

FLORA OF EGYPT

Volume Two

Geraniaceae - Boraginaceae

Loutfy Boulos

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Front cover photograph
by Rafik Khalil and Dina Aly (*Ferula sinaica*),
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FLORA OF EGYPT

Volume Two

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Foreword

This volume is the second volume what is now to be a four volume set, instead of three volumes as was originally proposed for the *Flora of Egypt*. Some people may wonder whether the traditional type of book Flora has been out-moded by modern processes and electronic devices. While they may be supplemented by such things, in my opinion there is no substitute for a well-researched and well-printed and illustrated Flora such as this one. Field-work often demands instant identification of plants in difficult circumstances where electricity is not available, nor the sophisticated apparatus necessary to use it. Such a Flora is vital in laboratory and herbarium not only to systematic botanists and students, but to agronomists, foresters, economic botanists, conservationists and anyone dealing with the environment. Others such as archaeologists find here a useful reliable work of reference.

This volume alone comprises 41 families containing 471 species. The author, while no mean taxonomist himself, has recruited the services of several distinguished taxonomist specialists to verify certain accounts, thereby ensuring an even more authoritative work.

Popularly Egypt may be thought of as mainly desert with a narrow strip of moist land bordering the Nile, but as Professor Kassas has pointed out in his Foreword to the first volume, Egypt has a wealth of biogeographic belts and diverse habitats. It lies in the interesting zone between the temperate and the tropical floras of Europe, South-west Asia and Africa. Much research has been carried out on the plants of these continents which has direct bearing upon those of Egypt, so Loutfy Boulos's task involves a wide and diverse study and he is to be congratulated on his perseverance as he comes into the second half of this worthwhile project.

Richmond, Surrey, May 2000

F. Nigel Hepper
Former Taxonomist
Kew Herbarium

Preface

It was planned that volume 2 would cover the remaining families of the Dicots: Geraniaceae to Compositae, about 920 species, and vol. 3 the Monocots, about 460 species. However, the work on vol. 2, as originally planned, would have needed about 4 years for its completion from the date of publication of vol. 1 (February 1999), a rather long period, and the volume would grow to a considerable size. It was decided therefore to publish the remaining Dicot families in two volumes: vol. 2, the present work; vol. 3 Verbenaceae-Compositae; and the Monocots in vol. 4. This brings the present volume, vol. 3 and 4 up to almost equal sizes, and the dates of publication at intervals of about two years.

This volume includes 41 families of native and naturalized plants (Geraniaceae-Boraginaceae) comprising 166 genera, 471 species and 82 infraspecific taxa. The sequence of families, as in vol. 1, is more or less that of Täckholm's *Students' Flora of Egypt*, which follows Engler's System.

The largest families are: Boraginaceae 58 species, Euphorbiaceae 55, Umbelliferae 49, Convolvulaceae 47, Zygophyllaceae 33 and Malvaceae 32 species. The largest genera are: *Euphorbia* 41 species (the largest in the flora of Egypt), *Convolvulus* 20, *Heliotropium* 16, *Fagonia* 15, *Erodium* 13, *Helianthemum* 11, *Tribulus* and *Ipomoea* 9 each, *Limonium*, *Cuscuta* and *Echium* 8 each. Endemic taxa are 9 in all (7 species, 1 subspecies and 1 variety). Near-endemic taxa are 19 (17 species and 2 varieties). The illustrations comprise line drawings of 402 species, 2 subspecies and 5 varieties in 71 plates by Margaret Tebbs, Camilla Speight and Magdy El-Gohary, and 94 colour photographs, 12 by Rafik Khalil and Dina Aly, the rest by the author. For the species illustrated by line drawings or colour photographs, please refer to the index.

One new combination is made, see page 71.

Three families are recognized here within Zygophyllaceae *sensu lat.*: Zygophyllaceae *sensu str.*, Nitrariaceae and Peganaceae. On the other hand, Balanitaceae is reduced to synonymy under Zygophyllaceae *sensu str.*, (see page 12 for the new classification of Zygophyllaceae).

Some genera have suffered the deletion of several or a few species: *Fagonia* was previously represented by 20 species (Boulos, Fl. Egypt Checklist 78-80, 1995); in the present work only 15 species are accepted, the remaining 5 being reduced to synonymy or to subspecific ranks. Similarly, *Zygophyllum* was represented by 10 species, 7 are accepted; *Tribulus* 10, reduced to 9; *Helianthemum* 13, now 11; *Frankenia* 3, now 2; *Cucumis* 4, now 3; *Ammannia* 5, now 4; *Torilis* 6 now 4; *Anagallis* 3, now 2; *Asclepias* 2, now 1; *Caralluma* 5, now 4; *Convolvulus* 23, now 20 and *Heliotropium* 17, now 16 species. On the other hand, the following genera have had more species added: *Linum* was represented by 3 species, now 4; *Phyllanthus* 3, now 4; *Haplophyllum* 1, now 2; *Ziziphus* 2, now 3; *Melhania* 1, now 2; *Bupleurum* 5, now 6; *Periploca* 1, now 2 (one species was overlooked by Boulos, *l. c.*); *Oldenlandia* 1, now 2; *Valantia* 1, now 2 and *Ipomoea* was represented by 7, now 9 species are known. Major taxonomic and/or nomenclatural changes were accomplished for several genera without bringing any changes to the previously recorded number of their species; e.g. *Polygala*, *Salvadora*, *Gossypium*, *Ammannia*, *Limonium*, *Olea*, *Jasminum*, *Carissa* and *Rhazya*.

Besides the notes on economic uses, geographical distribution, taxonomic and nomenclatural discussions, notes on the type specimens collected from Egypt are presented for the corresponding species; the locality, collector's name, number and the herbarium acronym where the specimen is deposited, are cited whenever information is available.

Cairo, October 2000

L. Boulos

Acknowledgements

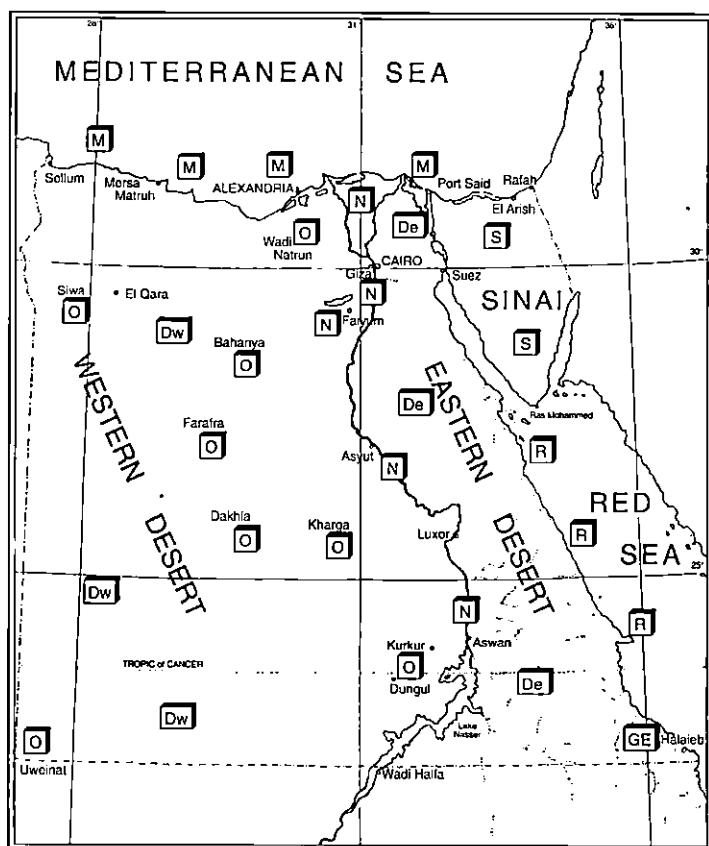
The major part of this volume was written and most of the drawings were done at the Herbarium, Royal Botanic Gardens, Kew, U. K., during the summer of 1999 and spring and summer of 2000. I wish to thank Professor Simon Owens, Keeper of the Herbarium, as well as all members of staff of the Herbarium and Library for the use of the facilities and their kind help; without their support this work would have never appeared in its present shape. The following colleagues at Kew kindly revised manuscripts: Henke Beentje (Burseraceae, Sapindaceae); Diane Bridson (Rubiaceae), Richard Brummitt (nomenclature); Susan Carter, Mike Gilbert, Petra Hoffmann and Alan Radcliff-Smith (Euphorbiaceae); Martin Cheek (Malvaceae); David Goyder (Apocynaceae, Asclepiadaceae); Peter Green (Oleaceae); Sebsebe Demissew (Convolvulaceae); Cliff Townsend (Umbelliferae); Bernard Verdcourt (Convolvulaceae, Lythraceae); Kaj Vollesen (Sterculiaceae). Arno Wörz (Stuttgart) kindly revised *Eryngium*. John Akeroyd, Adel El-Gazzar and Ruth Linklater carefully read the manuscript and contributed many corrections. I am indebted to Tom Cope for his continuous support and help during my long visits to Kew. It gives me a great pleasure to thank the botanical artists Margaret Tebbs, Camilla Speight and Magdy El-Gohary for their great skill and patience to produce the line drawings. I also wish to thank Rafik Khalil and Dina Aly for providing some colour photographs. My sincere thanks also to Rafik El-Ghareeb, Salah S. Ahmed and Mohamed El-Sayed for providing field facilities on my visits to the Mediterranean coastal region.

Colour photographs by Rafik Khalil and Dina Aly: *Zygophyllum simplex*, *Balanites aegyptiaca* (fruit), *Nitraria retusa*, *Pistacia khinjuk* var. *glabra*, *Salvadora persica*, *Rhizophora mucronata*, *Ferula sinaica*, *Limonium tubiflorum*, *Convolvulus lanatus*, *Alkanna lehmanii* and *Echium horridum*.

Line drawings by Magdy El-Gohary from Boulos, L. 1983. Medicinal Plants of North Africa. Algonac, Michigan: *Ricinus communis*, *Pistacia lentiscus*, *Salvadora persica*, *Coriandrum sativum*, *Deverra tortuosa*, *Ammi visnaga*, *Foeniculum vulgare* subsp. *vulgare*, *Solenostemma argel*, *Calotropis procera*, *Pergularia tomentosa* and *Leptadenia pyrotechnica*.

Phytogeographical regions

- N:** The Nile region including the delta, valley and Faiyum.
- O:** The oases of the Western Desert: Wadi Natrun, Siwa, Farafra, Bahariya, Kharga, Dakhla, Kurkur, Dungul and Uweinat.
- M:** The Mediterranean coastal strip from the border with Libya near Sollum to Port Said.
- D:** All the deserts of Egypt except that of Sinai.
- De:** Desert east of the Nile except that of Sinai.
- Dw:** Desert west of the Nile.
- R:** The Red Sea coastal strip.
- GE:** Gebel Elba and the surrounding mountainous region.
- S:** The entire Sinai peninsula including the coastal Mediterranean strip and El-Tih Desert east of Suez Canal.



Endemic taxa in this volume

Euphorbia punctata Delile
Euphorbia obovata Decne.
Euphorbia sanctae-catherinae Fayed
Polygala sinaica Botsch. var. *sinaica*
Helianthemum schweinfurthii Grosser
Pimpinella schweinfurthii Asch.
Ducrosia ismaelis Asch.
Primula boveana Decne. ex Duby
Limonium sinuatum (L.) Mill. subsp. *romanum* Täckh. & Boulos

Near-endemic taxa

Fagonia mollis Delile var. *hispida* Zohary (Egypt, Palestine).
Fagonia taeckholmiana Hadidi (Egypt, Libya).
Zygophyllum dumosum Boiss. (Egypt, Palestine).
Euphorbia parvula Delile (Egypt, Libya).
Halophyllum poorei C. C. Towns. (Sinai, Palestine).
Pistacia khinjuk Stocks var. *microphylla* Boiss. (Egypt, Northwest Saudi Arabia).
Helianthemum sphaerocalyx Gauba & Janch. (Egypt, Libya).
Reaumuria negevensis Zohary & Danin (Sinai, Palestine).
Pycnocycla tomentosa Decne. (Sinai, Northwest Saudi Arabia).
Bupleurum nanum Poir. (Egypt, Libya).
Pimpinella etbaica Schweinf. (Southeast Egypt, Northeast Sudan).
Ferula marmarica Asch. & Taub. (Egypt, Libya).
Centaurium malzacianum Maire (Sinai, Northwest Saudi Arabia).
Valantia lanata Delile ex Coss. (Egypt, Libya).
Galium sinaicum (Delile ex Decne.) Boiss. (Egypt, southern Palestine).
Convolvulus spicatus Haillier f. (Sinai, Palestine).
Convolvulus schimperii Boiss. (Sinai, Northwest Saudi Arabia).
Podonosma galalensis Schweinf. ex Boiss. (Egypt, Palestine).
Nonea vivianii A. DC. (Egypt, Libya).

New combination

Polygala sinaica Botsch. var. *glabrescens* (Zohary) Boulos, comb. nov., see page 71.

Abbreviations

<i>auct.</i>	<i>auctorum</i> : of authors.
<i>auct. mult.</i>	<i>auctorum multorum</i> : of many authors.
<i>c.</i>	<i>circa</i> : around.
<i>comb. inval.</i>	<i>combinatio non rite publicatum</i> : combination not validly published.
<i>comb. nov.</i>	<i>combinatio nova</i> : nomenclatural new combination.
<i>et al.</i>	<i>et alii</i> : and others.
<i>excl.</i>	<i>exclusus</i> : excluded.
<i>l. c.</i>	<i>loco citato</i> : on the page perviously cited.
<i>nom. ambig.</i>	<i>nomen ambiguum</i> : ambiguous name.
<i>nom. confus.</i>	<i>nomen confusum</i> : confused name.
<i>nom. conserv.</i>	<i>nomen conservandum</i> : conserved name.
<i>nom. illeg.</i>	<i>nomen illegitimum</i> : illegitimate name.
<i>nom. nud.</i>	<i>nomen nudum</i> : name unaccompanied by a description.
<i>nom. superfl.</i>	<i>nomen superfluum</i> : name superfluous when published.
<i>obs.</i>	<i>observatio</i> : observation.
<i>op. cit.</i>	<i>opere citato</i> : in the work previously cited.
<i>p. p.</i>	<i>pro parte</i> : in part.
<i>sensu lat.</i>	<i>sensu lato</i> : in a broad sense.
<i>s. n.</i>	<i>sine numero</i> : without a number.
<i>sensu str.</i>	<i>sensu stricto</i> : in a strict sense.
<i>syn.</i>	synonym.
<i>syns.</i>	synonyms.

Abbreviations of the authors' names follow those proposed by R. K. Brummitt & C. E. Powell, *Authors of Plant Names*, Kew (1992).

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(mainly the basic floras)

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GERANIACEAE

Annuals or perennials, sometimes low shrubs; leaves alternate, rarely opposite, usually stipulate, lobed or divided, rarely entire; flowers bisexual, regular or zygomorphic, 5-merous, in cymes, rarely solitary; sepals imbricate, persistent; petals imbricate, sometimes alternating with nectar glands; stamens 5, 10 or 15, obdiplostemonous, all fertile or some reduced to staminodes; filaments slightly connate at the base; ovary superior, carpels mostly 5, connate or adnate to a central column, placentation axile; ovules 1-2 per carpel; styles free or slightly connate; fruit a schizocarp with 5 mericarps, usually dehiscent from the beak (our species), rarely a capsule; mericarps 1-seeded; seeds with little or no endosperm. 14 genera, 730 species, mainly temperate regions, few tropical.

- 1. Leaves palmately lobed or divided; fertile stamens 10; beak of mericarp rolling upwards at maturity 1. **Geranium**
- + Leaves ± entire, pinnately lobed or divided; fertile stamens 5 or 15; beak of mericarp spirally twisted at maturity 2
- 2. Fertile stamens 5 2. **Erodium**
- + Fertile stamens 15 3. **Monsonia**

1. **Geranium** L.

Annuals (our species) or perennials, rarely woody at the base; leaves alternate or opposite, palmately lobed or dissected; flowers 2-3 in cymes, or solitary, regular; sepals awned; petals notched; stamens 10, usually all fertile; filaments free or connate at the base; styles adhering to the beak; stigmas 5, filiform; fruit a schizocarp of 5 mericarps; mericarps with a beak rolling upwards at maturity into a spiral, remaining attached at the apex and releasing the 1-seeded mericarp from the calyx. About 300 species, temperate regions and montane tropics.

- 1. Mericarps with 2 conspicuous recurved beaks 1. **G. biuncinatum**
- + Mericarps without recurved beaks 2
- 2. Mericarps with 3 keels or wings; lateral keels pectinate-dentate 2. **G. trilophum**
- + Mericarps not keeled or winged 3
- 3. Sepals with awns to 2 mm; mericarps 2-3 mm, villose, not wrinkled; seeds pitted-reticulate 3. **G. dissectum**
- + Sepals with awns 0.5 mm; mericarps 1.5-2 mm, glabrous, transversely wrinkled; seeds smooth 4. **G. molle**

1. **Geranium biuncinatum** Kokwaro, Webbia 25: 639 (1971).

Annual; stems erect or ascending; leaves 5-10 cm; stipules 2-3 x 1 mm, triangular; blade 4-5 cm, orbicular, palmatipartite, the lobes divided; inflorescence glandular-pilose; pedicels 0.3-1.5 cm; sepals 3-4 x 1.5 mm; petals 0.8-1 cm, mauve with a dark centre, claw absent; mericarps 4-6 mm, with 2 conspicuous recurved beaks, glabrous.

GE; sandy soils. Southeast Egypt, Northeast Sudan, Ethiopia, Somalia, southern Arabia.

2. **Geranium trilophum** Boiss., *Diagn. Pl. Orient.*, ser. 1, 6: 30 (1846).
 Syn. *Geranium yemense* Defflers, *Voy. Yémen* 118 (1889).

Pubescent annual 10-25 cm; stems erect to ascending; leaves 5-10 cm; stipules 1.5-2.5 mm; blade 2-3.5 cm, 5-7-lobed, palmatipartite, the lobes divided; inflorescence usually 2-flowered; pedicel 0.5-1.8 cm; sepals 5-7 mm, up to 1.2 cm in fruit; petals 0.5-1 cm, pink with a purple centre; mericarps 4-5 mm, with 3 keels or wings, the lateral keels pectinate-dentate; beak 0.8-1.2 cm at maturity; seeds 2-2.5 mm, smooth.

GE; sheltered crevices. Southeast Egypt, Northeast Sudan, Djibouti, Ethiopia, Somalia, Palestine, Arabia, Iran.

3. **Geranium dissectum** L., *Cent. Pl.* 1: 21 (1755).

Hispid annual 10-40 cm; stems procumbent; leaves 7-18 cm; stipules 2.5-6 mm; petiole 5-15 cm; blade 2.5-4.5 cm, 5-7-lobed, palmatipartite; peduncles 0.5-3.5 cm, usually 2-flowered; pedicel 0.5-1.5 cm; sepals 3-5 mm, up to 7 mm in fruit, glandular-hairy, with awns to 2 mm; petals 4-6 mm, purple; mericarps 2-3 mm, villose, not wrinkled; beak to 1.6 cm at maturity, glandular-hairy; seeds 2 mm, pitted-reticulate.

N, O, M; moist cultivated ground. Atlantic Islands, Mediterranean region, Europe, West Asia; adventive in some temperate regions.

4. **Geranium molle** L., *Sp. Pl.*, ed. 1, 682 (1753).

Syn. *Geranium stipulare* Kunze, *Flora (Regensburg)* 29: 698 (1846).

Sparsely pubescent annual 10-25 cm; stems decumbent; leaves 6-15 cm; stipules 2-3.5 mm; petiole 5-12 cm; blade 2-4 cm, 5-8-lobed, palmatipartite; peduncle 1-2.5 cm, 2-flowered; bracts 1-2 mm; pedicel 1-1.5 cm, upcurved in fruit; sepals 3.5-4.5 mm, with awns 0.5 mm; petals 0.5-1 cm, pink, deeply 2-lobed; mericarps 1.5-2 mm, glabrous, transversely wrinkled; beak 0.8-1 cm; seeds smooth.

M, S; waste ground, roadsides, fallow fields. Atlantic Islands, North Africa, Europe, West Asia.

2. **Erodium** L'Hér.

Annuals or perennials, rarely low shrubs; leaves opposite or alternate, pinnately lobed or dissected, rarely entire; inflorescence umbellate, bracteate; flowers usually bisexual, slightly zygomorphic; sepals 5, imbricate; petals 5, alternating with glands, imbricate; fertile stamens 5, free or connate at the base; staminodes 5; ovary of 5 carpels, 5-locular, beaked, adnate to central column of the flower; fruit a schizocarp, splitting with beak from central column at maturity, the beak curling spirally in its lower part; mericarps 1-seeded, usually with a pit and furrowed beneath the beak; beak plumose or bristly. About 60 species, Mediterranean region to Central Asia, tropical East and South Africa, Australia, South America.

- | | |
|--|---|
| 1. Leaves 1-3-pinnate, with distinct leaflets | 2 |
| + Leaves simple, entire, lobed or pinnatifid to pinnatisect but not divided into distinct leaflets | 4 |

2. Leaflets 2-4 cm, dentate or incised, not pinnatisect 12. **E. moschatum**
+ Leaflets 0.5-2 cm, pinnatisect 3
3. Mucro of sepal terminating in 1 eglandular or 2 white bristles equalling to
or longer than the mucro; pits of mericarp eglandular inside 11. **E. cicutarium**
+ Mucro of sepal without bristles; pits of mericarp
glandular inside 13. **E. touchyanum**
4. Annual; beak of mericarp with short hairs or bristles towards the base,
not plumose 5
+ Perennial, rarely annual or short-lived perennial; beak of mericarp distinctly
plumose throughout its length 10
5. Mericarp 1.2-1.5 cm; beak 6-12 cm, stout, thick 6
+ Mericarp 4-8 mm; beak 3-6 cm, slender 7
6. All leaves 1-2-pinnatisect; flowers 1.5-2 cm diam. at anthesis;
beak 8-12 cm in fruit 10. **E. ciconium**
+ Upper leaves lobed, not pinnatisect, the lower undivided;
flowers 2.5-3.5 cm diam. at anthesis; beak 6-8 cm in fruit 9. **E. gruinum**
7. Mericarp with furrows beneath the pits 8
+ Mericarp without furrows beneath the pits 9
8. Leaves undivided or shallowly lobed, crenate-dentate; mericarp 5 mm;
furrows broad and deep, glandular; beak 3-4 cm 5. **E. malacoides**
+ Leaves deeply lobed, lobes incised-dentate; mericarp 5-8 mm;
furrows narrow and shallow, eglandular; beak 5-6 cm 6. **E. neuradifolium**
9. Leaves undivided or shallowly 3-lobed; petals pink to white 8. **E. chium**
+ Leaves mostly pinnatipartite or pinnatisect; petals purple 7. **E. laciniatum**
10. Leaves pinnatisect; roots with subglobose tubers 1. **E. crassifolium**
+ Leaves undivided or 3-5-lobed; tubers, if present, not subglobose 11
11. Sepals 0.8-1 cm; petals 1-1.5(-2) cm, pink with a deep purple basal spot;
mericarps c. 8 mm 3. **E. arborescens**
+ Sepals c. 5 mm; petals 0.7-1 cm, pink or purple; mericarps 3-5 mm 12
12. Leaves leathery, glaucous, glabrous; roots with elongate tuberous thickenings;
corolla purple, actinomorphic 4. **E. glaucophyllum**
+ Leaves sparsely grey-canescens; roots without tuberous thickenings;
corolla pink, zygomorphic 2. **E. oxyrhynchum**

1. **Erodium crassifolium** L'Hér. in Aiton, Hort. Kew., ed., 1, 2: 414 (1789).

Syns. *Geranium hirtum* Forssk., Fl. Aegypt.-Arab. 123 (1775), nom. illeg., non
Burm. f.

Erodium hirtum (Forssk.) Willd., Sp. Pl., ed. 4, 3: 632 (1800).

Hirsute perennial 10-30 cm, with a woody base; root fusiform, woody, with spherical or
ovoid tubers; stems much-branched, hispid-pubescent; leaves 4-9 cm; stipules c. 5 mm,

petiole 2-5 cm; blade 3-5 x 3 cm, 1-2 pinnatisect, hispid; peduncles 1.5-7 cm; bracts 4-6, 2-3 mm, scarious; umbels 3-6-flowered; pedicel 1-1.8 cm; sepals 5-8 mm, mucronate, hirsute; petals 1.2-1.5 cm, purple; mericarps *c.* 5 mm, with 2 pits below the beak; beak 6-10 cm, plumose; seeds 3-3.5 x 0.8 mm, brownish, minutely pitted.

M, D, S; sandy and calcareous soils, coastal plains and desert wadis. North Africa, Crete, Cyprus, Sinai, Palestine, Arabia, Iraq.

2. *Erodium oxyrhynchum* M. Bieb., Fl. Taur.-Caucas. 2: 133 (1808).

Hispid annual or short-lived perennial, 15-35 cm; stems erect to procumbent; leaves 4-14 cm; stipules 1-3 mm, petiole to 12 cm; blade 1-4 x 0.5-2.5 cm, pinnatifid, thin, grey-canescens; peduncle 0.5-6.5 cm; bracts 2-3 mm; umbels 2-6-flowered; pedicel *c.* 5 mm; flowers zygomorphic; sepals 4-6 mm, the mucro 1 mm; petals 0.8-1 cm, pink, clawed; stamens *c.* 5 mm, filaments dilated near the base; staminodes *c.* 2 mm hairy at the apex; mericarps 4-6 mm, furrowed below the beak; beak 5.5-11 cm, feathery throughout its length.

Two subspecies occur in Egypt:

subsp. *oxyrhynchum*

Furrows of mericarp distinct, glabrous or glabrescent; beak 7-11 cm.

S; sandy plains and desert wadis. Sinai, Palestine, Arabia, Iraq, Iran, Afghanistan.

subsp. *bryoniifolium* (Boiss.) Schönbr.-Tem. in Rech. f., Fl. Iran. 69: 43 (1970).

Syn. *Erodium bryoniifolium* Boiss., Diagn. Pl. Orient., ser. 1, 1: 61 (1843).

Furrows of mericarp not distinct, covered with short white hairs; beak 5.5-7 cm.

N, O (Wadi Natrun), M, D, S; sandy plains and gravel deserts. Egypt, Palestine, Arabia, Iraq, Iran, Pakistan, Afghanistan.

NOTE: Davis, Fl. Turkey 2: 477 (1967), considers *Erodium bryoniifolium* Boiss. to be conspecific with *E. oxyrhynchum* M. Bieb. on the basis of intermediate specimens. Zohary, Fl. Palaest. 2: 234 (1972), comments on Davis' view that it still needs to be confirmed through a more fundamental study of the two taxa. In the present treatment, the concept of Schönbeck-Temesy, in Rech. f., Fl. Iran. (1970), is adopted which treats the two taxa as subspecies of *Erodium oxyrhynchum*. Greuter *et al.* in Med-Checklist 3: 255 (1986) also treat them at subspecific rank. The type was collected from Sinai, Aucher-Eloy 2087 (G, K).

3. *Erodium arborescens* (Desf.) Willd., Sp. Pl., ed. 4, 3: 638 (1800).

Syns. *Geranium arborescens* Desf., Fl Atlant. 2: 120 (1798).

Erodium hussonii Boiss., Diagn. Pl. Orient., ser. 1, 8: 119 (1849).

Appressed-puberulent perennial 20-40 cm, with woody base; root long with cylindrical thickenings; stems erect to ascending; leaves 2.5-11.5 cm, stipules 3-6 x 2-4 mm, hairy; petiole 1-8 cm; blade 2-3.5 x 1.5-2.5 cm, crenate to slightly lobed; umbels 4-6-flowered; pedicel 1-3 cm; bracts connate at the base, hairy; sepals 0.8-1 cm; petals 1-1.5(-2) cm,



Plate 1. GERANIACEAE: *Geranium biuncinatum* 1, flowering and fruiting branch; fruit enclosed by the calyx (right); mericarp (left). *Geranium trilophum* 2, flowering and fruiting branch, and basal leaf; fruit enclosed by the calyx (down left); mericarp (right). *Geranium dissectum* 3, flowering and fruiting branch; basal leaf (right); fruit with beaks rolling upwards and mericarps attached at the apex (left). *Geranium molle* 4, flowering and fruiting branch and basal leaf; fruit (down left); mericarp (left). *Erodium crassifolium* 5, habit; mericarp (down right). *Erodium oxyrhynchum* 6, habit and basal leaf; mericarp (left). *Erodium arborescens* 7, basal part with root, leaves and leaf-bases; fruiting branch and mericarp (right). *Erodium glaucophyllum* 8, basal part with root, leaves and leaf-bases; fruiting branch (right); mericarp (left). All drawings to the same scale, except the enlarged parts (scale given).

pink with a deep purple basal spot; stamens *c.* 8 mm; staminodes *c.* 3 mm; mericarp *c.* 8 mm with 2 pits below the beak, patent-hairy; beak 6-8 cm, plumose throughout its length.

De, S; stony wadis. Tunisia, Libya, Egypt, Palestine.

4. ***Erodium glaucophyllum*** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 416 (1789).

Syn. *Geranium glaucophyllum* L., Sp. Pl., ed. 1, 679 (1753).

Perennial 15-50 cm; roots with elongate tuberous thickenings; stems erect or ascending; leaves 2.5-12 cm; stipules 1.5-3.5 mm; petiole 1-8 cm; blade 1-4.5 x 0.5-2.5 cm, triangular-ovate to cordate, crenate-dentate or 3-5-lobed, leathery, glaucous, glabrous; umbels 3-5-flowered; bracts hairy; pedicel 1-2 cm; sepals 5-6 mm, with a purplish mucro, elongate in fruit; petals 1 cm, purple, actinomorphic; stamens *c.* 6 mm; staminodes *c.* 3 mm; mericarps 3-5 mm, with 2 pits below the beak, hairy; beak 6-11 cm, the upper $\frac{2}{3}$ feathery.

M, D, S; gypsaceous and sandy soils, wadi beds. North Africa, East Mediterranean region, Sinai, Arabia, Iraq, Iran.

5. ***Erodium malacoides*** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 415 (1789).

Syns. *Geranium malacoides* L., Sp. Pl., ed. 1, 680 (1753).

Erodium malacoides (L.) Willd., Phytogr. 1: 10 (1794).

Erodium althaeoides Jord., Mém. Acad. Roy. Sci. Lyon, Sect. Sci., sér. 2, 1: 252 (1851).

Erodium malvaceum Jord., Mém. Acad. Roy. Sci. Lyon, Sect. Sci., sér. 2, 1: 253 (1851).

Annual 10-40 cm, with spreading bristles and short-stalked glands; stems erect or ascending; leaves 3.5-10.5 cm; stipules 5-8 mm, membranous; petiole 1-5 cm; blade 1.5-5 x 1.5-4 cm, ovate-cordate, appressed-hairy, undivided or shallowly lobed, crenate-dentate; peduncle 2-5 cm; umbels 3-8-flowered; bracts 3-6, free, membranous; pedicel 1 mm, glandular-hairy; sepals 4-5 mm, scarious-margined, glandular-hairy; petals 6-7 mm, lilac; stamens *c.* 4 mm; staminodes *c.* 2 mm; mericarps *c.* 5 mm, the furrows broad and deep, glandular; beak 3-4 cm, with a tuft of basal hairs.

N, O, M, De, S; fields, waste ground, roadsides. Atlantic Islands, Mediterranean region, eastwards to Iran.

6. ***Erodium neuradifolium*** Delile ex Godr., Mém. Acad. Sci. Montpellier, Sect. Méd. 1: 425 (1853).

Syns. *Erodium aegyptiacum* Boiss., Diagn. Pl. Orient., ser. 2, 1: 111 (1854).

Erodium aragonense Loscos, Trat. Pl. Aragón 2: 228 (1880).

Erodium chium (L.) Willd. subsp. *aragonense* (Loscos) Maire in Emb. & Maire, Cat. Pl. Maroc 1058 (1941).

Somewhat patent-hairy annual, sometimes glandular-hairy, 10-40 cm; stems procumbent to ascending; leaves 2.5-10 cm; stipules 3-5 mm; petiole 1-5 cm; blade 1-4.5 x 0.5-2.5 cm, cordate-ovate, undivided or shallowly lobed, crenate-dentate; peduncle 2-7 cm; umbels 3-8-flowered; bracts 4-6, 2-3 mm, connate at the base; pedicel 0.5-2.5 cm; sepals 5-6 mm, the mucro 0.5-2 mm, the outer 5-nerved, the inner 3-nerved; petals 7-8 mm,

purplish-pink; stamens 3-4 mm, the filaments glabrous; mericarps 5-8 mm, with furrows narrow and shallow, eglandular; beak 3-4 cm.

M, De, R, GE; rocky and maritime ridges. Canary Islands, Mediterranean region, eastwards to Arabia, Iraq, Iran, Afghanistan; southwards to Sudan, Somalia.

NOTE: Some authors treat this species as a variety of *Erodium subtrilobum* Jord.

7. ***Erodium laciniatum*** (Cav.) Willd., Sp. Pl., ed. 4, 3: 633 (1800).

Syns. *Geranium laciniatum* Cav., Diss. 228 (1787).

Erodium affine Ten., Index Sem. Hort. Neapol. 1830: 13 (1830).

Erodium pyramidatum C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 3: 456 (1845).

Puberulent or hairy annual, 15-50 cm, sometimes glandular-hairy; stems procumbent or ascending; stipules 5-8 mm, membranous; leaves 1.5-10 cm; blade mostly pinnatipartite or pinnatisect; petiole 1-6.5 cm; peduncle 2-8 cm; umbels 3-8-flowered; bracts 2-4, 0.3-1.2 cm, membranous; pedicels 1-1.5 cm; sepals 6-8 mm, mucronate, appressed-hairy; petals 1-1.2 cm, purple; stamens c. 4 mm; mericarps 4-8 mm, without pits below the beak; beak 3-8 cm.

Two subspecies occur in Egypt:

subsp. ***laciniatum***

Leaf blade pinnatisect; bracts usually 2, 3-4(-7.5) mm, orbicular-ovate; sepals with a mucro 1.5-2 mm; beak of mericarp 4-8 cm.

N, M, D, R, GE, S; sandy plains, coastal and alluvial soils. Mediterranean region, Sinai, Arabia, eastwards to Pakistan.

subsp. ***pulverulentum*** (Boiss.) Batt. in Batt. & Trab., Fl. Algérie 1: 126 (1888).

Syns. *Geranium pulverulentum* Cav., Diss. 272 (1788).

Erodium pulverulentum (Cav.) Willd., Sp. Pl., ed. 4, 3: 632 (1800).

Erodium laciniatum var. *pulverulentum* (Cav.) Boiss., Fl. Orient. 1: 893 (1867).

Erodium pulverulentum subsp. *bovei* (Delile) Schönbr.-Tem. in Rech. f., Fl. Iran. 69: 53 (1970).

For full synonymy see Greuter *et al.*, Med-Checklist 3: 254 (1986).

Leaf-blade pinnatifid to pinnatipartite; bracts usually 3-4, 2-2.5(-5) mm, triangular-ovate; sepals with a mucro 0.5-1 mm; beak of mericarp 3-4.5 cm.

N, M, D, R, S; desert wadis, sandy and gravelly soils. Spain, North Africa, West Asia.

NOTE: The above two subspecies are treated by some authors as varieties of *Erodium laciniatum*, some others treat them as distinct species.

8. ***Erodium chium*** (L.) Willd., Phytogr. 10 (1795).

Syns. *Geranium chium* L., Syst. Nat., ed. 10, 1143 (1759).

Erodium cuneatum Viv., App. Fl. Cors. Prodr. 5 (1825).

Annual 10-40(-50) cm, covered with deflexed hairs; stems ascending to procumbent; leaves 4-13 cm; stipules 4-7 mm, membranous; petiole 2-8 cm; blade 2-5.5 x 1.5-4.5 cm, ovate-cordate, undivided or shallowly 3-lobed; peduncle 3-12 cm, umbels 2-8-flowered; pedicel 0.8-2.5 cm; bracts 3 mm; sepals 4-5 mm, glandular-hairy, the mucro 1 mm; petals 6-7 mm, pink to white; stamens 4.5-5 mm; mericarps 4-5 mm, white appressed-hairy; apical pits eglandular, furrows absent; beak 3-4 cm.

M, De, S; cultivated and waste ground, desert plains. Mediterranean region, Sinai.

9. **Erodium gruinum** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 415 (1789).

Syn. *Geranium gruinum* L., Sp. Pl., ed. 1, 680 (1753).

Retrorsely hirsute annual 15-50 cm; stems erect or ascending, grooved; leaves (2-)5-15 (-18) cm; petiole 2-15 cm; stipules 0.5-1 x 0.3-0.6 cm, ovate-lanceolate, acute; upper leaves lobed, not pinnatisect, the lower undivided; peduncle 3-12 cm; umbels (1-)3-5-flowered; flowers 2.5-3.5 cm diam. at anthesis; pedicel 2.5-4.5(-5) cm; bracts 4, 0.8-1 x 0.4 cm, connate in pairs, membranous; sepals 1 x 0.4 cm, conspicuously 5-nerved; petals 1-1.4 cm, pale violet; stamens 8-9 mm, the filaments glabrous; staminodes 4-5 mm; mericarps 1-1.5 cm, clothed with coarse white hairs; apical pits deep, eglandular; furrows 1-2 below the pits; beak in fruit 6-8 cm.

M; waste ground and roadsides. East Mediterranean region, eastwards to Iran.

10. **Erodium ciconium** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 415 (1789).

Syn. *Geranium ciconium* L., Sp. Pl., ed. 2, 952 (1763).

Hirsute and glandular-hairy annual, 15-50 cm; stems ascending or procumbent, furrowed; leaves 4-15 cm; stipules 5-8 x 3-6 mm, ovate-deltoid; petiole 3-12 cm; blade appressed-hairy, 1-2-pinnatisect; peduncle 5-12 cm; umbels (2-)3-6-flowered; flowers 1.5-2 cm diam. at anthesis; pedicel 1-2.5 cm; bracts ovate-lanceolate, hairy; sepals 0.6-1 cm, elongate in fruit, 5-nerved, the margin membranous, the mucro 2-4 mm; petals 1-1.5 cm, tapering to a basal pilose claw; stamens 8-9 mm, the filaments ciliate; staminodes 3-3.5 mm; mericarps 1.2-1.5 cm, clothed with rough hairs; apical pits narrow, deep, glandular-hairy; basal furrows absent; beak 8-12 cm.

M, S; roadsides, waste and cultivated ground. Mediterranean region, eastwards to Iran.

11. **Erodium cicutarium** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 414 (1789).

Syns. *Geranium cicutarium* L., Sp. Pl., ed. 1, 680 (1753).

Erodium arenarium Jord., Mém. Acad. Roy. Sci. Lyon, Sect. Sci., sér. 2, 1: 255 (1851).

White-pubescent annual 10-40 cm, often glandular-hairy; stems procumbent, ascending or erect; leaves 2.5-12(-15) x 1.5-3.5 cm, frequently in a basal rosette; stipules 4-7 x 2-4 mm, membranous, ovate, acute; petiole 1.5-4 cm; blade pinnate; leaflets 5-10, 0.5-2.2 cm, pinnatisect, appressed-hairy; peduncle 4-9 cm; umbels 3-6-flowered; pedicel 0.5-1.5 cm; bracts minute, membranous; sepals 3.5-4.5 mm, elongate in fruit, 3-5-nerved, appressed hairy, with a mucro terminating in 1 or 2 white bristles equal to or longer than the mucro; petals 4-5.5 mm, purplish-pink; stamens 3.5-4.5 mm, the filaments slightly dilated at the base, glabrous; mericarps 4-6.5 mm, white appressed-hairy, with a furrow below each pit; pits eglandular inside; beak 2.5-4.5 cm.

O, M, D, S; roadsides, cultivated and waste ground, desert plains. Atlantic Islands, Mediterranean region, Europe, West Asia.

12. **Erodium moschatum** (L.) L'Hér. in Aiton, Hort. Kew., ed. 1, 2: 414 (1789).

Syns. *Geranium cicutarium* L. var. *moschatum* L., Sp. Pl., ed. 1, 680 (1753).

Geranium moschatum (L.) L., Syst. Nat., ed. 10, 1143 (1759).

White-hairy annual 10-40 cm, glandular-hairy in the upper parts; stems procumbent, thick; leaves 5-14 cm; stipules 0.7-1.2 cm, broadly ovate, scarious; petiole 2-8 cm; blade pinnate; leaflets 5-13, 2-4 cm, alternate or opposite, ovate, dentate or incised; peduncle 3-10 cm; umbels 3-12-flowered; pedicel 0.5-1.5 cm; bracts 3-4 mm, connate at the base; sepals 5-6 mm, elongate in fruit, with a 1 mm mucro; petals 7-8 mm, pink; stamens 4-4.5 mm, with a tooth on each side at the base; mericarps 4.5-6 mm, with a furrow below each glandular pit; beak 2.5-4 cm.

M; cultivated ground. Mediterranean region, extending to Atlantic Islands and along Atlantic coasts to Britain and Ireland, Ethiopia.

13. **Erodium touchyanum** Delile ex Godr., Mém. Acad. Sci. Montpellier, Sect. Méd. 1: 423 (1853).

Syns. *Erodium moschatum* (L.) L'Hér. subsp. *deserti* Eig, Beih. Bot. Centralbl. 50 (2): 236 (1932).

Erodium deserti (Eig) Eig, Pal. J. Bot., Jerusalem, ser., 1: 311 (1939).

Densely white-hairy annual 5-20 cm, glandular-hairy especially in the upper part; stems ascending or procumbent; leaves 2.5-8 cm, often in a basal rosette; stipules 5-7 mm, membranous; petiole 1-3.5 cm; blade pinnate; leaflets 1-2 cm, pinnatisect; peduncle 2.5-8 cm; umbels 2-8-flowered; pedicel 0.5-1 cm; bracts 2-2.5 mm, membranous; sepals 3.5-4 mm, elongate in fruit; mucro 0.5 mm, without bristles; petals almost equalling the sepals, pink; stamens 3.5-4 mm, the filaments 2-dentate; staminodes with 2 teeth at the apex; mericarps 4-5 mm, with a furrow below each pit; pits glandular inside; beak 2.5-4 cm.

De, S; desert plains and wadis. North Africa, East Mediterranean region, Sinai, Arabia.

3. **Monsonia** L.

Annuals or perennials, sometimes woody at the base; leaves opposite or alternate, stipulate, petiolate, dentate, serrate or lobed; peduncle axillary; umbels 1- to many-flowered; flowers actinomorphic, 5-merous; pedicel bracteate; sepals 5, imbricate; petals 5, caducous; nectar glands 5, alternating with the petals; stamens 15, all fertile, connate into a ring at the base and united into 5 bundles of 3 filaments each, opposite the petals; ovary of 5 carpels, each with 2 ovules; styles and stigmas 5; fruit a schizocarp with indehiscent 1-seeded mericarps, separating from the axis; beak twisting at maturity, plumose or bristly; seeds oblong-ovoid. About 25 species, Africa, Southwest Asia to India.

1. Peduncle 0.5-2.5 cm, shorter than the leaves, usually 1-flowered;

beak of the mericarp bristly along the inner side

1. **M. senegalensis**

+ Peduncle 3-12(-22) cm, much longer than the leaves, (2-)4-20-flowered;

beak of the mericarp plumose

2



Plate 2. GERANIACEAE: *Erodium malacoides* 1, flowering and fruiting branch; basal leaf (right); mericarp (left). *Erodium laciniatum* subsp. *laciniatum* 2a, fruiting branch and basal leaf; mericarp and bract (down right); *Erodium laciniatum* subsp. *pulverulentum* 2b, basal leaf and bract. *Erodium gruinum* 3, fruiting inflorescence and basal leaf; mericarp (right). *Erodium ciconium* 4, fruiting inflorescence; basal leaf and mericarp (left). *Erodium cicutarium* 5, fruiting branch; basal leaf (left); mericarp (up left). *Erodium moschatum* 6, fruiting inflorescence and basal leaf; mericarp (left). *Monsonia senegalensis* 7, fruiting branch; mericarp (left). *Monsonia nivea* 8, habit; fruiting branch and mericarp (right). *Monsonia heliotropioides* 9, habit, fruiting branch and mericarp. All drawings to the same scale, except the enlarged parts (scale given).

2. Leaves ovate-oblong; pedicel 3-4 times as long as the calyx;
beak of mericarp 3.5-5 cm

2. *M. nivea*

+ Leaves ovate-cordate; pedicel ± equalling the calyx; beak of mericarp
6.5-8.5 cm

3. *M. heliotropioides*

1. *Monsonia senegalensis* Guill. & Perr., Fl. Seneg. Tent. 1: 131 (1832).

Annual or short-lived perennial 10-35 cm, covered with short recurved hairs, often glandular; stems decumbent or erect; leaves 2-7 cm; stipules 0.4-1.2 cm, subulate; petiole 1.5-4.5 cm; blade 1-4 x 0.5-2.5 cm, ovate, serrate or dentate, the base cordate, the apex acute; peduncle 0.5-2.5 cm, usually 1-flowered; pedicel 1.5-3.5 cm; bracts (1-)2, 0.5-1.5 cm, linear; sepals 0.5-1 cm, each with a 1-2 mm appendage, densely hairy; petals 0.8-1.2 x 0.6-0.75 cm, pink with dark veins; stamens 5-7 mm; mericarps 0.8-1 x 0.2-0.25 cm; beak 6-8 cm, bristly along the inner side.

GE; rocky and sandy soils. Egypt, westwards to Senegal, Sudan, tropical East Africa, southwards to Angola and Namibia, Arabia to India and Pakistan.

2. *Monsonia nivea* (Decne.) Webb, Fragm. Fl. Aethiop.-Aegypt. 59 (1854).

Syns. *Erodium niveum* Decne., Ann. Sci. Nat. Bot., sér. 2, 3: 285 (1835).

Erodium bonacellii Pamp., Agric. Colon. 22: 365 (1928).

Monsonia nivea var. *villosa* Täckh. & Boulos, Publ. Cairo Univ. Herb. 5:
48, f. 7a (1974).

Monsonia nivea var. *intermedia* Täckh. & Boulos, Publ. Cairo Univ. Herb.
5: 48, f. 8 (1974).

Silvery-canescens perennial 10-25(-40) cm; stems short, rarely branched, procumbent, white-hairy; leaves 1.5-5.5 cm, usually in a rosette; stipules 2-4 mm, oblong-lanceolate; petiole 1-3.5(-4.5) cm; blade 1-2.5 x 0.5-1.5 cm, ovate-oblong, crenate-dentate, silvery appressed-hairy, plicate; peduncle 6-12(-22) cm, 2-6-flowered; pedicel 3-4 times as long as the calyx; sepals 4.5-6 mm, oblong-ovate, mucronate, appressed-hairy, the margin membranous; petals ± equalling the sepals, pink; filaments ciliate at the base; mericarps 4-5 mm, appressed-hirsute, with 2 transverse apical furrows; beak 3.5-5 cm, plumose.

O, D, R, GE, S; sandy desert plains and wadis. North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Pakistan, Sudan (Red Sea Hills).

NOTE: The type was collected from El-Tor Desert, Sinai, Bové 154 (K, P.)

3. *Monsonia heliotropioides* (Cav.) Boiss., Fl. Orient. 1: 897 (1867).

Syns. *Geranium heliotropioides* Cav., Diss. 220 (1787).

Monsonia hispida Boiss., Diagn. Pl. Orient., ser. 1, 8: 120 (1849).

Monsonia densiflora Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 48, f. 9
(1974).

Monsonia heliotropioides Cav. var. *hassibii* Täckh. & Boulos, Publ. Cairo
Univ. Herb. 5: 48, f. 7b (1974).

Perennial, often flowering the first year, 15-40 cm, white-hispid; stems erect, branched; leaves 2-8 cm, cauline, opposite; stipules 4-5 mm, lanceolate-subulate; petiole 2-6(-8) cm; blade 1-3.5 x 0.8-2.5 cm, ovate-cordate, acute, dentate-serrate, white-canescens; peduncle to 12 cm, 6-12(-20)-flowered; pedicel ± equalling the calyx; sepals 5-7 mm,

obovate, with scarious margin and purple mucro; petals equal to or shorter than the sepals, pink; filaments 3.5-4 mm, ciliate at the base; mericarps 5-6 mm, densely setose, especially at the base, with (2-)3 transverse furrows at the apex; beak 6.5-8.5 cm, plumose.

De, R, GE, S; desert plains and rocky wadis. North Africa, Sinai, Palestine, Arabia, Iran, Pakistan, India, Sudan (Red Sea Hills).

ZYGOPHYLLACEAE

(incl. Tribulaceae and Balanitaceae)

Shrubs, undershrubs or herbs, rarely trees; leaves usually opposite, stipulate, entire, 2-3-foliolate or pinnate, often fleshy; flowers in cymes or solitary, usually bisexual, actinomorphic, rarely zygomorphic, 4-5-merous; sepals free, rarely connate; petals usually as many as sepals; receptacle with a disc or gynophore; stamens (4-)8-10; filaments sometimes with ligular appendages; ovary sessile, rarely short-stipitate (2-)4-5-celled, angular or winged; placentation axile; ovules 1-many in each cell; style 1, short or stigmas sessile; fruit a capsule, schizocarp or drupe. 17 genera, 270 species, tropical and warm arid regions.

NOTE: A phylogenetic analysis of Zygophyllaceae R. Br. based on morphological, anatomical and DNA data, by M. C. Sheahan & M. W. Chase (Bot. J. Linn. Soc. 122: 279-300, 1996) shows that *Peganum*, *Malacocarpus*, *Tetradiclis* and *Nitraria* appear widely separated from Zygophyllaceae *sensu str.*, and close to members of Sapindales. They recommend the recognition of Peganaceae (*Peganum*, *Malacocarpus*, *Tetradiclis*) and Nitrariaceae (*Nitraria*) as separate families. Furthermore, they subdivide Zygophyllaceae into 5 subfamilies of which 3 are represented in Egypt:

1. Subfam. Zygophylloideae
Type: *Zygophyllum* L.
Genera: *Zygophyllum* L., *Augea* Thunb., *Tetraena* Maxim., *Fagonia* L.
2. Subfam. Morkillioideae (Engl.) Rose & J. H. Painter (not in Egypt)
Type: *Morkillia* Rose & J. H. Painter
Genera: *Morkillia* Rose & J. H. Painter, *Viscainoa* (Kellogg) Greene
3. Subfam. Tribuloideae (Rchb.) D. M. Porter
Type: *Tribulus* L.
Genera: *Tribulus* L., *Kallstroemia* Scop., *Kelleronia* Schinz, *Neoluederitzia* Schinz, *Sisyndite* E. Mey. ex Sond. & Harv., *Balanites* Delile
4. Subfam. Seetzenioideae Sheahan & Chase
Type: *Seetzenia* R. Br.
Genera: *Seetzenia* R. Br. only
5. Subfam. Larreoideae Sheahan & Chase (not in Egypt)
Type: *Larrea* Cav.
Genera: *Larrea* Cav., *Bulnesia* Gay, *Porlieria* Ruiz & Pav., *Guaiacum* L.

- | | |
|---|--------------------|
| 1. Leaves pinnate, of 3-8 pairs of leaflets; fruit prickly, winged or tuberculate | 4. Tribulus |
| + Leaves 2-3-foliolate or simple; fruit not as above | 2 |
| 2. Stipules spiny | 1. Fagonia |
| + Stipules if present not spiny | 3 |

3. Trees; fruit a fleshy, oily drupe
+ Herbs or low shrubs; fruit a capsule

5. **Balanites**
4

4. Petals 0; stamens 5
+ Petals (4-)5; stamens 8-10

2. **Seetzenia**
3. **Zygodphyllum**

1. **Fagonia** L.

Low shrubs or perennial herbs, rarely annuals; leaves opposite, 3- or 1-foliolate; leaflets entire, mucronate; stipules spiny, acicular; flowers axillary, solitary, pedicellate, bisexual, actinomorphic; sepals 5, free, mucronate, caducous or persistent; petals 5, free, clawed, imbricate, caducous; stamens 10, free, inserted on a disc; filaments filiform, without appendages; ovary sessile, 5-celled; ovules 2 at the base of each cell; style persistent, 5-angled; stigma simple; fruit a septicidal capsule, pentagonous, deeply 5-lobed, splitting along the axis into 5 carpels; carpels 1-seeded; seeds ovate or ovate-oblong, compressed, with mucilaginous coat. About 30 species, Mediterranean region, Sahara, Southwest Asia to Northwest India, Southwest Africa, Southwest North America.

1. Stipular spines absent or minute
+ Stipular spines present, conspicuous

7. **F. taekholmiana**
2

2. All leaves 1-foliolate
+ All leaves 3-foliolate, or lower 3-foliolate and upper 1-foliolate

3
4

3. Annual; leaflets to 4 cm, oblong-linear, subsessile;
sepals caducous
+ Low shrub or perennial with woody base; leaflets 0.6-1.6 cm,
narrowly elliptic-lanceolate, distinctly articulate at the base,
petiololate; sepals persistent on young fruits

6. **F. paulayana**
5. **F. indica** var. **indica**

4. Lower leaves 3-foliolate, upper 1-foliolate; stipular spines longer than the leaves
+ All leaves 3-foliolate; stipular spines equal to or shorter than the leaves

5
8

5. Leaflets terete
+ Leaflets flattened

4. **F. thebaica**
6

6. Sepals caducous; capsule 5-7 mm diam.
+ Sepals persistent; capsule 3-4 mm diam.

1. **F. arabica**
7

7. Plant glandular-hairy; stipular spines 0.5-2.5 cm;
internodes 0.5-2.5 cm
+ Plant glabrous; stipular spines 3.5-6 cm; internodes 3-5 cm

2. **F. bruguieri**
3. **F. schimperi**

8. Plant glabrous, rarely with stipitate glands on upper parts
+ Plant hairy, glandular-hairy or viscid-glandular

9
10

9. Pedicel shorter than the capsule; capsule 0.8-1 cm diam.
+ Pedicel 2-3 times as long as the capsule; capsule 5-6 mm diam.

13. **F. cretica**
15. **F. tenuifolia**

10. Slender annual, basal leaves in a rosette
+ Perennial or low shrub; basal leaves not in a rosette

10. **F. latifolia**
11

11. Petiole 1.5-3 cm; lateral leaflets minute, terminal leaflet 3-4 mm
+ Leaves not as above 12. **F. microphylla** 12
12. Capsule 3.5-4 mm diam.
+ Capsule 5-7 mm diam. 14. **F. scabra** 13
13. Capsule 6-7 mm diam.; style 4-5 mm
+ Capsule 5 mm diam.; style 2-3 mm 9. **F. mollis** 14
14. Annual; terminal leaflet linear, 1-2 mm diam. 5. **F. indica** var. **schweinfurthii**
+ Perennial or low shrub; terminal leaflet broadly obovate, 0.35-1 cm diam. 15
15. Prostrate perennial with woody base, densely covered with stipitate glands and
adhering sand grains; terminal leaflet to 8 x 3.5 mm 8. **F. glutinosa**
+ Robust viscid low shrub, without adhering sand grains;
terminal leaflet to 2 x 1 cm 11. **F. isotricha**

1. **Fagonia arabica** L., Sp. Pl., ed. 1, 386 (1753).

Low shrub 20-60 cm, entirely covered with sessile or stalked capitate glands, often with adhering sand grains; stems terete, striate; stipular spines to 4 cm; lower leaves 3-foliolate, the upper 1-foliolate or 3-foliolate; leaflets 0.3-1.2(-1.5) cm, narrowly-elliptic to linear, mucronate; pedicel 4-8 mm; flowers 1-1.5 cm diam. at anthesis; sepals 3-4 x 1-1.5 mm, broadly lanceolate, acute, glandular, caducous; petals 7-9 mm, claw 2-2.5 mm, pinkish-violet or mauve; filaments 0.8-1 cm; capsule 4-5 x 5-7 mm, pubescent and glandular; fruit pedicel deflexed; seeds 3 x 2 mm, broadly ovate, tuberculate, with a narrow margin.

Two varieties occur in Egypt:

var. **arabica**

Syns. *Fagonia tilhoana* Maire, Bull. Mus. Hist. Nat. (Paris), sér. 2, 4: 907 (1932).

Fagonia arabica L. var. *tilhoana* (Maire) Maire, Bull. Soc. Hist. Nat. Afr. Nord 28: 349 (1937).

Fagonia arabica L. var. *imamii* Hadidi, Candollea 21: 21, f. 2B (1966).

Fagonia boulosii Hadidi, Candollea 21: 27, f. 5B (1966).

Fagonia boulosii Hadidi var. *crameri* Hadidi, Bot. Notiser 125: 527 (1972).

Fagonia arabica L. var. *negevensis* Zohary, Fl. Palaest. 2: 458 (1972).

Plant sparingly covered with capitate glands; lower leaves 3-foliolate, the upper 1-foliolate; leaflets 0.5-1.2(-1.5) cm; capsule to 7 mm diam., hairy.

O, M, D, S; sandy plains and desert wadis.

var. **viscidissima** Maire, Bull. Soc. Hist. Nat. Afr. Nord 20: 176 (1929).

Plant densely covered with capitate glands and adherent sand grains; lower and upper leaves 3-foliolate, the uppermost 1-foliolate; leaflets 3-5 mm; capsule 5-6 mm diam., hairy and glandular.

O, D; sandy plains and desert wadis.

Area of the species: Algeria, Libya, Egypt, Palestine, Arabia.

NOTE: *Fagonia arabica* is a very polymorphic species, sensitive to habitat variations, especially water content of the soil, which if abundant allows the development of longer internodes, stipular spines, etc. This has resulted in the description of several taxa at varietal and specific levels, difficult to separate. Zohary (Fl. Palaest. 2: 252, 1972) comments: "*F. arabica* shows a very pronounced seasonal and habitat polymorphism, and var. *negevensis* may perhaps represent one of these forms. Some of the forms tend towards 1-foliolate or long-petioled leaves and shorter or more horizontal stipular spines." In the present treatment 3 varieties: var. *tilhoana*, var. *imamii* and var. *negevensis*, as well as one species: *Fagonia boulosii* are listed for the first time as synonyms of *Fagonia arabica* var. *arabica*.

2. ***Fagonia bruguieri*** DC., Prodr. 1: 704 (1824).

Syns. *Fagonia echinella* Boiss., Diagn. Pl. Orient., ser. 1, 8: 123 (1849).

Fagonia diversifolia Boiss., Diagn. Pl. Orient., ser. 2, 1: 112 (1853).

Fagonia bruguieri DC. var. *laxa* Boiss., Fl. Orient. 1: 906 (1867).

Fagonia bruguieri DC. var. *haplotricha* Hadidi in Rech. f., Fl. Iran. 98: 8, t. 8, f. 2 (1972).

Fagonia haplotricha (Hadidi) Hadidi & El-Garf, Taekholmia 15: 83 (1995).

Glandular-hairy low shrub or perennial herb with woody base, 15-40 cm; stems many, branched, 4-angled, sulcate, brittle; internodes 0.5-2.5 cm; lower leaves 3-foliolate, the upper 1-foliolate; petiole 2-6(-9) mm; stipular spines 0.5-2.5 cm, spreading or slightly recurved; leaflets 0.4-9 x 1.5-3 mm, oblong-lanceolate, mucronate, rather fleshy; pedicel 2-5 mm, at first erect, later slightly deflexed; flowers 0.8-1.1 cm diam. at anthesis; sepals 2-3 mm, persistent; petals 4-8 mm, pink; capsule 4 x 3-4 mm, obconical; style 2 mm; seeds 2 x 1.5 mm, ovate, tuberculate, brownish.

O, M, D, GE, S; sandy plains and desert wadis. North Africa, Sinai, Palestine, Syria, Arabia, Iraq, Iran, Afghanistan.

3. ***Fagonia schimperii*** C. Presl, Bot. Bemerk 30 (1844).

Syns. *Fagonia myriacantha* Boiss., Diagn. Pl. Orient., ser. 1, 8: 123 (1849).

Fagonia kassasii Hadidi, Candollea 21: 23, f. 4 (1966).

Glabrous perennial herb with woody base, 15-30 cm; stems procumbent or erect, angular, sulcate; internodes 3-5 cm; stipular spines 3.5-6 cm; lower leaves 3-foliolate, the upper 1-foliolate; leaflets 3-6 mm, oblong-linear; pedicel 0.5-1.2 cm; flowers 1.2 cm diam. at anthesis; sepals 3 x 1.5 mm, glabrous, persistent; petals 5-7 mm, pink; capsule 3-4 x 4-5 mm, hairy; style 2.5 mm.

De, R, GE, S; sandy and stony desert wadis. Egypt, Palestine, Arabia.

NOTE: The type was collected in 1835 from Sinai, Schimper 251 (M).

4. ***Fagonia thebaica*** Boiss., Diagn. Pl. Orient., ser. 1, 8: 121 (1849).

Syn. *Fagonia thebaica* Boiss. var. *violacea* Boulos, Yale Peab. Mus. Nat. Hist. Postilla 100: 20 (1966).

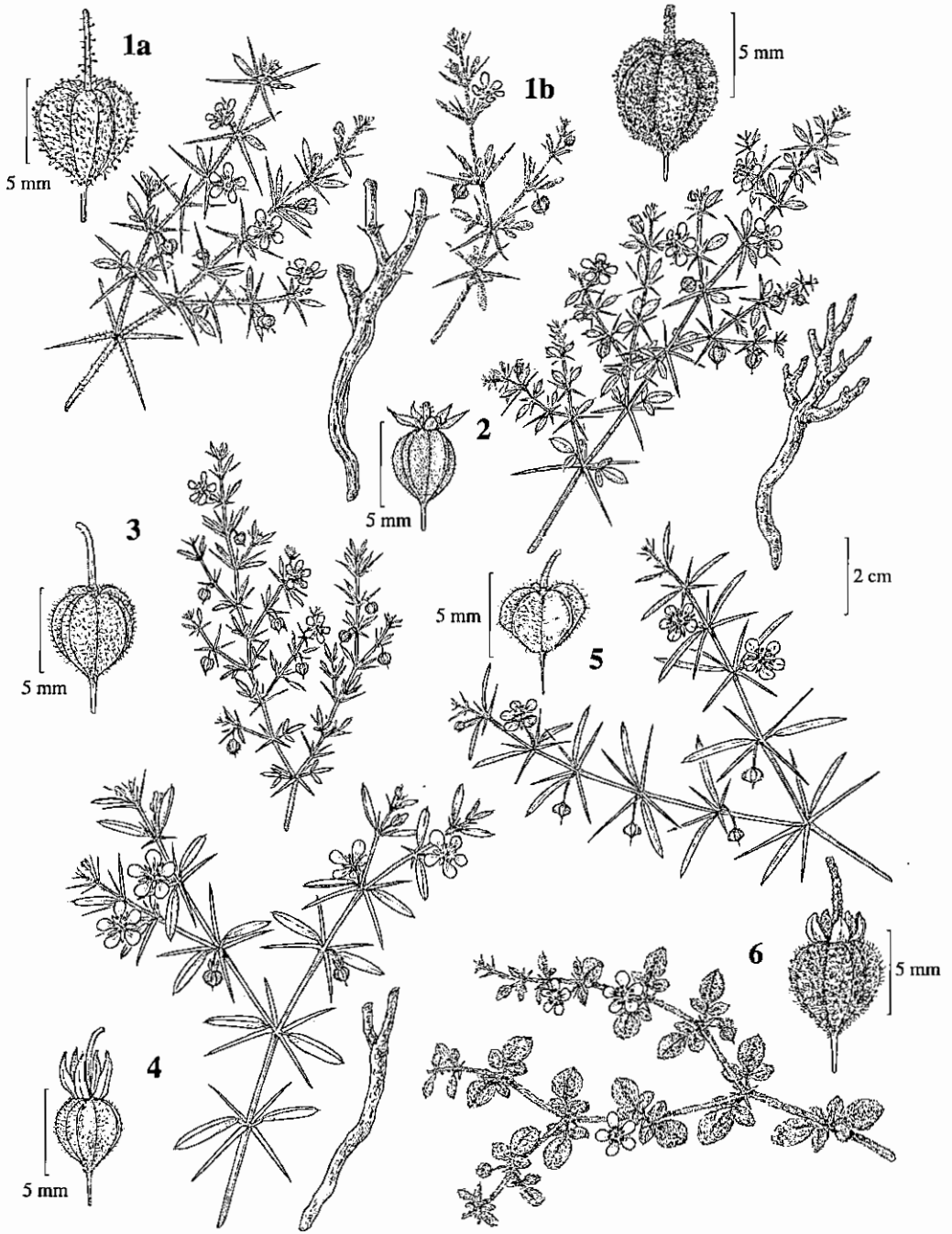


Plate 3. ZYGOPHYLLACEAE: flowering and fruiting branches of: *Fagonia arabica* var. *arabica* 1a, fruit (left), basal part (right). *Fagonia arabica* var. *viscidissima* 1b, fruit (right). *Fagonia bruguieri* 2, fruit (left), basal part (right). *Fagonia thebaica* 3, fruit (left). *Fagonia indica* 4, fruit (left), basal part (right). *Fagonia paulayana* 5, fruit (left). *Fagonia glutinosa* 6, fruit (right). All drawings to the same scale, except the enlarged fruits (scale given).

Glabrous low shrub 20-50 cm; stems terete, striate; internodes 0.8-1.8 cm; stipular spines 1-1.8 cm; lower leaves 3-foliolate, the upper 1-foliolate; petiole 0.5-1 cm; leaflets terete; pedicel 3-6 mm; flowers 1.2-1.5 cm diam. at anthesis; sepals 3.5 x 1.5 mm, oblong-lanceolate, glandular, caducous; petals 6-8 mm, pinkish-violet; capsule 3-5 x 4-5 mm, hairy.

D, S; desert wadis. Egypt, Libya, Chad, Niger.

NOTE: The type was collected by Boissier from Biban el Molouk near Thebes (Luxor) and hence the epithet "thebaica".

5. *Fagonia indica* Burm. f., Fl. Ind. 102, t. 34, f. 1 (1768).

Glabrous low shrub 20-50 cm, sometimes perennial with woody base, or annual; the juvenile parts often pruinose or glandular; stems terete, striate; internodes 1-4 cm; stipular spines 0.3-1.2 cm; leaves all 1-foliolate or 3- and 1-foliolate; leaflets 0.6-1.6 x 0.1-0.3 cm, narrowly elliptic-lanceolate to linear, distinctly articulate at the base, petiolulate, mucronate; pedicel 4-7 mm; flowers 1-1.2 cm diam. at anthesis; sepals 3 x 1.5 mm, ovate, persistent on young fruits; petals 5-6 mm, mauve; capsule 4 x 4 mm, hairy; style 2 mm; pedicel deflexed.

Two varieties occur in Egypt:

var. *indica*

Syns. *Fagonia mysorensis* Roth, Nov. Sp. Pl. Ind. Orient. 215 (1821).

Fagonia persica DC., Prodr. 1: 704 (1824).

Fagonia parviflora Boiss., Diagn. Pl. Orient., ser. 1, 8: 124 (1849).

Fagonia parviflora Boiss. var. *brevispina* Schweinf., Bull. Herb. Boissier 7, App. 2: 274 (1899).

Low shrub or perennial with woody base; all leaves 1-foliolate.

O, De, R, GE, S; desert wadis and coastal plains.

var. *schweinfurthii* Hadidi in Rech. f., Fl. Iran. 98: 6, t. 6 (1972).

Syn. *Fagonia schweinfurthii* (Hadidi) Hadidi, Österr. Bot. Zool. 121: 273 (1973).

Annual; lower leaves 3-foliolate, the uppermost 1-foliolate.

GE; stony wadis.

Area of the species: Egypt, Libya, Sahara, Sudan, Ethiopia, Kenya, Somalia, Djibouti, Arabia, Iran, Afghanistan, Pakistan, India.

6. *Fagonia paulayana* Wagner & Vierh., Österr. Bot. Zeitschr. 54: 34 (1904).

Syns. *Fagonia armata* R. Br., Salt. Voy. Abyss., App. 4: 64 (1814), nom. nud.

Fagonia elba Hadidi, Candollea 21: 29, f. 7B (1966).

Fagonia indica Burm. f. var. *elba* (Hadidi) Hadidi, Candollea 27: 88 (1972).

Like *Fagonia indica* Burm.f., but leaflets to 4 cm, oblong-linear, subsessile; sepals caducous; capsule 5 x 5 mm.

R, GE; stony wadis and coastal plains. Southeast Egypt, Sudan, Ethiopia, Kenya, Somalia, Socotra, Arabia.

7. *Fagonia taekholmiana* Hadidi, Candollea 21: 29, f. 7A (1966).

Almost glabrous perennial with woody base, 10-25 cm; stems procumbent or ascending, terete, striate; stipular spines absent or minute; leaves 1-foliolate, the lowermost ? 3-foliolate; petiole 1-3 mm, with a distinct joint between the petiole and the blade; leaflets 4-6 mm, lanceolate, mucronate, fleshy; pedicel 2-3 mm; flowers 1-1.2 cm diam. at anthesis; sepals 3.5 x 1.5 mm, ovate, glandular, deciduous; petals 5-6 mm, pink; capsule 4 x 5 mm; style 1-1.5 mm.

De; sandy soil. Egypt, Libya.

NOTE: *Fagonia taekholmiana* is known from Egypt only from the type collection: Heliopolis desert, near Cairo, 1952, El-Hadidi (CAI) and was thought to be endemic to Egypt. It was later collected from Libya, west of Tripoli, at Wadi Elheera, 29.4.1976, Grud 53 (ULT). The original description of the plant collected from Egypt shows that all leaves are 1-foliolate, while that from Libya shows basal 3-foliolate leaves. In the present description, the 3-foliolate basal leaves are retained with an interrogation mark, as they were not seen in the Egyptian material. Future collections from Egypt may confirm their presence or absence.

8. *Fagonia glutinosa* Delile, Descr. Egypte, Hist. Nat. 86, t. 28, f. 2 (1814).

Syns. *Fagonia glutinosa* Delile var. *grandiflora* Boiss., Fl. Orient. 1: 905 (1867).

Fagonia glutinosa Delile var. *nuda* Hadidi, Candollea 21: 33 (1966).

Perennial 20-60 cm, with woody base, densely covered with stipitate glands and adhering sand grains; stems prostrate, branched from the base, terete, striate; internodes 1.5-3 cm; stipular spines shorter than or scarcely equalling the leaf petiole; leaves mostly 3-foliolate, a few of the uppermost 1-foliolate; petiole to 6 mm; leaflets 3-8 x 2-3.5 mm, rhombic to oblong-ovate, mucronate; terminal leaflet much longer and broader than the 2 laterals; pedicel 2-5 mm; flowers 0.8-1 cm diam. at anthesis; sepals 2.5 x 1 mm, broadly ovate, mucronate, glandular, persistent; petals 0.6-1(-1.5) cm, pink; capsule 5 x 5 mm, densely hairy; style 3 mm; seeds 2.5 x 2 mm, ovate, brownish.

M, D, S; sandy and stony wadis and plains. North Africa, Sinai, Palestine, Arabia, Iran, Pakistan.

9. *Fagonia mollis* Delile, Descr. Egypte, Hist. Nat. 76, t. 27, f. 2 (1814).

Low shrub 20-40 cm, or perennial with woody base, glabrescent, hairy or glandular-hairy with sessile or stipitate glands; stems many, branched, angular, striate; stipular spines 0.5-1.2(-1.8) cm; leaves 3-foliolate; petiole 2-6 mm; leaflets 0.6-1.4 x 0.2-0.6 cm, ovate-elliptic, mucronate-spinulose; terminal leaflet longer and broader than the 2 laterals; pedicel 2-5 mm; flowers conspicuous, to 2 cm diam. at anthesis; sepals 2.5-4 mm, broadly-ovate, mucronate, caducous or persistent on mature fruits; petals 0.8-1.2 (-1.8) cm, pink; capsule 6 x 6-7 mm, obconical-obovoid, glandular; style 4-5 mm; seeds 2 mm, ovate, brownish.

Two varieties occur in Egypt:

var. **mollis**

- Syns. *Fagonia grandiflora* Boiss., Diagn. Pl. Orient., ser. 1, 8: 121 (1849).
Fagonia mollis Delile var. *grandiflora* (Boiss.) Post, Fl. Syr. Palest. Sinai
189 (1896).
Fagonia grandiflora Boiss. var. *sparse-glandulosa* Bornm., Verh.
Zool.-Bot. Ges. Wien 48: 569 (1898).
Fagonia mollis Delile var. *glabrata* Schweinf. ex Täckh., Stud. Fl. Egypt,
ed. 1, 257 (1956), nom. nud.

Plant glabrous or with few sessile glands; sepals glabrous to glabrescent, caducous.

De, S; sandy and stony desert wadis and plains. Egypt, Palestine, Syria, Arabia.

var. **hispida** Zohary, Fl. Palaest. 2: 458, t. 361b (1972).

- Syns. *Fagonia tristis* Sickenb., Mém. Inst. Egypt. 4: 201 (1901).
Fagonia tristis Sickenb. var. *boveana* Hadidi, Candollea 21: 33, f. 10A
(1966).
Fagonia boveana (Hadidi) Hadidi & El Garf, Taekholmia 12: 44 (1991).

Plant hispid, with long yellowish glandular hairs and short stipitate glands; sepals becoming membranous in fruit and persistent on mature capsules.

De, S; stony and sandy desert wadis. Egypt, Palestine.

10. **Fagonia latifolia** Delile, Descr. Egypte, Hist. Nat. 62, expl. pl. 86, t. 28, f. 3 (1814).

Slender annual 10-20 cm, covered with brownish glandular hairs; stems erect, angular, striate, branched; stipular spines 1-3 mm; basal leaves in a rosette; leaves mostly 3-foliolate; petiole 1-4 mm; leaflets 0.5-1.5 x 0.2-0.8 cm, broadly obovate, the terminal leaflet longer and broader than the 2 lateral; pedicel 1-3 mm; flowers 6-8 mm diam. at anthesis; sepals 2.5 x 1 mm, oblong-elliptic, glandular, caducous; petals 3.5-4 mm, rose; capsule 3 x 4 mm, hairy; style 1.5-2 mm.

De; desert wadis. Egypt, North and Central Sahara.

11. **Fagonia isotricha** Murb., Acta Reg. Soc. Physiogr. Lund 8: 54 (1897).

- Syns. *Fagonia lahovarii* Volkens & Schweinf., Liste Pl. Rec. Ghika-Comaneste 6
(1897).
Fagonia soturbensis Schweinf., Bull. Herb. Boissier 7, App. 2: 276 (1899).
Fagonia latifolia Delile subsp. *isotricha* (Murb.) Ozenda & Quézel, Trav.
Inst. Rech. Sah. 14: 62 (1956).

Robust viscid low shrub 10-25 cm, without adhering sand grains; stems striate; stipular spines 0.5-1 cm; leaves mostly 3-foliolate; petiole 2-4 mm; leaflets 0.8-2 x 0.5-1 cm, elliptic to broadly obovate, terminal leaflet to 2 x 1 cm; pedicel 2-5 mm; flowers 0.8-1 cm diam. at anthesis; sepals 2.5 x 1.5 mm, ovate, glandular, caducous; petals 4-6 mm, rose-pink; capsule 4 x 5 mm, hairy; style 2-2.5 mm.

De, R, GE; sandy and stony soils. North Africa, Mauritania, Cape Verde Islands, southern Sahara, Sudan.

12. **Fagonia microphylla** Pomel, Nouv. Mat. Fl. Atlant. 338 (1875).

Syn. *Fagonia microphylla* Pomel var. *fruticans* (Coss.) Maire ex Ozenda & Quézel, Trav. Inst. Res. Sah. 14: 58 (1956).

Perennial with woody base, 10-25 cm, covered with stipitate glands and frequently with adhering sand grains; stems procumbent or ascending; internodes 1-3 cm; stipular spines 2-6 mm; leaves 3-foliolate; petiole 1.5-3 cm; leaflets ovate, the lateral minute, the terminal 3-4 mm; pedicel 2-5 mm; flowers 1-1.2 cm diam. at anthesis; sepals 4 x 2.5 mm, lanceolate, glandular; petals 7-8 mm, rose-pink; capsule 4 x 5 mm, glandular-hairy.

S; stony wadis. Sinai, Tunisia, Algeria, Morocco.

13. **Fagonia cretica** L., Sp. Pl., ed. 1, 386 (1753).

Bright green glabrous perennial, 15-30 cm, with woody base; stems many, prostrate, 4-angled, sulcate; internodes to 3.5 cm; stipular spines 2-4(-8) mm; all leaves 3-foliolate; petiole 2-5(-8) mm; leaflets 0.5-1.8 x 0.2-0.3 cm, narrowly elliptic-lanceolate; terminal leaflet slightly longer than the 2 lateral; pedicel 3-5 mm, shorter than the capsule; flowers 1.6-2 cm diam. at anthesis; sepals 4-5 x 2-2.5 mm, lanceolate, glabrous, caducous; petals 0.8-1.2 cm, purple; capsule 0.8-1 cm diam., glabrous or hairy along the margin; style 2-2.5 mm.

M; calcareous coastal ridges. Canary Islands, North Africa, Spain, Balearic Islands, Sicily, Malta, Greece, Crete, Cyprus.

14. **Fagonia scabra** Forssk., Fl. Aegypt.-Arab. 88 (1775).

Syns. *Fagonia sinaica* Boiss., Diagn. Pl. Orient., ser. 1, 1: 61 (1843).

Fagonia kahirina Boiss., Diagn. Pl. Orient., ser. 1, 8: 122 (1849).

Fagonia kahirina Boiss. var. *sinaica* (Boiss.) Boiss., Fl. Orient. 1: 905 (1867).

Fagonia sinaica Boiss. var. *longipes* Maire, Bull. Soc. Hist. Nat. Afr. Nord 25: 297 (1934).

Fagonia sinaica Boiss. var. *kahirina* (Boiss.) Hadidi, Bot. Notiser 125: 531 (1972).

Glandular-hairy low shrub, 15-25 cm; stems erect, herbaceous with woody base, branched, 4-angled, sulcate; stipular spines 3-6 mm; leaves 3-foliolate; petiole 3-8 mm; leaflets 2-8 x 1-2 mm, elliptic-lanceolate, mucronate; pedicel 1-4 mm, elongate in fruit; flowers 0.8-1.2 cm diam. at anthesis; sepals 2-3.5 x 1.5 mm, ovate, glandular-hirsute or glabrescent; petals 0.6-1.1 cm, violet, clawed; capsule 3.5-4 x 3.5-4 mm, obconical, densely hairy; style 3 mm; seeds 2 x 1.5 mm, ovate, pitted, brownish.

De, S; stony desert wadis. North Africa, Sinai, Palestine.

15. **Fagonia tenuifolia** Steud. & Hochst. ex Boiss., Fl. Orient. 1: 909 (1867).

Syns. *Fagonia bischarorum* Schweinf., Bull. Herb. Boissier 7, App. 2: 276 (1899).

Fagonia flamandii Batt., Bull. Soc. Bot. France 47: 248 (1900).

Glabrous low shrub 15-25 cm; stems erect, terete, sulcate; internodes 2-4 cm; stipular spines 2-5 mm; leaves 3-foliolate; petiole 0.8-1.6 cm; leaflets 0.6-1.6 x 0.2 cm, linear, the terminal leaflet longer than the 2 lateral; pedicel 1-1.5 cm, elongate in fruit, 2-3 times as

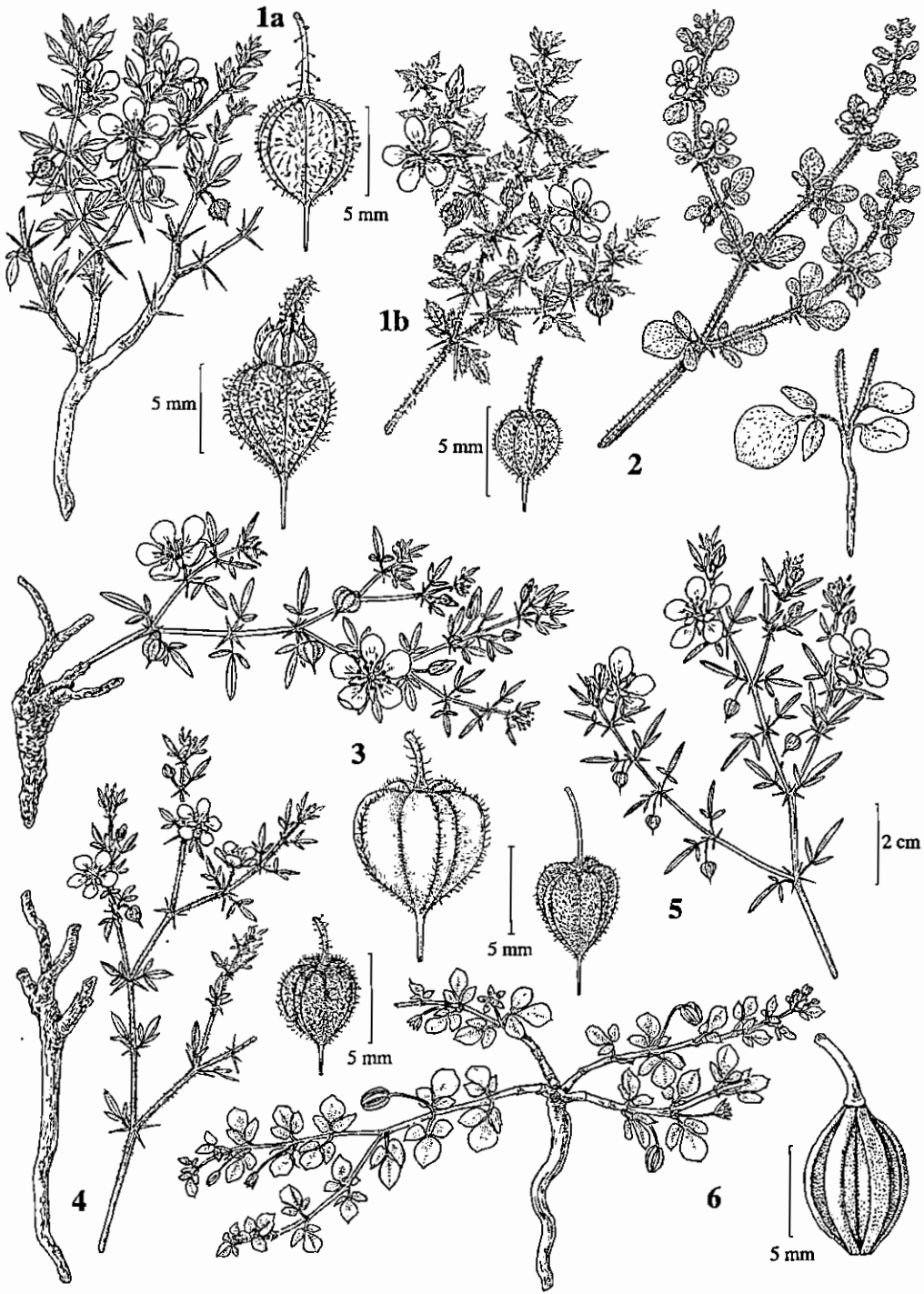


Plate 4. ZYGOPHYLLACEAE: flowering and fruiting branches of: *Fagonia mollis* var. *mollis* 1a, fruit (up right). *Fagonia mollis* var. *hispida* 1b, fruit (down left). *Fagonia latifolia* 2, fruit (left), basal part (right). *Fagonia cretica* with basal part 3, fruit (down right). *Fagonia scabra* 4, fruit (right), basal part (left). *Fagonia tenuifolia* 5, fruit (left). *Setzenia lanata* 6, fruit (right). All drawings to the same scale, except the enlarged fruits (scale given).

long as the capsule; flowers 1.2-1.5 cm diam. at anthesis; sepals 3-3.5 x 1.5-2 mm, ovate, glabrous, caducous; petals 6-8 mm, rose-pink; capsule 5 x 5 mm, hairy; style 2-3 mm.

De, R, GE; Southeast Egypt, Central Sahara, Arabia.

2. **Seetzenia** R. Br. ex Decne.

Herbaceous prostrate perennial; leaves opposite, stipulate, 3-foliolate; flowers axillary, bisexual; sepals 5, persistent; petals 0; stamens 5, inserted on a disc, without appendages at the base; ovary sessile, 5-celled, pentagonal, 5-locular, each locule 1-ovulate; styles 5, free; stigmas capitate; fruit a 5-angled capsule; seeds ovoid-oblong, compressed. 1 species, North and South Africa, Southwest Asia.

1. **Seetzenia lanata** (Willd.) Bullock, Kew Bull. 19: 204 (1965).

Syns. *Zygophyllum lanatum* Willd., Sp. Pl., ed. 4, 2: 564 (1799).

Zygophyllum prostratum Thunb., Fl. Cap. 189 (1800).

Seetzenia africana R. Br., Narr. Trav. Afr. App. 231 (1826).

Seetzenia prostrata (Thunb.) Ecklon & Zeyher, Enum. 98 (1834).

Seetzenia orientalis Decne., Ann. Sci. Nat. Bot., sér. 2, 3: 281, t. 7. (1835).

Perennial 10-30 cm, glabrous or scabrid; stems many, prostrate, herbaceous, striate; leaves 1-2 cm, 3-foliolate; stipules membranous; petiole 0.5-1 cm; leaflets 0.5-1.2 x 0.3-0.8 cm, obovate-cuneate, mucronate, the 2 lateral leaflets oblique and smaller than the terminal; pedicel 4-8 mm, elongate in fruit; sepals 3-4 mm, persistent and elongate in fruit, rather fleshy; capsule 7-9 x 4-5 mm, ellipsoid; seeds 4-5 mm, ovoid-oblong with tapering ends, glossy.

De, R, S; Egypt, Palestine, Arabia, Pakistan, Afghanistan, India, Sahara, Somalia, South Africa.

3. **Zygophyllum** L.

Shrubs, low shrubs or annuals; leaves opposite, 2-foliolate or simple (our species) or many-foliolate; stipules usually fleshy; leaflets succulent, terete or flattened; flowers bisexual, (4-)5-merous, pedicellate, solitary or few; sepals (4-)5, persistent or caducous; petals (4-)5, imbricate, clawed, entire; disc fleshy; stamens 8-10 (our species); filaments with an appendage at the base; ovary 4-5-celled, 4-5 angled, each cell with 2 or more ovules; style angular; fruit a 4-5-winged, lobed or angled capsule, indehiscent or dehiscent; seeds pendulous, with a brittle coat. About 80 species, Mediterranean region to Central Asia, South Africa, Australia, usually in arid and saline regions.

1. Annual, sometimes short-lived perennial; leaves simple, sessile
+ Shrubs; leaves 2-foliolate, petiolate

1. **Z. simplex**
2

2. Leaflets flattened
+ Leaflets terete

3
4

3. Capsule to 1 cm
+ Capsule 2-3 cm

5. **Z. decumbens**
7. **Z. fabago**

- | | |
|---|-----------------------------|
| 4. Capsule conspicuously winged, wings broader than the capsule
+ Capsule wingless | 6. Z. dumosum
5 |
| 5. Flowers 2-3(-4) at the nodes
+ Flowers solitary at the nodes | 3. Z. aegyptium
6 |
| 6. Leaves bright green, glabrous; pedicel equalling to or longer than the capsule;
capsule cylindrical | 4. Z. coccineum |
| + Leaves whitish, mealy-pubescent; pedicel much shorter than the capsule;
capsule pear-shaped | 2. Z. album |

1. **Zygophyllum simplex** L., Mant. 68 (1767).

Syn. *Zygophyllum portulacoides* Forssk., Fl. Aegypt.-Arab. 88 (1775), Icones t. 12 B (1776).

Glabrous annual or short-lived perennial, 10-40 cm; stems prostrate, much-branched; leaves 0.5-2.5 cm, simple, sessile, fleshy, cylindrical to obovoid, obtuse; stipules 1-2 mm, membranous, lanceolate, acute; pedicel 1-2 mm, elongate in fruit; flowers axillary, 1 or 2; sepals 1.5-2 mm, obovate, caducous, the margin scarious; petals 3 mm, yellow, long-clawed; capsule 2-3 mm, obovoid, glabrous, the lobes narrowly winged; style 2-3 mm, persistent; seeds 1 mm, broadly elliptic, smooth.

D, R, GE, S; desert wadis, sandy plains, edges of salt marshes. Arid regions of Africa, Palestine, Arabia to India.

2. **Zygophyllum album** L. f., Dec. Prim. Pl. Rar. Hort. Upsal. 11, t. 6 (1762).

Syns. *Zygophyllum proliferum* Forssk., Fl. Aegypt.-Arab. 87 (1775), Icones t. 11 (1776).

Zygophyllum amblyocarpum Baker, Kew Bull. 1894: 339 (1894).

Zygophyllum album L. f. var. *amblyocarpum* (Baker) Hadidi, Webbia 33: 52 (1972).

Mealy-canescens low shrub 25-50 cm; stems many, branched; leaves 2-foliolate, whitish, mealy-pubescent; stipules 1.5-2.5 mm, broadly triangular, connate at the base, scarious; petiole 0.6-1.2 cm; leaflets 3-8 mm, cylindrical to obovoid, fleshy; pedicel much shorter than the capsule; flowers axillary, solitary; sepals 2-3.5 mm, ovate; petals 5-7 mm, white, clawed; scales of the filaments basal, membranous, about 1/2 as long as the filament; capsule 6-9 x 5-7 mm, pear-shaped, 5-lobed; style 0.5-1 mm; seeds 1.5-2 mm, elliptic, tuberculate.

O, M, D, R, S; coastal and inland saline sandy soils. Spain, North Africa, East Mediterranean region, Sinai, southern Arabia, Socotra, tropical East Africa.

NOTE: *Zygophyllum album* is a widespread species in Egypt. The difference given between var. *album* (type grown in Uppsala from seeds collected in Egypt) and var. *amblyocarpum* (type from Hadramout, Yemen), the latter variety with acute and keeled capsule lobes, seem to be a continuous variation, as pointed out by Thulin, Fl. Somalia 1: 183 (1993). The numerous specimens which were examined from different localities in Egypt seem to belong to one taxon. The habitat variations usually allow slight differences which are of no taxonomic importance.

3. **Zygophyllum aegyptium** Hosny, Bot. Notiser 130: 467 (1977).

Glabrous or sparsely hairy shrub, 30-80 cm; stems erect, branched; old stems woody, whitish, glabrous, cylindrical, obscurely striate; young branchlets green, sparingly hairy, angular, striate; leaves 2-foliolate, greenish, glabrous; stipules 1 mm, broadly triangular; petiole 0.6-1.2(-1.4) cm; leaflets 0.5-1 cm, oblanceolate; flowers 2-3(-4) at the nodes; pedicel 1-2.5 mm, elongate in fruit; sepals 3-4 x 2 mm, ovate; petals 4-5 mm, white; stamens 10; staminal scales 2 mm; capsule 5-8 x 5-8 mm, obconical, 5-lobed; style 1.5 mm; seeds 1.5 x 1 mm, ovate.

N (northern Delta), M, S; sandy coastal dunes and inland plains. Egypt, Libya, Tunisia, Cyprus.

NOTE: The type was collected from Ras El-Bar near Damietta in July 1976 by El-Gazzar, *s.n.* (CAI!).

4. **Zygophyllum coccineum** L., Sp. Pl., ed. 1, 386 (1753).

Syns. *Zygophyllum desertorum* Forssk., Fl. Aegypt.-Arab. 87 (1775), Icones t. 11 (1776).

?*Zygophyllum propinquum* Decne., Ann. Sci. Nat. Bot., sér. 2, 3: 283 (1835).

Zygophyllum coccineum L. var. *berenicense* Muschl., Man. Fl. Egypt 578 (1912).

Zygophyllum berenicense (Muschl.) Hadidi, Bot. Notiser 131: 441 (1978).

Low shrub or perennial herb, 20-50 cm, sometimes flowering the first year; stems many, branched, erect, the young branches green; leaves 2-foliolate, bright green, glabrous; stipules 1.5 x 1.5 mm, broadly triangular, membranous; petiole 1-2.2 cm; leaflets 0.5-1.5 cm, cylindrical; flowers solitary, axillary; pedicel 0.8-1.2 cm; sepals 4-6 mm, the margin scarious; petals 6-8 mm, white, spathulate, long-clawed; filaments with basal scales; capsule 0.5-1 cm, cylindrical or obscurely 5-angled, truncate; style 0.5-1 mm; seeds 2 x 1 mm, ovate, acute, tuberculate.

O, D, R, S; desert wadis and plains, tolerant of saline soils. Egypt, southern Palestine, western Arabia, northern Sudan.

NOTE: *Zygophyllum coccineum* is the most widespread *Zygophyllum* species in Egypt and grows in diverse habitats and different soil types. Several related taxa were described which are difficult to separate from *Z. coccineum* and which are apparently extreme forms of the species due to environmental factors. They are therefore listed here as synonyms.

5. **Zygophyllum decumbens** Delile, Descr. Egypte, Hist. Nat. 221, t. 27, f. 3 (1814).

Syn. *Zygophyllum decumbens* Delile var. *megalocarpum* Hosny, Bot. Notiser 130: 467 (1977).

Glabrous glaucous low shrub, 20-50 cm; stems decumbent to ascending, much-branched, obscurely striate, the young branches greenish-white; leaves 2-foliolate; stipules 1.5-2 x 0.5-1 mm, narrowly triangular, acute, membranous; petiole 1-1.8 cm, narrowly winged; leaflets 0.8-1.8 x 0.5-1.2 cm, obovate, flattened; flowers 1.1-1.4 cm diam. at anthesis, in compound dichasial cymes; pedicel 0.6-1.2 cm; sepals 2-2.5 mm; petals 4-5 mm, white;



Plate 5. ZYGOPHYLLACEAE: flowering and fruiting branches of: *Zygothymus simplex* 1, fruit (left). *Zygothymus album* 2, fruit (up left). *Zygothymus aegyptium* 3, fruit (left). *Zygothymus decumbens* 4, fruit (up left). *Zygothymus coccineum* 5, fruit (down left). *Zygothymus dumosus* 6, fruit (right). *Zygothymus fabago* 7, fruit (right). All drawings to the same scale, except the enlarged fruits (scale given).

staminal scales deeply 2-fid, with acute teeth; capsule to 1 cm, obconical, glabrous, deeply 5-lobed; style 2-2.5 mm.

De, R, S; stony wadis and desert plains. Egypt, Northeast Sudan, Somalia, Socotra, Arabia.

NOTE: *Zygophyllum decumbens* var. *megalocarpum* is clearly a vigorous variant of *Z. decumbens* and is listed here as a synonym.

6. *Zygophyllum dumosum* Boiss., Diagn. Pl. Orient., ser. 1, 8: 125 (1849).

Appressed-canescens low shrub, 30-80 cm; stems many, intricate, angular; old stems woody, with fissured bark; young branches herbaceous, canescent; leaves 2-foliolate; stipules 1-1.5 mm, broadly triangular, connate at the base; petiole 0.5-1 cm, cylindrical, fleshy, persistent; leaflets 0.5-1 cm, canescent, cylindrical, deciduous; flowers solitary, axillary; pedicel 0.5-1 cm, elongate in fruit; sepals 6-8 mm oblong-ovate, the margin scarious; petals 1.2-1.6 cm, white, spatulate; filaments 6-8 mm, the basal scales suborbicular, with dentate apex; capsule 0.8 x 1 cm, conspicuously winged, the wings broader than the capsule; style 2-3 mm; seeds 3-3.5 x 2 mm, rhomboid, brownish.

De; S; stony wadis, hillsides. Egypt, Palestine.

NOTE: Zohary, Fl. Palaest. 2: 253 (1972) writes: "One of the most common shrubs in the deserts of Palestine and Sinai; a leading plant of several plant communities; highly resistant to extreme perennial drought and also to a certain degree of salinity. Attains an age of 200-250 years."

7. *Zygophyllum fabago* L., Sp. Pl., ed. 1, 385 (1753).

Glabrous glaucous perennial 20-60 cm, woody at the base; stems erect to ascending; stipules 3-6 mm, connate at the base; petiole 1.5-3 cm, narrowly winged; leaflets 1.5-3 x 1-1.8 cm, ovate-elliptic, fleshy, the apex acute; flowers solitary, axillary; pedicel 5-8 mm, elongate in fruit; sepals 5-7 mm, oblong-ovate, the margin scarious; petals 6-8 mm, whitish-cream, emarginate; filaments 1-1.2 cm, basal scales oblong, ciliate; capsule 2-3 cm, oblong-cylindrical, 5-angled; style 3 mm.

De, S; desert plains. Egypt, West Asia.

NOTE: The knowledge of the occurrence of *Zygophyllum fabago* in Egypt is based on old collections; the plant has not been observed or collected for some 50 years.

4. *Tribulus* L.

Annuals or short-lived perennials with woody base; leaves paripinnate, paired at each node, one shorter than the other, sometimes alternate by abortion; stipules 2, scarious; flowers solitary at each node, subtended by the smaller leaf, actinomorphic, bisexual; sepals 5, caducous or persistent; petals 5, white or yellow, imbricate, caducous; stamens 10, rarely 5 by abortion, inserted on the base of a ring-shaped disk; filaments with a basal gland; ovary sessile, 5-locular; ovules 2-5 in each locule; style 1 or 0; stigma 5-angled, conspicuous; fruit a schizocarp; mericarps 5, splitting at maturity, indehiscent, prickly, tuberculate or winged; seeds without endosperm. 25 species, tropical and warm regions.

1. Mericarps unarmed or without wings 2
+ Mericarps spiny or winged 4
2. Fruit 1-1.5 cm diam., subspherical 9. **T. kaiseri**
+ Fruit 0.5-1 cm diam., pyramidal 3
3. Mericarps 3 x 1.5 mm, sparsely hairy 7. **T. bimucronatus** var. **inermis**
+ Mericarps 0.8-1 x 0.25-0.4 cm, densely hairy 8. **T. mollis**
4. Mericarps winged 5
+ Mericarps spiny 7
5. Mericarps with triangular wings 1. **T. pentandrus**
+ Mericarps with semicircular or trapeziform wings 6
6. Fruit 1-2.5 cm diam.; mericarps 9 x 2 mm, densely hairy; wings trapeziform,
(2-)4-8 mm diam., dentate-serrate 2. **T. macropterus**
+ Fruit 0.6-1 cm diam.; mericarps 0.6-0.8 x 1.2 cm, sparsely hairy; wings
semicircular, 2.5-4 mm diam., entire, serrulate or crenate 3. **T. megistopterus**
7. Mericarps with 2 small basal spines 7. **T. bimucronatus** var. **bispinulosus**
+ Mericarps with basal and lateral spines 8
8. Fruit 6-9 mm diam.; spines 1-2.5 mm 6. **T. parvispinus**
+ Fruit 1-2.5 cm diam.; spines 2.5-5 mm 9
9. Fruit 1.5-2.5 cm diam.; mericarps appressed-hairy; spines thick,
rigid and sharp-pointed 4. **T. terrestris**
+ Fruit 1-1.5 cm diam.; mericarps villous; spines flattened, delicate,
not sharp-pointed 5. **T. spurius**

1. **Tribulus pentandrus** Forssk., Fl. Aegypt.-Arab. 88 (1775).

Syns. *Tribulus alatus* Delile, Descr. Egypte, Hist. Nat. 62 (1814), nom. superfl.

Tribulus longipetalus Viv., Plant. Aegypt. Dec. 4: 10 (1830).

Tribulus alatus Delile var. *odontopteris* Kralik, Ann. Sci. Nat., sér. 3, 11:
30 (1849), nom. illeg.

Pubescent annual or short-lived perennial; stems 20-60 cm, prostrate; leaves 2-6 cm; leaflets 3-7 pairs, 0.3-1.2 x 0.2-0.4 cm, ovate-lanceolate; stipules 3-6 mm; flowers 6-9 mm diam. at anthesis; pedicel 3-6 mm, elongate in fruit to 1.2 cm; sepals 3.5-4.5 mm, caducous; petals 4-6 mm, yellow or white; filaments 2-3.5 mm; fruit pyramidal to spherical, 0.6-1.2 cm diam. including the wings; mericarps 2-6 mm diam., sparsely hairy, 2-winged; wings triangular, entire or dentate-serrate.

O, D, GE, S; waste ground, sandy plains. North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Pakistan, India, Sudan, Eritrea, Somalia, Kenya.

NOTE: The type was collected in 1762 from Cairo, Egypt, Forsskål 743 (C).

2. **Tribulus macropterus** Boiss., Diagn. Pl. Orient., ser. 1, 1: 61 (1843).

Syn. *Tribulus persicus* Kralik, Ann. Sci. Nat., sér. 3, 11: 31 (1849).

Appressed-canescens annual; stems 20-40 cm, prostrate, branched from the base, striate; leaves 4-7 cm; leaflets 4-6 pairs, oblong-elliptical, acute; stipules 4-6 mm, ovate-oblong; flowers 1.2-1.5 cm diam. at anthesis; sepals 6-8 mm, lanceolate; petals almost equalling the sepals, obovate, yellow; fruit 1-2.5 cm diam.; mericarps 9 x 2 mm, densely hairy; wings trapeziform, (2-)4-8 mm diam., dentate-serrate.

O, D, S; desert plains and waste ground. Algeria, Libya, Egypt, Palestine, Arabia, Iraq, Iran, Afghanistan, Sudan.

3. **Tribulus megistopterus** Kralik, Ann. Sci. Nat., sér. 3, 11: 32 (1849)

subsp. **pterocharpus** (Ehrenb. ex C. Muell.) Hosni, Taeckholmia 11: 12 (1991).

Syn. *Tribulus pterocarpus* Ehrenb. ex C. Muell. in Walp., Ann. Bot. Syst. 4: 404 (1857).

Hispid-pilose annual; stems 30-60 cm, prostrate; leaves 3-6 cm; leaflets 5-7 pairs, oblong-lanceolate; stipules 4-6 mm; flowers 1-1.4 cm diam. at anthesis; fruit 0.6-1 cm diam.; mericarps 0.6-0.8 x 1.2 cm, sparsely hairy; wings semicircular, 2.5-4 mm diam., entire, serrulate or crenate.

De, GE; sandy plains. Southern Egypt, northern Sudan, Arabia (Red Sea coast).

4. **Tribulus terrestris** L., Sp. Pl., ed. 1, 387 (1753).

Syns. *Tribulus lanuginosus* L., Sp. Pl., ed. 1, 387 (1753).

Tribulus robustus Boiss. & Noë in Boiss., Diagn. Pl. Orient., ser. 2, 1: 112 (1854).

Green appressed-hairy annual; stems 20-60 cm, many, prostrate, branched, striate; leaves 3-8 cm; leaflets 5-8 pairs, 0.5-1.2 x 0.2-0.4 cm, ovate-oblong; stipules 3-4 mm; flowers 1.2-1.5 cm diam. at anthesis; pedicel 0.5-1.5 cm; sepals 3-5 mm, lanceolate; petals 0.6-1 cm, yellow; fruit 1.5-2.5 cm diam.; each mericarp with 4 spines, appressed-hairy; spines thick, rigid and sharp-pointed.

N, M, D, R, GE, S; desert plains, waste ground, weed of cultivation. Mediterranean region, tropical and subtropical regions.

5. **Tribulus spurius** Kralik, Ann. Sci. Nat., sér. 3, 11: 28 (1849).

Like *Tribulus terrestris*, but fruit 1-1.5 cm diam.; mericarps villous; spines flattened, delicate, not sharp-pointed.

Dw (Nubian Desert); sandy plains. Southern Egypt, northern Sudan, Arabia (Red Sea coast).

6. **Tribulus parvispinus** Presl, Bot. Bemerk. 29 (1844) var. **parvispinus**

Villous annual; stems 10-25 cm, prostrate; leaves 1-2.5 cm; leaflets 4-6 pairs, oblong-ovate, 2-4 x 2-2.5 mm; stipules 1 mm; pedicel 2-5 mm, elongate in fruit to 1.2 cm; sepals 1.5-2 mm, linear-lanceolate; petals 2-4 mm, yellow; filaments 1-2 mm; fruit disc-shaped 6-9 mm diam.; mericarps 2-3 x 1.5 mm; with 2 median and often 2 basal spines; spines 1-2.5 mm.

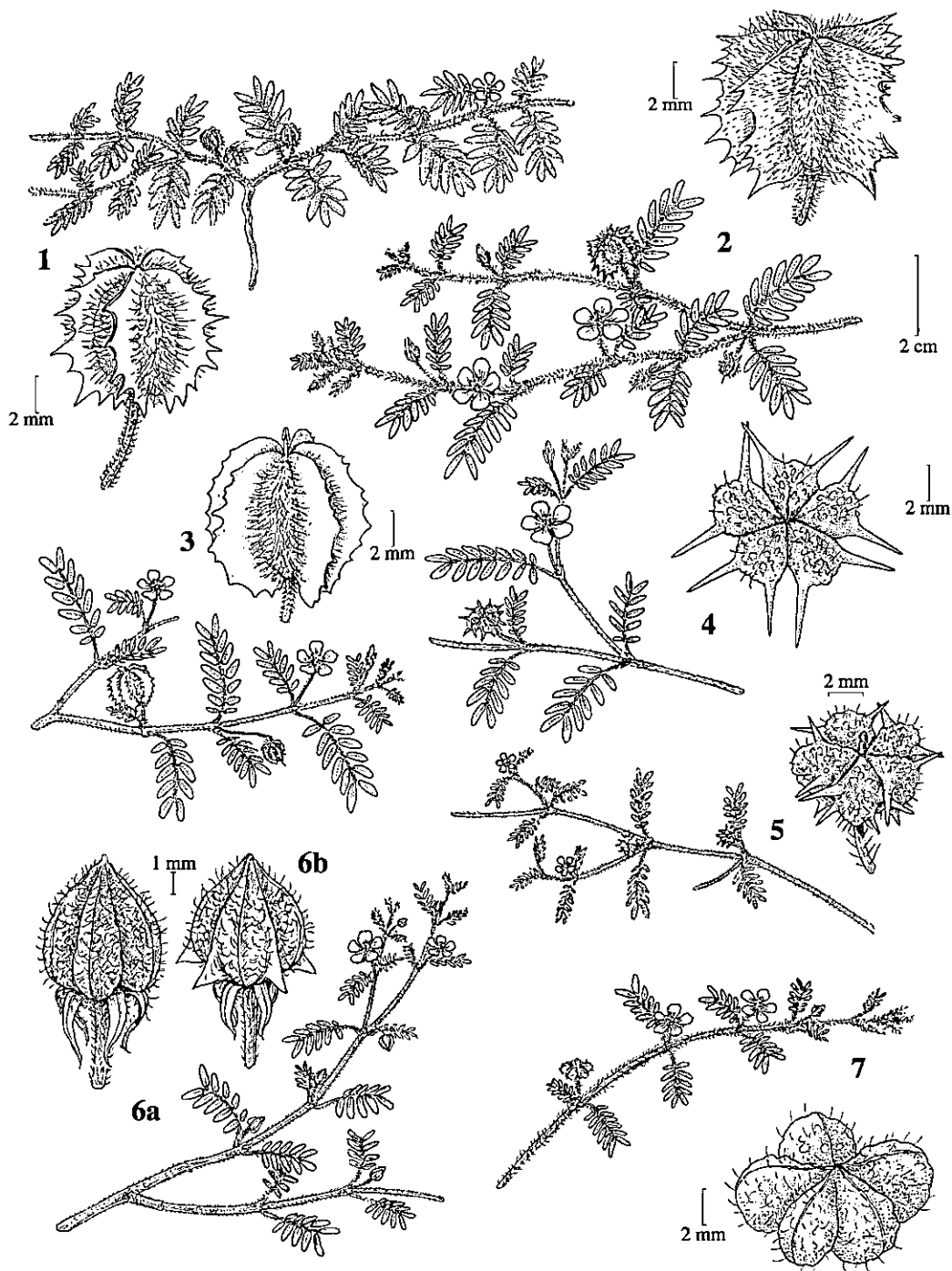


Plate 6. ZYGOPHYLLACEAE: flowering and fruiting branches of: *Tribulus pentandrus* 1, fruit (down left). *Tribulus macropterus* 2, fruit (up). *Tribulus megistopterus* subsp. *pterocarpus* 3, fruit (up right). *Tribulus terrestris* 4, fruit (up right). *Tribulus parvispinus* 5, fruit (up right). *Tribulus bimucronatus* var. *inermis* 6a, fruit (up left); var. *bispinosus* 6b, fruit (up right). *Tribulus kaiseri* 7, fruit (down). All drawings to the same scale, except the enlarged fruits (scale given).

