat. Soc. Bengal 67: 16. 1898; C. E. Parkinson, For. Fl. Andaman Is. 181. 1923. Fig. 72.

Trees, 8 - 15 m tall; bark yellowish brown; branchlets terete, compressed when young, pale brown, glabrous. Leaves oblong to oblong-elliptic or oblanceolate, rarely broadly elliptic, obtuse or cuneate and usually inequilateral at base, acute or short acuminate at apex, crenato-repand, undulate to subentire along margins, (9-) 15 - 32 (-35) x (4.5-) 6 - 10 (-12) cm, chartaceous when mature, glossy, glabrous, green above, pale beneath, turning to olivaceous or brown when dry; secondary veins (6-) 10 - 13 pairs, raised beneath, upturned; tertiary and quarternary veins together form dense reticulum which is prominent beneath; petioles 1 - 2.5 cm long, sulcate. Flowers ca 6 mm across, greenish white in densely bracteate glomerules on short tubercles; pedicels ca 6 mm long, glabrous; bracts ovate, minute. Calyx lobes broadly elliptic, concave, ca 4 mm long, glabrous. Stamens 10, 1 - 1.5 mm long; staminodes ca 1.5 mm long, with a tuft of hairs at apex. Ovary elongate-ellipsoid, densely hairy; style short; stigma capitate. Capsules ellipsoid or ovoid, 3 - 5 x 1.5 - 2 cm, green, yellow when ripe; aril white, turns pink on drying.

Fl. Jan. - April; *Fr.* ripens during Aug. - Sept.

Distrib. India: Evergreen forests. Andaman & Nicobar Islands (South and Middle Andamans).

Endemic.

2. *Casearia championii* Thwaites, Enum. Pl. Zeyl. 19. 1858. *C. esculenta* auct. non Roxb. 1832; C. B. Clarke in Fl. Brit. India 2: 592. 1879, p. p. *C. bourdillonii* N. Mukherjee in Bull. Bot. Soc. Bengal 19(2): 109. 1965 (1967), p. p.

Mal.: *Vella-kunnan*.

Shrubs or small trees, up to 4 m tall; bark greyish smooth; young shoots glabrous. Leaves elliptic, elliptic-oblong or oblanceolate, attenuate at base, acutely acuminate at apex (acumen often twisted), crenato-repand to subentire, (4.5-) 7 - 16.5 x (2.2-) 3 - 7.8 cm, glabrous, membranous when young, chartaceous, green and glossy when mature; secondary veins 6 - 8 pairs with a few intersecondary veins; quarternary veins irregularly branched with free endings and together with tertiary veins form dense imperfect reticulum of incomplete meshes, prominent on both surfaces; stipules foliaceous, caducous; petioles (2-) 4 - 7 mm long, glabrous. Flowers greenish yellow, ca 5 mm across, in axillary pubescent racemose clusters; pedicels ca 2 mm long, elongating to ca 4 mm in



Fig. 72. *Casearia andamanica* King : a. flowering twig; b. flower; c. stamens, staminal nodes and pistil.

fruits. Calyx broadly ovate, ca 2.5 mm long, glabrous, ciliolate along margins. Stamens 8; filaments ca 1 mm long, hairy; staminodes a little shorter than filaments, oblong, hairy. Ovary ovoid, ca 1 mm long, glabrous; stigma recurved on short style, obscurely lobed. Capsules ellipsoid, subglobose, ca 1.4 cm long, yellow when ripe, dehiscing by 2 valves.

Fl. May - June; *Fr.* June - Sept.

Distrib. India: Moist deciduous and degraded evergreen forests of Western Ghats, up to 1050 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Notes. The plants compare well with the types of *C. championii* Thwaites (Thwaites 2608 in CAL !), especially in the type of leaf reticulation.

3. *Casearia glomerata* Roxb. ex DC., Prodr. 2: 49. 1825; C. B. Clarke in Fl. Brit. India 2: 591. 1879.

Shrubs or trees, up to 15 m tall; young shoots pubescent. Leaves elliptic, oblong-elliptic or oblanceolate to obovate, usually cuneate (rarely in a few leaves subobtusate) at base, acuminate at apex, distantly serrulate-crenulate to subentire, 5.5 - 15 x 2.5 - 6 cm, chartaceous (subcoriaceous in specimens from twiggy shrubs), puberulous along midrib and secondary veins when young, at length glabrous or minutely puberulent along midrib near base above, glabrous beneath; secondary veins 7 - 9 pairs; petioles 6 - 10 mm long. Flowers yellowish, ca 5 mm across; pedicels 4 - 6 mm long, appressed pubescent. Calyx broadly elliptic to suborbicular, 2 - 3 mm long, appressed hairy outside. Stamens 8; anthers cordate; filaments ca 1.75 mm long, hairy; staminodes ca 1 mm long, scale-like, tufted hairy at top. Ovary ovoid, ca 2 mm long, glabrous; style less than 1 mm long; stigma subpeltate, obscurely lobed. Capsules ovoid-subglobose, ca 1.5 x 1.2 cm, bright yellow when ripe.

Fl. April - May; *Fr.* ripens during July - Aug.

Distrib. India: Mixed evergreen forests, 1000 - 3000 m. West Bengal (Darjeeling), Sikkim, Assam, Meghalaya and Arunachal Pradesh.

Bhutan.

Notes. In juvenile shoots the leaves are much larger (23 x 8.5 cm) and coriaceous with very few flowers in axils. The glabrescent forms of *C. kurzii* are sometimes difficult to distinguish from *C. glomerata* but can be delimited satisfactorily by obliquely rounded leaf-bases and spreading hairs on pedicels in the former and cuneate leaf-bases and appressed hairs on pedicels in the latter.

Specimens of both *C. glomerata* and *C. kurzii* with seemingly subentire subcoriaceous glabrous leaves have been recorded as *C. esculenta* Roxb. in Fl. Assam 1: 93. 1934.

C. sikkimensis N. Mukherjee (in J. Bombay Nat. Hist. Soc. 69: 392. 1973) could not be satisfactorily distinguished from *C. glomerata* and hence not regarded as distinct. It appears to be a form of *C. glomerata* with oblanceolate leaves minutely pubescent along midrib and with numerous (up to 25) slender flowers in dense glomerules found in Darjeeling and Sikkim Himalayas.

4. *Casearia graveolens* Dalz. in Hook. J. Bot. 4: 107. 1852; C. B. Clarke in Fl. Brit. India 2: 592. 1879.

Hindi: *Chilla*; Mar.: *Bokhada*; Or.: *Beniman, Jamurdi, Kokra*.

Shrubs or deciduous trees, up to 10 m tall; branchlets glabrous. Leaves broadly elliptic to elliptic-oblong, usually rounded at base, rarely in a few leaves cuneate, subtruncate or subcordate at base, obtuse or short acuminate at apex, shallowly crenate along margins, 8.5 - 20 x 4.5 - 12.5 cm, coriaceous, membranous when young, often conspicuously pellucid striated, glabrous; secondary veins 8 - 12 pairs, widely upcurved; tertiary veins forming dense reticulum, prominent especially beneath (coarse to touch); petioles 7 - 12 mm long, glabrous; stipules lanceolate-subulate, 5 - 8 mm long, caducous. Flowers 5 - 6 mm across, greenish, foetid, usually in dense clusters from leafless axils; pedicels ca 2 mm long, elongating to ca 4 mm in fruits, hairy below articulation, glabrous or rarely subglabrous above. Calyx ovate-oblong, ca 3 mm long, gland-dotted, pubescent outside at base. Stamens 8, ca 2.5 mm long; filaments glabrous, alternating with linear-oblong villous disk scales; staminodes oblong, ca 1 mm long, villous-pubescent. Ovary ovoid, ca 3 mm long, glabrous; style short; stigma capitate. Capsules ellipsoid-oblong, 2 - 2.5 cm long, orange yellow when ripe.

Fl. March - April; Fr. April - July.

Distrib. India: Widespread at low elevations in both deciduous and mixed forests, in open hills, valleys and ravines, sometimes ascending to 1800 m. Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Meghalaya, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Indo-china and Thailand.

Notes. The flowers exude a disagreeable odour.

5. *Casearia grewiaefolia* Vent. var. *gelonoides* (Blume) Sleumer in Fl. Males. I, 6: 944. 1972; N. Mukherjee in Bull. Bot. Surv. India 14: 183. 1972 (1975). *C. hexagona* Decne var. *gelonoides* Blume, Mus. Bot. Lugd.-Bat. 1: 225. 1850. *C. grewiaefolia* var. *deglabrata* Koord. & Val., Bijdr. Booms. Java 1: 174. 1894; Sleumer in Fl. Males. I, 5: 95. 1954. *C.*

leucolepis Turcz. in Bull. Soc. Nat. Moscou 31: 463. 1858; C. B. Clarke in Fl. Brit. India 2: 591. 1879.

Shrubs or trees, 2 - 12 m tall; bark greyish brown; branchlets terete, compressed when young, pubescent in younger parts. Leaves variable, ovate-oblong, ovate-lanceolate, elliptic-oblong or broadly elliptic, broadly cuneate, rounded, subtruncate or subcordate and always inequilateral and 3 - 5-plinerved at base, shortly acuminate at apex, shallowly crenate or repand to subentire, 6 - 19 x 3 - 8.5 cm, chartaceous, appressed pubescent especially beneath when very young, at length glabrous or sparsely pubescent along midrib beneath, dark green and glossy above, pale beneath, turning olivaceous or reddish brown when dry; basal primary and secondary veins (6-) 8 - 10 pairs, prominent beneath; lower ones straight, upper ones curved ascending; tertiary veins more or less transverse; quaternary veins dichotomously and irregularly branched to form incomplete meshes in the arcole, both little prominent; petioles 6 - 12 mm long, puberulous or glabrescent. Flowers whitish to yellowish green, usually many in axillary fascicles; pedicels ca 4 mm long, appressed pubescent. Calyx lobes obovate-concave, ca 2 x 1.5 mm, appressed pubescent outside. Stamens 8 (-10); filaments ca 1 mm long, glabrous; staminodes almost equal to filaments, with a tuft of hairs at apex. Ovary ovoid, ca 2 mm long, pilose especially towards apex or glabrous. Capsules in axillary clusters, on ca 5 mm long stalks, ellipsoid, 2 - 3 x 1.2 - 1.8 cm, green, turn orange-yellow when ripe; aril orange-red.

Fl. Sept. - April; Fr. Nov. - May.

Distrib. India: Coastal and inland forests and thickets, often on sandy, rocky or calcareous soils at low elevations. Andaman & Nicobar Islands. Rare in Andaman and common in Nicobar Islands.

Thailand, Indo-china, Malayan peninsula, Indonesia, Philippines, New Guinea and Melanesian Islands.

Notes. The fruits are sweet to taste.

The plants reported as *C. fuliginosa* (Blanco) Blanco from Car Nicobar Islands (Nair in Geobios 4: 221. 1977) belong to this highly variable taxon.

C. insularis Vasud. & T. Chakrab. (in J. Econ. Tax. Bot. 5: 991. 1984) has been reduced to a variety, *C. grewiaefolia* Vent. var. *insularis* (Vasud. & T. Chakrab.) T. Chakrab. & Gang. (in J. Econ. Tax. Bot. 16: 717. 1992) with the remark, '... represents a form with stunted growth, characteristic of the plants growing on the Saddle Peak range in North Andamans.' In *C. insularis* the staminodes have been described as yellowish pilose. The yellowish portion of the staminodes however represents vestiges of anther (Balakrishnan 5425 !), a feature whether constant or not could not be ascertained. In all other features *C. insularis* fall well within the range of variability of this taxon, and

hence pending examination of more specimens, I am reluctant to accord any distinct taxonomic status to this plant.

6. *Casearia kurzii* C. B. Clarke in Fl. Brit. India 2: 594. 1879.

Trees, 7 - 20 m tall; young shoots pubescent. Leaves lanceolate, oblong-lanceolate or oblong-elliptic, obliquely rounded or narrowed at base, acute or short acuminate at apex, serrulate to distantly crenate or subentire along margins, 5 - 17.5 x 2.5 - 6 cm, chartaceous or subcoriaceous, glabrous or minutely puberulent along midrib near base above, densely spreading yellowish pilose, especially along midrib, or sometimes even glabrescent beneath; secondary veins 7 - 9 pairs; petioles 5 - 10 mm long, densely spreading hairy or glabrescent. Flowers whitish, ca 4 mm across, (2-) 4 - 6 in fascicles or axillary tubercles; pedicels ca 5 mm long, densely spreading hairy to glabrescent, becoming ca 12 mm long in fruits. Calyx lobes broadly elliptic, 2 - 3 x 1 - 1.5 mm, minutely pubescent outside. Stamens 10; filaments ca 1.5 mm long, hairy; staminodes oblong, ca 1 mm long, tufted hairy at apex. Ovary ellipsoid, ca 2 mm long, glabrous; style ca 1 mm long; stigma discoid. Capsules ellipsoid, 1 - 1.7 cm long, black.

Fl. (Jan.-) March - May (-Nov.); *Fr.* ripens during Jan. - Feb. (-May).

Distrib. India: Tropical rain forests, 500 - 1500 m. West Bengal (Darjeeling), Sikkim, Assam, Meghalaya and Tripura.

Bangladesh and Myanmar.

7. *Casearia rubens* Dalz. in Hook., J. Bot. 4: 108. 1852; C. B. Clarke in Fl. Brit. India 2: 593. 1879. *C. rubens* Dalz. var. *gamblei* N. Mukherjee in J. Bombay Nat. Hist. Soc. 69: 393. 1973. *C. bourdillonii* N. Mukherjee in Bull. Bot. Soc. Bengal 19: 109. 1965 (1967), p. p.

Evergreen shrubs or trees, up to 15 m tall; young shoots glabrous. Leaves usually narrowly elliptic-oblong or elliptic-lanceolate, rarely broadly elliptic, usually unequal sided and cuneate or attenuate at base, obtusely short or long acuminate at apex, entire and revolute along margins, (4-) 7 - 19 (-20) x (2.4-) 3 - 7.5 (-9) cm, glabrous, subcoriaceous or coriaceous and shiny when mature, often turn blackish above on drying; secondary veins 7 - 12 pairs with numerous well-developed intersecondary veins form sparse imperfect reticulum usually indistinct on upper surface, irregularly branched; quarterary veins with free endings from moderately dense incomplete meshes inside the areole, but appear indistinct being concealed in fleshy mesophyll; petioles 7 - 12 mm long, glabrous. Flowers ca 4 mm across, greenish white; pedicels ca 1.5 mm long, minutely appressed pubescent. Calyx elliptic, ca 2 mm long, hairy outside. Stamens 8; filaments ca 1 mm long, narrowed towards apex, hairy; staminodes shorter than filaments, scale-like, hairy at apex. Ovary ovoid, ca 1.5 mm long, glabrous; style almost absent; stigma capitate. Capsules globular, ca 2 mm long, orange yellow when ripe.

Fl. Aug. - Nov.; *Fr.* March - June (ripe fruits in Oct.).

Distrib. India: Semievergreen and evergreen forests of Western Ghats, 200 - 2500 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. A number of old and authentic specimens of *C. rubens* could be examined in CAL. These appear to be more coriaceous and broadly elliptic leaved (with indistinct reticulum concealed within fleshy mesophyll!) forms, commonly identified as *C. esculenta* in Indian herbaria.

8. *Casearia thwaitesii* Briq., Ann. Cons. Jard. Bot. Geneve 62. 1898; Alston in Trimmen, Handb. Fl. Ceyl. 6(suppl.): 131. 1931. *C. coriacea* Thwaites, Enum. Pl. Zeyl. 20. 1858, non Vent. 1803; C. B. Clarke in Fl. Brit. India 2: 592. 1879; Gamble, Fl. Pres. Madras 521. 1919.

Trees, 4 - 20 m tall; young shoots glabrous. Leaves usually obovate, sometimes (in some leaves) oblanceolate or broadly elliptic to suborbicular, cuneate or attenuate at base, obtuse, rounded or in a few leaves even retuse or emarginate at apex, entire and revolute along margins, 4.5 - 11.5 x 2 - 7.5 cm, coriaceous or subcoriaceous, shiny, glabrous; secondary veins 6 - 7 pairs, prominently forming a sparse imperfect reticulum apparent on lower surface; irregularly branched; quarternary veins with free endings, sometimes forming dense reticulum of incomplete meshes together with tertiary veins; petioles 5 - 12 mm long, glabrous. Flowers light green, ca 4 mm across, 4 - 6 in clusters mostly from younger axils. Calyx ca 2 mm long, broadly elliptic to suborbicular, glabrous, ciliolate along margins. Stamens 8; filaments ca 1 mm long, glabrous; staminodes equal to filaments, alternate ones slender and clavate, thick and oblong, densely hairy with a tuft of hairs at top. Ovary ovoid, ca 1 mm long; style short; stigma capitate. Capsules ellipsoid, ca 1.7 cm long or orange yellow when ripe, 2-valved,

Fl. Sept.; *Fr.* March.

Distrib. India: Montane evergreen shola forests of Nilgiri, Anamalai and Palni hills, 1700 - 2000 m. Tamil Nadu.

Sri Lanka.

9. *Casearia tomentosa* Roxb., Fl. Ind. 2: 421. 1832; C. B. Clarke in Fl. Brit. India 2: 593. 1879. *Anavinga lanceolata* Lam., Encycl. 1: 148. 1783, non *C. lanceolata* Miq. 1844. *C. elliptica* Willd., Sp. Pl. 2: 628. 1799, nom. superfl. (based on *A. lanceolata* Lam.).

Beng.: *Maun*; Hindi: *Chilla, Churcha*; Mar.: *Karei*; Or.: *Kokra*; Tam.: *Kodichai*; Tel.: *Chilaka-duddi*.

Shrubs or small trees, up to 8 m tall; branchlets tomentose or pubescent, rarely glabrescent; younger parts sometimes velutinous tomentose. Leaves ovate-lanceolate, usually rounded, rarely cuneate or subtruncate and always somewhat oblique at base, obtuse or obtusely short acuminate at apex, coarsely but distantly serrate or crenate to subentire, 5 - 22 x 2.5 - 8.5 cm, subcoriaceous when mature, sparsely but softly pubescent to velvety tomentose (usually more dense along midrib and beneath) or glossy and glabrescent, often subdensely pellucid-punctate and lineolate (apparent in glabrescent young leaves); secondary veins 8 - 12 pairs; petioles 3 - 8 (-10) mm long, densely tomentose to sparsely pubescent. Flowers greenish white, 5 - 8 mm across, few or numerous in dense axillary glomerules; pedicels 4 - 5 mm long, densely tomentose to sparsely pubescent. Calyx broadly elliptic, ca 3 mm long, densely to sparsely so inside. Stamens 8; filaments ca 2 mm long, glabrous; staminodes shorter than filaments, clavate, villous pubescent at apex. Ovary ovoid, ca 1 mm long, glabrous; style short; stigma discoid. Capsules 1.5 - 2.8 cm long, ellipsoid.

Fl. (Jan.-) Feb. - April (-May); *Fr.* April - Aug.

Distrib. India: Common throughout from subhimalayan tracts to peninsular India up to an elevation of 900 m in dry deciduous forests, scrub jungles, waste lands and river valleys.

Sri Lanka and Pakistan.

Notes. The South Andaman record (Thothathri in Bull. Bot. Surv. India 2: 365. 1960) of this species is based on the erroneous identification of specimens of *Glochidion hirsutum* (Roxb.) Voigt (Euphorbiaceae).

10. *Casearia vareca* Roxb., Fl. Ind. 2: 418. 1832; C. B. Clarke in Fl. Brit. India 2: 593. 1879.

Asm.: Bhagni, Bon-jhalukia.

Shrubs, rarely small trees, up to 7 m tall, often branched from base; bark grey, warty with white blotches outside; branchlets angular, pubescent. Leaves oblong, oblong-elliptic or oblanceolate, cuneate at base, obtuse or abruptly apiculate to acuminate at apex, closely spinulose-serrate along margins, 7.5 - 16.5 x 2.5 - 5.5 cm, subcoriaceous, minutely puberulent along midrib or glabrous above, densely spreading ferruginous pilose to puberulous at least along costa beneath; midrib ridged beneath; secondary veins 7 - 12 pairs, arcuate, ridged and prominent beneath; petioles (3-) 5 - 10 mm long, densely to sparsely hairy. Flowers ca 3 mm across, greenish grey or whitish, in dense axillary fascicles; pedicels 2 - 3 mm long, becoming 4 mm in fruits, densely clothed with brownish hairs below articulation, glabrous or nearly so above. Calyx lobes broadly ovate to suborbicular, ca 2 mm long, glabrous. Stamens 6 - 12; filaments united into a tube, alternating with as many pubescent broad staminodes, a little shorter than anthers;

staminodes broad, hairy at apex. Ovary ovoid to oblong; style short; stigma capitate. Capsules ovoid, 7 - 10 mm long, bright orange yellow when ripe. Seeds 4 - 6, oblong, attached to the middle of the valves; aril fleshy, scarlet.

Fl. May - Sept.; *Fr.* Aug. - April.

Distrib. India: Subtropical rain forests, 100 - 1000 m. West Bengal (Cooch Behar, Jalpaiguri), Sikkim, Assam, Meghalaya, Arunachal Pradesh and Nagaland.

Bhutan, Bangladesh and Myanmar.

Notes. In Assam, fruits are made into a paste and given to those suffering from worms. The juice of the fruits are often used as ear drops when attacked by ticks.

11. *Casearia wynadensis* Beddome, Icon. Pl. Ind. Or. t. 160. 1874; C. B. Clarke in Fl. Brit. India 2: 594. 1879.

Mal.: *Kari-kunnan*.

Shrubs or small trees, up to 9 m tall; branches softly pubescent; younger parts aureo-villous. Leaves narrowly elliptic to elliptic-oblong, acute to cuneate at base, long-acuminate or rarely acute at apex, sharply serrate to serrulate along margins, except at basal part, 8.5 - 15.5 x 3 - 5 cm, membranous, becoming chartaceous with age, subdensely pellucid-punctate and lineolate, aureo-villous along midrib and veins and elsewhere pubescent when young, at length glabrescent above except the midrib and softly pubescent beneath especially along midribs and veins; secondary veins 7 - 9 pairs; petioles 7 - 10 mm long, softly brown pubescent. Flowers ca 5 mm across, 6 - 8 in axillary few-flowered fascicles; pedicels slender, ca 3 mm long, hairy. Calyx broadly elliptic, ca 2.5 mm long, pubescent outside, sparsely so inside, pellucid-punctate, ciliolate along margins. Stamens 8; filaments ca 1.5 mm long, connate at base with 8 alternating staminodes shorter than filaments, villous pubescent at top. Ovary oblong-ovoid, attenuated into a style, both hairy; stigma 2 - 4-lobed. Fruits ovoid to oblong-ellipsoid, shortly apiculate at apex, 13 - 16 mm long, 8 - 10 mm thick, orange.

Fl. May - June; *Fr.* July - Dec.

Distrib. India: Evergreen forests of Western Ghats, 700 - 1000 m. Tamil Nadu and Kerala. Rare.

Endemic.

12. *Casearia zeylanica* (Gaertner) Thwaites, Enum. Pl. Zeyl. 19. 1858; Alston in Trimen, Handb. Fl. Ceyl. 6 (suppl.): 131. 1931. *Vareca zeylanica* Gaertner, Fruct. 290, t. 60. 1788. *C. esculenta* Roxb., Fl. Ind. 2: 422. 1832; C. B. Clarke in Fl. Brit. India 2: 592.

1879, p. p. *C. bourdillonii* N. Mukherjee in Bull. Bot. Soc. Bengal 19(2): 109. 1965 (1967),
 quoad *C. varians* Beddome, excl. descr. et specim. cit.

Tam.: *Kottagovai*.

Evergreen shrubs or small trees, 6 - 8 m tall; bark white; young shoots angular, appressed hairy. Leaves closely arranged at apices of branches, elliptic to oblong-elliptic, cuneate at base, acute at apex, distantly crenate to subentire along margins, 7 - 14.5 x 2.5 - 5 cm, glabrous, subcoriaceous and shiny when mature, often becoming blackish green on drying; tertiary veins irregularly branched to join other tertiary veins forming dense imperfect reticulum; quarternary veins not developed; petioles 7 - 12 mm long. Flowers axillary, ca 4 mm across, yellowish; pedicels ca 1 mm long, appressed pubescent. Calyx elliptic, ca 2 mm long, pellucid-punctate and lineolate, hairy both inside (3 - 4 rows) and outside, ciliolate along margins. Stamens 8; filaments ca 1 mm long, hairy; staminodes shorter than filaments, broad, oblong, tufted hairy at tip. Ovary ovoid, ca 1.5 mm long, densely hirsute at least towards apex; stigma recurved on a short style, obscurely lobed. Capsules ellipsoid, ca 2.5 cm long; aril bright red.

Fl. July - Sept.; *Fr.* Oct. - Nov.

Distrib. India: East Coast of peninsular India and southwestwards to Anamalai hills, up to 800 m. Andhra Pradesh, Tamil Nadu and Kerala.

Sri Lanka.

Notes. In CAL, there is a specimen collected by Beddome, mounted on a blue sheet (Acc. no. 179582) with the label, '*Casearia varians*, Anamallay 1872'. This specimen agrees well with the plant figured in Beddome, Fl. Sylv. t. 208. 1873 and was correctly referred to *C. esculenta* Roxb. by C. B. Clarke. This specimen also agrees with Thwaites 415 (CAL !) from Sri Lanka (identified as *C. zeylanica*), Gamble 12832 from Sriharikota, Fischer 4680 & 4682 from Sriharikota, Fischer 3145 from Karandemal and Fischer 4471 from Karianshola, Annamalais (all in CAL !). In these specimens the young shoots are appressed pubescent and angular; the leaves are closely set in the apical region (nodes usually 5 - 7 mm or rarely 10 mm apart), glossy and greenish black. Though Beddome (l. c.) mentions the ovary as glabrous, in the above-mentioned specimen of Beddome the ovary is in fact hirsute towards apex (vide Thwaites, l. c. 19).

Gamble (Bull. Misc. Inf. Kew 1920: 56) mistook Bourdillon 104, Travancore (K, CAL !) to represent the plant figured as *C. varians* Thwaites by Beddome (l. c. t. 208) and 'pending the possibility of examining more and better specimens' called the plant '*C. varians* Bedd. not of Thw.' This specimen, however represents *C. championii* Thwaites from Sri Lanka.

Mukherjee (l. c. 109) proposed the name *C. bourdillonii* for the plant and created further taxonomic confusion. The description of *C. bourdillonii* applied to the elements recognised here as *C. rubens* Dalz., and of the three specimens cited by him (l. c. 110), Talbot 483 belongs to *C. rubens* Dalz., while Talbot 535 and Bourdillon 104 belong to *C. championii*.

3. *Flacourtia* L' Herit.

Trees or shrubs; trunk often armed with simple and branched thorns; branches usually with axillary thorns when young, at length unarmed. Leaves alternate, crenato-serrate or entire, pinnately veined, sometimes also 3 - 5-pliveined at base; secondary veins upcurved, diminishing near margin, joining superadjacent veins by a series of cross-veins and giving rise to lateral branches, each to end in a gland beneath the teeth or at margins; stipules absent. Flowers unisexual (plants dioecious), rarely bisexual in axillary or terminal short bracteate racemes or racemose fascicles; pedicels articulated. Sepals 4 - 5, imbricate, subpersistent. Petal absent. Disc extrastaminal, usually consisting of distinct glands inserted before sepals, and annular or lobed in female. *Male flowers*: Stamens numerous; anthers oblong or globular, usually dorsifixed and versatile; pollen tricolporate, reticulate, subprolate. Pistillode absent. *Female flowers*: Carpels (2-) 3 - 6 (-10), connate into as many incompletely loculed ovary with deeply intruding placentae; ovules usually 2 in each locule inserted on dividing walls. Styles free or connate, rarely absent; stigma retuse or shortly bilobed. Fruit fleshy, an indehiscent berry with indurate endocarp, globose when fresh, characteristically becoming obtusely cubiform-angular and constricted in middle when dry with 2 superposed pyrenes in each locule. Seeds 1 - 2, ovoid to obovoid; testa thinly coriaceous; cotyledons orbicular.

Tropical Africa, Asia and Polynesia; ca 15 species, 5 in India.

KEY TO THE SPECIES

- | | |
|--|------------------------|
| 1a. Leaves 15 cm or more long, pinnately veined from base; secondary veins 10 - 12 pairs | 1. <i>F. helferi</i> |
| b. Leaves mostly less than 15 cm long, 3 - 5-pliveined from or near base; basal primary and secondary veins together 4 - 6 pairs | 2 |
| 2a. Inflorescence glabrous; style fully connate into a distinct column with shallowly lobed stigma at apex, contracted into a solid beak in fruit, with radiating stigmas as minute points | 3. <i>F. jangomas</i> |
| b. Inflorescence usually pubescent; styles completely free or basally connate, conspicuously spreading and recurved both in flowers and fruits, or absent | 3 |
| 3a. Styles absent (stigma sessile) | 4. <i>F. latifolia</i> |
| b. Style distinct and conspicuous | 4 |
| 4a. Leaves 8 - 15 (-25) cm long, short or long acuminate at apex, coriaceous or subcoriaceous turning reddish brown on drying | 5. <i>F. montana</i> |
| b. Leaves 1.5 - 5 (-7) cm long, not acuminate at apex, membranous to subcoriaceous, not reddish brown on drying | 2. <i>F. indica</i> |

1. *Flacourtia helferi* Gamble ex Ridley in J. Bot. 74: 223. 1936. *F. sumatrana* Planch. ex Hook. f. & Thomson, Fl. Brit. India 1: 192. 1872, p. p.; Kanjilal et al., Fl. Assam 1: 90. 1934.

Trees, small, unarmed, dioecious; young shoots usually puberulous. Leaves oblong-elliptic or oblong-ovate, rarely a few oblanceolate, usually cuneate, rarely rounded or subtruncate at base, acutely acuminate at apex, coarsely (somewhat deeply) crenato-serrate (gland-tipped beneath) along margins, 15 - 28 x 6.5 - 12 cm, subcoriaceous, shiny, minutely puberulent along veins especially beneath or glabrate; secondary veins 10 - 12 pairs, impressed above, raised beneath; tertiary veins more or less perpendicular to midrib; petioles 10 - 15 mm long, minutely puberulent. Flowers in slender pubescent bracteate racemes or panicles (sometimes clustered), 3 - 5 cm long; pedicels ca 2 mm long, hairy. Sepals minute, hairy on both surfaces. *Male flowers*: Stamens numerous. *Female flowers*: Ovary ovoid, glabrous; styles 4, slender, recurved; stigma minute. Berry ovoid or oblong, ca 4 mm long.

Fl. July; *Fr.* Sept.

Distrib. India: Assam (Sibsagar, Moriani forest). Rare.

Myanmar (Tenasserim).

2. *Flacourtia indica* (Burm. f.) Merr., Interpr. Rumph. Herb. Amb. 377. 1917; Sleumer in Fl. Males. I, 5: 76. 1954. *Gmelina indica* Burm. f., Fl. Ind. 132, t. 39, f.5. 1768. *F. sepiaria* Roxb., Pl. Corom. 1: 48, t. 68. 1796; Hook. f. & Thomson, Fl. Brit. India 1: 194. 1872. *F. ramontchii* L' Herit., Strip. Nov. 3: 59, t.30 & 30 B. 1786; Hook. f. & Thomson, Fl. Brit. India 1: 193. 1872, pro maj. parte excl. var. *latifolia*.

Kan.: *Hettari-mullu*; Mal.: *Cherru-mullikka-chedi*, *Kuramullu*, *Kuramulli*; Tam.: *Kattukalai*, *Kodumundi*, *Sottukalai*.

Shrubs or small trees, dioecious, polymorphous, deciduous, up to 15 m tall; trunk in older trees often armed with branched thorns; juvenile shoots and branches with simple thorns; branchlets glabrous or pubescent. Leaves usually clustered towards apices on older branches, variable in shape, size, texture and indumentum, obovate, ovate, oblong or suborbicular, usually cuneate and 3 - 5-pliveined at base, acute, obtuse or sometimes emarginate at apex, coarsely crenate to subentire along margins, 1.5 - 5 (-7) x 1 - 3 (-4) cm, membranous to subcoriaceous, glabrous above and glabrous or more or less pubescent along midrib and veins beneath, or pubescent to softly tomentose on both surfaces; basal primary and upper secondary veins together 4 - 6 pairs; petioles (3-) 5 - 10 mm long, red, usually hairy. Flowers ca 4 mm across, yellowish green, solitary, or few in axillary bracteate glabrous racemose clusters or terminating in short lateral 3 - 4-leaved thorny twigs, or in distinct puberulous or tomentose panicles up to 3 cm long; pedicels articulated near middle, 3 - 5 mm long, puberulous or glabrous. Sepals 4 - 5,

slightly connate at base, ovate, obtuse, subglabrous outside, hairy inside. *Male flowers*: Stamens numerous; filaments ca 2.5 mm long, minutely hairy at base; anthers versatile; disc lobed. *Female flowers*: Disc entire; ovary globular, somewhat attenuate at apex, with 3 - 6 radiating ca 1 mm long terete thick styles little or not connate at base, with slightly bilobed recurved stigmas. Berries ellipsoid to subglobose, with 6 - 7 pyrenes, 5 - 10 mm across, dark purple or red when ripe; seeds trigonous, pale yellow to brown.

Fl. Dec. - March; *Fr.* ripens from May - Aug.

Distrib. India: Throughout in dry thickets, scrub jungles, dry deciduous and mixed forests, up to 1200 m. Common.

Widespread in S.E. Asia and tropical Africa.

Notes. Fruits of some varieties are sweet and eaten raw. Fruits are also used medicinally for jaundice and enlarged spleen.

Twiggy forms are sometimes grown as impenetrable hedges.

Following Sleumer (l. c.) *F. indica* is here accepted in a wider sense. *F. ramontchii* is usually a small tree with larger leaves, distinct paniculate inflorescences, and found in dry deciduous and mixed forests. *F. indica* (*F. sepiaria*) on the other hand is usually a twiggy shrub with smaller leaves, few flowers in axillary clusters and found in dry thickets and scrub forests.

In some regional floras though certain sets of characters have been proposed to segregate the two as distinct, these did not yield any satisfactory result when put to test on a larger collection with baffling intergrading forms.

3. *Flacourtia jangomas* (Lour.) Raeusch., Nom. Bot. ed. 3: 290. 1797; Sleumer in *Fl. Males.* I, 5: 72. 1954. *F. cataphracta* Roxb. ex Willd., Sp. Pl. 4: 830. 1806; Hook. f. & Thomson in *Fl. Brit. India* 1: 193. 1872. Fig. 73.

Asm.: Paniol, Luck-luki; *Beng.* & *Hindi*: Paniala; *Or.*: Baincha; *Tel.*: Kanji.

Trees, 6 - 10 (-20) m tall, dioecious, deciduous; trunk and branches densely beset with simple and branched thorns when young, becoming more or less thornless with age; young shoots usually minutely puberulent. Leaves ovate to ovate-lanceolate, cuneate to rounded and 3 - 5-pliveined at base, obtusely acuminate at apex, serrato-crenate along margins, 5 - 10.5 x (2-) 3 - 5 cm, thinly chartaceous, glabrous and shiny green above, minutely puberulent along midrib beneath; basal primary and secondary veins together 4 - 5 pairs; petioles 4 - 7 mm long, usually puberulent. Flowers greenish white, 5 - 6 mm across, few in glabrous bracteate racemes or corymbose 1 - 1.5 cm long fascicles. Sepals 4 (-5), subequal, broadly ovate, ca 2 mm long, minutely puberulous outside, densely so

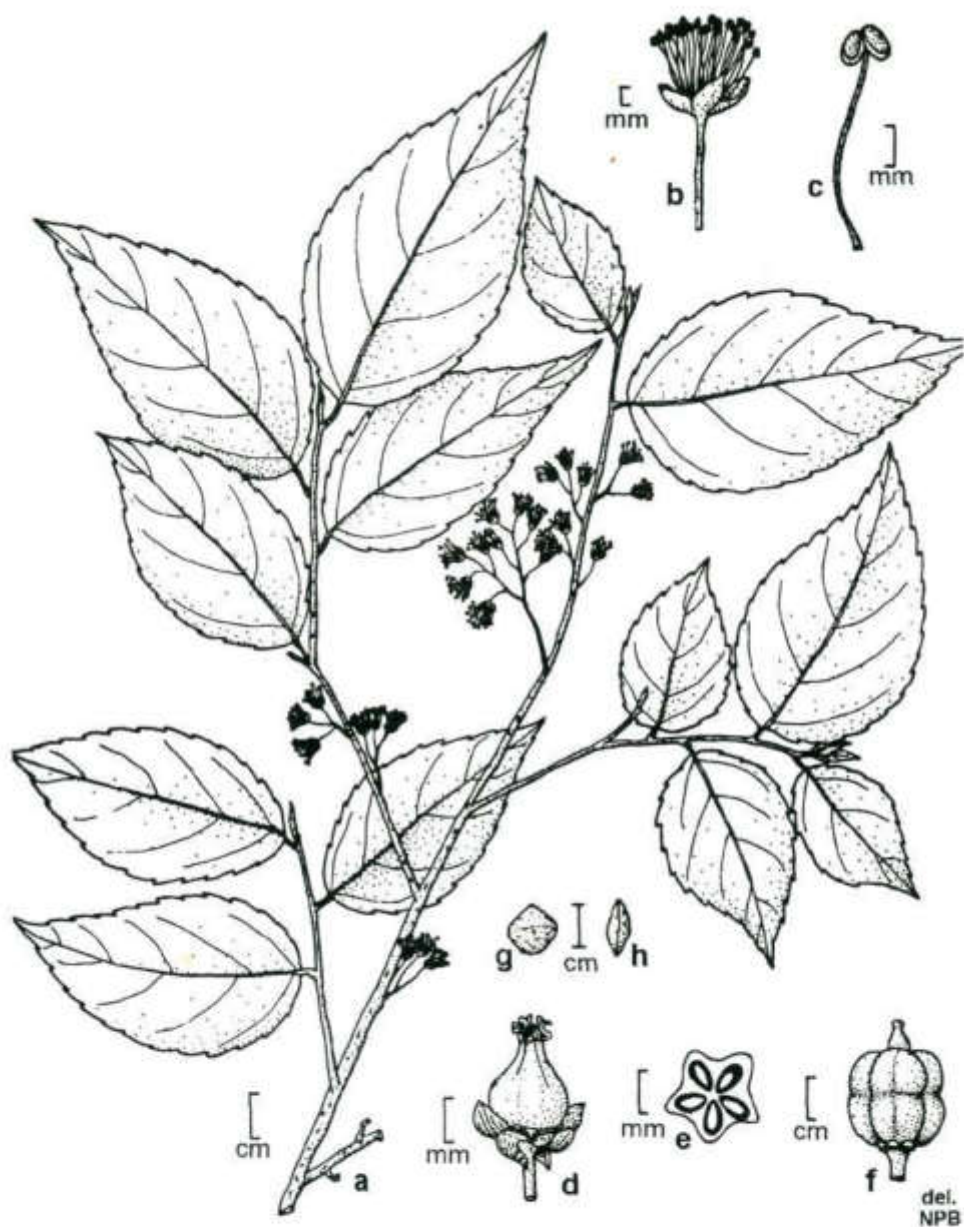


Fig. 73. *Flacourtia jangomas* (Lour.) Racusch.: a. branch with male flowers; b. male flower; c. stamen; d. female flower; e. ovary, t.s.; f. fruit; g. & h. seeds, two views.

del.
NPB

inside. *Male flowers*: Stamens numerous; filaments glabrous. *Female flowers*: Ovary flask-shaped to subglobose; styles 4 - 6, connate into a distinct column and contracted into a solid beak in fruits; stigma as many, dilated and shallowly bilobed, recurved, radiating as minute points in fruits. Berries subglobose, 1.5 - 2.5 cm across, dark red or purple when ripe.

Fl. March - May (-June); *Fr.* Aug. - Oct.

Distrib. India: Frequently semiwild in Brahmaputra Valley and adjoining areas in the North-east (probably originally from Bangladesh - Assam - Upper Myanmar), elsewhere cultivated. Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Manipur, Tripura, Orissa and Andhra Pradesh.

Widely cultivated in S.E. Asia and E. Africa.

Notes. Fruits are pleasantly acidic, eaten raw and made into jelly.

4. *Flacourtia latifolia* (Hook. f. & Thomson) Cooke, Fl. Bombay Pres. 1: 56. 1901. *F. ramontchii* L'Herit. var. *latifolia* Hook. f. & Thomson in Fl. Brit. India 1: 193. 1872.

Kan.: *Kal-champigai*, *Naga-champigai*; *Mar.*: *Tambat*.

Trees, 5 - 12 m tall, deciduous; main stem often ferociously armed at base, with simple and branched thorns, up to 11 (-25) cm long, usually unarmed above; young shoots tomentose. Leaves usually broadly elliptic to oblong-elliptic, sometimes ovate or oblanceolate, usually cuneate or sometimes subcordate and 3-pliveined at base, obtusely short or long (rarely also acutely) acuminate, rarely obtuse at apex, coarsely shallowly to obscurely crenate along margins, 5.5 - 14.5 x 2.8 - 7.5 (juvenile ones 19 x 9) cm, membranous when young, chartaceous or subcoriaceous at maturity, shiny, glabrous except minutely pubescent on both surfaces along midrib and veins; basal primary and secondary veins together 4 - 5 pairs; quarternary veins irregularly branched, together with tertiary veins form dense reticulum, more prominent beneath; petioles (5-) 7 - 12 mm long, densely puberulent. Flowers yellowish green, sweet scented, usually in slender lax pubescent bracteate racemes, up to 2 cm long, rarely solitary or in racemose clusters; pedicels 3 - 5 mm long, articulated at middle, pubescent. Sepals ca 1 mm long, broadly ovate to suborbicular, densely clothed with spreading hairs inside, minutely pubescent outside. Ovary urceolate, ca 1 mm long, glabrous, obscurely 3 - 4-lobed at apex with stigma at top. Berries subglobose, ca 9 mm across, green, dark purple when ripe, with obscurely bilobed stigmas, sessile at top.

Fl. (March -) April - May; *Fr.* (May -) July - Sept.

Distrib. India: Semievergreen and moist deciduous forests of Western Ghats, up to 1200 m. Maharashtra, Karnataka and Kerala.

Endemic.

Notes. Fruits are edible.

In CAL there are a few Herb. Blatter specimens of *F. latifolia* from Maharashtra and Karnataka determined as *F. indica* by Sleumer in Dec. 1955. Quoting observations of Sleumer on these specimens, Santapau (Fl. Khandala 10, 1960) did not recognise *F. latifolia* as distinct from *F. indica* complex. The stigmas (3 - 4) which are clearly sessile and unique in this Indian species, amply justifies its segregation as a distinct species.

I have examined a few specimens of *Xylosma latifolium* Hook. f. & Thomson (Fl. Brit. India 1: 194. 1872) in CAL including one male specimen from 'Bababoodan Hills, Malabar, Law' (Acc. no. 33129 - Type coll. !) and failed to distinguish them from *F. latifolia*. Surprisingly, the description of *Xylosma latifolium* Hook. f. & Thomson hardly differs from those provided for *F. latifolia* (Hook. f. & Thomson) Cooke, except perhaps in one character - 'style very distinct' (Hook. f. & Thomson, l. c. 195). In *Xylosma*, normally the style is very short and cylindrical or absent and there are only 2 stigmas. It is therefore presumed that the short neck of the young urceolate ovary of *F. latifolia* might have been mistaken for a style in *Xylosma latifolium*. Pending examination of more and authentic specimens, the species is therefore not recognised under *Xylosma* for the present.

5. *Flacourtia montana* Grahams, Cat. Pl. Bombay 10. 1839; Hook. f. & Thomson, Fl. Brit. India 1: 192. 1872.

Kan.: *Hennu-sampigi*, *Gajale*, *Nayibela*; Mal.: *Chalirin-pazham*, *Charal-maram*; Mar.: *Atlak*, *Tar-bor*, *Champari*.

Trees, (5-) 10 - 15 (-20) m tall, dioecious; trunk, sucker shoots and branches frequently armed with 5 - 8 cm long thorns; young shoots and branches often densely tomentose, sometimes minutely puberulous to glabrescent. Leaves broadly elliptic, oblong-elliptic, ovate-lanceolate, usually cuneate and conspicuously 3 - 5-pleined at base, acute or rarely long acuminate at apex, coarsely serrate or crenate to subentire, 8 - 22 x 3.5 - 9.5 cm, coriaceous or subcoriaceous, shiny green, turning reddish brown, especially beneath on drying, glabrous or sometimes densely to sparsely tomentose along midrib near base above, usually sparsely to densely along midrib and veins beneath; basal primary and secondary veins together 5 - 6 pairs, usually set widely apart; tertiary veins more or less perpendicular to midrib, together with quarternary veins form reticulum conspicuous beneath; petioles 4 - 8 mm long, densely tomentose to glabrescent. Flowers unisexual, creamy white, in short slender bracteate pubescent lax racemes or dense panicle clusters, up to 2 cm long; pedicels ca 3 mm long, up to 4 mm in fruits, hairy. Sepals minute, sparsely hairy or glabrescent outside, densely spreading hairy inside (appears ciliolate from above). *Male flowers*: Stamens numerous; filaments ca 3 mm long, glabrous. *Female flowers*: Ovary urceolate, ca 1.5 mm long, glabrous, sometimes

surrounded by a few staminodes at base; styles 5 (-6), spreading and recurved, bifid at apex; stigma minute. Berry ca 1.7 cm across, globose, obtusely ribbed, reddish purple when ripe; seeds 6, in 2 rows, compressed, hard, woody and rough.

Fl. Nov. - Feb. (June); *Fr.* Feb. - April.

Distrib. India: Semievergreen and moist deciduous forests of Western Ghats, up to 1000 m (1800 m). Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. Fruits are pleasantly acidic, eaten raw and made into jelly. Wood is heavy, used locally for building purposes.

CULTIVATED TAXA

1. *Flacourtia inermis* Roxb., Pl. Corom. 3: 16, t.222. 1811; Hook. f. & Thomson in Fl. Brit. India 1: 192. 1872.

An unarmed small tree with oblong-ovate, ovate-lanceolate or elliptic leaves, bisexual flowers in short racemose fascicles and red globose berries, ca 2.5 cm across with remnants of stamens at base.

Probably a native of Malaya, cultivated in some parts of Maharashtra, Kerala and elsewhere for the acidic fruits seems to be good for jams and pickles.

2. *Flacourtia rukkam* Zoll. & Mor., Syst. Verz. 33. 1846; Hook. f. & Thomson in Fl. Brit. India 1: 192. 1832.

A small tree, often ferociously thorny on trunk, with coarsely crenate oblong-ovate or oblong-elliptic leaves, greenish yellow flowers in short racemes and globose berries ca 2.5 cm across, crowned with peg-like free styles.

A native of Malaya, sometimes cultivated for the edible acidic fruits palatable by rubbing between palms.

4. *Gynocardia* R. Br.

Monotypic; description and distribution as for the species below.

Gynocardia odorata R. Br. in Roxb., Pl. Corom. 3: 95, t. 299. 1820; Hook. f. & Thomson in Fl. Brit. India 1: 195. 1872.

Fig. 74.

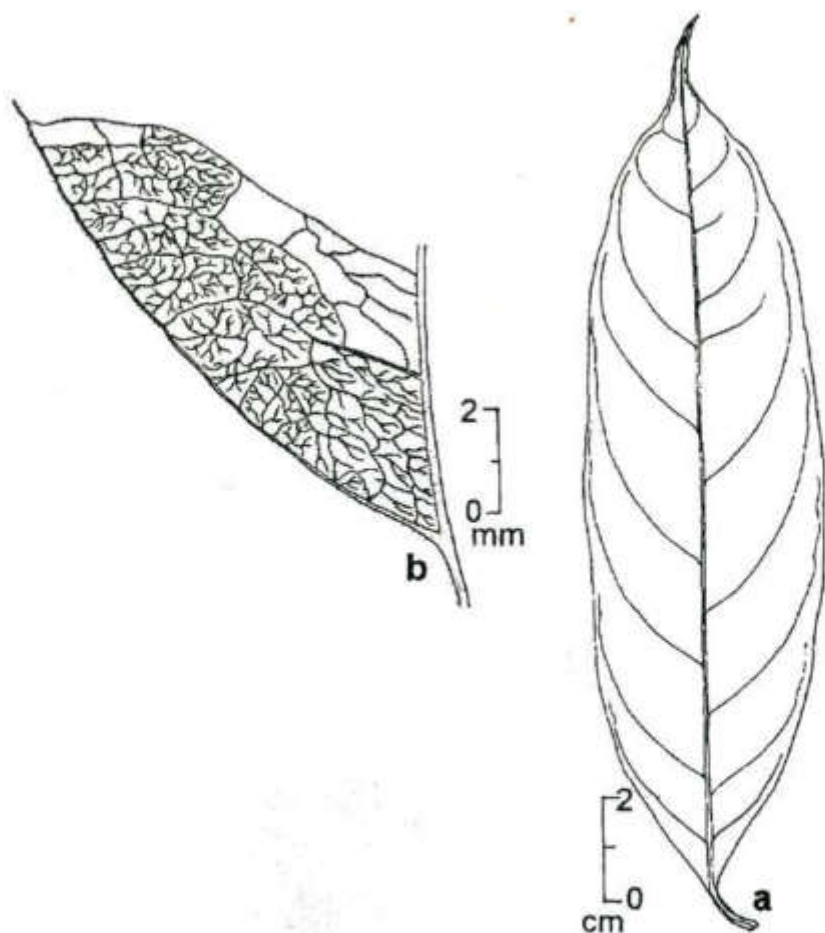


Fig. 74. *Gynocardia odorata* R. Br. : a. leaf; b. portion of venation on upper leaf surface showing granular depositions.

Ass.: *Bonsha, Lemtem*; Beng.: *Chaulmugra*; Kh.: *Dieng-soh-phailing*; Garo: *Sike-lulpi*.

Trees, dioecious, evergreen, 10 - 30 m tall, glabrous. Leaves alternate, entire, oblong, rarely ovate-oblong or obovate-oblong, rounded or cuneate at base, short or long acuminate, rarely even caudate-acuminate at apex, entire but somewhat uneven along margins, 10 - 33 x 3.5 - 10.5 cm, dark green above, paler beneath, glabrous, pinnately veined; secondary veins 5 - 9 pairs, arcuate, gradually diminishing apically close to margin, connected to superadjacent veins by a series of cross veins; tertiary and quaternary veins conspicuously impregnated with granular depositions; tertiary veins more or less perpendicular, giving rise to repeatedly dichotomously branched radially spreading lateral branches, facing especially midrib and together with quaternary veins forming incomplete meshes; petioles 0.7 - 2.2 cm long; stipules caducous. *Male flowers* pale yellow, 2.5 - 3.5 cm across, fragrant, solitary or few in axillary bracteate corymbs or numerous aggregated together in several corymbose clusters on tubercles on stems and older branches; pedicels 2.5 - 5 cm long. Calyx-lobes 5, connate into a cupular calyx, 5-lobed at apex, obtuse, ca 7 mm long. Petals 5, oblong, obtuse at apex, ca 15 x 7 mm, fleshy; epipetalous scales oblong, obtuse and densely ciliate along margins, ca 6 x 4 mm. Stamens ca 100; filaments broadened towards base, ca 10 mm long, woolly; anthers linear-oblong, basifixed, ca 5 mm long. Pistillode absent. *Female flowers* few on tubercles on stems and older branches. Sepals and petals similar to but bigger than those in males. Stamines 10 - 15, villous. Carpels 5, connate into a globose unilocular superior ovary; ovules numerous in parietal placentae; styles 5; stigmas hastate. Berry globose, 8 - 12 cm across; pericarp thick, hard, rugose, greyish, glabrous. Seeds numerous, variable, usually ovoid or ellipsoid, irregularly compressed, 2.5 - 3 x 1.8 - 2.2 cm; testa rough and pitted except for the fleshy silvery grey hilar region occupying about half of the seed surface; endosperm oily; cotyledons flat, fleshy.

Fl. March - May; *Fr.* ripens during Nov. - Dec.

Distrib. India: 300 - 1200 m. West Bengal (Jalpaiguri, Darjeeling), Sikkim, Assam, Meghalaya, Arunachal Pradesh, Manipur and Nagaland.

Bhutan, Bangladesh and Myanmar.

Notes. The granular depositions on the tertiary and quaternary veins, which is unique to this species in Flacourtiaceae and is evident under a hand lens, easily distinguishes sterile specimens of this species from *Hydnocarpus kurzii* with which it is often mistaken in the herbaria.

The seeds, though once thought to be the source of chaulmoogra oil, yield gynecardia oil, which does not contain any chaulmoogric acid or its homologue. The seeds also contain cyanogenic glycoside-gynocardine and used as fish poison.

5. *Homalium* Jacq.

Trees or shrubs, sometimes buttressed at base. Leaves usually coriaceous or subcoriaceous, crenate to subentire, pinnately veined; secondary veins branched towards margin to join superadjacent veins and to terminate in a gland beneath each teeth or at margin. Flowers bisexual, subtended by caducous or persistent bracts, spirally arranged, singly or in glomerules in terminal or subterminal racemes, panicles or spikes. Hypanthium funnel-shaped, adnate to lower half of ovary; sepals and petals in separate whorls, perigynous, somewhat accrescent in fruit. Sepals 4-8 (-12), with an episealous nectar gland opposite each. Petals as many, often similar to and alternating with sepals, inserted at throat of calyx-tube. Stamens solitary before each petal or 2 or more in fascicles on and or before each petal, between disc lobes and often alternating with staminodes; anthers didymous, dorsifixed, extrorse; pollen tricolporate, endoaperture alongate. Carpels 2-5, connate into unilocular, half inferior ovary usually hairy outside and sometimes also inside, maturing into a coriaceous or bony fruit, beaked at apex; ovules 1-many, pendulous on parietal placenta, confined to apex; styles (2-) 3-9, free or shortly connate at base; stigma capitellate. Fruits ovoid or subglobose, splitting into valves at apex or indehiscent. Seeds 1-few, minute, angular, oblong; endosperm fleshy; cotyledons foliaceous.

Pantropical; ca 200 species, 6 in India.

KEY TO THE SPECIES

- | | |
|---|----------------------------|
| 1a. Stamens solitary before each petal | 2 |
| b. Stamens in groups of 3 or more, on and or before each petal | 4 |
| 2a. Tertiary veins prominently raised beneath, oblique to midrib; flowers sessile, in glomerules of 2-5 in pendulous spikes | 4. <i>H. tomentosum</i> |
| b. Tertiary veins not prominently raised beneath, more or less perpendicular at least along midrib; flowers pedicelled, arranged singly or in glomerules in racemes or panicles | 3 |
| 3a. Flowers arranged singly in divaricately branched panicles | 3. <i>H. nepaulense</i> |
| b. Flowers in glomerules of 2-15 or more in simple racemes rarely shortly branched towards base | 1. <i>H. ceylanicum</i> |
| 4a. Flowers sessile in spikes | 6. <i>H. travancoricum</i> |
| b. Flowers pedicelled in racemes or panicles | 5 |
| 5a. Racemes simple, sparsely flowered | 2. <i>H. jainii</i> |
| b. Panicles divaricately branched, moderately flowered | 4. <i>H. schlichii</i> |

1. *Homalium ceylanicum* (Gardner) Benth. in J. Proc. Linn. Soc., Bot. 4: 35. 1860 (as "*zeylanicum*"); C. B. Clarke in Fl. Brit. India 2: 596. 1879. *Blackwellia ceylanica* Gardner in Calc. J. Nat. Hist. 7: 452. 1846.

Evergreen trees, 8-30 m tall; bark smooth, grey, peeling off in irregular flakes; trunk reaching up to 80 cm in diam. Leaves narrowly to broadly elliptic, rarely elliptic-oblong,

lanceolate or oblanceolate, cuneate at base, short or long acuminate at apex, coarsely crenate to subentire along margins, 7 - 19 x 3.5 - 10 cm, usually subcoriaceous, sometimes also membranous; secondary veins 5 - 7 pairs; tertiary and quaternary veins forming fine reticulum; petioles 7 - 12 mm long, usually puberulent. Racemes slender, axillary and subterminal, pendent, simple, rarely slightly branched towards base, 10 - 35 cm long. Flowers greenish white, foetid; pedicels ca 2 mm long, articulated below the calyx. Sepals 4 - 6, linear-oblong. Petals as many and a little longer and broader than sepals. Stamens as many and opposite to each petal, alternating with densely hairy epispalous glands, ciliate along margins; filaments 2 - 3 mm long. Ovary densely pilose to sparsely pubescent; styles 4 (-5), spreading, hairy, 1.5 - 2 mm long; stigmas capitate.

KEY TO THE SUBSPECIES

- 1a. Indumentum grey, minute and appressed; sepals and petals moderately to densely pubescent or tomentose outside, more densely so inside 1.1. subsp. *ceylanicum*
 b. Indumentum whitish, short and spreading; sepals and petals moderately to sparsely hirtellous outside, sparingly hirtellous to glabrate inside 1.2. subsp. *minutiflorum*

1.1. subsp. *ceylanicum*

Kan.: *Hulikaddi-mara, Kala*; Mal.: *Manthala-mukki*.

Young twigs puberulous. Leaves usually abruptly acuminate at apex, coarsely to repando-crenate along margins, 7 - 15 x 3.5 - 7 cm, shiny above, glabrous on both surfaces or minutely puberulous along midrib and veins towards base beneath. Racemes up to 22 cm long, appressed pubescent to densely tomentose. Flowers 3 - 4 mm across; pedicels 1 - 1.5 mm long, appressed tomentose. Hypanthium 1 - 1.5 mm long, often obscurely ribbed, appressed pubescent to tomentose. Sepals 1 - 1.7 mm long. Petals spatulate, both densely bearded pilose along margin. Ovary densely pilose.

Fl. (Feb.) March - May; *Fr.* Oct. - Dec.

Distrib. India: Evergreen forests of Western Ghats, 200 - 1300 m. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Notes: Ornamental; the timber is hard, heavy and durable, used for beams, poles, masts and building purposes.

1.2. subsp. *minutiflorum* (Kurz) Mitra, *stat. nov.* *H. minutiflorum* Kurz, *For. Fl. Brit. Burma* 1: 532. 1877; C. B. Clarke in *Fl. Brit. India* 2: 596. 1879. *H. bhamoense* Cubbitt & Smith in *Rec. Bot. Surv. India* 6: 33. 1913. *H. bhamoense* var. *debbamani*

Kanjilal et al. in Fl. Assam 1: 85. 1934, incl. forma *glabra*. *H. ciliatum* N. Mukherjee in J. Bombay Nat. Hist. Soc. 69: 390. 1973.

Young twigs glabrescent to densely hirsute. Leaves coarsely to repando-crenate or subentire along margins, 8 - 19 x 4 - 10 cm, glabrous or nearly so on both surfaces or minutely hirsute along midrib and veins above, moderately to densely hirsute on veins and sparsely so elsewhere beneath. Racemes up to 35 cm long, glabrescent to densely hirsute. Flowers 2 - 5 mm across; pedicels ca 2 mm long, slender, sparsely to moderately hirtellous. Hypanthium 1 - 2 mm long, faintly to moderately ribbed, sparsely to moderately hirtellous. Sepals 0.8 - 2.5 mm long, densely pilose to sparsely ciliate along margins. Petals 1 - 3 mm long, oblong, spatulate or oblanceolate, hairy, like sepals, along margins.

Fl. March - May; *Fr.* Oct. - Dec.

Distrib. India: Semievergreen and evergreen subtropical forests, 50 - 1500 m. West Bengal (Darjeeling), Sikkim, Assam (Cachar), Meghalaya (Garo Hills) and Mizoram. Bhutan, Bangladesh (Sylhet, Chittagong), Myanmar and Thailand.

Notes. The subspecies *minutiflorum* proposed here constitutes a distinct population of *H. ceylanicum* subsp. *ceylanicum*. The various forms often named as *H. bhamoense*, *H. bhamoense* var. *debbarmani* (*H. ciliatum*), *H. bhamoense* var. *debbarmani* forma *glabra* and the less known *H. minutiflorum*, in fact represent some of the typical elements of this highly variable intergrading population. Thus, Kanjilal et al. (l.c. 86) even while describing two such forms as distinct taxa expressed the apprehension that *H. bhamoense* together with those two infraspecific taxa may constitute a northeastern race of *H. ceylanicum* and might have to be combined with it.

The typical *H. minutiflorum* (Pegu - Type, CAL!) compares well with *H. bhamoense* var. *debbarmani* forma *glabra* (Sylhet, Chittagong) except that in the former some of the flower clusters in the lower part of the racemose inflorescence further develop into small racemose branchlets, a character, though not reported, is also noticed in two specimens of *H. ceylanicum* from Sri Lanka (Thwaites 388, CAL). However, the general tendency of the common stock of flower clusters to develop into rudimentary rachiules is clearly discernable in a number of specimens of both the subspecies.

Further, in *H. bhamoense* var. *debbarmani* forma *glabra*, though the flowers are usually smaller like *H. bhamoense* and *H. minutiflorum*, in a number of glomerules in two specimens from Sylhet (Kanjilal 7639, CAL) both small and much bigger (sterile!) flowers are noticed. These bigger flowers resemble those of *H. bhamoense* var. *debbarmani*.

2. *Homalium jainii* A.N. Henry & Swamin. in J. Bombay Nat. Hist. Soc. 78: 570. 1981.

Trees, up to 30 m tall; young twigs glabrous. Leaves narrowly elliptic to elliptic-oblong, cuneate or subobtuse at base, acuminate at apex, crenato-repand to subentire along margins, 4 - 11 x 1.5 - 4.5 cm, coriaceous, glabrous, shiny above; secondary veins 7 - 9 pairs, tertiary and quaternary veins forming distinct reticulum on both surfaces; petioles 6 - 12 mm long. Racemes up to 20 cm long, grey tomentose. Flowers 10 - 12 mm across, greenish yellow. Hypanthium ca 4 mm long, grey tomentose. Sepals 6 - 9, oblong to spatulate, obtuse at apex, 5 - 8 x 1.5 - 3 mm, tomentose. Petals triangular-ovate-oblong, 4 - 7 x 1.5 - 3 mm, tomentose, connivent over ovary after anthesis. Stamens 6 - 7 in fascicles on and before each petal (3 between nectar glands and rest on petal above the level of glands); filaments 4 - 5 mm long, sparsely pilose. Ovary tomentose; styles 6 - 9. Fruits not seen.

Fl. Oct.; reported to flower very rarely, possibly once in many years.

Distrib. India: Evergreen forests of S. Western Ghats, ca 1000 m; also in rocky lowlands along streams. Tamil Nadu (Kanniyakumari). Rare.

Endemic.

3. *Homalium napaulense* (DC.) Benth. in J. Proc. Linn. Soc., Bot. 4: 34. 1866; C. B. Clarke in Fl. Brit. India 2: 596. 1879, as "*nepalense*". *Blackwellia napaulense* DC., Prodr. 2: 54. 1825.

Trees, 8 - 15 m tall; young twigs usually puberulous. Leaves ovate, ovate-elliptic, cuneate, rounded or even subtruncate at base, acuminate at apex, crenate, 6 - 16 x 4.5 - 10 cm, subcoriaceous, usually glabrescent to moderately velutinous especially along midrib and veins rarely densely so both above and beneath; secondary veins 6 - 8 pairs, branched to terminate somewhat conspicuously into glands at margin; petioles 1.5 - 2.5 cm long, densely ferruginous tomentose. Panicles axillary, densely pyramidal, 5 - 15 cm long, densely ferruginous tomentose. Flowers ca 5 mm across, white, foetid; pedicels ca 1.2 mm long, densely hairy. Hypanthium ca 1.5 mm long, densely appressed hairy, slightly ribbed in fruits. Sepals 6 - 8, linear, densely pilose outside, sparsely so inside. Petals as many and slightly longer and broader than sepals, spatulate or oblanceolate, ca 2 x 0.7 mm, densely pilose outside, sparsely so or even glabrate inside, somewhat bearded along margins. Stamens as many and opposite to each petal, alternating with densely hairy episealous glands; filaments ca 1.5 mm long. Ovary densely pilose outside, sparsely pubescent inside; styles 3 - 4. Fruit not seen.

Fl. May - June.

Distrib. India: Tropical and subtropical mixed and evergreen forests, 700 - 2100 m. Nagaland, Bihar (Singhbhum), Orissa (Mayurbhanj, Ganjam, Koraput and Puri) and Andhra Pradesh (Vishakhapatnam and E. Godawari).

Nepal.

4. *Homalium schlichii* Kurz, For. Fl. Brit. Burma 1: 532. 1877; C. B. Clarke in Fl. Brit. India 2: 597. 1879; Kanjilal et al., Fl. Assam 1: 86. 1934.

Kh.: *Dieng-soh-mara*.

Evergreen or semievergreen trees, up to 35 m tall, buttressed at base when old; bark rough, dark brown; young twigs glabrous. Leaves elliptic to elliptic-oblong, rarely ovate, cuneate at base, obtusely short or long acuminate at apex, coarsely to repando-crenate along margins, 7 - 18 x 4 - 6.5 cm, subcoriaceous, glabrous; secondary veins 8 - 10 pairs; petioles 7 - 12 mm long. Panicles axillary or terminal, divaricately branched, 5 - 10 cm long, grey tomentose. Flowers white, ca 4.5 mm across, singly disposed; pedicels 1.5 - 3 mm long, tomentose; bracts small, early caducous. Hypanthium ca 1.25 mm long, tomentose. Sepals 5 - 6, connate or adnate to ovary at base, linear-oblong, ca 2 x 0.8 mm, densely tomentose on both sides with a densely hairy gland at base. Petals 5 - 7, slightly broader than sepals, oblanceolate or spatulate, densely tomentose outside, woolly tomentose inside and somewhat bearded along margin. Stamens antipetalous in groups of 3; filaments ca 2 mm long; anthers small, didymous. Ovary densely pilose; styles 4, filiform, hairy. Fruit a 2 - 5-valved capsule with coriaceous walls. Seeds few, oblong.

Fl. March - May; Fr. Oct. - Dec.

Distrib. India: Subtropical mixed and evergreen forests up to 1300 m. Assam and Meghalaya.

Bangladesh (Sylhet and Chittagong) and Myanmar.

5. *Homalium tomentosum* (Vent.) Benth. in J. Proc. Linn. Soc., Bot. 4: 34. 1860; C. B. Clarke in Fl. Brit. India 2: 596. 1879. *Blackwellia tomentosa* Vent., Choix 57, t. 57. 1803.

Deciduous trees, 20 - 40 m tall, buttressed with straight up to 1 m diam. trunk when old; bark thin greyish white, peeling off in irregular flakes showing green epidermis beneath; young twigs more or less tomentose. Leaves sessile, broadly obovate to obovate-oblong, rarely elliptic, cuneate but ultimately rounded at base, rounded or short acuminate at apex, shallowly and distinctly crenate along margins, 10 - 25 x 5 - 13.5 cm, coriaceous or subcoriaceous, minutely tomentose to glabrescent above, minutely pubescent to woolly tomentose beneath; secondary veins ca 12 pairs, prominently raised beneath, branched to terminate conspicuously into glands at margin; petioles 3 - 7 mm long, thick. Spikes stout, pendulous, 10 - 30 cm long, densely ferruginous tomentose. Flowers 3 - 4 mm across, greenish with a disagreeable odour, arranged in lax glomerules. Hypanthium ca 1.25 mm long, woolly tomentose, becoming ca 2 mm in fruits. Sepals 5 - 6, oblong-linear, ca 1.25 mm long, tomentose. Petals as long as sepals, more or less

spathulate, tomentose. Stamens as many and opposite to each petal, alternating with densely hairy episepalous glands; filaments ca 2 mm long. Ovary densely woolly tomentose outside, minutely appressed hairy inside; styles 3. Fruits ovoid or subglobose, ca 2 mm long, indehiscent, 1-seeded.

Fl. May - June; *Fr.* Oct. - Dec.

Distrib. India: Mixed forests of low elevations. Orissa (Ganjam and Puri).

Bangladesh, Myanmar, Indo-China, Thailand, Malaysia and Indonesia.

Notes. Ornamental; wood is hard and heavy, sometimes used like *H. ceylanicum*.

6. **Homalium travancorium** Beddome, *Fl. Sylv.* 2: t. 211. 1872; C.B. Clarke in *Fl. Brit. India* 2: 596. 1879. Fig. 75.

Evergreen trees, 7 - 12 m tall; young twigs glabrous. Leaves ovate, broadly elliptic or oblong-elliptic, rounded or subacute at base, coarsely to repando-crenate, 7 - 10 x 3 - 5.5 cm, coriaceous or subcoriaceous, shiny, glabrous; secondary veins 5 - 8 pairs; tertiary veins more or less oblique to midrib, forming reticulum with quarternary veins; petioles 8 - 12 mm long. Spikes dense, 5 - 10 cm long, ferruginous tomentose. Flowers greenish white, ca 5.5 mm across, subtended prominently by a cushion of imbricate bracts, singly disposed. Hypanthium ca 1.5 mm long, densely grey appressed pilose. Sepals 5 - 6, triangular-linear-oblong, ca 1.75 mm long, densely appressed outside, appressed pilose inside, with a densely hairy gland at base. Petals as many as sepals, spathulate, ca 3 mm long, appressed pilose outside, densely bearded along margins and inside. Stamens antipetalous in groups of 3 - 4; filaments ca 2.25 mm long, sparsely pilose. Ovary densely bearded pilose outside, white floccose inside; styles 3 - 4, ca 3 mm long, pilose towards base. Fruits ca 2 mm long, ovoid or subglobose, indehiscent, 1-seeded; seeds globose, 0.5 mm across.

Fl. March - May; *Fr.* Oct. - Feb.

Distrib. India: Evergreen forests of Southern Western Ghats at lower elevations between 300 - 700 m. Tamil Nadu and Kerala.

Endemic.

6. **Hydnocarpus** Gaertn.

Trees or rarely shrubs, evergreen, usually dioecious. Leaves alternate, entire or serrate, coriaceous or subcoriaceous, pinnately veined; secondary veins upturned, gradually diminishing apically close to margin, connected to superadjacent secondaries by a series of cross veins; petioles often thickened at apex; stipules foliaceous, caducous.

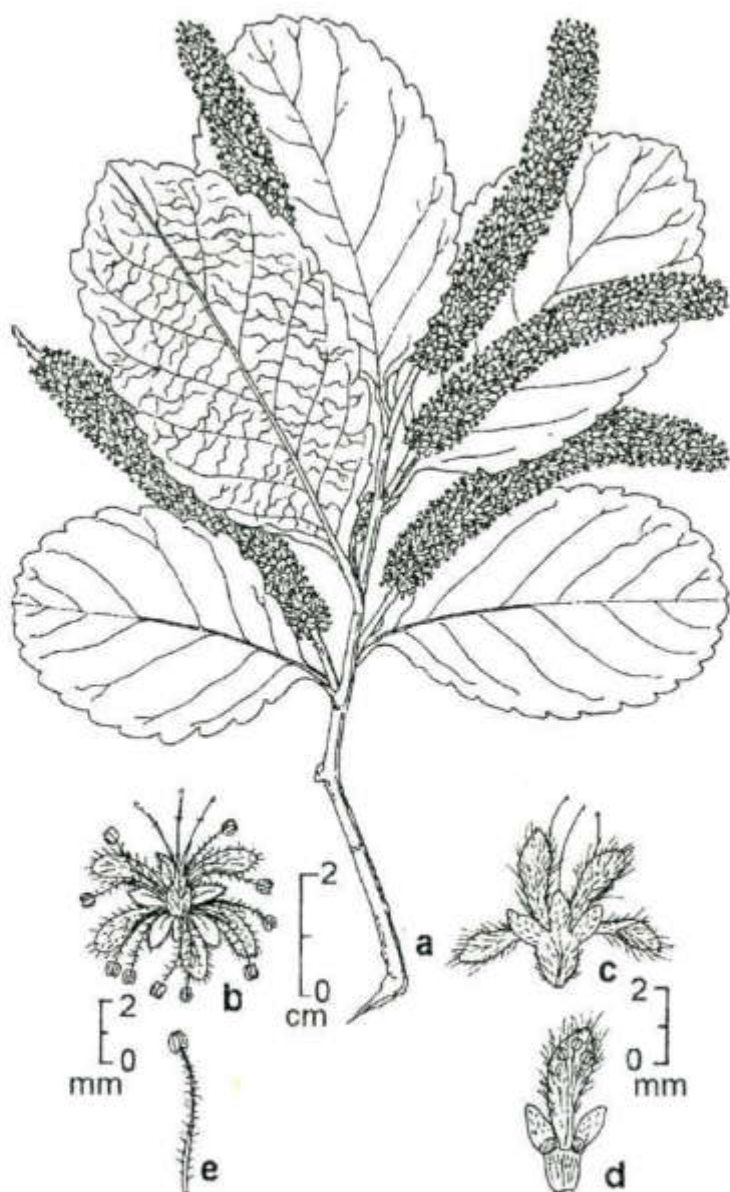


Fig. 75. *Homalium travancoricum* Beddome : a. flowering twig; b. flower; c. flower showing hypanthium; d. part of flower; e. stamen.

Racemes axillary, few-flowered; flowers unisexual or bisexual, regular, 5- or rarely 4-merous. *Male flowers* in 1-4 bracteate racemose or cymose fascicles on short axillary peduncles. Sepals usually 4-5, free or slightly connate at base, imbricate, subequal, concave, caducous. Petals 4-5, or in multiples there of up to 16, free or connate at base, with a somewhat fleshy pilose scale at base inside. Stamens 5-many, free; filaments broadened towards base at least at anthesis; anthers oblong, reniform or sagittate, basifixed; pollen tricolporate, reticulate, suboblate to subprolate. Ovary rudimentary, densely pilose, or absent. *Female flowers* solitary, or a few in fascicles on short axillary peduncles often arising from older nodes. Sepals and petals similar to but slightly bigger than those in males. Staminodes 5-many, sterile anthers mostly reduced in size. Carpels (3-) 4-5 (-6), connate into unilocular superior ovary; ovules 2-many in 6, 4 or 3 parietal placentae; stigmas as many as placentae, sessile, radially spreading, recurved, deeply bifid or bilobed and dilated at apex, glabrous above, pilose beneath. Fruit an indehiscent berry, large, globose or ovoid; pericarp thick and hard, or thin and fragile; exocarp sometimes radially fibrous. Seeds angular-ovoid-oblong, usually with membranous aril, crustaceous testa, oily endosperm and foliaceous cotyledons.

Rain forests of S. & S.E. Asia; ca 40 species, 4 in India.

Literature. SLEUMER, H. (1938) Monographie der Gattung *Hydnocarpus* Gaertner. Bot. Jahrb. 69: 1-94, tt. 1-4.

Notes. *Taraktogenos* Hassk. and *Asteriastigma* Beddome are treated as synonyms of *Hydnocarpus* Gaertn.

Among Indian species, the seeds of *H. alpina*, *H. kurzii* and *H. pentandra* produce oils commonly known as chaulmoogra oil, having high percentages of cyclopentenyl fatty acids. The true chaulmoogra oil is used extensively in the treatment of cutaneous diseases, especially leprosy. It has been replaced by the more preferred *Hydnocarpus* oil obtained from *H. pentandra*. However, at present sulphur drugs have replaced the usage of *Hydnocarpus* oil and its derivatives in the treatment of leprosy. Besides fatty acids, the seeds also contain cyanogenic glycosides discharging hydrocyanic acid and are used as fish poison.

The fruits set irregularly which remain on the tree and are harvested once in 2-3 years. They are suitable for planting as avenue trees in the hills and yield timber used for constructional purpose.

KEY TO THE SPECIES

- | | |
|---|---|
| 1a. Sepals 4, petals 8 or more, stamens 15-many | 2 |
| b. Sepals, petals and stamens 5 each | 3 |

- 2a. Leaves shiny; tertiary veins perpendicular, irregularly branched, perceptible on both surfaces; quaternary veins well developed, irregularly branched, forming a dense reticulum with tertiary veins and pinnately branched to end freely in the areole; petals 8 2. *H. kurzii*
- b. Leaves not shiny; tertiary veins perpendicular, seldom branched, conspicuous only on the lower surface; quaternary veins scarcely develop reticulation and never end freely in the areole; petals 12 3. *H. macrocarpa*
- 3a. Branchlets stellately puberulent; leaves entire, glabrous; tertiary veins somewhat irregularly arranged, together with quaternary veins form close reticulum; reticulum distinctly elevated and foveolate 1. *H. alpina*
- b. Branchlets simply puberulent; leaves serrate to remotely crenato-serrate, rarely subentire, minutely appressed pubescent at least along midrib and veins beneath; tertiary veins perpendicular, together with quaternary veins form sparse reticulum; reticulum neither elevated nor foveolate 4. *H. pentandra*

1. *Hydnocarpus alpina* Wight, Icon. Pl. Ind. Or. t. 942. 1845; Hook. f. & Thomson in Fl. Brit. India 1: 197. 1872. Fig. 76 & 77.

Kan.: *Sanusotti, Torathi*; Mal.: *Mala-maravetti, Mala-marotti*; Mar.: *Kastel*; Tam.: *Attuchankalai*.

Trees, 10 - 30 m tall, evergreen, buttressed when old; trunk ca 30 cm in diam.; outer bark cream-coloured; inner bark pinkish cream, ca 1 cm thick; twigs glabrous. Leaves variable, usually ovate-lanceolate, sometimes elliptic, ovate-oblong, or broadly ovate, cuneate or even subrotund and inequilateral at base, obtusely long or short acuminate at apex, entire, 6 - 25 x 2 - 9 cm, reddish when young, turns dark green with age; secondary veins 7 - 8 pairs; petioles 7 - 15 mm long. *Male flowers* 1.5 - 2 cm across, greenish white, few in 2 - 4 cymose fascicles on axillary 5 - 8 mm long ferruginous tomentose peduncles; pedicels up to 2 cm long, ferruginous tomentose. Sepals connate at base, ovate or elliptic-oblong, obtuse at apex; reflexed at anthesis, ca 7 x 4 mm, densely ferruginous tomentose. Petals oblong-lanceolate, concave with involute margins, reflexed at anthesis, 10 - 12 mm long, glabrous; epipetalous scales ca 2 mm shorter than petals, subulate, softly white pilose along margin. Stamens 4 - 5; filaments ca 2.5 mm long, shorter than petals. Ovary rudimentary, densely pilose. *Female flowers* solitary, axillary, rarely binate. Staminodes 5, linear-oblong, obtuse, appressed to ovary. Ovary ovoid-ellipsoid, faintly 5-angular, beaked at apex, densely yellowish white tomentose; stigmas 5, appressed to ovary. Berries ovoid-globose or globose, 5 - 7 cm across; pericarp woody, brownish tomentose. Seeds 10 - 12, embedded in white pulp, ellipsoid or subglobose, irregularly compressed, 1.5 - 2 x 1.3 - 1.7 cm; testa hard.

Fl. Feb. - April (July, Aug., Oct.) probably throughout the year in flashes; fruiting afterwards.

Distrib. India: Evergreen forests of S. Western Ghats up to 2000 m. Karnataka, Tamil Nadu and Kerala.

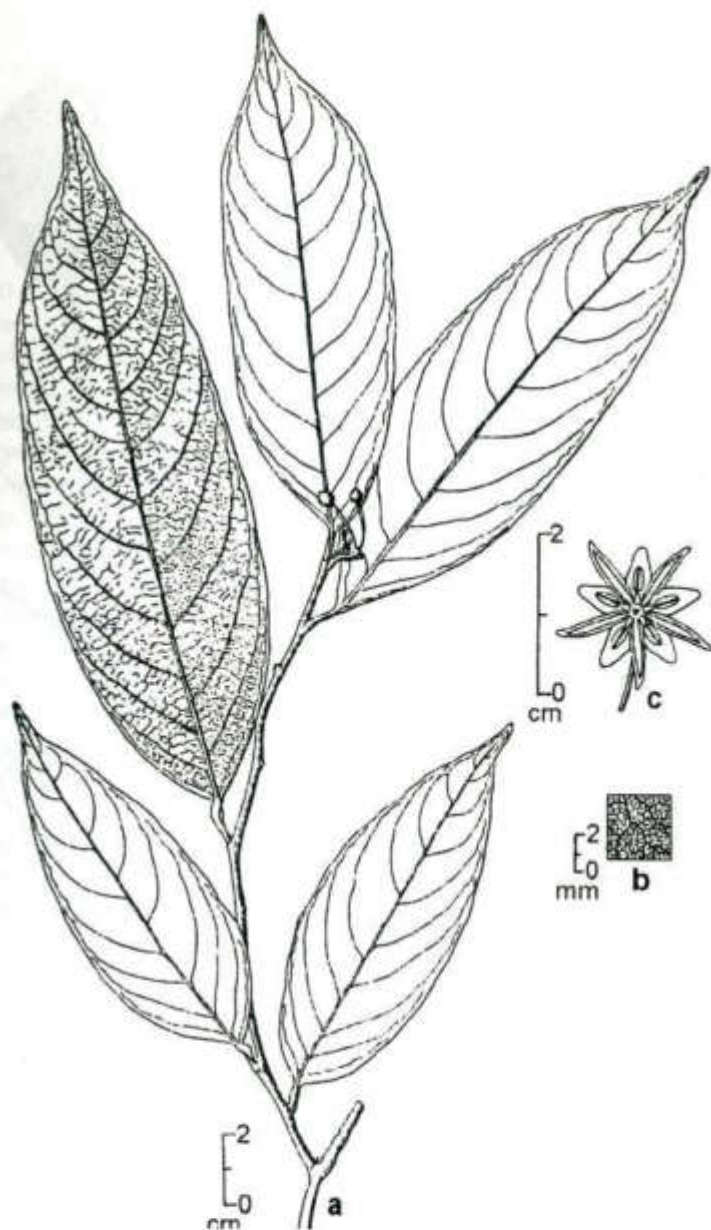


Fig. 76. *Hydrocarpus alpina* Wight (male) : a. flowering twig; b. portion of upper leaf surface showing venation; c. male flower.

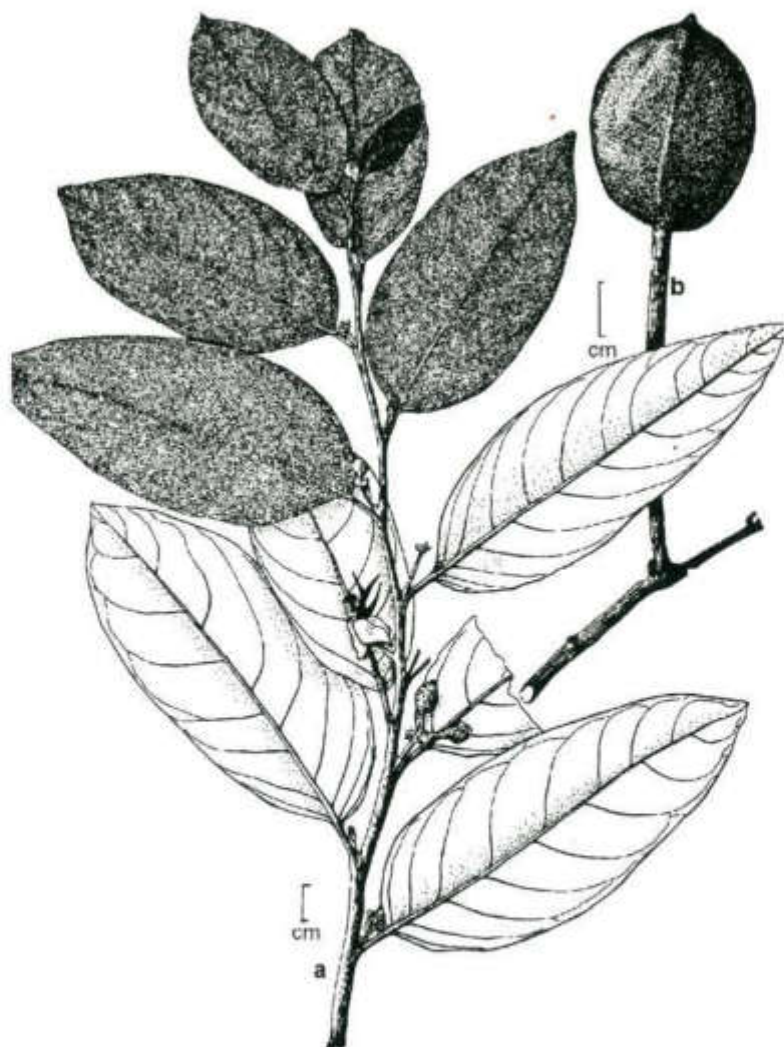


Fig. 77. *Hydnocarpus alpina* Wight (female): a. flowering twig; b. fruit.

Endemic.

2. *Hydnocarpus kurzii* (King) Warb. in Engler & Prantl, Pflanzenfam. 3, 60: 21. f. M-N. (fig. erroneo sub *Gynocardia odorata*). 1893; Kanjilal et al., Fl. Assam 1: 87. 1934. *Taraktogenos kurzii* King in J. Asiat. Soc. Bengal 59(2): 123. 1890.

Ass.: *Lantem*; Beng.: *Chaulamugra*, *Dalmungri*; Garo: *Bilibu*; Kh.: *Dieng-soh-lap*; Lus.: *Matta*; Man.: *Chalmugra*, *Uthou*; Nep.: *Bandre*; Tipp.: *Matta*.

Trees, 10 - 20 (-30) m tall, with narrow crown and hanging branches; bark plain grey, brown or almost black outside, often with white patches, yellow or yellowish brown inside; branchlets tawny tomentose, soon glabrescent. Leaves bifarious, variable, lanceolate, oblong-lanceolate, elliptic-oblong, obovate-oblong or even elliptic, usually cuneate, rarely rounded and somewhat inequilateral at base, obtusely short or abruptly long acuminate, or even obtuse at apex, entire, 9 - 25 (-30) x 3 - 7 (-10) cm, membranous and minutely appressed pubescent when young, soon glabrescent; secondary veins 7 - 9 pairs; petioles swollen and slightly geniculate at upper end, 1 - 3 cm long. *Male flowers* 8 - 12 mm across, pale yellow, 3 - 5 each in two compact fascicles atop a common peduncle 7 - 15 mm long; peduncles 2 - 3 mm long, pedicels 7 - 10 mm long, all strigosely fulvous tomentose. Sepals ovate-orbicular, concave, ca 5 x 4 mm, fulvous tomentose. Petals broadly ovate to ovate-orbicular, cuneate at base, ciliate along margins, ca 4 mm long; epipetalous scales obovate, densely white pilose at apex. Stamens (15-) 20 - 30; filaments ca 4 mm long, densely pilose. *Female flowers* 2 - 5 in a compact fascicle atop a ca 5 mm long peduncle, rarely solitary by abortion; pedicels ca 12 mm long, strigosely fulvous tomentose. Sepals and petals often fewer than in male flowers. Staminodes 10 - 16. Ovary ovoid, obscurely 6 - 7-ribbed, densely fulvous tomentose, with 4 parietal placentae; stigmas 4. Berries globose, somewhat protruded at apex, 8 - 10 cm across; pericarp reddish brown, velvety tomentose, afterwards scurfy. Seeds 12 - 18, tightly packed in fruit, angular-ovoid, 2.2 - 3.2 x 1.6 - 2 cm.

Fl. Feb. - April (Nov.), probably throughout the year in flashes; fruiting afterwards.

Distrib. India: Evergreen rain forests. Upper Assam, Manipur, Mizoram and Tripura.

Bangladesh and Myanmar.

Notes. The seeds of this tree yield the proper Chaulmugra oil, much used for all cutaneous complaints.

3. *Hydnocarpus macrocarpa* (Beddome) Warb. in Engler & Prantl, Pflanzenfam. 3, 3: 21. 1893. *Asteriastigma macrocarpa* Beddome, For. Man. Bot. t. 266. anal. pl. 27. 1873; Gamble, Fl. Pres. Madras 1: 52. 1915. *Taraktogenos macrocarpa* (Beddome) Balakr. in J. Bombay Nat. Hist. Soc. 67: 57. 1970.

Trees, 15 - 40 m tall, evergreen; outer bark light brownish with aromatic cyanide-like smell; inner bark ca 5 mm thick, pale purple brown; branchlets minutely yellowish pubescent. Leaves oblong, elliptic-oblong or oblanceolate, cuneate and inequilateral at base, usually abruptly short acuminate at apex, entire, 15 - 30 x 4.5 - 10 cm, glabrous, except sometimes sparsely hirtellous beneath along midrib and veins near base, pustulate below; secondary veins ca 7 pairs, prominently raised beneath; petioles 1 - 2 cm long, hirtellous. Flowers polygamous, foul-smelling, greenish white. *Male flowers* 2 - 2.5 cm across, 3 - 4 each in 2 - 3 racemose fascicles on a moderately thick common axillary ca 10 mm long peduncle; pedicels ca 8 mm long, ferruginous tomentose. Sepals ovate-suborbicular or orbicular, ca 9 x 4 mm, minutely appressed puberulous, ciliate along margins. Petals elliptic-oblong to obovate-oblong, ca 6 x 4 mm, densely ciliate along margins; epipetalous scales obovate, 3-ribbed inside and 3-fid at apex, ca 4 mm long, densely pilose. Stamens 50 - 60 (-70), many-seriate, shorter than petals. *Female flowers* few in racemose fascicles on short peduncles arising from older nodes; pedicels ca 10 mm long. Staminodes usually as many as stamens. Ovary ovoid, densely brownish tomentose; stigmas 6. Berries globose, 12 - 15 cm across; pericarp woody, dark brown, rugose, minutely pubescent; exocarp radially fibrous, 10 - 15 mm thick. Seeds ca 50, ovoid-oblong and variously angular, ca 3 x 2 cm, dark brown.

Fl. Feb. - April; probably throughout the year in flashes; fruiting afterwards.

Distrib. India: Evergreen forests of S. Western Ghats between 100 - 2000 m. Kerala (Icukki and Thiruvananthapuram) and Tamil Nadu (Kanniyakumari).

Endemic.

4. *Hydnocarpus pentandra* (Buch.-Ham.) Oken, *Allg. Naturgesh.* 3, 2: 1381. 1841.

Chilmoria pentandra Buch.-Ham. in *Trans. Linn. Soc., Lond.* 13: 501. 1822. *H. wightiana* Blume in *Rumphia* 4: 22. 1848; Hook. f. & Thomson in *Fl. Brit. India* 1: 197. 1872. *Munnicksia laurifolia* Dennst., *Schluss. Hort. Ind. Mal.* 27. 1818, nom. invalid. *H. laurifolia* (Dennst.) Sleumer in *Engler, Bot. Jahrb.* 69: 33. 1938, nom. invalid.; Ramamoorthy in *Fl. Hassan Dist.* 164. 1976.

Kan.: *Chaulmoogra*, *Suranti*, *Surti*, *Toratti*, *Yenna-mara*; Kon.: *Kavanthi*; Mal.: *Kodi*, *Koti*, *Maravetti*, *Marotti*, *Niralam*, *Nirvetti*, *Tamana*, *Vetti*; Mar.: *Kadu-kavata*, *Kantel*, *Kastel*, *Keti*, *Kobased*, *Kowti*; Sans.: *Garudaphala*, *Tuvrak*; Tam.: *Maravattai*, *Maravetti*, *Niradi-mattu*; Tel.: *Adi-badam*, *Niradi*.

Trees, evergreen, 5 - 25 m tall; trunk often fluted; bark brownish, rough; young parts brown pubescent. Leaves variable, ovate-elliptic, elliptic-oblong, oblong to oblanceolate, rarely ovate to ovate-lanceolate, cuneate or obtuse at base, obtusely short or long acuminate at apex, subserrate, 5 - 25 x 3.5 - 10 cm, dark green and shiny above, paler beneath, minutely appressed pubescent along midrib and veins above when young, at length glabrate, minutely appressed puberulous beneath, sparsely so with age; secondary

veins 5 - 8 pairs; petioles 7 - 15 mm long, ferruginous pubescent; stipules linear, puberulous, caducous. *Male flowers* ca 6 mm across, greenish, 3 - 6 each in 2 - 3 racemose fascicles atop a densely ferruginous tomentose peduncle, up to 1 cm long (sometimes thyrsoidly branched at base); pedicels ca 7 mm long, ferruginous tomentose. Sepals unequal, longest; outer ones broadly ovate to elliptic-orbicular; inner ones suborbicular, ca 2.5 mm across, densely appressed rusty puberulous outside, glabrous inside. Petals ovate to suborbicular, concave, ciliate along margins, smaller than sepals; epipetalous scales almost equal to petals. Stamens 5, ca 2 mm long at anthesis; anthers reniform and filaments filiform at first, at length anthers didymous and filaments thickened and gradually dilated towards hairy base. Ovary rudimentary, densely pilose. *Female flowers* ca 1 cm across, solitary or binate atop a common ca 8 mm long peduncle. Staminodes 5. Ovary ovoid, obscurely 5-ribbed, beaked at apex, densely yellowish pilose; stigmas 5-lobed. Berries globose or obovoid, protruded at apex, 5 - 10 cm across; pericarp reddish brown, scurfy, tomentose. Seeds 15 - 20, embedded in pulp, ovoid-oblong, obtusely angular, longitudinally striated, 1.7 - 2.2 x 1 - 1.5 cm.

Fl. Feb. - June (Sept.); fruiting afterwards.

Distrib. India: Moist deciduous and semievergreen forests of Western Ghats up to 850 m, often near water courses. Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala; elsewhere cultivated.

Endemic.

Notes. Timber used for building purposes. Seeds yield a yellow oil used for burning lamps and in medicine for leprosy, arthritis and swellings. Fruits are used as fish poison.

Since mere reference to an earlier description or diagnosis do not conform with the provision of a combined generico-specific description, the genus *Munnicksia* as well as the species *M. laurifolia* Dennst. (1818) is not considered as validly published.

EXCLUDED SPECIES

1. *Hydnocarpus castanea* Hook. f. & Thomson in Fl. Brit. India 1: 197. 1872.

In CAL a number of collections from Andamans have been identified either as *Hydnocarpus* sp. or *H. castanea*; all these however belong to *Drypetes longifolia* (Blume) Pax & Hoffm. (Euphorbiaceae).

Hook. f. & Thomson (l.c.) cited one of the type localities as 'King's Island, Andamans, ... Helfer; ...' On one of the type sheets, (Herb. E.I.C. no. 4364 - K, Photo !) the words 'Tennaserim and Andamans' printed on the Kew distribution label has been cut probably by J.D. Hooker himself and written in ink 'King's Island'. On one corner of the label the word 'Andamans' is also written on the sheet. Sleumer (Bot. Jahrb. 69: 39.

1938) while excluding Andamans from the distribution of the species erroneously referred Helfer's collection to Malay Peninsula. Helfer was actually stationed at Tennasserim in Myanmar (Burma) and made a brief journeys to Andamans where he lost his life. The island in question therefore appears to be the one in Mergui Archipiago, off Tennasserim coast.

2. *Hydnocarpus sharmae* P. S. N. Rao & Sreek. in Nord. J. Bot. 12: 225. 1992.

It represents *Siphonodon celastrineus* Griffith (Celastraceae) found in India (West Bengal, Sikkim, Bihar, Andhra Pradesh and Andamans), Myanmar (including Great Cocos islands) and Malesia.

An open flower kept in a packet attached to the holotype (Rao 20661, CAL!) clearly showed two most distinctive characters of the genus *Siphonodon*. Ovary half immersed in and adnate to a hemispherical disc and hollowed at apex with the central receptacular column resembling a style protruding through it. The protruded tip of the receptacular column has been mistaken for stigma and filaments of staminodes for epipetalous scales. Many other details of the flower provided in the protologue are grossly erroneous. J. D. Hooker's (Trans. Linn. Soc. London 22: t. 26. 1857) plate and the accompanying discussion gives a clear insight into its floral structure.

7. *Pangium* Reinw.

Monotypic; description and distribution as for the species below.

Pangium edule Reinw., Syll. Ratisb. 2: 13. 1825; Hore et al. in J. Econ. Tax. Bot. 6: 417. 1985.

Trees, usually dioecious, (10-) 20 - 45 m tall, with a dense crown and drooping branches; trunk up to 1 m in diam., buttressed when old; bark brownish, smooth; branchlets fistular, rufus tomentose, becoming glabrous and marbled with leaf scars when old. Leaves crowded at apices of branches, alternate, broadly ovate, cordate to subtruncate at base, acutely acuminate at apex, entire, (10-) 12 - 30 (-60) x 7.5 - 20 (-40) cm, chartaceous, dark green, shiny and glabrous above, paler and rusty scurfy, especially along veins beneath, palmately 5 - 7-veined from base; primary basal veins upcurved, gradually diminishing apically inside margin and joining superadjacent primary and secondary veins by a series of cross veins; petioles swollen at base, (7-) 10 - 30 (-50) cm long. *Male flowers* waxy pale green, 4 - 9 in rusty tomentose 6 - 24 cm long corymbs; pedicels 2.5 - 4 cm long. Calyx at first closed, globose, irregularly splitting into 2 - 3 (-4) caducous reflexed segments at anthesis, rusty tomentose in bud. Petals 4 - 9, imbricate, patent, ovate-oblong with recurved ciliate margins, 1.5 - 2.5 cm long, fleshy, waxy white, patent, reflexed afterwards; epipetalous scales ovate-orbicular, arched, 5 - 9 mm long, densely appressed brownish sericeous pilose. Stamens 20 - 25 (-30), free, half as long as petals, waxy white; anthers ovoid, dorsifixed; filaments broad; pollen tricolporate,

lanceolate, obovate to spheroidal. Pistillode absent. *Female flowers* solitary or 2 - 4 together in corymbs on main stem or older branches, slightly bigger than males; pedicels 6 - 11 cm long. Calyx and petals similar to those in males but petals somewhat bigger. Stamines as many as petals, inatherous. Carpels 2 - 4, connate into unilocular ovary, ovoid, brownish sericeous pilose; ovules many in parietal placenta; stigma sessile, obscurely 2 - 4-lobed. Berry 2 - 4 together, arising from trunk, pendulous, asymmetric, mostly ovoid-oblong or ellipsoid-oblong, beaked at apex, 15 - 25 x 7.5 - 12 cm and ca 1 - 2 kg in weight, indehiscent; pericarp brown, rufous pubescent. Seeds ca 20, enclosed by a white fleshy aril and embedded in sweet aromatic edible pulp, triangular-ovoid, 3.5 - 5 cm long, conspicuously marked with loosely branched ribs; testa hard, ribbed; endosperm oily; cotyledons foliaceous.

Fl. April - June, probably in flashes throughout the year; *Fr.* ripens mostly at the beginning of rainy season.

Distrib. India: Coastal and lowland interior forests along river banks. Great Nicobar Island (Laful forest).

Throughout Malesia, extending to Melanesia and Micronesia.

Notes. Trees producing male flowers are occasionally reported to bear both male, as well as one or two bigger terminal female flowers (apparently bisexual with 20 - 25 stamens with empty anthers) on the same inflorescence.

The fruits are aromatic and edible when ripe. The seeds and other parts of the plant contain cyanogenic glycoside-gynocardine and are used as fish and dart poison. In Malesia seeds are eaten after removing hydrocyanic acid by washing, boiling, etc., and an oil extracted from seeds is used as cooking medium and as an illuminant.

A potentially useful tree for afforestation and ecorestoration in Andaman & Nicobar Islands

8. *Ryparosa* Blume

Trees or shrubs, dioecious. Leaves alternate, often seemingly distichous or subopposite, exstipulate, entire, coriaceous, pinnately veined; secondary veins upturned, gradually diminishing apically inside the margin and connected to superadjacent veins by a series of cross veins; petioles rather long, thickened at both ends. *Male flowers* small, bracteate, in axillary or cauline elongated racemes arising singly or in fascicles of 2 - 3. Calyx at first closed, globose, irregularly splitting into 3 - 5 reflexed lobes at anthesis. Petals 4 - 5, imbricate, afterwards reflexed with a densely hirsute scale at base inside. Stamens as many as petals; filaments often connate into a central column enclosing the rudimentary ovary with anthers at top, rarely free and alternate with petals; anthers ovate, basifixed, reticulate; pollen tricolporate, finely reticulate, prolate to spheroidal;

pistillode absent. Ovary rudimentary or absent. *Female flowers* in shorter racemes. Calyx and petals similar to those in males. Staminodes 4 - 5, much reduced, often inatherous; filaments shortly connate at base into an annular disc or free. Carpels 2 - 3, connate into unilocular densely hairy ovary; ovules 1 - 2 on parietal placentae; stigma 2 - 3, sessile, radiating. Fruit a capsular berry, globose or variously angular, scantily pulpy; pericarp thinly coriaceous. Seeds 1 - 3 (-6), embedded in a little pulp, ellipsoid or subglobose, ribbed-reticulate or smooth.

Rain forests of S.E. Asia; ca 18 species, one in India (Andaman & Nicobar Islands).

Ryparosa javanica (Blume) Kurz in J. Bot. 11: 234. 1873, '*Ryparia*'; Sleumer in Fl. Males. I, 5: 45. 1954. *Bergsimia javanica* Blume, Rumphia 4: 23, t. 178C, f.2. 1849. *Ryparosa caesia* auct. non Blume 1825; Kurz in J. Asiat. Soc. Bengal 45: 117. 1876, '*Ryparia*' & For. Fl. Brit. Burma 1: 78. 1877, '*Ryparia*'. *R. kurzii* King in J. Asiat. Soc. Bengal 59(2): 125. 1890 & in Ann. R. Bot. Gard. Calc. 5: 130, t. 154. 1896; C. E. Parkinson, For. Fl. Andaman Is. 84. 1923.

Trees, evergreen, 4 - 15 (-30) m tall; bark grey to pale brown, rather smooth; branchlets striate, lenticellate, ferruginous appressed puberulous in younger parts. Leaves variable, elliptic, oblong-elliptic, ovate-lanceolate or oblong-obovate, cuneate or obtuse at base, usually short acuminate at apex, entire and revolute along margins, 18 - 35 (-45) x 6 - 17.5 cm, puberulent especially along midrib on both surfaces when young, afterwards glabrous, shiny and green above, paler beneath but turns yellowish when dry; midrib impressed above, raised beneath; secondary veins 6 - 7 pairs, mostly arcuate, raised beneath; tertiary veins forming fine reticulum, conspicuous on both sides; petioles 1.3 - 4 (-6) cm long, striate, puberulent or glabrescent. *Male flowers* 4 - 5 mm across, pale yellowish, in ferruginous tomentose slender pendulous 8 - 30 (-70) cm long racemes, arising singly or 2 - 3 together in fascicles, mostly from older axils of fallen leaves; pedicels 2 - 3 mm long, ferruginous tomentose; bracts subulate, minute. Calyx lobes ovate, acuminate, 2 - 2.5 mm long, ferruginous pubescent outside. Petals ovate-lanceolate, oblong-ovate or broadly ovate, 3 - 3.5 x 1.5 - 2 mm, ferruginous pubescent outside, glabrous inside; epipetalous scales ca 1.5 mm long, densely appressed ferruginous pilose. Stamens connate into a colum with reflexed anthers at tip; staminal tube ca 3.5 mm long, sparsely appressed pilose. *Female flowers* in much shorter racemes. Staminodes ca 1.5 mm long, inatherous, appressed pubescent, connate only at base into an annular disc. Ovary ovoid, contracted at both ends, ca 5 x 4 mm, densely ferruginous tomentose; stigma 2 (-3), flattened and reflexed. Berry globose, 1.5 - 2.5 (-3) cm across, greyish, scurfy lenticellate, crowned with knob-like remnants of stigmas. Seeds 1 (-2), ellipsoid, slightly curved, 1.5 (-2) cm long, yellowish white; aril fleshy, light yellow.

Fl. Jan. - April (July - Aug.); *Fr.* (May) July - Dec.

Distrib. India: Inland rain forests, often near streams Andaman & Nicobar Islands.

Malay Peninsula, Indonesia and New Guinea.

Notes. Since *Ryparia* Blume (1828) is considered as an orthographic variant of *Ryparosa* Blume (1825), Kurz (1873) though originally transferred *Bergsimia javanica* to *Ryparia*, the combination, according to Code is deemed to have been made under *Ryparosa*.

9. *Scolopia* Schreb., nom. cons.

Trees or shrubs, mostly evergreen; trunk and sucker shoots usually armed with simple and branched spines; branchlets of older trees usually unarmed. Leaves alternate, serrate-crenate to subentire, usually short or long acuminate at apex, 3-5-pliveined at base, coriaceous, or subcoriaceous, usually dark green and glossy above and generally glabrous, sometimes with a pair of distinct glands at lamina base or apex of petiole; basal primary and secondary veins upturned, gradually diminishing apically to join superadjacent veins by a series of cross veins and give rise to branchlets to terminate in a gland beneath serrate-crenate teeth or at margin; stipules minute, caducous. Flowers normally bisexual, usually laxly arranged in axillary or terminal bracteate racemes or paniculate cymes. Sepals 5-8, imbricate, ciliolate along margins, connate at base. Petals similar to but usually narrower and alternate with sepals. Receptacles flat, hairy around the base of ovary and filaments, or glabrous, sometimes with a row of extrastaminal glands. Stamens numerous, much longer than petals, incurved in buds; anthers ovoid, dorsifixed, connective produced into an apiculate appendage; pollen tricolporate, reticulate, suboblate to subprolate. Carpels 2-4 (-5) connate into an unilocular ovary; ovules few or each placenta protruded to about middle of the locule; styles connate, rather long, persistent in fruits; stigma subcapitate, shallowly 3-lobed, each again obscurely bilobed. Berry ellipsoid or globose, apiculate, 2-3 (-20)-seeded, with withered floral appendage at base. Seeds exarillate, with abundant albumen and foliaceous cotyledons.

Tropical and subtropical Africa, S.E. Asia to N.E. Australia; ca 37 species, 4 in India.

Literature. SLEUMER, H. (1972) A taxonomic revision of the genus *Scolopia* Schreb. (Flacourtiaceae). *Blumea* 20: 25-63.

KEY TO THE SPECIES

- | | |
|---|-----------------------|
| 1a. Leaves with a pair of distinct glands at lamina base or apex of petiole | 2 |
| b. Leaves without such distinct glands at lamina base or apex of petiole | 3 |
| 2a. Quinternary veins conspicuous only on upper surface, ultimate reticulum inside areoles thus more dense on upper surface than the lower; inflorescence sparsely to densely pubescent; extrastaminal disc glands absent; anther connectives hairy | 4. <i>S. spinosa</i> |
| b. Quinternary veins not apparent on either surfaces, ultimate reticulum inside areoles thus similar on both surfaces; inflorescence practically glabrous; extrastaminal disc composed of a row of short, thick glands before petals; anther connectives glabrous | 3. <i>S. kermodii</i> |

- 3a. Leaves usually subentire, rarely repando-crenate; petioles 3 - 4 (-6) mm long; quinternary veins conspicuous only on upper surface, ultimate reticulum inside areoles thus more dense on upper surface than the lower; extrastaminal disc composed of a few to rather numerous short, thick, distinct papillae before petals **1. *S. acuminata***
- b. Leaves usually coarsely serrato-crenate to crenato-repand, rarely subentire; petioles 6 - 12 mm long; quinternary veins not apparent on either surface, ultimate reticulum inside areoles thus similar on both surfaces **2. *S. crenata***

1. *Scolopia acuminata* Clos in Ann. Sci. Nat. 4, 8: 251. 1857. *S. crenata* auct. non (Wight) Clos, 1857: Hook. f. & Thomson in Fl. Brit. India 1: 191. 1872, p. p., quoad syn. *S. acuminata* et specim. Ceylon. *S. gaertneri* auct. non Thwaites; Rama Rao, Fl. Pl. Travancore 22. 1914. *S. schreberi* auct. non Gmelin; Bourdillon, For. Trees Travancore 17. 1908. **Fig. 78.**

Mal.: *Chera-kanji*.

Trees 5 - 15 m tall; young stems and branches of older trees unarmed; branchlets puberulent. Leaves ovate-lanceolate, elliptic to elliptic-lanceolate, obtusely short or subobtusely long acuminate at apex, cuneate and somewhat inequilateral at base, subentire, rarely repando-crenate, 5 - 9 x 2 - 4.5 cm, glabrous; secondary veins 4 - 5 (-6) pairs; petioles 3 - 4 (-6) mm long. Flowers 6 - 7 mm across, pinkish white, 5 - 15 in axillary or subterminal puberulous 2 - 5 cm long racemes; pedicels 4 - 8 (-12) mm long, grey puberulous. Sepals ovate-oblong or elliptic-oblong, obtuse and ciliolate along margins, ca 2 mm long, puberulent to subglabrous outside. Petals similar to sepals, but narrowly oblong to obovate, with markedly thinner margins, 1.5 - 2 mm long. Receptacle densely hairy. Disc glands of club-shaped ca 1.5 mm long papillae, ciliolate at apex. Stamens 40 - 60; anther connectives glabrous. Ovary glabrous; style slender, ca 4 mm long. Berry ovoid-globose, apiculate, up to 1.8 cm across, green, bright scarlet when ripe.

Fl. March - April; *Fr.* May - July.

Distrib. India: S. Western Ghats at low elevations. Kerala (Kulathupuzha, 750 m, Quilon, Vivekananthan 66184 - CAL!, MH !); Peninsular India, sine loc., Herb. Wight (Kew Distrib. no. 82, p. p. (CAL !)).

Sri Lanka.

Notes. The above two collections segregated from among the specimens identified as *S. crenata* (in CAL) agrees well with the duplicates of the type of *S. acuminata* (Thwaites 1077 - 3 sheets) from Sri Lanka in CAL, especially in the venation of upper leaf surface. Plants reported as *S. pusilla* (Gaertn.) Willd. from erstwhile Travancore under the names *S. schreberi* Gmelin (Bourdillon, l. c.) and *S. gaertneri* Thwaites (Rama Rao, l. c.) represent this species.



Fig. 78. *Scolopia acuminata* Clos : a. flowering twig; b. portion of venation on upper leaf surface.

2. *Scolopia crenata* (Wight) Clos in Ann. Sci. Nat. 4, 8: 250. 1857, excl. specimen. Philippin.; Hook. f. & Thomson in Fl. Brit. India 1: 191. 1872, p.p. excl. syn. *S. acuminata*, *S. chinensis* & *S. crassipes* et specim. China, Ceylon & Philippin. *S. crenata* var. *brevifolia* N. Mukherjee in J. Bombay Nat. Hist. Soc. 69: 394. 1973. *Phoberos crenatus* Wight in Wight & Arn., Prodr. 29. 1834.

Kan.: *Kodali-mara*; Kon.: *Laban-kavanthi*; Mal.: *Caralu*, *Sarelmaram*; Tam.: *Charalu*, *Kodali*, *Terunai*.

Trees 5 - 20 m tall; bark smooth, grey, rough and pustular by raised lenticels; trunk, young stem and branches with simple or branched spines up to 3 cm long; branches of older trees unarmed; branchlets 4-angled when young, terete in age. Leaves variable, ovate, ovate-lanceolate, elliptic to elliptic-lanceolate, cuneate, attenuate, or even obtuse and usually inequilateral at base, obtusely short or subobtusely long acuminate at apex, coarsely serrato-crenate to crenato-repand, or even subentire, 5 - 15 x 2.5 - 7.5 cm, dark green and glossy above, paler beneath, glabrous; secondary veins 5 - 8 pairs; petioles 6 - 12 mm long, minutely biglandular at junction of lamina. Flowers 7 - 8 mm across, white to yellowish white, fragrant, in lax puberulous simple racemes or paniculate cymes, 2.5 - 10 cm long; pedicels 5 - 12 mm long, grey puberulous; bracts caducous. Sepals 5, ovate-oblong or elliptic-oblong, obtuse and ciliolate along margin, ca 2.5 mm long, puberulent to subglabrous outside. Petals similar to sepals, but narrowly oblong to obovate, ca 2.5 mm long. Receptacles pubescent; disc glands absent. Stamens 60 - 100; anther connectives glabrous. Ovary glabrous; style ca 6 mm long. Berry subglobose, apiculate by stylar base, 1.5 - 1.7 cm across, shiny green. Seeds 2 - 8, semilunar.

Fl. (Feb.-) March - May(-July); Fr. ripens from July - Oct.

Distrib. India: Moist deciduous and evergreen forests in Western Ghats up to 1800 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. Though no collection of *S. crenata* from Andamans could be examined, the description of the plants ('Leaves ... ovate or ovate-oblong, acute, ... glands at the insertion of the petiole, ... glandular-crenate to almost entire, ... stamens ... with yellow glands outside them ...') recorded as *S. crenata* (C. E. Parkinson, For. Fl. Andaman Is. 84. 1923) and their distribution strongly suggest it to belong to *S. kermodii*.

3. *Scolopia kermodii* C. Fischer in Bull. Misc. Inf. Kew 1935: 574. 1935. *S. burmanica* N. Mukherjee in J. Bombay Nat. Hist. Soc. 69: 391. 1973.

Trees 8 - 25 m tall; main stem armed with simple and branched, up to 3 cm long spines; branchlets of older stems usually lenticellate, unarmed and glabrous; sucker shoots and their branches armed with simple spines and somewhat puberulent in

younger parts. Leaves, ovate-, elliptic-, or oblong-lanceolate, cuneate or obtuse at base, acute, subacute, or obtusely short or long acuminate at apex, remotely serrate to entire, 7 - 20 x 1.2 - 6.5 cm, glabrous; secondary veins 7 - 9 pairs, more prominent beneath; petioles 5 - 12 mm long, with a pair of thick glands at apex. Flowers 7 - 10 mm across, white, 5 - 15 in axillary or terminal lax 4 - 10 cm long racemes; pedicels 7 - 18 mm long; bracts ovate-lanceolate, ciliolate along margins. Sepals broadly ovate to suborbicular, ciliolate along margins, ca 2 mm long. Petals similar to sepals but ovate-oblong. Disc glands numerous, short and thick. Anther connectives glabrous. Receptacle pubescent. Ovary glabrous; style ca 4 mm long. Berry ellipsoid or globose, 2 - 2.5 cm across; seeds 3 - 4.

Fl. Jan.- March; *Fr.* afterwards.

Distrib. India: Rain forests at low elevations. Andaman & Nicobar Islands. (S. Andaman Is., Rutland Is.)

Myanmar.

4. *Scolopia spinosa* (Roxb.) Warb. in Engler & Prantl, Pflanzenfam. 3, 62: 29. 1893; Thothathri in Bull. Bot. Surv. India 2: 344. 1960. *Ludia spinosa* Roxb., Fl. Ind. 2: 507. 1832. *Phoberos roxburghii* Bennett in Bennett & Br., Fl. Jav. Rar. 192. 1840, nom. illegit. (based on *Ludia spinosa* Roxb.). *S. roxburghii* (Bennett) Clos in Ann. Sci. Nat. 4, 8: 250. 1857, nom. illegit.; Hook. f. & Thomson in Fl. Brit. India 1: 190. 1832. **Fig. 79.**

Trees, 3 - 10 (-20) m tall; main stem armed with simple and branched spines up to 7 cm long, unarmed and sometimes buttressed when old; branchlets of older stems unarmed; sucker shoots and their branches armed with simple spines. Leaves elliptic, ovate-elliptic, lanceolate or oblong-lanceolate, cuneate or rounded at base, obtusely short or long acuminate, sometimes even broadly obtuse at apex, subentire to remotely crenate with a basal pair of glands, 10 - 20 (-28) x 3.5 - 8 (-14.5) cm, rose-coloured when young, turns glossy dark green, glabrous; secondary veins 4 - 6, more prominent beneath; petioles 6 - 12 mm long, puberulous when young. Flowers ca 7 mm across, pale pinkish white, fragrant, in sparsely to densely pubescent lax racemes, 2.5 - 4.5 cm long; pedicels 6 - 18 mm long, pubescent. Sepals 4 - 6, shortly connate at base, ovate, ca 2.5 mm long, softly pubescent outside, ciliolate along margins. Petals similar to sepals, but usually narrower, ovate-oblong. Disc glands absent. Receptacle pubescent. Stamens numerous; anther-connectives hairy. Ovary glabrous; styles 4 - 6 mm long; stigma minute. Berry subglobose to ovoid, 15 - 20 cm across, green, black when dry.

Fl. Jan. - April (Nov.); reported to flower in flashes throughout the year in Malesia; *Fr.* old fruits (March, May, Aug.).

Distrib. India: Inland low forests. Andaman & Nicobar Islands (Car Nicobar Is.).



Fig. 79. *Scolopia spinosa* (Roxb.) Warb. : a. flowering twig; b. portion of venation on upper leaf surface; c. flower; d. stamens, dorsal and ventral views.

Myanmar, Thailand, Indo-China and Malasia.

Notes. The leaves turn characteristically reddish brown especially beneath on drying; the primary and secondary veins are somewhat impressed above and prominently raised like ribs beneath.

CULTIVATED SPECIES

Scolopia chinensis (Lour.) Clos in Ann. Sci. Nat. 4, 8: 249. 1857.

Shrubs or small trees with strong simple 1 - 5 cm long spines, elliptic to orbicular leaves with a pair of distinct glands at lamina base. A native of Indo-china and S. China, sometimes cultivated in S. India to form impenetrable hedges.

10. *Xylosma* G. Forster, nom. cons.

Trees or shrubs, deciduous; trunks often armed with simple and branched thorns at base; branchlets usually with axillary thorns. Leaves alternate, chartaceous or subcoriaceous, crenato-serrate to subentire with glands beneath teeth or at margins, pinnately veined; stipules absent. Flowers in axillary, bracteate racemes, racemose clusters or panicles on short branches or reduced to solitary flower; pedicels articulated near insertion. Sepals 4 - 8, imbricate, scale-like, subequal, subpersistent. Petals absent. Disc fleshy, extra-staminal, of distinct glands, annular or lobed in females. *Male flowers:* Stamens numerous, often surrounded by glandular disc; anthers subglobose, basifixed; pollen tricolporate, reticulate, prolate to spheroidal. Pistillode absent. *Female flowers:* Carpels 2 (-3), connate into unilocular ovary; ovules 2 to few on 2 - 4 parietal placentae; style usually connate, rarely free or absent; stigma dilated, usually 2 - 3-lobed. Fruit small, a rather dry berry, globose; pericarp thin coriaceous. Seeds few, obovoid; aril thin; testa smooth, crustaceous; cotyledons broad.

Tropical and subtropical regions, except Africa; ca 104 species, 3 in India.

KEY TO THE SPECIES

- 1a. Leaves usually oblong-elliptic, elliptic-lanceolate or ovate-lanceolate, long-acuminate at apex, 7 - 22 cm long, pinnately veined from base 2
- b. Leaves usually broadly ovate or ovate-elliptic, not long acuminate at apex, 3 - 5 cm long, usually 3 - 5-plivined at base 1. *X. congestum*
- 2a. Leaves chartaceous, subnitidus, dark reddish brown on drying, mostly attenuate at base; secondary veins 6 - 7 pairs, abruptly curved upwards towards apex and gradually diminishing near margin; styles in fruits 0.75 - 1 mm long 2. *X. controversum*
- b. Leaves coriaceous, conspicuously glossy, blackish green above on drying, mostly cuneate at base; secondary veins 8 - 12 pairs, gradually curved upwards towards margin and branch to end near margin; styles in fruits up to 0.25 mm long or absent (stigma sessile) 3. *X. longifolium*

1. *Xylosma congestum* (Lour.) Merr. in Philip. J. Sci. 15: 247. 1919; Raizada in Indian For. 67: 16. 1941. *Croton congestum* Lour., Fl. Cochinch. 582. 1790, excl. descr. fruct.

Shrubs or trees, up to 3 m tall; stems and branches often armed with sharp stout thorns, up to 2 cm long; young shoots usually minutely hairy. Leaves broadly ovate, cuneate and usually 3 - 5-veined at base, acute or acuminate at apex, shallowly crenato-serrate along margins, 3 - 5 x 1.5 - 3.6 cm, subcoriaceous, shiny, minutely puberulent along midrib near base on both sides, elsewhere glabrous; basal primary and secondary veins together ca 5 pairs; tertiary veins together with irregularly branched quaternary veins with free endings form dense reticulum often apparent on both surfaces; petioles 3 - 5 mm long, puberulent. Flowers yellowish, 3 - 4 mm across, usually crowded in densely pubescent, axillary, bracteate racemes (sometimes 2 - 3 clustered together) 1 - 1.5 cm long; bracts lanceolate, concave, glandular along upper margin, pubescent outside; pedicels ca 2 mm long, pubescent. Sepals 4, subequal, hairy outside, ciliolate along margins, ca 2 mm long; outer ones ovate-lanceolate; inner ones suborbicular. Stamens numerous; filaments ca 3 mm long; anthers basifixed. Berry globose, ca 6 mm across, turn black on drying.

Fl. July - Aug.; Fr. Oct.

Distrib. India: Montane forests of Kumaon at 1600 m. Uttar Pradesh (Almora, Pitoragarh). Rare.

China, Taiwan and Japan.

2. *Xylosma controversum* Clos in Ann. Sci. Nat. Hist. ser. 4, 8: 231. 1857; Hook. f. & Thomson in Fl. Brit. India 1: 194. 1872. Fig. 80.

Trees, 5 - 10 m tall; bark greyish brown, fairly smooth or somewhat rough; young stem usually beset with simple thorns near base. Leaves elliptic-oblong, ovate-lanceolate or elliptic, rarely a few obovate or oblanceolate, somewhat attenuate at base, usually long acuminate at apex, shallowly and distantly glandular serrate along margins, 4 - 18 x 2.5 - 7 cm, glabrous, chartaceous, subnitidus, shiny, green, turning reddish brown on drying; secondary veins 6 - 8 pairs, abruptly curved upwards towards apex and gradually diminishing near margins; tertiary veins often conspicuously subparallel and perpendicular to midrib; ultimate reticulum fine and usually prominent beneath; petioles 5 - 10 mm long, glabrous. Flowers ca 4 mm across, in axillary pubescent bracteate panicles, up to 4 cm long; pedicels ca 2 mm long, hairy. Sepals 4 (-5), subequal, 1.5 - 2 mm long, broadly ovate to ovate-orbicular, ciliate, puberulent outside, densely appressed pubescent inside. Disc fleshy, 4 - 8-lobed, glandular, extra-staminal. *Male flowers*: Stamens 25 - 40, exserted; filaments filiform; anthers subglobose, basifixed; pistillode absent. *Female flowers*: Ovary sessile on disc, ovoid, ca 1 mm long, glabrous with a distinct style of 0.75 - 1 mm long; stigmas 2 - 3-lobed. Berries globose, ca 4 mm across,

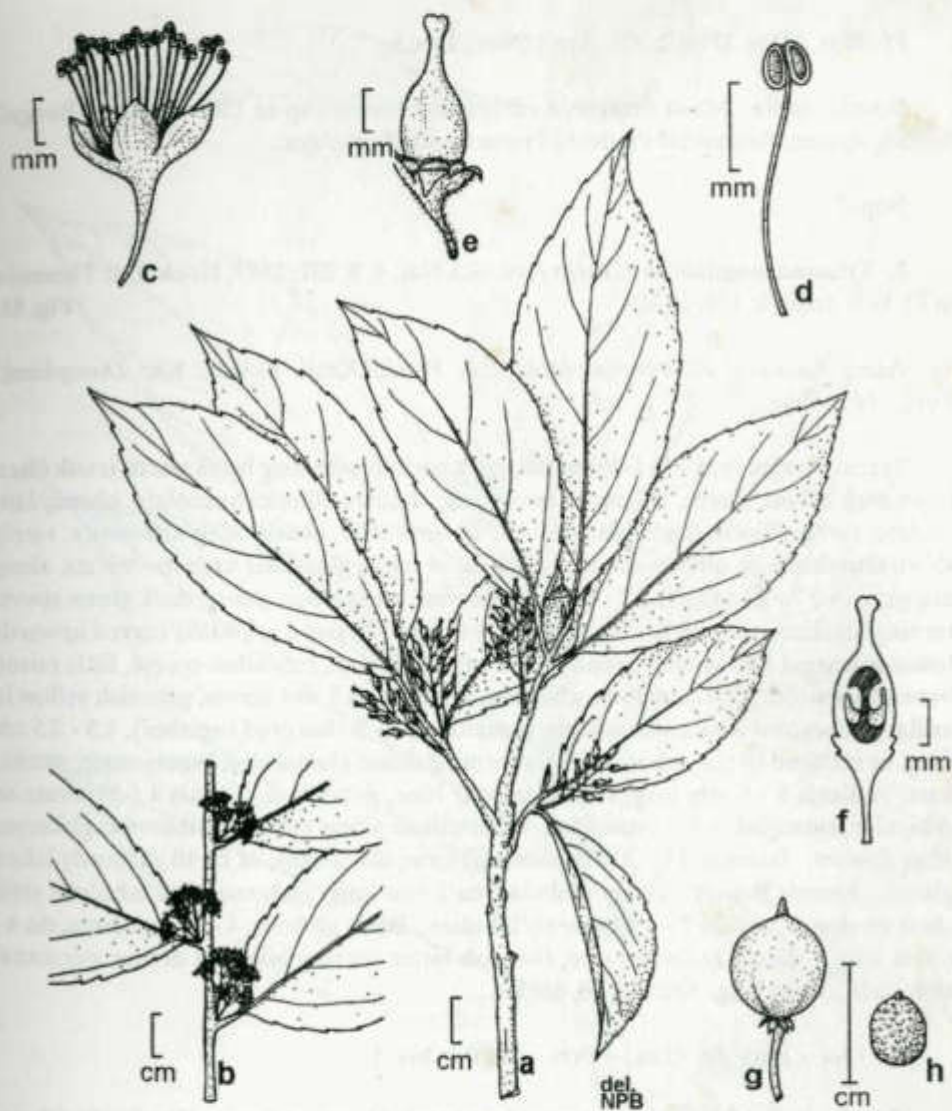


Fig. 80. *Xylosma controversum* Clos : a. branch with female flower; b. branch with female flowers; c. male flower; d. stamen; e. female flower; f. ovary, L.s.; g. fruit; h. seed.

red when ripe, turning black on drying, with a persistent style, usually 1 mm long. Seeds 2 - 8, plano-convex, smooth, shiny.

Fl. Nov. - Dec. (Feb.); *Fr.* April (Nov., Dec.).

Distrib. India: Moist evergreen subtropical forests, up to 1500 m. West Bengal, Sikkim, Assam, Arunachal Pradesh, Tripura and Meghalaya.

Nepal.

3. **Xylosma longifolium** Clos in Ann. Sci. Nat. 4, 8: 231. 1857; Hook. f. & Thomson in Fl. Brit. India 1: 194. 1872. Fig. 81.

Asm.: *Kata-koli, Kata-ponial, Mota-koli*; *Hindi:* *Katai, Kattari*; *Kh.:* *Dieng-kani*; *Punj.:* *Chirunda*.

Trees, evergreen, 5 - 15 (-20) m tall; bark smooth with long black warts; trunk often beset with robust thorns, 2.5 cm or more long. Leaves elliptic-lanceolate, oblong-lanceolate, rarely elliptic, ovate-lanceolate or oblanceolate, usually long-acuminate, rarely short-acuminate or obtuse at apex, cuneate at base, glandular crenato-serrate along margins, (5-) 7 - 22 x (1.8-) 2.5 - 6.5 cm, glabrous, coriaceous, glossy, dark green above, turning blackish green on drying; secondary veins 8 - 12 pairs, gradually curved upwards towards margin and branch to end near margin; ultimate reticulum coarse, little raised beneath; petioles 5 - 10 mm long, glabrous. Flowers ca 5 mm across, greenish yellow in axillary pubescent bracteate racemes (sometimes 2 - 3 clustered together), 1.5 - 2.5 cm long, or reduced to corymbose clusters forming dense glomerules; bracts ovate, acuminate; pedicels 3 - 6 mm long, articulate near base, pubescent. Sepals 4 (-5), ovate or orbicular, subequal, 1.5 - 2 mm long, crose-ciliate along margins, otherwise glabrous. *Male flowers:* Stamens 15 - 20; filaments filiform; disc fleshy, of ca 10 shallowly lobed glands. *Female flowers:* Ovary globular, ca 1 mm long, glabrous; disc lobulate; style short or absent; stigma 2 - 3, obscurely lobulate. Berry globose, 4 - 7 mm across, on 4 - 6 mm long pedicels, red when ripe, sweetish bitter, turning black on drying; persistent style ca 0.25 mm long. Seeds 3 - 8, angled.

Fl. Oct. - Jan.; *Fr.* (Jan. -) Feb. - April (- May).

Distrib. India: Moist evergreen ravines in sub-Himalayan zone, Khasi hills, Chotanagpur plateau and E. Ghats, up to 1500 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Arunachal Pradesh, Assam, Meghalaya, Manipur, Tripura, Orissa, Andhra Pradesh and Tamil Nadu (Nilgiri hills),

Pakistan, Nepal, Indo-china, Thailand and China.



Fig. 81. *Xylosma longifolium* Clos : a. flowering twig; b. flower; c. *X. controversum*, leaf showing secondary and tertiary veins.

PITTOSPORACEAE

(M. P. Nayar and G. S. Giri)

Trees, shrubs or sometimes climbers, rarely epiphytic, evergreen, usually with lenticels and rarely with spines. Leaves spirally arranged, alternate or whorled, often crowded at ends of branches, entire or rarely sinuate-toothed, petiolate, rarely sessile, exstipulate, simple, penninerved. Inflorescence axillary, terminal or pseudoterminal or lateral, mostly in thyrses, rarely simple cymes or corymbs, bracteate. Flowers actinomorphic, bisexual, rarely functionally unisexual, pedicellate. Sepals 3 - 5, free or connate to various degrees. Petals 3 - 5, free, rarely basally coherent, imbricate. Stamens 3 - 5, free, alternipetalous, episepalous, erect; filaments filiform-subulate, free or sometimes connivent below; anthers erect, oblong, basifixed, introrse; loculi 2, parallel, opening by longitudinal slits or rarely by 2 apical pores; disc absent or rarely present. Ovary superior, sessile or stipitate, 1-loculed, sometimes completely or incompletely 2 - 5-locular due to the projection of placentae; carpels 2 (3 - 5); placentae 2 - 5, parietal or basal, rarely axile; style simple, short or long, glabrous; stigma apical, capitate, thickened or obscurely 2 - 5-lobed; ovules 2 to many in each locule, parietal or basal, anatropous. Fruits 2 - several valved, loculicidal or sometimes septicidal capsules or berries, rarely dry and indehiscent, usually containing viscous pulp; seeds 2 - many, erect, rarely winged; embryo minute, linear; endosperm copious, firm-fleshy.

Tropical and subtropical regions of Old World, Africa,

Asia, Australia and the New Zealand; 9 genera and ca 250 species, 1 genus and 11 species in India.

Literature. NAYAR, M. P. & G. S. GIRI (1980) Pittosporaceae. In: Fasc. Fl. India 6: 1 - 15.

Pittosporum Banks ex Solander, nom. cons.

Trees, shrubs or undershrubs, erect, sometimes epiphytic, often aromatic; branching forked or verticillate. Leaves exstipulate, simple, alternate or whorled, often crowded in pseudo-whorls towards ends of branches. Inflorescence umbels, corymbs or panicles, terminal, pseudoterminal or lateral in axils of fallen leaves, rarely flowers solitary. Flowers bisexual, at times functionally unisexual. Sepals 5, free or coherent at base, recurved above. Petals 5, generally ligulate, free or connivent up to or beyond the middle in lower part; free segments recurved or spreading. Stamens 5, free, alternating with petals, occasionally coherent with corolla-tube; anthers dorsifixed, introrse, opening by longitudinal slits, much shorter than filaments. Ovary sessile or stipitate, uni-

locular or incompletely 2 - 5-locular with parietal placentae or rarely with placentae intruding to the middle; style glabrous; stigma capitate. Capsules 2 - 3-valved, globose, ellipsoid or obovoid; valves thin or woody of varying thickness, transversely ribbed or striate inside; seeds 2 to many, embedded in viscid, resinous pulp, irregularly angular, compressed, wrinkled or smooth, reddish or blackish.

Tropical and subtropical regions of Old World, Africa, Asia, Australia and New Zealand; ca 100 species, 11 species in India.

Literature. GOWDA, M. (1951) The genus *Pittosporum* in Sino-Indian region. *J. Arn. Arb.* 32: 263 - 343. 1951.

KEY TO THE SPECIES

- | | |
|--|-----------------------------------|
| 1a. Capsules 3-valved | 9. <i>P. podocarpum</i> |
| b. Capsules 2-valved | 2 |
| 2a. Inflorescence glabrous | 3 |
| b. Inflorescence puberulous or tomentose | 5 |
| 3a. Leaves verticillate, 3-nate towards ends of branches, linear-lanceolate, attenuate at apex; inflorescence simple, umbellate | 1. <i>P. anamallayense</i> |
| b. Leaves alternate, loosely crowded at ends of branches, ovate to broadly elliptic or oblanceolate, obtuse to acuminate at apex; inflorescence paniculately umbellate or sometimes simple racemes | 4 |
| 4a. Leaf-apex obtuse or rounded; peduncles equal to or longer than the subtending leaves | 2. <i>P. ceylanicum</i> |
| b. Leaf-apex acute or acuminate; peduncles shorter than subtending leaves | 8. <i>P. neelgherrense</i> |
| 5a. Valves of capsules thin and coriaceous; funicles basal or suprabasal | 6 |
| b. Valves of capsules thick and woody; funicles distributed up to middle of the placenta | 8 |
| 6a. Inflorescence few-flowered; flowers usually less than 10 in each inflorescence | 10. <i>P. tetraspermum</i> |
| b. Inflorescence many-flowered; flowers 10 to 50 or more per inflorescence | 7 |
| 7a. Leaves small, 3 - 7 x 0.8 - 1.2 cm, narrowly lanceolate; ovary glabrous | 6. <i>P. humile</i> |
| b. Leaves large, 5 - 20 x 2 - 8 cm, elliptic-oblong or elliptic-lanceolate or oblong-lanceolate; ovary pubescent | 7. <i>P. napaulense</i> |
| 8a. Stems and leaves glabrous | 11. <i>P. viridulum</i> |
| b. Stems and leaves rusty tomentose | 9 |
| 9a. Flower buds ovate, 4 - 6 mm long; sepals narrowly lanceolate | 5. <i>P. ferrugineum</i> |
| b. Flower buds oblong, 8 - 9 mm long; sepals triangular or ovate-lanceolate | 10 |
| 10a. Leaves elliptic or elliptic-lanceolate, 5 - 14 x 2 - 3 cm, broad at the middle | 3. <i>P. dasycaulon</i> |
| b. Leaves broadly oblong-obovate, oblong-oblancheolate, 6 - 8 x 3 - 5 (-9) cm, broad above the middle | 4. <i>P. eriocarpum</i> |

1. *Pittosporum anamallayense* Nayar & Giri in *Fasc. Fl. Ind.* 6: 4, ff. 1 - 5. 1980.

Fig. 82.

Shrubs. Leaves verticillate, linear-lanceolate, cuneate at base, attenuate at apex,

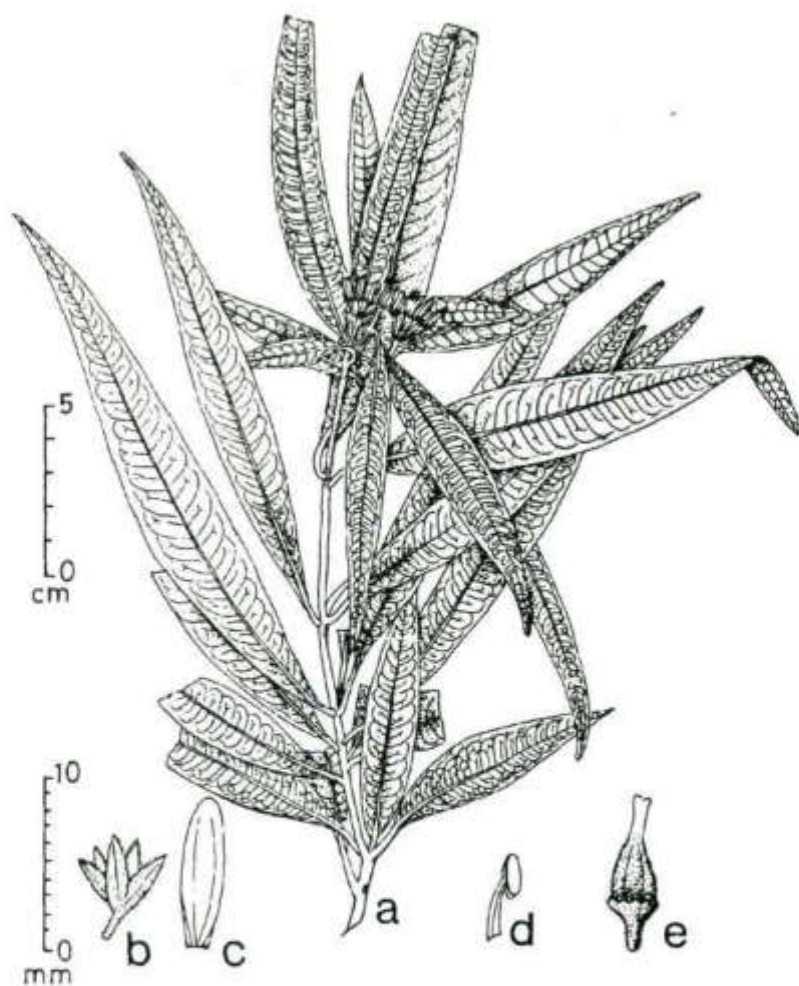


Fig. 82. *Pittosporum anamallayense* Nayar & Giri : a. branch with flowers; b. calyx; c. petal; d. stamen; e. pistil.

entire, 10 - 20 x 1.5 - 2.3 cm, membranous; lateral nerves 19 - 20 pairs, transversely horizontal, distinct beneath; petioles 8 - 12 mm long. Inflorescence terminal, umbellate; flower buds 4 - 6 mm long, glabrous; pedicels 8 - 12 mm long, puberulous or glabrous; bracts linear, 4 - 5 mm long, puberulous. Sepals 5, free, ovate-lanceolate, acuminate, 3 - 3.5 x 1 mm, puberulous or glabrous outside. Petals 5, oblong, obtuse or rounded at apex, 8 - 8.5 x 1.5 - 2 mm. Stamens 5; filaments ca 3 mm long; anthers ca 2 mm long. Ovary ca 2 mm in diam., densely tomentose; style minutely puberulous; stigma inconspicuously 2-fid. Capsules not seen.

Distrib. India: Tamil Nadu (Anamalai Hills).

Endemic.

Notes. Holotype and isotypes collected by R. H. Beddome from Anamalai Hills (ca 1500 m) are in MH. It is allied to *P. tetraspermum* Wight & Arn. but differs in having linear-lanceolate leaves in whorls of threes and 19 - 20 pairs of horizontal lateral veins and longer acuminate sepals. It can be superficially confused with *P. podocarpum* var. *angustatum* Gowda by the linear-lanceolate leaves but can be readily recognised by the horizontal lateral veins placed almost at right angles to the midrib and free sepals.

2. *Pittosporum ceylanicum* Wight, *Illus.* 1: 173. 1839; Hook. f. & Thomson in *Fl. Brit. India* 1: 198. 1872.

Shrubs or small trees, 4 - 8 m tall with warty bark; stems lenticellate, glabrous. Leaves crowded at ends of branches, alternate, oblong-elliptic, obovate-oblancoate, much tapering towards base, slightly obtuse or rounded at apex, sometimes acute, often rather recurved along margins, 4 - 9 x 1 - 2.5 cm, membranous, glabrous; petioles 5 - 18 mm long, glabrous. Inflorescence terminal or pseudo-terminal, in peduncled paniculately compound umbels, glabrous; peduncles 4 - 6.5 cm long; pedicels 5 - 8 mm long; flower-buds oblong, 5 - 8 mm long; flowers bisexual, light yellowish. Sepals ovate-lanceolate, subacute at apex, ca 3 x 1 - 1.5 mm, minutely ciliate along margins. Petals linear-oblong, obtuse at apex, 8 - 10 x 2 mm. Filaments ca 5 mm long; anthers oblong, 1 - 1.5 mm long. Ovary ca 3 mm in diam., densely brown tomentose; ovules 8; styles 4 - 5 mm long, glabrous. Capsules subglobose, 9 - 14 mm long, subcompressed, yellowish, black when dry; valves woody, resinous, hard, with a strong mango-like smell; seeds 6 - 8, angular, orange-red, pulpy.

Fl. & Fr. Mar. - June.

Distrib. India: Tamil Nadu (Nilgiri Hills at Dodabetta Peak).

Sri Lanka.

3. *Pittosporum dasycaulon* Miq., Anal. Bot. Ind. 3: 5. 1850; Hook. f. & Thomson in Fl. Brit. India 1: 199. 1872. Fig. 83.

Kan.: *Boogri*; Mar.: *Gapsundi*.

Small trees; young branches densely tomentose. Leaves cuneate at base, acute at apex, entire; petioles 8 - 18 mm long, puberulous. Inflorescence terminal or pseudoterminal, umbellate or racemose, densely brownish tomentose. Sepals 2 - 3 x 1 mm, tomentose. Petals oblong, 10 - 12 x 2 - 2.5 mm, yellow. Filaments 6 - 7 mm long; anthers ca 2 mm long. Ovary ca 3 mm long, densely tomentose; style 4 - 5 mm long, glabrous. Capsules globose, 8 - 10 mm in diam., woody; seeds 4 - 6, black or pinkish black.

Fl. & Fr. Sept. - Feb.

Distrib. India: Shola forests of Western Ghats, above 800 m. Maharashtra, Karnataka and Kerala.

Endemic.

Notes. An extract of the stem bark shows antibacterial and antifungal properties (Bhatnagar et al. in Indian J. Med. Res. 49: 799. 1961).

4. *Pittosporum eriocarpum* Royle, Illus. Bot. Himal. 1: 77. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 199. 1872.

Hindi: *Garsilug, Garshuma, Meda-tumra*; Nep.: *Kakria*.

Shrubs or small trees; branches densely tomentose. Leaves cuneate at base, acute to acuminate at apex, entire; petioles 15 - 20 mm long, tomentose. Inflorescence paniculately corymbose; peduncles 2 - 4 cm long; flowers yellow. Sepals ca 2 x 1 mm, pilose. Petals oblong, 9 - 10 x 2 - 2.5 mm. Filaments slender, ca 5 mm long; anthers 2 - 2.5 mm long. Ovary ca 2 mm long, ovoid, densely tomentose; style ca 3 mm long; stigma capitate. Capsules large, 12 - 15 mm in diam., densely pilose tomentose; seeds many, blackish red.

Fl. Mar. - May; *Fr.* Apr. - Oct.

Distrib. India: Uttar Pradesh in Garhwal Himalayas.

Endemic.

Notes. The bark is aromatic when freshly cut and is said to possess narcotic properties and is used in chronic bronchitis.



Fig. 83. *Pittosporum dasycaulon* Miq.: a. fruiting twig; b. flowering twig.

5. *Pittosporum ferrugineum* Aiton, Hort. Kew. ed.2: 27. 1811; Hook. f. & Thomson in Fl. Brit. India 1: 199. 1872.

Trees, 10 - 20 m tall, branching trifurcately; bark warty with prominent light brown lenticels; young branches and leaves densely ferruginous tomentose. Leaves spirally arranged, slightly crowded towards ends of branchlets, elliptic, narrowly obovate or ovate-lanceolate, acute to cuneate at base, acute to acuminate at apex, entire and slightly revolute and wavy along margins, 5 - 10 (-15) x 2 - 4 (-5) cm, glabrescent; lateral nerves 6 - 10 pairs, finely reticulate; petioles 1 - 2 cm long, channelled above. Inflorescence terminal, subumbellate or dense corymbose, rusty puberulous; peduncles 1 - 3 cm long, pubescent; pedicels 3 - 4 mm long; flowers bisexual or functionally unisexual, white or pale green. Sepals free or slightly connate at base, narrowly lanceolate, acuminate at apex, ca 3 mm long, puberulous outside, subglabrous inside. Petals free, linear-lanceolate, widened towards apex, 4 - 6 mm long, distinctly 3-nerved. Filaments linear, subulate, 3 - 5 mm long, glabrous; anthers oblong, sagittate, 1 - 1.5 mm long. Ovary subsessile, oblong, up to 3 mm long, densely brown-tomentose; styles short, stout, 1 - 1.5 mm long, glabrous. Capsules globose-ellipsoid, slightly compressed on sides, generally notched and mucronate at tip, 8 - 12 mm in diam, orange-red when fresh, black and warty when dry, densely tomentose; valves 2, rather thin; funicles short, inserted up to half-way on the valves; seeds 8 - 24, scarlet-red, 3 - 4 mm long, embedded in very viscid bright red fluid, becoming brown when dry.

Fl. Feb. - Aug.; *Fr.* Apr. - Dec.

Distrib. India; Seashores, swamp forests and secondary forests, up to 1500 m. Andaman & Nicobar Islands.

Sri Lanka, Myanmar, Thailand and Malaysia to Australia.

Notes. Leaves and fruits are used as fish poison.

6. *Pittosporum humile* Hook. f. & Thomson in Fl. Brit. India 1: 198. 1872.

Shrubs or undershrubs, bushy, 1 - 2 m tall; bark greyish; branchlets lenticellate, glabrescent; young parts glabrous. Leaves narrow-lanceolate, cuneate at base, acute or gradually acuminate at apex, entire and recurved along margins, 3 - 7 x 0.8 - 1.2 cm, coriaceous, glabrous, dark green and glossy above, pale beneath; secondary nerves oblique, faint; tertiaries impressed above, finely reticulate; petioles 5 - 10 mm long, channelled above. Inflorescence terminal or upper axillary, 2 - 5-flowered, racemose; peduncles up to 1.5 cm long; pedicels up to 5 mm long; bracts lanceolate, 5 - 6 x 1 - 1.5 mm, pubescent, often glandular ciliate; flower-buds 4 - 5 mm long. Sepals free, broadly lanceolate, oblong or ovate-lanceolate, acute or obtuse, ca 2.5 mm long. Petals free, oblong, strap-shaped, recurved at apex, 6 - 7 x 2 mm, yellowish green. Filaments ca 3 mm long, glabrous; anthers ca 2 mm long. Ovary glabrous; placenta 2; ovules several;

style ca 3 mm long, glabrous. Capsules subglobose, tipped by persistent style, rugose outside, red and horizontally striate inside; seeds 6 - 9, compressed laterally, covered by red aril, reddish black.

Fl. & Fr. April - Nov.

Distrib. India: Meghalaya.

Endemic.

Notes. Sometimes shoots smell of garlic.

7. *Pittosporum napaulense* (DC.) Rehder & Wilson in Pl. Wilson. 3: 326. 1916. *Senecia napaulensis* DC., Prodr. 1: 347. 1824. *P. floribundum* Royle, Illus. Bot. Himal. 1: 77. 1834. *P. floribundum* Wight & Arn., Prodr. 154. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 199. 1872.

Asm.: *Dieng-mulo, Shi-ing*; Hindi: *Bagh-muta, Kisan*; Kan.: *Tammatha*; Kh.: *Dieng-Duma, Dieng-thyllong*; Mar.: *Yekkuddy, Yekadia, Vikhari*; Tam.: *Kattu-sampangi, Nangundai*; Tel.: *Rakamuti*; Or.: *Debosundu*.

Shrubs or small trees, 2 - 8 m high; bark light grey, with large warty lenticels; branchlets subverticillate, often whorled. Leaves crowded at ends of branches, sometimes subverticillate, oblong-lanceolate, oblanceolate, acute to acuminate at apex, entire or slightly wavy along margins, 5 - 20 x 2 - 8 cm, subcoriaceous, glabrous; nerves impressed above; lateral nerves rather obscure, 7 - 11 pairs, oblique; petioles 1 - 2 (-3) cm long, channelled above. Inflorescence simple, umbellate, corymbose or paniculate, tomentose with white or brown hairs, glandular-pubescent; peduncles up to 3.5 cm long; pedicels up to 6 mm long; bracteoles ovate, oblong, ca 3 mm long; flowers 6 - 8 mm long, pale yellow, sweet-scented. Sepals free, broadly ovate or oblong, elliptic, 1.5 - 2.5 mm long, ciliate or not. Petals narrowly oblong, obtuse at apex, 6 - 7 x 2 mm. Filaments ca 3 mm long; anthers ca 1.5 mm long. Ovary appressed brownish-pubescent; style glabrous. Capsules globose, crowned by style remains, 2-valved, 6 - 8 mm in diam., orange-yellow; valves striate with horizontal lines; seeds 4 - 8 per capsule, covered with scarlet pulp.

Fl. & Fr. Feb. - Dec.

Distrib. India: Throughout, except Rajasthan.

Pakistan, Nepal, Bhutan, China (Tibet) and Madagascar.

Notes. The bark has ginger-like smell when freshly cut and hence often called "ginger-tree". The decoction of bark is used for skin diseases and chest infections

(Krishna & Badhwar in J. Sci. Industr. Res. 6(3), (suppl.): 41. 1947). Wood yields useful timber.

This is a highly variable species in size and shape of leaves and inflorescence. The number of seeds varies from 4 to 8 and attachment of funicles is either basal or suprabasal. There are intermediate forms and it is considered that *P. floribundum* of both Royle and Wight & Arn. are synonymous to *P. napaulense*.

8. *Pittosporum neelgherrense* Wight & Arn., Prodr. 1: 154. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 198. 1872.

Kan.: *Kushimavu*.

Shrubs or small trees, up to 3 m tall; twigs glabrous. Leaves entire, oblong-lanceolate, 3 - 8 x 2 - 4.5 cm, glabrous, coriaceous; petioles 5 - 15 mm long. Inflorescence subumbellate or in simple racemes; peduncles slender, 2 - 2.5 cm long; pedicels 8 - 15 mm long. Flowers pale yellow, fragrant. Sepals subulate, 1.5 - 2 x ca 1 mm. Petals oblong-lanceolate, obtuse or rounded at apex, 1.5 - 2 mm long, pale yellow. Filaments 3 - 4 mm long, slender; anthers 1 - 2 mm long. Ovary densely brown tomentose with 1 - 2 mm long hairs; styles ca 3 mm long. Capsules 8 - 10 mm in diam., with thick valves; seeds 4 - 8 per capsule; funicle basal to subbasal.

Fl. & Fr. Feb. - June.

Distrib. India: Shola forests of Western Ghats, above 1200 m. Karnataka, Tamil Nadu, and Kerala.

9. *Pittosporum podocarpum* Gagnepain in Notul. Syst. 8: 211. 1939. *P. glabratum* auct. non Lindley 1846; Hook. f. & Thomson in Fl. Brit. India 1: 198. 1872.

Kh.: *Dieng-thyllong, Dieng-sanyar-um, Dieng-lo-shiring-synrang, Dieng-soh-tyllul*.

Shrubs, 1 - 3 m tall; bark light grey to blackish; branchlets often whorled; young shoots and inflorescence covered with tufted glandular hairs. Leaves opposite or whorled, some alternate, oblong-lanceolate, elliptic, oblanceolate or linear-lanceolate, attenuate at base, acuminate or acute at apex, entire, 3 - 22 x 1 - 3.5 cm, glossy above, glabrous, coriaceous; lateral nerves oblique, faint, impressed above; petioles channelled, 5 - 16 mm long. Inflorescence subumbellate, or single-flowered; flowers with short stamens usually solitary, flowers with long stamens subumbellate; plants polygamodioecious; pedicels slender, 6 - 12 mm long. Sepals ovate, 2 - 3 mm long, glandular hairy. Petals clawed and coherent at base into a tube, sometimes free, 8 - 16 mm long; limb obovate-oblong, subacute, slightly hairy. Filaments 4 - 9 mm long; anthers oblong or shrivelled, apiculate, ca 2.5 mm long, opening by slits. Ovary globose or linear-oblong, densely tomentose; ovules many; style 3.5 - 5 mm long; stigma capitate. Capsules

obovoid, ovoid, oblong or ellipsoid, narrowed at base, tipped by persistent style base, 2 - 3.5 x 1.5 cm; valves wrinkled, prominently striate inside; seeds somewhat compressed, faceted ventrally, ca 8 x 5 mm, reddish, remaining attached by funicles long after dehiscence.

KEY TO THE VARIETIES

- | | |
|--|-----------------------------|
| 1a. Leaves linear-lanceolate, 6 - 22 x 1 - 2.5 cm | 9.1. var. <i>angustatum</i> |
| b. Leaves oblanceolate or elliptic-lanceolate, 5 - 16 x 2 - 3.5 cm | 9.2. var. <i>podocarpum</i> |

9. 1. var. *angustatum* Gowda in J. Arn. Arb. 32: 295. 1951.

This variety is also allied to *P. glabratum* var. *neriifolium* Rehder & Wilson of China, but differs in having dense tomentose ovary.

Fl. & Fr. Mar. - July.

Distrib. India: Nagaland, Manipur and Meghalaya.

Endemic.

9. 2. var. *podocarpum*

Fl. & Fr. Mar. - Dec.

Distrib. India: E. Himalayas and N.E. India, 1000 - 2000 m. Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Myanmar, Vietnam and China.

Endemic.

10. *Pittosporum tetraspermum* Wight & Arn., Prodr. 1: 154. 1834; Hook. f. & Thomson in Fl. Brit. India 1: 198. 1872.

Kan.: *Kuyimavu*; Mal.: *Kachapatta*, *Kaccapatta*; Tam.: *Sunari*.

Shrubs or small trees, branching dichotomously or in a whorl at top; young branches puberulous, young leaves and inflorescences ferruginous hirsute. Leaves densely crowded at ends of branches, subverticillate, ovate-oblong, acute at base, subacute or obtuse at apex, entire or sometimes revolute along margins, 4 - 8 x 1.5 - 4 cm, puberulous in juvenile state, coriaceous or glabrous when mature; petioles 4 - 10 mm long, slender. Inflorescence pseudoterminal in umbellate or subumbellate cymes, 4 - 8-flowered in each, puberulous, subsessile or on up to 10 mm long peduncles. Flowers bisexual,

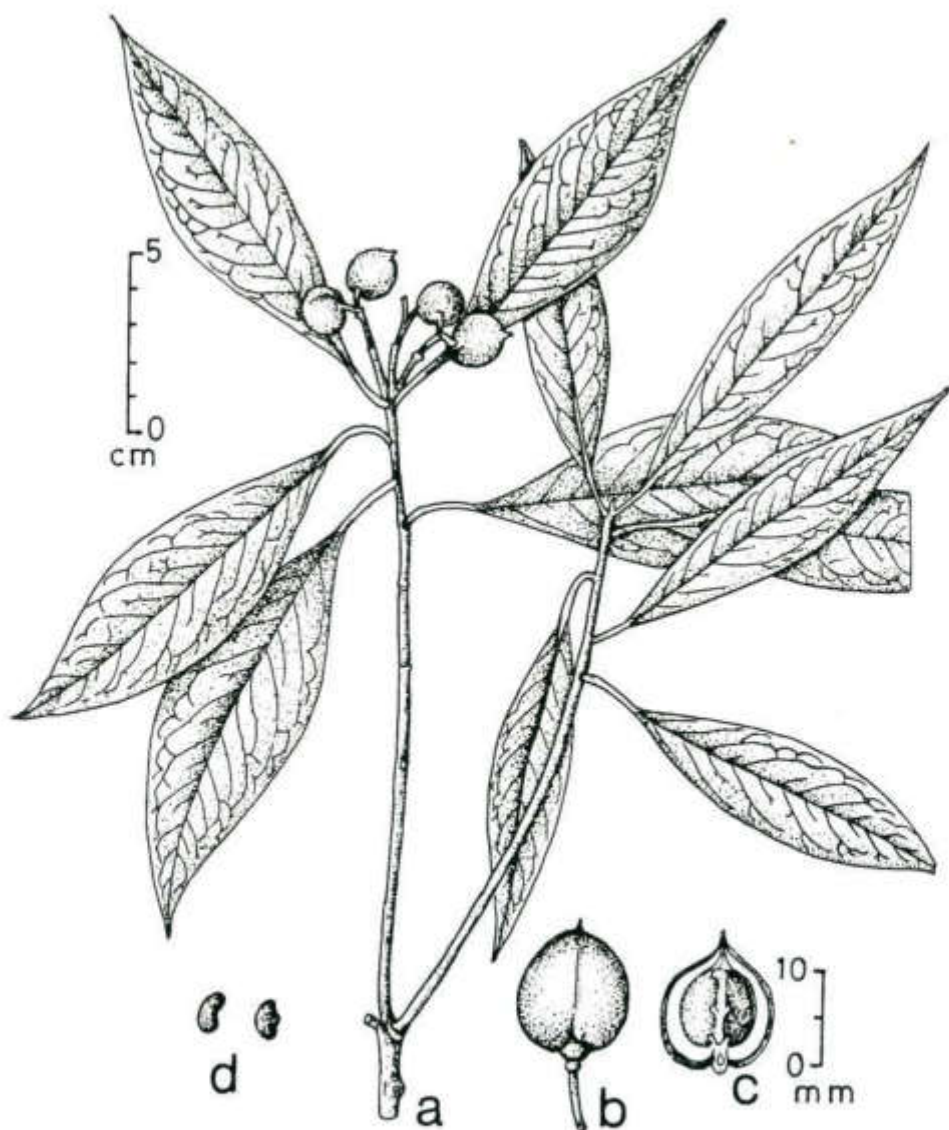


Fig. 84. *Pittosporum viridulum* Nayar et al.: a. branch with capsules; b. capsule; c. valve of the capsule, showing funicles; d. seeds.

yellowish-green; buds oblong, 8 - 10 mm long; pedicels up to 1 cm long, puberulent. Sepals free, triangular-subulate, 2 - 3 x 1 mm, pubescent, ciliate along margins. Petals linear-oblong or strap-shaped, 6 - 10 x 2.5 mm. Filaments erect, 2.5 - 3 mm long; anthers 1.5 - 2 mm long, yellowish green. Ovary ovoid-oblong, up to 3 mm long, densely brown-tomentose; ovules 4 per ovary; styles up to 2 mm long, glabrous. Capsules subglobose, tipped by withered style, ca 1 cm diam.; valves 2, rather thin, striate inside; seeds 4 per capsule, subtrigonal, dark red with an orange-red aril and sticky pulp.

Fl. & Fr. Feb. - Dec.

Distrib. India: Shola forests of Western Ghats, near streams and disturbed areas, 1200 - 2500 m. Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

11. *Pittosporum viridulum* Nayar et al. in *Fasc. Fl. India* 6: 11, ff. 1 - 4. 1980.
Fig. 84.

Small trees. Leaves elliptic or elliptic-lanceolate, acuminate at apex, cuneate at base, entire, 8 - 12 x 2 - 4 cm; lateral nerves 9 - 12 pairs, distinct beneath; petioles 10 - 18 mm long, channelled above, glabrous. Infrutescence terminal, pseudo-umbellate, puberulous. Capsules slightly compressed with stout-mucronate beak, pitted outside, 9 - 13 mm in diam.; valves yellowish green, thick; funicles with 4 attachments at the base and 4 at the middle; seeds 6 - 8, irregularly angled, reddish brown.

Fr. Aug. - Sept.

Distrib. India: Tamil Nadu (Nilgiri Hills).

Endemic.

Notes. The species is allied to *P. dasycaulon* but differs in having glabrous branches, leaves and capsules; leaves remaining greenish on drying and the capsules with 1.5 - 3 mm long mucronate beak.

POLYGALACEAE

(R. N. Banerjee)

Herbs, shrubs or woody climbers, rarely small trees, saprophytes or parasites. Leaves simple, entire, alternate, rarely opposite, distichous or rarely (partly) verticillate or whorled or reduced to scales or absent, pinnately nerved, exstipulate or rarely spinosely or discoidly stipulate. Inflorescences axillary or terminal, racemes, spikes or panicles or flowers solitary. Flowers bisexual, zygomorphic, basically 5-merous, 3-bracteate. Sepals 5 or rarely 4, imbricate in bud, free or rarely partly or entirely connate, the 2 inner ones mostly larger, petaloid, wing-like, deciduous or persistent. Petals 3, free or variously connate, sometimes minute and scale-like or absent; the upper 2 free or basally connate to staminal tube, the lowermost one keeled, boat-shaped, often with a dorsal 2- many lobed crest or appendage at beneath the top, rarely absent. Stamens basically 10, usually 8 (rarely 2 - 7) in 2 rows, monadelphous; sheath split above, often adnate to petals; anthers small, 1-loculed or rarely 2-loculed, basifixed, sessile or filamented, dehiscing by an apical or subapical pore or often by longitudinal or tangential slits. Disc absent or well-developed, annular or sometimes represented by intrastaminal glands. Ovary 2-carpelled, 2-locular, rarely 1-locular; style 1, curved; stigma entire or lobed; ovules 2, one in each on pendulous or axile placenta. Fruit a loculicidal capsule, 2-loculed, rarely seemingly 1-loculed, a samara, drupe, nut or berry. Seeds 2, arillate and sometimes strophiolate, often pilose; embryo straight, as long as the endosperm; cotyledons moderately thick, 1.5 - 3 times wider than radicle; endosperm copious, moderate or rarely absent.

Cosmopolitan, centred in American and African tropics; 12 genera and ca 800 species, 4 genera and 31 species in India.

Literature. CHODAT, R. (1890) Monographia Polygalacearum. Mem. Soc. Phys. Hist. Nat. Geneva. Suppl. 7: 1 - 143, tt. 1 - 12; *ibid.* 31: 1 - 500, tt. 1 - 23. 1893. DAR, M. I. (1973) Polygalaceae. In: *Fl. W. Pakistan* 52: 1 - 11. MEUDEN, R. van der (1988) Polygalaceae. In: *Fl. Males. I*, 10: 455 - 539, ff. 1 - 26.

KEY TO THE GENERA

- 1a. Low herbs; flowers sessile, in spikes; sepals equal or subequal in shape and size; keel petals without appendages; stamens 3 - 6; fruits sessile; seeds glabrous 2
- b. Tall herbs, shrubs or climbing shrubs; flowers pedicellate in racemes or panicles; sepals unequal in shape and size, 2 inner sepals much larger than outer ones and concolourous with the petals; keel petal with a dentate or lobed crest or without laciniate appendages at apex; stamens 8; fruits pedicellate; seeds pilose 3

- 2a. Saprophytic plants with minute scale-like non-green leaves; stamens 2 - 4 or 5; style straight or slightly curved; fruit enclosed by calyx, slightly compressed, inermous, with pellucid pericarp, indehiscent
1. *Epirixanthes*
- b. Autotrophic plants with green leaves; stamens 4 - 5 or 6; style sigmoid; fruit not enclosed by calyx, flattened, dehiscing along the muricate margin
3. *Salomonina*
- 3a. Robust shrubs; flowers panicled; ovary 1-ovuled; fruit samaroid or winged; seed 1, exarillate and ecarunculate
4. *Securidaca*
- b. Herbs or non-climbing shrubs; flowers racemed; ovary 2-ovuled; fruits capsular; seeds 2, with aril or caruncle
2. *Polygala*

1. *Epirixanthes* Blume

Herbs, annuals, erect, saprophytic, yellow, brown or violet. Leaves absent or minute, scale-like, appressed, spirally arranged, ovate or oblong-ovate. Flowers minute in terminal dense spikes, bracteate and minutely bracteolate. Sepals 5, persistent, free or connate, subequal. Petals 3, connate for about halfway or less, adnate to staminal sheath in lower half; the lowermost one (keel) broader than others, strongly vaulted without a crest; lateral ones somewhat longer and less vaulted. Stamens 2 - 4 or 5, monadelphous; tube adnate to corolla-tube; anthers opening by terminal pore. Ovary 2-loculed; locules 1-ovuled; style short or filiform, straight or slightly curved. Fruit enclosed by accrescent calyx, slightly compressed, inermous, indehiscent; ripe pericarp pellucid. Seeds black, glabrous, without a caruncle.