R, GE; coastal plains. Southeast Egypt, tropical East and southern Africa, Arabia, Iraq, Iran, Pakistan.

7. **Tribulus bimucronatus** Viv., Pl. Aegypt. Dec. 4 (1): 9, t. 2, f. 4 (1830).

Pubescent annual; stems 15-30 cm, prostrate; leaves 1.5-4 cm; leaflets 3-5 pairs, 4-6 x 2-3 mm, ovate-elliptic; stipules 1-2 mm, lanceolate; pedicel 2-5 mm, elongate in fruit to 8 mm; sepals 2-3.5 mm, lanceolate; petals 3.5-4.5 mm, yellow; filaments 2-3 mm; fruit 5-8 mm diam., pyramidal; mericarps 3 x 1.5 mm, sparsely to densely hairy, unarmed, tuberculate or with 2 small basal spines.

Two varieties occur in Egypt:

var. **inermis** (Kralik) Hosni, *Taeckholmia* 11: 14 (1991).

Syns. *Tribulus inermis* Kralik, *Ann. Sci. Nat.*, sér. 3, 11: 25 (1849).

Tribulus bimucronatus Viv. subsp. *inermis* (Kralik) Hosni in El-Hadidi, *Fl. Trop. E. Afr.*, *Zygophyllaceae* 3 (1985).

Mericarps unarmed, tuberculate, sparsely hairy.

De, R, GE; coastal and sandy plains. Egypt, Kenya, Ethiopia, Arabia.

var. **bispinulosus** (Kralik) Hosni, *Taeckholmia* 11: 16 (1991).

Syn. *Tribulus bispinulosus* Kralik, *Ann. Sci. Nat.*, sér. 3, 11: 26 (1849).

Mericarps with 2 basal small spines, densely hairy.

De, R, GE; coastal and sandy plains. Egypt, Sudan, tropical East Africa, Arabia.

8. **Tribulus mollis** Ehrenb. ex Schweinf., *Beitr. Fl. Aethiop.* 29 (1867).

Syns. *Tribulus ochroleucus* (Maire) Ozenda & Quézel, *Trav. Inst. Rech. Sahar.* 14: 74 (1956).

Tribulus macropterus Boiss. var. *ochroleucus* Maire, *Bull. Soc. Hist. Nat. Afr. Nord* 20: 176 (1929).

Like *Tribulus bimucronatus* Viv. var. *inermis* (Kralik) Hosni, but mericarps 0.8-1 x 0.25-0.4 cm, densely hairy.

S; sandy plains. North Africa, Sinai, Arabia, Iran, Afghanistan, Pakistan, Mauritania, Niger, Chad, Sudan, Ethiopia, Somalia.

9. **Tribulus kaiseri** Hosni, *Taeckholmia* 9: 63 (1978).

Green, hairy annual; stems 10-20 cm, prostrate; leaves 2-4 cm; leaflets 3-6 pairs, ovate-elliptic; stipules 2-4 mm; flowers 1 cm diam. at anthesis; sepals 2.5-3.5 mm, caducous; petals 5-7 mm, cream; fruit 1-1.5 cm diam., subspherical; mericarps 3-5 x 2 mm, unarmed, sparsely hirsute, rugose.

S; desert wadis. Sinai, northern Arabia, Iran (Kerman).

5. *Balanites* Delile, nom. conserv.

Shrubs or trees; stems with spinescent branches and axillary spines; leaves exstipulate, alternate, 2-foliolate; leaflets entire, leathery; flowers in axillary clusters, regular, pedicellate, disc thick; sepals 5, free, caducous; petals 5, imbricate; stamens 10, free, inserted below the disc; filaments filiform; ovary 5-locular; style short; stigmas minute; fruit a fleshy, 1-seeded oily drupe, 5-angled; endocarp bony; seeds ovoid. About 25 species, tropical Africa to Burma.

1. *Balanites aegyptiaca* (L.) Delile, Descr. Egypte, Hist. Nat., 263, t. 28, f. 1 (1814).
Syn. *Ximenia aegyptiaca* L., Sp. Pl., ed. 1, 1194 (1753).

Tree 4-10 m, bark grey; branches pubescent, with axillary spreading spines to 4 cm; leaves 2-foliolate; petiole 2-6 mm; leaflets 2-6 x 2-3.5 cm, elliptic-obovate, entire, coriaceous; flowers in axillary clusters; sepals 4-5 x 2-3 mm; petals 5-6 x 2 mm, yellow-green; ovary embedded in the disc, pubescent at the apex; style 2-3 mm; fruit 2-4 x 1-2 cm, subcylindrical, obscurely 5-angled, glabrous, ripening yellow.

N, O, D, GE, S; desert wadis and plains. Egypt, Palestine, Arabia, tropical Africa.

NOTE: The fruit is edible, of a sweet-sour taste; oil extracted from the fruit is used in folk medicine. According to Wood, Yemen Flora 202 (1997) the seeds contain a poison that can kill the snails that act as a host for the *Bilharzia* parasite.

NITRARIACEAE

Description as for *Nitraria*, the only genus in the family.

1. *Nitraria* L.

Shrubs; stems spinescent; leaves simple, fleshy, alternate or clustered; stipules caducous or indurate; flowers bisexual, in a loose cymose inflorescence, actinomorphic, 5-merous; calyx 5-partite, persistent; petals 5, free; disc inconspicuous; stamens 15, inserted at the disc margin; ovary 3-locular, pyramidal, tapering into a short style; stigmas 3, connivent; fruit a conical drupe, 1-celled, 1-seeded; apex splitting into 6 small, subulate teeth; seeds pendulous, ovoid; endosperm absent. 6 species, Sahara, South Russia, East Siberia, West Asia, Southeast Australia, usually in saline soils.

1. *Nitraria retusa* (Forssk.) Asch., Verh. Bot. Vereins. Prov. Brandenb. 18: 94 (1876).
Syns. *Peganum retusum* Forssk., Fl. Aegypt.-Arab. LXVI, 211 (1775).
Nitraria senegalensis Poir. in Lam., Encycl. 4: 493 (1797).
Nitraria tridentata Desf., Fl. Atlant. 1: 372 (1798).
Nitraria sericea Jaub. & Spach, Ill. Pl. Orient. 3: 142, t. 294 (1850).

Shrub 1-2 m; stems many, spinescent, appressed-canescenscent; leaves 1-2.5 x 0.5-1.5 cm, alternate or in fascicles, petiolate, fleshy, obovate-cuneate, retuse or crenate-dentate at the apex; stipules minute, persistent; flowers 5-8 mm, in loose dichotomous cymes on young branches; pedicel 3-6 mm; sepals 2-2.5 mm; persistent; petals 4-5 mm, greenish-white, hispid; stamens 15; fruit a fleshy drupe, 0.6-1 x 0.5-0.6 cm, trigonous, pear-shaped, red.

N, O, M, D, R, GE, S; coastal and inland saline soils, edges of salt marshes. North Africa, Sinai, Palestine, Syria, Arabia, Iraq, Iran, Pakistan.

NOTE: The sweet fruit is edible.

PEGANACEAE
(incl. Tetradiclidaceae)

Annuals, perennials or shrubs; leaves entire or irregularly dissected, sometimes with minute setaceous stipules; flowers solitary, axillary, sometimes forming bracteate spicate inflorescence, bisexual, actinomorphic, (3-)4-5-merous; sepals persistent; petals free, contorted; stamens 15, in 3 rows or (3-)4, attached to the extrastaminal nectary disc; filaments dilated at the base; gynoecium of 2-4 carpels; ovary 2-4-locular; ovules many per locule; fruit a loculicidal capsule or 2-locular berry. 3 genera (*Peganum*, *Malacocarpus*, *Tetradiclis*), 8 species, Mediterranean region to Mongolia, southeastern Russia, southern North America.

NOTE: A. Takhtajan, 1996, Diversity and Classification of Flowering Plants, pp. 330-331 treats *Tetradiclis* under a separate monotypic family Tetradiclidaceae.

1. Perennial; flowers conspicuous, to 1.5 cm; sepals and petals 5;
stamens 15

1. Peganum

+ Annual; flowers inconspicuous, c. 1 mm; sepals and petals (3-)4;
stamens (3-)4

2. Tetradiclis

1. Peganum L.

Perennial herbs or shrubs; leaves alternate, irregularly dissected; stipules bristle-like; flowers bisexual, in terminal raceme-like dichasia; sepals 5, persistent; petals 5, imbricate; stamens (12-)15, dilated at the base, inserted in 3 rows at the base of a cup-shaped disc; ovary 3-celled, globose, ovules numerous; fruit a capsule, 3-valved, loculicidal or indehiscent and berry-like; seeds angular, with a spongy coat. About 6 species, Mediterranean region to Mongolia, southern North America.

1. Peganum harmala L., Sp. Pl., ed. 1, 444 (1753).

Perennial with woody base, glaucous, glabrous, 20-50 cm; stems much-branched, erect or ascending; stipules 1-2 mm, subulate; leaves 3-8 cm, sessile; blade irregularly pinnatisect; lobes linear, entire, acute; flowers in terminal cymose inflorescences; pedicel 0.5-1.2 cm; sepals 1-1.5 cm, narrowly linear, sometimes with 2 small lateral lobes; petals 1.2-1.5 x 0.3-0.5 cm, oblong-elliptic, white; capsule 5-8 mm, 3-celled, subglobose, glabrous, the style persistent; seeds 1.5-2 mm triangular, tuberculate.

M, De, S; roadsides and waste ground. North Africa, southern Europe, Southwest Asia to Tibet.

2. Tetradiclis Steven ex M. Bieb.

Succulent annual; leaves exstipulate, sessile, entire or dissected, the lower opposite, the cauline alternate; flowers bisexual, small, in terminal bracteate spicate inflorescences;

sepals (3-)4, persistent; petals (3-)4, short-clawed; stamens (3-)4; ovary 3-4-celled; stigmas 4, divergent; fruit a capsule, tetragonous, loculicidal, many-seeded; seeds minute, oblong. 1 species, Egypt, Palestine, Iraq, Iran, Pakistan, Afghanistan, Southeast Russia.

1. **Tetradiclis tenella** (Ehrenb.) Litv., Trav. Mus. Bot. Acad. Pétersb. 3: 122 (1907).

Syns. *Anatropa tenella* Ehrenb., Linnaea 4: 404 (1829).

Tetradiclis salsa M. Bieb., Fl. Taur.-Caucas. 3: 277, 648 (1819), sine nom.
sp. descr. gen. monotyp.

Tetradiclis salsa C. A. Mey., Verz. Pfl. Cauc. 226 (1831).

Tetradiclis salsa Steven ex Bunge, Linnaea 14: 178 (1840).

Glabrous annual 10-25 cm; stems many from the base, erect or ascending, slender; leaves 0.5-1.5 cm, exstipulate, fleshy, glabrous, linear, entire or dissected into linear lobes; flowers c. 1 mm, white, in terminal spicate inflorescences, (3-)4-merous; sepals deltate, connate to 1/2 their length; petals c. 1 mm, longer than the sepals; stamens (3-)4; capsule 3-3.5 mm, 4-valved, subglobose; seeds 0.5 mm, oblong, brownish.

M; saline soils. Distribution as for the genus.

NOTE: The type was collected from Alexandria, Egypt, in 1824 by Ehrenberg (K, G).

LINACEAE

Annuals (our species), shrubs, trees or climbers, glabrous or with simple hairs; leaves alternate or opposite, simple, stipulate; stipules caducous; flowers in terminal or axillary cymes, sometimes solitary, regular, bisexual; sepals 4-5, imbricate, free or connate at the base; petals 4-5, free or connate at the base; stamens usually 5, rarely 10; filaments fused at the base into a tube, often with staminodal teeth between the stamens; ovary superior, 2-5-locular, each locule usually divided by a false septum with 2 ovules in each; styles 3-5, free or connate at the base; fruit a capsule, dehiscent into 10 1-seeded valves; seeds flattened. 14 genera, 250 species, cosmopolitan.

1. *Linum* L.

Annuals or perennials; leaves sessile, alternate, rarely opposite, with or without stipular glands; flowers in terminal or axillary cymes, rarely solitary, regular, 5-merous; sepals imbricate, persistent, often glandular ciliate at the margin; petals 5, contorted, caducous, usually clawed, often connate at the base; stamens 5, connate at the base, sometimes with dentate staminodes alternating with the filaments; nectaries 5 or less, adnate to the staminal tube; carpels 5; ovary 10-locular due to false septa; styles 5, free or connate at the lower half; stigma linear or capitate; fruit a capsule; seeds flattened, smooth, glossy. About 180 species, temperate and subtropical regions, but especially the Mediterranean region.

1. Pedicel 1-3 cm 2
+ Pedicel 1-2 mm 3

2. Petals bright blue; capsule 0.8-1 cm 1. *L. usitatissimum*
+ Petals red; capsule 4-5.5 mm 2. *L. decumbens*



Plate 7. ZYGOPHYLLACEAE: *Balanites aegyptiaca* 1, flowering and fruiting branch; fruit (left). NITRARIACEAE: *Nitraria retusa* 2, flowering and fruiting branch; fruit (right). PEGANACEAE: flowering and fruiting branches of: *Peganum harmala* 3, fruit (down). *Tetradiclis tenella* 4, fruit (left). LINACEAE: flowering and fruiting branches of: *Linum decumbens* 5, fruit (left). *Linum strictum* 6, fruit (left). *Linum pubescens* 7, fruit (right). All drawings to the same scale, except the enlarged fruits (scale given).

3. Plant scabrid; petals yellow
+ Plant pubescent; petals pink

4. **L. strictum**
3. **L. pubescens**

1. **Linum usitatissimum** L., Sp. Pl., ed. 1, 277 (1753).

Glabrous erect annual 30-60 cm; stems usually branched at the base; basal leaves 1-2 x 0.3-0.5 cm, oblong, withering before fruiting; upper leaves 1.5-5 x 0.2-0.4 cm, linear, acuminate; inflorescence a lax leafy cyme; flowers leaf-opposed; pedicel 1-3 cm, to 4 cm in fruit; sepals 5-8 x 3-5 mm, elliptic, acute, glabrous; petals 1.3-1.8 x 1-1.5 cm, bright blue, the base cuneate; stamens 7-8 mm; ovary 4-5 x 2.5-3 mm, ovoid; styles 3-4 mm; stigmas linear; capsule 0.8-1 cm, subglobose, dehiscent or indehiscent; seeds 4-4.5 x 2 mm, oblong, brown.

N, O; edges of fields, escape from cultivation. Widely cultivated in temperate regions; the plant is not known in the wild.

NOTE: The plant, flax, has been cultivated in Egypt since time immemorial for its fibres of which very fine "linen" clothes were made by the Ancient Egyptians. It is now cultivated in Egypt mainly for the seeds which yield linseed oil.

2. **Linum decumbens** Desf., Fl. Atlant. 1: 278 (1798).

Glabrous annual 15-40 cm; stems decumbent or ascending; leaves 0.8-2 x 0.1-0.4 cm, linear-lanceolate, acute, 1-3(-5) nerved, the margin scabrid; pedicel 1-1.5 cm; sepals 6-8 mm, acuminate, the margin scarious, ciliate near the apex; petals 1.2-1.8 cm, red; stigmas linear; capsule 4-5.5 mm, subglobose; beak c. 1 mm, acute; seeds 3 x 2 mm, broadly ovoid, flattened, brownish.

M; cultivated ground. North Africa, southern Italy, Sicily, Sardinia.

3. **Linum pubescens** Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 2: 268 (1794).

Erect pubescent annual 10-35 cm; stems single or branched at the base, slender; leaves 1-3.5 x 0.3-0.8 cm, sparsely hairy; flowers in a terminal irregular cyme; pedicel 1-2 mm, slightly elongate in fruit; sepals 0.8-1 x 0.2-0.3 cm, the apex acute, hairy; petals 2-3 x 1-1.5 cm, pink, clawed; stamens connate at the base into a short tube; styles connate into a 3-4 mm tube, free for c. 2 mm; stigmas c. 1 mm; capsule 3-4 mm, subglobose, 10-ribbed, with a short apical beak; seeds 2-2.5 x 1-1.5 mm, oblong-elliptic.

De, S; cultivated fields and hillsides. East Mediterranean region, Sinai.

4. **Linum strictum** L., Sp. Pl., ed. 1, 279 (1753).

Scabrid annual 10-30 cm; stems erect, branched at the base, obscurely ridged; leaves 0.5-1.5 x 0.15-0.25 cm, linear-acuminate, the margin scabrid, the lower leaves much shorter than the upper; flowers in spicate inflorescences; pedicel c. 1 mm, slightly elongate in fruit; bracts foliaceous, rigid; sepals 4-5.5 x 1-1.5 mm, ovate-lanceolate, 3-nerved, long-acuminate, serrulate, glandular-ciliate; petals 5-6 x 1.5 mm, yellow, free; styles 5, 1.5 mm; stigmas capitate; capsule 2-3 mm, globose, dehiscent; seeds c. 1.5 x 1 mm, brown.

M; waste and stony ground. Mediterranean region, eastwards to Iran and Afghanistan.

EUPHORBIACEAE

Herbs, shrubs, trees, succulents or climbers, sometimes spiny, sometimes with stellate hairs, peltate scales or stinging hairs; plant often with latex; leaves alternate or opposite; stipules 0, minute or large and foliaceous; inflorescence axillary, leaf-opposed or terminal, mostly racemose, rarely cymose, or flowers very reduced and contained within flower-like cyathia; flowers usually regular, unisexual, dioecious or monoecious, rarely bisexual; sepals (0-)3-6(-8), free or united; petals (0-)3-6(-8), free or united; stamens 1-c. 1000, free or united; ovary superior, (2-)3-locular; placentation axile with 1 or 2 ovules per locule; fruit a dehiscent capsule or a drupe; seeds often with a caruncle. 340 genera, 8100 species, cosmopolitan, excluding arctic regions.

- | | |
|---|-----------------------|
| 1. Flowers in cyathia, with gland-bearing involucre, each cyathium with numerous male flowers, each reduced to 1 stamen, surrounding a single female flower;
latex present | 8. Euphorbia |
| + Flowers not as above; latex absent | 2 |
| 2. Leaves deeply palmately lobed, glabrous | 3 |
| + Leaves pinnately veined, not or slightly lobed; if lobed then densely stellate-hairy | 4 |
| 3. Leaves 3-5-lobed; petiole 1-4 cm; fruit 0.8-1 x 0.6-0.8 cm, glabrous | 7. Jatropha |
| + Leaves 7-9-lobed; petiole 8-20 cm; fruit 1-2 x 1-1.6 cm,
usually densely covered with bristle-tipped fleshy processes 3-5 mm | 5. Ricinus |
| 4. Leaves opposite | 6. Mercurialis |
| + Leaves alternate | 5 |
| 5. Leaves densely stellate-hairy; seeds 1 per locule | 4. Chrozophora |
| + Leaves glabrous or scabrous, not stellate-hairy; seeds 2 per locule | 6 |
| 6. Dioecious; pistillode style-like | 2. Flueggea |
| + Monoecious; pistillode absent or small | 7 |
| 7. Stems erect; petals 0; pistillode 0 | 3. Phyllanthus |
| + Stems prostrate or decumbent; petals 5; small pistillode present | 1. Andrachne |

1. *Andrachne* L.

Monoecious perennial herbs or shrubs; leaves simple, alternate, petiolate, entire; flowers axillary, the male usually in clusters, the females solitary; *male flowers*: sepals 5(-6), imbricate; petals 5(-6); disc glands 5(-6), free, opposite the petals; stamens 5(-6); pistillode present, small; *female flowers*: sepals usually larger than those of male flowers; petals minute or 0; disc glands free or united; ovary 3-celled, with 2 ovules in each cell; styles 3, 2-fid; stigmas capitate; fruit a capsule, dehiscing into 3 cocci; seeds 2 in each cell, ecarunculate. About 25 species, widespread in the tropics and subtropics, extending into the Mediterranean region and West Asia.

- | | |
|---|---------------------------|
| 1. Leaves suborbicular-ovate, glabrous; stipules chaffy; petiole 0.5-2 mm;
capsule glabrous; persistent sepals rhombic | 2. A. telephioides |
| + Leaves suborbicular-reniform, prominently glandular-scabrous; | |

stipules green; petiole 3-8 mm; capsule glandular-pubescent; persistent sepals lanceolate

1. *A. aspera*

1. *Andrachne aspera* Spreng., Syst. Veg., ed. 16, 3: 884 (1826).

Glaucous glandular-scabrous perennial with woody base or low shrub, 15-30 cm; stems much branched, prostrate or ascending; stipules green; petiole 3-8 mm; blade 0.3-0.8 x 0.5-1.2 cm, suborbicular-reniform, glandular-scabrous, the apex notched or rounded; stipules 1 mm, oblong; *male flowers*: pedicel 2 mm; petals 1.5 mm, whitish; *female flowers*: pedicel 3-5 mm; sepals 2-2.5 mm, lanceolate, persistent; petals minute; capsule 2.5-3.5 mm diam., depressed-globose, glandular-pubescent; seeds 1.5 mm, angular, reticulate-foveolate.

De, R, GE, S; desert wadis, stony hillsides. Cape Verde Islands, North Africa, West Asia, Cameroon, Sudan, Ethiopia, Somalia, Socotra.

2. *Andrachne telephioides* L., Sp. Pl., ed. 1, 1014 (1753).

Like *Andrachne aspera*, but leaves suborbicular-ovate, glabrous; stipules chaffy; petiole 0.5-2 mm; capsule glabrous; persistent sepals rhombic.

De, S; desert wadis, sandy plains, stony ground. Cape Verde Islands, Mediterranean region, West Asia, Somalia, Socotra.

2. *Flueggea* Willd.

Dioecious trees or shrubs; stems unarmed or spinescent; leaves alternate, simple, shortly petiolate, entire, penni-nerved, stipulate; flowers axillary, fasciculate; *male flowers*: numerous, sepals 5, petals 0, disk glands 5, interstaminal, stamens 5; pistillode present, style-like; *female flowers*: few or solitary, sepals 5, petals 0, disc flat; ovary 2-3-celled, with 2 ovules in each cell; style 2-3, connate at the base; fruit globose, slightly or scarcely fleshy, usually loculicidally dehiscent, 3-celled; seeds 2 per cell. 14 species, tropical regions.

1. *Flueggea virosa* (Willd.) Voigt, Hort. Suburb. Calc. 152 (1845) subsp. ***virosa***

Syns. *Phyllanthus virosa* Willd., Sp. Pl., ed. 4, 4: 578 (1805).

Securinega abyssinica A. Rich., Tent. Fl. Abyss. 2: 256 (1851).

Securinega virosa (Willd.) Baill., Adansonia 6: 334 (1866).

For full synonymy see Radcliffe-Smith in Polhill (ed.), Fl. Trop. E. Afr., Euphorbiaceae 70 (1987).

Dioecious unarmed glabrous shrub or small tree, 2-5 m; branches reddish-brown; petiole 2-5 mm, narrowly winged; blade 2.5-6 x 1-3 cm, obovate, entire; stipules 1-2 mm, lanceolate, caducous; flowers in axillary clusters, fragrant; *male flowers*: pedicel 2-5 mm; sepals 1-1.5 mm; stamens 2 mm; anthers minute, yellow; *female flowers*: pedicel 2-4(-8) mm; sepals ± like those of male flowers; ovary 1 mm, subglobose; styles 3, 1 mm, 2-fid, recurved; fruit loculicidally dehiscent, 2-3 x 3-5 mm, compressed-globose, smooth, green, becoming white-waxy and fleshy; seeds 2 x 1.5 mm, brownish.

GE; rocky ridges. Southeast Egypt, tropical Africa, Asia, Australia.

3. *Phyllanthus* L.

Monoecious (our species) or dioecious herbs, shrubs or trees; leaves alternate, simple, petiolate, entire, penni-nerved; flowers axillary, solitary or in clusters; *male flowers*: pedicel capillary, sepals 4-6, biseriate, imbricate, subequal; petals 0; disc glands 4-6, free; stamens 2-6; pistillode 0; *female flowers*: pedicel more robust than those of male flowers; sepals similar to those of male flowers; disc annular or cupular; ovary 3- to many-celled, with 2 ovules in each cell; styles 3-many; fruit 3-4-celled, dehiscent into 2-valved cocci; seeds trigonous, ecrunculate. About 600 species, tropical and warm regions, but especially Africa.

- | | |
|--|-------------------------------|
| 1. Sepals 5 | 2 |
| + Sepals 6 | 3 |
| 2. All stamens free | 2. <i>P. nummulariifolius</i> |
| + Central 3 stamens fused, the outer 2 free | 1. <i>P. reticulatus</i> |
| 3. Leaves linear-lanceolate, spirally arranged; female flowers with disc of 6 separate glands | 3. <i>P. maderaspatensis</i> |
| + Leaves orbicular-ovovate, distichously arranged so branches look like pinnate-leaves; female flowers with annular disc | 4. <i>P. rotundifolius</i> |

1. *Phyllanthus reticulatus* Poir., Encycl. 5: 298 (1804).

Syn. *Phyllanthus multiflorus* Willd., Sp. Pl., ed. 4, 4: 581 (1805).

Glabrous puberulent or pubescent shrub or small tree, 1-3 m; bark rough, peeling; leaves 1.5-4.5 x 0.6-2 cm, oblong-elliptic; stipules 1-1.5 mm; flower clusters of 3 male and 1 female; *male flowers*: pedicel 2-4 mm; sepals 5, 1 x 1 mm; stamens 5(-6), the outer 2 free, the central 3 connate at the base; *female flowers*: pedicel 2 mm; sepals like those of male flowers; disc glands 5; ovary sessile; styles very short, free; fruit 3-4 x 4-5 mm, subglobose-depressed, smooth; seeds 2 mm, ovoid-trigonous, slightly reticulate.

Two varieties occur in Egypt:

var. **reticulatus**

Flowering shoots, especially the young branchlets, pedicel and outer calyx-lobes puberulent or pubescent.

GE; rocky hillsides. Old World tropics.

var. **glaber** (Thwaites) Müll. Arg., Linnaea 32: 12 (1863).

Syns. *Phyllanthus polyspermus* Schumach. & Thonn., Beskr. Guin. Pl. 416 (1827).

Kirganelia prieuriana Baill. var. *glabra* Baill., Adansonia 1: 83 (1860).

Kirganelia multiflora (Willd.) Baill. var. *glabra* Thwaites, Enum. Pl. Zeyl. 282 (1861).

Phyllanthus prieurianus (Baill.) Müll. Arg. var. *glaber* (Baill.) Müll. Arg., Linnaea 32: 12 (1863).

Leafy and flowering shoots, leaves, pedicel and calyx-lobes entirely glabrous.

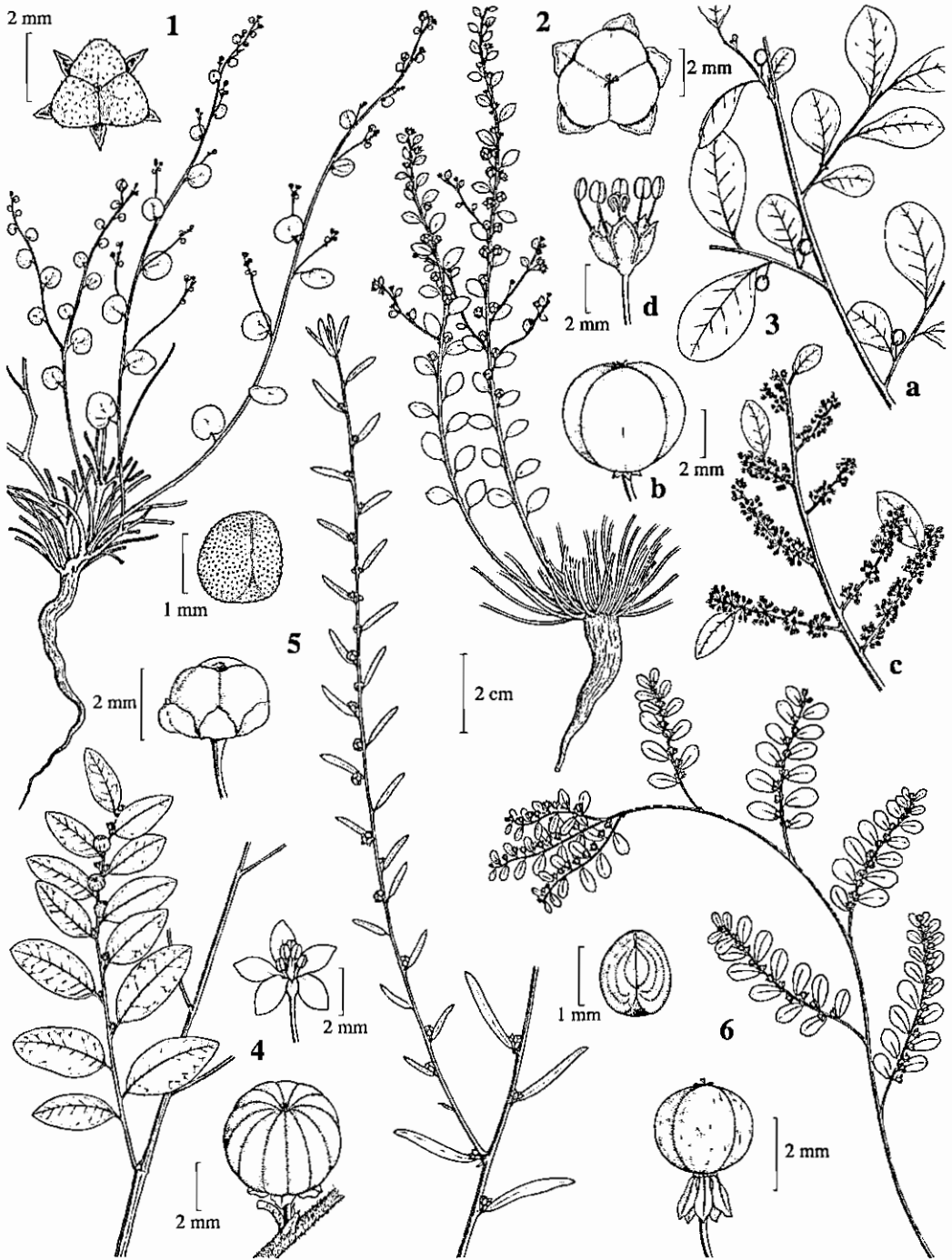


Plate 8. EUPHORBIACEAE: *Andrachne aspera* 1, habit; fruit (up). *Andrachne telephioides* 2, habit; fruit (up right). *Flueggea virosa* 3; a, fruiting female branch; b, fruit; c, flowering male branch; d, male flower. *Phyllanthus reticulatus* 4, branch with male flowers and fruits; male flower (up right); fruit on a branchlet (down right). *Phyllanthus maderaspatensis* 5, branch with male flowers and fruits; seed (up left); fruit (left, below the seed). *Phyllanthus rotundifolius* 6, branch with male flowers and fruits; fruit (down right). All drawings to the same scale, except the enlarged parts (scale given).

N (Luxor), among hedges in cultivated ground. Old World tropics, introduced into the West Indies.

NOTE: The only available specimen of var. *glaber*, kindly identified by A. Radcliffe-Smith, Kew, was collected by F. W. Oliver B 50 (K!), from Luxor, Egypt, among hedges in a garden.

2. **Phyllanthus nummulariifolius** Poir., Encycl. Méth. Bot. 5: 302 (1804).

Syns. *Phyllanthus capillaris* Schumach. & Thonn., Beskr. Guin. Pl. 417 (1827).

Phyllanthus stuhlmannii Pax, Pfl. Ost-Afr. C: 236 (1895).

Phyllanthus capillaris Schumach. & Thonn. var. *stuhlmannii* (Pax) Hutch., Fl. Trop. Afr. 6 (1): 709 (1912).

Monoecious or dioecious decumbent or \pm erect herb or shrub, like *Phyllanthus reticulatus* var. *glaber*, but male flowers with all the 5 stamens free.

M; garden weed. Egypt, Sudan, westwards to Sierra Leone and southwards to South Africa (Natal), Madagascar, Mascarene Islands, Seychelles.

NOTE: The plant is apparently naturalized as a garden weed in Alexandria. The only specimen I have seen from Egypt. (K!), kindly identified by A. Radcliffe-Smith, was collected by Malak Rezk, *s.n.*, in 1999 from the Botanic Garden of Alexandria University.

3. **Phyllanthus maderaspatensis** L., Sp. Pl., ed. 1, 982 (1753).

Low shrub or perennial with woody base, 20-50 cm; stems terete, the ultimate branches angular; leaves 0.5-2(-5) x 0.2-0.7 cm, linear-lanceolate, spirally arranged; petiole *c.* 1 mm; stipules 1-1.5 mm, lanceolate; flowers in clusters of 2-4 male and 1 female; *male flowers*: 2 mm diam.; pedicel 1 mm; sepals 6, ovate; stamens 3; *female flowers*: 2.5 mm diam., with disc of 6 separate glands; pedicel 1.5-2 mm; sepals persistent; disc glands 6, free; capsule 3 mm diam., subglobose-depressed; seeds 1 mm.

GE; stony wadis. Southeast Egypt, tropical Africa, Arabia, India, Sri Lanka, Java, China, Australia.

4. **Phyllanthus rotundifolius** Willd., Sp. Pl., ed. 4, 4: 584 (1805).

Syn. *Phyllanthus scabrifolius* Hook. f., Fl. Brit. Ind. 5: 299 (1887).

Monoecious annual 10-40 cm; stems erect, branched, angular, scabrid; leaves to 1.5 x 1 cm, orbicular-obovate, distichously arranged so branches look like pinnate leaves, obtuse, glaucous; stipules 1-1.5 mm, scarious; male and female flowers occurring together in some axils; *male flowers*: pedicel 1 mm; sepals 6; disc glands 6; stamens 3, filaments united into a short column; *female flowers*: pedicel 1.5-2 mm; sepals 6; disc annular; capsule 2 mm diam., smooth; seeds dark brown.

N, M, De, R, GE, S; sandy and alluvial soils. Africa, Sinai, Arabia, Socotra, Pakistan, India, Sri Lanka.

4. *Chrozophora* Juss., nom. conserv.

Annuals, perennials or low shrubs, often with a stellate indumentum; leaves simple, entire, dentate or slightly lobed; stipules chaffy; flowers monoecious, male and female flowers in racemose or paniculate inflorescence, the females at the base and the males in the terminal part; sepals 5, valvate; petals 5, alternating with the sepals, disc 5-lobed; *male flowers*: with (3-) 5-15 stamens, variously united; *female flowers*: with 5 or 0 staminodes; styles 3, 2-fid; capsule 3-seeded; seeds without caruncle. 7 species, Mediterranean region, tropical Africa, West Asia.

1. Capsule stellate-hairy; anthers 15 1. *C. plicata*
+ Capsule covered with scurfy scales; anthers 3-12 2
2. Leaf blade 1-2(-2.5) x 0.5-1.5 cm, ovate-deltoid to -elliptic, undulate; petiole 2-6 mm; inflorescence *c.* 1 cm, dense; capsule sessile, not deflexed; seeds smooth 3. *C. brocchiana*
+ Leaf blade (2-)3-8 x 1-4(-6) cm, oblong-lanceolate, ovate-rhombic or -lanceolate; petiole to 9 cm; inflorescence to 4 cm, lax; capsule long-pedicellate, deflexed; seeds scabrous-tuberculate 3
3. Annual, sometimes woody at the base; leaf blade ovate-rhombic or ovate-lanceolate, sometimes indistinctly 3-lobed, entire to repand-dentate, obtuse; petiole to 9 cm 4. *C. tinctoria*
+ Perennial; leaf blade oblong-lanceolate, entire or sharply incised-dentate, acute; petiole to 4 cm 2. *C. oblongifolia*

1. ***Chrozophora plicata*** (Vahl) Spreng., Syst. Veg. 3: 850 (1826), excl. syn. Lam.
Syns. *Croton plicatus* Vahl, Symb. Bot. 1: 78 (1790).
Croton obliquifolius Vis., Pl. Quae. Aeg. Nub. Enum. Ill. no. 171: 39, t. 7, 2 (1836).

White stellate-hairy annual or short-lived perennial, 15-50 cm; stems prostrate or ascending; petiole 1-4.5 cm; blade 1.5-5 x 1-4 cm, plicate, broadly ovate or ovate-rhombic, sometimes slightly 3-lobed; stipules 2-3 mm, linear; *male flowers*: pedicel 1 mm; sepals 3 x 1 mm, acute, stellate-hairy; petals 3 x 1 mm, elliptic-oblong, pink; staminal column 3-4 mm; anthers 15; *female flowers*: pedicel 3-7 mm, elongating in fruit to 3 cm; sepals 1.5-2 x 0.5 mm, stellate-hairy; petals minute or 0; ovary 2 x 2 mm, densely stellate-hairy; styles 2 mm, deeply 2-fid; capsule 4-5 x 8 mm, trigonous, densely stellate-hairy; seeds 3-4 mm, ovoid- subglobose, ± smooth.

N, O, De (along Suez Canal), S; waste ground, roadsides, edges of cultivation. Egypt, Palestine, western Arabia, tropical Africa.

NOTE: The type was collected from Giza, Egypt, in June 1762 by Forsskål (C).

2. ***Chrozophora oblongifolia*** (Delile) Spreng., Syst. Veg., ed. 16, 3: 850 (1826).
Syn. *Croton oblongifolius* Delile, Descr. Egypte, Hist. Nat., 283 (1814).

Greyish stellate-hairy perennial herb, 30-80 cm, woody at the base; stems erect, many; petiole to 4 cm; blade 3-7 x 1-2.5 cm, oblong-lanceolate, entire to sharply incised-dentate, acute; stipules minute, caducous; flowers in terminal and axillary racemes; *male*



Plate 9. EUPHORBIACEAE: flowering and fruiting branches of: *Chrozophora plicata* 1; fruit (left). *Chrozophora oblongifolia* 2; fruit (up left); seed (up right). *Chrozophora brocchiana* 3; fruit (up right). *Chrozophora tinctoria* 4; fruit (right). *Mercurialis annua* 5 a, female flowering branch; 5 b, male flowering branch; 5 c, fruit. *Jatropha glauca* 6; seed and fruit (right). All drawings to the same scale, except the enlarged parts (scale given).

flowers: 4-5 mm, subsessile, in spicate racemes; *stamens* 4-6(-8); *female flowers*: 2-4, pedicel 3-8, elongate and deflexed in fruit; *sepals* 10, 2-3 mm, linear; *petals* equalling the *sepals*; *capsule* 4-5 x 8 mm, covered with scurfy scales; *seeds* 4-5 mm, tuberculate.

O, De, GE, S; desert wadis, sandy plains, edges of cultivation. Egypt, Palestine, Arabia, Iran, Northwest India, Sudan, Ethiopia, Eritrea, Djibouti, Somalia, Socotra.

NOTE: The type was collected from Egypt by Delile.

3. *Chrozophora brocchiana* Vis., Pl. Aegypt. Nub. 39, t. 8, f. 2 (1836).

Densely whitish-yellow stellate-hairy perennial with woody base, or low shrub to 1 m; stems erect, much-branched; petiole 2-6 mm; blade 1-2(-2.5) x 0.5-1.5 cm, ovate-deltoid to -elliptic, undulate, obtuse, rusty whitish-yellow on both surfaces; flowers on c. 1 cm axillary and terminal dense inflorescences; capsule 5 x 6 mm, subsessile, not deflexed, covered with whitish, violet-tinged, scurfy scales; style 2.5 mm, persistent; seeds 4 x 3 mm, subglobose, whitish, smooth.

De, R, GE; sandy plains. Southeast Egypt, North Sudan, Chad, North Nigeria, Senegal, Mauritania, Cape Verde Islands, Arabia.

4. *Chrozophora tinctoria* (L.) Raf., Chlor. Aeth. 4 (1813).

Syns. *Croton tinctorium* L., Sp. Pl., ed. 1, 1004 (1753).

Chrozophora obliqua (Vahl) Juss. ex Spreng., Syst. Veg. 3: 850 (1826).

Chrozophora verbascifolia (Willd.) Juss. ex Spreng., Syst. Veg. 3: 851 (1826).

Chrozophora hierosolymitana Spreng., Syst. Veg. 3: 850 (1826).

Stellate-hairy annual 20-80 cm, sometimes woody at the base; stems erect or ascending, much-branched; petiole to 9 cm; blade 3-7 x 2-7 cm, ovate-rhombic or ovate-lanceolate, sometimes indistinctly 3-lobed, entire to repand-dentate, obtuse; stipular 3-5 mm, filiform; inflorescence to 4 cm; *male flowers*: *sepals* 3-4 mm, linear, stellate-hairy; *petals* 3-4 mm, elliptic, *stamens* united into a 3-4 mm column; *female flowers*: *sepals* and *petals* similar to those of the male flowers; ovary densely covered with peltate scales; capsule 6 x 8 mm, warty, covered with whitish peltate scales.

N, O, M, D, R, GE, S; waste ground, sandy plains, edges of cultivation. North Africa, southern Europe, East Mediterranean region, West and Central Asia.

NOTE: The plant produces an indigo dye which was used for dyeing linen, hence the epithet "tinctoria".

5. *Ricinus* L.

Monoecious annual or perennial herb or shrubby and tree-like; leaves alternate, petiolate, stipulate, palmately lobed; petiole glandular at apex and base; stipules united to form a caducous sheath; inflorescence paniculate, with male flowers in the lower half and female in the upper, or all female; *male flowers*: *petals* 0, disc 0, *stamens* up to 1000, filaments variously united; *female flowers*: *sepals* 5, caducous; *petals* 0, disc 0; ovary 3-celled, with 1 ovule per cell; fruit 3-lobed, dehiscing into 3 cocci; seeds carunculate. 1 species, Northeast tropical Africa, widely cultivated and becoming naturalized throughout the tropics, subtropics and warm temperate regions.

1. **Ricinus communis** L., Sp. Pl., ed. 1, 1007 (1753).

Shrubby or tree-like annual or perennial herb, 50-80 cm (spontaneous form) or 1-5 m (cultivated form); stems single, much-branched, hollow, woody at the base; petiole 8-20 cm, petiolar glands of variable shapes; blade 7-9-lobed, the median lobe to 20 x 6 cm, lateral lobes progressively smaller, coarsely serrate, acuminate; stipular sheath 1-2 cm; inflorescence 10-30 cm; bracts *c.* 1 cm; *male flowers*: pedicel *c.* 1 cm; sepals 6-9 x 3-4 mm, ovate-elliptic, acute; stamens to 1000, pale yellow; *female flowers*: pedicel 3-5 mm, elongate to 2 cm in fruit; sepals 5-6 mm, acuminate; ovary 2 x 2 mm; styles 3-8 mm; fruit 1-2 x 1-1.6 cm, usually densely covered with 3-5 mm bristle-tipped fleshy processes; seeds 0.6-1.2 x 0.5-0.8 cm, glossy, of variable colours but generally brownish; caruncle depressed-conical.

De, GE; wadis and plains, sandy soil. Spontaneous in Southeast Egypt; escaped from cultivation and naturalized in all other regions of Egypt. World distribution as for the genus.

NOTE: The occurrence of spontaneous *Ricinus communis* in southern Egypt probably represents the northernmost locality for the range of this tropical species. The seeds, castor beans, are rich in oil which is used in industry and medicine. They also contain a very poisonous substance, ricinin. The leaves are used in herbal medicine.

6. **Mercurialis** L.

Annual (our species) or perennial, usually dioecious herbs; leaves opposite, simple, crenate-serrate, stipulate; *male flowers*: in long, loose spikes; perianth-segments 3, valvate; stamens 6-20, filaments free; *female flowers*: in axillary clusters; perianth segments 3, imbricate; disc of 2 filiform glands; ovary 2-celled, ovules 1 per cell; styles 2, free; seeds subglobose, carunculate. 8 species, Mediterranean region, temperate Eurasia to North Thailand.

1. **Mercurialis annua** L., Sp. Pl., ed. 1, 1035 (1753).

Dioecious, \pm glabrous annual, 10-40 cm; stems erect or ascending, branched, striate; leaves 2-7 cm; petiole 0.5-2.5 cm; blade 3-5.5 x 1-2.5 cm, ovate to elliptic-lanceolate, crenate-serrate, obtuse, with a pair of glands at the base; stipules 1-1.5 mm; male inflorescence 4-5 cm; *male flowers*: \pm sessile, perianth segments 3, sepaloid, *c.* 2 mm, stamens 6-12; *female flowers*: 1.5 mm diam., \pm sessile; ovary bristly; capsule 3-4 mm diam., compressed, covered with bulbous hairs; seeds 2 mm, ellipsoid, tuberculate.

N, M, S; waste ground, roadsides. Macaronesia, Europe, North Africa, Sinai, East Mediterranean region, Iraq, Arabia.

7. **Jatropha** L.

Monoecious shrubs or herbs; leaves alternate, palmately lobed, stipulate; flowers in terminal or axillary cymes; *male flowers*: sepals 4-6, often connate; petals 5, free or connate; stamens 6-10, usually in 2 whorls, filaments partly connate; *female flowers*: sepals and petals resembling those of male flowers; staminodes sometimes present; disc annular; ovary usually 2-3-celled, with 1 ovule in each cell; styles connate at the base; fruit a capsule (our species); schizocarp or drupe-like; seeds carunculate. 175 species, tropical and warm regions, but especially Africa and North America.



Plate 10. EUPHORBIACEAE: *Ricinus communis*, flowering branch with female flowers on top of male flowers; inflorescence with immature fruits (left); mature fruit and seed (up right). All drawings to the same scale.

1. **Jatropha glauca** Vahl, Symb. Bot. 1: 78 (1790).

Syns. *Croton lobatum* Forssk., Fl. Aegypt.-Arab. 162 (1775), non L. (1753).

Jatropha lobata (Forssk.) Müll. Arg. in DC., Prodr. 15(2): 1085 (1866),
nom. illeg.

Low glabrous shrub 20-40 cm; stems branched at the base; petiole 1-4 cm; blade 4-7 cm, palmately 3-5-lobed, bright green, glabrous; base cordate, cuneate or truncate; margin dentate; stipules 3-4 mm, filiform, branched, gland-tipped; flowers few, red, in axillary cymes; peduncle to 5 cm; capsule 0.8-1 x 0.6-0.8 cm, glabrous; seeds 7-8 x 5 mm, oblong-ellipsoid, smooth; caruncle reddish.

GE; rocky ground. Southeast Egypt, Sudan, Ethiopia, Djibouti, Eritrea, Somalia, Yemen, Saudi Arabia.

8. **Euphorbia** L.

Syns. *Tithymalus* Graetn., *Euphorbium* Hill, *Anisophyllum* Haw.,

Chamaesyce S. F. Gray, *Poinsettia* Graham, *Agaloma* Raf.

Monoecious herbs, shrubs, trees or succulents; milky latex always present; leaves alternate, opposite or whorled, the lower or stem-leaves usually alternate, the median or pseudumbel-leaves whorled, the upper or ray leaves whorled or opposite, all usually sessile, rarely shortly-petiolate, simple, entire or toothed, penni- or palmi-nerved; stipules present or absent; inflorescence a cyathium, with several male flowers and 1 female flower, enclosed in a gland-bearing involucre; cyathia axillary or in pseudumbels; involucre usually 5-lobed, with 1-5 glands alternating with them; *male flowers*: 1 stamen borne on its own pedicel; *female flower*: 3-locular ovary on a pedicel, usually elongate in fruit; ovules 1 per locule; styles 3, free or connate at the base; stigmas often 2-fid; fruit 3-celled capsule, dehiscent into 2-valved, 1-seeded cocci; seeds carunculate or not, smooth or wrinkled. About 2000 species, cosmopolitan, but especially tropical, subtropical and warm-temperate regions.

- 1. Succulent shrubs, sometimes leafless 2
- + Non-succulent shrubs or herbs 4

- 2. Stems 4-5(-7) angled, with spine-shields continuous along the ribs 15. **E. polyacantha**
- + Stems terete, unarmed 3

- 3. Seeds ovoid, minutely tuberculate, yellowish-brown 16. **E. consobrina**
- + Seeds oblong, smooth, greyish 17. **E. mauritanica**

- 4. Leaves asymmetric, with obliquely rounded base; stipules present 5
- + Leaves symmetric, base not obliquely rounded; stipules absent, if present, glandular 19

- 5. Leaves linear, about 10 times as long as broad 13. **E. arabica**
- + Leaves suborbicular, ovate, elliptic, ovate-oblong or -lanceolate, 1-3 times as long as broad 6

- 6. Leaves 1-4 (-5) x 0.5-2 (-2.5) cm; cyathia 10 or more, clustered in terminal and axillary pedunculate, often capitate, cymes to 1.5 cm diam. 7

- + Leaves (0.1-) 0.3-0.9 (-1.2) x 0.2-0.8 cm; cyathia solitary to 5 together in congested leafy cymes 10
7. Capsule completely glabrous, both when young and mature 4. *E. hyssopifolia*
+ Capsule pubescent, at least when young 8
8. Leaves acute, margin sharply serrate 1. *E. hirta*
+ Leaves obtuse, margin crenulate or denticulate 9
9. Leaves ovate-oblong to elliptic; capsule sparsely hairy or glabrous 2. *E. indica*
+ Leaves oblong; capsule densely pubescent 3. *E. lasiocarpa*
10. Plant entirely glabrous 11
+ Plant all or partly pubescent 13
11. Leaves suborbicular, 1-3 mm diam. 8. *E. serpens*
+ Leaves oblong, ovate or ovate-oblong, 3-8 mm broad 12
12. Leaves thin, petiole 1-1.5 mm, margin serrate or obscurely serrate; capsule 1.5-1.75 mm; seeds 1.25 mm (garden weed) 10. *E. inaequilatera*
+ Leaves fleshy, sessile, margin repand-dentate or entire; capsule 3-4 mm; seeds 2 mm (coastal sands) 5. *E. peplis*
13. Capsule glabrous or hairy only along the keels 14
+ Capsule hairy all over 16
14. Glands with minute appendages 12. *E. prostrata*
+ Glands with prominent white petaloid appendages 15
15. Leaves suborbicular to obliquely ovate, finely denticulate 7. *E. chamaesyce*
+ Leaves obovate to linear-oblong, entire 6. *E. granulata*
16. Leaves obliquely ovate-oblong, margins serrate-spinulate 11. *E. scordifolia*
+ Leaves suborbicular, ovate, obovate or elliptic, margins entire, remotely dentate or serrulate-crenate near the apex 17
17. Leaves entire 6. *E. granulata*
+ Leaves remotely dentate or serrulate-crenate near the apex 18
18. Plant hirsute to canescent; leaves 2-5 (-7) x 2-3 mm, suborbicular to ovate, almost all alike 7. *E. chamaesyce*
+ Plant appressed- and/or crispate-hairy; leaves 0.4-1.2 x 0.3-0.8 cm, oblong-elliptic, variable 9. *E. forsskaolii*
19. Branchlets spinescent 20
+ Branchlets not spinescent 21
20. Small tree or shrub to 4 m; cymes reduced to solitary cyathia or clustered in terminal 2-5-branched umbels (Gebel Elba) 18. *E. cuneata*
+ Low shrub to 40 cm; cyathia solitary on terminal or dichotomous branchlets (Sinai) 26. *E. erinacea*

21. Cyathia in short, axillary cymes	19. <i>E. acalyphoides</i>	22
+ Cyathia umbellate		
22. Leaves all petiolate		23
+ Leaves sessile or tapering at the base		24
23. Plant densely villous; leaf blade 1.2-3.5 x 0.8-1.5 cm; cyathial glands 4 or 5, lobed	20. <i>E. petiolata</i>	
+ Plant glabrous, or sparsely pilose; leaf blade 4-10 x 2-5 cm, cyathial glands solitary, \pm funnel-shaped	14. <i>E. heterophylla</i>	
24. Caruncle at least $\frac{1}{2}$ as long as the seed		25
+ Caruncle, absent or less than $\frac{1}{2}$ as long as the seed		26
25. Caruncle about as long as or longer than the seed	23. <i>E. grossheimii</i>	
+ Caruncle about $\frac{1}{2}$ as long as the seed	22. <i>E. retusa</i>	
26. Leaves serrate, serrulate or pectinate-dentate		27
+ Leaves entire		31
27. Seeds smooth	24. <i>E. arguta</i>	
+ Seeds reticulate		28
28. Leaves dentate-pectinate; seeds 2-3.25 mm		29
+ Leaves serrulate; seeds 1.25-2 mm		30
29. Seeds 2 mm, prominently and irregularly reticulate-rugulose	27. <i>E. oxyodonta</i>	
+ Seeds 2.5-3.25 mm, very shallowly and irregularly reticulate-rugulose	30. <i>E. sintenisii</i>	
30. Capsule 1 x 1.5 mm, with 2 undulate wings on each valve	28. <i>E. pterococca</i>	
+ Capsule 2.5 x 3.5 mm, not winged	29. <i>E. helioscopia</i>	
31. Shrubs with woody stems		32
+ Herbaceous perennials, sometimes woody at the base, or annuals		34
32. Capsule covered with conical and cylindrical warts	25. <i>E. hierosolymitana</i>	
+ Capsule smooth		33
33. Leaves to 1 x 1.2 cm, broadly obovate to suborbicular, fleshy; capsule 3-3.3 x 3 mm	38. <i>E. obovata</i>	
+ Leaves 3-8 x 0.4-0.8 cm, linear to lanceolae, thin; capsule 5 x 6 mm	21. <i>E. dendroides</i>	
34. Seeds tetragonus, with 1 row of 4-6 transverse furrows or pits on each of the 4 faces	34. <i>E. falcata</i>	
+ Seeds not as above		35
35. Perennial; capsule 3-5 x 3-6 mm; seeds smooth		36
+ Annual; capsule 1.5-2 x 1.5-2.5 mm; seeds tuberculate or rugulose, pitted or sulcate		38

36. Leaves 0.6-1.1 x 0.4-0.8 cm, obovate to suborbicular; capsule 3 mm diam., not deeply sulcate 41. **E. sanctae-catharinae**
 + Leaves to 4 (-6) x 1.5 cm, ovate-oblong, elliptic-oblong to linear-lanceolate; capsule 4-6 mm diam., deeply sulcate 37
37. Cauline leaves to 2 cm, elliptic to oblong, sessile, with rounded broad base, densely imbricate, fleshy; caruncle minute 40. **E. paralias**
 + Cauline leaves to 4 (-6) cm, oblong-linear to linear-lanceolate, rather spaced, thin; caruncle conspicuous, boat-shaped 39. **E. terracina**
38. Seeds tuberculate or rugulose 39
 + Seeds pitted or sulcate 41
39. Stems much-branched from the base; leaves 1.5-5 x 0.3-0.5 cm; capsule 2.5-2.8 mm; seeds 2-2.25 mm 33. **E. dracunculoides**
 + Stems with few braches; leaves 0.3-2.5 x 0.1-0.2 cm; capsule 1.5-2 mm, seed 1-1.25 mm 40
40. Plant not more than 10 cm; leaves to 1 cm; cyathium glands with 2 short horns or unappendaged 31. **E. parvula**
 + Plant 10-30 cm; leaves to 2.5 cm; cyathium glands with 2 conspicuous horns 32. **E. exigua**
41. Plant c. 3 cm; cauline leaves sessile; seeds 1 x 0.8 mm 37. **E. punctata**
 + Plant 5-30 cm; cauline leaves petiolate; seeds 1.5 x 1 mm 42
42. Leaves thin, of variable shapes and sizes; capsule with 2 wing-like ridges on each keel; seed pits dark grey 35. **E. peplus**
 + Leaves rather fleshy, almost all alike; capsule not winged along the keels; seed pits pale grey with black median slit 36. **E. chamaepeplus**

1. **Euphorbia hirta** L., Sp. Pl., ed. 1, 454 (1753).

Syns. *Euphorbia pilulifera*, sensu Boiss. in DC., Prodr. 15(2): 21 (1862), non L. (1753).

Chamaesyce hirta (L.) Millsp., Publ. Field Columb. Mus., Bot. 2: 303 (1909).

Hispid annual 20-50 cm; hairs multicellular, drying yellow; stems erect to ascending, branched mainly from the base; leaves 1-4 x 0.5-1.5 cm, opposite, rhombic-ovate to -lanceolate, asymmetrically cuneate at the base, acute, the margin sharply serrate; stipules 1-2 mm, subulate; cyathia in dense axillary clusters 0.5-1 cm diam.; peduncle 3-8 mm, capsule c. 1.2 x 1.2 mm, sharply trigonous, appressed-hirsute; seeds 0.8 mm, tetragonous, transversely wrinkled.

N, M, S; weed of cultivation, lawns, roadsides; naturalized. Pantropical weed.

2. **Euphorbia indica** Lam., Encycl. 2: 423 (1786).

Syns. *Euphorbia hypericifolia*, sensu Täckh., Stud. Fl. Egypt, ed. 2, 323 (1974); sensu Greuter *et al.*, Med-Checklist 3: 215 (1986), non L. (1753).

Chamaesyce indica (Lam.) Croizat, Lilloa 8: 406 (1942).

Annual 30-60 cm, with sparse unicellular white hairs; stems decumbent, ascending or erect; leaves opposite; petiole 1-1.5 mm; blade 1-2.5 x 0.5-1(-1.5) cm, ovate-oblong to elliptic, obliquely round at the base, serrulate; stipules 1-1.5 mm, triangular; cyathia in loose axillary clusters; cyathial glands with white or pink orbicular petaloid appendages; capsule 1.5 x 2 mm, trigonous, sparsely hairy or glabrous; seeds 1 x 0.8 mm, ovoid-quadrangular, grey, smooth, ecarunculate.

N; roadsides, canal banks, edges of cultivation. Africa, Arabia, eastwards to China.

3. ***Euphorbia lasiocarpa*** Klotzsch, Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 19, Suppl. 1: 414 (1843).

Syn. *Chamaesyce lasiocarpa* (Klotzsch) Arthur, Torreya 11: 260 (1911).

Like *Euphorbia indica*, but leaves oblong with crenulate margins; capsule densely pubescent.

S; cultivated and waste ground. Native to Mexico extending to Peru, West Indies; naturalized elsewhere.

4. ***Euphorbia hyssopifolia*** L., Sp. Pl., ed. 1, 454 (1753).

Syns. *Euphorbia brasiliensis* Lam., Encycl. 2: 423 (1786).

Chamaesyce hyssopifolia (L.) Small, Bull. New York Bot. Gard. 3: 429 (1898).

Erect or ascending annual 10-40 cm, glabrous except for a few scattered hairs on young branches and leaves; stems branched; leaves 1-2.5 x 0.4-1 cm, lanceolate or ovate-elliptic, base obliquely rounded, the apex rounded, the margin minutely dentate; petiole 1-1.5 mm; stipules 0.8 mm, triangular, fimbriate; cyathia 1 x 1 mm, in terminal and axillary cymes, peduncle to 1 cm; glands minute, green tinged red; *male flowers*: with fimbriate bracteoles; stamens 1 mm; *female flower*: with short-pedicellate ovary; styles 0.5 mm, 2-fid; capsule 2 x 2 mm, glabrous, exerted on a 1.5 mm reflexed pedicel; seeds 1 x 0.5 mm, oblong-conical, with 3 transverse ridges.

N (Qalioubia, Nile Delta); cultivated ground, naturalized. Central America; naturalized in tropical East and West Africa.

5. ***Euphorbia peplis*** L., Sp. Pl., ed. 1, 455 (1753).

Syn. *Tithymalus peplis* (L.) Scop., Fl. Carniol., ed. 2, 1: 340 (1771).

Glabrous glaucous fleshy annual, 10-25 cm; stems procumbent, branched from the base; leaves 1-1.5 x 0.5-0.8 cm, opposite, sessile, fleshy, ovate-oblong to rhombic, repand-dentate or entire; base asymmetric, with an obtuse auricle; stipules 2-2.5 mm, with 2-3 subulate lobes; cyathia c. 1.5 mm, solitary, axillary; peduncle c. 3 mm thick; styles 2-lobed; capsule 3-4 mm, obovoid, glabrous, smooth; seeds 2 x 1.5 mm, ovoid, greyish-white, smooth, ecarunculate.

M, S; sandy and gravelly sea shores. Mediterranean region, Sinai, Southwest Europe, extending along Atlantic coasts to North France, Black Sea region.

6. ***Euphorbia granulata*** Forssk., Fl. Aegypt.-Arab. 94 (1775).

Syn. *Chamaesyce granulata* (Forssk.) Soják, Cas. Nár. Muz. (Praha) 140 (3-4) : 169 (1972).

Prostrate annual 5-25 cm, covered with short straight hairs, or sparsely covered with long spreading hairs and the upper surface of leaves glabrous; stems much-branched from the base; leaves 3-8 x 2-4.5 mm, obovate or oblong-ovate, base obliquely rounded, the apex rounded, margin entire; petiole 0.5-1 mm; stipules 1-1.5 mm, ending with 2-4 linear teeth; cyathia c. 1 x 1 mm, solitary; peduncle c. 0.5 mm; glands 4, with white or pink appendages; *male flowers*: stamen 1 mm; *female flower*: ovary pedicellate; styles minute, spreading; capsule 1.5 x 1.5 mm, sharply 3-lobed; pedicel 1.5 mm; seeds 1 x 0.5 mm, oblong-conical, 4-angled, pinkish-brown, wrinkled, ecarunculate.

Two varieties occur in Egypt:

var. **granulata**

Whole plant covered with short straight hairs.

D, R, GE, S; desert wadis.

var. **glabrata** (J. Gay) Boiss. in A. DC., Prodr. 15(2): 34 (1862).

Syn. *Euphorbia forsskaolii* J. Gay var. *glabrata* J. Gay in Webb & Berthel., Phyt. Canar. 3(3): 243 (1847).

Plant sparsely covered with long spreading hairs, the upper surface of leaves glabrous.

D, R, GE, S; desert wadis, sandy and alluvial plains.

Area of the species: Canary Islands, North and tropical Africa, Sinai, Palestine, Syria, Arabia, Iran, Pakistan, Afghanistan, North India, Central Asia.

NOTE: Both varieties are widespread and fairly common in the deserts of Egypt.

7. **Euphorbia chamaesyce** L., Sp. Pl., ed. 1, 455 (1753).

Syns. *Euphorbia canescens* L., Sp. Pl., ed. 2, 652 (1762).

Tithymalus chamaesyce (L.) Moench, Methodus 666 (1794).

Euphorbia massiliensis DC. in Lam. & DC., Fl. Fr., ed. 3, 5: 357 (1815).

Euphorbia libassii Lojac., Fl. Sicula 2(2): 329 (1907).

Euphorbia pinnulosa Lojac., Fl. Sicula 2(2): 329 (1907).

Chamaesyce hirta Millsp., Publ. Field Columb. Mus., Bot. 2: 303 (1909).

Chamaesyce chamaesyce (L.) Hurus., J. Fac. Sci. Univ. Tokyo, sect. 3, Bot., 6: 283 (1954).

Like *Euphorbia granulata*, but leaves suborbicular to obliquely ovate, finely denticulate.

Dw; cultivated ground. South Europe, North Africa, West and Central Asia.

NOTE: Uncommon, known only from a few localities in the Western Desert.

8. **Euphorbia serpens** Kunth, Nov. Gen. & Sp. 2: 52 (1817).

Syns. *Euphorbia minutiflora* N. E. Br., Fl. Trop. Afr. 6(1): 1036 (1913).

Chamaesyce serpens (Kunth) Small, Fl. Southeast U. S. 709 (1903).

Glabrous annual; stems 10-20 cm, prostrate, often rooting at nodes; leaves 1-4 mm, opposite, suborbicular, base obliquely cordate, margin entire; petiole 0.2-0.8 mm;

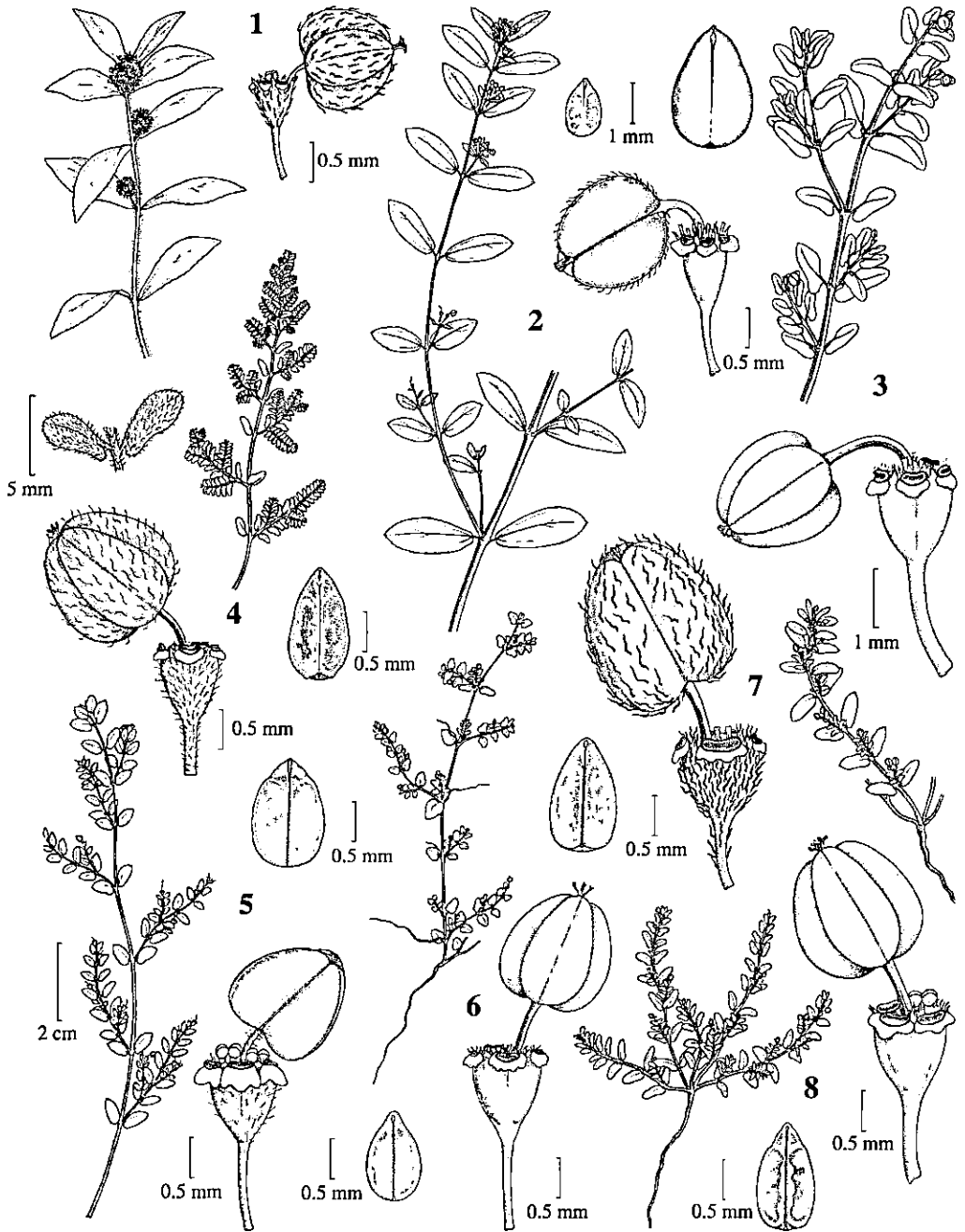


Plate 11. EUPHORBIACEAE: *Euphorbia hirta* 1, flowering and fruiting branch; cyathium with a capsule (right). *Euphorbia indica* 2; flowering and fruiting branch; cyathium with a capsule (right); seed (up right). *Euphorbia peplis* 3, flowering and fruiting branch; cyathium with a capsule (down); seed (up left). *Euphorbia granulata* var. *granulata* 4, flowering and fruiting branch; branchlet with two leaves (left); cyathium with capsule (down left); seed (down right). *Euphorbia chamaesyce* 5, flowering and fruiting branch; cyathium with capsule (down right); seed (up right). *Euphorbia serpens* 6, habit; cyathium with capsule (down right); seed (down). *Euphorbia forsskaolii* 7, habit; cyathium with capsule (left); seed (left to the capsule). *Euphorbia inaequilatera* 8, habit; cyathium with capsule (right); seed (down right). All drawings to the same scale, except the enlarged parts (scale given).

stipules *c.* 0.5-1.2 mm, connate at the swollen nodes, triangular; cyathia 0.8 x 0.8 mm, solitary; peduncle 0.5-1.5 mm; glands 4, minute, with white petaloid appendages; *male flowers*: stamens 0.8 mm; *female flower*: ovary short-pedicellate; styles 0.2 mm, 2-fid; capsule *c.* 1.5 x 1.8 mm, 3-lobed, yellowish-green; seeds 1 x 0.6 mm, oblong-conical, pinkish, smooth.

N; cultivated ground, naturalized. Pantropical weed.

9. ***Euphorbia forsskaolii*** J. Gay in Webb & Berthel., Phyt. Canar. 3: 240 (1847).

Syn. *Euphorbia aegyptiaca* Boiss., Cent. Euphorb. 13 (1860), nom. illeg.

Prostrate annual, appressed- and/or crispate-hairy, 10-30 cm; stems many, branched from the base; leaves 0.4-1.2 x 0.3-0.8 cm, opposite, oblong-elliptic, the base obliquely rounded, the margin obscurely serrate-crenate near the apex; petiole 0.5-1 mm; stipules 1.5 mm, connate at the base, ending with narrow lanceolate teeth; cyathia 1-1.5 mm, in short axillary leafy racemes; involucre hirsute; glands reddish, with narrow appendages; capsule 1.5-2 mm, 3-lobed, crispate-white-hairy; seeds 1 mm, oblong-conical, whitish-pink.

N, O, M, D, GE, S; weed of cultivation, waste ground, desert sandy soils. Libya, Egypt, Palestine, Syria, Arabia, Sudan, Ethiopia, Canary Islands, Cape Verde Islands.

10. ***Euphorbia inaequilatera*** Sond., Linnaea 23: 105 (1850) var. ***inaequilatera***

Syns. *Euphorbia sanguinea* Boiss. in DC., Prodr. 15(2): 35 (1862).

Euphorbia inaequalis N. E. Br., Fl. Trop. Afr. 6(1): 512 (1911).

Prostrate glabrous annual 10-30 cm; stems branched, longitudinally ridged and narrowly winged, especially when dry; leaves 0.5-1.5 x 0.2-0.6 cm, oblong elliptic; base obliquely rounded, the apex obtuse, the margin serrate; petiole 0.5-1.5 mm; stipules 1-1.5 mm, divided into 3-5 narrow teeth; cyathia 1 x 1 mm, solitary; peduncle *c.* 1 mm; glands 4, minute, red, with small white or pink appendages; involucre lobes with sharply toothed margins; *male flowers*: stamen 1-2 mm; *female flower*: ovary pedicellate; styles 0.5 mm. 2-fid, capsule 1.5 x 1.75 mm, exserted on a reflexed 2 mm pedicel, strongly 3-lobed, the angles usually purple-tinged; seeds 1.25 x 0.75 mm, oblong-conical, greyish, with shallow pits.

N (Aga, Nile delta), probably more widespread; garden weed. Egypt, Arabia, Somalia, Ethiopia, tropical East and southern Africa.

11. ***Euphorbia scordifolia*** Jacq., Ic. Pl. Rar. 3: t. 476 (1794).

Syn. *Chamaesyce scordifolia* (Jacq.) Croizat in Degener, Fl. Hawaii. Fam. 190, leaflet 3, in obs. et in adnot. (1937).

Prostrate annual 10-30 cm, all parts densely white-hairy; stems branched, striate; leaves 0.4-1.2 x 0.3-0.8 cm, opposite, obliquely ovate-oblong, the margin serrate-spinulate; petiole 0.5-1.5 mm; stipules 1-1.5 mm, linear, caducous; cyathia on short dense lateral branches; peduncle 1-1.5 mm; involucre *c.* 1 mm, cup-shaped; gland appendages 1 mm, pinkish or white; capsule 1.8 x 1.8 mm; seeds 1.2 x 0.8 mm, ovoid, grey, smooth, with shallow pits.

De, R, GE; coastal sandy plains. Southeast Egypt, Arabia, Somalia, Ethiopia, westwards to Cape Verde Islands.

12. **Euphorbia prostrata** Aiton, Hort. Kew., ed. 1, 2: 139 (1789).

Syns. *Tithymalus prostratus* (Aiton) Samp., Anais Fac. Sci. Porto 17: 45 (1931).

Chamaesyce prostrata (Aiton) Small, Fl. Southeast U. S. 713 (1903).

Prostrate annual 10-25 cm; leaves glabrous beneath, pilose with short curled white hairs on the upper; stems much-branched, often tinged purplish; leaves 3-8 x 2-4 mm, ovate; base obliquely rounded, apex rounded, margin obscurely dentate; petiole c. 1 mm; stipules 0.5-1 mm, triangular, with 2 apical teeth; cyathia 1 mm, solitary, on short leafy shoots; peduncle 1-1.25 mm; involucre barrel-shaped; glands 4, minute, red, with minute white or pink appendages; *male flowers*: few; stamens 1 mm; *female flower*: with pedicellate ovary; styles 0.25 mm, 2-fid; capsule 1.25 x 1.25 mm, exserted on a pilose 1.5 mm pedicel, strongly 3-lobed; sutures purple-tinged, pilose; seeds 1 x 0.5 mm, conical-oblong, acutely 4-angled, greyish, with transverse ridges.

N, M, S; weed of cultivation, waste ground, roadsides; naturalized. Pantropical weed, originating from the West Indies.

13. **Euphorbia arabica** T. Anderson, Fl. Aden, J. Linn. Soc. 5, Suppl. 34 (1860),

Hochst. & Steud. ex Boiss. in DC., Prodr. 15(2): 33 (1862).

Syn. *Chamaesyce arabica* (Hochst. & Steud. ex Boiss.) Soják, Cas. Nár. Muz. (Praha) 140 (3-4): 168 (1972).

Glabrous annual 10-25 cm; stems erect, slender, branched; leaves linear, about 10 times as long as broad, 1.5-2.3 x 0.15-0.2 cm, base obliquely rounded, apex acute, margin entire; petiole c. 1 mm; stipules 0.8 mm, linear; cyathia 1 x 1 mm, solitary, glands minute; peduncle c. 1 mm; *male flowers*: stamens 1.5 mm; *female flower*: ovary pedicellate; styles 0.5 mm, 2-fid; capsule c. 1.5 x 1.5 mm, sharply 3-lobed, on a pedicel 1-1.25 mm; seeds 1.2 x 0.8 mm, pinkish, pitted.

GE; stony sheltered cliffs. Southeast Egypt, Northeast Sudan, Ethiopia, Eritrea, Djibouti, Somalia, Kenya, Arabia.

NOTE: *Euphorbia arabica* was described by T. Anderson in 1860. Boissier, using the same type material, and applying the same name, described the same species in 1862. *Euphorbia arabica* Boiss. is therefore a later homotypic name.

14. **Euphorbia heterophylla** L., Sp. Pl., ed. 1, 453 (1753).

Syns. *Euphorbia geniculata* Ortega, Hort. Matr. Dec. 18 (1797).

Euphorbia prunifolia Jacq., Hort. Schoenbr. 3: 15, t. 277 (1798).

Erect annual 30-60 cm, glabrous or sparsely pilose in the upper parts; stems dichotomously branched; leaves 4-10 x 2-5 cm, elliptic, base cuneate, apex acute, margin with distant minute gland-tipped teeth; petiole 2-4 cm; glandular stipules rather large; cyathia 3.5 x 2.5 mm, glabrous, in densely clustered axillary and terminal cymes; bracts similar to leaves but progressively smaller, more lanceolate and sessile above; involucre cylindrical-obovoid, glabrous; lobes ovate, fringed; cyathial gland solitary, ± funnel-shaped; *male flowers*: stamens 4 mm long; *female flower*: ovary pedicellate; styles 1 mm, 2-fid; capsule 4.5 x 5.5 mm, exserted on a reflexed pedicel to 5 mm, deeply 3-lobed; seeds 2.5 x 2 mm, conical, tuberculate.

N, O, M; weed of cultivation, naturalized. Pantropical weed, originating from Central America.

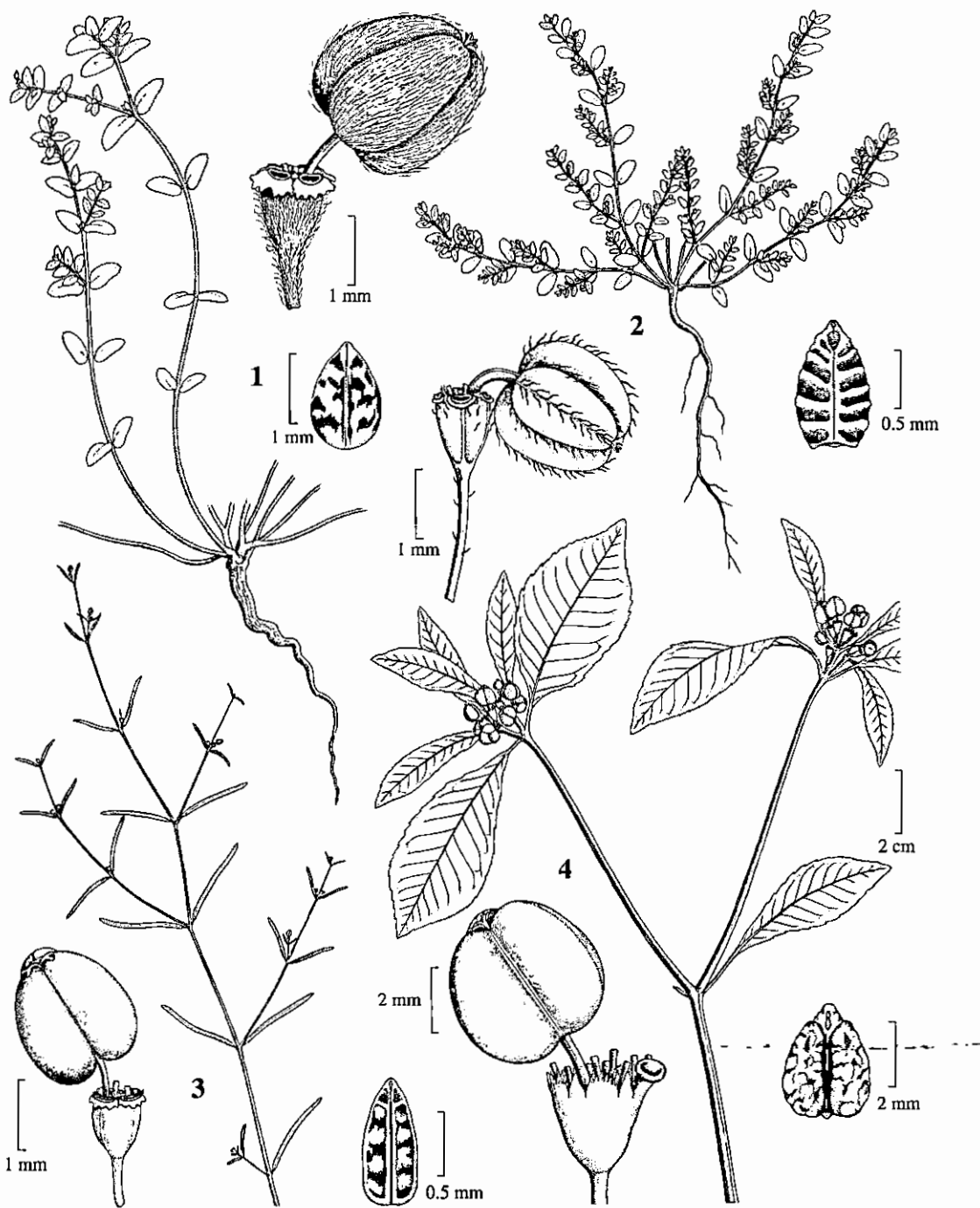


Plate 12. EUPHORBIACEAE: *Euphorbia scordifolia* 1, habit; cyathium with capsule (up right); seed (down right). *Euphorbia prostrata* 2, habit; cyathium with capsule (down left); seed (down right). *Euphorbia arabica* 3, flowering and fruiting branch; cyathium with capsule (down left); seed (down right). *Euphorbia heterophylla* 4, flowering and fruiting branch; cyathium with capsule (down left); seed (down right). All drawings to the same scale, except the enlarged parts (scale given).

15. **Euphorbia polyacantha** Boiss., *Cent. Euphorb.* 25 (1862).

Syns. *Euphorbia tetragona* A. Rich., *Fl. Abyss.* 2: 238 (1851), non Haw. (1826).

Euphorbia thi Schweinf., *Verh. Zool.-Bot. Ges. Wien* 18: 660 (1868).

Euphorbia polyacantha Boiss. var. *subinarticulata* Schweinf., *Bull. Herb. Boissier* 7, *Append.* 2: 323 (1899).

Euphorbia polyacantha Boiss. subsp. *rosenii* Pax, *Bot. Jahrb.* 39: 632 (1907).

Euphorbia thi Schweinf. var. *subinarticulata* (Schweinf.) N. E. Br., *Fl. Trop. Afr.* 6(1) 582 (1912).

Euphorbia infausta N. E. Br. in Dyer, *Fl. Trop. Afr.* 6(1) 580 (1912), non N. E. Br. (1915).

Spiny leafless succulent glabrous shrub, 0.6-1.2 m, densely branched from the base; stems erect, 4-5(-7)-angled, 2-4 cm diam., shallowly segmented; spine-shields continuous along the ribs; spines paired, 0.3-1(-1.5) cm; cymes 3-5 mm excluding the capsule; peduncle 4-8 mm; involucre 1.5-2 x 2.5-3 mm, cupular; capsule 3-4 x 3.5-4.5 mm, not exerted from the involucre, subglobose, 3-lobed, dark purple; seeds 1.5 x 1.3 mm; broadly ovoid, greyish, rugose.

GE; rocky terraces and slopes at high altitudes, usually above 1000 m. Southeast Egypt, Northeast Sudan (Red Sea Hills), Ethiopia, Eritrea.

16. **Euphorbia consobrina** N. E. Br. in Dyer, *Fl. Trop. Afr.* 6(1): 555 (1911).

Syns. *Euphorbia nubica*, sensu Täckh., *Stud. Fl. Egypt*, ed. 2, 327 (1974);

Greuter *et al.*, *Med-Checklist* 3: 217 (1986).

Euphorbia schimperii, sensu Boulos, *Fl. Egypt Checklist* 85 (1995).

Unarmed glabrous shrub 0.4-1.5 m; stems erect to spreading, dense and much-branched from the base, terete, with prominent callose, brownish leaf-scars; old stems woody; young branchlets succulent; leaves 0.5-2.5 x 0.2-0.5 cm, alternate, sessile, linear-lanceolate, exstipulate, caducous; cymes in terminal umbels, 2-5-branched; bracts 3 x 3 mm, ovate, sessile, semi-persistent; cyathia 5.5-6.5 mm diam.; glands 4-5, separate, 2 mm broad, yellow becoming red; ovary glabrous; styles 2.5 mm, 2-fid; capsule 4.5 x 5.5 mm, exerted on a recurved pedicel 3-5 mm, distinctly 3-lobed; seeds 2.5 x 2 mm, ovoid, minutely tuberculate, yellowish-brown; aruncle 0.5 mm.

R, GE; rocky slopes and sandy soils. Southeast Egypt, Northeast Sudan (Red Sea Hills), Somalia, ?Eritrea, Arabia.

17. **Euphorbia mauritanica** L., *Sp. Pl.*, ed. 1, 452 (1753).

Like *Euphorbia consobrina*, but margin of glands \pm crenulate; cyathia larger; capsule larger; seeds oblong, smooth, greyish.

N, M; sandy and rocky soils, naturalized. Native to Southern Africa.

18. **Euphorbia cuneata** Vahl, *Symb. Bot.* 2: 53 (1791).

Shrub or small tree 1.5-4 m, with purplish peeling bark; branches with alternate spinescent branchlets, spreading at right angles; leaves 0.8-2.2 x 0.2-0.6 cm, shortly petiolate to almost sessile, cuneate-spathulate, the apex rounded or notched; stipules

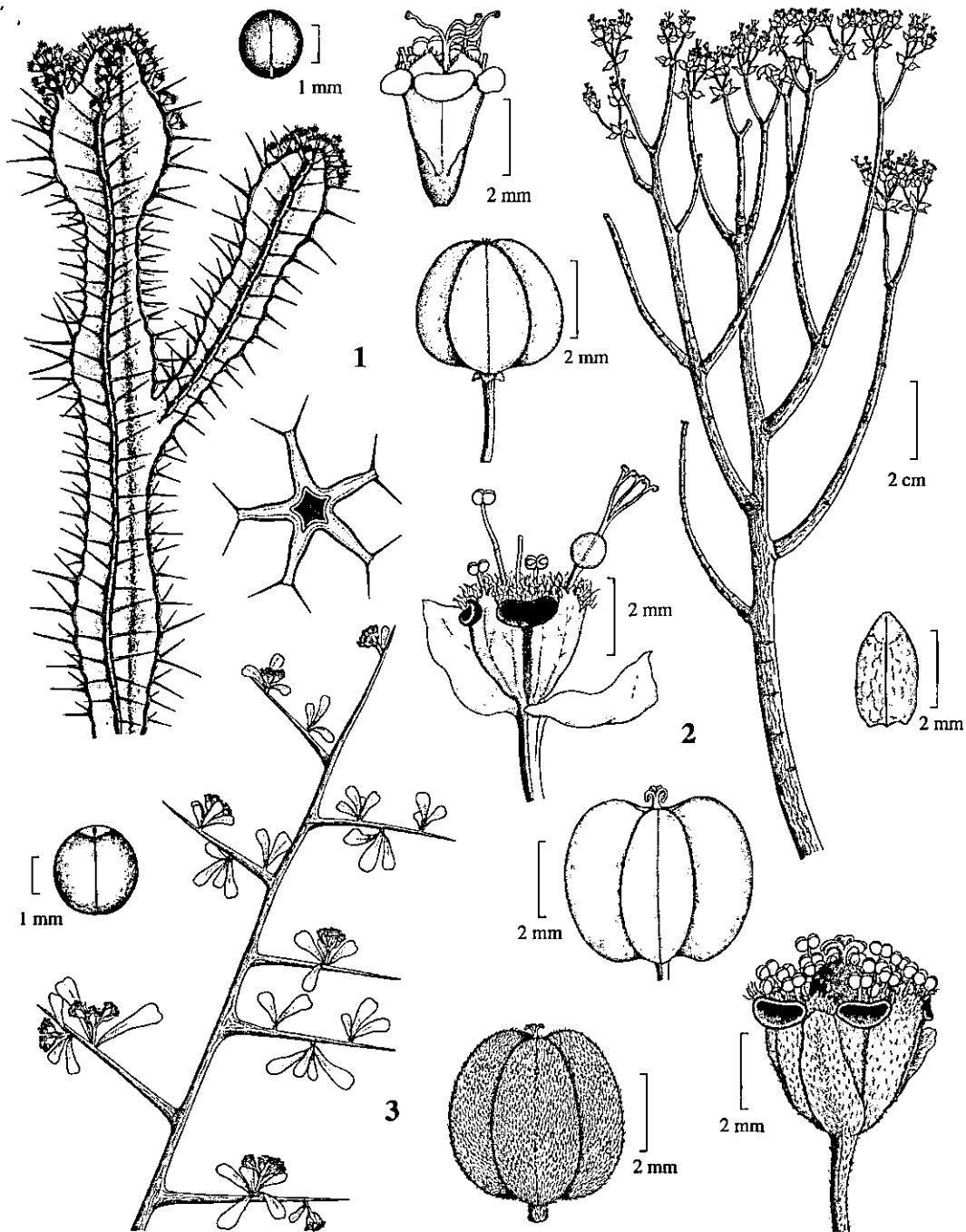


Plate 13. EUPHORBIACEAE: *Euphorbia polyacantha* 1, flowering branch; transverse section in stem (down right); capsule (right); cyathium (up right); seed (up). *Euphorbia consobrina* 2, flowering and fruiting branch; capsule (down left); cyathium (left); seed (right). *Euphorbia cuneata* 3, flowering and fruiting branch; capsule (down right); seed (left), cyathium (right to the capsule). All drawings to the same scale, except the enlarged parts (scale given).

glandular, small; cymes reduced to solitary cyathia or clustered in terminal 2-5-branched umbels; bracts 1.5-4 mm, leaf-like, the margin ciliate; cyathia 4-6 mm diam.; glands 5, 1.5-2.5 mm broad, funnel-shaped, yellow; stamens exserted; styles 2 mm; capsule 4-6 x 5-7 mm; seeds 2-2.5 mm, subglobose, smooth, brownish.

De, R, GE; rocky slopes. Southeast Egypt, Northeast Sudan (Red Sea Hills), Ethiopia, Somalia, Kenya, Tanzania, Mozambique, Arabia.

19. **Euphorbia acalyphoides** Hochst. ex Boiss. in DC., Prodr. 5(2): 98 (1862).

Syns. *Euphorbia fodhiana* Defflers, Bull. Soc. Bot. France 43: 230 (1896).

Euphorbia incurva N. E. Br. in Dyer, Fl. Trop. Afr. 6(1): 552 (1911).

Pilose annual 15-40 cm; stems branched, spreading, grooved; leaves 2-5 x 0.5-1.5 cm, ovate-lanceolate, base cuneate, apex obtuse or rounded, margins entire; petiole 1-2.5 mm; stipules glandular, minute; cymes axillary, 1-2-forked; bracts 2-4 mm, suborbicular; cyathia 2-3 mm diam., in axillary short cymes; involucre funnel-shaped; glands 4, 1 x 1.5 mm, reddish-yellow, hairy; *male flowers*: few, stamens 2 mm; *female flower*: with a densely pubescent ovary; styles 2 mm, 2-ñid; capsule 3.5 x 4.5 mm, exserted on a pedicel 1.75 mm, 3-lobed, covered with crispate hairs; seeds 2.5 x 2 mm, conical, with acute apex and 2 horizontal constrictions, blackish-brown.

GE; sandy soils in open *Acacia* scrub. Southeast Egypt, Northeast Sudan, Ethiopia, Somalia, Kenya, Tanzania, Angola, Arabia.

20. **Euphorbia petiolata** Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 2: 253 (1794).

Syns. *Euphorbia lanata* Spreng., Syst. Veg. 3: 792 (1826).

Euphorbia petiolata Banks & Sol. var. *microphylla* (Post) Eig, J. Bot. London 75: 192 (1937).

Densely villous annual 15-40 cm; stems erect or spreading, branched, striate; all leaves opposite; blade 1.2-3.5 x 0.8-1.5 cm, ovate to ovate-elliptic, margin dentate-spinulose, apex mucronate; petiole 3-8 mm; stipules minute; cyathia c. 2 mm, axillary, umbellate, short-pedunculate; involucre campanulate, lobes triangular-ovate, fimbriate; cyathial glands 4 or 5, pectinately 3-8-lobed; capsule 5 x 5-6 mm, subglobose-ovoid, 3-lobed, densely white-villose; seeds 3.5-4 x 2.5 mm, tetragonous, truncate, tuberculate; caruncle transversely oblong.

S; cultivated ground. Algeria, Sinai, Palestine, Syria, Lebanon, Turkey, eastwards to Pakistan and Turkmenistan.

21. **Euphorbia dendroides** L., Sp. Pl., ed. 1, 462 (1753).

Shrub 0.5-1.5 m; stems dichotomously branched, the old branches with leaf-scars, the young branches leafy; cauline leaves 3-8 x 0.4-0.8 cm, linear to lanceolate, thin, sessile, entire, tapering at the base, the apex acute; floral leaves 6-8 mm, cordate-orbicular, acute, exceeding the campanulate involucre; umbels 3-10-rayed, dichotomously branched; cyathia 4-5 mm, pedunculate; involucral lobes 2-3-fid, fimbriate; glands semilunate, lobed; capsule c. 5 x 6 mm, depressed-globular, 3-lobed, glabrous, smooth; seeds 3.5 mm, broadly ovoid, smooth; caruncle crested.

M (Mersa Matruh - Sollum); maritime cliffs. Mediterranean region.

22. **Euphorbia retusa** Forssk., Fl. Aegypt.-Arab. 93 (1775).

Syns. *Euphorbia kahirensis* Raesch., Nomencl. Bot., ed. 3, 140 (1797), nom. illeg.

Euphorbia cornuta Pers., Syn. Pl. 2: 17 (1806), nom. illeg.

Glabrous glaucous perennial 20-60 cm, sometimes flowering the first year; stems erect, many from a woody base; leaves sessile, the cauline 1-3.5(-5) x 0.3-0.6 cm, oblong-linear, alternate; base rounded, apex acute to retuse, margin acutely serrate; umbellar and floral leaves opposite, broadest at the base, sharply serrate-denticulate; cyathia 2.5-3 mm, in forked umbels, pedunculate; involucre campanulate, lobes triangular, fringed; glands with 2-fid horns; capsule 5-6 x 4 mm, conical-ovoid, 3-lobed, smooth; seeds 2.5 mm; caruncle yellowish, about 1/2 as long as the seed, smooth.

M, D, S; sandy plains and desert wadis. Macaronesia, Mauritania, North Africa, Sinai, Palestine, Arabia to Pakistan.

23. **Euphorbia grossheimii** (Prokh.) Prokh., Fl. SSSR 14: 391 (1949).

Syns. *Tithymalus grossheimii* Prokh., Bull. Jard. Bot. Princ. SSSR 29: 551 (1930).

Euphorbia isthmia Täckh., Svensk Bot. Tidskr. 26: 374 (1932).

Euphorbia mariae Tamamsh., Dokl. Akad. Nauk Arm. SSR 1: 44 (1944).

Glabrous annual or short-lived perennial, 10-30 cm; stems branched from the base, erect or ascending; leaves 3-5 x 0.3-0.6 cm, sessile, linear to oblong-lanceolate, the cauline almost entire and acute; pseudumbellar leaves tricuspidate and denticulate towards the apex; cyathia c. 2 mm, in a 2-3-rayed pseudumbel, pedunculate; involucre campanulate, with triangular fimbriate lobes; glands minute, truncate; capsule 7-8 x 5-5.5 mm, ovoid-conical; seeds 3-3.5 mm, ovoid-spherical, smooth; caruncle yellow, about as long as or longer than the seed.

De, S; sandy and gravelly plains and desert wadis. Egypt, Palestine, Arabia, Iraq, Caucasus, Pakistan.

24. **Euphorbia arguta** Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 2: 253 (1794).

Villous annual 20-50 cm; stems erect, simple or branched from the base, striate; cauline and umbellar leaves 2-5(-7) x 0.5-1.5 cm, sessile, oblong-lanceolate, serrate, acute; floral leaves c. 1-2 x 0.5-1.5 cm, rhombic-ovate; umbels 3-5 rayed, dichotomously branched; cyathia c. 1 mm, turbinate, glabrous, the lobes fringed-dentate; glands transversely oblong; capsule c. 3.5 mm, depressed-globose, 3-lobed, glabrous or slightly hirsute; seeds 2 x 1.5 mm, globose-ovoid, smooth, brownish; caruncle depressed-globular.

N, O, M, Dw; weed of cultivation. East Mediterranean region.

25. **Euphorbia hierosolymitana** Boiss., Diagn. Pl. Orient., ser. 1, 12: 110 (1853).

Syns. *Euphorbia thamnoides* Boiss., Cent. Euphorb. 33 (1860).

Euphorbia ramanensis B. R. Baum, Bull. Soc. Bot. France 110: 49, f. 2 (1963).

Euphorbia bivonae, sensu Täckh., Stud. Fl. Egypt, ed. 2, 330 (1974).

Glabrous shrub 20-60 cm; old stems woody, much-branched; bark greyish; young branches herbaceous, striate, yellowish-green; cauline leaves 0.5-1.5(-2.8) x 0.4-0.8 cm,

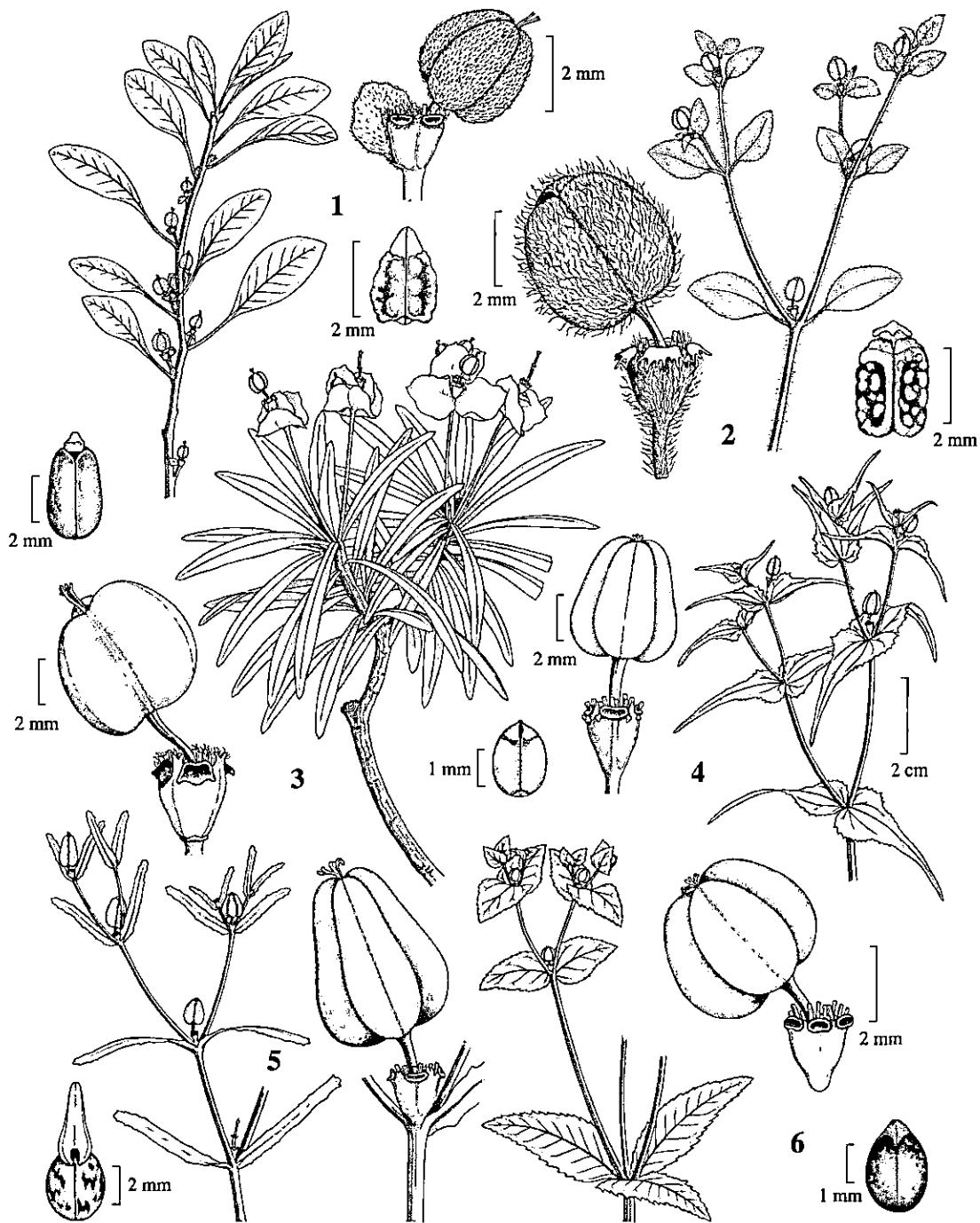


Plate 14. EUPHORBIACEAE: *Euphorbia acalyphoides* 1, flowering and fruiting branch; cyathium with capsule (up right); seed (right). *Euphorbia petiolata* 2, flowering and fruiting branch; cyathium with capsule (left); seed (right). *Euphorbia dendroides* 3, flowering and fruiting branch; cyathium with capsule (down left); seed (up left). *Euphorbia retusa* 4, flowering and fruiting branch; cyathium with capsule, and seed (left). *Euphorbia grossheimii* 5, flowering and fruiting branch; cyathium with capsule (right); seed (left). *Euphorbia arguta* 6, flowering and fruiting branch; cyathium (up right); seed (down right). All drawings to the same scale, except the enlarged parts (scale given).

alternate, sessile or subsessile, oblong-obovate, tapering at the base, apex rounded to obtuse, margin entire or repand; umbellar and floral leaves smaller; umbel rays 3-5; cyathia 2-3 mm, pedunculate; gland crescent-elliptic; capsule 3.5-4 mm, ± globose, 3-lobed, covered with conical warts, seeds c. 3 x 2.5 mm, broadly ellipsoid, smooth, glossy; caruncle globose-depressed.

M, S; stony wadis and calcareous terraces. East Mediterranean region, Sinai.

NOTE: The East Mediterranean *Euphorbia hierosolymitana* known from Turkey, Syria, Lebanon, Palestine and Egypt, has been confused with *E. bivonae* Steud. from North Africa (excluding Egypt), Malta and Sicily (El-Hadidi in Täckholm, Stud. Fl. Egypt, ed. 2, 330, 1974). Some authors consider both species as conspecific (Jafri & El-Gadi, Euphorbiaceae 89: 8, 1982). According to Smith & Tutin in Tutin *et al.*, Fl. Europ. 2: 220 (1968), *E. bivonae* has linear-lanceolate to ovate-lanceolate, acute or acuminate leaves, and a glabrous capsule to 4.8 mm. On the other hand, *E. hierosolymitana* has oblong-obovate leaves with rounded to obtuse apex and the 3.5-4 mm capsule is covered with conical warts. Although Jafri & El-Gadi, *l.c.*, list *E. hierosolymitana* as a synonym of *E. bivonae*, they confine the species area to North Africa, Malta and Sicily which is the area of *E. bivonae*, *sensu str.*

26. ***Euphorbia erinacea*** Boiss. & Kotschy in Boiss., Diagn. Pl. Orient., ser. 2, 4: 87 (1859).

Like *Euphorbia hierosolymitana*, but branchlets spinescent after anthesis, bearing a single capsule at their tips; leaves serrulate; cyathium with involucre hirsute within; capsule with flattened orbicular warts; caruncle subspherical.

S; rocky ground. Sinai, Palestine (Gaza), Syria, Lebanon.

NOTE: This species has been overlooked by Zohary, Fl. Palaest. 2 (1972) although it has been collected by Bové 490, sables de Gaza, juillet 1882 (K!).

27. ***Euphorbia oxyodonta*** Boiss. & Hausskn. in A. DC., Prodr. 15(2): 1267 (1866).

Sparingly villous annual 10-40 cm; stems erect, branched from the base; cauline and umbellar leaves 1-4 x 0.6-1.5 cm, sessile, deeply dentate-pectinate, elliptical; lower leaves spatulate, petiolate; floral leaves 0.5-1.8 x 0.5-0.8 cm, ovate-triangular; umbels with 3-6 dichotomously branched rays; cyathia c. 2 mm, pedunculate; involucre turbinate, glabrous, the lobes ciliate; glands ovate, orange-yellow; capsule c. 3 x 4 mm, broadly ovoid, 3-lobed, glabrous; seeds 2.2 x 2 mm, broadly ovoid, prominently and irregularly reticulate-rugose, brown; caruncle 0.8 mm, whitish.

N; weed of cultivation. East Mediterranean region.

28. ***Euphorbia pterococca*** Brot., Fl. Lusit. 2: 312 (1804).