India, Bangladesh, Malaysia and Indonesia; 3 species, 1 in India.

Epirixanthes elongata Blume, Cat. Gew. Buitenz. 25. 1823. *Salomonina aphylla* Griffith in Proc. Linn. Soc. 1: 221. 1844 & in Trans. Linn. Soc. 19: 342. 1845; Bennett in Fl. Brit. India 1: 207. 1872. Fig. 85.

Herbs, slender, 6 - 25 cm high, simple or sparingly branched above, terete, reddish to violet, glabrous to puberulent; roots much-branched, deep lying stems with rigid erect branches, glossy, violet or yellowish brown. Leaves sessile, scaly, ovate-lanceolate, broad at base, acute to acuminate at apex, 1.2 - 1.7 mm long, ca 1 mm wide, violet or yellow; lower ones bearing vegetative buds with imbricating scales in axils; upper ones almost erect. Spikes terminal, rather dense-flowered, conical or cylindrical, acute or rather obtuse at apex, 2 - 9 cm long, fertile portion 1 - 3.5 cm long, fruiting part 2.5 - 3 mm thick; bracts ovate, acuminate, ca 1 mm long, early caducous, yellowish white with a violet median streak or blotch. Flowers 1.5 - 2 mm long, cream-yellow, ovoid-globose in bud. Sepals free, subequal, ovate to elliptic-ovate, ca 1 x 0.5 mm. Petals 3, narrowly lanceolate, 1.5 - 2 mm long, up to 0.7 mm wide, yellowish white. Stamens 4 - 5, monadelphous; anthers rounded, sessile at mouth of hyaline tube of filaments. Ovary sessile, laterally compressed, 1 - 2 mm in diam., glabrous, 2-ovuled; style slightly curved, 0.5 - 1.2 mm long, thin, equal to ovary or somewhat longer; stigma globose, dark red. Capsules

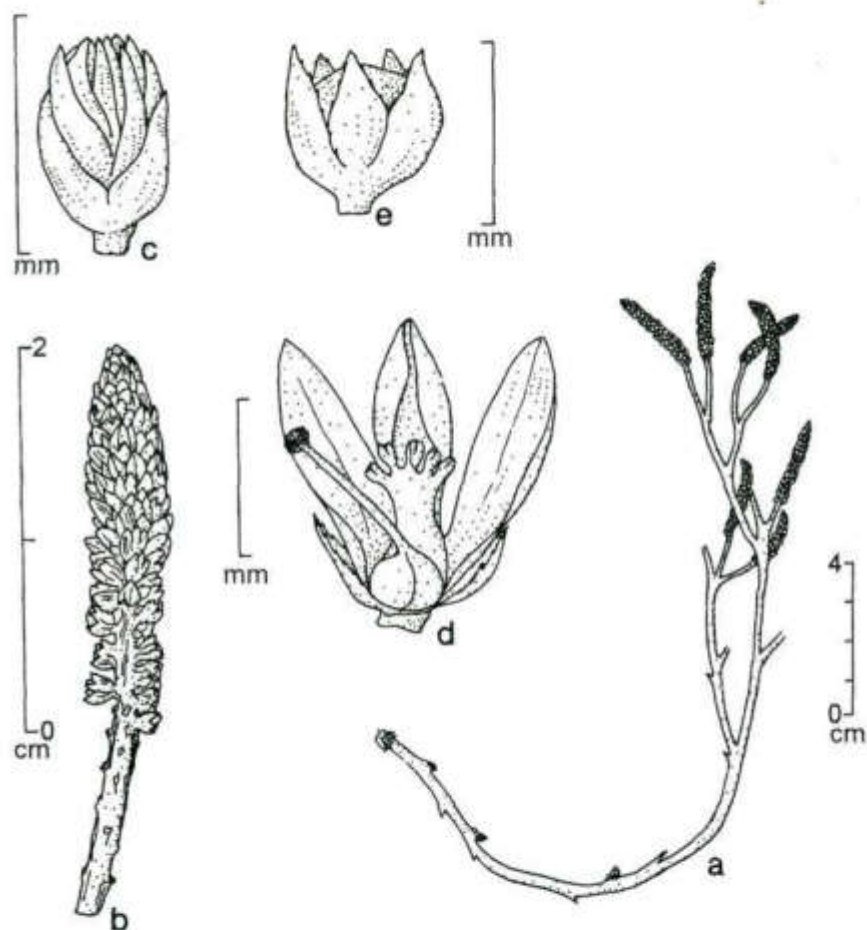


Fig. 85. *Epirixanthes elongata* Blume : a. habit; b. flowering spike; c. vegetative bud; d. flower with calyx and corolla split open; e. fruit, enclosed in calyx.

ellipsoid to broadly obcordate, slightly shorter than and enclosed by sepals, ca 1 mm wide. Seeds ellipsoid, shiny black, glabrous.

Fl. & Fr. Sept. - Dec.

Distrib. India: Shaded humid localities, in humus-rich soils, up to 1200 m. Assam, Meghalaya and Mizoram.

Bhutan, Bangladesh, Myanmar and Malaysia.

Notes. Joseph (in Bull. Bot. Surv. India 12: 73. 1970 & Fl. Nongpoh and Vicinity, p. 37. 1982) reports it from Nongpoh, along the northern slopes of Meghalaya towards Guwahati, with descriptions and illustrations.

2. *Polygala* L.

Herbs, shrubs or treelets, sometimes spiny, annuals or perennials. Leaves simple, alternate or spirally arranged, exstipulate. Flowers in terminal or lateral racemes; bracts small, persistent or caducous, bracteoles 2, caducous or persistent. Sepals 5, caducous or usually wholly or partially persistent, unequal; wing sepals (inner) the largest, often petaloid. Petals 3, 2 upper ones (lateral) basally adnate to the staminal tube; lower one (keel) boat-shaped, clawed at base with the basal part above claw sometimes auricled, entire or bearing a dorsal crest consisting of 2 lobes, each entire or divided into various number of appendages. Stamens 8, monadelphous with filaments united basally for varying lengths into a tubular staminal tube split on one side; anthers sessile on mouth of tube or with free filaments above the tube. Ovary laterally compressed, 2-loculed, each with one anatropous ovule, pendulous from apex; style terminal, variously curved, flattened and dilated towards apex; stigma lateral, oblique or spaced into 2 spots. Capsules flattened-compressed, mostly margined, sometimes with a double wing, dehiscing loculicidally by marginal split, 2-seeded, often enclosed in persistent sepals or wing sepals. Seeds oblong, mostly dark, densely or sparsely hairy with a cap-like entire or lobed caruncle at micropylar part close to the attachment of the funicle, sometimes with a black glossy strophiole (appendage) at the other end.

Around the World in tropical, subtropical and temperate regions, herbaceous species usually not seen in primary forests, common in woodlands, grasslands, roadsides, wastelands and cultivated fields; ca 500 species, 27 in India.

Notes. The fragrance of the roots when pulled out fresh from the soil is a sure generic character (Mathew, Fl. Tamilnadu Carnatic 1: 64. 1983).

Literature. ADEMA, F. (1966) A review of the herbaceous Polygala in Malesia (Polygalaceae). *Blumea* 14: 253 - 356, ff. 1 - 19. CHANDRABOSE, M. & N.C. NAIR (1981). The genus *Polygala* L. (Polygalaceae) in Andhra Pradesh, Kerala, and Tamil Nadu (South India). *Proc. Indian Acad. Sci. (Plant Sci.)* 90: 107 - 127, ff. 1 - 176. MUKERJEE, S. K. (1958) A synopsis of Indian and Burmese *Polygala*. *Bull. Bot. Soc. Bengal* 12: 29 - 49, t. 1. PAUL, S. R. & A. L. KHARBANDA (1975) Revision of the genus *Polygala* from India (Polygalaceae) 1. The species of the Bihar and Orissa. *Bangladesh J. Bot.* 4: 49 - 58. PAL, G. D. & G. S. GIRI (1990) Distributional notes on *Polygala* Linn. (Polygalaceae) from Arunachal Pradesh. *J. Econ. Tax. Bot.* 14: 225 - 228. SMITH, R. R. & D. B. WARD (1976) Taxonomy of the genus *Polygala*, series *Decurrentes* (Polygalaceae). *Sida* 6(4): 284 - 310. SHARMA, M. L. & P. N. MEHRA (1978) Chromosome numbers in some northwest Indian species of *Polygala*. *Cytologia (Japan)* 43: 589 - 593.

KEY TO THE SPECIES

- 1a. Sepals caducous after flowering 2
 b. Sepals or at least wing sepals persistent in fruits 4
- 2a. Keel petal split at apex, not crested; capsules notched, bipapillate at apex 23. *P. tartarinowii*
 b. Keel petal entire at apex, crested; capsule not bipapillate at apex 3
- 3a. Herbs, up to 25 cm high; wing sepals clawed at base; keel petal crested with 2 flap-like appendages 10. *P. furcata*
 b. Shrubs, more than 1 m high; wing sepals not clawed at base; keel petal crested with more than 8 flattened forked appendages 2. *P. arillata*
- 4a. Leaves usually petiolate; petioles 5 - 15 mm long 5
 b. Leaves usually sessile or subsessile; petioles up to 2 mm long 9
- 5a. Herbs, less than 1 m tall; stems weak; crest usually 2-lobed; disc flat 26. *P. umbonata*
 b. Shrubs, 2 m or more high; stems woody; crest much branched; disc cupular 6
- 6a. Stems with projecting cicatrices of fallen leaves; leaves coriaceous; racemes paniculate, erect; outer solitary sepal gibbous; anthers conical 25. *P. tricholopha*
 b. Stems smooth; leaves membranous or chartaceous; racemes unbranched, drooping; outer sepals concave, not gibbous; anthers linear, oblong 7
- 7a. Leaves not glaucous beneath, green on drying; crest consisting of plicate convolute appendages; seeds glabrous 11. *P. globulifera*
 b. Leaves glaucous beneath, not green on drying; crest consisting of linear forked appendages; seeds hairy 8
- 8a. Branches blackish in colour; leaves membranous; flowers pale lilac in colour; ovary sessile, subglobose; fruits suborbicular; seed hairs less than 1 mm long, whitish 16. *P. karenium*
 b. Branches greenish; leaves subcoriaceous; flowers greenish yellow or brown; ovary oblong, stipitate; fruits clavate; seed hairs ca 5 mm long, brownish 19. *P. mariesii*
- 9a. Wing sepals broader above the middle, acute to obtuse at apex 10
 b. Wing sepals broader below the middle, acute to acuminate at apex 17
- 10a. Wing sepals falcate, acute; petals lavender blue; lateral lobes linear-oblong; middle lobe rounded 9. *P. sibirica*
 b. Wing sepals not falcate, or if falcate, then obtuse; petals purple or yellow; lateral lobes obovate; middle lobe acute 11

- 11a. Capsules glabrous 12
 b. Capsules hispid puberulous or at least ciliate along margins 14
- 12a. Stems sharply angular and deeply furrowed; racemes dense-flowered; wing sepals symmetric 18. *P. longifolia*
 b. Stems terete; racemes lax-flowered; wing sepals asymmetric 13
- 13a. Stems with conspicuous cicatrices of fallen leaves; bracts and sepals hairy; lateral petals equal to or longer than keel petal; caruncle 2-lobed 12. *P. irregularis*
 b. Stems without such cicatrices; bracts and sepals glabrous; lateral petals much shorter than keel petal; caruncle 3-lobed 1. *P. abyssinica*
- 14a. Stems and racemes dichotomously branched above; wing sepals symmetric, suborbicular, rounded, not mucronate at apex 20. *P. persicariifolia*
 b. Stems and racemes not dichotomously branched; wing sepals asymmetric, elliptic-oblong, obtuse and mucronate at apex 15
- 15a. Leaf margins recurved; wing sepals with anastomosing veinlets forming a hyaline zone along margins; petals pink; crest consisting of 2 bundles of appendages 9. *P. erioptera*
 b. Leaf margins flat; wing sepals not with hyaline zone along margins; petals blue, purple or purplish white; crest consisting of one or three bundles of appendages 16
- 16a. Stems terete throughout; leaves large, up to 6 x 2.8 cm; flowers ca 7 mm long; bracts persistent; outer sepals ca 2.5 mm long; wing sepals 9 - 11-nerved; petals 6 - 8 mm long, purple or purplish white 15. *P. crotalaroides*
 b. Stems terete below, angled above; leaves smaller, ca 3 x 0.8 cm; flowers ca 3 mm long; bracts caducous; outer sepals ca 1.5 mm long; wing sepals 3 - 5-nerved; petals ca 4 mm long, blue 24. *P. telephioides*
- 17a. Racemes longer than leaves 18
 b. Racemes shorter than leaves 22
- 18a. Wing sepals symmetric, triangular, obovate, elliptic, blunt at apex, petaloid 19
 b. Wing sepals asymmetric, subfalcate, oblong to elliptic, acute at apex, green, not petaloid 20
- 19a. Wing sepals triangular, hairy; anthers on filaments at mouth of staminal tube; fruits oblong, subquad-rangular, notched at both ends, narrowly winged around, puberulous. 15. *P. javana*
 b. Wing sepals elliptic, glabrous; anthers sessile at mouth of staminal tube; fruits suborbicular, obcordate, broadly winged at apex, glabrous 14. *P. japonica*
- 20a. Middle lobe of petals distinctly auricled at base; ovary glabrous; style with 2 wings near apex; filaments above tube grouped into 3 bundles, consisting of 2 half united bundles in middle and 3 each on either side 27. *P. wightiana*
 b. Middle lobe of petals not auricled at base; ovary hairy or ciliate at apex; style not winged; filaments above tube not so grouped 21
- 21a. Racemes 10 - 20 cm long; middle lobe of petals hairy at clawed base; capsules asymmetric, unequally lobed at apex, oblong-rhomboid; seeds long hairy 8. *P. elongata*
 b. Racemes up to 9 cm long; middle lobe of petals glabrous at base; capsules symmetric, equally lobed at apex, suborbicular; seeds short hairy 4. *P. bulbothrix*
- 22a. Free portion of filaments on staminal tube of much different lengths; filaments in 3 groups with 2 free filaments in centre and 2 bundles of 3 connate filaments each on either side 5. *P. buxiformis*
 b. Free portion of filaments on staminal tube of almost same length; all filaments free almost to the mouth of tube 23

- 23a. Branching erect upwards; racemes and flowers erect; outer sepals obovate-oblong, mucronulate at apex 21. *P. rosmarinifolia*
- b. Branching prostrate, decumbent or ascending; flowers drooping; outer sepals ovate-falcate, acuminate at apex 24
- 24 a. Caruncle with broad membranous winged appendages, covering more than half the length of seeds 13. *P. jacobii*
- b. Caruncle with shortly toothed or linear to narrowly oblong appendages covering less than half the length of seeds 25
- 25a. Prostrate or decumbent weak herbs; leaves orbicular or oblong-obovate, up to 4 cm long; caruncle appendages subequal 3. *P. arvensis*
- b. Erect stout herbs; stems woody; leaves linear to linear-lanceolate or oblong-ovate to oblong-lanceolate, 4 - 9 cm long; caruncle appendages equal. 26
- 26a. Leaves up to 10 mm broad, linear or linear-lanceolate, outer sepals obovate-oblong; petals yellowish or dull orange; stigma hooded 17. *P. linearifolia*
- b. Leaves 10 - 25 mm broad, oblong-elliptic; petals white with purple or violet tips; stigma bilobed 6. *P. chinensis*

1. *Polygala abyssinica* Fresen. in Mus. Senck. 2: 273. 1837; Bennett in Fl. Brit. India 1: 202. 1872.

Herbs, suffruticose, perennial, (5-) 30 - 48 cm high, pubescent or glabrous; stems slender, erect, many from woody rootstock. Leaves sessile, obovate or oblong, linear to linear-lanceolate, acute or acuminate and apiculate at apex, (6-) 10 - 20 x (0.5-) 2 - 3 mm, glabrous. Flowers in bifurcate slender lax-flowered terminal (5-) 20 - 30 mm long racemes; pedicels 1 - 2 mm long, spreading; bracts linear-lanceolate, acute, ca 1.5 mm long, membranous, deciduous. Sepals persistent, glabrous; outer solitary sepal obovate to linear-lanceolate; outer paired sepals linear, ca 1 mm long, glabrous; wing sepals obliquely obovate, obtuse at apex, 4 - 6 x 3 - 4 mm, enlarged in fruit, 3-nerved with anastomosing veinlets, pale grey with pinkish veins, glabrous. Middle lobe of petals ca 6 mm long, purple or pink, with ca 2 mm long tubercled crest; lateral lobes orbicular, unguiculate, much shorter than middle lobe. Staminal sheath ca 4 mm long. Ovary ca 1.5 mm long, glabrous; style ca 6 mm long; stigma bilobed. Capsules obovate, emarginate, 3 - 4 mm long, 2 - 2.5 mm wide with ca 0.5 mm broad wing along margins, glabrous. Seeds oblongoid, pilose; caruncle 3-lobed, 2-appendiculate with minute appendages.

Fl. April - July; *Fr.* Aug. - Dec.

Distrib. India: Open or shaded grassy hill slopes. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Madhya Pradesh and Rajasthan.

Nepal, Pakistan, Afghanistan, West Asia to Africa.

2. *Polygala arillata* D. Don, Prodr. Fl. Nep. 199. 1825; Bennett in Fl. Brit. India 1: 200. 1872, p. p. *P. angustifolia* (Chodat) R. N. Banerjee in Bull. Bot. Surv. India 26: 2-3. 1985. Fig. 86.

Nep.: *Marcha*.

Shrubs or small trees, erect or subscandent, up to 4 m tall; branches greyish when fresh, smooth; young branches puberulous. Leaves elliptic, oblong or ovate-lanceolate, rounded, acute or cuneate at base, acute-mucronate at apex, revolute or not along margins, (4-) 7 - 11 (-18) x (2-) 3 - 4 (-6) cm, subcoriaceous, glabrous except on nerves beneath, dull green to dark tan on drying; lateral nerves 5 - 12 pairs, arcuate, forming loops near margins, impressed or not above, raised beneath, reticulations prominent beneath; petioles 5 - 15 mm long, puberulous or glabrous. Flowers 12 - 18 mm long, bright yellow to deep orange, in simple or rarely paniculate (3-) 5 - 8 (-12) cm long axillary terminal or supra-axillary pendulous glabrous or sparsely hairy racemes; pedicels 2 - 10 mm long, glabrous; bracts linear-subulate, 2 - 2.5 mm long, deciduous; bracteoles 3, lanceolate, ciliate along margins, 1.5 - 2 mm long. Sepals 5, caducous; outer 3 sepals ovate-elliptic, obovate, acute, acuminate or rounded at apex, 3 - 8 x 2 - 6 mm, unequal, puberulous or glabrous; inner 2 sepals (wings) elliptic-obovate, concave, attenuate at base, obtuse or rounded at apex, 10 - 14 x 6 - 7 mm, purplish green, distinctly veined, glabrous, except the ciliate margins. Petals 3-lobed, 1 - 2 cm long; lateral petals oblong, obovate, obtuse, up to 4 mm broad, connate with keel petal for almost half the length, hairy inside; keel petal crested at the back of apex with a tuft of 15 - 20 linear shortly notched appendages. Stamens 8, shorter than petals; sheath 8 - 12 mm long, adnate to keel and split into 2 short free bundles, each bearing 4 free 2 - 3 mm long filaments; anthers oblong or ovate. Ovary suborbicular, obcordate, ca 2 mm long, sparsely ciliate or not along margins; style slightly curved at apex, ca 8 mm long, broadened at middle, glabrous; stigma flat. Infructescence glabrous or pubescent. Capsules suborbicular or broadly reniform, compressed, deeply notched at apex, narrowly and thinly winged along margins, 10 - 12 x 12 - 15 mm, pink, prominently veined, puberulous or glabrous. Seeds 2, one in each locule, subglobose, minutely tubercled, 4 - 8 mm in diam., brown-black, glabrous or sparsely white silky with appressed hairs; caruncle cupular, hood-shaped, with 2 - 3 winged appendages, covering one-third to two-third of the seed, orange-red to yellow.

Notes. A very variable species. The following varieties are discernible though sometimes there are intermediaries and the distinctions tend to break down.

The roots are often used in fermentation of alcoholic drinks in Nepal.



Fig. 86. *Polyala arillata* D. Don : a. shoot with flower and fruit; b. flower with 2 outer and one inner sepals removed; c. staminal sheath adnate to keel petal; d. pistil.

KEY TO THE VARIETIES

- 1a. Main nerves of leaves impressed above, reticulations prominent and forming distinct areolate structure 2.4. var. *purpurascens*
 b. Main nerves of leaves not impressed above, with obscure reticulations 2
- 2a. Leaf margins revolute 2.5. var. *revoluta*
 b. Leaf margins not revolute 3
- 3a. Leaves broadly oblanceolate, broadest above middle, cuspidate at apex 2.2. var. *chartacea*
 b. Leaves lanceolate or elliptic-lanceolate, broadest at or below middle, acuminate at apex 4
- 4a. Leaves dull green on drying; flowers glabrous; infructescences glabrous; fruits glabrous 2.3. var. *laevicarpa*
 b. Leaves dark green or tan on drying; flowers hairy; infructescences pubescent; fruits hairy 2.1. var. *arillata*

2. 1. var. *arillata*

Fl. Mar. - May; *Fr.* June - Aug.

Distrib. India: Subtropical evergreen forests, 1000 - 2000 m. Sikkim, Arunachal Pradesh, Nagaland, Meghalaya, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Nepal, Bhutan, Myanmar, Sri Lanka, Vietnam, S. China, Malaysia and Phillippines.

2. 2. var. *chartacea* (Mukerjee) Giri in Bull. Bot. Surv. India 26: 5. 1984 (1985). *P. arillata* forma *chartacea* Mukerjee in Bull. Bot. Soc. Bengal 12: 32. 1958.

Fl. & Fr. Jan - Dec.

Distrib. India: Subtropical evergreen forests, 1000 - 2000 m. Tamil Nadu and Kerala.

Endemic.

2. 3. var. *laevicarpa* R. N. Banerjee & Giri in Candollea 42: 555 - 558, f. 1. 1987.

Fl. & Fr. June - Dec.

Distrib. India: Subtropical and temperate regions, amongst shrubs, 300 - 2000 m. Sikkim and Arunachal Pradesh.

E. Nepal.

2. 4. var. *purpurascens* Clarke ex Mukerjee in Bull. Bot. Soc. Bengal 12: 32. 1958. *P. arillata* forma *sikkimensis* Mukerjee, l. c., p. p.

Fl. & Fr. Feb. - Aug.

Distrib. India: Subtropical evergreen forests, 1000 - 2500 m. West Bengal, Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Bhutan.

2. 5. var. *revoluta* (Mukerjee) Giri in Bull. Bot. Surv. India 25: 5. 1984 (1985). *P. arillata* forma *revoluta* Mukerjee in Bull. Bot. Soc. Bengal 12: 32. 1958.

Fl. & Fr. Mar. - Aug.

Distrib. India: Subtropical forests, 1500 - 2000 m. Tamil Nadu (Nilgiris).

Endemic.

3. *Polygala arvensis* Willd., Sp. Pl. 3(2): 876. 1803. *P. chinensis* auct. non L. 1753; Bennett in Fl. Brit. India 1: 204. 1872, p. p. *P. chinensis* var. *linarifolia* sensu Mukerjee in Bull. Bot. Soc. Bengal 12: 40. 1958. Fig. 87.

Hindi: *Maradu*; Kon.: *Negli*; Mar.: *Phutani*; Sant.: *Gaighura*.

Herbs, procumbent or erect, 5 - 30 (-40) cm high; branches arising from base, glabrous or pubescent. Leaves sessile, orbicular, obovate, oblanceolate to oblong, narrowed towards base, subacute, obtuse or emarginate and mucronate at apex, 10 - 40 (-50) x 5 - 20 mm, fleshy when fresh, coriaceous when dry, glabrous to densely pubescent or hirsute, subchartaceous; petioles up to 3 mm long. Flowers ca 4 mm long, usually yellow, sometimes purplish white and pink-streaked, solitary or in 3 - 15-flowered 5 - 20 mm long axillary or lateral racemes, rarely subcapitate; bracts oblong-ovate, acute, ca 1 mm long, ciliate, persistent; pedicels 2 - 3 mm long. Sepals persistent; outer sepals broadly ovate to ovate-lanceolate, acuminate, acute, mucronate, 1.5 - 2.5 x 1 - 1.5 mm, pubescent outside, white-hyaline and ciliate along margins, 1-nerved; wing sepals obliquely ovate, falcate, narrowed at base, acute or acuminate, straight at upper margin, rounded at lower margin, 4 - 7 x 2 - 4 mm, sparsely puberulous, membranous and hairy along margins, persistent. Petals yellow; middle lobe keeled, auricled at base, with a crest of shortly multifid or notched, up to 1 mm long appendages; lateral lobes of petals suborbicular or broadly obovate, ca 3 mm long. Staminal sheath free, 1.5 - 2 mm long; free portion of filaments up to 2 mm long, united at same level. Ovary obovoid, hairy along margins, ca 1 mm across; style curved, flat, dilated and hooked at apex forming a hood with lateral broad capitate stigma at its concavity. Capsules ovoid, orbicular or obliquely obcordate, compressed, emarginate at apex, narrowly winged along margins, 3 - 5 x 2.5 - 4 mm, glabrous on walls, patently hairy along margins. Seeds oblong-ellipsoid, ca 3 x 2 mm, black, pilose; caruncle hood-shaped, 3-fid almost to base with short appendages.

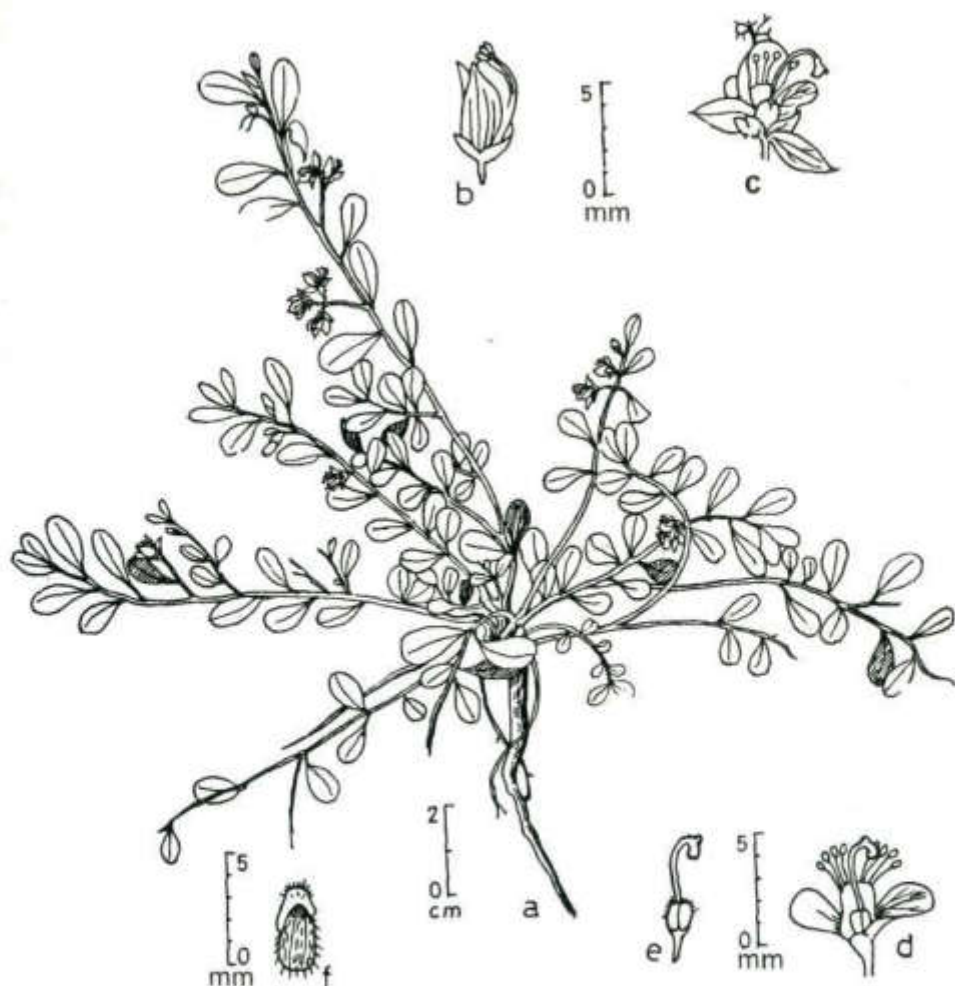


Fig. 87. *Polygala arvensis* Willd. : a. habit; b. flower; c. & d. flower, split, showing stamens and pistil; e. pistil; f. seed, showing hood-shaped caruncle.

Fl. June - Aug.; *Fr.* Aug.-Jan.

Distrib. India: Wastelands, cultivated fields, roadsides, in plains and hills up to 2000 m. Punjab, Delhi, Uttar Pradesh, Bihar, West Bengal, Assam, Tripura, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Nepal, Bangladesh, Myanmar and S.E. Asia to N. Australia.

4. *Polygala bulbothrix* Dunn in Gamble, Fl. Pres. Madras 1: 58. 1915 & in Bull. Misc. Inf. Kew 1916: 13. 1916. *P. ciliata* Wight & Arn., Prodr. 1: 38. 1834. *P. ramaswamiana* Mukerjee in J. Bombay Nat. Hist. Soc. 53: 55. 1955.

Herbs, annual, diffuse, erect or ascending; branches up to 50 cm long, puberulous or glittering velutinous, mixed with strigose spiny bulbous-based hairs. Leaves elliptic, obovate, oblong, narrowed or cuneate at base, obtuse, rounded or emarginate and often mucronate at apex, entire and revolute along margins, 8 - 37 x 5 - 15 mm, subcoriaceous. Flowers 4 - 7 mm long, pink, few or many in lax slender leaf-opposed axillary or extra-axillary 2 - 9 cm long patent velutinous racemes; pedicels 2 - 4 mm long, tomentose; bracts 3, opposite, deltoid, lanceolate, acuminate at apex, 1 - 3 mm long, unequal. Outer sepals ovate-lanceolate, setaceous, acuminate at apex, 2 - 3 x 0.7 - 1 mm, membranous, ciliate outside; wing sepals obliquely elliptic-ovate, narrowed at base, subacute to acuminate at apex, 4.5 - 5 x 2 - 2.5 mm, 5 - 7-nerved, velutinous outside, hyaline along margins. Petals 3-lobed, pink or yellow, lobed up to base; middle lobe ca 3.5 mm long, auricled, keeled, with a crest of filiform forked appendages; lateral lobes oblong, suborbicular, emarginate, clawed and ciliate-margined at base, ca 2.5 mm long. Staminal sheath free, ca 2.5 mm long; free portion of filaments ca 1.7 mm long, connate at slightly different levels. Ovary orbicular, slightly oblique, compressed, hispid along margins; styles curved, widened and horse-shoe shaped at apex, ca 2.5 mm long, with lateral hooded stigma. Capsules suborbicular, emarginate, longitudinally grooved at middle, 3 - 4 mm across, stiff hairy, emarginate and unequally halved. Seeds oblongoid, obtusely truncate at apex, 2.5 - 3.5 x 1.2 - 2 mm, black, pilose; caruncle hood-shaped with 3 obtusely toothed appendages.

KEY TO THE VARIETIES

- | | |
|--|---------------------------------|
| 1a. Inflorescence leaf-opposed, or extra-axillary, many flowered | 4.2. var. <i>devicolamensis</i> |
| b. Inflorescence axillary, 2 - 3-flowered | 2 |
| 2a. Hairs on the stem somewhat spiny, bulbous at base | 4.3. var. <i>pulniensis</i> |
| b. Hairs on the stem not spiny (hispid), not bulbous at base | 4.1. var. <i>bulbothrix</i> |

4. 1. var. bulbothrix

Fl. April - May; *Fr.* June - Dec.

Distrib. India: Grasslands in hills and plains, up to 1000 m. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

4. 2. var. devicolamensis (Mukerjee) R. N. Banerjee, **comb. nov.** *P. ramaswamiana* Mukerjee forma *devicolamensis* Mukerjee in J. Bombay Nat. Hist. Soc. 53: 56. 1955.

Fl. Mar. - Apr.; *Fr.* Apr. - May

Distrib. India: Tamil Nadu and Kerala (Devicolam range).

Endemic.

4. 3. var. pulniensis (Mukerjee) R. N. Banerjee, **comb. nov.** *P. ramaswamiana* Mukerjee var. *pulniensis* Mukerjee in J. Bombay Nat. Hist. Soc. 53: 56. 1955.

Fl. Feb. - July.

Distrib. India: Tamil Nadu and Kerala (Pulney- Devicolam range).

Endemic.

5. Polygala buxiformis Hassk. in Miq., Ann. Mus. Lugd.- Bat. 1: 161. 1864; Bennett in Fl. Brit. India 1: 205. 1872.

Herbs, weak, decumbent-ascending. Leaves erect, usually imbricating at base of upper ones, narrowly oblong or oblanceolate or elliptic-oblong, obtuse at both ends, apiculate at apex, recurved along margins, 4 - 14 x 2 - 5 mm, subcoriaceous, glabrous except the thin crispy hairs beneath. Flowers ca 5 mm long, sessile in leaf-opposed or lateral 3 - 10 cm long spikes; rachis angular, tomentose with raised semicircular cicatrices of fallen pedicels; bract 1, ovate-oblong, obtuse, ca 2 mm long, ciliate, caducous; bracteoles 2, linear, sharply acute or acuminate, ciliate, caducous; pedicels up to 1 mm long. Outer sepals 3, ovate-acuminate, 1 - 1.5 mm long, ciliate hairy, accrescent, up to 1.8 mm long in fruits; wing sepals falcate to elliptic-falcate, acuminate at apex, 2.5 - 3 mm long, hispid hairy, accrescent, up to 3.5 mm long in fruits, 5- nerved, ciliate along margins. Petals violet or blue; middle lobe boat-shaped, clawed, auricled at base, 3 - 5 mm long; crests 20 - 30, forked in 3 bundles; lateral lobes obovate, truncate and emarginate at apex, ca 2 mm long. Stamens 8, monadelphous; sheath adnate at base to midlobe of petal, divided halfway down into 3 bundles with the middle bundle of 2 anthers and 2 lateral bundles of 2 anthers each; anthers oblong, ca 3 mm long. Ovary sessile, orbicular, ciliate hairy; style ca 2 mm long; stigma hooked. Capsules orbicular,

ca 2 mm in diam., silky stiff hairy; caruncle hood-shaped, unequally 3-partite; the longer arm membranous, appressed to seed.

Fl. & Fr. Aug. - Feb.

Distrib. India: Common in dry shaded places near forests in grasslands and wastelands, up to 1500 m. Delhi, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Kerala and Andaman & Nicobar Islands (Kamorta Is.).

Pakistan, Sri Lanka, Bangladesh, Myanmar to China, Malaysia and Philippines.

6. *Polygala chinensis* L., Sp. Pl. 2: 704. 1753; Bennett in Fl. Brit. India 1: 204. 1872. *P. glomerata* Lour., Fl. Cochinch. 426. 1790; Bennett, l. c. 206. **Fig. 88.**

Herbs, perennial, up to 75 cm high, erect or ascending; stem woody at base; branches terete, hairy. Leaves elliptic, linear-lanceolate, oblong or obovate, acute or narrowed at base, acute and mucronulate at apex, (1-) 4 - 9 x (0.4-) 1 - 2.5 cm, glabrous or sparsely puberulous; lateral nerves faint; petioles 1 - 2 mm long, pubescent. Flowers 6 - 7 mm long, pale blue or greenish white with pink violet blotches, arranged densely in 5 - 20 mm long, supraaxillary few-flowered, 3 - 14 fasciculate erect or patent racemes; pedicels 1 - 2 mm long; bracts lanceolate, acute, ca 1 mm long, 6 - 7-nerved, ciliate, caducous. Sepals persistent; outer sepals unequal, ovate-lanceolate, elliptic, falcate, acute to acuminate and long mucronate or aristate at apex, ciliate along margins, 1.5 - 3 x 0.8 - 1 mm; wing sepals falcate, obliquely ovate, broad at base, acute or acuminate and mucronulate at apex, 6 - 7 x 3 - 4 mm, 5-nerved, green to greenish brown, ciliate along margins. Petals 3-lobed; middle lobe 4 - 8 mm long, keeled, white with purple or violet apex, crested with 16 - 20 filiform appendages in 2 bundles; lateral lobes obovate, as long as middle. Staminal sheath free or adnate to base of petal, 2.5 - 3 mm long, hairy; free portion of filaments arising at different levels on sheath, 1.5 - 2.5 mm long. Ovary orbicular, emarginate at apex, ca 1 mm long, ciliate; style recurved, 4 - 5 mm long; stigma bilobed, horse-shoe shaped. Capsules suborbicular, notched at apex, 5 - 7 mm across, pubescent pilose, strongly ciliate along narrow marginal wings. Seeds obovoid or ellipsoid, black, white silky hairy; caruncle hood-shaped, with 2 narrowly oblong membranous appendages and a short tooth, yellowish.

Fl. & Fr. April - Jan.

Distrib. India: Moist evergreen forest edges, amidst grasses, 1500 m. Bihar, West Bengal, Sikkim, Assam, Nagaland, Manipur, Tripura, Meghalaya, Madhya Pradesh, Tamil Nadu and Kerala.

Pakistan, Bhutan, Bangladesh, Myanmar, S. China, Vietnam, Thailand, Malaysia, Philippines and New Guinea.



Fig. 88. *Polygala chinensis* L. : a. plant; b. flower; c. sepal; d. wing petal; e. keel petal; f. stamens; g. ovary; h. fruit; i. seed.

Notes. The photographs of type specimen of *P. chinensis* L. (Herb. Linnaeus 882, 6 at LINN) and of *P. glomerata* Lour. (at P) have been examined and compared with authentic specimens of both species at CAL, and it became evident that both are conspecific.

7. *Polygala crotalarioides* Buch.-Ham. ex DC., Prodr. 1: 327. 1824; Bennett in Fl. Brit. India 1: 201. 1872. *P. crotalarioides* var. *glabrescens* Collett & Hemsley in J. Linn. Soc., Bot. 28: 22. 1890.

Herbs or undershrubs, perennial, 10 - 30 cm high, erect; rootstock woody, tuberous; stems woody and branched at base, villous; branches erect or spreading, terete, crisp hairy. Leaves sessile, elliptic, ovate, oblong or obovate to oblanceolate, cuneate or acute at base, obtuse, rounded and often apiculate at apex, 1.5 - 6 x 0.8 - 2.8 cm, faintly pellucid-dotted and finely villous on both surfaces. Flowers purple or purplish white, short-pedicellate, 6 - 8 mm long, in leaf-opposed lateral or extra-axillary 1 - 3 cm long dense-flowered pubescent racemes; bracts 2, subulate, ovate-lanceolate, 2 - 3 mm long, persistent. Outer sepals lanceolate, 2.5 - 3 x 1.5 - 2 mm, hairy on margins; wing sepals asymmetrical, obovate or oblanceolate, attenuate at base, obtuse, shortly mucronate at apex, 4 - 6 x 3 - 3.5 mm, persistent, enlarging to 8 - 9 mm in fruit, ciliate along margins, pinkish green with 9 - 11 subparallel nerves. Petals 6 - 8 mm long, pink, purple or purplish white; middle lobe ciliate-margined from base upwards, 4 - 5 mm long, keeled with 3 bundles of linear filiform appendages; lateral lobes obovate, orbicular, ca 2.5 mm long, hairy. Staminal sheath 2 - 4 mm long, adnate to lower portion of petals; free portion of filaments less than 0.5 mm long. Ovary broadly obovoid to oblong, notched at apex, less than 1 mm long, ciliate-margined; style curved, 4 - 5 mm long; stigma bidentate. Capsules broadly oblong or orbicular, notched at apex, narrowly winged and ciliate along margins, 4 - 5 x 6 - 7 mm. Seeds ovoid, ca 3 x 2 mm, shiny black, densely appressed white silky; caruncle hood-shaped, deeply 3-fid into narrow appendages, one-third as long as seed.

Fl. & Fr. May - Nov.

Distrib. India: Grasslands, forest edges and wastelands, 1000 - 2000 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Assam, Manipur, Tripura, Meghalaya, Orissa and Madhya Pradesh.

Pakistan, Nepal, Bhutan, Myanmar, S. China, Vietnam and Thailand to E. Asia.

8. *Polygala elongata* Klein in Willd., Sp. Pl. 3: 879. 1802; Bennett in Fl. Brit. India 1: 203. 1872, p. p.

Mal.: *Periyanka*; Tamil: *Periyanka*, *Parappu-chedi*.

Herbs, annual, erect, ascending or prostrate; branches 15 - 40 cm long; stems angled near apex. Leaves sessile, oblong or elliptic, oblanceolate to linear-lanceolate,

cuneate or attenuate at base, obtuse, subacute or retuse at apex, entire and reflexed along margins, 3 - 60 x 1 - 12 mm, glabrous on both surfaces or puberulous, chartaceous; petioles up to 1.5 mm long. Flowers 6 - 8 mm long, yellow, in supra-axillary or terminal up to 12 cm long racemes; pedicels 6 - 8 mm long, tomentose; bracts ca 1 mm long, persistent. Outer sepals ovate, elliptic, acute and mucronate at apex, 1.5 - 2.5 x 0.6 - 1.5 mm, ciliate along margins, glabrescent otherwise; wing sepals obliquely falcate, ovate or elliptic, acute and mucronate at apex, 4 - 5 x 2 - 3 mm, sparsely ciliate or glabrous, persistent. Petals 5 - 6 mm long, 3-lobed, yellow with brown streaks; middle lobe keeled, with a crest of branched and shortly forked and notched appendages; lateral lobes obovate, suborbicular, clawed at base, rounded at apex, ca 6 x 4 mm. Staminal sheath free, up to 3 mm long; free portion of filaments up to 2 mm long, joined at different levels. Styles curved, up to 4 mm long, hooked at apex, with stigma inside. Capsules rhombate, obliquely emarginate at apex, inequilateral at base, narrowly margined, 4 - 6.5 x 2.5 - 4.5 mm, glabrous, ciliate. Seeds oblong-obovoid, 2.7 - 3.5 x 1.2 - 2 mm, black, white silky pilose; caruncle pale brown, hood-shaped with 3 toothed or linear appendages.

Fl. July - Sept.; *Fr.* Sept. - Jan.

Distrib. India: Waste places, grasslands, roadsides, in plains and hills, on exposed slopes, up to 1000 m. Bihar, Orissa, Madhya Pradesh, Rajasthan, Maharashtra, Goa, Daman & Diu, Karnataka, Tamil Nadu and Kerala.

Notes. A decoction or the powder of the leaves is reported to be useful for bileousness and constipation (Rama Rao, *Fl. Travancore* 26. 1914).

9. *Polygala erioptera* DC., *Prodr.* 1: 326. 1824; Bennett in *Fl. Brit. India* 1: 203. 1872.

Fig. 89.

Herbs, annual or perennial, erect, ascending or prostrate, somewhat pubescent; branches up to 60 cm long. Leaves subsessile, oblong to linear, elliptic-obovate, oblanceolate, narrowed at base, revolute along margins, acute or obtuse and emarginate at apex, 6 - 45 x 1 - 8 mm, glabrescent above, patently hairy near margins, tomentose beneath. Flowers ca 4.5 mm long, pink or purple, solitary or in up to 3.5 cm long condensed leaf-opposed or extra-axillary racemes; pedicels up to 2 mm long; bracts persistent, shorter than pedicels. Sepals persistent; outer sepals ovate-lanceolate to ovate-elliptic, acute-mucronate at apex, concave, 1.5 - 2.5 x 0.7 - 1.2 mm, unequal, hyaline along margins, glabrous to densely hairy outside; wing sepals elliptic-obovate, oblong, obtuse to subobtuse, sometimes apiculate, 4 - 5 x 2 - 2.7 mm, 3 - 5-nerved with anastomosing veinlets leaving a hyaline zone along margins, sparsely patently hairy outside, membranous in fruit. Petals 3-lobed, pink; middle lobe keeled, 2.5 - 4.5 mm long, with a crest of 2 bundles of filiform pale pink appendages; lateral lobes deltoid, ovate, subacute, ca 3 x 4 mm. Staminal sheath free or slightly adnate to middle lobe of petal, ca 1.5 mm long; free portion of filaments ca 1.5 mm long. Ovary ovoid, ca 1 mm

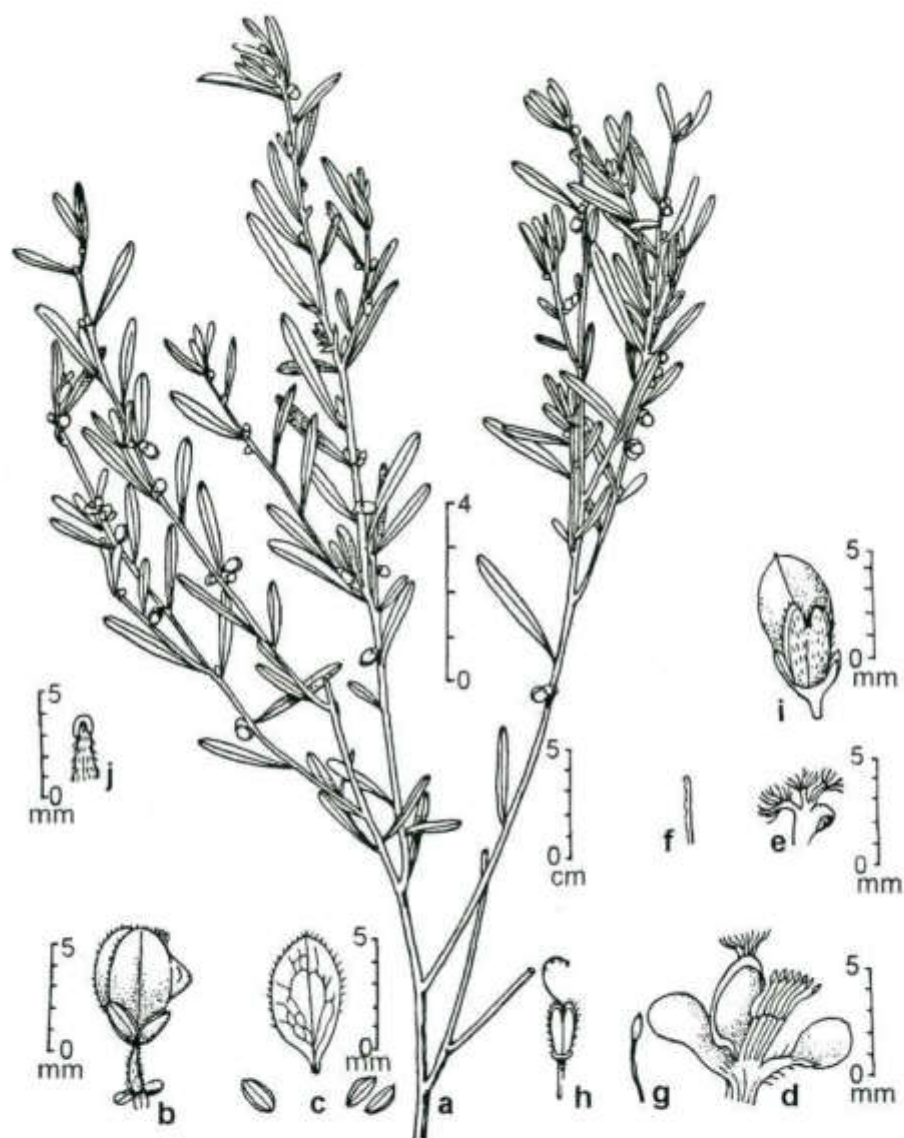


Fig. 89. *Polygala erioptera* DC. : a. branch with flowers; b. sepals; c. petals; d. corolla; e. crest of keel petal; f. appendage of crest; g. filament and anther; h. pistil; i. capsule; j. seed.

long, pilose; style curved, broadened at middle, up to 3 mm long; stigma capitate. Capsules oblong, ellipsoid, obliquely notched, margined, 3.5 - 5 x 2 - 2.5 mm, pubescent. Seeds oblong, ca 3 x 1.5 mm, black, densely pilose; caruncle galeate, bristly crustaceous, lined by 3 membranous appendages.

Fl. & Fr. Jan. - Dec.

Distrib. India: Waste places, cultivated fields, fallow lands, roadsides, scrub jungles. Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala.

Myanmar, Pakistan, West Asia and Africa.

10. *Polygala furcata* Royle, *Illus. Bot. Himal.* 3: 78, t. 19B (1-4). 1834. *P. triphylla* D. Don, *Prodr.* 200. 1825, non Burm. f. 1768. *P. triphylla* var. *glaucescens* (Royle) Bennett in *Fl. Brit. India* 1: 201. 1872, p. p.

Nep.: Phabare-ghans.

Herbs, erect, 4 - 25 cm high, glabrous; stems slender, narrowly winged in upper portions, dichotomously branched at apex, often bearing a raceme at the point of dichotomy. Leaves opposite below, crowded towards top, elliptic or ovate-lanceolate, attenuate at base, subacute at apex, 1 - 6 x 0.5 - 3.5 cm, membranous, ciliate along margins, appressed pubescent above, glabrous beneath; lateral nerves 5 - 6 pairs; petioles 5 - 10 mm long, glabrous. Flowers yellow, 4 - 5 mm long, usually secund in axillary, terminal or lateral, long-peduncled up to 8 cm long, glabrous racemes; bracts 2 - 3, linear, 1 - 2 mm long, glabrous, caducous. Outer sepals unequal, ovate or narrow-ovate, clawed at base, obtuse or subacute at apex, 2 - 3 mm long; wing sepals oblong, clawed-attenuate at base, obtuse at apex, 1.5 - 2 mm long, petaloid, deciduous. Petals 3 - 3.5 mm long; lateral petals oblong, obtuse; keel petal crested with 2 flap-like appendages at back near apex. Stamens 6 - 8; sheath almost completely adnate to petals; filaments free, ca 1.5 mm long. Ovary laterally compressed, ca 2 mm long; styles curved, broadened towards apex, 3.5 - 4 mm long; stigma urceolate, 2-lipped. Capsules obovate, suborbicular, truncate or emarginate at apex, narrowly winged, ca 2.5 x 2 mm across, glabrous; wings 1 - 2 mm wide above, lesser towards base. Seeds ellipsoid, oblong or rounded, ca 1.7 x 0.8 mm, shiny black with white hairs; caruncle hood-shaped, usually with 2 (-4) membranous appendages, white; strophiole cylindric, obliquely truncate.

Fl. & Fr. (Jan.-) June - Dec.

Distrib. India: Subtropical to temperate regions, grassy slopes. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur, Orissa, Meghalaya, Madhya Pradesh, Maharashtra and Andhra Pradesh.

Pakistan, Nepal, Bhutan, Bangladesh, Vietnam and S. China.

11. *Polygala globulifera* Dunn in J. Linn. Soc., Bot. 35: 486. 1903; Mukerjee in Bull. Bot. Soc. Bengal 12: 33. 1958. **Fig. 90.**

Shrubs, 2 - 3 m tall; branches glabrous or sparsely puberulous. Leaves elliptic-lanceolate, ovate-elliptic, acute at base, acute to long acuminate or apiculate at apex, entire, (8-) 10 - 20 (-24) x (2-) 5 - 7 (8.5) cm, glabrous above, sparsely pubescent on nerves beneath; lateral nerves 10 - 15 pairs; petioles 8 - 15 mm long, glabrous. Flowers 8 - 10 mm long, in terminal or leaf-opposed, 8 - 35 cm long racemes; pedicels 6 - 10 mm long, sparsely puberulous. Outer lateral sepals ovate, 2 - 2.5 mm long; solitary sepal keeled, 4 - 4.5 mm long; wing sepals narrowly oblong, 7 - 10 mm long. Petals joined above the middle; lobes almost similar in length, midlobe keeled with a globular crest of plicate convolute appendages. Capsules red when fresh, blackish when dry, 10 - 15 mm in diam.; wing 1 - 2.5 (-3) mm broad, glabrous. Seeds 5 - 6 mm in diam., smooth; caruncle cupular, covering half portion on one side and almost completely on the other side.

KEY TO THE VARIETIES

- 1a. Leaves elliptic or ovate-elliptic, acute or apiculate at apex; racemes usually shorter than leaves **11.1. var. *globulifera***
- b. Leaves lanceolate or elliptic-lanceolate, long acuminate at apex; racemes elongated, lax, usually much longer than leaves **11.2. var. *kachinensis***

11. 1. var. *globulifera*

Fl. May - July; *Fr.* Aug. - Dec.

Distrib. India: Assam, Meghalaya and Arunachal Pradesh.

Nepal, Myanmar and China.

11. 2. var. *kachinensis* (Mukerjee) R. N. Banerjee in Bull. Bot. Surv. India 26: 6. 1985. *P. arillata* forma *kachinensis* Mukerjee in Bull. Bot. Soc. Bengal 12: 30. 1958.

Fl. Feb. - April; *Fr.* Aug. - Dec.

Distrib. India: Arunachal Pradesh.

Myanmar.

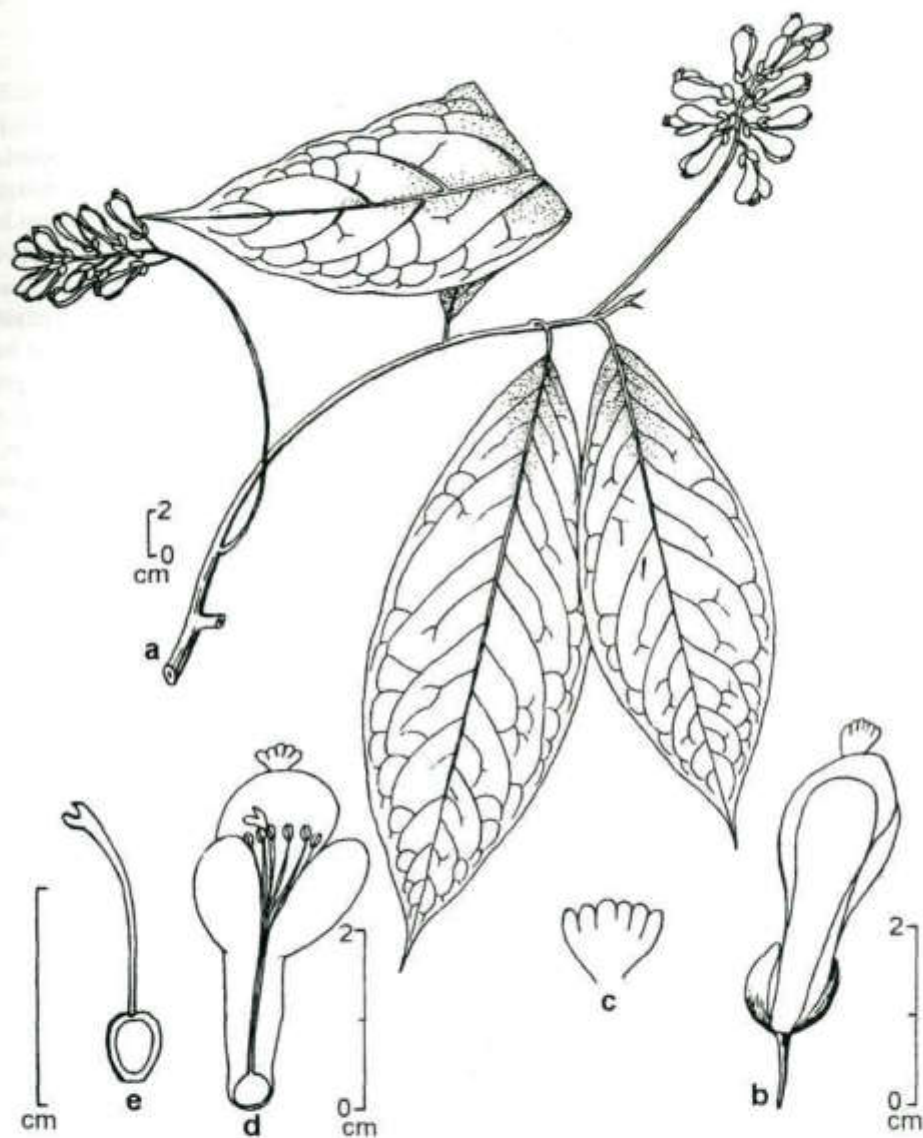


Fig. 90. *Polygala globulifera* Dunn : a. flowering branch; b. flower; c. crest of keel petal; d. corolla opened to show pistil and stamens; e. pistil.

12. *Polygala irregularis* Boiss., *Diagn. scr.* 1, 1: 8. 1842 & *Fl. Orient.* 1: 469. 1867; Cooke, *Fl. Pres. Bombay* 1: 61. 1901.

Herbs, perennial or annual, pubescent with usually spreading or widely ascending 15 - 40 cm long branches from woody base; stems with conspicuous cicatrices of fallen leaves. Lower leaves obovate, 15 - 20 x 2 - 3 mm; upper leaves linear-oblong, lanceolate, attenuate at base, retuse, obtuse or acute, mucronate at apex, recurved along margins, 25 - 40 x 3 - 5 mm, puberulous on both surfaces, coriaceous. Flowers in 5 - 12 cm long lateral or terminal racemes; pedicels 1.5 - 2 mm long, hairy, pendulous, thickened at apex; bracts 3, ovate, strongly keeled, acute, ciliate, 1.5 - 2 mm long, hairy, caducous. Sepals persistent, hairy; outer sepals linear-oblong to ovate, hyaline and ciliate along margins, ca 2 mm long; wing sepals obliquely ovate or obovate, gibbous at base, ca 4.5 x 2.5 mm, glabrous or sparsely hairy above, greenish white with purple or green arched veins. Petals pink or purple; middle lobe 3.5 - 5 mm long with crested keel; lateral lobes obovate, cuneate at base, truncate at apex, obscurely undulate along margins, 3 - 5 x 3 - 4 mm, ciliate at base. Staminal sheath 1.5 - 2 mm long. Ovary orbicular, glabrous; styles ca 3 mm long; stigma hooded, concave. Capsules obliquely obovate or orbicular, emarginate, winged, 3 - 4 mm in diam., glabrous. Seeds obovoid, conical, acute at apex, sericeous, crowned by bulbous-based hairs; caruncle lateral, 2-lobed, inconspicuous, cuneiform, pendent.

Fl. Dec.; *Fr.* Jan. - Oct.

Distrib. India: Sandy plains and open gravelly ground. Jammu & Kashmir, Punjab, Haryana, Uttar Pradesh, Rajasthan, Gujarat and Maharashtra.

Pakistan, Iran and West Asia to N.E. Africa.

13. *Polygala jacobii* Chandrab. in *Bull. Bot. Surv. India* 9: 288 - 290. 1967. *P. dunnii* Panigr. in *Kew Bull.* 29: 655. 1974.

Herbs, perennial; branches arising from rootstock, slender, sparsely branched, erect or decumbent-ascending, 5 - 60 cm long; slightly grooved, brownish, tomentose, glandular. Leaves oblong-obovate, elliptic to oblanceolate, narrowed at base, obtuse, rounded, retuse or emarginate and mucronate at apex, 3 - 4.5 x 2 - 15 mm, glabrous above, glaucous and sparsely pubescent on nerves beneath; petioles 1 - 1.5 mm long, pubescent. Flowers ca 6 mm long, yellow, solitary or in axillary, extra-axillary or often leaf-opposed, 1 - 3.5 cm long 5 - 10-flowered racemes; bracts persistent; pedicels 2 - 3 mm long, accrescent, up to 3.5 mm long, winged. Outer sepals ovate, lanceolate, acute or acuminate, 1 - 3 x 1 - 1.8 mm, 1-nerved, ciliate, hyaline along margins; wing sepals falcate, obliquely ovate, acuminate, mucronate, 3 - 8 x 1.5 - 4.5 mm, 5 - 7-nerved, persistent. Petals yellow; midlobe glabrous at base, undulate along margins, ca 4 mm long, keeled, crested behind near apex, with stalked bifurcate filiform forked fimbriate appendages; lateral lobes suborbicular, clawed at base, ca 4 mm across. Staminal sheath ca 1.5 mm long, free from

petals; free portion of filaments ca 2 mm long, bears 8 anthers at different levels. Styles laterally compressed, curved, widened and hooked at apex. Capsules suborbicular or laterally elliptic, oblique at base, notched at apex, unequally bilobed, 3 - 5 x 4 - 6.5 mm, ciliate along narrow margins. Seeds ovoid or obovoid, ca 4 mm long, black brown, appressedly stiff silky hairy; caruncle hood-shaped, 3-lobed; lobes flat, covering almost two-third the length of seed, membranous, creamy white.

Fl. & Fr. May - Dec.

Distrib. India. Weed among grasses in wet lands, riversides and waste places. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

14. *Polygala japonica* Houtt., Handl. 10, t. 62, f. 1. 1779. *P. khasyana* Hassk. in Miq., Ann. Mus. 1: 176. 1864. *P. sibirica* auct. non L. 1753; Bennett in Fl. Brit. India 1: 205. 1872, p. p.

Herbs, perennial, prostrate or ascending; rootstock thickened, woody, rhizomatous; stems terete, short hairy, 10 - 20 cm long. Leaves subsessile, ovate, elliptic to linear-lanceolate, acute, 2 - 15 x 3 - 8 mm, recurved along margins, prominently reticulate-veined, mostly puberulous on midrib and margins, faintly pellucid-dotted; petioles up to 1 mm long. Flowers purple to lavender blue, in lateral 1 - 3 cm long, few-flowered racemes; bracts small, puberulous, caducous. Outer sepals lanceolate, acute, puberulous; wing sepals ovate-elliptic, acute, mucronate, up to 6 mm in fruit, 3 - 5-nerved. Lateral lobes of petals suboblong, ciliate and hairy at the adnation with the staminal tube; midlobe keeled with 2 bundles of fringe-like appendages. Staminal tube short ciliate at the adnation with lateral petals; anthers sessile. Ovary suboblong, glabrous; style long, somewhat curved, not widened above; stigmas 2, spaced, 1 apical and the other lateral on slightly knob-like base. Capsules suborbicular, emarginate at apex, winged along margins, 4 - 5 mm across, slightly shorter than wing sepals. Seeds flattened-ovoid, ca 3 mm long, black, puberulous; caruncle hood-shaped with 3 membranous appendages covering almost half the seed.

Fl. Aug. - Sept.

Distrib. India: Roadsides, grasslands, 500 - 2000 m. Meghalaya.

China, Taiwan, Japan, Philippines and New Guinea.

15. *Polygala javana* DC., Prodr. 1: 324. 1824; Bennett in Fl. Brit. India 1: 201. 1872. *P. raoii* R. N. Banerjee & L. K. Banerjee in Proc. Indian Acad. Sci. 21(B): 218 - 220. 1975. *P. sibirica* var. *heyneana* Bennett in Fl. Brit. India 1: 205. 1872, p. p. *P. javana* var. *angustifolia* Thwaites, Enum. Pl. Zeyl. 22. 1864.

Tam.: *Selagachedi*.

Herbs and undershrubs, erect-ascending, 15 - 100 cm high; stems woody at base; branches slender, divaricate. Leaves subsessile, obovate, oblanceolate or elliptic-oblong to linear-oblong, cuneate or attenuate at base, obtuse or rounded and mucronulate or apiculate at apex, entire, (5-) 15 - 45 x (2-) 5 - 20 mm, rusty strigose on both surfaces; petioles 1 - 2 mm long, puberulous. Flowers 7 - 8 mm long, yellow with purple crest, in extra-axillary terminal or leaf-opposed, erect or pendulous, 2 - 9 cm long 5 - 15-flowered racemes; bracts 3, ovate, 1 - 3 x 0.5 - 1 mm, puberulous, persistent or rarely caducous; pedicels up to 6 mm long. Sepals 5, unequal, puberulous, yellow; outer sepals broadly ovate or lanceolate to elliptic-oblong, acute or subacute and mucronate at apex, 1.5 - 4 x 1.2 - 2.5 mm, puberulous; wing sepals broadly ovate, triangular, cordate at base, obtuse or subacute and mucronate at apex, 6 - 12 x 4 - 9 mm, distinctly veined, puberulous, yellowish at first, afterwards pale green or reddish violet, persistent. Petals 3, adnate at base for half the length, yellow; lateral petals ovate or elliptic-oblong, ca 3 mm long; keel petal 4 - 5 mm long, pale yellowish or green with violet multifid filiform ca 2 mm long crest at back of apex. Stamens 8, pinkish; sheath 2 - 4 mm long, encircling the style; free portion of filaments 0.5 - 0.7 mm long; anthers oblong-ovoid. Ovary stipitate, obcordate, up to 1 mm long, velutinous; style curved, broadened towards the middle, up to 5 mm long; stigma subterminal, funnel-shaped, violet. Capsules enclosed in persistent wing sepals, broadly oblong or suborbicular, notched at apex, margined, 4 - 6 x 3 - 5 mm, puberulous. Seeds oblongoid, ca 4 x 2.5 mm, densely stiff-pubescent; caruncle hood-shaped, 3-armed, with 2 arms larger and winged, as long as and covering the seed.

Fl. & Fr. March - Sept.

Distrib. India: Dry regions, grassy fields, roadsides and forest edges, on exposed slopes, up to 1000 m. S. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Malaysia and Indonesia.

16. *Polygala karensium* Kurz in J. Asiat. Soc. Bengal 41(2): 292. 1872; Mukerjee in Bull. Bot. Soc. Bengal 12: 32 - 33. 1958.

Fig. 91.

Shrubs, erect, ca 2 m high, glabrous; stem and branches slender, blackish. Leaves ovate-lanceolate, attenuate at base, acuminate at apex, 8 - 10 x 2.5 - 3.5 cm, olive green above, glaucous beneath, thin, membranous; petioles up to 15 mm long. Flowers in up to 10 cm long axillary or terminal racemes; pedicels ca 4 mm long, recurved; bracts 3, linear-lanceolate, 2 - 3 mm long; flowers white, tipped purple. Outer sepals obovate, 3 - 3.5 x 2 mm; outer solitary sepal boat-shaped, hooded, ca 3.5 mm long; wing sepals obovate, ca 17 x 6 mm. Petals up to 28 mm long, pinkish red; lateral lobes ca 5 mm long; crest 2 - 5-lobed. Staminal sheath membranous; free portion of filaments ca 2 mm long. Styles filiform below, expanding and curved towards apex, ca 25 mm long; stigma capitate, opposite to a blunt projection. Disc cupular, wavy along margins, ca 1.5 mm

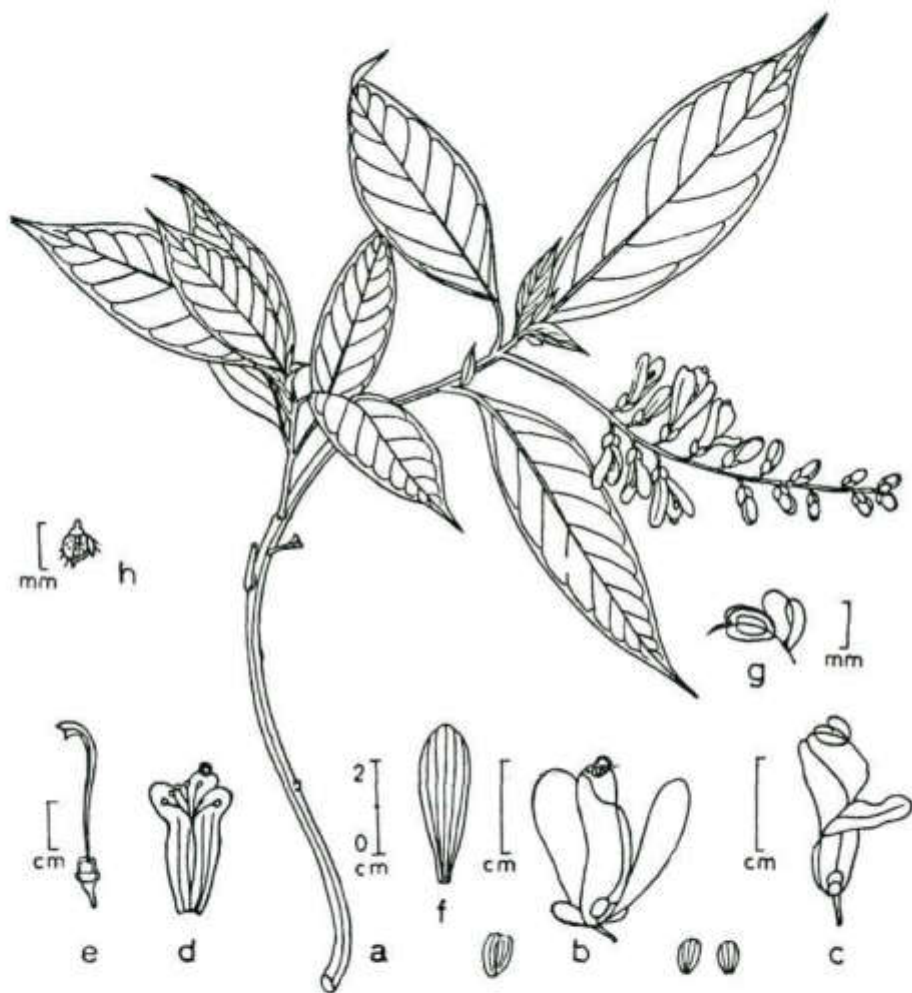


Fig. 91. *Polygala karenium* Kurz : a. branch; b. flower with inner sepals removed; c. petals; d. keel petal; e. pistil; f. outer sepal; g. capsule; h. seed.

across. Capsules orbicular, broadly winged, emarginate, ca 5 mm across. Seeds obovoid, ca 2 mm long, densely white hairy; caruncle 3-appendiculate, white.

Fl. Nov. - Jan.; *Fr.* March - Oct.

Distrib. India: Grassy slopes and edges of forests, 1000 - 2000 m. Sikkim, Arunachal Pradesh and Meghalaya.

Bhutan, Myanmar and Vietnam.

17. *Polygala linarifolia* Willd., Sp. Pl. 3: 877. 1803. *P. chinensis* L. var. *linarifolia* (Willd.) Chodat in Mem. Soc. Phys. Nat. Hist. 31(2): 386. 1893. **Fig. 92.**

Herbs, erect, prostrate or ascending, up to 35 cm high; branches arising from base, terete or somewhat angled above, tomentose. Leaves sessile, linear to narrowly lanceolate, apiculate at apex, 4 - 5 x 0.5 - 1 cm, strongly single-nerved, glabrous and dark green above, pale and scarcely ciliate on nerves beneath; petioles ca 1 mm long. Flowers yellow, 5 - 7 mm long, in leaf-opposed up to 2 cm long many-flowered glabrous racemes; bracteoles minute, caducous; pedicels drooping, 2 - 3 mm long, glabrous. Outer sepals oblong-obovate, ca 2 mm long; wing sepals green, ovate-lanceolate, asymmetrical, curved, apiculate, ca 7 mm long, ciliate hairy outside, glabrous inside. Midlobe of petal ca 5 mm long; lateral lobes ca 3 mm long. Ovary sessile, obovate, ca 1.5 mm long, ciliate at apex. Capsules obcordate, unequal and emarginate at apex, narrowly winged, glabrous on surface, patently ciliate along margins; caruncle of seeds 3-lobed.

Fl. & Fr. April - Nov.

Distrib. India: Along slopes of dried up water courses, moist meadows near forests, up to 1000 m. Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Tripura, Orissa, Madhya Pradesh, Maharashtra, Goa, Andhra Pradesh, Tamil Nadu and Kerala.

Nepal, S.W. China, Thailand, Vietnam and Malesia.

18. *Polygala longifolia* Poiret in Lam., Encycl. 5: 501. 1804. *P. leptalea* DC., Prodr. 1: 325. 1824; Bennett in Fl. Brit. India 1: 202. 1872.

Herbs, 20 - 60 cm high; stems slender, erect, usually unbranched, sometimes branched, sharply angular or deeply furrowed, ribbed, glabrous. Leaves sessile, 1-nerved, pale beneath; basal leaves obovate, linear to elliptic or oblong-lanceolate, attenuate at base, rounded at apex, revolute along margins, 10 - 25 x 5 mm; upper leaves linear-oblong or linear-lanceolate, narrowed at base, acute to subacute and mucronulate at apex, 15 - 40 x 2 - 4 mm, glabrous. Flowers 2 - 3 mm long, pink or purplish white, densely arranged in terminal 3 - 18 cm long racemes, bracts linear to subtriangular, acute,

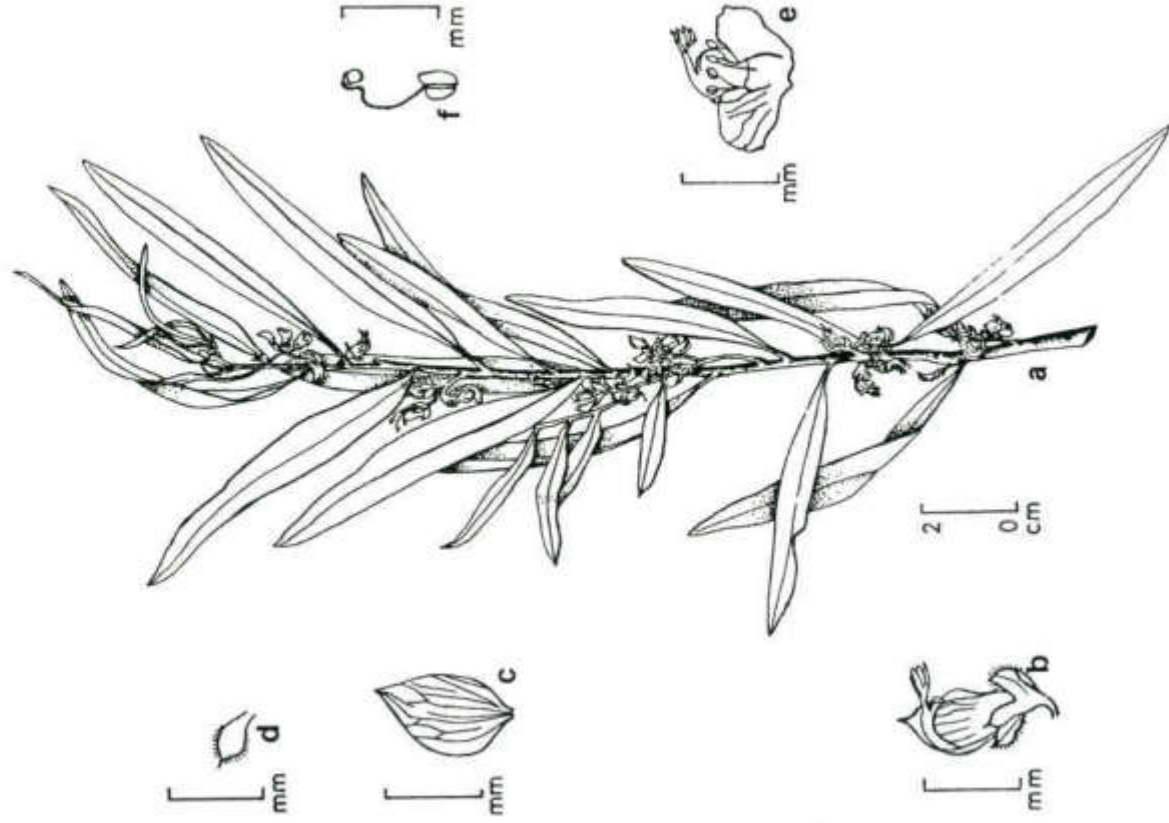


Fig. 92. *Polygala linearifolia* Willd.: a. branch with flowers and fruits; b. flower; c. sepal; d. bracteole; e. petals and stamens; f. pistil.

ca 1 mm long, caducous, puberulous; pedicels ca 1 mm long. Sepals persistent; outer sepals elliptic-obovate or lanceolate to oblanceolate, obtuse or acute, 1.5 - 3 mm long, puberulous along margins, green; wing sepals broadly elliptic, narrowed at base, obtuse at apex, 2.5 - 4 x 1.5 - 2.5 mm, broader above the middle, 3-nerved. Petals purple or pinkish red; middle lobe keeled, ca 2 mm long, crested with one bundle of 4 - 6 flattened incised appendages; lateral lobes obliquely subtriangular to obovate, 2.5 - 3.5 mm long, hairy inside. Staminal sheath 1 - 2 mm long; free portion of filaments up to 1 mm long, united at same level; anthers ca 1 mm long, oblong. Ovary obovate, ca 1 mm long, glabrous; style curved, ca 1 mm long; stigma rounded. Capsules oblong or broadly obovate, notched at apex, narrowly winged along margins, 3 - 4 mm long, ca 2.5 mm wide, glabrous, enclosed in persistent up to 5 mm long wing sepals. Seeds narrowly oblong-ellipsoid, ca 2 x 1 mm, black with short appressed white silky hairs; caruncle small, membranous, 3-fid to the base, with very narrow sinuses and short lobes.

Fl. & Fr. June - Jan.

Distrib. India: Along borders of forests, shaded places, amidst grass. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Arunachal Pradesh, Assam, Nagaland, Manipur, Meghalaya, Orissa, Madhya Pradesh, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Nepal, Bhutan, Myanmar, S. China, Vietnam, Thailand, Malaysia, Philippines and Australia.

19. *Polygala mariesii* Hemsley in J. Linn. Soc., Bot. 23: 61, t. 2B, ff. 7 - 13. 1886; Sparre & Fischer in Bull. Misc. Inf. Kew 1929: 252. 1929; Chowdhuri in Bull. Bot. Surv. India 12: 263. 1970. Fig. 93.

Shrubs, ca 3 m tall; branches greenish. Leaves crowded at ends of branches, elliptic-lanceolate, attenuate at base, acute at apex, 4.5 - 12 x 1.2 - 2.9 cm, glabrous on both surfaces, subcoriaceous; petioles 1 - 1.5 cm long. Flowers greenish yellow or brown, in 2 - 22 cm long pendulous axillary or terminal glabrous racemes; bracts caducous; pedicels 3 - 4 mm long. Outer solitary sepal 3 - 4 x 2 - 3 mm; outer paired sepals 2 - 3 x 1 - 2 mm; wing sepals 11 - 13 x 5 - 7 mm. Petals 3-lobed, yellow, turning purple; middle lobe 1.5 - 1.7 cm long; lateral lobes 2 - 3 mm long; sinus rounded. Filaments 3 - 4 mm long. Ovary oblong, stipitate, 2 - 3 mm long, glabrous; style 1.3 - 1.5 cm long; stigma capitate. Disk cupular. Capsules compressed, clavate, winged. Seeds brown pilose, hairs ca 5 mm long.

Fl. March - May; *Fr.* June - Oct.

Distrib. India: On rocky slopes along the river banks above flood level. Arunachal Pradesh, Nagaland and Meghalaya.

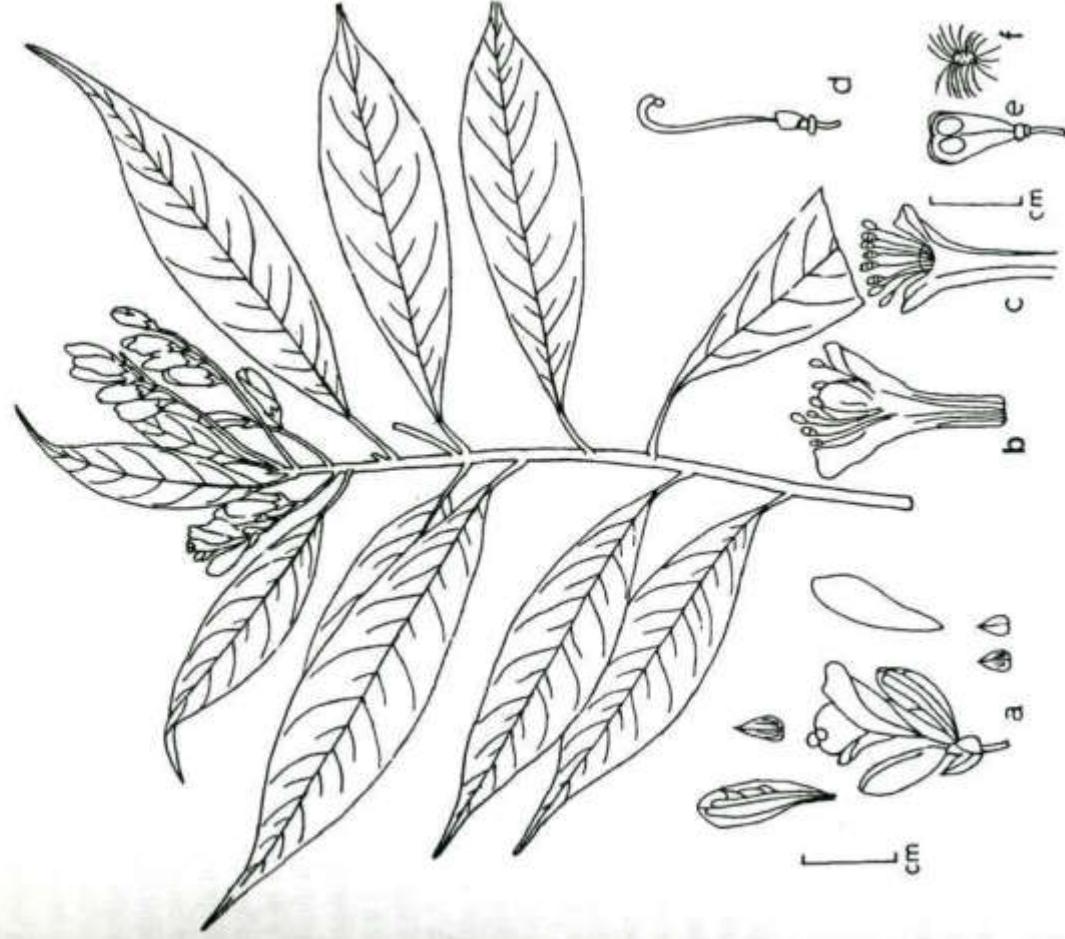


Fig. 93. *Polygala mariesii* Hemsley : a. flowering branch; b. flower, with sepals separated; c. petals, showing stamens; d. pistil; e. capsule; f. seed.

Bhutan and China.

20. *Polygala persicariifolia* DC., Prodr. 1: 326. 1824; Bennett in Fl. Brit. India 1: 202. 1872 (as *persicariaefolia*).

Herbs, 10 - 65 cm high; stems terete, erect or decumbent, dichotomously branched at top or simple and arising directly from base, finely crisp-haired. Leaves alternate, sessile, ovate-oblong, lanceolate, elliptic or linear-oblong, subacute or cuneate at base, acute or subacute and mucronate at apex, 15 - 65 x 3 - 20 mm, revolute or flat along margins, glabrous, sparsely pubescent or strigose along nerves below; basal leaves smaller. Flowers 3 - 5 mm long, rose-purple or reddish-violet with pink streaks, in 4 - 14 cm long terminal and extra-axillary or leaf-opposed, erect or patent racemes; pedicels 1 - 3 mm long, downwardly directed; bracts 3, lanceolate, 1 - 2 mm long, persistent. Sepals persistent; outer sepals elliptic-oblong, lanceolate, obtuse, subequal, 2.5 - 3 mm long, puberulous on margins; wing sepals rounded, broadly obliquely obovate to suborbicular, rounded at apex, 5 - 6 mm long, 4 - 5 mm wide, petaloid, glabrescent or puberulous on margins, 3 - 5-nerved, reddish. Petals pink, purple or yellowish with purple streaks, hairy inside; middle lobe ca 6 mm long, keeled with a crest of 2 - 3 bundles of linear membranous forked appendages; lateral lobes obliquely oblong, smaller. Staminal sheath adherent to petals, 1.5 - 2.5 mm long; free portion of filaments ca 1.2 mm long. Ovary obovoid, less than 1 mm long, ciliate along margins; style curved, widened towards middle, broadened at apex, ca 3 mm long; stigma oblique, lateral. Capsules elliptic, obcordate, symmetrical at base, very narrowly winged, emarginate at apex, compressed, 5 - 6 x 4 - 4.5 mm, membranous, marginally winged, ciliate along margins towards upper portion. Seeds oblong-ellipsoid, 3 - 3.5 x 1.3 - 1.5 mm, shiny reddish black, hirsute with dense silky light brownish or white hairs; caruncle hood-shaped, 3-lobed with short blunt lobes and very narrow sinuses.

Fl. May - July; *Fr.* Aug. - Nov.

Distrib. India: In grassy shaded slopes on black humus soil. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Meghalaya, Orissa, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

♣ Nepal, Bhutan, S. China, Vietnam, Indonesia (Java only), Philippines, N. Australia and Tropical E. Africa.

21. *Polygala rosmarinifolia* Wight & Arn., Prodr. 1: 37. 1834; Bennett in Fl. Brit. India 1: 204. 1872.

Herbs, erect, decumbent or prostrate, up to 45 cm high, branching upwards; branches densely appressed-pubescent. Leaves sessile or subsessile, linear, elliptic or very rarely oblong or oblanceolate, attenuate at base, thickened and recurved along

margins, acute or acuminate and apiculate at apex, (5-) 10 - 40 (-55) x 2 - 4 (-6) mm, erect, hairy on upper surface, pubescent beneath, densely so on midrib; petioles up to 0.5 mm long. Flowers ca 4.5 mm long, yellow, rarely solitary or in lateral extra-axillary or axillary, erect, up to 3 cm long 3 - 8-flowered racemes; bracts caducous; bracteoles 3, ovate, ca 1 mm long, tomentose, ciliate along margins, persistent; pedicels erect, pubescent, ca 1.5 mm long in flowers, up to 2.5 mm long in fruit. Outer sepals with pale yellow or chocolate-coloured tips, ovate to obovate or lanceolate, acute-mucronate at apex, 2 - 2.5 x 0.4 - 1.2 mm, ciliate along margins, patently hairy; wing sepals obliquely oblong or elliptic, acute or short acuminate at apex, ca 4.5 x 2 - 3 mm, glabrous, ciliate along margins, subparallelly 5-nerved, persistent. Petals yellow with red markings; middle lobe up to 3 mm long, keeled with a crest of forked filiform appendages on back, 3.5 - 4 mm long; lateral lobes suborbicular, spatulate, truncate, 2.5 - 3 x 2 mm, membranous, prominently nerved, wrinkled. Staminal sheath up to 1.5 mm long; lateral pairs of filaments subconnate, terminal filaments free or up to 0.6 mm long; anthers oblong, up to 0.4 mm long. Ovary obliquely obovate, emarginate, ca 3 mm across, ciliate along margins; style up to 3 mm long, curved, broadened towards the horse-shoe shaped apex; stigma lateral, capitate. Capsules rhombate or obliquely obovate, inequilateral at base, emarginate at apex, narrowly winged and ciliate along margins, 4 - 5 x 2.5 - 3 mm. Seeds oblong, subcylindrical, truncate at apex, 2.5 - 3 x 1 - 1.5 mm, black, brownish hirsute; caruncle hood-shaped with 2 oblong curved ca 0.8 mm long appendages and a short tooth.

Fl. & Fr. Jan. - Dec.

Distrib. India: Open hilly grasslands, roadsides, cleared areas, 500 - 2000 m. Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

22. *Polygala sibirica* L., Sp. Pl. 702. 1753; Bennett in Fl. Brit. India 1: 205. 1872, p. p. *P. heyneana* Wight & Arn., Prodr. 1: 38. 1834, p. p. **Fig. 94.**

Herbs, perennial, erect or decumbent, 10 - 45 cm long, pubescent; stems slender, many, deep-rooted, ascending from base, crispate-pubescent. Leaves linear-oblong to elliptic-lanceolate, rounded or attenuate at base, acute-mucronulate at apex, flat or recurved along margins, 6 - 35 x 2 - 10 mm, coriaceous, scabrid above, hairy on nerves beneath; lateral nerves 3 - 9 pairs, veinlets prominently reticulate; petioles ca 1 mm long, hairy. Racemes leaf-opposed or terminal, 2 - 10 cm long, elongating in fruit; bracts linear-lanceolate, 3 - 4 mm long, puberulous, caducous; pedicels 3 - 4 mm long, slender, elongating and recurved in fruit, pubescent. Flowers deep bluish purple, 6 - 7 mm long. Sepals green with purple edges, pubescent, persistent; outer sepals subequal, oblong-ovate to linear-lanceolate, concave, subacute, 2.5 - 3.5 x 1.5 - 2 mm; wing sepals falcately ovate-lanceolate or obovate, narrowed at base, acute, obtuse or rounded at apex, falcate or oblique, 5 - 8 x 2 - 4 mm, membranous, 3 - 7-nerved, glabrous, ciliate or puberulous

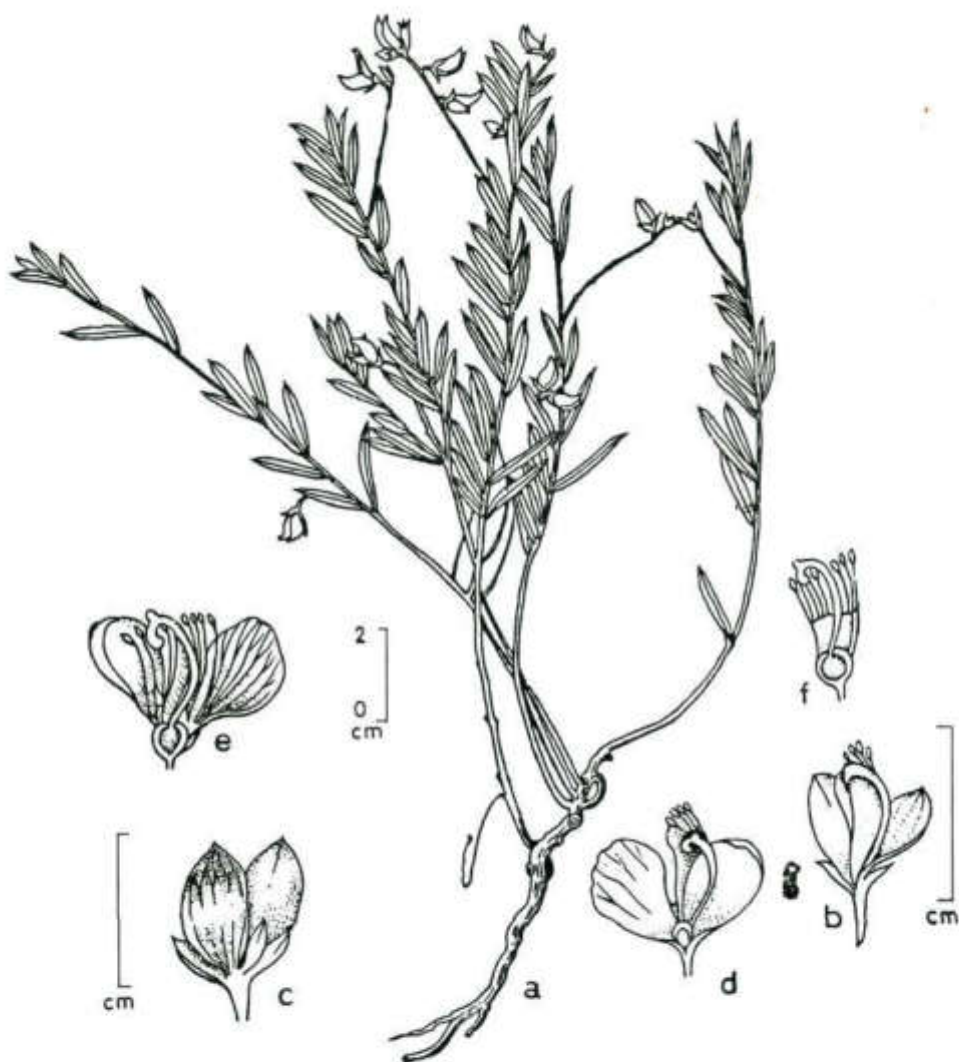


Fig. 94. *Polygala sibirica* L. : a. habit; b. flower; c. sepals; d-e. petals, with stamens and pistil; f. stamens and pistil.

along margins. Petals lavender blue; lateral lobes linear-oblong, obtuse, mucronate, 4 - 5 mm long; middle lobe rounded, keeled, 5 - 6 mm long, with a much-branched linear-appendaged white crest on back near apex. Stamens 8; filaments connate at different levels in a sheath, more or less encircling the ovary, not adherent to petals, up to 2.5 mm long, free portion up to 1 mm long. Ovary subglobose, glabrous; style ca 6 mm long, enlarged and curved at apex; stigma terminal, bidentate, superposed. Capsules suborbicular, obcordate, narrowly 1 - 2 mm wide winged along margins, notched at apex, 4 - 5 x 5 - 6 mm, glabrous. Seeds oblong-ellipsoid, 3 - 4 x 2 - 2.5 mm, sparsely minutely white pilose, dark brown; caruncle 3-fid, the longer arm ca 2.5 mm long, the shorter arms ca 1.5 mm long, covering half to two-third the length of the seed.

Fl. & Fr. Mar. - Dec.

Distrib. India: Grasslands, cleared forests, roadsides in damp soil, 1500 to 2800 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Sikkim, entire N.E. India, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, Nepal, Bhutan, Myanmar, S. & S.W. China and E. Asia, extending to Europe.

23. *Polygala tartarinowii* Regel in Bull. Soc. Nat. Moscou 34(2): 523. 1861. *P. triphylla* auct. non D. Don; Bennett in Fl. Brit. India 1: 201. 1872; Pal & Giri in J. Econ. Tax. Bot. 14: 226, ff. A - C. 1990. Fig. 95.

Herbs, annual, erect, 5 - 18 cm high; stems slender, simple or sparingly branched, glabrous, faintly ribbed. Leaves ovate to broadly obovate, suborbicular, spatulate or rounded, obtuse or acutely decurrent at base, obtuse-mucronulate or acute at apex, 7 - 40 x 2 - 20 mm, shortly hairy, ciliate; petioles 3 - 10 mm long, up to 15 mm in fruit, sometimes subulate, ciliate along margins. Flowers rose-red to purple, ca 3 mm long, in 1 - 8 cm long terminal or axillary dense racemes; peduncles 3 - 25 mm long, subtended by 2 - 3 leaves; pedicels ca 1 mm long in fruits; bracts 2 - 3, lanceolate, 1.5 - 2 mm long, membranous, caducous; bracteoles lanceolate, 0.5 - 1 mm long, early caducous. Sepals caducous, rugose; outer sepals concave, subovate, blunt, 1.5 - 2 mm long; wing sepals orbicular, obovate or spatulate, narrowed below, obtuse at apex, 2 - 3.5 mm long, 3 - 5-nerved. Petals deep yellow or pinkish; middle lobe keeled, orbicular at apical part, 3 - 4 mm long, split at apex, not crested, papillose; lateral lobes oblong, longer than keel petal. Staminal sheath adnate to lower part of petals, glabrous inside; anthers globular. Ovary subglobose; style flattened, curved, trumpet-shaped and obliquely cut at apex, ca 2.5 mm long; stigma hooded at the shortest end of the trumpet. Capsules discoid, rounded, subquadrangular, narrowly winged along margins, notched or emarginate at apex with a short blunt acumen, ca 2 x 2.5 mm, 2-papillate at apex, rugose. Seeds oblong-ellipsoid, black, shortly white silky hairy; caruncle small, hooded, 3-lobed with 2 minute rounded thin appendages.

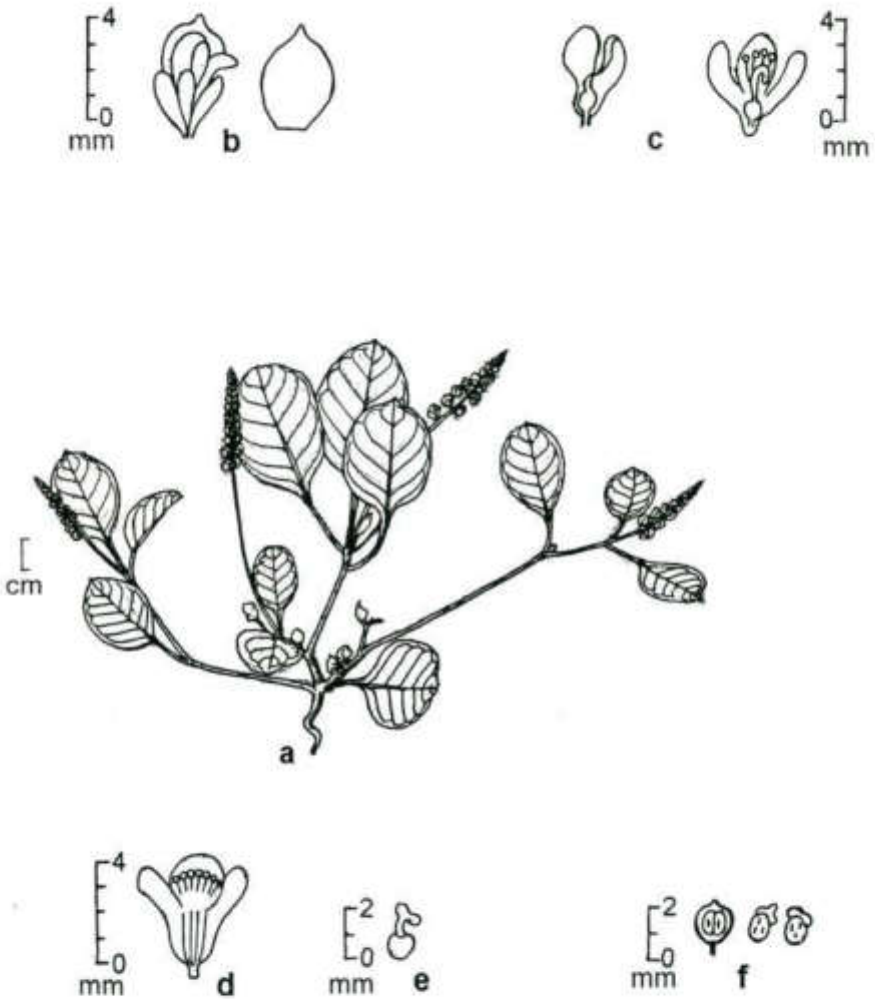


Fig. 95. *Polygala tartarinowii* Regel. : a. habit; b. flower with sepals separated; c. petals, split open; d. stamens, adnate to corolla; e. pistil; f. fruit, with 2 seeds.

Fl. March - Aug.; *Fr.* April - Oct.

Distrib. India: Subtropical open grassy places, 600 - 2000 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam, Meghalaya, and Madhya Pradesh.

Pakistan, Bhutan, Nepal, Myanmar and China to Japan and S.E. Asia, up to Phillipines.

24. *Polygala telephioides* Willd., Sp. Pl. 3(2): 876. 1802; Bennett in Fl. Brit. India 1: 205. 1872.

Herbs, 5 - 30 cm high, with a woody rootstock; stems usually unbranched, prostrate, ascending or rarely erect, terete below, angled above, velutinous or sericeous. Leaves sessile, or subsessile, elliptic, obovate, oblong or linear-oblong, attenuate at base, obtuse or acute and mucronate at apex, recurved along margins, 5 - 30 x 2 - 8 mm, glabrous or sericeous on both surfaces; nerves prominent beneath, obscure above; petioles up to 1 mm long, spreading, exposing internodes. Flowers ca 3 mm long, violet or blue, crowded in leaf-opposed or lateral up to 12 mm long racemes; bracts caducous. Outer sepals linear-lanceolate to ovate-lanceolate, acute, mucronate, concave, 1 - 2 x 0.5 - 1.2 mm, pubescent outside, glabrous inside, ciliate along margins; wing-sepals obliquely elliptic or ovate-lanceolate, acuminate, apiculate at apex, ca 5 x 3 mm, 3 - 5-nerved, glabrous or sericeous, persistent. Petals blue, ca 4 mm long; middle lobe keeled, crested with stalked capitate finger-like appendages on back near apex; lateral lobes obovate, subobtusate, ca 1.5 mm long. Staminal sheath adherent to base of petals, ca 1.8 mm long, split for two-third the length; filaments 8, arising at different levels from sheath, with 2 free filaments in the middle and 2 bundles of 3 connate filaments on either side with sessile anthers. Ovary orbicular, flat, pilose along margins; styles bent, broadened at middle and apex, ca 3 mm long, glabrous; stigma hooded. Capsules enclosed in wing sepals, broadly ovoid or suborbicular, emarginate at apex, ca 2.5 mm across, glabrous, sericeous along margins. Seeds oblongoid or cylindrical, obtuse, ca 3 mm long, silky hairy; caruncle hood-shaped, with 3 linear short appendages.

Fl. & Fr. Aug. - Jan.

Distrib. India: Sandy humus soil in open grasslands along moist situations, up to 1000 m. Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Tamil Nadu and Kerala.

Sri Lanka, S. China, Malaysia and Phillipines.

25. *Polygala tricholopha* Chodat in Mem. Soc. Phys. Geneva 31(2): 98, t. 17, f. 20. 1898. *P. arillata* sensu Bennett in Fl. Brit. India 1: 200. 1872, p. p. **Fig. 96.**

Mani.: *Yup-Nga-Lap*.

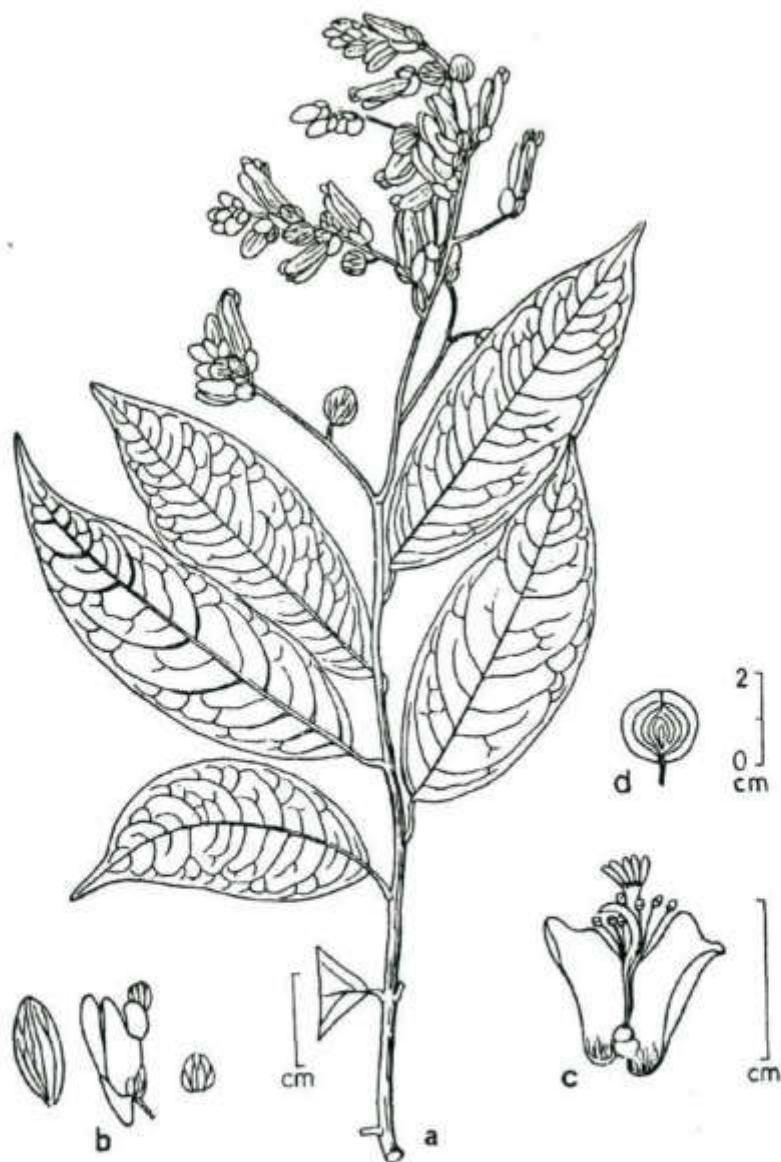


Fig. 96. *Polygala tricholopa* Chodat : a. branch with flowers and fruits; b. flower with sepals separated; c. petals, split open; d. capsule.

Shrubs, often straggling; stems with projecting cicatrices of fallen leaves. Leaves elliptic, oblong, 9 - 15 x 3 - 5 cm, coriaceous, glabrous above, pale and subglaucous beneath; petioles 5 - 10 mm long. Flowers 16 - 17 mm long, in leaf-opposed or extra-axillary or sometimes terminal 9 - 10 cm long paniculate racemes with zig-zag rachis; bracts and bracteoles caducous; petioles 5 - 10 mm long. Sepals ciliate, caducous; outer paired ones ovate to suborbicular, obtuse and often emarginate at apex, 3 - 4 mm long, ciliate; outer solitary sepal gibbous, 5 - 7 mm long; wing sepals elliptic, revolute along margins, 6 - 6.5 mm long, many-nerved. Petals 3-lobed, 10 - 13 mm long; middle lobe keeled, 6 - 8 mm long with 1 - 3 mm long pedicellate crests. Stamens 3 - 3.5 mm long; filaments free above; anthers conical. Ovary ovate; styles ca 6 mm long, dilated above; stigma unequally bilobed, pointed above, capitate. Capsules elliptic to suborbicular, winged, beaked, 4 - 7 x 6 - 7 mm, dark reddish purple, glabrous. Seeds subglobose, black; caruncle large, helmet-shaped.

Fl. June - Aug.; *Fr.* Sept. - Jan.

Distrib. India: 1000 - 2000 m West Bengal, Sikkim, Assam, Manipur and Meghalaya.

Bhutan, Myanmar, Thailand, Malaysia and Indonesia (Sumatra).

26. *Polygala umbonata* Craib in Bull. Misc. Inf. Kew 1916: 260. 1916; Mukerjee in Bull. Bot. Soc. Bengal 12: 35. 1958. *P. triphylla* sensu Haines in Bot. Bihar Orissa 42. 1925, non Burm. f. 1798, nec D. Don 1825.

Herbs, annual, 15 - 20 cm high; stems weak, grooved, glabrous, dichotomous above. Leaves lanceolate, ovate-lanceolate, tapering at base, mucronate at apex, 4.5 - 6 x 2 - 3 cm, setulose along margins, membranous, glabrous above, sparsely pubescent and pale beneath; petioles 8 - 10 mm long. Flowers 4 - 5 mm long, in axillary or terminal glabrous racemes; pedicels 1 - 1.2 mm long; bracts longer than pedicels, narrow, deciduous. Sepals 5, outer paired sepals 1 - 1.5 mm long; outer solitary sepal ovate, ca 2 mm long; wing sepals obovate, cuneate at base, rounded at apex, 3.7 - 4 x 3 - 3.5 mm. Petals 3-lobed, ca 4 mm long; lateral petals acute; keel petal with 2-lobed rounded crests. Stamens 2.5 - 3 mm long; filaments coherent below, glabrous; free portion 1 - 2 mm long, hyaline. Ovary ovoid; style flat, bent at middle, 2.5 - 3 mm long, flat; stigma minute. Capsules obovate or orbicular, 3 - 3.5 mm across, narrowly winged, emarginate at apex. Seeds oblong, 1 - 2 mm long, black, pubescent, minutely and copiously tubercled; caruncle 3-lobed, gelatinous; strophiole black, shiny, hollow, about one-third as long as seed, narrower than seed, curved slightly at apex, ending in an orbicular sunken membranous lamella.

Fl. Oct. - Nov.

Distrib. India: Nagaland.

Myanmar, Vietnam, Laos and Cambodia.

27. *Polygala wightiana* Wight & Arn., Prodr. 38. 1834; Gamble, Fl. Pres. Madras 59. 1915. *P. elongata* auct. non Klein 1802; Bennett in Fl. Brit. India 1: 203. 1872, p. p.

Herbs, erect or ascending; branches 10 - 40 cm long, often dichotomous at apex, glabrous, glaucous. Leaves subsessile or shortly petioled, linear-oblong or narrowly oblanceolate, narrowed towards base, entire, flat or recurved along margins, obtuse, subacute and mucronate at apex, 3 - 35 x 1 - 3 mm, chartaceous, glabrous. Flowers 3 - 4 mm long, yellow, in extra-axillary or leaf-opposed 1 - 8 cm long racemes; bracts ca 1 mm long. Sepals persistent; outer sepals unequal, lanceolate to ovate-lanceolate, acute-mucronate at apex, 2 - 2.5 x 0.5 - 1.2 mm, glabrous; wing sepals obliquely ovate, falcate, subacute and mucronate or apiculate at apex, ca 4.5 x 2.5 mm, 5-nerved, glabrous, petaloid. Petals 2 - 2.5 mm long, greenish, tinged with pink; middle lobe keeled, auricled at base, up to 3.5 mm long, with a crest of linear forked appendages on back; lateral lobes obovate, clawed and hairy at base, rounded at apex, up to 2.5 mm. Staminal sheath free, ca 1.5 mm long; filaments connate into 3 bundles; the lateral ones bearing 3 sessile anthers each and the middle one bearing 2 anthers with filaments united for half way. Ovary ovoid, glabrous, ciliate along margins; style slender, curved, hooked at apex with membranous wings, up to 3.5 mm long; stigma dilated. Capsules overtopped by wing sepals, oblong, emarginate at apex, margined, 2.5 - 4 x 1.5 - 2.5 mm, glabrous. Seeds oblongoid, truncate at apex, 2 - 3 x 0.5 - 1 mm, black, densely silky hairy; caruncle hood-shaped, with 3 curved small toothed appendages.

Fl. & Fr. Aug. - Dec.

Distrib. India: Wastelands, cultivated fields, roadsides in hills and plains, up to 1000 m. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Malesia to N. Australia.

3. *Salomonina* Lour., nom. cons.

Herbs, annual, small, erect or ascending; stems angular. Leaves alternate, sessile or petiolate, entire, 3-nerved. Flowers sessile, small, crowded in terminal or axillary spikes, opposite or superposed, each in axil of an acute caducous bract, minutely bibracteolate at base. Sepals 5, subequal; inner 2 larger, persistent; 2 anterior ones shorter; segments pointing backwards, acute. Petals 3, connate at base into a tube and adnate to staminal tube, cleft above, violet; lower petal keeled, vaulted, subentire, longer than the outer ones without a crest. Stamens 4 - 5 or 6, monadelphous; filaments united in lower half, adnate to corolla-tube at base; anthers confluent in one rectangular mass, opening by terminal pore. Ovary 2-loculed; ovule 1 in each locule, pendulous; style incurved at apex, thickened upwards. Capsules laterally compressed, obcordate, thin-

walled, transversely oval or subreniform, loculicidally dehiscent along the muriculate margins. Seeds orbicular, black, glabrous; strophiole very small, gelatinous or absent.

Tropical S., E. and S.E. Asia to Australia, Europe and N. Mexico; ca 12 species, 2 in India.

KEY TO THE SPECIES

- 1a. Leaves shortly petiolate, ovate, truncate or cordate at base, 8 - 25 x 5 - 18 mm; lower sepal equalling or smaller than other sepals; anthers 6; fruits transversely oval, muricate at lower margin; seeds estrophiolate 1. *S. cantoniensis*
- b. Leaves sessile, oblong-lanceolate, rounded or obtuse at base, 3 - 11 x 2 - 4 mm; lower sepals larger than other sepals; anthers 4; fruits obreniform, not muriculate at lower margin; seeds gelatinously strophiolate 2. *S. ciliata*

1. *Salomonina cantoniensis* Lour., Fl. Cochinch. 17. 1790. *S. eduntula* DC., Prodr. 1: 334. 1824; Bennett in Fl. Brit. India 1: 207. 1872.

Herbs, annual, erect or ascending, 5 - 25 cm high, glabrous; stems angular or narrowly winged, much-branched, dichotomously branched at tips producing spikes; roots aromatic. Leaves ovate, lanceolate, cuneate, broadly rounded, truncate or cordate at base, obtuse or subacute at apex, 5 - 25 x 4 - 16 mm, often pinkish above, pale beneath, flaccid, glabrous or sparsely ciliate, 3 - 5-nerved at base; petioles up to 4 mm long, winged. Inflorescence 2 - 10 cm long, terminal or rarely upper axillary spikes; rachises winged or not; bracts lanceolate, fugaceous, ca 1 mm long. Sepals 5, scaly, linear-subulate, subequal, ca 1 mm long, persistent; lateral sepals as long as keel. Petals 3, equal or subequal, connate at base into a cleft tube, 1.5 - 2.5 mm long, light violet or pink. Stamens 4, rarely 6, monadelphous; filaments ca 1 mm long, connate at base and adnate to corolla; anthers opening by apical pores. Ovary obcordate, ca 1 mm long; style sigmoid, curved at apex, ca 2 mm long, hyaline, not exerted. Capsules sessile, obcordate or orbicular, flat, not winged but with a row of curved triangular teeth or minute hairs along margins, 1 - 1.5 x 2 mm, thin-walled. Seeds lenticular, ca 1 mm across, shiny red or blackish brown, with a very small strophiole or estrophiolate.

KEY TO THE VARIETIES

- 1a. Inflorescences 5 - 10 cm long; margins of fruits minutely toothed 1.1. var. *cantoniensis*
- b. Inflorescences up to 4.5 cm long; margins of fruits microscopically hairy or ciliate 1.2. var. *eduntula*

1. 1. var. *cantoniensis*

Fl. Jan. - April; *Fr.* May - Oct.

Distrib. India: Wastelands, marshy places, on sandy soil, up to 1600 m. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tirpura, Meghalaya and Madhya Pradesh.

Nepal, Bangladesh, Myanmar, Vietnam and S. China.

1. 2. var. *edentula* (DC.) R. N. Banerjee, *stat. et comb. nov.* *P. edentula* DC., Prodr. 1: 334. 1824; Bennett in Fl. Brit. India 1: 207. 1872.

Leaves cordate-triangular. Rachises winged. Lateral sepals nearly as long as keel.

Fl. Feb. - May; Fr. May - Oct.

Distrib. India: West Bengal, Sikkim, Arunachal Pradesh and Assam.

Nepal.

2. *Salomonnia ciliata* (L.) DC., Prodr. 1: 334. 1824; Bennett in Fl. Brit. India 1: 206. 1872. *Polygala ciliata* L., Sp. Pl. 705. 1753. *S. oblongifolia* DC., Prodr. 1: 334. 1824; Bennett, l. c. 207. Fig. 97.

Herbs, slender, erect or decumbent, 6 - 26 cm high; stems simple or sparingly branched, angular, fluted, often glabrous. Leaves sessile, elliptic to oblong-lanceolate, rounded-obtuse or subcordate at base, acute to obtuse and mucronate at apex, entire and ciliate along margins, 4 - 14 x 2 - 8 mm, sparingly ciliate or glabrous, usually 3-nerved. Inflorescences terminal and axillary, 10 - 17 cm long; rachis winged; bracts linear, ca 1.5 mm long. Flowers opposite, superposed, crowded, 2 - 3 mm long, pink. Sepals unequal, linear-lanceolate, acute at apex, 1.5 - 2 mm long, up to 0.5 mm broad, persistent, ciliate, 2 inner somewhat larger. Petals 3, pink or white and purplish tipped; median petal keeled, ca 3 mm long; lateral ones lanceolate, up to 1.8 mm long, adnate to keel petal. Stamens 4, monadelphous, with ca 2 mm long sheath; anthers 2-loculed, undifferentiated. Ovary compressed, sessile, obcordate or orbicular, spinulose; style ca 2 mm long, flat, hyaline, curved; stigma capitate. Capsules obreniform, deeply notched or 2-lobed at base, winged along margins, ca 1 x 2 mm; central area with subparallel margins; upper prickles 0.5 - 0.75 mm long, erecto-patent; lower margin inermous. Seeds gelatinously strophiolate, rounded, ca 0.5 mm in diam., shiny dark brown or black.

Fl. & Fr. Aug. - Dec.

Distrib. India: Slightly shaded damp waste places, grasslands and along borders of cultivated fields, up to 1500 m. Uttar Pradesh, Bihar, West Bengal, Sikkim, Meghalaya, Orissa, Madhya Pradesh, Maharashtra, Goa, Daman & Diu, Karnataka and Kerala.

Myanmar, Sri Lanka, E. Asia, Malaysia, Philippines and Europe.

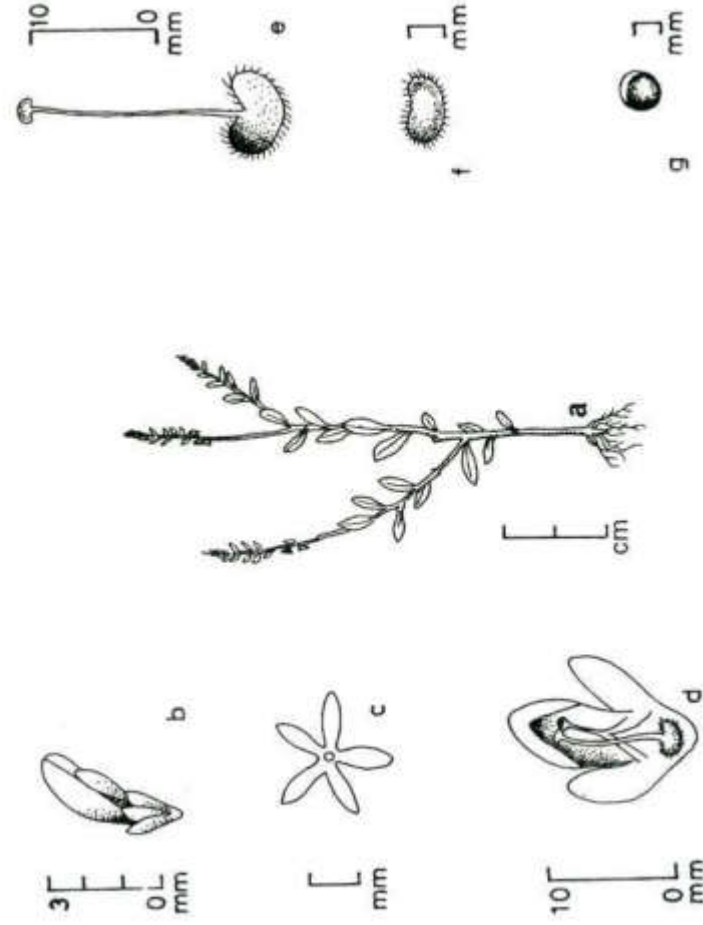


Fig. 97. *Salomonnia ciliata* (L.) DC.: a. habit; b. flower; c. capyx, spread out; d. corolla, spread out showing stamens and pistil; e. pistil; f. fruit; g. seed.

4. *Securidaca* L.

Scandent shrubs or lianas. Leaves alternate, distichous, entire, sometimes biglandular. Inflorescences terminal and axillary, simple racemes or panicles; bracts present, often with 2 bracteoles. Sepals 5, unequal, deciduous, 2 inner ones (wings) largest, petaloid. Petals 3; 2 lateral ones free or shortly connate with the lowermost one at base, violet with citrine top; lowermost one (keel) strongly folded, dorsally crested, pink. Stamens 8, monadelphous; filaments united at base into a split sheath adnate at back to petals; anthers 2-locular; each locule dehiscent by a terminal oblique, intorse pore. Ovary 1-loculed; 1-ovuled; style subterete, dilated and incurved at apex; stigma emarginate or somewhat 2-lobed. Fruit 1-seeded indehiscent samara, apically winged or not; wings broad, coriaceous. Seeds ecarunculate, estrophiolate, exalbuminous, glabrous; cotyledons thick and fleshy.

Tropics and subtropics of Asia, Africa, Australia and America; ca 80 species, one in India.

Securidaca inappendiculata Hassk., Pl. Jav. Rar. 295. 1848. *S. tavoyana* Bennett in Fl. Brit. India 1: 208. 1872. **Fig. 98.**

Asm.: *Phackcena-lata*.

Robust lianas with dark brown stem; stem fibres strong, silky; branchlets puberulous. Leaves elliptic, obovate, oblong or oblanceolate, cuneate at base, cuspidate or abruptly acuminate at apex, entire, 5 - 13 x 2 - 5 cm, coriaceous, glabrous and deep green above, finely pubescent and pale beneath; lateral nerves 8 - 12 pairs, oblique; petioles 5 - 7 mm long. Flowers lax in 10 - 22 cm long subcorymbose panicles; pedicels filiform, 2 - 5 mm long, lower pedicels longer than upper, up to 15 mm long; bracts ovate, ca 1 mm long, hairy. Outer sepals 3, ovate-elliptic to rounded, slightly oblique at base, ca 3 x 2 mm, ciliate; inner wing sepals 2, elliptic, patent, alternate at base, rounded at apex, concave, 5 - 6 x 3 - 5 mm. Petals 3; middle petal 5 - 6 mm long, keeled, crested; lateral petals 2, adnate at base to keel, truncate. Stamens 8, 4 - 5 mm long. Ovary sessile, terete, 1.5 - 2 mm long excentric; style ca 5 mm long, geniculate bent at top; stigma bilobed. Fruit 6 - 10 x 1.5 - 2.5 cm, strongly corrugate; wings oblique, entire, oblong to obovate, straight on one side, rounded or obtuse at apex, rugose, closely strongly arcuate-nerved. Seeds suborbicular, compressed, ca 7 mm long.

Fl. June - Oct.; Fr. Sept. - Feb.

Distrib. India: Evergreen forests, up to 2000 m. West Bengal, Assam, Tripura, Meghalaya and Orissa.

Nepal, Bhutan, Bangladesh, Myanmar, Vietnam, S. China and Malaysia.

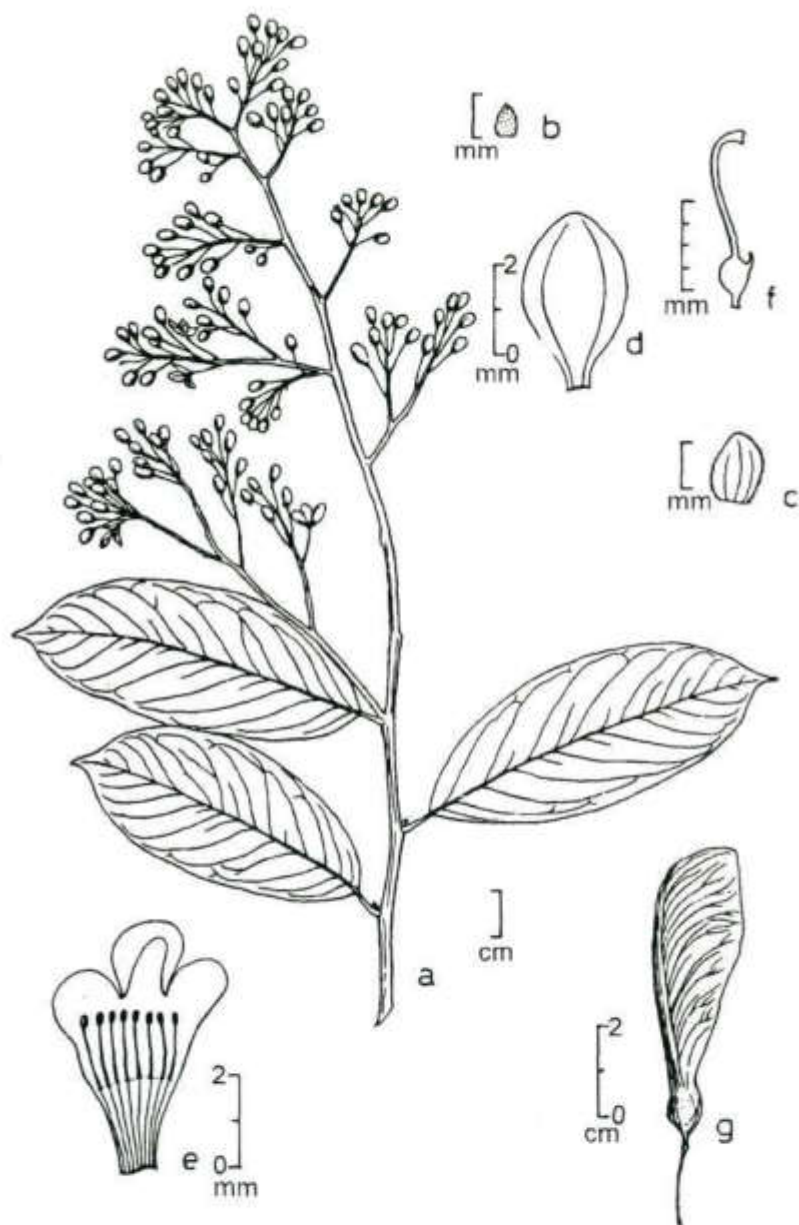


Fig. 98. *Securidaca inappendiculata* Hassk. : a. branch with inflorescence; b. bract; c. outer sepal; d. inner sepal; e. petal with stamens; f. pistil; g. fruit.

XANTHOPHYLLACEAE

(R. N. Banerjee and N. P. Balakrishnan)

Trees or shrubs. Leaves alternate, exstipulate, coriaceous or chartaceous, often drying yellowish; petioles thick, channelled above. Racemes axillary, extra-axillary or terminal, simple or paniculate, patently branched; flowers 2-3-nate, shortly pedicelled. Sepals 5, nearly equal, free, inner 2 larger. Petals 5, or rarely 4, free, declinate, subequal, glabrous; the lowest one keeled, boat-shaped, not crested, sometimes softly pubescent; the other 4 subequal, narrowly oblong, glabrous; 2 upper ones recurved in upper half. Stamens mostly 8 (-10), usually all free or 2 partially adnate to keel, 4 coherent with other petals singly at base, and the remaining 2 quite free, inserted on disk; filaments strigose-ciliate at base or not, upcurved; anthers 2-locular, erect, longitudinally dehiscent by double slits. Disk hypogynous, annular. Ovary 1-loculed or imperfectly 2-loculed, stalked or sessile, woolly or glabrous; stigma terminal, small. Fruits usually 1-seeded indehiscent drupes, globose, exalate, fleshy when fresh, woody and coriaceous on drying; seeds globose or subglobose, estrophiolate; endosperm copious or absent; cotyledons thick, fleshy, plano-convex.

South and S.E. Asia from India to N. Australia and Solomon Islands; one genus and ca 40 species, 4 species in India.

Literature. MEIDEN, R. Van der (1982) Systematics and evolution of Xanthophyllum (Polyalaceae). Leiden Botanical Series 7: 1 - 159, ff. 1 - 22.

Xanthophyllum Roxb., nom. cons.

(Description and distribution as for the family)

KEY TO THE SPECIES

- 1a. Leaves recurved along margins; sepals glabrous outside, ciliate along margins; ovary glabrous; 2 stamens adnate to petals and 6 attached to disc 1. **X. andamanicum**
- b. Leaves flat or undulate along margins; sepals pubescent throughout; ovary densely pubescent or strigose; stamens not so 2
- 2a. Leaves not glossy, pale green; racemes singly arranged; rachis thin; two stamens connate to each other at base, one adhering to middle petals and rest free 2. **X. burkillii**
- b. Leaves glossy green; racemes branched; rachis thick or strongly flattened; stamens all free or shortly connate at base or 6 adnate to petals or 2 on disc 3
- 3a. Branchlets puberulous, with spinular protuberances in 2-3 vertical rows above petiole; flowers white or yellowish; petals without white incrustations; keel petals glabrous outside; fruits glabrous 3. **X. flavescens**
- b. Branchlets glabrous, without such spinules; flowers pale violet; turning to yellow, brown or dark red; petals often with white incrustations; keel petals appressed hairy outside; fruits hairy 4. **X. vitellinum**

1. *Xanthophyllum andamanicum* King in J. Asiat. Soc. Bengal 59(2): 135. 1891; C.E. Parkinson, For. Fl. Andaman Islands 85. 1923. **Fig. 99.**

And.: *Chonoo, Thit-phew.*

Trees, evergreen, up to 25 m tall; trunk up to 3 m in d.b.h.; bark pale grey, smooth, yellowish brown when cut; branches black. Leaves elliptic-ovate to lanceolate, cuneate at base, subacute at apex, recurved along margins, 8 - 13 x 3 - 5 cm, glabrous and dark green above, glaucous beneath, membranous or subcoriaceous; lateral nerves irregular, not much more prominent than the reticulate venation; petioles 8 - 9 mm long, glabrous. Inflorescences lax, paniculate, 4 - 9 cm long, branched, puberulous upwards, glabrous below, pedicels 5 - 7 mm long; flowers ca 1.2 cm across. Sepals ca 4 x 2 mm, glabrous outside, ciliate along margins. Petals oblong, ca 11 x 4 mm, white with pink flush; 2 petals reflexed and dashed with yellow, 2 spreading and keel petal ca 9 mm long. Stamens ca 6 mm long; 2 filaments adnate to keel petals and 6 filaments attached to the disc. Ovary sessile, glabrous. Fruits globose, shiny green when young, yellowish when ripe, not verrucose when dry.

Fl.: Feb. - March; *Fr.*: April - May.

Distrib. India: Tropical lowland evergreen forests. Andaman & Nicobar Islands. Bangladesh and Myanmar.

2. *Xanthophyllum burkillii* J.R. Drumm. & Dunn in Bull. Misc. Inf. Kew 1920: 145. 1920; Burkill in Rec. Bot. Surv. India 10(1): 45, 74. 1924 & *ibid.* 10(2): 239. 1925.

Trees, moderate-sized. Leaves lanceolate, ovate, oblong or elliptic, cuneate or subrotund at base, acuminate at apex, 6 - 12 x 3 - 6 cm, glabrous on both surfaces; lateral nerves about 10 pairs, two marginal nerves forming thick margins; young ones lilac-flushed, pendent; matured petioles ca 7 mm long. Flowers in 3.5 cm long racemes; pedicels ca 8 mm long; bracteoles ca 15 mm long. Sepals ca 3 x 5 mm, pubescent. Petals oblong, ca 14 mm long, pale yellow or cream-coloured, becoming golden-brown. Stamens ca 9 mm long; 2 filaments connate to each other at base, one adhering to middle petal, the rest free; connectives hairy. Ovary stipitate, conical, strigose; style ca 3 mm long; ovules up to 8, arranged in two series. Fruits not seen.

Fl.: March - May; *Fr.*: May - Aug.

Distrib. India: Submontane wet hillslopes, on gravelly soil. Arunachal Pradesh (Daphla, Abhor & Mishmi Hills).

Endemic.

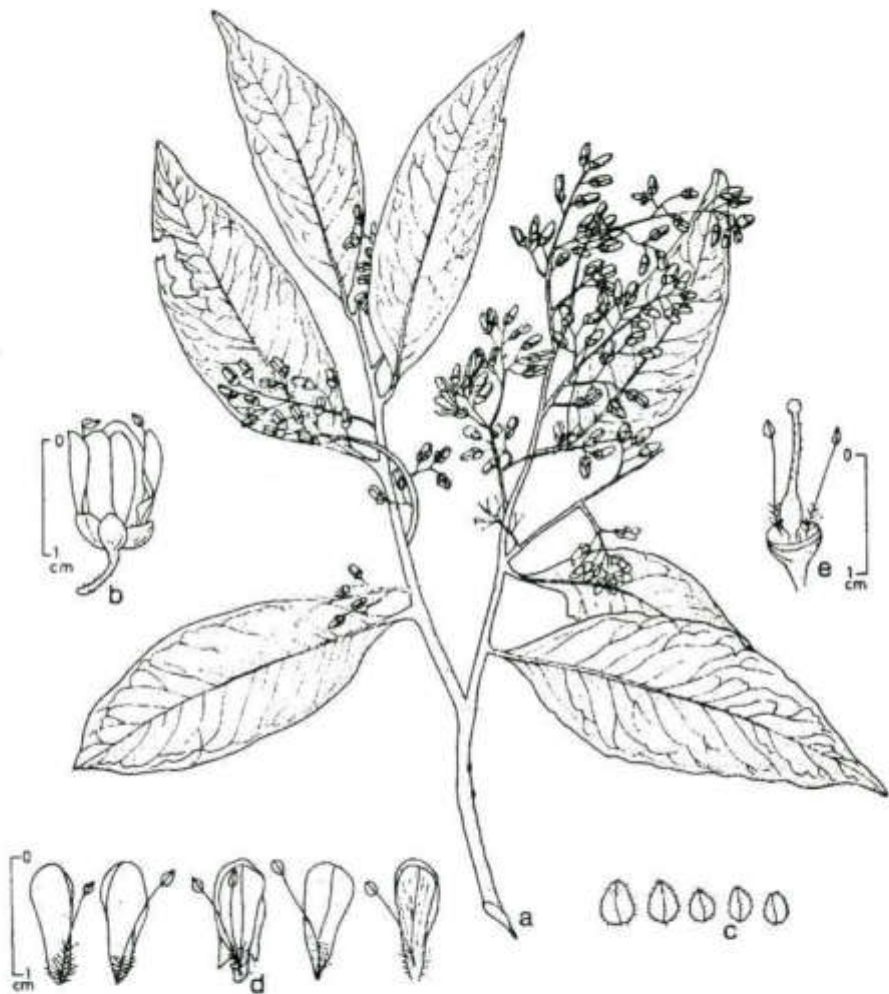


Fig. 99. *Xanthophyllum andamanicum* King: a. twig; b. flower; c. sepals; d. petals with adnate stamens; e. pistil with free stamens.

3. *Xanthophyllum flavescens* Roxb., Pl. Corom. 3: 81, t. 284. 1820; Bennett in Fl. Brit. India 1: 209. 1874. *X. virens* Roxb., Fl. Ind. 2: 221. 1832.

Mal.: *Karungali, Madakka*; Tam.: *Mattei, Karunali*.

Evergreen trees, 3 - 10 m tall; bark grey, warty and corky with fine fissures; branchlets slender, pendulous, puberulous with ca 1 mm long blunt spinular protuberances in vertical series of 2 - 3 above the axils of petioles. Leaves elliptic or oblong-lanceolate, acute or subacute at base, bluntish long-acuminate at apex, entire to subundulate along margins, 5 - 20 x 3 - 6 cm, coriaceous, glabrous, glossy above, yellowish green when dry; main lateral nerves 5 - 9 pairs, with short intermediaries, scattered, often with a few perforated glands at axils of nerves or at angles of nervules; petioles 5 - 10 mm long, rugose, grooved above, glabrous. Flowers white or yellowish, 10 - 12 mm across, in 9 - 15 cm long upper axillary or terminal pubescent panicle of racemes; pedicels ca 5 mm long, puberulous. Sepals subequal, elliptic, suborbicular, 3 - 5 x 2 mm, brownish yellow, densely pubescent, fleshy. Petals (4-) 5, subequal, narrowly oblong, obtuse, 7 - 10 x 3 - 4 mm, yellowish; 2 upper ones with recurved upper half. Stamens 8, 7 - 9 mm long, strigose-ciliate at base, rarely glabrous, 6 adnate to petals, 2 on disc; filaments green; anthers white. Disk hypogynous, annular, deeply lobed. Ovary shortly stipitate or sessile, ovoid, densely brownish strigose; ovules 4 - 12; style covered with brown hairs, curved with truncate white stigma. Fruits globose, 1.5 - 2.2 cm in diam., rugose when dry, olive-coloured when young, yellow when mature, glabrous; seeds oblongoid to ovoid, ca 1.5 cm in diam.

KEY TO THE VARIETIES

- 1a. Leaves narrowly lanceolate, undulate along margins, 5 - 9 x 1.6 - 2.5 cm; ovules 4
3.1. var. *angustifolium*
- b. Leaves elliptic-lanceolate or oblong-lanceolate, flat, not undulate along margins, 9 - 20 x 3 - 6 cm;
ovules 9 - 12
3.2. var. *flavescens*

3.1. var. *angustifolium* (Wight) Bennett in Hook. f., Fl. Brit. India 1: 209. 1874. *X. angustifolium* Wight, Illus. I: 50, t. 23. 1840. *X. amottianum* Wight, I. c.

Fl. & Fr. Feb. - Sept.

Distrib. India: Tamil Nadu (Courtallum in Tirunelveli Dist.).

Endemic.

3.2. var. *flavescens*

Fig. 100.

Fl.: Feb. - May; *Fr.* May - Oct.



Fig. 100. *Xanthiophyllum flavescens* Roxb. var. *flavescens* : a. twig; b. flower; c1-4. petals with adnate stamens; d. pistil with free stamens; e. fruits; f. seed.

Distrib. India: Evergreen lowland forests, swamp forests, up to 1500 m. Assam, Meghalaya, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar and Malaysia.

4. *Xanthophyllum vitellinum* (Blume) Dietr., Syn. Pl. 2: 1277. 1840; Vasudeva Rao & T. Chakrab. in J. Econ. Tax. Bot. 6: 444. 1985. *Jakkia vitellina* Blume, Cat. 17, 64. 1823.

Shrubs or trees, up to 30 m high, with glabrous branches; axillary buds varying from narrowly triangular with strongly thickened base and 1.5 - 3 mm long ones to ovoid-rhomboid or oblong-ovoid and then often 6 - 11 mm long ones. Leaves ovate-oblong, rounded or subacute at base, shortly acuminate at apex, flat or undulate along margins, 8 - 25 (-30) x 3.5 - 10 (-11) cm, glabrous, shiny, greyish green above, yellowish green beneath, drying to yellowish brown; secondary nerves (6-) 7 - 9 (-11) pairs, forming an indistinct intramarginal nerve near apex; glands mostly more than 10, situated near midrib or scattered; basal glands mostly present; petioles 6 - 15 mm long. Inflorescences branched, 8 - 20 cm long; branches often in pairs in lower part; rachises mostly strongly flattened and grooved near bases, glabrous to densely shortly hairy; flowers in triads in basal part, but solitary in apical part; lower bracts nearly opposite; pedicels 1.5 - 5.5 mm long, grooved, densely shortly appressed hairy. Sepals more or less wrinkled and thickened at base, 2 - 4 (-5) x 2 - 4 (-5) mm. Petals at first pale violet, later turning to yellow or brown or to dark reddish and often with white incrustations; the longest one (7-) 8 - 13 (-15) mm long; keel petal densely appressed hairy outside; outer petals glabrous outside, or with a few hairs at apex. Stamens 8, rarely 9; filaments free or shortly connate at base, widened above with a knob-like rather densely hairy appendage at inner side. Ovary subsessile, up to 1 mm long, stipitate, densely short-pubescent; style hairy at basal half; ovules 4. Fruits globular, ca 2 cm in diam, often wrinkled when dry, dull or shiny, usually light brown, sometimes dark reddish brown, hairy; pericarp thin.

Fl. March; *Fr.* June.

Distrib. India: Lowland evergreen tropical forests. Andaman & Nicobar Islands (Great Nicobar Is.).

Malaysia, Indonesia and Philippines.

Notes. Reported from Great Nicobar Island by Vasudeva Rao & Chakrabarty (in J. Econ. Tax. Bot. 6: 444. 1985).

FRANKENIACEAE

(N. P. Balakrishnan)

Herbs or undershrubs, annual or perennial, sometimes with articulate stems and branches. Leaves opposite, simple, entire, exstipulate. Inflorescence in terminal and axillary dichasia or scorpioid cymes, sometimes flowers solitary at forks of branches, regular, small, bisexual, or rarely plants polygamo-monoecious. Calyx gamosepalous, hypogynous, persistent, 4 - 6 (-7)-lobed, induplicate-valvate in bud. Petals 4 - 6 (-7), hypogynous, free, clawed at base; claw with an adherent ligular scale, imbricate in bud. Stamens 4 - 6, or more in 2 series, free or shortly connate at base; anthers small, versatile, 2-loculed, dorsifixed. Ovary free, sessile, composed of 3 - 4 carpels, unilocular; style slender; stigmas 3 (2 - 4), linear; ovules many in 2 - 3 parietal placentae, anatropous or amphitropous; funicles slender, long. Fruit a loculicidal capsule, enclosed in persistent calyx, opening by as many valves as there are placentae; seeds oblong or ovoid, with subterminal hilum, linear raphe and crustaceous testa; embryo straight, in the centre of mealy endosperm.

Mediterranean (S. Europe & N. Africa), S.W. Asia, S. Africa, S. United States to S.America, W. and S.E. Australia and New Zealand; 5 genera and ca 75 species, one genus and one species in India.

Frankenia L.

Herbs or undershrubs, annual, halophytic; stems with jointed nodes. Leaves opposite, decussate, small. Flowers solitary, axillary or in cymes, sessile, pink. Sepals 4 - 6, induplicate or valvate, persistent. Petals 4 - 5, imbricate, claw with a ligular scale on the inner side. Stamens 4 - 6. Stigmas 2 - 3, forked. Capsule unilocular, splitting by 3 valves.

Tropical and subtropical coastal and interior saline areas, around the world; ca 70 species, one in India.

Frankenia puberulenta L., Sp. Pl. 332. 1753; Edgew. in Fl. Brit. India 1: 212. 1874.

Herbs, slender, exceedingly branched, procumbent, diffuse, puberulous; branches wiry, leafy, 15 - 50 cm long. Leaves subsessile or short-petioled, obovate, or spatulate, retuse, 4 - 6 x 1 - 3 mm, inrolled, hoary pubescent beneath; petiole base sheathing, ciliate. Flowers sessile, axillary, solitary or in dichasial cymes, pink, shorter than leaves. Calyx-tube cylindrical, funnel-shaped, strongly ribbed outside, 5-fid, ca 4 mm long, puberulous; each sepal acute, ca 1 mm long, glabrous. Petals 5, wedge-shaped, cuneate at base, obtuse and slightly fimbriate at apex, ca 4 mm long with a membranous appendage at base, pink. Stamens 6, free; filaments flat and broad at base, narrowed above, ca 2.5 mm long. Capsules oblong, ca 3 mm long, splitting by 3 valves; seeds many, ovoid, less than 1 mm long.

Fl. & Fr. Mar. - May.

Distrib. India: Saline sandy habitats, up to 1700 m. Punjab, Haryana, Uttar Pradesh and Gujarat.

Pakistan, West Asia, S. Europe, Senegal and S. Africa.

CARYOPHYLLACEAE

(N. C. Majumdar)

Herbs, subshrubs, rarely shrubs, annual, biennial or perennial, dichotomously branched; stems often swollen at nodes. Leaves usually opposite, sometimes alternate, rarely whorled, simple, entire, rarely serrulate, often connate at base; stipules scarious, sometimes connate, rarely absent. Inflorescences usually terminal, paniculate, racemiform or capitata dichasial cymes or cincinni, sometimes few-flowered or single-flowered; bracts often scarious. Flowers actinomorphic, usually bisexual, rarely unisexual. Sepals 4 - 5 (-25), rarely spirally arranged, free or united into a tube, often scarious-margined. Receptacle often prolonged into an anthophore carrying petals, stamens and ovary. Petals (4-) 5 (-12), free, entire, emarginate or 2-fid, rarely 4-fid, often basally clawed, sometimes with appendages on inner face, sometimes small or absent. Stamens (3-) 10 (-13), free, usually in 2 series, mostly obdiplostemonous; filaments free, filiform, those opposite sepals sometimes with a glandular thickening at base; anthers 2-locular, dorsifixed; locules parallel, sometimes separate, dehiscent longitudinally. Ovary superior, unilocular or rarely incompletely 2 - 5-locular at base; ovules 2-many, rarely one, campylotropous or semianatropous; placentation free-central, axile or basal; styles 1 - 5, free or partially connate. Fruit a capsule, opening by as many or twice as many apical teeth or valves as there are styles, sometimes fleshy (*Cucubalus*) and dehiscent irregularly or indehiscent, sometimes an achene or nutlet; seeds usually many, rarely few to one, endospermous; embryo usually curved or straight.

Cosmopolitan, mainly confined to temperate and alpine regions, some tropical; ca 70 genera and ca 1750 species; 25 genera and 122 species in India.

Notes. Following the family delimitation proposed by Cronquist (1981), the family Illecebraceae is included in the Caryophyllaceae.

Literature. GHAZANFAR, S. A. & Y. J. NASIR (1986) Caryophyllaceae. In: Nasir & Ali, Fl. W. Pakistan 175: 1 - 125. GRIERSON, A. J. C. (1984) Caryophyllaceae. In: Grierson & Long, Fl. Bhutan 1(2): 197 - 216. HARA, H. & M. C. TEBBS (1979) Caryophyllaceae. In: Hara & Williams, Enum. Fl. Pl. Nepal 2: 51 - 59. MCNEILL, J. (1962) Taxonomic studies in the Alsinoideae I. Generic and infrageneric groups. Notes R. Bot. Gard. Edinb. 24: 79 - 155. MCNEILL, J. (1963) Taxonomic studies in the Alsinoideae II. A revision of the species in the Orient. Ibid. 24: 241 - 404. PAX, F. & K. HOFFMANN (1934) Caryophyllaceae. In: Engler & Prantl, Pflanzenfam. ed. 2, 16c: 273 - 364. WILLIAMS, F. N. (1909) The Caryophyllaceae of Tibet. J. Linn. Soc., Bot. 38: 395 - 407.

KEY TO THE GENERA

- 1a. Sepals free 2
 b. Sepals united forming a distinct calyx tube or united partially at base only 18
- 2a. Petals usually absent; fruit an indehiscent nutlet or achene; seeds 1 or 2 3
 b. Petals present; fruit a dehiscent capsule; seeds few to many 4
- 3a. Leaves free at base, stipulate; fruit an achene with a membranous wall **8. Herniaria**
 b. Leaves connate at base, exstipulate; fruit a nutlet with a hardened wall **19. Scleranthus**
- 4a. Leaves stipulate 5
 b. Leaves exstipulate 9
- 5a. Styles 3 - 5, free up to base 6
 b. Styles 3, united at base 7
- 6a. Axillary fascicles of leaves borne on both sides of nodes; stipules not connate; styles 3 - 5
 b. Axillary fascicles of leaves borne on one side of nodes only; stipules connate; styles 3 **21. Spergula**
- 7a. Leaves usually cordate at base; petals deeply 2-fid **22. Spergularia**
 b. Leaves not cordate at base; petals not 2-fid **6. Drymaria**
- 8a. Herbs diffuse; sepals keeled or hooded **16. Polycarpon**
 b. Herbs erect; sepals neither keeled nor hooded **15. Polycarpaea**
- 9a. Capsule valves as many as styles 10
 b. Capsule valves twice as many as styles 13
- 10a. Styles fewer than sepals 11
 b. Styles as many as sepals 12
- 11a. Styles 3; capsules 3-valved **12. Minuartia**
 b. Styles 2; capsules 2-valved **10. Lepyroclis**
- 12a. Leaves linear-subulate; sepals less than 3 mm long; capsule teeth entire **18. Sagina**
 b. Leaves ovate; sepals more than 5 mm long; capsule teeth 2-fid **13. Myosoton**
- 13a. Petals 2-fid to halfway or more (rarely emarginate, sometimes minute or absent) **23. Stellaria**
 b. Petals 2-fid to one-third or entire, emarginate or lacerate, rarely absent 14
- 14a. Plants with napiform or fusiform bulbs or tubers arising laterally from rhizomes; fertile cleistogamous flowers present **17. Pseudostellaria**
 b. Plants without bulbs or tubers; cleistogamous flowers absent 15
- 15a. Inflorescence an umbel-like cyme; petals irregularly toothed **9. Holosteum**
 b. Inflorescence a dichotomous cyme or panicle, sometimes reduced to a single flower; petals entire, emarginate or 2-fid 16
- 16a. Petals 2-fid up to one-third, rarely emarginate; capsules cylindrical **3. Cerastium**
 b. Petals entire or subentire, rarely absent; capsules not cylindrical 17
- 17a. Herbs climbing; petioles becoming curved and hard; capsules globose; seed one per capsule **2. Brachystemma**
 b. Herbs not climbing; petioles neither becoming curved nor hard; capsules not globose, various, other than cylindrical; seeds few to many per capsule **1. Arenaria**
- 18a. Calyx tube with commissural veins alternating with midnerve of sepals; styles 3 - 5 19
 b. Calyx tube without commissural veins; styles usually 2, rarely 3 21

- | | |
|--|---------------------------|
| 19a. Fruits fleshy, berry-like, dehiscent irregularly | 4. <i>Cucubalus</i> |
| b. Fruits dry, capsular, dehiscent by 3 - 6 valves | 20 |
| 20a. Capsule teeth 2-fid, twice as many as styles | 20. <i>Silene</i> |
| b. Capsule teeth entire, as many as styles | 11. <i>Lychnis</i> |
| 21a. Calyx tube with scarious intervals between nerves | 22 |
| b. Calyx tube without scarious intervals between nerves | 23 |
| 22a. Seeds peltate, dorso-ventrally compressed with a facial hilum | 14. <i>Petrohragja</i> |
| b. Seeds not peltate, subreniform, flattened on both sides with a lateral hilum | 7. <i>Gypsophila</i> |
| 23a. Bracteoles (epicalyx) present | 5. <i>Dianthus</i> |
| b. Bracteoles (epicalyx) absent | 24 |
| 24a. Plants forming hard cushions; leaves densely crowded; petals borne on calyx tube | 24. <i>Thylacospermum</i> |
| b. Plants not forming cushions; leaves not densely crowded; petals hypogynously inserted on a short thick receptacle | 25. <i>Vaccaria</i> |

1. *Arenaria* L.

Herbs, annual or perennial, erect, prostrate or often cushion-forming. Leaves opposite, rarely somewhat whorled, exstipulate, oblong, oblong-elliptic, oblong-lanceolate, ovate, orbicular, elliptic, elliptic-lanceolate, linear, linear-lanceolate or linear-subulate. Flowers solitary, terminal or in dichasial terminal or axillary cymes, usually 5-merous. Sepals 4 or 5, free, herbaceous throughout or scarious-margined. Petals entire or lacerate, white or pink, rarely absent. Stamens 2 - 10, on a hypogynous disc, those opposite to sepals glandular-thickened at base. Ovary 1-locular; styles 2 or 3 (-4), filiform. Capsules 2- 6-valved, short, rarely exceeding sepals; seeds few or many.

Temperate and arctic regions; ca 250 species, 24 species in India.

Notes. Growing at various altitudes, at high altitudes sometimes forming very dense, globose tufts of the size of a human head. In alpine regions smaller stunted forms are found.

Literature. WILLIAMS, F. N. (1898). A revision of the genus *Arenaria*. J. Linn. Soc., Bot. 33: 326 - 437.

KEY TO THE SPECIES

- | | |
|---|-------------------------------|
| 1a. Styles 2; capsules 4-valved (styles 2 - 3; capsules 4 - 6-valved in <i>A. melandryiformis</i>) | 2 |
| b. Styles 3; capsules 6-valved | 6 |
| 2a. Flowers solitary | 3 |
| b. Flowers in cymes (solitary in <i>A. littledalei</i>) | 4 |
| 3a. Pedicels less than 1 cm long; petals 10 - 14 mm long | 16. <i>A. melandryoides</i> |
| b. Pedicels more than 1.5 cm long; petals 7 - 10 mm long | 15. <i>A. melandryiformis</i> |
| 4a. Petals longer than sepals | 5. <i>A. debilis</i> |

- b. Petals shorter than sepals or absent 5
- 5a. Sepals 4; petals present; stamens 2 - 3 14. *A. littedalei*
- b. Sepals 5; petals absent; stamens 5 24. *A. thangoensis*
- 6a. Leaves hardened and coriaceous or membranous along margins and apex 7
- b. Leaves herbaceous or with scarios margins, otherwise pungent and setaceous 12
- 7a. Leaves not densely imbricate, oblong-lanceolate, elliptic or ovate-elliptic, acute or acuminate; sepals acute, usually hardened along margins and apex 8
- b. Leaves densely imbricate, linear to linear-subulate or lanceolate; sepals obtuse or subacute, membranous along margins and apex 10
- 8a. Plants perfectly glabrous 23. *A. stracheyi*
- b. Plants hairy 9
- 9a. Hairs sparse, long, stiff, ciliate 2. *A. cillolata*
- b. Hairs dense, glandular 11. *A. glanduligera*
- 10a. Sepals oblong-orbicular 19. *A. oreophila*
- b. Sepals ovate-elliptic 11
- 11a. Petals linear 6. *A. densissima*
- b. Petals obovate 20. *A. polytrichoides*
- 12a. Leaves mostly linear to subulate, markedly scarios-margined; sepals mostly variously lanceolate 13
- b. Leaves mostly not linear to subulate, not markedly scarios-margined; sepals mostly variously ovate 19
- 13a. Flowers in cymes 14
- b. Flowers solitary 16
- 14a. Petals longer than sepals 10. *A. festucoides*
- b. Petals shorter than sepals 15
- 15a. Leaves 25 - 55 mm long; sepals 8 - 10 mm long 4. *A. curvifolia*
- b. Leaves 5 - 9 mm long; sepals 5 - 6 mm long 9. *A. ferruginea*
- 16a. Sepals 1-nerved; anthers black 13. *A. kansuensis*
- b. Sepals 3-nerved; anthers not black 17
- 17a. Bracts foliaceous 8. *A. edgeworthiana*
- b. Bracts absent 18
- 18a. Leaves 1-nerved, minutely ciliate 1. *A. bryophylla*
- b. Leaves nerveless, strongly ciliate 21. *A. pulvinata*
- 19a. Leaves subulate, setaceous and pungent; sepals markedly hard at base, becoming ligneous in fruit 12. *A. griffithii*
- b. Leaves not subulate, herbaceous, sometimes coriaceous; sepals neither hard at base nor becoming ligneous in fruit 20
- 20a. Perennials with sterile leafy shoots along with flowering shoots 21
- b. Annuals without sterile leafy shoots 22
- 21a. Leaves linear to lanceolate, acute or obtuse at apex; seeds winged 3. *A. compressa*
- b. Leaves ovate to orbicular, rounded at apex; seeds not winged 23
- 22a. Herbs suberect; flowers many in cymes 22. *A. serpyllifolia*
- b. Herbs diffuse; flowers few or solitary 7. *A. depauperata*

23a. Sepal with a dorsal pubescent nerve; petals longer than sepals; seeds transversely striate

17. *A. neelgherrensis*

b. Sepal without a dorsal pubescent nerve; petals shorter than sepals; seeds smooth 18. *A. orbiculata*

1. *Arenaria bryophylla* Fernald in *Rhodora* 21: 5. 1919. *A. musciformis* Wallich ex Edgew. & Hook. f. in *Fl. Brit. India* 1: 237. 1874, non Triana & Planchon 1862.

Herbs, forming matted hard dense glabrous tufts; roots long and hard; stems very short, densely leafy. Leaves subulate with a broad scarious sheathing base, 4.5 - 8.5 mm long, spreading, recurved, rigid, subsquarrose, minutely ciliate, 1-nerved beneath. Flowers solitary, sessile, ca 8.5 mm across. Calyx narrow, somewhat truncate and hard at base; sepals oblong-lanceolate, acute at apex, 7 - 8 mm long, broadly scarious-margined, green, 3-nerved. Petals linear-obovate, rounded at apex, longer than sepals, persistent. Styles 3. Capsules globose, 6-valved.

Fl. Aug. - Sept.; *Fr.* Oct.

Distrib. India: Alpine Himalayas, 4200 - 5200 m. Jammu & Kashmir, Uttar Pradesh and Sikkim.

Nepal and China (Tibet).

2. *Arenaria ciliolata* Edgew. in *Fl. Brit. India* 1: 240. 1874. *A. ramellata* F. Williams in *J. Linn. Soc., Bot.* 38: 399. 1909.

Herbs, perennial, laxly caespitose, 2 - 7 cm high, hairy; stems with 2 obscure lines of hairs on either side. Leaves spreading, sessile, oblong or elliptic, rounded or narrowed at base, sharply acute at apex, 7 - 9 x 2 - 3 mm, thickened and pale along margins, pungent, with long jointed yellowish hairs chiefly confined to margins and beneath. Flowers solitary or few in leafy cymes; pedicels 1 (-2) cm long, erect or recurved. Sepals lanceolate, acute at apex, 6 - 8 x 2 - 3 mm, thick and hard along margins and apex, scattered yellowish ciliate. Petals obovate-rounded, 7 - 9 x 3 mm, white. Stamens ca 2.5 mm long; filaments flat, connate at base. Styles 3, slender, ca 3 mm long, recurved. Capsules globose, 6-valved.

KEY TO THE VARIETIES

1a. Pedicels erect

2.1. var. *ciliolata*

b. Pedicels recurved

2.2. var. *pendula*

2. 1. var. *ciliolata*

Fl. July - Sept.

Distrib. India: Alpine Himalayas, 3000 - 5000 m. Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (Tibet).

2. 2. var. pendula Duthie ex F. Williams in J. Linn. Soc., Bot. 33: 373. 1898.

Distrib. India: Western Himalayas, ca 3900 m. Uttar Pradesh.

Nepal.

3. Arenaria compressa J. McNeill in Notes R. Bot. Gard. Edinb. 24: 118. 1962. *A. trichotoma* Royle ex Edgew. & Hook. f. in Fl. Brit. India 1: 235. 1874, non Boiss. 1853.

Herbs, perennial, dichotomously branched, 30 - 45 cm high; glabrous to finely pubescent. Leaves in distant pairs or somewhat whorled, sessile, linear or linear-lanceolate, 1.2 - 3.6 cm long, glabrous, thick, 1-nerved. Peduncles trichotomous, long, slender, erect. Flowers erect, ca 6 mm across; pedicels slender; bracts scarious. Calyx rounded; sepals ovate-oblong, acute at apex, 3 - 3.5 mm long, glabrous. Petals linear-lanceolate, longer than sepals, white. Stamens 5 fertile, 5 sterile. Capsules thin, with 6 long teeth, coriaceous; seeds ovate-discoid, compressed, winged.

Fl. June.

Distrib. India: Temperate Himalayas, 2400 - 3000 m, on rocks. Himachal Pradesh.

Afghanistan.

4. Arenaria curvifolia Majumdar in Blumea 26: 446, f.1 a-h. 1980. **Fig. 101.**

Herbs, 30 - 60 cm high, branching at upper nodes; stems cylindrical, minutely puberulent. Leaves linear, subulate or linear-lanceolate, acuminate at apex, 25 - 55 x 1 - 3 mm, scabro-puberulent at base, usually curved. Flowers few, in terminal cymes; pedicels up to 3.2 cm long; bracts foliaceous, 4 - 6 mm long. Sepals 5, ovate to ovate-lanceolate, 8 - 10 mm long, glabrous. Petals 5, oblong, entire, obuse at apex, 5 - 6 mm long. Stamens 4 - 6 mm long; anthers elliptic. Ovary globose, 1 - 2 mm in diam.; styles 3. Capsules obovate, 6-valved, 4 - 5 mm long; seeds ovate-oblong, ca 3 mm long, flat, rough.

Fl. July - Aug.; *Fr.* Sept.

Distrib. India: Western Himalayas, 3340 - 3650 m. Uttar Pradesh (Kauri Pass, Garhwal).

Endemic. So far known from the type locality only.

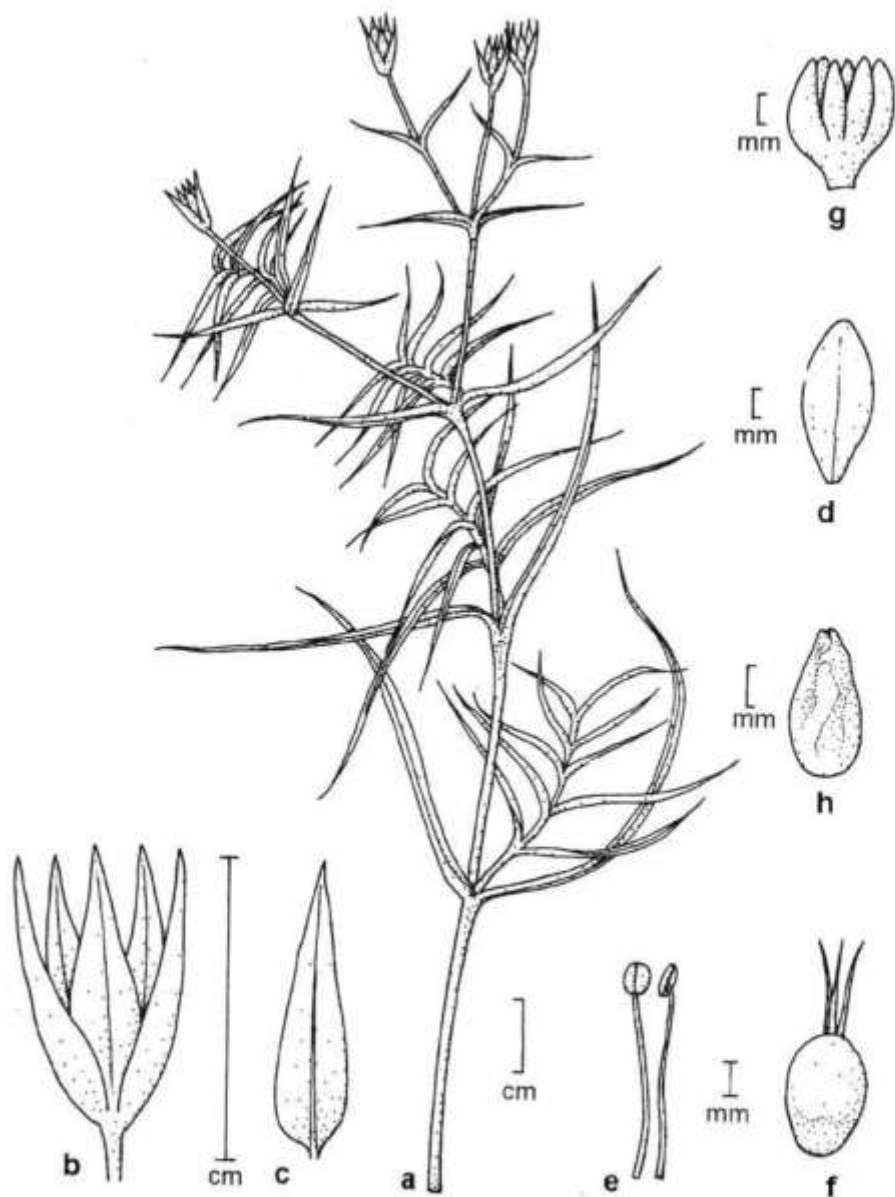


Fig. 101. *Arenaria curvifolia* Majumdar : a. flowering shoot; b. calyx; c. sepal; d. petal; e. stamens; f. mature pistil; g. dehiscent capsule; h. seed.

5. *Arenaria debilis* Hook. f., Fl. Brit. India 1: 242. 1874. *A. benthamii* Edgew. in Fl. Brit. India 1: 242. 1874, non Fenzl ex Torrey & A. Gray 1840. *Odontostemma glandulosa* Benth. ex G. Don, Gen. Hist. 1: 449. 1831. *A. glandulosa* (Benth. ex G. Don) F. Williams in J. Linn. Soc., Bot. 33: 431. 1898, non Jacq. 1798. *A. blinkworthii* J. McNeill in Notes R. Bot. Gard. Edinb. 24: 128. 1962.

Herbs, slender, erect, branched or unbranched, 7 - 90 cm high, glandular-pilose. Leaves ovate, elliptic or oblanceolate, narrowed at base, subacute or obtuse at apex, 1.5 - 3 x 0.3 - 1 cm, ciliate along margins, pubescent; lower leaves petiolate; upper ones sessile. Flowers few or many, nodding, 0.6 - 1.2 cm across; pedicels divaricate, ciliate. Sepals oblong or linear-lanceolate, 4 - 5 x 2 mm, glandular, narrowly scarious-margined. Petals obovate-spathulate, lacerate at apex and margin, 4 - 8 x 2 mm, white. Filaments dilated below. Styles 2. Capsules 4-valved, shorter than the sepals; seeds few, ovoid or rounded, flat, brownish, ca 1.5 x 2 mm.

Fl. May - Sept.; *Fr.* Oct.

Distrib. India: Alpine and temperate Himalayas, 3000 - 5000 m, river banks and forest clearings. Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (Tibet).

6. *Arenaria densissima* Wallich ex Edgew. & Hook. f. in Fl. Brit. India 1: 239. 1874. *Cherleria juniperina* D. Don, Prodr. Fl. Nep. 214. 1825, non *Arenaria juniperina* Villars 1789, nec Thuill. 1799.