Glabrous annual 10-25 cm; stems erect, simple; leaves 1-2.5 x 0.6-0.8 cm, alternate, sessile, oblong-obovate, serrulate, obtuse, the lower spatulate, petiolate; ray-leaves similar to the cauline but slightly narrower; rays usually 5, 1-2 cm, trichotomously branched, then dichotomously, slender; glands without petaloid appendages; capsule 1 x

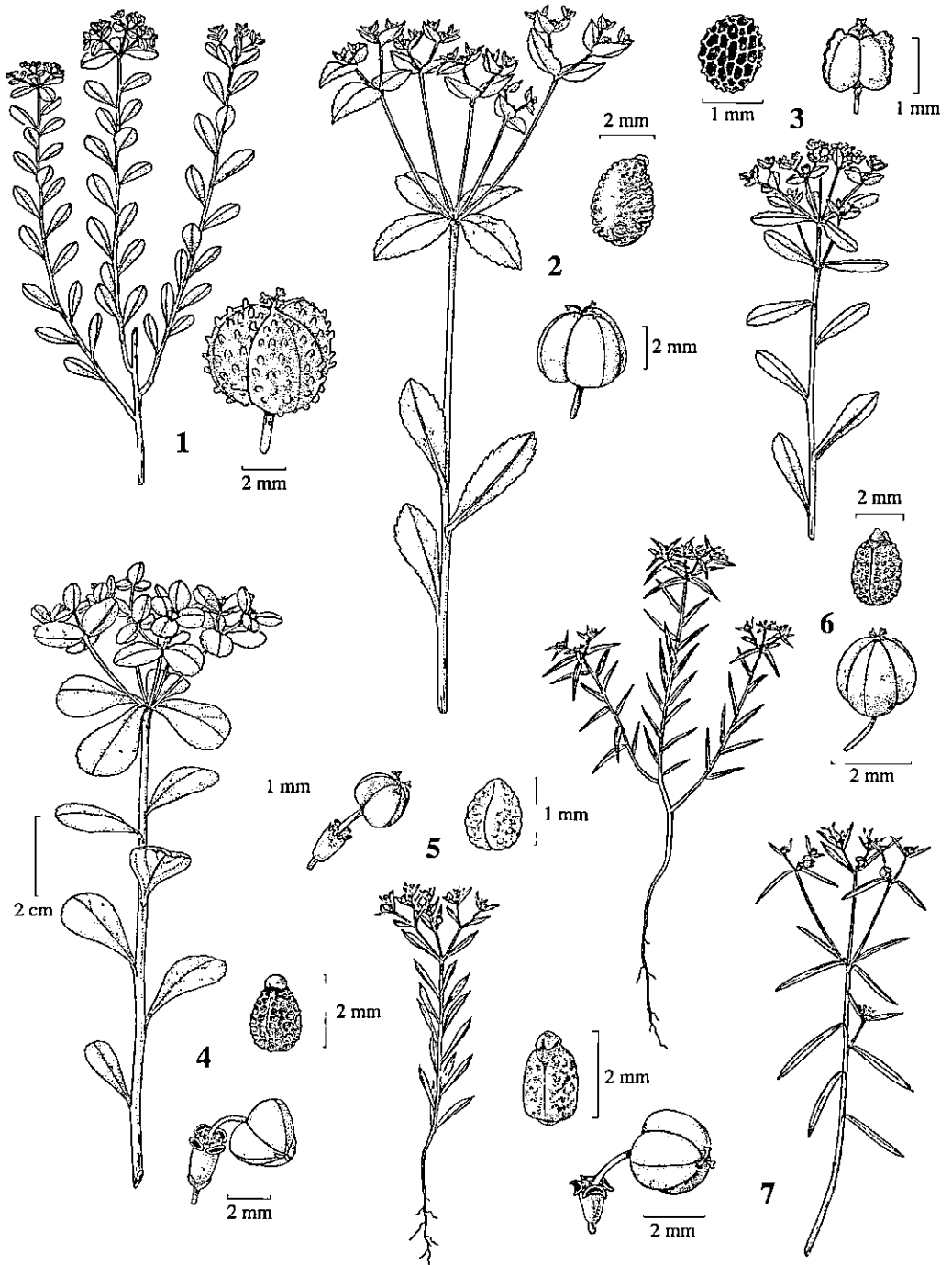


Plate 15. EUPHORBIACEAE: *Euphorbia hierosolymitana* 1, flowering and fruiting branch; capsule (right). *Euphorbia oxydonta* 2, flowering and fruiting branch; seed and capsule (right). *Euphorbia pterococca* 3, flowering and fruiting branch; seed and capsule (up). *Euphorbia helioscopia* 4, flowering and fruiting branch; seed and cyathium (down right). *Euphorbia parvula* 5, habit; cyathium and seed (up). *Euphorbia exigua* 6, habit; seed and cyathium (right). *Euphorbia dracunculoides* 7, flowering and fruiting branch; cyathium and seed (left). All drawings to the same scale, except the enlarged parts (scale given).

1.5 mm, with 2 undulate wings on each valve, smooth; seeds 1.25 mm, reticulate-alveolate, dark brown.

M; cultivated ground. Mediterranean region.

29. **Euphorbia helioscopia** L., Sp. Pl., ed. 1, 459 (1753).

Glabrescent annual 10-40 cm; stems erect, single or branched from the base; cauline leaves 1-4 x 0.5-1.5 cm, caducous, spatulate, tapering at the base, sessile, serrulate especially towards the rounded apex; umbellar and floral leaves larger, obovate; umbel rays 4-5, dichotomously or trichotomously branched; cyathia 2 mm, pedunculate; involucre lobes fringed; glands ovate, entire; capsule 2.5 x 3.5 mm, subglobose, 3-sulcate, glabrous; seeds 2 x 1.5 mm, ovoid, foveolate-reticulate, brown; caruncle 0.5 mm, sessile, flat, transversely ovate.

N, M; weed of cultivation. Europe, North Africa, West Asia; introduced into many temperate regions.

30. **Euphorbia sintenisii** Boiss. ex Freyn, Bull. Herb. Boissier 6: 986 (1898).

Like *Euphorbia helioscopia*, but leaves elliptic-oblong, coarsely dentate-pectinate, acute; seeds very shallowly and irregularly reticulate rugose, black; caruncle protuberant, hemispherical-conical.

N; weed of cultivation. Libya, Egypt, Palestine, Syria, Cyprus.

31. **Euphorbia parvula** Delile, Descr. Egypte, Hist. Nat. 235 (1814).

Tiny glabrous annual 3-10 cm; stems branched, striate; cauline leaves 0.2-1 x 0.1-0.2 cm, alternate, spatulate, entire, the apex mucronate; ray leaves 0.5-1 x 0.1-0.2 cm, oblong-lanceolate, acuminate; rays 2-3, twice forked; cyathium 1 x 0.5 mm; cyathial lobes oblong, ciliate; glands transversely ovate, with 2 short horns or unappendaged; capsule 1 x 1.5 mm, conical-spherical, glabrous; seeds 1-1.2 x 0.8 mm, ovoid, white, tuberculate; caruncle absent.

M; cultivated ground. Egypt, Libya.

32. **Euphorbia exigua** L., Sp. Pl., ed. 1, 456 (1753).

Glabrous annual 10-30 cm; stems branched from the base; cauline leaves 0.5-2.5 x 0.1-0.2 cm, linear to oblong-cuneate, the apex acute; ray leaves similar to the upper cauline leaves or broader at the base; rays 3-5, forked several times; cyathium 1.5 mm, glands with 2 conspicuous horns; capsule 1.5-2 mm, conical, 3-lobed, glabrous; seeds 1.2 x 1 mm, ovoid-quadrate, tuberculate, grey.

O (Dakhla); cultivated ground. Canary Islands, North Africa, Europe, West Asia.

33. **Euphorbia dracunculoides** Lam., Encycl. 2: 428 (1788) subsp. **dracunculoides**

Glabrous annual 10-25 cm; stems much-branched from the base; cauline leaves 1.5-5 x 0.3-0.5 cm, linear to linear-lanceolate, sessile; ray leaves shorter; rays 2-3, several times

dichotomously branched; bracts leaf-like; cyathia 1.5 x 1.5 mm, sessile, with cup-shaped involucre; glands 4, transversely oblong, 0.75 mm diam., with 2 horns to 0.75 mm, the margin ciliate; capsule 2.5-2.8 mm, conical-subglobose, exerted on a pedicel 3-4 mm, deeply 3-lobed, glabrous; seeds 2-2.25 x 1.75 mm, ovoid, blackish-brown, with whitish network of thin ridges; caruncle 0.5 mm.

De, GE; sandy soils. Spain, North Africa, Tanzania.

34. *Euphorbia falcata* L., Sp. Pl., ed. 1, 456 (1753).

Glabrous annual 10-25 cm; stems much-branched, sometimes simple, erect or spreading; lower leaves 1-2 x 0.2-0.5 cm, linear-lanceolate to spatulate, alternate, sessile, often caducous; umbellar and floral leaves 0.5-1.5 cm, ovate-elliptic to broadly ovate, mucronate; rays 3-5, forked several times; cyathia c. 1 mm, pedunculate; involucre turbinate, fringed; glands with long, short or no horns; capsule 1.5-2 mm, ovoid, 3-lobed; seeds 1-1.5 x 1 mm, tetragonous, with 1 row of 4-6 transverse furrows or pits on each face.

M, S; sandy soils. Mediterranean region, West Asia.

35. *Euphorbia peplus* L., Sp. Pl., ed. 1, 456 (1753).

Syns. *Euphorbia peploides* Gouan, Fl. Monsp. 174 (1764).

Euphorbia peplus L. var. *peploides* (Gouan) Vis., Fl. Dalm. 3: 229 (1852).

Annual glabrous herb 10-30 cm; stems much-branched, erect or spreading; leaves 0.5-2 x 0.3-1 cm, entire; lower cauline leaves opposite, petiolate, obovate, tapering at the base, the apex obtuse to rounded; umbellar leaves larger, subsessile; floral leaves broadly ovate; umbel rays 3, forked several times; cyathia 1-1.5 mm, pedunculate; involucre turbinate, the lobes ovate, fimbriate; glands lunate, with slender horns to 1 mm; capsule c. 2 x 2 mm, ovoid-subglobose, 3-lobed, glabrous; carpels keeled, with 2 wing-like ridges on each keel; seeds 1.5 x 1 mm, ovoid-hexagonal; caruncle depressed-conical, white, sulcate on 2 ventral facets, pitted on lateral and dorsal facets.

N, O, M, D, S; widespread weed of cultivated ground. Macaronesia, Europe, Mediterranean region, West and Central Asia; introduced into many other regions of the world.

36. *Euphorbia chamaepeplus* Boiss. & Gaill. in Boiss., Diagn. Pl. Orient., ser. 2, 4: 88 (1859).

Syn. *Euphorbia chamaepeplus* Boiss. & Gaill. var. *sinaica* Hochst. ex Boiss. in DC., Prodr. 15(2): 142 (1862).

Glabrous annual 5-15 cm; stems branched from the base, erect or spreading, striate; leaves 3-8 x 3-5 mm, ovate to elliptic, almost all alike, rather fleshy, sessile or petiole to 3 mm, entire, the apex acute or apiculate; rays 2-3, simple, rarely forked; cyathia c. 1 mm, pedunculate; involucre with fringed lobes; glands red, with 2 slender horns to 0.5 mm; capsule c. 2 x 2 mm, broadly ovoid, 3-lobed, glabrous; carpels keeled, not winged along the keels; seeds 1.5 x 1 mm, cylindrical-hexagonal, with 2 longitudinal furrows and 4 rows of transverse deep pits; raised network white, furrows and pits black; caruncle depressed-conical, white.

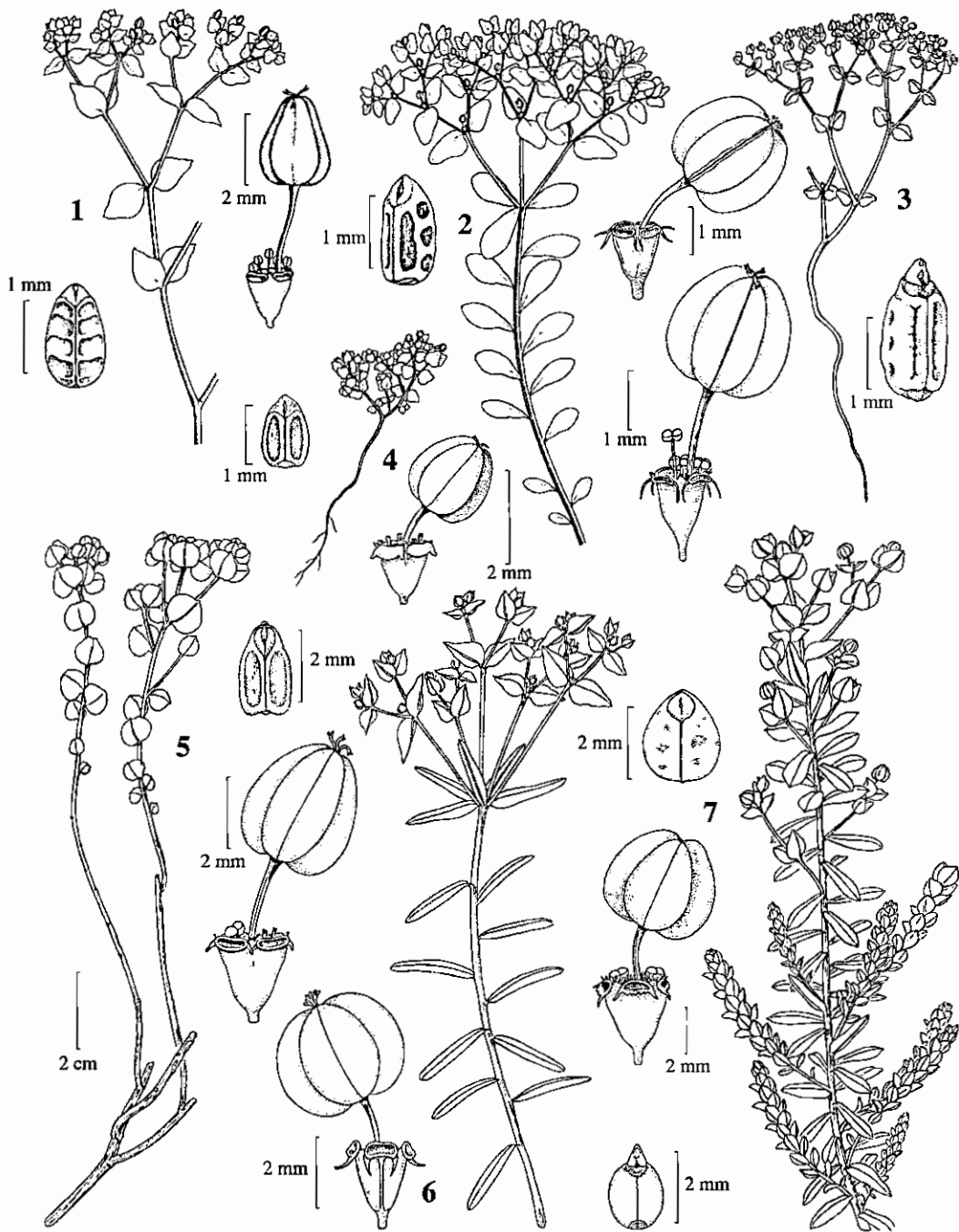


Plate 16. EUPHORBIACEAE: *Euphorbia falcata* 1, flowering and fruiting branch; cyathium (right); seed (down left). *Euphorbia peplus* 2, flowering and fruiting branch; cyathium (up right); seed (left). *Euphorbia chamaepeplus* 3, habit; cyathium (down left); seed (right). *Euphorbia punctata* 4, habit; cyathium (right); seed (left). *Euphorbia obovata* 5, flowering and fruiting branch; cyathium (middle right); seed (up right). *Euphorbia terracina* 6, flowering and fruiting branch; cyathium (down left); seed (down right). *Euphorbia paralias* 7, flowering and fruiting branch; cyathium (middle left); seed (up left). All drawings to the same scale, except the enlarged parts (scale given).

M, De, S; shaded crevices and hillsides, edges of cultivation. Egypt, Palestine, Syria, Lebanon, Cyprus, Arabia, Iraq.

NOTE: The differences between var. *chamaepeplus* and var. *sinaica* seem to overlap and therefore var. *sinaica* is listed here as a synonym.

37. **Euphorbia punctata** Delile, Descr. Egypte, Hist. Nat. 234 (1814).

Like *Euphorbia chamaepeplus*, but plant c. 3 cm; stems narrowly winged; leaves fleshy; cauline leaves sessile, broadly obovate, usually caducous; umbellar leaves broadly ovate; seeds 1 x 0.8 mm.

M, S; cultivated ground. Endemic.

38. **Euphorbia obovata** Decne., Ann. Sci. Nat. Bot., sér. 2, 2: 241 (1834).

Low shrub 20-30 cm; stems much-branched, terete, striate; leaves fleshy; cauline leaves 3-8 x 2-6 mm, alternate, obovate, subsessile, entire, apiculate, caducous; umbellar leaves to 1 x 1.2 cm, broadly ovate to suborbicular, sessile, entire, apiculate; floral leaves smaller; umbel rays 3-5, repeatedly forked; cyathia 2 mm, short-pedunculate; involucre campanulate, with fringed lobes; glands lunate, horned; capsule 3-3.5 x 3 mm, ovate, 3-lobed, glabrous, smooth; seeds 2-2.5 mm.

S; in the mountains. Endemic.

NOTE: The type was collected by Schimper 325, from Mt. Sinai (K!).

39. **Euphorbia terracina** L., Sp. Pl., ed. 2, 654 (1762).

Syns. *Euphorbia modesta* Boiss., Cent. Euphorb. 34 (1860).

Euphorbia terracina L. var. *modesta* (Boiss.) Boiss. in DC., Prodr. 15: 158 (1862).

Euphorbia terracina L. var. *alexandrina* (Delile) El-Karemy, Fedd. Repert. 105 (5-6): 280 (1994).

Perennial 20-60 cm, woody at the base, sometimes flowering the first year; stems erect or ascending, sometimes prostrate, branched especially from the base; leaves 1-4(-6) x 0.4-0.8 cm, entire; lower cauline leaves alternate, oblong to oblong-linear or linear-lanceolate, obtuse or truncate, mucronate, rather spaced; upper cauline leaves acute; umbellate leaves 1-2.5 cm, oblong-elliptic; floral leaves smaller, ovate-triangular to suborbicular; umbel rays 3-5, repeatedly forked; cyathia c. 2 mm, pedunculate; involucre campanulate, the lobes ovate, fimbriate; glands with 2 horns to 2 mm; capsule 3-4 x 3 mm, depressed-globose, 3-lobed, smooth, glabrous; seeds 2 x 1.5 mm, ovoid, laterally compressed, smooth, greyish; caruncle prominent and boat-shaped, depressed-conical, white.

M, S; coastal sandy soils. Mediterranean region, Sinai.

40. **Euphorbia paralias** L., Sp. Pl., ed. 1, 458 (1753).

Glabrous glaucous low shrub, 30-50 cm; stems many from the base, erect, leafy; cauline leaves 1-2 x 0.2-0.5 cm, elliptic to oblong, sessile, with rounded broad base, densely imbricate; umbellar and floral leaves 0.6-1.2 cm, broadly ovate with cordate base,

mucronate, all leaves fleshy; umbel rays 3-5, short, simple or branched; cyathia c. 3 mm, pedunculate; involucre campanulate, the lobes oblong, ciliate; glands lunate, dentate, with 2 short horns; capsule 4 x 5.5 mm, depressed-globose, 3-lobed, finely wrinkled, glabrous; seeds 3 x 2.5 mm, broadly ovoid, grey with blackish rounded spots, smooth; caruncle small, reniform.

M, S; maritime sands. Atlantic Islands, Mediterranean region, West Europe, Black Sea coasts.

41. **Euphorbia sanctae-catharinae** Fayed, Folia Geobot. Phytotax. (Praha) 18: 321 (1983).

Short-lived glabrous perennial 10-35 cm; stems procumbent; cauline leaves 0.6-1.1 x 0.4-0.8 cm, obovate to suborbicular, subsessile, entire, obtuse, mucronate; cyathia in terminal or lateral umbels; umbel rays 3-5, forked several times; bracts ovate, elliptic, suborbicular or triangular; involucre 1-2 mm, campanulate; glands 4, lunate, with 2 horns; capsule c. 3 mm diam., glabrous; seeds 3 x 2 mm, smooth, with few spaced shallow pits; caruncle 0.5 mm diam., on a short stalk, yellow.

S; in the mountains, Gebel Katherine. Endemic.

NOTE: The above description is based mainly on the original publication; no material has been examined. The type was collected from Gebel Katherine, alt. 2350 m, southern Sinai, by El-Hadidi *et al.*, 20.8.1982 (CIA).

RUTACEAE

156 genera, about 1800 species, cosmopolitan, especially tropical. *Haplophyllum* is the only genus in Egypt.

1. **Haplophyllum** Juss., nom. conserv.

Perennial aromatic herbs or shrubs; leaves alternate, simple or 3-fid; inflorescence a bracteate dichasial cyme; flowers bisexual, actinomorphic, yellow or reddish; sepals 5; petals 5, entire; stamens 10, the filaments free or connate at the base; ovary 5-celled, 5-lobed; ovules (1-)2-4(-8) in each cell; styles fused into a single column; fruit a glandular, dehiscent capsule; seeds reniform, transversely wrinkled. 66 species, Mediterranean region, Northeast Africa, Arabia, East Siberia.

1. Leaves 1-5 cm, obovate, oblong-spathulate or linear, with projecting glands on the leaf surface and stems; capsule glabrous 1. **H. tuberculatum**
+ Leaves 3-6 mm, ovate to lanceolate; glands not projecting from the leaf surface and stems; capsule hairy 2. **H. poorei**

1. **Haplophyllum tuberculatum** (Forssk.) Juss., Mém. Mus. Hist. Nat. Paris 12: 528, t. 17, no. 10 (1825).

Syns. *Ruta tuberculata* Forssk., Fl. Aegypt.-Arab. 68 (1775).

Haplophyllum longifolium Boiss., Diagn. Pl. Orient., ser. 1, 8: 127 (1849).

Haplophyllum obovatum (Hochst. ex Boiss.) Hand.-Mazz., Verh.

Zool.-Bot. Ges. Wien 63: 54 (1913).

For full synonymy, see Townsend in Townsend & Guest (eds.), Fl. Iraq 4: 460, 462 (1980).

Perennial 20-50 cm, woody at the base, glabrous or crispate-hairy, with projecting glands on the stems and leaves; stems many, erect or ascending, branched; leaves (1-)1.5-5 x 0.2-0.5 cm, obovate, oblong-spathulate or linear, the margin undulate or flat; flowers subsessile; sepals *c.* 1 x 0.8 mm, lanceolate to ovate, glabrous to lanate, glandular; petals 4-6.5 x 2 mm, yellow; filaments fused at the base; capsule 3.5-5 mm, glabrous or woolly, glandular-tuberculate; seeds 1-1.5 mm, reniform, rugose.

N, O, M, D, GE, S; sandy and stony desert wadis and alluvial plains. North Africa, Sinai, East Mediterranean region, Arabia, Iran, Pakistan, Afghanistan, North Sudan.

2. **Haplophyllum poorei** C. C. Towns., Kew Bull. 20: 97, f. 3 (1966).

Dwarf pubescent shrub 15-30 cm; stems usually simple, woody at the base; glands not projecting from the leaf surface and stems; leaves 3-6 x 1-2.5 mm, rather dense, almost all similar, ovate to lanceolate, entire, appressed-hairy, with sparse glandular dots; inflorescence umbellate, 4-6-flowered; pedicel short, indurate and elongating to *c.* 6 mm in fruit; sepals 1-2 mm, broadly ovate, hirsute; petals 6-9 x 4-5 mm, the middle part reddish-brown and yellowish at the broad membranous margin, ovate, obtuse, hairy or glabrous; filaments free, hairy at the base; capsule 2-3 mm, depressed-globose, glandular-tuberculate at maturity.

S; stony ground. Sinai, Palestine.

BURSERACEAE

17 genera, 540 species, tropical regions, especially America and Northeast Africa. *Commiphora* is the only genus in Egypt.

1. **Commiphora** Jacq., nom. conserv.

Small dioecious trees or shrubs; outer bark peeling from the green under-bark; exudate a gummy resin or liquid; stems spine-tipped or not; leaves alternate on long branches or in clusters on short shoots, usually 3-foliolate or imparipinnate, rarely 1-foliolate or simple; inflorescence of elongate panicles or dichasial cymes or reduced to few-flowered clusters, or flowers solitary; flowers pedicellate or sessile, small, regular, greenish-yellow or dark red, imperfectly unisexual; sepals 4(-5), tubular, rarely valvate; petals 4 (-5), free, valvate; stamens 8; ovary usually 2-locular, with 2 pendulous ovules per locule; style short; stigma subcapitate, obscurely 4-lobed; fruit a drupe. About 250 species, warm regions of Africa and Madagascar, Arabia to Sri Lanka, Mexico, Brazil.

1. Leaves 3-5-foliolate; stems spineless
+ Leaves simple; branchlets spine-tipped

1. **C. gileadensis**
2. **C. quadricincta**

1. **Commiphora gileadensis** (L.) C. Chr., Dansk Bot. Arkiv. 4(3): 18 (1922).

Syns. *Amyris gileadensis* L., Amoen. Acad. 7: 68 (1762).

Amyris opobalsamum L., Amoen. Acad. 7: 68 (1762).

Commiphora opobalsamum (L.) Engl. in DC., Monogr. Phan. 4: 15 (1883).

Tree or shrub 1.5-4 m; branches long, slender, striate, without spines; bark reddish or greyish; leaves 3-5-foliolate, in clusters on short shoots, glabrous or finely pubescent;

petiole 0.5-1.5 cm; leaflets 0.3-1 x 0.3-0.6 cm, obovate, entire, the apex rounded or emarginate; terminal leaflet usually largest; flowers 2-3 mm, in clusters; drupe 0.8-1 x 0.6-0.8 cm, broadly ovoid to ellipsoid, apiculate, smooth, glabrous, with persistent calyx.

GE; sandy plains and hillsides. Southeast Egypt, Northeast Sudan (Red Sea Hills), Arabia.

NOTE: The "Balm of Gilead" of the Bible.

2. *Commiphora quadricincta* Schweinf., Bull. Herb. Boissier 7, App. 2: 283 (1899).

Tree or shrub 3-5 m; trunk and main branches covered by greyish-brown flaking bark; branchlets spine-tipped; leaves simple, 1-2.5 x 1-2.5 cm, broadly ovate to orbicular, entire, the apex rounded, obtuse or emarginate, glabrous; petiole 0.5-1.5 cm; flowers c. 4 mm, in clusters; sepals c. 1.5 mm, cup-shaped, the teeth broadly triangular; petals 4 mm, red; drupe c. 1 x 0.8 cm, broadly ovate, apiculate, glabrous, reddish, with 3 red longitudinal wings, pedicellate, with persistent calyx.

R, GE; rocky hillsides and sandy plains. Southeast Egypt, Sudan, Arabia.

POLYGALACEAE

17 genera, 950 species, cosmopolitan, except West Pacific. *Polygala* is the only genus in Egypt.

1. *Polygala* L.

Herbs or low shrubs; leaves alternate, rarely opposite or whorled; flowers in terminal racemes; sepals 5, persistent, the inner 2 sepals petaloid, wing-like, much larger than the outer sepaloid ones; petals 3, connate at the base and adnate to the staminal tube, the lower one usually the largest and often with a fimbriate crest, enclosing the stamens; stamens 8, the filaments united into a tube; fruit a compressed winged capsule; seeds 2 per capsule, silky-hairy. About 500 species, subcosmopolitan, not in New Zealand.

- | | |
|---|-----------------------------|
| 1. Spinescent shrubs | 1. <i>P. sinaica</i> |
| + Unarmed shrubs or herbs | 2 |
| 2. Leaves 0.4-0.8(-1) cm, ovate to broadly elliptic or spatulate | 2. <i>P. hohenackeriana</i> |
| + Leaves 1-4 cm, linear to oblong-linear | 3 |
| 3. Inner sepals (wings) prominently veined, with a white membranous margin;
corolla yellow | 3. <i>P. irregularis</i> |
| + Inner sepals (wings) with a prominent green midrib and no lateral veins;
corolla mauve | 4. <i>P. erioptera</i> |

1. *Polygala sinaica* Botsch., Novosti Sist. Vyss. Rast. 1: 368 (1964).

Syn. *Polygala spinescens* Decne., Ann. Sci. Nat. Bot., sér. 2, 3: 275 (1835), non Gillies in Hook., Bot. Misc. 3: 146 (1833).

Low spinescent shrub 20-50 cm, velvety-pubescent with dense semi-patent hairs or

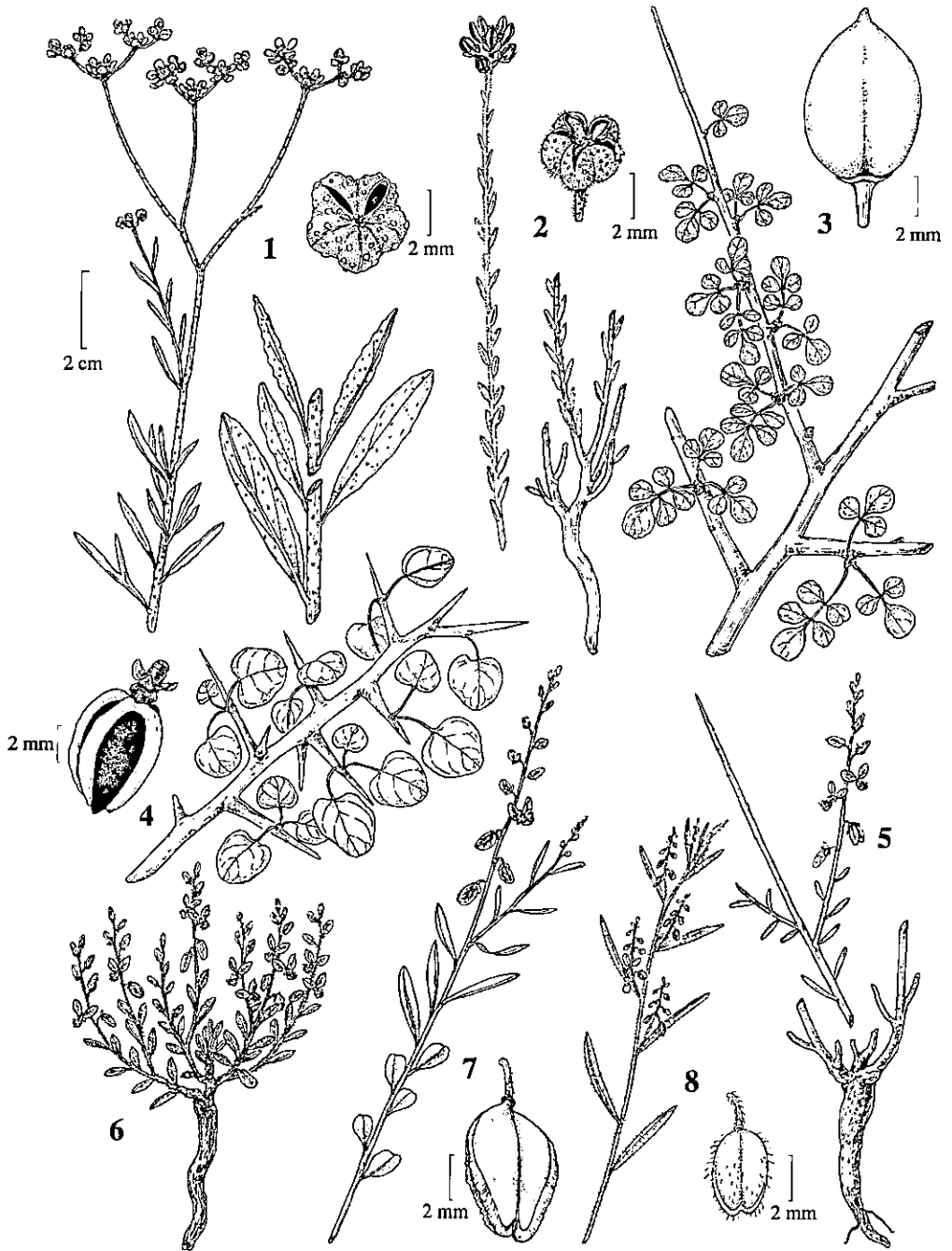


Plate 17. RUTACEAE: *Haplophyllum tuberculatum* 1, flowering branch, leaf variation and fruit. *Haplophyllum poorei* 2, flowering branch, basal part and fruit. BURSERACEAE: *Commiphora gileadensis* 3, leafy branch and fruit. *Commiphora quadricincta* 4, leafy branch and fruit. POLYGALACEAE: *Polygala sinaica* var. *glabrescens* 5, flowering and fruiting branch and basal part. *Polygala hohenackeriana* 6, flowering and fruiting plant. *Polygala irregularis* 7, flowering and fruiting branch; fruit (right). *Polygala erioptera* 8, flowering and fruiting branch; fruit (right). All drawings to the same scale, except the enlarged fruits (scale given).

dispersed appressed hairs; stems much-branched; branches rigid, spinescent, yellowish-green; leaves 0.4-1.8 x 0.1-0.2 cm, oblong-linear, alternate, sessile or short-petiolate, acute, pubescent, caducous; flowers 6-8 mm, in terminal racemes; 3 outer sepals 2-2.5 mm, almost equal, elliptic, membranous, with a broad green midrib; the 2 inner sepals (wings) 7-8 mm, white, clawed, densely nerved; petals 3-5 mm, unequal, the middle longer than the laterals, purple; filaments connate into a tube to half of their length; capsule 5-6 mm, obovate, truncate, glabrous; seeds 3-4 mm, appressed silky-hairy.

Two varieties occur in Egypt:

var. **sinaica**

Plant velvety-pubescent with dense semi-patent hairs.

S; crevices between the granite rocks. Endemic.

NOTE: The type was collected in Mount Sinai, 21.5.1835, lectotype Schimper 448 (K!) chosen here.

var. **glabrescens** (Zohary) Boulos, comb. nov.

Basionym: *Polygala spinescens* Decne. var. *glabrescens* Zohary in Eig & Zohary, Pal. J. Bot., Jerusalem ser., 1: 310 (1939).

Syn. *Polygala negevensis* Danin, Israel J. Bot. 36: 67 (1987).

Plant with sparse appressed hairs.

S; stony desert wadis. Sinai, Palestine, Saudi Arabia.

NOTE: Danin (Israel J. Bot. 36: 67, 1987) describes *Polygala negevensis* on the basis of its sparse appressed pubescence compared with *P. sinaica* which is velvety-pubescent with dense semi-patent hairs, and notes that *P. negevensis* is confined to more extreme habitats than *P. sinaica*. He adds that pubescence was used by Boissier to distinguish two geographically separated species: *P. sinaica* and *P. muscatensis* Boiss. However, populations of the same species growing in an area including Sinai, southern Palestine and northwestern Saudi Arabia are most likely to show variations in their pubescence. Moreover, this area is geographically continuous, not to be compared by Sinai and Oman which are obviously geographically widely separated. Again *P. sinaica* and *P. muscatensis*, besides their distant geographical separation, are morphologically distinct. Therefore, the varietal rank for the two taxa of *Polygala sinaica* is retained here, as proposed by Zohary, *l.c.* The formal nomenclatural change is made and *Polygala negevensis* is listed as a synonym of *P. sinaica* var. *glabrescens*.

2. ***Polygala hohenackeriana*** Fisch. & C. A. Mey., Ind. Sem. Hort. Petrop. 4: 42 (1838).

Syn. *Polygala edumea* Zohary, Pal. J. Bot., Jerusalem ser., 2: 89 (1940), nom. nud.

Perennial 6-15 cm, densely appressed-canescens with crispate hairs; stems branched, ascending; leaves 0.4-0.8(-1) cm, ovate to broadly elliptic or spatulate, alternate, sessile, entire, the apex obtuse or acute; flowers 6-8 mm, in terminal racemes; bracts 1-2 mm, membranous; pedicel 1-2 mm; 3 outer sepals unequal, the 2 inner sepals (wings) *c.* 7 mm, obovate-elliptic, white, 3-nerved, nerves green, the median nerve thicker than the 2

laterals; corolla white or pink; filaments connate to apex; capsule 6 x 4 mm, obovate, glabrous, with winged margins; seeds 3-4 mm, appressed-hairy.

S (Gebel Libni, northern Sinai); hillsides. Sinai, West Asia.

3. ***Polygala irregularis*** Boiss., Diagn. Pl. Orient., ser. 1, 1: 8 (1843).

Syn. *Polygala irregularis* Boiss. var. *aegyptiaca* Chodat ex Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 90 (1974).

Puberulent annual or short-lived perennial, 20-30 cm; stems much-branched from the base, ascending, striate; leaves 1.5-4 x 0.1-0.4 cm, linear to oblong-linear; flowers 6-8 mm; pedicel 1.5-2.5 mm; bracts 1 mm, membranous, caducous; 3 outer sepals 1.5-2 mm; the 2 inner sepals (wings) 5.5-7 x 5 mm, broadly ovate, shortly pubescent, prominently veined, with a white margin; corolla yellow; capsule 6-7 x 3.5-4.5 mm, broadly ovate, wings unequal, glabrous; seeds ovoid, 3-3.5 mm, densely silky-hairy, with a basal tuft of hairs.

R, GE; wadi beds and sandy plains. Southeast Egypt, Sudan, Kenya, Ethiopia, Somalia, Djibouti, westwards to Senegal, Arabia, eastwards to India.

4. ***Polygala erioptera*** DC., Prodr. 1: 326 (1824).

Syn. *Polygala thurmanniana* Chodat, Mém. Soc. Phys. Genève 31(2): 346 (1893).

Grey-pubescent annual or short-lived perennial, 10-30 cm; stems erect, decumbent or prostrate, branched; leaves 1-3.5 x 0.2-0.3 cm, linear to oblong-linear, sessile or short-petiolate, alternate, entire, the apex obtuse, flowers 3-4.5 mm, in axillary clusters; 2 inner sepals (wings) to 4.5 x 3 mm, with a prominent green midrib and no lateral veins; corolla mauve; capsule 3 x 2.5 mm, ovate, margin narrow, sparsely hairy; seeds 2.5 x 1 mm, silky-hairy.

N, De, R, GE, S; sandy plains and desert wadis. Egypt, Sudan, Somalia, tropical Africa, Arabia, eastwards to India.

ANACARDIACEAE

(incl. Pistaciaceae)

Trees or shrubs, usually deciduous; leaves alternate, simple or compound, exstipulate or stipules caducous; flowers bracteate, in cymose or racemose inflorescence, bisexual or unisexual, regular; calyx 3-5-lobed; petals as many as the calyx-lobes or 0; disc flat or cup-shaped; stamens as many as or double the number of calyx-lobes, inserted under the disc; ovary superior, 1-3(-5)-celled, with 1 ovule per cell; style 1 or more; fruit a drupe or nut-like, 1- or many-seeded; seeds with thin or no endosperm. 70 genera, 875 species, tropical and subtropical regions, Mediterranean region, Sinai, temperate North America.

1. Leaves 3-foliolate or pinnate with toothed and hairy leaflets
+ Leaves pinnate; leaflets entire, glabrous

1. **Rhus**
2. **Pistacia**

1. *Rhus* L.

Shrubs or small trees, usually dioecious, sometimes polygamous; leaves alternate, simple, 3-foliolate or imparipinnate; flowers many, small, in thyrses or lateral and terminal compound spikes, bisexual or unisexual; calyx lobes 5, connate at the base; petals and stamens 5; ovary sessile, of 3 united carpels of which only one is fertile; fruit a red drupe, with red simple and glandular hairs; seeds with membranous testa. About 200 species, temperate and warm regions.

- | | |
|--|--------------------------|
| 1. Leaves imparipinnate; leaflets 5-7 pairs | 1. <i>R. coriaria</i> |
| + Leaves 3-foliolate | 2 |
| 2. Branchlets spinescent; leaflets lobed | 2. <i>R. tripartita</i> |
| + Branchlets not spinescent; leaflets not lobed | 3 |
| 3. Leaflets to 15 cm, ovate-lanceolate, apex acute | 3. <i>R. abyssinica</i> |
| + Leaflets to 5 cm, suborbicular to ovate-elliptic, apex rounded | 4. <i>R. flexicaulis</i> |

1. *Rhus coriaria* L., Sp. Pl., ed. 1, 265 (1753).

Polygamous shrub or small tree, 2-4 m; leaves 8-20 cm, imparipinnate, rough-hairy, deciduous; leaflets 5-7 pairs, 2-4 x 0.8-2 cm, sessile, oblong-elliptic to ovate-lanceolate, coarsely serrate-dentate, the apex obtuse or acute; flowers 3-4 mm, greenish-white, unisexual in terminal or axillary dense panicles; sepals 5, c. 2 mm, ovate-orbicular, densely hairy; petals 5, 2.5-3.5 mm, ovate; stamens 5, rudimentary in female flowers; disc broad; ovary with 3 stigmas, rudimentary in male flowers; fruit a drupe, 4.5-6 mm, globose, red, densely brownish glandular-hairy.

S; sheltered mountain cliffs. Macaronesia, Southeast Europe, Mediterranean region, eastwards to Central Asia.

2. *Rhus tripartita* (Ucria) Grande, Bull. Orto Bot. Regia Univ. Napoli 5: 62 (1918).

Syns. *Rhamnus tripartitus* Ucria, Nuovo Racc. Opusc. Aut. Sicil. 6: 249 (1793).

Rhus oxyacanthoides Dum. Cours., Bot. Cult. 3: 569 (1802).

Rhus ziziphina Tineo, Pl. Rar. Sicil. Pugill. 1: 8 (1817), nom. illeg.

Dioecious shrub 1-2.5 m, almost glabrous; stems reddish; branchlets spinescent; leaves 1.5-3 cm, 3-foliolate; petiole 0.5-1.2 cm; leaflets 0.5-2 x 0.5-1 cm, sessile, obovate, cuneate, lobed, the lobes usually dentate, sometimes entire; flowers minute, in 2-3 cm axillary or terminal panicles; calyx c. 1 mm, with 5 ovate lobes; petals 5, 2 mm, ovate-lanceolate, obtuse, greenish; stamens 5; drupe 5-6 mm, globose, red, glabrous, glossy.

M, De, R, GE, S; rocky desert wadis and hillsides. Sicily, North Africa, Sinai, West Asia, Sudan, Niger, Central Sahara.

3. *Rhus abyssinica* Hochst. (1841, nom. nud.) ex Oliv., Fl. Trop. Afr. 1: 438 (1868).

Syn. *Rhus foliosa* A. Rich., Tent. Fl. Abyss. 1: 143 (1847).

Dioecious shrub or tree, 2-5 m; stems and leaves densely pubescent; leaves 3-foliolate; petiole 3-8 cm; leaflets sessile, ovate-lanceolate, entire or crenate towards the acute apex;



Plate 18. ANACARDIACEAE: *Rhus coriaria* 1, flowering male branch; fruits (left). *Rhus tripartita* 2, flowering male branch and fruiting female branch. *Rhus abyssinica* 3, flowering male branch. *Rhus flexicaulis* 4, fruiting female branch. *Pistacia khinjuk* var. *glabra* 5, fruiting female branch. *Pistacia atlantica* 6, fruiting female branch; male inflorescence (left). All drawings to the same scale, except the enlarged part (scale given).

terminal leaflet 5-15 x 4-7 cm, lateral leaflets smaller; flowers brownish-white, in axillary and terminal panicles to 16 cm; drupe 3 x 2 mm, ellipsoid, brown, on villose pedicels 2-3 mm; calyx persistent.

GE; mountain ledges, usually above 1000 m. Southeast Egypt, Sudan, Ethiopia, Eritrea, Arabia.

4. *Rhus flexicaulis* Baker, Kew Bull. 1895: 316 (1895).

Shrub 2-3 m, densely pilose-tomentose throughout; leaves 3-foliolate; leaflets 2-5 x 1.5-3 cm, suborbicular to ovate-elliptic, sessile, entire, the apex rounded, the terminal leaflet larger than the 2 lateral; flowers in lax terminal panicles; drupe 5 x 4 mm, brownish, glossy; pedicel villous, 1-2 mm.

GE; mountain ledges above 1000 m. Southeast Egypt, Sudan, Arabia.

2. *Pistacia* L.

Resinous dioecious trees or shrubs; leaves alternate, exstipulate, usually pinnate; flowers unisexual, apetalous, in axillary panicles or racemes; *male flowers*: with 1 bract, 2 bracteoles and 1-2 perianth segments, all forming a 5-fid perianth; stamens 3-5(-7) around the disc; pistil 0 or rudimentary; *female flowers*: with 1 bract, 2 bracteoles and 2-5 small scarious perianth segments; disc 0 or rudimentary; ovary sessile, 1-celled with 1 ovule; style short, 3-fid, the stigmas capitate; fruit a 1-seeded drupe; seeds compressed, the testa membranous. 9 species, Mediterranean region, West Asia, Malaysia, southern USA, Central America.

- | | |
|--|------------------------|
| 1. Evergreen shrub; leaves paripinnate; female flowers in congested spicate inflorescences | 3. <i>P. lentiscus</i> |
| + Deciduous tree or shrub; leaves imparipinnate; female flowers in loose paniculate inflorescences | 2 |
| 2. Leaf rhachis narrowly winged; leaflets obtuse | 2. <i>P. atlantica</i> |
| + Leaf rhachis not winged; leaflets acuminate | 1. <i>P. khinjuk</i> |

1. *Pistacia khinjuk* Stocks, Hooker's J. Bot. Kew Gard. Misc. 4: 143 (1852).

Deciduous tree 3-6 m; leaves 8-15 cm, imparipinnate, glabrous (our varieties), the rhachis terete, not winged; leaflets 1-4 pairs, 2-6 x 1-2.5 cm, lanceolate, the base oblique, the apex acuminate; terminal leaflet petioliolate, slightly shorter than the laterals; *male flowers*: subsessile, in erect, much-branched loose panicles to 10 cm; stamens 4-5, filaments, rudimentary; pistil minute; *female flowers*: pedicellate, in loose spreading panicle to 15 cm; perianth *c.* 2.5 mm; ovary *c.* 2.5 mm; style very short, stigmas longer than the ovary; drupe 5-6 x 5 mm, depressed globose-ovoid, apiculate, glabrous.

Two varieties occur in Egypt:

var. **glabra** Schweinf. ex Engl. in DC., Monog. Phan. 4: 291 (1883).

Syn. *Pistacia khinjuk* Stocks var. *glaberrima* Schweinf. ex Boiss., Fl. Orient. Suppl. 154 (1888).

Leaflets 2-4-paired, at least some 4-paired, 3-6 x 1.5-2.5 cm.

De, GE, S; sheltered cliffs in the mountains. Egypt, Palestine, Northwest Arabia.

var. **microphylla** Boiss., Fl. Orient. Suppl. 154 (1888).

Leaflets 1-2(-3)-paired, never 4-paired, 1.5-2.5 x 1-1.5 cm.

De (South Galala Mountain), sheltered cliffs. Egypt, Northwest Saudi Arabia.

NOTE: *Pistacia khinjuk* Stocks var. *khinjuk*, which has leaves with pubescent rachis and midrib, is not known from Egypt.

2. **Pistacia atlantica** Desf., Fl. Atlant. 2: 364 (1799).

Deciduous tree 3-10 m; leaves 8-16(-20) cm, imparipinnate, the rachis narrowly winged; leaflets 3-5 pairs, 2-6 x 0.5-2 cm, lanceolate to oblong-elliptic, obtuse; *male flowers*: in compact panicles, becoming more lax, 3-8 cm; stamens 5(-7); filaments almost absent; *female flowers*: in loose panicles, 8-12 cm; the perianth ± equalling the ovary; ovary c. 3 mm; style 1.5 mm; drupe 6-8 x 5-6.5 mm, obovoid-globular, yellowish-brown, glabrous.

S; desert wadis. North Africa, Sinai, East Mediterranean region, Caucasus, Crimea, Arabia, Iran, Pakistan.

3. **Pistacia lentiscus** L., Sp. Pl., ed. 1, 1026 (1753).

Evergreen shrub 1-2.5 m; leaves 4-10 cm, persistent, paripinnate; the rachis winged; leaflets 2-3(-4)-paired, 1.5-2.5 x 0.5-1.2 cm, leathery, ovate to oblong-lanceolate or elliptic, obtuse, glabrous; *male flowers*: short-pedicellate in compact spicate racemes, 1-3 cm; stamens 4-5, with a rudimentary ovary; *female flowers*: ± sessile, in axillary fascicles of 1-4 spicate racemes 1-3 cm; perianth c. 1.5 mm, ± equalling the ovary; style shorter than the ovary and stigmas; drupe c. 3 x 4 mm, ovoid-globular, slightly compressed, reddish, glabrous, reticulate when dry, the 3-fid style persistent.

M (Wadi Batoum, south of Sollum); wadi beds. Atlantic Islands, Portugal, Mediterranean region, tropical East Africa.

SAPINDACEAE

Trees, shrubs, woody climbers or herbs; leaves usually alternate, pinnately compound, rarely simple, exstipulate or stipules small; flowers in cymes or panicles, actinomorphic or zygomorphic, unisexual, rarely bisexual; sepals 4-5, free or connate; petals 4-5, or 0, free; disc usually present; stamens 5-20, often 8; filaments free; ovary superior, 1-8-locular, usually 3-locular; placentation axile; ovules 1-2 or sometimes many per locule; style 1, simple or lobed, terminal or gynobasic; fruit a capsule or indehiscent; seeds often arillate, without endosperm. 147 genera, about 2000 species, tropical and subtropical regions, few temperate.

1. Herbaceous climbers; leaves compound biternate
+ Shrubs or small trees; leaves simple

1. **Cardiospermum**
2. **Dodonaea**

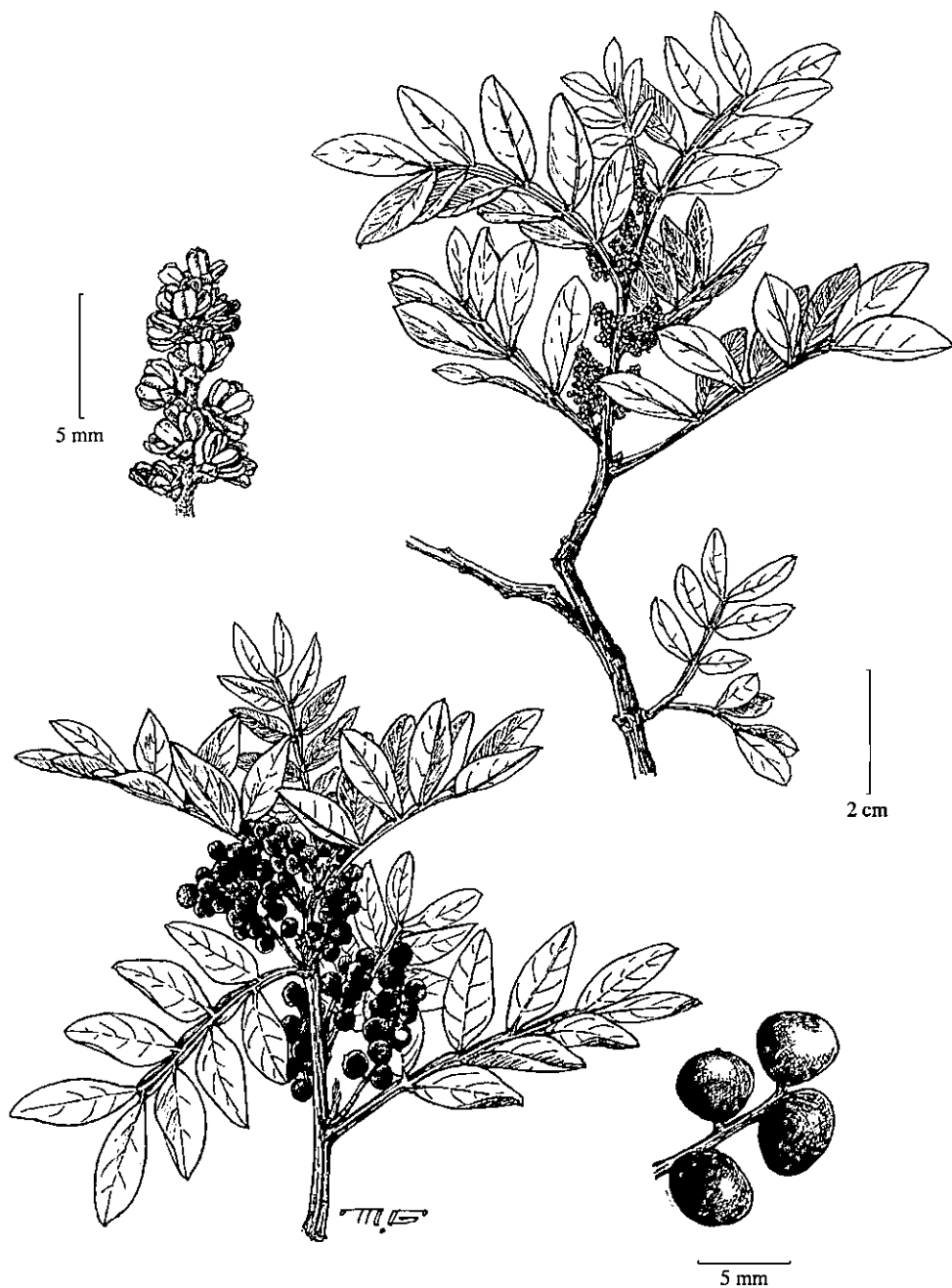


Plate 19. ANACARDIACEAE: *Pistacia lentiscus*, flowering branch of male plant (up); branchlet of male inflorescence (up left); fruiting branch of female plant (down); fruits (down right). Drawings to the same scale, except the enlarged parts (scale given).

1. *Cardiospermum* L.

Monoecious annual or perennial herbaceous or woody climbers, some with tendrils; leaves compound ternate; inflorescences axillary, with branched thyrses; flowers slightly irregular; sepals 4, unequal; petals 4, each with a scale-like appendage directed away from the petal, together forming an additional perianth whorl; *male flowers*: with 8 stamens and a minute pistillode; *female flowers*: with 8 staminodes; ovary 3-celled; style 3-fid; fruit an inflated capsule with 3, 1-seeded locules; seeds globose, black with a white hilum. 14 species, tropical regions, but especially America.

1. *Cardiospermum halicacabum* L., Sp. Pl., ed. 1, 366 (1753).

Annual herbaceous climber, 0.5-2.5 m; stems deeply grooved; leaves 4-10 x 5-10 cm, stipulate, biternate, composed of \pm equal divisions, each of a petiolule and 3 leaflets, each leaflet deeply 3-fid; leaflets 1.5-5 x 1-2 cm, serrate or dentate, with acute or rounded apex, sparingly hairy; inflorescence corymbose, with recemose thyrses, each 2-5-flowered; peduncle below tendrils 1.5-8 cm; pedicel 1-2 mm, elongate in fruit; sepals 1-3 mm, unequal, yellowish-green; petals 2-3 mm, white, cream or greenish, with appendages 1 mm; stamens 8; filaments 2 mm, pilose; ovary 2 mm; style 0.5 mm; stigma 0.5 mm, yellow; fruit 2-3.5 x 2-4 cm, bladder-like, inflated; seeds 5 mm, black with a white hilum.

N, O (Dakhla); edges of cultivation. Pantropical weed.

2. *Dodonaea* Mill.

Evergreen shrubs or small trees; leaves simple (our species) or compound; flowers regular, bisexual or unisexual; sepals 3-4, free (our species) or connate at the base, caducous or persistent; petals 0; stamens 5-8(10), inserted into the outer surface of the circular disk; filaments glabrous; ovary 2-4(-6)-locular, each locule with 2 ovules; ovary rudimentary in male flowers; fruit a papery capsule, often winged, dehiscent by splitting along 2-3 central septa; seeds 1(-2) per valve, black, globose, without an aril. 53 species, tropical and warm regions, mostly Australian.

1. *Dodonaea viscosa* (L.) Jacq., Enum. Syst. Pl. 19 (1760).

Syns. *Ptelea viscosa* L., Sp. Pl., ed. 1, 118 (1753).

Dodonaea angustifolia L. f., Suppl. Pl. 218 (1781).

Dodonaea burmanniana DC., Prodr. 1: 616 (1824).

Monoecious or dioecious, glabrous shrub or small tree, 1-4 m (elsewhere to 9 m); leaves 3-8 x 1-2.2 cm, simple, sessile or short-petiolate, oblanceolate to elliptic, entire, obtuse, apiculate, glandular on both surfaces and coated with sticky exudate; flowers unisexual or bisexual, in loose thyrsoid panicles; pedicel 1-1.5 cm, glandular; *male flowers*: sepals 3-4, c. 2 mm, greenish-yellow; stamens 7(-9), with a minute rudimentary ovary; *female flowers*: sepals free, green; ovary oblong, flattened, 2-lobed, glandular; style 2-3-lobed; *bisexual flowers*: sepals 3-4, c. 2 mm, greenish-yellow; anther 1.5-2 mm; fruit 1.5-2.2 x 1 cm, disc-shaped, with a wing 4-7 mm wide; seeds 2-3 mm, subglobose, 2 per locule, black.

GE; mountain ledges. Tropical West and East Africa to Mozambique, Madagascar, Arabia, India, Malaysia, Australia, Pacific Islands, America, tropical and subtropical regions.



Plate 20. SAPINDACEAE: *Cardiospermum halicacabum* 1, flowering and fruiting branches. *Dodonaea viscosa* 2, flowering and fruiting branches. CELASTRACEAE: *Maytenus senegalensis* 3, flowering and fruiting branches. RHAMNACEAE: *Rhamnus dispermus* 4, fruiting branch. *Rhamnus lycioides* subsp. *oleoides* 5, flowering branch (up); fruiting branch (down). All drawings to the same scale.

NOTE: The plant is cultivated as a garden hedge in Egypt and some other Mediterranean and tropical countries.

CELASTRACEAE

88 genera, 1300 species, mainly tropical, few temperate. *Maytenus* is the only genus in Egypt.

1. *Maytenus* Molina, nom. conserv.

Trees or shrubs; branches sometimes ending in a spine, or condensed to form short shoots; leaves alternate or in fascicles; stipules free, small or absent; flowers bisexual or unisexual; sepals and petals usually 5; disc intrastaminal; stamens usually 5, free or united with the base of the disc; ovary superior, sessile, free or up to half-immersed in the disc, 2-3-locular, with 2 ovules per locule; style simple; stigma 2-3-branched; fruit a capsule, dehiscent to the base; seeds 1-6, glossy, reddish-brown, with a yellow aril forming a fleshy basal cupule, not winged. About 200 species, tropical and warm regions.

1. *Maytenus senegalensis* (Lam.) Exell, Bol. Soc. Brot., sér. 2, 26: 223 (1952).

Syns. *Celastrus senegalensis* Lam., Encycl. 1: 661 (1785).

Celastrus montanus Roth in Roem. & Schult., Syst. Veg., ed. nov., 5: 427 (1819).

Celastrus coriaceus Guill. & Perr., Fl. Senegamb. Tent. 1: 142, t. 36 (1831).

Catha montana (Roth) G. Don, Gen. Syst. 2: 10 (1832).

Celastrus saharae Battand., Bull. Soc. Bot. France 47: 251 (1900).

For full synonymy see N. Robson, Bol. Soc. Brot., sér. 2, 39: 14 (1965) and Sebsebe, Symb. Bot. Upsal. 25(2): 84 (1985).

Shrub or small tree 2-8 m, unarmed or with spines to 4 cm; branches glabrous, rather flattened, reddish-purple; leaves 2-10 x 0.5-4 cm, petiolate, oblong, oblanceolate to oblong-elliptic, the apex obtuse, rounded or retuse, the margin usually entire; petiole 3-8 mm; flowers 2-4 cm diam., unisexual; sepals 5, subequal, 0.4-1 cm; petals 5, 1-3 mm, greenish-white; *male flowers*: with 5 stamens; *female flowers*: with 5 staminodes, 2 (-3)-locular ovary, style as long as the ovary; capsule 3-5 mm, subglobose, smooth; seeds 1-2, reddish-brown, glossy, with a fleshy white aril.

GE; mountain ledges. North and tropical Africa, extending to southern Spain, Arabia, Afghanistan, Pakistan, India, Bangladesh.

SALVADORACEAE

3 genera, 11 species, warm Old World, especially dry regions. *Salvadora* is the only genus in Egypt.

1. *Salvadora* L.

Unarmed trees or shrubs; flowers bisexual, small, numerous, in axillary or terminal panicles; calyx 4-toothed, campanulate; petals 4, campanulate; stamens 4, inserted at the base of the corolla-tube; disc consisting of 4 glands alternating with the stamens, or

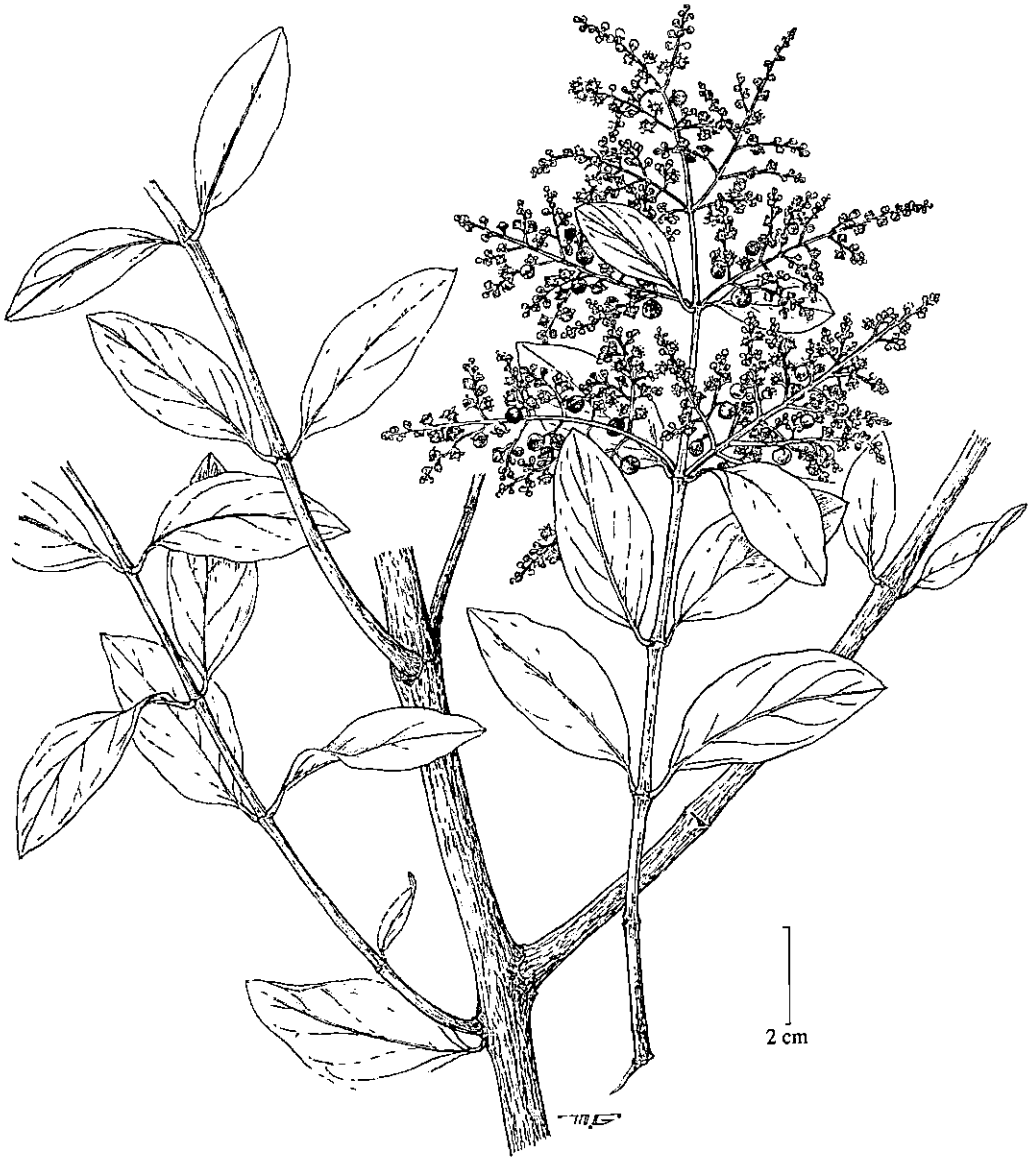


Plate 21. SALVADORACEAE: *Salvadora persica*, flowering and fruiting branch (right); vegetative branch (left). Drawings to the same scale.

absent; ovary 1-locular; style 0 or short; stigma peltate or truncate; ovule solitary; fruit a globose drupe. 5 species, tropical Africa and Asia.

1. *Salvadora persica* L., Sp. Pl., ed. 1, 122 (1753).

Glabrous or pubescent evergreen shrub, 2-5 m, often forming impenetrable thickets; stems much-branched, whitish; leaves 3-8 x 1-3.5 cm, oblong to ovate-elliptic, opposite, entire, coriaceous, pale green, the apex acute to rounded; petiole 0.5-2.5 cm; flowers c. 1.5 mm, greenish-white, in lateral and terminal leafless panicles to 12 cm; drupe c. 4 mm, globose, ripening red.

Two varieties occur in Egypt:

var. **persica**

Shoots, leaves and inflorescences mostly glabrous, or with only a small amount of pubescence on the shoots.

N, O, D, R, GE, S; desert wadis, coastal and inland sandy plains.

var. **pubescens** Brenan, Kew Bull. 4: 90 (1949).

Syn. *Salvadora villosa* Maire, Notul. Syst. (Paris) 8: 24 (1939).

Shoots, leaves and inflorescences distinctly pubescent.

D, R, GE, S; desert wadis, coastal and inland sandy plains.

Area of the species: North and East Africa to Mozambique, Malawi, Zambia, West and Southwest Africa, West Asia to India and Sri Lanka.

NOTE: Verdcourt, Kew Bull. 19: 147-162 (1964) describes and enumerates several varieties of *Salvadora persica*, provides the differences between them as well as their geographical distribution. Of these, var. *persica* and var. *pubescens* occur in Egypt. Maire, *l. c.* (1939) described a new species: *Salvadora villosa*, based on one collection from Sinai by Malzac in 1851, and points out that the main difference between *S. villosa* and *S. persica* is that his new species is villous while *S. persica* is nearly glabrous. He adds that both species are extremely similar. In the present treatment Verdcourt's concept, which is based on the study of ample material covering the entire area of distribution of *Salvadora persica*, is adopted, and *S. villosa* Maire is listed as a synonym of *S. persica* L. var. *pubescens* Brenan.

RHAMNACEAE

Deciduous or evergreen trees or shrubs; leaves alternate, rarely opposite, stipulate, simple, 3-5-nerved from the base or pinnately nerved; flowers bisexual, sometimes unisexual, actinomorphic, small, green; hypanthium usually present; sepals 4-5, caducous; petals 4-5 or 0, inserted on a disc or at the throat of hypanthium; disc free or adnate to the base of stamens, or 0; stamens 4-5, opposite the petals; ovary 2-3-celled, free or immersed in disc; ovules mostly 1 per locule; stigmas 2-4; fruit a capsule, schizocarp or a drupe. 49 genera, 900 species, cosmopolitan, but especially tropical and warm regions.

1. Leaves opposite
+ Leaves alternate

2. **Sageretia**
2

2. Stipular spines present; leaves 3-5-nerved from the base
+ Stipular spines 0; leaves pinnately nerved

3. **Ziziphus**
1. **Rhamnus**

1. **Rhamnus** L.

Dioecious, monoecious or polygamous shrubs or trees; branches alternate, rarely subopposite, sometimes spinescent; leaves alternate, opposite or in fascicles, petiolate, pinnately nerved; stipules caducous; flowers usually unisexual, rarely bisexual, small, greenish, in clusters, racemes or cymes, rarely solitary; hypanthium urceolate or turbinate; calyx 4-5-fid; petals 4-5 or 0, inserted at the hypanthium margin; stamens 4-5; ovary superior, 2-celled; style 2-4-cleft or undivided; stigmas papillose; fruit a drupe. 125 species, northern hemisphere to Brazil and South Africa.

1. Leaves spatulate, puberulent, indistinctly nerved on
the lower surface
+ Leaves elliptic, glabrous, conspicuously pinnately nerved on
the lower surface

1. **R. dispersum**

2. **R. lycioides**

1. **Rhamnus dispersum** Boiss., Fl. Orient. Suppl. 156 (1888).

Dioecious or polygamous shrub, 0.5-1.5 m; stems intricately branched into spinescent twigs; leaves 0.5-1.2 x 0.2-0.4 cm, spatulate, entire, the apex rounded, puberulent, indistinctly nerved on the lower surface; petiole 1-2 mm; flowers c. 2 mm, in clusters on short shoots; pedicel 2-4 mm, capillary; sepals 4, c. 2 mm, yellowish, spreading-deflexed, triangular; petals minute, linear, reddish-yellow; drupe 3-4 mm, subglobose, 2-lobed, yellowish-brown, glabrous; seeds 2.5 mm, obovoid, yellowish, glabrous.

De (South Galala Mountain), S (St. Katherine); in the mountains. Egypt, Palestine, Lebanon.

2. **Rhamnus lycioides** L., Sp. Pl., ed. 2, 279 (1762) subsp. **oleoides** (L.) Jahand. & Maire, Cat. Pl. Maroc 476 (1932).

Syns. *Rhamnus oleoides* L., Sp. Pl., ed. 2, 279 (1762).

Rhus amygdalina Desf., Fl. Atlant. 1: 198 (1798).

Rhus oleoides L. subsp. *microphylla* (Halácsy) P. H. Davis, Notes Roy. Bot. Gard. Edinb. 21: 115 (1953).

Like *Rhamnus dispersum*, but leaves elliptic, glabrous, conspicuously pinnate-nerved on the lower surface; drupe 4-6 mm.

M (Sollum area); rocky ground. Mediterranean region.

2. **Sageretia** Brongn.

Armed or unarmed shrubs; branchlets usually opposite; leaves opposite or subopposite; stipules minute, caducous; flowers bisexual, in axillary clusters or terminal paniculate spikes; sepals 5; disc cup-shaped, 5-lobed; petals 5, clawed; stamens 5, filaments distinct; ovary immersed in the disc, free, 3-celled; style 3-grooved; stigmas 3; drupe berry-like, separating into 3 leathery nutlets; seeds elongate, not grooved. 35 species, Sinai, Southwest Asia to Taiwan, Somalia, tropical and warm America.

1. **Sageretia thea** (Osbeck) M. C. Johnston, J. Arnold Arbor. 49: 378 (1968).

Syn. *Rhamnus thea* Osbeck, Dagb. Ostind. Resa 232 (1757).

Sageretia brandrethiana Aitch., J. Linn. Soc. 8: 62 (1865).

Sageretia spinosa Wettst., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 98: 385 (1889).

Sageretia horrida O. Schwarz, Feddes Repert. 54: 30 (1944).

Shrub 1-2 m; branches opposite; leaves 1-2 x 0.5-1 cm, opposite, ovate to broadly-elliptic or orbicular, shortly petiolate, glabrous, green, shiny; apex rounded or obtuse, the margin denticulate; flowers minute, sessile, yellow, in paniculate inflorescences of numerous short spikes; drupe 3-4 mm, subglobose, blackish.

S; mountain cliffs near St. Katherine. Sinai, Arabia, Turkey, northern Iraq, Iran, Afghanistan.

3. **Ziziphus** Mill.

Shrubs or trees, deciduous or evergreen; stipular spines present, usually recurved; leaves alternate, petiolate, 3-5-nerved; flowers bisexual, in axillary cymes or solitary; hypanthium obconical; sepals 5; petals 5 or rarely 0; disc lining the hypanthium, flat, 5-10-lobed or angled; stamens 5; ovary superior, partly immersed in the disc, 2 (-4)-celled; style 2(-4)-fid; stigmas minute, papillose; fruit a drupe, ± globose; stone 2 (-4)-celled, (1-)2(-3)-seeded, bony; seeds compressed, suborbicular, smooth; endosperm 0. About 86 species, tropical and warm regions.

1. Tree with distinct trunk; leaves 2-6 cm, persistent

1. **Z. spina-christi**

+ Shrub; leaves 1-2 cm, caducous

2

2. Leaves glabrous

2. **Z. lotus**

+ Leaves tomentose on both surfaces

3. **Z. nummularia**

1. **Ziziphus spina-christi** (L.) Desf., Fl. Atlant. 1: 210 (1798).

Syn. *Rhamnus spina-christi* L., Sp. Pl., ed. 1, 195 (1753).

Evergreen tree 4-8 m, with a distinct trunk and a large ± globose crown; branches glabrous; stipular spines to 1 cm, unequal, the shorter usually recurved; leaves 2-6 x 1.5-3.5 cm, ovate-elliptic, 3-nerved, shallowly crenate, persistent, apex obtuse or rounded; petiole 0.4-1.2 cm; flowers 4-5 mm diam., in axillary cymes, yellowish-green; pedicels 3-5 mm; sepals woolly on the outer surface; petals shorter than the sepals, yellow, hooded; disc 5-angled; drupe 1.2-1.8 cm, globose, yellowish-brown at maturity; seeds 5-6 mm, brown.

N, O, M, D, R, GE, S; desert wadis, plains, mountains. North Africa, West Asia; widely cultivated and naturalized in dry and warm regions, especially Africa.

NOTE: Apart from the spontaneous trees, the tree is cultivated in the Nile valley in villages and parks, etc., for its shade, timber and edible fruits.

2. **Ziziphus lotus** (L.) Lam., Encycl. 3: 317 (1789).

Syn. *Rhamnus lotus* L., Sp. Pl., ed. 1, 194 (1753).



Plate 22. RHAMNACEAE: *Sageretia thea* 1, flowering and fruiting branches. *Ziziphus spina-christi* 2, flowering and fruiting branches. *Ziziphus lotus* 3, fruiting branch. *Ziziphus nummularia* 4, fruiting branch. VITACEAE: *Cayratia ibuensis* 5, fruiting branch. *Cissus quadrangularis* 6, flowering branch; fruits and stem (right). All drawings to the same scale.

Deciduous thorny shrub 1-3 m high, often forming thickets to 5 m diam.; stems intricately branched, glabrous; stipular spines 0.5-1.2 cm, very sharp, one shorter and curved; leaves 1-2 x 0.5-1 cm, ovate-oblong to broadly elliptic, obtuse, crenulate, with a minute gland at the top of each crenule, 3-nerved, glabrous; petiole 1-2 mm; flowers 3-4 mm, axillary, solitary or few in axillary clusters; pedicel 2-3 mm, glabrous; bracts minute; sepals c. 2 x 1.5 mm, glabrous; petiole c. 2 x 1 mm, yellowish; stamens 1.5 mm, the filaments glabrous; disc flat, with a 10-lobed crenate margin; ovary completely sunk in the disk; styles 2, 0.5 mm; stigmas minute; drupe c. 1 cm, globose, yellowish at maturity; seeds 6 x 5 mm, brown.

M (Sollum area); stony and sandy ground. Spain, North Africa, East Mediterranean, Arabia, Socotra.

3. **Ziziphus nummularia** (Burm. f.) Wight & Walk.-Arn., Prodr. 126 (1834).
Syn. *Rhamnus nummularia* Burm. f., Fl. Ind. 61 (1768).

Deciduous tomentose thorny shrub, 1-2.5 m; stems many, divaricate, flexuous; stipular spines 0.3-1.2 cm; leaves 0.8-1.2 x 0.4-0.8 cm, ovate-orbicular, 3-nerved, entire, apiculate or mucronate, tomentose on both surfaces; petiole 2-3.5 mm; pedicel 0.4-1 cm; flowers 3-4 mm, axillary, yellowish-green; sepals triangular, tomentose; petals equalling the sepals, obovate; disc 10-lobed; fruit c. 1 cm, subglobose, bright yellow; seeds c. 4 mm, dark brown.

S; desert wadis. Sinai, Palestine, Arabia, Iraq, Iran, Afghanistan, Pakistan, India.

NOTE: This species is known in Egypt from one collection at Ka-el-Nabq, c. 15 km northwest of Taba.

VITACEAE

Climbing herbs, succulents or lianes, sometimes erect or trailing, rarely shrubs or small trees; tendrils often present; leaves alternate, simple or digitately compound, stipulate; flowers usually regular, bisexual, in much-branched cymes; calyx 4-6-lobed, or entire; petals 4-6, free or coherent at apex; stamens 4-6, opposite the petals; filaments free; disc intrastaminal, annular or of separate glands; ovary superior, 2-locular, with 2 ovules per locule; style short; stigma subulate or capitate; fruit a 1-4-seeded berry; seeds ovoid, often pointed at one end. 14 genera, about 1000 species, tropical and warm regions.

1. Leaves simple, undivided or 3-lobed; cymes leaf-opposed
+ Leaves pinnately 3-foliolate; cymes axillary

1. **Cissus**
2. **Cayratia**

1. **Cissus** L.

Erect or climbing perennials, lianes or shrubs, sometimes succulent; rootstock tuberous; tendrils usually present, leaf-opposed; leaves simple, entire or lobed, or digitately 3-7-foliolate, usually petiolate; stipules present but often caducous; inflorescence usually leaf-opposed, sometimes terminal or axillary; flowers 4-merous; disc annular, entire or lobed, adnate to and usually including the ovary; ovary 2-locular with 2 ovules per locule; fruit usually 1-seeded; seeds often beaked. About 250 species, tropical and subtropical regions.

1. *Cissus quadrangularis* L., Syst. Nat., ed. 12, 2: 124 (1767).

Succulent glabrous liane 1-2 m; root-tubers present; stems 0.5-1.5 cm diam., branched, 4-angled, square in section; tendrils unbranched; leaves 2-8 x 1-8 cm, simple, undivided and broadly ovate, or 3-lobed, the margin entire; inflorescence cymose, umbel-like, leaf-opposed, 5-15-flowered; calyx 1 x 2 mm, cupular; petals 2-2.5 mm, white or cream to yellowish-green, glabrous; fruit 1.2 cm, globose, red, glabrous, 1-seeded; seeds 6-8 x 5 mm, smooth.

GE; wadi beds. Southeast Egypt, tropical Africa, Arabia, India, Sri Lanka, Burma, Malaysia, Philippines.

2. *Cayratia* Juss., nom. conserv.

Climbing perennial herbs; tendrils leaf-opposed; leaves usually 3-foliolate, stipulate, the leaflets toothed; cymes usually axillary; flowers unisexual or bisexual, 4-merous; calyx entire or lobed; petals caducous; filaments short; staminodes present in female flowers; disc annular, undulate or 4-lobed; ovary immersed in the disc; style simple; stigma capitate; fruit 2-4-seeded, thinly fleshy; seeds with a basal projection, smooth. About 50 species, Old World tropics.

1. *Cayratia ibuensis* (Hook. f.) Suesseng., Mitt. Bot. Staatssamml. München 1: 353 (1953).

Syns. *Cissus ibuensis* Hook. f. in Hook., Niger Fl. 265 (1849).

Vitis ibuensis (Hook. f.) Baker, Fl. Trop. Afr. 1: 402 (1868).

Vitis intricata Baker, Fl. Trop. Afr. 1: 404 (1868).

Glabrescent to puberulent climbing herb, 1-2 m; leaves pinnately 3-foliolate; leaflets 3-7 x 2-3.5 cm, ovate-elliptic, the apex acute, finely serrate; petiole 1-3.5 cm; petioliole of the median leaflet 0.5-1.5 cm; stipules 3-4 mm, ovate; cymes axillary; peduncle 5-8 cm; pedicel c. 1 mm; bracts and bracteoles c. 1 mm, triangular; flowers c. 2 mm, calyx entire; corolla greenish-yellow; fruit 7-8 mm, subglobose; seeds 2-4 per fruit, 6-7 x 4.5-5 mm, ovoid, with a narrow basal projection, smooth.

GE; wadi beds. Southeast Egypt, Sudan, tropical Southeast Asia, Central and South Africa.

TILIACEAE

Trees, shrubs or herbs, often stellate-hairy; leaves usually alternate, rarely opposite, undivided or lobed; stipules small, caducous or 0; flowers bisexual, rarely unisexual, actinomorphic, in cymose inflorescences; sepals 4-5, free or united; petals 4-5, free, rarely 0; stamens numerous, rarely 10 or fewer; filaments free or united into fascicles of 5 or 10; staminodes sometimes present; ovary superior, of 2-10 carpels, 2- to many-celled, each cell with 1-many ovules, usually with axile placentation; style 1, lobed or not; fruit drupe-like, berry-like, nut-like or a capsule; seeds usually with endosperm. 46 genera, 680 species, subcosmopolitan.

1. Leaves pinnately nerved

+ Leaves palmately nerved or 3-veined from the base

1. *Corchorus*

2

2. Flowers in racemes; fruit covered with hooked spines

2. *Triumfetta*

- + Flowers solitary, umbellate or in compact cymes in the leaf axils; fruit spineless

3. **Grewia**

1. **Corchorus** L.

Herbs or small shrubs, glabrous or with simple or stellate hairs; leaves alternate, stipulate; flowers solitary or few in cymes, yellow; sepals 4-5, free; petals 4-5; stamens numerous or twice as many as the sepals, free; ovary 2-5-locular; ovules several to many per locule; fruit a capsule, dehiscent by 2-5 valves; seeds without endosperm. About 40 species, tropical regions.

- 1. Prostrate perennial; leaves 0.5-2 cm, the base without aristate teeth; capsule 4-valved 1. **C. depressus**
- + Erect annual; leaves 3-10 cm, the base usually with 2 aristate teeth; capsule 3- or 5-valved 2
- 2. Capsule with 3 spreading teeth at the apex 3. **C. tridens**
- + Capsule beaked at the apex 3
- 3. Capsule 4-6 mm wide, 5-valved, glabrous 2. **C. olitorius**
- + Capsule 2-3 mm wide, 3-valved, scabrid 4. **C. trilocularis**

1. **Corchorus depressus** (L.) Stocks, Proc. Linn. Soc. 1: 367 (1848).

Syns. *Antichorus depressus* L., Mant. 46 (1767).

Corchorus antichorus (L.) Raeusch., Nomencl. Bot., ed. 3, 158 (1797).

Glabrous or sparingly hairy perennial; stems prostrate, mat-forming, much-branched from a woody rootstock; leaves 0.5-2 x 0.3-1 cm, elliptic, the margin crenate, the base without aristate teeth; petiole 0.5-1.5 cm; stipules 1-1.5 mm, subulate; flowers 4 mm, solitary or 2, opposite the leaves; calyx 3 mm; corolla 4 mm, yellow; stamens 8-10; capsule 1-1.5 cm, narrowly cylindrical, beaked, curved or straight, 4-valved; seeds 1 x 0.5 mm, oblong with truncate ends, longitudinally grooved, brown, glabrous.

O (Uweinat), De, R, GE; crevices between rocks, wadi beds and hillsides. Cape Verde Islands, North and tropical Africa, Arabia, Pakistan, India.

2. **Corchorus olitorius** L., Sp. Pl., ed. 1, 529 (1753).

Glabrous or glabrescent annual, 15-80 cm (elsewhere to 2.5 m); stems erect or ascending, branched; leaves 3-10 x 1-4 cm, oblanceolate or oblong-elliptic, the apex acute, the margin serrate, the base with 2 aristate teeth; petiole 1-4 cm; stipules 5-8 mm, subulate; flowers 1.2-1.5 cm diam., on short-pedunculate 1-3-flowered cymes, opposite the leaves; sepals 5-7 x 2-3 mm; petals 7-8 x 2.5-3.5 mm, yellow; stamens numerous, united at the base; capsule 3-8 x 0.4-0.6 cm, glabrous, 5-valved, with a conical undivided beak 4-6 mm, the valves transversely septate internally; seeds numerous, 2 x 1.5 mm, triangular, greenish-black.

N, O, M, S; weed of cultivation. Pantropical weed.

NOTE: The plant is also cultivated in Egypt for the leaves, which provide one of the most popular potherbs, especially in summer. In India, Pakistan and Bangladesh, the plant yields the jute fibre of commerce.

3. **Corchorus tridens** L., Mant. Alt. 566 (1771).

Syns. *Corchorus burmanii* DC., Prodr. 1: 505 (1824).

Corchorus senegalensis Juss. ex Steud., Nom., ed. 2, 1: 417 (1840).

Glabrescent annual 20-50 cm; stems erect or ascending, branched; leaves 2-8 x 0.5-1.5 cm, oblong to linear-lanceolate, the margin crenate-serrate, the base with 2 aristate teeth; petiole 0.5-1.2 cm; stipules 2-3 mm, subulate; flowers 8 mm diam., in 1-3-flowered cymes opposite the leaves; sepals c. 4.5 mm; petals 3-4 mm, yellow; stamens 10-15; capsule 2-4 x 0.2 cm, cylindrical, 3-valved, with 3 spreading teeth at the apex; seeds 1.5 x 1 mm, angular, obliquely truncate at base and apex, black.

N (Aswan); weed of cultivation. Tropical Africa and Asia, North Australia.

4. **Corchorus trilocularis** L., Mant. 77 (1767).

Syns. *Corchorus serraefolius* DC., Prodr. 1: 504 (1824).

Corchorus triflorus Bojer, Hort. Maurit. 43 (1837).

Corchorus asplenifolius E. Mey. ex Harv. & Sond., Fl. Cap. 1: 229 (1860).

Annual 20-80 cm; stems erect or ascending, branched mainly from the base, pubescent; leaves 2-10 x 1-3 cm, sparsely hairy on both surfaces, oblong-lanceolate to ovate-elliptic, the margin crenate-serrate, the base with 2 aristate teeth, sometimes very short or absent; petiole 0.6-1.2 cm, pilose; stipules 4-8 mm, setose; flowers 1-1.2 cm diam., in 1-3-flowered cymes, peduncle to 2 mm, opposite the leaves; pedicel 2.5 mm, glabrous; bracts 2-3 mm; calyx c. 5 mm; petals 5-6 mm, yellow; stamens 15-20; filaments 5-6 mm; capsule 3-6 x 0.2-0.3 cm, with c. 2.5 mm undivided beak, 3-valved, scabrid; seeds 1.2 x 1 mm, rectangular-ovate at one or both ends, black.

N, O, GE; weed of cultivation. North and tropical Africa, tropical Asia.

2. **Triumfetta** L.

Shrubs, rarely perennial or annual herbs; leaves alternate, petiolate, palmately 3-5-lobed or unlobed, serrate, the basal serrations mostly glandular, stipulate; inflorescence of racemes, axillary or opposite the leaves; flowers bisexual or female, pedicellate; sepals 5, free, usually awned at the apex; petals 5, rarely 0, inserted on the glandular androphore; carpels 2-5, usually with uncinata hairs, with 2 ovules per locule; style filiform; stigma 2-5-lobed; capsule indehiscent or dehiscent, covered with uncinata spines, 2-5-locular, each locule 1-2 seeded; seeds with endosperm. 70 species, tropical and subtropical regions.

1. Lower teeth of leaves glandular; fruit subglobose,

2- or more-seeded

+ Lower teeth of leaves eglandular; fruit ovoid, 1-seeded

1. **T. rhomboidea**

2. **T. flavescens**

1. **Triumfetta rhomboidea** Jacq., Enum. Syst. Pl. Carib. 22 (1760).

Syns. *Triumfetta trilocularis* Roxb., Hort. Bengal. 36 (1814), nom. nud.

Triumfetta riparia Hochst., Flora 27: 295 (1844).

Perennial with a woody base, 0.5-1.2 m, green; hairs stellate or simple; stems much-branched; leaves 3-8 x 2.5-7 cm, rhomboid-ovate, hairy on the lower surface, palmately 3-lobed or not, irregularly serrate, the lower teeth glandular, the apex acute; petiole to 4.5

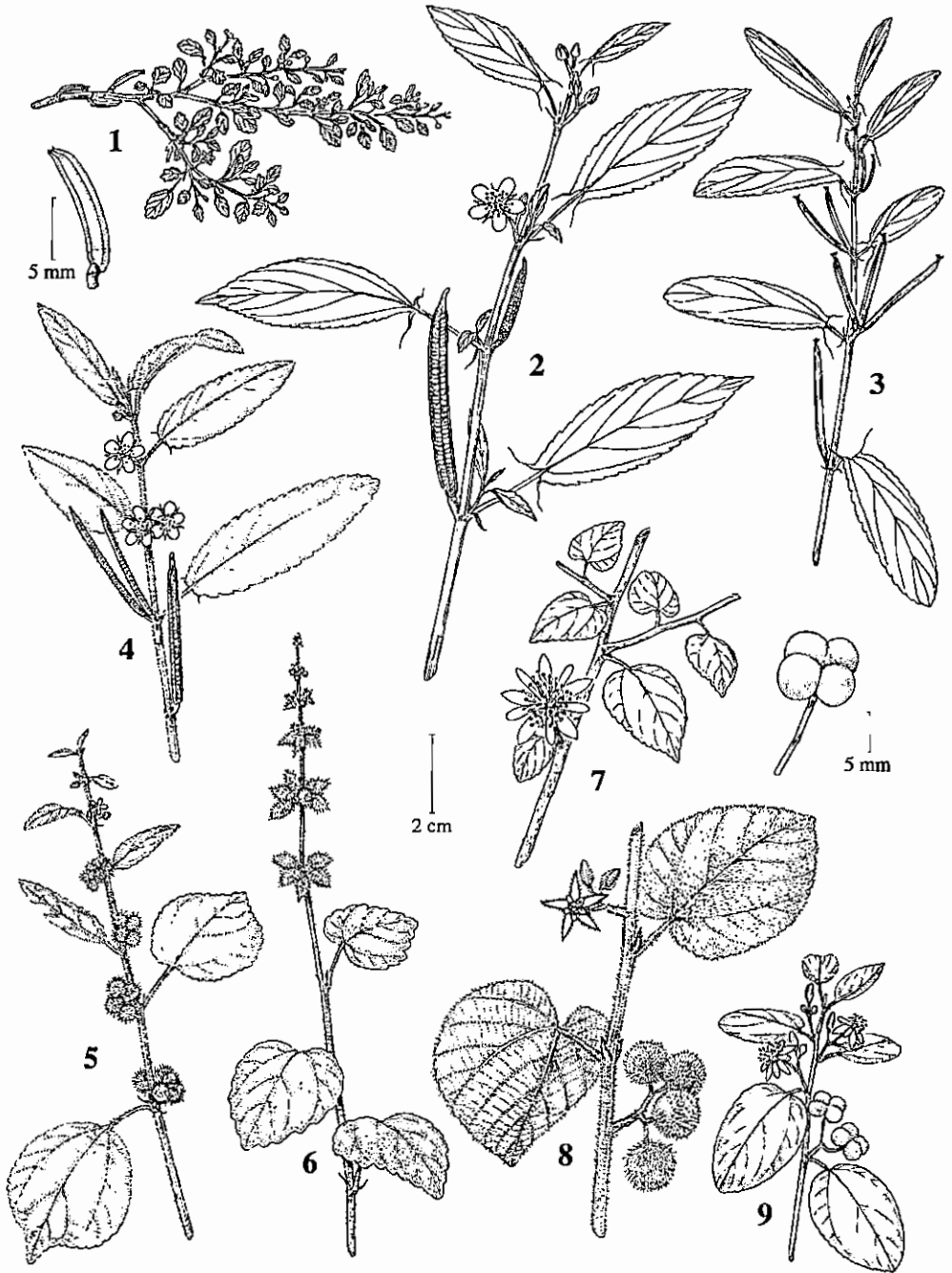


Plate 23. TILIACEAE: *Corchorus depressus* 1, flowering and fruiting branch; fruit (down left). *Corchorus olitorius* 2, flowering and fruiting branch. *Corchorus trilocularis* 3, flowering and fruiting branch. *Triumfetta rhomboides* 4, flowering and fruiting branch. *Triumfetta flavescens* 5, flowering and fruiting branch. *Grewia tenax* 7, flowering branch; fruits (right). *Grewia villosa* 8, flowering and fruiting branch. *Grewia tembensis* 9, flowering and fruiting branch. All drawings to the same scale, except the enlarged fruits (scale given).

cm; stipules 3-4 mm, subulate; cymes in terminal spike-like racemes or leaf-opposed; flowers 5-6 mm diam., subsessile; sepals 3-4 mm, awned at the apex, hairy outside; petals equalling the sepals or slightly shorter, golden yellow, hairy at the base; stamens usually 15; fruit indehiscent capsule, 5-6 mm, including the hooked spines, several-locular, 2- or more seeded.

GE; wadi beds and hillsides. Tropical regions.

2. **Triumfetta flavescens** Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 82 (1847).

Like *Triumfetta rhomboidea*, but yellowish-green; leaves rarely lobed, hairy on both surfaces, the lower teeth eglandular; fruit ovoid, 1-locular, 1-seeded.

GE; wadi beds and hillsides. Southeast Egypt, Sudan (Red Sea Hills), Kenya, Uganda, Tanzania, Ethiopia, Somalia, Arabia.

3. **Grewia** L.

Small trees or shrubs, stellate-hairy; leaves alternate, petiolate, rarely lobed, stipulate; inflorescence axillary or leaf-opposed, of umbellate cymes or panicles; flowers bisexual, yellow, orange, pink or white, bracteate; sepals 5, free, valvate, leathery; petals 5, rarely 0, free, usually shorter than the sepals; stamens numerous, free, inserted over the androphore; ovary superior at apex of the androphore, 2-4-locular, with 2 or more ovules per locule; style subulate; stigma 2-4-lobed; fruit a globose drupe, yellow, red or violet, entire or 4-lobed, each lobe 1-2-seeded; seeds with copious or no endosperm. 150 species, Old World tropics.

1. Leaves to 3.5 cm, ± glabrous; flowers solitary 1. **G. tenax**
+ Leaves to 7 cm, pubescent or villous; flowers umbellate or in compact cymes 2

2. Leaves ± orbicular, upper surface pubescent, lower villous; flowers in subsessile cymes; drupe unlobed 2. **G. villosa**
+ Leaves ovate, ovate-lanceolate or broadly elliptic, upper surface glabrous, lower minutely stellate-hairy; flowers in cymes; peduncle to 2 cm; drupe 4-lobed 3. **G. tembensis**

1. **Grewia tenax** (Forssk.) Fiori, Agric. Colon. Ital. 5, Suppl. 23 (1912).

Syns. *Chadara tenax* Forssk., Fl. Aegypt.-Arab. 105 (1775).

Grewia populifolia Vahl, Symb. Bot. 1: 33 (1790).

Grewia betulaeifolia Juss., Ann. Mus. Nat. Paris 4: 92 (1804).

Grewia erythraea Schweinf., Verh. Zool. Bot. Ges. Wien 18: 671 (1868).

Shrub 1-2 m; stems with grey bark; young twigs stellate-hairy; leaves 1-3.5 x 0.5-3 cm, variable, ovate-elliptic to suborbicular, ± glabrous on both surfaces, sharply serrate, the apex acute or obtuse; petiole 0.3-1.2 cm, hairy; stipules 2-3 mm, caducous; flowers 2-2.5 cm diam., solitary, opposite the leaves; peduncle 1-1.4 cm; pedicel 5-6 mm, hairy; sepals 1.2-1.4 cm, stellate-hairy on the outer side; petals 0.8-1 cm, white; stamens numerous; ovary 4-lobed; style 8 mm; stigma cupular; drupe 2-4-lobed, the lobes 5-6 mm diam., glabrous, orange-yellow, glossy.

De, R, GE, S; rocky wadis and hillsides. North and tropical Africa, Sinai, Arabia, Iran, Pakistan, India, Sri Lanka.

NOTE: The type was collected from Egypt, Forsskål 388 (C). The fruit is eaten by local people.

2. **Grewia villosa** Willd., Ges. Naturf. Freunde Berlin Neue Schr. 4: 205 (1803).

Syns. *Grewia echinulata* Delile, Cent. Pl. Meroe 82 (1826).

Grewia orbiculata G. Don, Gen. Syst. 1: 551 (1831).

Grewia corylifolia A. Rich. in Guill. & Perr., Fl. Senegal. Text. 95, t. 20 (1830-1833).

Shrub 2-3 m; stems with grey bark; young twigs densely stellate-hairy; leaves 2-7 x 1.5-7 cm, ± orbicular, upper surface pubescent, the lower villous, the margin crenate-serrate, the apex apiculate, the base cordate; petiole 0.5-2 cm, villous; stipules 0.8-1 x 0.3 cm, foliaceous, villous; flowers 1.8-2 cm diam., in short-pedunculate, axillary cymes; bracts 6-8 mm, lanceolate, stellate-hairy; sepals 0.8-1 x 0.25 cm, villous, brownish; petals c. 5 x 2 mm, reddish-brown; stamens numerous, the filaments c. 5 mm; ovary globose, hairy; style 3-4 mm, stellate-hairy; stigmas 4-lobed; drupe c. 1 cm, unlobed, subglobose, densely villous, yellowish-brown to reddish.

GE; stony wadis and hillsides. Southeast Egypt, tropical Africa, Cape Verde Islands, Arabia, Pakistan, India.

3. **Grewia tembensis** Fresen., Mus. Senckenb. 2: 158 (1837).

Shrub 1-3 m; stems with grey bark; young twigs stellate-hairy; leaves 1-6 x 0.8-4 cm, very variable in size and shape, ovate-lanceolate to ovate or broadly elliptic; margin serrate, the base cordate or rounded, the upper surface glabrous, the lower minutely stellate-hairy; flowers 1.5 cm diam., in 2-3-flowered umbellate cymes; peduncle to 2 cm; pedicel to 1.2 cm; sepals 6-7 x 2.5 mm; petals 5 mm, white; stamens numerous; drupe 4-lobed the lobes 5 x 4 mm, subglobose, red at maturity, glabrous, glossy.

GE; rocky ground and hillsides. Southeast Egypt, tropical Africa, Arabia.

MALVACEAE

Herbs, shrubs or trees, usually stellate-hairy; leaves alternate, stipulate, lobed or divided, usually palmately lobed; flowers usually bisexual, actinomorphic, often conspicuous, axillary, solitary or in terminal inflorescences; epicalyx present or 0; sepals 5, rarely 3 or 4; petals 5, usually connate at the base and adnate to the staminal column; receptacle short or elongate into a central axis; stamens numerous, rarely 5, connate into a staminal column; anthers 1-celled; ovary superior, of 2-many carpels; placentation axile; style divided at apex into lobes or stigmas, as many as or twice the number of carpels; fruit a dehiscent capsule or schizocarp, rarely a berry; seeds usually hairy. 111 genera, 1800 species, cosmopolitan, but especially tropical.

1. Epicalyx absent 2
+ Epicalyx present 3

2. Flowers large, conspicuous; fruit 1-2 cm 7. **Abutilon**
+ Flowers small; fruit 3-8 mm 6. **Sida**

3. Epicalyx of leaf-like segments, exceeding the calyx + Epicalyx not as above	10. Gossypium 4
4. Epicalyx of 3 segments + Epicalyx of 5-12 segments	5 7
5. Flowers yellow + Flowers purple, pink or white	3. Malvastrum 6
6. Epicalyx of 3 connate segments + Epicalyx of 3 free segments	2. Lavatera 1. Malva
7. Fruit a dehiscent capsule + Fruit a schizocarp of numerous mericarps	9. Hibiscus 8
8. Epicalyx of capillary segments, twice as long as the calyx + Epicalyx \pm equalling the calyx	8. Pavonia 9
9. Corolla 3.5-7.5 cm + Corolla c. 0.5 cm	4. Alcea 5. Althaea

1. **Malva L.**

Annual or perennial herbs; leaves usually lobed or divided, stipulate; flowers bisexual, axillary, solitary or in clusters; epicalyx usually of 3 free segments at the base of the calyx; sepals 5, connate at the base; petals 5, free, purplish or white, notched; staminal column of numerous anther-bearing filaments; ovary of numerous carpels, each with 1 ovule; style much-branched, the branches filiform; fruit a schizocarp of numerous mericarps; mericarps 1-seeded, indehiscent, separating from a conical receptacle. About 40 species, Mediterranean region, temperate Asia, tropical African mountains.

1. Petals 1.5-2.5 cm, 3-4 times as long as the sepals + Petals 0.3-1 cm, 1-2 times as long as the sepals	5. M. sylvestris 2
2. Leaves palmatisect, with palmatipartite lobes + Leaves shallowly-lobed	1. M. aegyptia 3
3. Epicalyx segments 5-8 mm, elliptic or narrowly ovate + Epicalyx segments 3-4 mm, oblong-linear or filiform	4. M. nicaeensis 4
4. Sepals accrescent in fruit; mericarps wrinkled, with sharp crested margins + Sepals not accrescent in fruit; mericarps with \pm rounded margins	2. M. parviflora 3. M. neglecta

1. **Malva aegyptia** L., Sp. Pl., ed. 1, 690 (1753).

Appressed-hispid annual 10-20 cm; stems erect or ascending, branched mainly from the base; leaf-blade 1.5-4.5 cm, orbicular, palmatisect, the lobes palmatipartite; petiole of lower leaves to 4.5 cm, shorter in upper leaves; stipules ovate-lanceolate, the margin setose, acuminate; flowers axillary and terminal, solitary or clustered; pedicel to 3 cm, usually exceeding the subtending leaf; epicalyx of 2 linear segments, shorter than the

sepals; sepals 6-8 mm, accrescent in fruit, the lobes ovate-triangular, densely setose, acuminate; petals slightly shorter than the calyx, pink, drying blue; mericarps 1.5-2 mm, wrinkled; seeds brownish, smooth.

M, S; weed of cultivation, roadsides. Mediterranean region, eastwards to Central Asia.

2. **Malva parviflora** L., Sp. Pl., ed. 2, 969 (1763).

Syn. *Malva flexuosa* Hornem., Hort. Hafn. 2: 655 (1815).

Glabrescent annual 10-40(-80) cm; stems erect, ascending or decumbent; leaf blade 1.5-6(-12) cm, orbicular, undivided or shallowly 5-7-lobed, the base reniform, the margin dentate; petiole to 20 cm; stipules 3-8 mm, oblong-lanceolate, acuminate, ciliate; flowers 2-5, in dense axillary subsessile clusters; pedicel 0.2-2.2 cm; epicalyx of 3 linear segments, 3-4 mm; sepals 3.5-6.5 mm, to 8-9 mm, spreading and accrescent in fruit, the lobes broadly ovate, apiculate; petals 3-6 mm, pinkish to white, notched; mericarps 7-9, c. 2 mm, glabrous, wrinkled, with sharp crested margins; seeds brown, rugose.

N, O, M, D, R, GE, S; weed of cultivation, waste ground, roadsides, desert plains. Europe, North Africa, temperate Asia; naturalized in other temperate regions.

NOTE: The leaves are used as a potherb and in traditional medicine. The plant is one of the most widespread species in the country and grows in different habitats from very moist to arid, which gives it different habits and sizes, especially the leaf size. It is also cultivated on a small scale for its edible leaves.

3. **Malva neglecta** Wallr., Syll. Pl. Nov. 1: 140 (1824).

Annual 10-25 cm, appressed-hairy; stems many, erect or procumbent; leaf-blade 1-4.5 cm, orbicular-reniform in outline, shallowly lobed or unlobed, crenate-dentate, the base cordate; petiole 3-12 cm; stipules 3-8 mm, lanceolate, ciliate; flowers few, in the leaf axils; pedicel 1-3.5 cm; epicalyx of 3 segments, c. 3 x 1 mm, oblong-linear; sepals 4-5 mm, triangular, stellate-hairy, not accrescent in fruit; petals 0.8-1 cm, emarginate, mauve, bearded at the base; mericarps 2 mm, pubescent, the dorsal surface almost smooth; seeds dark brown, rugulose.

S; waste ground. Europe, North Africa, West Asia.

4. **Malva nicaeensis** All., Fl. Pedem. 2: 40 (1785).

Like *Malva neglecta*, but leaf blades larger, 3-8 cm, suborbicular, with 5-7 shallow lobes; epicalyx segments 5-8 mm, elliptic or narrowly ovate; mericarp 2-3 mm, glabrous, with a prominently reticulate dorsal surface.

N, M, S; weed of cultivation, waste ground, Mediterranean region, Sinai, Arabia, Iraq, Iran; introduced into temperate regions.

5. **Malva sylvestris** L., Sp. Pl., ed. 1, 689 (1753).

Stellate-hairy or glabrescent annual (in Egypt), 20-50 cm; stems erect, ascending or procumbent, branched mainly at the base; leaf blade 3-8 cm, ± orbicular in outline, undivided or shallowly 5-7-lobed, the margin dentate-crenate, the base cordate; petiole

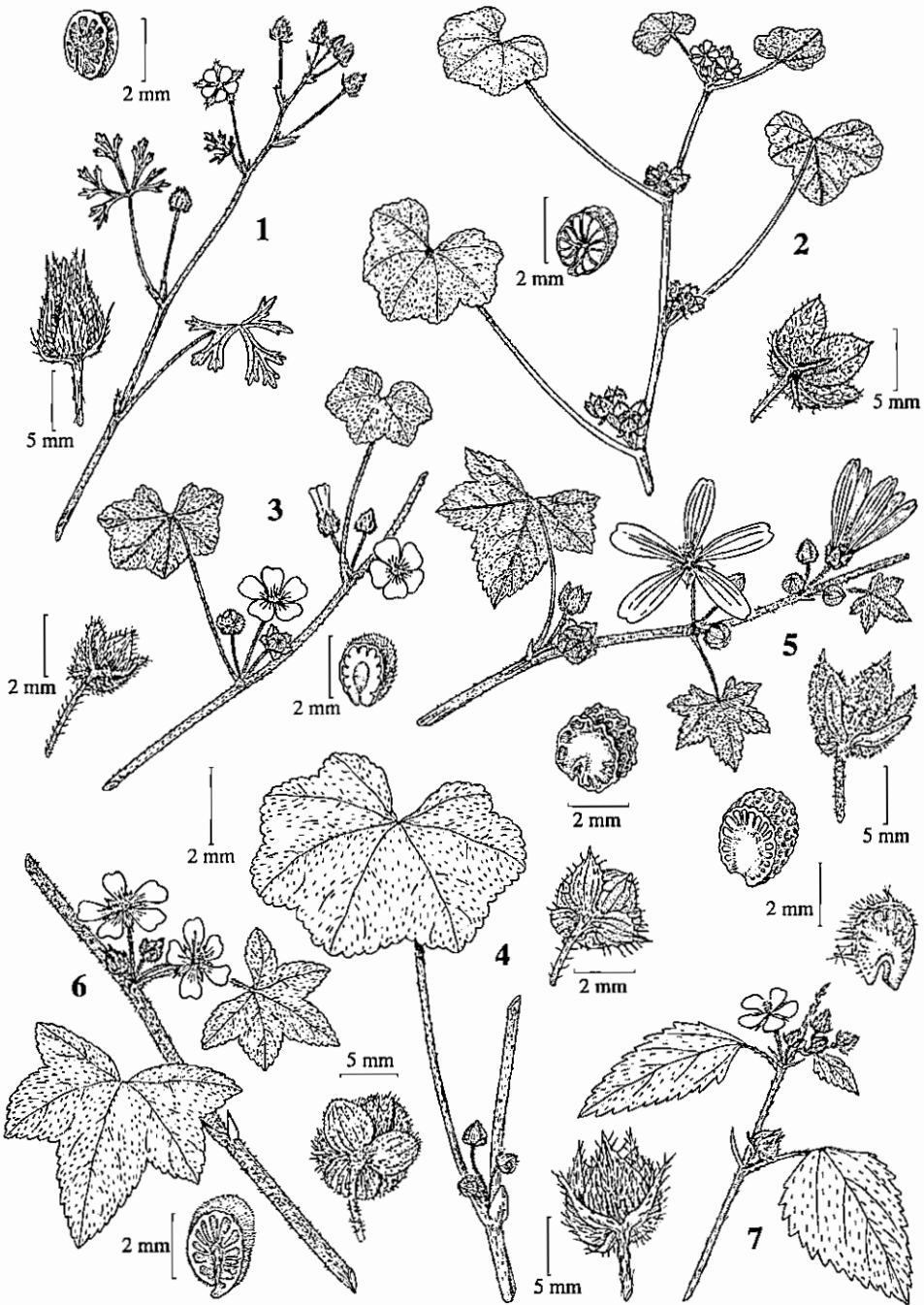


Plate 24. MALVACEAE: *Malva aegyptia* 1, flowering and fruiting branch; fruiting calyx and epicalyx (down left); mericarp (up left). *Malva parviflora* 2, flowering and fruiting branch; fruiting calyx and epicalyx (right); mericarp (left). *Malva neglecta* 3, flowering and fruiting branch; fruiting calyx and epicalyx (left); mericarp (right). *Malva nicaensis* 4, branch with a leaf and flower buds; mericarp (up right); fruiting calyx and epicalyx (below the mericarp). *Malva sylvestris* 5, flowering and fruiting branch; fruiting calyx and epicalyx (down right); mericarp (down middle). *Lavatera cretica* 6, flowering branch; fruiting calyx and epicalyx (right); mericarp (left). *Malvastrum coromandelianum* 7, flowering and fruiting branch; fruiting calyx and epicalyx (down left); mericarp (up right). All drawings to the same scale, except the enlarged parts (scale given).