Herbs, densely caespitose; roots long, woody; stems crowded, densely leafy, 7 - 10 cm long. Leaves ovate or subulate-lanceolate, abruptly acuminate at apex, concave, 6.5 - 8.5 mm long, up to 2 mm broad, glabrous along margins, recurved, pungent, shiny, nerveless. Flowers small, solitary, axillary, shortly pedicellate; bracts elliptic, mucronate, concave. Sepals ovate, subacute at apex, ca 2.5 mm long. Petals linear-spathulate, very narrow, 4 - 5 x 1.25 mm. Capsules globose, ca 2 mm in diam.

Fl. June - Aug.; *Fr.* Sept. - Oct.

Distrib. India: Alpine regions, 4000 - 5000 m, on rocks. Sikkim.

Nepal, Bhutan and China (Tibet).

7. *Arenaria depauperata* (Edgew.) H. Hara in J. Jap. Bot. 51: 129. 1976. *Stellaria depauperata* Edgew. in Fl. Brit. India 1: 234. 1874. *A. bhutanica* Majumdar & Babu in J. Arn. Arb. 50: 626, f. 1. 1969.

Herbs, annual, slender, delicate, suberect, 5 - 10 cm high; stems 4-angular with a line of pubescence upwards. Leaves opposite, sessile, oblong-lanceolate, acute or acuminate at apex, 5 - 10 x 1.5 - 2 mm, minutely tuberculate, spreading and recurved. Flowers solitary or few; pedicels very slender, 1 - 2.5 cm long, pubescent, recurved in fruit. Sepals 5, free, lanceolate, subacute at apex, 3.8 - 4 x 0.8 - 1(-1.2) mm, broadly scarios-margined. Petals oblong-spathulate, entire, obtuse at apex, 1.5 - 5 mm long, white, sometimes absent. Stamens 10, alternate, 3 - 3.5 mm long; filaments blue, glandular at base; anthers dark purple or blackish. Ovary ovoid, ca 1.2 mm, glabrous; styles 3, papillose. Capsules 6-valved, shorter than sepals; seeds 3 - 6, subreniform, compressed, ca 1 mm broad.

Fl. & Fr. June - Sept.

Distrib. India: Temperate to subalpine regions, 3000 - 5000 m, on rocks. Uttar Pradesh, West Bengal and Sikkim.

Nepal and Bhutan.

8. *Arenaria edgeworthiana* Majumdar in J. Indian Bot. Soc. 44: 141. 1965. *A. monticola* Edgew. in Fl. Brit. India 1: 238. 1874, non Buckley 1862.

Herbs, densely caespitose forming subglobose tufts, up to 5 cm high, 15 - 30 cm across; branches densely leafy. Leaves linear-lanceolate, acicular at apex, 7 - 9 x 1 mm, broadly scarios and sheathing at base, thick and ciliate along margins, rigid, recurved, shiny with a prominent midnerve; upper most leaves of flowering shoots bract-like, ca 2 mm broad, subscarios. Flowers solitary at branch ends, sessile. Sepals ovate-lanceolate, acuminate at apex, 10 - 11 x 2 - 3 mm, scarios-margined; nerves 3, strong and closely placed in middle. Petals obovate, shortly clawed, 11 - 12 x 6 - 7 mm, white. Filaments 5 - 6 mm long. Styles 3, slender. Capsules subglobose, 6-valved, 4 - 5 mm in diam.

Fl. July - Aug.; *Fr.* Sept.

Distrib. India: Alpine regions, 4500 - 5500 m. Sikkim.

Nepal, Bhutan and China (Tibet).

9. *Arenaria ferruginea* Duthie ex F. Williams in J. Linn. Soc., Bot. 33: 410. 1898.

Herbs, laxly caespitose with slender branches; stems much branched, pubescent, angular below. Leaves linear-subulate, acuminate at apex, 5 - 9 x 1 - 1.5 mm, rigid, sometimes recurved. Bracts similar to leaves but smaller. Sepals 5, lanceolate, acuminate at apex, 5 - 6 mm long, broadly scarios-margined, thick, hard, 1-nerved. Petals ovate-lanceolate, clawed, acute at apex, ca 4 mm long. Stamens glandular at base, ca 4

mm long. Ovary ovoid, ca 1.5 mm in diam.; style ca 3 mm long. Capsules 6-valved, ca 3.8 mm long; seeds few, flat, pale yellow.

Fl. & Fr. July - Sept.

Distrib. India: Temperate and subalpine Himalayas, 2000 - 3000 m. Uttar Pradesh.

Endemic.

10. *Arenaria festucoides* Royle, *Illus. Bot. Himal.* 81, t. 21, f. 3. 1834; Edgew. & Hook. f. in *Fl. Brit. India* 1: 236. 1874.

Herbs, densely caespitose, 5 - 20 cm high. Leaves subulate, concave, 6 - 38 mm long, ciliate along margins, shiny, rigid, recurved, pungent, 1-nerved beneath. Peduncles 1 - few-flowered, 2 - 12 mm long, glandular-pubescent; bracts ovate-subulate, broadly scarious-margined. Sepals ovate-lanceolate to subulate-lanceolate, acuminate at apex, 7 - 12 mm long, broadly scarious-margined, pungent; nerves 3, merging into one. Petals obovate, longer than sepals, variable in size. Capsules oblong, shorter than sepals, coriaceous; seeds flat with a fimbriate wing, ca 1.7 mm in diam., pale brown.

Fl. July - Aug.; *Fr.* Sept. - Oct.

Distrib. India: Alpine Western Himalayas, 3500 - 4500 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan and China (Tibet).

11. *Arenaria glanduligera* Edgew. in *Fl. Brit. India* 1: 240. 1874.

Herbs, perennial, laxly caespitose, densely glandular-pubescent; stems shiny, 2 - 6 cm long, brownish below, with a line of hairs above. Leaves ovate or elliptic, acute or acuminate at apex, 3 - 7 (-12) x 2 - 3 (-4) mm, hardly thick along margins, glandular pubescent on both surfaces. Flowers solitary, terminal, 8.5 - 12.5 mm across; pedicels up to 2 cm long, pubescent. Sepals spreading, ovate or lanceolate, obtuse or acute at apex, 4 - 5 x 1.5 mm, scarious-margined, often purplish. Petals obovate, 6 - 7 x 2.5 - 4 mm, white or purplish. Stamens ca 4 mm long; filaments united below. Ovary obovoid, ca 2 mm long; styles 3, ca 3 mm long. Capsules 6-valved; seeds few.

Fl. July - Aug.

Distrib. India: Alpine Himalayas, 4000 - 5000 m, on sandy slopes. Jammu & Kashmir, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China (Tibet).

12. *Arenaria griffithii* Boiss., Diagn. Pl. Orient. 2, 1: 89. 1853; Edgew. & Hook. f. in Fl. Brit. India 1: 237. 1874.

Herbs, suffruticose, caespitose, glabrous to glandular-puberulent; flowering branches erect, 4-9 cm high. Leaves densely crowded, subulate, sometimes recurved at apex, 7-9 mm long, setaceous, ciliolate, pungent. Bracts subulate, 3-angular, acuminate, ca 3 mm long, concave. Calyx thick and round at base; sepals ovate, acute, ca 4.5 x 2.5 mm, glandular, broadly scarious-margined, concave, coriaceous. Petals obovate, ca 6.5 x 3.5 mm. Stamens ca 4 mm long. Ovary ovoid, ca 2 mm long; styles ca 1.5 mm long. Capsules globose or broadly ovoid, 6-valved, shorter than sepals, coriaceous.

Fl. June - Aug.

Distrib. India: Subalpine regions, 3000 - 4000 m. Jammu & Kashmir.

Pakistan, China (Tibet) and Afghanistan.

13. *Arenaria kansuensis* Maxim. in Bull. Acad. Imp. Sci. St. Petersb. 26: 428. 1880; F. Williams in J. Linn. Soc., Bot. 33: 402. 1898.

Herbs, densely caespitose. Leaves subulate from base, 3-angular, ca 7 mm long, scarious and ciliate along margins, glabrous, pungent; leaves of flowering branches 4-5 mm long, almost wholly scarious; upper leaves bract-like, ciliate. Pedicels 4-5 mm long, viscid-pubescent. Sepals acute, 6-8 mm long, hyaline-margined, 1-nerved. Petals elliptic, obtuse, white. Anthers black. Ovary globose. Capsules ovate-oblong, included in calyx; seeds with densely cristate-tuberculate margins and glabrous disc.

Fl. & Fr. Aug. - Sept.

Distrib. India: Alpine Himalayas, 3800 - 4600 m, on rocks. Uttar Pradesh.

Nepal, Bhutan and China (Tibet).

14. *Arenaria littledalei* Hemsley in Bull. Misc. Inf. Kew 1896: 209. 1896. *Gooringia littledalei* (Hemsley) F. Williams in Bull. Herb. Boiss. 5: 530. 1897.

Herbs, annual, minute, 2-3.5 cm high, glabrous; branches slender. Leaves linear, subacute at apex, up to 8 mm long, glabrous. Flowers solitary or in few-flowered cymes, terminal or axillary; pedicels erect or suberect, 5-16 mm long, glabrous. Sepals 4, narrow, linear-lanceolate, 2-3.5 mm long, scarious-margined, glabrous. Petals 4, 1-1.5 mm long, white. Stamens 2 (-3). Capsules ca 2 mm long, 4-valved; seeds few, smooth, ca 0.4 mm in diam.

Fl. July - Aug.

Distrib. India: Alpine regions, 4300 - 5000 m. Sikkim.

China (Tibet).

15. *Arenaria melandryiformis* F. Williams in J. Linn. Soc., Bot. 38: 402. 1909.

Herbs, perennial, glandular-pubescent or finely purplish pilose; stems simple or branched, lax, suberect, 6 - 15 cm high. Leaves in distant pairs, sessile, oblong-elliptic, spatulate or lanceolate, obtuse to subacute at apex, 5 - 17 x 2 - 3 mm. Flowers solitary, terminal, nodding; pedicels 1.5 - 2 cm long, curved in flower, becoming erect, up to 4.5 cm long in fruit. Sepals obtuse at apex, somewhat recurved, 5 - 7 x 1 - 2 mm, green, dark purplish pubescent, not scarious. Petals linear to oblanceolate, narrowed and clawed at base, rounded at apex, 7 - 10 x 1.5 - 3.5 mm. Stamens 5 - 6 mm long. Styles 2 - 3. Capsules ovoid, 4 - 6-valved, 7 - 9 mm long; young seeds broadly winged.

Fl. July - Aug.; *Fr.* Sept.

Distrib. India: Alpine regions, 4200 - 6000 m, in sandy or stony grasslands. Sikkim.

Nepal, Bhutan and China (Tibet).

16. *Arenaria melandryoides* Edgew. in Fl. Brit. India 1: 241. 1874. *A. cerastiiformis* F. Williams in J. Linn. Soc., Bot. 38: 402. 1909.

Herbs, perennial, 7 - 8 cm high; roots long; branches arising from base, terete, with 2 rows of scabrid hairs, 1-flowered. Leaves elliptic, scabro-puberulent along margins, 8 - 15 x 3 - 5 mm, thick, 1-nerved. Pedicels short, 5 - 10 mm long, usually erect. Sepals linear to linear-lanceolate, saccate at base, scarcely acute at apex, 5 - 7 mm long, hispid, glandular-ciliate along margins, not scarious. Petals oblong, clawed and cuneate at base, 10 - 14 mm long, white to pale rose. Filaments subulate. ciliolate. Styles 2. Capsules 4-valved.

Fl. Aug. - Sept.; *Fr.* Sept. - Oct.

Distrib. India: Alpine regions, 4000 - 5000 m. Sikkim.

China (Tibet).

17. *Arenaria neelgherrensis* Wight & Arn., Prodr. 43. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 239. 1874.

Herbs, annual; stems much branched, procumbent, elongate, with a line of hairs. Leaves subsessile, obovate or elliptic, obtuse at apex, 6 - 15 x 3 - 6 mm, glabrous, gland-dotted. Flowers solitary, axillary or in small terminal cymes, 3 - 4 mm across;

pedicels slender, 9 - 10 mm long, viscid-pubescent; bracts leafy. Sepals ovate, acute at apex, ca 4 x 1 mm, scarious-margined, glabrous except the dorsal pubescent nerve. Petals longer than sepals. Styles usually 3, rarely 4. Capsules ovoid, as long as sepals; seeds compressed, transversely striate.

Fl. April - June; *Fr.* July - Aug.

Distrib. India: Subtropical and temperate Himalayas and the Western Ghats. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Sikkim, Maharashtra and Tamil Nadu.

Pakistan and Nepal.

18. *Arenaria orbiculata* Royle ex Edgew. & Hook. f. in Fl. Brit. India 1: 240. 1874.

Herbs, perennial, with sterile shoots and many flowering shoots; branches decumbent or prostrate, with a line of hairs. Leaves sessile, orbicular or elliptic, obtuse, acute or apiculate at apex, 2 - 7 mm long, 1-nerved; petioles up to 2 mm long, ciliate. Flowers solitary or in few-flowered cymes. Sepals ovate or lanceolate, 3 - 4 x 1 - 1.5 mm, glabrous, 1-nerved. Petals ovate-lanceolate, ca 3 x 1 mm. Styles 3. Capsules 6-valved; seeds many, ca 0.7 mm in diam., dark brown, smooth.

Fl. May - Sept.; *Fr.* June - Oct.

Distrib. India: Temperate to alpine Himalayas, 2500 - 5000 m, on rocks. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Pakistan and Bhutan.

19. *Arenaria oreophila* Hook. f., Fl. Brit. India 1: 238. 1874.

Herbs, densely caespitose, forming small compact hemispherical tufts; stems short, densely leafy. Leaves spreading, narrowly linear-subulate, sheathing at base, acute at apex, 12 - 13 mm long, quite glabrous, rigid, recurved; uppermost pair short, bract-like, ciliate. Flowers solitary, ca 6 mm across; pedicels stout, shorter than calyx, puberulous. Calyx rounded and thickened at base; sepals oblong-orbicular, concave, ca 4 x 1.5 mm, minutely ciliate, coriaceous, nerveless. Petals obovate-spathulate, very narrow, rounded at apex, twice as long as sepals. Filaments slender; disc-glands prominent. Styles short. Capsules broadly ovoid, obtuse, 6-valved up to base, rather exceeding sepals, coriaceous; seeds somewhat auriform.

Fl. July - Aug.

Distrib. India: Alpine regions, ca 5400 m. Sikkim.

Bhutan and China (Tibet).

20. *Arenaria polytrichoides* Edgew. in Fl. Brit. India 1: 237. 1874.

Herbs, densely caespitose, forming hemispherical 5 - 10 cm high tufts; stems densely compressed, cylindrical, 2 - 10 cm long, together with leaves ca 6.5 mm in diam. Leaves densely imbricate, sessile, recurved, linear-lanceolate, broadly sheathing, scariosus and ciliate at base, narrowed and aristate at apex, 3 - 6 x 1 - 1.25 mm, thick along margins, bright green, rigid, pungent. Flowers minute, terminal, subsessile; pedicels lengthening up to 4 mm in fruit. Sepals broadly elliptic, obtuse at apex, concave, ca 2.5 x 1.5 mm, not scariosus-margined, glabrous, indistinctly 3-nerved. Petals obovate, narrowed at base, ca 4 x 1.75 mm. Filaments ca 3 mm long. Styles 3. Capsules broadly ovoid, shortly 6-valved, equalling sepals, coriaceous; seeds small, black, angular.

Fl. June - Aug.; *Fr.* Aug. - Sept.

Distrib. India: Alpine Himalayas, 4200 - 4600 m, on rocks. Himachal Pradesh and Sikkim.

Pakistan, Nepal and Bhutan.

21. *Arenaria pulvinata* Edgew. in Fl. Brit. India 1: 238. 1874.

Herbs, densely caespitose; branches densely leafy. Leaves semiterete, subulate, with scariosus sheathing base, abruptly mucronate at apex, convex on the back, 3 - 5 x 1 mm, strongly ciliate along margins, spreading, pale green. Flowers subsessile. Calyx rounded and thickened at base; sepals ovate-lanceolate, subacute at apex, 4 - 5 x 1.3 - 1.7 mm, hard and scariosus-margined; nerves 3, close together in the middle. Petals obovate, 6 - 10 x 2 mm. Styles 3, slender. Capsules ovoid, 6-valved, ca 3 x 1.5 mm; seeds ovate or reniform, nearly smooth.

Fl. July - Aug.; *Fr.* Sept. - Oct.

Distrib. India: Alpine regions, 4500 - 5500 m, on rocks. Sikkim.

Nepal, Bhutan and China (Tibet).

22. *Arenaria serpyllifolia* L., Sp. Pl. 423. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 239. 1874. **Fig. 102.**

Herbs, annual, small; stems branched from base, 10 - 30 cm high; branches slender, suberect or decumbent, hairy with often recurved hairs. Leaves subsessile, ovate to ovate-lanceolate, acuminate at apex, 5 - 7 mm long, stiff with scattered bristles. Flowers numerous, in cymes, 5 - 7 mm across; pedicels slender, erect; bracts herbaceous. Sepals

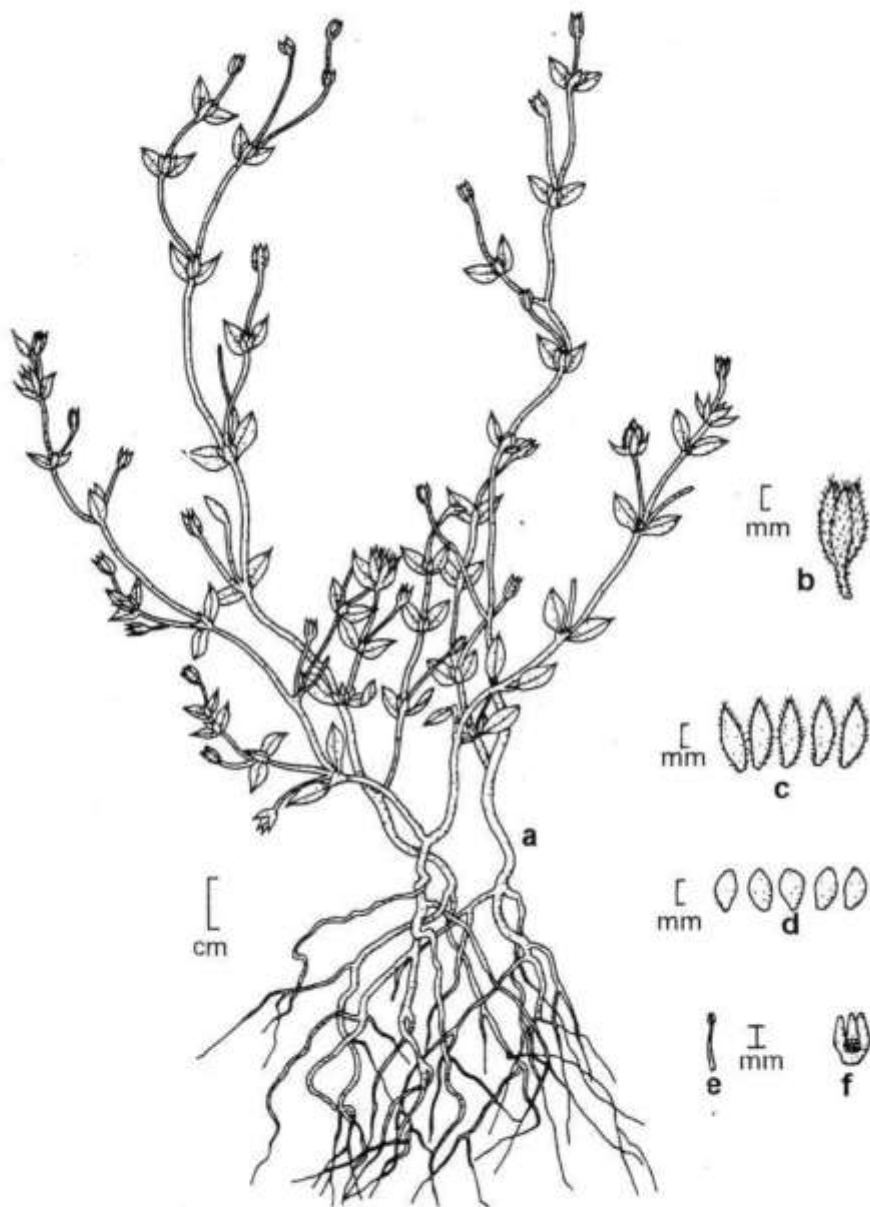


Fig. 102. *Arenaria serpyllifolia* L. : a. habit; b. flower; c. sepals; d. petals; e. stamen; f. dehiscent capsule.

5, free, ovate-lanceolate, acute at apex, 3 - 4 x 1 mm, 3 - 5-nerved, bristly. Petals 5, narrowly obovate, entire, ca 1.5 x 0.8 mm, white. Stamens 10. Styles 3. Capsules flask-shaped with a hard wall, 6-valved, ca 3.5 mm long; seeds many, rounded-reniform, 0.5 - 0.7 mm in diam., dark brown, papillose.

Fl. March - Aug.; *Fr.* June - Sept.

Distrib. India: Subtropical and temperate regions, 1000 - 3200 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Sikkim, Rajasthan and Tamil Nadu.

Pakistan, Nepal, China (Tibet), temperate Asia, Australia, Europe and N. America.

23. *Arenaria stracheyi* Edgew. in Fl. Brit. India 1: 240. 1874.

Herbs, perennial, small, entirely glabrous; stems laxly caespitose, 2 - 5 cm high. Leaves oblong-lanceolate, acute or acuminate and thickened at apex, 6 - 7.5 x 2 mm. Flowers solitary, terminal, 1.1 - 1.7 cm across; pedicels ebracteate. Sepals lanceolate, acuminate at apex, ca 5 mm long, coriaceous. Petals obovate, ca 7 x 4 mm, white. Styles 3. Capsules 6-valved, shorter than sepals; seeds somewhat auriform, pale, smooth.

Fl. Aug.

Distrib. India: Alpine Himalayas, 4500 - 5000 m, on rocks. Jammu & Kashmir and Sikkim.

Pakistan, Bhutan and China (Tibet).

24. *Arenaria thangoensis* W. Smith in Rec. Bot. Surv. India 4: 180. 1911.

Fig. 103.

Herbs, small, delicate, branched, 2 - 3 cm high, viscid-pubescent; stems with a line of whitish to brownish hairs. Leaves broadly lanceolate, 3 - 4 mm long, ciliate along margins, 1-nerved. Flowers few, in cymes; pedicels divaricate, 3 - 4 mm long, hairy. Sepals 5, broadly lanceolate, 1.5 - 3 mm long, hairy. Petals absent. Stamens 5, 1.2 - 1.5 mm long. Ovary ovoid, ca 1 mm long; styles 2. Capsules 4-valved, ca 3 mm long; seeds few, subglobose, 0.6 - 0.8 mm in diam.

Fl. & Fr. July - Aug.

Distrib. India: Alpine regions, ca 4500 m. Sikkim.

Endemic.

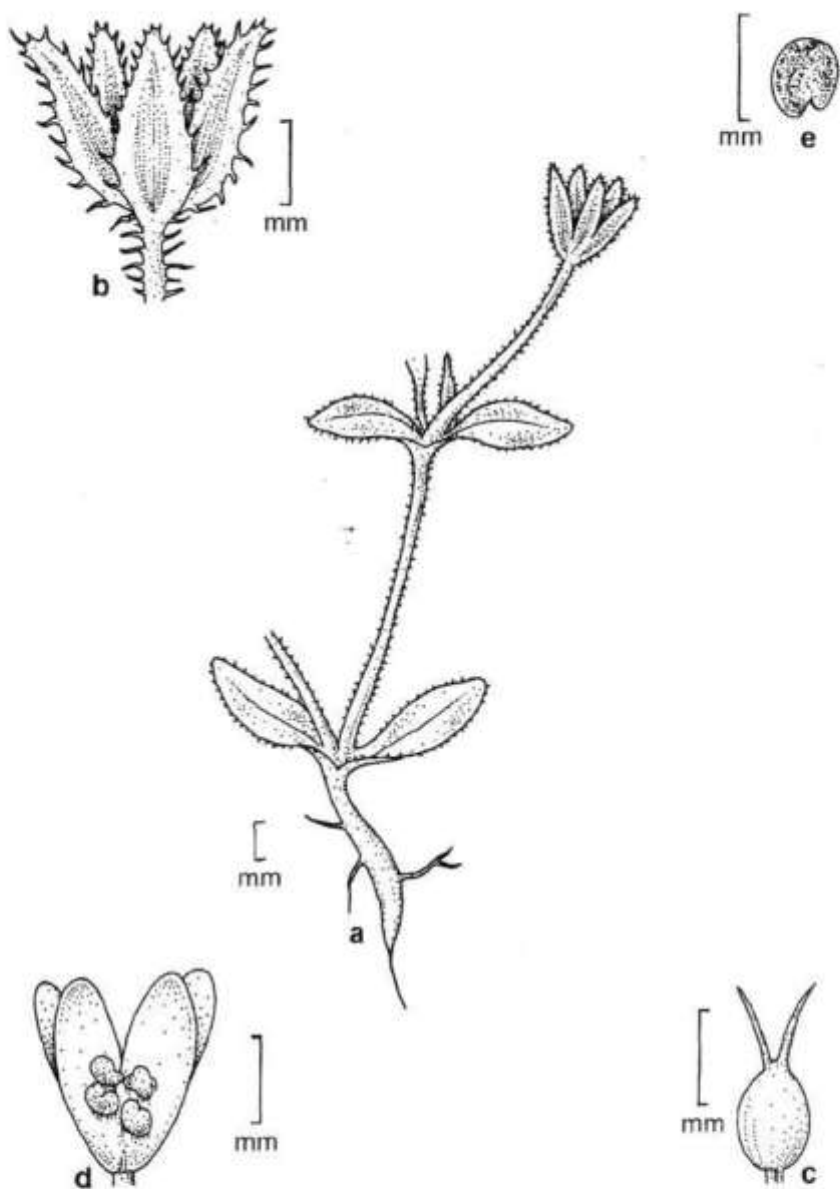


Fig. 103. *Arenaria thangoensis* W. Smith : a. habit; b. calyx; c. pistil; d. dehiscent capsule; e. seed.

2. *Brachystemma* D. Don

Monotypic; description and distribution as for the species below.

Brachystemma calycinum D. Don, Prodr. Fl. Nep. 216. 1825; Edgew. & Hook. f. in Fl. Brit. India 1: 235. 1874. **Fig. 104.**

Herbs, glabrous, glossy, climbing on trees up to 6 m high from ground; stems 4-angular, somewhat pilose at apex. Leaves opposite, ovate-lanceolate, rounded or cuneate at base, crenulate to ciliate and serrulate along margins, mucronate at apex, 2.5 - 7 x 0.6 - 2.5 cm, glabrous to pilose; petioles up to 2 cm long, becoming recurved, thickened and hardened. Panicle axillary or terminal, many-flowered; branches minutely pubescent; bracts linear-lanceolate, up to 4 mm long, recurved, glandular-pubescent. Sepals 5, oblong to elliptic-lanceolate, entire, acute at apex, 5 - 7 x 1.5 - 2 mm, scarious, shiny, faintly 3-nerved. Petals 5, lanceolate to elliptic, acute at apex, 2.5 - 4 x 1 mm, white. Stamens 5, 1 - 2 mm long, sometimes with 5 staminodes; anthers ovoid. Ovary 1-locular, ca 1.2 mm in diam., 3-ovuled; styles 2, revolute, bristly on inside margin. Capsules globose, 4-valved; seed 1, globose or reniform, reticulate.

Fl. & Fr. Dec. - May.

Distrib. India: Temperate Himalayas. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Meghalaya.

Nepal, Bhutan, Myanmar, China and Indochina.

3. *Cerastium* L.

Herbs, annual or perennial. Leaves sessile or subsessile, entire, small. Flowers usually in terminal, dichotomous cymes, 5-merous, rarely 4-merous. Sepals 5, free, scarious, membranous-margined. Petals as many as sepals, 2-fid or emarginate at apex, white, rarely absent. Stamens usually 10, rarely less, hypogynous; nectaries present. Ovary 1-locular; styles 3 - 5, filiform. Capsules cylindrical, exceeding sepals, opening by twice as many short teeth as styles; seeds many, spherical or reniform, rough, compressed, often tuberculate.

Almost cosmopolitan; ca 60 species, 7 species in India.

KEY TO THE SPECIES

- | | |
|---|---------------------------------|
| 1a. Styles usually 3 | 2. <i>C. cerastoides</i> |
| b. Styles usually 5 | 2 |
| 2a. Capsule teeth curved or recurved, plain along margins | 3 |
| b. Capsule teeth straight, recurved along margins | 4 |

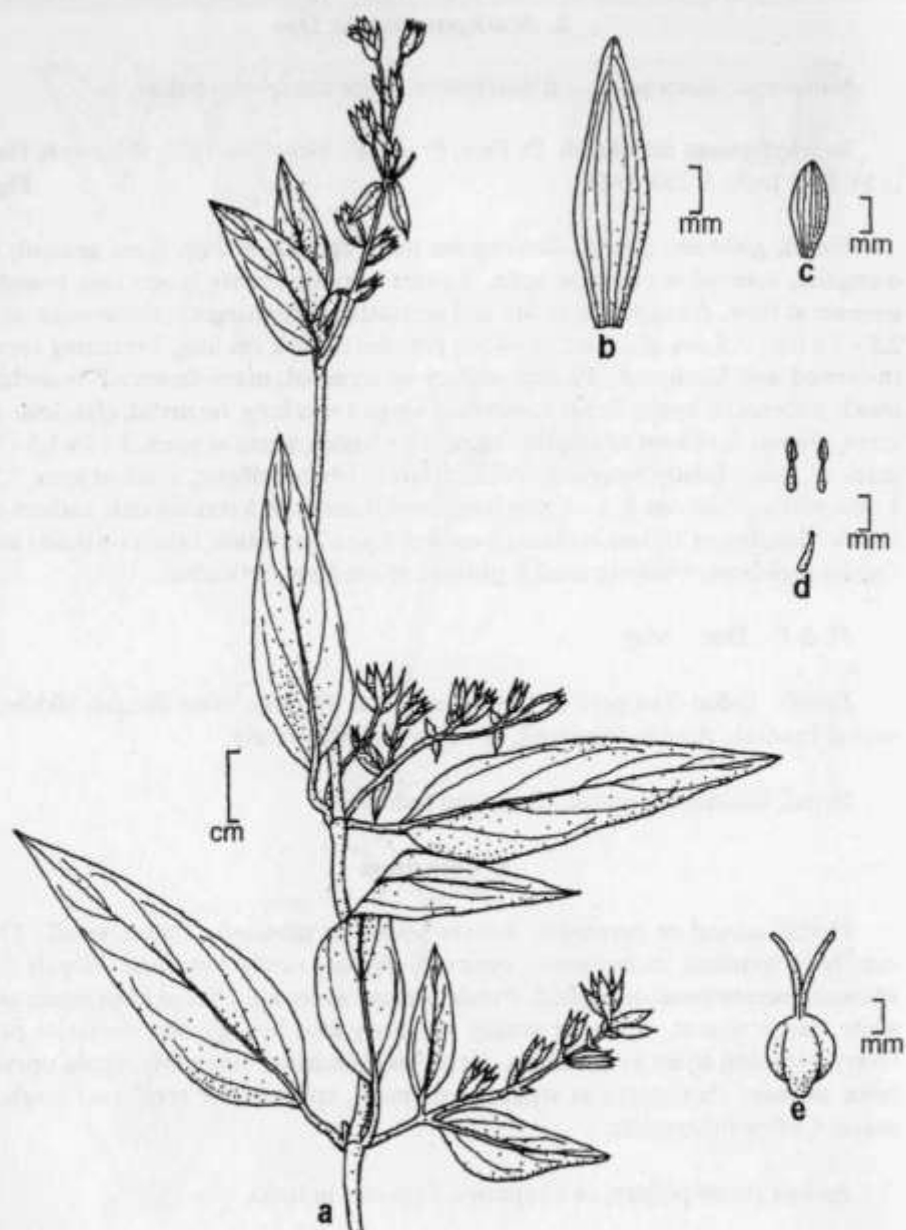


Fig. 104. *Brachystemma calycinum* D. Don : a. flowering shoot; b. sepal; c. petal; d. stamens and staminodes; e. pistil.

- | | |
|--|-------------------------|
| 3a. Plants glabrous; capsules much longer than calyx | 3. <i>C. dahuricum</i> |
| b. Plants glandular-pubescent; capsules slightly longer than calyx | 6. <i>C. indicum</i> |
| 4a. Leaves linear-oblong; cymes in umbel-like clusters | 7. <i>C. thomsonii</i> |
| b. Leaves not linear-oblong; cymes lax or compact | 5 |
| 5a. Flowers 1 - 5; sepals 7 - 10 mm long | 1. <i>C. alpinum</i> |
| b. Flowers many; sepals less than 5 mm long | 6 |
| 6a. Flowers in compact clusters; fruiting pedicels not exceeding sepals; sepals with long white hairs projecting beyond apex | 5. <i>C. glomeratum</i> |
| b. Flowers in dichasia, lax in fruit; fruiting pedicels exceeding sepals; sepals without such long hairs | 4. <i>C. fontanum</i> |

1. *Cerastium alpinum* L., Sp. Pl. 438. 1753; Kachroo et al., Fl. Ladakh 62. 1977.

Herbs, perennial, 7 - 20 cm high, glabrous or hairy. Leaves ovate to elliptic-lanceolate, acute or obtuse at apex, ca 10 x 5 mm. Flowers 1 - 5; pedicels 1 - 4 cm long; bracts acute, scarious-margined. Sepals truncate at base, acute at apex, 7 - 10 mm long. Petals 2-fid, twice as long as sepals, white. Capsules narrow, slightly curved upwards, 8 - 14 mm long; seeds 1 - 1.4 mm in diam., acutely tuberculate.

Fl. May - June.

Distrib. India: Alpine Himalayas. Jammu & Kashmir.

Russia (Siberia), Arctic and subarctic Europe.

Notes. It is included on the basis of Kachroo et al. (l. c.) who reports its occurrence in Ladakh.

2. *Cerastium cerastoides* (L.) Britton in Mem. Torrey Bot. Club 5: 152. 1894. *Stellaria cerastoides* L., Sp. Pl. 422. 1753. *Cerastium trigynum* Villars, Hist. Pl. Dauphine 3: 645. 1789; Edgew. & Hook.f. in Fl. Brit. India 1: 227. 1874. **Fig. 105.**

Herbs, perennial; stems slender, glabrous except for a line of short hairs; flowering shoots 10 - 30 cm high. Leaves linear to lanceolate, obtuse at apex, 6 - 18 x 0.5 - 2 mm, usually curved, pale green. Cymes few-flowered; pedicels slender, glandular-pubescent; bracts leaf-like. Sepals linear-lanceolate, 4 - 5 mm long, glandular-pubescent, 1-nerved. Petals 2-lobed, ca 9 mm long, white. Styles usually 3. Capsules 6-valved, 7 - 9 mm long; seeds ca 0.5 mm in diam., brown with 8 rows of dorsal tubercles.

Fl. & Fr. July - Sept.

Distrib. India.: Alpine Himalayas, above 2700 m. Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh.

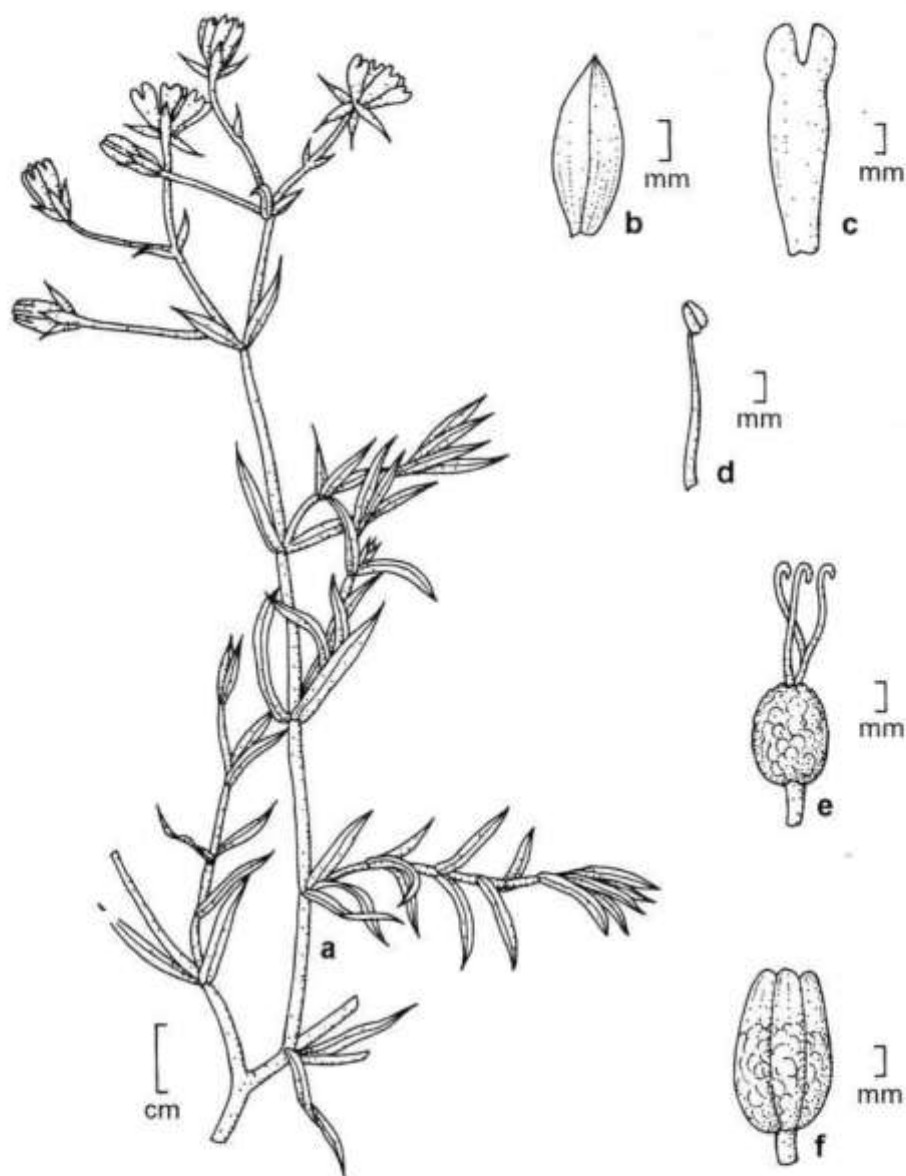


Fig. 105. *Cerastium cerastoides* (L.) Britton : a. flowering branch; b. sepal; c. petal; d. stamen; e. pistil; f. capsule.

Pakistan, Russia, Africa, W. Asia and Europe.

3. *Cerastium dahuricum* Fischer in Sprengel, Pl. Min. Cogn. Pug. 2: 65. 1815; Edgew. & Hook. f. in Fl. Brit. India 1: 227. 1874.

Herbs, perennial; stems 3 - 6 mm thick, shiny, glabrous above, sometimes pubescent below. Leaves sessile, ovate or oblong, amplexicaul, acute or rarely obtuse at apex, 2.5 - 6 x 1 - 2.2 cm. Flowers in cymes; pedicels 1 - 2 cm long, up to 4 cm long in fruit. Sepals oblong-elliptic, acute at apex, 9 - 10 mm long, shiny, scarious-margined. Petals obovate, 2-lobed, 18 - 19 mm long with ciliate claw. Capsules straight, 15 - 19 mm long, striate, many-nerved with recurved teeth; seeds 1 - 1.2 mm in diam., tuberculate.

Fl. & Fr. June - Sept.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh.

Pakistan, W. Asia, Russia and Europe.

4. *Cerastium fontanum* Baumg. subsp. *triviale* (Link) Jalas in Arch. Soc. Zool. Bot. Fenn. "Vanamo" 18: 63. 1963. *C. triviale* Link, Enum. Pl. Hort. Berol. Alt. 1: 433. 1821. *C. vulgatum* L. var. *triviale* (Link) Edgew. & Hook. f. in Fl. Brit. India 1: 228. 1874.

Herbs, laxly caespitose, hirsute throughout or glandular-pubescent upwards. Leaves sessile, oblong, elliptic to ovate, acute at apex, 1 - 3 x 0.3 - 1 cm, minutely hairy. Cymes glandular-pubescent; bracts herbaceous. Sepals ovate-lanceolate, 3 - 5 mm long, with scarious margins and glabrous apex. Petals 2-fid for 1/3 to 1/5 of length, equalling or slightly exceeding sepals. Stamens 10; filaments glabrous; anthers yellow. Capsules narrowly cylindrical, 9 - 12 mm long; seeds 0.5 - 0.9 mm, reddish brown, rugose-tuberculate.

Fl. & Fr. April - Sept.

Distrib. India: Temperate and alpine Himalayas. Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Pakistan, Nepal and Asia.

5. *Cerastium glomeratum* Thuill., Fl. Env. Paris ed. 2, 226. 1799. *C. vulgatum* auct. non L. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 228. 1874, p. p. *C. vulgatum* var. *glomeratum* (Thuill.) Edgew. & Hook. f., l. c. 228.

Herbs, annual, 10 - 40 cm high, glandular-pubescent, with erect or ascending

flowering shoots. Leaves oblong, lanceolate, ovate or elliptic, apiculate, 10 - 25 x 6 - 9 mm, white-hairy. Cymes clustered; pedicels 2 - 4 mm long; bracts herbaceous, hairy. Sepals lanceolate, acuminate at apex, 4 - 5 x 1 - 1.5 mm, pubescent. Petals 2-fid, as long as sepals, white. Stamens 5 (-10). Capsules terete, cylindrical, curved upwards, 8 - 11 mm long, scarios, straw-coloured, opening by 10 straight teeth; seeds 0.5 - 0.6 mm, pale brown, rugose-tuberculate.

Fl. & Fr. July - Oct.

Distrib. India: Throughout the hilly regions.

Bhutan and Nepal.

6. **Cerastium indicum** Wight & Arn., Prodr. 43. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 227. 1874.

Herbs, perennial, slender, 40 - 60 cm high, glandular-pubescent. Leaves sessile, lanceolate, ovate or elliptic, acute at apex, 3 - 5.5 x 0.5 - 1.5 cm, membranous. Flowers few, in terminal dichotomous cymes; pedicels slender, tomentose. Sepals oblong-lanceolate, acute at apex, 4 - 5 mm long, narrowly scarios-margined. Petals 5 - 6 mm long. Capsules slightly longer than sepals, with curved teeth.

Fl. & Fr. Sept. - Feb.

Distrib. India: Western Ghats (Nilgris and Palnis). Tamil Nadu.

Sri Lanka.

7. **Cerastium thomsonii** Hook. f., Fl. Brit. India 1: 228. 1874.

Herbs, 15 - 40 cm high, glandular-hairy; stems erect, slender, branched at base. Leaves linear-oblong, subacute at apex, 20 - 30 (-40) x 2 - 4 (-10) mm. Cymes few-flowered. Flowers 1.2 - 1.9 cm across; pedicels slender; bracts narrowly scarios-margined. Sepals oblong-lanceolate, acute at apex, 6 - 7 mm long, scarios-margined. Petals broad, 8 - 9 mm long. Capsules cylindrical, 10 - 12 x 3 - 4 mm; seeds many, flattened.

Fl. & Fr. June - Aug.

Distrib. India: Alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

4. *Cucubalus* L.

Monotypic; description and distribution as for the species below.

Cucubalus baccifer L., Sp. Pl. 413. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 222. 1874. **Fig. 106.**

Herbs, perennial; stems diffusely branched, 60 - 90 cm high, often subsucculent; flowering shoots pubescent with short curved white hairs. Leaves ovate-lanceolate, rounded at base, acuminate at apex, 2.5 - 7 x 1 - 2.5 cm, sparsely pubescent, membranous; petioles up to 1 cm long; upper leaves sessile, entire or somewhat sinuate. Flowers ca 1.8 cm across, bisexual, nodding, solitary, axillary or few, terminal in leafy cymes at ends of branches; pedicels 4 - 12 mm long, tomentose. Calyx campanulate, divided to below middle into teeth, 8 - 12 mm long, inflated in fruit, with indistinct nerves; teeth 5, unequal, subacute, about twice as long as tube. Petals 5, white, inserted hypogynously at apex of gynophore, about as long as calyx, deeply 2-lobed; claw cylindrical, wider at junction with limb, with 2 scales at base of limb. Receptacle slightly elongated up to 3 mm, bearing petals, stamens and ovary at apex. Stamens 10; filaments filiform; anthers didymous, 2-locular, dehiscent longitudinally. Ovary 1-locular above, partially 3-locular at base; styles 3, filiform, stigmatose inside. Fruits berry-like, globose, 1 - 1.5 cm in diam., black when ripe, on a short carpophore, indehiscent or bursting irregularly; seeds many, reniform, ca 1.5 mm in diam., black.

Fl. June - Sept

Distrib. India: Temperate Himalayas, grassy edges of pine forests, 1500 - 2200 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Himalayas, Japan, Russia (Siberia) and C. & S. Europe.

5. *Dianthus* L.

Herbs, annual, biennial or perennial, rarely shrubby. Leaves narrow, linear, elliptic or lanceolate, sometimes connate at base. Flowers solitary or in paniced cymes; bracteoles (epicalyx scales) 2 - many, closely adpressed to calyx. Calyx tubular, without scarious commissures or commissural veins, 5-toothed. Petals long-clawed, entire, toothed or fimbriate but never 2-fid, without appendages. Receptacle elongated, bearing petals, stamens and ovary at apex. Stamens 10. Styles 2, filiform. Capsules oblong, cylindrical or ovoid, dehiscent by 4 teeth; seeds peltate with a facial hilum.

Africa, Asia, Europe and North America; ca 270 species, 9 species in India.

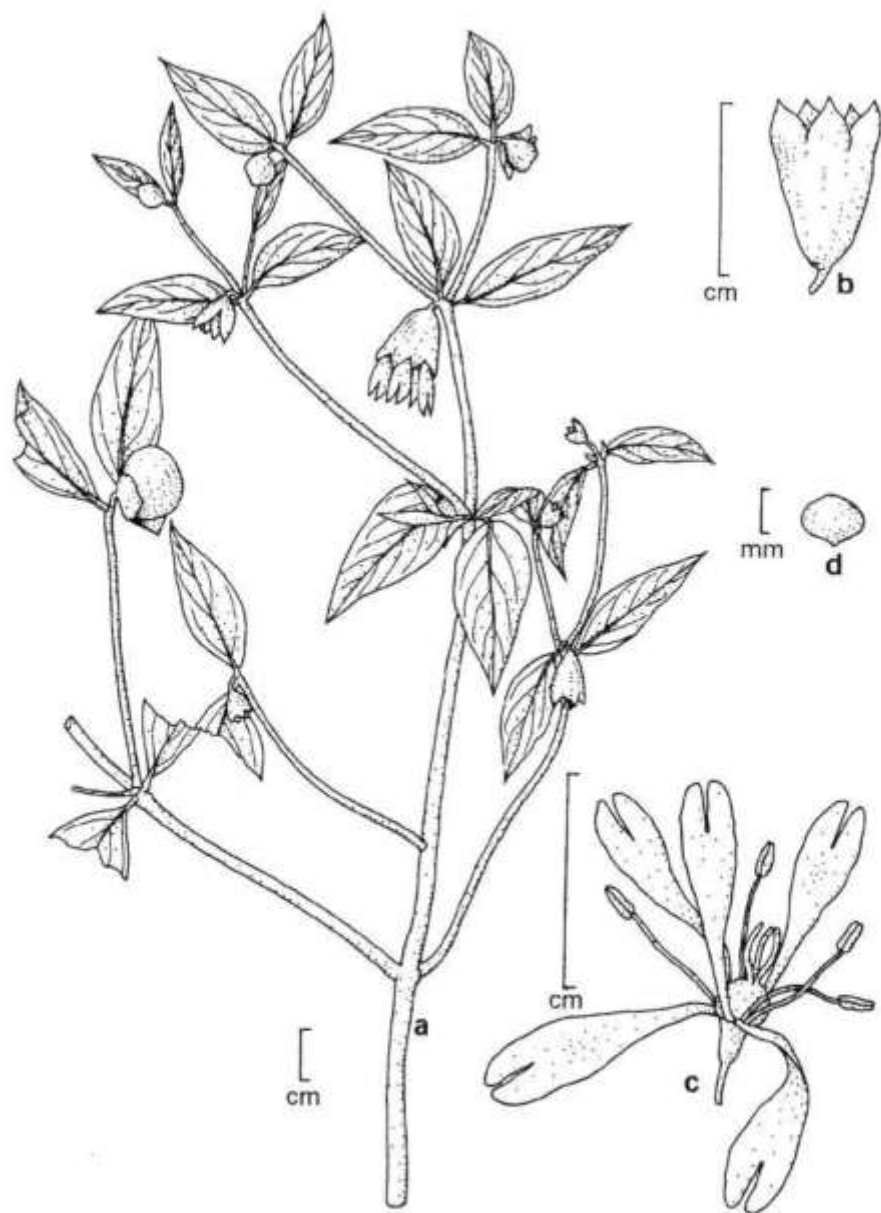


Fig. 106. *Cucubalus baccifer* L. : a. habit; b. calyx; c. flower without calyx; d. seed.

Notes. *Dianthus caryophyllus* L. (Carnation) and its cultivars and hybrids; *D. chinensis* L., a native of China; *D. barbatus* L. and *D. plumarius* L., natives of Europe, are commonly cultivated in Indian gardens.

Literature. WILLIAMS, F. N. (1893) A monograph of the genus *Dianthus*. J. Linn. Soc., Bot. 29: 346 - 378.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Petals fimbriate along margins | 2 |
| b. Petals not fimbriate along margins | 3 |
| 2a. Leaves 1-nerved; calyx more than 2.5 cm long; bracteoles 9 - 14 mm long | 5. <i>D. crinitus</i> |
| b. Leaves 3-nerved; calyx less than 2.5 cm long; bracteoles 4 - 6 mm long | 9. <i>D. orientalis</i> |
| 3a. Petal limb barbulate | 4. <i>D. chinensis</i> |
| b. Petal limb cbarbulate | 4 |
| 4a. Calyx more than 1.8 cm long | 5 |
| b. Calyx less than 1.8 cm long | 8 |
| 5a. Flowers in paniculate cymes | 3. <i>D. caryophyllus</i> |
| b. Flowers solitary or few | 6 |
| 6a. Calyx ca 5 cm long | 7. <i>D. falconeri</i> |
| b. Calyx 1.8 - 2.5 cm long | 7 |
| 7a. Leaves 1-nerved; calyx teeth pungent | 8. <i>D. jacquemontii</i> |
| b. Leaves 3-nerved; calyx teeth not pungent | 2. <i>D. cachemiricus</i> |
| 8a. Bracteoles (4-) 8; calyx 9 - 11-nerved | 1. <i>D. anatolicus</i> |
| b. Bracteoles 2 (-4); calyx 7-nerved | 6. <i>D. deltoides</i> |

1. *Dianthus anatolicus* Boiss., *Diagn. Pl. Orient.* 1, 1: 22. 1843; Edgew. & Hook. f. in *Fl. Brit. India* 1: 214. 1874.

Herbs, perennial, densely caespitose with a short woody stock; stems slender, 8 - 35 cm high. Leaves narrow, slender, linear, long-acuminate at apex, 3-nerved with thickened margins; radical leaves ca 3 cm long; cauline ones ca 2.4 cm long, channelled. Flowers solitary or often 2 - 3 together; pedicels more than 5 mm long; bracteoles (4-) 6 (-8), broadly cuspidate, sometimes with foliaceous points, shorter than calyx. Calyx contracted above, 8.5 - 11 x 2 - 3.5 mm; teeth lanceolate, acute, often mucronate, ca 2 mm long, ciliolate, scarious-margined, 9 - 11-nerved. Petals oblong-spathulate, dentate, 2.5 - 3.5 mm long, glabrous, white.

Fl. May - Aug.

Distrib. India: Alpine Himalayas, above 2700 m. Jammu & Kashmir.

China (Tibet) to Asia Minor.

2. *Dianthus cachemicus* Edgew. in Fl. Brit. India. 1: 214. 1874.

Herbs, perennial; stems slender, erect, 48 - 52 cm high, branched from base, glabrous. Leaves narrow, linear, acuminate at apex, channelled, 3-nerved; radical leaves ca 3.4 cm long; cauline ones ca 2.4 cm long. Flowers solitary or few, terminal; bracteoles lanceolate with a long foliaceous point, sometimes as long as calyx. Calyx ca 2.5 cm long, purple; teeth 5, ovate-lanceolate, acuminate, scarious-margined, 7-nerved. Petals 5, obovate, pink; limb 1.2 - 1.6 x 2.5 cm, dentate, or almost entire along margins. Stamens 10. Ovary on a long gynophore, 1-locular; styles 2. Capsules opening by 4 teeth.

Fl. Sept.

Distrib. India: Alpine regions. Jammu & Kashmir.

Endemic.

3. *Dianthus caryophyllus* L., Sp. Pl. 411. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 214. 1874.

Herbs, perennial, erect, glabrous, glaucous; stems 60 - 70 cm high, stout, jointed and leafy below. Leaves opposite, obtuse at apex, thick, channelled, 5-nerved; midnerve prominent; laterals obscure; radical leaves 9 - 9.3 cm long; cauline ones linear, 7 - 7.5 cm long, recurved. Flowers in lax paniculate cymes, long-pedicellate, fragrant, rose-purple or white; bracteoles 4, obovate, mucronate, 6 - 7 mm long. Calyx cylindrical, 2.5 - 3 cm long, smooth; teeth 5, narrow, scarious-winged, ciliolate, 9-nerved. Petals dentate and crenate; limb obovate-cuneate or truncate-subrhomboid. Stamens 10; anthers oblong. Capsules ovoid-cylindrical, longer than calyx; seeds pyriform, granulate.

Fl. Nov. - Jan.

Distrib. India: Jammu & Kashmir and Punjab.

N. Africa and S. Europe.

4. *Dianthus chinensis* L., Sp. Pl. 411. 1753. *D. seguierii* Villars, Prosp. Hist. Pl. Dauphine 48. 1779 & Hist. Pl. Dauphine 1: 330. 1786 & 3: 594. 1789; Edgew. & Hook. f. in Fl. Brit. India 1: 215. 1874. Fig. 107.

Herbs, perennial, caespitose, up to 50 cm high; stems dichotomously branched, 4-angular. Leaves linear-lanceolate, smooth and entire, acuminate at apex, flat, rigid, patent, channelled, 3 - 5-nerved; laterals obscure; radical leaves up to 6.4 cm long; upper ones 2 (-4) cm long. Flowers solitary or in lax cymes; pedicels 2 - 5 mm long; bracteoles 4, ovate-lanceolate, acuminate, half as long as or equalling calyx. Calyx subcylindrical, wider at lower half, 7-nerved; teeth triangular, lanceolate, acuminate. Petals acutely

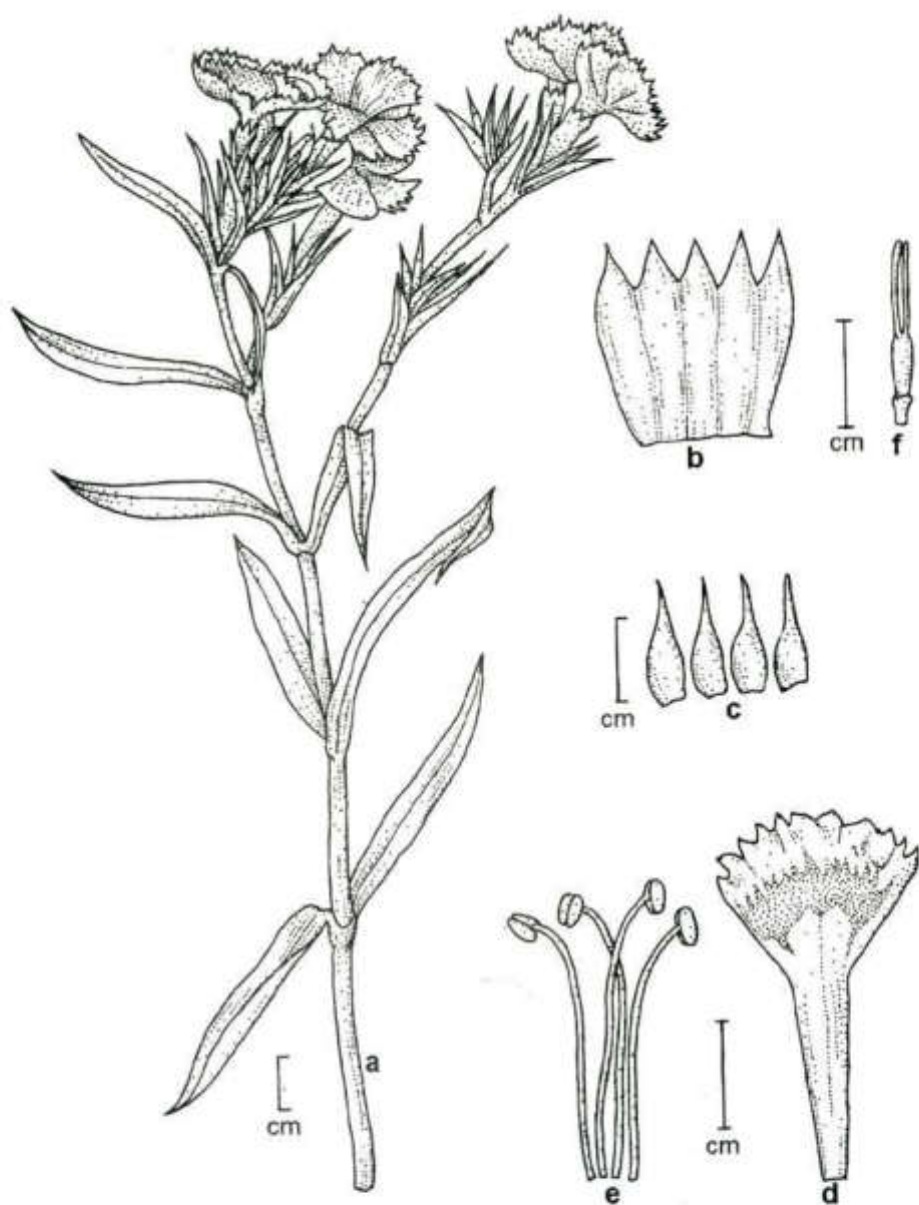


Fig. 107. *Dianthus chinensis* L. : a. flowering shoot; b. calyx; c. bracteoles; d. petal; e. stamens; f. pistil.

serrate, incurved along margins, pubescent at base, barbulate, pink to purple, rarely white. Anthers dark blue or purple. Capsules sessile, ovoid; seeds granulate.

Fl. Feb. - March.

Distrib. India: Temperate regions. Jammu & Kashmir, Uttar Pradesh and Tripura. Also cultivated in Indian gardens.

China (Tibet), Russia (Siberia and Caucasus), Turkey, Greece and C. Europe.

5. *Dianthus crinitus* Smith in Trans. Linn. Soc., Lond. 2: 300. 1794; Edgew. & Hook. f. in Fl. Brit. India 1: 215. 1874.

Herbs, perennial, erect, robust, with a woody base; branches rigid, 20 - 45 cm high, few-flowered. Leaves narrow, linear, acute at apex, 3 - 12 cm x 0.8 - 1.3 mm, recurved, 1-nerved; leaves of flowering shoots shorter than internodes, erect. Flowers solitary; pedicels more than 2 cm long; bracteoles 4 - 6, ovate, aristate to cuspidate at apex, 9 - 14 mm long. Calyx cylindrical, 25 - 40 x 3 - 5 mm; teeth linear-lanceolate, acuminate to aristate, 8.5 - 10.5 mm long, finely ciliate along margins. Petals 12 - 17 mm long, fimbriate up to more than half the blade; segments capillary, ebarbulate; claw exerted, white to pale pink, fragrant. Anthers white.

Fl. June - Aug.

Distrib. India: Temperate and alpine regions. Jammu & Kashmir.

Pakistan, China (Tibet), Iran, Afghanistan, Turkey and C. Asia.

6. *Dianthus deltooides* L., Sp. Pl. 411. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 214. 1874.

Herbs, caespitose, scabro-puberulent; stems slender, ca 25 cm high, terete, forked. Radical leaves oblanceolate; cauline ones linear-lanceolate, acute at apex, up to 1.2 cm long, 3-nerved. Flowers ca 1.8 cm across, shortly pedicellate, fragrant; bracteoles 2 (-4), ovate, acute, spreading, coriaceous, scarious-margined. Calyx slender; teeth lanceolate, acuminate, scarious-winged, 7-nerved, often dark-coloured. Petals pale flesh-coloured to rose-purple, rarely white; limb obovate, ca 7 cm long. Anthers oblong, purple. Capsules cylindrical; seeds smooth, reticulate.

Fl. July - Aug.

Distrib. India: Jammu & Kashmir (Ladakh).

China (Tibet), Japan, Russia and Europe.

7. *Dianthus falconeri* Edgew. in Fl. Brit. India 1: 214. 1874.

Herbs, perennial, suffrutescent, with a woody stock; stems rigid, branched, 30 - 60 cm high. Leaves linear, serrulate along margins, 7 - 15 x 0.3 cm, channelled; radical leaves 3-nerved; cauline ones 1-nerved. Flowers usually solitary; bracteoles 4 (-6), ovate, long-cuspidate, ca 1.2 cm long. Calyx ca 5 cm long, striate with 9 - 11-nerved teeth. Petals finely dentate, smooth, pink.

Fl. July.

Distrib. India: Alpine Himalayas. Jammu & Kashmir.

China (Tibet).

8. *Dianthus jacquemontii* Edgew. in Fl. Brit. India 1: 214. 1874.

Herbs, small, caespitose, with a woody stock; stems slender, 15 - 25 cm high, 4-angular, 1-flowered. Leaves linear, acute at apex, flat, coriaceous, 1-nerved; radical leaves up to 3 cm long, recurved; cauline ones up to 2.2 cm long, incurved with thickened margins, green when dry. Flowers usually solitary, fragrant; bracteoles 4, obovate, 4 - 6 mm long, suddenly contracted into a point, sometimes thickened and obtuse. Calyx 1.8 - 2.5 cm long with acuminate teeth, scarious-winged, 7-nerved, pungent with hard tips. Petals 5, pink; limb obovate-cuneate, deeply dentate. Stamens 10. Styles 2.

Fl. July - Sept.

Distrib. India: Alpine regions. Jammu & Kashmir.

Endemic.

9. *Dianthus orientalis* Adams in Fried. Weber. & Mohr, Beitr. 1: 54. 1805. *D. fimbriatus* M. Bieb., Fl. Taur.-Cauc. 1: 332. 1808; Edgew. & Hook. f. in Fl. Brit. India 1: 215. 1874.

Herbs, perennial, 15 - 40 cm high, glabrous, glaucous, usually with an extensive woody base; stems many, erect, rigid, 4-angular below, 1-flowered. Leaves linear, acute or acuminate at apex, serrulate along margins, 12 - 70 x 0.5 - 3 mm, flaccid or rigid, erect, channelled or not, 3-nerved; leaf sheaths as broad as leaves. Flowers usually solitary, terminal, pedicellate; bracteoles 4 - 8, ovate or oblong, acuminate; lower ones cuspidate, 4 - 6 mm long. Calyx tubular, broad below and narrow above, 1.2 - 2.5 cm long; teeth lanceolate, 6 - 9(-11) mm long. Petals 5, obovate-oblong, lilac, rose, pink or white; limb fimbriate for 1/3 of the length, barbulate; claw exserted. Stamens 10. Ovary stalked; styles 2. Capsules oblong, opening by 4 teeth.

KEY TO THE VARIETIES

- 1a. Leaves flaccid; calyx 12 - 18 mm long; petals rose coloured 9.1. var. *angulatus*
 b. Leaves rigid; calyx 20 - 25 mm long; petals lilac, pink or white 9.2. var. *orientalis*

9.1. var. *angulatus* (Royle ex Benth.) Majumdar, **comb. et. stat. nov.** *D. angulatus* Royle ex Benth. in Royle, *Illus. Bot. Himal.* 79. 1834; Edgew. & Hook. f. in *Fl. Brit. India* 1: 215. 1874.

Fl. June - Oct.

Distrib. India: Alpine Himalayas, above 2400 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

9.2. var. *orientalis*

Fl. June - Sept.

Distrib. India: Alpine Himalayas, 2400 - 2800 m. Jammu & Kashmir and Himachal Pradesh.

China (Tibet), Afghanistan, Iran, Russia (Caucasus) and Turkey.

6. *Drymaria* Schultes

Herbs, annual, prostrate to suberect, branching, glabrous or pubescent. Leaves opposite, sessile or petiolate, rounded; stipules persistent or fugacious, small, scarious. Flowers in dichasial cymes, rarely solitary, axillary. Sepals 5, free, scarious-margined. Petals 3 - 5, usually 2-fid, often auriculate, white. Stamens 2 - 5; filaments slightly connate at base; anthers versatile. Carpels usually 3; ovary shortly stiped, 1-locular; ovules campylotropous; styles 2 - 3, more or less united below up to middle. Capsules ovoid to globose, 3-valved; seeds 1-many, globose, reniform, cochleate, tuberculate.

Tropical and subtropical regions of Asia, Malesia, Africa and Madagascar, America and the West Indies; ca 48 species, 2 species in India.

Literature. DUKE, J. A. (1961) A preliminary revision of the genus *Drymaria*. *Ann. Missouri Bot. Gard.* 48: 173 - 268. MAJUMDAR, N. C. (1969) The genus *Drymaria* in India. *Bull. Bot. Surv. India* 10: 293 - 295.

KEY TO THE SPECIES

- 1a. Plants glabrous to glandular-papillate; pedicels glandular-pubescent; sepals carinate; petals without auricles; seeds more than 1 mm in diam. 1. *D. diandra*

- b. Plants villous to hirsute with long septate hairs; pedicels villous; sepals not carinate; petals with auricles; seeds less than 1 mm in diam.

2. *D. villosa*

1. *Drymaria diandra* Blume, Bijdr. 62. 1825. *D. cordata* sensu Edgew. & Hook. f. in Fl. Brit. India 1: 244. 1874, non (L.) Roem. & Schultes 1819. Fig. 108.

Herbs, annual, prostrate or ascending, glabrous to glandular-papillate; branches arising from base, rooting at nodes, slender, elongate. Leaves deltoid-ovate to subreniform, obtuse to cordate at base, acute or obtuse and mucronate at apex, 5 - 25 x 3 - 20 mm, glabrous, 3 - 7-nerved; petioles 2 - 5 mm long; stipules lacerate into 1 - 2 mm long filaments. Cymes terminal; pedicels 1 - 8 mm long, finely glandular-pubescent; bracts lanceolate, 2 - 5 mm long. Sepals 5, narrowly obovate to elliptic-ovate, 2 - 4.5 mm long, keeled, 3-nerved, inflexed, glandular-papillose on nerves. Petals 3 - 5, 2-fid nearly up to middle or more, white; lobes oblong, obtuse at apex, 1.5 - 3 mm long, 1-nerved. Stamens 2 - 3, 1.6 - 2.2 mm long; anthers suborbicular. Ovary globose; styles 2- or 3-fid. Capsules 2 - 3-valved, 1.5 - 2.5 mm long; seeds 1 or few, cochleate, 1 - 2 mm in diam., finely tuberculate.

Fl. & Fr. Jan. - Dec.

Distrib. India: Low hills, up to 1000 m, on damp grounds. Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Meghalaya, Orissa, Karnataka and Tamil Nadu.

Nepal, Bhutan, Bangladesh, Sri Lanka, China, Taiwan, Indo-china, Malesia, Australia and Tropical Africa.

2. *Drymaria villosa* Cham. & Schlecht. in Linnaea 5: 232. 1830; Mizushima in Fl. E. Himal. 80. 1966.

Herbs, annual, prostrate or ascending, villous to hirsute with up to 2 mm long white septate hairs, sometimes glabrescent. Leaves orbicular to reniform, cordate to truncate at base, 5 - 15 mm across, villous with long whitish hairs; stipules usually entire. Cymes paniculate; pedicels 2 - 20 mm long, sparsely villous; bracts 0.5 - 1.5 mm long. Sepals 5, ovate-elliptic, 2 - 3.5 x 1 - 2 mm, scarious-margined, indistinctly 3-nerved, sparsely pubescent. Petals 5, 2 - 3.6 mm long, 2-fid up to middle or more; lobes acute to deeply emarginate, with caducous filiform auricles at base, 4-nerved. Stamens 5, 2 - 3.5 mm long; anthers oblong. Ovary ovoid to globose; styles 1 - 1.5 mm long, 3-fid to half their length. Capsules ovoid or ellipsoid, 2 - 3.5 mm long; seeds many, cochleate, 0.5 - 0.9 mm in diam., minutely papillate or tuberculate.

Fl. April - June; *Fr.* July - Oct.

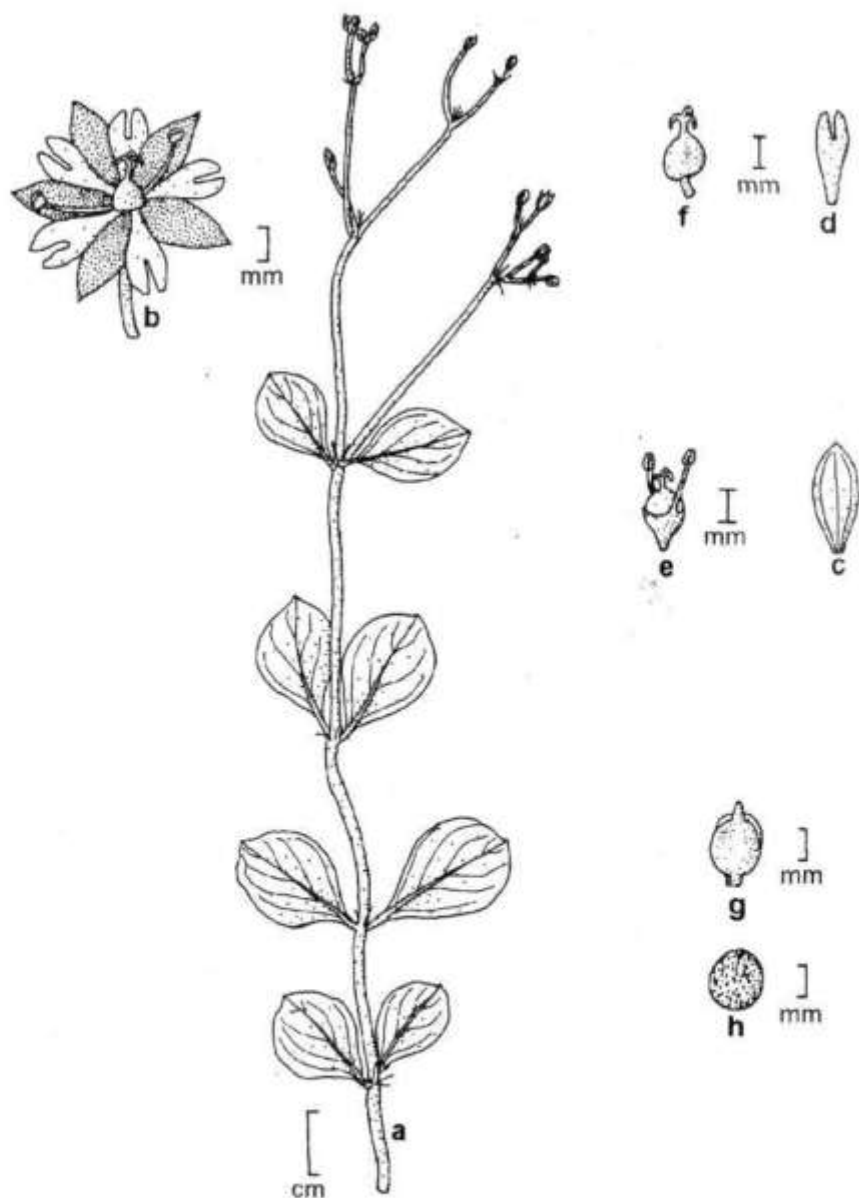


Fig. 108. *Drymaria diandra* Blume : a. flowering shoot; b. flower; c. sepal; d. petal; e. stamens with pistil; f. pistil; g. capsule; h. seed.

Distrib. India: Introduced and naturalised in the subtropical hills of West Bengal, Sikkim, Meghalaya, Karnataka and Tamil Nadu.

Widely naturalised in Nepal, Bhutan, Malesia, Africa, Mexico and C. & S. America.

7. *Gypsophila* L.

Herbs, annual, biennial or perennial, rarely shrubby, often glandular-hairy. Leaves opposite, linear-subulate, lanceolate or obovate, usually flat, often subfleshy. Flowers bisexual, generally numerous, small, arranged in lax dichasial leafy cymes, panicles or heads, rarely solitary; bracts green, scarious; bracteoles absent. Receptacle not elongated. Calyx campanulate, rarely tubular, 5-toothed, with scarious seams between main nerves. Petals 5, narrowly clawed at base; limb entire or notched, without coronal scales, white to pink, often with purple streaks. Stamens 10. Ovary ellipsoid, 1-locular, many-ovuled; styles 2, rarely 3, filiform. Capsules globose to oblong, opening by 4 (-6) teeth; seeds compressed with a prominent radicle and flat or echinate tubercles, rarely smooth.

Chiefly in Europe and West Asia; ca 80 species, 2 species in India.

Literature. WILLIAMS, F. N. (1889) A revision of the genus *Gypsophila*. *J. Bot.* 27: 321 - 329. STROH, G. (1937). *Die Gattung Gypsophila*. *Beih. Bot. Centralbl.* 59: 455 - 477. BARKOUDAH, Y. I. (1962). A revision of *Gypsophila*, *Bolanthus*, *Ankyropetalum* and *Phryna*. *Wentia* 9: 1 - 203.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Leaves obovate-spathulate; calyx 5 - 7 mm long; seeds subreniform | 1. <i>G. cerastioides</i> |
| b. Leaves linear; calyx ca 2 mm long; seeds cochleate | 2. <i>G. sedifolia</i> |

1. *Gypsophila cerastioides* D. Don, *Prodr. Fl. Nep.* 213. 1825; Edgew. & Hook. f. in *Fl. Brit. India* 1: 217. 1874. **Fig. 109.**

Herbs, perennial, caespitose; stems many, erect, 10 - 25 cm high, 4-angular, sparsely pubescent, often reddish; branches prostrate or decumbent. Leaves sparsely pubescent on both surfaces especially along margins; radical leaves long-petiolate, spathulate, attenuate at base, mucronulate at apex, 12 - 50 x 4 - 18 mm; cauline ones opposite, subsessile, obovate, rotundate at apex, 7 - 13 x 3 - 7 mm. Flowers in lax terminal corymbs, often glomerate. Calyx campanulate, 5 - 7 mm long, 5-lobed up to middle; lobes lanceolate, subacute, with membranous margins, densely ciliate with curved hairs, purplish at tip. Petal limb obovate-spathulate, emarginate, ca 5 x 3.5 mm, a little exceeding calyx, white, mauve or white with purple streaks. Stamens 10, short, unequal. Styles 2 (-3), straight, terete, exceeding stamens; stigma obtuse, pruinose. Capsules subrotund, 1-locular, 5-valved, ca 6 mm long, shorter than calyx; seeds subreniform, brown, tuberculate.

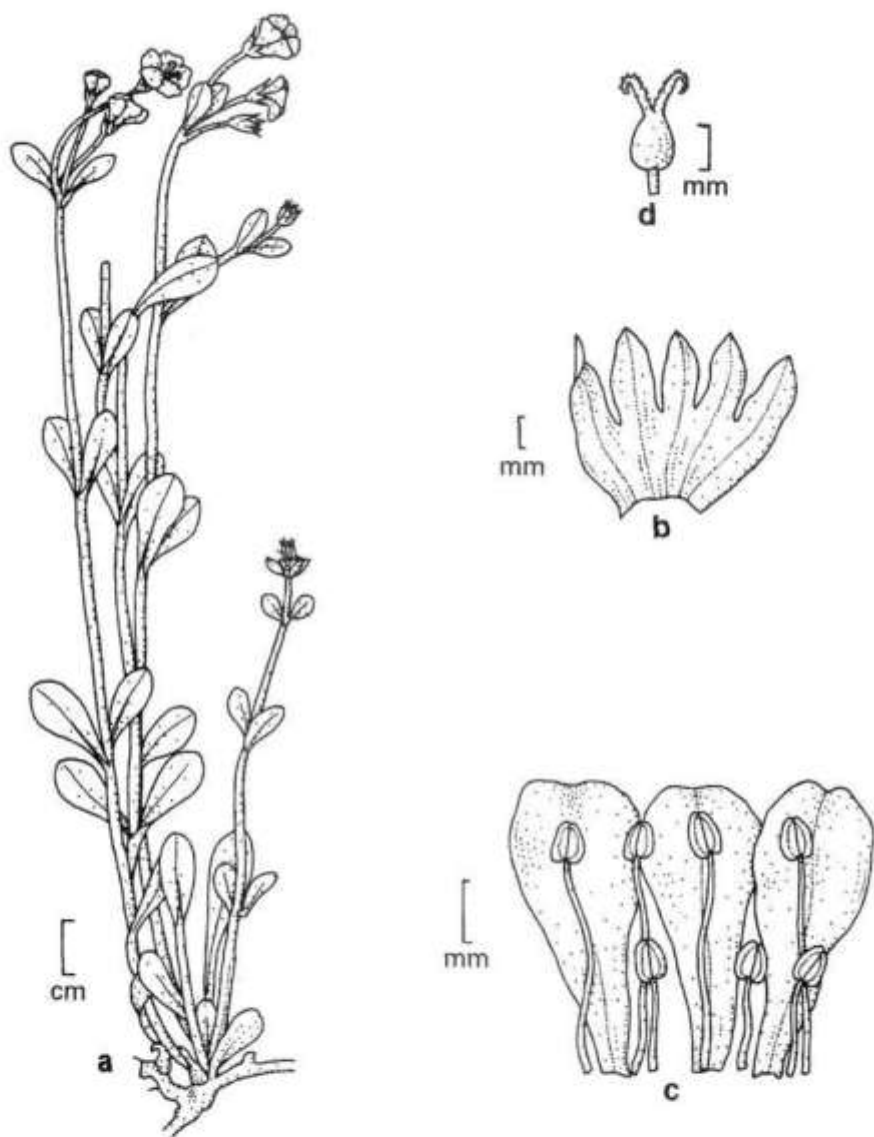


Fig. 109. *Gypsophila cerastioides* D. Don : a. habit; b. calyx; c. petals and stamens; d. pistil.

Fl. & Fr. May - Oct.

Distrib. India: Alpine Himalayas 3000 - 4700 m, on grassy slopes and streamsides. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Nepal and Bhutan.

2. *Gypsophila sedifolia* Kurz in Flora 30: 285. 1872; Edgew. & Hook. f. in Fl. Brit. India 1: 217. 1874.

Herbs, perennial, caespitose, pubescent throughout; roots stout, woody; branches many, short, decumbent, pale green. Leaves fascicled, linear, obtuse at apex, ca 6 mm long, thick, nerveless. Cymes capitate on elongated branches, 2 - 7 cm across. Flowers 4 - 6 mm across; bracts linear, obtuse. Calyx ca 2 mm long, 5-lobed; lobes obtuse, scarious-margined. Capsules included in calyx; seeds cochleate.

Fl. & Fr. May - July.

Distrib. India: Alpine Himalayas, above 2700 m. Jammu & Kashmir.

China (Tibet).

8. *Herniaria* L.

Herbs, annual or perennial, prostrate, procumbent or ascending, sometimes woody at base. Leaves opposite or sometimes apparently alternate, small. Flowers very small, in leaf-opposed or apparently axillary, rarely terminal clusters, sometimes 4-merous; bracts inconspicuous. Sepals usually 5, rarely 4, subequal. Petals absent. Stamens 2 - 5; staminodes usually 5, filiform, minute or absent. Stigmas notched or 2-lobed. Achenes indehiscent, with a membranous pericarp, shorter or longer than sepals; seeds subglobose to reniform.

Africa, Europe and Western Asia; ca 35 species, 3 species in India.

Literature. WILLIAMS, F. N. (1896) A systematic revision of the genus *Herniaria*. Bull. Herb. Boissier 2. 4: 556 - 570. HERMANN, F. (1937) Übersicht über die *Herniaria* - Arten des Berliner Herbars. Fedde, Repert. Spec. Nov. 42: 203 - 224.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Plants annual; flowers 1 - 1.5 mm across; stamens 2 - 3 | 2. <i>H. hirsuta</i> |
| b. Plants perennial; flowers 1.5 - 2.5 mm across; stamens 5 | 2 |
| 2a. Styles distinct | 1. <i>H. cachemiriana</i> |
| b. Styles not distinct | 3. <i>H. incana</i> |

1. *Herniaria cachemiriana* Gay in Duchartre, Rev. Bot. 2: 370. 1847; Singh & Kachroo, For. Fl. Srinagar 176. 1976.

Herbs, perennial, prostrate; branches 3 - 20 cm long, pubescent. Leaves elliptic-oblongate to oblong-ovate, entire and ciliate along margins, 3 - 10 (-15) mm long, strigose-pubescent when young; stipules ovate-triangular, minute. Flowers in leaf-opposed cymes, turbinate when young, 1.8 - 2 mm long, green. Sepals 5, free, oblong-elliptic, ca 1 mm long, hairy. Stamens 5. Ovary ovoid, papillose above; styles distinct, 2-furcate; stigmas 2, divergent. Fruits ovoid; seeds lenticular.

Fl. April - July.

Distrib. India: Jammu & Kashmir.

Pakistan, Iran and Afghanistan.

2. *Herniaria hirsuta* L., Sp. Pl. 218. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 712, 1875.