1.5-10 cm; upper leaves with shorter petioles than the lower; stipules 3-5 mm, lanceolate; flowers 2-5 in axillary clusters; pedicel 0.5-2.5 cm; epicalyx 4-6 x 1.5-2 mm, oblong-lanceolate, hairy; calyx 0.6-1 cm, stellate-hairy; petals 1.5-2.5 cm, 3-4 times as long as the sepals, pink to purplish, with darker veins that are branched at the base; mericarps 2-3 mm, glabrous, wrinkled.

N, M, S; roadsides, edges of cultivation. Europe, Mediterranean region, Asia; naturalized in some other temperate regions.

2. *Lavatera* L.

Annuals, perennials or shrubs, stellate-hairy; leaves palmately lobed; flowers bisexual, solitary or in short racemes, pedicellate, bracteate; epicalyx of 3 segments, connate at the base; sepals 5; petals 5, lilac or violet, connate with the base of the staminal column; carpels 6-many; ovary many-locular, each locule with 1 ovule; styles filiform; stigmas decurrent; fruit a schizocarp; mericarps many, separating at maturity from the axis; each mericarp 1-seeded; seeds transversely ribbed or smooth, erect. About 25 species, Macaronesia, Mediterranean region to Central Asia and Northwest Himalayas, Australia, California.

1. *Lavatera cretica* L., Sp. Pl., ed. 1, 691 (1753).

Stellate-hairy annual or short-lived perennial, 20-80 cm; stems erect or ascending, branched, angular; leaf-blade 3-9 cm, ± orbicular or cordate, shallowly 5-7-lobed, margin dentate-crenate, stellate-hairy on the lower surface; petiole 3-14 cm, pubescent; stipules 2-8 mm, deltoid; pedicel 1-2.5 cm; flowers in clusters of 3-8, in the axils of upper leaves; epicalyx 4-7 mm, of 3 connate segments, hirsute; sepals 6-9 mm, acuminate, hirsute; petals 1.2-1.5 cm, violet-mauve, lobed at the apex, with a barbed base; mericarps 3 mm, reniform, wrinkled on their dorsal side or along the margins; seeds brown, papillose.

N, M, S; waste ground, edges of cultivation. Atlantic Islands, Mediterranean region, Sinai.

3. *Malvastrum* A. Gray, nom. conserv.

Herbs or shrubs; leaves entire or lobed; flowers in terminal spikes, axillary fascicles or solitary; epicalyx of 3 segments; calyx campanulate; petals 5, yellow; staminal tube branched at the apex; carpels 5-many; ovary 5- to many-locular, with 1 ovule per locule; style branches as many as the carpels; stigma capitate; mericarps with or without awns, strigose; seeds reniform, glabrous. 14 species, tropical and warm regions.

1. *Malvastrum coromandelianum* (L.) Garcke, Bonplandia 5: 295 (1857).

Syns. *Malva coromandeliana* L., Sp. Pl., ed. 1, 687 (1753).

Malva tricuspidata R. Br. in W. T. Aiton, Hort. Kew., ed. 2, 4: 210 (1812).

Malvastrum tricuspidatum (R. Br.) A. Gray, Pl. Wright, 1: 16 (1852).

Annual 30-80 cm; stems much-branched, appressed strigose, with simple and 4-rayed stellate hairs; leaves alternate; blade 1.5-6 x 0.5-4 cm, ovate to elliptic, acute, dentate-serrate, appressed-hairy on both surfaces; petiole 1-4 cm, stellate-hairy; flowers axillary, solitary or in fascicles; pedicel 1-5 mm; epicalyx segments 3, 4-6 x 1-1.5 mm, lanceolate, acuminate, strigose; sepals 5-8 mm, the lobes triangular, acuminate, strigose; petals 7-9 mm, obovate, hairy at the base; staminal tube 2-4 mm, glabrous; mericarps

8-14, c. 2 mm, curved, with 1-1.5 mm apical awn and 2 dorsal awns 0.5 mm; seeds brownish-black.

N (Cairo and El-Saff); weed of cultivation. Tropical regions.

4. *Alcea* L.

Perennial herbs (our species), rarely shrubs, usually densely tomentose; leaves variously divided or lobed, usually thick; flowers bisexual, large, often forming long racemes; epicalyx 6-11-lobed, shorter than the calyx; sepals 5-fid, often accrescent in fruit; petals pink, purple or yellow and white, emarginate, with a short hairy claw; staminal column 5-angled, with numerous filaments; ovary with many carpels, mericarps numerous, 1-seeded; seeds reniform. 50 species, Mediterranean region to Central Asia.

- | | |
|---|--------------------------|
| 1. Plant stemless or with procumbent stems | 2. <i>A. acaulis</i> |
| + Plant with well-developed erect stems | 2 |
| 2. Epicalyx about 1/2 or less as long as the calyx | 1. <i>A. striata</i> |
| + Epicalyx 3/4 as long as the calyx | 3 |
| 3. Mericarps deeply grooved dorsally, margins with 2 parallel wings | 4. <i>A. rosea</i> |
| + Mericarps not or obscurely grooved, wings absent | 3. <i>A. apterocarpa</i> |

1. *Alcea striata* (DC.) Alef., Österr. Bot. Zeitschr. 12: 253 (1862).

Syns. *Althaea striata* DC., Prodr. 1: 437 (1824).

Althaea haussknechtii Boiss., Fl. Orient. 1: 830 (1867).

White appressed-tomentose perennial, 40-80 cm; stems erect or ascending, terete; leaf blade 4-6 cm, broadly ovate to orbicular-cordate, undivided, shallowly or deeply 3-5-lobed, the terminal lobe triangular or ovate-oblong, the margin crenate-dentate; petiole 5-18 cm, that of lower leaves long-petiolate, the upper with shorter petioles; stipules 6-8 mm, 2-fid; flowers in leafy racemes; pedicel 0.3-1.5 cm, thick; uppermost flowers subsessile; epicalyx about 1/2 or less as long as the calyx, of 6-8 triangular acute segments; calyx 1.5-1.8 cm, the lobes triangular-ovate, striate; corolla 5-6 cm diam., creamy-white, the apex notched, the base cuneate; mericarps numerous, 5 mm, radially wrinkled, hairy, black, the margin thick.

Two subspecies occur in Egypt:

subsp. **striata**

Leaves shallowly 3-5-lobed, the terminal lobe triangular.

S; waste ground. Sinai, Palestine, Syria, Turkey.

subsp. **rufescens** (Boiss.) Cullen, Notes Roy. Bot. Gard. Edinb. 27: 216 (1967).

Syns. *Althaea rufescens* Boiss., Diagn. Pl. Orient., ser. 2, 1: 102 (1854).

Alcea rufescens (Boiss.) Boiss., Fl. Orient. 1: 828 (1867).

Leaves deeply 3-5-lobed, the terminal lobe ovate-oblong.

S; waste ground. Sinai, Palestine, Syria, Turkey.

NOTE: Some authors treat the above two subspecies as distinct species, see Zohary, Fl. Palaest. 2: 324-325 (1972).

2. ***Alcea acaulis*** (Cav.) Alef., Österr. Bot. Zeitschr. 12: 251 (1862).

Syn. *Althaea acaulis* Cav., Diss. 93 (1786).

Perennial 10-25 cm, woody at the base, tomentose with stellate hairs; main stem very short or 0; branches few, procumbent; leaf blade 2-5 cm, cordate to reniform, not or very shallowly 3-5-lobed, green on the upper surface, greyish beneath, crenate; petiole 4-18 cm; stipules 4-8 mm, triangular, acuminate; flowers axillary, solitary, subsessile; epicalyx 5-6 mm, the lobes ovate-triangular; calyx 1.2-1.5 cm, the lobes ovate-triangular, striate; corolla 3.5-4.5 cm, pink or white; mericarps c. 4 mm, glabrous, wrinkled, not winged.

M, S; waste ground. Egypt, Palestine, Syria, Turkey.

3. ***Alcea apterocarpa*** (Cihac.) Boiss., Fl. Orient. 1: 830 (1867).

Syns. *Althaea apterocarpa* Cihac., Asie Min., Bot. 1: 180 (1860).

Alcea lasiocalycina Boiss., Fl. Orient. 1: 830 (1867).

Appressed-tomentose or villose perennial, 60-80 cm; stems erect, branched; leaf blade 4-7 cm, ovate-orbicular, 3-7-palmatifid, dentate-crenate; petiole 2-7.5 cm; stipules 3-5 mm, narrowly triangular, deeply 2-fid, acuminate; flowers 6-10 cm, solitary, in racemes, leafless above; epicalyx 3/4 as long as the calyx, the lobes triangular, acute, striate; calyx 1.5-1.8 cm, the lobes ovate-triangular; corolla 5-7 cm, white, yellow, pink or violet; mericarps not or obscurely grooved, hirsute; wings absent.

S; stony ground. East Mediterranean region, Sinai.

4. ***Alcea rosea*** L., Sp. Pl., ed. 1, 687 (1753).

Syns. *Alcea ficifolia* L., Sp. Pl., ed. 1, 687 (1753).

Althaea rosea (L.) Cav., Diss. 91 (1786).

Althaea ficifolia (L.) Cav., Diss. 92 (1786).

Perennial or short-lived perennial, 0.8-1.5 m; stems erect, unbranched or little branched, rough, with stellate-hairs; leaf blade 4-8 cm, rounded or ovate, 3-7-lobed, crenate-dentate, stellate-hairy on both surfaces; petiole 5-15 cm; flowers 5-8 cm diam., axillary, solitary or 2-3 in fascicles, on long spicate racemes; pedicel 0.5-1.5 cm, elongate in fruit; epicalyx segments 6-7, 1.2-1.6 cm, the lobes ovate-lanceolate, stellate-hairy; calyx to 2 cm, stellate-hairy; corolla 5-7.5 cm; mericarps deeply grooved dorsally; margins 25-40, with 2 parallel wings.

S; escape from cultivation. East Mediterranean region, Sinai; widely cultivated in temperate and warm regions.

5. ***Althaea*** L.

Annuals or perennials; leaves simple, palmately lobed; flowers pedicellate, solitary or in racemose or paniculate inflorescences; epicalyx segments 6-12, connate at the base; calyx 5-lobed; petals 5, entire or emarginate; staminal tube terete, hairy; carpels

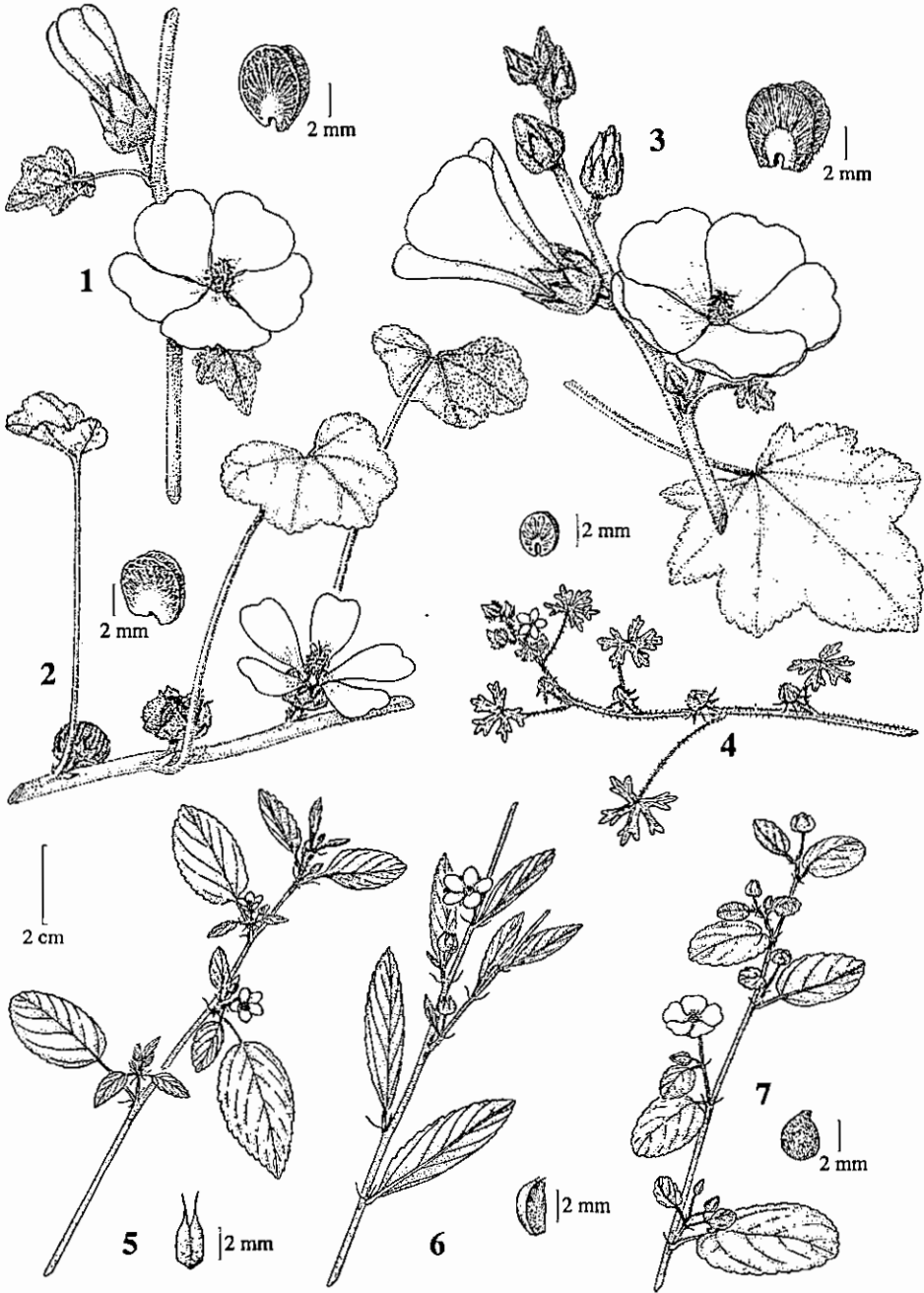


Plate 25. MALVACEAE: *Alcea striata* subsp. *striata* 1, flowering branch; mericarp (right). *Alcea acaulis* 2, flowering and fruiting branch; mericarp (up). *Alcea apterocarpa* 3, flowering branch and basal leaf; mericarp (up). *Althaea ludwigii* 4, flowering and fruiting branch; mericarp (up). *Sida alba* 5, flowering branch; mericarp (right). *Sida rhombifolia* 6, flowering and fruiting branch; mericarp (right). *Sida ovata* 7, flowering and fruiting branch; mericarp (right). All drawings to the same scale, except the enlarged parts (scale given).

numerous; ovary multilocular, each locule with 1 ovule, stigmas filiform; fruit a schizocarp; mericarps 10-25, 1-seeded, wingless, indehiscent. 12 species, Europe to Northeast Siberia, South Australia.

1. ***Althaea ludwigii*** L., Mant. 98 (1767).

Annual or short-lived perennial 10-40 cm, with mixed appressed-stellate and spreading simple hairs; stems decumbent, branched; leaf blade 0.6-3 cm, palmatisect, stellate-hairy, the lobes obovate-oblong with a rounded apex; petiole 1-6 cm; stipules 2-3 mm; flowers axillary, solitary or 2-3 in fascicles; pedicel 0.1-1 cm, elongate and accrescent in fruit; epicalyx of 8-10 segments, 4-5 mm, linear-lanceolate, stellate-hairy; sepals 5-6 mm, lobes narrowly lanceolate, acuminate, stellate-hairy, elongate in fruit to c. 1 cm; corolla c. 6 mm, white or pink; staminal tube hairy at the base; schizocarp 5-6 mm, depressed-globose; mericarp 8-10, 2-2.5 mm diam., the margin sharp, the sides wrinkled; seeds 1 mm, glabrous, brown.

N, O, M, De, S; sandy plains, edges of cultivation. North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Russia, Afghanistan, Pakistan, South Africa.

6. ***Sida*** L.

Pubescent annuals, perennials or shrubs; leaves alternate, stipulate, petiolate; flowers axillary, solitary, in fascicles, racemose or paniculate; epicalyx absent; calyx campanulate; corolla yellow, white, pink or orange; staminal column with numerous filaments; carpels 5-10, ovary 5-10-locular, each locule with 1 ovule; style branches equalling the number of carpels; stigma capitate; fruit awned; mericarps 1-seeded; seeds glabrous or hairy. About 200 species, tropical and warm regions, but especially America.

- | | |
|--|---------------------------------|
| 1. Leaves glabrous or thinly pilose | 3. <i>S. acuta</i> |
| + Leaves with dense stellate indumentum on the lower surface | 2 |
| 2. Mericarps rugose, awnless | 4. <i>S. ovata</i> |
| + Mericarps with 2 awns | 3 |
| 3. Fruit with 8-10 mericarps | 2. <i>S. rhombifolia</i> |
| + Fruit with 4-5 mericarps | 1. <i>S. alba</i> |

1. ***Sida alba*** L., Sp. Pl., ed. 2, 960 (1763).

Syn. *Sida spinosa* L., Sp. Pl., ed. 1, 683 (1753), pro parte.

Stellate-pubescent annual or short-lived perennial, 30-80 cm; stems erect, branched; leaf blade 1-4 x 0.3-2.5 cm, ovate or ovate-lanceolate to elliptic, margin serrate-dentate, the base rounded, the apex acute or obtuse; petiole 0.3-2 cm, with 1-3 spiny tubercles on the stem at the base; stipules 2-5 mm, filiform; flowers axillary, solitary or 2-5 in fascicles; pedicel 2-5 mm, elongate in fruit to 2 cm, jointed in the upper part; sepals 3-4 mm, slightly accrescent in fruit, the lobes triangular, acute; petals 4-5 mm, white or cream; fruit depressed-globose; mericarps 4-5, 2-3 mm, trigonous, with 2 apical divergent awns 1 mm; seeds 1.5 mm, glabrous, brownish-black.

N, O, M; weed of cultivation. Tropical and subtropical regions.

2. *Sida rhombifolia* L., Sp. Pl., ed. 1, 684 (1753).

Pubescent low shrub or woody perennial 30-80 cm; stems erect or ascending; leaf blade 1-4 x 0.5-1 cm, elliptic, the margin crenate-dentate, the base cuneate, the apex acute; upper surface dark green, the lower light green, pubescent; petiole 2-4 mm; stipules 2-3 mm, filiform; flowers axillary, solitary or few in clusters; pedicel 2-5 mm; sepals c. 5 mm, the lobes triangular, acute; petals 7-8 mm, pale yellow; fruit with 8-10 mericarps; mericarps 3 mm, semicircular, with 2 awns 0.5 mm.

S; cultivated ground. Pantropical weed.

3. *Sida acuta* Burm. f., Fl. Ind. 147 (1768).

Very sparsely hairy perennial, 30-80 cm, with a woody base; stems erect, branched; leaf blade 1-6 x 0.5-1.5 cm, lanceolate, glabrous or thinly pilose, the margin serrate, the base rounded, the apex acute; petiole 2-6 mm; stipules 0.5-1.2 x 0.1 cm, linear-lanceolate to filiform; flowers axillary, solitary or in clusters of 2-3; pedicel 2-5 mm, jointed at the middle; sepals 5-6.5 mm, campanulate, the lobes acuminate; petals 8-9 mm, yellow; mericarps 6-10, 3-4 mm, tetrahedral, with 2 apical awns, reticulate, glabrous; seeds 2 mm, glabrous, dark brown.

N (Cairo); weed of cultivation. Pantropical weed.

4. *Sida ovata* Forssk., Fl. Aegypt.-Arab. 124 (1775).

Syn. *Sida grewoides* Guill. & Perr., Fl. Senegamb. Tent. 1: 71 (1831).

Shrub 0.8-1.2 m, stellate-pubescent; stems much-branched; leaf blade 1-4 x 1-3.5 cm, broadly ovate to ± orbicular, the margin dentate-crenate, the base rounded, the apex ± truncate, pubescent on both surfaces; petiole 0.5-1.2 cm; stipules 3-6 mm, linear; flowers axillary, solitary or in pairs; pedicel 5-7 mm, elongate in fruit to 2 cm; calyx 5-6 mm, lobes ovate-triangular, acuminate; petals 7-8 mm, orange-yellow; fruit 7-8 mm, depressed globose; mericarps 7-8, 3 mm, rugose, glabrous, awnless; seeds 2 mm, reniform, brown.

GE; stony ground. Southeast Egypt, tropical Africa, Arabia, Iran, Pakistan, India.

7. *Abutilon* Mill.

Annuals, perennials or shrubs, rarely small trees, stellate-hairy, sometimes mixed with simple hairs; leaves alternate, petiolate, stipulate, toothed or lobed; flowers axillary or terminal, solitary or in leafy racemes or panicles; epicalyx absent; calyx 5-lobed; corolla yellow, orange-yellow or purple; staminal column divided at the apex into numerous filaments; carpels 5- to many-locular, each locule with 2-9 ovules; stigmas capitate; style branches as many as the carpels, filiform-clavate; fruit a subglobose, truncate or cylindrical, dehiscent schizocarp; mericarps acute, acuminate or obtuse, 2-9-seeded; seeds reniform, glabrous or hairy. About 100 species, tropical and warm regions.

1. Annual; mericarps with 2 conspicuous awns	1. <i>A. theophrasti</i>
+ Shrub; mericarps rounded at the apex, acute or acuminate, awnless	2
2. Mericarps rounded at the apex	3
+ Mericarps acute to acuminate	5

- | | |
|--|-------------------------|
| 3. Flowers purple, in terminal and axillary, almost leafless panicles;
mericarps 1-seeded | 2. A. longicuspe |
| + Flowers yellow or yellow and purple, solitary or in pairs;
mericarps 2-3-seeded | 4 |
| 4. Flowers 3.5-4.5 cm diam.; calyx 1-1.5 cm;
petals yellow with purple centre | 3. A. pannosum |
| + Flowers 2-2.5 cm diam.; calyx 0.5-0.8 cm; petals orange-yellow | 4. A. figarianum |
| 5. Flowers solitary or in pairs in the leaf axils; mericarps 8-11 | 5. A. fruticosum |
| + Flowers usually in short axillary panicles, sometimes
solitary or in pairs; mericarps 14-16 | 6. A. bidentatum |

1. **Abutilon theophrasti** Medik., Malenfam. 28 (1787).

Syns. *Sida abutilon* L., Sp. Pl., ed. 1, 685 (1753).

Abutilon avicennae Gaertn., Fruct. 2: 251, t. 135, f. 1 (1791).

Tomentose annual 0.8-2 m; stems much-branched; leaf blade 4-12 cm, ± orbicular or broadly ovate, margin slightly crenate-dentate, the base cordate, the apex acuminate, velutinous-stellate hairy on both surfaces; petiole 3-18 cm; stipules 5-8 mm, caducous; flowers axillary and solitary, or few in terminal racemes; pedicel 1.5-3.5 cm, articulate near the apex, tomentose; sepals 0.8-1 cm, lobes ovate, acute, tomentose; petals 1.2 cm, yellow; staminal tube 2-4 mm, glabrous, ovary globose, villous; fruit c. 1.5 cm, excluding the awns; mericarps 12-16, 0.8-1.2 x 0.4-0.5 cm (excluding the awns), 1-2-seeded, 2-awned; awns 2-2.5 mm, spreading; seeds c. 2.5 mm, ovate-reniform, appressed bristly, brownish-black.

N, S; weed of cultivation. Tropical and subtropical regions; naturalized in North America and elsewhere.

2. **Abutilon longicuspe** Hochst. ex A. Rich., Tent. Fl. Abyss. 1: 69 (1847).

Tomentose perennial 1.5-3 m, woody at the base; stems much-branched, tomentose, with long hairs; leaf blade to 18 x 12 cm, ovate-cordate, the margin shallowly dentate, the base cordate, the apex acuminate, dark green on the upper surface, grey-felted beneath; petiole to 12 cm, densely villous; stipules 6-8 mm, subulate, villous, caducous; flowers in terminal and axillary, almost leafless panicles; pedicel 0.5-2.5 cm; calyx c. 1 cm, 5-lobed; lobes triangular, acuminate, densely yellowish-tomentose; petals 1.5-1.8 cm, purple; staminal tube c. 1.5 cm, exserted; filaments pale purple; anthers and stigmas dark purple; fruit c. 1.5 cm; mericarps 20-25, each 1-seeded.

GE; rocky slopes above 1200 m. Southeast Egypt, Sudan, Yemen.

3. **Abutilon pannosum** (G. Forst.) Schldl., Bot. Zeitung (Berlin) 9: 828 (1851).

Syns. *Sida pannosa* G. Forst., Commentat. Soc. Regiae Sci. Gott. 9: 62 (1789).

Abutilon glaucum (Cav.) Sweet, Hort. Brit., ed. 1, 54 (1826).

Abutilon muticum (DC.) Sweet, Hort. Brit., ed. 2, 65 (1830).

Tomentose perennial 1-2 m; stems branched, with long yellow-white hairs; leaves to 12 x 11 cm, ovate-cordate to ± orbicular, the margin shallowly serrate-dentate, apex acute, the base cordate, tomentose on both surfaces; petiole to 10 cm; stipules 0.8-1.2 cm, subulate,

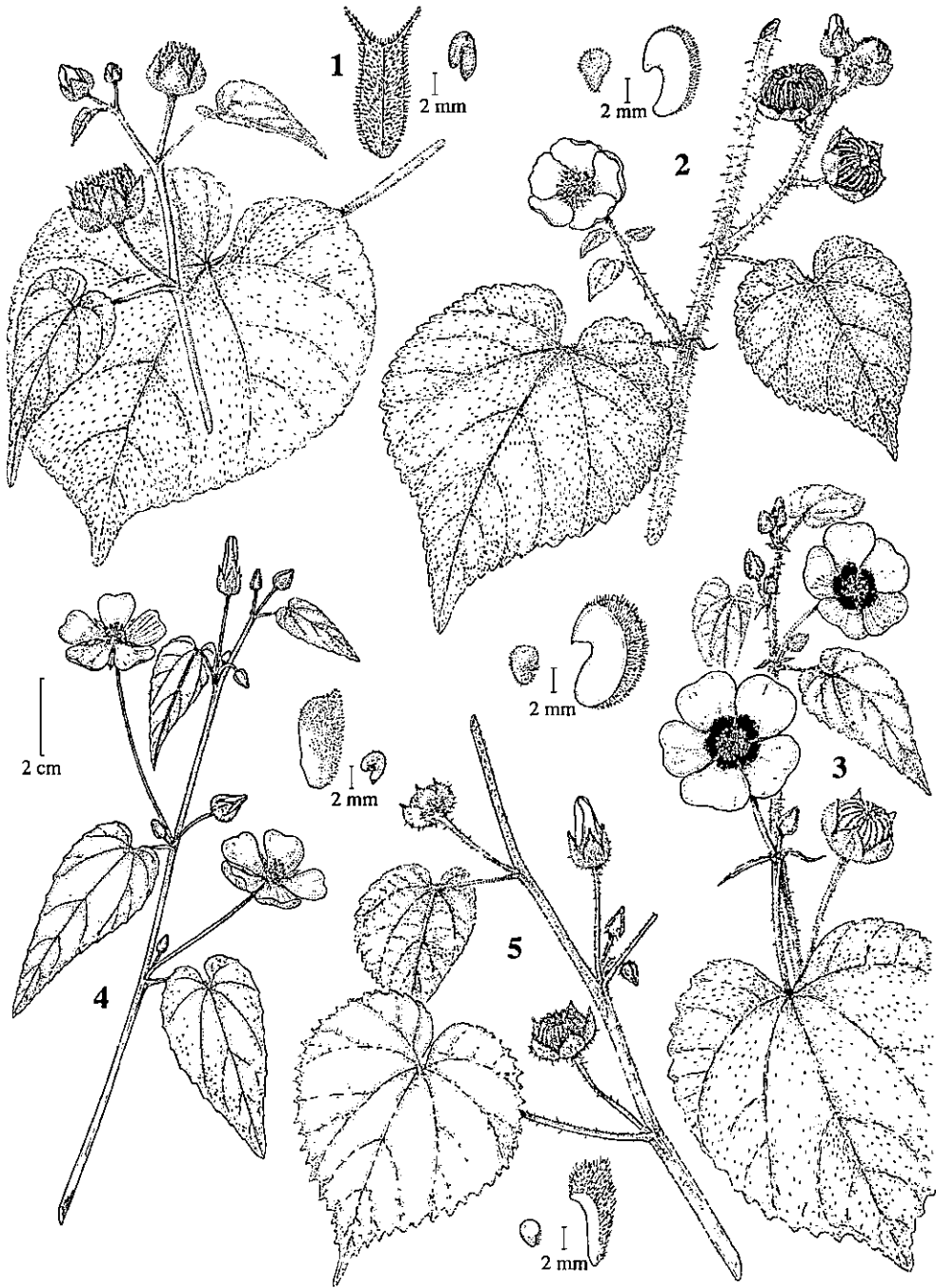


Plate 26. MALVACEAE: *Abutilon theophrasti* 1, basal leaf and branch with flower buds and fruits; mericarp and seed (up right). *Abutilon figarianum* 2, flowering and fruiting branch; mericarp and seed (up). *Abutilon pannosum* 3, flowering and fruiting branch; mericarp and seed (up left). *Abutilon fruticosum* 4, flowering and fruiting branch; mericarp and seed (right). *Abutilon bidentatum* 5, branch with flower buds and fruits; mericarp and seed (down). All drawings to the same scale, except the enlarged parts (scale given).

caducous; flowers 3.5-4.5 cm diam., axillary, solitary or in leafy terminal racemes and panicles; pedicel 1-3.5 cm; calyx 1-1.5 cm, the lobes to 8 mm, triangular, acute; petals 1.6-2 cm, yellow with purple centre; staminal tube 6 mm; fruit 1-1.5 cm, subglobose, villous; mericarps 24-28, 7-9 x 4-5 mm, reniform, glabrous and smooth, hairy on the dorsal margin; seeds 2-3 in each mericarp, 2.5 x 2 mm, ovate-reniform, hairy, brownish.

N, O, De, R, GE, S; desert wadis, edges of cultivation, waste ground. Egypt, Palestine, Arabia, Iraq, Iran, Pakistan, Afghanistan, India, Sudan, Nigeria, Senegal.

4. **Abutilon figarianum** Webb, *Fragm. Fl. Aethiop.-Aegypt.* 52 (1854).

Like *Abutilon pannosum*, but flowers 2-2.5 cm diam.; calyx 5-8 mm; petals orange-yellow, without a purple centre.

N; edges of cultivation. Egypt, Sudan, Ethiopia, tropical Africa, Pakistan.

5. **Abutilon fruticosum** Guill. & Perr. in Guill., Perr. & Rich., *Fl. Senegamb. Tent.* 1: 70 (1831).

Syn. *Abutilon denticulatum* (Fresen.) Webb, *Fragm. Fl. Aethiop.-Aegypt.* 51 (1854).

Low grey-canescens shrub 0.5-1.2 m; stems much-branched; leaf blade to 8 x 5 cm, ovate, grey on both surfaces; margin denticulate, the base cordate, the apex acute to obtuse; petiole 1.5-5 cm; stipules 4-6 mm, subulate, caducous; flowers 2.5-3 cm diam., axillary, usually solitary, sometimes paired; pedicel 1-4.5 cm, tomentose; sepals 7-9 mm, the lobes triangular, acuminate, tomentose; petals 1.5-1.8 cm, yellow; staminal tube 3-4 mm; fruit 8-9 mm, cylindrical, truncate; mericarps 8-11, 5-8 mm, pubescent, acute; seeds 2-3 in each mericarp, 2 mm, hairy, dark brown.

De, R, GE, S; stony wadis and hillsides, widespread. Egypt, Palestine, tropical Africa, Arabia, Pakistan, India.

6. **Abutilon bidentatum** A. Rich., *Tent. Fl. Abyss.* 1: 68 (1847).

Stellate-pubescent glandular perennial, 0.6-1.2 m, woody at the base; stems much-branched; leaf blade 2.5-12 x 2-10 cm, broadly ovate, the margin coarsely serrate, the base green on the upper surface, grey beneath, cordate, the apex acuminate or acute, petiole 3-10 cm; stipules 6-9 mm, subulate, caducous; flowers 1.8-2 cm diam., usually in short axillary panicles, sometimes solitary or paired; calyx 0.8-1.1 cm, pubescent on both surfaces, slightly accrescent in fruit, the lobes triangular, acuminate; petals 1.5-1.8 cm, orange-yellow or yellow; staminal column 3-4 mm, stellate-pubescent; fruit 0.8-1 cm; mericarps 14-16, spreading at maturity, 6-7 x 4 mm, acute, pubescent, 2-3-seeded; seeds 1.5 mm, brown.

N, O, De, GE; desert wadis, sandy plains, edges of cultivation. Egypt, tropical Africa, Arabia, Pakistan, India, China.

8. **Pavonia** Cav., nom. conserv.

Annuals, perennials or shrubs; leaves petiolate, stipulate, lobed or unlobed; flowers axillary, solitary or in fascicles, sometimes in leafy racemes or panicles; epicalyx

segments 5-15, free or connate; calyx 5-lobed or toothed; corolla red, pink, yellow, white or purple; staminal column with numerous filaments; carpels 5; styles 10; stigmas capitate; fruit a schizocarp; mericarps 5, indehiscent, with or without wings, reticulately veined; seeds 1 per mericarp, reniform. About 150 species, tropical and warm regions.

- | | |
|--|-------------------------|
| 1. Mericarps broadly winged | 2. <i>P. kotschyi</i> |
| + Mericarps not winged | 2 |
| 2. Mericarps coated with soft reflexed prickles | 1. <i>P. hirsuta</i> |
| + Mericarps not prickly | 3 |
| 3. Epicalyx segments broadly elliptic, obtuse; mericarps glabrous or glabrescent, reticulate | 3. <i>P. burchellii</i> |
| + Epicalyx segments filiform, acuminate; mericarps pubescent, not reticulate | 4 |
| 4. Leaves 3-lobed | 5. <i>P. triloba</i> |
| + Leaves unlobed | 4. <i>P. arabica</i> |

1. *Pavonia hirsuta* Guill. & Perr., Fl. Senegamb. Tent. 1: 51 (1831).

Yellow stellate-pubescent low shrub, 0.8-1.5 m; stems erect or ascending, sometimes prostrate; leaf-blade suborbicular, or shallowly 3-5-lobed, crenate-dentate, pubescent on both surfaces, the base cordate, the apex rounded; petiole 1-10 cm; stipules 6-8 mm, subulate, caducous; flowers 3.5-4 cm diam., axillary, solitary or in terminal leafy racemes; pedicel 0.5-2 cm, accrescent in fruit; epicalyx of 12-14 segments, 1-1.2 x 0.1 cm, linear; calyx ± equalling the epicalyx, the lobes triangular, acute: calyx and epicalyx accrescent in fruit; petals 3 x 2 cm, yellow with a purple centre; ovary globose; stigmas 10; staminal tube 1.5 cm; fruit subglobose, 1-1.2 cm, indehiscent; mericarps 7-8 x 3-4 mm, coated with soft reflexed prickles; seeds 4 x 2 mm, ovate-triangular, brownish, glabrous.

De; stony soils. Egypt, Sudan, West and Southwest tropical Africa.

2. *Pavonia kotschyi* Hochst. ex Webb, Fragm. Fl. Aethiop.-Aegypt. 43 (1854).

Stellate-hispid perennial 20-60 cm, woody at the base, sometimes flowering in first year; stems herbaceous or woody, branched; leaf blade 1-3 x 1-2.5, orbicular to broadly ovate, dentate-crenate, pubescent on both surfaces, the base and apex rounded, petiole 0.5-1.5 cm; stipules 5-6 mm, filiform, caducous; flowers 1 cm diam., axillary; pedicel 1-2(-3) cm, slender, articulate near the apex; epicalyx 10-13 segments, 1-1.2 cm, filiform, pectinate, persistent and forming a basket around the fruit; calyx 5-6 mm; lobes 5 x 1 mm, elliptic; petals 8 mm, pale yellow; fruit 6-7 x 4.5 mm, excluding the wings; mericarps 4.5-6 x 3 mm, softly pubescent, broadly winged; wings 0.8-1 x 0.6 mm, softly pubescent; seeds 2.5 x 1.5 mm, ovoid-triangular, dark brown, with short white hairs.

GE; rocky wadis and hillsides. Southeast Egypt, Sudan, Arabia.

3. *Pavonia burchellii* (DC.) Dyer, Kew Bull. 1932: 152 (1932).

Syns. *Althaea burchellii* DC., Prodr. 1: 438 (1824).

Pavonia kraussiana Hochst., Flora 27: 293 (1844).

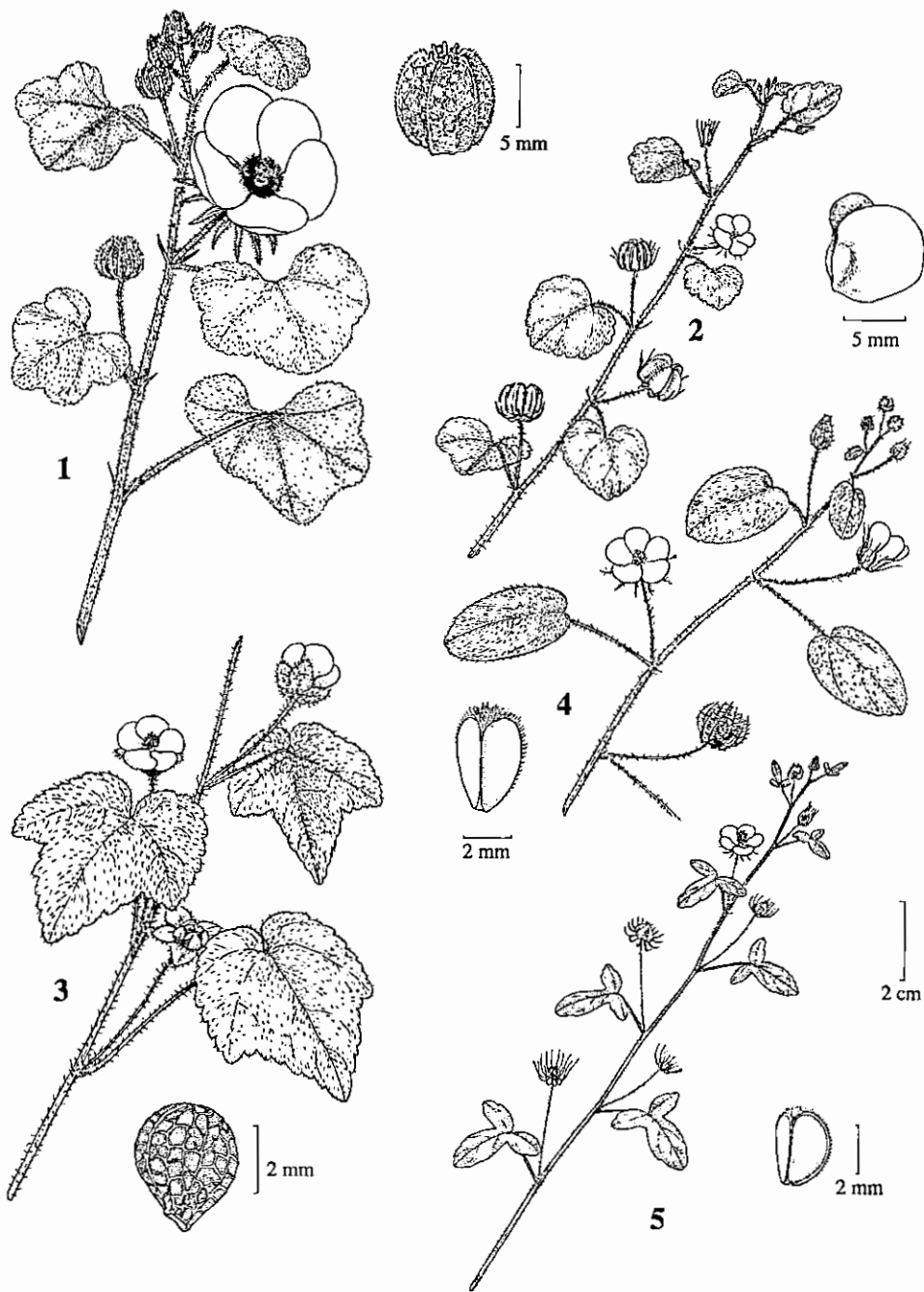


Plate 27. MALVACEAE: *Pavonia hirsuta* 1, flowering and fruiting branch; fruit (right). *Pavonia kotschy* 2, flowering and fruiting branch; mericarp (right). *Pavonia burchellii* 3, flowering and fruiting branch; mericarp (down right). *Pavonia arabica* 4, flowering and fruiting branch; mericarp (down left). *Pavonia triloba* 5, flowering and fruiting branch; mericarp (right). All drawings to the same scale, except the enlarged parts (scale given).

Low shrub 0.5-1.2 m; stems much-branched, ascending or procumbent, pubescent; young branches pilose; leaf blade 3-7 x 3-6 cm, broadly ovate, shallowly 3-lobed, crenate-dentate, the lower surface paler, more pubescent and pilose along the veins than the upper, the base cordate, the apex obtuse; petiole 1.5-5 cm, pilose; stipules 3-5 mm, filiform, pilose, caducous; flowers 1.8-2 cm diam., axillary; pedicel 4-7 cm, slender, pilose, articulate near the apex; epicalyx segments 0.9-1.1 x 0.5-0.6 cm, broadly elliptic, obtuse, pubescent, ciliate along the margin, persistent and accrescent in fruit; calyx slightly shorter than the epicalyx, pubescent; petals 1.2 x 0.8 cm, orange-yellow; fruit 0.8 x 1 cm; mericarps 8 x 4 mm, glabrous or glabrescent, reticulate.

N; edges of fields. Egypt, Sudan, Ethiopia, Eritrea, tropical East and South Africa, Arabia.

4. **Pavonia arabica** Hochst. ex Steud., Nomencl. Bot., ed. 2, 2: 279 (1841).

Glandular stellate-pubescent perennial, 20-40 cm; stems branched; leaves variable; leaf blade 1.5-4 x 1-3.5 cm, ovate to elliptic, unlobed, the margin usually entire or slightly dentate towards the apex, pubescent on both surfaces, the base cordate, the apex obtuse or emarginate; petiole 1-4 cm, pubescent; stipules 5-8 mm, subulate, setose, caducous; flowers 1.2 cm diam., axillary, solitary or in terminal leafy racemes or panicles; pedicel 1-2 cm, glandular-hairy; epicalyx segments 9-11, 0.8-1.1 cm, filiform, pectinate; calyx 3-4 mm, the lobes elliptic, pubescent; petals 1 x 0.6 cm, pink; fruit 5 x 8 mm, subglobose, enclosed by the persistent epicalyx; mericarps 4 x 2.5 mm, trigonous, pubescent, not reticulate; seeds 2 x 1 mm, ovate-trigonous, finely tuberculate.

De; stony wadis. Egypt, Sudan, Somalia, Kenya, Tanzania, Arabia, Pakistan, Northwest India.

5. **Pavonia triloba** Guill. & Perr. in Guill., Perr. & Rich., Fl. Senegamb. Tent. 1: 50 (1831).

Short-lived perennial 20-30 cm, sometimes flowering in first year, glandular stellate-pubescent; stems branched, pilose; leaf blade 1-2 x 1-2 cm, deeply or shallowly 3-lobed, more pubescent on the lower surface than the upper, the terminal lobe largest, the base truncate or slightly cordate, the apex rounded, the margin entire or with few teeth; petiole 0.2-1.5 cm; stipules 1-2 mm, caducous; flowers 1 cm diam., axillary, solitary or in short fascicles; pedicel 0.5-1.5 cm, glandular-hairy; epicalyx 8-10 segments, 7-8 mm, filiform, pectinate, glandular-hairy, persistent, accrescent in fruit; calyx 3 mm, the lobes triangular, acute; petals c. 8 x 4 mm, pink; fruit 4-5 mm, subglobose, enclosed by persistent epicalyx; mericarp 3 x 2 mm, pubescent, not winged; seeds 1.5 x 1 mm, ovate-trigonous, brown, with fine white hairs.

GE; stony wadis and hillsides. Southeast Egypt, Sudan, Ethiopia to West Africa, Arabia, Northwest India.

9. **Hibiscus** L., nom. conserv.

Annuals, perennials, shrubs or trees, usually stellate-hairy; leaves palmately lobed or unlobed; flowers axillary, usually solitary or in fascicles, leafy racemes or panicles; pedicel with or without a joint; epicalyx segments 3-many, rarely 0, free or connate, sometimes adnate to the calyx, persistent or caducous; calyx campanulate, 5-lobed, persistent; corolla of 5 petals, of various colours; staminal column exerted or included;

carpels 5; ovary mostly 5-locular, each locule with 3-many ovules; style 5-branched above; fruit a dehiscent capsule, usually 5-celled; seeds 3-many in each cell, glabrous or pubescent, angular, globose or reniform. About 300 species, warm temperate and tropical regions.

- | | | |
|---|-------------------------|---|
| 1. Calyx inflated in fruit | 3. H. trionum | 2 |
| + Calyx not inflated in fruit | | |
| 2. Calyx fleshy, crimson-red in fruit | 2. H. sabdariffa | 3 |
| + Calyx not fleshy, green in fruit | | |
| 3. Leaves undivided; capsule not winged; seeds cottony | 1. H. micranthus | |
| + At least some leaves 3-5-palmately-lobed; capsule 5-winged; seeds tuberculate | 4. H. vitifolius | |

1. **Hibiscus micranthus** L. f., Suppl. Pl. 308 (1781).

Low stellate-hairy shrub 0.5-1.2 m; stems stiff, branched, erect or ascending; leaf blade 1-3.5 x 1-3 cm, variable in size and shape, broadly ovate to lanceolate, undivided, serrate-dentate, the base rounded or truncate, the apex acute; petiole 0.2-1.2 cm; stipules 2-4 mm, subulate; flowers 1.2-1.5 cm diam., axillary, solitary; pedicel 0.5-4.5 cm, jointed or not, accrescent in fruit; epicalyx segments 6-8, 2-4 mm, filiform; calyx 3-4 mm, the lobes triangular-lanceolate, acute; petals 5-6 mm, pale pink, stellate-hairy outside; staminal tube 4-5 mm; capsule 0.8-1 cm, globose-ovoid; seeds 2 x 1 mm, numerous, reniform, densely covered by long cottony hairs.

De, R, GE, S; stony wadis and hillsides. Egypt, Palestine, Arabia, Pakistan, India, tropical Africa.

2. **Hibiscus sabdariffa** L., Sp. Pl., ed. 1, 695 (1753).

Annual or short-lived perennial, 0.5-1.5 m, glabrous or glabrescent; stems branched, reddish; leaf-blade 6-16 cm, the lower entire, the upper 3-7-lobed; the lobes elliptic, crenate-serrate, acute; petiole to 20 cm; stipules 6-8 mm, subulate; flowers 3-4 cm diam., solitary, axillary, or in terminal leafy racemes; epicalyx 8-10 segments, 1-1.2 x 0.3 cm, ovate-lanceolate, acute; calyx 1.5-2 x 0.4-0.5 cm, ovate-lanceolate, acute; epicalyx and calyx crimson-red, sparsely hairy, accrescent, enlarged and fleshy in fruit; petals 3.5-4.5 cm, yellowish with a purple spot at the base; staminal column short, included; capsule 2-2.5 cm, ovoid-acuminate, glabrous or sparsely hairy; seeds many, 4 mm, reniform, pitted, stellate-hairy.

N, O; escape from cultivation. Probably native to tropical Asia, cultivated in tropical and warm regions.

NOTE: The plant is widely cultivated in southern Egypt and the oases for its fleshy calyx which is used in the preparation of a refreshing drink, also in herbal medicine.

3. **Hibiscus trionum** L., Sp. Pl., ed. 1, 697 (1753).
Syn. *Hibiscus ternatus* Cav., Diss. 172 (1787).

Hispid annual 15-50 cm; stems erect or decumbent, branched, with simple and stellate

hairs; leaf blade 3-7 x 3-6 cm, deltoid or rounded, 3-palmatisect, often the 2 lateral lobes further dissected to appear 5-palmatisect; median lobe longest, usually further lobed, glabrous or glabrescent on the upper surface, with strigose hairs beneath; petiole 1.5-4 cm, pubescent; stipules 3-5 mm, subulate, covered with strigose hairs; flowers 3-4 cm diam., axillary, solitary; peduncle 2.5-5 cm, covered with strigose and stellate hairs; epicalyx of 9-12 free segments, 0.8-1.3 cm, linear, with stiff tuberculate-based long hairs; calyx 1-1.2 cm, the lobes triangular-lanceolate, acuminate, membranous, inflated and accrescent to 2.5 cm in fruit, with stiff tuberculate-based long hairs along the veins; petals 2-2.5 cm, broadly obovate-rounded; staminal tube 4-5 mm; capsule c. 1.5 cm, subglobose, pubescent, enclosed by the inflated calyx; seeds 2.5-3 x 2 mm, trigonous-reniform, tuberculate, brownish-black.

N, O, M, S; weed of cultivation. Mediterranean region, West and Central Asia to Mongolia and Japan, Australia, tropical Africa; naturalized in America.

4. *Hibiscus vitifolius* L., Sp. Pl., ed. 1, 696 (1753).

Syns. *Hibiscus heterotrichus* DC., Prodr. 1: 450 (1824).

Fioria vitifolia (L.) Mattei, Bol. R. Orto Bot. Palermo 2: 71 (1916).

Shrub 0.8-1.5 m, densely stellate-tomentose, with glandular and long stiff tuberculate-based simple hairs, especially on the stems; stems erect, branched; lower leaves unlobed, the upper 3-5-lobed; leaf blade 3-7(-10) x 3-6(-10) cm, ovate-cordate, dentate-serrate, the base cordate, the apex acute; petiole 2-8(-12) cm; stipules 3-5 mm, filiform, caducous; flowers 5.5-7 cm diam., axillary, solitary; pedicel 1-3 cm; epicalyx segments 9-12, 0.8-1.2 cm, subulate; calyx 1.5-2 cm, the lobes triangular-lanceolate, acute, elongate and accrescent in fruit; petals c. 4 x 2.5 cm, obovate, yellow with a maroon centre; staminal column 1.5-2 cm; capsule 1-1.5 cm, subglobose, villous, 5-winged; wings transversely striate, thinly covered with short bristles along the veins and the margins; seeds 2.5 mm, reniform, tuberculate.

GE; rocky hillsides. Tropical and subtropical Africa, Asia, Australia.

10. *Gossypium* L.

Annuals, perennials or shrubs; leaves simple, entire or lobed, usually gland-dotted and with large secretory glands on the lower surface, bracteoles and peduncles; flowers conspicuous, axillary, cymose, rarely solitary, yellow, white or purple; epicalyx of 3-(5-7) large segments, free or connate at the base, dentate or lacinate, with dark glandular dots; calyx campanulate, shortly 5-dentate; petals 5, free; staminal column with numerous filaments in the upper part; ovary 5-locular, each locule with numerous ovules; fruit a dehiscent capsule; seeds with a dense fleece, or lanate. 39 species, warm temperate and tropical regions.

1. *Gossypium herbaceum* L., Sp. Pl., ed. 1, 693 (1753).

Syn. *Gossypium arboreum*, sensu Täckh., Stud. Fl., Egypt, ed. 2, 356 (1974);

Greuter *et al.*, Med-Checklist 4: 235 (1989); Boulos, Fl. Egypt Checklist 93 (1995).

Shrubby perennial 1.5-3 m, stellate-pubescent, with simple spreading hairs; stems much-branched, mainly from the base; leaf-blade 3-8 cm, cordate-orbicular, (3-)-5 (-7)-lobed; lobes broadly ovate, narrowed below, the apex acute; leaf more stellate-pubescent and with more simple spreading hairs beneath than on the upper

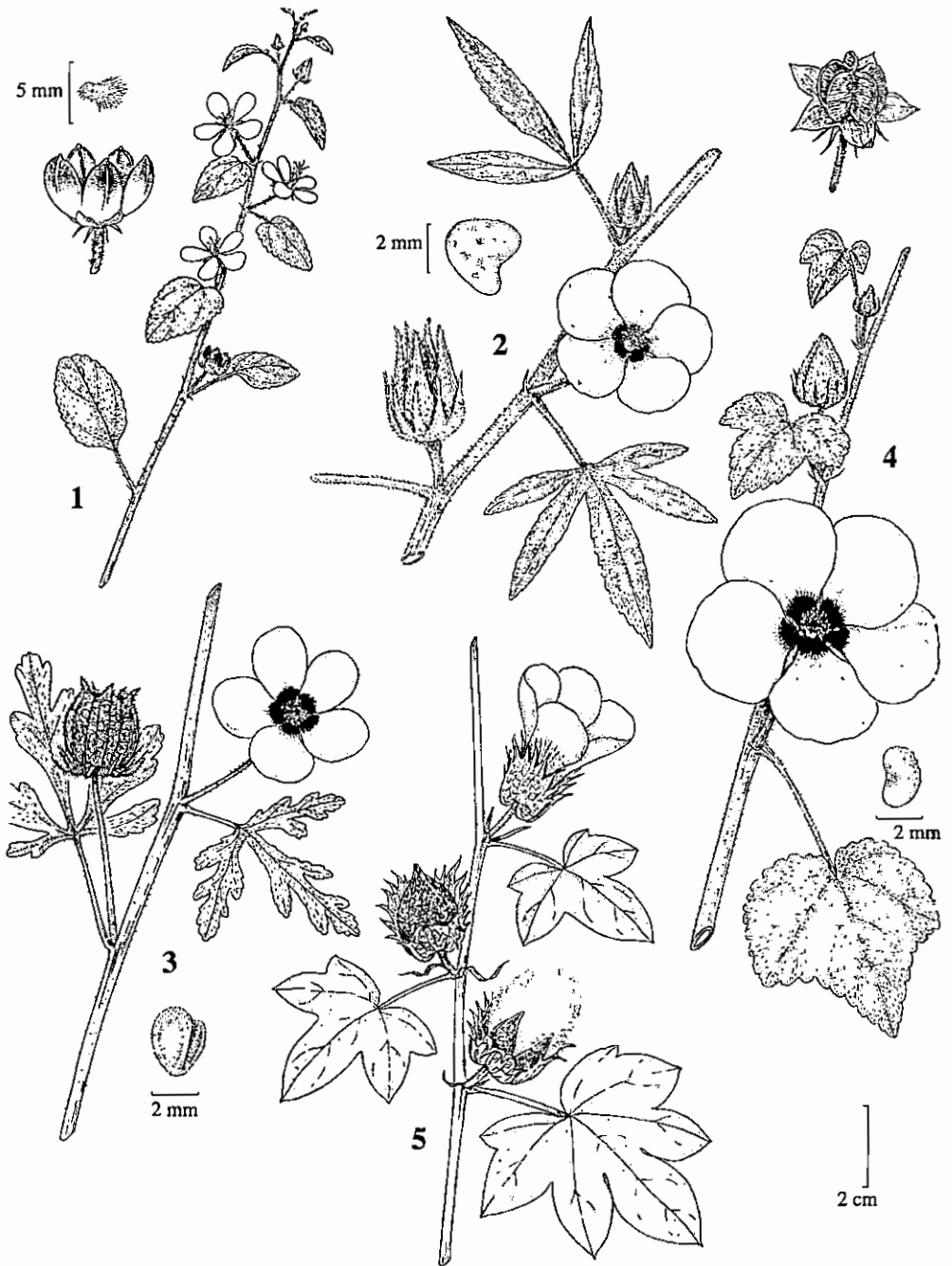


Plate 28. MALVACEAE: *Hibiscus micranthus* 1, flowering and fruiting branch; capsule and seed (left). *Hibiscus sabdariffa* 2, flowering and fruiting branch; seed (left). *Hibiscus trionum* 3, flowering and fruiting branch; seed (right). *Hibiscus vitifolius* 4, flowering branch; fruit (up); seed (right). *Gossypium herbaceum* 5, flowering and fruiting branch. All drawings to the same scale, except the enlarged seeds (scale given).

surface; lower surface gland-dotted; petiole 2-5.5 cm, stellate-pubescent, with long simple spreading hairs; stipules 0.8-1 x 0.15 cm, linear-lanceolate, acuminate, stellate-pubescent, caducous; flowers 2.5-3.5 cm diam., solitary, axillary; pedicel 1.5-3 cm; epicalyx of 3 segments, 2.5-3 x 2 cm, fused at the cordate base, the margin deeply toothed especially at the apex, pubescent; calyx 0.8-1 cm, campanulate, shallowly dentate, with black glands; petals c. 4 x 3 cm, obovate, yellow, with a purple centre; capsule 2.5-3 cm, subglobose, acuminate, dark brown; valves with deep rounded pits, exposing the cotton fibres on dehiscence; seeds 6-8 x 3-5 mm, ovoid, with long white (cotton) hairs.

O (Bahariya and Siwa); plains close to cultivation. Cultivated for cotton fibres in many regions of Africa and Asia, not known in the wild state, but probably native to Central Asia.

NOTE: The plants growing in Egypt seem to be a part of the natural vegetation and attain a height of 3 m, but probably have long been naturalized from cultivated forms. I was told in Siwa Oasis by the farmers that these cotton plants are "wild" and nobody has cultivated them. This species has long been confused with *Gossypium arboreum* L., but its morphology strongly suggests *Gossypium herbaceum*. In a recent chemosystematic study by Wafa Amer (Bull. Fac. Sci. Assiut Univ. 28, 2D: 161-172, 1999), the Egyptian material from Siwa and Bahariya oases proved to be *G. herbaceum*.

STERCULIACEAE

Trees or shrubs, rarely herbs; leaves alternate, rarely opposite, simple and entire, palmately lobed or digitally compound, frequently stellate-hairy; stipules present, caducous; flowers bisexual, unisexual or polygamous; actinomorphic, rarely zygomorphic, axillary in various types of inflorescence; sepals 3-5, valvate, slightly fused at the base; petals 5 or 0, small, free or connate at the base of the staminal tube; stamens often connate into a tube, in 2 whorls, those of the outer whorl absent or reduced to staminodes; ovary superior, with axile placentation, 4-5-locular; ovules 2 per locule; styles free or fused to one stylar column; fruit indehiscent or variously dehiscent, rarely a fleshy berry; seeds with copious or scanty endosperm. 67 genera, 1500 species, mainly tropical and warm regions.

- | | |
|---|---------------------|
| 1. Tree; petals 0; flowers unisexual or polygamous | 1. Sterculia |
| + Herb or shrub; petals present; flowers bisexual | 2 |
| 2. Glandular slender annual | 2. Hermannia |
| + Grey-tomentose perennial | 3 |
| 3. Flowers axillary, solitary or few in umbellate cymes,
included within large red epicalyx segments | 3. Melhania |
| + Flowers in globose axillary clusters or in terminal cymes,
corymbs or spikes; bracteoles linear-lanceolate | 4. Waltheria |

1. **Sterculia** L.

Deciduous trees or shrubs; leaves simple, alternate, entire, palmately lobed or digitately compound; stipules caducous; flowers in axillary or terminal panicles or racemes,

unisexual and bisexual on the same plant (polygamous) or unisexual (monoecious), actinomorphic, pedicellate; calyx 4-5-lobed, tubular or campanulate; petals 0; stamens 10-30, monadelphous in a column; carpels (3-)4-5, syncarpous, becoming free in fruit; ovary usually sessile; locules as many as the carpels, each locule with 2-many ovules; style with a 4-5-lobed or peltate stigma; fruit a cluster of woody follicles; seeds 1-many. About 150 species, tropical regions.

1. **Sterculia africana** (Lour.) Fiori, Agric. Colon. Ital. 1911, 5, Suppl. 37 (1912).
Syn. *Triphaca africana* Lour., Fl. Cochinch. 577 (1790).

Tree 3-6 m; bark smooth, peeling in papery flakes; leaf blade to 10 x 10 cm, cordate, orbicular or 3-5-lobed with an acuminate apex, sparingly pubescent to subglabrous; petiole 3-10 cm; flowers c. 1 cm diam. in small axillary panicles; calyx 0.8-1 cm, pubescent outside, smooth and reddish inside; lobes triangular, acute; staminal column 3-4 mm; fruiting carpels 3-5, 6-8 x 4-5 cm, ovoid, subsessile, acuminate, spreading, densely greyish-green tomentose; seeds numerous, 0.8-1 x 0.6 cm, ellipsoid, smooth, greyish-black, with a whitish aril at one end.

GE; rocky slopes. Southeast Egypt, Northeast Sudan, Ethiopia, Eritrea, Somalia, tropical East, South and West Africa.

2. **Hermannia** L.

Herbs or small shrubs, stellate-hairy, sometimes also with simple or glandular hairs; leaves dentate or incised; stipules foliaceous or minute; flowers bisexual, 1-several on axillary peduncles; calyx 5-lobed; petals 5; stamens 5, opposite the petals; filaments free or connate at the base; ovary 5-locular, each locule with 3-many ovules; styles 5, ± united; capsule dehiscent, with 5 valves; seeds numerous, sub-reniform, smooth. About 100 species, tropical and warm regions, but especially South Africa.

1. **Hermannia modesta** (Ehrenb.) Planch. ex Mast. in Oliv., Fl. Trop. Afr. 1: 232 (1868).
Syns. *Trichanthera modesta* Ehrenb., Linnaea 6: 402 (1829).
Hermannia arabica Hochst. & Steud. ex Fisch. & C. A. Mey., Ind. Sem. Hort. Petrop. 6: 51 (1839).
Hermannia filipes Harv. in Harv. & Sond., Fl. Cap. 1: 206 (1860).

Annual 20-50 cm; stems much-branched, the branches slender, pubescent, glandular-hairy; leaf-blade 1-3.5 x 0.1-0.2 cm, linear, entire, thinly stellate-pubescent on both surfaces, often glandular-hairy; petiole 1-2 mm; stipules 1.5-2 mm, subulate; flowers 5 mm diam., axillary, solitary on peduncles 3-4 cm; pedicel 5-8 mm, articulate with the peduncle; calyx 4-5 mm, campanulate, the lobes lanceolate, acuminate; petals 6 x 2.5 mm, purplish-red; capsule 8 x 6 mm, oblong-ovoid, truncate, sparsely stellate-hairy; seeds 1.5 x 0.75 mm, arcuate, wrinkled and minutely tuberculate, black.

De, R, GE; sandy wadis and plains. Egypt, Sudan, Ethiopia, Eritrea, Somalia, Angola, southern Africa, Arabia.

3. **Melhanianthus** Forssk.

Perennial herbs or shrubs, densely stellate-tomentose; leaves penni-nerved, with a rounded to cordate base, serrate-crenate or entire, stipulate; flowers bisexual, solitary or

2-several on axillary peduncles; bracteoles 3, forming an epicalyx immediately below the calyx, persistent; sepals 5, free almost to the base; petals 5, yellow, unequal-sided, broadly obovate, with a truncate apex; stamens 5, opposite the petals, alternating with 5 ligulate staminodes, all united into a short basal tube; ovary sessile, 5-locular; ovules 1-many per locule; style 1; stigmas 5, linear; fruit a loculicidally dehiscent capsule, splitting from above; seeds 1-several per locule, obtrigonal, smooth or tuberculate. About 60 species, Old World tropics.

1. Leaf-blade 4-10 x 2-6 cm; peduncle 1.5-4 cm; fruiting bracteoles (epicalyx) 2-4 x 2-5 cm 1. **M. phillipsiae**
+ Leaf-blade 1-4 x 0.5-2 cm; peduncle 0.5-1.5 cm; fruiting bracteoles (epicalyx) 1.5-2 x 1.5-2.5 cm 2. **M. denhamii**

1. **Melhania phillipsiae** Baker f., J. Bot. 1898: 4 (1898).

Syns. *Melhania grandibracteata* (K. Schum.) K. Schum. in Engl., Monogr. Afr. Pfl. 5: 15 (1900).

Melhania fiorii Chiov., Ann. Bot. (Roma) 1912: x, 383 (1912).

Shrubby perennial 30-80 cm; young branches tomentose to lanate; leaf-blade 4-10 x 2-6 cm, ovate to broadly ovate, tomentose-pubescent, the margin crenate-serrate, the apex rounded to truncate; petiole 1.5-5.5 cm; stipules 0.8-1.8 cm, subulate; flowers in 2-6-flowered cymes; peduncle 1.5-4 cm; pedicel 0.5-1.5 cm; bracteoles (epicalyx) 1-2 x 1-2.5 cm in flower; fruiting bracteoles 2-4 x 2-5 cm, broadly reniform, pubescent; sepals 1-1.2 x 0.2-0.3 cm, to 2.5 x 0.5 cm in fruit, densely pilose; petals 0.7-1 cm; staminodes 4-7 mm; style 2-3 mm; capsule 0.8-1 cm, subglobose-ovoid, the locules 2-3 seeded; seeds 3-4 mm, tuberculate.

GE; limestone and volcanic hillsides. Southeast Egypt, Northeast Kenya, Ethiopia, Somalia, Chad, Niger, Arabia.

2. **Melhania denhamii** R. Br. in Denham & Clapperton, Narr. Trav. Afr. App. 232 (1826).

Syns. *Brotera bracteosa* Guill. & Perr. in Guill., Perr. & Rich., Fl. Senegamb. Tent. 1: 80, t. 17 (1831).

Melhania bracteosa (Guill. & Perr.) Boiss., Fl. Orient. 1: 841 (1867).

Shrubby perennial 30-80 cm; young branches, leaves and inflorescence tomentose-lanate; leaf-blade 1-4 x 0.5-2 cm, ovate to elliptic; the margin dentate-serrate, the apex rounded to truncate; petiole 0.5-1.5 cm; stipules 3-6 mm, filiform; flowers in 1-3 (-4)-flowered cymes; peduncle 0.5-1.5 cm; pedicel 3-7 mm; bracteoles (epicalyx) 0.5-0.8 x 0.5-1 cm in flower; fruiting bracteoles 1.5-2 x 1.5-2.5 cm, reniform, pubescent, free at the base; sepals 5-8 x 2-3 mm, pilose in fruit; petals 5-7 mm; staminodes 4-5 mm; style 0.5 mm; capsule 5-7 mm, subglobose-ovoid, pubescent locules (1-)2-seeded; seeds 2-3 mm, obtrigonal, smooth, brown.

GE; stony ground. Southeast Egypt, Sudan, Ethiopia, Somalia, Chad, Niger, Mali Mauritania, Senegal, Arabia, Pakistan, India.

NOTE: The occurrence of *Melhania phillipsiae* in Egypt has long been confused with *M. denhamii*, although both species are known from Gebel Elba, and are quite distinct. As an example, the illustration in Täckholm, Stud. Fl. Egypt, ed. 2, p. 359 (1974)

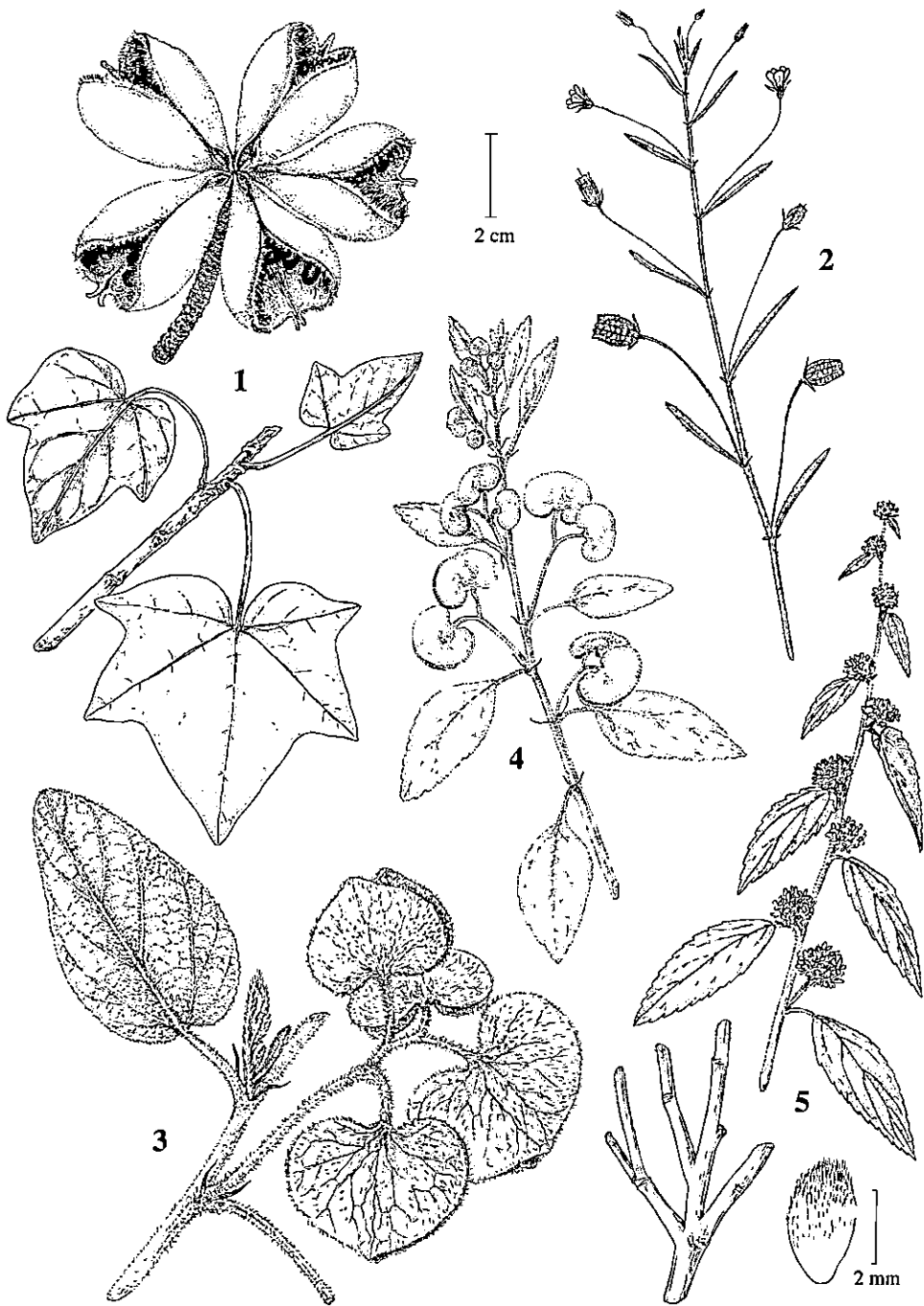


Plate 29. STERCULIACEAE: *Sterculia africana* 1, leafy branch and fruits. *Hermannia modesta* 2, flowering and fruiting branch. *Melhania phillipsiae* 3, fruiting branch. *Melhania denhamii* 4, flowering and fruiting branch. *Waltheria indica* 5, flowering and fruiting branch, basal part and fruit. All drawings to the same scale, except the enlarged part (scale given).

erroneously referred to *M. denhamii*, while the illustrated specimen is *M. phillipsiae*. The two species are easily separated; see the above key, description and illustrations of both.

4. *Waltheria* L.

Herbs or low shrubs, stellate-pubescent; leaves petiolate, crenate or serrate, 3-5 nerved from the base; stipules present; flowers small, bisexual, in globose clusters, spikes or branched cymes or corymbs; bracts and bracteoles present; calyx 5-lobed; petals 5; stamens 5, opposite the petals, the filaments united in the tube; ovary sessile, 1-locular; ovules 2; style excentric; capsule 2-valved, 1(-2)-seeded. About 40 species, tropical America and Africa, Madagascar, Malay Peninsula, Taiwan.

1. *Waltheria indica* L., Sp. Pl., ed. 1, 673 (1753).

Syn. *Waltheria americana* L., Sp. Pl., ed. 1, 673 (1753).

Stellate-pubescent perennial 0.5-1 m; leaf-blade 2-6 x 1-2 cm, ovate-oblong to elliptic, serrate-crenate, 5-nerved, veins prominent on the lower surface, the apex obtuse, the base rounded; petiole 0.5-2 cm; stipules 2-4 mm, subulate; flowers 4 mm diam., in dense globose, sessile or pedunculate axillary clusters, or in terminal cymes, corymbs or spikes; bracts and bracteoles 2-3 mm, linear-lanceolate; calyx 2-3 mm, campanulate, villous, the lobes triangular, acute; petals 3-4 mm, yellow, ovate-oblong, clawed; stamens with the filaments united into a tube, shorter than the petals; capsule 3 x 2 mm, obovoid, villous above, 1(-2)-seeded; seeds 2 x 1.5 mm, obovoid, dark brown, smooth.

GE; sandy plains. Tropical and subtropical regions.

THYMELAEACEAE

53 genera, 750 species, cosmopolitan, especially Australia and tropical Africa. *Thymelaea* is the only genus in Egypt.

1. *Thymelaea* Mill., nom. conserv.

Shrubs or herbs; leaves persistent or caducous, alternate, small or scale-like; flowers bisexual or unisexual, axillary or in clusters; hypanthium persistent, tubular or funnel-shaped; sepals 4; petals 0; stamens 8, in 2 rows, 4 at the top of the hypanthium and 4 lower; filaments very short; style short or 0, lateral or terminal; stigma small, capitate; fruit a nutlet, naked or enclosed by the hypanthium; seeds covered by a crustaceous coat; endosperm sparse or absent. 30 species, north temperate regions of the Old World, but especially the Mediterranean region.

1. *Thymelaea hirsuta* (L.) Endl., Gen. Suppl. 4(2): 65 (1848).

Syn. *Passerina hirsuta* L., Sp. Pl., ed. 1, 559 (1753).

Dioecious or monoecious evergreen shrub, 0.5-1.8 m; stems rigid, fibrous, much-branched, the young branches white-woolly; leaves 2-5 x 1-2 mm, imbricate, sessile, leathery, ovate-triangular, the upper surface green, the lower white-woolly, the apex acute or obtuse, the margin entire, involute; flowers 3-4 mm diam., sessile, few in axillary clusters on young branches, bractless; hypanthium 3-4 mm, yellow, campanulate, villous; sepals 1-1.5 mm, yellow, ovate-triangular; male flowers with 8

stamens, shorter than the hypanthium; female flowers with a sessile ovary 1.5 mm; nutlets 2-3 mm, ovoid, black.

O (Uweinat), M, D, S; sandy and stony plains. Mediterranean region, Sinai.

VIOLACEAE

20 genera, 800 species, cosmopolitan, *Viola* in temperate regions; only genus in Egypt.

1. *Viola* L.

Perennials, annuals or shrubs; leaves alternate, undivided, stipulate; flowers axillary, solitary, pedicellate, bracteolate; sepals usually with appendages near the base; petals unequal, the lower largest, spurred or saccate at the base, the others clawed; stamens with free, short filaments, each of the 2 anterior stamens with a spur-like nectary at the base included within the spur of the lower petal; ovary with 3-carpels, 1-celled; style thick; capsule dehiscent explosively, many-seeded, smooth; seeds ovoid or globose, with a short oily body attractive to ants (elaiosome). About 400 species, temperate regions, but especially north and the Andes.

1. Low shrublet, woody at the base
+ Herbaceous annual

1. *V. scorpiuroides*
2

2. Stipules filiform, inconspicuous; corolla blue

2. *V. cinerea* var. *stocksii*

+ Stipules pinnatifid, conspicuous; corolla violet, yellow and white

3. *V. tricolor*

1. *Viola scorpiuroides* Coss., Bull. Soc. Bot. France 19: 80, t. 3 (1872).

Low shrublet 20-30 cm, woody at the base, sparsely covered with simple hairs; young branches herbaceous, reddish; leaves 2-5 x 0.5-1.2 cm, spatulate, much narrowed at the base to a distinct petiole, entire, almost glabrous, the apex acute; stipules 2-4 mm, subulate; flowers 6-8 mm diam., fragrant; peduncle 3-7 cm, articulate and with 2 membranous scales above the middle; sepals 4-5 x 1-1.5 mm, narrowly-triangular, the margins scarious and ciliate, the apex acute, persistent; petals 0.8-1.2 cm, yellow with a violet throat; spur 3-4 mm, obtuse; stamens 5, shorter than the petals, subsessile; capsule 6-7 mm, subglobose, glabrous; seeds 2 x 1 mm, ovoid, glabrous, brownish.

M, Dw; limestone rocks. Egypt, Libya, Crete, South Greece (Kithira).

2. *Viola cinerea* Boiss., Diagn. Pl. Orient., ser. 1, 1: 7 (1842). var. *stocksii* (Boiss.)

Becker, Beih. Bot. Zentralbl. 36: 37 (1918).

Syns. *Viola stocksii* Boiss., Fl. Orient. 1: 453 (1867).

Viola etbaica Schweinf., Verh. Zool.-Bot. Ges. Wien 18: 665 (1868).

Viola somalensis Engl., Abh. Preuss. Akad. Wiss. 1891: 308 (1892).

Viola nubica Hutch. in Brown & Massey, Fl. Sudan 66 (1929).

Delicate annual 10-15 cm (short-lived perennial in Somalia); stems branched or not, erect or ascending, glabrous to sparsely pubescent; leaves 2-3 x 0.5-1.2 cm, elliptic-spatulate or narrowly lanceolate, narrowed at the base to a distinct petiole, entire or slightly crenate-serrate, the apex acute, glabrous or thinly pubescent; stipules 3-5 mm, filiform,

inconspicuous; flowers solitary, axillary; peduncle 2-3.5 cm, articulate and with 2 minute filiform scales 2-5 mm below the flower; sepals 3-4 x 1 mm, triangular-lanceolate, acuminate, with scarious margins; petals 5-7 mm, blue, the lower petal with a short spur; capsule 4-5 mm, globose, glabrous; seeds 1.2 x 0.7 mm, ovoid, glabrous, smooth.

GE; sheltered rocky crevices. Southeast Egypt, Northeast Sudan (Red Sea Hills), Somalia, Arabia, eastwards to India.

3. *Viola tricolor* L., Sp. Pl., ed. 1, 935 (1753).

Annual (perennial plants are known outside Egypt) 15-25 cm, glabrous or sparsely pubescent; stems ascending or erect, branched; lower leaves cordate-ovate, obtuse, crenate, the upper ovate-lanceolate, attenuate at the base; stipules 1-2 cm, leaf-like, pinnatifid, conspicuous, the terminal segments larger than the laterals; flowers solitary, axillary, 1.5-2.5 cm diam.; peduncle to 12 cm; sepals 0.8-1 x 0.2 cm; petals 1.5-1.8 cm, violet, yellow and white; spur 4-6 mm; capsule 0.8-1.1 cm, ovate-elliptic; seeds 2 x 1 mm, yellowish-brown.

S; escape from cultivation. Europe, Mediterranean region, Sinai.

NOTE: Several subspecies have been described; our annual plants are probably subsp. *tricolor*.

CISTACEAE

Annuals, perennials or shrubs, stellate-hairy; leaves opposite, rarely alternate, entire, short-petiolate or sessile, stipulate or exstipulate; flowers regular, bisexual, solitary or in cymes; sepals 3-5, the outer 2 sometimes bract-like, free; petals usually 5, sometimes 3 or 0, white, yellow or pink; stamens numerous, free, all fertile or the outer sterile; style simple, short or long or 0; stigmas 1-5; ovary 1-locular or incompletely many-locular; ovules few to many; fruit a dehiscent capsule; seeds angular; endosperm present. 8 genera, 175 species, temperate and warm regions, but especially the Mediterranean region.

1. All stamens fertile, with anthers
+ Outer stamens sterile, without anthers

1. *Helianthemum*
2. *Fumana*

1. *Helianthemum* Mill.

Annuals, perennials or shrubs, mostly stellate-hairy, sometimes glandular; leaves simple, entire, petiolate or subsessile, opposite or rarely alternate, stipulate or exstipulate; flowers bisexual, actinomorphic, solitary or in cymose inflorescences, bracteate, conspicuous; sepals 3-5, equal or unequal; petals 5 rarely 3; stamens numerous, rarely 3-6, inserted on the disc-shaped receptacle; ovary superior; carpels 3-5, rarely more, 1-celled or incompletely septate, with 3-5(-10) parietal placenta; ovules numerous; style 1 or 0; stigma simple or divided; fruit a loculicidally dehiscent capsule, 3-valved; seeds small, angular; endosperm copious. About 110 species, Europe, Mediterranean region, Sinai, Sahara, Northeast Africa, Central Asia, North and South America.

1. Annual	2
+ Low shrub or perennial with woody base	4
2. Leaves linear	1. H. aegyptiacum
+ Leaves obovate, lanceolate, oblong-elliptic	3
3. Pedicel 2-5 mm, straight, thickened in fruit	2. H. ledifolium
+ Pedicel 1-1.5 cm, upcurved, not thickened in fruit	3. H. salicifolium
4. Petals pink to purplish	4. H. vesicarium
+ Petals yellow	5
5. Flowers sessile or subsessile	6
+ Flowers pedicellate	7
6. Calyx 6-7 mm in fruit	5. H. stipulatum
+ Calyx 3-4 mm in fruit	8. H. lippii
7. Flowers 2.5-3 cm diam.	11. H. sphaerocalyx
+ Flowers 0.8-1.5 cm diam.	8
8. Pedicel in fruit 3-4 times as long as the calyx	10. H. schweinfurthii
+ Pedicel in fruit \pm equalling the calyx	9
9. Inflorescence 5-12-flowered	9. H. kahiricum
+ Inflorescence 3-5-flowered	10
10. Old branches spinescent, white, glossy; inner sepals 3 times as long as broad, oblong-elliptic; petals 1-1.2 cm	7. H. sancti-antonii
+ Old branches not spinescent, not white, glossy; inner sepals twice as long as broad, ovate; petals 1.2-1.5 cm	6. H. ventosum

1. **Helianthemum aegyptiacum** (L.) Mill., Gard. Dict., ed. 8, no. 23 (1768).
Syn. *Cistus aegyptiacus* L., Sp. Pl., ed. 1, 527 (1753).

Annual 10-20 cm, sparsely appressed-pilose; stems simple or branched, erect, terete; leaves 1.2-3 x 0.1-0.3 cm, linear, short-petiolate, the margin revolute, the apex acute to obtuse; stipules 2-4 mm, subulate, acuminate, longer than the petiole; pedicel 5-8 mm, filiform, elongate and deflexed in fruit; flowers axillary, remote; sepals 0.8-1 cm, hispid along the red nerves, accrescent and inflated in fruit; petals shorter than the calyx, yellow; capsule 7-8 x 5 mm, ovoid, sparsely pubescent, enclosed within the inflated calyx; seeds 1.5 x 1 mm, angular, papillose, brownish.

M, S; stony ground. Mediterranean region, Southwest Asia.

2. **Helianthemum ledifolium** (L.) Mill., Gard. Dict., ed. 8, no. 20 (1768).
Syns. *Cistus ledifolius* L., Sp. Pl., ed. 1, 527 (1753).
Cistus niloticus L., Mant. Alt. 246 (1771).
Helianthemum niloticum (L.) Pers., Syn. Pl. 2: 78 (1806), non Moench,
Methodus 233 (1794).

Appressed-hairy annual 10-35 cm; stems branched, erect or ascending, the branches spreading; leaves 2-5 x 0.3-0.6 cm, elliptic-lanceolate, stellate-canescens on both surfaces, the margin revolute, the apex acute; stipules 0.6-1.2 cm, linear-lanceolate, acuminate; petiole 1-3 mm; pedicel 2-5 mm, straight, thickened in fruit; flowers solitary, axillary; sepals hispid-tomentose, especially along the nerves and margin, accrescent in fruit; outer sepals c. 8 x 1 mm, linear-subulate; inner sepals 0.8-1 x 0.3-0.5 cm, ovate-lanceolate; petals shorter than the calyx, yellow; capsule 0.8-1 cm, ovoid-globose, glabrous except at the ciliate margins of valves; seeds numerous, 1 mm, ± ovoid, smooth, brownish.

M, De, S; sandy plains. Mediterranean region, Sinai, Arabia, Iraq, Iran.

3. **Helianthemum salicifolium** (L.) Mill., Gard. Dict., ed. 8, no. 21 (1768).

Syn. *Cistus salicifolius* L., Sp. Pl., ed. 1, 527 (1753).

Appressed-hairy annual 10-35 cm; stems erect or ascending, branched mainly from the base; leaves 1-2.8 x 0.3-0.8 cm, the lower ovate-oblong, the upper lanceolate-elliptic, with revolute margin; stipules 4-8 x 1-2 mm, linear-lanceolate to subulate; petiole 2-8 mm; pedicel 1-1.5 cm, upcurved, not thickened in fruit, subtended by a leaf-like bract, to 1 cm; flowers solitary, axillary; sepals tomentose, with thick prominent nerves; outer sepals 3-4 x 1 mm, linear-lanceolate; inner sepals 6-8 x 3-4 mm, ovate-lanceolate, acute; petals ± equalling the sepals, yellow; capsule 4-7 mm, ovoid-globose, glabrous; seeds 1 mm, ovoid-compressed, finely tuberculate, brownish.

M, De, S; sand plains and desert wadis. Mediterranean region, Southwest Asia.

4. **Helianthemum vesicarium** Boiss., Diagn. Pl. Orient., ser. 1, 8: 50 (1849).

Greyish-tomentose shrubby perennial, 15-30 cm; stems procumbent, sometimes ascending, branched; leaves 1-2 x 0.1-0.3 cm, linear to linear-lanceolate, appressed-tomentose on both surfaces, the margin rather revolute, the apex obtuse; stipules 2-5 mm, subulate, petiole 1-2.5 mm; inflorescence terminal, 1-sided, simple, 3-8-flowered; bracts 2-5 mm, linear; pedicel 1-2 cm, slender, spreading, later deflexed; sepals with prominent, elevated, reddish, ciliate nerves, appressed-hairy or glabrous between the nerves; outer sepals 2-3 x 1 mm, elliptic; inner sepals 6-8 x 3-4 mm, broadly ovate; petals 1.5-1.8 cm, pink to purplish; fruiting calyx 0.8-1 cm; capsule 6-8 mm, subglobose, densely tomentose or glabrous, enclosed and exceeded by the fruiting calyx; seeds 1 mm, ovoid-compressed, finely tuberculate, brown.

Two varieties occur in Egypt:

var. **vesicarium**

Sepals appressed-hairy between the ciliate nerves; capsule densely tomentose.

O (Wadi Natrun), M, S; calcareous ridges, waste ground. East Mediterranean region, Sinai.

var. **ciliatum** (Desf.) Zohary, Fl. Palaest. 2: 340 (1972).

Syns. *Cistus ciliatus* Desf., Fl. Atlant. 1: 421, t. 109 (1798).

Helianthemum ciliatum (Desf.) Pers., Syn. Pl. 2: 79 (1806).

Sepals glabrous between the ciliate nerves, or almost glabrous throughout; capsule glabrous.

M, S; calcareous ridges, waste ground. Spain, North Africa, Sinai, Paestine.

5. **Helianthemum stipulatum** (Forssk.) C. Chr., Dansk Bot. Ark. 4 (3): 20, no. 11 (1922).

Syns. *Cistus stipulatus* Forssk., Fl. Aegypt.-Arab. 100 (1775).

Cistus ellipticus Desf., Fl. Atlant. 1: 418, t. 107 (1798).

Helianthemum ellipticum (Desf.) Pers., Syn. Pl. 2: 78 (1806).

Helianthemum ehrenbergii Willk., Icon. Descr. Pl. Nov. 2: 99 (1861).

Helianthemum lippii (L.) Dum. Cours. var. *ellipticum* (Desf.) Boiss., Fl. Orient. 1: 443 (1867).

Low shrub 30-50 cm; young branches densely tomentose; old stems woody, intricately branched; leaves 1-2 x 0.2-0.4 cm, oblong-elliptic, appressed-tomentose on both surfaces, the margin revolute, the apex obtuse; stipules 2-3.5 mm, linear-lanceolate, leaf-like; inflorescence terminal, 5-10-flowered, spicate; bracts 4-6 mm, subulate; flowers c. 1.2 cm diam., sessile or subsessile; calyx densely woolly-hairy; outer sepals c. 5 mm, subulate; inner sepals c. 7 x 4 mm, broadly ovate; petals 0.8-1 cm, yellow; capsule c. 8 mm, globose, villous, enclosed by the accrescent 6-7 mm persistent calyx; seeds 1.2 mm, tuberculate.

M, De, S; sandy and stony wadis and plains. North Africa, East Mediterranean region, Sinai, Arabia.

NOTE: The type was collected from Alexandria, Egypt, by Forsskål (C).

6. **Helianthemum ventosum** Boiss., Diagn. Pl. Orient., ser. 1, 8: 50 (1849).

Low shrub 10-30 cm; young branches appressed stellate-hairy; old stems woody, much-branched; leaves 0.5-2 x 0.2-0.5 cm, elliptic, appressed stellate-tomentose on both surfaces, the margin revolute, the apex acute; stipules 1-2 mm, subulate; petiole 1-2 mm; inflorescence 2-4-flowered; pedicel 3-4 mm, bracteate; flowers c. 2 cm diam.; sepals stellate-hairy, with prominent nerves and ciliate margins; outer sepals 4-4.5 mm, subulate; inner sepals 8-9 x 4-4.5 mm, ovate, accrescent in fruit; petals 1.2-1.5 cm, yellow; capsule 6-8 mm, globose-ovoid, tomentose, enclosed by the longer persistent calyx; seeds 1.5 mm, flattened, brownish.

De, S; stony ground. Egypt, Palestine, Arabia.

7. **Helianthemum sancti-antonii** Schweinf. ex Boiss., Fl. Orient. Suppl. 70 (1888).

Low shrub 15-30 cm; young branches white-grey canescent; stems intricately and dichotomously branched, the old branches spinescent, glabrous, glossy; leaves 0.5-1 x 0.1-0.2 cm, linear-elliptic, appressed white-canescens on both surfaces, the margin revolute, the apex obtuse to acute; stipules 1-2 mm; petiole 1-2 mm; inflorescence with 2-5 remote flowers, bracteate; pedicel 3-4 mm, deflexed in fruit; flowers 1.5 cm diam., sepals pilose on both surfaces; outer sepals 2-3 mm, subulate; inner sepals 7-9 x 2-3 mm, oblong-elliptic; petals 1-1.2 cm, yellow, obovate; capsule c. 6 mm, ovoid, tomentose, included within the persistent accrescent calyx; seeds 1.5 mm, flattened, brown.

De, S; stony hillsides. Egypt, Palestine, Arabia.



Plate 30. CISTACEAE: flowering and fruiting branch, and enlarged fruit of: *Helianthemum aegyptiacum* 1. *Helianthemum ledifolium* 2. *Helianthemum salicifolium* 3. *Helianthemum vesicarium* 4; leaf (down left). *Helianthemum stipulatum* 5. *Helianthemum lippü* 6. *Helianthemum kahircicum* 7. *Helianthemum schweinfurthii* 8. *Fumana arabica* 9. *Fumana thymifolia* 10. All drawings to the same scale, except the enlarged parts (scale given).

8. **Helianthemum lippii** (L.) Dum. Cours., Bot. Cult. 3: 130 (1802).

Syns. *Cistus lippii* L., Mant. Alt. 245 (1771).

Cistus sessiliflorus Desf., Fl. Atlant. 1: 417, t. 106 (1798).

Helianthemum sessiliflorum (Desf.) Pers., Syn. Pl. 2: 78 (1806).

Helianthemum velutinum Pomel, Nouv. Mat. Fl. Atlant. 351 (1875), non Jordan, Observ. Pl. Nouv. 3: 35 (1846).

Helianthemum lippii (L.) Dum. Cours. var. *sessiliflorum* (Desf.) Murb., Contrib. Fl. Afr. Nord (Tunisie) 1: 17 (1897).

Low shrub 20-40 cm; stems many, dichotomously and intricately branched; old branches woody, spinescent; young branches white-canescens, glossy; leaves 1-1.8 x 0.1-0.3 cm, elliptic to linear-lanceolate, more tomentose on the lower surface than the upper, the margin revolute, the apex acute to obtuse; stipules 1-3 mm, subulate; petiole 1-2.5 mm; inflorescence 4-8-flowered, spicate, 1-sided, bracteate; flowers c. 8 mm diam., sessile or subsessile; pedicel if present 0.5-1 mm; calyx pubescent; outer sepals 1.5-2 mm, subulate; inner sepals 3-4 x 2 mm, ovate-elliptic, slightly accrescent and not enlarging in fruit; petals 4-5 mm, yellow; capsule 3-4 mm, ± equalling the fruiting calyx, villous; seeds 1 mm, angular, brownish.

O, M, D, R, S; sandy and gravelly wadis and plains. North Africa, West Asia to Pakistan.

NOTE: *Helianthemum lippii* is a widespread species in Egypt and is known in different growth forms. *Helianthemum sessiliflorum* is treated here as a synonym since it represents just one or more of the growth forms of *H. lippii*. Some authors, e. g. Jafri in Jafri & El-Gadi, Flora of Libya, Cistaceae 48: 26-29 (1977), treat *H. sessiliflorum* as a variety of *H. lippii*. He writes: "intergrading forms, in the placement of flowers on the cymes, are not lacking between the 2 varieties", which are var. *lippii* and var. *sessiliflorum*. Some other authors, e. g. Zohary, Flora Palaestina 2: 342 (1972) treats both taxa as separate species, but the differences by which they are separated seem to be difficult to trace, e.g., stems intricately branched or sparingly branched; branches spinescent or not spinescent; branches white-glossy after flowering or yellowish-grey after flowering.

9. **Helianthemum kahiricum** Delile, Descr. Egypte, Hist. Nat. 237 (1814).

Appressed grey-canescens low shrub, 10-25 cm; stems many, branched; leaves 0.5-1.8 x 0.15-0.3 cm, oblong-lanceolate, appressed-pubescent, the margin strongly revolute, apex acute to obtuse; stipules 1-2 mm, ciliate; petiole 0.5-1 mm; inflorescence 5-12-flowered, 1-sided, bracteate; pedicel ± equalling the fruiting calyx, slender, villous, deflexed and elongating in fruit; flowers c. 8 mm diam.; calyx white-villous, violaceous; outer sepals c. 3 x 1 mm, subulate; inner sepals 4-6 x 2.5 mm, oblong-ovate, accrescent in fruit; petals ± equalling the sepals, yellow, often not opening (as most flowers cleistogamous); capsule 4-5 mm, ovoid-globose, hairy; seeds 1 mm, ovoid-compressed, smooth, brownish.

M, D, S; rocky wadis and plains, calcareous coastal ridges. North Africa, Sinai, Palestine, Syria, Iraq, Arabia.

10. **Helianthemum schweinfurthii** Grosser in Engl., Pflanzenr. 14: 95 (1903).

Like *Helianthemum kahiricum*, but inflorescence 5-8-flowered; pedicel in fruit 3-4 times as long as the calyx.

De (Gebel Shalufa); hillsides. Endemic.

NOTE: The type was collected 24 April 1880 by Schweinfurth 129, from Gebel Shalufa, northern Eastern Desert (isotype, K!). The only other specimen I could trace of this species is that collected by Muschler, *s. n.*, February 1906 (K!). The locality given by Muschler, Wadi Halfa, is very unlikely to be correct, as with many of Muschler's specimens. The plant was most probably collected from the northern part of the Eastern Desert, or from the type locality, Gebel Shalufa.

11. **Helianthemum sphaerocalyx** Gauba & Janch., Österr. Bot. Zeitschr. 79: 349 (1930).

Perennial 5-15 cm, woody at the base; stems branched from the base; leaves 1-1.5 x 0.3-0.5 cm, ovate to ovate-elliptic, fleshy, subsessile, glabrous; stipules 0.5-0.8 x 0.2 mm, ovate-elliptic, leaf-like, conspicuous; inflorescence 6-8-flowered, racemose; flowers 2.5-3 cm diam., fragrant, bracteate; pedicel 0.8-1 cm; outer sepals 2-3 x 1 mm, elliptic, white-villous; inner sepals *c.* 8 x 4 mm, ovate, white-villous, red-nerved; petals 1.2 cm, yellow; capsule *c.* 8 mm, globose, pubescent.

M; stony ground. Egypt, Libya.

NOTE: Jafri in Jafri & El-Gadi, Flora of Libya, Cistaceae 48: 33-35 (1977), considers *Helianthemum sphaerocalyx* to be a synonym of *H. crassifolium* Pers. He adds that the latter is a very variable species with a glabrous to very densely ciliate calyx; smaller forms have been called *H. sphaerocalyx*. The species is endangered in Egypt.

2. **Fumana** (Dunal) Spach

Low shrubs; stems richly branched; leaves alternate, rarely opposite, stipulate or exstipulate; inflorescence cymose; flowers conspicuous, usually long-pedicellate; sepals 5, scarious between the nerves and on the margin; outer sepals minute; petals 5, longer than the calyx, yellow; stamens 20-40, the outer sterile, shorter than the inner anther-bearing ones; ovary globose, 3-carpellate, 1-locular; ovules 3-12; style equalling the stamens; stigma 3-lobed; capsule dehiscent to base into 3 valves; seeds with a spiral embryo. 9 species, North Africa, Mediterranean region, Sinai, Arabia, Iran.

1. Leaves alternate; flower 2.5-3 cm diam.; capsule 6-8 mm

1. **F. arabica**

+ Leaves partly opposite; flower 1-1.5 cm diam.; capsule 4-5 mm

2. **F. thymifolia**

1. **Fumana arabica** (L.) Spach, Ann. Sci. Nat. Bot., sér. 2, 6: 359 (1836).

Syns. *Cistus arabicus* L., Cent. Pl. 1: 14 (1755).

Helianthemum arabicum (L.) Pers., Syn. Pl. 2: 80 (1806).

Low shrub 15-30 cm, pubescent, glandular-hairy above; stems many, procumbent or ascending, branched; leaves 0.8-1.8 x 0.2-0.3 cm, alternate, elliptic to linear-lanceolate, acute, the margin slightly revolute, the upper leaves glandular-hairy; petiole 1-1.5 mm; stipules 2-3 x 1 mm, lanceolate, leaf-like; flowers 2.5-3 cm diam., axillary on the branches; pedicel 0.8-1.5 cm, ebracteate, deflexed; sepals glandular-hairy, scarious between the nerves and at the margin; outer sepals *c.* 4 mm, linear-lanceolate; the inner 6-9 x 2.5 mm, ovate, acute, accrescent in fruit; petals 1.2-1.5 cm, yellow, obovate, clawed; capsule 6-8 mm, globose-ovoid, with short hairs at the tip, otherwise glabrous, smooth, glossy; seeds 2 x 1.2 mm, ovoid-trigonal, smooth, brownish.

M, S; stony ridges and wadis. North Africa, East Mediterranean region, Sinai, Arabia, Iraq, Iran.

2. **Fumana thymifolia** (L.) Spach ex Webb, Iter Hispan. 69 (1838).

Syns. *Cistus thymifolius* L., Sp. Pl., ed. 1, 528 (1753).

Cistus glutinosus L., Mant. 2: 246 (1767).

Helianthemum thymifolium (L.) Pers., Syn. Pl. 2: 79 (1806).

Fumana glutinosa (L.) Boiss., Fl. Orient. 1: 449 (1867).

Low shrub 15-30 cm, glandular-hairy; stems many, much-branched; branches intricate, erect or ascending; leaves 0.3-1.6 x 0.1-0.15 cm, partly opposite and partly alternate; linear, the margin revolute, acute to obtuse; stipules 1.5-3 x 1 mm, subulate; pedicel 0.8-1.2 cm, bracteate; flowers 1-1.5 cm diam., 3-8 in racemose inflorescences on terminal branches; sepals glandular-hairy; outer sepals 2 x 0.5 mm; inner sepals 4-5 x 1.5 mm, ovate; petals 6-8 mm, obovate, obtuse; capsule 4-5 mm, globose-ovoid, glabrous, smooth; seeds 1.5 x 1 mm, trigonous, slightly tuberculate, brownish.

M, S; stony hillsides and ridges. Mediterranean region, Sinai.

TAMARICACEAE

Trees or shrubs; leaves alternate, exstipulate, usually sessile, small and scale-like, herbaceous or fleshy, mostly with salt-secreting glands, persistent; flowers bisexual, actinomorphic, 4-5-merous; sepals and petals free or connate at the base; anthers versatile; ovary superior, 1-locular; carpels 2-5, with parietal placenta; ovules usually numerous; styles as many as the carpels, free or sometimes connate, or 0; stigmas capitate, sometimes sessile; fruit a loculicidal capsule; seeds many, hairy all around or with a tuft of hairs; endosperm present or absent. 4 genera, 78 species, Eurasia and Africa, but especially Mediterranean region to Central Asia.

1. Low shrubs; flower subtended by many bracts; stamens numerous

1. **Reaumuria**

+ Trees or shrubs; flower subtended by 1 bract; stamens 4-5(-12)

2. **Tamarix**

1. **Reaumuria** Hasselq. ex L.

Low shrubs, glaucous, glabrous or hirsute; leaves usually fleshy, cylindrical-linear or flattened; bracts 5-10, imbricate; flowers bisexual, terminal or axillary, solitary or in spikes; sepals 5, connate at the base, sometimes free; petals 5, free; stamens numerous, ± connate at the base, generally in 5 groups opposite the petals; filaments inserted on a fleshy disc; ovary with 5 carpels, 1-locular; styles 5; stigmas 5, simple; capsule dehiscing by 5 valves; seeds few, fleshy, densely hairy. 12 species, Mediterranean region to Central Asia.

1. Leaves and bracts all flattened, not succulent

1. **R. alternifolia**

+ Leaves and bracts terete, semiterete, or flattened, succulent

2

2. Leaves, bracts and calyx lobes acute to long-mucronate

2. **R. vermiculata**

+ Leaves, bracts and calyx lobes obtuse

3

3. Plant glabrous; leaves terete; calyx lobes entire

3. **R. negevensis**

+ Plant hirsute or puberulent to glabrescent; leaves semiterete or flattened;

calyx lobes irregularly denticulate

4. **R. hirtella**

1. **Reaumuria alternifolia** (Labill.) Britten, J. Bot. (London) 54: 110 (1916).
Syns. *Hypericum alternifolium* Labill., Ic. Pl. Syr. 2: 17, t. 10 (1791).
Reaumuria hypericoides Willd., Sp. Pl., ed. 4, 2: 1250 (1799).
Reaumuria billardieri Jaub. & Spach, Ann. Sci. Nat. Bot., sér. 3, 8: 381
(1847).
Reaumuria squarrosa Jaub. & Spach, Ill. Pl. Orient. 3: 55, 59, t. 247
(1848).

Glabrous scabrid low shrub, 15-40 cm; stems many from the base, branched, erect or ascending; leaves dimorphic; winter leaves 0.8-1.5 x 0.2-0.3 cm, sessile, elliptic-lanceolate, acute, flattened, not succulent, pitted on both surfaces; summer leaves 1-2 mm, on small branchlets; flowers terminal, 1.2-1.5 cm diam.; bracts 4-5 x 1 mm, oblong-linear, flattened, mucronate; sepals 5-7 x 2-2.5 mm, ovate-lanceolate, mucronate, connate at the base; petals 0.8-1.1 cm, pinkish, obliquely truncate; filaments dilated at the base; capsule c. 5 mm, ovoid; seeds hairy.

D, S; stony wadis. East Mediterranean region, Sinai.

2. **Reaumuria vermiculata** L., Syst. Nat., ed. 10, 2: 1081 (1759).
Syn. *Reaumuria mucronata* Jaub. & Spach, Ill. Pl. Orient. 3: 54, 57, t. 245
(1848).

Low glabrous shrub 20-50 cm; stems erect, branched; leaves 2-8 x 0.1-1.5 mm, semiterete, oblong-elliptic, the apex acute to long-mucronate; flowers 1-1.5 cm diam., solitary, terminal; bracts imbricate, similar to leaves, long-mucronate; sepals 6-8 x 2 mm, acuminate, long-mucronate, united at the base into a tube 2-3 mm, the margin scarious; petals 0.8-1(-1.2) x 0.5-0.6 cm, white, with 2 fimbriate appendages; filaments 7-8 mm, dilated; styles 4 mm, capsule c. 8 mm, subglobose; seeds c. 3 mm, with a tuft of brownish hairs.

O (Uweinat), M, D, S; gypseous and sandy soils. Sicily, North Africa, Sinai.

3. **Reaumuria negevensis** Zohary & Danin, Israel J. Bot. 19: 309, f. 3 (1970).

Low glabrous shrub 10-20 cm; stems ascending, branched mainly from the base; leaves 2-6 x 1 mm, terete, sessile, glabrous, slightly clasping, the apex rounded; bracts leaf-like, shorter than the calyx, terete, glabrous; flowers 0.8-1.1 cm diam., sessile or subsessile, in interrupted spikes; sepals c. 4 mm, connate at the base, the margin entire and scarious; petals c. 8 mm, pinkish to white, scales fringed; filaments dilated below; ovary 3 mm; style 3 mm; capsule 4-5 mm, ovoid; seeds 2 mm, with a tuft of long hairs.

S; rocky crevices. Sinai, Palestine.

4. **Reaumuria hirtella** Jaub. & Spach, Ill. Pl. Orient. 3: 54, 55, t. 244 (1848).

Low shrub 15-40 cm, hirsute or puberulent to glabrescent; stems many, branched, erect or ascending; leaves 0.3-2 x 0.1-0.2 cm, semiterete or flattened, linear, obtuse; bracts many, leaf-like, shorter to longer than the sepals, obtuse, hairy; flowers 0.8-1.5 cm diam., short-pedicellate in interrupted spikes; sepals 0.6-1 cm, connate at the base, the lobes triangular-lanceolate, the margin irregularly denticulate; petals 0.8-1.2 cm, whitish to pinkish, the scales ciliate; filaments dilated and undulate-denticulate at the base; capsule 4-6 mm, ellipsoid-conical; seeds c. 2 mm, with a long hairy tuft.

Three varieties occur in Egypt:

- | | |
|--|-------------------------|
| 1. Stems and sometimes leaves and bracts hirsute | var. hirtella |
| + Stems glabrescent or minutely puberulent | 2 |
| 2. Bracts equal to or longer than calyx lobes,
deflexed or slightly spreading | var. palaestina |
| + Bracts shorter than calyx lobes and usually adpressed to calyx | var. brachylepis |

var. **hirtella**

M, D, S; rocky and sandy ground.

var. **palaestina** (Boiss.) Zohary & Danin, Israel J. Bot. 19: 309, f. 2 (1970).
Syn. *Reaumuria palaestina* Boiss., Diagn. Pl. Orient., ser. 1, 10: 10 (1849).

S; stony ground, saline soils.

var. **brachylepis** Zohary & Danin, Israel J. Bot. 19: 309 (1970).

S; stony ground.

Area of the species: Libya, Egypt, Palestine, Syria, Lebanon.

2. **Tamarix** L.