Herbs, annual; stems slender, 4 - 12 (-22) cm; branches conspicuously alternate, covered with strigose patent hairs. Leaves elliptic to oblanceolate, up to 8 x 2.5 mm, covered with stiff hairs, rarely ciliate; stipules ciliate. Flowers 1 - 1.5 mm across, sessile, in dense leaf-opposed clusters, often contiguous on short lateral branches. Sepals 5, densely hirsute with rigid white spreading hairs. Stamens 2 - 3. Fruits scarcely equalling sepals, with a short style or subdivergent stigmatic lobes.

Fl. April.

Distrib. India: Temperate Himalayas. Jammu & Kashmir and Himachal Pradesh.

Pakistan, W. Asia, N. Africa and Europe.

3. *Herniaria incana* Lam., Encycl. 3: 124. 1789. *H. hirsuta* L. var. *incana* (Lam.) Hook. f., Fl. Brit. India 4: 712. 1885.

Herbs, perennial with a stout woody stock; stems 10 - 25 cm, with dense rigid hairs. Leaves oblanceolate to spatulate, up to 12 x 3 mm, densely covered with stiff white hairs; upper leaves smaller; stipules usually hairy beneath. Flowers 1.5 - 2 mm across, in somewhat contiguous clusters. Sepals 5, patent scabrid-hairy. Stamens 5. Fruits shorter than and completely enclosed by sepals, with a subsessile stigma of 2 widely divergent lobes.

Fl. April - May.

Distrib. India: Jammu & Kashmir.

Pakistan, W. Asia, N.W. Africa and Europe.

9. *Holosteum* L.

Herbs, small, glabrous below, glandular-hairy above. Leaves opposite, exstipulate, narrow. Flowers in terminal umbel-like cymes, 5-merous. Sepals 5, free. Petals 5, toothed or jagged, white. Stamens 3 - 5 (-10); nectaries present. Ovary 1-locular, many-ovuled; styles 3, rarely 4 or 5. Capsules cylindrical, opening by 6 revolute teeth; seeds peltate, concave-convex, papillose.

Central Europe, the Mediterranean region and Western Asia; ca 6 species, one species in India.

Holosteum umbellatum L., Sp. Pl. 88. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 227. 1874.

Herbs, annual, slender; stems erect or ascending, 4 - 25 cm high. Basal leaves narrowly spatulate, 10 - 25 mm long; upper ones sessile, linear to ovate, acute at apex, small. Cymes 3 - 16-flowered; pedicels filiform, 7 - 20 mm long, erect at first, soon becoming deflexed at base; bracts narrow, ca 1 mm long, membranous. Sepals ovate, acute at apex, ca 2 mm long, scarious-margined. Petals longer than sepals, white, usually with a glabrous claw. Stamens 5 or 10. Styles 3. Capsules cylindrical, 4 - 6 mm long; seeds peltate, furrowed, keeled on either side, ca 0.5 mm in diam.

Fl. March - April; *Fr.* May - Sept.

Distrib. India: Temperate Himalayas, 1500 - 2800 m. Jammu & Kashmir and Uttar Pradesh.

Pakistan, Afghanistan, Iran, Syria, Cyprus, Turkey and W. Europe.

10. *Lepyrodiclis* Fenzl

Herbs, annual, flaccid. Leaves elliptic to lanceolate. Flowers solitary or in loose panicle cymes; bracts herbaceous. Calyx cylindrical to campanulate; sepals herbaceous. Petals emarginate, lacerate or retuse. Stamens 7 - 10, on a glandular annular disc or disc obsolete. Ovary 4-ovuled; styles 2 (-3). Capsules globose, 2-valved, enclosed in calyx, membranous, few-seeded; seeds with a thick or tuberculate testa.

Central Asia and the Himalayas; 3 species, 2 species in India.

Literature. WAGENITZ, G. (1957) Zur Gattung *Lepyrodiclis* Fenzl. Ann. Naturhist. Mus. Wien 61: 74 - 77.

KEY TO THE SPECIES

- 1a. Leaves linear or linear-lanceolate; flowers solitary or in cymes; petals obovate or spatulate, retuse
 1. *L. holosteoides*
- b. Leaves elliptic or oblong-lanceolate; flowers solitary; petals linear, entire
 2. *L. tenera*

1. *Lepyrodiclis holosteoides* (C. Meyer) Fischer & C. Meyer, Enum. Pl. Nov. 1: 93. 1841. *Gouffeia holosteoides* C. Meyer, Verz. Pfl. Casp. 217. 1831. *Arenaria holosteoides* (C. Meyer) Edgew. in Fl. Brit. India 1: 241. 1874. **Fig. 110.**

Herbs, annual, slender, much branched, glabrous or glandular-pubescent, 60 - 90 cm high; stems on upper parts glandular-pubescent. Leaves sessile, linear or linear-lanceolate, cordate at base, acute or acuminate at apex, 2.5 - 7.5 cm long, spreading. Flowers solitary, axillary or in few-flowered cymes; pedicels bracteate in cymes but ebracteate in solitary flowers; bracts similar to leaves but becoming smaller upwards. Sepals usually linear-lanceolate, obtuse at apex, 4 - 6 x 0.7 - 1 mm, glabrous to glandular-ciliate. Petals obovate or spatulate, equalling or exceeding sepals, retuse, white. Filaments with broad flattened free bases. Styles 2, filiform. Capsules globose, 2-valved, included in persistent calyx, few-seeded; seeds ca 1.4 mm in diam., tuberculate.

Fl. June - Aug.; *Fr.* July - Sept.

Distrib. India: Temperate and Alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Punjab.

Pakistan, Iran, Afghanistan and Russia.

2. *Lepyrodiclis tenera* Boiss., Diagn. Pl. Orient. 2. 1: 84. 1853. *Arenaria tenera* (Boiss.) Edgew. in Fl. Brit. India 1: 242. 1874.

Herbs, annual, very slender, tufted; stems branched, filiform, 60 - 90 cm long, flaccid. Leaves long-petiolate, elliptic or oblong-lanceolate, acute at apex, 1 - 1.8 cm long, membranous. Petioles and pedicels capillary. Flowers solitary, axillary. Sepals ovate-oblong or lanceolate, ca 2.5 mm long, dorsally ciliate. Petals linear, dilated upwards, entire, ca 5 mm long, white. Filaments very slender, hardly united at base. Capsules globose, 2-valved, ca 2 mm in diam.; seeds subglobose, ca 1 mm in diam., acutely tuberculate.

Fl. & Fr. May - July.

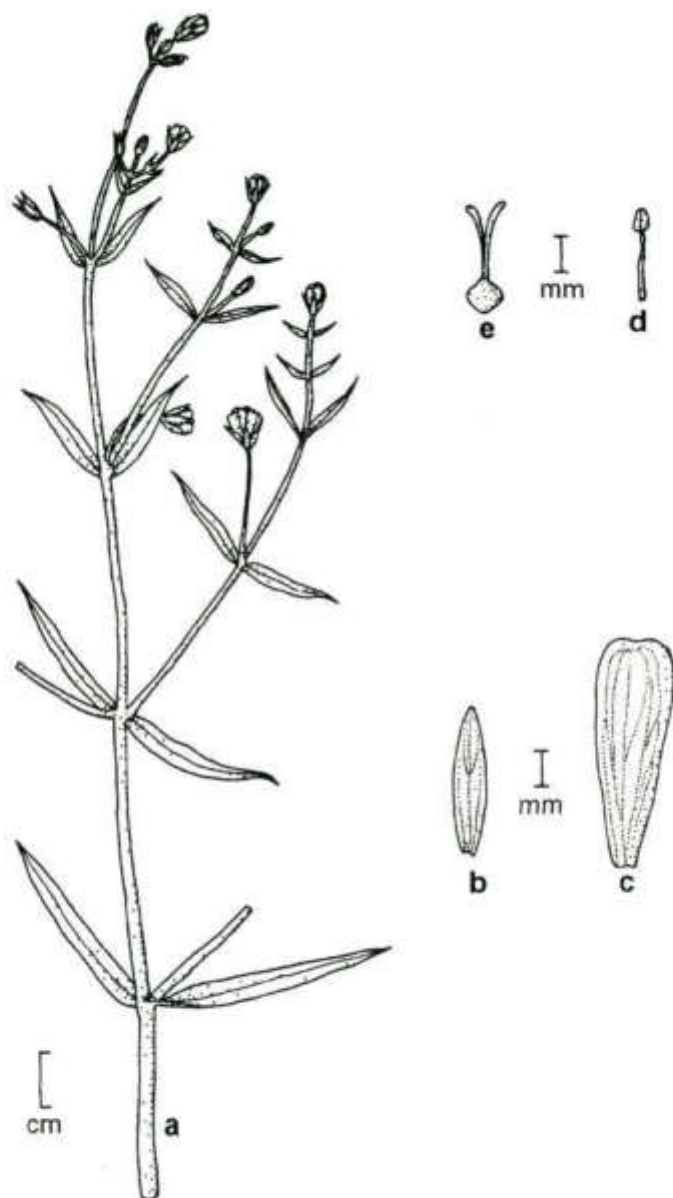


Fig. 110. *Lepyrodiclis holosteoides* (C. Meyer) Fischer & C. Meyer : a. flowering shoot; b. sepal; c. petal; d. pistil.

Distrib. India: Temperate Himalayas. Jammu & Kashmir and Himachal Pradesh. Pakistan and Afghanistan.

11. *Lychnis* L.

Herbs, annual or perennial. Flowers bisexual, 5-merous with contorted aestivation. Calyx shortly campanulate or clavate, narrow, firm, not conspicuously inflated, lower part tubular with 5 free teeth above, 10-nerved. Petals long-clawed with coronal scales at base of limb, red or white. Stamens 10. Ovary 1-locular throughout or 5-locular at base; styles 5, opposite calyx segments. Carpophore usually present. Capsules sessile or stalked, enclosed in calyx; seeds very small, rugose or tuberculate.

Northern hemisphere; ca 15 species, 2 species in India.

KEY TO THE SPECIES

- 1a. Plants tomentose with long straight silky hairs; petals obovate; seeds biconvex 1. *L. coronaria*
 b. Plants pubescent with short recurved hairs; petals obovate-cuneate; seeds rotundate-reniform 2. *L. ischnopetala*

1. *Lychnis coronaria* (L.) Desr. in Lam., *Encycl.* 3: 643. 1792; Edgew. & Hook. f. in *Fl. Brit. India* 1: 222. 1874. *Agrostemma coronaria* L., *Sp. Pl.* 436. 1753. **Fig. 111.**

Herbs, uniformly soft-tomentose with silky white hairs; stems erect, 30 - 75 (-100) cm high, sparingly branched. Radical leaves lanceolate to spatulate, 7 - 12 cm long; cauline leaves oblong, 4 - 7 cm long. Flowers in few-flowered cymes, long-pedicellate. Calyx conical, 1.5 - 2 cm long, hairy, 10-nerved; teeth contorted to left. Petals broadly obovate with stiff 2-toothed scales on claw, ca 2.5 cm long, red-purple. Capsules subsessile, 5-valved, entire, included in calyx; seeds biconvex, striate and tuberculate.

Fl. May - Aug.

Distrib. India: Jammu & Kashmir and Karnataka.

W. Asia and S. Europe.

Notes. An extract from the root is used in lung and liver diseases.

2. *Lychnis ischnopetala* (F. Williams) Majumdar, *comb. nov.* *Hedona ischnopetala* F. Williams in *J. Linn. Soc., Bot.* 38: 405. 1909.

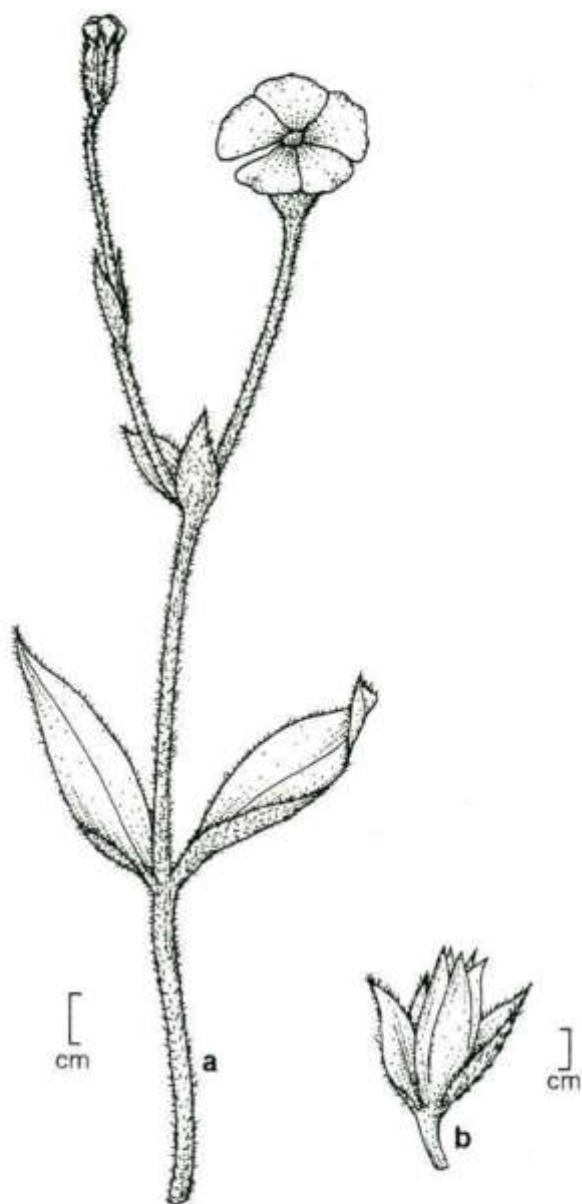


Fig. 111. *Lychnis corcnaria* (L.) Desr. : a. habit; b. dehiscent capsule with calyx.

Herbs with long slender roots; stems erect, branched above, pubescent with short recurved hairs. Leaves lanceolate, hard, 1-nerved; lower leaves broader, attenuate towards base; upper ones linear-lanceolate. Flowers in lax dichasia, long-pedicellate; bracteoles 4 at base of pedicel. Calyx densely clothed with short brittle curly hairs; teeth triangular, rarely acute, ciliate, membranous along margins; nerves united beyond curves of teeth. Petals narrow, obovate-cuneate, irregularly crose, ciliate only at base of claw. Capsules sessile, 5-valved; seeds rotundate-reniform, blackish blue, tuberculate on dorsal face.

Fl. May - July.

Distrib. India: Temperate and alpine regions of E. Himalayas. Sikkim.

China (Tibet).

12. *Minuartia* L.

Herbs, annual or perennial, rarely subshrubs, often densely caespitose or mat-forming. Leaves exstipulate, usually linear or setaceous, sometimes lanceolate, rigid. Flowers solitary or in cymes, axillary or terminal, sometimes in remote cymose clusters, usually 5-merous. Sepals 5, free, herbaceous or with 2 parallel white stripes on either side of midnerve, 3 - 9-nerved, occasionally with obscure lateral nerves. Petals 5, entire or rarely emarginate, occasionally very small, white or pink, rarely absent. Stamens (3-) 10, outer whorl with obsolete basal glands. Styles 3. Capsules ovoid or oblong, 3-valved; seeds buff to dark brown, exstrophiolate.

Temperate and Arctic regions; ca 70 species, 4 species in India.

Literature. MATTFELD, J. (1922) Geographische genetische Untersuchungen über die Gattung *Minuartia* (L.) Hiern. Fedde, Repert. Spec. Nov. Beih. 15: 1 - 228, tt. 1 - 5. MATTFELD, J. (1929) *Minuartia*. Pflanzenareale 2: 43 - 57.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Plants 3 - 7 cm high; leaves dentate to crenate; seeds smooth or reticulate | 2 |
| b. Plants 10 - 30 cm high; leaves entire; seeds honey-combed, tuberculate | 3 |
| 2a. Petals oblong, equal to or longer than sepals; seeds smooth or very obscurely reticulate | |
| | 1. <i>M. biflora</i> |
| b. Petals filiform, shorter than sepals; seeds finely reticulate | 4. <i>M. sedoides</i> |
| 3a. Cymes lax; pedicels longer than sepals, usually with a pair of bracteoles near middle | |
| | 3. <i>M. kashmirica</i> |
| b. Cymes compact; pedicels shorter than sepals, without bracteoles | 2. <i>M. ebracteolata</i> |

1. *Minuartia biflora* (L.) Schinz & Thell. in Bull. Herb. Boiss. 2, 7: 404. 1907; M. A. Rau, High Alt. Fl. Pl. 72. 1975. *Stellaria biflora* L., Sp. Pl. 422. 1753.

Herbs, perennial, slender, caespitose, dwarf; vegetative shoots prostrate or decumbent; flowering shoots more or less erect, 3 - 8 cm long, glabrous. Leaves crowded and imbricate on vegetative shoots, loosely arranged on flowering shoots, linear, slightly connate at base, dentate-crenate along margins, acute at apex, 7 - 13 x 0.6 - 1.2 mm, glabrous, flexuous, 1 - 3-nerved; lateral nerves usually obscure. Flowers paired, terminal or axillary, 1 - 3; pedicels 2 - 4 mm long, verrucose. Sepals 5, ovate-oblong, acute at apex, 4 - 5 x 1.5 - 2 mm, narrowly scarious-margined, glabrous, greenish white, 3-nerved, erect at anthesis. Petals oblong, as long as or slightly longer than sepals, membranous, finely nerved inside. Stamens 10; filaments 2 - 2.5 mm long, glabrous; anthers oblong, ca 0.5 mm long. Capsules 3-valved, slightly longer than sepals, glabrous, shiny; seeds ovoid, reddish, smooth or very obscurely reticulate.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 3300 m. Jammu & Kashmir and Himachal Pradesh.

Arctic Eurasia and the Alps.

2. *Minuartia ebracteolata* Majumdar & Giri in Candollea 38: 343. 1983.

Fig. 112.

Herbs, perennial, erect or loosely tufted, with vegetative shoots and 10 - 14 cm long flowering shoots; internodes very short in sterile shoots and long in flowering shoots. Leaves linear, slightly connate at base, entire, acute at apex, 10 - 15 x 0.75 - 1 mm, glandular-pubescent, often flexuous, 1 - 3-nerved; lateral nerves usually subobscure. Cymes few-flowered, compact; pedicels ebracteolate, 1 - 4 mm long, densely glandular-pubescent. Sepals 5, ovate-oblong or ovate-lanceolate, acute or apiculate at apex, 4 - 5 x 1.5 - 2 mm, broadly scarious-margined, dorsally glandular-pubescent, strongly 3-nerved, erect at anthesis. Petals 5, oblong, 8 - 9 x 3.5 - 4 mm, membranous, finely nerved inside. Stamens 5, attached to base of petals; filaments 6 - 7 mm long, glabrous; anthers oblong, ca 0.5 mm long, dorsifixed. Ovary urceolate, glabrous; styles 3, ca 2 mm long, glabrous; stigma flattened. Capsules 3-valved, 6 - 7 mm long; valves reflexed at apex on dehiscence; seeds ca 0.5 mm long, dark red, honey-combed, distinctly tuberculate.

Fl. June - July.

Distrib. India: Alpine Himalayas, above 3000 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan.

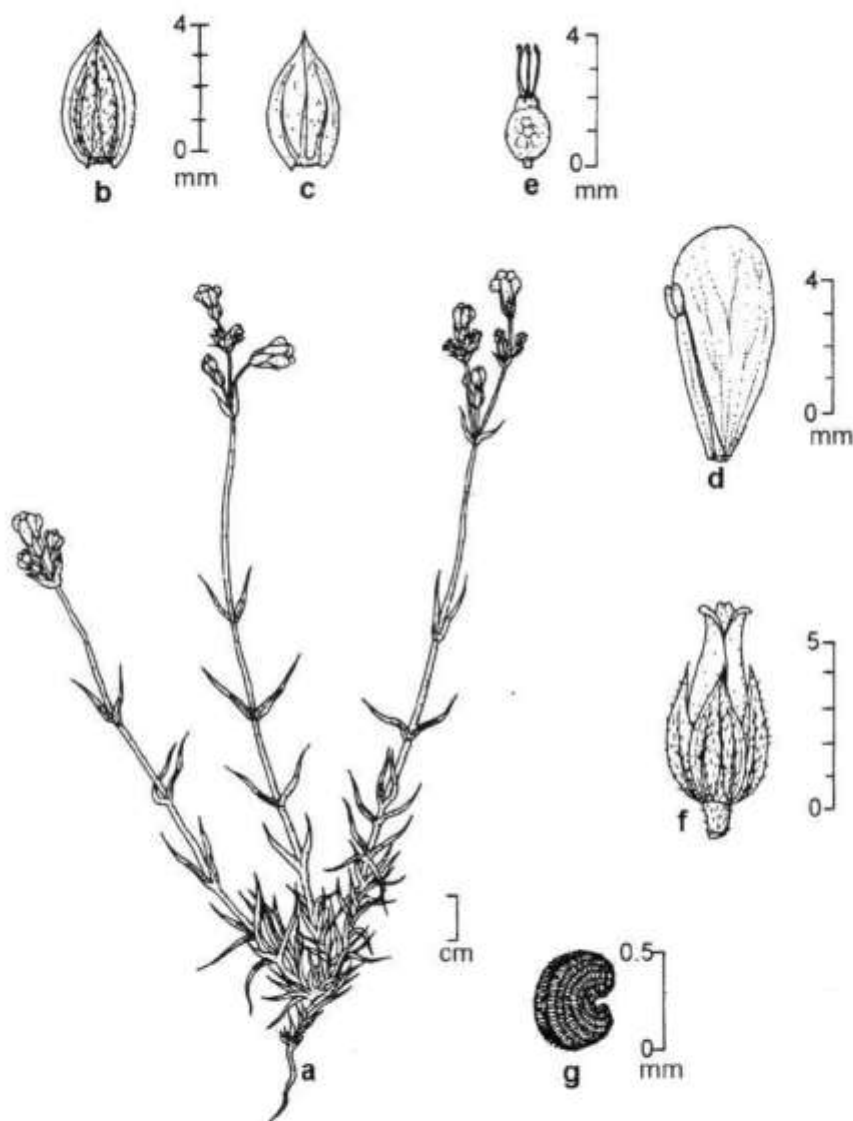


Fig. 112. *Minuartia ebracteolata* Majumdar & Giri : a. plant with flowers; b. sepal, dorsal face; c. sepal, ventral face; d. petal with stamen; e. pistil; f. dehiscent capsule; g. seed.

3. *Minuartia kashmirica* (Edgew.) Mattf. in Bot. Jahrb. Syst. 57 (Beibl. 126): 32. 1921; Nair, Fl. Bashahr Himal. 37. 1977. *Arenaria kashmirica* Edgew. in Fl. Brit. India 1: 236. 1874. *A. foliosa* Edgew. & Hook. f., l. c. 236.

Herbs, perennial, erect or loosely tufted, glabrous to glandular-pubescent, with shorter vegetative shoots and up to 25 cm high erect flowering shoots; internodes longer in flowering shoots. Leaves linear, entire, acuminate at apex, 12 - 15 x 0.75 - 1 mm, glabrous or sparsely glandular-pubescent, flexuous, 1 - 3-nerved. Cymes axillary or terminal, umbellate or subumbellate; peduncles long, glabrous or glandular-pilose. Flowers 6 - 8 mm across; pedicels up to 2.2 cm long, with a pair of ovate acute 1.5 - 2 mm long bracteoles. Sepals 5, ovate-lanceolate, acuminate at apex, 4 - 5 x 1.25 - 1.5 mm, narrowly scarious-margined, glabrous or dorsally glandular-pubescent, strongly 3-nerved. Petals 5, oblanceolate, entire, 8 - 9 x 3.5 - 4.5 mm, membranous. Stamens 10. Ovary ovoid, ca 1 mm long; styles 3. Capsules 3-valved, 5 - 6 mm long; seeds reniform or cuneoid, 0.75 - 1 x 0.75 mm, honey-combed and tuberculate.

Fl. & Fr. May - Sept.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal, China (Tibet) and Afghanistan.

4. *Minuartia sedoides* (L.) Hiern in J. Bot. 37: 321. 1899; Majumdar & Giri in Candollea 38: 347. 1983. *Cherleria sedoides* L., Sp. Pl. 425. 1753.

Herbs, perennial, densely caespitose, dwarf, with a long taproot and woody stock and flowering and sterile shoots forming a yellowish green cushion of ca 5 cm across; flowering shoots scarcely coming out of cushion. Leaves linear-triangular, shortly dentate-margined, acuminate at apex, 4 - 6 x 0.75 - 1 mm, glabrous, flexuous. Flowers unisexual, usually solitary, rarely 2 or 3, axillary or terminal, 4 - 5 mm across; pedicels 2 - 4 mm long, verrucose or finely glandular-pubescent. Sepals 5, ovate-oblong, acute at apex, 3 - 4 x 1.25 - 1.5 mm, glabrous, narrowly scarious-margined, greenish white, spreading at anthesis. Petals usually absent in female flowers, shorter than sepals in male flowers, membranous. Stamens 10 in male flowers, shorter than sepals. Ovary abortive in male flowers. Capsules 3-valved, 4.5 - 6 mm long, glabrous, shiny; seeds comma-like, 0.5 - 0.75 mm long, reddish, finely reticulate.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 3300 m. Jammu & Kashmir.

Europe.

13. *Myosoton* Moench

Monotypic; description and distribution as for the species below.

Myosoton aquaticum (L.) Moench, Methodus 225. 1794. *Cerastium aquaticum* L., Sp. Pl. 439. 1753. *Stellaria aquatica* (L.) Scop., Fl. Carn. ed. 2, 1: 319. 1772; Edgew. & Hook. f. in Fl. Brit. India 1: 229. 1874.

Herbs, perennial, erect, suberect or decumbent, 15 - 50 (-100) cm high; upper parts glandular-pubescent. Leaves narrowly ovate, acute at apex, 2 - 5 x 1 - 2 cm, sometimes longer; lower leaves often petiolate; upper ones sessile. Inflorescences somewhat lax, 5 - 20-flowered or more, elongating in fruit; bracts foliaceous. Sepals oblong to ovate-oblong, obtuse at apex, 5 - 7 mm long in flower, 7 - 10 mm in fruit, often not scarious-margined. Petals 2-fid up to base, 6 - 7 mm long, white. Stamens 10. Styles 5. Capsules ovoid, ca 9 mm long, dehiscent into 5, 2-dentate valves; seeds numerous, reniform to subglobose, ca 1 mm in diam., brown, tuberculate.

Fl. May - July; *Fr.* July - Sept.

Distrib. India: Temperate and alpine Himalayas, above 2100 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Meghalaya.

W. Asia and Europe.

14. *Petrorhagia* (Ser.) Link

Herbs, annual or perennial; stems slender, branched. Leaves narrow. Flowers in paniculate cymes or capitate, bracteate or ebracteate. Calyx obconical to cylindrical, 5-toothed, 5 - 15-nerved with scarious commissures. Petals 5, with or without a claw; coronal scales absent. Stamens 10. Styles 2. Capsules dehiscent by 4 teeth; seeds many, dorsiventrally compressed with a facial hilum, scutate; embryo straight.

Western Asia, Russia, Europe, Africa, Australia and the Pacific Islands; ca 25 species, one species in India.

Literature. BALL, P. W. & V.H. HEYWOOD (1964) A revision of the genus *Petrorhagia*. Bull. Brit. Mus. (Nat. Hist.) Bot. 3(4): 121 - 172.

Notes. The genus *Petrorhagia* with a wide circumscription including *Tunica* auct. and *Kohlrauschia* Kunth, as treated by Ball & Heywood (1964) is followed here. *Petrorhagia* is more or less intermediate between *Dianthus* L. and *Gypsophila* L.

Petrorhagia alpina (Habl.) Ball & Heywood in Bull. Brit. Mus. (Nat. Hist.) Bot. 3 (4): 145. 1964. *Gypsophila alpina* Habl. in Neue Nord. Beytr. Phys. Geogr. Erd-Volkerb. 4: 57. 1783. *Tunico stricta* (Ledeb.) Fischer & C. Meyer, Index Sem. Hort. Bot. Petrop. 4: 50. 1837; Edgew. & Hook. f. in Fl. Brit. India 1: 216. 1874. **Fig. 113.**

Herbs, annual, erect, branched, up to 40 cm high, glabrous. Basal leaves rosulate, linear-spathulate to oblong, usually acute and rarely obtuse at apex, 5 - 30 x 1 - 4 mm; cauline leaves linear, acute at apex, 1-nerved. Bracts not enclosing calyx. Calyx 2.5 - 5 mm long, glabrous, green; teeth acute to obtuse and mucronate, 1-nerved. Petals linear-oblong, entire, 3 - 6 mm long, not clawed, white. Seeds ovate-oblong, 0.7 - 1.2 x 0.4 - 0.9 mm, blackish brown with thickened margins, reticulately tuberculate.

Fl. May - July; *Fr.* July - Sept.

Distrib. India: Temperate and alpine regions. Jammu & Kashmir.

Pakistan, Russia and W. Asia.

15. *Polycarpaea* Lam., nom. cons.

Herbs, annual or perennial, usually erect. Leaves opposite or pseudoverticillate, linear to obovate; stipules fimbriate or scarious. Flowers many, in spreading or condensed cymes. Sepals 5, scarious, sometimes coloured. Petals 5, entire, 2-toothed or erose-margined. Stamens 5, united together and with the petals forming a tube. Ovary 1-locular, ovules few to many; style slender, 3-fid. Capsules 3-valved; seeds ovoid or flat.

Tropical and subtropical regions; ca 50 species, 3 species in India.

KEY TO THE SPECIES

- | | |
|---|------------------------|
| 1a. Leaves radical ones in rosettes, obovate to spatulate; flowers in spikes at top of fasciculate or subumbellate branches | 3. <i>P. spicata</i> |
| b. Leaves not in rosettes, linear to lanceolate; flowers in irregular cymes | 2 |
| 2a. Plants tomentose to glabrescent; stipules more than 1.2 mm long; cymes dense or lax | 1. <i>P. corymbosa</i> |
| b. Plants glabrous; stipules less than 1 mm long; cymes lax | 2. <i>P. diffusa</i> |

1. ***Polycarpaea corymbosa*** (L.) Lam., Tabl. Encycl. 2: 129. 1797; Edgew. & Hook. f. in Fl. Brit. India 1: 245. 1874. *Achyranthes corymbosa* L., Sp. Pl. 205. 1753.

Hindi: *Dolphuli, Machechi.*

Herbs, annual or perennial, decumbent, erect or suberect, densely tomentose to glabrescent, with a woody rootstock. Leaves pseudoverticillate, linear to linear-subulate, linear-oblong or linear-lanceolate, rounded to obtuse at base, entire, apiculate at

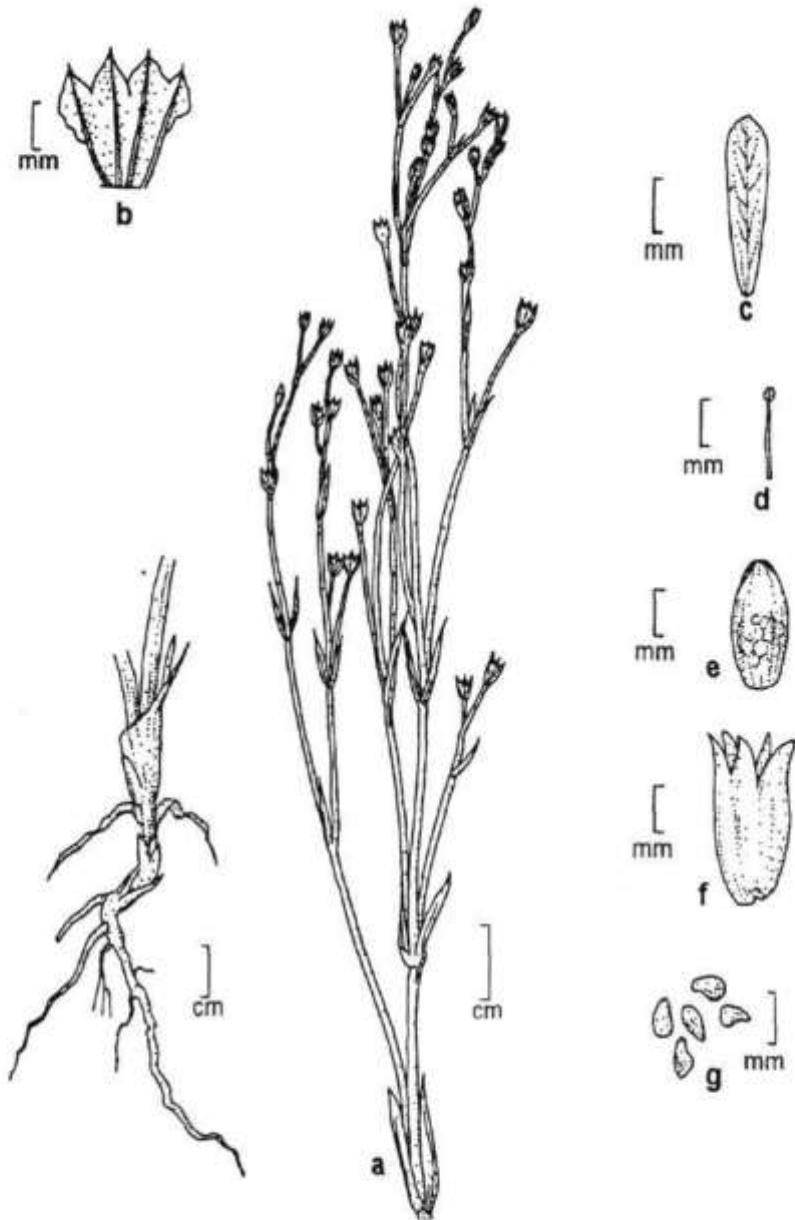


Fig. 113. *Petrorhagia alpina* (Habl.) Ball & Heywood : a. flowering shoot with root system; b. calyx; c. petal; d. stamen; e. immature capsule; f. dehiscent capsule; g. seeds.

apex, 5 - 20 x 1 - 3 mm, aristate with ca 1 mm long bristles, 1-nerved; stipules lanceolate, linear or subulate, 1 - 5 mm long, fimbriate or not, scariosus. Cymes dichasial, crowded and arranged in corymbs; pedicels 2 - 5 mm long, puberulent; bracts shorter than pedicels. Sepals 5, lanceolate, acuminate at apex, 1.5 - 5 mm long, scariosus-margined, glabrous, pinkish to brown. Petals 5, ovate or linear-oblong, slightly emarginate, obtuse at apex, 0.5 - 1.2 mm long, membranous, persistent, reddish. Stamens 5; filaments 0.5 - 1 mm long, flat; anthers oblong, ca 0.3 mm long. Ovary ovoid, ca 0.4 mm long, 5 - 13-ovuled; style ca 0.2 mm long. Capsules ovoid or ellipsoid, 1 - 2.5 mm long, 3-valved, entire, brown, shiny; seeds reniform, light brown, minutely corrugated.

KEY TO THE VARIETIES

- | | |
|--|------------------------------|
| 1a. Stipules linear, less than 1.25 mm long, not fimbriate | 1.1. var. <i>aurea</i> |
| b. Stipules lanceolate or subulate, more than 1.25 mm long, fimbriate or scariosus | 2 |
| 2a. Stipules fimbriate; sepals more than 2.5 mm long; capsules ellipsoid | 1.2. var. <i>corymbosa</i> |
| b. Stipules scariosus; sepals less than 2 mm long; capsules ovoid | 1.3. var. <i>longipetala</i> |

1. 1. var. *aurea* (Wight & Arn.) Wight, *Illus. Ind. Bot.* 2: 44. t. 110. 1850; Edgew. & Hook. f. in *Fl. Brit. India* 1: 245. 1874. *Polycarpaea aurea* Wight & Arn. in *Ann. Nat. Hist.* 3: 91. 1839.

Fl. Oct. - Dec.

Distrib. India: Orissa, Maharashtra and Tamil Nadu.

Endemic.

1. 2. var. *corymbosa*

Tam.: *Nilaisedachi*.

Fl. Aug. - Dec.

Distrib. India: Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan, Tropical Asia, Australia, Africa and America.

1. 3. var. *longipetala* Sriniv. & Narasimh. in *J. Econ. Tax. Bot.* 10: 347, ff. 1 & 2 a-c. 1987.

Fl. & Fr. Aug. - March.

Distrib. India: Andhra Pradesh and Tamil Nadu.

Endemic.

2. *Polycarpaea diffusa* Wight & Arn. in Ann. Nat. Hist. 3: 91. 1839; Edgew. & Hook. f. in Fl. Brit. India 1: 245. 1874.

Herbs, slender, glabrous, 15 - 45 cm high. Leaves pseudo-verticillate, narrow, linear or subulate, obtuse at apex, 6 - 12 mm long; stipules lanceolate, ca 0.75 mm long. Cymes lax, many-flowered, puberulous. Flowers ca 2 mm long. Sepals ovate-lanceolate, acuminate at apex, slightly longer than petals and capsules.

Fl. May.

Distrib. India: Coastal areas of Tamil Nadu.

Endemic.

3. *Polycarpaea spicata* Wight & Arn. in Ann. Nat. Hist. 3: 91. 1839; Edgew. & Hook. f. in Fl. Brit. India 1: 246. 1874.

Herbs, annual, glabrous, 5 - 12 cm high; branches erect, filiform. Leaves petiolate, obovate-spathulate, 6-12 mm long, fleshy, nerveless; radical leaves in rosettes; stipules lacerate, scarious. Cymes densely fasciculate or subumbellate, long-pedunculate. Flowers subspicate, crowded, ca 4 mm across, bracteate. Sepals ovate-elliptic to ovate-lanceolate, subacute at apex, 1.2 - 1.6 mm long, scarious with a deep brown midnerve. Petals oblong, obtuse, small, included. Capsules shorter than sepals; seeds shiny.

Fl. & Fr. Oct. - Nov.

Distrib. India: Coastal areas. Gujarat and Tamil Nadu.

Pakistan, W. Asia and Australia.

16. *Polycarpon* L.

Herbs, annual or perennial, small, diffuse, prostrate or suberect, dichotomously much branched. Leaves opposite but appearing whorled due to presence of axillary fascicles of leaves, obovate to orbicular; stipules conspicuous, scarious. Inflorescence a terminal dichasial branched compound condensed cyme. Flowers many, sessile or pedicellate, bisexual, hypogynous; bracts conspicuous, similar to stipules, scarious. Sepals 5, keeled and hooded, green, scarious-margined. Petals 5, narrow, entire or emarginate, shorter than sepals, hyaline, white. Stamens 1 - 5; filaments more or less united at base. Ovary 1-locular, many-ovuled; style short, 3-fid up to middle; stigmas 3.

Capsules 3-valved; valves twisting spirally into tubes; seeds ovoid, several.

Cosmopolitan; ca 16 species, 2 species in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Perennials; flowers subsessile | 1. <i>P. prostratum</i> |
| b. Annuals; flowers pedicellate; pedicels longer than flowers in older flowers | 2. <i>P. tetraphyllum</i> |

1. *Polycarpon prostratum* (Forsskal) Aschers. & Schweinf. in Oesterr. Bot. Z. 39: 128. 1889. *Alsine prostrata* Forsskal, Fl. Aegypt.-Arab. 207. 1775. *Hepalosia loeflingiae* Wight & Arn., Prodr. 358. 1834. *Polycarpon loeflingiae* (Wight & Arn.) Benth. in Benth. & Hook. f., Gen. Pl. 1: 153. 1862; Edgew. & Hook. f. in Fl. Brit. India 1: 245. 1874.

Fig. 114.

Herbs, perennial, prostrate or suberect, glabrous or more or less pubescent; branches 15 - 25 cm long. Leaves subsessile, linear-oblong, obovate, oblanceolate or spatulate, narrowed at base, acute or obtuse at apex, 6 - 18 x 2 - 5 mm; stipules lanceolate, 2 - 3 mm long. Flowers in terminal dichasial paniculate cymes, ca 3 mm across. Sepals linear-oblong or ovate, subequal, 2 - 3 mm long, obtusely keeled, broadly scarious-margined. Petals linear-lanceolate, truncate, entire or notched, dentate at apex, 1.3 - 1.4 mm long, rarely absent. Stamens 3. Capsules ovoid, 1.8 - 2 mm long; seeds subcylindrical, 0.3 - 0.6 mm, pale brown, minutely tuberculate.

Fl. March - June; *Fr.* July - Sept.

Distrib. India: Plains and hills, up to 1000 m. Rajasthan, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Bangladesh, Tropical Asia and Africa.

2. *Polycarpon tetraphyllum* (L.) L., Syst. Nat. ed. 10, 1: 881. 1759; Dunn in Gamble, Fl. Pres. Madras 64. 1915 (repr. ed. 46. 1957). *Mollugo tetraphylla* L., Sp. Pl. 89. 1753.

Herbs, annual, slender, much branched, suberect or ascending, 3 - 15 cm high, glabrous with rough angles. Leaves usually in whorls of 4, shortly petiolate, obovate to spatulate, cuneate at base, obtuse at apex, 8 - 13 x 4 - 6 mm, glabrous, green; stipules ovate to triangular, 2.5 - 3 mm long, scarious. Cymes dichotomous, compact. Flowers 2 - 3 mm across. Sepals 1.5 - 2.5 x 1 mm, green, broadly scarious-margined. Petals narrowly oblong, emarginate, deciduous, white. Stamens 3 - 5. Capsules ovoid, ca 1.5 mm long; seeds minute, brownish, finely papillose.

Fl. June - July.

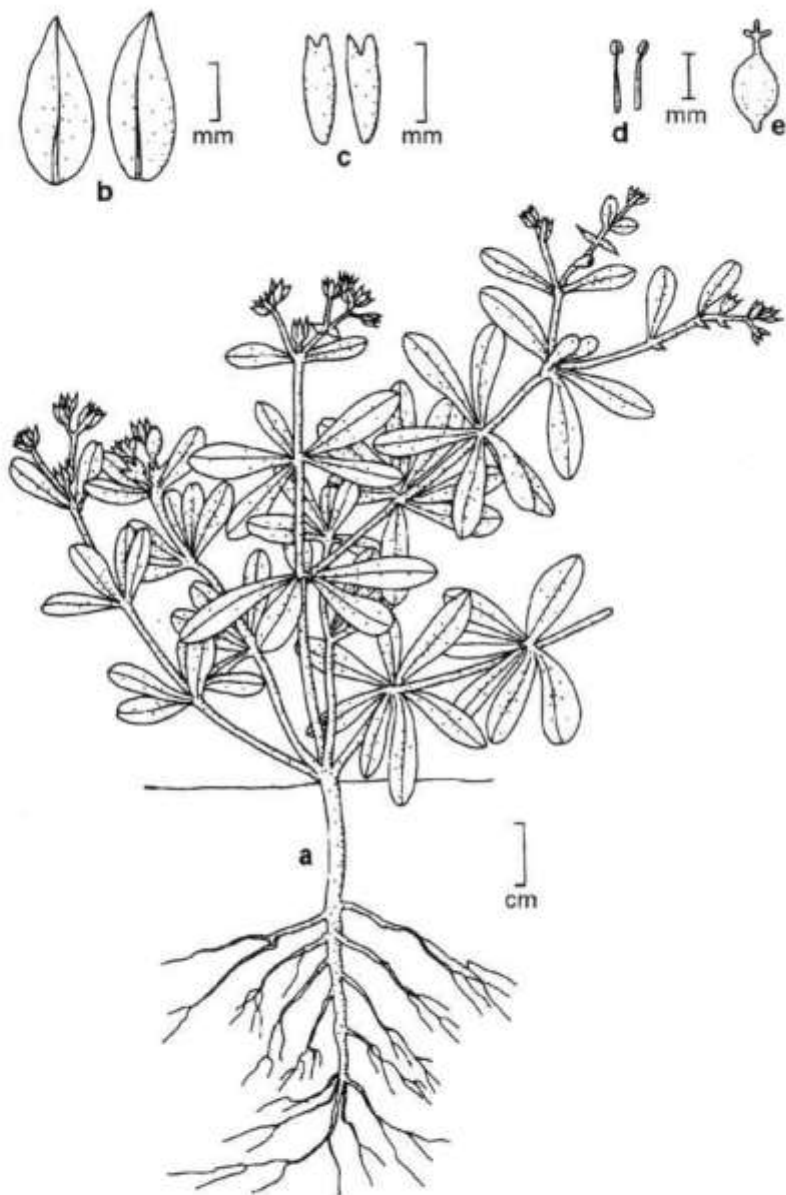


Fig. 114. *Polycarpon prostratum* (Forsskal) Aschers. & Schweinf. : a. habit; b. sepals; c. petals; d. stamens; e. pistil.

Distrib. India: At high altitudes. Tamil Nadu (Nilgiris, Pulnis and Anamalais).

Western Asia and Europe.

17. *Pseudostellaria* Pax

(*Krascheninikovia* Turcz. ex Fenzl 1840, non Gueldenst. 1772)

Herbs, perennial, weak, erect; rhizomes slender with napiform or fusiform bulbs or tubers. Leaves elliptic, obovate or linear-lanceolate. Flowers solitary, axillary or few in terminal cymes; cleistogamous flowers sometimes present in lower leaf axils. Sepals 5, scarious-margined. Petals 5, entire or rarely 2-fid, longer than sepals. Stamens 10, those opposite sepals thickened at base; anthers purple. Ovary ovoid; styles 2 - 3, filiform, minutely capitate. Capsules many-seeded; seeds white, turning dark purple when mature, with appendaged tubercles.

East Asia; ca 15 species; one species in India.

Literature. OHWI, J. (1937) A revision of the genus *Pseudostellaria*. *J. Jap. Bot.* 9: 95 - 105.

Pseudostellaria heterantha (Maxim.) Pax in Engler & Harms, *Pflanzenfam.* ed. 2, 16c: 318. 1934. *Krascheninikovia heterantha* Maxim. in *Bull. Acad. Imp. Sci. St. Petersburg.* 18: 376. 1873. *Stellaria bulbosa* auct. non Wulfen (1791); Edgew. & Hook. f. in *Fl. Brit. India* 1: 231. 1874, p. p.

var. *himalaica* Ohwi in *J. Jap. Bot.* 9: 102. 1937.

Fig. 115.

Herbs, perennial, slender; rhizomes with napiform 3 - 5 mm long tubers at nodes; stems erect or ascending, up to 15 cm high with a line of fine pubescence. Leaves opposite to opposite-decussate, elliptic or obovate, rounded or attenuate at base, acute or acuminate at apex, 0.7 - 2.5 x 0.4 - 1.5 cm, glabrous or hairy at base and margins; petioles up to 1 cm long. Pedicels up to 3.5 cm long. Sepals 5, ovate-elliptic, ca 5 mm long, membranous along margins, glabrous, rarely slightly hairy towards base. Petals 5, obovate or elliptic, shortly clawed at base, acute, rounded or slightly emarginate at apex, 7 - 8 x 3 - 5 mm, white. Stamens 10, as long as petals; anthers black-purple. Ovary ovoid; styles 2 - 3. Fruits and seeds unknown. Cleistogamous flowers not seen.

Fl. April - June.

Distrib. India: Temperate and alpine Himalayas, 2400 - 3800 m, in coniferous forests. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal and Sikkim.

Nepal, Bhutan, China (Tibet) and Afghanistan.

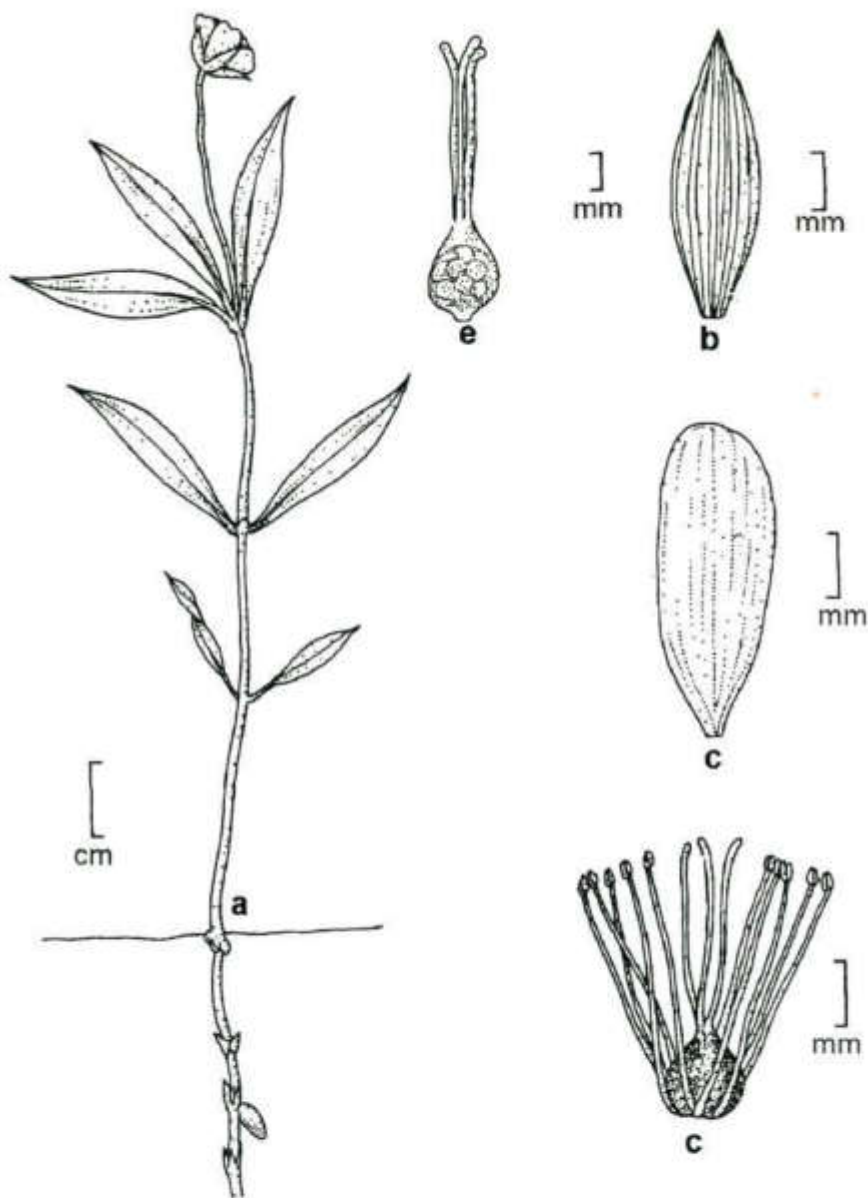


Fig. 115. *Pseudostellaria heterantha* (Maxim.) Pax var. *himalaica* Ohwi : a. habit; b. sepal; c. petal; d. stamens with pistil; e. pistil.

18. *Sagina* L.

Herbs, annual or perennial; flowering shoots slender, ascending or prostrate. Leaves opposite, exstipulate, linear, slightly connate at base. Flowers solitary or in few-flowered cymes, 4 - 5-merous. Sepals 4 - 5, free, scarious-margined. Petals, if present, entire, white. Stamens as many or twice as many as sepals. Ovary 1-locular, many-ovuled; styles 4 - 5, alternating with sepals. Fruit a capsule, splitting almost up to base into 4 - 5 valves; seeds many, minute.

Chiefly in the northern temperate zone in Asia, Europe, Africa and America; 20 - 30 species, 4 species in India.

KEY TO THE SPECIES

- | | |
|--|-------------------------|
| 1a. Flowers 4-merous | 2 |
| b. Flowers 5-merous | 3 |
| 2a. Pedicels hooked; seeds smooth to granulate | 5. <i>S. saginoides</i> |
| b. Pedicels erect; seeds rough-papillose | 2. <i>S. japonica</i> |
| 3a. Petals conspicuous, longer and broader than sepals | 4. <i>S. purtil</i> |
| b. Petals minute or absent | 4 |
| 4a. Upper leaves ciliate towards base; pedicels erect after anthesis | 1. <i>S. apetala</i> |
| b. Upper leaves not ciliate towards base; pedicels curved downwards after anthesis | 3. <i>S. procumbens</i> |

1. *Sagina apetala* Ard., Animadv. Bot. Sp. Alt. 2: 22, t. 8, f. 1. 1763; Mizushima in J. Jap. Bot. 35: 107. 1960.

Herbs, annual, slender, loosely tufted; stems leafy, erect or decumbent, 4 - 11 cm high, not rooting near base, many-flowered. Leaves linear, awned and long-mucronate at apex, 3 - 4 mm long, glabrous or ciliate; upper ones always ciliate towards base. Flowers solitary; pedicels filiform and erect in fruit, 2 - 14 (-20) mm long, glabrous or glandular. Sepals 4, ovate-oblong, hooded at apex, dorsally glandular-pilose, horizontally spreading in mature fruit. Petals minute, white, or absent. Stamens 4. Capsules 2.5 - 3 mm long, with obtuse valves; seeds deltoid or cuneoid, ca 0.2 mm in diam., brown, smooth to honey-combed, dorsally grooved.

Fl. & Fr. March - Sept.

Distrib. India: Jammu & Kashmir, Haryana and Uttar Pradesh.

Russia (Caucasus), Asia Minor, N. Africa, Europe. Introduced in India, Japan and America.

2. *Sagina japonica* (Sw.) Ohwi in J. Jap. Bot. 13: 438. 1937. *Spergula japonica* Sw. in Ges. Naturf. Freunde Berlin Neue Schriften 3: 164. 1801. *S. procumbens* auct. non L. (1753); Edgew. & Hook. f. in Fl. Brit. India 1: 243. 1874, p. p.

Herbs, annual or rarely perennial, 5 - 15 cm high with flowering stems and basal rosette of leaves. Leaves linear, acuminate to a fine awn-like tip at apex, 3 - 15 x 0.5 - 0.75 mm, glabrous or the uppermost sometimes glandular-ciliate near base. Pedicels 5 - 15 (-20) mm long, glabrous to glandular-pilose. Sepals usually 5, elliptic or ovate, 2 - 2.5 mm long, rounded, not keeled on back, scarious-margined. Petals usually 5, ovate, elliptic or oblong, rounded at apex, shorter or slightly longer than sepals. Stamens 5 - 8. Capsules globose, ovate or conical, 5-valved, longer than calyx; seeds reniform, swollen, rounded on back, 0.4 - 0.5 mm in diam., dark brown, rough with minute papillae.

Fl. & Fr. Feb. - Oct.

Distrib. India: 1700 - 4200 m, on moist roadsides. West Bengal, Sikkim, Arunachal Pradesh, Assam and Manipur.

Nepal, Bhutan, China (Tibet), Japan, Korea and Taiwan.

3. *Sagina procumbens* L., Sp. Pl. 128. 1753; Mizushima in J. Jap. Bot. 35: 193. 1960.

Herbs, perennial, mat-forming; lateral stems and branches procumbent, rooting at base, glabrous; main stem never flowering. Leaves linear, mucronate at apex, 5 - 10 mm long, glabrous. Flowers solitary; pedicels recurved near top after anthesis. Sepals 4, broadly ovate, obtuse at apex, ca 2 mm long, faintly scarious-margined. Petals minute, white or absent. Stamens 4. Capsules 4-valved, longer than the persistent, spreading sepals; seeds deltoid, ca 0.4 mm in diam., smooth, blackish brown, dorsally grooved.

Fl. & Fr. May - Aug.

Distrib. India: Jammu & Kashmir, Sikkim, West Bengal (Darjeeling) and Meghalaya (introduced).

Russia (Siberia), N. Africa, Europe, N. America and S. Greenland. Introduced widely in the Southern hemisphere and N. Japan.

Notes. It appears to be a recent introduction into India. Reported for the first time from Darjeeling in West Bengal by Mizushima (l. c.).

4. *Sagina purii* R. D. Gaur in J. Bombay Nat. Hist. Soc. 89: 236, ff. 1 A - J. 1992.

Herbs, annual, branched, erect, 5 - 8 cm high; branches spreading. Leaves linear to lanceolate, decurved at base forming a sheath, glandular-hairy along margins, attenuate

at apex, 4 - 6 mm long, glabrous. Flowers solitary, axillary or terminal; pedicels slender, elongating in fruit. Sepals 4, acute, ca 1.5 mm long, greenish white. Petals 4, obtuse, ca 1.7 mm long, broader than sepals, white. Stamens 4, rarely 2 or 3, ca 1.8 mm long. Capsules many-seeded; seeds pyramidal, minute, warty.

Fl. & Fr. April.

Distrib. India: In open cultivated fields. Uttar Pradesh (W. Himalayas).

Endemic.

5. *Sagina saginoides* (L.) Karsten, Deut. Fl. 539. 1883. *Spergula saginoides* L., Sp. Pl. 441. 1753. *Sagina procumbens* auct. non L. 1753; Edgew. & Hook.f. in Fl. Brit. India 1: 243. 1874, p. p.

Herbs, perennial, tufted, glabrous; leafy shoots numerous, decumbent, 2 - 7 cm high. Leaves linear, mucronate or awned at apex, 4 - 10 mm long, glabrous. Flowers usually solitary; pedicels 8 - 24 mm long, erect or ascending, glabrous. Sepals 5, ovate, rounded to obtuse at apex, 1.5 - 2 mm long, glabrous, narrowly scarious-margined. Petals rounded to ovate, somewhat shorter than to equalling sepals, white. Stamens 10 or less. Capsules ovoid, 3 - 4 mm long, exerted beyond tips of persistent sepals; seeds broadly deltoid, 0.3 - 0.4 mm in diam., brown, smooth or indistinctly granulate, dorsally grooved.

Fl. & Fr. May - Oct.

Distrib. India: Temperate and alpine Himalayas, up to 3600 m and the Western Ghats (Nilgiris), 1800 - 2400 m. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Sikkim and Tamil Nadu.

Nepal, Bhutan, China (Tibet), Japan, Russia, S.W. Asia, N.W. Africa, Europe, Greenland, N. America and Mexico.

19. *Scleranthus* L.

Herbs, annual, biennial or perennial, procumbent to erect; stems diffusely branched, hairy on two opposite sides. Leaves opposite, linear, connate at base. Flowers in axillary or terminal, lax or dense, cymose clusters; bracts not much different from leaves. Sepals 5, inserted on rim of urceolate perigynous zone, equal or slightly unequal. Petals absent. Stamens up to 10. Styles 2, free, long, filiform. Fruit an indehiscent, 1 (-2)-seeded nutlet, surrounded by a much thickened hard wall of perigynous zone and persistent sepals, flower falling off as a whole at maturity; seeds lenticular, smooth.

Asia, Africa, Europe and Australia; ca 10 species, one introduced and naturalised species in India.

Literature. ROSSLER, W. (1955) Die Scleranthus Arten Österreichs und seiner Nachbarländer. Oesterr. Bot. Z. 102: 30 - 72. SELL, P. D. (1963) Notes on the European species of Scleranthus. Fedde, Reper. Spec. Nov. 68: 167 - 169.

Scleranthus annuus L., Sp. Pl. 406. 1753; Subba Rao & Kumari in Bull. Bot. Surv. India 13: 347. 1971.

Herbs, annual or biennial, 2.5 - 25 cm high; taproot slender; stems much branched, ascending or decumbent, glabrous or shortly hairy. Leaves opposite, exstipulate, channelled, linear, obtuse, ciliate and connate at base by their narrow scarious margins, 5 - 15 (-20) mm long. Flowers subsessile, solitary at forks of stem and in axillary and terminal clusters, ca 4 mm across, green; bracts longer than flower-clusters. Sepals 5, triangular, lanceolate, acute or subacute at apex, glabrous, narrowly scarious-margined, suberect or slightly incurved in fruit. Petals absent. Stamens 10 or less, situated on calyx, much shorter than sepals. Ovary 1-locular; styles 2, long, filiform; stigma capitate. Fruits indehiscent, hard, 1.5 - 4.5 mm long, enclosed by a glabrous 10-furrowed perigynous hard tube.

Fl. & Fr. Nov.

Distrib. India: Tamil Nadu (Nilgiris). Introduced.

Asia, N. Africa and Europe, introduced in N. America.

20. *Silene* L.

Herbs, annual, biennial or perennial, often suffrutescent, erect, decumbent or climbing. Leaves opposite, exstipulate, entire. Flowers in cymes, short or long-pedunculate, sometimes looking like large racemes with short axillary cymules, sometimes reduced to a single flower. Calyx variable, often inflated and with 5 teeth united below into a calyx tube, not scarious, 10 - 60- nerved. Petals 5, limb and claw usually distinct, junction often marked by 2 lateral auricles; limb 2-fid or 4-partite, emarginate or entire; coronal scales usually present, variable in form. Anthophore usually conspicuous. Stamens 10, 5 usually adnate to petals. Ovary 1-locular above, 3- or 5-locular at base; styles 3 - 5. Fruit a capsule, opening by twice as many teeth as styles, usually on a carpophore; seeds variable.

Temperate Europe, Asia, Africa and North America; ca 450 species, 28 species in India.

Literature. CHOWDHURI, P. K. (1957) Studies in the genus *Silene*. Notes R. Bot. Gard. Edinb. 22: 221 - 278. BOCQUET, G. (1969) Revisio Physolychnidium (*Silene* sect. *Physolychnis*). Phan. Monogr. 1: 1 - 342. tt. 43.

KEY TO THE SPECIES

- 1a. Inflorescences racemously paniculate with long, sometimes short lateral cymules (rarely reduced to opposite pairs or one flower) 2
- b. Inflorescences dischasia or monochasia cymes, not paniculate 21
- 2a. Petals eligulate, entire 9. *S. falconeriana*
- b. Petals ligulate, entire or divided 3
- 3a. Main inflorescence axis short (lateral cymules 3 - 7, rarely 1-flowered); pedicels with 2 bracteoles 4
- b. Main inflorescence axis long; pedicels without bracteoles 5
- 4a. Calyx 1.8 - 2.5 cm long; auricle of the petal claw toothed 18. *S. moorcroftiana*
- b. Calyx 0.8 - 1 cm long; auricle of the petal claw not toothed 24. *S. stewartii*
- 5a. Panicles spreading, not racemiform; cymules long, 3 - 7 (reduced to 2 or rarely 1-flowered) 6
- b. Panicles not spreading, racemiform; cymules short, 1 - 3-flowered, the lower 3 - 5 or 7-flowered 7
- 6a. Flowers small; petal claw ciliate; filaments pilose at base 15. *S. kunawurensis*
- b. Flowers large; petal claw smooth; filaments glabrous 26. *S. viridiflora*
- 7a. Calyx cylindrical, not inflated, subcoriaceous, adpressed in fruit 27. *S. viscosa*
- b. Calyx campanulate, inflated, membranous, not adpressed in fruit 8
- 8a. Styles 3 1. *S. amoena*
- b. Styles (4-) 5 9
- 9a. Calyx teeth more than 1/2 the total calyx length 3. *S. cancellata*
- b. Calyx teeth less than 1/2 the total calyx length 10
- 10a. Calyx much inflated, more than 1.2 cm across 11
- b. Calyx not much inflated, less than 1.2 cm across 14
- 11a. Anthophore less than 2 mm long 12
- b. Anthophore more than 2 mm long 13
- 12a. Seeds covered with setae or papillae, not winged 22. *S. setisperma*
- b. Seeds not covered with setae or papillae, broadly winged 20. *S. nigrescens*
- 13a. Anthophore more than 6 mm long; petals 4-partite, more than 8 mm longer than calyx; seeds winged 16. *S. laxantha*
- b. Anthophore less than 6 mm long; petals 2-fid, less than 7 mm longer than calyx; seeds not winged 21. *S. rechingeri*
- 14a. Seeds dorsally winged 15
- b. Seeds dorsally echinate or tuberculate, sometimes nearly smooth, not winged 16
- 15a. Calyx campanulate; seeds 1.5 - 2 x 2 - 2.5 mm, laterally compressed, broadly winged 8. *S. falconeri*
- b. Calyx not campanulate; seeds 1.1 - 1.5 x 1.2 - 1.8 mm, not laterally compressed, narrowly winged 11. *S. gonosperma*
- 16a. Anthophore less than 1.5 mm long; seeds less than 0.9 x 1 mm 17
- b. Anthophore more than 2 mm long; seeds more than 1 x 1.2 mm 19
- 17a. Plants eglandular-hairy 19. *S. nepalensis*
- b. Plants glandular-hairy 18
- 18a. Plants less than 15 cm high 17. *S. madens*
- b. Plants more than 30 cm high 23. *S. songarica*
- 19a. Petals 4-partite, more than 8 mm longer than calyx 7. *S. edgeworthii*
- b. Petals 2-fid, less than 8 mm longer than calyx 20

- | | |
|---|---------------------------|
| 20a. Anthophore 2 - 3 mm long; petals 3 - 4 mm longer than calyx | 12. <i>S. indica</i> |
| b. Anthophore more than 3 mm long; petals 6 - 8 mm longer than calyx | 4. <i>S. cashmeriana</i> |
| 21a. Cymes dichasial, sometimes becoming monochasial above | 22 |
| b. Cymes monochasial with simple axis or 1 - 3-forked below (sometimes appearing as unilateral racemes) | 26 |
| 22a. Calyx inflated at anthesis; nerves anastomosing | 23 |
| b. Calyx not inflated at anthesis; nerves not anastomosing | 24 |
| 23a. Calyx 15 - 20-nerved | 28. <i>S. vulgaris</i> |
| b. Calyx 10-nerved | 14. <i>S. kumaonensis</i> |
| 24a. Calyx conical, 20- or more-nerved | 6. <i>S. conoidea</i> |
| b. Calyx not conical, 10-nerved | 25 |
| 25a. Leaves ciliate | 13. <i>S. khasiana</i> |
| b. Leaves not ciliate | 25. <i>S. vagans</i> |
| 26a. Plants perennial, with a woody stock | 27 |
| b. Plants annual, without a woody stock | 10. <i>S. gallica</i> |
| 27a. Petals white with an included claw; capsules sessile | 2. <i>S. caespitella</i> |
| b. Petals rose with an exerted claw; capsules on a carpophore | 5. <i>S. colorata</i> |

1. *Silene amoena* L., Sp. Pl. 417. 1753. *S. tenuis* Willd., Enum. Pl. 474. 1809; Edgew. & Hook. f. in Fl. Brit. India 1: 219. 1874.

Herbs, perennial, glabrous, sometimes viscid-pubescent above; stems many, erect or ascending, 15 - 46 cm high. Radical leaves linear-lanceolate, acute or acuminate and ciliate at base, 3 - 8 x 0.1 - 0.4 cm, glabrous; cauline leaves few. Inflorescence a raceme-like panicle composed of short cymules. Flowers often in whorls, 1.2 - 1.4 cm long, sometimes nodding; pedicels 3 - 6 mm long; bracts subulate, short, ciliate, broadly white-margined. Calyx campanulate, rounded at base, 9 - 13 mm long, membranous, 10-nerved; teeth rotundate, obtuse, spreading, white-margined. Petals pale yellow or brown, deeply 2-partite; lobes oblong, obtuse, auriculate with a ciliate claw; scales 2, oblong, short, sometimes absent. Styles 3. Capsules oblong; seeds with 5 dorsal and 5 lateral rows of tubercles.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 3900 m. Jammu & Kashmir and Himachal Pradesh.

Pakistan, China (Tibet), N. Asia and Russia (Siberia).

2. *Silene caespitella* F. Williams in J. Linn. Soc., Bot. 38: 403. 1909. *S. maheshwarii* Bocq. in Candollea 22: 4. 1967.

Herbs, perennial; scapes many, erect, 5 - 40 (-60) cm high, glabrous below, hirsute above, with 3 - 4 leaf pairs. Lower leaves linear-spathulate, acute at apex, 2 - 6(-10) x

0.2-0.5 cm, glabrous or finely pubescent, subfleshy, greyish green, slightly recurved along margins, 1-nerved; upper leaves sessile, linear. Cymes (1-) 3-11(-15)-flowered. Flowers nodding, later erect. Calyx slightly inflated, narrowly campanulate, 2.5-3 x 5-6 mm, open at mouth, sparsely hirsute but more hirsute on nerves; teeth triangular, 2-2.5 x 2.5-3 mm, more or less recurved, acute, with ciliate margins. Petals reddish, 2-fid, slightly exceeding or equalling calyx; claw cuneiform, auriculate with 2 lateral teeth towards base and 2 scales at throat. Anthophore less than 1 mm long. Stamens included. Ovary 1-1.5 x 2.5 (-3) mm during pollination; styles 5. Capsules ca 9 x 6-7 mm, 10-toothed; seeds minute, grey or dark brown, laterally striate, tuberculate.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, 3500-4800 m. Jammu & Kashmir, Uttar Pradesh and Sikkim.

Nepal, Bhutan and China (Tibet).

3. *Silene cancellata* (Edgew. & Hook. f.) Majumdar in J. Indian Bot. Soc. 42: 660. 1963 (1964). *Lychnis cancellata* Edgew. & Hook. f. in Fl. Brit. India 1: 226. 1874.

Herbs, slender, erect, densely pubescent; stems simple, densely covered with long spreading hairs, glandular-pubescent above. Leaves ovate-lanceolate or orbicular, acute or acuminate at apex, 2.5-5 cm long; radical ones petiolate; cauline ones sessile. Flowers in distant pairs, inclined, short-pedicellate. Calyx subcampanulate, 8.5-12.5 mm long, densely tomentose or woolly, viscid-glandular, green, 10-nerved, 5-toothed; teeth oblong, subacute or acute, 1/2 or 3/4 of total length of calyx, erect or spreading, ciliate with a recurved tip. Petals 4-fid with ca 6.5 mm long limbs; claw woolly, auriculate with 2-fid scales. Stamens woolly. Styles 4-5. Carpophore woolly. Seeds granulate.

Fl. July - Sept.

Distrib. India: Alpine Himalayas. Jammu & Kashmir and Himachal Pradesh.

Endemic.

4. *Silene cashmeriana* (Royle ex Benth.) Majumdar in J. Indian Bot. Soc. 42: 649. 1963 (1964). *Lychnis cashmeriana* Royle ex Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 224. 1874.

Herbs, perennial; scapes robust, simple, erect, 30-60 cm high, closely hirsute above with short whitish hairs, greyish green, 4-7-noded. Leaves linear to lanceolate or very narrowly elliptic, acuminate at apex, 4.5-8 x 0.6-1.5 cm, glabrous or hirsute; upper ones much hirsute, ciliate-scarious along margins. Cymes (1-) 3-10-flowered. Bracts 1.8-3 cm long. Calyx clavate-campanulate, vesiculiform, ca 17 x 9 mm, hirsute, membranous.

yellowish green; nerves brown or blackish, anastomosing; teeth triangular, acute, ciliate-scarious along margins. Anthophore 4 - 5 mm long. Petals 6 - 8 mm longer than calyx, dirty white or brown; limb 2-fid with entire or slightly incised lobes; claw included. Stamens not exceeding corolla throat. Ovary ovoid, ca 5 x 2.5 mm; styles 5. Capsules 5-toothed; seeds reniform, thick, dark brown, dorsally tuberculate or papillate.

Fl. & Fr. July - Oct.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir.

China (Tibet).

5. *Silene colorata* Poiret, Voy. Barbarie 2: 163. 1789. *Silene intrusa* Wight & Arn., Prodr. 42. 1834. *Melandrium intrusum*: (Wight & Arn.) Rohrb. in *Linnaea* 36: 242. 1869-1870; Edgew. & Hook. f., *Fl. Brit. India* 1: 226. 1874.

Herbs, perennial with a woody stock; stems dichotomously branched, glabrous below, scabrid-viscid above. Leaves broadly lanceolate, obtuse at apex. Flowers in lax cincinnus; middle flowers sometimes abortive; pedicels short; bracts lanceolate, small, densely ciliate. Calyx clavate-truncate, umbilicate, glandular-pubescent with 10 connected blackish nerves; fruiting calyx slightly enlarged and constricted below capsule; teeth lanceolate, acute, densely ciliate. Petals exerted, 2-partite, rose-coloured; lobes broadly ovate-oblong with 2 oblong appendages and a glabrous claw. Capsules ovoid, subequal to carpophore.

Fl. July - Aug.

Distrib. India: Tamil Nadu (Nilgris).

Mediterranean region and N.W. Africa.

6. *Silene conoidea* L., *Sp. Pl.* 418. 1753; Edgew. & Hook. f. in *Fl. Brit. India* 1: 218. 1874.

Herbs, annual, stout, erect, 10 - 45 cm high, glandular-pubescent; stems dichotomously branched, erect or ascending. Leaves 3 - 12 x 0.4 - 1.1 cm; radical ones spatulate or narrowly lanceolate; cauline ones sessile, oblong or lanceolate, acute at apex. Inflorescence a terminal panicle of dichotomous cymes. Flowers few, erect, 2 - 2.7 x 0.6 - 1 cm. Calyx tubular, narrow above, inflated in fruit, 2 - 2.3 cm long, finely grooved; teeth linear-lanceolate, 1/3 the length of tube. Anthophore 1 - 2 mm long. Petals pink, with obovate entire or erose short limb; claw auriculate with 2 scales at base. Stamens 10. Ovary oblong-ovoid. Capsules ovoid, 1.5 - 1.9 cm long, pointed, crustaceous, shiny, enclosed in inflated calyx, 6-toothed; seeds cochleate with 5 dorsal and 5 lateral rows of tubercles.

Fl. & Fr. March - Aug.

Distrib. India: Temperate and alpine regions. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Rajasthan.

Pakistan, Nepal, Afghanistan, N. Africa, Turkey and S. Europe.

7. *Silene edgeworthii* Bocq. in Candollea 22: 13. 1967. *Agrostemma fimbriatum* Wallich ex G. Don, Gen. Hist. 1: 417. 1831, non *Silene fimbriata* Sims 1806. *Lychnis indica* (Roxb. ex Otth) Benth. var. *fimbriata* (Wallich ex G. Don) Edgew. & Hook. f. in Fl. Brit. India 1: 225. 1874.

Herbs, perennial; scapes ascending or spreading, 30 - 80 cm high, branched, glandular-hirsute above, 5 - 10-noded. Leaves ovate-lanceolate or elliptic, acute at apex, 3 - 10 x 0.7 - 2 cm, glabrous or glabrescent, scabro-hirsute along margins and nerves, green. Cymes 5 - 20 (-27)-flowered. Flowers drooping, later erect; bracts large. Calyx campanulate, vesiculiform, inflated, ca 1.2 x 1.4 cm at maturity, open at mouth, hirsute on nerves; teeth 5, broadly triangular, scarious and ciliate along margins. Anthophore ca 4 mm long, hairy. Petals 8 - 10 mm longer than calyx; limb 4-partite, ca 7 x 7 mm; lobes laciniate with 2 appendages; claw ca 3 mm exerted, moderately auriculate. Stamens slightly exceeding corolla throat. Ovary ovoid, ca 6 x 2 mm; styles 4 - 5. Capsules globose, 10-toothed; seeds reniform, greyish brown, tuberculate.

Fl. & Fr. Aug. - Oct.

Distrib. India: Alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

China (Tibet).

8. *Silene falconeri* (Rohrb.) Bocq. in Candollea 22: 9. 1967. *Melandrium falconeri* Rohrb. in Linnaea 36: 220. 1869-1870. *Lychnis apetala* auct. non L. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 222. 1874, p. p.

Herbs, perennial, tufted; scapes simple, many, erect, 5 - 15 cm high, glandular-hirsute. Radical leaves narrowly oblanceolate, cuneiform, 2.5 - 3.8 x 0.3 - 0.7 cm, glandular-hirsute; cauline ones 1 - 2 (-3) pairs, very narrowly elliptic, small. Cymes 1 - 3-flowered. Flowers inclined, finally erect. Calyx broad campanulate, hemispherical, 1 - 1.2 x 0.9 - 1.2 cm, hirsute, membranous; teeth triangular, subacute, scarious and ciliate along margins. Anthophore 1 - 1.5 mm long. Petals 3 - 5 mm longer than calyx; limb 2-fid with lobes rounded or deeply cut into 2 teeth; scales 2, oblong, arched, 0.5 - 0.8 mm; claw cuneiform, narrowly auriculate. Stamens equalling corolla throat; anthers yellow. Ovary 4 - 5 x 2 mm; styles 5. Capsules 9 - 10 x 11 - 12 mm, 10-toothed; seeds flat, broadly winged, light brown.

Fr. July - Sept.

Distrib. India: Alpine Himalayas. Jammu & Kashmir.

China (Tibet).

9. *Silene falconeriana* Royle ex Benth. in Royle, *Illus. Bot. Himal.* 79, t. 20, f. A 1 - 3. 1834; Edgew. & Hook. f. in *Fl. Brit. India* 1: 220. 1874.

Herbs, perennial; stems stout, erect, 30 - 80 cm high, arising from a woody stock, branched, pubescent, velvety and sticky below. Leaves linear-lanceolate, 3 - 7 x 0.3 - 0.5 cm, glabrous or velvety. Racemes long, lax, composed of opposite or whorled axillary cymes. Flowers erect or inclined, white; pedicels up to 1.2 cm long; bracts minute. Calyx narrow, tubular, truncate at base, 1 - 1.2 cm long, membranous, green, 10-nerved, much inflated in fruit; teeth short, obtuse. Petals 5, linear, 7 - 8 mm longer than calyx, without auricles or appendages; limb narrow, obtuse. Stamens 10. Styles 3. Carpophore 3 - 4 mm long. Capsules ovoid, 7 - 8 mm long, 6-toothed; seeds many, flat or convex, minute, dorsally grooved.

Fl. & Fr. Sept. - Oct.

Distrib. India: Temperate Himalayas, above 1200 m. Himachal Pradesh and Uttar Pradesh.

Nepal.

10. *Silene gallica* L., *Sp. Pl.* 417. 1753; Edgew. & Hook. f. in *Fl. Brit. India* 1: 218. 1874.

Herbs, annual; stems erect, 10 - 45 cm high, often branched, sparsely pubescent, often glandular above. Leaves 1.8 - 3.7 cm long; radical leaves petiolate, linear-oblong or spatulate, obtuse or mucronate at apex; cauline ones sessile, lanceolate to oblanceolate. Inflorescence a long, secund, unilateral raceme. Flowers 8 - 13 mm across; lower ones shortly pedicellate; upper ones sessile, on one side of peduncle. Calyx ovoid, rounded at base, contracted above, 8 - 12 mm long, 10-nerved with long and short glandular hairs; teeth subulate-lanceolate, 1/6 the length of calyx. Petals emarginate, small, slightly exerted above calyx tube with 2 scales at throat. Filaments villous below. Styles 3. Capsules sessile, ovoid; seeds minute, flat with auriform depression on face, striate-tuberculate, not grooved.

Fl. July - Oct.

Distrib. India: Himalayas and Western Ghats (Nilgiris and Palnis). Himachal Pradesh, Uttar Pradesh and Tamil Nadu.

W. Asia and Europe.

11. *Silene gonosperma* (Rupr.) Bocq. in *Candollea* 22: 7. 1967. *Physolychnis gonosperma* Rupr. in *Mem. Acad. Imp. Sci. St. Petersburg*. 14: 4. 1969. *Lychnis pumila* Royle ex Benth. in *Royle, Illus. Bot. Himal.* 80. 1834, non *Silene pumila* St. Lager 1880.

Herbs, perennial, tufted; scapes simple, erect, 5 - 35 cm high, greenish or blackish, glandular-hirsute or pubescent especially above, with 2 - 4 leaf pairs. Basal leaves in rosettes, oblanceolate, acute at apex, 3 - 8 x 0.3 - 0.6 cm, slightly recurved along margins, glabrous or glabrescent to sparsely hirsute along margins and nerves, hirsute on both surfaces. Cymes 1 - 3 (-5)-flowered. Flowers nodding, erect after anthesis. Calyx ovoid-fusiform, cylindrical or campanulate, slightly inflated, 10 - 11 x 8 - 9 mm, ca 14 x 11 mm at maturity, constricted or not at mouth, not umbilicate, densely hirsute; teeth narrowly triangular or obcordate, coarctate or erect-coarctate, subacute or obtuse, ca 3 x 2.5 mm. Anthophore ca 1 mm long, villous. Petals not or scarcely 1 - 2 mm longer than calyx; limb 2-lobed or crenate-emarginate, up to 3 mm long, whitish or reddish purple, conspicuously exerted with 2 small obtuse teeth at base; appendages 2, arched, ca 0.5 mm long, purple; claw included, glabrous, auriculate. Stamens included; anthers pale yellow. Ovary ovoid, ca 5 x 2 mm; styles 5. Capsules broadly ovoid, ca 1.3 x 1 cm; teeth 10, recurved; seeds reniform, dark brown; wings equal or unequal, plicate (angular).

KEY TO THE SUBSPECIES

- | | |
|---|----------------------------------|
| 1a. Plants pubescent; basal leaves glabrous or glabrescent; calyx ovoid-fusiform, not inflated, constricted at mouth with coarctate teeth; seed wings equal | 11.1. subsp. gonosperma |
| b. Plants glandular-hirsute; basal leaves hirsute; calyx cylindrical-campanulate, inflated, not constricted at mouth, not coarctate; seed wings unequal | 11.2. subsp. himalayensis |

11. 1. subsp. **gonosperma**

Fl. July - Sept.

Distrib. India: Alpine Himalayas. Jammu & Kashmir and Sikkim.

China (Tibet), Mongolia and Russia (Siberia).

11. 2. subsp. *himalayensis* (Rohrb.) Bocq. in *Candollea* 22: 7. 1967. *Lychnis apetala* L. var. *himalayensis* Rohrb. in *Linnæa* 36: 220. 1869 - 1870. *L. himalayensis* (Rohrb.) Edgew. & Hook. f. in *Fl. Brit. India* 1: 223. 1874. *S. himalayensis* (Rohrb.) Majumdar in *J. Indian Bot. Soc.* 42: 648. 1963 (1964).

Fl. & Fr. June - Sept.

Distrib. India: Alpine Himalayas, 3600 - 4800 m, on grassy slopes. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

China (Tibet), Russia (Siberia) and Afghanistan.

12. *Silene indica* Roxb. ex Otth in DC., Prodr. 1: 368. 1824. *Lychnis indica* (Roxb. ex Otth) Benth. in Royle, Illus. Bot. Himal. 81. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 225. 1874. *L. nutans* Royle ex Benth. in Royle, l. c. 80; Edgew. & Hook. f., l. c. 225, p. p., non L. 1753. *S. thomsonii* Majumdar in J. Indian Bot. Soc. 42: 650. 1963 (1964).

Herbs, perennial; scapes many, simple or branched, ascending or spreading, 40 - 90 cm, glandular-hirsute above, 4 - 10-noded. Leaves all cauline, narrow, lanceolate, sometimes ovate-elliptic, acute at apex, 2 - 10 (-12) x 1 - 2 cm, glabrous or hirsute with blackish hairs, dark green. Cymes lax, 5 - 22 (-30)-flowered. Flowers nodding, finally erect; pedicels elongate. Calyx cylindrical or campanulate, slightly inflated, open at mouth, 1 - 1.4 x 0.4 - 1.8 cm, membranous, yellowish green; teeth broadly ovate, triangular, obtuse, 3 - 4 mm long, scarious and slightly ciliate along margins. Anthophore 2 - 3 mm long, glabrous below, slightly villous above. Petals 3 - 4 mm longer than calyx, with a 2-lobed limb; lobes entire or crenulate, ca 4 - 6 x 4 - 5 mm, brownish purple, with 2 appendages; claw included, narrowly auriculate. Stamens slightly exceeding corolla throat. Ovary ovoid, 6 - 8 x 3 mm; styles 4 - 5. Capsules ovoid, 10 - 12 x 7 - 8 mm; teeth 8 - 10, recurved; seeds 1.2 - 1.3 mm, brownish, dorsally tuberculate or papillate.

KEY TO THE VARIETIES

- 1a. Leaves 5 - 12 cm long, densely hirsute with blackish hairs; calyx 14 - 18 mm across; petal limb more than 4 mm long; anthophore more than 2 mm long; ovary more than 6 mm long **12.1. var. bhutanica**
- b. Leaves 2 - 7 cm long, sparsely hirsute; calyx 4 - 8 mm across; petal limb less than 4 mm long; anthophore less than 2 mm long; ovary less than 6 mm long **12.2. var. indica**

12.1. var. bhutanica (W. Smith) Bocq. in Candollea 22: 12. 1967. *Lychnis bhutanica* W. Smith in Notes R. Bot. Gard. Edinb. 10: 51. 1917. *Silene bhutanica* (W. Smith) Majumdar in J. Indian Bot. Soc. 42: 649. 1963 (1964).

Fl. & Fr. July - Sept.

Distrib. India: Alpine meadows and cliffs, 3600 - 4000 m. Sikkim.

Nepal, Bhutan and China (Tibet).

12.2. var. indica

Fl. & Fr. July - Oct.

Distrib. India: Alpine Himalayas, 2400 - 4000 m, on stream sides. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and China (Tibet).

13. *Silene khasiana* Rohrb. in *Linnæa* 36: 258. 1869 - 1870; Edgew. & Hook. f. in *Fl. Brit. India* 1: 221. 1874.

Herbs, straggling, brittle with rigid branches; stems subscaudent, glandular-pubescent above. Leaves sessile, ovate, acuminate at apex, 2.5 - 4 x 1.5 - 2 cm, glabrous or sparsely pubescent, ciliolate, not membranous, pale beneath, 3 - 5-nerved. Flowers solitary or in terminal short cymes, erect, 1.2 - 2.5 cm long, bracteate. Calyx cylindrical, rounded at base, 8 - 9 mm long, with 10 broad nerves ending in broad acute teeth. Petals pale pink with a 2-partite obtuse limb and small scales and a cuneate claw. Filaments glabrous; anthers didymous. Carpophore very short. Capsules oblong, broad with very small teeth, ca 5 times longer than carpophore; seeds dorsally rounded, laterally convex with rows of tubercles.

Fl. July - Aug.

Distrib. India: Meghalaya. Rare.

Nepal.

Notes. This species has not been collected after the type (K and CAL) collection from the Khasi Hills in Meghalaya. There is a specimen from Nepal (K) grown from seeds collected by Robinson in 1931 (Bocquet & Chater in Hara & Williams, *Enum. Fl. Pl. Nepal* 2: 56. 1979).

14. *Silene kumaonensis* F. Williams in *J. Linn. Soc., Bot.* 32: 43. 1896.

Herbs, subscaudent; stems ascending, 60 - 80 cm, branched, pubescent. Leaves acuminate at apex; radical leaves lanceolate; cauline ones broadly lanceolate to ovate-lanceolate, undulate along margins, 1.5 - 3.5 x 0.5 - 2 cm. Inflorescences cymose, somewhat lax, dichotomous, long-pedunculate with distant flowers. Bracts similar to leaves; bracteoles 3 - 4 mm long. Calyx ovate-campanulate, umbilicate, 13 - 15 x 6 - 8 mm, scabrid-puberulous, membranous; teeth lanceolate, acute, ciliolate. Petals narrow, ca 7 mm longer than calyx, greenish, 2-fid with oblong-linear lobes. Styles 3. Carpophore 3 - 4 mm long. Capsules ovoid, ca 8 x 6 mm; seeds broadly convex on back, concave on face, prominently tuberculate.

Fl. & Fr. Aug. - Sept.

Distrib. India: Alpine Himalayas, above 3000 m. Uttar Pradesh (Kumaon).

Nepal.

15. *Silene kunawurensis* Royle ex Benth. in Royle, *Illus. Bot. Himal.* 79. 1834; Edgew. & Hook. f. in *Fl. Brit. India* 1: 220. 1874.

Herbs, perennial, tufted; branches arising from a stock, slender, usually prostrate, glabrous or puberulous; flowering scapes slender, 15 - 30 cm high, usually glabrous above. Leaves grass-like, narrowly spatulate or lanceolate, 4 - 7 x 0.3 - 0.5 cm, minutely pubescent on both surfaces; upper leaves gradually shorter. Inflorescence reduced to opposite pairs of flowers at nodes. Flowers nodding; pedicels slender, equalling or exceeding calyx. Calyx cylindrical or subclavate when young, clavate in fruit, intruded at base, 9 - 12 x 3 - 4 mm, quite glabrous, membranous; teeth short, obtuse, scarious-margined. Petals deeply 2-partite, without auricles; scales 2, linear-oblong. Capsules ovoid, twice as long as carpophore; seeds dorsally channelled, almost flat on sides.

Fl. July - Aug.

Distrib. India: Temperate and alpine Himalayas. Himachal Pradesh.

Endemic.

16. *Silene laxantha* Majumdar in *J. Indian Bot. Soc.* 42: 650. 1963 (1964). *Lychnis pilosa* (Edgew.) Edgew. & Hook. f. in *Fl. Brit. India* 1: 226. 1874. *Melandrium pilosum* Edgew. in *Trans. Linn. Soc., Lond.* 20: 34. 1866, non *Silene pilosa* Willd. 1809.

Herbs, perennial, stoloniferous; scapes 20 - 50 cm high, glandular-woolly with 1 - 2 mm long hairs, 7 - 10-noded. Middle cauline leaves elliptic to orbicular, wavy and ciliate along margins, acute or apiculate at apex, 1.2 - 2.2 x 2.5 - 3.7 cm, soft glandular-woolly, light green, 1-nerved; lower and upper leaves smaller. Cymes thyriform, 1 - 7-flowered. Flowers inclined, later erect. Calyx long-campanulate, inflated with an open mouth, 8 - 9 x 16 - 20 mm, membranous, up to 12 x 22 mm at maturity, densely woolly; teeth narrowly triangular, 5 - 6 mm long, densely glandular-ciliate along margins. Anthophore 6 - 7 x 2 mm, woolly. Petals 8 - 10 mm longer than calyx; limb 4-partite with 8 - 9 x 7 mm segments; scales 2 at throat, oblong, ca 1 x 2 - 3 mm; claw 2 - 3 mm exerted, broader towards apex, auriculate. Stamens a little exceeding corolla throat; filaments villous at base. Ovary ca 2 x 5 mm, conical, attenuate at apex; styles 5. Capsules 13 - 14 x 8 mm, light brown, 10-toothed; seeds ca 1.2 x 1.3 mm, dark brown, dorsally with 0.2 - 0.4 mm long papillae.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 3200 m. Jammu & Kashmir and Uttar Pradesh.

Nepal.

17. *Silene madens* Majumdar in J. Indian Bot. Soc. 42: 648. 1963 (1964). *Lychnis macrorhiza* Royle ex Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 223. 1874, non *Silene macrorhiza* Gay & Durieu ex Lacaita 1929.

Herbs, perennial, 10 - 15 cm high; roots thick, elongated; stems many, simple, slender, short, tufted, glandular-pubescent, 1-flowered. Leaves lanceolate to obovate-spathulate, obtuse or subacute at apex, pubescent; lower leaves narrowed to a long petiole; upper ones sessile. Flowers solitary, erect. Calyx broadly oblong, inflated, 12 - 18 mm long, vesicular, pale, pubescent; nerves free or united in calyx teeth. Petals shorter than calyx; limb 2-lobed, scarcely crenulate, short, dark purple. Carpophore stout, tomentose, brown. Seeds dorsally rounded, pale chestnut in colour, wingless, minutely concentrically granulate.

Fl. & Fr. July - Aug.

Distrib. India: Alpine Himalayas. Himachal Pradesh.

Nepal.

18. *Silene moorcroftiana* Wallich ex Benth. in Royle, Illus. Bot. Himal. 79. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 219. 1874.

Herbs, perennial, glandular-pubescent; scapes many from a woody stock, slender, erect, 15 - 45 cm high, densely tufted. Radical leaves spathulate-lanceolate, acute at apex, 3 - 5(-9) x 0.1 - 2 cm; cauline ones linear or linear-lanceolate, acute or obtuse at apex, shorter. Flowers bracteate, erect, few, in terminal or subterminal cymes, sometimes 1-flowered. Calyx tubular-clavate, slender below, intruded at base, 1.8 - 2.5 cm long, glandular-puberulent, 10-nerved; teeth short, obtuse, scarious-margined. Petals exserted, white or reddish; limb 2-partite, lingulate; claw auriculate with a long acute tooth; scales 2, long. Stamens 5, epipetalous. Styles 3. Carpophore exceeding capsule. Capsules ovoid, 9 - 13 mm long; seeds flat, not grooved, with 5 rows of lateral and 5 rows of dorsal tubercles.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 2400 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal, China (Tibet) and Afghanistan.

19. *Silene nepalensis* Majumdar in J. Indian Bot. Soc. 42: 649. 1963 (1964). *Lychnis multicaulis* Wallich ex Benth. in Royle, Illus. Bot. Himal. 80. 1834, non *Silene multicaulis* Guss. 1826; Edgew. & Hook. f. in Fl. Brit. India 1: 224. 1874. *L. brachypetala* sensu Edgew. & Hook. f. in Fl. Brit. India 1: 223. 1874, non Hornem. 1819.

Herbs, slender; fertile scapes numerous, erect, 20 - 50 (-80) cm high, hirsute above with short whitish hairs. Leaves linear or linear-spathulate, attenuate at base, acute at apex; basal ones 5 - 11 x 0.5 - 0.9 cm, gradually reduced upwards, usually in 3 - 4 pairs, glabrous, slightly inrolled along margins. Cymes 1 - 5-flowered. Flowers nodding, later erect; pedicels short. Calyx campanulate, a little inflated, 9 - 13 mm long at maturity; nerves brown, purple or blackish, united in teeth; teeth triangular with scarious and ciliate margins. Anthophore 1 - 1.5 mm long. Petals 2 - 3 mm longer than calyx; limb 1.5 - 3 x 2 - 3 mm, minutely toothed. Stamens included. Ovary ca 4 x 2 mm; styles 5, included. Capsules 11 - 12 x 6 - 7 mm, opening by 5 - 10 teeth, some teeth 2-fid; seeds small, rugose on sides, dorsally tuberculate, nearly papillate.

Fl. & Fr. July - Nov.

Distrib. India: Temperate Himalayas, 2100 - 3400 m, on grassy slopes. Jammu & Kashmir, Himachal Pradesh and Sikkim.

Nepal, Bhutan and China (Tibet).

20. *Silene nigrescens* (Edgew.) Majumdar in J. Indian Bot. Soc. 42: 647. 1963 (1964). *Lychnis nigrescens* Edgew. in Fl. Brit. India 1: 223. 1874.

Herbs, perennial, laxly tufted; scapes many, erect, 8 - 15 (-25) cm high, slender, with blackish glandular hairs above. Radical leaves linear or oblanceolate, attenuate at base, acute or acuminate at apex, 3 - 8 x 0.2 - 1 cm, ciliate along margins, glabrous, blackish upwards, 1-nerved; cauline leaves 2 - 5 pairs, linear, smaller. Cymes 1 - 3-flowered. Flowers nodding, later erect. Calyx much inflated, vesiculiform, constricted at mouth, 1.8 - 2 x 1.2 - 1.6 cm, membranous, pale green, glandular-hirsute with dark purplish pubescent nerves; teeth broadly triangular, ciliate along margins. Anthophore 1.5 - 2 mm long, violet, woolly. Petals pink, 4 - 5 mm longer than calyx; limb crenulate with 2 scales at throat, arched, ca 1 mm long; claw auriculate. Stamens slightly exceeding corolla throat; anthers violet. Ovary ca 3 x 6 mm; styles 5. Capsules globose, ca 11 x 12 mm, 5-toothed; seeds ca 2 x 1.8 mm; wings broad, unequal, dark brown, somewhat angular.

Fl. June - Oct.

Distrib. India: Alpine Himalayas, 3900 - 4500 m. Uttar Pradesh and Sikkim.

Nepal, Bhutan, Myanmar and China (Tibet).

21. *Silene rechingeri* Bocq. in Candollea 22: 11. 1967. *Lychnis cuneifolia* Royle ex Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 226. 1874, non *Silene cuneifolia* J. Gmelin 1791.

Herbs, perennial, laxly tufted; branches elongate, slender; scapes many, ascending, erect, 10 - 25 cm high, with 0.2 - 0.3 mm long blackish hairs above and 1 - 3 pairs of leaves. Radical leaves very narrowly oblanceolate, obtuse or rounded at apex, 3 - 6 x 0.5 - 1.2 cm, glandular-hirsute with one thick nerve; cauline leaves very narrowly elliptic or lanceolate, smaller, much glandular-hirsute. Cymes 1 - 5 (-7)-flowered. Flowers inclined, later erect; pedicels 1 - 7 cm long. Calyx inflated, vesiculiform, 1 - 1.3 x 1.6 - 2 cm, increasing at maturity and becoming clavate-campanulate, umbilicate, densely glandular-hirsute, membranous, yellowish green; nerves brownish and not jointed in calyx teeth; teeth broadly triangular, rounded, 3 - 4 mm long, scarious and ciliate along margins. Anthophore ca 4 mm long, woolly. Petals 6 - 7 mm longer than calyx, with a 2-fid limb and rounded or incised lobes at apex; teeth at base 2, purple; teeth at throat 2, truncate, ca 2 x 2 mm; claw cuneiform, ca 1.5 cm long, auriculate, villous at base. Stamens a little exceeding corolla throat; filaments woolly at base. Ovary ovoid, 6 - 8 x 3 mm; styles 5. Capsules ovoid, 10 - 11 mm long, 5-toothed; seeds globose to reniform, ca 1 x 1.5 mm, purple, shiny, smooth.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 4000 m. Jammu & Kashmir and Himachal Pradesh.

China (Tibet).

22. *Silene setisperma* Majumdar in J. Indian Bot. Soc. 42: 649. 1963 (1964). *Agrostemma inflata* Wallich ex G. Don, Gen. Hist. 1: 417. 1831, non *Silene inflata* Smith 1800. *Lychnis inflata* (Wallich ex G. Don) Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 225. 1874.

Herbs, 25 - 40 cm high; scapes simple, erect, leafy, minutely pubescent, swollen at nodes, glandular-pubescent above. Leaves 4 - 6 x 1.6 - 2.2 cm; basal leaves petiolate, elliptic, acute or acuminate at apex; upper ones lanceolate, smaller. Flowers solitary, terminal, large, drooping; pedicels slender, ebracteolate. Calyx much inflated, 1.6 - 1.9 x 1.2 - 1.5 cm, membranous, pale green with dark brown nerves; nerves free or united in calyx teeth or below them; teeth broad, rounded, hyaline, not ciliate. Petal limb short, rotundate or apiculate with a broad claw and 2 scales. Carpophore short, woolly. Seeds reniform, compressed, dorsally ornamented with setae or papillae in rows.

Fl. July - Aug.

Distrib. India: Alpine Hiamalayas, above 3100 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal.

23. *Silene songarica* (Fischer, C. Meyer & Ave-Lall.) Bocq. in *Candollea* 22: 3, 1967. *Melandrium songaricum* Fischer, C. Meyer & Ave-Lall., *Suppl. Index Sem. Hort. Petrop.* 9: 14. 1844. *Lychnis brachypetala* Hornem., *Suppl. Hort. Bot. Hafn.* 51. 1819; Edgew. & Hook. f. in *Fl. Brit. India* 1: 223. 1874, non *Silene brachypetala* Rob. & Cast. ex DC. 1815. **Fig. 116.**

Herbs, slender, glandular-hairy; scapes numerous, simple, 30 - 60 cm high with blackish glandular hairs. Leaves 4 - 5 pairs, all cauline, linear-spathulate to linear-elliptic, 1.5 - 7 x 0.2 - 0.5 (-0.7) cm; upper ones gradually smaller. Cymes 1 - 7-flowered. Flowers nodding, finally erect; pedicels short. Calyx slightly inflated or not, ca 10 x 4 mm, fusiform, constricted at mouth, yellowish green with dark or green nerves; teeth triangular, acute, scarious and ciliate along margins. Petals short, included or slightly exerted; limb with 2 rotundate lobes; claw narrowly auriculate. Stamens included. Ovary 6 - 7 mm long, glabrous. Carpophore short or absent. Capsules exceeding calyx by ca 1 mm, 5-toothed; seeds thick, grey or brown, dorsally tuberculate.

Fl. & Fr. June - Sept.

Distrib. India: Alpine regions, above 4800 m. Jammu & Kashmir and Sikkim.

China (Tibet), Mongolia, Russia (Siberia).

24. *Silene stewartii* (Edgew.) Majumdar in *Bull. Bot. Surv. India* 16: 153. 1974. *Lychnis stewartii* Edgew. in *Fl. Brit. India* 1: 224. 1874. *S. chambensis* Majumdar in *J. Indian Bot. Soc.* 42: 649. 1963 (1964).

Herbs, slender, grass-like; flowering stems slender, 15 - 25 cm high, hoary below, viscid-tomentose above. Leaves narrow, linear to lanceolate, 2.5 - 5.5 x 0.15 - 0.2 cm, recurved along margins, spreading, keeled by a stout midnerve. Flowers few, solitary in the upper axils or in opposite pairs, nodding; pedicels pubescent with 2 linear bracteoles in upper part. Calyx oblong, 8 - 10 mm long, membranous, pubescent; nerves green, faint, free or united; teeth rounded, scarious with long curved cilia along margins. Petals obovate, white; limb 2-partite, very short, recurved; claw very broad, auriculate, a little longer than calyx. Styles 3, very short. Carpophore densely woolly. Capsules longer than calyx.

Fl. & Fr. July - Aug.

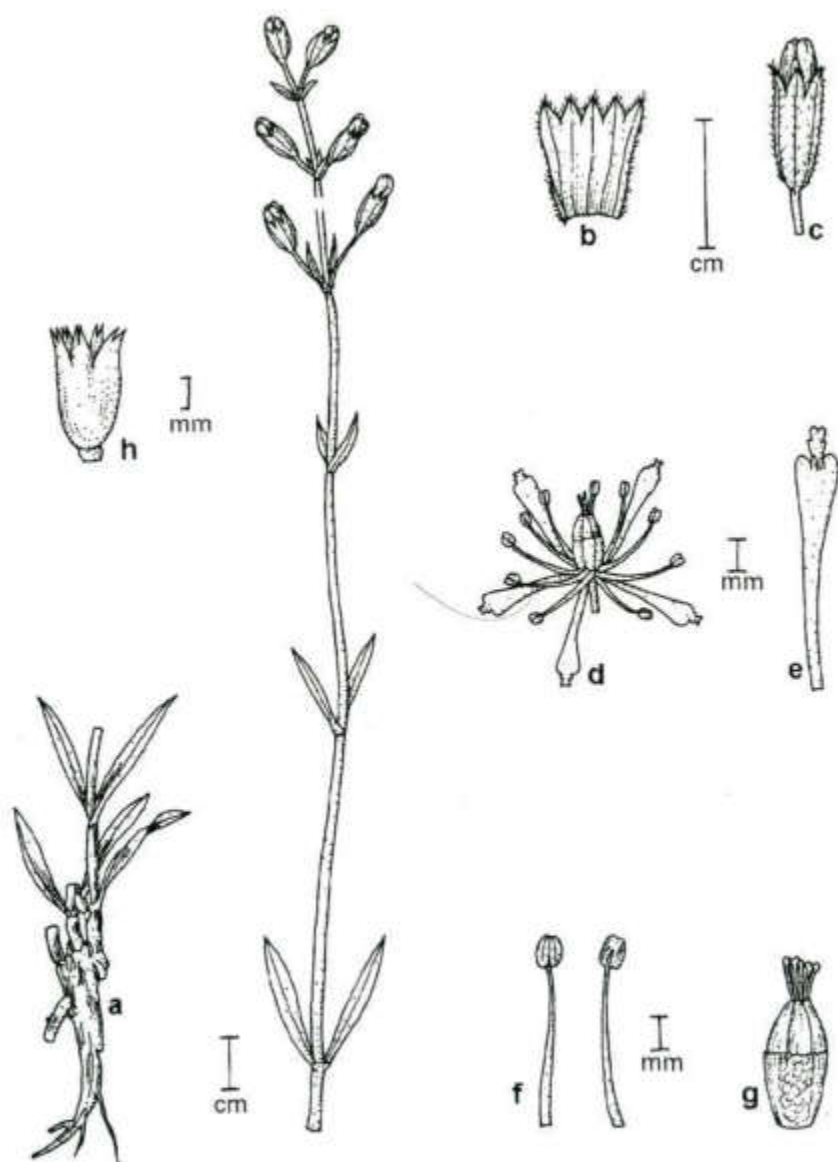


Fig. 116. *Silene songarica* (Fischer, C. Meyer & Ave-Lall.) Bocq. : a. flowering shoot with root system; b. calyx; c. flower; d. flower without calyx, opened out; e. petal; f. stamens; g. pistil; h. dehiscent capsule.

Distrib. India: Alpine Himalayas, above 2700 m. Jammu & Kashmir and Himachal Pradesh.

Endemic.

25. *Silene vagans* C.B. Clarke in J. Linn. Soc., Bot. 25: 6. 1889.

Herbs, subscent with climbing branches; stems pubescent. Leaves lanceolate, narrowed at base, acuminate at apex, faintly 3-nerved. Flowers in terminal lax dichotomous few-flowered cymes; bracts minute, inserted in middle of pedicel. Calyx cylindrical, constricted below, pubescent; teeth lanceolate, acute. Carpophore short. Capsules ovoid, 2 - 3 times longer than carpophore; seeds convex on dorsal face, tuberculate.

Fl. Nov.

Distrib. India: Temperate regions. Nagaland.

Endemic.

Notes. This species appears to be a rare one in that there is no other collection except the type collected by Clarke himself.

26. *Silene viridiflora* L. forma *webbiana* (Wallich ex Benth.) Rohrb., Monogr. Silene 215. 1868. *S. webbiana* Wallich ex Benth. in Royle, Illus. Bot. Himal. 79. 1834; Edgew. & Hook. f. in Fl. Brit. India 1: 220. 1874.

Herbs, erect, slender, tall, minutely pubescent. Cauline leaves broadly ovate-cordate, amplexicaul, acuminate at apex, 5 - 6.5 x 1.4 - 1.5 cm, puberulous, 5 - 9-nerved. Cymes opposite, lax, few-flowered; peduncles 1.3 - 1.5 cm long. Flowers drooping; pedicels 1.3 - 2 cm long, tomentose; bracts ovate-lanceolate, 1.5 - 1.8 cm long, glandular. Calyx cylindrical, slender, 1.5 - 2 cm long, glandular, 10-nerved; teeth lanceolate-subulate, intruded at base, scarious-margined, ventricose in fruit. Petals long, greenish white; limb 2-fid with linear-ligulate lobes; appendages 2, oblong; claw long-exserted. Filaments glabrous. Ovary cylindrical, globose at apex; styles 3. Capsules cylindrical-oblong, slightly longer than carpophore; seeds dorsally faintly channelled, laterally tuberculate.

Fl. July - Sept.

Distrib. India: Alpine Himalayas. Himachal Pradesh.

Notes. Probably a rare taxon. It has not been collected since the type by Webb.

27. *Silene viscosa* (L.) Pers., Syn. Pl. 1: 497. 1805. *Cucubalus viscosus* L., Sp. Pl. 414. 1753. *Silene griffithii* Boiss., Fl. Orient. 1: 637. 1867; Edgew. & Hook. f. in Fl. Brit. India 1: 220. 1874.

Herbs, perennial, robust; stems simple or branched, 30 - 45 (-100) cm high, densely tomentose, woolly to velvety, viscous above. Radical leaves spatulate-lanceolate, narrowed into a broad petiole, acuminate at apex, 5 - 9.5 x 1 - 1.8 cm; cauline leaves sessile, oblong or ovate to ovate-lanceolate, sometimes cordate at base, acuminate at apex, 4 - 8 x 2 - 4 cm, velvety. Racemes branched, composed of cymules, opposite, axillary, ca 3-flowered. Pedicels 8 - 10 mm long. Calyx cylindrical, rounded or truncate at base, 1.5 - 2.2 cm long, green, 10-nerved with acute teeth, glabrous; fruiting calyx dilated, densely glandular-pilose. Petals white, deeply 2-lobed; lobes 3 - 6-partite, without scales or appendages. Carpophore ca 4 mm long. Capsules oblong, 14 - 16 x 9 - 11 mm; seeds triangular, reniform, minute, granulate, dorsally grooved.

Fl. & Fr. May - Oct.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Afghanistan and C. Asia, extending to Russia.

28. *Silene vulgaris* (Moench) Garcke, Fl. N. Mitt. Deutschland ed. 9, 64. 1869. *Behen vulgaris* Moench, Methodus 709. 1794. *Silene inflata* Smith, Fl. Brit. 467. 1794; Edgew. & Hook. f. in Fl. Brit. India 1: 218. 1874.

Herbs, perennial, velvety pilose or glabrous, glossy; stems cylindrical, erect or ascending, 30 - 150 cm high. Leaves in opposite pairs, ovate, denticulate along margins, acute at apex, 2.5 - 7 x 1 - 3.5 cm, pale green; upper leaves gradually smaller. Inflorescence a terminal drooping, lax, dichotomous cyme. Flowers erect or drooping, 2 - 2.5 x 1.2 - 1.8 cm; bracts thin. Calyx ovoid, inflated, intruded at base, up to 2 cm long, glabrous or glaucous with 15 - 20 anastomosing veins; teeth 5, broadly triangular. Petals 5, white; limb 2-lobed with a pouch-like enlargement. Stamens 10. Styles 3. Ovary broadly ovoid. Carpophore short. Capsules globose, 6-toothed; seeds many, concave, convex at base, with lines of tubercles.

Fl. & Fr. June - Sept.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal, Temperate Asia, N. Africa and Europe. Naturalised in Japan and America.

21. *Spergula* L.

Herbs, annual or rarely perennial; stems ascending or decumbent, much-branched at base. Leaves opposite, apparently whorled with short dense shoots of leaf fascicles borne on both sides at each node, linear, obtuse; stipules small, not united to surround node, scarious, deciduous. Flowers in terminal, lax, dichasial cymes; pedicels deflexed after flowering, becoming erect again. Sepals 5, free, scarious-margined, green. Petals 5, entire, white. Stamens 10 or sometimes 5. Ovary 1-locular; styles 5, rarely 3. Capsules ovoid to subglobose, dehiscent by 5, rarely 3 valves; seeds often winged.

Temperate regions; 5 species, 2 in India.

KEY TO THE SPECIES

- | | |
|---|-----------------------|
| 1a. Styles 5; capsules 5-valved; seeds sharply keeled or very narrowly winged | 1. <i>S. arvensis</i> |
| b. Styles 3; capsules 3-valved; seeds compressed, broadly winged | 2. <i>S. fallax</i> |

1. *Spergula arvensis* L., Sp. Pl. 440. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 243. 1874. Fig. 117.

Hindi: *Khandilal*, *Muchmuchia*.

Herbs, annual, 5 - 70 cm high with ascending stems, branched at base, sparsely glandular-pubescent. Leaves linear, acute at apex, 10 - 30 (-80) x 0.5 mm, fleshy, channelled beneath, glandular-hairy above. Flowers 4 - 7 mm across, in cymose panicles; pedicels 1 - 2.5 cm long; bracts small, scarious. Sepals 5, ovate, obtuse at apex, 3 - 5 mm long, narrowly scarious-margined. Petals 5, obovate, obtuse at apex, slightly longer than sepals, white. Stamens 5 - 10. Capsules ovoid, 5-valved, 4 - 8 mm long; seeds subglobose, slightly compressed, ca 1.5 mm in diam., grey-black, keeled or very narrowly winged, covered with whitish papillae or not.

Fl. & Fr. Throughout the year.

Distrib. India: A weed of cultivated grounds, in hills up to 2500 m. Throughout the country.

Cosmopolitan.

2. *Spergula fallax* (Lowe) E.H. Krause in Sturm, *Deutschl. Fl.* ed. 2., 5: 21. 1901. *Spergularia fallax* Lowe in Hooker's *J. Bot. Kew Gard. Misc.* 8: 289. 1856. *Spergularia pentandra* sensu Edgew. & Hook. f. in *Fl. Brit. India* 1: 243. 1874, non L. 1753. *Spergularia vernalis* auct. non Willd. 1809; Bhatt et al. in *Bull. Bot. Surv. India* 12: 264. 1970; Bhatt in *J. Bombay Nat. Hist. Soc.* 68: 492. 1971.

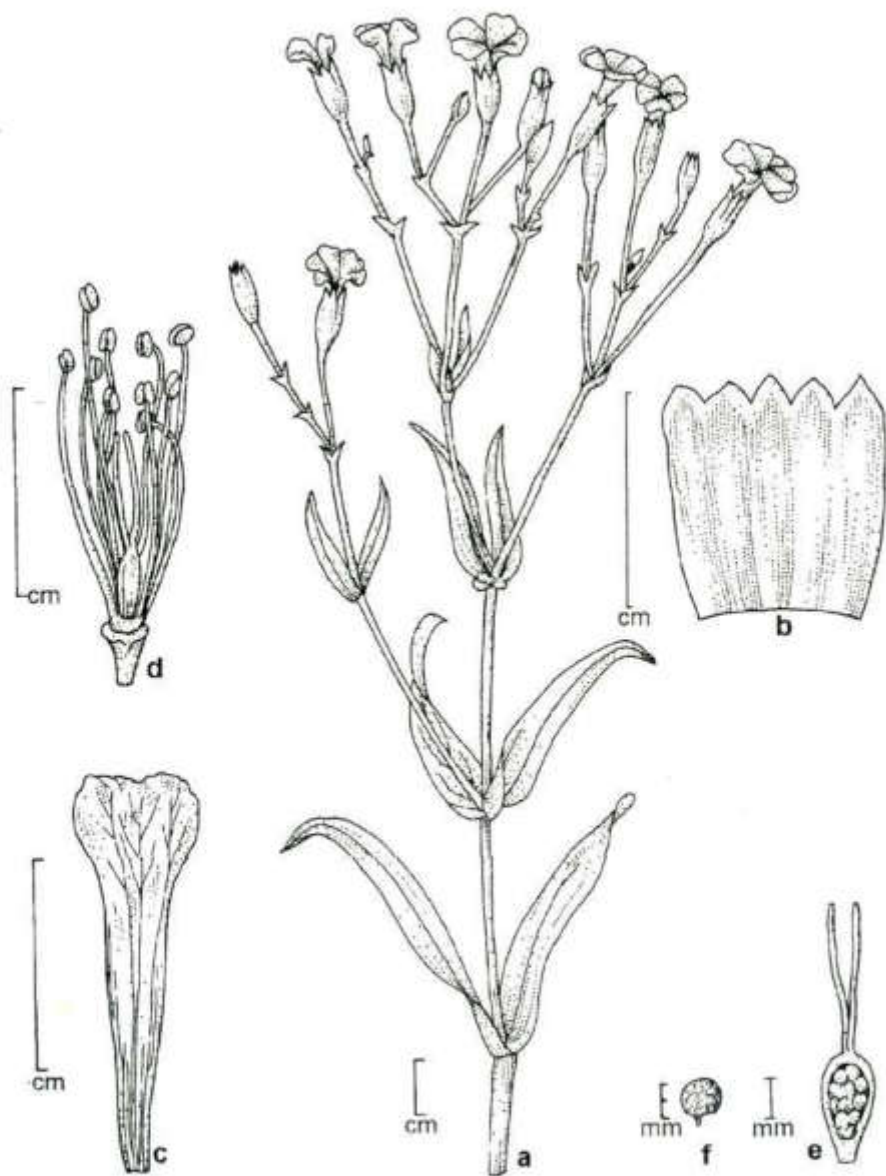


Fig. 117. *Spargula arvensis* L. : a. flowering shoot; b. flower; c. sepal; d. petal; e. stamens; f. pistil.

Herbs, annual, 4 - 40 cm high; stems ascending or decumbent, branched at base. Leaves opposite, with axillary fascicles appearing whorled, linear, 0.5 - 3 cm long. Flowers 4 - 7 mm across, in cymose panicles; pedicels 4 - 12 mm long; bracts ca 1 mm long, scarious. Sepals ovate, subacute at apex, 4 - 5 mm long, narrowly scarious-margined. Petals ovate, entire, ca 3 mm long, contiguous, white. Stamens 6 - 7. Capsules ovoid, 4 - 5 mm long; seeds ca 1.5 mm in diam. including broad scarious wing, glossy.

Fl. & Fr. Dec. - April.

Distrib. India: Throughout, in plains and hills, except Assam and Meghalaya.

Pakistan, Afghanistan, Iran, Arabia, Palestine, Egypt, N. Africa, Madeira and the Canary Islands.

Notes. Bhatt, Sabnis and Bedi (Bull. Bot. Surv. India 12: 264 - 265, 1970) and Bhatt (J. Bombay Nat. Hist. Soc. 68: 492 - 493, 1971) reported *Spergularia vernalis* Willd. from Gujarat. Examination of their specimens indicates that the plants are *Spergula fallax* (Lowe) E. H. Krause.

22. *Spergularia* (Pers.) J. S. & C. Presl, nom. cons.

Herbs, annual or perennial, sometimes woody at base; stems erect, decumbent or procumbent, somewhat flattened, dilated at nodes. Leaves opposite-decussate, linear, often fleshy; stipules pale, scarious, united around node forming more or less triangular structures on either side of stem; leaf fascicles, if present, on one side of node only. Flowers in cymes. Sepals 5, free, scarious-margined. Petals 5, entire, white or pink. Stamens 1 - 10. Ovary 1-locular; styles 3 - 5. Capsules 3-valved; seeds spherical or pyriform, often winged.

Cosmopolitan; ca 40 species, one species in India.

Spergularia rubra (L.) J.S. & C. Presl, Fl. Cech. 94. 1819. *Arenaria rubra* L., Sp. Pl. 423. 1753. *Spergula rubra* (L.) Edgew. & Hook. f. in Fl. Brit. India 1: 244. 1874.

Herbs, annual, biennial or perennial with a slender or somewhat woody taproot; stems diffuse, decumbent or procumbent, 5 - 25 cm long. Leaves opposite, linear, tapering, awned at apex, 4 - 25 mm long, not fleshy, fasciculate; stipules lanceolate, acuminate, lacerate at apex, silvery. Bracts subequal to leaves. Sepals ovate-lanceolate, 3 - 4 mm long, glandular, broadly scarious-margined. Petals ovate, shorter than sepals, pink. Stamens 5 - 10. Styles 3. Capsules ovoid, about as long as sepals; seeds subtriangular, 0.4 - 0.5 mm in diam., brownish, not winged.

Fl. Feb. - May; *Fr.* April - Sept.

Distrib. India: Plains and hills, usually a weed in cultivated fields, up to 2500 m. Jammu & Kashmir, Haryana and Uttar Pradesh.

Pakistan, N. Africa and Europe; introduced in Australia.

23. *Stellaria* L.

Herbs, annual or perennial, usually slender, often diffuse, tufted or ascending, rarely scrambling, glabrous or pubescent. Leaves simple, opposite, exstipulate, usually entire. Flowers usually in dichasial cymes, rarely solitary. Sepals 5 or 4, free, often scarious-margined. Petals 5 or 4, 2-fid up to middle or base, rarely emarginate or laciniate, white, sometimes absent. Stamens 10 or 8, rarely few, hypogynous or perigynous; nectaries present. Ovary 1-locular, rarely 3-locular; styles 3, rarely 2 - 5. Capsules globose or ovoid, opening usually by twice as many teeth as styles; seeds 1-many, tuberculate, granulate or nearly smooth.

Temperate regions; ca 120 species, 17 species in India.

Notes. Occurs in various habitats, from plains to alpine regions, often in shady situations or on rocky slopes, sometimes in open places, also represented in arid regions.

KEY TO THE SPECIES

- | | |
|---|-----------------------------|
| 1a. Ovary 3-locular; capsules 1- or 2-seeded | 6. <i>S. monosperma</i> ✓ |
| b. Ovary 1-locular; capsules 2- to many-seeded | 2 |
| 2a. Sepals free up to base | 3 |
| b. Sepals connate at base forming a funnel-shaped calyx tube | 9 |
| 3a. Styles 3 (2 - 3 in <i>S. wallichiana</i>) | 4 |
| b. Styles 2 | 8 |
| 4a. Petals shorter than sepals or absent | 5 |
| b. Petals longer than sepals | 7 |
| 5a. Flowers solitary, 4-merous | 16. <i>S. wallichiana</i> |
| b. Flowers many in cymes, 5-merous | 6 |
| 6a. Plants glabrous; seeds with sharp tubercles | 5. <i>S. media</i> |
| b. Plants with long ciliate spreading hairs; seeds smooth | 11. <i>S. sikkimensis</i> |
| 7a. Branches pubescent with white woolly hairs | 10. <i>S. semivestita</i> ✓ |
| b. Branches densely glandular-hairy | 13. <i>S. tibetica</i> |
| 8a. Plants glaucous; capsules as long as sepals; seeds papillate marginally | 17. <i>S. webbiana</i> |
| b. Plants tomentose above; capsules shorter than sepals; seeds smooth | 3. <i>S. himalayensis</i> |
| 9a. Densely tufted rigid herbs; filaments dilated at base | 1. <i>S. decumbens</i> ✓ |
| b. Laxly tufted flaccid herbs; filaments not dilated at base | 10 |
| 10a. Plants variously pubescent | 11 |
| b. Plants glabrous or only leaf base ciliate | 13 |
| 11a. Stellate hairs present | 15. <i>S. vestita</i> |

- | | |
|---|----------------------------|
| b. Stellate hairs absent | 12 |
| 12a. Plants with long lax silky hairs | 8. <i>S. patens</i> ✓ |
| b. Plants densely woolly | 4. <i>S. lanata</i> |
| 13a. Petals absent; capsules much longer than sepals | 12. <i>S. subumbellata</i> |
| b. Petals present (rarely absent in <i>S. uliginosa</i>); capsules as long as or shorter than sepals | 14 |
| 14a. Leaves thick-margined | 15 |
| b. Leaves not thick-margined | 16 |
| 15a. Leaves ciliolate towards base; bracts wholly scarious | 2. <i>S. graminea</i> |
| b. Leaves not ciliolate towards base; bracts, if present, scarious along margins only | 7. <i>S. palustris</i> |
| 16a. Leaves lanceolate; lower leaves not attenuate at base | 14. <i>S. uliginosa</i> ✓ |
| b. Leaves broadly ovate; lower leaves often abruptly attenuate at base | 9. <i>S. reticulivena</i> |

1. *Stellaria decumbens* Edgew. in Trans. Linn. Soc., Lond. 20: 35. 1846. *S. cherleriae* (Fischer ex Ser.) F. Williams, in Bull. Herb. Boiss. ser. 2, 7: 830. 1907, p. p.

Herbs, densely tufted, cushion-like, shiny; roots woody; stems many, erect or decumbent, 5 - 15 cm long, somewhat 4-angular; branches lax or densely fascicled, glabrous or with a line of pubescence. Leaves ovate, lanceolate, linear-lanceolate to linear-subulate, incurved at apex or not, 3 - 5 mm long, glabrous or ciliolate, obscurely 3-nerved, 1-nerved or nerveless; sometimes with axillary fascicles of leaves. Flowers solitary or in 1 - 3-flowered to many-flowered cymes, pedunculate or sessile. Sepals 4 - 5, oblong-lanceolate, acute or acuminate at apex, ca 3 mm or longer, coriaceous. Petals very short, narrow, deeply 2-partite. Stamens 8 - 10. Capsules shorter than sepals; seeds 2 - 8, suborbicular, dark-brown, dotted.

KEY TO THE VARIETIES

- | | |
|---|-----------------------------|
| 1a. Cymes 1 - 3-flowered | 2 |
| b. Cymes many-flowered | 4 |
| 2a. Plants forming dense globose tufts; leaves 1.2 - 2 mm broad, incurved at apex | 1.5. var. <i>pulvinata</i> |
| b. Plants not forming dense globose tufts; leaves ca 1 mm broad, not incurved at apex | 3 |
| 3a. Plants small, with axillary fascicles of leaves | 1.3. var. <i>minor</i> |
| b. Plants large, without axillary fascicles of leaves | 1.2. var. <i>decumbens</i> |
| 4a. Leaves ovate or lanceolate, pubescent | 1.4. var. <i>polyantha</i> |
| b. Leaves linear-subulate, glabrous | 1.1. var. <i>acicularis</i> |

1. 1. var. *acicularis* Edgew. & Hook. f. in Fl. Brit. India 1: 235. 1874.

Fl. June - Oct.

Distrib. India: Alpine regions, above 3300 m. Sikkim.

Endemic.

1. 2. var. **decumbens** *S. decumbens* Edgew. var. *edgeworthii* Edgew. & Hook. f. & var. *stracheyi* Edgew. & Hook. f. in Fl. Brit. India 1: 234. 1874.

Fl. & Fr. July - Oct.

Distrib. India: Alpine Himalayas, above 2700 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Pakistan, China, Mongolia and Russia (Siberia).

1. 3. var. **minor** Edgew. & Hook. f. in Fl. Brit. India 1: 234. 1874.

Fl. & Fr. July - Oct.

Distrib. India: Alpine Himalayas, above 3200 m, on rocks. Jammu & Kashmir, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Endemic.

1. 4. var. **polyantha** Edgew. & Hook. f. in Fl. Brit. India 1: 234. 1874.

Fl. June - Oct.

Distrib. India: Alpine Himalayas, above 4500 m. Jammu & Kashmir, Uttar Pradesh and Sikkim.

Nepal and Bhutan.

1. 5. var. **pulvinata** Edgew. & Hook. f. in Fl. Brit. India 1: 235. 1874.

Fl. Sept. - Oct.

Distrib. India: Alpine Himalayas, above 3600 m, on rocks. Jammu & Kashmir, Uttar Pradesh and Sikkim.

Pakistan, Nepal, Bhutan, China (Tibet) and Russia (Siberia).

2. **Stellaria graminea** L., Sp. Pl. 422. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 233. 1874.

Herbs, perennial, 10 - 40 cm high, glabrous; flowering shoots tufted, 4-angular. Leaves sessile, linear-oblong, acute at apex, 1.2 - 3 cm long, thick-margined. Cymes terminal. Flowers 7 - 10 mm across; pedicels slender, 1 - 3 cm long, divaricate; bracts oblong-lanceolate. Sepals linear-oblong, 4 - 7 mm long, green, shiny, 3-nerved, mem-

branous along margins. Petals 2-partite, white. Stamens 10. Styles 3. Capsules ovoid-oblong, shorter than sepals; seeds ca 1 mm in diam., reddish brown, rough, granulate.

Fl. May - July.

Distrib. India: Alpine Himalayas, above 3000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Pakistan, Nepal, China (Tibet), Mongolia, Russia (Siberia), C. Asia, Afghanistan and Europe.

Notes. The plant is said to be poisonous. Alkaloid content is maximum during the flowering period.

3. *Stellaria himalayensis* Majumdar in J. Indian Bot. Soc. 44: 141. 1965 (as "*himalayense*"). *S. latifolia* (Benth. ex G. Don) Edgew. & Hook. f. in Fl. Brit. India 1: 231. 1874, non Pers. 1805, nec Gray 1821. *Leucostemma latifolia* Benth. ex G. Don, Gen. Hist. 1: 449. 1831.

Herbs, branched, procumbent, 7 - 25 cm, tomentose above, glabrous below. Lower leaves shortly petiolate, ovate-cordate or orbicular, mucronate at apex, 5 - 17 x 4 - 8 mm, thick-margined; upper leaves lanceolate, smaller. Flowers solitary; pedicels arising from upper axils, slender, glabrous. Sepals 4, subulate, lanceolate, 5 - 7 mm long, narrowly scarious-margined. Petals 4, 2-fid with oblong obtuse lobes, twice as long as sepals, white. Stamens 8. Styles 2. Capsules ovoid, ca 3 x 2 mm, hyaline; seeds suborbicular, compressed, 0.7 - 1 mm in diam., brown, smooth.

Fl. & Fr. April - June.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal.

4. *Stellaria lanata* Hook. f., Fl. Brit. India 1: 232. 1874.

Herbs, 20 - 30 cm high; stems laxly tufted, decumbent, slender, terete and shiny below, densely woolly above; upper branches 4-angular. Leaves sessile, narrowly ovate to linear-lanceolate, subcordate at base, acute at apex, 6 - 30 x 2 - 4 mm, spreading and recurved, glabrescent above, white soft-woolly beneath, 1-nerved. Cymes terminal; peduncles 2 - 3.8 cm long. Flowers few, 4 - 5 mm across; pedicels erect, 1 - 12 mm long. Sepals oblong, acute at apex, 2.5 - 3 mm long, narrowly scarious-margined. Petals absent or minute, 2-partite with thread-like lobes. Stamens 8. Styles 3. Capsules oblong-ovoid, 4 - 6-valved, 4 - 5 mm long; seeds reniform, dark brown.

Fl. & Fr. June - Oct.

Distrib. India: Alpine Himalayas, 3000 - 4000 m, in marshy grounds. West Bengal and Sikkim.

Nepal, Bhutan and China (Tibet).

5. *Stellaria media* (L.) Villars, Hist. Pl. Dauphine 3: 615. 1789, p. p.; Edgew. & Hook. f. in Fl. Brit. India 1: 230. 1874, p. p. *Alsine media* L., Sp. Pl. 272. 1753.

Asm.: *Morolia*; Hindi: *Buch-bucha*, *Safed-phulke*.

Herbs, 10 - 60 cm high; stems suberect or decumbent, 4-angular with a line of hairs on one side of internodes, rooting at nodes. Leaves 3 - 28 mm long; lower ones long-petiolate, ovate, cordate or cuneate at base, acute or shortly acuminate at apex; upper ones sessile, ovate or elliptic, smooth or with elevated points; petioles up to 1.5 cm long. Flowers numerous or few, in terminal leafy cymes; pedicels up to 1.5 cm long, glandular-pubescent. Sepals 5, ovate-lanceolate, subacute or obtuse at apex, 3 - 5 mm long, narrowly scarious-margined, sparsely glandular-pubescent. Petals 5, shorter than sepals, white, sometimes absent. Stamens 3 - 10. Styles 3. Capsules ovoid-oblong, longer than calyx; seeds plano-convex, reddish brown with acute conical tubercles.

Fl. & Fr. Throughout the year.

Distrib. India: Plains and hills. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Maharashtra and Tamil Nadu.

Nepal, Bhutan, Afghanistan, Russia, Turkey, Europe and America.

Notes. The plant is taken as a vegetable, raw or boiled. It contains toxic nitrates which may be fatal to animals and may cause mild paralysis in man. Effective against inflammation of the digestive, renal, respiratory and reproductive tracts and has a soothing action on mucous and dermoid surfaces. Also used in inflammation of the skin such as erysipelas, ulcer, eczema, haemorrhoids and of the eye. Employed in the form of powder, extract, decoction or ointment. Sometimes also used as plasters for swellings and fractured bones.

6. *Stellaria monosperma* D. Don, Prodr. Fl. Nep. 215. 1825. *S. crispata* Edgew. & Hook. f. in Fl. Brit. India 1: 229. 1874.

Herbs, scrambling, 60 - 120 cm high; stems 4-angular, shiny with a line of fine hairs; nodes often hairy. Leaves sessile or petiolate, oblong, elliptic or lanceolate, cordate at base, acuminate at apex, 3 - 20 x 1 - 4 cm, minutely crisped along margins, glabrous;

nerves spreading, with intramarginal nerve. Cymes many-flowered, terminal or axillary, glandular; peduncles and pedicels spreading or divaricate; bracts 2.5 - 3 mm long, green. Sepals 5, oblong-lanceolate, acuminate at apex, 3 - 6 mm long, narrowly scarious-margined. Petals 5, 2-fid to middle, shorter than or as long as sepals. Stamens 10. Styles 3. Capsules 6-valved, as long as calyx, ca 4 mm in diam.; seed 1 or 2, suborbicular to angular-orbicular, dark brown, with conical tubercles, notched or beaked.

KEY TO THE VARIETIES

- 1a. Leaves sessile; sepals 5 - 6 mm long; petals as long as sepals; seeds more than 2 mm in diam., notched
6.1. var. **monosperma**
- b. Leaves petiolate; sepals 3 - 4 mm long; petals only half as long as sepals; seeds less than 2 mm in diam., beaked
6.2. var. **paniculata**

6.1. var. **monosperma**

Fl. July - Sept.; *Fr.* Sept. - Oct.

Distrib. India: Temperate and alpine Himalayas. Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

Pakistan, Nepal, Bhutan, Iran and Afghanistan.

Notes. Sometimes used as vegetable.

6.2. var. **paniculata** (Edgew.) Majumdar in J. Indian Bot. Soc. 44: 141. 1965. *S. paniculata* Edgew. in Trans. Linn. Soc., Lond. 20: 35. 1846; Edgew. & Hook. f. in Fl. Brit. India 1: 229. 1874.

Fl. & Fr. July - Oct.

Distrib. India: Temperate and alpine Himalayas and the Western Ghats. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Meghalaya and Tamil Nadu.

Indochina and Afghanistan.

7. **Stellaria palustris** Retz., Fl. Scand. Prodr. ed. 2, 106. 1795. *S. glauca* With., Arr. Brit. Pl. ed. 3, 2: 420. 1796; Edgew. & Hook. f. in Fl. Brit. India 1: 233. 1874.

Herbs, perennial with a slender horizontal stock; stems suberect or erect, 4-angular, glabrous; flowering shoots slender, weak and brittle, 9 - 30 cm high. Leaves sessile, linear-lanceolate, rounded at base, acuminate at apex, 1.5 - 5 cm long, glabrous with thick margins and a distinct midnerve. Flowers 1.2 - 1.8 cm across; pedicels erect, 3 - 6

cm long. Sepals lanceolate, acute at apex, 5 - 6 mm long, green, 3-nerved, broadly scarious-margined. Petals 2-fid to base, as long as or longer than sepals, white. Stamens 10. Styles 3. Capsules broadly ovoid, 6-valved, as long as sepals; seeds ovoid, ca 0.7 x 1 mm, reddish brown, bluntly tuberculate.

Fl. & Fr. July - Sept.

Distrib. India: Alpine Himalayas, above 3900 m, on rocks. Jammu & Kashmir and Himachal Pradesh.

Pakistan, China (Tibet), Russia, W. Asia, Europe and Greenland.

8. *Stellaria patens* D. Don, Prodr. Fl. Nep. 215. 1825. *S. longissima* Edgew. & Hook.f. in Fl. Brit. India 1: 231. 1874.

Herbs, laxly tufted, decumbent; stems slender, 15 - 45 cm long, much branched, with long white silky hairs. Leaves sessile, lanceolate to narrowly elliptic, acute at apex, 10 - 25 x 1 - 2 mm, spreading and recurved, white-pilose beneath, flat, opaque, 1-nerved. Flowers ca 1.2 cm across, solitary, axillary or in terminal few-flowered cymes; peduncles erect, 2.5 - 6.5 cm long. Sepals narrowly lanceolate, 5 - 6 mm long, glabrous, broadly scarious-margined. Petals as long as sepals, white. Stamens 10. Styles 3. Capsules 5-valved, shorter than sepals; seeds dark brown, tuberculate.

Fl. May - Sept.; *Fr.* Sept. - Nov.

Distrib. India: Temperate and alpine Himalayas, 2000 - 2500 m, near cultivated areas. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Arunachal Pradesh and Meghalaya.

Nepal and Bhutan.

9. *Stellaria reticulivena* Hayata, Icon. Pl. Formos. 7: 1, f. 1. 1918; Majumdar in Bull. Bot. Surv. India 21: 172, ff. 1 - 9. 1979. *S. micrantha* Hayata, Mat. Fl. Formosa 36. 1911, non Spruce ex Rohrb. 1871 - 73.

Herbs, slender, suberect or decumbent, glabrous; internodes 1 - 2 (-3) cm long. Leaves sessile, broadly ovate, rounded at base, acuminate at apex, 6 - 15 x 4 - 10 mm, sometimes ciliate along margins, pale green; midnerve impressed above, prominent beneath; minor nerves reticulate. Flowers in slender leafless branched cymes; pedicels divaricate; bracts ovate, acute, scarious. Sepals 5, ovate to ovate-oblong, acute at apex, 2 - 2.5 mm long, scarious-margined. Petals 5, 1 - 1.5 mm long, white. Stamens 5 - 10, ca 2 mm long. Styles 3, recurved at apex. Capsules ovoid, 6-valved, ca 3 mm long; seeds globose, compressed, 0.6 - 0.8 mm in diam., dark brown, shortly beaked, reticulate.

Fl. & Fr. April - June.

Distrib. India: Temperate Himalayas, 1800 - 2800 m, by stream sides in forests. Sikkim and Arunachal Pradesh.

Bhutan and Taiwan.

10. *Stellaria semivestita* Edgew. in Fl. Brit. India 1: 230. 1874.

Herbs, caespitose; stems decumbent, 15 - 45 cm high; branches ascending, crowded, pubescent with white woolly hairs. Leaves linear-subulate, 8 - 32 x 1 - 2 mm, spreading, recurved, 1-nerved, woolly to glabrescent on both surfaces. Flowers solitary, ca 1.2 cm across; pedicels 2 - 2.8 cm long. Sepals lanceolate, acuminate at apex, ca 6 mm long, broadly scarious-margined, glabrate to tomentose. Petals longer than sepals. Stamens 10. Styles 3. Capsules elliptic-oblong, 6-valved, ca 4 x 6 mm; seeds few, suborbicular, flattened, ca 1 mm in diam., dark brown, rough with blunt elevations.

Fl. & Fr. April - Sept.

Distrib. India: Temperate Himalayas. Jammu & Kashmir and Uttar Pradesh.

Nepal.

Notes. An alcoholic extract shows anticancer activity against human epidermoid carcinoma of the nasopharynx in tissue culture. The plant is toxic to adult albino mice.

11. *Stellaria sikkimensis* Hook. f., Fl. Brit. India 1: 230. 1874.

Herbs, caespitose, decumbent, with brown patent hairs; stems branched, villous, shiny below. Leaves sessile or subsessile, ovate or ovate-lanceolate, 6 - 20 x 2 - 8 mm, spreading, ciliate on both surfaces. Cymes terminal, lax. Flowers 5 - 6 mm across; pedicels up to 8 mm long. Sepals lanceolate, acuminate at apex, 4 - 5 x 1 mm, broadly scarious-margined, pilose. Petals 3 - 4 mm long. Stamens 10. Styles 3. Capsules ovoid-oblong, 5-valved, entire, 5 - 6 mm long; seeds many, ca 0.7 mm in diam., dark brown, smooth.

Fl. May - Aug.; *Fr.* July - Oct.

Distrib. India: Temperate and subalpine regions, on rocks and moist edges of forests. West Bengal, Sikkim and Arunachal Pradesh.

Nepal and Bhutan.

12. *Stellaria subumbellata* Edgew. in Fl. Brit. India 1: 233. 1874.

Herbs, decumbent, 10 - 20 cm, glabrous; stems very slender, sometimes tufted. Leaves sessile, linear or elliptic-oblong, acute or acuminate at apex, 3 - 18 x 0.75 - 1.5 mm, thick along margins. Flowers ca 4 mm across, solitary, axillary or in terminal subumbellate cymes; pedicels capillary, 8 - 25 mm long, deflexed in fruit; bracts ovate, ca 2 mm long, membranous. Sepals ovate to ovate-lanceolate, acute at apex, 2 - 2.5 mm long, scarious-margined, green, 3-nerved. Petals absent. Stamens 5. Styles 3. Capsules narrowly ovoid or subcylindrical, 5-valved, ca 4 mm long; seeds ovate, angular, pale brown, rough.

Fl. & Fr. Aug. - Sept.

Distrib. India: Alpine Himalayas, above 3500 m. Jammu & Kashmir, Uttar Pradesh and Sikkim.

Pakistan, Nepal, Bhutan and China (Tibet).

13. *Stellaria tibetica* Kurz in Flora 55: 285. 1872; Edgew. & Hook. f. in Fl. Brit. India 1: 231. 1874.

Herbs, densely glandular-pubescent; stems ascending, 9 - 14 cm high, shiny at base. Leaves sessile, suberect, oblong, acute to subacute at apex, 8 - 20 x 5 - 7 mm, opaque; midnerve slender, others obscure. Cymes axillary and terminal, erect, pedunculate, few-flowered. Flowers erect, ca 1 cm across; pedicels 3 - 8 mm long; bracts 3 - 4 mm long, coriaceous; bracteoles narrowly ovate, acute at apex, ca 2 mm long. Sepals elliptic, acute at apex, 5 - 6 mm long, scarious-margined. Petals 2-fid with obtuse lobes. Stamens shorter than sepals. Ovary ca 1 mm in diam., many-ovuled; styles 3, slender, 2 - 3 mm long. Capsules broadly ovoid, 6-valved, shorter than sepals; seeds 8 - 9, flat, brown, muricate.

Fl. & Fr. July - Aug.

Distrib. India: Alpine Himalayas, above 4000 m, on rocky slopes. Jammu & Kashmir.

Pakistan and China (Tibet).

14. *Stellaria uliginosa* Murray, Prodr. Stirp. Gott. 55. 1770; Edgew. & Hook. f. in Fl. Brit. India 1: 233. 1874.

Herbs, annual, suberect or procumbent, glabrous; stems slender, 10 - 40 cm high, 4-angular, glaucous. Leaves sessile, ovate-lanceolate to linear-lanceolate, acute or acuminate and sometimes mucronate at apex, sometimes undulate along margins, 8 - 25

mm long, often with white lacerate stipule-like processes at base. Cymes axillary and terminal, few-flowered; bracts ca 1 mm long, scarious. Sepals lanceolate to subulate, acuminate at apex, 2.5 - 3.5 mm long. Petals minute, more or less equalling sepals, or absent, 2-fid almost up to base; lobes oblong, divergent. Stamens 5 - 10. Styles 3. Capsules ovoid, 6-valved, equalling sepals; seeds ca 0.5 x 0.6 mm, pale brown, smooth or covered with low mammillae.

KEY TO THE VARIETIES

- | | |
|--|-----------------------------|
| 1a. Leaves entire; stamens 10; seeds smooth | 14.1. var. <i>uliginosa</i> |
| b. Leaves undulate-margined; stamens 5 - 8; seeds mammillate | 14.2. var. <i>undulata</i> |

14. 1. var. *uliginosa*

Fl. March - July; *Fr.* Aug. - Sept.

Distrib. India: Alpine Himalayas, above 2800 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Assam and Tamil Nadu.

Pakistan, Nepal, Bhutan, China, Russia (Siberia), N. Africa, W. Asia, Europe and N. America.

Notes. A decoction of the leaf is said to be used as a galactagogue.

14. 2. var. *undulata* (Thunb.) Fenzl in Ledeb., *Fl. Ross.* 1: 393. 1842; Mizushima in *Fl. E. Himal.* 82. 1966. *S. undulata* Thunb., *Fl. Jap.* 185. 1784.

Distrib. India: Temperate Himalayas. Sikkim and Arunachal Pradesh.

Nepal, Bhutan, Taiwan and E. Asia.

15. *Stellaria vestita* Kurz in *J. Bot.* 11: 194. 1873. *S. saxatilis* D. Don, *Prodr. Fl. Nep.* 215. 1825; Edgew. & Hook. f. in *Fl. Brit. India* 1: 232. 1874. 1825, non Scop. 1772.

Herbs, weak, greyish, laxly tufted, up to 90 cm high; stems decumbent, upper parts densely woolly-tomentose with stellate hairs. Leaves sessile, ovate-oblong or ovate-elliptic, rounded at base, acute at apex, 4 - 24 (-54) x 3 - 15 mm. Cymes lax, few-flowered, axillary and terminal; peduncles 1.3 - 5 cm long; pedicels 0.8 - 2.5 cm long; bracts linear-subulate, 3(-5) mm long. Sepals oblong, acute at apex, 5 - 6 mm long, narrowly membranous along margins. Petals 2-fid almost up to base, ca 4 mm long. Stamens 10. Styles 3. Capsules ovoid-oblong, 5-valved, as long as sepals; seeds ca 10, ca 1 mm in diam., black, rough, without tubercles.

Fl. March - May; *Fr.* May - June.

Distrib. India: Temperate Himalayas and the Western Ghats, 1400 - 2700 m, edges of cultivated fields. Sikkim, Arunachal Pradesh, Assam, Meghalaya and Tamil Nadu.

Nepal, Bhutan, China (Tibet), Japan, Taiwan, Cambodia, Laos, Vietnam, Indonesia (Java) and Philippines.

Notes. A decoction of the plant is said to relieve boneache and rheumatic pain.

16. *Stellaria wallichiana* Benth. ex Haines in Bull. Misc. Inf. Kew 1920: 66. 1920. *S. media* (L.) Villars, Hist. Pl. Dauphine 3: 615. 1789, p. p.; Edgew. & Hook. f. in Fl. Brit. India 1: 230. 1874.

Herbs; stems slender, with 2 lines of pubescence and scattered glandular hairs. Leaves petiolate, ovate or ovate-lanceolate, broadly cordate at base or cuneate towards petiole, 1 - 2.5 cm long; petioles slender, pubescent. Flowers solitary, twice as long as sepals or longer. Sepals 4, ovate, acute or acuminate at apex, 2.5 - 3 mm long. Petals 4, ovate, 2-fid or emarginate. Stamens hypogynous. Ovary ovoid; styles 2 - 3, recurved.

Capsules 6-valved, shorter than sepals; seeds 10 - 15, rough or faintly obtusely tuberculate.

Fl. Feb. - Aug.

Distrib. India: Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Manipur and Meghalaya.

Bangladesh.

17. *Stellaria webbiana* (Benth. ex G. Don) Edgew. & Hook. f. in Fl. Brit. India 1: 230. 1874. *Leucostemma webbianum* Benth. ex G. Don, Gen. Hist. 1: 449. 1831.

Herbs, slender, decumbent, 15 - 30 cm high, glabrous or sparsely white-hairy; stems 4-angular, branched. Leaves sessile, linear, acicular, 8 - 16 mm long, spreading, rigid, shiny, 1-nerved. Flowers axillary, suberect, white; pedicels capillary, 2.5 - 5 cm long. Sepals 4, lanceolate, acuminate at apex, 5 - 7 mm long, broadly scarious-margined, shiny. Petals 2-fid up to middle, 10 - 11 mm long with narrow obtuse lobes. Stamens 8. Styles 2. Capsules ovoid, 6-valved, equalling sepals; seeds compressed, 0.8 - 1 mm in diam., pale brown, papillate along margins.

Fl. & Fr. April.

Distrib. India: Temperate Himalayas. Jammu & Kashmir and Uttar Pradesh.

Nepal and Afghanistan.

24. *Thylacospermum* Fenzl

Monotypic; description and distribution as for the species below.

Thylacospermum caespitosum (Cambess.) Schischkin in Spiosk Rast. Gerb. Russk. Fl. Bot. Muz. Rossijsk. Akad. Nauk. 9: 90. 1932. *Periandra caespitosa* Cambess. in Jacquem., Voy. 4 (Bot.): 27, t. 29. 1835. *Thylacospermum rupifragum* (Karelin & Kir.) Schrenk, Enum. Pl. Nov. 2: 53. 1842; Edgew. & Hook. f. in Fl. Brit. India 1: 243. 1874. *Bryomorpha rupifraga* Karelin & Kir. in Bull. Soc. Imp. Nat. Moscou 15: 172. 1842.

Herbs, perennial, densely caespitose, glabrous; stems numerous, forming large hard spherical or hemispherical cushions of 25 - 100 cm across. Leaves densely crowded, sessile, ovate, acute to acuminate at apex, 2 - 4 x 0.75 mm, glabrous, nerveless, keeled near apex, scarcely recurved, sharp to touch at tips. Flowers subsessile, solitary at apex of stem, hidden between leaves, ca 2.5 mm across. Calyx-tube funnel-shaped, divided up to middle into 4 - 5 lobes. Petals 4 - 5, oblong, entire, ca 1.5 mm long, white. Stamens 8 - 10, on a glandular ring; glands placed between bases of filaments, small, oblong. Ovary shortly stalked, 1-locular with few-ovules; styles 2 - 3, filiform. Capsules spherical, 4 - 6-valved, coriaceous, shiny; seeds few, large with soft loose seed coats.

Fl. & Fr. June - Sept.

Distrib. India: Alpine Himalayas, on slopes and rocks. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Nepal, China (Tibet) and C. Asia.

25. *Vaccaria* Medikus

Herbs, annual, glabrous, often growing among grasses; stems erect. Leaves opposite, oblong or lanceolate, connate at base. Cymes large, corymbiform. Flowers red; epicalyx absent. Calyx ovoid-pyramidal, 5-angular; tube winged with 5 teeth, without commissural veins. Petals 5, hypogynously inserted on a short thick anthophore; limb obovate, denticulate with a linear claw. Stamens 10, inserted with petals; filaments filiform; anthers 2-locular, dehiscing longitudinally. Ovary 2-locular, rarely 3-locular, many-ovuled; styles 2, rarely 3. Capsules ovoid, 4- or 6-dentate at apex; seeds many, globose, granulate.

Mediterranean region; 3 species, one species in India.

Vaccaria pyramidata Medikus, Philos. Bot. 1: 96. 1789. *Saponaria vaccaria* L., Sp. Pl. 409. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 217. 1874, p. p. Fig. 118.

Beng.: *Sabuni*; Hindi: *Musna*.

Herbs, annual, robust, 15 - 60 cm high, branched, glabrous; taproot slender. Leaves cordate-lanceolate, acute at apex, 2.5 - 7.5 x 0.8 - 1.8 cm, glabrous; lower leaves somewhat petiolate, the rest sessile. Flowers erect, in lax corymbose dichasial cymes; pedicels slender. Calyx tube inflated, ca 1.2 cm across, with 5 sharp angles or wings; teeth 5, triangular. Petals rose-coloured; limb cuneate or rounded or somewhat emarginate; coronal scales absent. Capsules globose, 4-valved, 4-locular below, included; seeds globose, ca 2 mm in diam., black, granulate.

Fl. & Fr. May - Sept.

Distrib. India: An introduced weed, throughout the plains and hills.

Temperate Asia, Europe; also introduced in N. America and Australia.

EXCLUDED SPECIES

Arenaria ludlowii H. Hara has been recorded from Bhutan whereas *A. globiflora* (Fenzl) Edgew. & Hook. f. has been reported from Nepal and Tibet. *A. melanandra* (Maxim.) Mattf. ex Hand-Mazz., *A. mukerjeeana* (Majumdar) H. Hara, *A. paramelanandra* H. Hara and *A. roseiflora* Sprague have been recorded from Nepal only.

Cerastium fontanum Baumg. subsp. *grandiflorum* (Buch-Ham. ex D. Don) H. Hara has been reported from Nepal.

Dianthus chinensis L. var. *aspera* Koch, reported to occur in Ladakh, is excluded in the absence of any specimen.

Pseudostellaria heterantha (Maxim.) Pax var. *nepalensis* (Majumdar) H. Hara has been reported from Bhutan, China (Tibet) and Nepal, whereas *P. sylvatica* (Maxim.) Pax has been recorded from Bhutan.

Silene alba (Mill.) E.H. Krause, a western species, reported as an addition to the flora of India by Nair (Bull. Bot. Surv. India 11: 201. 1969) is not yet naturalised. *S. ameria* L. and *S. noctiflora* L. are ornamental species which sometimes occur as escapes from cultivation. *S. pendula* L., reported to have extended into India by Chowdhuri (1957) is excluded as there are no specimens. *S. stracheyi* Edgew. is excluded following Chowdhuri (l. c.). *S. chodatii* Bocq. (1969), based on Kingdon-ward 14134 from Ze la (Arunachal Pradesh) is excluded as the exactness of the type locality is in doubt. *S. brigittae* Bocq., *S. fissicalyx* Bocq. & Chater, *S. helleboriflora* Excell & Bocq., *S. holos-*

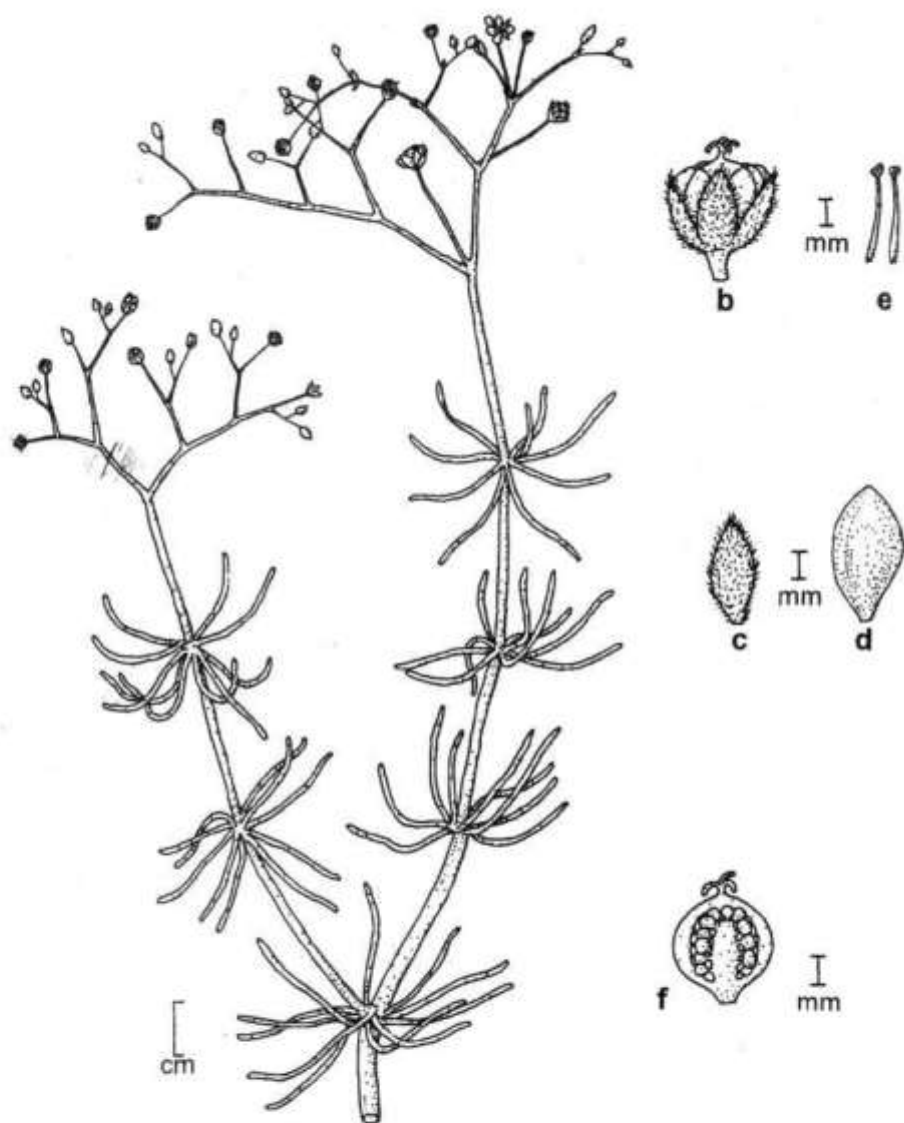


Fig. 118. *Vaccaria pyramidata* Medikus : a. flowering shoot; b. calyx; c. petal; d. stamens and pistil; e. pistil; f. seed.

teifolia Bocq. & Chater, *S. julaensis* Grierson, *S. lineae* Bocq, *S. pseudo-cashmeriana* Bocq. & Chater, *S. purii* Bocq. & Saxena and *S. vautierae* Bocq. are either from Nepal or Bhutan.

Spergula rosea Blatter (J. Asiat. Soc. Bengal n.s. 26: 340. 1930) was described from Bombay. It is excluded here due to the absence of any specimen including the type (Hallberg 19799).

Stellaria depressa Schmid, *S. gyangtsensis* F. Williams and *S. media* (L.) Villars var. *procera* Klatt & Richter have been recorded from Ladakh, Sikkim and Darjeeling respectively. Having not seen any specimens, they are excluded. *S. congestiflora* H. Hara, *S. nepalensis* Majumdar & Vartak and *S. ovatifolia* (Mizushima) Mizushima have been recorded only from Nepal.