Trees or shrubs; stems profusely branched; leaves sessile, small, scale-like, sheathing, mostly with salt-exuding glands; inflorescence simple or compound spike-like racemes; flowers bisexual, rarely unisexual; calyx and corolla 4-5(-6)-merous, usually pedicellate, bracteate; sepals free or connate at the base; petals free or connate at the base, white, pink or reddish; disc of various forms, usually with 4-5 lobes or almost 0; stamens episepalous, 4 or 5 or diplostemonous and inner whorl 1-10, epipetalous; ovary of 3-4 carpels, 1-locular; placenta basal-parietal; styles 3 or 4, rarely 2 or 5; stigmas short, capitate; capsule many-seeded, conical, pyramidal or pyriform, loculicidally dehiscent; seeds with apical sessile pappus of unicellular hairs. 54 species, Eurasia, Africa, dry regions.

- | | |
|---|----------------------------|
| 1. Leaves sheath-like, without a blade | 1. T. aphylla |
| + Leaves with distinct free blades | 2 |
| 2. All or most of the flowers with 4 styles; capsule 4-valved | 2. T. tetragyna |
| + All or most of the flowers with 3 styles; capsule 3-valved | 3 |
| 3. Stamens 4-5 | 3. T. nilotica |
| + Stamens 6-13 | 4 |
| 4. Petals 1.5-2.5 mm, white; disc absent | 4. T. amplexicaulis |
| + Petals 3-5(-6) mm, pale pink; disc present | 5 |
| 5. Sepals usually acute; stamens 10-13; capsule 6-7 mm | 5. T. passerinoides |
| + Sepals usually obtuse; stamens 6-10; capsule 0.7-1.3 cm | 6. T. macrocarpa |

1. **Tamarix aphylla** (L.) H. Karst., *Deutschl. Fl. Pharm.-Med. Bot.* 641 (1882).
Syns. *Thuja aphylla* L., *Cent. Pl.* 1: 35 (1755), pro parte
Tamarix orientalis Forssk., *Fl. Aegypt.-Arab.* 206 (1775).
Tamarix articulata Vahl, *Symb. Bot.* 2: 48, t. 32 (1791), nom. illeg.

Glabrous tree or large shrub, 3-12 m; bark reddish-brown; stems with tender green shoots; branchlets jointed, green; leaves sheath-like, with a short pointed apex, without a blade; inflorescence paniculate, the racemes 3-8 x 0.3-0.4 cm; bracts 1 mm, triangular, clasping, acuminate; pedicel 0.5-1 mm; flowers 2-2.5 mm diam., sepals 5, 1-1.5 mm; petals 5, 1.5-2 mm, white or pinkish; stamens 5, the filaments jointed with the deep sinuses of the disc; styles 3; capsule 3-4 mm, pyriform; seeds 0.5 mm, with an apical tuft of hairs.

N, O, M, D, R, GE, S; saline soils, desert wadis and sandy plains. North Africa, Sinai, Arabia, Iran, Pakistan, Afghanistan, Sudan, Ethiopia, Somalia, Northwest tropical Africa.

NOTE: The tree is widely cultivated in Egypt, especially in coastal and desert regions as a windbreak and for its timber and shade. The type was collected from Egypt, Herb. Linn. 1136/3 (LINN).

2. **Tamarix tetragyna** Ehrenb., *Linnaea* 2: 258 (1827).
Syns. *Tamarix effusa* Ehrenb., *Linnaea* 2: 258 (1827).
Tamarix deserti Boiss., *Diagn. Pl. Orient.*, ser. 1, 10: 9 (1849).
Tamarix meyeri Boiss., *Diagn. Pl. Orient.*, ser. 1, 10: 9 (1849).

Papillose to glabrous shrub, 1-3 m; bark purple to dark brown; leaves 2-6 mm, sessile, oblong-lanceolate, not clasping at the base, the apex acute to acuminate; inflorescence of lateral solitary racemes 5-10 x 0.6-1.2 cm; bracts 2-3.5 mm, oblong-linear, the lower obtuse, the upper acuminate; pedicel 1-1.5 mm; flowers 5-6 mm diam.; sepals 4(-5), 1-2 mm, ovate-elliptic, the margin membranous; petals 4(-5), 3-4.5 mm, obovate-elliptic, white; stamens 4(-5), rarely with 1-3 extra epipetalous stamens; filaments inserted at the entire or retuse disc lobes; styles mostly 4, club-shaped; capsule 3-5.5 x 1.5-2 mm, pyramidal, 4-valved; seeds 1.2 mm, oblong, with a tuft of hairs.

N, O, M, D, R, S; saline sandy soils, swamps, edges of salt marshes. North Africa, East Mediterranean region, Iran, Southwest Russia.

NOTE: The type was collected from Lake Manzala, Egypt, by Ehrenberg (K!). Some authors treat *Tamarix deserti* and *T. meyeri* as separate species, others treat them as varieties of *T. tetragyna*. The two taxa are considered here as variants of *T. tetragyna* and listed as synonyms.

3. **Tamarix nilotica** (Ehrenb.) Bunge, *Tent. Tamaric.* 54 (1852).
Syns. *Tamarix (gallica) nilotica* Ehrenb., *Linnaea* 2: 269 (1827).
Tamarix arabica Bunge, *Tent. Tamaric.* 55 (1852).
Tamarix mannifera Bunge, *Tent. Tamaric.* 63 (1852).
Tamarix arborea (Ehrenb.) Bunge, *Tent. Tamaric.* 67 (1852).

For detailed taxonomy and nomenclature see Zohary, *Fl. Palaest.* 2: 355-358 (1972).

Shrub or tree 2-5 m; bark reddish-brown; young parts glabrous or papillose; leaves 1-3 mm, sessile, ovate-deltoid to lanceolate, slightly clasping, acute to acuminate; racemes

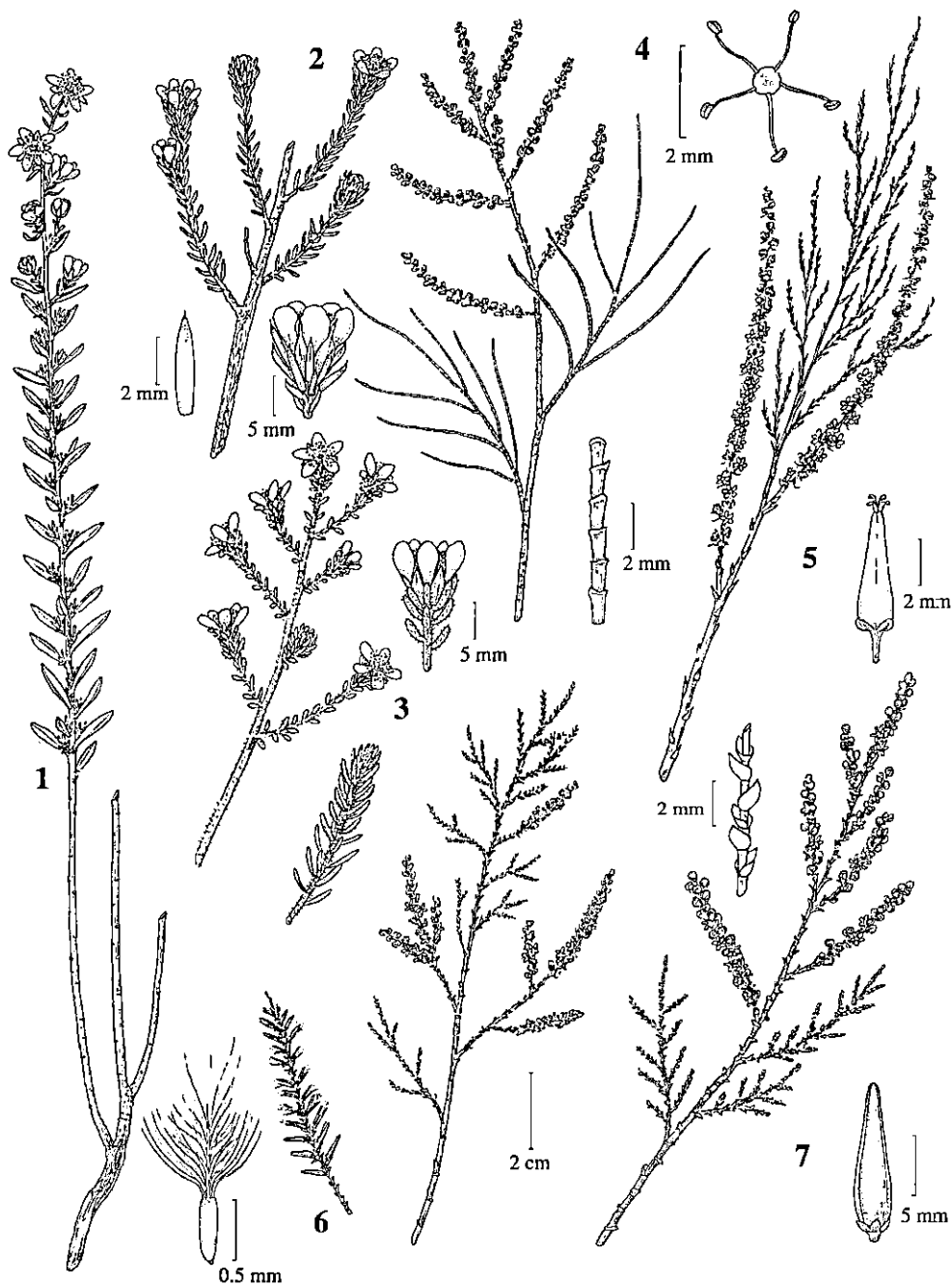


Plate 31. TAMARICACEAE: *Reaumuria alternifolia* 1, flowering branch. *Reaumuria vermiculata* 2, flowering branch; leaf (down left); flower (down right). *Reaumuria hirtella* 3, flowering branch; leafy branch (down right); flower (up right). *Tamarix aphylla* 4, flowering branch; vegetative branchlet (down right); disc and stamens (up right). *Tamarix tetragyna* 5, flowering branch; capsule (right). *Tamarix nilotica* 6, flowering branch; fruiting branch and seed (down left). *Tamarix passerinoides* 7, flowering branch; leafy branchlet (up left); capsule (down right). All drawings to the same scale, except the enlarged parts (scale given).

5-10 x 0.3 cm, lateral, slender, sometimes paniculate; bracts 1-2 mm, narrowly triangular, acuminate; pedicel 0.5-0.75 mm; flowers 3-4 mm diam.; sepals 5, 1-1.2 mm, margin membranous, apex obtuse; petals 5, 1.5-2 mm, ovate-elliptic, white, caducous; stamens 4-5; filaments exerted, inserted in the sinuses of the disc; styles 3, club-shaped; capsule 3.5-4.5 x 2 mm, pyramidal; seeds 0.5 mm, terete, with an apical tuft of hairs 1.5-2 mm.

N, O, M, D, R, GE, S; saline sandy soils, edges of salt marshes, coastal and inland sandy plains, Nile banks. North and Northeast Africa, East Mediterranean region, Sinai, Arabia.

NOTE: Widespread species in Egypt; very variable and several varieties are described which are often treated as separate species; Zohary, Fl. Palaest. 2: 255-258 lists 9 varieties. The type was collected from Egypt by Ehrenberg (K!).

4. **Tamarix amplexicaulis** Ehrenb., *Linnaea* 2: 275 (1827).

Glabrous shrub 1-2 m, usually covered with salt grains; bark reddish-brown; leaves 1.5-2.5 mm, ovate-deltoid, the base cordate and clasping, punctate, the apex acute to acuminate and spreading, margin not membranous; inflorescence 3-4 x 0.3 cm, of simple compact spikes; bracts *c.* 1 mm, leaf-like, acute; pedicel 0; flowers 3-4 mm diam., ± sessile; sepals 5, *c.* 1 mm, ovate, acute; petals 5, 1.5-2.5 x 0.75 mm, oblong-elliptic, white; disc 0; stamens 8-10; filaments 2 mm, dilated at the base; anthers apiculate; styles 3, club-shaped; capsule 5-6 x 2-2.5 mm, pyramidal, attenuate towards the apex; seeds 1-1.25 mm, ovoid-oblong, with an apical tuft of hairs 3-4 mm.

N, O, D, R; saline soils. Libya, Egypt, Palestine, Syria, Arabia, Sudan.

NOTE: The type was collected from Egypt.

5. **Tamarix passerinoides** Delile ex Desv., *Ann. Sci. Nat. Bot.*, sér. 1, 4: 349 (1825).

Shrub 1-2 m; bark purple-brown; young parts papillose; leaves 1-1.5 mm, amplexicaul, the apex acute, spreading; inflorescence of simple racemes or paniculate; racemes 3-5 x 0.5-0.8 cm; bracts *c.* 1 mm, clasping, acute; pedicel 1-1.5 mm; flowers 2.5-3.5 mm diam.; sepals 5, 1.5-2 mm, broadly ovate, acute; petals 5, 3.5-4.5 mm, broadly-elliptic to ovate, spreading, pink; stamens 10-13, in 2 whorls, filaments shorter than the petals; capsule 0.6-1 x 0.2-0.3 cm, ovoid-pyramidal; seeds 1-1.5 mm, oblong, with an apical tuft of hairs 4-5 mm.

N, O, M, D, S; saline soils. Sudan, Libya, Egypt, Palestine, Arabia, Iran, Afghanistan, Russia.

NOTE: The type was collected from Faiyum, Egypt, by Redouté (MPU).

6. **Tamarix macrocarpa** (Ehrenb.) Bunge, *Tent. Tamaric.* 80 (1852).

Syn. *Tamarix passerinoides* Delile ex Desv. var. *macrocarpa* Ehrenb., *Linnaea* 2: 276 (1827).

Like *Tamarix passerinoides*, but sepals usually obtuse; stamens 6-10; capsule 0.7-1.3 cm.

N, O, D, R, S; saline soils. North Africa, Sinai, extending eastwards to Pakistan.

NOTE: The type was collected from the Eastern Desert, Egypt by Ehrenberg (isotype, K!). Some authors consider *Tamarix macrocarpa* to be conspecific with *Tamarix passerinoides*; others treat it as a variety of the latter species.

FRANKENIACEAE

Annuals, perennials or low shrubs; leaves opposite or whorled, exstipulate; flowers regular, bisexual (our species), solitary or in cymes; sepals 4-7, persistent; petals 4-7, clawed, often with a scale-like appendage inside; stamens 4-6 or numerous, free or connate at the base; ovary superior, sessile, 1-locular, with 2-4 parietal placentas, style filiform; capsule loculicidally dehiscent by valves, enclosed within the persistent calyx; seeds with mealy endosperm. 2 genera, 81 species, mostly temperate and subtropical saline habitats.

1. *Frankenia* L.

Low shrubs or herbs; flowers bisexual; sepals (4-)5; stamens 3-6, free, in 2 whorls, outer stamens shorter than the inner; stigmas filiform or \pm capitate; ovary of 2-4 carpels; fruit a capsule, enclosed by the persistent calyx; seeds smooth, glabrous, papillose or pubescent. About 80 species, temperate and subtropical saline habitats.

1. Prostrate annual; leaves obovate to spatulate, petiolate,
margin flat or slightly revolute

1. *F. pulverulenta*

+ Low shrub; leaves linear to linear-oblong, sessile, margin strongly
revolute

2. *F. hirsuta*

1. *Frankenia pulverulenta* L., Sp. Pl., ed. 1, 332 (1753).

Prostrate annual, finely pubescent to glabrescent, branched at the base; stems 5-25 cm, terete; leaves 2-5 x 1-3 mm, clustered in whorls of 3-4, obovate to spatulate, the margin entire, flat or slightly revolute, the apex rounded; petiole 0.5-2 mm; flowers sessile, solitary or in dichasial leafy cymes; sepals 2-3 mm, the tube with 5 prominent ribs, the teeth acute; petals 3.5-4 mm, pink, narrowed into a long claw; stamens 6, in 2 whorls; style 3-fid; stigmas linear-clavate; capsule 2-3 x 1 mm, oblong-ovoid; seeds 1 x 0.5 mm, oblong-ellipsoid, minutely papillose, brownish.

N, O, M, D, R, S; moist saline soils, edges of salt marshes, roadsides. Macaronesia, Portugal, Mediterranean region, Sinai, Arabia, Iraq, Iran, Pakistan, Afghanistan, Central and North Asia; introduced elsewhere.

2. *Frankenia hirsuta* L., Sp. Pl., ed., 1, 331 (1753).

Syns. *Frankenia revoluta* Forssk., Fl. Aegypt.-Arab. 75 (1775).

Frankenia hispida DC., Prodr. 1: 349 (1824).

Frankenia intermedia DC., Prodr. 1: 349 (1824).

Frankenia aucheri Jaub. & Spach, Ill. Pl. Orient. 2: 105, t. 187 (1847).

Frankenia hirsuta L. var. *erecta* Boiss., Fl. Orient. 1: 780 (1867).

Frankenia laevis L. subsp. *intermedia* (DC.) Maire in Jahand. & Maire,
Cat. Pl. Maroc 486 (1932).

Frankenia hirsuta L. subsp. *intermedia* (DC.) E. Fourn., Quatre Fl. France
441 (1936).

Frankenia laevis L. subsp. *hirsuta* (L.) Emb. & Maire, Cat. Pl. Maroc 1071 (1941).

Low scabrid-puberulent shrub, 10-30 cm; stems hispid, branched; leaves 3-6 x 1-1.5 mm, sessile, in fascicles, linear to linear-oblong, hispid with spreading white hairs, the margin strongly revolute; flowers sessile, in dichasial leafy cymes; sepals 5-6 mm; calyx-tube oblong, pubescent with short white hairs and 5 prominent ribs; teeth 1-1.5 mm, triangular, acute; petals 5-7 mm, pink or purplish, narrowed into a long claw, the apex irregularly dentate; stamens 6; capsule 2.5-3 mm, ovoid, 3-valved; seeds 0.75 mm, ellipsoid, papillose.

O, M, De, S; sea shores, saline sandy soils, edges of salt marshes. Central Europe, Mediterranean region, Sinai, Iran, Central Asia.

ELATINACEAE

Annuals, perennials or low shrubs; leaves simple, opposite or whorled, entire, stipulate; flowers solitary or in cymes, axillary, bisexual, actinomorphic; sepals 3-5, free or connate at the base, imbricate; petals 3-5, free, imbricate; stamens as many as or twice as many as the petals; ovary superior, 3-5-locular; placentation axile; styles 3-5, free; ovules numerous; fruit a septicidal capsule; seeds often curved, endosperm 0 or scanty. 2 genera, 34 species, temperate and tropical regions.

1. Leaves entire, glabrous
+ Leaves denticulate, hairy

1. **Elatine**
2. **Bergia**

1. **Elatine** L.

Small aquatic herbs, glabrous or glabrescent; leaves opposite or whorled; flowers minute, generally solitary; sepals 3-4, obtuse; petals white or pink, caducous; stamens 3-4, 6 or 8, free; ovary globose; styles 3-4, free; capsule membranous; seeds cylindrical, straight or curved, wrinkled or pitted. 10 species, tropical and temperate regions.

1. **Elatine macropoda** Guss., Fl. Sic. Prodr. 1: 475 (1827).

Syn. *Elatine campylosperma* Seub. in Walp., Repert. Bot. Syst. 1: 284 (1842).

Glabrous annual 3-10 cm; stems prostrate, reddish, mat-forming, rooting at the nodes, branched; leaves 0.4-1 x 0.1-0.2 cm, opposite, oblong-spathulate, deep green, entire, glabrous, the apex rounded, the base tapering to a petiole 3-6 mm; stipules 0.5 mm, interpetiolar, deltoid; flowers axillary, solitary, 4-merous; peduncle 1.5 mm, elongate to 5-8 mm in fruit; sepals 4, 1-2 mm, persistent, oblong, obtuse, connate at the base; petals 4, c. 1.5 x 1 mm, oblong, white or pinkish; stamens 8, c. 1 mm, the filaments flattened; ovary 1-1.5 mm, subglobose; styles 4, c. 0.25 mm; stigmas subcapitate; capsule c. 2 mm, ± spherical, dehiscing into 4 parts; seeds 0.8 mm, curved, ribbed.

N (El-Khanka, near Cairo); muddy pool margins. Mediterranean region, Southwest Siberia.

NOTE: The only record of this species from Egypt is a specimen collected by Schweinfurth in August 1880 from El-Khanka, near Cairo (K!).

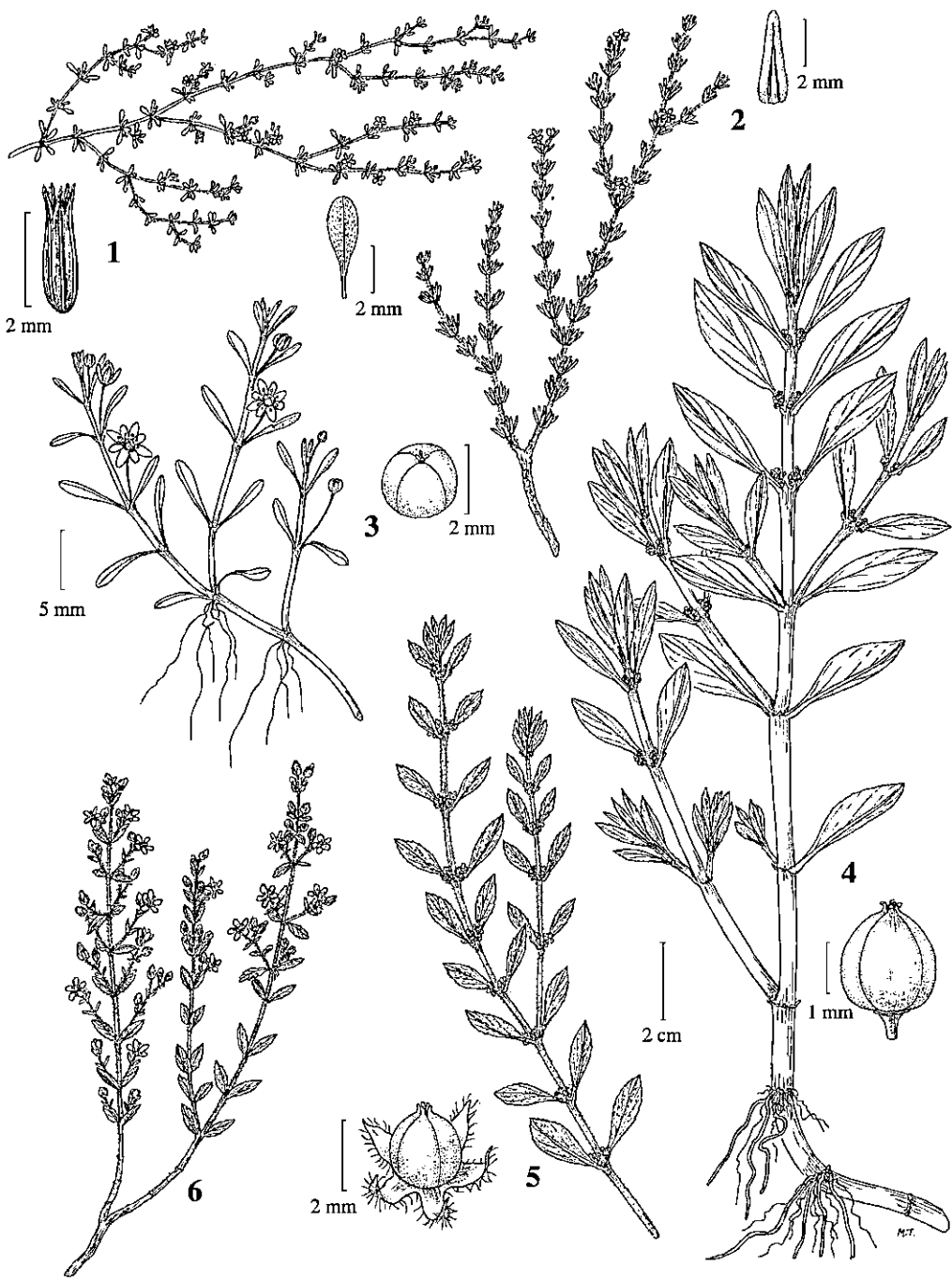


Plate 32. FRANKENIACEAE: *Frankenia pulverulenta* 1, flowering branch; leaf (down right); calyx (down left). *Frankenia hirsuta* 2, flowering branch; leaf (up right). **ELATINACEAE:** *Elatine macropoda* 3, flowering branch; fruit (right). *Bergia capensis* 4, habit; fruit (down right). *Bergia ammannioides* 5, flowering branch; fruit (down left). *Bergia suffruticosa* 6, flowering branch. All drawings to the same scale, except the enlarged parts (scale given).

2. *Bergia* L.

Annuals or perennials, hairy or glandular-hairy, rarely glabrous; leaves opposite, denticulate; flowers 5-merous, rarely 3-merous, in axillary clusters or umbels, rarely solitary, bracteate; sepals and petals usually free; stamens 10, rarely 5 or more than 10; ovary 5(3-6)-locular, ovoid-globose; styles as many as the locules; stigmas capitate; fruit a dehiscent corky capsule; seeds numerous, small, smooth or wrinkled. 24 species, warm regions, but especially Australia.

1. Low shrub
+ Annual herb

3. *B. suffruticosa*
2

2. Plant glabrous
+ Plant hairy

1. *B. capensis*
2. *B. ammannioides*

1. *Bergia capensis* L., Mant. Alt. 241 (1771).

Syn. *Bergia aquatica* Roxb., Pl. Coast Corom. 2: 22, t. 142 (1791).

Glabrous annual; stems thick, succulent, creeping, 20-50 cm, rooting at the nodes; branches erect or ascending, reddish; leaves 1-4.5 x 0.6-1.8 cm, opposite, subsessile to short-petiolate, oblong-lanceolate, the apex acute to obtuse, the margin finely serrulate, with reddish teeth; petiole 1-5 mm; stipules 1.5-3 mm, triangular, acute; flowers in dense axillary clusters; pedicel 0.5-2 mm; sepals 5, 1-2 mm, lanceolate-elliptic, acuminate; petals 5, 1-2 x 0.5 mm, white or pink; stamens 10; filaments filiform; ovary subglobose; styles 0.25 mm, recurved; capsule 2.5-3 mm, subglobose; seeds 0.5 mm, oblong-ellipsoid, curved, reticulate, glossy, brown.

N, O; rice fields, irrigation canals. Egypt, Sudan, tropical East and South Africa, Iraq, Caucasus, India, Sri Lanka, Vietnam, Java.

2. *Bergia ammannioides* F. Heyne ex Roth, Nov. Pl. Sp. Ind. Orient. 219 (1821).

Syn. *Bergia ammannioides* Roxb., Hort. Bengal. 34 (1814), nom. nud.

Annual 10-30 cm; stems erect, reddish, decumbent or prostrate, branched, pilose or glandular-hairy; leaves 0.5-3.5 x 0.2-1.5 cm, opposite, subsessile or short-petiolate, elliptic-oblong, the margin serrulate, with reddish teeth, the apex acute, glandular-hairy; petiole 1-5 mm; stipules 1-3 mm, serrulate, acute; flowers 3-5-merous, in dense axillary clusters; pedicel 1-3 mm; sepals 1.5-3 mm, lanceolate, acute or acuminate; petals 1-2.5 x 0.5-1 mm, obtuse, white or pink; stamens 5-10; ovary ovoid-globose; styles 0.25 mm, recurved; capsule 2 mm, globose, reddish; seeds 0.4 mm, ± cylindrical, reticulate, glossy, brown.

N; rice fields, irrigation canals. Egypt, tropical Africa, Southwest and East Asia, India, Sri Lanka, Philippines, Australia.

3. *Bergia suffruticosa* (Delile) Fenzl, Denkschr. Bayer. Bot. Ges. Regensb. 3: 183 (1841).

Syn. *Lancretia suffruticosa* Delile, Descr. Egypte, Hist. Nat. 213, t. 25 (1814).

Aromatic low shrub 30-80 cm; stems erect with many opposite branchlets, the young densely hispid; old branches glabrous with rust-coloured bark; leaves 0.3-2.5 x 0.1-0.5

cm, opposite or whorled, sessile or short-petiolate, elliptic, the margin serrate, the apex acute, densely scabrid-pubescent, sometimes glandular; petiole 0-2.5 mm; stipules 1.5-2 mm, linear-lanceolate, pubescent; flowers 5-merous, solitary or in 2-6-flowered fascicles; pedicel 1-5 mm, pubescent; sepals 2.5-4 mm, acute to acuminate, pubescent, the margin membranous; petals 3-4 x 1.5 mm, obovate-oblong, white to pinkish; stamens 10; ovary 5-sulcate, ovoid; style 1 mm; capsule 2 mm, ovoid, pinkish; seeds 0.5 mm, ellipsoid, reticulate, glossy, blackish-brown.

N (Elephantine Island, Aswan); moist ground. Senegal, Mauritania, Egypt, Sudan, Arabia, Pakistan, India.

NOTE: The species in Egypt seems to be restricted to Elephantine Island, Aswan. The three available specimens were recorded from the same locality: two were collected in 1846 and 1917 and the most recent by P. H. Davis 6001 B, 8 December 1943 (K!).

CUCURBITACEAE

Herbaceous or woody climbers, or stems trailing; tendrils usually present; leaves alternate, simple and palmately veined (our species) or compound; flowers usually unisexual, axillary, monoecious or dioecious; petals (3-5), free or united; stamens usually 5, sometimes 3, alternate with the petals, inserted on the receptacle-tube or on the basal disc; ovary usually inferior, generally 1-locular, of (2-)3(-5) united carpels; placentation parietal or rarely axillary; ovules 1-many; style 1, usually with 3, 2-lobed stigmas; fruit a dry or fleshy capsule, berry or hard-shelled pepo, indehiscent or dehiscent, 1-many-seeded; seeds large, compressed; endosperm absent. 119 genera, 775 species, tropical and warm regions, few temperate.

- | | |
|---|---------------------------|
| 1. Leaves glabrous, sometimes punctate on the upper surface | 2 |
| + Leaves hairy, strigose or scabrid | 4 |
| 2. Tendrils 2-fid; male and female flowers intermixed in the same leaf axil | 2. Diplocyclos |
| + Tendrils simple; male and female flowers in separate leaf axils | 3 |
| 3. Fruit 3-7 x 1.5-4 cm, ellipsoid | 5. Coccinia |
| + Fruit 7-9 x 5.5-7 mm, subglobose | 3. Zehneria |
| 4. Fruits in clusters | 5 |
| + Fruits solitary | 6 |
| 5. Flowers greenish-yellow; stamens 5; fruit ovoid or conical, short-beaked | 7. Corallocarpus |
| + Flowers greenish-white; stamens 3; fruit globose, not beaked | 1. Bryonia cretica |
| 6. Male flowers in racemes | 7 |
| + Male flowers solitary | 8 |
| 7. Fruit conical or pyriform, beaked by the persistent style | 4. Kedrostis |
| + Fruit globose, not beaked | 1. Bryonia syriaca |

8. Fruit 6-12 cm diam., globose, smooth
+ Fruit 1.5-5 cm long, ellipsoid, with fleshy spines, bristly or prickly-tuberculate

6. *Citrullus*

8. *Cucumis*

1. *Bryonia* L.

Dioecious or rarely monoecious scandent herbs, with tuberous rootstock; leaves simple, palmately lobed; tendrils simple; male flowers in racemes; female flowers in racemes or rarely solitary; receptacle-tube short, ± campanulate; calyx 5-dentate; corolla deeply 5-fid, almost rotate, segments ovate; stamens 3, one 1-theous, two 2-theous; ovary globose; fruit a globose, few-seeded berry; seeds smooth. 12 species, Eurasia, North Africa, Canary Islands.

1. Petals of female flower equalling the sepals; fruits solitary
+ Petals of female flower twice as long as the sepals; fruits clustered

1. *B. syriaca*

2. *B. cretica*

1. *Bryonia syriaca* Boiss., *Diagn. Pl. Orient.*, ser. 2, 2: 59 (1856).

Syn. *Bryonia micrantha* Boiss., *Diagn. Pl. Orient.*, ser. 1, 10: 7 (1849), non Hochst. ex A. Rich. (1847).

Perennial dioecious herb, rarely monoecious; stems angular, grooved, glandular-hairy; tendrils simple, long; leaves strigose, scabrid on both surfaces; blade 3-7 x 2.5-5 cm, cordate-ovate, repand-dentate, not or obscurely lobed; petiole 1-3 cm; *male flowers*: 1.2 cm diam., in 3-12-flowered racemes; peduncle 5-10 cm; petals 1.2 cm, hairy, yellow, green-veined; *female flowers*: solitary; petals equalling the sepals; berry 1-1.2 cm, solitary, globose, smooth, orange, on a glandular-hairy stalk 0.5-1 cm.

S; stony ground. Sinai, Palestine, Lebanon, Syria, Turkey.

2. *Bryonia cretica* L., *Sp. Pl.*, ed. 1, 1013 (1753).

Perennial dioecious herb, rarely monoecious; stems angular, grooved, glabrous or sparsely hairy; tendrils simple, long; leaves strigose or with bulbous hairs; blade 2-5 x 2-5 cm, suborbicular in outline, deeply 5-7-lobed, the base cordate; lobes lanceolate, entire or with few lobules, acute; petiole 0.5-1.5 cm; *male flowers*: 1-1.2 cm diam., 10-25-flowered racemes; peduncle to 15 cm; pedicel 3-8 mm, filiform; petals pubescent; *female flowers*: on racemes 5-20-flowered; petals twice as long as the sepals; berry 7-9 mm, globose, orange, in clusters, on a stalk 3-8 mm.

M; limestone crevices. Libya, Egypt, Palestine, Turkey, Crete, Aegean Islands.

2. *Diplocyclos* (Endl.) Post & Kuntze

Perennial herbaceous climbers; leaves simple, palmately lobed; tendrils 2-fid; flowers monoecious, the male and female flowers intermixed in the same leaf axil; receptacle-tube short and broad; calyx lobes small; corolla 5-lobed; stamens 3, 2 double 2-theous and 1 single 1-theous, free; ovary green with longitudinal white lines; ovules few; stigma 3-lobed; fruit solitary or in clusters, subsessile, globose or ovoid, thin-walled, fleshy, indehiscent, red with white longitudinal stripes; seeds small, with 2-grooved margin. 4 species, tropical Africa and Asia.

1. **Diplocyclos palmatus** (L.) C. Jeffrey, Kew Bull. 15: 352 (1962).
Syns. *Bryonia palmata* L., Sp. Pl., ed. 1, 1012 (1753).
Bryonia affinis Endl., Fl. Norfolk 1: 68 (1853).

Perennial herbaceous climber 1-3 m; rootstock fleshy; young stems glabrous, angular, grooved; leaves glabrous, sometimes punctate on the upper surface; leaf blade 4-10 x 4-10 cm, broadly ovate-cordate, palmately 5-lobed; lobes lanceolate-elliptic, narrowed below, entire, acute; petiole 2.5-6 cm; *male flowers*: 2-6, in sessile clusters, intermixed with female flowers; pedicel 0.5-1.5 cm; receptacle-tube 3-4 mm; calyx-lobes 0.5-1.2 mm, filiform; petals white, cream or greenish yellow; *female flowers*: on pedicels 1-5 mm; ovary c. 5 x 3 mm, ellipsoid, green with longitudinal white markings; fruits 1.5-2 x 1.5-2.5 cm, subglobose to ovoid-ellipsoid, solitary or in clusters of 2-5, on stalks 1-5 mm, bright scarlet with white longitudinal stripes; seeds 5 x 3.5 mm, pyriform.

GE; climber on various shrubs. East and Central tropical Africa, tropical Asia and Australia.

3. **Zehneria** Endl.

Herbaceous climbers, sometimes becoming woody at the base; leaves simple, petiolate, often palmately lobed; tendrils simple; flowers monoecious or dioecious, usually white; male flowers solitary or in clusters, pedicellate; receptacle-tube campanulate, the lobes small, dentiform; petals small, connate at the base; stamens usually 3, all 2-theccus; female flowers solitary or in clusters, pedicellate; ovary subglobose to fusiform, smooth; staminodes 3, usually present; disc prominent; stigma 3-lobed; fruit solitary or in clusters, globose to fusiform, smooth or punctate when dry; seeds small, elliptic to ovate, with an obscure or distinct border. 30 species, Old World tropics.

1. **Zehneria anomala** C. Jeffrey, Kew Bull. 15: 364, f. 3 (1962).

Perennial climber; young stems glabrous, soon becoming woody, with grey bark; tendrils simple; leaves glabrous, somewhat fleshy; blade 1.5-3 x 1.5-3 cm, deeply 3-5-lobed, lobes variable in shape; petiole 0.5-1.2 cm; flowers dioecious or monoecious; *male flowers*: in 2-6-flowered subsessile clusters; pedicel 3-4 mm, filiform; receptacle-tube 2.5 mm; petals c. 1.5 mm, yellowish; stamens 3; *female flowers*: solitary, subsessile; petals c. 1.5 mm; ovary c. 3.5 mm, fusiform; fruit 7-9 x 5.5-7 mm, subglobose, solitary, scarlet, on a pedicel 3-5 mm; seeds 3 x 2 mm, lenticular, obscurely bordered.

GE; climber on trees and shrubs. Southeast Egypt, Northeast Sudan, Kenya, Ethiopia, Arabia.

4. **Kedrostis** Medik.

Climbing or trailing perennial herbs, sometimes woody; leaves simple, palmately lobed, sometimes deeply dissected; tendrils simple; flowers monoecious or dioecious, small, greenish-white, greenish-yellow or yellow; *male flowers*: in racemes or fascicles, pedicellate; receptacle-tube campanulate, the lobes small; petals connate at the base; stamens 5, all 1-theccous; *female flowers*: solitary or few in fascicles, subsessile; staminodes 5; stigma 2(-3)-lobed; fruit solitary, paired or few in fascicles, subsessile or stalked, fleshy, conical or pyriform, usually beaked, red, hairy; seeds small, pyriform to subglobose, usually smooth. 23 species, Old World tropics.



Plate 33. CUCURBITACEAE: *Bryonia syriaca* 1, flowering branch; fruiting branch (left). *Bryonia cretica* 2, flowering branch; fruiting branch (down right). *Diplocyclos palmatus* 3, flowering branch; fruit (down left). *Zehneria anomala* 4, flowering and fruiting branch; fruit (up right). *Kedrostis foetidissima* 5, fruiting branch; fruit (down left). *Kedrostis gijef* 6, flowering branch; fruit and old stem (right). All drawings to the same scale, except the enlarged parts (scale given).

1. Leaves unlobed; flowers monoecious; stamens 3; fruit 1.5-2.5 cm, pyriform, hairy, beak 1-1.2 cm 1. **K. foetidissima**
 + Leaves 3-lobed; flowers dioecious; stamens 5; fruit 1.2-1.5 cm, conical, glabrous, beak 2-3 mm 2. **K. gijef**

1. **Kedrostis foetidissima** (Jacq.) Cogn. in A. & C. DC., Monogr. Phan. 3: 634 (1881).
 Syns. *Trichosanthes foetidissima* Jacq., Collect. Bot. 2: 341 (1789).
Bryonia rostrata Rottl., Neue Schrift. Ges. Nat. Freunde Berlin 4: 213 (1803).
Rhynchocharpa foetida Schrad., Linnaea 12: 403 (1838).

For full synonymy see Jeffrey in Milne-Redhead & Polhill (eds.) Fl. Trop. E. Afr. Cucurbitaceae 138 (1967).

Climbing or trailing perennial herb, 0.5-2 m, with offensive odour when crushed, densely strigose or glandular hairy, sometimes with bulbous hairs; young stems quadrangular; old stems thick at the base, arising from a tuberous rootstock; leaves 3-8 x 2.5-6 cm, deltoid to orbicular-cordate, unlobed, scabrid, hairy, the base hastate, the margin spinulose, the apex acute; petiole 0.5-4.5 cm; tendrils simple; flowers monoecious; *male flowers*: in axillary lax fascicles; receptacle-tube 2 mm, campanulate, hairy; calyx-lobes 1-2 mm, filiform; petals 3.5 x 2 mm, yellow; stamens 3; *female flowers*: usually solitary, rarely in pairs; ovary beaked; fruit 1.5-2.5 cm, pyriform, hairy, the beak 1-2 cm; seeds 4-6 x 3 mm, pyriform, smooth.

GE; trailing or climbing on shrubs. Tropical and South Africa, tropical Asia.

2. **Kedrostis gijef** (J. F. Gmel.) C. Jeffrey, Kew Bull. 15: 354 (1962).
 Syns. *Turia gijef* J. F. Gmel., Syst. Nat., ed. 13, 2: 403 (1791).
Corallocarpus gijef (J. F. Gmel.) Hook. f., Fl. Trop. Afr. 2: 566 (1871).
Corallocarpus parvifolius Cogn. in A. & C. DC., Monogr. Phan. 3: 658 (1881).
Corallocarpus harmsii A. Zimm., Cucurbitac. 2: 177, 93, f. 70/5 (1922).

Perennial climber 1-3 m; young stems quadrangular, herbaceous; old stems woody and thickened, with rough pinkish bark; leaves 2-5 x 2-7 cm, simple, 3-lobed, the lobes rounded, sinuate-toothed, apiculate; petiole 1-2.5 cm, scabrid; tendrils simple; flowers dioecious; *male flowers*: solitary or in axillary clusters, receptacle-tube 2-3 mm; calyx-lobes 1-2 mm, triangular, acuminate; petals 1.5-2.5 x 1.5 mm, greenish-yellow; stamens 5; *female flowers*: solitary or in groups of 2-5; fruit solitary or in clusters, 1.2-1.5 cm, conical, glabrous, the beak 2-3 mm; seeds 6 x 3.5 mm, pyriform, rugose.

GE; climber on trees and shrubs. Southeast Egypt, Sudan, Ethiopia, Kenya, Tanzania, Somalia, Arabia.

5. **Coccinia** Wight & Arn.

Climbers or trailers; leaves simple; tendrils simple or proximally 2-fid; flowers orange, yellow or brownish-yellow, dioecious; male flowers solitary, clustered or more frequently in racemes; receptacle-tube short and broad; calyx lobes usually small, dentiform; corolla gamopetalous, 5-lobed; stamens usually 3, all 2-theous; female flowers solitary or rarely in racemes; ovary smooth; ovules numerous; stigma 3-lobed; fruit globose to elongate, fleshy, terete or ribbed, indehiscent, red or red mottled with

green; seeds compressed, ovate. 30 species, tropical regions, but especially tropical and South Africa.

1. Male flowers solitary or in clusters of 2-4, on short peduncles; fruit 3-6 x 1.5-3.5 cm, globose-ellipsoid, reddish-orange when ripe **1. C. grandis**
+ Male flowers in racemose clusters of 5-7 on peduncles to 16 cm; fruit 5-7.5 x 3.5-4 cm, ellipsoid, red with lines of paler spots when ripe **2. C. abyssinica**

1. **Coccinia grandis** (L.) Voigt, Hort. Suburb. Calc. 59 (1845).

Syns. *Bryonia grandis* L., Mant. 126 (1767).

Coccinia indica Wight & Arn., Prodr. 347 (1834).

Coccinia palmatisecta Kotschy, Pl. Bind. 11, t. 4 (1865).

For full synonymy see Jeffrey in Milne-Redhead & Polhill (eds.), Fl. Trop. E. Afr., Cucurbitaceae 69 (1967).

Herbaceous perennial, climber, trailer or deciduous soft-woody climber to 12 m, with tuberous rootstock; leaf-blade 4-10 x 4-12 cm, broadly ovate, obscurely to deeply 3-5-lobed, glabrous or punctate on the upper surface, the base cordate, the margin sinuate-dentate; petiole 1-4 cm, glabrous; *male flowers*: solitary or in clusters of 2-4, on short peduncles; receptacle-tube 4-7 mm, obconical; calyx-lobes 3-6 mm, triangular-lanceolate; petals 1.5-2 x 1-1.5 cm, connate in the lower half, pale yellow; *female flowers*: solitary, pedicel 0.5-2.5 cm; petals 2-3.5 cm, yellow; ovary 0.5-1.5 cm, ellipsoid; fruit 3-6 x 1.5-3.5 cm, globose-ellipsoid, reddish-orange when ripe, on a stalk 0.5-4 cm; seeds 6 x 2.5-3 mm, ovoid, compressed, covered with fibres.

GE; climber on trees and shrubs. Tropical Africa, Asia and Australia.

2. **Coccinia abyssinica** (Lam.) Cogn. in A. & C. DC., Monogr. Phan. 3: 536 (1881).

Syns. *Bryonia abyssinica* Lam., Encycl. 1: 497 (1785).

Cephalandra diversifolia Naudin, Ann. Sci. Nat., sér. 5, 5: 18, t. 7 (1866).

Coccinia diversifolia (Naudin) Cogn. in A. & C. DC., Monogr. Phan. 3: 536 (1881).

Herbaceous perennial, climber or trailer, 0.5-3 m; rootstock tuberous, fleshy; leaf-blade 6-15 x 6-17 cm, ovate, shallowly to deeply palmately 5-lobed; lobes triangular to ovate, the margin sinuate-dentate, the apex acute; petiole 2-12 cm; tendrils simple; *male flowers*: in racemose clusters of 5-7; peduncle to 16 cm; receptacle-tube 6-7 mm, conical-campanulate, villous; sepals 2-6 mm, linear-lanceolate; petals 1.5-2 cm, connate in the lower half, pale yellow; *female flowers*: solitary; ovary 1.5-2 cm, ellipsoid, villous; fruit 5-7.5 x 3.5-4 cm, ellipsoid, red with lines of paler spots when ripe; seeds 6-7 x 3.5 mm, covered with fibres.

GE; climber on shrubs and trees, or trailing. Southeast Egypt, North and Central Sudan, Ethiopia.

6. **Citrullus** Schrad. ex Eckl. & Zeyh., nom. conserv.

Monoecious annual or perennial herbs, climbers or trailers; tendrils branched or unbranched; leaves deeply palmately-lobed; lobes lobulate; male and female flowers solitary, axillary; *male flowers*: receptacle-tube short, campanulate; sepals narrow; petals

rotate or broadly campanulate, lobed, yellow; stamens free; *female flowers*: perianth similar to that of male flowers, ovary subglobose, hairy; staminodes present; stigma 3-lobed; fruit \pm spherical, large, greenish, fleshy, firm-walled, indehiscent; seeds many, compressed, ovate, smooth. 4 species, tropical and South Africa.

1. **Citrullus colocynthis** (L.) Schrad., *Linnaea* 12: 414 (1838).

Syns. *Cucumis colocynthis* L., *Sp. Pl.*, ed. 1, 1011 (1753).

Colocynthis vulgaris Schrad., *Ind. Sem. Hort. Gött.* 2 (1832).

Scabrous perennial; stems 0.5-1.5 m, procumbent, branched, angular, hirsute; root fleshy; leaves rough on both surfaces; leaf-blade 3-10 x 2-5 cm, triangular-ovate, deeply 5-7 lobed; lobes lobate, sinuate-undulate, the base cordate; petiole 1-3 cm, rigid; tendrils simple, short; *male flowers*: on pedicels 1-2 cm; receptacle-tube 1.5-2.5 mm, broadly obconical; calyx-lobes 2-4 mm, lanceolate; petals 1 x 0.5 cm, yellow, connate at the base; *female flowers*: on pedicels 1-4.5 cm; ovary 8 x 6-8 mm, subglobose, hairy; fruit 6-12 cm diam., globose, smooth, green, mottled with yellow or entirely yellow when ripe, with a firm wall, fleshy, on a stalk 1.5-5.5 cm; seeds 6-9 x 3.5-4 mm, ovate, compressed.

N, O, M, D, R, GE, S; sandy plains, desert wadis, edges of cultivation in reclaimed lands. Atlantic Islands, North Africa, Sinai, Sudan, Kenya, Ethiopia, West Asia to Afghanistan and Pakistan.

NOTE: All parts of the plant are very bitter, and used in medicine as a purgative.

7. **Corallocarpus** Welw. ex Hook. f.

Herbaceous perennial climbers or trailers; roots tuberous; leaves simple, the blade palmately lobed; tendrils simple; flowers monoecious, small, greenish-yellow; *male flowers*: in subcapitate or racemose inflorescences; receptacle-tube campanulate; calyx-lobes small; petals connate at the base; stamens 5, all 1-theous; *female flowers*: solitary or in fascicles, staminodes when present 5; stigmas 2(-3)-lobed; fruit a small red ovoid or conical, often short-beaked berry; seeds small, pyriform, rarely subglobose. 13 species, tropical Africa, Madagascar, Arabia, India.

1. **Corallocarpus schimperi** (Naudin) Hook. f. in Oliv., *Fl. Trop. Afr.* 2: 567 (1871).

Syns. *Rhynchocharpa schimperi* Naudin, *Ann. Sci. Nat.*, sér. 4, 16: 180 (1862).

Corallocarpus erostris (Schweinf.) Hook. f. in Oliv., *Fl. Trop. Afr.* 2: 567 (1871).

Corallocarpus chrenbergii (Schweinf.) Hook. f. in Oliv., *Fl. Trop. Afr.* 2: 566 (1871).

Corallocarpus velutinus C. B. Clarke in Hook. f., *Fl. Brit. Ind.* 2: 628 (1879).

Corallocarpus courbonii (Naudin) Cogn. in A. & C. DC., *Monogr. Phan.* 3: 655 (1881).

For full synonymy see Jeffrey in Milne-Redhead & Polhill (eds.), *Fl. Trop. E. Afr.*, Cucurbitaceae 145 (1967).

Perennial climber; young stems herbaceous, soon thickening to develop a reddish-brown, papery bark; leaves 3-8 x 3-10 cm, broadly ovate-cordate, slightly fleshy, unlobed or 3-5-lobed, sinuate-dentate, densely and finely scabrid-hairy; petiole 2-4 cm; *male*

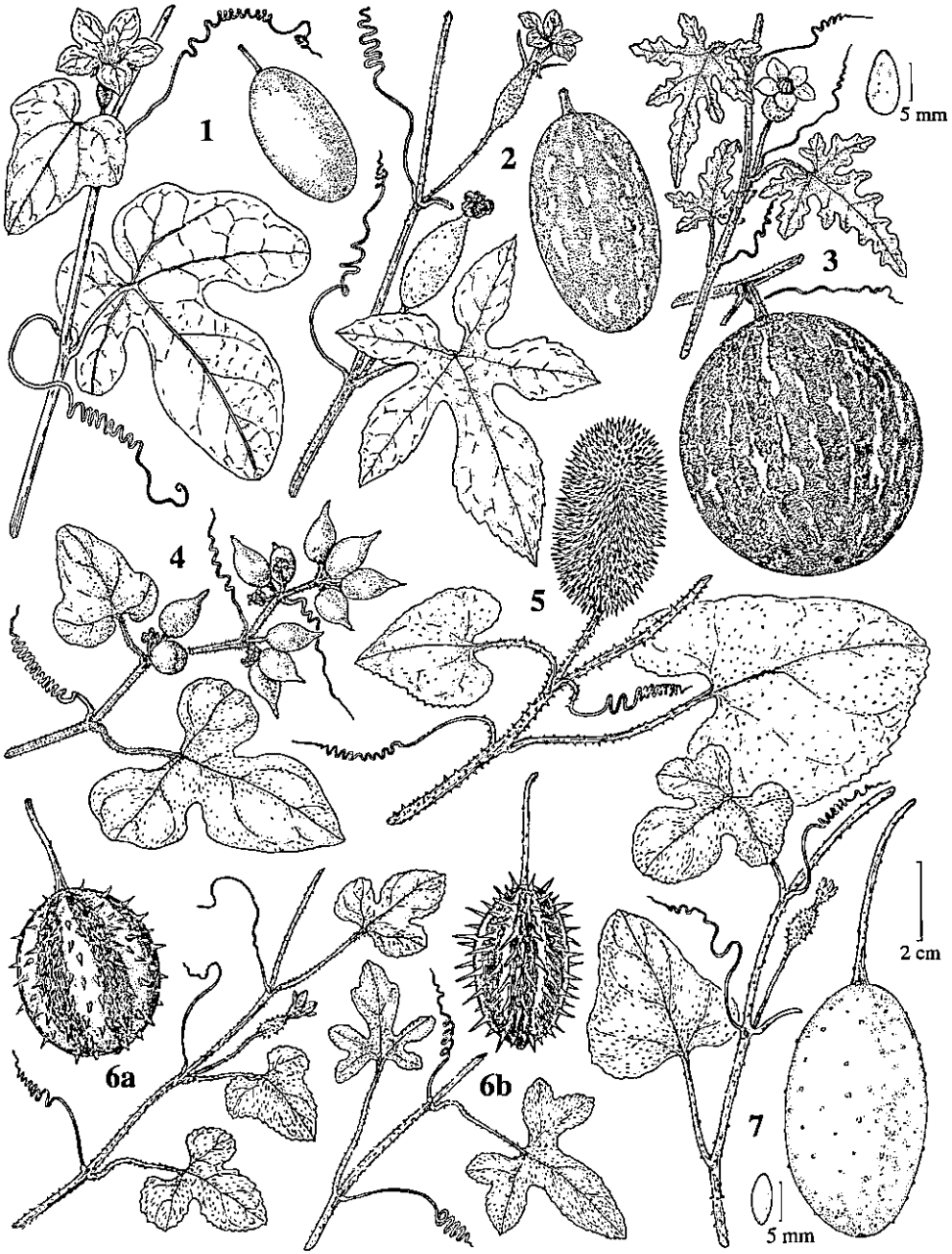


Plate 34. CUCURBITACEAE: *Coccinea grandis* 1, branch with female flower; fruit (up right). *Coccinea abyssinica* 2, branch with male flower and immature fruit; mature fruit (right). *Citrullus colocynthis* 3, branch with female flower; fruit on a branchlet (down); seed (up right). *Corallocarpus schimperii* 4, fruiting branch. *Cucumis dipsacus* 5, fruiting branch. *Cucumis prophetarum* subsp. *prophetarum* 6a, branch with female flower; fruit (left). *Cucumis prophetarum* subsp. *dissectus* 6b; leafy branch; fruit (up). *Cucumis pustulatus* 7, branch with female flower; seed and fruit (right). All drawings to the same scale, except the enlarged seeds (scale given).

flowers: 10-40, in racemes 1-6 cm; receptacle-tube 1.5 mm; calyx-lobes 1-1.2 mm, triangular-lanceolate; petals c. 2 mm, yellow with green veins; stamens 5; *female flowers*: in sessile 1-20-flowered clusters, often on leafless branches; ovary 3.5-4 x 1.5 mm, hairy; fruit 1-1.5 x 0.8-1 cm, solitary or in clusters of 2-7, red, ovoid or conical, the beak 1-2 mm; seeds 3 x 2.5 mm, subglobose, smooth.

GE; climber on various shrubs. Southeast Egypt, Sudan, Ethiopia, Kenya, Somalia, Arabia, Iran, Pakistan, India.

8. *Cucumis* L.

Herbaceous climbers or trailers, perennials or annuals, or subshrubs; stems angular, hispid- or scabrid-hairy; leaves simple, palmately lobed, petiolate; tendrils simple; flowers yellow, monoecious, rarely dioecious; *male flowers*: solitary or in few-flowered groups; sepals 5, rarely 4; petals connate at the base; stamens 3, 2 double 2-theous, 1 single 1-theous; *female flowers*: usually solitary, the perianth similar to that of male flowers, ovary hairy, ovules numerous; staminodes 3, often present; stigma 3-lobed; fruit fleshy, indehiscent, with fleshy spines, bristly or prickly tuberculate, rarely smooth; seeds small, lenticular, elliptic, usually more pointed at the base. 32 species, Old World tropics.

- 1. Annual, without a woody rootstock; fruit densely and softly spiny all over 1. *C. dipsacus*
- + Perennial, with a woody rootstock; fruit softly aculeate, the aculei scattered and the body of the fruit visible between them 2
- 2. Fruit 2.5-4.5 x 1.2-3.5 cm, ellipsoid to broadly ellipsoid or ± globose, bicoloured, with longitudinal stripes from the base to apex; seeds 4.3-6 x 2-2.6 mm, 1-1.3 mm thick 2. *C. prophetarum*
- + Fruit 5.5-8.5 x 3.5-5 cm, ellipsoid to cylindrical, monocoloured when mature; seeds 5.6-6.8 x 2.7-3.2 mm, 1.3-1.6 mm thick 3. *C. pustulatus*

1. *Cucumis dipsacus* Ehrenb. ex Spach, Hist Nat. Vég. Phan. 6: 211 (1838).

Climbing or trailing annual, without a woody rootstock; roots fibrous; stems 0.5-1.5 m, angular, grooved, hispid, with stiff bristly hairs; leaf-blade 2-8 x 2.5-9 cm, ovate-cordate, unlobed or shallowly 3-lobed, scabrid-hairy on both surfaces, the margin sinuate-toothed; petiole 2-10 cm, hispid; *male flowers*: solitary or 2-4; pedicel 0.8-1.2 cm; receptacle-tube 3.5-5 mm; calyx-lobes 2-4 mm; petals 5-9 x 3-5 mm, connate at the base, yellow; *female flowers*: on pedicels 0.5-1 cm; ovary 0.8-1.6 x 0.4-0.8 cm, ellipsoid, bristly; receptacle-tube 3-4 mm; calyx lobes 3-5 mm, spreading; petals 0.6-1.5 x 0.4-0.8 mm; fruit 4-6 x 2.5-4 cm, ellipsoid, densely and softly spiny, the spines covering the entire body of the fruit, each spine ending in a hyaline bristle; seeds 4.5 x 2 mm, 1 mm thick, elliptic.

GE; sandy plains. Southeast Egypt, Sudan, Somalia, Ethiopia, Kenya, Uganda, Tanzania; introduced into other tropical regions.

2. *Cucumis prophetarum* L., Cent. Pl. 1: 33 (1755).

Perennial with a woody rootstock; stems 0.5-2 m, climbing or trailing, hispid or scabrid, with appressed hairs; basal stems thickened; leaf-blade 1-8 x 1-7 cm, broadly ovate to

suborbicular, unlobed or palmately, shallowly or deeply 3-5-lobed, the base cordate, the margin sinuate-toothed; petiole 0.5-8 cm, hispid; *male flowers*: solitary or 2-6, pedicel 0.5-2.5 cm; receptacle-tube 2.5-5 mm; calyx-lobes 1-2.5 mm, subulate; petals 5-7 x 2-3.5 mm, yellow, connate at the base; *female flowers*: on pedicels 0.5-3 cm; ovary 0.5-1.5 x 0.3-0.5 cm, softly papillose, each papilla ending in a hyaline bristle; receptacle-tube 2.5-4 mm; calyx-lobes 1-3 mm, subulate; petals 5-8 x 2.5-3.5 mm, connate at the base; fruit 2.5-4.5 x 1.2-3.5 cm, ellipsoid to broadly ellipsoid or \pm globose, bicoloured, with longitudinal stripes from the base to apex, on a stalk 1-4 cm, with 0.5-1.2 cm soft terete bristle-tipped aculei scattered on the body of the fruit, otherwise usually glabrous; seeds 4.3-6 x 2-2.6 mm, 1-1.3 mm thick, elliptic, compressed, smooth.

Two subspecies occur in Egypt:

subsp. **prophetarum**

Syns. *Cucumis arabicus* Delile, Index Sem. Horti Reg. Bot. Monsp. 2 (1843), nom. nud.

Cucumis amarus Stocks ex Naudin, Ann. Sci. Nat., sér. 4, 11: 14 (1859), pro syn.

Cucumis anguinus Anders., J. Proc. Linn. Soc., Suppl., 5: 19 (1860), pro syn.

Cucumis mascatensis Gand., Bull. Soc. Bot. France 65: 28 (1918).

Plant greyish-green; fruit pedicel 1-2.5(-3) cm; fruit 2-4 cm diam.; seeds 5-6 x 2.4-2.6 mm.

De, R, GE, S; sandy plains and desert wadis. Egypt, Sudan, Somalia, northern Nigeria, Mali, Mauritania, Senegal, Southwest Asia, northern India, Pakistan.

subsp. **dissectus** (Naudin) C. Jeffrey, Kew Bull. 15: 351 (1962).

Syns. *Cucumis figarei* Delile ex Naudin var. *echinophorus* Naudin, Ann. Sci. Nat., sér. 4, 11: 16 (1859).

Cucumis pustulatus Hook. f. var. *echinophorus* A. Terr., Ann. Ist. Bot. Roma 5: 108 (1894).

Cucumis lyratus A. Zimm., Cucurbitac. 2: 178, f. 81/3 (1922).

Cucumis nigristriatus A. Zimm., Cucurbitac. 2: 178 (1922).

Cucumis halabarda Chiov., Flora Somala 1: 185 (1929).

Plant bright green; fruit pedicel 2-3.5(-6.5) cm; fruit 1.2-2.5 cm diam.; seeds 4.3-5 x 2-2.2 mm.

R, GE; sandy and stony plains and wadis. Egypt, Sudan, Chad, Ethiopia, Somalia, Kenya, Tanzania, Uganda, Rwanda, Niger, Mauritania, Saudi Arabia, Yemen.

3. ***Cucumis pustulatus*** Naudin ex Hook. f. in Oliv., Fl. Trop. Afr. 2: 544 (1871).

Syn. *Cucumis figarei* Delile ex Naudin var. *ficifolius* Naudin, Ann. Sci. Nat., sér. 4, 11: 17 (1859).

Like *Cucumis prophetarum*, but fruit 5.5-8.5 x 3.5-5 cm, ellipsoid to cylindrical, monocoloured when mature; seeds 5.6-6.8 x 2.7-3.2 mm, 1.3-1.6 mm thick.

GE; stony and sandy ground. Southeast Egypt, Sudan, Ethiopia, Kenya, Tanzania, Uganda, Chad, Niger, Nigeria, Saudi Arabia, Yemen.

LYTHRACEAE

Herbs or shrubs, rarely trees; stems often quadrangular; leaves opposite or alternate, rarely whorled; stipules minute or absent; flowers bisexual, actinomorphic or zygomorphic, (3-)4-6-merous, in axillary or terminal spike-like cymes or panicles, sometimes solitary; hypanthium (calyx) persistent, tubular or campanulate; margin of hypanthium with (3-)4-6(-8) valvate sepals (inner calyx-lobes), and often alternating with epicalyx segments (outer calyx-lobes); petals as many as the sepals (inner calyx), inserted near the top of hypanthium; stamens 2-8(-numerous), inserted below the petals; ovary superior, usually 2-6-celled; placentation axile, rarely parietal; ovules numerous; style simple; stigma capitate; capsule usually septicidally dehiscent, sometimes 1-celled; seeds without endosperm. 27 genera, 600 species, tropical regions, few temperate.

- 1. Flowers solitary, axillary, sometimes in terminal leafy spikes;
petals to 8 mm 1. **Lythrum**
- + Flowers in axillary clusters or cymes; petals 0, or
(if present) to 2.5 mm 2. **Ammannia**

1. **Lythrum** L.

Annuals or herbaceous perennials (our species) or shrubby perennials; leaves opposite or alternate, sometimes in whorls; flowers axillary, in spikes or solitary, 2-bracteate, pink or purple; hypanthium tubular, 8-12-ribbed; epicalyx 4-6, alternating with the inner 4-6 sepals; petals usually 4-6, inserted on the upper part of the hypanthium; stamens 2-12, in 1 or 2 whorls, inserted at the base or middle of the hypanthium; ovary sessile, incompletely 2-celled, ovules numerous; capsule 2-valved; seeds usually numerous. 36 species, temperate regions, mainly northern hemisphere.

- 1. Flowers 1-1.5 cm; petals 6-8 mm; stamens 12, some exerted 4. **L. junceum**
- + Flowers 4-8 mm; petals 1-3 mm; stamens 2-6, all included 2
- 2. Leaves to 2 mm wide; stamens 2 2. **L. thymifolia**
- + Leaves to 6(-8) mm wide; stamens 4-6 3
- 3. All leaves alternate, linear-lanceolate or narrowly oblong, acute; bracteoles 2,
1-1.5 mm, membranous, subulate, persistent; flowers *c.* 8 mm 3. **L. hyssopifolia**
- + Upper leaves alternate, lower opposite, narrowly ovate, obovate or oblong,
obtuse; bracteoles 2-3, equalling or shorter than the hypanthium, oblong-elliptic,
green, acute; flowers 4-5 mm 1. **L. tribracteatum**

- 1. **Lythrum tribracteatum** Salzm. ex Spreng., Syst. Veg. 4, 2: 190 (1827).
Syn. *Lythrum bibracteatum* Salzm. ex DC., Prodr. 3: 81 (1828).

Glabrous annual 10-40 cm; stems erect, ascending or prostrate, branched mainly from the base; leaves 0.5-1.8 x 0.1-0.4 cm, the upper alternate, the lower opposite, narrowly ovate, obovate or oblong, entire, tapering at the base, the apex obtuse; bracteoles 2-3, equalling or shorter than the hypanthium, oblong-elliptic, green, acute; flowers 4-5 mm, solitary along the leafy branches; hypanthium *c.* 4 mm, cylindrical, elongate in fruit, 10-12-striate; teeth 8-11, very short; petals 1.5-2.5 mm, violet, narrowly obovate; stamens 4-6, included; capsule cylindrical, glabrous, enclosed by the hypanthium.

N, O, M; moist ground. Mediterranean region, Southwest Asia, South Russia.

2. ***Lythrum thymifolia* L.**, Sp. Pl., ed. 1, 447 (1753).

Glabrous or somewhat scabrid annual, 10-25 cm; stems prostrate or procumbent, angular; leaves 0.5-1.8 x 0.1-0.2 cm, alternate, linear to narrowly oblong-lanceolate, the margin scabridulous; bracteoles 1 mm, caducous; flowers 5-6 mm, 4(-5)-merous, solitary, subsessile; hypanthium 4-5 mm, cylindrical, 8-nerved; teeth 8, the outer acute, the inner shorter and apiculate; petals 1.5-2.5 mm, pinkish-violet; stamens 2, opposite, included; capsule oblong, enclosed by the hypanthium.

N; moist ground, canal banks. Mediterranean region, South Russia, Caucasus, Transcaspia, Siberia.

3. ***Lythrum hyssopifolia* L.**, Sp. Pl., ed. 1, 447 (1753).

Glabrous annual 15-40 cm; stems erect or ascending, much-branched, angular; leaves 1-2.5 x 0.2-0.6 cm, all alternate, sessile, linear-lanceolate or narrowly oblong, entire, acute to obtuse; bracteoles 2, 1-1.5 mm, membranous, subulate, persistent; flowers c. 8 mm, solitary, axillary, subsessile; hypanthium 4-5 mm, tubular; teeth 10, the outer 1-1.5 mm, the inner shorter; petals 1.5-2 mm, pink; stamens 4-6, included; capsule 4 x 1 mm, cylindrical, enclosed by the hypanthium; seeds 0.75 mm, ovoid, winged at the distal end.

N, O, M; moist ground, marshes and ditches. Atlantic Islands, Central and southern Europe extending to Britain, North Africa, Southwest and Central Asia; introduced into some tropical and subtropical regions.

4. ***Lythrum junceum* Banks & Sol.** in Russell, Nat. Hist. Aleppo, ed. 2, 2: 253 (1794).

Glabrous perennial 20-50 cm; stems erect or ascending, branched mainly from the base, angular; leaves 1-4 x 0.2-0.8 cm, alternate, the lower oblong-elliptic, the upper linear-lanceolate; bracteoles 1 mm, subulate, membranous; flowers 1-1.5 cm, solitary, subsessile; hypanthium 5-6.5 mm, 10-12-nerved, often with purple spots in the lower half; teeth 12, triangular, acute, the outer with dark tips, the inner shorter; petals 6-8 x 2.5-3 mm, purplish, obovate; stamens 12, some exserted; capsule 3.5-4.5 x 1.5 mm, cylindrical, enclosed by the hypanthium.

M, S; moist ground, swamps, ditches. Atlantic Islands, Mediterranean region, Sinai.

2. ***Ammannia* L.**

Semi-aquatic glabrous annual herbs; stems erect or decumbent, 4-angled, sometimes winged; leaves opposite, sessile, linear-lanceolate or narrowly elliptic; leaf-base attenuate, auriculate or cordate, 1-nerved; flowers 4-(5-8)-merous, in (1-)3-many-flowered subsessile to pedunculate axillary dichasia; pedicel 0 or present; bracteoles small, linear; calyx-tube campanulate to urceolate, 8-ribbed; calyx-lobes 4(-5), triangular, mostly short and broad; appendages thick, shorter than or \pm equalling the lobes or absent; petals 1-4, white, pink or purple, small, strongly caducous, or absent; stamens 4-8, included or exserted; ovary incompletely 2-4(-5)-locular; ovules numerous; style 0 or well developed; stigma capitate; capsule globose to ellipsoid, thin, enclosed by the calyx, irregularly circumscissile or dehiscent on decay; seeds numerous, small, obovoid, angular, brown. 25 species, cosmopolitan, mostly in wet places.

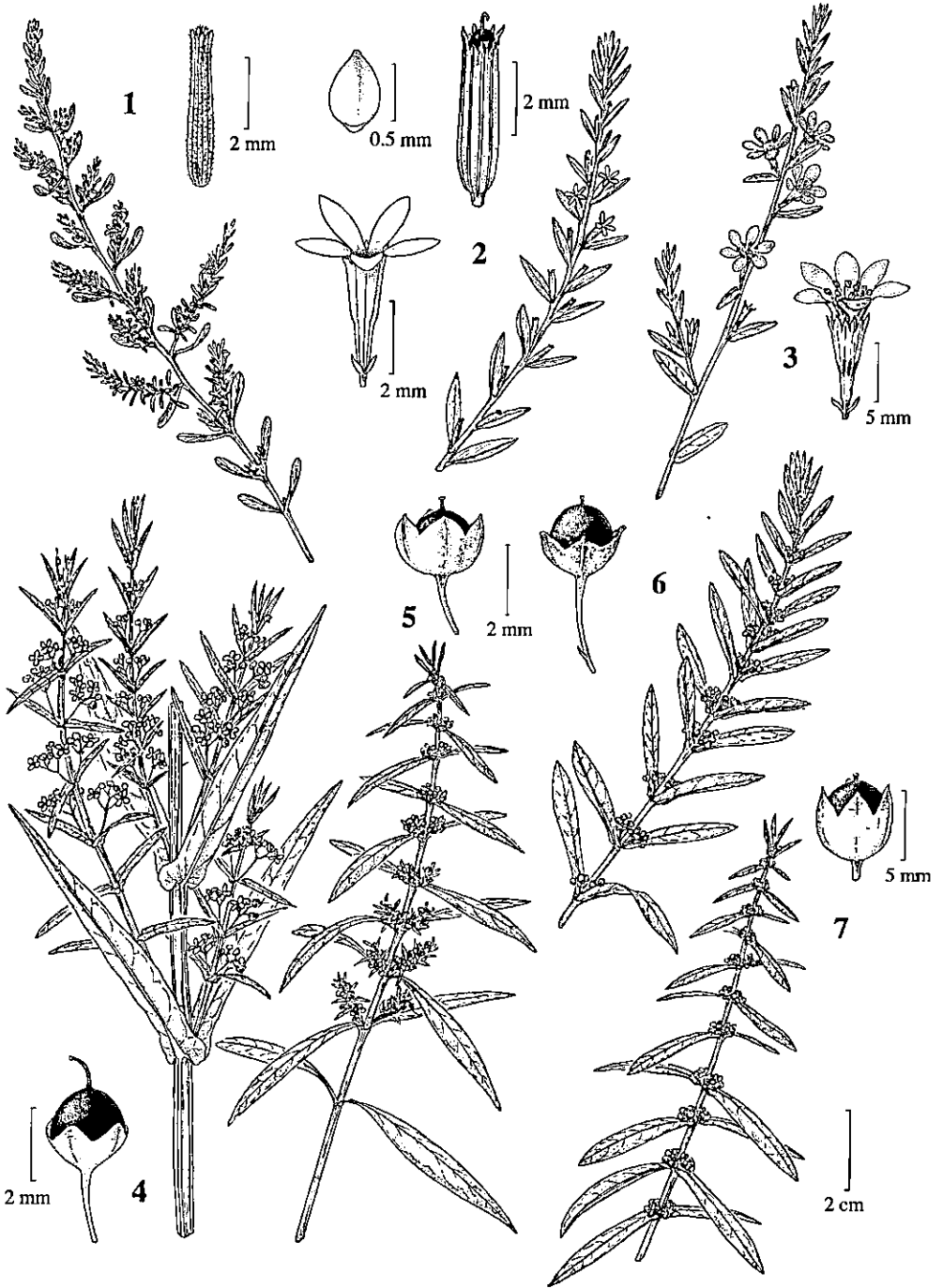


Plate 35. LYTHRACEAE: flowering and fruiting branches of: *Lythrum tribracteatum* 1; hypanthium (up right). *Lythrum hyssopifolia* 2; flower (down left); hypanthium enclosing the capsule, and seed (up left). *Lythrum junceum* 3; flower (right). *Ammannia auriculata* 4; capsule enclosed by the calyx (down left). *Ammannia baccifera* 5; capsule enclosed by the calyx (up). *Ammannia senegalensis* 6; capsule enclosed by the calyx (left). *Ammannia aegyptiaca* 7; capsule enclosed by the calyx (up right). All drawings to the same scale, except the enlarged parts (scale given).

1. Leaves auriculate at the base; cymes lax, on peduncles 0.5-1.5 cm; petals 1.2-1.5 mm; style 1.2-1.8 mm **1. A. auriculata**
- + Leaves attenuate, ± cordate or rounded at the base, not auriculate; cymes compact or slightly lax, sessile or on peduncles 1-4 mm; petals absent or 0.2 mm; style 0-0.3 mm **2**
2. Flowers sessile or subsessile, in compact cymes; peduncle 0 **4. A. aegyptiaca**
- + Flowers distinctly pedicellate; peduncle 2-4 mm **3**
3. Leaves attenuate to a cuneate base; calyx-lobes 1-1.5 mm; without appendages; petals nearly always 0; capsule ± included within the calyx **2. A. baccifera**
- + Leaves ± cordate or rounded at the base; calyx-lobes 0.3 mm, with short appendages; petals 0-4, 0.2 mm; capsule exceeding the calyx **3. A. senegalensis**

1. **Ammannia auriculata** Willd., Enum. Pl. Hort. Berol. 1: 7, t. 7 (1803).

Syns. *Ammannia arenaria* Kunth, Nov. Gen. Sp. 6: 190 (1830).

Ammannia auriculata Willd. var. *arenaria* (Kunth) Koehe, Bot. Jahrb. 1: 245 (1880).

Erect annual 15-50(-70) cm; stems branched, 4-angular, narrowly winged above; leaves 2-8 x 0.3-1.2 cm, linear-lanceolate, auriculate at the base, narrowed to an acute apex, 1-nerved, entire; flowers 4-merous, in lax 3-12-flowered dichasial cymes; peduncle 0.5-1.5 cm; pedicel 0.5-3 mm; bracteoles 0.5-1 mm; calyx-tube 1-1.5(-2) mm, campanulate; calyx-lobes c. 0.5 mm, triangular, with appendages 0.3-0.5 mm; petals 1.2-1.5 x 1.2-1.3 mm, pink, obovate to ± rounded; stamens 4-8, exserted; ovary 1-1.5 mm, globose; style 1.2-1.8 mm, filiform; capsule 1.8-2.5 mm, globose, exceeding the calyx lobes; seeds 0.4-0.5 mm, brownish.

N, O; ponds, rice fields; Egypt, tropical Africa, West Asia to India, China, Australia, West Indies; North, Central and South America.

NOTE: The type was collected near Rosetta, Egypt, and cultivated in Berlin (B-WILLD 3081).

2. **Ammannia baccifera** L., Sp. Pl., ed. 1, 120 (1753).

Syn. *Ammannia attenuata* A. Rich., Tent. Fl. Abyss. 1: 278 (1847).

Annual 15-60 cm; stems erect or ascending, simple or branched, 4-angular, sometimes narrowly winged; leaves 2-6 x 0.2-0.8 cm, linear-elliptic, narrowed to an acute apex, nearly always attenuate to a cuneate base, entire, glabrous; flowers 4-merous, in ± lax 3-many-flowered dichasia; peduncle 1-2 mm; pedicel 1-2.5 mm; bracteoles minute; calyx-tube 1-1.2(-1.5) mm; calyx-lobes 4, 1-1.5 mm, without appendages; petals nearly always absent; stamens 4, ± equalling the calyx-lobes; ovary 1-1.2 mm, globose; style 0.1-0.3 mm, or stigma sessile; capsule 1.5-2.5 mm, globose, ± included within the calyx; seeds 0.5 mm, brownish.

N, O; rice fields, ditches, pools. Egypt, tropical Africa, Madagascar, Mascarenes, India, Sri Lanka, Java, Philippines, China, Japan, Australia; introduced into the West Indies and Russia.

3. *Ammannia senegalensis* Lam., Tabl. Encycl. 1 (2): 311 (1792), t. 77, f. 2 (1791).

Like *Ammannia baccifera* but leaves \pm cordate or rounded at the base; calyx-lobes 0.3 mm, with short appendages; petals 0-4, 0.2 mm; capsule 1-2 mm, exceeding the calyx.

N, O; rice fields, swamps and pools. Egypt, Kenya, Tanzania, Ethiopia, southern Africa, tropical West Africa.

4. *Ammannia aegyptiaca* Willd., Enum. Pl. Hort. Berol. 1: 6, t. 6 (1803).

Syn. *Ammannia salicifolia* Monti, Comm. Bonon 5(1): 112 (1767), nom. inval.

Glabrous annual 20-60 cm; stems erect, simple or branched, terete, 4-angular and narrowly winged above; leaves 1.5-5 x 0.2-0.6 cm, oblong-linear or lanceolate-elliptic, the base cuneate or cordate, the apex acute; flowers sessile or subsessile, in compact axillary cymes; peduncle 0; bracteoles 1 mm, subulate; calyx-tube 1-2 mm, broadly campanulate; lobes 0.8 mm, triangular, acute, spreading, appendages present or 0; petals often 0; stamens 4; style 0.1-0.3 mm; capsule 2-3 mm, globose, included within the calyx; seeds 0.5 mm, ovoid-angular, brownish.

N, O; rice fields, ditches, swamps. Tropical regions.

NOTE: *Ammannia aegyptiaca* is often treated as a synonym, variety or subspecies of *A. baccifera*, e.g. Täckholm, Stud. Fl. Egypt, ed. 2, 378 (1974). However, *A. aegyptiaca* is readily separated from the other three species known from Egypt by its sessile or subsessile flowers in compact axillary cymes. The type was collected from Damietta, Egypt.

RHIZOPHORACEAE

15 genera, 120 species, trees and shrubs, often mangroves, Old World tropical regions. *Rhizophora* is the only genus in Egypt.

1. *Rhizophora* L.

Trees or shrubs; branches opposite, stout; aerial roots present, acting as stilt-roots, from the middle and lower nodes of main stems; leaves evergreen, petiolate, entire, leathery, glabrous; flowers in cymose inflorescences; bracteoles prominent; corolla tube partly adnate to the ovary; sepals 4-5, persistent, reflexed in fruit; petals 4-5; stamens 8-12, in a single whorl; ovary inferior, 2-celled; fruit a leathery indehiscent berry; seeds solitary, viviparous; hypocotyl terete, elongate; embryo separated from the cotyledons remaining in the fruit on the tree. 9 species, tropical coasts.

1. *Rhizophora mucronata* Lam., Encycl. 6: 189 (1804).

Tree 3-6 m; bark reddish-brown; leaves glabrous, dark green; blade 6-12 x 4-6 cm, elliptic, the apex mucronate; petiole 1.5-3.5 cm; flowers c. 1 cm, in axillary 8-10-flowered cymes; bracts 1.5-2 mm, coriaceous, persistent; calyx lobes 4, oblong-ovate; petals fleshy, villous; stamens 8; hypocotyl to 40 cm.

R; muddy flats, along the southern Red Sea coast. Red Sea and Indian Ocean shores.

ONAGRACEAE

Herbs, rarely shrubs or trees; leaves opposite, alternate or whorled, entire or toothed; stipules caducous or 0; flowers bisexual, actinomorphic or somewhat zygomorphic, usually solitary and axillary, or in terminal spikes or racemes; hypanthial tube often present; sepals 2, 4 or 5, valvate; petals 0, 2, 4 or 5, free, contorted or imbricate; stamens 2 or 4 in a single whorl, or 8-10 in 2 whorls; ovary inferior, (1-)2-, 4- or 5-locular, with 1-many ovules per locule; style 1; fruit a capsule, nutlet or berry; seeds without endosperm. 18 genera, 650 species, cosmopolitan, but especially temperate and warm North America.

- | | |
|--|---|
| 1. Flowers in leafy terminal racemes; petals pink or purplish
+ Flowers solitary; petals yellow | 1. Epilobium
2 |
| 2. Aquatic plant; stems and leaves glabrous
+ Terrestrial plant; stems and leaves hairy | 2. Ludwigia
3. Oenothera |

1. **Epilobium** L.

Annual or perennial herbs, rarely woody; leaves opposite, alternate or whorled; flowers bisexual, actinomorphic or slightly zygomorphic, axillary, white, pink or purple, solitary or in racemes or spikes; hypanthial tube short or 0; sepals 4, caducous; petals 4; stamens 8, 4 long and 4 short; ovary erect; style filiform; stigmas 4; capsule 4-locular, linear, 4-angled, dehiscent from apex to base loculicidally by 4 valves, leaving the seed-bearing column in the middle; seeds numerous, with a tuft of long hairs. 165 species, mainly western North America.

1. **Epilobium hirsutum** L., Sp. Pl., ed. 1, 347 (1753).

Syns. *Epilobium tomentosum* Vent., Descr. Pl. Jard. Cels., t. 90 (1802).

Epilobium hirsutum L. var. *tomentosum* (Vent.) Boiss., Fl. Orient. 2: 746 (1872).

Villous rhizomatous perennial 0.5-1.5 m; stems erect, branched; leaves 3-8 x 1-2.5 cm, opposite, sessile, ovate-lanceolate, acute, serrulate, hirsute on both surfaces; flowers 1.5-2 cm diam., in leafy terminal racemes; sepals 0.5-1 cm, lanceolate, apiculate; petals 1-2 cm, pink or purplish, notched; stigma 4-lobed, exceeding the stamens; capsule 4-8 cm, linear, covered by soft hairs; seeds 1-1.2 mm, oblong-obovoid, papillose, brownish, with a long tuft of hairs.

N, O, M; roadsides, canal banks, swamps. Mediterranean region, Europe, Asia, Northeast and southern Africa; introduced into North America.

2. **Ludwigia** L.

Syns. *Jussiaea* L., *Isnardia* L.

Perennial aquatic herbs, rarely shrubs; leaves alternate or opposite, usually entire; stipules small or 0; flowers actinomorphic, usually 4-5-merous, yellow, axillary, usually 2-bracteate, solitary or clustered in heads or spikes; sepals 4-5; petals 4-5 or 0, conspicuous, caducous; stamens 8 or 10; ovary 4-5-celled; ovules numerous; stigma capitate or 4-lobed; capsule elongate, terete or angular, 8-10-ribbed, dehiscent irregularly; seeds numerous, without a tuft of hairs. 82 species, cosmopolitan, but especially North and South America.

1. Stems creeping or floating; petals 5, 1-1.6 cm; capsule 3-4 cm
 + Stems erect; petals 4, 3.5-5 mm; capsule 1-2 cm

1. *L. stolonifera*

2. *L. erecta*

1. *Ludwigia stolonifera* (Guill. & Perr.) P. H. Raven, *Reinwardtia* 6: 390 (1963).

Syns. *Jussiaea diffusa* Forssk., *Fl. Aegypt.-Arab.* 210 (1775).

Ludwigia diffusa (Forssk.) Greene, *Fl. Francisc.* 1: 227 (1891), non Buch.-Ham., *Trans. Linn. Soc. London* 14: 301 (1824).

Jussiaea stolonifera Guill. & Perr. in Guill., Perr. & Rich., *Fl. Senegamb. Tent.* 292 (1833).

Jussiaea repens, sensu Boiss.; *Fl. Orient.* 2: 751 (1872), non L., *Sp. Pl.*, ed. 1, 388 (1753); sensu Täckh., *Stud. Fl. Egypt*, ed. 2, 380 (1974).

Jussiaea repens L. var. *diffusa* (Forssk.) Brenan, *Kew Bull.* 1953: 171 (1953).

Aquatic glabrous perennial; stems 20-80 cm, creeping or floating, with vesicular and fibrous roots at the nodes; leaves 2-8 x 0.5-2.2 cm, elliptic to lanceolate, alternate, the margin entire, the base attenuate, the apex acute or obtuse; petiole 0.3-2 cm; flowers solitary, pedicellate; hypanthium 0.8-1.2 cm, elongate in fruit; sepals 5, 0.8-1.2 cm, lanceolate, acuminate; petals 5, 1-1.6 x 0.6-0.8 cm, obovate, yellow; stamens 8-10; capsule 2.5-4 x 0.3-0.5 cm, terete, with 10 conspicuous ribs, white-pilose, crowned with the persistent calyx; seeds 1-1.2 mm, uniseriate in each locule, embedded in the endocarp.

N, O, M, S; canals, ditches. Egypt, Palestine, Syria, Turkey, Iraq, tropical Africa.

2. *Ludwigia erecta* (L.) Hara, *J. Jap. Bot.* 28: 292 (1953).

Syn. *Jussiaea erecta* L., *Sp. Pl.*, ed. 1, 388 (1753).

Erect glabrous annual 0.8-1.5 m; leaves 2.5-10 x 0.3-2.5 cm, lanceolate to elliptic, acute; petiole 0.2-1.2 cm; flowers axillary; sepals 4, 2-5 mm; petals 4, 3.5-5 mm; stamens 8; capsule 1-2 x 0.2 cm, 4-ribbed, crowned with the persistent calyx; seeds 0.3-0.5 mm.

N; canal banks. Native to the New World, naturalized in tropical Africa.

3. *Oenothera* L.

Annuals or perennials; leaves alternate; flowers conspicuous, actinomorphic, axillary, solitary, sometimes in leafy terminal spikes; hypanthial tube long; sepals 4, usually reflexed; petals 4, yellow, rarely white or pink, often with a narrow claw; stamens 8, in 2 rows, all equal or the inner shorter; ovary 4-locular, cylindrical; stigma of 4 linear lobes, rarely capitate; fruit a loculicidal capsule, splitting into 4 valves; seeds without a tuft of hairs. 124 species, mainly temperate South America.

1. *Oenothera drummondii* Hook., *Bot. Mag.* 3361 (1834).

Syn. *Oenothera humifusa*, sensu Täckh., *Stud. Fl. Egypt*, ed. 2, 380 (1974);

Boulos, *Fl. Egypt Checklist* 100 (1995).

Densely villous perennial 20-60 cm; stems erect or procumbent, much-branched, villous; leaves 3-5.5 x 1-2 cm, lanceolate or oblong-lanceolate, densely pubescent, the base cuneate or rounded, the apex acute, the margin entire; flowers 5-6 cm diam., sepals 2.5-3 cm, linear-lanceolate, reflexed; petals 3 x 2 cm, bright yellow, ovate; stigma deeply 4-fid; capsule 3-4.5 cm, obscurely 4-angled; seeds numerous.

N, S; roadsides, cultivated land. Native to South America, naturalized elsewhere.

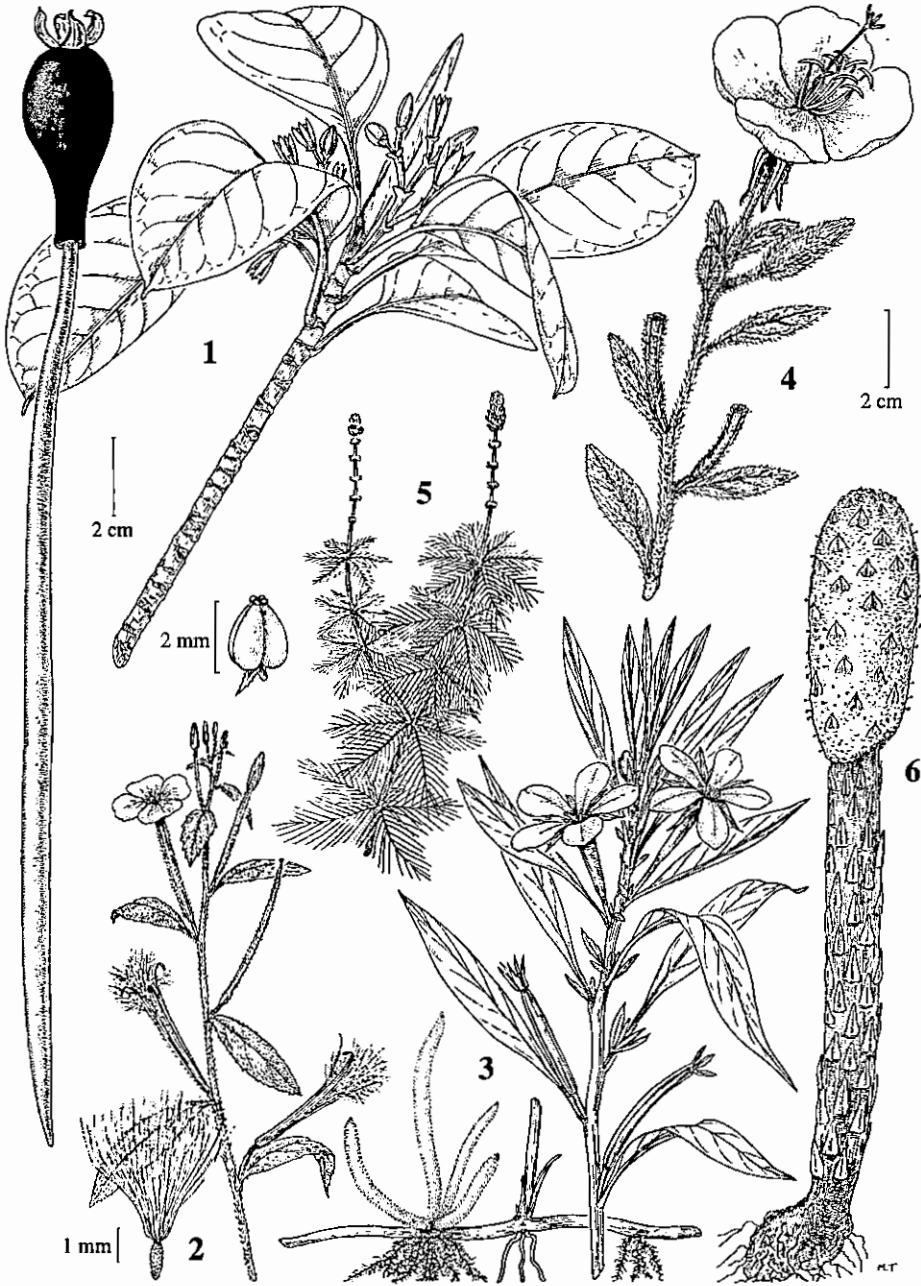


Plate 36. RHIZOPHORACEAE: *Rhizophora mucronata* 1, flowering branch; hypocotyl (left). ONAGRACEAE: *Epilobium hirsutum* 2, flowering and fruiting branch; seed (down left). *Ludwigia stolonifera* 3, flowering and fruiting branch, and stem with vesicular and fibrous roots. *Oenothera drummondii* 4, flowering and fruiting branch. HALORAGIDACEAE: *Myriophyllum spicatum* 5, flowering and fruiting branch; fruit (left). BALANOPHORACEAE: *Cynomorium coccineum* 6, habit. All drawings to the same scale, except the enlarged parts (scale given).

HALORAGIDACEAE

9 genera, 145 species, cosmopolitan, especially southern hemisphere. *Myriophyllum* is the only genus in Egypt.

1. *Myriophyllum* L.

Aquatic herbaceous perennials, free-floating or attached to the substrate by rhizomes; dioecious, monoecious or polygamous; stems submerged except for the inflorescences, densely leafy; leaves whorled, opposite or alternate, pinnatisect; aerial leaves and bracts often simple; flowers in leafy or bracteate terminal spikes, in the leaf axils, the upper flowers usually staminate, the lower pistillate; *male flowers*: sepals and petals 4 or 0, caducous; stamens 8, sometimes 4 or 6; *female flowers*: sepals and petals small; ovary 4-locular; stigmas 4, persistent, villous; fruit dry, separating into 4 nutlets. 60 species, cosmopolitan, but especially Australia.

1. *Myriophyllum spicatum* L., Sp. Pl., ed. 1, 992 (1753).

Aquatic glabrous perennial, with creeping rhizomes attached to the substratum; stems to 1.5 m; leaves 1.2-2 cm, whorled, pinnatisect into filiform segments; spikes 3-8 cm, terminal; male flowers in the upper whorls of the spike, subtended by 3 short bracts; sepals 4, 1 mm; petals 4, 2.5-3 mm, red, caducous; stamens 8; female flowers in the lower whorls of the spike, subtended by 3 bracts; petals minute; fruit a dry ovoid, 1-seeded nutlet c. 2 mm.

N, De (Qantara): canals and pools. Mediterranean region, Europe, Asia, South Africa, North and South America.

BALANOPHORACEAE

(incl. Cynomoriaceae)

18 genera, 44 species, tropical and subtropical regions. *Cynomorium* is the only genus in Egypt.

1. *Cynomorium* L.

Herbaceous leafless, fleshy perennial root parasites, without chlorophyll; inflorescence a terminal spadix of numerous inconspicuous densely crowded polygamous flowers, each subtended by a small bracteole; perianth-segments 1-5, fleshy; stamen 1, absent in female flowers; ovary inferior, 1-locular, rudimentary in male flowers; ovule 1; style 1, terminal; fruit a nutlet. 1 species, Mediterranean region, Southwest Asia.

1. *Cynomorium coccineum* L., Sp. Pl., ed. 1, 970 (1753).

Fleshy perennial 10-30 cm, parasitic on the roots of various trees and shrubs, leafless, without chlorophyll; stem unbranched, cylindrical, covered with reddish scales; inflorescence a terminal fleshy spadix, of numerous inconspicuous densely crowded polygamous flowers, each subtended by a small bracteole; perianth-segments 1-5, linear-oblongate, obtuse, fleshy; stamen 1, absent in female flowers; ovary inferior, 1-locular, rudimentary in male flowers; ovule 1; style 1, terminal; fruit a nutlet.

M, De, S; sandy saline plains and coastal dunes. Parasitic on the roots of *Tamarix*, *Nitraria*, *Salsola* and other plants. Mediterranean region, Southwest Asia.

UMBELLIFERAE

Annuals, perennials, shrubs or rarely small trees; leaves alternate, exstipulate, with sheathing petioles, mostly pinnately or palmately divided, rarely simple; inflorescence a compound umbel, rarely simple, of few or many rays, subtended by an involucre of bracts; umbel-rays terminating in bracteate umbels; sometimes bracts and bracteoles 0; flowers usually bisexual, rarely monoecious or dioecious, actinomorphic; calyx mostly inconspicuous, adnate to the ovary, with or without 5 lobes or teeth; corolla of 5 distinct petals, equal or unequal; stamens 5, alternate with the petals, inflexed in bud; anthers 2-celled; ovary inferior, 2-carpellate, 2-locular, rarely 1-locular; placentation axile; ovules solitary in each cell, anatropous; styles 2, divergent, often broadened at the base and forming an epigynous disc, the stylopodium; stigma capitate or 0; fruit a schizocarp of 2 mericarps; each mericarp usually with 5 primary ribs, 3 dorsal and 2 lateral; vittae (oil ducts) generally present in the furrows between the ribs; mericarps 1-seeded, usually suspended on a slender carpophore; seeds adnate to the pericarp; endosperm copious. 446 genera, 3540 species, cosmopolitan, but especially north temperate and tropical mountains.

- | | |
|--|----------------------|
| 1. Plant with spiny involucre of bracts and prickly leaves | 1. Eryngium |
| + Plant not spiny; leaves not prickly | 2 |
| 2. Leaves undivided | 5. Bupleurum |
| + Leaves variously pinnatifid to pinnatisect | 3 |
| 3. Fruit linear, beaked; beak as long as the seed-bearing part or much longer | 14. Scandix |
| + Fruit usually not linear; if linear, then not beaked | 4 |
| 4. Umbel-rays densely woolly | 2. Pycnocycla |
| + Umbel-rays glabrous | 5 |
| 5. Desert shrub; usually leafless at flowering | 9. Deverra |
| + Herbaceous perennial or annual, rarely woody at the base; plant leafy at flowering | 6 |
| 6. Roots tuberous | 4. Astomaea |
| + Roots not tuberous | 7 |
| 7. Bracteoles absent | 8 |
| + Bracteoles present | 14 |
| 8. Flowers white | 9 |
| + Flowers yellow | 11 |
| 9. Fruit glabrous | 6. Apium |
| + Fruit pubescent | 10 |

- | | |
|--|-------------------------|
| 10. All leaves with narrow acute lobes | 7. Brachyapium |
| + At least lower leaves with broad leaf-segments or leaflets | 12. Pimpinella |
| 11. Plant pubescent | 21. Malabaila |
| + Plant glabrous | 12 |
| 12. Leaf-segments flattened | 18. Ferula |
| + Leaf-segments capillary | 13 |
| 13. Fruit terete | 15. Foeniculum |
| + Fruit laterally compressed | 8. Ridolfia |
| 14. Fruit spiny | 15 |
| + Fruit spineless | 17 |
| 15. Bracts absent | 26. Torilis |
| + Bracts present | 16 |
| 16. Umbel-rays 2-5 | 23. Pseudorlaya |
| + Umbel-rays more than 5 | 25. Daucus |
| 17. Fruit flattened | 18 |
| + Fruit terete, ovoid or globose | 22 |
| 18. Fruit margin with long silky hairs, not yellow | 24. Ammodaucus |
| + Fruit margin yellow | 19 |
| 19. Flowers yellow | 21. Malabaila |
| + Flowers white or reddish | 20 |
| 20. Plant glabrous | 17. Ducrosia |
| + Plant pubescent | 21 |
| 21. Fruit pubescent, flattened, of one kind | 20. Zosima |
| + Fruit glabrous, the outer flattened, the inner urn-shaped | 19. Tordylium |
| 22. Leaves thick, distinctly fleshy | 16. Crithmum |
| + Leaves thin | 23 |
| 23. Bracts present | 24 |
| + Bracts absent | 26 |
| 24. Bracts 4-5-partite | 10. Ammi |
| + Bracts simple | 25 |
| 25. Aquatic perennial; stems hollow; bracts 5-7, 1-2 cm, leaf-like;
fruit c. 1.5 mm | 11. Berula |
| + Mesophytic biennial; stems solid; bracts 1-4, 3-8 mm, subulate;
fruit 2.5-3 mm | 22. Petroselinum |
| 26. Petals radiating | 3. Coriandrum |
| + Petals not radiating | 27 |
| 27. Umbels terminal | 13. Ammoides |
| + Umbels leaf-opposed | 6. Apium |

1. *Eryngium* L.

Perennials, mostly spiny; leaves undivided to 3-pinnatisect, the margin usually prickly-toothed; umbels simple, capitate, surrounded by a spiny involucre of large bracts; flowers in synflorescences (compound inflorescences), bisexual, sessile, subtended by spiny bracteoles; calyx-teeth rigid, sharp; petals white or purple; stylopodium dilated, with an elevated margin around the filiform styles; fruit obovoid or terete, covered with white scales or tubercles; carpophore adnate to mericarps. 250 species, tropical and temperate regions, except tropical and southern Africa, East and Southeast Asia, some naturalized in southern Asia.

1. Bracteoles 3-lobed, cuspidate; inflorescence metallic-blue at maturity 1. *E. creticum*
+ Bracteoles not lobed; inflorescence not metallic-blue 2
2. Petiole with short inconspicuous leaf-sheaths; capitula in spreading corymbose cymes 2. *E. campestre*
+ Petiole with long conspicuous leaf-sheaths; capitula in narrow thyrsoid inflorescences 3. *E. glomeratum*

1. *Eryngium creticum* Lam., Encycl. 4: 754 (1798).

Glabrous glaucous perennial 20-50 cm; stems divaricately branched, angular; basal leaves 5-8 cm; petiole \pm as long as the blade, flattened; blade ovate, crenate, soon withering; lower leaves sessile, rigid, pinnatipartite, the lobes prickly-toothed; upper leaves palmatisect, the segments prickly-toothed; synflorescence forked repeatedly, metallic-blue at maturity; heads 0.8-1 cm; bracts usually 5, 2-4 cm, linear, spreading; flowers overtopped by 3-lobed, cuspidate bracteoles; calyx-teeth 2-3 mm, ovate, mucronate, with scarious margin; fruit covered with bristles, ribbed.

M, S; roadsides, edges of cultivation. Balkan peninsula, East Mediterranean region to Iraq.

2. *Eryngium campestre* L., Sp. Pl., ed. 1, 233 (1753).

Erect glabrous perennial 30-60 cm; stems solitary or branched; basal leaves 10-25 x 8-16 cm, coriaceous, persistent, triangular-ovate in outline, mostly ternate, with 2-pinnatifid segments; lobes and winged rhachis spiny-dentate; cauline leaves smaller, the median and upper with amplexicaul, spiny-margined base, the uppermost 3-partite; petiole with short inconspicuous leaf-sheaths; synflorescence of a wide spreading corymbose cyme; capitula numerous, 0.8-1.2 cm diam., ovoid-globose; bracts 5-6, linear-lanceolate, pungent, straight, entire or spinulose; bracteoles entire, longer than the sepals; sepals 2.5 mm, aristate; fruit covered with lanceolate scales.

M, S; barley fields, roadsides, stony hillsides. West and Central Europe, South Russia, Mediterranean region, Southwest Asia to Afghanistan.

3. *Eryngium glomeratum* Lam., Encycl. 4: 755 (1798).

Erect glabrous glaucous perennial, 40-80 cm; stems many, branched, strongly ribbed; leaves 5-15 x 5-12 cm; petiole with long, conspicuous, prominently-nerved leaf-sheaths; blade 2-3-pinnatisect; lobes linear-lanceolate, spiny-toothed; capitula 0.8-1 cm diam., in



Plate 37. UMBELLIFERAE: *Eryngium creticum* 1, flowering branch; basal leaves (down right); leafy stem (up right). *Eryngium campestre* 2, flowering branch; basal and cauline leaves (down right). *Eryngium glomeratum* 3, flowering branch and cauline leaf. *Pycnocycla tomentosa* 4, basal part with leaves; fruiting umbellule (up left); fruit (down left). *Astomaea seselifolium* 5, tuberous root and basal leaf; flower, flowering branch and fruit (left). All drawings to the same scale, except the enlarged parts (scale given).

narrow thyrsoid synflorescences; bracts usually 5, 3-4 cm, rigid, subulate, entire; bracteoles \pm equalling the flowers, broad at the base, entire; calyx-teeth 2-3 mm, mucronate; fruit flattened, covered with scales, crowned with the persistent calyx-teeth.

S; stony ground. East Mediterranean region to Iraq.

2. *Pycnocycla* Lindl.

Perennials; leaves pinnately dissected; umbels sessile, with a central bisexual flower surrounded by pedicellate male flowers; calyx-teeth 5, prominent; fruit cylindrical to ellipsoid, narrowed at the top; ridges obtuse; furrows 1-3-vittate; pericarp membranous; inner face of seed deeply grooved. 12 species, tropical West Africa to Northwest India.

1. *Pycnocycla tomentosa* Decne., Ann. Sci. Nat. 2, sér. 3, 258 (1835).

Erect perennial 30-80 cm; stems branched mainly from the base, leafy and woody at the base, grooved; lower leaves 2-pinnatisect, the blade pubescent, the petiole glabrous; stems almost leafless above, the upper leaves reduced to sheaths; umbels solitary or in pairs on a long peduncle; umbel-rays numerous, 0.5-1 cm, densely woolly; bracts 2-4 mm, subulate, pubescent; bracteoles 2-3 mm, linear-lanceolate, acuminate, pubescent; flowering umbels globose, 1-1.2 cm diam.; sepals 1-2.5 mm, pubescent, persistent; petals white, pubescent; fruit 0.8-1.2 x 0.1 cm, pubescent, slightly arcuate, crowned with the persistent calyx-teeth.

S; stony ground. Sinai, Northwest Saudi Arabia.

NOTE: The type was collected 5 June 1835 by Schimper 148, from Wadi Hebran, El-Tor region, Sinai (K!).

3. *Coriandrum* L.

Annuals or short-lived perennials, glabrous, aromatic; leaves 1-3-pinnatisect; umbels terminal and opposite the leaves; umbel-rays many; bracts 0 or 1; bracteoles few, small; flowers bisexual and male in each umbel; calyx-teeth persistent, unequal; petals radiating, white or reddish, notched or 2-lobed; stylopodium conical; styles long; fruit ovoid or globose; mericarps \pm spherical; primary ribs 5, secondary ribs 4, prominent. 3 species, East Mediterranean region, Southwest Asia.

1. *Coriandrum sativum* L., Sp. Pl., ed. 1, 256 (1753).

Glabrous annual 15-50 cm; stems erect, branched mainly from the base, terete, striate; basal leaves long-petiolate, 3-lobed or ternatisect; lower cauline pinnatisect, the lobes ovate-cuneate; upper leaves sessile, 2-3-pinnatisect, the lobes linear; peduncle 3-7 cm; umbel-rays 3-8; rays 1-3 cm; bracts 1, minute or 0, bracteoles 3-5, 2-3 mm, linear-subulate; fruit 3-4 mm, globose, crowned with the persistent, unequal calyx-teeth and the 2 styles. .

N, O, M, S; roadsides, edges of cultivation; naturalized. East Mediterranean region, Sinai; escape of cultivation in Europe, Asia and America.