INDEX

(Botanical Names)

- A**
- Acacia* sp. 265
- Achyranthes corymbosa* L. 549
- Agrostemma coronaria* L. 542
- fimbriatum* Wallich ex G. Don 565
- inflata* Wallich ex G. Don 573
- Alliaria* Scop. 92, 224
- officinalis* Andr. ex M. Bieb. 225
- petiolata* (M. Bieb.) Cavara & Grande 225
- Alsine prostrata* Forsskal 553
- media* L. 585
- Alsodeia* Thouars 347
- bengalensis* Wallich 348
- griffithii* Hook. f. & Thomson 348
- longiracemosa* Kurz 350
- macrophylla* Decne 351
- racemosa* Hook. f. & Thomson 350
- roxburghii* Hook. f. & Thomson 348
- wallichiana* Hook. f. & Thomson 348
- zeylanica* (Arn.) Thwaites 348
- Alyssum* L. 89, 93
- canescens* DC. 99
- cochlearioides* Roth 191
- desertorum* Stapf 93
- minimum* auct. non L. 93
- Alytostylis* Hook. f. 332
- Anastatica syriaca* L. 172
- Anavinga lanceolata* Lam. 397
- Aphragmus* Andr. ex DC. 92, 225
- oxycarpus* (Hook. f. & Thomson) Jafri 225
- var. *oxycarpus* 226
- var. *stenocarpa* (O. Schulz) G. C. Das 226
- Arabidopsis* Heynh. 92, 226
- himalaica* (Edgew.) O. Schulz 227
- lasiocarpa* O. Schulz 227, 228
- mollissima* auct. non N. Busch 103
- mollissima* (C. Meyer) N. Busch 227, 228
- nuda* (Bel. ex Boiss.) Bornm. 123
- pumila* (Stephan) N. Busch 227, 228
- russelliana* Jafri 227, 229
- stricta* (Cambess.) N. Busch 227, 229, 230
- taraxacifolia* (T. Anderson) Jafri 227, 231
- thaliana* (L.) Heynh. 227, 231
- wallichii* (Hook. f. & Thomson) N. Busch 227, 232
- Arabis* L. 90, 99
- alpina* auct. non L. 103
- aticola* O. Schulz 100
- amplexicaulis* Edgew. 100
- auriculata* auct. non Lam. 103
- auriculata* Lam. 101
- bijuga* G. Watt 100, 101
- glabra* (L.) Bernh. 133
- glandulosa* Karelin & Kir. 122
- himalaica* Edgew. 227
- montbretiana* Boiss. 101
- nova* Vill. 100, 101, 102
- nuda* Bel. ex Boiss. 123
- nudicaulis* (L.) DC. 223
- pangiensis* G. Watt 100, 101
- pangiensis* O. Schulz 101
- petiolata* M. Bieb. 225
- pterosperma* Edgew. 100, 103, 104
- recta* Vill. 100, 103
- saxicola* Edgew. 100, 105
- var. *elatior* (O. Schulz) Jafri 105
- var. *saxicola* 105
- scapigera* Boiss. 123
- scaposa* O. Schulz 105
- var. *elatior* O. Schulz 105
- taraxacifolia* T. Anderson 231
- tenuirostris* O. Schulz 100, 105
- thaliana* L. 231
- tibetica* Hook. f. & Thomson 100, 106
- thomsonii* Hook. f. 106
- Arcyosperma* O. Schulz 92, 232
- primulifolium* (Thomson) O. Schulz 232, 233
- Arenaria* L. 503, 504
- benthamii* Edgew. 509
- bhutanica* Majumdar & Babu 509

- blinkworthii* J. Mc Neill 509
bryophylla Fernald 505, 506
cerastiiformis F. Williams 513
ciliolata Edgew. 505, 506
 var. *ciliolata* 506
 var. *pendula* Duthie ex F. Williams 506, 507
compressa J. Mc Neill 505, 507
curvifolia Majumdar 505, 507, 508
debilis Hook.f. 504, 509
densissima Wallich ex Edgew. & Hook.f. 505, 509
depauperata (Edgew.) H. Hara 505, 509
edgeworthiana Majumdar 505, 510
ferruginea Duthie ex F. Williams 505, 510
festucoides Royle 505, 511
foliosa Edgew. & Hook.f. 547
glanduligera Edgew. 505, 511
glandulosa (Benth. ex D. Don) F. Williams 509
globiflora (Fenzl) Edgew. & Hook.f. 593
griffithii Boiss. 505, 512
holosteoides (C. Meyer) Edgew. 540
juniperina Villars 509
kansuensis Maxim. 505, 512
kashmirica Edgew. 547
littledalei Hemsley 505, 512
ludlowii H. Hara 593
melanandra (Maxim.) Mattf. ex Hand - Mazz. 593
melandryiformis F. Williams 504, 513
melandryoides Edgew. 513
monticola Edgew. 510
mukerjeeana (Majumdar) H. Hara 593
musciiformis Wallich ex Edgew. & Hook.f. 506
neelgherrensis Wight & Arn. 506, 513
orbiculata Royle ex Edgew. & Hook.f. 514
oroophila Hook.f. 505, 506, 514
paramelanandra H. Hara 593
polytrichoides Edgew. 505, 515
pulvinata Edgew. 505, 515
ramellata F. Williams 506
roseiflora Sprague 593
rubra L. 580
serpyllifolia L. 505, 515, 516
stracheyi Edgew. 505, 517
tenera (Boiss.) Edgew. 540
thangoensis W. Smith 505, 517, 518
trichotoma Royle ex Edgew. & Hook.f. 507
Argemone L. 2
leiocarpa E. Greene 3
mexicana L. 2
 forma *leiocarpa* (E. Greene) Ownbey 2, 3
 forma *mexicana* 3, 4
ochroleuca Sweet 2, 5, 6
subfusiformis Ownbey 2, 5
Asteriastigma Beddome 417
macrocarpa Beddome 421
Atelanthera Hook.f. & Thomson 91, 176
pentandra Jafri 178
perpusilla Hook.f. & Thomson 178
- B**
- Barbarea* R. Br. 89, 106
elata Hook.f. & Thomson 107
intermedia Boreau 106, 107
sicula Presl 107
taurica DC. 107
vulgaris R. Br. 107
 var. *sicula* Hook.f. & T. Anderson 107
 var. *taurica* Hook.f. & T. Anderson 107
Behen vulgaris Moench 577
Bennettiodendron Merr. 387, 388
 leprosipes (Clos) Merr. 338
Bennettia longipes Oliver 388
Bergsima javanica Blume 426, 427
BIXACEAE 380
Bixa L. 380
 orellana L. 381, 382
Blackwellia ceylanica Gardner 410
napaulense DC. 413
tomentosa Vent. 414
Bombax religiosum L. 383
Bouchea marrubifolia 317
Brachystemma D. Don 503, 519
 calycinum D. Don 519, 520
BRASSICACEAE 88
 Tribe *Alyseae* Grenier & Fordon 89, 93
 Tribe *Arabideae* DC. 89
 Tribe *Brassicaceae* Hayek 89, 90

- Tribe Drabeae O.Schulz 89, 91
 Tribe Euclidean DC. 89, 91
 Tribe Hesperideae Prantl 89, 91
 Tribe Lepidieae DC. 89, 91
 Tribe Matthioleae O. Schulz 89, 92
 Tribe Sisymbriaceae DC. 89, 92
- Brassica** L. 90, 133
alba (L.) Rabenh. 149
campestris L. 138
 subsp. *rapa* (L.) Hook.f. & T.Anderson 138
 var. *napus* (L.) Hook.f. & T.Anderson 135
eruca L. 143
erucoides Roxb. 143
griffithii Hook.f. & Thomson 142
juncea (L.) Czern. 134
muralis (L.) Huds. 143
napus L. 134, 135
 subsp. *napobrassica* (L.) Jafri 135
 subsp. *napus* 135
 var. *quadrialvis* (Hook.f. & Thomson)
 O.Schulz 135
 var. *trilocularis* (Roxb.) O.Schulz 136
nigra (L.) Koch 134, 136
oleracea L. 134, 136
 var. *botrytis* L. 137
 var. *capitata* L. 137
 var. *gemmifera* Zenker 137
 var. *gongyloides* L. 137
 var. *napobrassica* L. 135
quadrialvis Hook.f. & Thomson 135
rapa L. 134, 138
 subsp. *campestris* (L.) Clapham 138, 139
 subsp. *rapa* 138
 var. *campestris* (L.) Peterm. 138
stocksii Hook.f. & Thomson 140
tournefortii Gouan 134, 140
trilocularis (Roxb.) Hook.f. & Thomson 136
- Braya** Sternb. & Hoppe 92, 234
alpina auct. non Sternb. & Hoppe 225, 235
oxycarpa Hook.f. & Thomson 225
 var. *stenocarpa* O.Schulz 226
rosea (Turcz.) Bunge 234
thomsonii Hook.f. 234, 235
tibetica Hook.f. & Thomson 234, 235
uniflora Hook.f. & Thomson 188
- Bryomorpha** *rupifraga* Karelín & Kir. 592
- Bunias** *tatarica* Willd. 173
- C**
- Cadaba** Forsskal 249
fruticosa (L.) Druce 249, 250
indica Lam. 250
trifoliata (Roxb.) Wight & Arn. 249, 251
- Camelina** Crantz 92, 236
sativa (L.) Crantz 236
- CAPPARACEAE** 248, 315
- Capparis** L. 249, 252
- Capparis* sp. Hook. f. & Thomson 292, 294
acutifolia Sweet 254, 255, 258
 subsp. *acutifolia* 256
 subsp. *bodinieri* (A.Leveille) Jacobs 256
 subsp. *sabiaeifolia* (Hook.f. & Thomson)
 Jacobs 256, 257
 subsp. *viminea* Jacobs 256, 257
assamica Hook. f. & Thomson 254, 258, 259
andamanica King 271
apetala Roth 329
aphylla Roth 265
assamica Hook.f. & Thomson 254, 258
baducca auct non L. 285, 287
bodinieri A.Leveille 255, 256
brevispina DC. 253, 260, 261, 281, 299
cantonensis 260
cantonensis Lour. 254, 260
cataphylla Jacobs 263
cathcartii Hemsley ex Gamble 292
cinerea Jacobs 255, 262
cleghornii Dunn 255, 263, 264, 279
decidua (Forsskal) Edgew. 253, 265
divaricata Lam. 253, 266, 267, 269, 287, 289
diversifolia Wight & Arn. 255, 267, 268
flavicans Kurz 253, 269
flavicans Hook.f. & Thomson 269
floribunda Wight 254, 270, 271
fusifera Dunn 255, 271, 272, 292
galeata Presen. 295
glauca Wallich ex Hook.f. & Thomson 289, 290
grandiflora Hook.f. & Thomson 254, 273, 289
grandis L. f. 254, 274
heyneana Wallich ex Wight & Arn. 285
himalayensis Jafri 296
horrida L.f. 298

- incanescens* DC. 289
leucophylla DC. 296
longispina Hook.f. & Thomson 287
loranthifolia Lindley 267
oblongifolia Forsskal 331
orbiculata Hook.f. & Thomson 287
magna Lour. 324
membranifolia Kurz 255, 257
micracantha DC. 254, 275, 276, 299
moonii Wight 254, 277, 278, 279, 299
multiflora Hook.f. & Thomson 254, 280
nilgiriensis Subbarao, Kumari & Chandras. 253, 281, 282
olacifolia Hook.f. & Thomson 254, 283
pachyphylla Jacobs 254, 283, 284
parviflora sensu Beddome 271
parviflora Boiss. 292
parviflora Hook.f. & Thomson 290, 292
pedunculosa Wallich ex Wight & Arn. 287
pyrifolia Lam. 299
pyrifolia Wight & Arn. 273
pumila Benth. 260
rheedei DC. 253, 285, 286
rheedii 285
rotundifolia Rottler 255, 287
roxburghii auct. non DC. 263
roxburghii DC. 255, 274, 279, 288
roydsiaefolia Kurz 275
sabiaeifolia Hook.f. & Thomson 255, 256
sepiaria L. 255, 274, 289, 331
 var. *incanescens* (DC.) Hook.f. & Thomson 289
shevaroyensis Sund.-Ragh. 255, 290, 291
sikkimensis Kurz 254, 292, 293, 294
 subsp. *sikkimensis* 294
spinosa L. 254, 294
 var. *galeata* (Fresen.) Hook.f. & Thomson 294, 295
 var. *himalayensis* (Jafri) Jacobs 294, 295, 296
 var. *leucophylla* sensu Hook.f. & Thomson 296
 var. *spinosa* 295, 296
srilankensis Sund.-Ragh. 281
stylosa DC. 266
tenera Dalz. 254, 258, 297
tomentella Dunn 271, 292
viminea auct. non Oliver 255, 257
viminea Oliver 258
viminea Hook. f. & Thomson 258
zeylanica auct. non L. 260
zeylanica L. 254, 298, 299
Capsella Medikus 92, 189
bursa-pastoris (L.) Medikus 189
elliptica C.Meyer 195
thomsonii Hook.f. & T.Anderson 193
Cardamine L. 90, 108
africana L. 108, 109
circaeoides Hook.f. & Thomson 108, 109
elegantula Hook.f. & Thomson 109, 110
flexuosa Withering 109, 110, 111
griffithii Hook.f. & Thomson 109, 112
hirsuta L. 109, 112, 113
 var. *oxycarpa* Hook.f. & T.Anderson 118
 var. *sylvatica* auct. non Link 110
 var. *sylvatica* (Link) Hook.f. & T.Anderson 112
impatiens L. 109, 114
inayatii O.Schulz 118
loxostemonoides O.Schulz 109, 114
macrophylla Willd. 109, 115, 116
 subsp. *polyphylla* (D.Don) O.Schulz 115
nudicaulis L. 223
polyphylla D. Don 115
pratensis auct. non L. 114
 forma *luxuriana* Jafri 114
scoriarum W. Smith 108, 115
scutata Thunb.
 subsp. *flexuosa* (Withering) Hara 110
sikkimensis Hara 118
smithiana Biswas 115
subumbellata Hook. f. & T. Anderson 117
trichocarpa Hochst. ex A.Rich. 109, 117
trifoliolata Hook.f. & Thomson 108, 117
violacea (D.Don) Hook.f. & Thomson 108, 117
yunnanensis Franchet 109, 118
Cardaria Desv. 91, 190
 chalepense (L.) Hand.-Mazz. 190
CARYOPHYLLACEAE 502
Casearia Jacq. 387, 389
 andamanica King 391, 392
 bourdillonii N.Mukherjee 391, 396, 400, 401

- championii* Thwaites 390, 391, 393, 400, 401
coriacea Thwaites 397
elliptica Willd. 397
esculenta auct. non Roxb. 391
esculenta Roxb. 394, 397, 399, 400
fuliginosa (Blanco) Blanco 395
glomerata Roxb. ex DC. 390, 393, 394
graveolens Dalz. 390, 394
grewiaefolia Vent.
 var. *deglabrata* Koord. & Val. 394
 var. *gelonoides* (Blume) Sleumer 390, 394
 var. *insularis* (Vasud. & T.Chakrab.)
 T.Chakrab. & Gang. 395
hexagona Decne
 var. *gelonoides* Blume 394
insularis Vasud. & T. Chakrab. 395
kurzii C.B.Clark 390, 393, 394, 396
lanceolata Miq. 397
leucolepis Turcz. 395
rubens Dalz. 390, 396, 397, 401
 var. *gamblei* N. Mukherjee 396
sikkimensis N. Mukherjee 394
thwaitesii Briq. 390, 397
tomentosa Roxb. 390, 397
vareca Roxb. 390, 398
varians Thwaites 400
varians Beddome 400
wynadensis Beddome 390, 399
zeylanica (Gaertner) Thwaites 390, 399, 400
Cathcartia Hook.f. 10
 lyrata Prain 19
 villosa Hook. 25
Celastraceae 424
Cerastium L. 503, 519
 alpinum L. 521
 aquaticum L. 548
 cerastoides (L.) Britton 519, 521, 522
 dahuricum Fischer 521, 523
 fontanum Baumg. 521
 subsp. *grandiflorum* (Buch.-Ham.)
 ex D.Don) H.Hara 593
 subsp. *triviale* (Link) Jalas 523
 glomeratum Thuill. 521, 523
 indicum Wight & Arn. 521, 524
 thomsonii Hook.f. 521, 524
 trigynum Villars 521
 triviale Link 523
 vulgatum auct. non L. 523
 vulgatum L.
 var. *glomeratum* (Thuill.) Edgew. & Hook.f.
 523
 var. *triviale* (Link) Edgew. & Hook.f. 523
Cheiranthus L. 91, 178
 albiflorus T.Anderson 127
 cheiri L. 178
 himalayensis Cambess. 119
 incanus L. 219
 parryoides Hook.f. & T.Anderson 127
 stewartii T.Anderson 121
 tristis L. 221
Cherleria juniperina D.Don 509
 sedoides L. 547
Chilmoria pentandra Buch.-Ham. 422
Chorispora R.Br. ex DC. 92, 214
 bungeana Fischer & Meyer 215
 elegans Cambess. 216
 var. *sabulosa* (Cambess.) O.Schulz 216
 macropoda Trautv. 215
 sabulosa Cambess. 215, 216
 var. *eglandulosa* Naray. ex Naithani &
 Uniyal 216
 var. *sabulosa* 216
 sibirica (L.) DC. 214, 217
 tenella (Pallas) DC. 214, 217
Christolea Cambess. 90, 118
 albiflora (T.Anderson) Jafri 127
 crassifolia Cambess. 119
 himalaicus Hook.f. & Thomson 119
 himalayensis (Cambess.) Jafri 119
 lanuginosa (Hook.f. & Thomson) Ovcz. 120
 parkeri (O.Schulz) Jafri 119, 120
 pumila (Kurz) Jafri 119, 121
 scaposa Jafri 119, 121
 stewartii (T.Anderson) Jafri 119, 121
Cleome L. 249, 299, 300, 326
 angustifolia Forsskal 300, 301, 302
 ariana Hedge & Lammond 300, 302
 aspera Koenig ex DC. 300, 301, 303, 313
 asperima Blatter 314, 315
 brachycarpa Vahl ex DC. 317
 var. *glauca* Blatter & Hallberg 316
 var. *longipetiolata* Sabnis 316

- burmannii* Wight & Arn. 300, 301, 304, 305, 313
chelidonii L.f. 300, 302, 306, 307, 308
dolichostyla Jafri 309
felina L.f. 300, 302, 308
fimbriata Vicary 300, 301, 308, 309
fruticosa L. 250
gynandra L. 300, 301, 309, 312, 320
 var. *gynandra* 310, 311
 var. *nana* (Blatter & Hallberg)
 Bhandari 300, 310
hassieriana Chodat 300, 316, 320
heptaphylla L. 320
houtteana Schlecht. 320
monophylla L. 300, 301, 312, 313
ornithopodioides Forsskal 317
ornithopodioides L. 317
papillosa Steudel 314
parviflora R. Br. 317
quinquenervia DC. 309
quinquenervia sensu Hook.f. & Thomson 308
rutidosperma DC. 300, 301, 304, 313
scaposa DC. 300, 301, 314
simplicifolia (Cambess.) Hook.f. & Thomson
 300, 301, 314, 315
speciosa Raf. 300, 301, 316, 321
spinosa Jacq. 321
tenella L.f. 302
vahlia Fresen. 300, 302, 316, 317
 var. *glauca* Blatter & Hallberg 317
 var. *longipetiolata* 317
viscosa L. 300, 302, 317
 var. *nagarjunakondensis* Sund.-Ragh. 300,
 318, 319
 var. *viscosa* 318, 320
Chypeola maritima L. 98
Cochlearia L. 92, 190
cochlearioides (Roth) Santapau & Maheshw.
 191
flava Roxb. ex Hook.f. & T.Anderson 191
himalaica Hook.f. & Thomson 191
hobsonii Pearson 241
scapiflora Hook.f. & Thomson 126
Cochlospermum Kunth ex DC. 380, 383
gossypium DC. 383
religiosum (L.) Alston 383, 384
Conringia Fabr. 90, 140
 planisiliqua Fischer & Meyer 140
Coronopus Zinn. 91, 191
 didymus (L.) Smith 192
Corydalis DC. 35, 36
 adiantifolia Hook.f. & Thomson 37, 40
 var. *adiantifolia* 40
 var. *heterocarpa* Jafri 40
 alpestris C. Meyer 36, 41
 astragalina Hook.f. & Thomson 73
 borii C.Fischer 37, 41
 boweri Hemsley 39, 42
 cashmeriana Royle 36, 42, 43
 var. *ecristata* Prain 42
 casimiriana Duthie & Prain 38, 43, 71
 cavei D.Long 38, 44
 crispa Prain 38
 chaerophylla DC. 37, 44, 59
 var. *geraniifolia* (Hook.f. & Thomson)
 Hara 57
 changuensis D.Long 38, 45
 clarkei Prain 37, 46
 cornuta Royle 39, 46, 47, 73
 crassifolia Royle 36, 48, 49
 crassissima Cambess. 49
 crispa Prain 38, 44, 49
 crithimifolia Royle 37, 49
 denticulato-bracteata Fedde 62
 diphylla Wallich 36, 50, 51
 dorjii D. Long 36, 52
 drepanantha D.Long 38, 52
 dubia Prain 39, 53
 duthiei Maxim. 39, 53
 var. *sikkimensis* Prain 71
 ecristata (Prain) D.Long 42
 var. *longicalcarata* D.Long 42, 43
 elegans Hook.f. & Thomson 39, 53
 elegans sensu Hook.f. 46
 falconeri Hook.f. & Thomson 38, 53
 filicina Prain 38, 39, 55
 filiformis Royle 38, 55, 71
 flabellata Edgew. 37, 56
 flaccida Hook.f. & Thomson 36, 56
 gerdae Fedde 64
 geraniifolia Hook.f. & Thomson 37, 57, 58
 gortschakovii auct. non Schrenk 75

- gortschakovii Schrenk 39, 59
 govaniiana Wallich 37, 60, 61
graminea Prain 69
hendersonii Hemsley 37, 60
hookeri Prain 39, 62
juncea Wallich 37, 63
laelia Prain 38, 63
lathyroides Prain 37, 64
latifolia Hook.f. & Thomson 36, 64
leptocarpa Hook.f. & Thomson 36, 65
longipes auct. non DC. 55, 70
 var. *burkilli* 70
 var. *phallutiana* 70
 var. *smithii* 70
longipes DC. 71
meifolia Wallich 39, 66
 var. *sikkimensis* Prain 66
 var. *violacea* Prain 66
moorcroftiana Wallich ex Hook.f. & Thomson
 49, 59
mucronifera Maxim. 38, 66
nana Royle 36, 67
 var. *jacquemontii* Fedde 73
oligantha Ludlow 36, 67
ophiocarpa Hook.f. & Thomson 37, 68
pakistanica Jafri 40, 68, 71
polygalina Hook.f. & Thomson 38, 69
prainiana Kanodia & Mukerjee 43
pseudocrithimifolia Jafri 37, 70
pseudolongipes Liden 39, 70, 71
ramosa Hook.f. & Thomson 67
 var. *nana* Hook.f. 67
 var. *vaginans* Hook.f. 76
rutaefolia 50
rutifolia auct. non Sibth. & Smith 50
shakya Liden 37, 71
sibirica auct. non (L.f.) Persoon 43, 70
sikkimensis (Prain) Fedde 39, 71
stacheyoides Fedde 49
stewartii Fedde 38, 72
stracheyi Prain 39, 73
stricta DC. 37, 73
tibetica Hook.f. & Thomson 37, 74
thyrsiflora Prain 39, 71, 75
trifoliata Franchet 36
trifoliolata auct. plur. 75
vaginans Royle 39, 76
Crambe L. 90, 141
cordifolia Steven
 subsp. *kotschyana* (Bolss.) Jafri 141
 var. *cordifolia* 142
 var. *kotschyana* (Boiss.) O.Schulz 141
kotschyana Boiss. 141
Crataeva 321
Crateva L. 249, 321
adansonii DC.
 subsp. *odora* (Buch.-Ham.) Jacobs 322, 323
lophosperma Kurz 324
magna (Lour.) DC. 322, 323, 324
nurvala Buch.-Ham. 324
nurvala sensu Blatter 322
odora Buch.-Ham. 322, 324
religiosa auct. non Forster f. 324
religiosa Forster f. 322, 325, 326
 var. *nurvala* (Buch.-Ham.) Hook.f. &
 Thomson 324
 var. *roxburghii* (R.Br.) Hook.f. &
 Thomson 322
religiosa sensu Dunn 323
roxburghii R.Br. 322, 323, 324, 326
unilocularis Buch.-Ham. 322, 323, 325
Croton congestum Lour. 434
Cucubalus L. 502, 504, 525, 526
 baccifer L. 525
 viscosus L. 577
Cuscuta 310
D
Dactylicapnos macrocapnos (Prain) Hutch. 78
roylei (Hook.f. & Thomson) Hutch. 79
thalictrifolia Wallich 79
torulosa (Hook.f. & Thomson) Hutch. 81
Descourainia Webb & Berth. 92, 236
sophia (L.) Webb ex Prantl 237, 238
Dianthus L. 504, 525, 548
 anatolicus Boiss. 527
 angulatus Royle ex Benth. 532
 barbatus L. 527
 cachemicus Edgew. 527, 528
 caryophyllus L. 527, 528
 chinensis L. 527, 528, 529
 var. *aspera* Koch 593

- crinitus* Smith 527, 530
deitoides L. 527, 530
falconeri Edgew. 527, 531
fimbriatus M. Bieb. 531
jacquemontii Edgew. 527, 531
orientalis Adams 527, 531
 var. *angulatus* (Royle ex Benth.)
 Majumdar 532
 var. *orientalis* 532
olumarius L. 527
seguierii Villars 528
Dicentra *Bernhardi* 35, 77
grandifoliolata Merrill 79
macrocapnos Prain 78
paucinervia K.Stern 77, 78, 79
roylei Hook.f. & Thomson 77, 79
scandens auct. non (D.Don) Walp. 78
scandens (D.Don) Walp. 77, 79, 80, 82
thalictrifolia (Wallich) Hook.f. & Thomson
torulosa Hook.f. & Thomson 77, 81
ventii Khanh 78, 82
Dicranostigma Hook.f. & Thomson 1, 7
 lactuoides Hook.f. & Thomson 7
Dielytra *scandens* D.Don 79
Dilophila Thomson 91, 192
 salsa Thomson 193, 194
Diploaxis DC. 90, 142
 griffithii (Hook.f. & Thomson) Boiss. 142
 muralis (L.) DC. 142, 143
Dipterygium Deesne 249, 326
 glaucum Deesne 327, 328
Dontostemon Andr. ex Ledeb. 90, 122
 glandulosus (Karelitš & Kir.) O.Schulz 122
 pectinatus (DC.) Ledeb. 122, 123
Draba L. 91, 151
 alpina auct. non L. 153, 159, 164, 166
 var. *korschinskyi* O. Fedtsch. 161
 altaica (C.Meyer) Bunge 152, 153
 afghanica Boiss. 152, 153
 var. *rostrata* (Pohle) O.Schulz 153
 amoena O.Schulz 152, 154
 aubrietoides Jafri 152, 154
 cachemirica Gandoger 151, 155
 cholaensis W.Smith 152, 155
 var. *leiocarpa* Hara 155
 dasyastra O.Schulz 153, 156
 elata auct. non Hook.f. & Thomson 166
 elata Hook.f. & Thomson 152, 156
 ellipsoidea Hook.f. & Thomson 152, 157
 eriopoda Turcz. 152, 157
 falconeri O.Schulz 153, 158
 fladritzensis var. *homotricha* (Ledeb.)
 Hook.f. & T. Anderson 153
 glacialis auct. non Adams 155, 167
 glomerata Royle 152, 158
 var. *dasycarpa* O.Schulz 158
 gracillima Hook.f. & Thomson 152, 159, 160
 humillima O.Schulz 151, 159
 incana auct. non L. 161, 162
 incompacta auct. non Steven 170
 korschinskyi (O.Fedtsch.) Pohle 151, 161
 lanceolata Royle 152, 161
 var. *leiocarpa* O.Schulz 161
 lasiophylla auct. non Royle 158, 163, 168
 lasiophylla Royle 152, 161
 linearis auct. non Boiss. 168
 ludlowiana Jafri 153, 162
 melanopus Komarov 152, 162
 muralis auct. non L. 163
 nemorosa L. 152, 163
 nubigena O.Schulz 161
 oariocarpa O.Schulz 153, 163
 obscura Dunn 241
 olgae Regel & Schmalh. 152, 164
 oreades Schrenk 152, 164, 165
 polyphylla O.Schulz 152, 166
 pyriformis Pohle 167
 radicans Royle 152, 166
 rosea Turcz. 234
 rostrata Pohle 153
 rupestris R.Br. var. *altaica* C.Meyer 153
 setosa Royle 151, 167
 sikkimensis (Hook.f. & Thomson)
 Pohle 153, 167
 stenobotrys Gilg & O.Schulz 153, 168
 var. *leiocarpa* O.Schulz 168
 stenocarpa Hook.f. & Thomson 152, 168
 tenerrima O.Schulz 151, 169
 var. *trichocarpa* O.Schulz 169
 tibetica Hook.f. & Thomson 152, 169
 var. *duthiei* O.Schulz 169
 var. *thomsonii* Hook.f. & T. Anderson 169

- var. *sikkimensis* Hook.f. & Thomson 167
 var. *winterbottomii* Hook.f. & Thomson 158, 170
trinervis O.Schulz 151, 170
verna L. 171
wahlenbergii Schur.
 var. *homotricha* Ledeb. 153
wardii W.Smith 159
winterbottomii (Hook.f. & Thomson) Pohle 153, 170
Drabopsis C.Koch 89, 123
verna C.Koch 123
Drymaria Schultes 503, 532
cordata sensu Edgew. & Hook.f. 533
diandra Blume 532, 533, 534
villosa Cham. & Schlecht. 533
Drypetes longifolia (Blume) Pax & Hoffm. 423

E

- Erophila* DC. 91, 171
tenerrima (O.Schulz) Jafri 169
verna (L.) Besser 171
vulgaris DC. 171
Epirixanthes Blume 451
elongata Blume 451, 452
Ermania albiflora (T.Anderson) O.Schulz 127
himalayensis (Cambess.) O.Schulz 119
koelzii O.Schulz 121
parkeri O.Schulz 120
scaposa (Jafri) Botsch. 121
stewartii (T.Anderson) O.Schulz 121
Eruca Miller 90, 143
sativa Miller 143
vesicaria (L.) Cav. var. *sativa* (Miller) Thell. 143
Erysimum L. 91, 178
aitchisonii O.Schulz 179
alliaria L. 225
altaicum C. Meyer 179, 180, 181
barbaraea L. 107
bhutanicum W.Smith 182
bicornis Aiton 221
cachemicum O.Schulz 179, 180
deflexum Hook.f. & Thomson 179, 180
funiculosum Hook.f. & Thomson 179, 182
hieraciifolium L. 179, 182, 183

- longisiliquum* Hook.f. & Thomson 179, 182
melicentae Dunn 179, 184
odoratum auct. non Ehrh. 184
officinale L. 244
pachycarpum Hook.f. & Thomson 179, 184
parkeri O.Schulz 184
planisiliquum (Fischer & Meyer) Steudel 140
repandum L. 179, 184
strictum Gaertner f. 182
thomsonii Hook.f. 179, 185
violaceum D. Don 117
Eschscholtzia Cham. 1, 8
californica Cham. 8, 9
Euclidium R.Br. 91, 172
syriacum (L.) R.Br. 172
tartaricum (Willd.) DC. 173
tenuissimum (Pallas) O.Fedtsch. 172, 173
Eutrema primulifolium (Thomson) Hook.f. & Thomson 232
septigerum Bunge 213

F

- Farsetia* Turra 89, 94
aegyptiaca auct. non Turra 97
edgeworthii Hook.f. & Thomson 97
hamiltonii Royle 94, 95
heliophila Bunge ex Cosson 94, 96
jacquemontii Hook.f. & Thomson 94, 95, 96
 subsp. *edgeworthii* (Hook.f. & Thomson) Jafri 97
 subsp. *jacquemontii* 97
macrantha Blatter & Hallberg 94, 97
 FLACOURTIACEAE 386, 387
Flacourtia L'Herit. 387, 401
cataphracta Roxb. ex Willd. 403
helferi Gamble 401, 402
indica (Burm.f.) Merr. 401, 402, 403, 406
inermis Roxb. 387, 407
jangomas (Lour.) Raeusch. 401, 403, 404
latifolia (Hook.f. & Thomson) Cooke 401, 405, 406
montana Grahams 387, 401, 406
ramontchii L'Herit. 402, 403
 var. *latifolia* Hook.f. & Thomson 402, 405
rukkam Zoll. & Mor. 387, 407
sepiaria Roxb. 402, 403

sumatrana Planch. ex Hook.f. & Thomson 402

FRANKENIACEAE 500

Frankenia L. 500

puberulenta L. 500

FUMARIACEAE 34

Fumaria L. 35, 82

capreolata L. 83

indica (Haussk.) Pugsley 83, 84

officinalis L. 83, 84

parviflora Lam. 84

subsp. *vaillantii* (Loisel.) Hook.f. &

Thomson 84, 85

vaillantii Loisel. 83, 84, 85

var. *indica* Haussk. 84

G

Glochidion hirsutum (Roxb.) Voigt 398

Gmelina indica Burm.f. 402

Goldbachia DC. 91, 185

hispida Blatter & Hallberg 186

laevigata (M.Bieb.) DC. 185

Gooringia littedalei (Hemsley) F.Williams 512

Gouffea holosteoides C.Meyer 540

Guillenia E.Greene 92, 237

axillare (Hook.f. & Thomson) Bennet 237

duthiei (O.Schulz) Bennet 237, 239

flaccidum (O.Schulz) Bennet 237, 239

minutiflorum (Hook.f. & Thomson) Bennet

237, 240

Gynandropsis 317

brachycarpa (Vahl) DC. 316, 317

pentaphylla (L.) DC. 309

var. *nana* Blatter & Hallberg 310

speciosa (Raf.) DC. 316

Gynocardia R. Br. 388, 407

odorata R. Br. 407, 408, 421

Gypsophila L. 504, 535, 548

alpina Habl. 549

cerastioides D.Don 535, 536

sedifolia Kurz 535, 537

H

Hedina Ostenf. 91, 193

tibetica (Thomson) Ostenf. 193

Hedona ischnopetala F.Williams 542

Heliotropium rariflorum 317

Hepalosalia loeflingiae Wight & Arn. 553

Herniaria L. 503, 537

cachemiriana Gay 537, 538

hirsuta L. 537, 538

var. *incana* (Lam.) Hook.f. 538

incana Lam. 537, 538

Hesperis africana L. 186

Holosteum L. 503, 539

umbellatum L. 539

Homalium Jacq. 388, 410

bhamaense Cubbitt & Smith 411, 412

forma *glabra* 412

var. *debbarmani* Kanjilal et al. 412

ceylanicum (Gardner) Benth. 410, 412, 415

subsp. *ceylanicum* 411, 412

subsp. *minutiflorum* (Kurz) Mitra 411, 412

ciliatum N. Mukherjee 412

jainii A.N. Henry & Swamin. 410

minutiflorum Kurz 411, 412

napaulense (DC.) Benth. 413

nepalense C.B.Clarke 410, 413

schlichii Kurz 410, 414

tomentosum (Vent.) Benth. 410, 414

travancoricum Beddome 410, 415, 416

zeylanicum 410

Hutchinsia tibetica Thomson 193

Hybanthus Jacq. 342, 343

enneaspermus (L.) F. Muell. 343, 344

travancoricus (Beddome) Melchior 343, 345,

346

Hydnocarpus Gaertn. 388, 415, 417, 423

alpina Wight 417, 418, 419, 420

castanea Hook.f. & Thomson 423

kurzii (King) Warb. 409, 417, 418, 421

laurifolia (Dennst.) Sleumer 422

macrocarpa (Beddome) Warb. 418, 421

pentandra (Buch.-Ham.) Oken 417, 418, 422

sharmae P.S.N.Rao & Sreek. 424

wightiana Blume 422

Hymenolobus Nutt. ex Torrey & Gray 92, 195

procumbens (L.) Nutt. ex Torrey & Gray 195

Hypocoum L. 34, 35, 85

leptocarpum Hook.f. & Thomson 86

parviflorum Karelin & Kir. 87

pendulum L. 86, 87

var. *parviflorum* (Karelin & Kir.) Cullen 87

- var. *pendulum* 87
procumbens auct. non L. 87
procumbens L.
- I**
- Iberidella andersonii* Hook. f. & Thomson 211
Iberis L. 92, 195
 amara L. 196
 odorata L. 196
 sempervirens L. 196, 197
 umbellata L. 196, 197
 Illicebraceae 502
Ionidium suffruticosum (L.) Roemer & Schultes 343
 travancoricum Beddome 345
Isatis L. 91, 198
 costata C.Meyer 198
 tinctoria L. 198, 199, 200
- J**
- Jakkia vitellina* Blume 499
- K**
- Kohlruschia* Kunth 548
Krascheninikovia Turcz. ex Fenzl 555
heterantha Maxim. 555
- L**
- Lepidium* L. 92, 199
 africanum (Burm.f.) DC. 201
 apetalum Willd. 201, 202
 calycinum Stephan ex Willd. 246
 capitatum Hook.f. & Thomson 201, 202
 chalepense L. 190
 didymum L. 192
 divaricatum auct. non Soland. 201
 draba L.
 subsp. *chalepense* (L.) O.Schulz. 190
 latifolium L. 201, 203, 204
 subsp. *obtusum* (Basiner) Thell. 203
 var. *platycarpum* Trautv. 203
 obtusum Basiner 201, 203
 perfoliatum L. 201, 205
 pinnatifidum Ledeb. 201, 205
 procumbens L. 195
 ruderales auct. non L. 202
 ruderales L. 201, 206
 sativum L. 201, 206
 virginicum L. 201, 207, 208
Lepyrodiclis Fenzl 503, 539
 holosteoides (C.Meyer) Fischer & C. Meyer 540, 541
 tenera Boiss. 540
Leucostemma latifolia Benth. ex G.Don 584
 webbianum Benth. ex G.Don 591
Lignariella Baehni 92, 240
 duthiei Naqshi 225
 hobsonii (Pearson) Baehni 241
 subsp. *serpens* (W. Smith) Hara 241
 obscura (Dunn) Jafri 241
Lobularia Desv. 89, 98
 maritima (L.) Desv. 98
Loxostemon Hook.f. & Thomson 90, 123
 pulchellus Hook.f. & Thomson 123
Ludia spinosa Roxb. 431
Lychnis L. 504, 542
 apetala auct. non L. 565
 apetala L. var. *himalayensis* Robrb. 567
 bhutanica W.Smith 568
 brachypetala Hornem. 574
 brachypetala sensu Edgew. & Hook.f. 572
 cancellata Edgew. & Hook.f. 563
 cashmeriana Royle ex Benth. 563
 coronaria (L.) Desr. 542, 543
 cuneifolia Royle ex Benth. 573
 himalayensis (Röhrb.) Edgew. & Hook.f. 567
 indica (Roxb. ex Otth) Benth. 568
 var. *fimbriata* (Wallich ex G.Don) Edgew. & Hook.f. 565
 inflata (Wallich ex G.Don) Benth. 573
 ischnopetala (F.Williams) Majumdar 542
 macrorrhiza Royle ex Benth. 571
 multicaulis Wallich ex Benth. 572
 nigrescens Edgew. 572
 nutans Royle ex Benth. 568
 pilosa (Edgew.) Edgew. & Hook.f. 570
 pumila Royle ex Benth. 567
 stewartii Edgew. 574
- M**
- Maerua* Forsskal 249, 327
 apetala (Roth) Jacobs 329, 330

- arenaria* (DC.) Hook.f. & Thomson 331
 var. glabra 331
 var. scabra 331
oblongifolia (Forsskal) A. Rich. 265, 329, 331
Malcolmia R.Br. 91, 186
africana (L.) R.Br. 186
intermedia C.A.Mey. 186, 187
stricta Cambess. 229
strigosa Boiss. 186, 187
taraxacifolia Balbis ex Vass. 187
Matthiola R.Br. 92, 217
flavida Boiss. 218
incana (L.) R.Br. 219, 220
odoratissima auct. non (Pallas) R.Br. 219
tenera Rech.f. 221
tristis (L.) R.Br. 221
Meconopsis Viguiier 1, 10
aculeata Royle 10, 11, 12
bella Prain 11, 13
betonicifolia Franchet 11, 13
bikramii Aswal 11
chelidonifolia 20
compta Prain 19, 20
discigera Prain 10, 14, 15
horridula Hook.f. & Thomson 10, 13, 17, 18
grandis Prain 11, 16, 17
latifolia (Prain) Prain 11, 19
lyrata (Prain) Prain 11, 18, 19, 20
napaulensis DC. 11, 20, 21, 22
neglecta G.Taylor 10
nepalensis 21
nipalensis sensu Hook.f. & Thomson 21
paniculata Prain 11, 21
polygonoides Prain 19, 20
racemosa Maxim. 17
robusta Hook.f. & Thomson 11, 22, 23
simplicifolia (D.Don) Walp. 11, 22, 23
sinuata Prain 11, 24
 var. latifolia Prain 19
superba Prain 11, 25
villosa (Hook.f.) G.Taylor 10, 25, 26
wallichii Hook.f. 20
Megacarpaea DC. 91, 209
bifida Benth. 209
polyandra Benth. 209, 210
Melandrium intrusum (Wight & Arn.) Rohrb. 564
falconeri Rohrb. 565
pilosum Edgew. 567
songaricum Fischer, C.Meyer & Ave-Lall. 574
Mezoneuron cucullatum 263
Microsymbrium axillare (Hook.f. & Thomson)
 O. Schulz 237
duthiei O.Schulz 239
flaccidum O.Schulz 239
minutiflorum (Hook.f. & Thomson)
 O.Schulz 240
Minuartia L. 503, 544
biflora (L.) Schinz & Thell. 544, 545
ebracteolata Majumdar & Giri 544, 545, 546
kashmirica (Edgew.) Mattf. 544, 547
sedoides (L.) Hiern 544, 547
Mollugo tetraphylla L. 553
Moullava spicata 263
Munnicksia 423
laurifolia Dennst. 422, 423
Myagrum L. 91, 173
perfoliatum L. 173
sativum L. 236
Myosoton Moench 503, 548
aquaticum (L.) Moench. 548
N
Nasturtium R.Br. 90, 124, 128
benghalensis DC. 128
indicum auct. non (L.) DC. 129
indicum (L.) DC. 129
 var. benghalensis (DC.) Hook.f. &
 T.Anderson 128
madagascariensis DC. 129
microphyllum Boenn. ex Reichb. 124
montanum Hook.f. & Thomson 131
officinale R.Br. 124, 125
palustre (L.) DC. 131
sylvestre (L.) R.Br. 132
Neslia Desv. 91, 174
apiculata Fischer, C. Meyer &
 Ave-Lall. 174, 175
paniculata auct. non Desv. 174
paniculata (L.) Desv.
 subsp. thracica (Velent.) Bornm. 174
thracica Velent. 174
Neurotoma nudicaule (L.) DC. 223

- Niebuhria apetal* (Roth) Dunn 329
arenaria DC. 331
linearis DC. 329
- Notoceras R.Br. 92, 221
bicorne (Aiton) Amo 221
canariense R.Br. 221
hispanicum DC. 221
- O**
- Ochradenus Del. 336
baccatus Del. 337
- Odontostemma glandulosa* Benth. ex G.Don 509
- Oligomeris Cambess. 336, 337
glaucescens Cambess. 337
linifolia (Vahl) Macbr. 337
- P**
- Pangium Reinw. 388, 424
edule Reinw. 424
- PAPAVERACEAE 1
- Papaver L. 1, 27
dubium L. 28
hybridum L. 27, 28
macrostomum Boiss. 27, 29, 30
nudicaule L. 27, 31
rhoeas L. 28, 31
simplicifolium D.Don 22
somniferum L. 27, 32
- Parrya R.Br. 92, 222
chitralensis Jafri 222
exscapa Ledeb. 222, 223
lanuginosa Hook.f. & Thomson 120
macrocarpa R. Br. 223
minjanensis Rech.f. 222, 223
nudicaulis (L.) Regel 222, 223
platycarpa Hook.f. & Thomson 222, 224
pumila Kutz 121
stenocarpa Karelín & Kir.
 subsp. *gilgitica* Jafri 223
 var. *pinnatisecta* O.Schulz 223
- Pegacophyton* Hayek & Hand.-Mazz. 90, 125
minutum Hara 125
scapiflorum (Hook.f. & Thomson) Marquand 125, 126
- Pterandra caespitosa* Cambess. 592
- Pterohagia* (Scr.) Link 504, 548
- alpina* (Habl.) Ball & Heywood 549, 550
- Phaeonychium O.Schulz 90, 126
albiflorum (T.Anderson) Jafri 126, 127
parryoides (Hook.f. & T.Anderson) O.Schulz 126, 127
- Phoberos crenatus* Wight 430
roxburghii Bennett 431
- Physolychnis gonosperma* Rupr. 567
- PITTOSPORACEAE 438
- Pittosporum Banks ex Solander 438
anamallayense Nayar & Giri 439, 440
ceylanicum Wight 439, 441
dasycaulon Miq. 439, 442, 443, 449
eriocarpum Royle 439, 442
ferrugineum Aiton 439, 444
floribundum Royle 445, 446
floribundum Wight & Arn. 445, 446
glabratum auct. non Lindley 446
 var. *neriifolium* Rehder & Wilson 447
humile Hook.f. & Thomson 439, 444
neelgherrense Wight & Arn. 439, 446
napaulense (DC.) Rehder & Wilson 439, 445, 446
podocarpum Gagnepain 439, 446
 var. *angustatum* Gowda 441, 447
 var. *podocarpum* 447
tetraspermum Wight & Arn. 439, 441, 447
viridulum Nayar et al. 439, 448, 449
- Polanisia chelidoni* (L.f.) DC. 306
felina (L.f.) DC. 308
simplicifolia Cambess. 314
- Polycarpha Lam. 503, 549
aurea Wight & Arn. 551
corymbosa (L.) Lam. 549
 var. *aurea* (Wight & Arn.) Wight 551
 var. *corymbosa* 551
 var. *longipetala* Sriniv. & Narasimh. 551
diffusa Wight & Arn. 549, 552
spicata Wight & Arn. 549, 552
- Polycarpon L. 503, 552
loeflingiae (Wight & Arn.) Benth. 553
prostratum (Forsskal) Aschers. & Schwenf. 553, 554
tetraphyllum (L.) L. 553
- POLYGALACEAE 450
- Polygala L. 451, 453

- abyssinica* Fresen. 455, 456
angustifolia (Chodat) R.N.Banerjee 457
arillata D. Don 454, 457, 458
 forma *chartacea* Mukerjee 459
 forma *kachinensis* Mukerjee 470
 forma *revoluta* Mukerjee 460
 forma *sikkimensis* Mukerjee 459
 var. *arillata* 459
 var. *chartacea* (Mukerjee) Giri 459
 var. *laevicarpa* R.N.Banerjee & Giri 459
 var. *purpurascens* Clarke ex Mukerjee 459
 var. *revoluta* (Mukerjee) Giri 459, 460
arillata sensu Bennett 485
arvensis Willd. 465, 460, 461
bulbothrix Dunn 455, 462
 var. *bulbothrix* 462, 463
 var. *devicolamensis* (Mukerjee) R.N. Banerjee 462, 463
 var. *pulniensis* (Mukerjee) R.N. Banerjee 462, 463
buxiformis Hassk. 455, 463
chinensis auct. non L. 460
chinensis L. 456, 464, 465, 466
 var. *linarifolia* (Willd.) Chodat 476
 var. *linarifolia* sensu Mukerjee 460
ciliata L. 490
ciliata Wight & Arn. 462
crotalarioides Buch.-Ham. ex DC. 455, 466
 var. *glabrescens* Collett & Hemsley 466
dunnii Panigr. 472
elongata auct. non Klein 488
elongata Klein 455, 466
eriptera DC. 455, 467, 468
furcata Royle 454, 469
glomerata Lour. 464, 466
globulifera Dunn 454, 470, 471
 var. *kachinensis* (Mukerjee) R.N. Banerjee 470
 var. *globulifera* 470
heyneana Wight & Arn. 481
irregularis Boiss. 455, 472
jacobii Chandrab. 456, 472
japonica Houtt. 455, 473
javana DC. 455, 473
 var. *angustifolia* Thwaites 473
karensium Kurz 454, 474, 475
khasyana Hassk. 473
leptalea DC. 476
linarifolia Willd. 456, 476, 477
longifolia Poiret 455, 476
mariesii Hemsley 454, 478, 479
persicariaefolia 480
pericariifolia DC. 480
raoii R.N.Banerjee & L.K.Banerjee 473
ramaswamiana Mukerjee 462
 forma *devicolamensis* Mukerjee 463
 var. *pulniensis* Mukerjee 463
rosmarinifolia Wight & Arn. 456, 480
sibirica auct. non L. 473
sibirica L. 454, 481, 482
 var. *heyneana* Bennett 473
tartarinowii Regel 454, 483, 484
telephoides Willd. 455, 485
tricholopha Chodat 454, 485, 486
triphylla auct. non D.Don 483
triphylla D.Don 469
 var. *glaucescens* (Royle) Bennett 469
triphylla sensu Haines 487
umbonata Craib 454, 487
wightiana Wight & Arn. 455, 488
Prosopis spicigera 265
Pseudostellaria Pax 503, 555
 heterantha (Maxim.) Pax 555
 var. *himalaica* Ohwi 555, 556
 var. *nepalensis* (Majumdar) H.Hara 593
 sylvatica (Maxim.) Pax 593
Ptilotrichum C.Meyer 89, 98
 canescens (DC.) C.Meyer 99
Pycnophilanthus O.Schulz 91, 188
 uniflorus (Hook.f. & Thomson) O.Schulz 188

R

- Raphanus* L. 90, 144
 caudatus L. 146
 laevigatus M.Bieb. 186
 raphanistrum L. 145
 sativus L. 145
 var. *caudatus* (L.) Hook.f. & T.Anderson 146
 var. *sativus* 146
 sibiricus L. 217
 tenellus Pallas 217
 RESEDACEAE 336

- Reseda* L. 336, 338
alba L. 339
aucheri Boiss. 338, 339
linifolia Vahl 337
luteola L. 338, 340
odorata L. 339, 341
pruinosa Del. 339, 340
subulata Del. 337
Rinorea Aublet 342, 347
bengalensis (Wallich) O.Ktze 348, 349
heteroclita (Roxb.) Craib 347, 348
longiracemosa (Kurz) Craib 347, 350
macrophylla (Decsne) O.Ktze 348, 351
Rorippa Scop. 90, 107, 127, 128
benghalensis (DC.) Hara 128
dubia (Pers.) Hara 128, 129
indica (L.) Hiern 128, 129, 130
 var. *benghalensis* (DC.) Deb 128
islandica auct. non (Deder) Borbas 131
madagascariensis (DC.) Hara 128, 129
montana (Hook.f. & Thomson) Small 128, 131
nasturtium-aquaticum (L.) Hayek 125
palustris (L.) Besser 128, 131
pseudoislandica H.J.Chowdhery & R.R.Rao 131
sylvestris (L.) Besser 128, 132
Roydsia Roxb. 332
 parviflora Griffith 332
 suaveolens Roxb. 333
Ryparia Blume 426, 427
Ryparosa Blume 388, 425, 427
 caesia auct. non Blume 426
 javanica (Blume) Kurz 426
 kurzii King 426

S
Sagina L. 503, 557
 apetala Ard. 557
 japonica (Sw.) Ohwi 557, 558
 procumbens auct. non L. 558, 559
 procumbens L. 557, 558
 purii R.D.Gaur 557, 558
 saginoides (L.) Karsten 557, 559
Salomonina Lour. 451, 488
 aphylla Griffith 451
 cantoniensis Lour. 489
 var. *cantoniensis* 489
 var. *edentula* (DC.) R.N.Banerjee 489, 490
 ciliata (L.) DC. 489, 490, 491
 edentula DC. 489, 490
 oblongifolia DC. 490
Salvadora oleoides 265
Salvadora persica 265
Saponaria vaccaria L. 593
Schouwia DC. 90, 147
 arabicum (Vahl) DC. 147
 purpurea (Forsskal) Schweinf. 147, 148
Scleranthus L. 503, 559
 annuus L. 560
Scolopia Schreb. 388, 427
 acuminata Clos 428, 429, 430
 burmanica N. Mukherjee 430
 chinensis (Lour.) Clos 430, 433
 crassipes 430
 crenata auct. non (Wight) Clos 428
 crenata (Wight) Clos 428, 430
 var. *brevifolia* N. Mukherjee 430
 guertneri Thwaites 428
 gaertneri auct. non Thwaites 428
 kermodii C. Fischer 427, 430
 pusilla (Gaertn.) Willd. 428
 roxburghii (Bennett) Clos 431
 schreberi auct. non Gmelin 428
 schreberi Gmelin 428
 spinosa (Roxb.) Warb. 427, 431, 432
Securidaca L. 451, 492
 inappendiculata Hassk. 492, 493
 tavoyana Bennett 492
Senecia napaulensis DC. 445
Seneciera didyma (L.) Pers. 192
 pinnatifida DC. 192
Silene L. 504, 560
 alba (Mill.) E.H.Krause 593
 amoena L. 561, 562
 armeria L. 593
 bhutanica (W.Smith) Majumdar 568
 brachypetala Rob. & Cast. ex DC. 574
 brigitiae Bocq. 593
 caespitella F.Williams 562
 cancellata (Edgew. & Hook.f.) Majumdar 561, 563
 cashmeriana (Royle ex Benth.) Majumdar 562, 563

- chambensis* Majumdar 574
chodatii Bocq. 593
colorata Poiret 562, 564
conoidea L. 562, 564
cuneifolia J.Gmelin 573
edgeworthii Bocq. 561, 565
falconeri (Rohb.) Bocq. 561, 565
falconeriana Royle ex Benth. 561, 566
fimbriata Sims 565
fissicalyx Bocq. & Chater 593
gallica L. 562, 566
gonosperma (Rupr.) Bocq. 561, 567
 subsp. *gonosperma* 567
 subsp. *himalayensis* (Rohb.) Bocq. 567
griffithii Boiss. 577
helleboriflora Excell & Bocq. 593
himalayensis (Rohrb.) Majumdar 567
holosteifolia Bocq. & Chater 595
indica Roxb. ex Oth. 562, 568
 var. *bhutanica* (W.Smith) Bocq. 568
 var. *indica* 568
inflata Smith 573, 577
intrusa Wight & Arn. 564
julaensis Grierson 595
khasiana Rohrb. 562, 569
kumaonensis F.Williams 562, 569
kunawurensis Royle ex Benth. 561, 570
laxantha Majumdar 561, 570
linae Bocq. 595
madens Majumdar 561, 571
macrorhiza Gay & Durieu ex Lacaita 571
maheshwarii Bocq. 562
moorcroftiana Wallich ex Benth. 561, 571
multicaulis Guss. 572
nepalensis Majumdar 561, 572
nigrescens (Edgew.) Majumdar 561, 572
noctiflora L. 593
pendula L. 593
pilosa Willd. 570
pseudo-cashmeriana Bocq. & Chater 595
pumila St.Lager 567
purii Bocq. & Saxena 595
rechingeri Bocq. 561, 573
setisperma Majumdar 561, 573
songarica (Fischer, C.Meyer
 & Ave-Lall.) Bocq. 561, 574, 575
stewartii (Edgew.) Majumdar 561, 574
stracheyi Edgew. 593
tenuis Willd. 562
thomsonii Majumdar 568
vagens C.B.Clarke 562, 576
vautierae Bocq. 595
viridiflora L. 561
 forma *webbiana* (Wallich ex Benth.)
 Rohrb. 576
viscosa (L.) Pers. 561, 577
vulgaris (Moench.) Garcke 562, 577
webbiana Wallich ex Benth. 576
Sinapis L. 90, 147
 alba L. 149, 150
 erysimoides Roxb. 136
 juncea L. 134
 nigra L. 136
 trilocularis Roxb. 136
Siphonodon 424
 celastrineus Griffith 424
Sisymbrium L. 92, 242
 alhiaria (L.) Scop. 225
 altissimum L. 242
 axillare Hook.f. & Thomson 237
 amphibium L. var. *palustre* L. 131
 bhutanicum Balakr. 228
 brassiciforme C.Meyer 242, 243
 columnae Jacq. 245
 columnae auct. non Jacq. 243
 dubium Pers. 129
 foliosum Hook.f. & Thomson 229
 heteromalum C.Meyer 242, 243
 himalaicum (Edgew.) Hook.f. & Thomson 227
 humile C. Meyer 247
 indicum L. 129
 irio L. 242, 243
 irioides Boiss. 243
 lasiocarpum Hook.f. & Thomson 228
 loeselii L. 242, 244
 minutiflorum Hook.f. & Thomson 240
 mollissimum C.Meyer 228
 murale L. 143
 nasturtium-aquaticum L. 125
 nudum (Bel. ex Boiss.) Boiss. 123
 officinale (L.) Scop. 242, 244
 orientale L. 242, 245

- panicum* Jacq. 242
pectinatum DC. 123
planisiliquum (Fischer & Meyer) Hook. f. & Thomson 140
primulifolium Thomson 232
pumilum Stephan 228
sophia L. 237
strictum (Cambess.) Hook.f. & Thomson 229
sylvestre L. 132
thalianum (L.) Gay & Monnard 231
thomsonii Hook.f. 228
wallichii Hook. f. & Thomson 232
 Smelowskia C.Meyer 92, 245
 calycina (Stephan ex Willd.) C.Meyer 246
Sodada decidua Forsskal 265
Spergula L. 503, 578
 arvensis L. 578, 579
 fallax (Lowe) E.H.Krause 578, 580
 japonica Sw. 558
 rosea Blatter 595
 rubra (L.) Edgew. & Hook.f. 580
 saginoidea L. 559
Spergularia (Pers.) J.S. & C.Presl 503, 580
 fallax Lowe 578
 pentandra sensu Edgew. & Hook.f. 578
 rubra (L.) J.S. & C.Presl 580
 vernalis auct. non Willd. 578
 vernalis Willd. 580
Stellaria L. 503, 581
 aquatica (L.) Scop. 548
 biflora L. 545
 bulbosa auct. non Wulfen 555
 cerastoides L. 521
 cherleriae (Fischer ex Ser.) F.Williams 582
 congestiflora H.Hara 595
 crispata Edgew. & Hook.f. 585
 decumbens Edgew. 581, 582
 var. *acicularis* Edgew. & Hook.f. 582
 var. *decumbens* 582, 583
 var. *edgeworthii* Edgew. & Hook.f. 583
 var. *minor* Edgew. & Hook.f. 582, 583
 var. *polyantha* Edgew. & Hook.f. 582, 583
 var. *pulvinata* Edgew. & Hook.f. 582, 583
 var. *stracheyi* Edgew. & Hook.f. 583
 depauperata Edgew. 509
 depressa Schmid 595
 glauca With. 586
 graminea L. 582, 583
 gyangtsensis F.Williams 595
 himalayense 584
 himalayensis Majumdar 581, 584
 lanata Hook.f. 582, 584
 latifolia (Benth. ex G.Don) Edgew. & Hook.f. 584
 longissima Edgew. & Hook.f. 587
 media (L.) Villars 581, 585, 591
 var. *procera* Klatt & Richter 595
 micrantha Hayata 587
 monosperma D.Don 581, 585
 var. *monosperma* 586
 var. *paniculata* (Edgew.) Majumdar 586
 nepalensis Majumdar & Vartak 595
 ovatifolia (Mizushima) Mizushima 595
 palustris Retz. 582, 586
 patens D.Don 582, 587
 paniculata Edgew. 586
 reticulivena Hayata 582, 587
 saxatilis D.Don 590
 semivestita Edgew. 581, 588
 sikkimensis Hook.f. 581, 588
 subumbellata Edgew. 582, 589
 tibetica Kurz 581, 589
 uliginosa Murray 582, 589
 var. *uliginosa* 590
 var. *undulata* (Thunb.) Fenzl 590
 undulata Thunb. 590
 vestita Kurz 581, 590
 wallichiana Benth. ex Haines 581, 591
 webbiana (Benth. ex G.Don) Edgew. & Hook.f. 581, 591
Steriphoma Spreng. 248
Stylopodium lactucoides (Hook.f. & Thomson) Benth. & Hook.f. 7
Stixis Lour. 249, 332
 manipurensis Deb & Rout 332, 333
 scandens Lour. 332, 333
 suaveolens (Roxb.) Pierre 332, 333, 334
Storemeria 251

Stroemia trifoliata Roxb. 251
Subularia purpurea Forsskal 147

T

Taraktogenos Hassk. 417
kurzii King 421
macrocarpa (Beddome) Balakr. 421
Tauscheria Fischer ex DC. 91, 176
lasiocarpa Fischer ex DC. 176, 177
Thlaspi L. 92, 210
africanum Burm.f. 201
alpestre auct. non L. 213
andersonii (Hook.f. & Thomson) O.Schulz 211
arabicum Vahl 147
arvense L. 210, 211
bursa-pastoris L. 189
cardiocarpum Hook.f. & Thomson 212
cochleariforme auct. non DC. 213
 subsp. *griffithianum* (Boiss.) Jafri 213
cochlearioides Hook.f. & Thomson 211, 212
kotschyianum Boiss. & Hohen 210, 212
montanum L. 211, 213
septigerum (Bunge) Jafri 211, 213
Thylacospermum Fenzl 504, 592
caespitosum (Cambess.) Schischkin 592
rupifragum (Karelin & Kir.) Schrenk 592
Torularia (Coss.) O.Schulz 92, 246
humilis (C.Meyer) O.Schulz ex
 Limpricht 247
Tunica auct. 548
stricta (Ledeb.) Fischer & C. Meyer 549
Turritis L. 90, 132
glabra L. 133

V

Vaccaria Medikus 504, 592
pyramidata Medikus 593, 594
Vareca heteroclitia Roxb. 348
zeylanica Gaertner 399
Vella tenuissima Pallas 173
VIOLACEAE 342
Viola L. 342, 351
alba Besser 372
apetala auct. non Schmidt 365
arcuata Blume 363
arenaria DC. 373

betonicifolia J. Smith 352, 353, 355, 366
 subsp. *betonicifolia* 355
 subsp. *jaunsarensis* (W.Becker) Hara
 355, 356, 357
 subsp. *nepalensis* (Ging.) W.Becker 355
biflora auct. non L. 378
biflora L. 352, 353, 355, 379
 var. *hirsuta* 358
 var. *platyphylla* 358
bulbosa Maxim.
 subsp. *bulbosa* 359
 subsp. *tuberifera* (Franchet) W.Becker
 354, 358, 359
caespitosa D.Don 355
cameleo Boiss. 353, 359
canescens Wallich 252, 354, 359
canina L.
 var. *sylvatica* (Fries ex Hartman f.)
 Hook.f. & Thomson 376
cinerea Boiss. 360
 forma *kathiawarensis* 361
 forma *stocksii* 361
 var. *cinerea* 361
 var. *stocksii* (Boiss.) W.Becker 352,
 353, 360, 361
cinerea sensu Hook.f. & Thomson 360
diffusa Ging. 352, 354, 361
distans Wallich 363
 var. *acaulis* Hook.f. & Thomson 363
 var. *fimbriata* Hook.f. & Thomson 362, 363
enteasperma L. 343
falconeri Hook.f. & Thomson 367
fedtschenkoana W.Becker 352, 353, 361
 var. *fedtschenkoana* 362
 var. *muzaffarabadensis* W.Becker 362
glaucescens Oudem. 352, 353, 362
 var. *rubella* W.Becker 363
hamiltoniana D.Don 352, 354, 363
hediniana W.Becker 353, 359, 364
himalayensis W.Becker 374
hookeri Thomson 352, 354, 364, 365, 372, 374
hossei W.Becker 354, 365, 379
inconspicua Blume 352, 353, 365
indica W.Becker 352, 354, 366
 forma *barbata* (W.Becker) S.P.Bauerjee &
 Pramanik 366

- forma indica* 366
var. barbata W. Becker 366
jangiensis W. Becker 353, 367
jordanii Hanry
var. falconeri (Hook.f. & Thomson)
 W. Becker 354, 367
kashmiriana 357
kunawarensis Royle 352, 353, 367
var. angustifolia W. Becker 368
macroceros Bunge 352, 353, 368
moupinensis Franchet 354, 368, 370
odorata L. 352, 354, 369, 372, 376
paravaginata Hara 353, 370
patrinii sensu Hook.f. & Thomson 355, 368
patrinii DC.
var. nepalensis Ging. 355
var. suaveolens G. Watt 357
philippica Cav. 353, 370
subsp. philippica 371
subsp. munda 371
var. garhwalensis 371
pilosa Blume 352, 363, 371
pilosa Blume 354, 360, 371
placcida W. Becker 354, 372
pogonantha W. Smith 354, 372
prionantha Bunge
subsp. jaunsarensis W. Becker 357
reichenbachiana Jordan ex Boreau 354, 373
reniformis Wallich 357, 378
rupestris F.W. Schmidt 354, 373, 374
var. himalayensis (W. Becker) S.P. Banerjee
 & Pramanik 373, 374
var. rupestris 373, 374
serpens Wallich ex Ging. 371
subsp. serpens 371
subsp. garhwalensis W. Becker 371
var. canescens (Wallich) Hook.f. &
 Thomson 359
var. deltoidea W. Becker 371
var. glabra Hook.f. & Thomson 371
sikkimensis W. Becker 354, 365, 374, 375
stockii Boiss. 360
suavis M. Bieb. 354, 376
suffruticosa L. 343
sylvatica Fries ex Hartman f. 352, 354, 376
thomsonii Oudem. 354, 377
tricolor L. 352, 353, 377
tuberifera Franchet 358
wallichiana Ging. 353, 357, 378
yunnanensis W. Becker 354, 379
Vyedenskiella pumila (Kurz) Botsch. 121

X

XANTHOPHYLLACEAE 494

Xanthophyllum Roxb. 494

- andamanicum* King 494, 495, 496
angustifolium Wight 497
arnottianum Wight 497
burkillii J.R. Drumm. & Dunn 494, 495
flavescens Roxb. 494, 497
var. angustifolium (Wight) Bennett 497
var. flavescens 497, 498
virens Roxb. 497
vitellinum (Blume) Dietr. 494, 499
Xylosma G. Forst. 387, 406, 433
congestum (Lour.) Merr. 433, 434
controversum Clos 433, 434, 435
latifolium Hook. f. & Thomson 406
leprosipes Clos 388
longifolium Clos 433, 436, 437

Index

(Common names)

A

Aayiti-kura (Tel.) 310
Abhini (Tel.) 32
Abini (Tam.) 32
Adalavithulu (Tel.) 206
Adanda (Tam.) 260
Adandai (Tam.) 298
Adandi (Tel.) 298
Addamorinika (Tel.) 250
Adeli (Tel.) 206
Adi-badam (Tel.) 422
Adkyakaran (Guj.) 310
Afim (Hindi) 32
Afim (Punj.) 32
Afium (Mal.) 32
Afyum (Hindi) 32
Ahifen (Sans.) 32
Ahlya (Raj.) 206
Ajagandha (Kan.) 310
Aliverai (Tam.) 206
Amburuha (Sans.) 343
Anatto tree (Engl.) 381
Ansarisha (Beng.) 310
Anthundikai (Kan.) 298
Aphina (Guj.) 32
Aphu (Mar.) 32
Apparutakka (Mal.) 383
Arishina-boorage (Kan.) 383
Arnatto (Eng.) 381
Asalio (Hindi) 244
Asaria (Hindi) 298

Assalia (Mar.) 206
Athandi (Tam.) 266
Atichara (Sans.) 343
Atlak (Mar.) 406
Attuchankalai (Tam.) 418
Avalu (Tel.) 136
Aveen (Mal.) 32
Avyata (Sans.) 343

B

Badreni (Tel.) 266
Baduhugli (Kan.) 263
Badumungri (Kan.) 263
Bagdanch (Nep.) 298
Bagh-muta (Hindi) 445
Bagnai (Hindi) 298
Bagra (Hindi) 318
Baincha (Or.) 403
Bagro (Raj.) 318
Ban-saaphla (Beng.) 84
Banafsha (Beng., Guj. & Hindi) 369
Banafsha (Guj. & Punj.) 360
Banafsha (Hind. & Punj.) 371
Banafsha (Hindi & Punj.) 371
Bandha-gobhi (Asm., Beng., Guj. & Hindi) 137
Bandre (Nep.) 421
Banfsa (Hindi) 357
Barna (Beng. & Hindi) 323
Barna (Hindi) 324
Barosial-kanta (Beng.) 3
Barun (Asm.) 325
Barun (Beng. & Hindi) 323

- Barun (Hindi) 325
 Benarisi-rai (Beng.) 136
 Beniman (Or.) 394
 Bhagni (Asm.) 398
 Bhagri(Raj.) 310
 Bhar-bhand(Hindi) 3
 Bhat-kateya(Punj.) 3
 Bhatkani (Guj.) 250
 Bhatmil(Punj.) 3
 Bher-bhandi(Punj.) 3
 Bhumichakkarai (Tam.) 331
 Bhutmala(Asm.) 310
 Bil-rai(Beng.) 128
 Bilepatra (Kan.) 324
 Bilibu (Garo) 421
 Bir-surajmukhi (Sant.) 343
 Birma-dandu(Tam.) 3
 Blue-mustard (Eng.) 217
 Bokhada (Mar.) 394
 Bon-jhalukia (Asm.) 398
 Bonsha (Ass.) 409
 Boogri (Kan.) 442
 Borun-khosai (Asm.) 283
 Brahma-dandi(Sans.) 3
 Brahma-dandi-chettu(Tel.) 3
 Brahma-danti(Mal.) 3
 Brama-dandi(Urdu.) 3
 Broad-leaved-pepper-grass (Eng.) 203
 Buch-bucha (Hindi) 585
 Bugra (Punj.) 318
 Buraasaria (Sans.) 298
- C**
- Cabbage (Eng.) 137
 Caralu (Mal.) 430
 Cauliflower (Eng.) 137
 Chach (Kash.) 210
 Chaitrin-pazham (Mal.) 406
 Chalmugra (Man.) 421
 Chamani (Mar.) 312
 Champari (Mar.) 406
 Charal-maram (Mal.) 406
 Charalu (Tam.) 430
 Charati (Sans.) 343
 Chatri (Kash.) 210
 Chattarhak (Kash.) 210
 Chaulamugra (Beng.) 421
 Chauimoogra (Kan.) 422
 Chaulmugra (Beng.) 409
 Chavruka (Hindi & Kou.) 285
 Cheka-chumu (Nep.) 211
 Chekmadi (Tel.) 250
 Chera-kanji (Mal.) 428
 Cherru-mullikka-chedi (Mal.) 402
 Chila-pati (Nep.) 255, 256, 257
 Chilaka-duddi (Tel.) 397
 Chilla (Hindi) 394, 397
 Chimurudi (Tel.) 250
 Chiple (Nep.) 323
 Chirunda (Punj.) 436
 Chonoo (And.) 495
 Chorakazhita-chedi (Tam.) 266
 Chosa(Sans.) 32
 Chovanna-kashakhasa(Mal.) 31
 Chum-sue (Nep.) 206
 Churcha (Hindi) 397
 Churota(Hindi) 310
 Clasping-leaved pepper-grass (Eng.) 205

Common Turnip (Eng.) 138
 Common-pepper-cress (Eng.) 201
 Curled-cress (Eng.) 206

D

Dabi (Raj.) 250
 Dalmungri (Beng.) 421
 Darudi(Guj.) 3
 Debosundu (Or.) 445
 Dela (Hindi) 265
 Diangsh-sah-saw (Kh.) 258
 Dieng-Duma (Kh.) 445
 Dieng-kani (Kh.) 436
 Dieng-lo-shiring-synrang (Kh.) 446
 Dieng-mulo (Asm.) 445
 Dieng-sanyar-um (Kh.) 446
 Dieng-sia (Kh.) 283
 Dieng-sning-sning (Kh.) 256
 Dieng-soh-lap (Kh.) 421
 Dieng-soh-mara (Kh.) 414
 Dieng-soh-phailing (Kh.) 409
 Dieng-soh-tyllul (Kh.) 446
 Dieng-thyllong (Kh.) 445, 446
 Dittander (Eng.) 203
 Doda(Punj.) 32
 Dolphuli (Hindi) 549
 Drati (Kash.) 189
 Duan (Hindi) 143
 Dumra (Guj.) 274
 Dumrejohod (Guj.) 274
 Dyer's wood (Eng.) 199

E

Edging-candytuft (Eng.) 197
 Ekkathari (Tam.) 298

Elluku-sakkalathi (Tam.) 312
 Eva-gassa-gassa-la(Tel.) 31
 Eva-postakaya(Tel.) 31

F

Farangi-dhutura(Hindi) 3
 Field Penny-cress (Eng.) 211

G

Gaighura (Sant.) 460
 Gailshe(Ladakhi) 3
 Gajale (Kan.) 406
 Galgal (Hindi) 383
 Gandhuli(Hindi) 310
 Ganeri (Mar.) 383
 Ganth-gobi, (Hindi & Beng.) 137
 Gapsundi (Mar.) 442
 Garden-cress (Eng.) 206
 Garshuma (Hindi) 442
 Garsilug (Hindi) 442
 Garudaphala (Sans.) 422
 Gasagasala(Tel.) 32
 Gasalu(Tel.) 32
 Gasha-gasha(Tam.) 32
 Globe-candytuft (Eng.) 197
 Gohawa (Hindi) 143
 Golden-Silk-Cotton-Tree (Eng.) 383
 Gonyach (Ladakh) 203
 Govind-phal (Mar.) 260
 Gorjuoi-saag (Tel.) 312
 Gulcla-kebija(Urdu.) 31

H

Hade-hurhuria (Beng.) 318
 Hais (Nep.) 283

- Halim (Beng.) 206
 Halim (Hindi) 206
 Handi-bagro (Raj.) 318
 Handiphuta (Or.) 288
 Hathi-ankusa (Or.) 289
 Heens (Hindi) 289
 Hemkand (Guj.) 331
 Henu-sampigi (Kan.) 406
 Heti (Kan.) 306
 Hettari-mullu (Kan.) 402
 Higul (Punj.) 318
 Hiram-chabba (Hindi) 94
 Hulhul(Hindi) 310
 Hulhulia(Hindi) 310
 Hulikaddi-mara (Kan.) 411
 Hunkura (Sans.) 298
 Hurhura (Beng.) 312
 Hurhuria (Hindi) 316
 Hurwal (Punj.) 192
I
 Iruvalli (Tam.) 329
 Izhudhi (Tam.) 250
J
 Jaginbel (Hindi) 298
 Jamurdhi (Or.) 394
 Japhara (Tam.) 381
 Jong-sia (Garo) 325
 Jungli-mooli (Hindi) 145
 Jungliswas (Hindi) 306
K
 Kaba (Mar.) 331
 Kabia (Beng.) 296
 Kabra (Hindi) 296
 Kabra (Mar.) 296
 Kaccapatta (Mal.) 447
 Kachapatta (Mal.) 447
 Kadagatthi Tam.) 250
 Kadu-kavata (Mar.) 422
 Kadugu (Mal.) 136
 Kadugu (Tam.) 136
 Kadukattiri (Tam.) 289
 Kadukokku (Kan.) 324
 Kadusassive (Kan.) 318
 Kaduthottimara (Kan.) 331
 Kagnika (Kan.) 250
 Kakkaltee (Mar.) 287
 Kakria (Nep.) 442
 Kal-champigai (Kan.) 405
 Kala (Kan.) 411
 Kala-pinjola (Guj.) 331
 Kalaria (Hindi) 316
 Kalasakal (Mar.) 250
 Kalavri (Mar.) 296
 Kali-sarson (Hindi) 136
 Kaliakhara (Beng.) 289
 Kalipot (Nep.) 348
 Kalitaka (Mar.) 250
 Kalthamara (Mal.) 343
 Kalvari (Sind.) 296
 Kavikhima (Raj.) 310
 Kalwari (Mar.) 331
 Kandiyari(Punj.) 3
 Kanji (Tel.) 403
 Kanphuti (Kan.) 318
 Kantala (Guj.) 296
 Kantel (Mar.) 422

- Kanthar (Guj.) 289
 Kanthara (Mar.) 289
 Kanthare (Guj.) 289
 Kanthera (Guj.) 296
 Kanthodi (Mar.) 289
 Kantikapala (Or.) 289
 Kantukusam(Or.) 3
 Kaodimi (Or.) 288
 Karei (Mar.) 397
 Kari-kunnan (Mal.) 399
 Karil (Hindi) 265
 Karina (Kan.) 265
 Karipandal-chedi (Tam.) 281
 Karir (Hindi) 265
 Kariuppugida (Kan.) 265
 Karphut (Hindi) 318
 Karunali (Tam.) 497
 Karungali (Mal.) 497
 Karunkurichi (Tam.) 252
 Kasa-kasa(Tam.) 32
 Kasouli-lahara (Nep.) 333
 Kastel (Mar.) 418, 422
 Kasturi (Guj.) 316
 Kasturi (Raj.) 316
 Kata-koli (Asm.) 436
 Kata-ponial (Asm.) 436
 Katai (Hindi) 436
 Katar (Guj.) 295
 Katarlingad (Mar.) 324
 Katei(Punj.) 3
 Kathal(Punj.) 310
 Katikial (Guj.) 250
 Kattari (Hindi) 436
 Kattu-kadugu (Tam.) 129, 310
 Kattukalai (Tam.) 402
 Kattukanji (Tam.) 260
 Kattukoiya (Tam.) 274
 Kattu-sampangi (Tam.) 445
 Kavanthi (Kon.) 422
 Kedar-jowar (Mar.) 312
 Kelu-kira (Beng.) 260
 Ker (Hindi) 265
 Kera-guj (Guj.) 265
 Kerdo (Guj.) 265
 Kerail (Punj.) 296
 Keri (Punj.) 296
 Keti (Mar.) 422
 Khakasa(Sans.) 32
 Khandilal (Hindi) 578
 Khas-khas(Hindi) 32
 Khas-khas(Punj.) 32
 Khas-khashiyah(Urdu.) 31
 Khasa(Sans.) 32
 Khasakasa(Tel.) 32
 Khash-khasu-faid(Urdu.) 32
 Khasha-khasha(Mal.) 32
 Khira-mor (Raj.) 316
 Khishshash(Punj.) 32
 Khub-khala (Hindi) 244
 Khus-khus(Guj.) 32
 Khus-khus(Mar.) 32
 Kidagogu (Tel.) 383
 Kindagogu (Tel.) 383
 Kisan (Hindi) 445
 Knol-khol (Eng.) 137
 Kobased (Mar.) 422
 Kodali (Tam.) 430
 Kodali-mara (Kan.) 430

Kodhab (Hindi) 250
 Kodi (Mal.) 422
 Kodichai (Tam.) 397
 Kodumundi (Tam.) 402
 Kokra (Or.) 394, 397
 Kolisna (Mar.) 287
 Kolu-gadde (Kan.) 137
 Kotahar (Asm.) 283
 Kothi (Kan.) 289
 Koti (Mal.) 422
 Kottagovai (Tam.) 400
 Kowti (Mar.) 422
 Kral-mund (Kash.) 189
 Kuramulli (Mal.) 402
 Kudagai (Tam.) 323
 Kumbi (Hindi) 383
 Kuramullu (Mal.) 402
 Kurukkum-chedi (Tam.) 3
 Kushimavu (Kan.) 446
 Kuyimavu (Kan.) 447
 Kyadoo (And.) 348

L

Laban-kavanthi (Kon.) 430
 Lahi (Asm.) 134
 Lai (Asm.) 134
 Lakshmishreshtha-padma (Sans.) 343
 Lala (Guj.) 31
 Lalkhaskhas (Guj.) 31
 Lalposht (Beng.) 31
 Lalpost (Hindi) 31
 Lantem (Ass.) 421
 Lemtem (Ass.) 409
 Lens-podded hoary cress (Eng.) 190
 Lephra (Or.) 260

Lesser-wart cress (Eng.) 192
 Lokra (Asm.) 283
 Luck-luki (Asm.) 403
 Lukki-chettu 329
 Luthikai (Kon.) 277

M

Machechi (Hindi) 549
 Madakka (Mal.) 497
 Madhabimalati (Asm.) 333
 Madhio (Raj.) 316
 Madholata (Kh.) 333
 Madhumalati (Asm.) 333
 Mala-maravetti (Mal.) 418
 Mala-marotti (Mal.) 418
 Malaithothikai (Kan.) 263
 Malayvarinai-pooundu (Tam.) 303
 Maloone (Punj.) 192
 Mamiran (Kash.) 76
 Mamiri (Kash.) 76
 Manja-kadugu (Tam.) 318
 Manoj (Kh.) 333
 Manthala-mukki (Mal.) 411
 Manudu-kkurundu (Tam.) 252
 Maradu (Hindi) 460
 Maragacha (Kan.) 250
 Maragadhachoppu (Kan.) 250
 Maralinga (Tam.) 324
 Maravattai (Tam.) 422
 Maravetti (Mal.) 422
 Maravetti (Tam.) 422
 Marcha (Nep.) 457
 Marotti (Mal.) 422
 Matta (Lus.) 421
 Matta (Tipp.) 421

- Mattei (Tam.) 497
 Maula (Jaunsar) (Hindi) 211
 Maun (Beng.) 397
 Mavilandam (Tam.) 323
 Meda-tumra (Hindi) 442
 Menasinakare (Kan.) 312
 Mibonji (Kachari) 325
 Mochukkodi (Tam.) 331
 Mohari (Mar.) 136
 Mootaghos, Muttakhoos (Mal. & Tam.) 137
 Morolia (Asm.) 585
 Morundan (Tam.) 298
 Mota-koli (Asm.) 436
 Motio-hiran-chabbo (Raj.) 97
 Mougri (Punj.) 146
 Muchmuchia (Hindi) 578
 Mudkondai (Tam.) 274
 Mugalinga (Tel.) 323
 Mugra (Punj.) 146
 Mula (Beng.) 146
 Muli (Hindi) 146
 Mullangi (Tel., Tam., Kan., & Mal.) 146
 Mulmurandai (Tam.) 331
 Musna (Hindi) 593
 Mustard (Eng.) 136
 Muuva (Tel.) 323
- N**
- Nadi (Raj.) 316
 Naga-champigai (Kan.) 405
 Naga-sentur (Naga) 325
 Naikadugu (Tam.) 302, 318
 Naivelai (Tam.) 318
 Nakkulijam (Tam.) 274
 Nalla-velai (Tam.) 310
 Nangundai (Tam.) 445
 Narum-byale-soppu (Kan.) 310
 Naski (Nep.) 283
 Navi-karemanjahanu (Kan.) 263
 Nayibela (Kan.) 318, 406
 Neela-naikadugu (Tam.) 306
 Neelchedi (Tam.) 252
 Neervalu (Kan.) 324
 Negji (Kon.) 460
 Nelasakregadde (Kan.) 331
 Nemali-adugu (Tel.) 329
 Nilaisedachi (Tam.) 551
 Nilakobari (Tel.) 343
 Niphera (Or.) 260
 Nir-mathalam (Mal.) 324
 Niradi (Tel.) 422
 Niradi-mattu (Tam.) 422
 Niralam (Mal.) 422
 Nirvala (Kan.) 323
 Nirvetti (Mal.) 422
 Noli (Raj.) 316
 Nunbora (Beng.) 343
- O**
- Odhaperali (Tam.) 252
 Orlathamara (Mal.) 343
 Ol-gobhi (Hindi & Beng.) 137
 Orapa (Raj.) 331
 Orilai-tamarai (Tam.) 343
- P**
- Pachara (Mar.) 274
 Pachra (Mar.) 289
 Pachuda (Mar.) 289
 Pachuada (Mar.) 266

Pachundi (Mar.) 274
 Padmcharini (Sans.) 343
 Padmavaha (Sans.) 343
 Padmavati (Sans.) 343
 Pahchunda (Mar.) 289
 Pandri-tilwan(Mar.) 310
 Paniala (Beng. & Hindi) 403
 Paniol (Asm.) 403
 Parappu-chedi (Tam.) 466
 Parpapata(Ladakh) 86
 Pepper-grass (Eng.) 207
 Perennial-pepper-grass (Eng.) 203
 Periyanka (Mal.) 466
 Periyanka (Tam.) 466
 Phabare-ghans (Nep.) 469
Phackcena-lata (Asm.) 492
 Philla-phang (Kachari, Asm.) 283
 Phulgobhi (Hindi) 137
 Phutani (Mar.) 460
 Pila-dhutura(Hindi) 3
 Pilahurshur (Hindi) 318
 Pilwani (Punj.) 331
 Pinjola(Guj.) 331
 Pit-papra(Hindi) 84
 Pitpada(Mar.) 84
 Pivili-tilwan (Mar.) 318
 Ponwar (Raj.) 316
 Poorwi (Mar.) 277
 Post(Hindi) 31
 Posta(Guj.) 32
 Posta(Mar.) 32
 Postaka(Tam.) 32
 Postehij(Hindi) 32
 Postekhiya(Hindi) 31

Posto(Beng.) 32
 Potiakand (Hindi) 331
 Pula-tiga (Tel.) 269
 Purna (Tam.) 252
 Purusharatnam (Tam.) 343
 Pushkaranadi (Sans.) 343
 Pushkarini (Sans.) 343
 Pushkarna (Sans.) 343

R

Radish (Eng.) 146
 Rai (Beng. & Hindi) 134
 Rakamuti (Tel.) 445
 Rakta-posta-virkshaka(Sans.) 31
 Raichat(Ladakh) 54
 Raichatnakpo(Ladakh) 60
 Ramya (Sans.) 343
 Rangamala (Kan.) 381
 Ratanpuras (Hindi) 343
 Revdi (Kan.) 266
 Roadside-pepper-grass (Eng.) 206
 Rocket-candytuft (Eng.) 196
 Rubble-pepper-cress (Eng.) 201

S

Sabuni (Beng.) 593
 Sadahurhuria(Beng.) 310
 Safed-bagro(Raj.) 310
 Safed-phulke (Hindi) 585
 Safed-sarson (Hindi) 149
 Santal (Mar.) 312
 Sanusotti (Kan.) 418
 Sarayda (Sans.) 343
 Sarcimaram (Mal.) 430
 Sasive (Kan.) 136

Satitalwani(Guj.) 310
 Satyanasa(Punj.) 3
 Sebuwa (Hindi) 143
 Selagachedi (Tam.) 474
 Sendri (Mar.) 381
 Sengam (Tam.) 265
 Sengathali (Tam.) 266
 Serraputtai (Tam.) 289
 Shalgam (Hindi) 138
 Shepherd's purse (Eng.) 189
 Shial-kanta(Hindi) 3
 Shield-crest (Eng.) 205
 Shi-ing (Asm.) 445
 Sial-kanta(Beng.) 3
 Sial-kanta(Punj.) 3
 Sigappu-gashagasha(Tam.) 31
 Siguppu-postaka(Tam.) 31
 Sike-lulpi (Garo) 409
 Sinduriva (Hindi) 381
 Singri (Hindi) 146
 Sipligan (Nep.) 325
 Sirikaladide(Kan.) 310
 Sottukalai (Tam.) 402
 Srigala-kanta(Sans.) 3
 Srikala(Kan.) 310
 Sthalapadmini (Sans.) 343
 Sthalaruha (Sans.) 343
 Sugandhamula (Sans.) 343
 Sunari (Tam.) 447
 Supuskhara (Sans.) 343
 Suranti (Kan.) 422
 Surti (Kan.) 422
 Suryavarta(Kan.) 310
 Sweet Violet (Eng.) 369

Sweet-scented-candytufts (Eng.) 196
 Swet-sarisha (Beng.) 143

T

Taiwala(Tam.) 310
 Talwani(Guj.) 310
 Tamana (Mal.) 422
 Tambat (Mar.) 405
 Tammatha (Kan.) 445
 Tar-bor (Mar.) 406
 Taramira (Punj.) 143
 Taramoni (Beng.) 143
 Taranuri (Hindi) 143
 Taribad (Kash.) 192
 Telichemkand (Guj.) 250
 Terunai (Tam.) 430
 Thaivela(Mal.) 310
 Thanim-niu-tre (Asm.) 279
 Thikari (Guj.) 274
 Thirudi-bhaji (Tel.) 318
 Thit-phew (And.) 495
 Thorattai (Tam.) 289
 Thottala (Kan.) 266
 Thottimara (Kan.) 273
 Thungtu (Garh.) 371
 Tikthashak (Beng.) 324
 Tiloni(Kan.) 310
 Tinnani (Guj.) 318
 Tondai (Tam.) 298
 Tondi-sol (Sant.) 343
 Torathi (Kan.) 418
 Toratti (Kan.) 422
 Toratti (Mar.) 298
 Toratti (Tam.) 266, 298

Tripanjozadi (Guj.) 324

Turatta (Tam.) 274

Tuvrak (Sans.) 422

U

Ubhitaveli (Guj.) 306

Ullasata(Sans.) 32

Uskiaman (Tel.) 324

Uthou (Man.) 421

V

Vaita(Tel.) 310

Vaivarna (Mar.) 323

Vaivarna (Guj.) 324

Vaminka(Tel.) 310

Vayilettu (Tel.) 369

Vayiti-kura(Tel.) 310

Vela-kura(Tel.) 310

Vella-kunnan (Mal.) 391

Vellai-chedi(Tam.) 310

Ventum(Tel.) 310

Vetti (Mal.) 422

Vialettu (Tam.) 369

Vikhari (Mar.) 445

Viluti (Tam.) 252

Violethoo (Kan.) 369

Virginian-pepper-cress (Eng.) 207

Voolemara (Tel.) 324

Vulimiri-chettu (Tel.) 324

Vundri (Mar.) 296

W

Wagati (Mar.) 260, 277, 298

Wagboti (Hindi) 331

Wairoda (Mar.) 323

Water-cress (Eng.) 125

Wild Radish (Eng.) 145

Wood-Dog Violet (Eng.) 373

Y

Yekadia (Mar.) 445

Yekkuddy (Mar.) 445

Yenna-mara (Kan.) 422

Yenuka-parika (Tel.) 250

Yup-Nga-Lap (Mani.) 485

Z

Zinko-banaphsha (Guj. & Punj.) 360