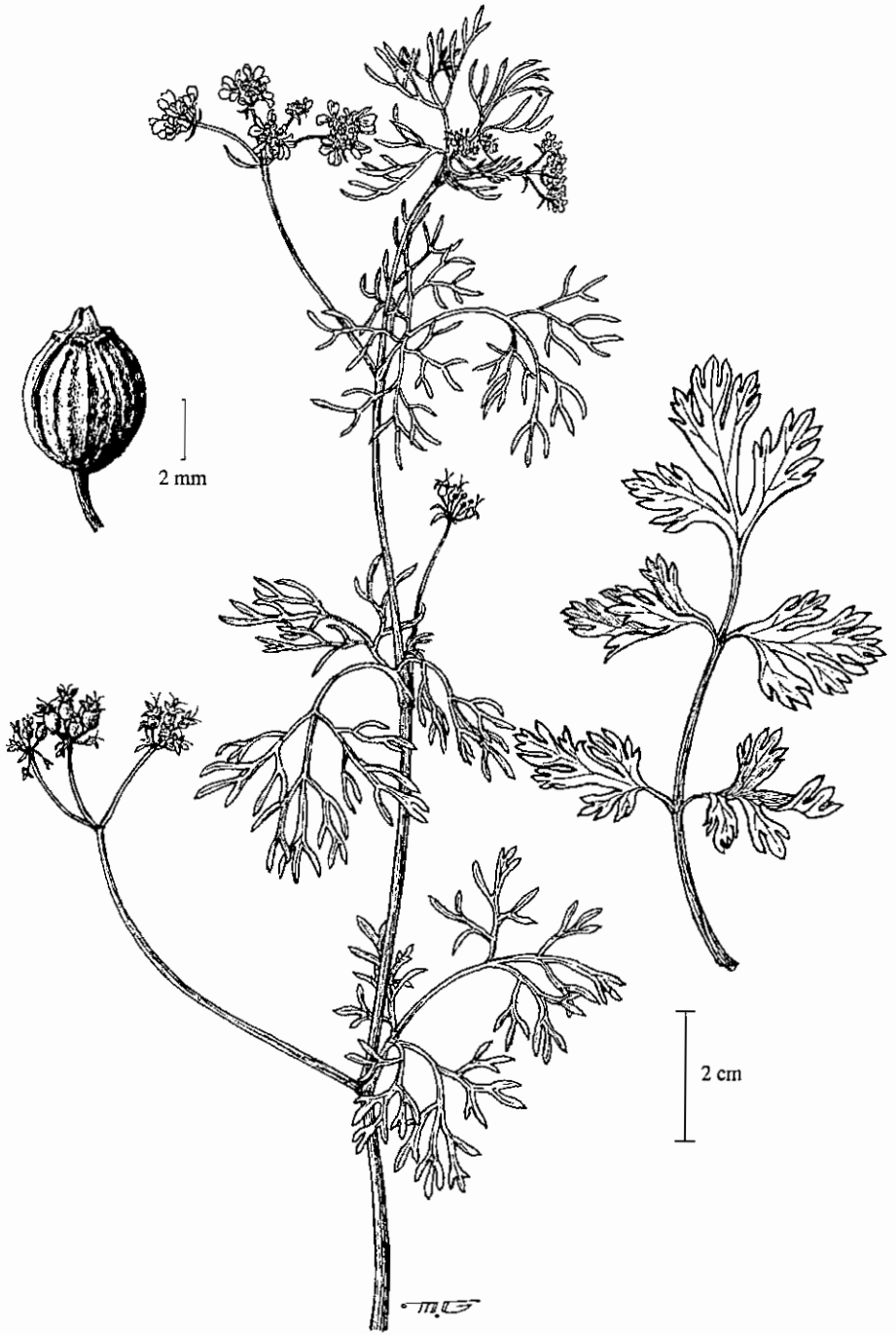


Plate 38. UMBELLIFERAE: *Coriandrum sativum*, flowering and fruiting branch; basal leaf (right); mericarp (left). Drawings to the same scale, except the enlarged part (scale given).

4. *Astomaea* Reichb.
Syn. *Astoma* DC.

Perennials with tuberous roots; leaves pinnatisect; umbels terminal, many-rayed; bracts and bracteoles present, the bracts caducous; flowers small, bisexual and staminate; calyx-teeth minute; petals white, not radiating, notched; stylopodium depressed, located in the sinus between the mericarps; styles long, deflexed; fruit broader than long, depressed; carpophore 2-fid; mericarps \pm globose, the ribs distinct; oil ducts 2 in each furrow. 1 species, East Mediterranean to Central Asia.

1. *Astomaea seselifolium* DC., Coll. Mém. 5: 71, t. 17 (1829).

Glabrous perennial 15-40 cm, with tuberous roots; stems branched; basal and lower cauline leaves long-petiolate, with broad leaf-sheaths; blade 2-pinnatisect, the segments ovate-oblong; upper cauline leaves sessile or with short sheaths, the segments linear; peduncle 5-10(-12) cm; umbel-rays 8-12, 3-6 cm; staminate umbels lateral; bracts and bracteoles 4-6, 0.5-1.5 cm, linear; calyx teeth minute; petals white, not radiating; styles 1.5 mm, deflexed, persistent; fruit 1.2-1.5 mm, \pm globose, black, with 5 white, distinct ribs; oil ducts 2 in each furrow.

S; rocky hillsides. Sinai, Palestine, Syria, Lebanon.

5. *Bupleurum* L.

Annuals, perennials or dwarf shrubs; leaves entire, usually sessile; umbels compact; umbel-rays few to several, erect to divaricate; bracts and bracteoles leaf-like, sometimes bracts 0; flowers bisexual; calyx-teeth minute; petals mostly equal, orbicular to ovate, yellow or yellowish-green, sometimes reddish; stylopodium flattened or depressed, rarely conical; styles short, divaricate; fruit \pm laterally compressed, mostly ovoid or ellipsoid; carpophore usually 2-partite; mericarps with 5 equal primary ribs; secondary ribs 0; oil ducts usually 2-3 in each furrow; seeds \pm cylindrical. About 180 species, Eurasia, Canary Islands, North Africa.

The distinction between *Bupleurum nanum* and *B. nodiflorum* is based on S. Snogerup, *Taekholmia* 7-8: 57-62 (1977).

- | | |
|---|-----------------------------|
| 1. Perennial with woody base | 6. B. falcatum |
| + Annual | 2 |
| 2. Upper leaves broad, perfoliate | 3 |
| + Upper leaves linear, linear-lanceolate or subulate, not perfoliate | 4 |
| 3. Umbellule 5-15-flowered; styles much shorter than the stylopodium | 1. B. lancifolium |
| + Umbellule 15-25-flowered; styles equalling or longer than the stylopodium | 2. B. subovatum |
| 4. Bracteoles linear-subulate, not enveloping the fruits | 5. B. semicompositum |
| + Bracteoles ovate-lanceolate, becoming erect to envelop the fruits | 5 |
| 5. Umbel-rays in central umbel 5-7; bracteoles 3(-4) per umbellule | 3. B. nodiflorum |
| + Umbel-rays in central umbel 8-15; bracteoles 5(-6) per umbellule | 4. B. nanum |

1. **Bupleurum lancifolium** Hornem., Hort. Bot. Hafn. 1: 267 (1813).

Syn. *Bupleurum heterophyllum* Link, Enum. Hort. Berol. 1: 262 (1821).

Glabrous annual 10-50 cm; stems erect or ascending, branching from the base, terete, striate; basal leaves 4-8 x 0.4-1 cm, linear-lanceolate, long-acuminate, tapering at the base; upper leaves 1.5-10 x 0.5-2 cm, perfoliate, lanceolate, the base rounded; umbels terminal and axillary; peduncle 1-2.5 cm, (2-)3(-5)-rayed; bracts 0; umbellule 5-15-flowered; bracteoles 5-6, 0.5-1.5 x 0.4-0.8 cm, ovate, mucronate, 5-7-nerved, connate at the base; petals minute, ovate, the apex truncate or emarginate; styles much shorter than the stylopodium; fruiting umbellules capitate; fruit 3 mm, ovoid; mericarps dark brown, prominently ribbed, the furrows tuberculate.

N, M, S; cultivated fields. South Europe, East Mediterranean region, eastwards to Iran and Transcaucasus.

NOTE: The type was cultivated in Copenhagen Botanic Garden from seeds taken from an Egyptian plant.

2. **Bupleurum subovatum** Link ex Spreng., Sp. Umbel. Disp. Prodr. 19 (1818).

Syns. *Bupleurum protractum* Hoffmsgg. & Link, Fl. Portug. 2: 387 (1820).

Bupleurum intermedium (Lois. ex DC.) Steud., Nomen. Bot., ed. 1, 128 (1821).

Like *Bupleurum lancifolium*, but basal leaves 3-8 x 1-2.5 cm, oblong or oblong-lanceolate, not long-acuminate; upper leaves 2-8 x 1.5-4 cm, broadly ovate, apiculate, not lanceolate, the base conspicuously perfoliate; umbellules 15-25-flowered; styles equalling or longer than the stylopodium.

N; cultivated ground. Mediterranean region, West and Central Europe.

NOTE: Some authors, e.g., Zohary, Fl. Palaest. 2: 411 (1972), consider *Bupleurum subovatum* Link ex Spreng. to be conspecific with *B. lancifolium* Hornem. var. *lancifolium*.

3. **Bupleurum nodiflorum** Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1: 177 (1806).

Glabrous annual 1-10(-15) cm, with an erect main stem, terminating in a central umbel and erecto-patent to ascending side branches 2-25(-40) cm; small specimens sparsely branched, with a few umbels; larger ones richly branched, with 10-50(-70) umbels; leaves in groups of 2-3, those on the distal parts of the stem simple, very narrowly linear, (1-)2-5(-8) mm broad, with 1-3(-5) prominent veins on the lower surface, acuminate, the margin serrulate; peduncle 0.5-2 mm; umbel-rays in the central umbel 5-7, unequal, shorter or longer than the bracts; bracts 3-5, unequal, 1.5-4 cm, oblong-lanceolate, long-acuminate, with 3 prominent nerves, the margin scariosus; bracteoles 3(-4) per umbellule, 5-8 x 3 mm, ovate-lanceolate, acuminate, cuspidate, with 3 prominent nerves, herbaceous between the nerves; flowers pedicellate, the pedicels unequal; petals 0.6-0.8 x 0.4-0.6 mm, white, 2-3-lobed; stylopodium 0.6-0.75 mm; styles 0.25 mm; ripe mericarp 1.75-2 x 0.6-0.7 mm, semicylindrical, smooth, dark greyish-brown, ribbed.

S; dry sandy plains. Sinai, Palestine, Cyprus, Lebanon, Syria, Turkey.

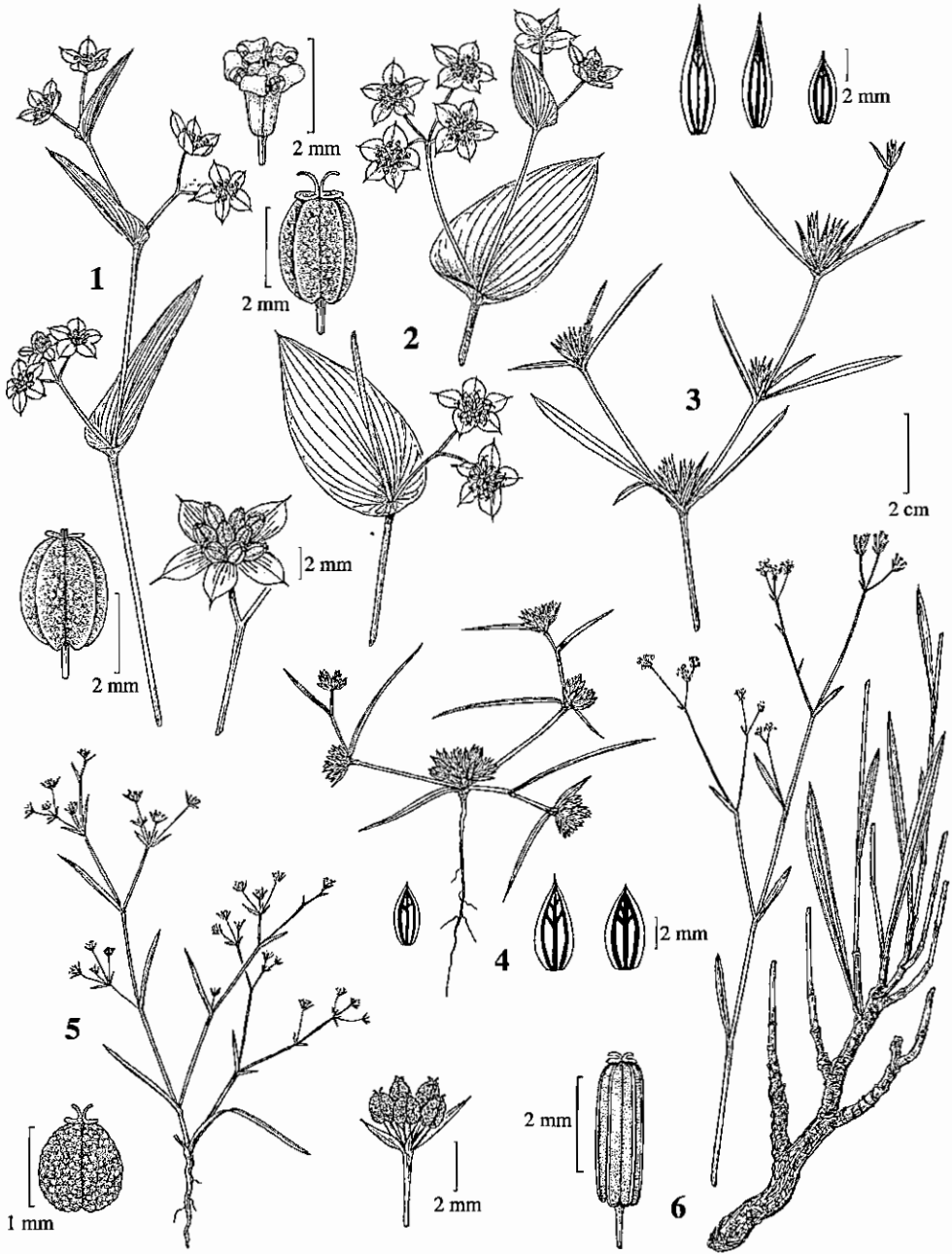


Plate 39. UMBELLIFERAE: *Bupleurum lancifolium* 1, flowering and fruiting branch; flower (up right); fruiting umbellule (down right); fruit (down left). *Bupleurum subovatum* 2, flowering branch; fruiting branch (down); fruit (left). *Bupleurum nodiflorum* 3, fruiting branch; bracteoles (up). *Bupleurum nanum* 4, habit, bracteoles (down). *Bupleurum semicompositum* 5, habit; fruiting umbellule (down right); fruit (down left). *Bupleurum falcatum* 6, basal part with leaves; flowering and fruiting branch (left); fruit (down left). All drawings to the same scale, except the enlarged parts (scale given).

4. **Bupleurum nanum** Poir. in Lam., Encycl. Suppl. 1: 750 (1811).

Syns. *Bupleurum proliferum* Delile, Descr. Egypte, Hist. Nat. 205, t. 22, f. 2 (1814).

Bupleurum nodiflorum Sm. subsp. *nanum* (Poir.) Jafri, Fl. Libya, Umbelliferae 117: 67 (1985).

Like *Bupleurum nodiflorum* Sm., but main stem 0.5-1 cm, terminating in a central umbel and prostrate to ascending side branches 2-10(-20) cm; leaves (1-)2-3(-5) mm broad; umbels 1-10, usually 3-8 (10-50(-70) in *B. nodiflorum*); umbel-rays in the central umbel 8-15; bracteoles per umbellule 5(-6); bracteoles semi-transparent between the nerves.

M; rocky ground. Egypt, Libya.

NOTE: The type was collected from the Mariut region, Egypt.

5. **Bupleurum semicompositum** L., Demonstr. Pl. 7 (1753).

Syns. *Bupleurum glaucum* Robill. & Cast. in Lam. & DC., Fl. Fr., ed. 3, 6: 515 (1815).

Bupleurum semicompositum L. var. *glaucum* (Robill. & Cast.) H. Wolff in Engl., Pflanzenr. 43 (IV. 228): 106 (1910).

Dwarf glabrous glaucous annual, 5-15 cm; stems dichotomously branched from the base, angular; leaves 1-3.5 x 0.1-0.2 cm, linear-subulate, the base slightly clasping, the apex acuminate; umbels terminal and axillary; umbel-rays 3-6, unequal; bracts 0.5-1.2 cm, shorter than the longer rays, lanceolate, 3-nerved; bracteoles 2.5-4 mm, exceeding the flowering umbellules, linear-lanceolate, aristate, 3-nerved; flowers pedicellate, the pedicel 0.3-2 mm; stylopodium discoid, shorter than the styles; petals yellowish or greenish; fruit 1-1.5 mm, ovoid-globose, blackish, tuberculate.

N, M, D, S; sandy plains and desert wadis. Mediterranean region, Southwest Asia.

6. **Bupleurum falcatum** L., Sp. Pl., ed. 1, 237 (1753) subsp. **exaltatum** (M. Bieb.) H.

Wolff var. **linearifolium** (DC.) H. Wolff in Engl., Pflanzenr. 43, (IV, 228): 135 (1910).

Syn. *Bupleurum linearifolium* DC., Prodr. 4: 131 (1830).

Perennial 50-80 cm, with woody base; stems erect, much-branched from the base; basal leaves 3-5 x 0.3-0.6 cm, linear-lanceolate, petiolate; cauline leaves 4-8 x 0.1-0.25 cm, linear-oblancoate; leaf-veins 7-9, acuminate; umbel-rays 4-10; bracts 1-3, unequal; bracteoles 5, minute, 3-veined; petals yellow; fruit 3-4 mm, oblong-ellipsoid, the furrows with 3 vittae.

S; stony ground, hillsides.

Area of the species: Europe to Central Asia and the Himalayas.

6. **Apium** L.

Glabrous annuals or perennials; leaves pinnately or ternately divided; umbels terminal or axillary; bracts and bracteoles 0 or conspicuous; flowers mostly bisexual; calyx teeth minute; petals white, greenish or reddish, mostly entire; stylopodium short-conical; styles

short; fruit broadly ovoid to subglobose; carpophore undivided or slightly 2-fid; mericarps with prominent ribs; oil ducts 1(-3) in each furrow. 25 species, temperate and warm regions, but especially South America.

- | | |
|---|---------------------------|
| 1. Bracteoles 0 | 2 |
| + Bracteoles 5-8 | 3 |
| 2. Leaf segments filiform | 1. A. leptophyllum |
| + Leaf segments 1-3 cm, deltoid | 2. A. graveolens |
| 3. All leaves with lanceolate to ovate segments and serrate margin;
bracteoles with scarious margin | 3. A. nodiflorum |
| + Lower leaves with segments divided into filiform lobes;
bracteoles herbaceous, without scarious margin | 4. A. crassipes |

1. **Apium leptophyllum** (Pers.) F. Muell. ex Benth., Fl. Austral. 3: 372 (1867).

Syns. *Sison ammi* Jacq., Hort. Vindob. 2, t. 200 (1772), non L. (1753), nom. illeg.

Cnidium tenuifolium Moench, Meth. 98 (1794).

Pimpinella leptophylla Pers., Syn. Pl. 1: 324 (1805).

Apium ammi (Jacq.) Urb. in Mart., Fl. Bras. 11 (1): 341 (1879).

Apium tenuifolium (Moench) Thell. in Hegi, Ill. Fl. Mittel-Eur. V (2): 1140, in obs. (1926).

Delicate glabrous annual 15-50 cm, with a slender taproot; stems erect, ascending or procumbent, branched especially from the base, striate; lower and central cauline leaves 5-8 cm, 3-pinnate; segments 0.5-2 x 0.1 cm, filiform, mucronate; sheath 0.3-1.5 cm, with broad scarious margins; upper leaves shorter, with a few segments to 2.5 cm; umbels (2-)3(-4)-rayed, sessile; umbel-rays 1-3 cm; involucre 0; flowers 5-15 in each umbellule; pedicel 3-8 mm; bracteoles 0; calyx-teeth minute; petals 0.3-0.5 mm, white, glabrous; fruit 1-1.5 mm, subglobose, the primary ribs broad; styles very short.

N, M; garden lawns, waste ground, fields, nurseries. Native to Central America, naturalized in many tropical and subtropical regions.

2. **Apium graveolens** L., Sp. Pl., ed. 1, 264 (1753).

Glabrous aromatic annual 20-80 cm; roots fusiform; stems erect or ascending, branched, strongly grooved; leaves rather fleshy; basal leaves petiolate, 1-pinnatisect; segments 3-5, 1-3 cm, deltoid, incised-dentate; cauline leaves short-petiolate or sessile, ternately divided; umbels axillary and terminal, short-pedunculate or sessile; umbel-rays few to many, subequal; bracts and bracteoles 0; pedicel 1-2.5 mm; flowers 0.5 mm; petals greenish-white or white; styles longer than the stylopodium; fruit 1.5 m, broadly ovoid; mericarps c. 1 mm, subglobose, with 5 prominent ribs.

M, De, S; escape from cultivation. Temperate and subtropical regions.

3. **Apium nodiflorum** (L.) Lag., Amen. Nat. 1 (2): 101 (1821).

Syns. *Sium nodiflorum* L., Sp. Pl., ed. 1, 251 (1753).

Helosciadium nodiflorum (L.) Koch, Nov. Act. Caes. Leop.-Carol. Nat.

Cur. 12 (1): 126 (1824).

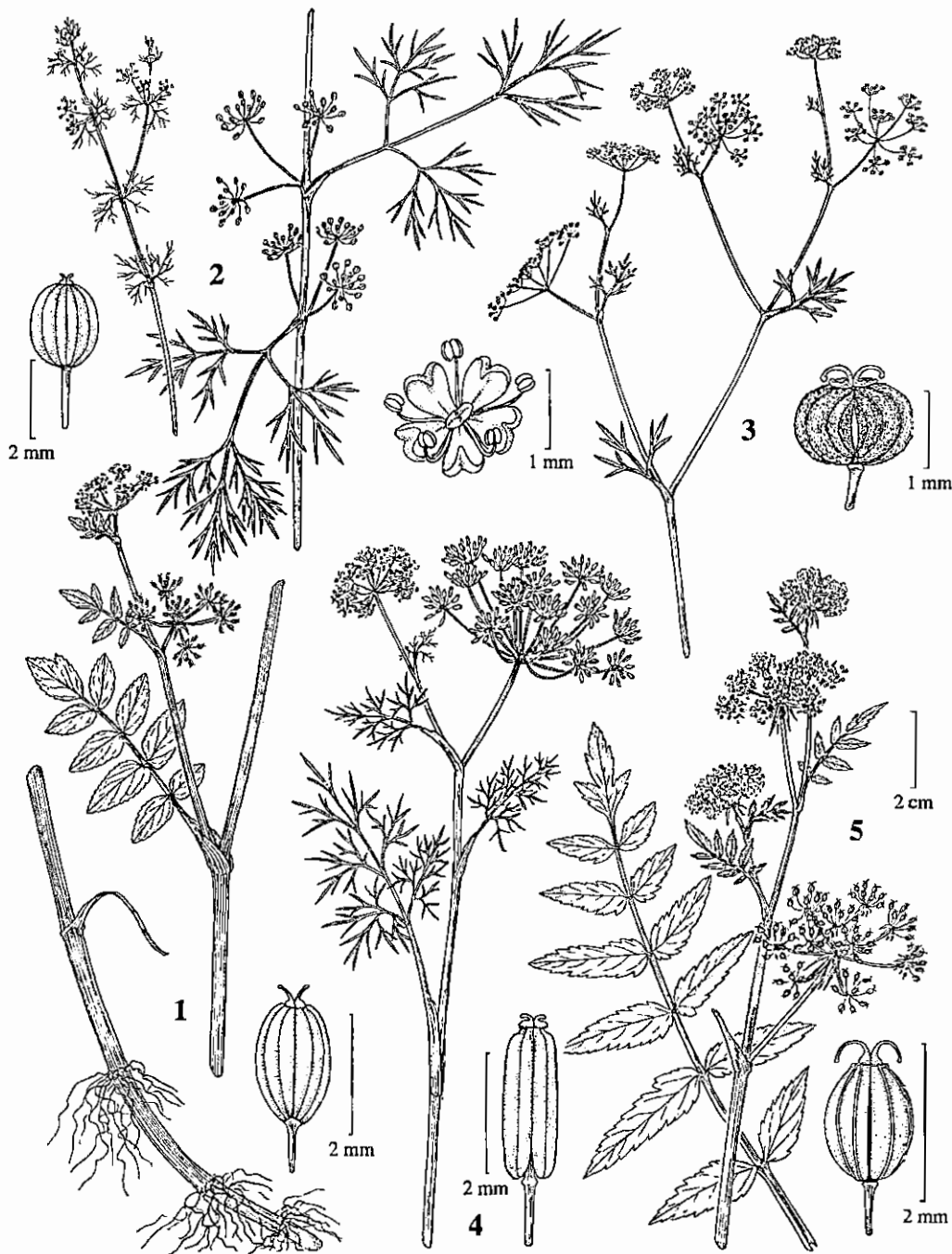


Plate 40. UMBELLIFERAE: *Apium nodiflorum* 1, flowering and fruiting branch; basal rooting nodes (left); fruit (right). *Apium leptophyllum* 2, flowering and fruiting branches; fruit (left). *Brachyapium dichotomum* 3, flowering and fruiting branch; flower (left), fruit (right). *Ridolfia segetum* 4, flowering and fruiting branch; fruit (right). *Berula erecta* 5, flowering and fruiting branch, and basal leaf; fruit (right). All drawings to the same scale, except the enlarged parts (scale given).

Glabrous perennial 30-80 cm; roots fusiform; stems ascending to procumbent, rooting at the basal nodes, grooved, hollow; leaves petiolate, 1-pinnatisect with 3-6 pairs of segments; segments 1.5-3.5 x 1-1.8 cm, lanceolate to ovate, sessile, the base oblique, the margin serrate; umbels opposite the leaves, sessile or the peduncle to 5 mm; rays few, unequal; bracts 0; bracteoles 4-6, usually exceeding the short pedicel, with scarious margin, 3-nerved; flowers 0.6-1 mm; petals white; styles longer than the stylopodium; fruit c. 1.5 mm, with narrow, prominent ribs.

O, M; ponds, ditches. Temperate and warm regions.

4. **Apium crassipes** (Koch ex Rchb.) Rchb. f. in Rchb. & Rchb. f., Icon. Fl. Germ. 21: 9 (1863).

Syn. *Helosciadium crassipes* Koch ex Rchb., Nov. Act. Acad. Leop.-Carol. Nat. Cur. 12 (1): 125 (1824).

Perennial 10-30 cm, usually partly or entirely submerged; leaves 1.5-4 cm, pinnate; lower leaves with segments divided into filiform lobes; upper leaves with ovate, often 3-lobed segments; umbel-rays 3-5; fruiting pedicel thickened at the base; bracteoles 5-8, herbaceous, without scarious margin; styles longer than the stylopodium.

M (Alexandria); ditches and ponds. Egypt, Italy, Sardinia, Sicily, Corsica.

7. **Brachyapium** (Baill.) Maire

Annuals; leaves 2-3-pinnatisect; bracts and bracteoles 0; sepals 0; petals white to pinkish, suborbicular, with inflexed apex; umbel terminal and axillary; umbel-rays few to many; fruit small, cordate-ovoid, laterally compressed, hispid to glabrous, with prominent ridges; vittae solitary. 4 species, Iberian peninsula, North Africa.

1. **Brachyapium dichotomum** (L.) Maire, Bull. Soc. Hist. Nat. Afr. Nord 23: 186 (1932).

Syns. *Pimpinella dichotoma* L., Mant. 58 (1767).

Tragiopsis dichotoma (L.) Pomel, Nouv. Mat. Fl. Atlant. 139 (1874).

Annual 5-15 cm; stems slender, grooved, branched; lower leaves 2-3-pinnatisect; lobes 2-8 mm, linear-lanceolate, acute; lower and upper leaves sheathing at the base; sheath with broad scarious margin; umbel-rays 4-8, 0.8-1.5 cm, subequal; bracts and bracteoles absent; petals white to pinkish; fruit c. 1 mm, subglobose, densely papillose-scabrid.

M (Sidi Barrani); stony ground. Spain, North Africa.

8. **Ridolfia** Moris

Annuals; lower leaves long-petiolate, with broad sheathing base, pinnatisect into filiform lobes; upper leaves smaller, with short sheaths; uppermost leaves sheath-like; umbels long-pedunculate; umbel-rays slender; umbellules many-flowered; petals yellow; fruit laterally compressed; mericarps 5-ribbed. 1 species, Mediterranean region, Sinai.

1. **Ridolfia segetum** (L.) Moris, Enum. Sem. Hort. Taur. 1841: 43 (1841).

Syn. *Anethum segetum* L., Mant. Alt. 219 (1771).

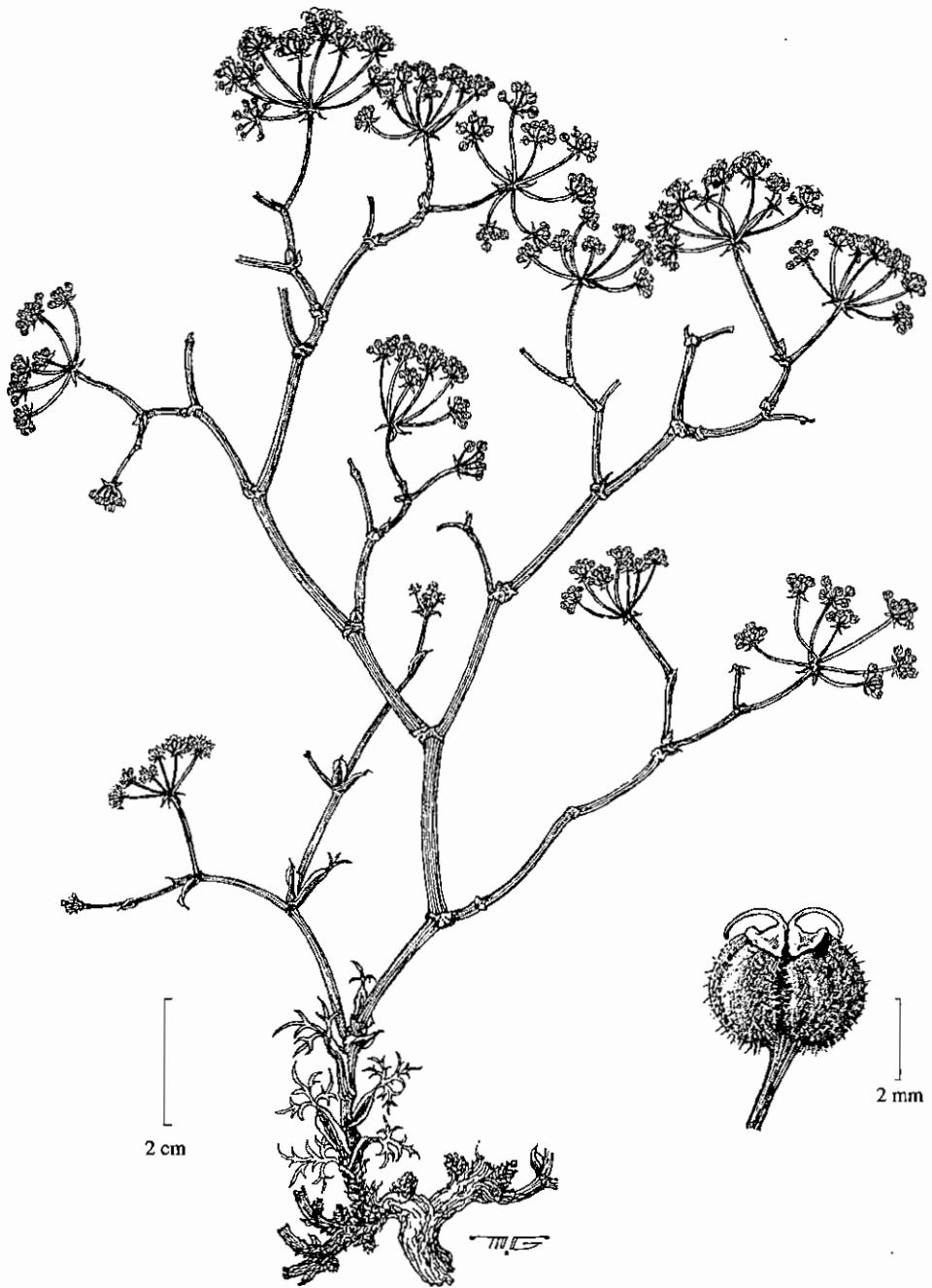


Plate 41. UMBELLIFERAE: *Deverra tortuosa*, flowering and fruiting branch; fruit (right). Enlarged fruit (scale given).

Glabrous annual 30-80 cm; stems erect, branched, grooved; lower leaves 15-25 cm, long-petiolate, with broad sheathing base, 3-pinnatisect into filiform lobes, the ultimate lobes 1-2 cm; upper leaves smaller, with short sheaths, dissected into filiform lobes; uppermost leaves sheath-like, undivided; umbels long-pedunculate; umbel-rays 3-8 cm, slender; umbellules many-flowered; pedicel 2-6 mm, unequal; petals yellow; fruit c. 1.5 mm, laterally compressed, oblong-prismatic, glabrous; mericarps obscurely 5-ribbed.

S; weed of cultivation. Mediterranean region, Sinai.

9. **Deverra** DC.
Syn. *Pituranthos* Viv.

Dwarf shrubs or perennials; stems green, glaucous, almost leafless; leaves mostly basal, usually divided into filiform lobes; uppermost leaves usually reduced to sheaths; umbels terminal or axillary; bracts and bracteoles often caducous; flowers bisexual; calyx-teeth minute; petals greenish-white; stylopodium depressed-conical; styles short, deflexed; fruit laterally compressed, ovoid-globose, hairy or setose; carpophore 2-partite; mericarps with 5 prominent ribs; oil ducts solitary in each furrow. 7 species, Old World deserts and semideserts.

1. Bracts and bracteoles persistent; umbel-rays 6-10; fruit 1-1.5 mm, globose 1. **D. tortuosa**
+ Bracts and bracteoles caducous; umbel-rays 3-5; fruit 3-4 mm, oblong-ellipsoid 2. **D. triradiata**

1. **Deverra tortuosa** (Desf.) DC., Prodr. 4: 143 (1830).
Syns. *Bubon tortuosum* Desf., Fl. Atlant. 1: 257, t. 73 (1798).
Pituranthos tortuosus (Desf.) Benth. ex Asch. & Schweinf., Mém. Inst. Egypt. 2: 80 (1887).

Strongly aromatic glabrous shrub, 30-80 cm; stems dichotomously branched, striate; leaves caducous; basal leaves 3-8 cm, 2-pinnatisect into linear-subulate, acute lobes; petiole sheathing, with broad scarious margin; lower cauline leaves with sheaths to 1.5 cm; blade 1-2.5 cm, ternatisect, the lobes linear-subulate; upper leaves reduced to sheaths with filiform apices; umbels mostly terminal; peduncle 1.5-4 cm, stout; umbel-rays 6-10, 1-2 cm, subequal; bracts 2-3 x 1-1.5 mm, triangular, the margin scarious, the apex mucronate; bracteoles minute; bracts and bracteoles persistent; pedicel 0-1.5 mm; flowers hardly opening; petals almost glabrous; styles longer than the depressed stylopodium; fruit 1-1.5 mm, globose, hirsute.

O, M, D, R, S; desert wadis, sandy and stony plains. Tunisia, Libya, Egypt, Palestine, Saudi Arabia.

NOTE: Widespread desert shrub, highly palatable by livestock, especially camels, and constitutes an important range plant during summer time. The tender shoots and leaves are used as a condiment.

2. **Deverra triradiata** Hochst. ex Boiss., Fl. Orient. 2: 861 (1872).
Syn. *Pituranthos triradiatus* (Hochst. ex Boiss.) Asch. & Schweinf., Mém. Inst. Egypt. 2: 80 (1887).

Like *Deverra triradiata*, but shrub more robust to 1.5 m; bracts and bracteoles caducous; umbel-rays 3-5; fruit 3-4 mm, oblong-ellipsoid; mericarps often curved.

De, S; stony wadis. Egypt, Palestine, Arabia, Iraq.

NOTE: The type was collected 8 August 1835 by Schimper 454, from Sinai, Egypt (K').

10. *Ammi* L.

Glabrous annuals or biennials; leaves pinnate or pinnatisect into filiform or lanceolate segments; umbels terminal, compound, many-rayed; bracts numerous, conspicuous, mostly dissected; bracteoles numerous, entire; flowers bisexual, mostly fertile; sepals minute or obsolete; petals white, partly radiating, 2-lobed; stylopodium depressed, shorter than the deflexed styles; fruit laterally compressed, ovoid-oblong; carpophore entire or 2-fid; mericarp 5-ribbed; oil ducts solitary in each furrow. About 4 species, Macaronesia, Mediterranean region, West Asia, naturalized elsewhere.

- 1. Segments of upper leaves linear or filiform; umbel-rays in fruit convergent, closely packed together 1. *A. visnaga*
- + Segments of upper leaves linear-lanceolate, serrulate; umbel-rays in fruit divergent, forming an open umbel 2. *A. majus*

1. *Ammi visnaga* (L.) Lam., Fl. Fr., ed. 1, 3: 462 (1778).
Syn. *Daucus visnaga* L., Sp. Pl., ed. 1, 242 (1753).

Annual 30-80 cm; stems erect, branched, terete; basal leaves 1-pinnatisect, withered at anthesis; cauline leaves 3-pinnatisect; ultimate lobes 1-2.5 x 0.05-0.1 cm, linear or filiform; umbels mainly terminal, peduncle to 12 cm; umbel-rays many, rigid, open in flower, convergent and closely packed in fruit; outer umbel-rays 3-7 cm, the inner shorter; bracts 2-4 cm, 3-5-partite, the lobes filiform; umbellules many-flowered; bracteoles 3-6 mm, linear-subulate, acuminate; pedicel 1.5-4 mm; petals white, not radiating; styles deflexed; fruit 1.5 mm, oblong-ovoid, ribbed, glabrous.

N, M; weed of cultivation, canal banks. Atlantic Islands, Mediterranean region, Southwest Asia, Ethiopia.

NOTE: Khellin, a coumarin extracted from the fruit is used as a pharmaceutical product for the treatment of asthma and angina pectoris. Recently, khellin has been applied as a photochemotherapeutic agent for the treatment of vitiligo. The umbel-rays are used as tooth picks.

2. *Ammi majus* L., Sp. Pl., ed. 1, 243 (1753).
Syn. *Apium ammi* Crantz., Stirp. Austr. 3: 109 (1767).

Glabrous annual 25-60 cm; stems erect, branched, ridged; leaves to 12 cm, greenish-glaucous; lower leaves long-petiolate, pinnately lobed into oblong-lanceolate, serrulate segments; upper leaves divided; segments linear-lanceolate, serrulate; peduncle to 10 cm; flowering umbels 6-8 cm diam., fruiting umbels open; bracts 1-1.5 cm, 3-5-partite, the segments filiform; bracteoles 1-2 mm, scarious-margined, subulate; pedicel longer than the flower and fruit; petals white, not radiating; styles divaricate, longer than the conical stylopodium; fruit 1.5 mm, oblong-ovoid, with prominent ribs.

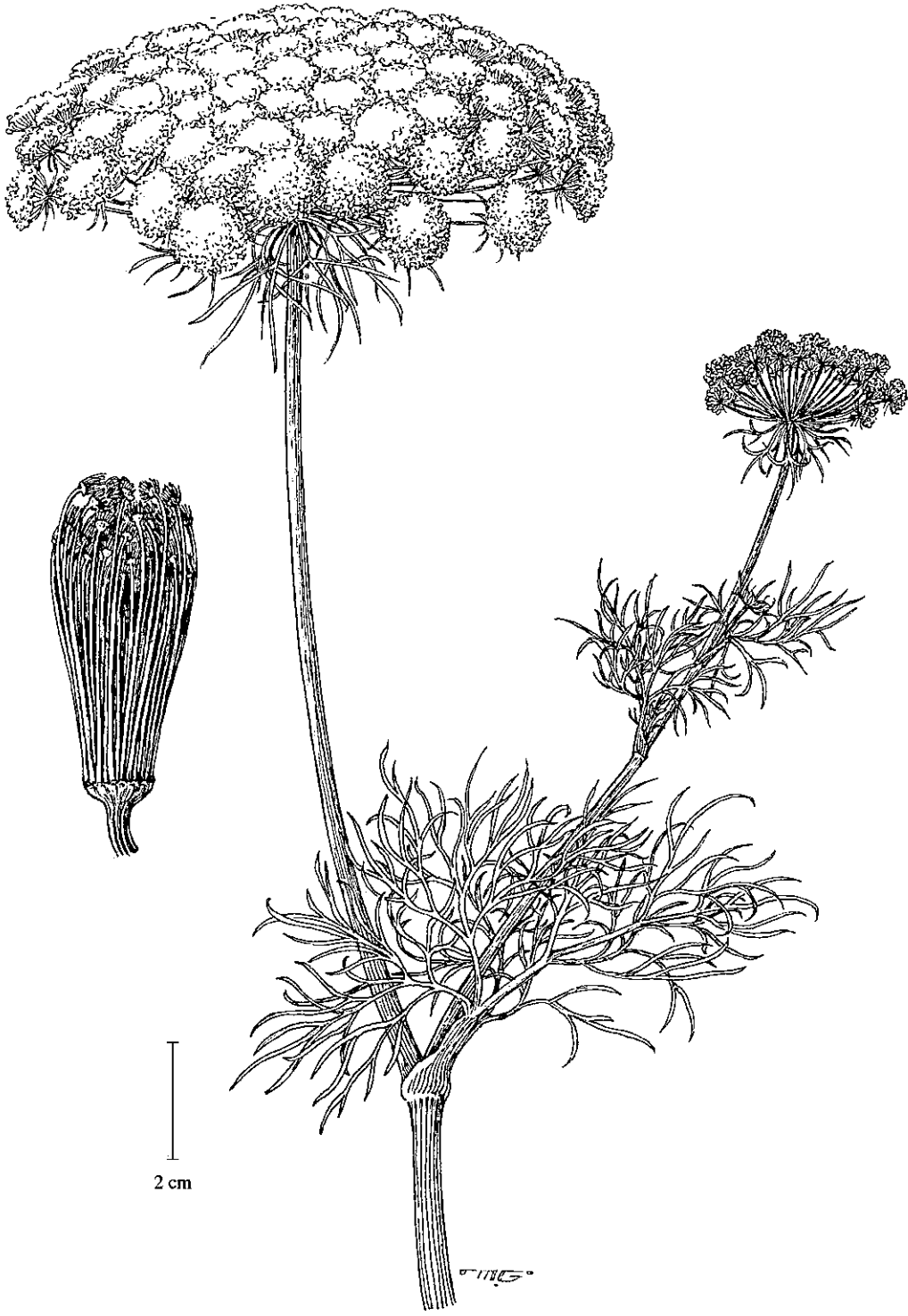


Plate 42. UMBELLIFERAE: *Ammi visnaga*, flowering branch; mature inflorescence (left). Drawings to the same scale.

N, O, M, S; weed of cultivation, roadsides, canal banks. Atlantic Islands, Europe, Mediterranean region, West Asia; naturalized or adventive in many temperate and warm regions.

NOTE: The seeds are used in folk medicine.

11. *Berula* Koch

Aquatic perennials; stems hollow, grooved; basal leaves submerged, pinnate; segments sessile, subopposite; cauline leaves smaller, the segments sessile; umbels opposite the leaves; umbel-rays many; bracts leaf-like; petals white; fruit ovoid-globose. 1 species. Europe, East Mediterranean region, Caucasus, North and Central Asia, Iran, Afghanistan, North America.

1. *Berula erecta* (Huds.) Coville, Contr. U. S. Nat. Herb. 4: 115 (1893).

Syns. *Sium erectum* Huds., Fl. Angl., ed. 1, 1: 103 (1762).

Sium angustifolium L., Sp. Pl., ed. 2, 1672 (1763).

Berula angustifolia (L.) Mert. & Koch in Röhling, Deutschl. Fl., ed. 3, 2: 433 (1826).

Glabrous aquatic perennial 30-60 cm; stems erect or decumbent, hollow, grooved; basal leaves 8-22 cm, submerged, 1-pinnate; segments 5-10 pairs, 2-5 x 1-2 cm, subopposite, sessile, ovate-oblong, serrate; petiole 2.5-10 cm; cauline leaves smaller; segments 5-8 pairs, sessile, ovate-lanceolate, acute, serrate; umbels opposite the leaves; peduncle 1.5-5 cm; umbel-rays many, 2-4 cm; bracts 5-7, 1-2 cm, leaf-like; bracteoles 4-6 mm; flowers 1-2 mm, on pedicels 1-3 mm; petals white; fruit c. 1.5 mm, ovoid-globose, the ribs narrow.

N (Delta), O (Wadi Natrun), M (Alexandria); swamps, ditches, canals. Distribution as for the genus.

12. *Pimpinella* L.

Annuals or perennials; basal leaves undivided or pinnatisect with dentate segments; umbels mostly terminal; umbel-rays many; bracts and bracteoles usually 0, rarely 1-5; flowers bisexual and male; calyx usually obsolete; petals mostly white, sometimes radiating; stylopodium depressed or conical; styles mostly long; fruit ovoid-globose; carpophore 2-fid; mericarps with prominent ribs, or ribs obsolete; oil ducts usually 2-3 in each furrow. 150 species, Eurasia, Africa.

1. Leaf segments rounded or obovate-cuneate;

umbel-rays pubescent

1. *P. schweinfurthii*

+ Leaf segments linear; umbel-rays glabrous

2

2. Mericarps appressed-hairy, hairs straight

2. *P. cretica*

+ Mericarps densely white-hispid, hairs hooked

3. *P. etbaica*

1. *Pimpinella schweinfurthii* Asch., Verh. Bot. Vereins. Prov. Brandenb. 21 (1879): 57 (1880).

Pubescent-hirtellous annual 20-60 cm; stems branched above; basal leaves long-petiolate, pinnately ternate and biternate; lobes rounded, the margin bidentate; stem

leaves sessile, the lower biternate, the upper ternate; lobes obovate-cuneate, incised-dentate; terminal umbel-rays 11, the lateral 5-6, all umbel-rays pubescent; bracts and bracteoles 0 or rarely 1; stylopodium conical; style soon deciduous; fruit 1.5 mm.

O (Kharga); weed of cultivation. Endemic.

NOTE: I have not seen any material of this species and the above description is based on the original publication.

2. *Pimpinella cretica* Poir. in Lam., Encycl. Suppl. 1: 684 (1811).

Annual glabrous herb 10-40 cm; stems branched from the base, striate; basal and lower cauline leaves long-petiolate; blade 1-2 x 1-2 cm, ovate-orbicular, the base cordate, the margin dentate; middle and upper cauline leaves ternately-divided into ovate-cuneate segments; uppermost leaves sessile, with a sheath 0.8-1.2 cm and blade 3-fid or undivided; umbels terminal and axillary; peduncle 1.5-3.5 cm; umbel-rays 5-15, glabrous; bracts and bracteoles 0; petals slightly radiating, white, deeply 2-fid, glabrous; stylopodium conical, shorter than the divergent styles; fruit 1.25 mm, ovoid, appressed-hairy; ribs of mericarp 5, narrow.

S; stony wadis. East Mediterranean region, Sinai, Arabia, Iraq.

NOTE: According to Matthews in Davis (ed.), Fl. Turkey 4: 356 (1972), two varieties of *Pimpinella cretica* occur in Sinai: var. *cretica* and var. *arabica* (Boiss.) Boiss., Fl. Orient. 2: 866 (1872). Syn. *Pimpinella arabica* Boiss., Ann. Sci. Nat., sér. 3, 1: 130 (1844). The difference given between the two varieties is as follows:

- | | |
|---|---------------------|
| 1. Plant 10-30 cm; basal leaves simple | var. cretica |
| + Plant dwarf, 5-10 cm; basal leaves 3-sect, the segments cuneate | var. arabica |

On the other hand, Zohary, Fl. Palaest. 2: 426-427, f. 617, 617a (1972) enumerates three varieties which occur in the Flora Palaestina area: var. *cretica*, var. *lasiopetala* Feinbr., Repert. Sp. Nov. 29: 134 (1931), and var. *petraea* (Nab.) Zohary, Fl. Palaest. 2: 427 (1972), Syn. *Pimpinella petraea* Nab., Publ. Fac. Sci. Univ. Masaryk 35: 122, t. 13, f. 2 (1923). Of these three varieties listed by Zohary, two occur in Sinai: var. *cretica* and var. *petraea*. This leaves us with three varieties in Sinai: var. *cretica*, var. *arabica* (Boiss.) Boiss. and var. *petraea* (Nab.) Zohary, if we consider that var. *petraea* was overlooked by Matthews and var. *arabica* was overlooked by Zohary. There is no evidence to consider var. *arabica* to be identical to var. *petraea*, since the descriptions of both taxa seem to separate them adequately: var. *petraea* is 50-80 cm, while var. *arabica* is a dwarf plant 5-10 cm; basal leaves are 3-sect in var. *arabica*, while in var. *petraea* they are orbicular-cordate.

3. *Pimpinella etbaica* Schweinf., Verh. Zool.-Bot. Vereins. Wien 18: 667 (1868).

Annual 5-25 cm; stems erect, branched, finely striate, glabrous or sparsely hairy; basal leaves ternate-pinnate; petiole 2-4 cm; lower cauline leaves 1-2.5 x 1-2 cm, ovate-orbicular, 2-pinnatisect; segments cuneate, the ultimate segments acute or obtuse; upper cauline leaves 3-partite, the segments 0.5-1.5 x 0.1 cm, linear; petiole 3-5 mm, sheathing, the sheath scarious-margined, ciliate; peduncle 1-2.5 cm; umbel-rays 3-7; bracts and bracteoles 0; umbellules 7-12-flowered; pedicel 1-2 mm; flowers white; fruit 1.2 mm; mericarps densely white-hispid, the hairs hooked.

GE; stony ground. Southeast Egypt, Northeast Sudan (Red Sea Hills).

13. *Ammoides* Adans.

Glabrous annuals; leaves 1-2-pinnate into linear segments; umbels compound, pedunculate; bracts 0 or minute; bracteoles dimorphic; flowers bisexual, white; calyx teeth 0; petals with a projecting lobe; fruit ovoid, glabrous; carpophore 2-fid; mericarps with 5 prominent ribs; each furrow with a single oil duct. 2 species, Portugal, Mediterranean region.

1. *Ammoides pusilla* (Brot.) Breistr., Bull. Soc. Sci. Dauph. 61: 628 (1947).
Syns. *Seseli pusillum* Brot., Fl. Lusit. 1: 457 (1804).
Ptychotis ammoides Koch, Nov. Act. Cur. 12 (1): 125 (1824).

Slender glabrous annual 10-30 cm; lower leaves 2-3 x 0.3-0.5 cm, 2-pinnate; lobes 7-11, linear-mucronate; middle leaves with 3-5 pairs of segments, the upper with 2-3 filiform segments to 1 cm; umbel-rays 5-11, unequal; peduncle 2-5 cm; bracts 0 or few and caducous; umbellules 10-20-flowered; pedicel 1-2 mm, elongate in fruit; bracteoles 4-6, 3-4 mm, dimorphic, linear-lanceolate or narrowly spatulate, acuminate; petals 0.5 mm, white, inflexed, the apex emarginate; fruit 1 mm, ovoid; mericarps with filiform ribs.

O (Dakhla); cultivated ground. Portugal, Mediterranean region.

14. *Scandix* L.

Annuals; leaves 2-3-pinnatisect into linear or filiform lobes; umbels terminal or axillary, long-pedunculate; umbel-rays few; bracts mostly 0; bracteoles 2-lobed, scarious-margined, ciliate; flowers bisexual, with few male flowers in the centre of the umbel; calyx-teeth minute or 0; petals white, obovate, notched; stylopodium as long as the styles or shorter, obconical; carpophore 2-fid; fruit oblong-linear, long-beaked; the seed-bearing part compressed; mericarps usually separating at maturity, 5-ribbed; oil ducts 1-3 in each furrow. About 20 species, Europe, Mediterranean region, West Asia.

1. Mericarps 1.5-2.5 cm, including the beak
 - + Mericarps 4-6 cm, including the beak
1. *S. stellata*
 2. *S. pecten-veneris*

1. *Scandix stellata* Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 2: 249 (1794).
Syns. *Scandix pinnatifida* Vent., Descr. Pl. Jard. Cels, t. 14 (1800-1801).
Scandicum stellatum (Banks & Sol.) Thell., Repert. Sp. Nov. 16: 16 (1919).

Glabrous or glabrescent annual, 10-25 cm; stems erect or ascending, branched, terete, striate; basal and lower cauline leaves 2-5 cm, ovate, 2-3-pinnatisect; ultimate segments linear, acute; petiole sheathing, scarious-margined; upper cauline leaves sessile, the segments 0.5-1.5 cm, filiform; umbel-rays 1-3, 2-4 mm, thick; bracts 0; umbellules many-flowered; bracteoles 0.5-1 cm, pinnatisect into linear lobes; flowers minute, male flowers few or 0; petals slightly radiating, white, notched; styles minute, as long as the stylopodium; mericarps 1.5-2.5 cm, including the beak, sessile; beak 2-3 times as long as the seed-bearing part, compressed, the ribs filiform.

S; stony ground. Mediterranean region, West Asia.

2. *Scandix pecten-veneris* L., Sp. Pl., ed. 1, 256 (1753).

Hairy annual 15-30 cm; stems erect or ascending, branched from the base, striate; leaves



Plate 43. UMBELLIFERAE: *Pimpinella cretica* 1, habit; fruit (right). *Pimpinella etbaica* 2, habit; fruit (left). *Scandix stellata* 3, flowering and fruiting branch; fruit (down left). *Scandix pecten-veneris* 4, flowering and fruiting branch; fruit (left). *Crithmum maritimum* 5, flowering branch; fruit (down left). All drawings to the same scale, except the enlarged parts (scale given).

2-3-pinnatisect; ultimate segments 1-4 x 0.5 mm, linear, acute; lower leaves long-petiolate; petiole sheathing, scarious-margined; upper leaves short-petiolate or sessile; peduncle 2-4 cm; umbel-rays 2-3, 1-3 cm, accrescent in fruit; bracts 0; umbellules 4-7-flowered; bracteoles 0.5-1 cm, simple or 2-3-fid, oblong, the margin ciliate, the apex acute; flowers mostly bisexual, a few staminate; petals slightly radiating, white, obovate, notched; styles 2-3 times as long as the stylopodium; mericarps 4-6 cm including the beak, the margin scabrous, the ribs prominent; beak 3-4 times as long as the seed-bearing part, compressed.

M; cultivated ground. Europe, Mediterranean region, western Asia to Northwest India.

15. *Foeniculum* Mill.

Perennials, often woody at the base, rarely annuals; leaves 2-4-pinnatisect into filiform segments; umbels terminal and axillary; umbel-rays many; bracts and bracteoles 0; flowers bisexual; calyx-teeth obsolete; petals yellow, ovate, notched; stylopodium conical; styles short, recurved; fruit ovoid-oblong; carpophore 2-fid; mericarps 5-ribbed; oil ducts 1 in each furrow. 1 species, Europe, Asia, Africa, widely cultivated as a culinary herb in temperate regions.

1. *Foeniculum vulgare* Mill., Gard. Dict., ed. 8, no. 1 (1768).

Syns. *Anethum foeniculum* L., Sp. Pl., ed. 1, 263 (1753).

Foeniculum officinale All., Fl. Pedem. 2: 25 (1785).

Glabrous perennial 0.5-1.5 m; roots fusiform; stems erect, solid, striate; leaves 30-50 cm, ovate, 3-4-pinnatisect; lower leaves long-petiolate, the upper sessile; sheathing petiole 1.5-6 cm; ultimate segments of all leaves filiform, the apex mucronate; blade of uppermost leaves much reduced or 0; umbel rays 4-15, unequal; flowers small; styles 0.25 mm; fruit 4-5 x 2-2.5 mm; mericarps 5-angled, with prominent ribs.

Two subspecies occur in Egypt:

subsp. **vulgare**

Syn. *Foeniculum capillaceum* Gilib., Fl. Lit. 2: 40 (1781).

Umbel-rays 12-15; fruit sweet-tasting.

N, S; fields, gardens, escape from cultivation.

subsp. **piperitum** (Ucria) Cout., Fl. Portug., ed. 1, 450 (1913).

Syns. *Anethum piperitum* Ucria, Nouv. Racc. Opusc. Aut. Sic. 6: 250 (1793).

Foeniculum piperitum (Ucria) Presl, Fl. Sic. 1: XXVI (1826).

Umbel-rays 4-10; fruit acid.

N, M, S; roadsides, canal banks, hillsides.

Area of the species as for the genus.

16. *Crithmum* L.

Perennials with fleshy rhizomes; stems solid, grooved; leaves long-petiolate, ternately pinnatisect; upper leaves much reduced, subsessile, ternately lobed; umbels conspicuous,

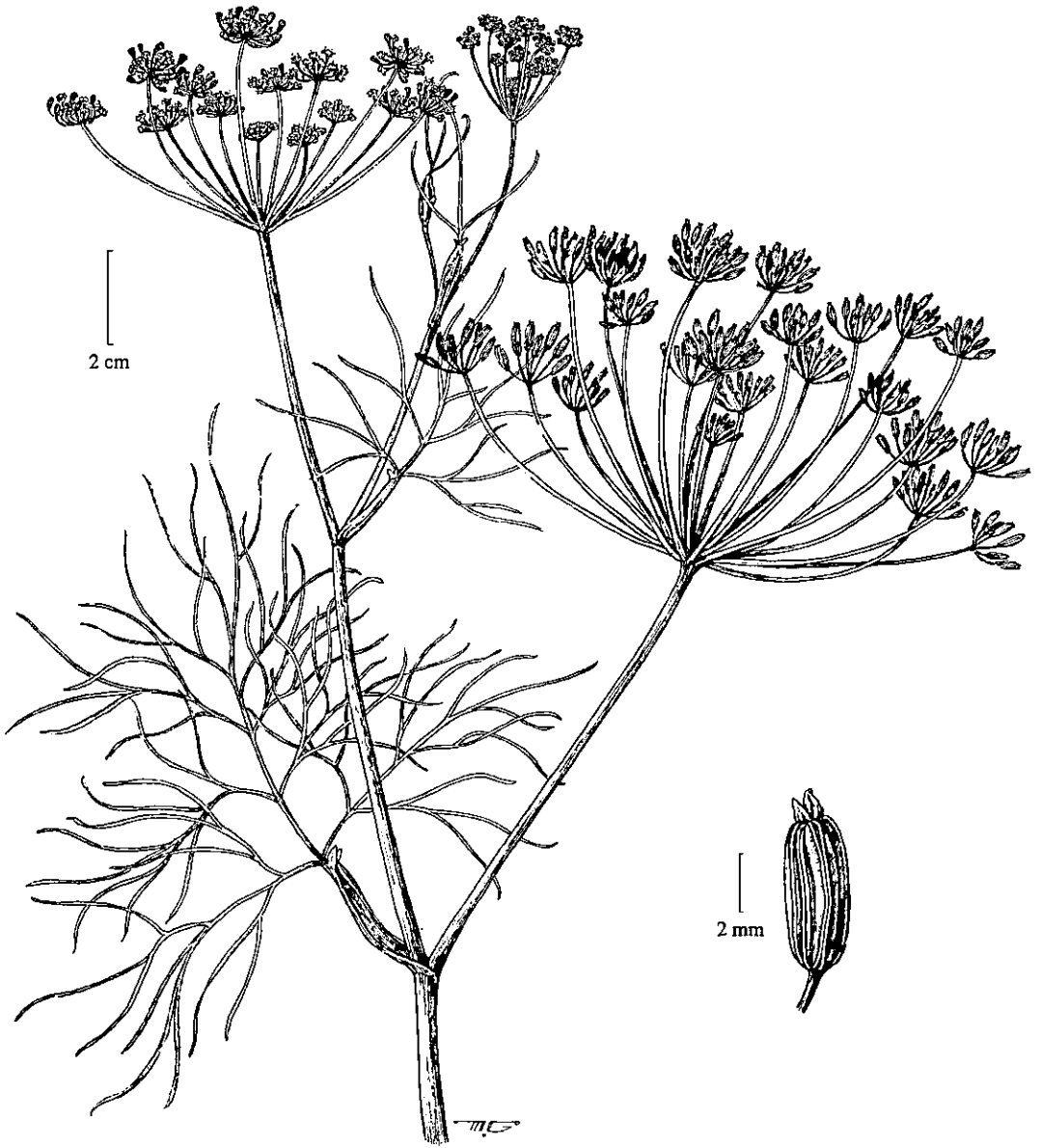


Plate 44. UMBELLIFERAE: *Foeniculum vulgare* subsp. *vulgare*, flowering and fruiting branch; mericarp (right). Enlarged part (scale given).

especially in fruit; peduncle thick, stout; umbel-rays many, striate; bracts and bracteoles deflexed; flowers greenish-yellow; stylopodium conical; fruit corky, 5-ribbed. 1 species, Macaronesia, coasts of Atlantic Europe, Mediterranean region and Black Sea coasts.

1. **Crithmum maritimum** L., Sp. Pl., ed. 1, 246 (1753).

Glabrous fleshy rhizomatous perennial, 30-60 cm; stems much-branched from the base, solid, grooved; leaves long-petiolate, ternately 1-2-pinnatisect; segments 1-6 x 0.3-1.2 cm, linear-lanceolate to oblong, acute, entire, tapering at the base; upper leaves much reduced, subsessile, ternately lobed; umbels conspicuous, especially in fruit; peduncle 4-10 cm, thick, stout; umbel-rays 10-25, 2-6 cm, striate; bracts and bracteoles linear to lanceolate, deflexed, the margin scarious, the apex acute; flowers greenish-yellow 1.5-2 mm diam.; stylopodium conical, about as long as the styles; fruit 5-8 x 3-4 mm, oblong-ellipsoid, corky; ribs 5, glabrous.

M; rocky maritime cliffs. Distribution as for the genus.

17. **Ducrosia** Boiss.

Perennials; leaves 1-3-pinnatisect into linear to ovate segments; umbels compound, lateral and terminal; umbel-rays few or many; bracts and bracteoles linear to ovate, sometimes 0; calyx-teeth minute; petals hairy on the outer surface; stylopodium conical; styles slender; fruit pubescent, flattened dorsally; dorsal and intermediate ridges thin, the lateral winged, corky; vittae 1 per furrow. 3 species, Egypt to Northwest India.

1. **Ducrosia ismaelis** Asch., Verh. Bot. Vereins. Prov. Brandenb. 21 (1879): 67 (1880).

Glabrous glaucous perennial 15-40 cm; stems much-branched, woody and densely leafy at the base; leaves pruinose on the lower surface, long-petiolate, pinnately ternate. the lobes sessile; terminal lobe divided into linear-lanceolate segments, the acute apex with a white mucronate; sheath short, broadly white-margined; umbel-rays 4-9; bracts and bracteoles triangular-lanceolate, with broad white margin; ovary slightly hirtellous; fruit 3.5 mm, narrowly elliptic; mericarps thick-margined, tomentellous along the furrows.

O (Kharga); edges of cultivation. Endemic.

NOTE: No material of this species has been examined, the above description is based on the original publication.

18. **Ferula** L.

Perennials; leaves usually very large, finely 2-5-pinnately or -ternately dissected, the lobes narrow; flowering branches terminating in opposite or whorled compound umbels; central umbel short-peduncled or sessile; bracts and bracteoles 0 or bracts few, often caducous bracts; flowers of the central umbel bisexual, fertile, the lateral mostly staminate; calyx-teeth minute; petals yellow, yellowish-green or whitish-green; stylopodium depressed-conical, the margin lobed; fruit large, flattened, ovate-elliptic; mericarps 5-ribbed, the margin wing-like; oil ducts 1-4 in each furrow. 172 species, Mediterranean region to Central Asia.

1. Upper leaf-sheaths lanceolate, open, not turgid
+ Upper leaf-sheaths boat-shaped, clasping, turgid

1. **F. sinaica**
2. **F. marmarica**

1. *Ferula sinaica* Boiss., Diagn. Pl. Orient., ser. 1, 10: 40 (1849).

Glaucous perennial 0.6-2 m; roots fusiform; stems 1-1.5 cm thick, solid, terete, striate; lower leaves 12-18 cm, ternately divided into 3-4 pinnatisect segments; ultimate lobes 0.3-1.4 x 0.05-0.2 cm, linear, arcuate, the margin revolute, the apex mucronate-callose; upper leaves with sheaths 6-12 x 1.5 cm, lanceolate, open, not turgid; blade 8-12 cm, the segments less dissected than in lower leaves; inflorescence much-branched; umbels 7-12-rayed, on short or long peduncles; central umbel fertile, the branches subtended by 2 bracts 3-5 x 1-1.5 cm; bracteoles minute; petals yellow; styles deflexed; fruit 1-1.2 x 0.6-0.8 cm, \pm equalling the pedicel, elliptic-obovate; ribs prominent, marginal ribs winged; oil ducts 2-3 per furrow.

S (St. Katherine); in the mountains. Sinai, Palestine, Saudi Arabia.

NOTE: The type was collected by Schimper 149, from St. Katherine Mountain, Sinai, in 1835 (K!).

2. *Ferula marmarica* Asch. & Taub., ex Asch. & Schweinf., Bull. Herb. Boissier 1: 649 (1893).

Perennial 60-80 cm; rootstock thick, often covered with fibres of dead leaves; stems erect, 0.8-1 cm thick, glabrous, narrowly striate; leaves pale green; upper leaf sheaths boat-shaped, clasping, turgid; blade 3-4-pinnatisect; ultimate segments entire or 3-fid, obtuse, mucronate; umbels 1 large terminal and 5-10 smaller lateral; bracts and bracteoles 0; petals yellow; fruit ovate-elliptic, the margins narrow; vittae 3-4 per furrow.

M, Dw (Mashruka); stony ground. Egypt, Libya.

19. *Tordylium* L.

Annuals or biennials; leaves 1-3-pinnatisect; umbel-rays few; bracts few or 0; bracteoles present; flowers bisexual and staminate; calyx-teeth triangular; petals white, cuneate or clawed; outer petals large, often unequally 2-lobed; stylopodium conical, the margin undulate; styles deflexed; fruits mostly of 2 kinds, rarely mericarps all alike; carpophore 2-partite; mericarps ribbed; oil ducts 1-3 per furrow, rarely more; seeds flattened. 18 species, Mediterranean region, Southwest Asia.

1. *Tordylium aegyptiacum* (L.) Poir. in Lam., Encycl. 7: 711 (1806).
Syn. *Hasselquistia aegyptiaca* L., Cent. Pl. 1: 9 (1755).

Pilose annual 30-60 cm; stems erect, branched from the base, terete, grooved; leaves 8-20 cm, patent-pubescent; lower leaves long-petiolate, 1-pinnatisect, the lobes simple or 3-4-lobuled; cauline leaves 2-3-pinnatisect, the ultimate segments incised into acute lobes; uppermost segments reduced to broad sheaths and 1-pinnatisect blades; peduncle to 8 cm; umbel-rays 7-15, 3-10 cm; bracts and bracteoles linear-subulate; flowers rather conspicuous; petals strongly radiating, the outer petal deeply 2-partite; outer fruits 5-9 mm, suborbicular, glabrous or finely papillose, notched at the apex and base, outer margin 1 mm broad, white; the inner 1.5 mm broad, translucent; ribs filiform; oil ducts 1 in each furrow; inner fruits 3-5 mm, urceolate.

M, S (El-Arish); cultivated and waste ground. East Mediterranean region to Iraq.

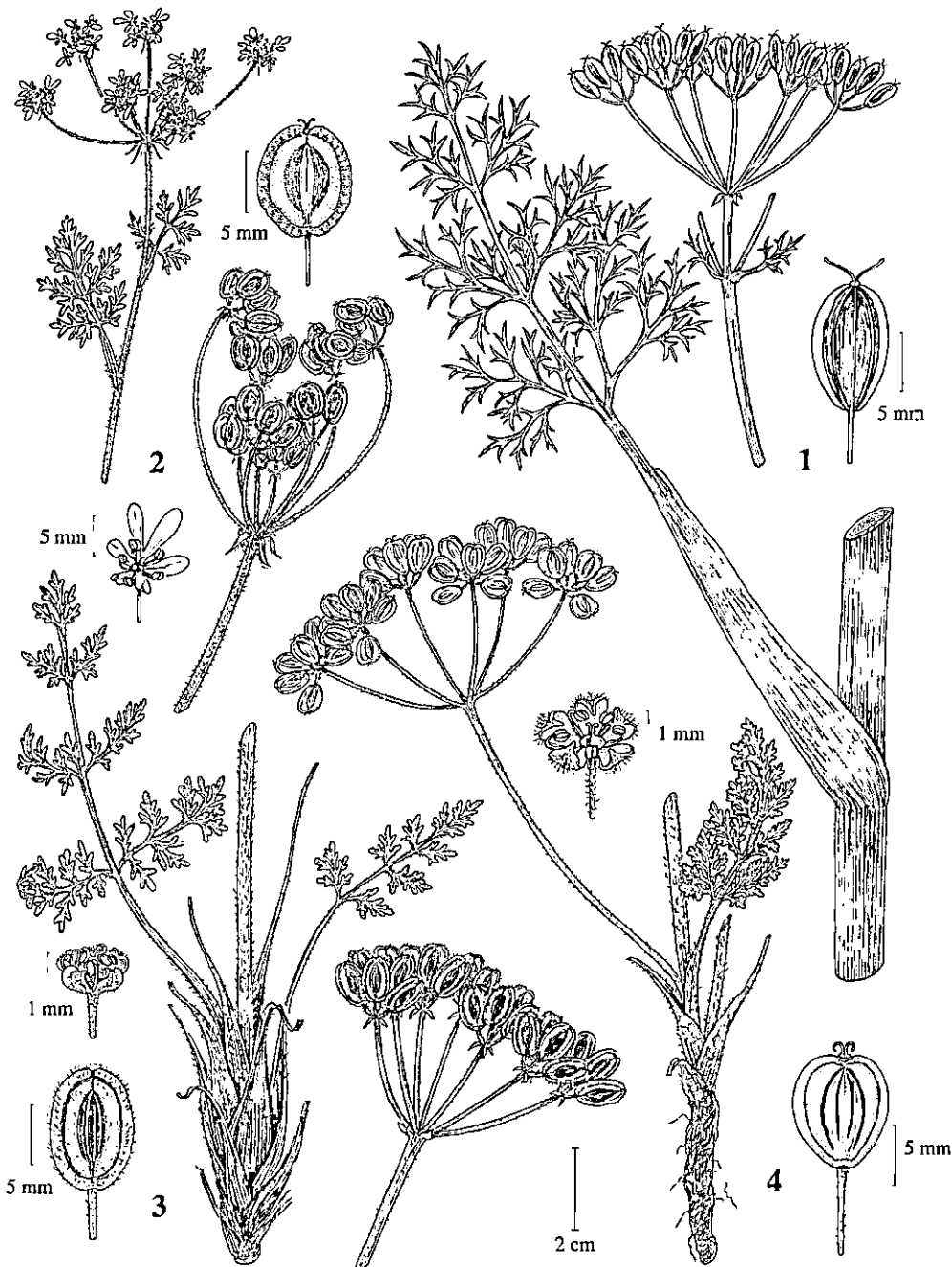


Plate 45. UMBELLIFERAE: *Ferula sinaica* 1, stem with a lower leaf; fruiting inflorescence and fruit (up). *Torzylidium aegyptiacum* 2, flowering branch; fruiting inflorescence and flower (down right); fruit (up right). *Zosima absinthifolia* 3, basal part with leaves and sheaths of dead leaves; fruiting inflorescence (right); fruit (down left); flower (up left). *Malabaila suaveolens* 4, habit; flower (up left); fruit (down right). All drawings to the same scale, except the enlarged parts (scale given).

20. *Zosima* Hoffm.

Pubescent perennials; roots fusiform; stems leafy at the base; leaves 2-3-pinnatisect; umbels terminal, on a long peduncle, umbel-rays many; bracts few; bracteoles many; flowers bisexual and staminate; calyx-teeth minute; petals white or yellowish, notched, pubescent; stylopodium depressed, as long as the styles; fruit compressed, the outer part of margin inflated, the inner translucent; carpophore 2-partite; ribs slender; oil ducts 1 per furrow, occupying the entire furrow; seeds flattened. 4 species, Egypt, West and Central Asia.

1. *Zosima absinthifolia* (Vent.) Link, Enum. Hort. Berol. Alt. 1: 274 (1821).

Syns. *Heracleum absinthifolium* Vent., Choix des Plantes, t. 7 (1803).

Tordylium absinthifolium (Vent.) Pers., Syn. 1: 314 (1805).

Heracleum tomentosum Sibth. & Sm., Fl. Graec. Prodr. 1: 192 (1806).

Zosima orientalis Hoffm., Gen. Umb., t. 4 (1814).

Grey-pubescent perennial 25-60 cm; taproot thick; stems erect, stout, deeply furrowed, covered at the base with fibrous sheaths of dead leaves; stems often 0 and the peduncles arising from the base; leaves mostly basal, 2-pinnatisect, the subultimate segments 4-6, dissected into small obtuse lobes; peduncle to 30 cm, stout; umbel-rays 5-12, angular; bracts 3-5, 0.5-1.2 cm, subulate, pubescent; bracteoles numerous, 3-8 mm, pubescent; flowers numerous per umbellule; petals white or yellowish-green, pubescent; stylopodium depressed-cupuliform, 1.5 mm diam., the margin undulate; pedicel 0.8-1 cm; fruit 0.8-1 x 0.7-0.9 cm, flattened, suborbicular to broadly elliptic, the apex retuse, glabrescent or pubescent; mericarps with 3 median filiform ribs and 2 thicker ones near the whitish winged margin.

De, S; stony wadis. Egypt, Southwest and Central Asia.

21. *Malabaila* Hoffm.

Perennials; stems mostly simple or branched above; leaves undivided or 1-3-pinnatisect; umbels mostly terminal; peduncle long; umbel-rays subequal; bracts and bracteoles present or 0; flowers bisexual or staminate; calyx-teeth minute; petals yellow, notched at the apex; stylopodium depressed-conical, with undulate margin; fruit compressed, winged, the wing thickened at the margin and translucent at its inner part; carpophore 2-partite; mericarps with filiform ribs and 1 oil duct in each furrow. About 8 species, East Mediterranean region to Iran and Central Asia.

1. *Malabaila suaveolens* Delile ex Coss., Bull. Soc. Bot. France 19: 82 (1872).

Syns. *Tordylium suaveolens* Delile, Descr. Egypte, Hist. Nat. 58, t. 63, f. 13 (1814), nom. nud.

Malabaila numidica Coss., Bull. Soc. Bot. France 9: 297 (1862).

Malabaila pumila Boiss., Fl. Orient. 2: 1058 (1872).

Pubescent perennial 20-50 cm; stems erect, simple or branched, sulcate; leaves 8-18 x 5-10 cm, 2-pinnatisect into obovate-cuneate segments; upper leaves reduced to sheaths; peduncle to 10 cm; umbel-rays 4-15, 4-8 cm; bracts 0; umbellules 10-15-flowered; pedicel 2-4 mm, filiform, elongate to 8 mm in fruit; bracteoles 2-5, 0.5-2 mm; petals yellow, hairy or glabrescent on the dorsal surface; styles longer than the stylopodium; fruit 0.8-1 cm, suborbicular, the apex retuse; mericarps flattened, the ribs filiform, the furrows with brown oil ducts; wings 1 mm broad.

M; stony ground. North Africa.

NOTE: The type was collected near Alexandria, Egypt.

22. *Petroselinum* A. W. Hill

Biennials with thick rootstock; fibrous collar absent; leaves 2-pinnate, the segments usually large, lobed, cuneate; bracts and bracteoles present; sepals minute; petals white or yellowish, obovate, emarginate; stylopodium shortly conical; styles short, erect or reflexed; fruit weakly compressed, ovoid, glabrous; ridges filiform; furrows with 1 oil duct. 2 species, Mediterranean region, West Asia.

1. *Petroselinum crispum* (Mill.) A. W. Hill, Hand-list Herb. Pl. Kew, ed. 3, 122 (1925).

Syns. *Apium crispum* Mill., Gard. Dict., ed. 8, no. 2 (1768).

Petroselinum hortense P. Hoffm., Gen. Pl. Umbel., ed. 1, 163, f. 7 (1814),
nom. nud.

Petroselinum sativum (L.) P. Hoffm., Gen. Pl. Umbel., ed. 2, 219 (1816).

Glabrous biennial 40-60 cm; stems erect, terete, solid, striate; leaves 3-12 x 2-7 cm, triangular-ovate; segments cuneate-obovate to linear-lanceolate; inflorescence paniculate; peduncle to 8 cm; umbel-rays 8-18, 1.5-4 cm, subequal; bracts 1-4, 3-8 mm, subulate; bracteoles 5-8, small, subulate; petals greenish-yellow; fruit 2.5-3 x 0.8 mm, broadly ovoid; mericarps slightly arcuate at maturity, glabrous.

N, M, S; escape of cultivation. South Europe, East Mediterranean region to West Asia.

NOTE: The plant, parsley, is widely cultivated in Egypt and elsewhere for its foliage, a popular culinary aromatic herb.

23. *Pseudorlaya* (Murb.) Murb.

Pubescent annuals; stems procumbent; leaves 2-3-pinnatisect; umbels with few unequal rays; bracts and bracteoles present; flowers small, bisexual and staminate in the same umbel; calyx-teeth distinct; petals slightly radiating, white or purplish, the apex notched, inflexed; stylopodium conical; styles short; fruit compressed; carpophore slender, filiform; ribs 5, hairy; secondary ribs 4; prickles in 2-3 distinct rows; oil ducts solitary under the secondary ribs. 2 species, Mediterranean region, Sinai, Europe.

1. *Pseudorlaya pumila* (L.) Grande, Nuov. Giorn. Bot. Ital., n. s., 32: 86 (1925).

Syns. *Caucalis pumila* L., Syst. Nat., ed. 10, 955 (1759).

Caucalis maritima Gouan, Hort. Reg. Monsp. 135 (1762).

Orlaya maritima (Gouan) Koch, Nov. Act. Nat. Cur. 12, 1: 79 (1824).

Orlaya pumila (L.) Halácsy, Consp. Fl. Graec. 1: 622 (1901).

Grey-pubescent annual 10-25 cm; stems procumbent, branched from the base, striate, hollow; leaves 5-12 cm, 2-3-pinnatisect; ultimate lobes 1-2 mm, ovate, bristly; umbel-rays 2-5, 1.5-3 cm, unequal; bracts 0.5-1.2 cm, linear-subulate; bracteoles 3-4 mm, linear, bristly; fruit 0.8-1.2 x 0.6-0.8 cm, including the prickles, elliptic; prickles straight, in 2-3 rows, each with a glochidiate tip and triangular base; marginal prickles longer and more connate at the base than the dorsal.

Two varieties occur in Egypt:

var. **pumila**

Fruit 1-1.2 cm; prickles \pm equalling the width of the seed-bearing part.

M, S; maritime sand.

var. **breviaculeata** (Boiss.) Täckh. ex Zohary, Fl. Palaest. 2: 400 (1972).

Syn. *Orlaya maritima* (Gouan) Koch var. *breviaculeata* Boiss., Fl. Orient. 2: 1071 (1872).

Fruit 7-9 mm; prickles shorter than the width of the seed-bearing part.

M, S; sandy plains and dunes.

Area of the species: Mediterranean region, Sinai.

24. **Ammodaucus** Coss. & Durieu

Annuals; leaves rather fleshy, pinnatisect; segments oblong-linear; umbel rays few, unequal; bracts pinnatisect; bracteoles 3-partite; flowers 5-10 per umbellule; petals minute, white; fruit ovoid, densely covered with yellowish-brown soft hairs; mericarps compressed, ribbed. 1 species, Atlantic Islands, Mauritania, Mali, North Africa.

1. **Ammodaucus leucotrichus** Coss. & Durieu, Pl. Alg. Select. Exicc. no. 42 (1858).

Erect glabrous annual 10-25 cm; stems striate, branched; leaves rather fleshy, with sheathing petioles, 2-3-pinnatisect; segments oblong-linear, 2-4 x 1 mm; peduncle 1-4 cm; umbel-rays 2-4, 0.5-3 cm, unequal; bracts 2-4, 1-2.5 cm, pinnatisect; bracteoles 3-partite; pedicel 0.5-1 cm; flowers 5-10 per umbellule; petals 1 mm, shallowly 2-lobed, white; fruit 1-1.2 x 0.5-0.6 cm, ovoid, densely covered with yellowish-brown soft hairs 4-6 mm; mericarps compressed, ribbed.

Dw; alluvial and sandy desert plains. Distribution as for the genus.

25. **Daucus** L.

Annuals or biennials, hispid or bristly; stems mostly erect, branched; leaves 2-4-pinnatisect; umbels terminal and axillary; bracts and bracteoles mostly dissected or 3-fid; flowers bisexual or staminate; calyx-teeth minute; petals white, yellowish-white or reddish, unequal, often radiating, notched with an inflexed apex; stylopodium conical; fruit ovoid to oblong or cylindrical; mericarps with 5 primary ribs and 4 secondary (more prominent than the primary), winged or broadly keeled, with 1 row of prickles; oil ducts solitary under secondary ribs. 22 species, Mediterranean region to East Asia, tropical and South Africa.

1. Leaves fleshy; bracts undivided or 3-fid
+ Leaves not fleshy; bracts pinnatisect

2. **D. litoralis**
2

2. All bracteoles undivided
+ At least some bracteoles divided

1. **D. guttatus**
3

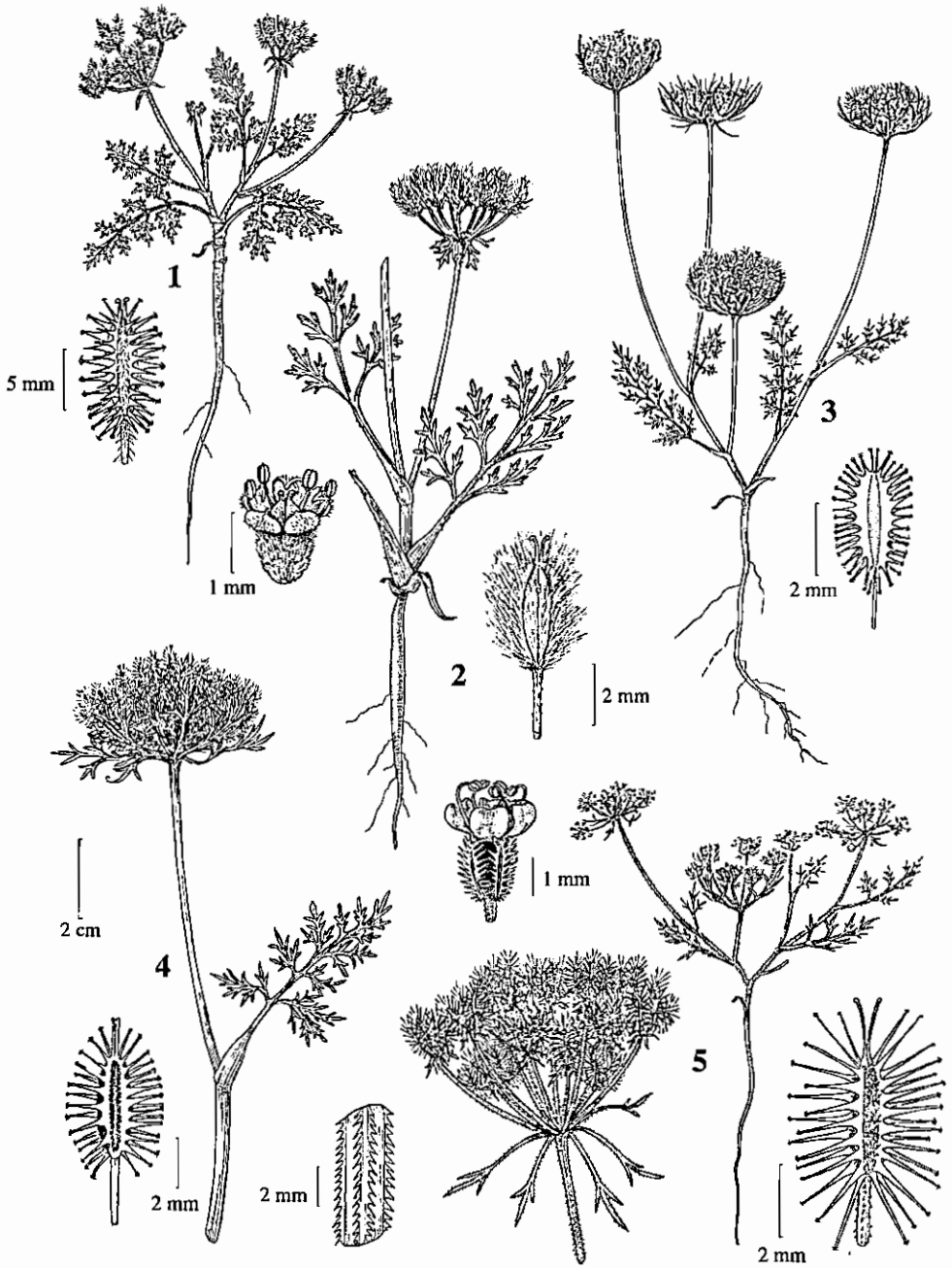


Plate 46. UMBELLIFERAE: *Pseudorlaya pumila* 1, habit; flower (down right); fruit (left). *Anmodaucus leucotrichus* 2, habit; fruit (right). *Daucus guttatus* 3, habit; fruit (right). *Daucus syrticus* 4, fruiting branch; fruit (left). *Daucus sahariensis* 5, habit; fruiting inflorescence (down left); fruit (down right); flower (up left); part of the stem (left to the fruiting inflorescence). All drawings to the same scale, except the enlarged parts (scale given).

3. Umbel-rays 15-20(-25); flowers white, becoming yellow when dried 5. **D. aureus**
+ Umbel-rays 5-12; flowers reddish or white, not becoming yellow when dried 4

4. Leaf-segments acute; bracts 1-2-pinnatisect; flowers reddish 3. **D. syrticus**
+ Leaf-segments obtuse; bracts not dissected or 3-lobed at the tip;
flowers white 4. **D. sahariensis**

1. **Daucus guttatus** Sibth. & Sm., Fl. Graec. Prodr. 1: 184 (1806).

Syns. *Daucus bicolor* Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1: 184 (1806).

Daucus broteri Ten., Fl. Nap. 4, Syll. App. 3: IV, t. 222 (1830).

Daucus setulosus Guss. ex DC., Prodr. 4: 211 (1830).

Daucus setulosus Guss. ex DC. var. *brachylaenus* Boiss., Fl. Orient. 2:
1075 (1872).

Scabrid or glabrous annual 15-25 cm; stems erect, branched from the base; leaves 3-8 cm, 2-pinnatisect; segments 1-3 mm, oblong-linear, acute; upper leaves 1-pinnatisect; umbels terminal; umbel-rays 3-6, 1-1.5 cm; bracts 1-1.8 cm, pinnatisect; bracteoles 2-5 mm, linear-setaceous, undivided; pedicel 3-8 mm; flowers bisexual, staminate or sterile; central flowers of each umbellule usually sterile and crimson; petals radiating, white; fruit c. 4 x 2.5 mm including the prickles, ellipsoid; secondary ribs of mericarp with prickles as long as the seed-bearing part, free almost to base, glochidiate at the apex, broad at the base.

N, M, S; cultivated ground. Southern Europe, North Africa, East Mediterranean region, Sinai .

2. **Daucus litoralis** Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1: 185 (1806).

Glabrous or bristly annual 20-50 cm; stems branched from the base, erect, ascending or procumbent; leaves fleshy, long-petiolate, sheathing, 2-3-pinnatisect, scabrid; segments divided into 1-3-fid lobes; ultimate lobes oblong-lanceolate; umbels terminal and axillary; peduncle to 12 cm; umbel-rays 4-12, 0.5-1.5 cm, unequal; central umbellules often sessile; bracts 1-2.5 cm undivided or 3-fid, with a prominent nerve; bracteoles 2-4 mm, oblong-lanceolate, entire, broadly scarious-margined; flowers bisexual, staminate or sterile; petals radiating, white, yellowish or pinkish; fruit 6-8 x 2-3 mm, oblong-ellipsoid; primary ribs with short whitish bristles; secondary ribs 5-11, with 1-1.5 mm prickles, free or short-connate at the base, narrowly-triangular, glochidiate at the apex.

Three varieties occur in Egypt:

1. Longest umbel-rays 10-12(-15) cm var. **longiradiatus**
+ Longest umbel-rays 4-6 cm 2

2. Prickles on the secondary ribs of the mericarp 4-7(-8),
broadly triangular var. **forsskaolii**
+ Prickles on the secondary ribs of the mericarp 8-12, lanceolate var. **litoralis**

var. **litoralis**

S; coastal sand-dunes.

var. **longiradiatus** Post, Fl. Syr. Palest. Sinai, ed. 1, 371 (1896).

S; coastal plains.

var. **forsskaolii** Boiss., Fl. Orient. 2: 1074 (1872).

Syns. *Caucalis glabra* Forssk., Fl. Aegypt.-Arab. 206 (1775).

Daucus glaber (Forssk.) Thell., Mém. Soc. Sci. Cherbourg 38: 407
(1911-1912), non Celak., Arch. Nat. Landes Böhm 3 (Bot. Abth.):
582 (1875).

Daucus litoralis Sm. var. *glabra* (Forssk.) Hosni, Taeckholmia 12: 54 (1991).

N, M, D, S; coastal and inland sandy plains.

Area of the species: Mediterranean region, Sinai.

3. **Daucus syrticus** Murb., Contr. Fl. Nord-Ouest Afr. 1: 87, f. 1-3 (1897).

Scabrid annual 10-25 cm; stems branched from the base, terete, striate; leaves 2-3-pinnatisect, petiolate, the petioles sheathing, scarious-margined; ultimate segments 1-4 x 0.5 mm, oblong-linear, acute; bracts 1.5-3 cm, 1-2-pinnatifid, conspicuous; ultimate lobes 2-8 x 0.5-0.75 mm, acute, strongly 1-nerved beneath; peduncle to 8 cm; umbel-rays 5-12, 1.5-3 cm, scabrid; bracteoles 3-fid; lobes 3-8 x 1 mm, strongly 1-nerved; petals reddish, not radiating; fruit 6 x 3 mm, including the prickles, ellipsoid; prickles c. 2 mm, yellow, regularly arranged, free at the base, the apex glochidiate.

M; sandy and rocky desert plains. North Africa.

4. **Daucus sahariensis** Murb., Acta Univ. Lund. 33 (12): 89 (1897).

Tiny scabrid annual 5-15(-25) cm; stems erect, deeply grooved, branched from the base, retrorse-hispid; leaves 2-5(-7) cm, 2-3-pinnatisect; ultimate lobes of segments 1-3 x 0.5 mm, oblong-linear, obtuse; peduncle to 8 cm, stout; bracts 1.5-2.5 x 0.1-0.15 cm, linear, not dissected or 3-lobed at the tip, mucronate; bracteoles 0.5-1.2 x 0.1 cm, linear, rarely 3-fid at the tip, mucronate; umbel-rays 8-12, 0.5-2.5 cm, unequal, scabrid; petals 0.75 mm, notched, white; styles 1-5 mm, pink, spreading; fruit 6-8 x 4-5 mm, including the prickles; prickles on the secondary ridges 2-2.5 mm, much longer than the seed-bearing part of the mericarp, yellow, free at the base, the apex glochidiate.

S (Mitla Pass); rocky ground. North Africa, Sinai.

5. **Daucus aureus** Desf., Fl. Atlant. 1: 242, t. 61 (1798).

Erect glabrescent annual 25-60 cm; stems branched from the base, striate; leaves 8-20 cm, triangular-ovate in outline, 2-3-pinnatisect; segments cut into linear-lanceolate acute lobes; umbels terminal; peduncle to 20 cm, stout; umbel-rays 15-20(-25), 3-8 cm; bracts 10-12, 2-3 cm, pinnatisect into filiform lobes 1-1.5 cm; bracteoles 0.5-1.2 cm, 3-5-fid or undivided; petals slightly radiating, white, becoming yellow when dried; fruit 6-8 x 4-6 mm, including the prickles; bristles on the primary ribs with bulbous bases; prickles on the secondary ribs numerous, 2-3 mm, narrowly-lanceolate, connate at the base, the apex glochidiate.

N (Cairo), S; cultivated ground. Mediterranean region, Sinai.

26. **Torilis** Adans.

Hairy annuals; leaves 1-3-pinnatisect; umbels sessile to long-pedunculate; bracts several, 1 or 0; bracteoles several; flowers bisexual and staminate; calyx-teeth persistent; petals

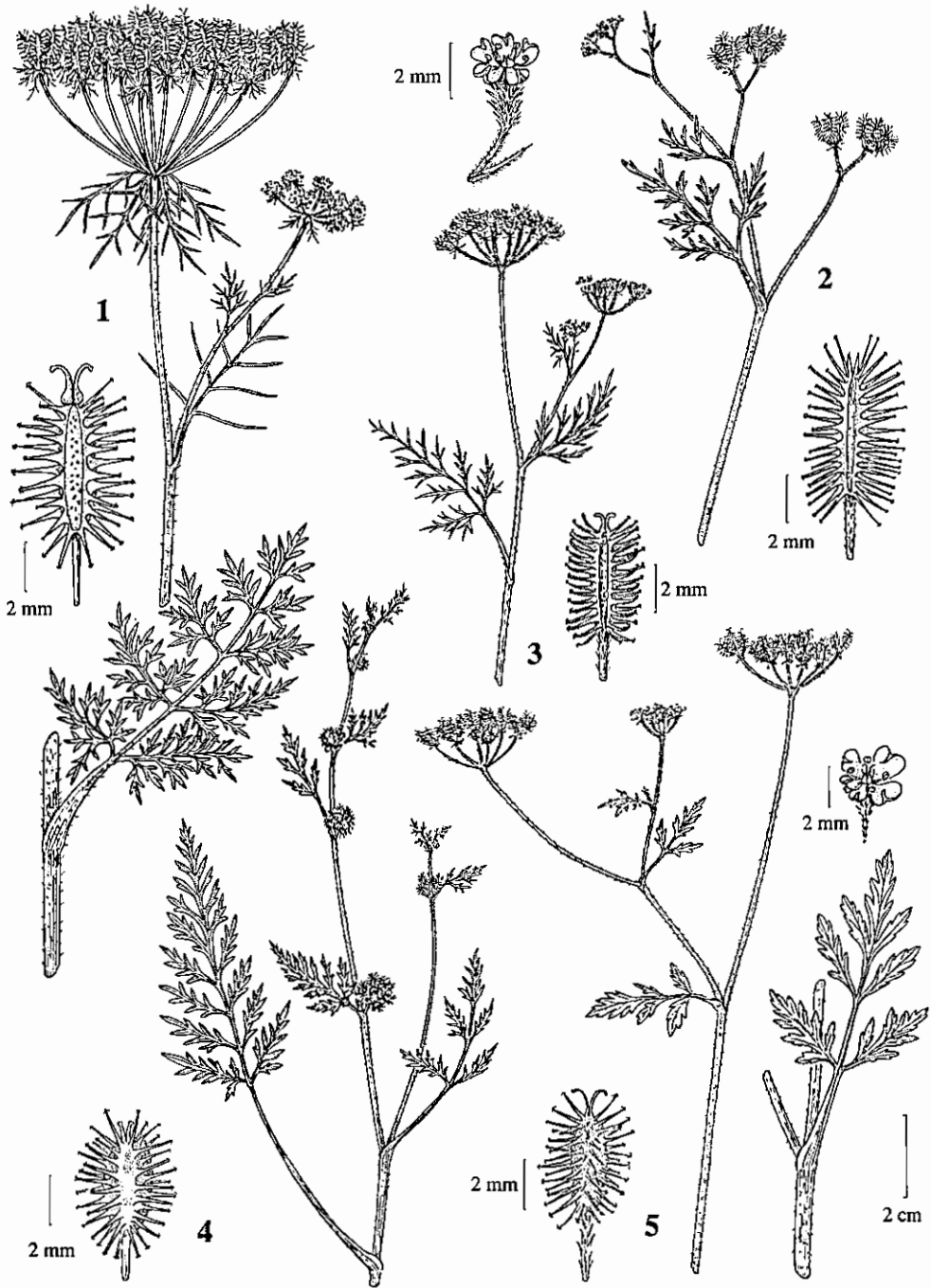


Plate 47. UMBELLIFERAE: *Daucus aureus* 1, flowering and fruiting branch; stem with a lower leaf (down); fruit (left). *Torilis leptophylla* 2, flowering and fruiting branch; flower (up left); fruit (down right). *Torilis tenella* 3, flowering branch; fruit (down right). *Torilis nodosa* 4, fruiting branch; fruit (down left). *Torilis arvensis* subsp. *neglecta* 5, flowering and fruiting branch; stem with a lower leaf (down right); flower (up right); fruit (down left). All drawings to the same scale, except the enlarged parts (scale given).

often radiating, white or pinkish, obovate, with an inflexed apex; stylopodium short; styles persistent; fruit slightly compressed, ovoid-oblong; carpophore \pm 2-fid; mericarps with 5 narrow primary ribs and numerous rows of prickles which occupy the furrows; secondary ribs armed with prickles or tubercles; oil ducts solitary under secondary ribs; seeds flattened. 15 species, Canary Islands, Mediterranean region, West and Central Asia, tropical and South Africa.

1. Umbels sessile or subsessile; mericarps heteromorphic 3. **T. nodosa**
 + Umbels on peduncles more than 1 cm; mericarps all similar 2

2. Umbel-rays 2-3(-4) 1. **T. leptophylla**
 + Umbel-rays 4-12 3

3. Mericarps linear-cylindrical, with prickles much longer than the width of the mericarp 2. **T. tenella**
 + Mericarps ovoid, with prickles shorter than the width of the mericarp 4. **T. arvensis**

1. **Torilis leptophylla** (L.) Rchb. f. in Rchb., Icon. Fl. Germ. 21: 83, t. 169, f. 1-9 (1866).
 Syn. *Caucalis leptophylla* L., Sp. Pl., ed. 1, 242 (1753).

Appressed-setulose erect annual, 10-30(-40) cm; stems branched, striate; leaves 3-8 x 1-3 cm, 2-3-pinnatisect; ultimate lobes linear-acute; peduncle 1.5-3.5(-5) cm; umbels leaf-opposed; umbel-rays 2-3(-4), 1-2 cm, thickened in fruit; bracts 1 or 0; bracteoles 3 or more, linear, with broad scarious margins; petals white or pink, slightly radiating; styles shorter than the conical stylopodium; fruit 6-8 x 2.5-3.5 mm, including the prickles, oblong-linear, crowned by the persistent calyx-teeth; secondary ribs with 2-3 rows of prickles much longer than the width of the seed-bearing part; bristles scabrid, yellow or purplish-black, glochidiate at the tip.

S; waste ground, edges of cultivation. Mediterranean region, West and Central Asia.

2. **Torilis tenella** (Delile) Rchb. f. in Rchb. & Rchb. f., Icon. Fl. Germ. 21: 84 (1867).
 Syn. *Caucalis tenella* Delile, Descr. Egypte, Hist. Nat. 58, t. 21, f. 3 (1814).

Appressed-setulose erect annual, 10-30 cm; stems branched, grooved; leaves 3-8 x 1-4 cm, 2-pinnatisect; ultimate lobes 1-2 x 0.5 mm, narrowly-oblong, acute; umbel-rays 4-12, 0.5-3.5 cm, unequal, on terminal or leaf-opposed peduncles 4-7 cm; bracts 1 or 0, caducous; bracteoles 3-5, 3-6 x 0.5-1 mm, linear, with narrow scarious margins; umbellules 6-10-flowered; pedicel 1-2 mm, to 3 mm in fruit; sepals *c.* 1 mm, mucronate, persistent; petals 0.5-1 x 0.5 mm, obovate, white; styles shorter than the conical stylopodium; fruit 4-5 x 2-4 mm, including the prickles; mericarps linear-cylindrical, appressed-hispid along the primary ribs; secondary ribs with 1 row of prickles; prickles 2-3 mm, much longer than the width of the mericarp, scabrid, greenish-white, with glochidiate tips.

M, S; Waste and cultivated ground. Libya, Egypt, Greece, Cyprus, Turkey, Iran.

NOTE: The type was collected from Alexandria, Egypt (MPU).

3. **Torilis nodosa** (L.) Gaertn., Fruct. Sem. Pl. 1: 82, t. 20, f. 6 (1788).
 Syns. *Tordylium nodosum* L., Sp. Pl., ed. 1, 240 (1753).
Caucalis nodosa (L.) Scop., Fl. Carniol., ed. 2, 192 (1772).

Appressed-hispid annual, 10-30 cm; stems erect or decumbent, terete, striate; leaves 2-pinnatisect; segments 1.5-3 cm, the ultimate lobes 2-4 x 1 mm, elliptic, acute; peduncle 0-5 mm; umbels opposite the leaves, sessile or subsessile; umbel rays 2-3, 0-3 mm; bracts 0; bracteoles 4-6, 3-5 mm, subulate; flowers minute; petals pinkish, radiating; styles very short; fruit 4-6 mm, subsessile, ovoid, heteromorphic; outer mericarps with 2-3 rows of spreading glochidiate-tipped prickles, the inner tuberculate.

N, O, M; cultivated ground. Atlantic Islands, South Europe, East Mediterranean region.

4. *Torilis arvensis* (Huds.) Link, Enum. Hort. Berol. Alt. 1: 265 (1821).

Syn. *Caucalis arvensis* Huds., Fl. Angl. 99 (1762).

Robust retrorsely-setose annual, 40-80 cm; stems grooved, branched; leaves 1-2-pinnatisect, the upper sometimes 3-foliolate, the segments pinnatifid or toothed; ultimate lobes 2-8 x 1.5-2.5 mm, oblong-elliptic, acute; umbels terminal; umbel-rays 4-12; bracts 0-1; bracteoles 5-8, 2-4 mm, setose; flowers 2 mm; petals white or pink, radiating or not; mericarps 3-5 x 2 mm, ovoid, the secondary ribs with 2-3 rows of glochidiate-tipped prickles shorter than the width of the mericarp.

Two subspecies occur in Egypt:

subsp. *arvensis*

Syns. *Torilis helvetica* C. C. Gmel., Fl. Bad. 1: 617 (1805).

Caucalis fallax Boiss. & Blanche in Boiss., Fl. Orient. 2: 1086 (1872).

All leaves usually 2-pinnate, the segments pinnatifid or toothed; terminal segment usually not larger than the laterals; outer petals 1 mm, not radiating.

N, M; cultivated and waste ground. Europe, Mediterranean region, Caucasus, Arabia, Afghanistan, tropical Africa.

subsp. *neglecta* (Spreng.) Thell. in Hegi, Ill. Fl. Mittel-Europ. 5 (2): 1055 (1926).

Syns. *Torilis radiata* Moench, Meth. 103 (1794).

Torilis neglecta Spreng. in Roem. & Schult., Syst. Veg. 6: 484 (1820).

Torilis arvensis (Huds.) Link var. *heterocarpa* (Batt.) Maire, Cat. Plant. Maroc 2: 525 (1932).

Torilis infesta Hoffm. var. *heterocarpa* Batt., Fl. Alg. 375 (1889).

Lower leaves 2-pinnate, the segments pinnatifid; upper leaves 3-foliolate; the terminal segment longer than the laterals and regularly pinnatifid; outer petals 2 mm, distinctly radiating.

N, M; Central and South Europe, Mediterranean region, Southwest Asia (except Caucasus and Afghanistan).

PRIMULACEAE

(incl. Coridaceae)

Annuals or perennials, rarely shrubs; leaves alternate, opposite or basal, simple, usually entire; stipules 0; inflorescence scapose or flowers axillary, whorled or in spikes,

racemes or panicles, sometimes umbellate, often bracteate; flowers 5-merous (our species), bisexual; corolla usually gamopetalous, actinomorphic; stamens epipetalous, opposite the corolla-lobes; staminodes often present; ovary mostly superior; placentation free-central; stigma capitate; fruit a 5-valved or circumscissile capsule; seeds usually numerous. 22 genera, 825 species, subcosmopolitan, but especially northern hemisphere.

- | | |
|---|-----------------------|
| 1. Flowers verticillate (in whorls), yellow; corolla-tube 2.5-3 cm | 1. Primula |
| + Flowers solitary in the leaf axils, or in racemes, white, red or blue; corolla-tube 0-1 mm | 2 |
| 2. Annual; flowers solitary in the leaf axils | 3 |
| + Perennial; flowers in racemes | 4 |
| 3. Corolla red, blue or white, exceeding the calyx | 3. Anagallis |
| + Corolla yellowish-green, much shorter than the calyx | 4. Asterolinon |
| 4. Leaves 4-10 x 1-3 cm, spatulate or obovate, forming a loose basal rosette, a few cauline, not fleshy | 2. Samolus |
| + Leaves 0.2-1.5 x 0.1-0.2 cm, oblong-linear, all cauline and fleshy | 5. Coris |

1. **Primula L.**

Rhizomatous perennials; leaves basal, entire or lobed; flowers conspicuous, dimorphic, heterostylous, in umbels, heads or spikes, or verticillate, rarely solitary; involucre bracts leaf-like; calyx tubular or campanulate, sepals imbricate; corolla with a long tube, hypogynous, the petals imbricate; stamens 5, inserted within, or at the mouth of the corolla-tube; filaments short; ovary superior; style simple; stigma capitate; ovules numerous; capsule dehiscent by valves; seeds numerous. About 400 species, northern hemisphere.

1. **Primula boveana** Decne. ex Duby in A. DC., Prodr. 8: 35 (1844).

Glabrous or white-mealy rhizomatous perennial, 15-40 cm; stems erect, unbranched; leaves sessile, thin, glabrous or often white-mealy beneath; basal leaves 3-20 x 1-4 cm, forming a rosette, oblanceolate to spatulate, the margin irregularly double serrate-dentate towards the apex; cauline leaves in 1-3 distant whorls, 1.5-6 x 0.5-3 cm, ovate-elliptic, irregularly serrate-dentate, the apex acute; flowers in whorls in the axils of upper involucre-like cauline leaves; pedicel 1.5-4 cm; calyx 0.8-1.2 cm, campanulate; lobes 5-8 x 2-3 mm, triangular, acute, often further lobed near the apex; corolla lemon-yellow; corolla-tube 2.5-3 cm, much exceeding the calyx; corolla-lobes 3-5 x 3-4 mm, obovate, the margin dentate; stamens inserted; capsule 4-5 mm, globose; seeds not seen.

S; moist ground in the vicinity of wells, sheltered mountain areas. Endemic.

NOTE: This endemic species seems to be restricted to the St. Katherine Mountain area, Sinai, where the type was collected by N. Bové in June 1832 (K!).

2. **Samolus L.**

Perennials (our species), rarely small shrubs; leaves simple, alternate, entire, sometimes forming a loose basal rosette; flowers 5-merous, in terminal racemose or corymbose



Plate 48. PRIMULACEAE: *Primula boveana* 1, habit; fruit (down right). *Samolus valerandi* 2, habit; flower (middle left). *Anagallis arvensis* 3, flowering and fruiting branch; fruit (up left). *Asterolinon linum-stellatum* 4, habit; flower (up right); fruit (down right). *Coris monspeliensis* 5, habit; flower (up right); fruit enclosed by the calyx (down left). All drawings to the same scale, except the enlarged parts (scale given).

bracteate inflorescences; bracts often adnate to the pedicel; calyx-lobes persistent; corolla subcampanulate or rotate; stamens inserted near the base of the corolla-tube, opposite the lobes and alternating with the staminodes; ovary semi-inferior, globose; style simple; ovules numerous; fruit a capsule, opening by 5 teeth or valves. 15 species, cosmopolitan, but especially salt marshes.

1. *Samolus valerandi* L., Sp. Pl., ed. 1, 171 (1753).

Glabrous perennial 10-40 cm; stems erect, branched or simple, terete; leaves 4-10 x 1-3 cm, forming a loose basal rosette, a few cauline, spatulate or obovate, entire, apex rounded, the base tapering to a petiole 1-3 cm; flowers in many-flowered branched or unbranched racemes; bracts 1-1.5 x 0.5 mm, adnate to the pedicel to \pm half of its length; pedicel 0.4-1 cm; calyx 2-2.5 mm, campanulate; lobes 0.75 mm, deltoid; corolla white, exceeding the calyx; tube c. 1 mm; lobes obovate, spreading; stamens included; staminodes subulate; capsule 2.25-2.5 mm, globose, opening by 5 recurved teeth; seeds c. 0.5 mm, polyhedral, blackish.

N, O, M, De, S; streams, marshes. Cosmopolitan.

3. *Anagallis* L.

Annuals or perennials; leaves opposite or alternate, occasionally in 3s, sessile or petiolate, entire; flowers axillary, pedicellate; calyx persistent, divided nearly to base; corolla rotate or campanulate, deeply divided into 5 lobes; stamens 5, inserted near the base of the corolla; filaments \pm connate at base; ovary globose; ovules numerous; style slender; stigma truncate or capitate; capsule globose, circumscissile; seeds angled. 28 species, Europe, Mediterranean region, African mountains, South America; one species pantropical.

1. All leaves opposite; flowers blue or red
+ Upper leaves alternate, the lower opposite; flowers white

1. *A. arvensis*
2. *A. pumila*

1. *Anagallis arvensis* L., Sp. Pl., ed. 1, 148 (1753).

Glabrous annual; stems sprawling or decumbent, much-branched, distinctly 4-angled, 15-40 cm; leaves 0.5-2.5 x 0.5-1.5 cm, opposite, sessile, broadly ovate to ovate-lanceolate, the margin entire, the apex acute; flowers solitary in the leaf axils; pedicel 1-3.5 cm, slender, erect, lengthening and recurving in fruit; calyx-lobes lanceolate, acuminate, with scarious margin; petals 5-9 x 3-5 mm, obovate to suborbicular, red or blue, the margin denticulate, with numerous minute 3-celled stalked glands; filaments shortly connate at the base, pilose; ovary 1.5 mm, globose; style c. 2.5 mm; stigma capitate; capsule 4.5-6 mm, globose; seeds 1.5 x 1 mm, sharply trigonous, papillose, dull brown.

Two subspecies (one with 2 varieties) occur in Egypt:

1. Corolla red
+ Corolla blue

A. arvensis var. *arvensis*
2

2. Petals overlapping, the margin with numerous minute glands;
pedicel exceeding the broad subtending leaf

A. arvensis var. *caerulea*

+ Petals not overlapping, eglandular or sparsely glandular; pedicel not or slightly exceeding the narrow subtending leaf **A. arvensis** subsp. **foemina**

subsp. **arvensis**

Petals broadly obovate or suborbicular, overlapping, the apical margin fringed with numerous 3-celled stalked glands; filaments with 5-8-celled hairs; pedicel at anthesis much exceeding the subtending broad leaf.

var. **arvensis**

Syns. *Anagallis arvensis* L. var. *phoenicea* Gouan, Fl. Monsp. 29 (1765).

Anagallis phoenicea Scop., Fl. Carniol., ed. 2, 1: 139 (1772).

Anagallis arvensis L. var. *phoenicea* (Scop.) Gren. & Godr., Fl. Fr. 2: 467 (1852).

Anagallis arvensis L. subsp. *phoenicea* (Scop.) Vollmann, Ber. Bayer. Bot. Ges. 9: 44 (1904).

Corolla red with a purplish basal zone.

N, O, M, D, R, GE, S; cultivated ground.

var. **caerulea** Gouan, Fl. Monsp. 30 (1765).

Syns. *Anagallis caerulea* L., Fl. Monsp. 11 (1756), nom. vix rite publ.

Anagallis arvensis L. forma *caerulea* Lüdi in Hegi, Illustr. Fl. Mittel-Europ. 5 (3): 1870 (1927).

Anagallis arvensis L. forma *azurea* Hyl., Uppsala Univ. Årsskr. 1945 (7): 256 (1945).

Corolla blue with a purplish basal zone.

N, O, M, D, R, GE, S; cultivated ground.

subsp. **foemina** (Mill.) Schinz & Thell., Bull. Herb. Boissier, sér. 2, 7: 497 (1907).

Syns. *Anagallis foemina* Mill., Gard. Dict., ed. 8, no. 2 (1768).

Anagallis caerulea Schreb., Spic. Fl. Lips. 5 (1771).

Anagallis arvensis L. var. *caerulea* (Scherb.) Gren. & Godr., Fl. Fr. 2: 467 (1852).

Anagallis arvensis L. var. *gentianeae* Beck, Ann. K. K. Naturhist. Hofmus. Wien 13: 3 (1898).

Petals blue, obovate-cuneate, not overlapping, the apical margin irregularly denticulate, with a few 4-celled stalked glands; pedicel at anthesis shorter than or slightly exceeding the subtending relatively narrow, ovate leaf.

S; cultivated ground.

Area of the species: warm and temperate regions, widespread.

NOTE: Several authors treat *Anagallis foemina* as a distinct species, e.g. Feinbrun-Dothan, Fl. Palaest. 3: 6, f. 8 (1978); Leblebici in Davis, Fl. Turkey 6: 141 (1978); Boulos, Fl. Egypt Checklist 105 (1995). However, here the concept of Meikle,

Fl. Cyprus 2: 1083-1085 (1985) is adopted, by which *Anagallis foemina* is considered a subspecies of *Anagallis arvensis*.

2. **Anagallis pumila** Sw., Prodr. Veg. Ind. Occ. 40 (1783).

Glabrous annual 15-25 cm; stems procumbent, slender, much-branched; leaves 3-8 x 2-4 mm, broadly elliptic to ovate-elliptic, sessile or short-petiolate, entire, acute; pedicel 3-6 mm, to 8 mm in fruit; sepals 2-3 mm, lanceolate, aristate; petals 3-4 mm, white, not fringed with glands; capsule 2-2.5 mm, globose; seeds 3-angled, brown, minutely rugose.

N; cultivated ground. Tropical and subtropical regions.

4. **Asterolinon** Hoffmanns. & Link

Tiny annuals; leaves opposite, sessile, entire, glabrous; flowers solitary in the leaf axils, pedicellate; calyx persistent and spreading in fruit, deeply divided into 5 lobes; corolla minute, much shorter than the calyx; stamens 5, free, inserted near the base of the corolla; ovary globose; style filiform; stigma minute; capsule globose, 5-valved; seeds few, corrugate. 2 species Mediterranean region to Iran and Ethiopia.

1. **Asterolinon linum-stellatum** (L.) Duby in DC., Prodr. 8: 68 (1844).

Syns. *Lysimachia linum-stellatum* L., Sp. Pl., ed. 1, 148 (1753).

Asterolinon stellatum Hoffmanns. & Link, Fl. Portug. 1: 333 (1813-1820),
nom. illeg.

Small glabrous annual 3-10 cm; stems erect, branched, sharply 4-angled; leaves 0.3-1 x 0.1 cm, opposite, sessile, linear-lanceolate, acuminate, the base slightly clasping; pedicel 1.5-3 mm, filiform, downcurved; calyx deeply 5-lobed; lobes c. 2.5 x 0.6 mm, narrowly lanceolate, acuminate; petals 0.5 mm, suborbicular; filaments 0.4 mm; ovary 0.5 mm, glabrous; style 0.3 mm; stigma minute, capitate; capsule 2-2.25 mm, globose, 5-valved; seeds 1 x 0.8 mm, ovoid-ellipsoid, dark brown, corrugate.

M, S; limestone hillsides. Atlantic Islands, South and West Europe, Mediterranean region, Southwest Asia.

5. **Coris** L.

Perennial herbs; stems woody at the base; leaves alternate, subsessile; flowers zygomorphic, in terminal spike-like racemes; calyx campanulate, with 2 rows of teeth; corolla-tube short; corolla limb 5-lobed, the lobes unequally 2-fid; stamens 5, exerted; fruit a 5-valved capsule; seeds few, papillose. 2 species, Mediterranean region, Somalia.

1. **Coris monspeliensis** L., Sp. Pl., ed. 1, 177 (1753).

Glabrous or puberulent perennial, 5-15 cm; stems erect or ascending, branched from the woody base; leaves 0.2-1.5 x 0.1-0.2 cm, oblong-linear, entire, glabrous to puberulent, often with black spots near the revolute margin; upper leaves usually with spinose-dentate margin; flowers in dense racemes; sepals 4-6 mm, pinkish, with 2 rows of teeth, the outer 6-15, spinose, unequal; inner 5 teeth triangular-lanceolate, acuminate, with a central black patch; petals c. 1 cm, pink; corolla-tube 2.5-3 mm, the limb deeply 5-lobed; stamens 5, exerted; capsule 1-2 mm, globose, 5-valved; seeds c. 5 per capsule, papillose.

M; calcareous coastal ridges. Western Mediterranean region to Northwest Egypt, Somalia.

PLUMBAGINACEAE

Annuals, perennials or shrubs; leaves alternate, often in a basal rosette, undivided or lobed; stipules 0; epidermal cells with glands exuding calcium salts; flowers in bracteate racemes or cymes, actinomorphic, 5-merous, bisexual; calyx persistent, tubular or infundibular, dentate or lobed, coloured and conspicuous; corolla lobed almost to base, or tubular; stamens 5, epipetalous, opposite the petals; ovary superior, with 5 carpels, 1-locular, 1-ovulate; styles 5, free or partly united; stigmas sometimes dimorphic; fruit dry, membranous, 1-seeded, enclosed by the persistent calyx, dehiscent irregularly or circumscissile, or indehiscent. 27 genera, 730 species, cosmopolitan, but especially maritime.

- 1. Calyx covered with stalked glands; stamens free; style 1 3. **Plumbago**
- + Calyx eglandular or with minute glands; stamens epipetalous; styles 5 2
- 2. Corolla-tube much shorter than the lobes; styles free or connate at the base 1. **Limonium**
- + Corolla-tube about as long as the lobes; styles connate in basal half 2. **Limoniastrum**

1. **Limonium** Mill., nom. conserv.

Perennials, annuals or low shrubs; leaves simple, usually in a basal rosette (sometimes withered at anthesis); inflorescence a corymbose panicle with terminal 3-bracteate, 1- to 5-flowered spikelets; calyx infundibular; limb scarious, usually coloured, sometimes shortly dentate between the lobes; corolla-tube short; stamens inserted at the base of the corolla; styles 5, free or connate at the base; stigmas filiform; fruit dehiscent irregularly or circumscissile. About 350 species, cosmopolitan, but especially maritime and arid northern hemisphere.

- 1. Leaves lobed; flowering branches winged 2
- + Leaves entire or absent; flowering branches not winged 3
- 2. Perennial, with a tough woody rootstock, rarely annual (subsp. *romanum*); leaves 4-12 x 1-4 cm 1. **L. sinuatum**
- + Annual, with a slender taproot; leaves 2-6(-7) x 1-1.6 cm 2. **L. lobatum**
- 3. Flowers c. 1 cm diam., conspicuous; calyx 1-1.2 cm; calyx-teeth ending in a reddish-brown awn 2-3 mm; petals c. 1.5 cm, bright rose 8. **L. tubiflorum**
- + Flowers much smaller; calyx 3-5 mm; calyx-teeth awnless; petals 4-6 mm, pale pink or violet 4
- 4. Plant densely pruinose; leaves on flowering branches caducous 5. **L. pruinatum**
- + Plant not pruinose; leaves persistent 5
- 5. Annual, with slender taproot 7. **L. echioides**
- + Perennial, with woody rootstock 6
- 6. Low shrub; stems leafy, usually branched; leaves 2-8 mm broad 6. **L. axillare**
- + Perennial, stemless; leaves in a basal rosette, 1-4.5 cm broad 7

7. Leaves 10-35 x 1.5-4.5 cm, oblanceolate to narrowly obovate, distinctly pinnate-veined; calyx 4.5-5 mm, glabrous 4. **L. meyeri**
 + Leaves 2-8 x 1-2(-3) cm, spatulate to broadly elliptic, distinctly to obscurely parallel-veined; calyx 3-4 mm, hairy at the base 3. **L. narbonense**

1. **Limonium sinuatum** (L.) Mill., Gard. Dict., ed. 8, no. 6 (1768).
 Syn. *Statice sinuata* L., Sp. Pl., ed. 1, 276 (1753).

Setulose or glabrous perennial, 15-50 cm, sometimes flowering in first year; rootstock tough and woody on old specimens; stems simple or branched at the base, conspicuously winged; wings 3-5, 0.3-1.5 cm broad, usually terminating at the nodes as linear leaf-like appendages; leaves 4-12 x 1-4 cm, sinuate-pinnatifid; lobes rounded-ovate, the terminal aristate; spikelets 2-flowered, forming compact spikes on broadly winged branchlets; outer bracts 2, 5-6 x 1-1.5 mm, rust-coloured, lanceolate-subulate, ciliate; inner bracts 7-8 x 2 mm, 2-carinate, with 2-3 spinescent apical mucros; calyx 1-1.2 cm, glabrous; limb blue or yellow, truncate, crenate; corolla shorter than the calyx, pale yellow; fruit circumscissile.

Three subspecies occur in Egypt:

1. Calyx-limb yellow subsp. **bonduellei**
 + Calyx-limb blue 2
2. Setulose perennial; leaf-like appendages conspicuous; wings on flowering branchlets 3-7 mm broad subsp. **sinuatum**
 + Glabrous annual; leaf-like appendages inconspicuous or 0; wings on flowering branchlets 0.6-1.5 cm broad subsp. **romanum**

subsp. **sinuatum**

M; coastal sands. Mediterranean region, widespread.

subsp. **bonduellei** (Lestib.) Sauvage & Vindt, Trav. Inst. Sci. Chérifien 4: 50 (1952).
 Syns. *Statice bonduellei* Lestib., Ann. Sci. Nat. Bot., sér. 3, 16: 81 (1851).
Limonium bonduellei (Lestib.) Kuntze, Revis. Gen. Pl. 1: 395 (1891).

M; coastal plains. North Africa (Egypt to Morocco).

subsp. **romanum** Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 90, t. 14 (1974).

M; moist ground (Bir Romani, Mersa Matruh). Endemic.

2. **Limonium lobatum** (L. f.) Chaz., Suppl. Dict. Jard. 2: 36 (1790).
 Syns. *Statice lobata* L. f., Suppl. Pl. 187 (1781).
Statice thouinii Viv., Elench. Pl. 34 (1802).
Statice aegyptiaca Pers., Syn. Pl. 1: 334 (1805).
Limonium thouinii (Viv.) Kuntze, Revis. Gen. Pl. 1: 396 (1891).

Glabrous annual 15-30 cm; taproot slender; stems winged, erect, few to several from the base, branched above; leaves 2-6(-7) x 1-1.6 cm, sinuate-pinnatifid; leaf lobes and sinuses rounded, terminal lobe aristate; spikes on obconical branchlets with 3 leaf-like,

coriaceous, prominently-veined wings; spikelets 2- to 3-flowered; outer bracts c. 2 x 1.5 mm, ovate, membranous, the conspicuous midrib ending in a mucro; inner bract c. 6 x 1.5 mm, oblong, mostly coriaceous, partly membranous, 2-carinate, ending in 2 recurved horn-like spines; calyx 1-1.2 cm, glabrous; limb pale blue to white, 5-lobed; calyx-lobes broadly triangular, with 5 brownish bristles in the sinuses between the lobes; corolla yellow, ± equalling the calyx; fruit circumscissile, falling at maturity within the spike as a dispersal unit.

M, S; waste ground, sandy plains. Southern Spain, North Africa, Sinai, Palestine, Syria, Arabia, Iraq, Iran.

3. **Limonium narbonense** Mill., Gard. Dict., ed. 8, no. 2 (1768).

Syns. *Statice angustifolia* Tausch, Syll. Pl. Nov. 2: 254 (1828).

Statice serotina Rchb., Iconogr. Bot. Pl. Crit. 8: 21 (1830).

Statice globulariifolia Desf. var. *glauca* Boiss., Voy. Espagne 531 (1841), t. 155, f. a, 1a-5a (1840).

Statice delicatula Girard, Ann. Sci. Nat., sér. 3, 2: 327 (1844).

Statice raddiana Boiss. in DC., Prodr. 12: 653 (1848).

Limonium delicatulum (Girard) Kuntze, Revis. Gen. Pl., 2: 395 (1891).

Limonium vulgare Mill. subsp. *serotinum* (Rchb.) Gams in Hegi, Illust. Fl. Mitt.-Europ. 5: 1884 (1927).

Limonium angustifolium (Tausch) Turrill, Bull. Misc. Inform., Kew 1937: 252 (1937).

Limonium vulgare Mill. subsp. *angustifolium* (Tausch) P. Fourn., Quatre Fl. France 720 (1937).

Statice mucronulata H. Lindb., Iter Cypr. 26 (1946).

Limonium serotinum (Rchb.) Pignatti, Giorn. Bot. Ital. 107: 220 (1973).

Limonium mucronulatum (H. Lindb.) Osorio-Tafall & Seraphim, List Vasc. Pl. Cyprus 82 (1973), nom. inval.

Limonium mucronulatum (H. Lindb.) Greuter & Burdet, Willdenowia 19: 40 (1989).

Limonium mareoticum El Garf in El-Hadidi & Fayed, Materials Excurs. Fl. Egypt, Taeckholmia 15: 114, f. 2 (1995).

Erect perennial 20-60 cm; rootstock thick; all leaves basal, coriaceous, forming a dense rosette, 2-8 x 1-2(-3) cm, spatulate to broadly elliptic, distinctly to obscurely parallel-veined, the margin entire; apex obtuse or rounded, ending in a brown awn 1-2 mm; base tapering to a flattened petiole 0.3-1.5 cm; inflorescence 20-60 cm, repeatedly branched; spikelets 2- to 3-flowered; bracts brown, coriaceous, with scarious margin; outer bracts 1.2-1.5 x 1 mm, broadly ovate, the inner 3.5 x 1.5 mm, concave; calyx 3-4 mm, narrowly infundibular; strongly 5-nerved from the brown base to just below the 5 apical teeth, hairy at the base; limb 2 mm wide, membranous; teeth 0.5 x 0.5 mm, triangular, acute; corolla c. 3 mm, lavender-blue; lobes 1.2 x 1 mm; fruit not seen.

M, S; coastal salt marshes. Spain, France, North Africa, Sinai, Palestine, Cyprus.

NOTE: *Limonium narbonense* is a rather widespread species of salt marshes along the Mediterranean coastal region in Egypt. Among the classic localities where it grows are (from west to east): Burg El-Arab and westwards towards Mersa Matruh, Dkheila, Alexandria, Abu Qir, Rosetta, Baltim, Damietta and eastwards to Sinai. The specimens examined are rather uniform in most characters, with the exception of the leaf venation,

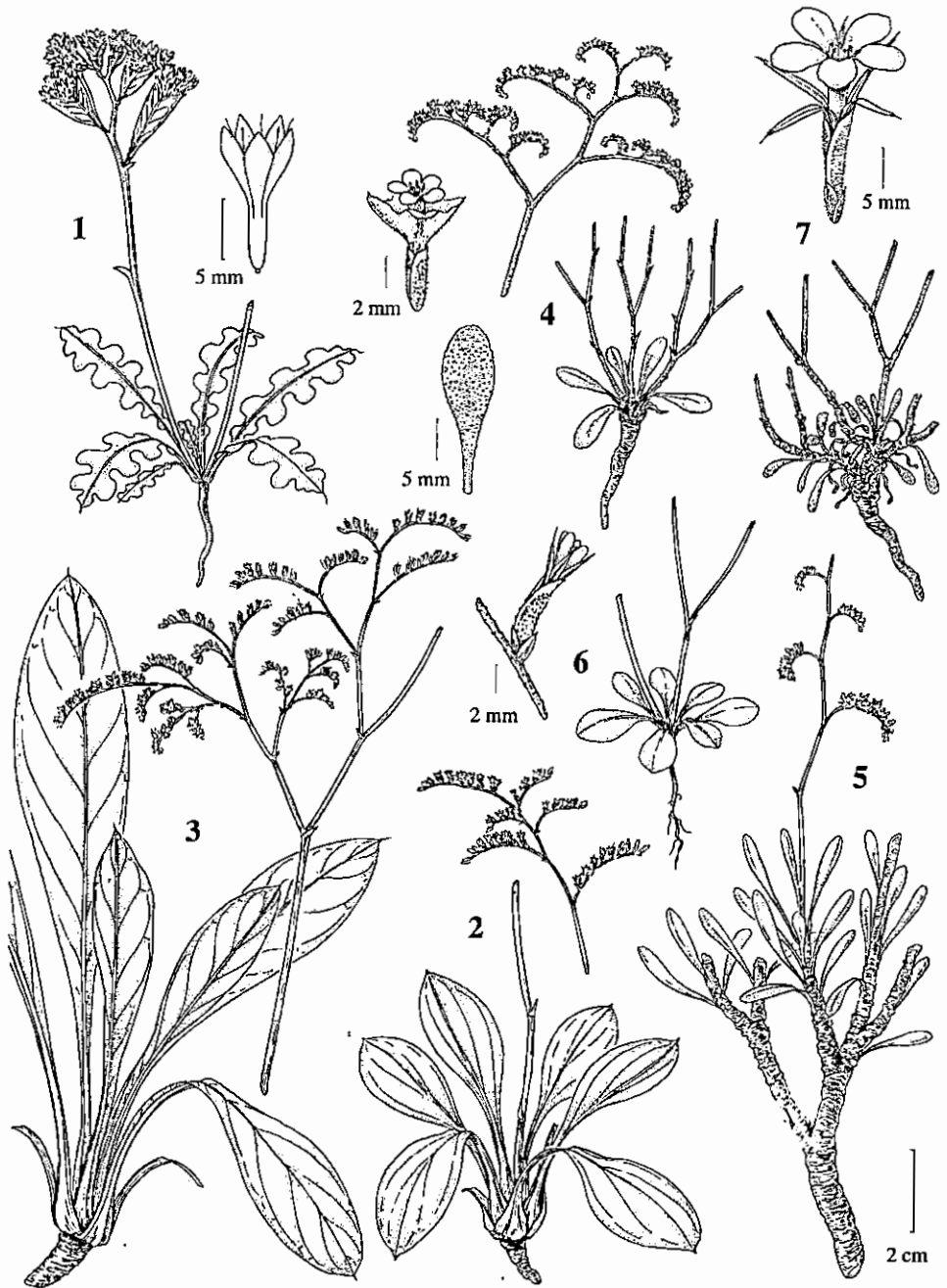


Plate 49. PLUMBAGINACEAE: *Limonium lobatum* 1, habit; flower (right). *Limonium narbonense* 2, basal part with leaves; inflorescence (up). *Limonium meyeri* 3, basal part with leaves; inflorescence (right). *Limonium pruinosum* 4, basal part with leaves, inflorescence (up); flower (up left); leaf (down left). *Limonium axillare* 5, habit. *Limonium echioides* 6, basal part with leaves; flower (up). *Limonium tubiflorum* 7, lower part with leaves; flower (up). All drawings to the same scale, except the enlarged parts (scale given).

which varies from distinctly to obscurely parallel-veined, but almost always recognizable. The parallel venation of the leaves is clearly shown on the illustration of the type specimen of recently described species from Egypt, *Limonium mareoticum* (Holotype, isotype CAI). It is unfortunate that its affinity to the nearest known species, was not designated by the author; however, its lengthy description strongly suggests *L. narbonense*. Moreover, the locality from which *L. mareoticum* was collected lies within the range of the widespread *L. narbonense*. According to Meikle, Fl. Cyprus 2: 1069 (1985) *L. narbonense* is known from Palestine. I have seen one specimen, collected by W. A. Hayne in March 1872, from the northeastern shores of the Dead Sea (K!), most probably the specimen on which Meikle, *l. c.* based his distribution record. However, *L. narbonense* was overlooked by Feinbrun-Dothan, Fl. Palast. 2 (1978).

4. ***Limonium meyeri*** (Boiss.) Kuntze, Revis. Gen. Pl. 2: 395 (1891).

Syns. *Statice meyeri* Boiss. in DC., Prodr. 12: 645 (1848).

Statice gmelinii Willd. var. *laxiflora* Boiss. in DC., Prodr. 12: 646 (1848).

Erect perennial 30-80 cm, with tough rootstock; all leaves basal, forming a rosette, 10-35 x 1.5-4.5 cm, oblanceolate to narrowly obovate, distinctly pinnate-veined, the margin entire; apex obtuse-acute, ending in a 2 mm brown awn; base narrowed to an indistinct flattened petiole 2-4 cm; inflorescence 30-80 cm, repeatedly branched, forming a lax panicle; spikelets 1- to 2-flowered; bracts brown, coriaceous, scarious-margined; outer bracts 1.2-2 x 1.5 mm, unequal, bluntly ovate, apex mucronate, the inner 2.5-3 x 2-2.5 mm, broadly ovate; calyx 4.5-5 mm, narrowly obconical, glabrous, strongly 5-nerved from the brown base to just below the apical teeth; limb 2 mm wide, membranous; teeth 10, 0.2 mm, dentate; corolla pale blue; fruit not seen.

M; moist saline ground. Egypt, Palestine, Syria, Turkey, southern Russia, Crimea, Caucasus, Northwest and North Iran.

NOTE: *Limonium meyeri* is known in Egypt from a restricted Mediterranean coastal area around Rosetta and Alexandria, a distribution which overlaps that of *L. narbonense* within Egypt. Although both species are similar in habit, their leaves differ in size, shape and venation, very useful characters to separate them even in sterile specimens (see key).

5. ***Limonium pruinosum*** (L.) Chaz., Suppl. Dict. Jard. 2: 36 (1790).

Syns. *Statice pruinosa* L., Mant. 59 (1767).

Limonium pruinosum (L.) Kuntze, Revis. Gen. Pl. 2: 396 (1891).

Densely pruinose perennial 25-50 cm, covered with greyish scale-like tubercles; stems brittle, branched; lower branches sterile; the upper with scorpioid spikes; leaves 0.5-3 x 0.4-0.7 cm, spatulate, tapering to a short petiole, entire, the apex rounded; flowering branches usually leafless; spikelets 1-flowered; bracts glabrous or hairy; outer bracts c. 1 x 1 mm, acute, margin scarious, the inner bracts c. 2 x 1.5 mm, scarious at the margin and the apical part; calyx 3.5-4 mm, broadly infundibular, strongly 5-nerved from the brown basal short tube to the limb; tube and veins hairy or glabrous; limb 3.5-4 mm wide, scarious, spreading; teeth 5, 0.5-1 mm; corolla c. 4 mm, purplish; fruit not seen.

Two varieties occur in Egypt:

var. ***pruinosa***

Bracts and calyx-tube glabrous.

M, D, S; edges of salt marshes.

var. **hirtiflorum** (Cavara) Täckh. ex Feinbrun, Fl. Palaest. 3: 11 (1978).

Syns. *Statice pruinosa* L. var. *hirtiflora* Cavara in Pamp., Bull. Ort. Bot. Nap. 9: 49 (1928).

Limonium pruinatum (L.) Kuntze var. *hirtiflorum* (Cavara) Täckh., Stud. Fl. Egypt, ed. 1, 190 (1956), comb. inval.

Bracts and calyx-tube hairy.

M, D, S; edges of salt marshes.

Area of the species: North Africa, Sinai, Palestine, Syria.

6. **Limonium axillare** (Forssk.) Kuntze, Revis. Gen. Pl. 1: 395 (1891).

Syn. *Statice axillaris* Forssk., Fl. Aegypt.-Arab. 58 (1775).

Low shrub 20-50 cm; stems erect, leafy, usually branched, the old branches covered with the basal parts of dead leaves; leaves 1-5 x 0.2-0.8 mm, oblanceolate, gradually narrowed into a petiole, coriaceous, glabrous, the apex obtuse, short-mucronate; inflorescence 10-30 cm, branched, forming a panicle; spikelets 1-flowered; bracts coriaceous, reddish-brown, the margin scarious; outer bracts 1.5-2 x 1.5 mm, broadly ovate, the inner 2.5-3 x 2 mm, broadly elliptic; calyx c. 4 mm, infundibular, strongly 5-nerved from the reddish-brown base to the apex of the teeth; limb c. 3 mm wide, scarious, spreading; teeth 5, 0.5 mm; corolla c. 4 mm, rose-purple; fruit not seen.

R, S; salt marshes along the coastal regions of the Red Sea, the Gulf of Suez and the Gulf of Aqaba. Egypt, Sudan, Ethiopia, Somalia, Arabia.

7. **Limonium echioides** (L.) Mill., Gard. Dict., ed. 8, no. 11 (1768).

Syn. *Statice echioides* L., Sp. Pl., ed. 1, 275 (1753).

Erect annual 10-30 cm, with a slender taproot; stems branched, divaricate; all leaves basal, forming a rosette, 1.5-4 x 1-1.5 cm, obovate to spatulate, with rounded apex, tapering into a petiole, pinnate-veined, tuberculate; inflorescence 10-30 cm, repeatedly dichotomously branched; spikelets 1- to 2-flowered; bracts brownish-red, coriaceous, with membranous margin; outer bracts 1.5 x 1 mm, ovate, overlapping, the inner c. 6 mm, curved, tuberculate on the dorsal side; calyx c. 5 mm, narrowly infundibular, with 5 prominent nerves from the brown base to the apex of the teeth; limb c. 2.5 mm, membranous; teeth uncinatate in fruit; corolla 5-6 mm, pinkish; seed 2-2.5 mm, brown.

M; coastal sands. Mediterranean region.

8. **Limonium tubiflorum** (Delile) Kuntze, Revis. Gen. Pl. 1: 396 (1891).

Syn. *Statice tubiflora* Delile, Descr. Egypte, Hist. Nat. 215 (1814).

Perennial 10-35 cm, woody at the base, densely covered with scale-like tubercles; stems 1-5 cm, simple to richly branched, leafy; old stems covered with the remains of dead leaves; leaves restricted to basal part of the short stems, 0.5-2 x 0.2-0.5 cm, oblanceolate, tapering to a petiole, entire; apex ending in a 1-2 mm brown awn; flowering stems branched, brittle; lower branches sterile, the upper with scorpioid spikes; spikelets 1- to 3-flowered; flowers c. 1 cm diam., conspicuous; bracts brownish, coriaceous, glabrous or hairy, the margin membranous; outer bracts 1.5-3.5 x 2 mm, unequal, broadly ovate,

acute, the inner 7-9 x 2.5 mm, strongly clasping the calyx-tube; calyx 1-1.2 cm, tube 4-5 mm, strongly 5-veined from the base to the top of the limb; limb membranous, deeply divided; calyx-teeth ending in a reddish-brown awn 2-3 mm; petals c. 1.5 cm, vivid rose, lobes 5-6 x 2-3 mm, obovate; fruit not seen.

Two varieties occur in Egypt.

var. **tubiflorum**

Bracts glabrous; calyx c. 1 cm, glabrous.

M, Dw (south of Mersa Matruh); calcareous ridges.

var. **zanonii** (Pamp.) Maire, Bull. Soc. Hist. Nat. Afr. Nord 29: 435 (1938).

Syns. *Statice tubiflora* Delile var. *zanonii* Pamp., Nuovo Giorn. Bot. Ital., ser. 2, 24: 148 (1917).

Limonium tubiflorum (Delile) Kuntze subsp. *zanonii* (Pamp.) Brullo, Webbia 33:143 (1978).

Bracts hairy; calyx c. 1.2 cm, hairy.

M, Dw (south of Mersa Matruh); calcareous ridges.

Area of the species: North Africa.

NOTE: The type was collected from Egypt (? MPU). The above infraspecific taxa are treated as varieties, rather than subspecies, as they grow in Egypt in mixed populations. The combination *Limonium tubiflorum* var. *zanonii* (Pamp.) Täckh., Stud. Fl. Egypt, ed. 1, 190 (1956), has already been made by Maire in 1938.

2. **Limoniastrum** Fabr.

Low shrubs; leaves entire or obscurely dentate, fleshy, coriaceous, covered with calcareous scales; flowers in loose spikes; spikelets closely appressed to the rhachis or divaricate; calyx tubular, membranous; limb minute, 5-lobed; corolla infundibular, the tube about as long as the lobes; stamens 5, inserted in the middle of the corolla-tube; styles connate in basal half; stigma filiform; fruit a membranous indehiscent utricle. 9 species, Mediterranean region, northern Somalia.

1. Leaves 1-3(-4) x 0.3-0.6 cm, lanceolate; spikelets closely appressed to the rhachis;
outer bract 6-8 mm; corolla 1.2-1.5 cm **1. L. monopetalum**
+ Leaves 3.5-6 x 0.1-0.25 cm, narrowly linear to subcylindrical; spikelets divaricate;
outer bract 2-3 mm; corolla 0.8-1 cm **2. L. guyonianum**

1. **Limoniastrum monopetalum** (L.) Boiss. in A. DC., Prodr. 12: 689 (1848).

Syns. *Statice monopetala* L., Sp. Pl., ed. 1, 276 (1753).

Limonium articulatum Moench, Meth. 423 (1794).

Low shrub 20-80 cm, densely covered with calcareous scales; stems erect or procumbent, much-branched, leafy; leaves 1-3(-5) x 0.3-0.6 mm, fleshy, spatulate to narrowly oblanceolate, attenuate to a sheathing petiole, the apex obtuse; flowers in terminal panicles 5-12 cm; rhachis brittle; spikelets (1-) 2-flowered, closely appressed to the



Plate 50. PLUMBAGINACEAE: *Limoniastrum monopetalum* 1, flowering branch; flower (right). *Limoniastrum guyonianum* 2, flowering branch; flower (down left). *Plumbago zeylanica* 3, flowering branch. EBENACEAE: *Euclea racemosa* subsp. *schimperi* 4, fruiting branch. OLEACEAE: *Olea europaea* subsp. *cuspidata* 5, flowering and fruiting branches. *Jasminum grandiflorum* subsp. *floribundum* 6, flowering branch. *Jasminum fluminense* subsp. *gratissimum* 7, flowering branch. All drawings to the same scale, except the enlarged parts (scale given).

rhachis; outer bract 5-8 mm, cupuliform, obliquely truncate, enrolling the spikelet and rhachis at its base; inner bract 7-9 mm; calyx c. 1 cm, reddish, membranous; teeth 1-1.5 mm, mucronate; corolla 1.2-1.5 cm, purplish-pink, the lobes obovate; utricle c. 8 mm, compressed.

M, S; coastal salt marshes, widespread. West Mediterranean region, Egypt, Crete (Gaidouronisi); naturalized in Balearic Islands.

2. *Limoniastrum guyonianum* Boiss. in A. DC., Prodr. 12: 689 (1848).

Like *Limoniastrum monopetalum*, but leaves 3.5-6 x 0.1-0.25 cm, narrowly linear to subcylindrical; spikes divaricate; outer bract 2-3 mm; corolla 0.8-1 cm.

M; salt marshes, uncommon. North Africa.

3. *Plumbago* L.

Perennials or shrubs; leaves simple, alternate; flowers in terminal spikes; calyx tubular, 5-ribbed, scarious between the ribs, 5-toothed, persistent; corolla with a narrow tube and rotate limb; stamens free; ovary 1-locular; style 1; stigma 5-lobed; fruit a 1-seeded membranous capsule enclosed by the persistent calyx, dehiscing by a ring near the base or splitting into 5 valves from the base; seeds blackish, slightly flattened, tapering towards the apex. 24 species, tropical and warm regions.

1. *Plumbago zeylanica* L., Sp. Pl., ed. 1, 151 (1753).

Scandent low shrub 0.4-1.5 m; stems glabrous, with minute white waxy spots, ridged; leaves 3-8 x 1-4 cm, ovate-lanceolate to elliptic, acute, the base cuneate, glabrous with white spots beneath; petiole 2-8 mm; peduncle covered with sessile glands; flowers with faint fragrance; pedicel 1-2 mm; bracts 2-6 x 1.5 mm, ovate-lanceolate, acuminate, with stalked glands; calyx 1-1.2 cm, densely covered with stalked glands 1-2 mm; calyx-teeth 1-1.5 mm; corolla 1.5-2.5 cm, white; lobes 5-8 x 3-4.5 mm, obovate, mucronate; seeds 5-6 x 1.5 mm, brownish-black.

GE; stony hillsides. Tropical and subtropical regions.

EBENACEAE

2 genera, 485 species, tropical and warm regions, a few temperate. *Euclea* is the only genus in Egypt.

1. *Euclea* Murray

Dioecious trees or shrubs, usually evergreen; leaves alternate, subopposite or subverticillate, coriaceous, entire; flowers in raceme-like inflorescences (our species) or rarely solitary, the male usually larger than the female; calyx 4-5-lobed; corolla campanulate, 4-5-lobed; stamens 10-30, basically 2 opposing and 2 alternating with each corolla-lobe; filaments usually shorter than the anthers; rudimentary ovary usually very reduced; disc fleshy, fimbriate; staminodes absent or very reduced in female flowers; ovary globose; locules usually 4-6, 1 to (2-3)-ovulate; styles 2-3, free or united below; fruit a 1 to (-3)-seeded globose berry; seeds subglobose with 3 lines radiating from the apex. 12 species, tropical Africa, Arabia, Comoro Islands.

1. *Euclea racemosa* Murray, Syst. Veg., ed. 13, 747 (1774) subsp. *schimperii* (A. DC.)
 F. White, Bull. Jard. Bot. Belg. 50: 399 (1980).
 Syns. *Kellaua schimperii* A. DC., Ann. Sci. Nat., sér. 2, 18: 209 (1842).
Euclea kellau Hochst., Flora 26: 83 (1843), nom. illeg.
Euclea bilocularis Hiern, Trans. Camb. Phil. Soc. 12: 102 (1873).
Euclea schimperii (A. DC.) Dandy in F. W. Andrews, Fl. Pl. Anglo-Egypt.
 Sudan 2: 370 (1952).

For full synonymy see White & Verdcourt in Polhill, Fl. Trop. East Afr., Ebenaceae 46 (1996).

Evergreen dioecious shrub or small tree, 2-6 m; bark grey, minutely fissured; leaves 3-7 x 1-3 cm, alternate, subopposite, opposite or verticillate, dark green, glossy, coriaceous, obovate to oblanceolate, widest above the middle, the apex rounded, the base cuneate, the margin undulate; petiole 1-3 mm; inflorescence 1.5-4.5 cm; *male flowers*: 4-5 mm; calyx 2 mm, shallowly lobed; corolla white, lobed in the upper half; stamens 10-20, mostly in pairs; *female flowers*: similar but much smaller; staminodes absent; ovary strigulose; fruit 5-7 mm, globose, with short appressed scale-like hairs.

GE; rocky ground; Southeast Egypt, Arabia, Comoro Islands, East Africa southwards to Zimbabwe and westwards to Congo.

OLEACEAE

Trees, shrubs or woody climbers; leaves opposite, rarely alternate, simple, trifoliolate or pinnately compound; stipules 0; flowers bisexual, actinomorphic, in cymes or panicles; calyx 4-lobed, often small or 0; petals usually 4, sometimes more (*Jasminum*) free or united, sometimes 0; stamens 2, rarely 4, epipetalous; disc absent; ovary superior, 2-locular; ovules usually 2 per locule; style simple; stigma 2-lobed; fruit a 1-4-seeded capsule, berry, drupe or samara, 24 genera, 615 species, subcosmopolitan, but especially Asia.

1. Leaves simple; flowers inconspicuous, many, in panicles; fruit a drupe,
 not divided into 2 lobes 1. *Olea*
 + Leaves pinnately compound; flowers conspicuous, few, in cymes; fruit a berry,
 deeply 2-lobed or sometimes simple by abortion of 1 lobe 2. *Jasminum*

1. *Olea* L.

Evergreen trees and shrubs; leaves opposite, sometimes subopposite near the inflorescence, simple, entire, coriaceous; flowers bisexual, in racemes or panicles; calyx small, with 4 teeth or shallow lobes; corolla valvate, 4-lobed; stamens 2, epipetalous; filaments short; anthers large, exerted; style short; fruit a 1-2-seeded oleaginous drupe; stone large, bony. 30 species Old World tropical and warm temperate regions.

1. *Olea europaea* L., Sp. Pl., ed. 1, 8 (1753).

Evergreen tree or shrub 2-8 m; leaves 2-6(-8) x 0.5-1.5(-2.5) cm; oblong-lanceolate, the apex mucronate, the base cuneate, greyish-green and glabrous on the upper surface, silvery and densely covered by peltate scales beneath, subsessile or petiole 2-4 mm; flowers in axillary panicles 1-10 cm; pedicel 0.5-2 mm; bracts c. 2 mm, caducous; calyx 0.5 x 1.5-2 mm, cupulate, with 4 lobes c. 0.25 mm; corolla-tube ± equalling the calyx;

corolla-lobes 4, valvate, 2-3 x 1.5 mm, oblong-ovate, obtuse, white-cream, spreading; drupe 0.5-3(-4) x 0.5-2(-3) cm, ellipsoid to subglobose, green when unripe, becoming purplish to blackish.

Two subspecies occur in Egypt:

1. Inflorescence 1-3(-4) cm; drupe 1-3(-4) x 0.5-2(-3) cm;
mesocarp thick subsp. **europaea**
+ Inflorescence 4-10 cm; drupe 0.6-1 x 0.4-0.5 cm; mesocarp thin subsp. **cuspidata**
- subsp. **europaea**

Two varieties occur in Egypt:

1. Tree; branches not spinescent; drupe large, to 3(-4) x 1-2(-3) cm;
mesocarp rather rich in oil var. **europaea**
+ Shrub; branches spinescent; drupe much smaller;
mesocarp poor in oil var. **sylvestris**

var. **europaea**

The cultivated olive; fruit with a thick, fleshy mesocarp, rich in oil.

N, O, M, D, S; widely cultivated, especially in the oases, the Nile delta, the Mediterranean coastal region; also in gardens, parks and along the highways, e.g. Alexandria-Cairo desert road. Mediterranean region, cultivated in other warm- temperate regions of the world.

NOTE: Several olive cultivars are grown in Egypt for oil and the pickled fruits. The drought resistant cultivar 'Shemlali' is widely cultivated in the Mediterranean coastal region.

var. **sylvestris** (Mill.) Ehr, Diss. Bot.-Med. Olea: 20 (1779).

Syns. *Olea sylvestris* Mill., Gard. Dict., ed. 8, no. 3 (1768).

Olea europaea L. var. *oleaster* (Hoffmanns. & Link) DC., Prodr. 8: 284 (1844).

The "wild" olive of the Mediterranean region; shrub, frequently with small leaves and spinescent branches; fruit small with thin mesocarp; spontaneous from seed of the cultivated plant.

M, Dw; coastal and adjacent desert regions. Mediterranean region.

subsp. **cuspidata** (Wall. ex G. Don) Ciferri, L'Olivicoltura 19 (5): 96 (1942).

Syns. *Olea africana* Mill., Gard. Dict., ed. 8, no. 4 (1768).

Olea chrysophylla Lam., Tab. Encycl. 1: 29 (1791).

Olea europaea L. var. *verrucosa* Willd., Sp. Pl., ed. 4, 1: 44 (1797).

Olea verrucosa (Willd.) Link, Enum. Hort. Berol. 1: 33 (1821).

Olea ferruginea Royle, Illustr. Bot. Him. 267, t. 65, f. 1 (1835).

Olea cuspidata Wall. ex G. Don, Gen. Syst. 4: 49 (1837).

Olea somalensis Baker in Dyer, Fl. Trop. Afr. 4 (1): 18 (1902).

Olea europaea L. var. *nubica* Schweinf. ex Baker in Dyer, Fl. Trop. Afr. 4 (1): 18 (1904).

Olea schimperi Gand., Bull. Soc. Bot. France 65: 58 (1918).

Olea aucheri Chev. ex Ehrend., Anz. Math.-Nat. Kl. Österr. Acad. Wiss. 97: 155 (1960).

Olea europaea L. subsp. *africana* (Mill.) P. S. Green, Kew Bull. 34: 69 (1979).

For full synonymy and more details, see Green & Wickens; The *Olea europaea* complex, in Kit Tan *et al.* (eds.), Davis & Hedge Festschrift 287-299 (1989).

Leaves often tinged reddish beneath; inflorescence 4-10 cm; drupe 0.6-1 x 0.4-0.5 cm, with a poorly developed mesocarp, slightly bitter; sweet fruits have been reported from isolated populations in Saudi Arabia, and should be looked for in Egypt.

De, GE; rocky hillsides. Southeast Egypt, tropical Africa, Arabia, Iran, Pakistan, Afghanistan, China.

NOTE: The combination subsp. *cuspidata* (Wall. ex G. Don) Ciferri, based on the Asian *Olea cuspidata*, has priority, at this rank, over subsp. *africana* (Mill.) P. S. Green, based on *Olea africana*. According to Green & Wickens, *l. c.* (1989) it has proved impossible consistently to distinguish taxonomically between the representative specimens from Africa and Asia, and therefore the earlier combination of Ciferri must be applied to this subspecies.

2. *Jasminum* L.

Shrubs, mostly climbers or scramblers; leaves simple, 3-foliolate or compound pinnate, opposite, alternate or whorled; flowers solitary or in cymes, heterostylous, conspicuous; calyx with a ± campanulate tube and variably shaped of lobes or teeth; corolla hypocrateriform, with a slender narrow-cylindrical tube and 4-10 imbricate lobes, often fragrant, white, yellow or flushed pink externally; stamens 2, inserted in the upper part of the corolla-tube; filaments short; anthers large; ovary 2-locular; style slender; stigma capitate or bilobed; ovules 2 per locule; fruit a berry, deeply 2-lobed or simple by abortion of 1 lobe; seed 1 per lobe. About 200 species, tropical regions of the Old World, a few temperate.

1. Leaves (3-)5(-9)-foliolate
+ All leaves 3-foliolate

1. ***J. grandiflorum* subsp. *floribundum***
2. ***J. luminense* subsp. *gratissimum***

1. ***Jasminum grandiflorum* L. subsp. *floribundum* (R. Br. ex Fresen.) P. S. Green,** Kew Bull. 41: 414 (1986).

Syns. *Jasminum floribundum* R. Br. ex Fresen., Mus. Senckenb. 2: 168 (1837).

Jasminum steudneri Schweinf. ex Baker in Dyer, Fl. Trop. Afr. 4 (1): 12 (1902).

Jasminum floribundum R. Br. ex Fresen. forma *decipiens* Di Capua, Ann. Ist. Bot. Roma 8: 208 (1904).

Jasminum floribundum R. Br. ex Fresen. var. *decipiens* (Di Capua) Fiori. Boschi Pl. Legnose Eritrea 295 (1912).

Jasminum floribundum R. Br. ex Fresen. var. *steudneri* (Schweinf. ex Baker) Gilg & Schellenb. in Bot. Jahrb. Syst. 51: 83 (1913).

Jasminum officinale, sensu Khattab & El-Hadidi, Publ. Cairo Univ. Herb. 4: 77 (1971), non L., Sp. Pl., ed. 2, 9 (1762).

Glabrous or glabrescent low shrub or scrambler, 1-3 m; stems striate; leaves opposite, imparipinnate, (3-)5(-9)-foliolate; leaflets 1-4 x 0.4-1.5 cm, ovate to broadly-lanceolate; the terminal leaflet larger than the laterals, entire, the apex acute, the base often asymmetric on lateral leaflets; petiole 4-8 mm in terminal leaflet, 0-3 mm to the laterals; flowers sweet-scented, in terminal or axillary, 3-7-flowered cymes; calyx-tube 1.5-2 mm; calyx-lobes 2-5(-8) mm, linear; corolla-tube 1.6-2 cm; the lobes 0.6-1 x 0.3-0.6 cm, broadly elliptic, white, streaked with red or crimson on the lower surface; berry deeply 2-lobed, the lobes 6-8 x 5 mm, broadly ovate-elliptic, often reduced to 1 by abortion.

GE; high altitude mountain slopes. Southeast Egypt, Sudan, Ethiopia, Somalia, Rwanda, Uganda, Kenya, Arabia.

NOTE: According to Green, Kew Bull. 41: 414 (1986), *Jasminum grandiflorum* subsp. *floribundum* is the "wild" variant of the species. On the other hand, *Jasminum grandiflorum* subsp. *grandiflorum*, known only as a cultivated plant, is widely grown in warm-temperate and tropical regions throughout the world and often used in the perfume industry as a source of jasmine oil.

2. *Jasminum fluminense* Vell. subsp. *gratissimum* (Deflers) P. S. Green, Kew Bull. 41: 417 (1986).

Syns. *Jasminum gratissimum* Deflers, Voy. Yémen 162 (1889).

Jasminum abyssinicum Hochst. ex DC. var. *gratissimum* (Deflers) Di
Capua, Ann. Ist. Bot. Roma 8: 207 (1904).

For full synonymy and more details, see Green, Kew Bull. 41: 413-418 (1986).

Like *Jasminum grandiflorum* subsp. *floribundum*, but stems and basal parts of leaves, including the petiole and petioles usually tomentose; all leaves 3-foliolate; calyx-tube 2-3 mm; calyx-lobes usually reduced to minute teeth; corolla-tube 2-3 cm, creamy-white.

GE; high altitude mountain slopes. Southeast Egypt, Sudan, Ethiopia, Arabia.

GENTIANACEAE

Annuals or perennials; leaves simple, opposite, decussate, entire, exstipulate, often sessile, generally glabrous; flowers bisexual, actinomorphic, 4-5(-12)-merous, in dichasial cymes; bracts and bracteoles present or absent; calyx usually with imbricate lobes; corolla infundibular, hypocrateriform, campanulate or rotate; corolla-lobes mostly convolute; stamens epipetalous, as many as the petals and alternate with them; ovary superior, usually 1-locular, with parietal (rarely axile) placentation; ovules numerous; style simple; stigma simple or 2-lobed; fruit a septicidal capsule, rarely a berry; seeds numerous, small. 78 genera, 1225 species, cosmopolitan, but especially temperate and subtropical mountains.

1. Annual; flowers in spicate or dichasial cymes

+ Perennial; flowers in axillary cymes

1. **Centaurium**

2. **Enicostema**

1. **Centaurium** Hill

Glabrous annuals, biennials or rarely perennials; stems angled; leaves opposite, sessile, the basal usually forming loose rosettes; flowers usually in dichasial or spicate cymes,

rarely solitary; calyx deeply (4-)5-lobed; corolla hypocrateriform, pink or purplish, sometimes white or yellow, (4-)5-lobed; stamens epipetalous, inserted at the apex of the corolla-tube; style slender, persistent, 2-fid at apex; stigmas capitate or oblong; capsule 1-locular, 2-valved; seeds minute, reticulate. 20 species, northern hemisphere, but especially Armenia.

- | | |
|---|--------------------------|
| 1. Flowers sessile, in monochasial spicate inflorescences | 1. C. spicatum |
| + Flowers subsessile, short- or long-pedicellate, in dichasial cymes | 2 |
| 2. Corolla yellow; inflorescence 2-8-flowered | 5. C. maritimum |
| + Corolla pink; inflorescence usually many-flowered | 3 |
| 3. Plant to 1.1 m; inflorescence to 45 cm; corolla-lobes 6-7 mm | 4. C. malzacianum |
| + Plant 5-50 cm; inflorescence (3-)5-25 cm, corolla-lobes 2.5-4 mm | 4 |
| 4. Stem usually branched below; cauline internodes 2-4; inflorescence usually lax, spreading; flowers usually long-pedicellate | 2. C. pulchellum |
| + Stem usually branched above; cauline internodes usually 5-8; inflorescence usually dense, erect, fastigiate; flowers subsessile, or short-pedicellate | 3. C. tenuiflorum |

1. **Centaurium spicatum** (L.) Fritsch, Mitt. Naturwiss. Vereins. Univ. Wien, ser. 2, 5: 97 (1907).

Syns. *Gentiana spicata* L., Sp. Pl., ed. 1, 230 (1753).

Erythraea spicata (L.) Pers., Syn. Pl. 1: 283 (1805).

Erect glabrous annual 30-50 cm; stems angled, much-branched from the base; basal leaves 0.5-2 x 0.4-0.8 cm, oblong-obovate to suborbicular, forming a loose rosette, soon withering; cauline leaves 1-3.5 x 0.4-1 cm, ovate-lanceolate, 3-5-veined; inflorescence monochasial, spicate; bracts 0.5-1.2 x 0.15-0.35 mm, narrowly lanceolate or subulate, acute; flowers sessile; calyx lobes 5, unequal, 8-9 mm, acuminate, sharply keeled; corolla pink; corolla-tube 0.8-1.1 cm, ± equalling and adhering to the calyx-lobes; corolla-lobes 4-5, 3-4 x 1-1.5 mm, elliptic, obtuse; fruit 7-9 x 2 mm; seeds 0.3-0.4 mm, subglobose, reticulate, brown.

N, O, M, De, S; marshy ground, canal banks and springs, edges of fields with soils of high salinity. Mediterranean region, Europe, West and Central Asia.

2. **Centaurium pulchellum** (Sw.) Druce, Fl. Berkshire 342 (1898).

Syns. *Gentiana pulchella* Sw., Kongl. Vetensk. Akad. Nya Handl. 4: 85 (1783).

Gentiana ramosissima Vill., Fl. Delph. 23 (1786).

Erythraea ramosissima (Vill.) Pers., Syn. Pl. 1: 283 (1805).

Erythraea pulchella (Sw.) Fries, Novit. Fl. Svec. 30 (1814).

Erythraea meyeri Bunge in Ledeb., Fl. Altaica 1: 220 (1829).

Centaurium ramosissimum (Vill.) Druce, Bot. Soc. Exch. Club Brit. Isles 4: 274 (1915).

Centaurium meyeri (Bunge) Druce, Bot. Soc. Exch. Club Brit. Isles 4: 613 (1917).

Centaurium pulchellum (Sw.) Druce subsp. *ramosissimum* (Vill.) P. Fourm., Quatre Fl. France 855 (1938).

Centaurium pulchellum (Sw.) Druce subsp. *meyeri* (Bunge) Tzvelev in Fedorov, Fl. Evr. Casti SSSR 3: 63 (1978).

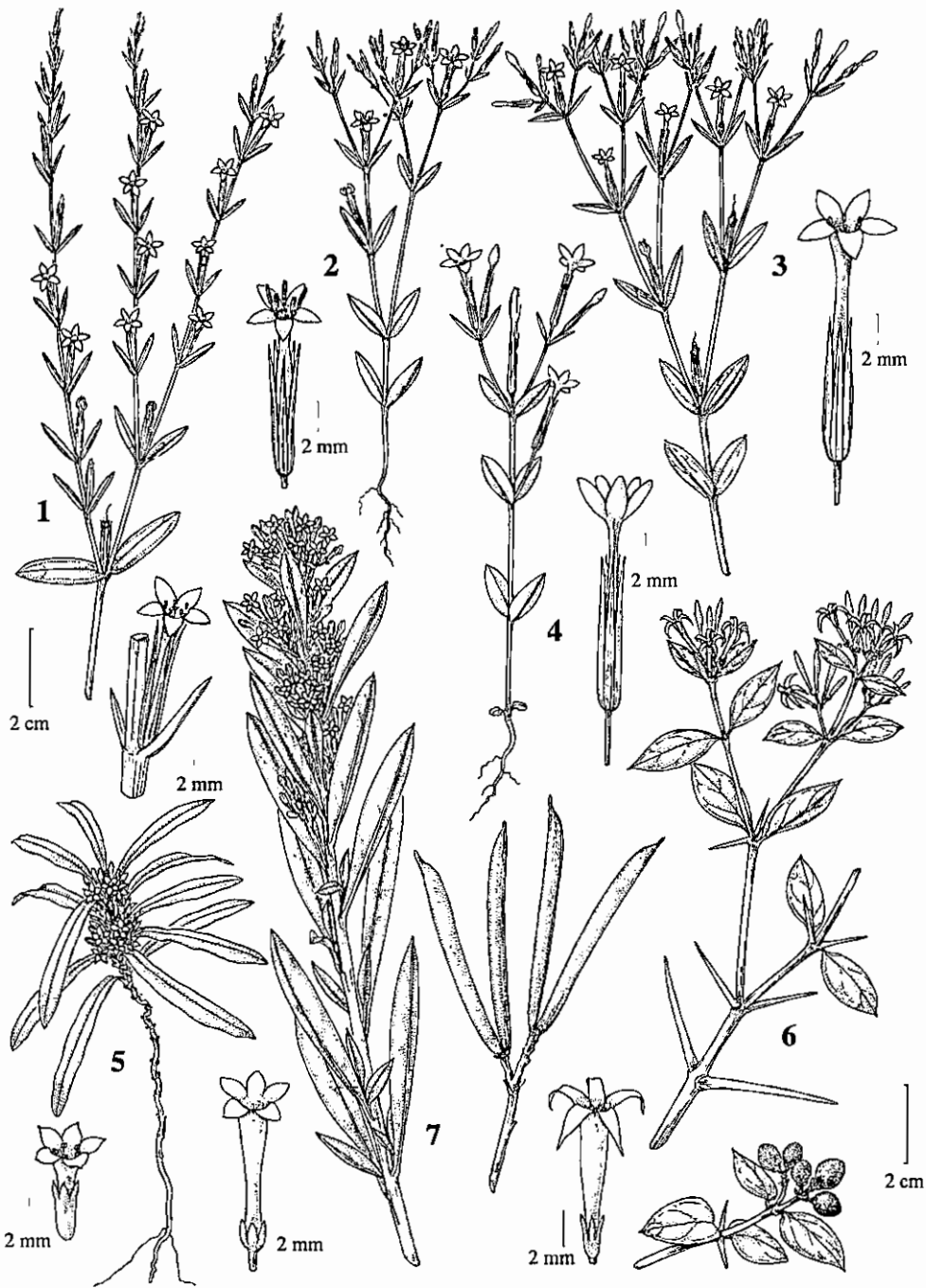


Plate 51. GENTIANACEAE: *Centaurium spicatum* 1, flowering and fruiting branch; flower (down right). *Centaurium pulchellum* 2, habit; flower (left). *Centaurium tenuiflorum* 3, flowering and fruiting branch; flower (right). *Centaurium maritimum* 4, habit; flower (right). *Enicostema axillare* 5, habit; flower (left). APOCYNACEAE: *Carissa spinarum* 6, flowering branch; fruiting branch, (down right); flower (down left). *Rhazya stricta* 7, flowering branch; fruiting branch (right); flower (left). All drawings to the same scale, except the enlarged parts (scale given).

Erect glabrous annual 5-20(-30) cm, without a basal leaf-rosette; stems usually branched in the lower part; cauline internodes 2-4; cauline leaves 0.4-1.8 x 0.2-1 cm, ovate-lanceolate, acute, the upper oblong-lanceolate; inflorescence usually a lax spreading dichasial cyme, sometimes few-flowered or solitary in small unbranched plants; flowers 1-1.2 cm, pink, rarely white, usually long-pedicellate; calyx \pm equalling the corolla-tube; corolla-lobes 2.5-4 x 1.5-2 mm; stamens inserted at the apex of the corolla-tube; fruit 1-1.2 x 0.2-0.25 cm; seeds *c.* 0.25 mm, irregularly subglobose or elongate.

S; sheltered mountain crevices and around freshwater springs. Western Europe, Mediterranean region, Sinai, eastwards to China.

NOTE: *Centaurium pulchellum*, which is easily confused with *C. tenuiflorum* (see note under *C. tenuiflorum*), is not as widespread in Egypt as was thought. The only authentically identified specimens of *C. pulchellum* I have seen are from the southern mountainous region of Sinai, where it grows in sheltered crevices along hillsides and moist ground by freshwater springs, not in or around salt marshes. More collections of this species are needed to determine its distribution in Egypt.

3. ***Centaurium tenuiflorum*** (Hoffmanns. & Link) Fritsch, Mitt. Naturwiss. Vereins Univ. Wien, ser. 2, 5: 97 (1907).

Syns. *Erythraea tenuiflora* Hoffmanns. & Link, Fl. Portug. 1: 354. (1820).

Centaurium pulchellum (Sw.) Druce subsp. *tenuiflorum* (Hoffmanns. & Link) Maire, Mém. Soc. Sci. Nat. Maroc 17: 41 (1928).

Centaurium pulchellum (Sw.) Druce subsp. *taxiflorum* (H. Lindb.) Maire in Jahand. & Maire, Cat. Pl. Maroc 576 (1934).

Like *C. pulchellum*, but stem usually branched above; cauline internodes usually 5-8; inflorescence usually dense, erect, fastigiate; flowers 1.2-1.4 cm, subsessile or short-pedicellate; fruit 0.7-1 x 0.15-0.2 cm.

N, O, M; coastal and inland salt marshes and saline soils around springs, especially in the oases. Mediterranean region, western Europe.

NOTE: The occurrence of *Centaurium tenuiflorum* in Egypt was entirely overlooked by almost all authors who previously dealt with the genus *Centaurium* for the flora of Egypt. However, in an attempt to prepare an account of the family Gentianaceae for the "Flora of Egypt", Sven Snogerup, Lund, studied in 1983 specimens of *Centaurium* collected from Egypt and deposited in the Kew Herbarium (K!). The result was that the majority of these specimens, previously identified as *C. pulchellum*, proved to be *C. tenuiflorum*. The distribution and ecology of both species in Egypt, based on the available examined material, show that *C. pulchellum* is rare, restricted to sheltered crevices and around freshwater springs in the mountains of southern Sinai. On the other hand, *C. tenuiflorum* is widespread in the Nile delta, Bahariya and Farafra oases and the Mediterranean coastal region, generally on moist saline soils. As pointed out by Meikle (Fl. Cyprus 2: 1116, 1985), many authors have remarked upon the difficulty of distinguishing *C. pulchellum* from *C. tenuiflorum*. More material is needed to study the range of variation within and between these two closely allied species.

4. ***Centaurium malzacianum*** Maire, Notul. Syst. (Paris) 8: 25 (1939).

Robust glabrous annual to 1.1 m; stems terete, finely ribbed; basal leaves to 4 cm, in a rosette, persistent at anthesis, sessile, linear, finely 3-nerved, attenuate at the base, apex \pm

acute; cauline leaves to 5.5 x 0.8 cm, linear-lanceolate; uppermost leaves linear; inflorescence a lax dichasium to 45 cm; flowers long-pedicellate, ± equalling the calyx; calyx 7-8 mm, the tube 0.3 mm; calyx-lobes subulate; corolla c. 1.5 cm, pink; corolla-tube 8-9 mm, constricted below the limb; corolla-lobes 6-7 x 2-2.5 mm, lanceolate, acute; stamens and style exserted; anthers c. 4 mm; capsule longer than the calyx.

S; damp cliffs. Sinai, Northwest Saudi Arabia.

NOTE: The above description follows Maire's original diagnosis. According to him, *L.c.* (1939), the type collection was made by Malzac during a trip from Suez to Sinai in 1851. The type specimen is most probably deposited in MPU.

5. ***Centaurium maritimum*** (L.) Fritsch, Mitt. Naturwiss. Vereins. Univ. Wien, ser. 2, 5: 97 (1907).

Syns. *Gentiana maritima* L., Mant. 55 (1767).

Erythraea maritima (L.) Pers., Syn. Pl. 1: 283 (1805).

Erect annual 5-15(-20) cm; stems angled, usually unbranched; basal leaves small, not forming a rosette; cauline leaves 0.5-1.5 x 0.3-0.8 cm, oblong-ovate; flowers in lax, erecto-patent, 2-8-flowered dichasia; bracts 0.5-1.2 x 0.1-0.3 cm, foliaceous; calyx-lobes 0.8-1.2 cm, connate at the base; corolla pale yellow; corolla-tube 1.5-1.8 cm, the lobes 5-8 x 2-3.5 mm; fruit 1.2-1.4 x 0.2 cm, brownish.

M, calcareous ridges. Mediterranean region, western Europe.

NOTE: The occurrence of this species in Egypt needs confirmation.

2. ***Enicostema*** Blume, nom. conserv.

Annuals, perennials or low shrubs; stems 4-ridged; leaves sessile, linear-lanceolate, narrowed at the base; inflorescences axillary, congested; flowers (3-)4-5(-6)-merous, regular, sessile; calyx tubular; corolla-tube distinct, the lobes shorter than the tube; stamens epipetalous; filaments with 2 hoods at the base; anthers oblong, versatile; ovary 1-locular; style subulate; stigma capitate; capsule dehiscent septically, 2-valved; seeds numerous, subglobose, reticulate. 3 species, Central America, West Indies, Africa, Madagascar, Arabia.

1. ***Enicostema axillare*** (Lam.) Raynal, Adansonia, sér. 2, 9: 75, t. 2, f. 1, 2 (1969).

Syns. *Gentiana verticillata* L., Syst. Nat., ed. 10, 952 (1759), pro parte.

Gentiana axillaris Lam., Illustr. Gen. 1, 2: 487 (1793), non Raf. (1828).

Exacum hyssopifolium Willd., Sp. Pl., ed. 4, 1: 640 (1798).

Enicostema littorale Blume, Bijdragen Fl. Nederl. Ind. 848 (1826).

Enicostema verticillatum (L.) Engl. ex Gilg in Engl. & Prantl, Pflanzenfam. 4, 2: 67 (1895).

Perennial 10-40 cm; stems unbranched or branched from the base, 4-angled; leaves 2-8 x 0.3-1.2 cm, glabrous, linear-lanceolate, entire, acute, 3-nerved beneath; flowers sessile in congested axillary cymes; calyx-tube 1-2.5 mm; calyx-lobes 1-2 x 0.75 mm, lanceolate, the margin scarious, the apex acute; corolla whitish, drying yellow; corolla-tube 4-7 mm, the lobes 1.5-2 x 1 mm, ovate-triangular, acute; filaments 2.5 mm, inserted, with 2 hoods

at the insertion point; ovary 3.5-4.5 x 1.5 mm, ovoid; style 1.5 mm, subulate; stigma subglobose; capsule 5-7 x 2.5 mm, obovoid; seeds 0.5 mm, reticulate.

GE; stony ground. Southeast Egypt, Sudan, Ethiopia, Kenya, Tanzania, Arabia.

APOCYNACEAE

Trees, shrubs and woody climbers, sometimes herbaceous; leaves simple, opposite or whorled, entire; stipules generally absent, or modified; inflorescence usually cymose or sometimes flowers solitary and axillary; bracts and bracteoles usually present; flowers actinomorphic, (4-)5-merous, bisexual; sepals usually almost free; corolla hypocrateriform, infundibular, campanulate, urceolate or rotate, often hairy within; corolla-lobes contorted in bud, rarely valvate; stamens 5, epipetalous, free or connivent around the styler head; filaments very short or almost 0; anthers introrse, dehiscing longitudinally; disc and nectaries often present; ovary superior, or sometimes partly sunk in the disc, generally of 2 free carpels united above by the style; ovules 1-many per carpel; style simple; fruit of 2 divaricate follicles, sometimes of 2 indehiscent mericarps; seeds usually flattened, winged or with a tuft of hairs; endosperm present or absent. 215 genera, 1900 species, mostly tropical, few temperate.

1. Spiny shrub; leaves opposite

1. *Carissa*

+ Unarmed woody herb; leaves alternate

2. *Rhazya*

1. *Carissa* L., nom. conserv.

Syns. *Carandas* Adans., nom. reg.; *Arduina* Mill. ex L.;

Antura Forssk.; *Jasminonerium* Kuntze

Armed shrubs or small trees, much-branched; leaves opposite, coriaceous; stipules 0; flowers in terminal corymbs or cymes; calyx-lobes free to base; corolla hypocrateriform; tube cylindrical, almost straight, hairy within; corolla-lobes contorted; stamens inserted usually at the top of the corolla-tube; anthers sessile; ovary glabrous, 2-locular, with 1-4 ovules per locule; style slender; stigma 2-lobed; fruit a berry, ovoid or ellipsoid, with (1-)2-8 seeds, rarely more; seeds discoid or compressed. 36 species, Old World warm regions.

1. *Carissa spinarum* L., Mant. Alt. 559 (1771), non Lodd. ex A. DC., Prodr. 8: 336 (1844).

Syns. *Antura edulis* Forssk., Fl. Aegypt.-Arab. CVI, 63 (1775).

Carissa edulis (Forssk.) Vahl, Symb. Bot. 1: 22 (1790).

Antura hadiensis G. F. Gmel., Syst. Nat., ed. 13: 405 (1791), nom. illeg.

Carissa pubescens A. DC., Prodr. 8: 334 (1844).

Carissa tomentosa A. Rich., Tent. Fl. Abyss. 2: 30 (1851).

Carissa pilosa Schinz, Verh. Bot. Ver. Prov. Brand. 30: 258 (1888).

Jasminonerium edule (Forssk.) Kuntze, Rev. Gen. Pl. 2: 415 (1891).

Jasminonerium pubescens (A. DC.) Kuntze, Rev. Gen. Pl. 2: 415 (1891).

Jasminonerium tomentosum (A. Rich.) Kuntze, Rev. Gen. Pl. 2: 415 (1891).

For full synonymy and more details see Leeuwenberg & Kupicha in Launert (ed.), Apocynaceae, Fl. Zambes. 7 (2): 399 (1985).

Much-branched spiny shrub 1-2.5 m; young twigs with green bark, glabrous or thinly to densely pubescent; older branches with greyish-brown bark; spines usually simple; leaves 2-4.5 x 1.5-3 cm, broadly ovate to elliptic, the base rounded, the apex acute or mucronate, glabrous, coriaceous; flowers subsessile, sweetly scented, in terminal cymes; peduncle 0.5-2 cm; pedicel 0.5-1.5 mm; calyx 2.5-3 mm, persistent; calyx-lobes c. 2.5 x 1 mm, lanceolate, acuminate, pubescent; corolla 1.2-1.5 cm, white, purplish-red outside; corolla-tube cylindrical; corolla-lobes 2.5-3 x 1 mm, lanceolate, spreading; stamens 5; filaments very short, inserted near the top of the corolla-tube; ovary 2-locular, glabrous; style simple; stigma shortly cylindrical with a 2-fid tip; fruit a berry, 6-8 x 4-6 mm, subglobose to broadly ovate, glabrous, reddish-brown, 2-4-seeded; seeds flattened.

GE; stony hillsides, 600-1500 m. Southeast Egypt, Sudan, Ethiopia, Somalia, tropical East Africa, westwards to Senegal and southwards to Transvaal and Namibia; Madagascar, Socotra, southern Arabia, Pakistan, India, Burma, Thailand, Sri Lanka, Islands of the Indian Ocean.

NOTE: The genus *Carissa* is currently being revised by F. J. H. van Dilst and A. J. M. Leeuwenberg (WAG). According to them, *Carissa spinarum* L., formerly thought to be restricted to the Punjab, through India, Sri Lanka and Burma, is conspecific with the widely distributed and well-known *C. edulis* (Forssk.) Vahl. *Carissa spinarum* is the earlier name and must therefore be applied to the species in its present wider circumscription. The fruit is eaten by local people and the plant is cultivated as a hedge for its spiny impenetrable branches, and in arid regions as an ornamental shrub for its hardy evergreen foliage and its sweetly scented flowers.

2. *Rhazya* Decne.

Evergreen glabrous subshrubs or perennials, woody at the base; leaves alternate, coriaceous; inflorescence of terminal and axillary cymes; calyx 5-lobed; corolla white, hypocrateriform; corolla-tube cylindrical, with a constricted throat, hairy within; stamens 5, inserted above the middle of the tube; filaments short; anthers lanceolate; disc annular, sometimes absent; carpels free; ovules numerous, 2-seriate; style filiform; stigma globose; follicle of cylindrical; seeds numerous. 1 species, Egypt, Sudan, Arabia, Iraq, Iran, Afghanistan, Pakistan, India.

1. *Rhazya stricta* Decne., Ann. Nat. Sci., sér. 2, 4: 80 (1835).

Syn. *Rhazya greissii* Täckh. & Boulos, Cairo Univ. Publ. 5: 7, t. 1 (1974).

Glabrous stout erect perennial, 15-40 cm, woody at the base; stems branched mainly near the base; leaves evergreen, coriaceous, 3-9.5 x 0.5-1.6 cm, narrowly elliptic, the base attenuate, the apex acute; inflorescence of terminal cymes; peduncle 0.8-1.5 cm; flowers c. 2.5 cm diam. at anthesis; calyx c. 4 mm, deeply lobed; corolla 1-1.4 cm, white; corolla-tube ± cylindrical; the lobes ovate, with a rounded mucronate apex; follicles 2, 4.5-6.5 x 0.5 cm, straight or slightly curved, striate, glabrous; seeds 5-6 mm, rugose.

O (Kharga); waste ground. Distribution as for the genus.

NOTE: *Rhazya greissii* is known only from the type collection: E. Greiss, s.n., 15 February 1937, Kharga Oasis (CAI), of one flowering branch, several sterile branches and no fruits. Within the geographical range of *Rhazya stricta*, extending from Egypt and Sudan throughout Arabia to India, the diverse habitat types are expected to allow certain

morphological variations among the different populations, and *R. greisseii* may represent one of these populations. Despite the wide and variable range of *R. stricta*, no other taxa known to me, at any rank, apart from *R. greisseii* were described from these populations prior to the publication of *R. stricta* in 1835. After examining ample material from the entire range of *R. stricta*, I find it difficult to justify separating the Egyptian material at any taxonomic rank, specific or subspecific. Consequently, *R. greisseii* is listed here as a synonym of *R. stricta*. Further collections from Egypt, hopefully in flower and fruit, are most desirable to further justify its taxonomic status.

ASCLEPIADACEAE

Perennial twining or scrambling herbs, subshrubs, shrubs or succulents, seldom trees, with clear or milky latex; leaves opposite, simple, sometimes reduced or absent; stipules 0 or present as an interpetiolar ridge (some Periplocoideae); flowers bisexual, actinomorphic, 5-merous, usually in cymes, corymbs or umbels; calyx deeply 5-lobed; corolla gamopetalous, rotate, campanulate or tubular; corolla-lobes valvate or twisted in bud, rarely imbricate; stamens 5, epipetalous, alternating with the corolla-lobes; anthers connivent or connate and adnate to the style apex; corona attached to the corolla or to the staminal column; pollen either granular in tetrads (Periplocoideae) discharging on to a spatulate pollen-carrier with adhesive base, or united into 1 waxy pollinium (Asclepiadoideae) or 2 pollinia (Secamonoideae, not in Egypt) per anther locule; pollinia of adjacent locules of adjacent anthers connected by the translator apparatus; carpels 2, superior, united by the style apex, otherwise free; placentation parietal; fruit of 2 divaricate follicles, sometimes 1 by abortion; seeds flattened, with an apical tuft of silky hairs (comose). 315 genera, 2900 species, tropical and warm regions, few temperate.

- | | |
|--|------------------------------------|
| 1. Stems succulent, conspicuously 4-angled | 12. <i>Caralluma</i> |
| + Stems not as above | 2 |
| 2. Leafless shrub; juvenile branches leafy, but leaves small, caducous | 3 |
| + Leafy herb, shrub or small tree; leaves well-developed, persistent | 4 |
| 3. Corolla 1-1.5 cm diam., greenish outside, dark purple inside | 1. <i>Periploca aphylla</i> |
| + Corolla 5-7 mm diam., pale yellowish-green | 11. <i>Leptadenia pyrotechnica</i> |
| 4. Follicle echinate | 5 |
| + Follicle smooth | 7 |
| 5. Plant twining; leaves cordate | 10. <i>Pergularia</i> |
| + Plant not twining; leaves lanceolate, linear-lanceolate, ovate or ovate-lanceolate | 6 |
| 6. Perennial herb; leaves usually with undulate margin; flowers inconspicuous, in cymes not exceeding the leaves | 3. <i>Glossonema</i> |
| + Shrub; leaves not undulate; flowers conspicuous, in axillary pedunculate umbels much exceeding the leaves | 6. <i>Asclepias</i> |
| 7. Plant erect | 8 |
| + Plant twining or scrambling | 11 |
| 8. Shrub or small tree 2-4 m; leaves to 12 cm broad; follicle 6-9 cm diam., with rounded apex, spongy | 7. <i>Calotropis</i> |

- + Low shrub; leaves not more than 1.5 cm broad; follicle 1-3 cm diam., with long attenuate apex, not spongy 9
- 9. Flowers numerous, in long-pedunculate dense cymes; follicle 2-2.5 cm broad, bony 4. **Solenostemma**
- + Flowers few, in subsessile or short-pedunculate lax umbels; follicle 0.6-1.5 cm broad, not bony 10
- 10. Leaves ovate to ovate-elliptic; petiole 3-8 mm; follicle 4-6.5 x 1-1.5 cm 2. **Pleurostelma**
- + Leaves oblong-elliptic, subsessile; follicle 6-11 x 0.6-0.8 cm 1. **Periploca angustifolia**
- 11. Shrub, woody at least at the base 12
- + Herbaceous perennial 13
- 12. Leaves rather fleshy, ovate to ovate-elliptic; flowers in subsessile axillary umbels 2. **Pleurostelma**
- + Leaves not fleshy, very variable in shape: linear, linear-lanceolate or ovate; flowers in pedunculate umbels 11. **Leptadenia arborea**
- 13. Slender twiner; roots tuberous; flowers in subsessile umbels 9. **Pentatropis**
- + Much-branched twiner; roots not tuberous; flowers in pedunculate umbels 14
- 14. Leaves 0.3-1 cm broad, linear or linear-lanceolate, long-acuminate; follicle 4-6 cm 5. **Oxystelma**
- + Leaves to 8 cm broad, cordate, acute; follicle 6-12(-18) cm 8. **Cynanchum**

1. **Periploca** L.

Erect or twining glabrous shrubs; leaves opposite, sometimes absent; flowers in axillary or terminal cymes; calyx 5-lobed, with 5 glands on the inner surface; corolla rotate, 5-lobed, usually hairy inside; corona single, 10-lobed, often with 5 free awned segments; stamens 5; filaments short, free; anthers bearded, adjacent but not adnate to the stigma; pollen grains in tetrads; follicle cylindrical, smooth, glabrous; seeds comose. 11 species, Mediterranean region, West and East Asia, tropical Africa.

- 1. Leafy shrub 0.5-1.5 m; leaves 1.2-2.8 x 0.2-0.5 cm, oblong-elliptic; corolla-lobes greenish-yellow outside, purple-yellow and whitish inside, the edges lighter coloured 1. **P. angustifolia**
- + Generally leafless shrub 2-4 m; leaves few on juvenile branches (if persistent), 5-8 x 2-3 mm, lanceolate or ovate; corolla-lobes deep purple inside, the margin densely bearded 2. **P. aphylla**

1. **Periploca angustifolia** Labill., Icon. Pl. Syr. Dec. 2: 13, t. 7 (1791).

Syns. *Periploca audiacea* Raeusch, Nom. ed. 3: 72 (1797).

Periploca rigida Viv., Fl. Lib. 14, t. 6, f. 3, 4 (1824).

Periploca fasciculata Viv. ex Coss., Bull. Soc. Bot. France 12: 278 (1865).

Periploca laevigata Aiton var. *angustifolia* (Labill.) Fiori, Nouv. Fl. Anal. Ital. 2: 247 (1926).

Periploca laevigata Aiton subsp. *angustifolia* (Labill.) Markgraf, Bot. J. Linn. Soc. 64: 375 (1971).

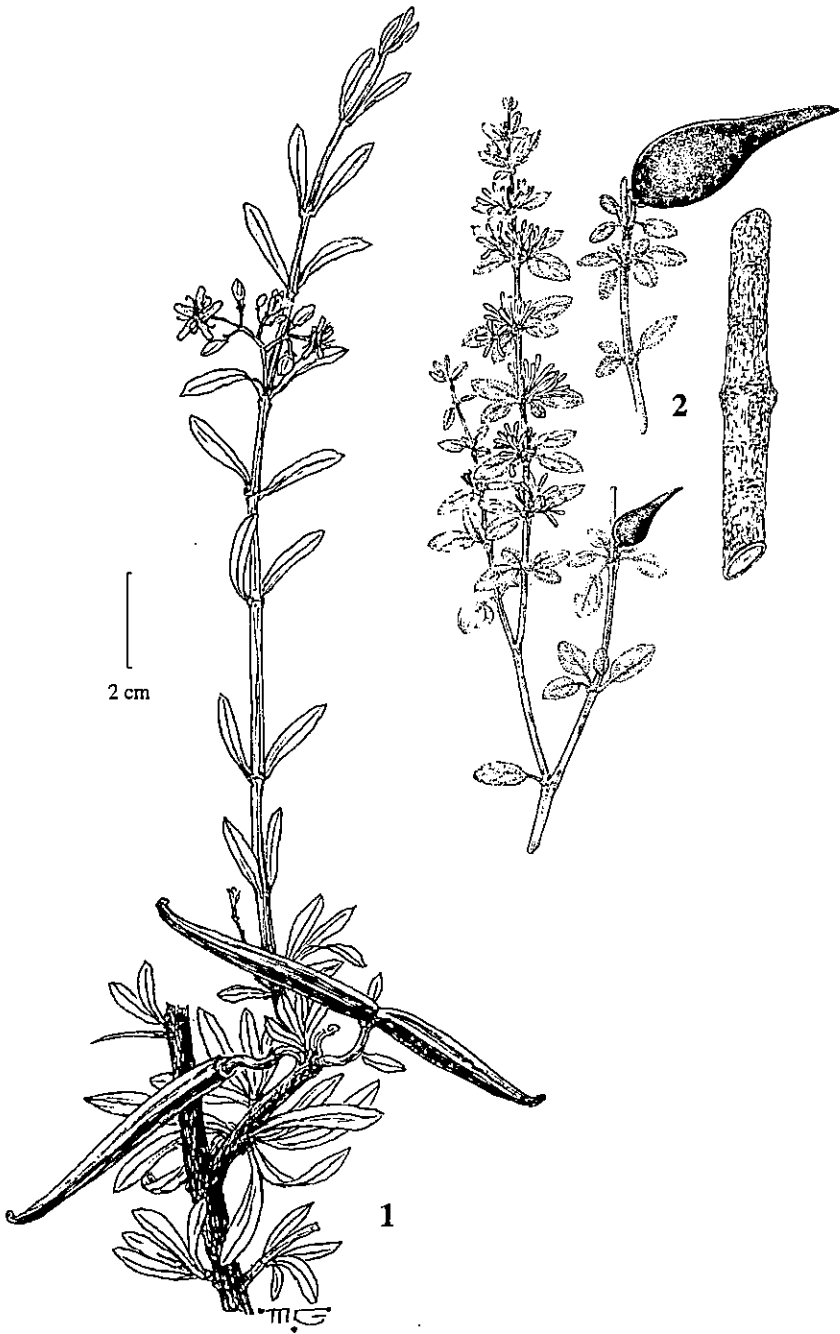


Plate 52. ASCLEPIADACEAE: *Periploca angustifolia* 1, flowering and fruiting branch. *Pleurostelma schimperii* 2, flowering and fruiting branch; fruiting branch and woody stem (right). All drawings to the same scale.

Glabrous shrub 0.5-1.5 m; stems much-branched, rigid, intricate, the upper branches lax; leaves opposite or clustered, 1.2-2.8 x 0.2-0.5 cm, oblong-elliptic, subsessile, the base attenuate, the apex acute; flowers few in axillary cymes; peduncle 0.5-1.2 cm, accrescent and curved in fruit; corolla c. 1 cm diam.; corolla-lobes greenish-yellow outside, purple-yellow and whitish inside, the edges lighter coloured, with a white spot in the centre 1-1.5 mm; awns of the corona deflexed; follicle 6-11 x 0.6-0.8 cm, narrowly fusiform, striate, glabrous; seeds 6-8 x 2-2.5 mm, flattened, black; coma 2.5-3 cm.

M; calcareous ridges, often close to the seashore. Canary Islands, Southeast Spain, North Africa, Crete (Gàvdhos), Syria.

NOTE: This species was overlooked by Boulos, Fl. Egypt Checklist (1995); recent collections in 1998 and 1999 were made from several localities along the western Mediterranean coastal region, especially between Mersa Matruh and Sollum. The plants are often overgrazed by goats and camels.

2. **Periploca aphylla** Decne. in Jacq., Voy. Inde 4, Bot. 109, t. 116 (1844).

Generally leafless glabrous shrub, 2-4 m; leaves few on juvenile branches (if persistent), 5-8 x 2-3 mm, lanceolate or ovate, caducous; flowers fragrant, in terminal or lateral cymes; peduncle indurate in fruit; calyx c. 3 mm; corolla 1-1.5 cm diam.; lobes 5-6 x 2.5 mm, deep purple inside, with elliptic white spot 2-3 mm, densely bearded along the margin; awns of the corona as long as the corolla-lobes, curved, glabrous, violet; follicle 6-10 x 0.4-0.6 cm, fusiform, straight or slightly curved; seeds 6-8 x 2-2.5 mm, fusiform, dark brown, slightly compressed, wrinkled on one side, with a longitudinal canal on the other formed by the folded margins.

Two subspecies occur in Egypt:

subsp. **aphylla**

Flowers subsessile, in dense compact cymes; peduncle 2-5 mm, leafless or with 1-2 pairs of small caducous basal leaves; shoots, leaves, peduncles and follicles somewhat pubescent.

S; rocky ground. Sinai, Palestine, Arabia, Iraq, Iran, Afghanistan, Pakistan, India.

subsp. **laxiflora** Browicz, Arbor. Kórnickie 11: 62 (1966).

Flowers on pedicels 3-8 mm, in lax cymes; peduncle to 2.2 cm, with distant pairs of small leaves; shoots, leaves, peduncles and follicles glabrous.

GE; rocky ground. Southeast Egypt, Northeast Sudan, Palestine, southern Saudi Arabia, Yemen, Oman, Iran.

2. **Pleurostelma** Baill.

Syns. *Microstephanus* N.E. Br., *Podostelma* K. Schum.

Low shrubs; leaves ovate or ovate-elliptic, petiolate, rather fleshy; flowers in axillary umbels; gynostegium sessile or elevated by a short bulge; corona not obscuring the gynostegium; upper part of stylar head very long and slender, exceeding the lower part which bears the corpuscules; follicle lanceolate, smooth. 2 species of coastal habitats, southeastern Egypt, East Africa, Madagascar, Aldabra.

1. **Pleurostelma schimperi** (Vatke) Liede, Bot. J. Linn. Soc. 114 (1): 91 (1994).

Syns. *Astephanus schimperi* Vatke, Österr. Bot. Zeitschr. 26: 145 (1876).

Podostelma schimperi (Vatke) K. Schum., Bot. Jahrb. Syst. 17: 133 (1893).

Low, wholly tomentose (except the fruits) shrub to 80 cm; stems much-branched, the branches sometimes twining; leaves 1-2.5 x 0.5-1.5 cm, ± fleshy, ovate to ovate-elliptic, the base rounded, the apex obtuse, acute or mucronate; petiole 3-8 mm; flowers 6-8 mm, sweet-scented, in 2-8-flowered subsessile axillary umbels; pedicel 1.5-3 mm; calyx c. 2 mm; calyx-lobes 0.5 mm; corolla deeply lobed, cream; corona very small and inconspicuous, arising from the filament region of the staminal column; follicle 4-6.5 x 1-1.5 cm, narrowly cylindrical, tapering at the apex, smooth, glabrous; seeds 5-7 x 1.5-2 mm, wrinkled, dark brown; coma c. 2 cm.

GE; sandy soils and stony hillsides. Southeast Egypt, East African coast from Somalia to Mozambique, Madagascar, Aldabra.

3. **Glossonema** Decne.

Perennials; leaves opposite; flowers few in lateral cymes; calyx 5-lobed, glandular inside; corolla rotate or campanulate with a short tube, the lobes twisted in bud; corona epipetalous, arising just above the origin of the staminal column; corona-lobes 5, alternating with the corolla-lobes; staminal column short; pollinia solitary in each cell, pendulous; stigma exserted, conical; follicle echinate; seeds comose. 4 species, tropical Africa and Asia.

1. **Glossonema boveanum** (Decne.) Decne., Ann. Sci. Nat. Bot., sér. 2, 9: 335 (1838).

Syn. *Cynanchum boveanum* Decne., Ann. Sci. Nat. Bot., sér. 2, 4: 82 (1835).

Hairy canescent perennial 10-30 cm; stems much-branched from the base; leaves 1-2 x 0.5-1.2 cm, ovate, ovate- or oblong- to linear-lanceolate, the base cuneate or truncate, the apex acute or mucronate, the margin usually undulate; petiole 0.2-1 cm; flowers (1-)2-6 in sessile cymes; calyx 2-3 mm, deeply lobed, the lobes oblong-linear, hairy; corolla 3-4 mm, whitish-yellow, glabrous; follicle 2.5-5 x 1-1.5 cm, cylindrical or ovoid, acuminate, pubescent, echinate, greenish; seeds 6-8 x 5-6 mm, flattened, ovate, brown with a narrow white margin; coma c. 1 cm.

Two subspecies occur in Egypt:

subsp. **boveanum**

Leaves ovate or ovate-lanceolate; flowers solitary or 2-3 in cyme; follicle ovoid, strongly echinate.

De, GE, S; sandy plains and desert wadis.

subsp. **nubicum** (Decne.) Bullock, Kew Bull. 10: 617 (1956).

Syns. *Glossonema nubicum* Decne. in A. DC., Prodr. 8: 555 (1844).

Glossonema gautieri Batt. & Trab., Bull. Soc. Bot. France 53: XXVIII (1907).

Leaves linear or linear-lanceolate, the apex acute; flowers 2-6 in cyme; follicle lanceolate, acuminate, softly echinate.

De, R, GE; sandy plains.

Area of the species: Egypt, Palestine, Arabia, Sudan, Ethiopia, Somalia, Mali.



Plate 53. ASCLEPIADACEAE: *Glossonema boveanum* 1, flowering branch; flower (up right); fruiting branch (down right). *Oxystelma esculentum* 2, flowering and fruiting branch; fruit and seed (down). *Asclepias sinaica* 3, flowering branch; fruit (left). *Cynanchum acutum* 4, flowering branch; fruit (right); seed (down left). *Pentstemon nivalis* 5, flowering branch; fruit and seed (left). All drawings to the same scale, except the enlarged parts (scale given).

4. *Solenostemma* Hayne

Shrubs; stems rigid; leaves fleshy, subsessile; flowers numerous, in dense axillary cymes; corolla white, 5-lobed; corona cup-shaped, with 5 short rounded lobes surrounding the base of the long stipitate gynostegium; stigma 5-angled; follicle solitary, bony, smooth. 1 species, Chad, Niger, Morocco, Algeria, Libya, Egypt, Sudan, Palestine, Arabia.

1. *Solenostemma arghel* (Delile) Hayne, Getreue Darstell. Gew. 9, t. 38 (1825).

Syns. *Cynanchum arghel* Delile, Mém. Egypte 3: 319 (1802).

Cynanchum oleifolium Nectoux, Voy. Egypte 20 (1808).

Solenostemma oleifolium (Nectoux) Bullock & Bruce, Kew Bull. 8: 359 (1953).

Glabrous shrub 0.4-1 m, much-branched from the base; stems erect, rigid; leaves 1.5-4 x 0.5-1.2 cm, lanceolate to elliptic, subsessile, fleshy; flowers numerous in dense pedunculate axillary cymes; calyx 5-lobed, the lobes longer than the tube; corolla 6-8 mm, white, 5-lobed; corolla lobes oblong-linear, obtuse; corona cup-shaped, with 5 short rounded lobes surrounding the base of the long stipitate gynostegium; stigma 5-angled; follicle solitary, 4-5 x 2-2.5 cm, cylindrical-ovate, bony, smooth; seeds 5-6 x 2-3 mm, ovate, short-attenuate at the apex, brown; coma 2-2.5 cm.

De, S; stony and sandy wadis. Distribution as for the genus.

5. *Oxystelma* R. Br.

Twining glabrous herbs or low shrubs; leaves opposite, lanceolate to linear-lanceolate; flowers in lax axillary cymes or solitary; calyx-lobes glandular inside; corolla with a short tube or almost rotate; corona in 2 series, the outer a densely pubescent annulus at the base of the corolla-tube, the inner of 5 lanceolate segments connate to the staminal column and longer than the anthers; stamens inserted at the base of the corolla-tube; pollinia solitary in each anther loculus; follicle oblong-lanceolate; seeds comose. 2 species, Old World tropics.

1. *Oxystelma esculentum* (L. f.) R. Br., Mem. Wern. Soc. 1: 40 (1810).

Syns. *Periploca esculenta* L. f., Suppl. Pl. 168 (1781).

Oxystelma alpini Decne. in A. DC., Prodr. 8: 543 (1844).

Oxystelma esculentum (L. f.) R. Br. var. *alpini* (Decne.) N.E. Br. in Thiselton-Dyer, Fl. Trop. Afr. 4 (1): 382 (1904).

Sarcostemma esculentum (L. f.) Holm, Ann. Miss. Bot. Gard. 37: 482 (1950).

Twining glabrous perennial with milky juice; stems to 3 m, much-branched, slender; juvenile shoots often tomentose; leaves 4-8 x 0.3-1 cm, linear or linear-lanceolate, long-acuminate, acute, tapering to a petiole 0.5-1.2 cm; flowers in axillary, pedunculate 2-4-flowered cymes; peduncle 1.5-5 cm; pedicel 1-2 cm; calyx-lobes 1.5-3 mm, glabrous; corolla 2-2.5 cm diam., pale rose or white; corolla-lobes pubescent; follicle 4-6 cm, glabrous; seeds 3-3.5 mm, broadly ovate; coma 1.5-2 cm.

N, De, S; waste moist ground, edges of cultivation, canal banks. Egypt, Sudan, Ethiopia. Palestine, Iraq, Pakistan, India, Burma, Sri Lanka, Indonesia.



Plate 54. ASCLEPIADACEAE: *Solenostemma argel*, flowering and fruiting branch; mature fruit with seeds (left). Drawings to the same scale.

6. *Asclepias* L.

Perennials or low shrubs with milky latex; leaves opposite; cymes umbellate; flowers variously coloured; calyx 5-lobed, usually with 5-10 glands at the base of the sinuses; corolla rotate or reflexed, 5-lobed; corona usually of 5 tubular hoods attached to the top of gynostegium stipe; anthers with a membrane at their tips; pollinia 2 per anther, oblong, pendulous in the anther thecae; stigma-head 5-angled or lobed; follicle covered with soft bristles; seeds comose. 120 species, mostly North and Central America, few African.

1. *Asclepias sinaica* (Boiss.) Muschl., Man. Fl. Egypt 753 (1912).

Syn. *Gomphocarpus sinaicus* Boiss., Diagn. Pl. Orient., ser. 1, 11: 80 (1849).

Greenish-yellow shrub 0.5-1.2 m; juvenile growth densely white-tomentose, becoming less tomentose on adult parts; stems many from the base, simple, spreading, leafy; leaves 3-8 x 0.4-0.8 cm, linear-lanceolate, the apex acute, the margin revolute, the base attenuate; petiole 2-4 mm; flowers in axillary pedunculate umbels, much exceeding the leaves; corolla 1.5-2.4 cm broad, yellow, the lobes broadly ovate, acute; corona without teeth; follicles 4-6.5 x 1.2-1.5 cm, lanceolate, tapering to a beak, tomentose, with pinkish soft bristles and longitudinal white green stripes; seeds comose.

De, S; rocky hillsides. Egypt, Palestine, Arabia.

NOTE: The type was collected from Sinai. Täckholm, Stud. Fl. Egypt, ed. 2, 410 (1974), lists *Asclepias fruticosa* under *Gomphocarpus fruticosus*. Boulos, Fl. Egypt Checklist 109 (1995), gives *Asclepias fruticosa* as a naturalized species. In fact, the plant is rarely cultivated in Egypt as a garden ornament and has never been naturalized.

7. *Calotropis* R. Br.

Shrubs or small trees; stems thick; leaves opposite, large, rather fleshy; inflorescence of terminal or axillary umbel-like cymes; calyx and corolla 5-lobed; corolla-lobes free for $c. \frac{2}{3}$ of their length; corona of 5 fleshy, laterally compressed segments, adnate to the gynostegium, each with a recurved spur at the base; anthers short and broad, with 1 pendulous pollinium in each cell; head of stigma pentagonal; follicle large, inflated, smooth; seeds comose. 3 species, tropical and warm Africa and Asia.

1. *Calotropis procera* (Aiton) W. T. Aiton, Hort. Kew., ed. 2, 2: 78 (1811).

Syn. *Asclepias procera* Aiton, Hort. Kew., ed. 1, 1: 305 (1789).

Shrub or small tree 2-4 m; old stems with whitish fissured corky bark, the young branches white-tomentose; latex milky, abundant; leaves 8-18 x 4-12 cm, broadly ovate, obovate or elliptic, the apex rounded, apiculate, the base auriculate; juvenile leaves white-mealy, later \pm glabrous; flowers pedicellate; sepals 4-6 x 3-4 mm, ovate, acute, hairy outside; corolla 2-2.5 cm broad; lobes ovate, spreading, purple at the upper $\frac{1}{2}$, white at the base, pinkish outside; follicle 8-14 x 6-9 cm, subglobose to obliquely ovoid, the apex rounded, green, spongy, smooth; seeds 6-8 x 5-6 mm, ovate; coma 2.5-4 mm.

N, O, D, R, GE, S; sandy desert plains, alluvial soils close to cultivation. Morocco, Algeria, Libya, Egypt, Palestine, Arabia, Iraq, Iran, Pakistan, Afghanistan, India, Sudan, Ethiopia, Djibouti, Somalia; introduced into some tropical regions.

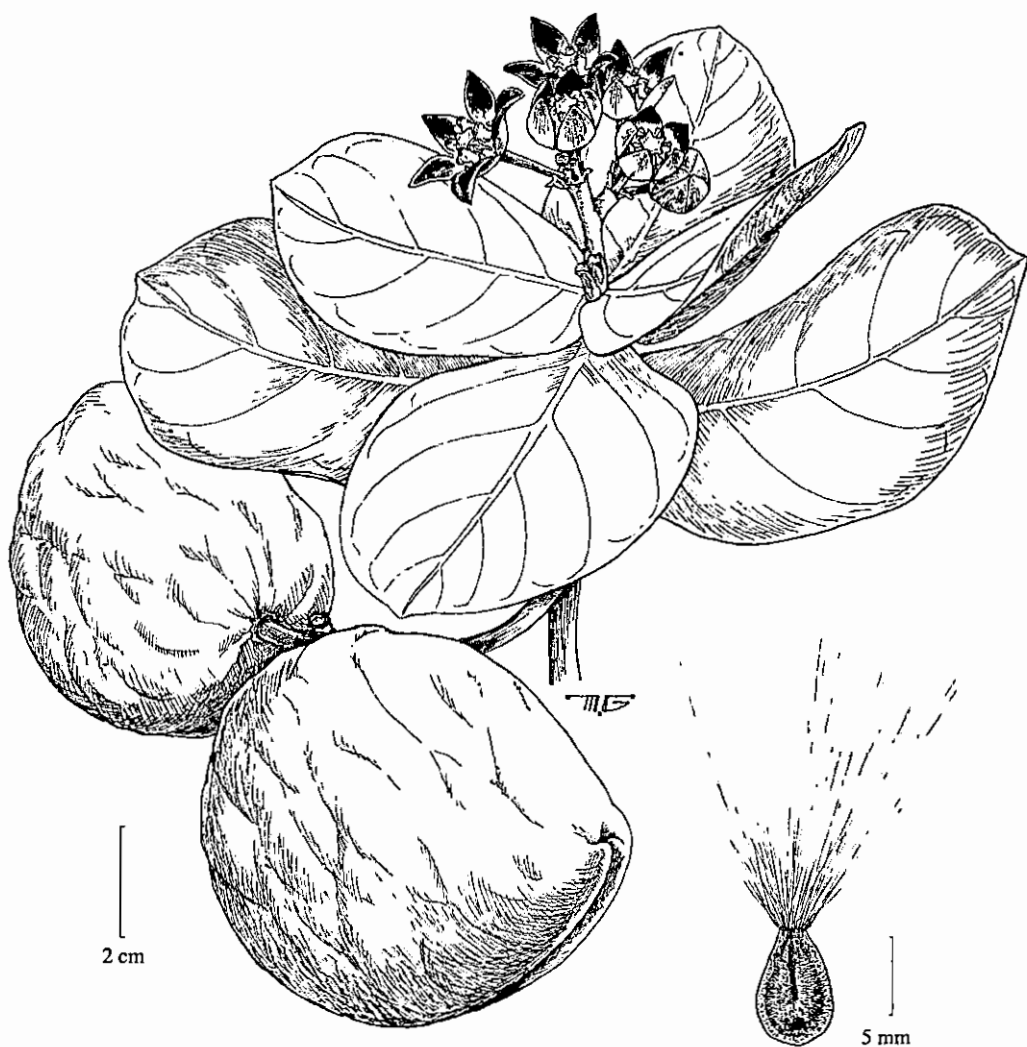


Plate 55. ASCLEPIADACEAE: *Calotropis procera*, flowering and fruiting branch; seed (right). Enlarged part (scale given).

NOTE: The plant is used in traditional medicine. The latex causes serious inflammation and may lead to blindness if it gets into the eyes.

8. *Cynanchum* L.

Perennial herbs, shrubs or woody climbers; leaves opposite, petiolate; flowers in axillary or terminal umbel-like cymes; corolla rotate, the lobes spreading; corona double; outer corona short, ring-shaped, 10-lobed; inner with 5 erect fleshy segments, tapering to an appendage; pollinia 1 in each cell, pedulous, waxy; follicle lanceolate, echinate or smooth. 200 species, tropical and warm regions.

1. *Cynanchum acutum* L., Sp. Pl., ed. 1, 212 (1753) subsp. *acutum*

Syn. *Cynanchum monspeliacum* L., Sp. Pl., ed. 1, 212 (1753).

Glabrous or glabrescent perennial; stems to 2.5 m, twining; leaves 3-10 x 1.5-8 cm, cordate, the apex acute, the base broadly auriculate; petiole 1-3.5 cm; flowers in axillary cymes; peduncle 1-5 cm; pedicel 0.5-1 cm; calyx 1-2 mm, hairy, the teeth triangular; corolla 0.8-1.2 cm broad, pinkish-white, glabrous; lobes 4-5 mm, linear, acute; corona 5-lobed, the lobes caudate; follicles 6-12(-18) x 0.6-1 cm, the apex attenuate, glabrous.

N, O, M; canal banks, edges of cultivation. Algeria, Libya, Egypt, South Europe, Southwest Asia.

NOTE: The Egyptian plant is subsp. *acutum*, although Boulos, Fl. Egypt Checklist 109 (1995) includes 2 subspecies from Egypt: subsp. *acutum* and subsp. *sibiricum* (Willd.) Rech. f., Fl. Iran. 73: 9 (1970). According to Greuter *et al.*, Med-Checklist 1: 56 (1984) only subsp. *acutum* occurs in Egypt.

9. *Pentatropis* R. Br. ex Wight & Arn.

Twining glabrous herbs or low shrubs; leaves opposite, fleshy; flowers in axillary, sessile, umbel-like cymes; calyx-lobes 5; corolla 5-lobed, greenish tinged purple; corona of 5 segments, attached to the staminal column; pollinium 1 in each locule, pendulous; follicles lanceolate, attenuate into a beak, glabrous. 6 species, warm regions of the Old World.

1. *Pentatropis nivalis* (J. F. Gmel.) D. V. Field & J. R. I. Wood, Kew Bull. 38: 215 (1983).

Syns. *Asclepias nivalis* J. F. Gmel. in L., Syst. Nat., ed. 13, 2: 444 (1791).

Asclepias nivea Forssk., Fl. Aegypt.-Arab. 51 (1775), non L., Sp. Pl., ed. 1, 215 (1753).

Pentatropis spiralis, sensu Täckh., Stud. Fl. Egypt, ed. 2, 413 (1974);
Feinbrun-Dothan, Fl. Palaest. 3: 28, f. 40 (1978).

Slender twining perennial 0.5-1.2 m; roots tuberous; old stems with corky bark; leaves 1-4 x 0.5-1.5 cm, oblong to elliptic, fleshy, the apex acute, the base shallowly cordate; petiole 2-8 mm; flowers 2-6, in axillary, subsessile cymes; peduncle 2-5 mm; pedicel 0.5-1.2 cm, sparsely hairy; bracts minute; calyx-lobes 1-2 mm; corolla 1.4-1.8 cm broad, lanceolate, greenish, glabrous outside, puberulent within; corona-lobes 1.5-2 mm; follicles 5-8 x 0.6-0.8 cm; seeds 4-5 mm, broadly ovate, flattened; coma 2-2.5 cm.

De, R, GE, S; desert plains and wadis; Egypt, Palestine, Arabia, Iran, Afghanistan, Pakistan, India, tropical East Africa.

10. *Pergularia* L.

Twining herbs and shrubs; stems pubescent; leaves opposite, cordate, tomentose; flowers in pedunculate, axillary umbel-like cymes; calyx 5-lobed; corolla rotate-campanulate, yellowish or greenish; corona of an outer 5-lobed annulus at the base of the staminal column, and inner 5 fleshy lobes, each lobe with 2 spurs; pollinium 1, pendulous in each locule; follicle lanceolate, echinate or smooth; seeds comose. About 4 species, North and tropical Africa, Arabia to India and Sri Lanka.

1. Grey-canescens twining shrub; stems tomentose; leaves 1.5-4.5 x 1-4 cm, thick; peduncle 1-5 cm; follicle sparsely covered with soft prickles 1-1.5 mm 1. *P. tomentosa*
+ Green twining or trailing perennial herb; stems pilose; leaves 6-15 x 5-12 cm, thin; peduncles 5-10 cm; follicle densely covered with fleshy bristles 2-2.5 mm 2. *P. daemia*

1. *Pergularia tomentosa* L., Syst. Nat., ed. 12, 2: 191 (1767).

Syns. *Daemia cordata* R. Br., Asclepiadeae 50 (1810).

Daemia tomentosa (L.) Pomel, Bull. Soc. Sci. Phys. Algérie 11: 82 (1874).

Grey-canescens shrub 0.5-1.2 m, with milky sap; stems tomentose, the young branches twining around the older ones; leaves 1.5-4.5 x 1-4 cm, cordate, thick; petiole 0.5-1.2 cm; flowers in umbel-like cymes; peduncle 1-5 cm, thickened and elongate in fruit; pedicel 1-2.5 cm; sepals 2-3.5 mm, pubescent; corolla 0.8-1.1 cm, white tinged with pink; lobes 6-8 mm, hairy outside; follicle 4.5-6.5 x 1.2-1.5 cm, tapering and hooked towards the apex, sparsely covered with soft prickles 1-1.5 mm; seeds comose.

O (Uweinat), D, R, GE, S; Libya, Egypt, Palestine, Arabia, Iran, Afghanistan, Pakistan.

2. *Pergularia daemia* (Forssk.) Chiov., Result. Sci. Missione Stefan.-Paoli Somalia Ital. 1: 115 (1916).

Syns. *Asclepias daemia* Forssk., Fl. Aegypt.-Arab. 51 (1775).

Cynanchum extensum Jacq., Misc. 2: 353 (1781-1782).

Daemia extensa (Jacq.) W. T. Aiton, Hort. Kew, ed. 2, 2: 76 (1811).

Green twining or trailing perennial herb, with milky sap; stems 1-3 m, pilose; leaves 6-15 x 5-12 cm, thin, broadly ovate to suborbicular, pubescent on the lower surface; apex acute to acuminate, the base cordate; petiole 3-10 cm; flowers in axillary umbel-like cymes; peduncle 5-10 cm; pedicel 2-4.5 cm, hairy; bracts minute; sepals 2-3 mm, lanceolate, hairy; corolla 1-1.2 cm, greenish-yellow, the lobes oblong-ovate, spreading, hairy; outer corona membranous, truncate, the inner lobed; lobes with narrowly-elliptic horns; follicle 5.5-7.5 x 1.2-1.5 cm, lanceolate, beaked, densely covered with fleshy bristles 2-2.5 mm; seeds 7-8 x 3-4 mm, ovate with a truncate tip; coma 2.5-3.5 cm.

GE, S; stony hillsides. Egypt, Arabia, Iran, Afghanistan, Pakistan, India, Sri Lanka, Burma, Malaysia, tropical and South Africa.

NOTE: The type was described from specimens collected from Egypt and Arabia.



Plate 56. ASCLEPIADACEAE: *Pergularia tomentosa*, flowering and fruiting branch.

11. *Leptadenia* R. Br.

Shrubs or twining herbs with woody base; sap watery; leaves opposite, small, persistent or caducous; flowers in short-pedunculate or sessile, umbel-like axillary cymes; calyx deeply 5-fid; corolla rotate or campanulate, greenish-yellow, pubescent; corona double, the outer of 5 short fleshy segments adnate to the base of the corolla and alternating with the lobes, the inner an undulate ring at the base of the gynostegium; filaments united; anthers incumbent on the stigma; pollinium 1 in each loculus, erect, with curved appendages at the tip; follicle oblong to narrowly-elliptic, tapering at both ends, smooth; seeds comose. 4 species, Old World tropics.

1. Leafless shrub 1.2-4 m (juvenile branches leafy, but leaves soon caducous);
cymes few-flowered; follicle 8-12 cm x 0.5-0.7 cm 1. ***L. pyrotechnica***
+ Leafy twining or trailing shrub, 0.5-1.2 m; cymes with numerous flowers;
follicle 5-8 x 0.5-2 cm 2. ***L. arborea***

1. ***Leptadenia pyrotechnica*** (Forssk.) Decne., Ann. Sci. Nat. Bot., sér. 2, 9: 270 (1838).
Syn. *Cynanchum pyrotechnicum* Forssk., Fl. Aegypt.-Arab. 53 (1775).

Leafless shrub 1.2-4 m; stems erect, much-branched, terete, green, ± spinescent; leaves (on juvenile branches) 0.5-1.5 x 0.2-0.35 cm, linear-lanceolate, sessile, acute, glabrous; flowers in axillary, few-flowered umbel-like cymes; peduncle 2-6 mm; pedicel 2-3 mm, pubescent; calyx 1-2 mm, pubescent; corolla 3-4 mm, broadly funnel-shaped, deeply divided, the lobes pubescent on both surfaces; follicle 8-12 x 0.5-0.7 cm, narrowly elliptic, terete, glabrous; seeds 6-8 mm; coma 2.5-4 cm.

N, D, R, GE, S; sandy desert plains and wadis. Algeria, Libya, Egypt, Palestine, Arabia, Iran, Pakistan, India, Chad, Sudan, Ethiopia, Somalia.

NOTE: The type was collected from Egypt. Fruits and young twigs are eaten by local people. The plant is used in popular medicine and for making ropes from its fibres.

2. ***Leptadenia arborea*** (Forssk.) Schweinf., Arab. Pfl. Ägypt. 167 (1912).
Syns. *Cynanchum arboreum* Forssk., Fl. Aegypt.-Arab. 53 (1775).
Cynanchum heterophyllum Delile, Cent. Pl. Afr. 47 (1826).
Leptadenia heterophylla (Delile) Decne., Ann. Sci. Nat. Bot., sér. 2, 9: 270 (1838).

Glabrous twining shrub 0.5-1.2 m, or trailing shrub with stems to 6 m; leaves variable, 3-8 x 0.5-3.5 cm, opposite, entire, ovate, lanceolate or elliptic, the apex acute or acuminate, the base cuneate or hastate; petiole 0.8-2.5 cm; flowers numerous in axillary umbel-like cymes; peduncle 0.5-1.5 cm; pedicel 0.4-1.2 cm; calyx 1.2-2 x 0.5-1 mm, lobed to 1/2, the lobes ovate; corolla 1.4-3.8 x 8.0-1.4 mm, white; lobes ovate-oblong, pubescent; stamens alternating with the corolla-lobes; filaments connate at the base into a tube around the ovary; follicle 5-8 x 0.5-2 cm; seeds comose.

N (Aswan); Nile banks and Islands. Egypt, Sudan, Eritrea, East tropical Africa, Niger, Mali, Arabia.

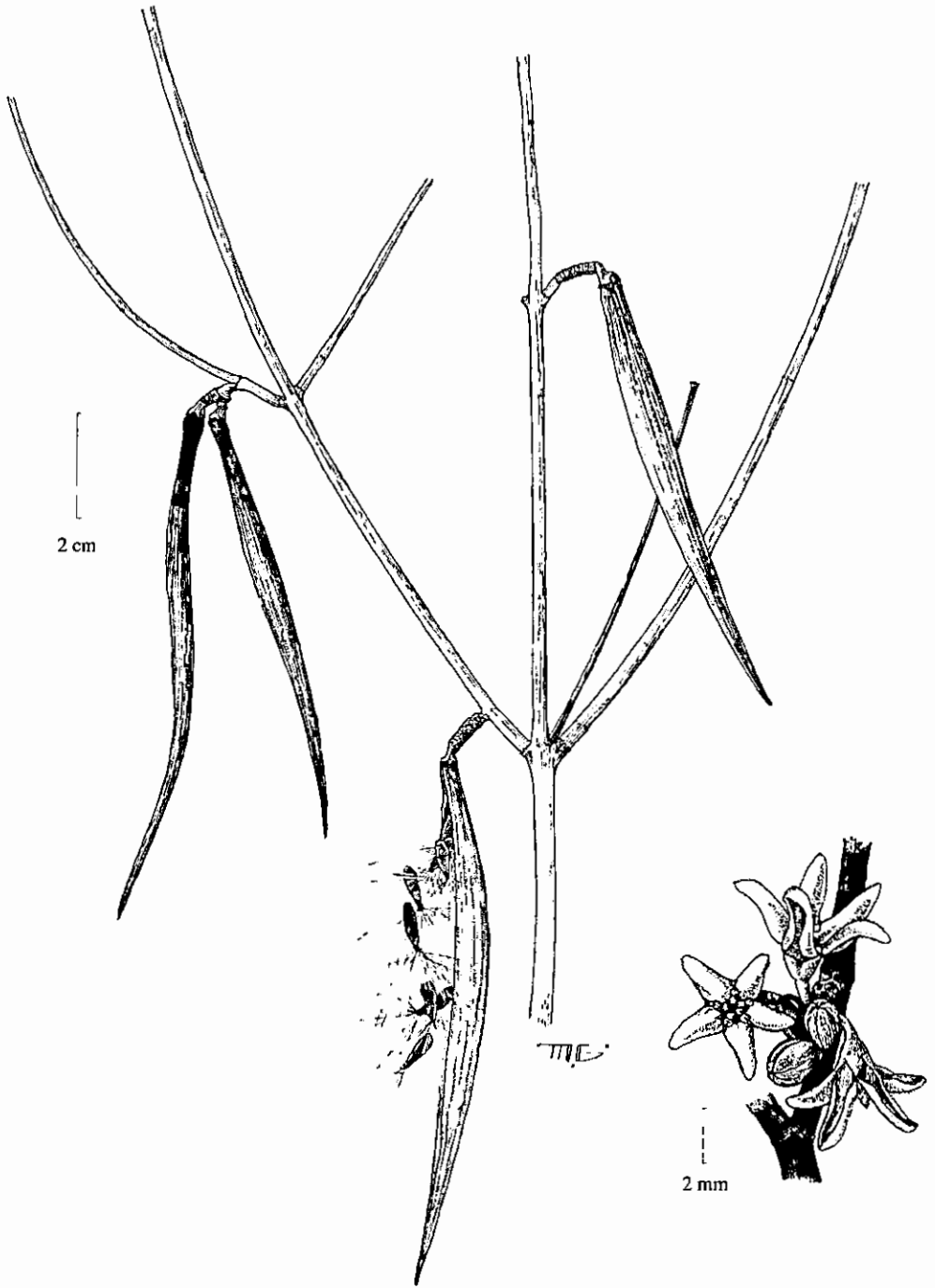


Plate 57. ASCLEPIADACEAE: *Leptadenia pyrotechnica*, fruiting branch; flowering branchlet (right). Enlarged part (scale given).

12. *Caralluma* R. Br.

Succulent stoloniferous perennials; stems decumbent or erect, 4-angled, glabrous; leaves small, caducous; flowers single or few to many in sessile, lateral or terminal cymes; calyx 5-lobed; corolla 5-lobed, purple or yellow, rotate or campanulate; corona double, attached to the staminal column, the outer of 5 deeply 2-fid segments, the inner of 5 linear segments incumbent on the anthers; staminal column short, connate to the base of the corolla; anthers without appendages; pollinium 1 in each anther cell, with a pellucid margin; follicle linear, smooth. About 60 species, Macaronesia, Mediterranean region, Arabia, eastwards to Pakistan, India and Burma, tropical East Africa.

- | | |
|---|-------------------------|
| 1. Cactus-like succulent to 1 m; stems stout, 4-angled; angles with deltoid recurved teeth | 4. <i>C. acutangula</i> |
| + Dwarf succulent to 30 cm; stems procumbent, spreading to ascending, 4-angled; angles slightly toothed, rounded or acute, without recurved teeth | 2 |
| 2. Stems with slightly toothed angles; flowers glabrous | 1. <i>C. edulis</i> |
| + Stems with rounded or acute angles; flowers hairy | 3 |
| 3. Corolla yellow, sometimes with purplish spots | 2. <i>C. sinaica</i> |
| + Corolla with dark purple to reddish-purple bands, on a greenish to pale yellow background | 3. <i>C. europaea</i> |

1. *Caralluma edulis* (Edgew.) Benth. & Hook. f., Gen. Pl. 2: 782 (1876).

Syns. *Boucerosia edulis* Edgew., J. Linn. Soc. 6: 205 (1862).

Boucerosia stocksiana Boiss., Fl. Orient. 4: 64 (1879).

Caralluma longidens N. E. Br., Gard. Chron. 12: 369 (1892).

Caralluma vittata N. E. Br., Fl. Trop. Afr. 4: 483 (1904).

Caralluma mouretii Chev., Rev. Bot. Appl. 270 (1934).

Perennial 10-20 cm; stems 4-angled, glabrous, slightly toothed at the angles, the teeth strongly bearing minute ovate, acuminate leaves, soon caducous; flowers solitary or 2-4, terminal; pedicel 0.4-1.2 cm; corolla-tube white, with dark purple stripes; lobes 4 x 2 mm, dark purple, glabrous.

GE; rocky ground. Southeast Egypt, Northeast Sudan, Ethiopia, Somalia, Mauritania, Arabia, Pakistan, India.

2. *Caralluma sinaica* (Decne.) Benth. & Hook. f., Gen. Pl. 2: 782 (1876) var. *sinaica*

Syns. *Boucerosia sinaica* Decne. in DC., Prodr. 8: 649 (1844).

Caralluma maris-mortui Zohary, Pal. J. Bot., Jerusalem ser. 2: 175 (1941).

Perennial 10-40 cm; stems 4-angled, grooved; leaves 3-8 mm, narrowly triangular, caducous; flowers in 3-5-flowered cymes on the tips of terminal branches; pedicel 1-2 mm, glabrous; calyx 1.5-2 mm, the lobes ovate, acuminate; corolla 6-8 mm diam., campanulate, yellow, often with purplish spots, the upper surface hairy, the lower glabrous; lobes ovate, acute; outer corona yellowish, 10-segmented, of which 5 segments bidentate; inner longer, 5-segmented, narrowed into linear-subulate apex; follicle 6-8 x 0.3-0.5 cm, tapering at both ends.

S; rocky ground. Sinai, Palestine, Saudi Arabia, Yemen.

NOTE: The type was collected from Sinai, April-May 1831, Aucher-Eloy 2850 (P).

3. *Caralluma europaea* (Guss.) N. E. Br., Gard. Chron., ser. 3, 12: 369 (1892).
 Syns. *Stapelia europaea* Guss., Fl. Sic. Prodr., Suppl. 1: 65 (1832).
Apteranthes gussoneana Mikan, Nov. Act. Nat. Cur. 17: 594 (1835).
Stapelia gussoneana (Mikan) Lindl., Bot. Register, t. 1731 (1835).
Boucerosia gussoneana (Mikan) Hook. f., Bot. Mag. 100, t. 6137 (1874).
Boucerosia maroccana Hook. f., Bot. Mag. 100, t. 6137 (1874).
Caralluma aaronis Hart, Trans. Roy. Irish Acad. 28: 436 (1885).
Boucerosia europaea (Guss.) Caruel in Parl., Fl. Ital. 6: 725 (1886).
Caralluma maroccana (Hook. f.) N. E. Br., Gard. Chron. 12: 370 (1892).
Caralluma affinis de Wild., Icon. Select. Hort. Then. 5: 29 (1904).
Caralluma simonis hort. ex Berger, Monatsschr. Kakt. 14: 6 (1904).
Caralluma confusa Font Quer, Bull. Inst. Cat. Hist. Nat. 1922: 31 (1922).
Caralluma europaea (Guss.) N. E. Br. var. *confusa* (Font Quer) Font Quer,
 Mem. Mus. Cienc. Nat. Barcel. 2: 10 (1924).
Caralluma europaea (Guss.) N. E. Br. subsp. *gussoneana* (Mikan) Maire in
 Jahand. & Maire, Cat. Pl. Maroc 3: 582 (1924).
Caralluma europaea (Guss.) N. E. Br. subsp. *maroccana* (Hook. f.) Maire
 in Jahand. & Maire, Cat. Pl. Maroc 3: 582 (1924).
Caralluma europaea (Guss.) N. E. Br. subsp. *maroccana* (Hook. f.) Maire
 var. *barrueliana* Maire, Bull. Soc. Hist. Nat. Afr. Nord 26: 218
 (1935).
Caralluma europaea (Guss.) N. E. Br. subsp. *maroccana* (Hook. f.) Maire
 var. *albotigrina* Maire, Bull. Soc. Hist. Nat. Afr. Nord 27: 29
 (1936).
Caralluma europaea (Guss.) N. E. Br. subsp. *maroccana* (Hook. f.) Maire
 var. *decipiens* Maire, Bull. Soc. Hist. Nat. Afr. Nord 29: 436
 (1938).
Caralluma europaea (Guss.) N. E. Br. var. *affinis* (De Wild.) Berger forma
parviflora Maire, Bull. Soc. Hist. Nat. Afr. Nord 30: 357 (1939).
Caralluma europaea (Guss.) N. E. Br. var. *judaica* Zohary, Pal. J. Bot.,
 Jerusalem ser. 2: 172 (1941).
Caralluma europaea (Guss.) N. E. Br. var. *micrantha* Maire, Bull. Soc.
 Hist. Nat. Afr. Nord 32: 213 (1941).
Caralluma europaea (Guss.) N. E. Br. var. *schmuckiana* Gattef. & Maire,
 Bull. Soc. Hist. Nat. Afr. Nord 34: 183 (1943).
Caralluma negevensis Zohary, Fl. Palaest. 3: 449 (1978).

For full synonymy see M. G. Gilbert. A review of *Caralluma* R. Br. and its segregates. *Bradleya* 8: 16-17 (1990).

Perennial 5-20 cm; stems ascending or procumbent, slightly grooved or almost flat between the angles; leaves 1.5-2.5 x 1-2.5 mm, sessile, broadly ovate; flowers 6-12, subterminal, pedicel 1-3 mm; calyx lobes 1.5-2.5 mm; corolla 1.2-1.5 cm diam., rotate, dark purple or red-purple-banded, on greenish to pale yellow ground; tube shallow; lobes broadly ovate, ciliate at the base and along the margin; outer corona dark purple, of 5 bidentate segments, yellow at the tip; the inner of 5 segments with rounded tips; follicle 8-12 x 0.4-0.6 cm, linear, slightly curved, tapering at the tip.

M, S; rocky ground. Southeast Spain, islands off Sicily (Linosa, Lampedusa), North Africa, Sinai, Palestine.

NOTE: Gilbert, *l. c.*, points out that many infraspecific taxa have been recognized within this widespread and variable species. Some of the taxa have been confused by early

authors. He adds that it does not seem advisable to make any further new combinations until the complex has been revised in its entirety. The picture is further confused by the complex series of subspecies, varieties and forms published by Maire between 1935 and 1943. He concludes: The impression is that there are a limited number of geographical variants that could be either subspecies or closely related but distinct species.

4. **Caralluma acutangula** (Decne.) N. E. Br., Gard. Chron. 12: 369 (1892).

Syns. *Desmidorchis acutangula* Decne., Ann. Sci. Nat. 9: 265 (1838).

Boucerosia acutangula (Decne.) Decne. in DC., Prodr. 8: 648 (1844).

Caralluma hirtiflora N. E. Br., Kew Bull. 1895: 264 (1895).

Caralluma retrospicimens Ehrenb. ex N. E. Br., Fl. Trop. Afr. 4 (1): 480 (1904).

For full synonymy see M. G. Gilbert. A review of *Caralluma* R. Br. and its segregates. *Bradleya* 8: 18 (1990).

Perennial 0.4-1 m; stems cactus-like, erect, stout, branched, sharply 4-angled, the angles with deltoid recurved teeth; flowers in terminal, sessile umbel-like cymes, clustered at the tips of stems and forming a dense globose head of 50-80 flowers; corolla blackish-purple, 1.2-2 cm diam., rotate; lobes ovate; follicle 10-15 x 0.4-0.6 cm, linear, slightly curved at the attenuate apex.

GE; rocky ground. Southeast Egypt, Northeast Sudan, Mauritania eastwards to Ethiopia, Somalia, Kenya, Saudi Arabia, Yemen.

RUBIACEAE

Trees, shrubs, climbers, annual or perennial herbs; stems cylindrical or quadrangular; branches opposite; leaves simple, opposite and decussate or whorled, always entire; stipules interpetiolar (or intrapetular, not in Egypt), mostly persistent, sometimes leaf-like; flowers (3-)4-5 (or 8-10)-merous, usually bisexual, actinomorphic (rarely zygomorphic but not in Egypt); inflorescences various or flowers solitary; calyx often with tubular limb, usually lobed, lobes 4-5(-8), sometimes both tube and lobes reduced; calyx limb mostly persistent in fruit, occasionally accrescent; corolla salver-shaped, infundibular, campanulate or less often rotate, 4-5(-10)-lobed; stamens epipetalous, usually as many as the corolla-lobes and alternating with them; disc usually present, annular or cushion-shaped; ovary inferior (or sometimes superior but not in Egypt), 2- or (1 or 3-8- locular, not in Egypt); ovules 1-many in each locule; placentation axile or apparently basal or apical, rarely parietal; style simple or branched; stigmas 2- to many lobed or capitate (or in species with secondary pollen presentation acting as a pollen-presenter with the stigmatic surface restricted to apical lobes, not in Egypt); fruit a capsule, berry or drupe, or of 2 mericarps, 1- to many seeded; seeds with endosperm (albumin), or sometimes lacking endosperm, but not in Egypt. 650 genera, 13200 species, cosmopolitan, but especially tropical and warm regions.

1. Leaves opposite, with clearly differentiated stipules 2
 + Leaves whorled, or less often paired, in which case stipules not apparent 4

2. Low shrubs; stipules not fimbriate; fruit of 2-winged mericarps 3. **Pterogailonia**
 + Annual or short-lived perennial herbs; stipules fimbriate; fruit a capsule 3

- | | |
|--|-----------------------|
| 3. Stems erect; inflorescences mostly terminal with some axillary; anthers and stigmas included, anthers always above the stigma (desert plants) | 2. Kohautia |
| + Stems often procumbent; inflorescences all axillary; either anthers or stigmas exerted (weeds) | 1. Oldenlandia |
| 4. Inflorescence spike-like, flowers subtended by stiff bracteoles; corolla salver-shaped | 7. Crucianella |
| + Inflorescence axillary, not spike-like; bracteoles either membranous or inconspicuous; corolla rotate | 5 |
| 5. Bracts conspicuous, membranous; fruit 1 mericarp | 4. Callipeltis |
| + Bracts inconspicuous, fruit of 2 mericarps | 6 |
| 6. Flowers in 3; the lateral male ones 3-merous; the central one female, 4-merous; fruit concealed by accrescent recurved fleshy peduncle | 5. Valantia |
| + Flowers not as above; peduncle never accrescent and fleshy | 7 |
| 7. Flowers 4-merous; fruit dry | 6. Galium |
| + Flowers 5-merous; fruit fleshy | 8. Rubia |

1. **Oldenlandia** L.

Delicate herbs or low shrubs; stems tetragonal; leaves opposite, connate at the base with fimbriate stipules; flowers axillary or terminal, 4-merous, often heterostylous; calyx-tube subglobose; calyx-teeth persistent, distant in fruit; corolla hypocrateriform or funnel-shaped; stamens 4-5, inserted at the throat of the corolla; style 2-fid; fruit a capsule dehiscing by 2 valves and crowned by persistent calyx-teeth; seeds numerous. 300 species, tropical regions, but especially Africa.

- | | |
|---|------------------------|
| 1. Flowers solitary, sessile or on pedicels 1-3 mm, or in subsessile axillary fascicles | 1. O. capensis |
| + Flowers solitary, on a pedicel 0.3-1.2 cm, or in pedunculate umbel-like cymes | 2. O. corymbosa |

1. **Oldenlandia capensis** L. f., Suppl. Pl. 127 (1781).

Glabrescent annual 10-20 cm; stems procumbent or ascending; branches ridged, glabrous or minutely setulose; leaves 1-3 x 0.1-0.4 cm, linear to narrowly elliptic, acute, at the cuneate base; petiole 0-2 mm; stipule-sheath 1-2 mm, fimbriate; flowers solitary, sessile or on pedicels 1-3 mm, or in subsessile axillary fascicles; peduncle 0-2 mm; calyx-tube c. 1 mm, campanulate; calyx-lobes 0.5-1 mm, the margin setulose; corolla white or lilac; corolla-tube 6-9 mm, the lobes 0.5 mm; anthers included; style 0.2 mm; stigma-lobes 0.2 mm; capsule c. 2 mm, obconical; beak 0.3-0.4 mm; seeds 0.3 mm, ellipsoid-angular, with flat base.

Two varieties occur in Egypt:

var. **capensis**

Calyx-lobes 4.

N; weed of cultivation, moist ground. Throughout Africa, Madagascar.

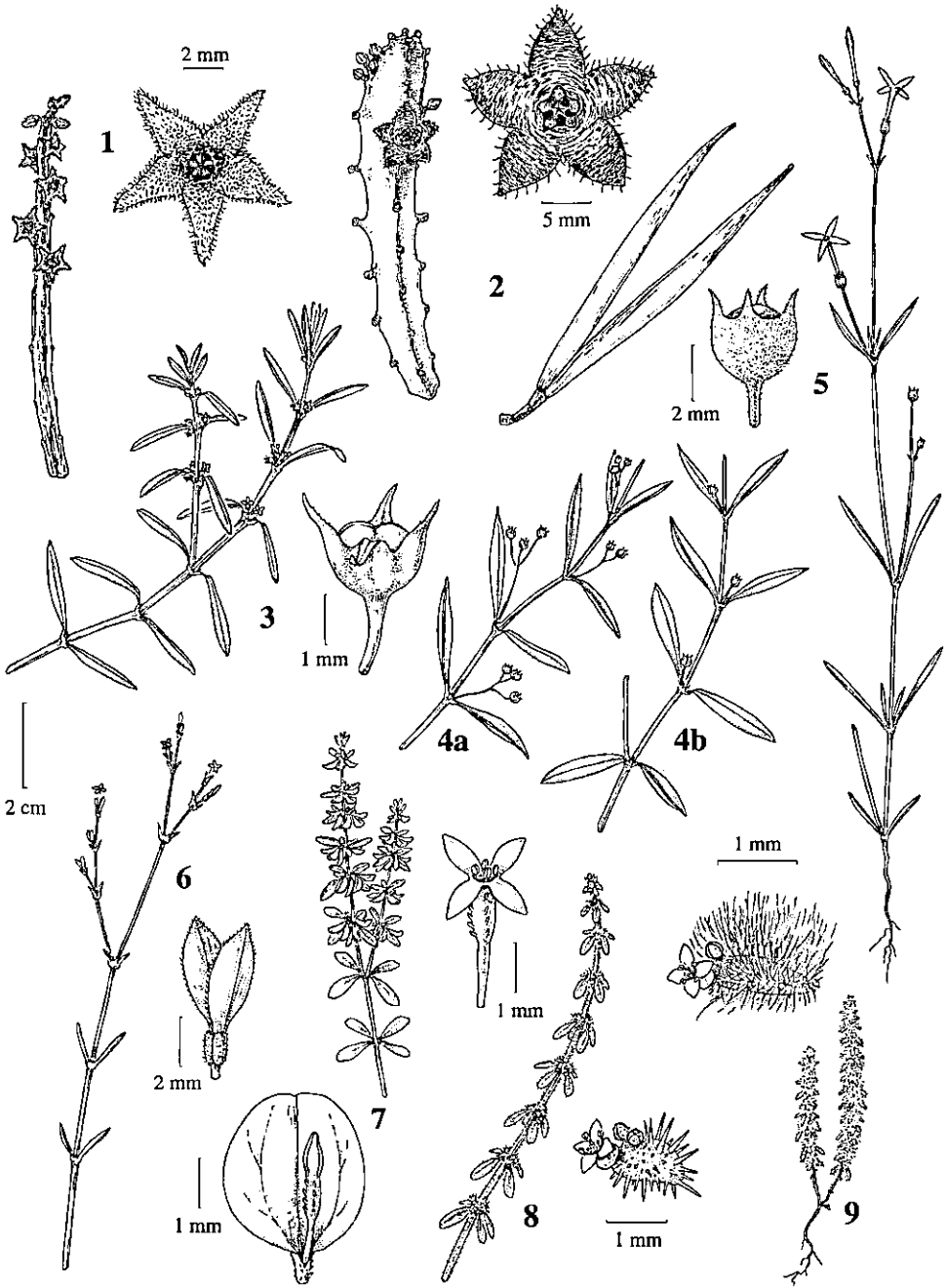


Plate 58. ASCLEPIADACEAE: *Caralluma sinaica* 1, flowering branch; flower (right). *Caralluma europaea* 2, flowering branch; flower (up right); fruits (down right). RUBIACEAE: *Oldenlandia capensis* var. *pleiosepala* 3, flowering and fruiting branch; fruit (right). *Oldenlandia corymbosa* var. *corymbosa* 4a; var. *caespitosa* 4b, fruiting branches. *Kohautia caespitosa* 5, habit; fruit (left). *Pterogaillonia calycoptera* 6, flowering and fruiting branch; fruit (right). *Callipeltis cucullaris* 7, flowering and fruiting branch; flower (right); closed flower with bract (down left). *Valantia hispida* 8, flowering and fruiting branch; flowering cyme (down right). *Valantia lanata* 9, habit; flowering cyme (up). All drawings to the same scale, except the enlarged parts (scale given).

var. **pleiosepala** Bremek., Verh. K. Nederl. Akad. Wet. Afd. Natuurk., ser. 2, 48(2): 267 (1952).

Calyx-lobes 5-8.

N, GE; weed of cultivation, moist ground. Throughout Africa. Madagascar, Northeast Turkey, Transcaucasus, Iran.

2. **Oldenlandia corymbosa** L., Sp. Pl., ed. 1, 119 (1753).

Syn. *Hedyotis corymbosa* (L.) Lam., Tab. Encycl. 1: 272 (1792).

Glabrescent annual 10-30 cm; stems procumbent to erect, ridged, glabrous or scabridulous along the ribs; leaves 1-3.5 x 0.2-0.6 cm, linear to narrowly elliptic, sessile, the apex acute and apiculate, the base cuneate; stipule-sheath 1-2.5 mm, fimbriate; flowers solitary or in pedunculate umbel-like cymes; peduncle 0.5-2 cm; peduncles and pedicels slender; pedicel 0.3-1.2 cm; calyx-tube c. 1 mm; calyx-lobes 0.5-1.5 mm, triangular, the margin setulose; corolla white, bluish, pink or purple; corolla-tube 0.5-1 mm, the lobes 0.5-1.2 mm, oblong-ovate; style 0.5-1.5 mm; capsule 1.5-2 mm, broadly ovoid; beak inconspicuous; seeds 0.3 mm, ellipsoid, reticulate, brownish.

Two varieties occur in Egypt:

var. **corymbosa**

Inflorescence 3-6-flowered; style glabrous.

N (Delta); weed of cultivation. Subcosmopolitan weed, probably native to Africa and India.

var. **caespitosa** (Benth.) Verdc., Kew Bull. 30: 298 (1975).

Syns. *Oldenlandia herbacea* (L.) Roxb. var. *caespitosa* Benth. in Hook., Niger Fl. 403 (1849).

Oldenlandia caespitosa (Benth.) Hiern, Fl. Trop. Afr. 3: 61 (1877).

For full synonymy see Verdcourt in Polhill (ed.), Fl. Trop. E. Afr., Rubiaceae 1: 311 (1976).

Flowers mostly solitary at the nodes, or few in 2-flowered cymes; style sparsely hairy in the middle part.

N (Delta); weed of cultivation. Cape Verde Islands; North, West and East Africa, Natal. Madagascar, Mascarene Islands, Southwest Asia.

2. **Kohautia** Cham. & Schldl.

Annual or perennial herbs, occasionally low shrubs; leaves sessile, opposite, linear and mostly 1-nerved; stipules with 2 or several fimbriate; flowers usually in terminal inflorescences, often with axillary ones as well; calyx-lobes 4, small, equal; corolla-tube narrowly cylindrical, the lobes 4; stamens always included in the upper swollen part of the corolla-tube; ovary 2-locular; ovules numerous; style always included; stigma 2-fid or undivided, always below the anthers; capsule \pm globose, scarcely beaked, splitting loculicidally at the apex; seeds numerous, angular. 60 species, Old World tropics.

1. **Kohautia caespitosa** Schnizl., Flora 25, Beibl. 1: 145 (1842) subsp. **caespitosa**

Scabridulous-pubescent annual or perennial, sometimes woody at the base, 10-60 cm; stems erect, usually branched at the base; leaves 0.5-4.5 x 0.05-0.3 cm, linear to linear-lanceolate, acute or apiculate, attenuate at the base; stipular sheath 1-3.5 mm, fimbriate; flowers in dichasial or trichotomous inflorescences, scented; peduncle 0-4.5 cm; pedicel 0-1.5 cm; calyx-tube c. 1.5 mm, ovoid; the lobes c. 1.5 mm, narrowly triangular, acute; corolla white, grey, yellowish or pink, papillose outside; corolla-tube 1-1.2 cm, narrowly cylindrical, the lobes 3-5 x 1 mm, oblong-linear; style 2-4 mm; stigma 2-fid, lobes 1-2 mm; capsule 2-3 mm, subglobose, verrucose; seeds c. 0.25 mm, greenish-brown, angular, reticulate.

De, R, GE, S.; sandy and stony desert wadis and plains. Egypt, Sudan, Somalia, Eritrea, Arabia.

NOTE: According to D. Mantell in E. Launert (ed), Fl. Zambesiaca 5: 88 (1989), 3 subspecies are known of this species. Our specimens from Egypt may belong to subsp. *caespitosa*, the typical subspecies.

3. **Pterogaillonia** Lincz.

Low shrubs; leaves opposite, connate with sheathing interpetiolar stipules; calyx-limb persistent; corolla 4-lobed, infundibular; stamens inserted at the throat of the corolla; style filiform; stigmas 2; fruit of 2 mericarps, with accrescent calyx-lobes. 3 species, Southwest Asia, Egypt.

1. **Pterogaillonia calycoptera** (Decne.) Lincz., Nov. Syst. Pl. Vasc. 10: 233 (1973).

Syns. *Spermacoce calycoptera* Decne., Ann. Sci. Nat. Bot., sér. 2, 2: 267 (1834).

Gaillonia calycoptera (Decne.) Jaub. & Spach, Ill. Pl. Orient. 1: 147, t. 80 (1843).

Jaubertia calycoptera, sensu Täckh., Stud. Fl. Egypt, ed. 2, 420 (1974).

Low shrub 20-50 cm; stems much-branched, becoming woody, white and glabrous when old; young shoots herbaceous, greenish, puberulent; leaves 0.5-1.8 x 0.1 cm, linear, the margin revolute, the apex acute or apiculate; bracts and stipules connate into an obconical, dentate sheath 2.5-4 m; calyx 3-4 mm; corolla 7-8 mm, pubescent outside, the lobes c. 1.2 mm; fruit of 2 mericarps, puberulent, each with a membranous striate wing.

De, R, GE, S; stony desert wadis. Egypt, Palestine, Arabia, Iran.

4. **Callipeltis** Steven.

Annuals; leaves and leaf-like stipules in whorls of 4 (our species); flowers bisexual, pedicellate, in supra-axillary 3-flowered cymes, the central flower naked, the lateral subtended by conspicuous, membranous veined bracts; calyx-limb obsolete; corolla (3-)4-merous, yellowish-green, rotate; stamens 4; filaments very short; style 2-lobed; stigmas capitate; ovary 1-carpellate by abortion; fruit a single mericarp. 3 species, Spain, North Africa, Southwest Asia to Pakistan.

1. **Callipeltis cucullaris** (L.) Steven, Mém. Soc. Naturalistes Moscou 7: 275 (1829).

Syns. *Valantia cucullaris* L., Cent. Pl. 1: 33 (1755).

Valantia cucullaria L., Amoen. Acad. 4: 296 (1759).
Callipeltis cucullaria (L.) DC., Prodr. 4: 613 (1830).
Callipeltis cucullaris (Jusl.) Rothm., Feddes Repert. 50: 72 (1941).

Annual 5-15 cm; stems simple or branched mainly from the base, 4-angled, erect or ascending, glabrous, hirsute or scabridulous along the angles; leaves 0.3-1.2 x 0.1-0.4 cm, oblong-elliptic, obtuse, short-petiolate, glabrous, the margin scabridulous; flowers in subsessile cymes; central flower sessile, naked; lateral flowers short-pedicellate; pedicel 0-1.2 mm, reflexed in fruit; bracts 3-6 mm in fruit, orbicular, ovate or obovate, flat or folded around the fruit; corolla c. 0.5 mm, cup-shaped; mericarps single, 1.5-2 mm, slightly curved, hispidulous at the tip.

Two forms occur in Egypt:

forma **cucullaris**

Bracts 3-4 mm, orbicular or ovate, folded lengthwise and enveloping the fruit.

De, S; sheltered mountain crevices, among the stones in desert wadis. Spain, North Africa, Sinai, Syria, Turkey, Caucasus, Arabia, Iran, Afghanistan, Pakistan, Central Asia.

forma **aperta** (Boiss. & Buhse) Ehrend., Notes Roy. Bot. Gard. Edinb. 22: 397 (1958).
Syn. *Callipeltis aperta* Boiss. & Buhse, Aufz. Reis. Transkauk. Per. 110 (1860).

Bracts 4-6 mm, obovate, not folded in fruit.

De, S; stony desert wadis, sheltered mountain crevices. Egypt, Arabia, Iraq, Iran, Pakistan.

NOTE: Some authors treat these two variants as separate species.

5. **Valantia** L.

Syn. *Vaillantia* Hoffm.

Annuals, rarely short-lived perennials; leaves and leaf-like stipules in whorls of 4; flowers in axillary 3-flowered cymes, the central bisexual, 4-merous, the lateral male, 3-merous; calyx-limb absent; corolla white, yellowish-green or pink, rotate or cup-shaped; stamens 3-4, included; style-branches 2; stigmas capitate; fruit of 1-2 mericarps concealed by the accrescent recurved peduncle and pedicels of the 3 flowers; seeds subglobose. About 4 species, Macaronesia, eastwards to Iran.

1. Lower internodes exposed; peduncle and pedicels strongly accrescent, incurved and encircling the fruit; only 1 mericarp usually maturing 1. **V. hispida**
+ Internodes hardly exposed, the whole plant densely covered with long white stiff hairs; peduncle and pedicels slightly accrescent in fruit; both mericarps usually maturing 2. **V. lanata**

1. **Valantia hispida** L., Syst. Nat., ed. 10, 1307 (1759).

Annual 8-20 cm; stems much-branched, especially from the base, erect or ascending, sharply 4-angled, scabrid along the angles; lower internodes exposed; leaves 3-8 x 1-3

mm, obovate-spathulate, subacute or apiculate, attenuate at the base; peduncle and pedicels strongly accrescent, incurved and encircling the fruit, the central bisexual flower 1.5-2 mm, the lateral male flowers 0.5-1.2 mm diam.; corolla whitish to purplish, rotate; mericarps 1-2, 1.2-1.5 x 1 mm, ± reniform, hispidulous, dark brown, with a band of raphides around the hilum.

M, De, GE, S; sheltered crevices, stony ground, hillsides. Canary Islands, Mediterranean region, Sinai, Arabia, Iran.

2. **Valantia lanata** Delile ex Coss., Bull. Soc. Bot. France 12: 178 (1865).

Syns. *Galium columella* Ehrenb. ex Boiss., Fl. Orient. 3: 81 (1875).

Galium lanatum (Delile ex Coss.) Boiss., Fl. Orient. Suppl. 283 (1888).

Valantia columella (Ehrenb. ex Boiss.) Meikle, Fl. Cyprus 1: 776 (1977).

Like *Valantia hispida*, but 3-8 cm; whole plant densely covered with long white stiff hairs; peduncle and pedicels slightly accrescent in fruit; both mericarps usually maturing.

M; sheltered crevices among stones. Egypt, Libya (Cyrenaica).

NOTE: The type was collected from Marmarica, Egypt, Delile (MPU).

6. **Galium** L.

Perennials and annuals, sometimes low shrubs; stems 4-angled, glabrous, hispid or scabrid; leaves in whorls of 3 to many, rarely 2 opposite, sometimes prickly on the margins; stipules leaf-like; flowers bisexual, rarely unisexual; calyx-tube ovoid, limb mostly obsolete; corolla (3-)4-(-5)-merous, rotate, campanulate or infundibular, white, yellow or reddish; stamens (3-)4; filaments short, inserted in the short tube; ovary 2-locular, the ovules solitary in each locule; styles 2, short, sometimes connate at the base; stigmas capitate; disc annular; fruit of 2-lobed mericarps, smooth, tuberculate or bristly, dry, rarely fleshy (not in Egypt); seeds with a cavity on dorsal face. About 300 species, cosmopolitan.

- | | |
|---|-----------------------|
| 1. Perennial, with a woody base | 2 |
| + Annual | 4 |
| 2. Leaves opposite or in whorls of 4 | 1. G. sinaicum |
| + Leaves in whorls of 4-10 | 3 |
| 3. Plant woody at the base, canescent, densely villose all over;
leaves in whorls of 4-6; cymes axillary | 2. G. canum |
| + Plant not woody at the base; glabrous; leaves in whorls of 6-8;
cymes terminal | 3. G. mollugo |
| 4. Leaf margin with setae pointing downwards | 5 |
| + Leaf margin with setae pointing upwards | 8 |
| 5. Leaves glabrous; mericarp papillose | 6 |
| + Leaves tuberculate-pubescent on the upper surface;
mericarp with hooked bristles, or smooth | 7 |

6. Peduncle 4-8 mm; cymes ± equalling the leaves;
mericarp 2.5-4 mm 4. **G. tricornutum**
+ Peduncle 1-2.5 mm; cymes much shorter than the leaves;
mericarp 1.5-2 mm 7. **G. ceratopodum**
7. Corolla white; mericarp 2.5-3.5 mm, densely tuberculate-setose 6. **G. aparine**
+ Corolla greenish-white; mericarp c. 1.5 mm, with hooked setae
lacking tuberculate bases 7. **G. spurium**
8. Cymes 1-3-flowered; mericarps 1.5-2 mm, cylindrical, arcuate when ripe,
with spreading hooked hairs 8. **G. murale**
+ Cymes many-flowered; mericarps not as above 9
9. Stems subterete; leaves 0.6-1.5 x 0.05-0.08 cm, narrowly-linear,
the lowest narrowly spatulate; bracts 4-8 mm; pedicel 2-6 mm 9. **G. setaceum**
+ Stems sharply angled; leaves 3-6 x 1-2.5 mm, lanceolate;
bracts 1-1.5 mm; pedicel 0.5-2 mm 10. **G. parisiense**

1. **Galium sinaicum** (Delile ex Decne.) Boiss., Fl. Orient. 3: 63 (1875).
Syn. *Asperula sinaica* Delile ex Decne., Ann. Sci. Nat. Bot., sér. 2, 2: 268 (1834).

Scabrid, hispid or glabrescent perennial, 10-20 cm, woody at the base; stems many, in tufts, ascending, brittle; leaves opposite or in whorls of 4, 0.5-1.2 x 0.1 cm, oblong-linear, the margin revolute; midrib prominent on the lower surface; cymes axillary, few-flowered; peduncle 3-8 mm; pedicel 1-2 mm; corolla rotate, yellowish with purplish veins, hispid or glabrous; mericarps 1-1.5 mm, minutely papillose.

De, S; sheltered crevices, mountains, hillsides. Egypt. southern Palestine.

2. **Galium canum** Req. in DC., Prodr. 4: 602 (1830).

Canescent perennial 10-25 cm, woody at the base, densely villose all over; stems brittle; leaves in whorls of 4-6, 2-6 x 1-1.5 mm, oblong-elliptic, the margin revolute, the apex acute; midrib prominent on the lower surface; cymes axillary, paniculate; peduncles and pedicels filiform; peduncle 0.3-1 cm; pedicel 1.5-4 mm, pubescent; corolla rotate, purple, the lobes mucronate; mericarps 0.75-1 mm, reniform, villose.

M; sheltered rocky crevices. East Mediterranean region.

3. **Galium mollugo** L., Sp. Pl., ed. 1, 107 (1753).

Glabrescent perennial 30-80 cm; stems erect, the internodes to 6 cm; leaves in whorls of 6-8, 1-2 x 0.15-0.4 cm, oblong-lanceolate, the margin revolute, the apex acute; cymes terminal; corolla white or yellowish; mericarp c. 1 mm, brownish, glabrous.

GE; hillsides. Europe, Mediterranean region, Southeast Egypt, West Asia.

4. **Galium tricornutum** Dandy, Watsonia 4: 47 (1957).
Syn. *Galium tricorne* Stocks in With., Bot. Arr. Brit. Pl., ed. 2, 1: 153 (1787),
nom. illeg.

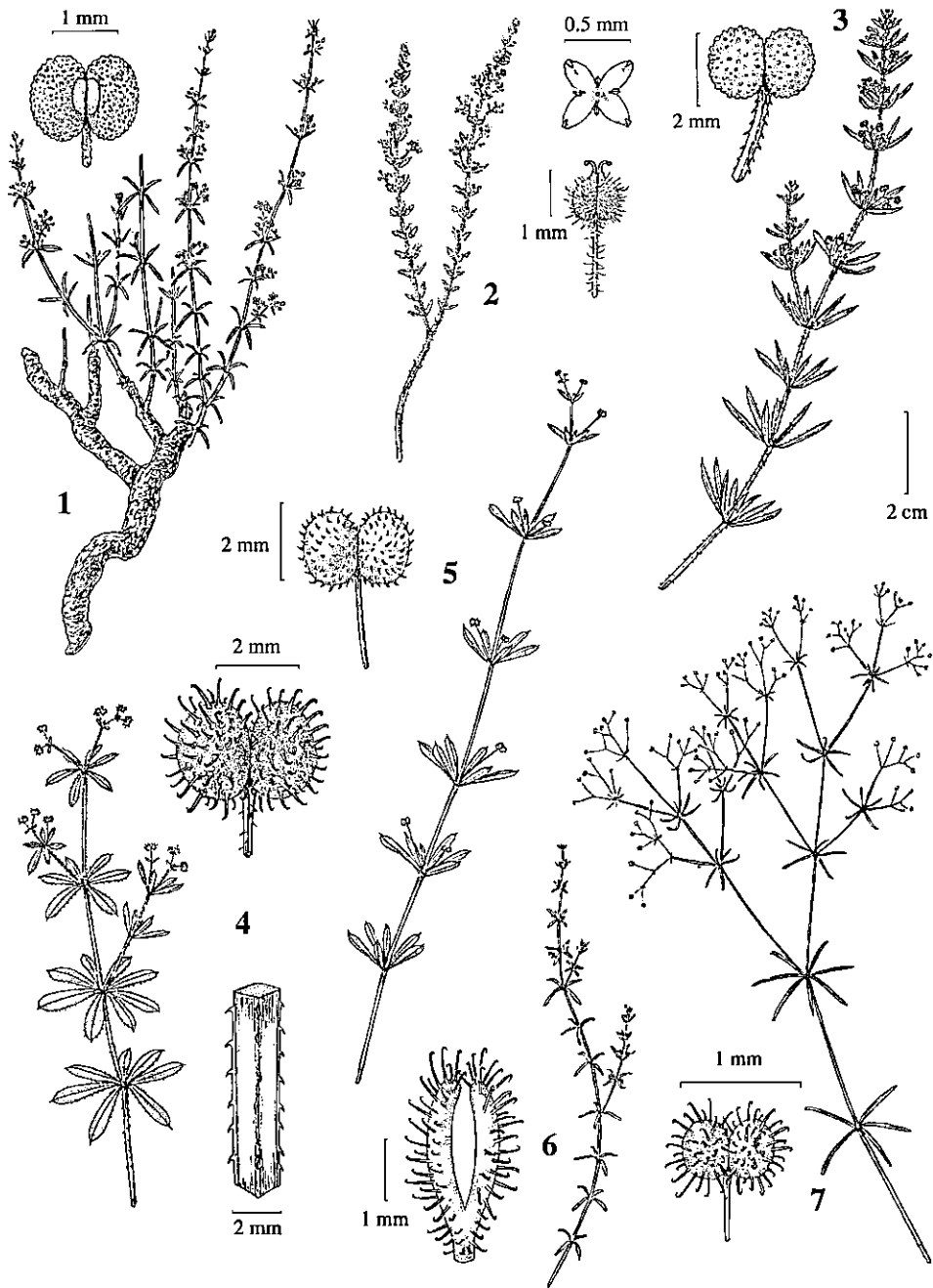


Plate 59. RUBIACEAE: *Galium sinaicum* 1, habit; fruit (up). *Galium canum* 2, flowering and fruiting branch; flower (up right); fruit (down right). *Galium tricorrutum* 3, flowering and fruiting branch; fruit (up left). *Galium aparine* 4, flowering and fruiting branch; fruit (up right); stem (down right). *Galium spurium* 5, flowering and fruiting branch; fruit (up left). *Galium murale* 6, flowering and fruiting branch; fruit (down left). *Galium setaceum* 7, flowering and fruiting branch; fruit (down left). All drawings to the same scale, except the enlarged parts (scale given).

Glabrous annual 15-50 cm; stems climbing, the angles retrorsely aculeolate; leaves in whorls of 6-8, 0.5-1.8 x 0.2-0.35 cm, linear-lanceolate, the margin retrorsely aculeolate; cymes axillary, ± equalling the leaves, 1-4-flowered; peduncle 4-8 mm; pedicel 1-3 mm; flowers bisexual; corolla c. 1.5 mm diam., rotate, whitish, the lobes ovate, acute; fruiting pedicel strongly recurved; mericarps usually 2, 2.5-4 mm, globose, densely papillose.

N, O, M, De, S; weed of cultivation. Europe, Mediterranean region, eastwards to Central Asia.

5. ***Galium ceratopodum*** Boiss., *Diagn. Pl. Orient.*, ser. 1, 3: 45 (1843).

Like *Galium tricornutum*, but cymes much shorter than the leaves; peduncle 1-2.5 mm; flowers subsessile; corolla c. 0.75 mm diam.; mericarp 1.5-2 mm.

S; rocky hillsides. Sinai, Arabia, Iraq, Iran, Afghanistan to Central Asia.

6. ***Galium aparine*** L., *Sp. Pl.*, ed. 1, 108 (1753).

Annual 25-80 cm; stems climbing, the angles retrorsely aculeolate; leaves in whorls of 6-10, 1-2.5 x 0.3-0.6 cm, oblanceolate, flat, the apex mucronate, the base tapering, aculeolate along the margin and lower midrib, tuberculate-pubescent on the upper surface; cymes axillary, few-flowered, exceeding the leaves; flowers bisexual; corolla rotate, white; mericarps 2.5-3.5 mm, densely covered with setae arising from a basal tubercle.

?De, ?S; sheltered habitats. Europe, North Africa, Sinai, East Mediterranean region to Central Asia; widely introduced elsewhere.

NOTE: The occurrence of this species in Egypt is based on literature records, without detailed localities. It has perhaps been confused with *Galium spurium*. Therefore, it is desirable to clarify its distribution within Egypt by acquiring more collections.

7. ***Galium spurium*** L., *Sp. Pl.*, ed. 1, 106 (1753) subsp. ***africanum*** Verdc., *Kew Bull.* 30: 324 (1975).

Scrambling annual 20-80 cm; stems weak, prickly; leaves in whorls of 6-8, 1-2 x 0.1-0.3 cm, linear-oblanceolate, the apex apiculate, the margin prickly, tuberculate-pubescent on the upper surface; cymes 1-5-flowered; peduncle 0.5-2 cm; pedicel 0-6 m; most fruits borne on unbranched peduncles; corolla c. 1.5 mm, greenish-white, the lobes 0.8-1 mm, triangular; mericarp c. 1.5 mm, with white hooked setae lacking tuberculate bases.

De, GE, S; sandy desert wadis. Egypt, Sudan, tropical East, Central and South Africa, Arabia, Socotra.

NOTE: The Egyptian material of this species seem to belong to subsp. *africanum* Verdc., *Kew Bull.* 30: 324 (1975), which differs from the typical subspecies by having "many fruits borne on what appear to be unbranched peduncles; fruit covered with white hooked hairs which do not have tuberculate bases".

8. ***Galium murale*** (L.) All., *Fl. Pedem.* 1:8, t. 77, f. 1 (1785).
Syn. Sherardia muralis L., *Sp. Pl.*, ed. 1, 103 (1753).

Hispid annual 5-20 cm; stems slender, branched mainly from the base; leaves in whorls of 4 or opposite, 1-8 x 1 mm, oblong-lanceolate, flat; apex mucronate, the base tapering;

margin with setae pointing upwards, sometimes slightly revolute; cymes 1-3- flowered; peduncle 3-6 mm; pedicel c. 1 mm, reflexed in fruit; corolla rotate, yellow, the lobes oblong; mericarps 1.5-2 mm, cylindrical, arcuate when ripe, with spreading hooked hairs.

M, S; stony hillsides. Mediterranean region, Sinai.

9. *Galium setaceum* Lam., Encycl. 2: 584 (1788).

Delicate glabrescent annual 15-30 cm; stems slender, subterete, fragile, dichotomously branched; leaves in whorls of 5-8, 0.6-1.5 x 0.05-0.08 cm, narrowly-linear, the lowermost narrowly spatulate, the margin revolute, the apex acute, glabrous or sparingly hispid; cymes axillary and terminal, lax; peduncle 1-3.2 cm; bracts 1-2, 4-8 mm, leaflike; pedicel 2-6 mm, filiform; corolla c. 0.6 mm diam., rotate, purple, glabrous; mericarp c. 0.8 mm, subglobose, covered with long hooked hairs.

De, R, GE, S; sheltered hillsides, desert wadi beds. Mediterranean region, Southwest Asia to Afghanistan, Pakistan and India.

10. *Galium parisiense* L., Sp. Pl., ed. 1, 108 (1753).

Sprawling slender annual; stems much-branched, sharply 4-angled, retrorsely spinulose along the angles; leaves 5-7-whorled, 3-6 x 1-2.5 mm, lanceolate, acute, the margin slightly revolute; cymes axillary and terminal; peduncle 2-5 mm; bracts 1-2, 1-1.5 mm, leaf-like; peduncles and pedicels widely divaricate; pedicel 0.5-2 mm; corolla c. 0.8 mm diam., greenish-white; mericarps c. 1 mm, subglobose, minutely papillose, clothed by short bristles.

? GE; mountain hillsides. Atlantic Islands, Europe, Mediterranean region, Caucasus, Iran.

NOTE: I have not seen any material of *Galium parisiense* from Egypt. The above description is based on specimens from Cyprus. The occurrence of this species in Gebel Elba, Egypt, remains doubtful.

7. *Crucianella* L.

Annuals, perennials or low shrubs; leaves and leaf-like stipules in whorls of 4-8; flowers bisexual, sessile, in spikes, mostly solitary in the axil of a bract, subtended by 2 bracteoles; calyx collar-like or 0; corolla funnel- or salver-shaped, the lobes 4-5, mostly with an incurved apical awn; style unequally 2-fid; stigmas capitate; fruit 2 mericarps, 1-seeded, glabrous. About 30 species, Europe, Mediterranean region to Iran and Central Asia.

1. Perennial, woody at the base; leaves coriaceous
+ Annual; leaves not coriaceous

4. *C. maritima*
2

2. Leaves in whorls of 4; corolla 4-lobed; mericarps tuberculate-vesicular
+ Leaves in whorls of 6; corolla 5-lobed; mericarps marked with longitudinal white lines, not tuberculate-vesicular

3. *C. ciliata*
3

3. Outer bract recurved, much longer than the inner ones
+ Outer bract straight, slightly longer than the inner ones

2. *C. membranacea*
1. *C. aegyptiaca*

1. **Crucianella aegyptiaca** L., Mant. 38 (1767).

Syn. *Crucianella herbacea* Forssk., Fl. Aegypt.-Arab. 30 (1775).

Scabrid annual 10-30 cm; stems much-branched mainly from the base, erect or ascending, 4-angled, scabrid along the angles; leaves in whorls of 6, 0.6-1.2 x 0.1-0.15 cm, linear-lanceolate, mucronate, the margin spinulose; flowers in spikes 2-8(-12) cm, the rhachis spinulose; bracts narrowly lanceolate, acute, the margin scarious, the outer midrib thick; outer bract 6-9 mm, straight, slightly exceeding the inner bracts; corolla ± equalling the outer bract; corolla-lobes ovate, the awns ± equalling the lobes; mericarps 2, free, c. 2 x 1 mm, oblong, marked with longitudinal white lines.

M; coastal sandy soils. Tunisia, Libya, Egypt, Palestine, Cyprus.

2. **Crucianella membranacea** Boiss., Diagn. Pl. Orient., ser. 1, 3: 27 (1843).

Like *Crucianella aegyptiaca*, but the outer bract recurved, much longer than the inner ones; awns shorter than the corolla-lobes.

N (Cairo), De, S; sandy desert wadis and plains, edges of cultivation. Egypt, Palestine, Lebanon, Syria, Iraq, Arabia.

3. **Crucianella ciliata** Lam., Encycl. 2: 217 (1786).

Syns. *Crucianella diffusa* Roth, Usteri Ann. Bot. 10: 40 (1794).

Crucianella hispidula Decne., Ann. Sci. Nat., sér. 2, 2: 269 (1834).

Crucianella ciliata Lam. var. *hispidula* (Decne.) Boiss., Fl. Orient. 3: 24 (1875).

Scabrid annual 3-15 cm; stems erect or ascending, whitish; leaves in whorls of 4, 0.5-1.2 x 0.1-0.15 cm, linear-lanceolate; margin white, strongly revolute, scabrid; bracts 5-8 x 1-1.5 mm, narrowly lanceolate, acute, keeled, margin scabrid; corolla 4-lobed, 2.5-3 mm; lobes ovate, mucronate; mericarp c. 2 x 1.75 mm, tuberculate-vesicular.

S; sheltered stony crevices, mountain slopes. Sinai, Palestine, Syria, Iraq, Saudi Arabia, southern Iran.

4. **Crucianella maritima** L., Sp. Pl., ed. 1, 109 (1753).

Perennial, woody at the base, 10-30 cm; stems procumbent or ascending, whitish, glabrous; leaves in whorls of 4, 4-8 x 1-2 mm, lanceolate, coriaceous, the margin white, the apex mucronate, the base imbricate; outer bracts 6-8 x 1.5-3 mm, ovate-elliptic, free, the margin white and ciliate; inner bracts shorter, connate at the base; corolla 1-1.2 cm, exceeding the bracts, 5-lobed, greenish-yellow; lobes oblong, the awns as long as the lobes; mericarp not seen.

M, O (Wadi Natrun), De, S; maritime sands and coastal rocky cliffs. Mediterranean region, Sinai.

8. **Rubia** L.

Herbaceous perennials or shrubs; stems 4-angled; leaves often petiolate, in whorls of 4-8, rarely opposite; stipules leaf-like; flowers usually bisexual, (3-)-5-merous, in axillary and terminal cymes; calyx-limb 0; corolla 4-5-lobed, rotate, campanulate or funnel-shaped; style deeply 2-fid; stigmas capitate; fruit of fleshy mericarps, usually 1-locular, 1-seeded. About 60 species, Mediterranean region, Africa, temperate Asia and America.

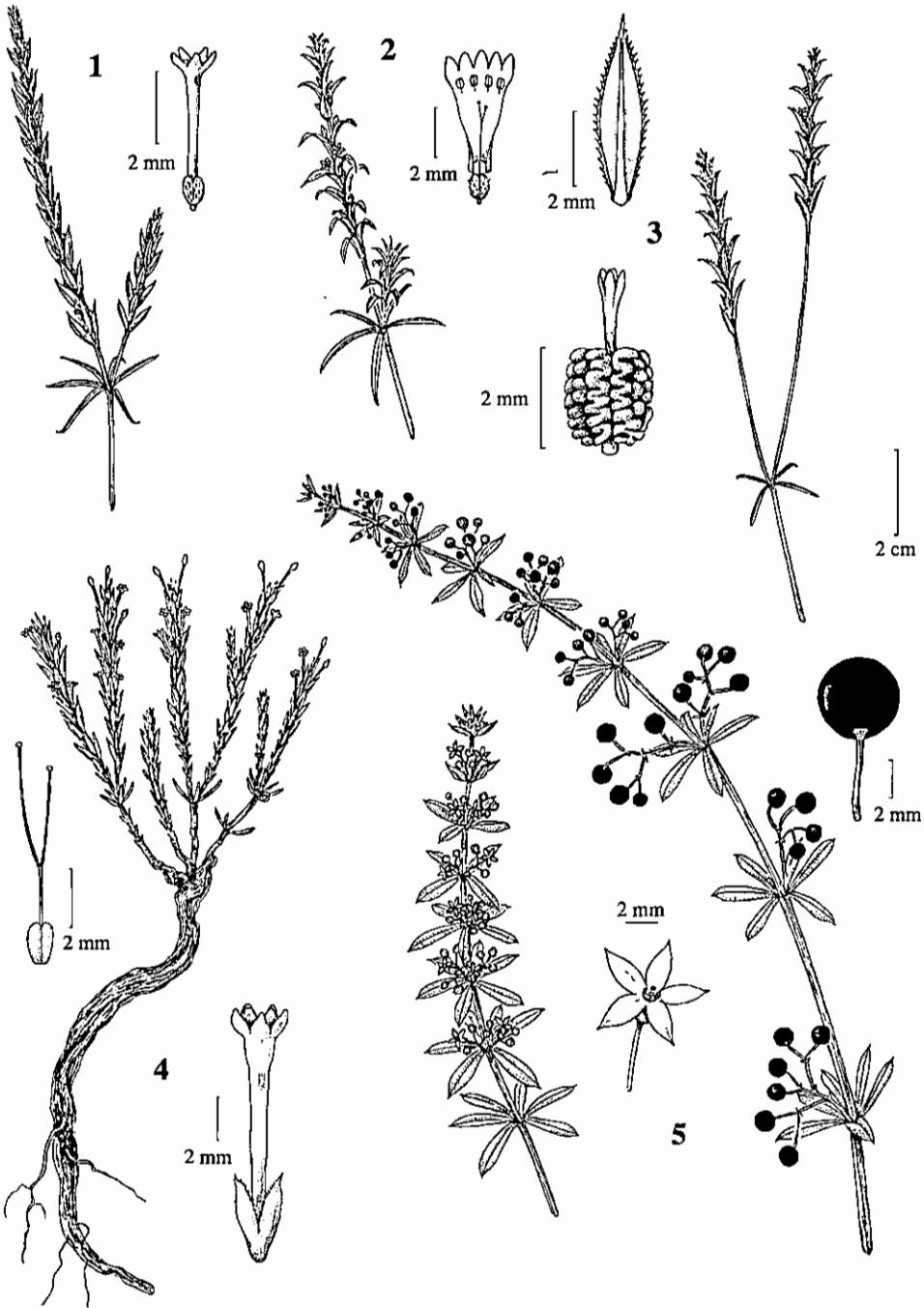


Plate 60. RUBIACEAE: *Crucianella aegyptiaca* 1, flowering and fruiting branch; flower (right). *Crucianella membranacea* 2, flowering and fruiting branch; flower (right). *Crucianella ciliata* 3, flowering and fruiting branch; leaf (up left); fruit (down left). *Crucianella maritima* 4, habit; flower (down right); pistil (left). *Rubia tenuifolia* 5, flowering branch and flower; fruiting branch and fruit (right). All drawings to the same scale, except the enlarged parts (scale given).

1. **Rubia tenuifolia** d'Urv., Mém. Soc. Linn. Paris 1: 273 (1822).
 Syn. *Rubia olivieri* A. Rich., Mém. Soc. Hist. Nat. Paris 5: 132 (1834).

Low shrub 40-80 cm; stems trailing, the branches scabrid to glabrescent; leaves in whorls of 4-6, 0.6-1.8 x 0.3-0.5 cm, oblong-linear to elliptic, leathery, the dorsal nerve conspicuous, the margin retrorsely scabrid, the apex mucronate; cymes axillary, few-flowered, shorter than the leaves; corolla 5-7 mm diam., rotate, yellowish-green, lobes 5, lanceolate; mericarp 4-6 mm, globose, drupe-like, black.

S (Gebel Halal); rocky hillsides. Sinai, Palestine, Syria, Lebanon, Cyprus, Greece, Crete, Aegean Islands, Turkey, Iraq.

CONVOLVULACEAE (incl. Cuscutaceae)

Herbs, shrubs or leafless parasites, usually twining or prostrate, a few erect; leaves alternate, exstipulate, simple, entire or lobed; flowers usually bracteate, solitary or in cymose inflorescences, regular, bisexual; sepals 4-5, imbricate, free or connate at the base; corolla funnel-shaped, salver-shaped or campanulate, entire or 4-5-lobed; stamens 4-5, inserted in the corolla-tube and alternating with the lobes; pollen smooth or spinulose; ovary superior, entire or 2-4-lobed, usually 1-4-locular; styles 1 or 2; stigmas 1-4, variously shaped; fruit usually a capsule, rarely a berry or nut-like; seeds usually 1-4; endosperm present. 56 genera, 1600 species, cosmopolitan, but especially warm regions.

- | | |
|---|------------------------|
| 1. Twining leafless parasite, ± devoid of chlorophyll, with haustoria;
corolla with petaloid scales opposite the stamens | 10. Cuscuta |
| + Chlorophyllous non-parasitic leafy plant; corolla without scales | 2 |
| 2. Styles 2 | 3 |
| + Style 1 | 5 |
| 3. Each style forked to about half of its length | 6. Evolvulus |
| + Styles not forked | 4 |
| 4. Stamens and styles included | 7. Seddera |
| + Stamens and styles exerted | 8. Cressa |
| 5. Ovary distinctly 2-lobed | 9. Dichondra |
| + Ovary not lobed | 6 |
| 6. Stigmas long and linear, ± equalling the styles in thickness | 1. Convolvulus |
| + Stigmas oblong, elliptic or ± globose | 7 |
| 7. Stigmas ± globose | 8 |
| + Stigmas ovate or elliptic | 9 |
| 8. Pollen smooth; leaves pedately or palmately divided into (flowers white)
usually 5 broad or (flowers pink) very narrow leaflets | 4. Merremia |
| + Pollen spinulose; leaves not as above, or if deeply 5-7-lobed and
flowers pink or mauve (<i>I. cairica</i>) then leaf divisions not linear | 5. Ipomoea |
| 9. Plant glabrous; corolla white | 2. Calystegia |
| + Plant hairy; corolla blue | 3. Jacquemontia |

1. *Convolvulus* L.

Partly after F. Sa'ad, 1967. The *Convolvulus* species of the Canary Isles, the Mediterranean region and the Near and Middle East. Bronder-Offset, Rotterdam.

Annual or perennial herbs or low shrubs; stems erect, prostrate or twining; leaves mostly hastate or sagittate, glabrous or pubescent; flowers bracteate, in terminal or axillary cymes or heads, sometimes solitary; sepals free, equal or unequal; corolla campanulate or funnel-shaped, variously coloured; stamens and style included; ovary ovoid, conical or globose, hairy or glabrous, with a cup-shaped or annular disc at the base, 2-locular, 4-ovular; style simple; stigmas 2, filiform or narrowly cylindrical, \pm equalling the styles in thickness; capsule 2-locular, usually 4-valved; seeds usually 4, or fewer by abortion, glabrous or pubescent, smooth or tuberculate. About 100 species, cosmopolitan, but especially temperate regions.

- | | |
|---|------------------------------|
| 1. Spinescent shrub | 2 |
| + Perennial or annual, not spinescent | 3 |
| 2. Corolla blue | 1. <i>C. hystrix</i> |
| + Corolla white-pinkish | 2. <i>C. lanatus</i> |
| 3. Plant twining or trailing; leaves distinctly petiolate, hastate, sagittate, auriculate, or base cordate | 4 |
| + Plant not twining or trailing; leaves \pm sessile, not hastate, sagittate or auriculate, or the base cordate | 11 |
| 4. Inflorescence capitate, 4-10-flowered; peduncle 1-5 cm; bracteoles longer than the calyx, acuminate; sepals 0.8-1.2 cm, elliptic, acuminate, covered with long silky hairs | 11. <i>C. glomeratus</i> |
| + Inflorescence and flowers not as above | 5 |
| 5. Corolla 0.8-1 cm, blue | 19. <i>C. siculus</i> |
| + Corolla to 4 cm, white, pink, purple or yellow | 6 |
| 6. Corolla yellow | 7 |
| + Corolla white, pink or purple | 8 |
| 7. Plant glabrous; inner sepals much longer than the outer | 14. <i>C. scammonia</i> |
| + Plant appressed-hairy; sepals \pm of equal length | 15. <i>C. palaestinus</i> |
| 8. Corolla 0.8-1 cm, \pm twice as long as the calyx | 18. <i>C. fatmensis</i> |
| + Corolla 1.5-4 cm, 3-4 times as long as the calyx | 9 |
| 9. Plant generally glabrous; leaves hastate or sagittate, not lobed; calyx c. 4 mm; corolla white or with pinkish bands | 13. <i>C. arvensis</i> |
| + Plant hairy; at least some leaves distinctly lobed; calyx 0.5-1 cm; corolla purple or purplish-pink | 10 |
| 10. Upper leaves with linear, obtuse lobes; sepals 0.8-1 cm; corolla purplish-pink; capsule 6-7 mm | 16. <i>C. althaeoides</i> |
| + Upper leaves with deltoid, acute lobes; sepals 5-6 mm; corolla deep purple; capsule c. 1 cm | 17. <i>C. stachydifolius</i> |

11. Annual; corolla 0.8-1.2 cm 12
+ Perennial; corolla longer 13
12. Flowers in sessile, brown-villose heads, all along the stem;
sepals 5-7 mm, unequal; corolla blue (Gebel Elba) 12. *C. rhygiospermus*
+ Flowers solitary, crowded into terminal subcapitate inflorescences;
sepals 2-3 mm; corolla violet (Mediterranean region) 20. *C. humilis*
13. Plant dwarf, 5-15 cm; basal leaves to 7.5 cm 5. *C. lineatus*
+ Plant over 15 cm; basal leaves shorter 14
14. Flowers in terminal corymbose or paniculate inflorescences 15
+ Flowers in axillary cymes 16
15. Plant silvery appressed-silky; corolla with silky bands along the stripes
on the outer surface; capsule hairy 4. *C. oleifolius*
+ Plant green; corolla glabrous throughout; capsule glabrous 3. *C. dorycnium*
16. Stems stout, rust-coloured, densely villose 17
+ Stems slender, green, not densely villose 19
17. Leaves undulate-crenate 8. *C. schimperi*
+ Leaves entire 18
18. Cymes on peduncles 2-3.5 cm; corolla white to pale pink, glabrous 7. *C. spicatus*
+ Cymes sessile; corolla yellowish, with silky bands on
the outer surface 6. *C. secundus*
19. Flowers sessile or subsessile; corolla rose-yellow to flesh-coloured 9. *C. prostratus*
+ Flowers pedicellate; corolla pink 10. *C. pilosellifolius*

1. *Convolvulus hystrix* Vahl, Symb. Bot. 1: 16 (1790).

Syns. *Convolvulus spinosus* Forssk., Fl. Aegypt.-Arab. CVI (1775), non Burm.
(1768).

Convolvulus armatus Delile, Descr. Egypte, Hist. Nat. 189, t. 18, f. 2
(1814).

Densely villose low shrub, 40-80 cm; stems much-branched, the branches spinescent, strongly entangled; leaves 0.3-1.2 x 0.2-0.4 cm, the apex acute, the base truncate or auriculate, the margin entire and ciliate; flowers sessile, 2-6 in dense axillary clusters; bract 4-6 x 3-4 mm; bracteoles 5-7 x 3-5 mm, leafy, obovate, the tip recurved; sepals 7-9 x 6-8 mm, the 2 outer broadly obovate, the 3 inner oblong, mucronate; corolla 1-1.3 cm, blue, with hairy bands on the lower surface; stamens unequal; filaments with stalked glands on the dilated part; anthers sagittate, with a retuse apex; ovary conical, with a membranous 5-toothed disc at the base; style filiform; stigmas narrowly cylindrical or filiform; capsule c. 3 x 2.5 mm, obovoid, 1-locular, 1-seeded; seeds ovoid, glabrous, greyish-brown.

D, R, GE, S; sandy desert plains and wadis. Egypt, Sudan, Somalia, Eritrea, Arabia.

2. **Convolvulus lanatus** Vahl, Symb. Bot. 1: 16 (1790).

Syns. *Convolvulus forsskaolii* Delile, Descr. Egypte, Hist. Nat. 46, t. 18, f. 3 (1814).

Convolvulus el-arishensis Boulos, Bull. Fac. Sci. Cairo Univ. 34: 77 (1958).

Brownish densely tomentose low shrub, 20-60 cm; root woody; stems much-branched, the branches spinescent; leaves 1-3.5 x 0.2-0.5 cm, linear-lanceolate to linear, the apex acute, the base cuneate; flowers 2-6, sessile, in compact axillary cymes; bracts oblong-lanceolate, acute; bracteoles c. 1 x 0.5 cm, leafy, ovate, acute; sepals 0.7-1 x 0.2-0.5 cm, unequal, elliptic, acuminate; corolla 1.5-2 cm, white-pinkish, with hairy bands on the outer surface; stamens 0.6-1 cm, unequal; filaments glabrous; style equalling the cylindrical stigmas; capsule c. 4 x 2 mm; seeds c. 2 x 1.2 mm, ovate-elliptic.

M, D, S; sandy dunes and desert plains. Egypt, Palestine, South Turkey, Arabia.

3. **Convolvulus dorycnium** L., Syst. Nat., ed. 10, 923 (1759).

Perennial 40-80 cm, woody at the base; stems rigid, divaricately branched, shortly appressed-hairy; basal leaves 3.5-6 x 0.5-1.2 cm, spatulate or oblong-linear, sessile, the apex acute, the base decurrent; cauline leaves 1.5-4 x 0.2-0.5 cm, oblong-linear or linear-lanceolate, the apex acute, the base attenuate, appressed-pilose; flowers 1-7, axillary; bracts linear, shorter than the peduncle; bracteoles minute; pedicel 1-2.5 mm, quadrangular because of the decurrent outer sepals; sepals 3-5 mm, unequal, mucronate; corolla 1.2-2 cm, pink, with hairy bands on the outer surface; corolla-tube glabrous; anthers oblong, apex retuse; ovary ovoid, glabrous or sparingly hairy at the apex; style equalling the stigmas; capsule 5-6 x 4 mm, obovate, glabrous, 1-locular, 1-seeded; seeds 3 x 2.5 mm, subglobose, puberulous, brownish.

M; calcareous hillsides. Egypt, Libya, Tunisia, Greece, Crete, Aegean Islands, Turkey, Cyprus, Syria, Palestine.

4. **Convolvulus oleifolius** Desr. in Lam., Encycl. 3: 552 (1792).

Syns. *Convolvulus linearis* Curt., Bot. Nag., t. 289 (1795).

Convolvulus tournefortii Sieb. ex Spreng., Syst. 1: 611 (1825).

Convolvulus oleifolius Desr. var. *pauciflorus* Feinbr., Pal. J. Bot., Jerusalem ser., 2: 97 (1940).

Silvery appressed-hairy low shrub, 20-60 cm; stems much-branched, the branches herbaceous, spreading or tufted, leafy; basal leaves 2.5-6 x 0.3-0.8 cm, sessile, linear-lanceolate, the apex subacute, the base attenuate; cauline leaves 1.2-3 x 0.1-0.4 cm, apex subacute, the base cuneate; flowers in 1-5 congested axillary or terminal cymes, forming dichasial inflorescences; bracts leaf-like, exceeding the peduncle; bracteoles 0.8-1 cm, subulate, exceeding the pedicel; sepals 6-9 mm, unequal, oblong-lanceolate, tomentose, acute; corolla 1.6-2.2 cm, pink, with silky bands along the stripes on the outer surface, corolla-tube glabrous; stamens 0.6-1.1 cm, unequal, the filaments glabrous; anthers oblong-sagittate, with a retuse apex; ovary hairy; style stout, hairy; stigmas longer than the style, filiform; capsule c. 5 x 5 mm, subglobose, enclosed by the persistent calyx, 1-4-seeded; seeds 3 x 2 mm, densely hairy, brown.

M, S; calcareous ridges, maritime hillsides. Malta, Libya, Egypt, Greece, Crete, Aegean Islands, Cyprus.

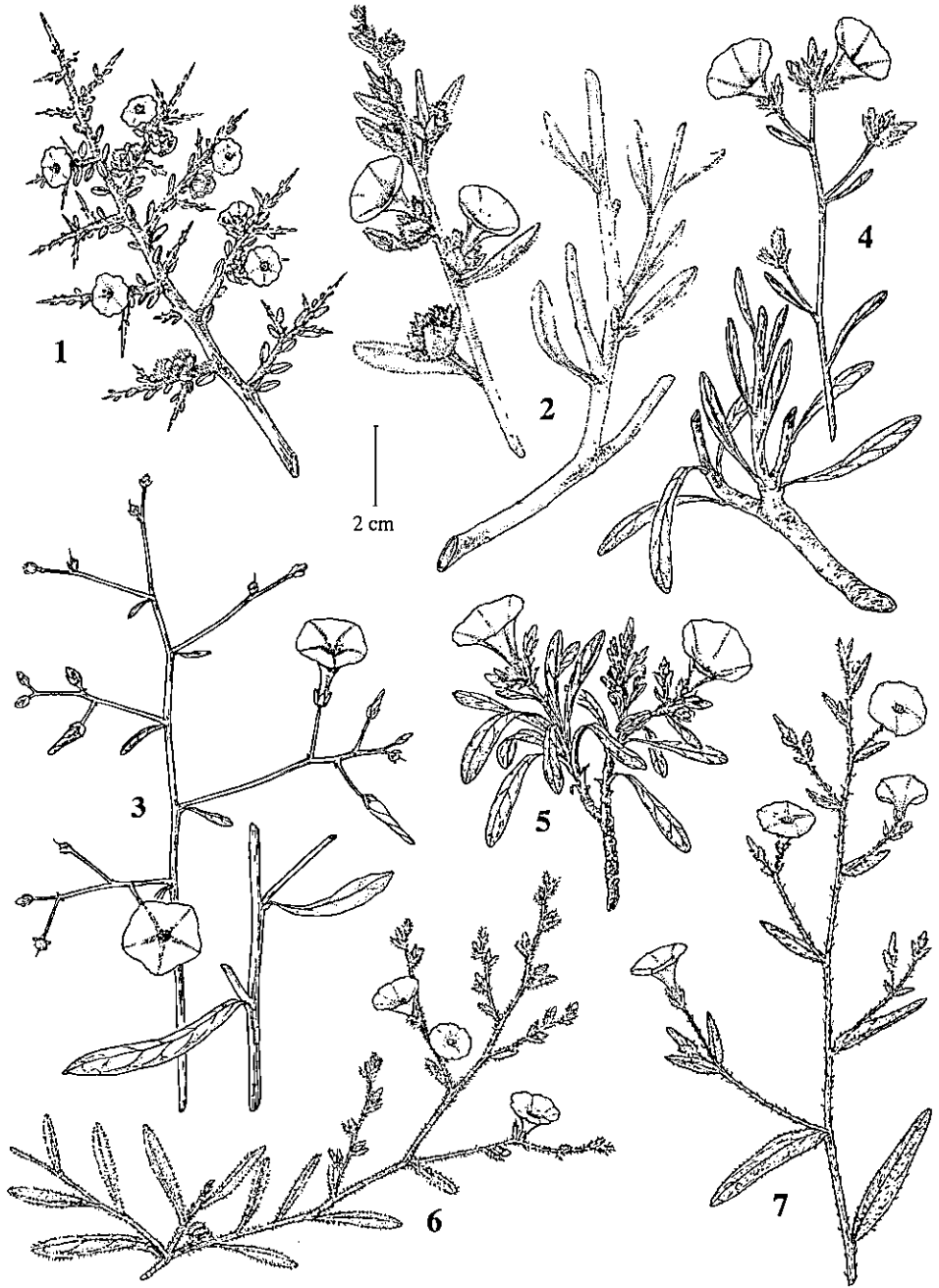


Plate 61. CONVOLVULACEAE: flowering branches of: *Convolvulus hystrix* 1. *Convolvulus lanatus* 2; basal branch (right). *Convolvulus dorycnium* 3; basal branch (right). *Convolvulus oleifolius* 4; basal branch (down left). *Convolvulus lineatus* 5, habit. *Convolvulus prostratus* 6. *Convolvulus pilosellifolius* 7. All drawings to the same scale.

5. *Convolvulus lineatus* L., Syst. Nat., ed. 10, 923 (1759).

Like *Convolvulus oleifolius*, but plant dwarf, 5-15 cm; stems spreading or decumbent, clothed at the base with the remains of old leaves; basal leaves to 7.5 x 1.5 cm; sepals c. 6 mm; corolla 2-2.5 cm; seeds c. 4 x 3 mm.

M; calcareous ridges and sandy plains. Mediterranean region, eastwards to Russia and Central Asia.

6. *Convolvulus secundus* Desr. in Lam., Encycl. 3: 553 (1792).

Densely brown-woolly perennial, 20-60 cm; stems erect or ascending, branched from the woody base, the lower part leafy, the upper floriferous; leaves sessile, the basal 2-3.5 x 0.3-1 cm, linear-lanceolate or oblong-linear, the apex retuse, the base decurrent; cauline leaves 1.5-3 x 0.5-1.2 cm, oblanceolate or narrowly elliptic, the apex acute to obtuse, the base cuneate; flowers sessile, 1-5 in compact axillary sessile cymes; peduncle shorter than the subtending bract; bracts 1-2.2 x 0.3-0.6 cm, leaf-like; bracteoles 0.8-1.2 x 0.3-0.5 cm, narrowly lanceolate; sepals 1.2-1.5 cm, unequal; corolla 2-2.8 cm, yellowish, with silky bands on the outer surface; corolla-tube glabrous; stamens unequal, the longest 6-8 mm; filaments glabrous; anthers oblong; ovary subglobose, glabrous; style and stigmas filiform, equalling each other; capsule 5 x 5 mm, globose, enclosed by the persistent calyx, 1-locular, 1-seeded; seeds 3 x 2.5 mm, glabrous, brown.

?S; maritime sands. ?Sinai, Palestine, Lebanon.

NOTE: The occurrence of *Convolvulus secundus* in Egypt has been reported by Täckholm, Stud. Fl. Egypt 429 (1974) and Boulos, Fl. Egypt Checklist 112 (1995), but has not been confirmed. I have not seen any authentically identified specimens collected from Egypt of this species; the nearest known locality to Egypt is Gaza, Palestine (Boissier, *s.n.* E, L) according to Sa'ad, *l.c.*, p. 169.

7. *Convolvulus spicatus* Hallier f., Bot. Jahrb. Syst. 18: 99 (1894).

Like *Convolvulus secundus*, but cymes on peduncles 2-3.5 cm; corolla white to pale pink, glabrous.

S; sandy desert wadis. Sinai, Palestine.

NOTE: The type was collected from Wadi Feiran, Sinai, 16-18 May 1851 by March, *s.n.* (GOET, lectotype).

8. *Convolvulus schimperi* Boiss., Diagn. Pl. Orient., ser. 1, 11: 81 (1849).

Densely brown-woolly perennial, 20-50 cm, woody at the base; stems stout, simple or branched, rust-coloured, with long patent hairs; lower leaves 2-6.5 x 0.4-0.8 cm, linear-lanceolate, the margin undulate-crenate, the apex obtuse, the base attenuate, petiolate; upper leaves 1.5-2.5 x 0.2-0.4 cm, the apex obtuse, the base cuneate, sessile; flowers 1-5 in congested axillary pedunculate cymes; bracts and bracteoles leaf-like; pedicel 0; sepals 5-7 x 2-3 mm, unequal; corolla 1.4-1.6 cm, with hairy bands on the outer surface; corolla-tube glabrous (colour unknown); stamens 4.5-7 mm, unequal; anthers oblong-sagittate; ovary glabrous; style filiform, glabrous, equalling the stigmas; capsule not seen.

S; sandy desert wadis. Sinai, Northwest Saudi Arabia.

9. **Convolvulus prostratus** Forssk., Fl. Aegypt.-Arab. 203 (1775).

Syns. *Ipomoea microphylla* Roth, Nov. Sp. 112 (1821).

Convolvulus microphyllus (Roth) Spreng., Syst. Veg. 1: 611 (1824).

Convolvulus parviflorus Spreng., Syst. Veg. 1: 611 (1824).

Convolvulus pluricaulis Choisy, Mém. Soc. Phys. Hist. Nat. Genève 6: 477 (1833).

Convolvulus deserti Hochst. & Steud., Unio Itin. no. 783 (1837).

Convolvulus austro-aegyptiacus Abdallah & Sa'ad, Act. Bot. Neerl. 15: 190 (1966).

Convolvulus cancerianus Abdallah & Sa'ad, Convolv. Sp. Canar. Isl., Medit. Reg., etc. 176 (1967).

Brown-woolly perennial, 30-80 cm, woody and much-branched from the base; stems prostrate, decumbent or ascending, terete, densely appressed-pubescent, mixed with long patent hairs; leaves 0.8-4.5(-5.5) x 0.2-0.5 cm, linear-lanceolate, sessile, the apex obtuse to acute, the base rounded or attenuate; flowers sessile or subsessile, 1-4 in axillary clusters; bracts 0.4-1.2 cm, linear, acute; peduncle 0.2-1.5(-2.5) cm; bracteoles minute, filiform; pedicel 0-2 mm; calyx 4-7 mm; corolla 0.6-1.2 cm, rose-yellow or flesh-coloured, with hairy bands on the outer surface; corolla-tube glabrous; stamens 3-4 mm; filaments glabrous; anthers sagittate, with a retuse apex; ovary glabrous; style filiform, glabrous; stigmas 2-3 times as long as the style, filiform; capsule c. 3 x 3 mm, subglobose, glabrous, enclosed by the persistent calyx, 2-locular, 4-seeded; seeds blackish, sparsely hairy.

N, O, De, GE, S; sandy and alluvial desert plains, edges of cultivation. Egypt, Sudan, Arabia.

NOTE: A polymorphic species, probably representing an aggregate of closely allied taxa which need further taxonomic investigation.

10. **Convolvulus pilosellifolius** Desr. in Lam., Encycl. 3: 551 (1792).

Syn. *Convolvulus pilosellifolius* Desr. var. *linearifolius* Sa'ad, Convolv. Sp. Canar. Isl., Medit. Reg., etc. 191 (1967).

Appressed-pubescent perennial 25-60 cm, woody and branched from the base; stems decumbent or ascending, often with a few patent white hairs; leaves 1.5-4 x 0.2-0.6 cm, linear-lanceolate to oblanceolate, sessile, the apex acute, the base rounded or cuneate; upper leaves smaller; flowers 1-5 in lax dichasial or monochasial cymes; peduncle 1-3.5 cm; bracts 1-2.5 x 0.2-0.5 cm, linear-lanceolate, leaf-like; bracteoles 3-5 x 1-2 mm, linear; pedicel 1.5-6 mm; sepals 5-7 x 1.5-2 mm, unequal, densely pilose; corolla 1.2-1.5 cm, pink, with hairy bands on the outer surface; corolla-tube glabrous; stamens 6-9 mm, unequal; filaments glabrous; anthers sagittate, hairy, the apex retuse; ovary ovoid, glabrous; style 2.5-3 mm, filiform, glabrous; stigmas 3.5-4 mm, filiform; capsule 4-5 x 3.5 mm, oblong-ovoid; seeds c. 3 x 1.5 mm, densely covered with short appressed hairs.

N, O, M, De, GE, S; sandy and alluvial desert plains, edges of cultivation. Egypt, Palestine, Syria, Turkey, Iraq, Arabia, Iran, Afghanistan.

11. **Convolvulus glomeratus** Choisy in A. DC., Prodr. 9: 401 (1845).

Syns. *Ipomoea auricoma* A. Rich., Tent. Fl. Abyss. 2: 65 (1851).

Convolvulus glomeratus Choisy var. *gymnospermus* Sa'ad, Convolv. Sp. Canar. Isl., Medit. Reg., etc. 183 (1967).

Sparsely appressed-hairy perennial, 30-60 cm; stems simple or branched, decumbent, creeping or twining, terete, green, with few patent hairs; leaves 1-3.5 x 0.4-1.8 cm, broadly lanceolate, the apex acute or acuminate, the base auriculate (upper leaves) or attenuate (lower leaves); petiole 2-5 mm; flowers 4-10 in axillary capitate clusters; peduncle 1-5 cm, hairy; bracts leaf-like, longer than the calyx; bracteoles 0.8-1.2 cm, lanceolate, acuminate; sepals 0.8-1.2 x 2-4 mm, unequal, elliptic, acuminate, covered with long silky hairs; corolla 1.2-1.5 cm, whitish-blue, with hairy bands on the outer surface; corolla-tube glabrous; stamens 7-8.5 mm, subequal; filaments with sessile glands on the dilated part; anthers oblong; ovary subglobose, glabrous; style 3 times as long as the short cylindrical stigmas; capsule c. 5 x 4 mm, broadly ovoid, 2-4-seeded, glabrous; seeds 2.5 x 2 mm, tuberculate.

De, GE, S; sandy desert plains and wadis. Egypt, Sudan, Arabia, Iran, Pakistan, Afghanistan, India.

12. ***Convolvulus rhyniospermus*** Hochst. ex Choisy in A. DC., Prodr. 9: 405 (1845).

Densely appressed-hairy annual, 10-25 cm; stems branched from the base, wiry; leaves 1-3.5 x 0.3-0.6 cm, oblong-lanceolate or elliptic, the apex acute, the base cuneate, sessile; flowers 4-6 on subsessile or short-pedunculate brown-villous heads all along the stems; bracts leaf-like; bracteoles 1.5-3 x 1-1.25 mm, ovate; sepals 5-7 x 1-1.5 mm, unequal, ovate-lanceolate, acute, densely villous; corolla 4-5.5 mm, deeply lobed, pale pink, glabrous; ovary ovoid, glabrous; style filiform, persistent; stigmas filiform, equalling the style; capsule 3.5-4 mm, subglobose, 2-4-seeded; seeds 2 x 1.5 mm, tuberculate, brown.

GE; sandy desert plains. Southeast Egypt, Sudan, Kenya, Ethiopia, Eritrea, Somalia, Mozambique, Socotra, Arabia, Iran, Afghanistan, Pakistan, India.

13. ***Convolvulus arvensis*** L., Sp. Pl., ed. 1, 153 (1753).

Syns. *Convolvulus hastatus* Forssk., Fl. Aegypt.-Arab., Cent. VIII, 203 (1775).

Convolvulus auriculatus Desr. in Lam., Encycl. 3: 540 (1792).

Convolvulus longipedicellatus Sa'ad, Convolv. Sp. Canar. Isl., Medit. Reg., etc. 233 (1967).

Twining or prostrate, generally glabrous perennial; stems 20-80 cm, branched from the base; leaves 2-5 x 0.3-2.5 cm, hastate or sagittate, not lobed, the apex acute to obtuse; petiole 0.3-2 cm; flowers axillary, 1-3 on peduncles 2-6 cm; pedicel 0.8-2 cm; bracts and bracteoles 2-3.5 mm, subulate; sepals 4-5 x 3-3.5 mm, broadly oblong, the margin scarious, the apex retuse or apiculate; corolla 1.5-2.5 cm, pink or white with pinkish bands; stamens 7-9 mm, unequal; filaments with glands on the dilated part; ovary ovoid, glabrous; style 0.8-1 cm, filiform; stigmas 3-3.5 mm; capsule 6-7 x 5-6 mm, subglobose, 4-seeded; seeds 4 x 3 mm, tuberculate, dark brown.

N, O, M, D, S; weed of cultivation, waste ground, roadsides. Widespread in temperate and tropical regions of the world except Australia.

14. ***Convolvulus scammonia*** L., Sp. Pl., ed. 1, 158 (1753).

Glabrous, trailing or twining rhizomatous perennial, 30-80 cm; stems usually simple, striate; leaves 2-5.5 x 1-2.5 cm, ovate-triangular, the apex acute or acuminate, the base hastate or sagittate; upper leaves smaller; petiole 1-3 cm; flowers 1-3(-5) in axillary



Plate 62. CONVULVULACEAE: *Convolvulus glomeratus* 1, flowering branch. *Convolvulus rhytiosternus* 2, flowering branch. *Convolvulus arvensis* 3, flowering and fruiting branch. *Convolvulus scanmonia* 4, flowering branch; fruit (right). *Convolvulus althaeoides* 5, flowering branch; fruit (down right). *Convolvulus fatmensis* 6, flowering and fruiting branch. *Convolvulus siculus* 7, flowering and fruiting branch. All drawings to the same scale, except the enlarged part (scale given).

cymes, peduncle 3-10 cm, exceeding the subtending leaf; pedicel 3-8 mm; bracts similar to the upper leaves; bracteoles 3-5 mm; sepals 0.6-1.2 cm, the inner much longer than the outer, the margin scarious, the apex obtuse; corolla 2.5-4.5 cm, pale yellow, purplish along the stripes, glabrous on the outside; stamens 1.5-1.8 cm, unequal; filaments with sessile glands on the dilated basal part; anthers oblong-sagittate, the thecae with sessile glands along the slits; ovary glabrous; style c. 8 mm, filiform; stigmas c. 3 mm; capsule 1.2 x 1 cm, broadly ovoid, glabrous, 3-4-seeded; seed obovoid, tuberculate, brown.

S; hillsides. Sinai, Palestine, Syria, Lebanon, East Aegean Islands, Turkey, Iraq.

15. ***Convolvulus palaestinus*** Boiss., Diagn. Pl. Orient., ser. 1, 11: 84 (1849).

Syns. *Convolvulus palaestinus* Boiss. var. *diversifolius* Boiss., Diagn. Pl. Orient., ser. 1, 11: 84 (1849).

Convolvulus palaestinus Boiss. var. *stenophyllus* Boiss., Diagn. Pl. Orient., ser. 2, 3: 124 (1856).

Convolvulus stenophyllus (Boiss.) Boiss., Fl. Orient. 4: 106 (1875).

Like *Convolvulus scammonia*, but plant appressed-hairy; base woody, not rhizomatous; leaves undulate-crenate or lobed; sepals \pm of equal length.

S; hillsides. Sinai, Palestine, Lebanon.

16. ***Convolvulus althaeoides*** L., Sp. Pl., ed. 1, 156 (1753).

Syns. *Convolvulus elegantissimus* Mill., Gard. Dict., ed. 8, no. 22 (1768).

Convolvulus sericeus Forssk., Fl. Aegypt.-Arab. 8: 204 (1775).

Convolvulus tenuissimus Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1: 133 (1806).

Convolvulus italicus Roem. & Schult., Syst. Veg. 4: 266 (1819).

Convolvulus althaeoides L. var. *pedatus* Choisy in DC., Prodr. 9: 409 (1845).

For full synonymy see Sa'ad, Convolv. Sp. Canary Iles, Medit. region, Near, Middle East 210-213 (1967).

Pubescent perennial 20-50 cm; stems much-branched from the base, the upper part twining, the indumentum of appressed and spreading hairs; leaves 1.5-4.5(-7) x 1-2.5 cm, cordate-ovate, crenate or lobed; petiole 1-5 cm; upper leaves smaller, with linear obtuse lobes; flowers 1-2, axillary, on peduncles exceeding the subtending leaf; pedicel 0.5-1.2 cm, densely villous; bracts 1.5-5.5 x 1-3.5 cm, leaf-like; bracteoles 0.5-1 cm, subulate; sepals 0.8-1 cm, obovate or elliptic, the margin scarious; corolla 2.5-4 cm, purplish-pink, with hairy bands on the outer surface, the tube glabrous; stamens 1.2-1.5 cm, unequal; filaments with sessile glands on the dilated part; anthers oblong; ovary conical, glabrous or sparsely hairy; style twice as long as the stigmas, glabrous; capsule 6-7 mm, subglobose, glabrous, the apex mucronate, 2-locular, 4-seeded; seeds 4-5 x 2-2.5 mm, tuberculate, brown.

M, De, S; maritime sand, rocky hillsides, roadsides, edges of cultivation, barley fields, olive groves. Macaronesia, Portugal, Mediterranean region, Sinai, Eritrea.

17. ***Convolvulus stachydifolius*** Choisy in A. DC., Prodr. 9: 408 (1845).

Like *Convolvulus althaeoides*, but the upper leaves with deltoid acute lobes; sepals 5-6 mm; corolla deep purple; capsule c. 1 cm.

Two varieties are known, of which one occurs in Egypt:

var. **stachydifolius**

Plant sparsely hairy; flowers up to 4(-7) in monochasia or dichasia.

Palestine, Syria, Turkey, Iraq, Iran (not known from Egypt).

var. **villosus** Hallier f., Bot. Jahr. Syst. Pflanzenges. Pflanzengeogr. 18:107 (1894).

Syn. *Convolvulus damascenus* Boiss. & Gaill. in Boiss., Diagn. Pl. Orient. ser. 2, 6: 122 (1859).

Plant pubescent; flowers 1-2, axillary.

M; cultivated ground, roadsides. Egypt, Palestine, Syria, Lebanon, Turkey.

NOTE: The type of var. *villosus* was collected from Egypt by Aucher-Eloy in 1893 (W, lectotype).

18. **Convolvulus fatmensis** Kunze, Flora (Regensburg) 23: 172 (1840).

Sparsely hairy annual or short-lived perennial, 15-60 cm; stems much-branched from the base, prostrate, slender, wiry; leaves 1.5-3.5 x 0.8-2 cm, oblong-ovate, dentate or shallowly and irregularly lobed, the apex acute to obtuse, the base cordate; petiole 0.5-3.5 cm, that of the upper leaves shorter; flowers 1-2(-3), axillary; peduncle 0.5-1.5 cm, much shorter than the subtending leaf; pedicel 3-5 mm, conspicuously recurved in fruit; bracts leaf-like; bracteoles 2-3 mm, filiform; sepals 4-5 x 2-3 mm, obovate, mucronate, scarious-margined; corolla 0.8-1 cm, lobed, \pm twice as long as the calyx, pale pink, hairy on the outside; stamens unequal; filaments with sessile glands on the dilated part; anthers sagittate; ovary ovoid, glabrous; style glabrous; stigmas shorter than the style; capsule 6-7 mm, subglobose, glabrous, exserted from the persistent calyx, 4-seeded; seeds c. 2 mm, broadly ovoid, rugulose, dark brown.

N, O, M, S; Moist ground, cultivated fields. Egypt, Palestine, Syria, Lebanon, Arabia, Iran.

NOTE: *Convolvulus fatmensis* is named after the type locality: Wadi Fatma, Hedjaz, western Saudi Arabia.

19. **Convolvulus siculus** L., Sp. Pl., ed. 1, 156 (1753).

Syn. *Convolvulus flexuosus* Pomel, Bull. Soc. Sci. Phys. Algérie 11: 84 (1874).

Appressed-hairy annual or perennial, 10-40 cm; stems branched from the base; leaves 2.5-6 x 0.5-2.5 cm, ovate or lanceolate, the apex acute or acuminate, the base cordate, rounded or truncate, the margin entire; petiole 0.5-1.2 cm; flowers 1-2, axillary, all along the stems; peduncle \pm equalling or shorter than the subtending leaf; pedicel 1-4 mm, bracts leaf-like; bracteoles 4-6 mm, narrowly lanceolate or subulate; sepals 5-7 x 1.5-3 mm, obovate, acute, pilose, ciliate along the margin; corolla 0.8-1 cm, distinctly lobed, with hairy bands on the outside; lobes broadly ovate, apiculate at the apex; stamens unequal; filaments with sessile glands on the dilated part; anthers sagittate; ovary subglobose, glabrous; style $\frac{1}{2}$ as long as the filiform stigmas; capsule c. 5 mm,

subglobose, glabrous, 4-seeded; seeds c. 3 x 2 mm, covered with tuberculate hairs, blackish.

According to Sa'ad (1967), *l.c.*, two subspecies and two varieties are known, all except one variety occurring in Egypt:

subsp. **siculus**

Pedicele shorter than the calyx or flowers sessile; bracteoles lanceolate to linear-lanceolate; leaves ovate.

O, M, GE; weed of cultivation, sandy plains. Macaronesia, Portugal, France, Sicily, Egypt, Palestine.

subsp. **agrestis** (Hochst. ex Schweinf.) Verdc., Kew Bull. 12: 344 (1957).

Syns. *Evolvulus agrestis* Hochst. ex Schweinf., Beitr. Fl. Aethiop. 92 (1867).

Convolvulus agrestis (Hochst. ex Schweinf.) Hall. f., Bot. Jahrb. 18: 101 (1893), non Choisy (1845), nom. illeg.

Plant robust; leaves 2-2½ times as long as broad, usually more distinctly oblong-ovate; bracteoles small; pedicel much longer than the calyx.

Two varieties of subsp. *agrestis* are known of which one occurs in Egypt:

var. **elongatus** (Willd.) Batt. in Batt. & Trab., Fl. Algérie 2: 595 (1888).

Syns. *Convolvulus elongatus* Willd., Enum. Pl. Hort. Berol. 205 (1809).

Convolvulus pseudosiculus Brouss., Elench. Hort. Bot. Monsp. 18 (1805).

Convolvulus refractus Pomel, Nouv. Mat. Fl. Atl. 1: 84 (1874).

Slender annual; leaves lanceolate.

R, GE; moist ground, sheltered crevices. North Africa extending to Sardinia, East Africa, Arabia.

20. **Convolvulus humilis** Jacq., Collectanea 4: 209, t. 32 (1791).

Syns. *Convolvulus undulatus* Cav., Icon. 3: 39 (1796).

Convolvulus evolvuloides Desf., Fl. Atlant. 1: 176, t. 49 (1798).

Appressed-hairy annual 10-25 cm; stems branched from the base, decumbent or ascending; leaves 1.5-3.5 x 0.5-1.5 cm, spatulate or linear-oblongate, the apex obtuse or rounded; lower leaves attenuate at the base, the upper sessile or clasping; flowers solitary, axillary, crowded into terminal subcapitate inflorescences; bracts leaf-like; bracteoles minute, membranous; pedicel 1-2 mm; sepals 2-3 x 1-1.25 mm, unequal, scarious, hairy; corolla 0.8-1.2 cm, the limb distinctly 5-lobed, violet, with hairy bands on the outside; corolla-tube glabrous, yellowish; stamens 2.5-4 mm, unequal; filaments with glands on the dilated parts; anthers oblong-elliptic; ovary ovoid, covered with long velutinous hairs; style equalling the cylindrical stigmas; capsule 5-6 mm, subglobose, exerted from the persistent calyx, 4-seeded; seeds c. 3 x 2 mm, tuberculate, dark brown.

M; weed of cultivation. West and Central Mediterranean region.

NOTE: I have not seen any authentic material of this species from Egypt, and it is desirable to acquire new collections in order to confirm its occurrence in the country.

2. *Calystegia* R. Br., nom. conserv.

Twining or trailing glabrous rhizomatous perennials; white latex present; leaves auriculate, entire, petiolate; flowers usually solitary, axillary, long-pedunculate bracteoles conspicuous, opposite, \pm enclosing the calyx; sepals free, \pm equal; corolla infundibuliform, glabrous or ciliate; stamens included; style 1; stigmas 2, large, clearly delimited from the style; ovary 1-locular, glabrous; capsule 4-seeded, globose, dehiscent by 4 valves. Pollen grains with smooth exine. About 25 species, cosmopolitan.

1. ***Calystegia silvatica*** (Kit.) Griseb., Spic. Fl. Rumel. 2: 47 (1844) subsp. ***silvatica***
Syns. *Convolvulus silvaticus* Kit., Neues J. Bot. 1 (1): 163 (1805).
Convolvulus sylvestris Willd., Enum. Hort. Berol. 1: 202 (1809).
Calystegia sylvestris (Willd.) Roem. & Schult., Syst. Veg. 4: 183 (1819).
Calystegia inflata G. Don in Sweet, Hort. Brit., ed. 2, 370 (1830).
Calystegia barbara Pomel, Bull. Soc. Sci. Phys. Algérie 11: 83 (1874).

Glabrous perennial; stems 1-2 m, twining; leaves 4-8 x 2.5-6 cm, cordate-sagittate, the apex acute, the sinus rounded; petiole 3-8 cm; flowers solitary; peduncle 4-12 cm; bracteoles 1.5-3.5 cm when flattened, overlapping, saccate at the base, concealing the calyx; corolla 5-8.5 cm, white; stamens 2.5- 3.5 cm; anthers 6-8 mm; ovary 1-locular; ovules 4.

M (Alexandria); gardens and orchards. Mediterranean region, Crimea, Caucasia, Iran; naturalized in West Europe and Australia.

3. *Jacquemontia* Choisy

Twining or prostrate herbs or low shrubs, hairy; leaves usually cordate; flowers in axillary pedunculate or capitate cymes, or solitary; sepals 5, equal or unequal; corolla funnel-shaped, blue, lilac or white, obscurely lobed; stamens and style included; ovary 2-locular, 4-ovulate; style 1, filiform; stigmas 2, elliptic or oblong; capsule \pm globose, 2-locular, 4-seeded. 90 species, tropical and warm regions, but especially American.

1. ***Jacquemontia tannifolia*** (L.) Griseb., Fl. Brit. W. Ind. 474 (1861).
Syns. *Ipomoea tannifolia* L., Sp. Pl., ed. 1, 162 (1753).
Convolvulus capitatus Desr. in Lam., Encycl. 3: 554 (1791).
Jacquemontia capitata (Desr.) G. Don, Gen. Syst. 4: 283 (1837).
Ipomoea capitata (Desr.) Choisy in DC., Prodr. 9: 365 (1845).
Convolvulus pycnanthus Choisy in DC., Prodr. 9: 365 (1845).

Appressed-pilose annual twiner; stems 0.5-2 m, with patent silky hairs; leaves 3-6 x 2-6 cm, ovate, the apex acute or acuminate, the base cordate; petiole 2-3.5 cm; flowers in pedunculate capitate cymes, densely brownish-hairy; peduncle 4-9 cm, pilose; bracts 1-2 x 0.8-1.2 cm, leaf-like; bracteoles smaller, lanceolate or linear; sepals 5-7.5 mm, \pm equal, lanceolate, densely hairy; corolla c. 1 cm, blue; capsule 4-5.5 mm, \pm globose; seeds 4, c. 2 mm, brownish.

GE; sandy and stony ground. Southeast Egypt, tropical Africa, Madagascar, South Africa, Namibia, Mascarene Islands, tropical America.

4. *Merremia* Dennst. ex Endl., nom. conserv.

Twining or prostrate herbs or low shrubs; leaves lobed or entire; flowers solitary or in axillary inflorescences; sepals usually \pm equal, sometimes accrescent in fruit; corolla funnel-shaped or campanulate, entire or lobed, white or yellow; stamens included; pollen smooth; ovary 2-4-locular, 4-ovulate; style 1, filiform; stigmas globose; capsule 1-4-locular, 4-valved or dehiscent irregularly. About 70 species, tropical regions.

1. Hirsute annual; leaves palmately compound; leaflets 1.2-3 cm broad 1. *M. aegyptia*
+ Glabrous perennial, with a woody rootstock and tuberous roots;
leaves palmatisect, with narrowly linear lobes 0.5-1 mm broad,
pedately arranged, not joined at the base 2. *M. semisagitta*

1. *Merremia aegyptia* (L.) Urb., Symb. Antill. 4: 505 (1910).

Syns. *Ipomoea aegyptia* L., Sp. Pl., ed. 1, 162 (1753).

Convolvulus pentaphyllus L., Sp. Pl., ed. 2, 223 (1762).

Ipomoea pentaphylla (L.) Jacq., Collect. 2: 297 (1788).

Batatas pentaphylla (L.) Choisy, Mém. Soc. Phys. Genève 6: 436 (1834).

Merremia pentaphylla (L.) Hall. f., Bot. Jahrb. Syst. 16: 552 (1893).

Hirsute twining annual; stems 0.5-1.5 m, with yellow patent trichomes 2-4 mm; leaves palmately compound; leaflets 5, 3-6 x 1.2-3 cm, unequal, broadly elliptic, entire, the apex acute, the base cuneate, sparingly appressed-hairy; flowers 2-4, in pedunculate cymes; sepals 1.8-2 x 0.8-1 cm, ovate, acute, with yellowish trichomes; corolla 2.2-3 cm, white; capsule 1.4-1.8 cm, subglobose, surrounded by the persistent calyx; seeds c. 5 x 4 mm, glabrous, brown.

GE; rocky hillsides and sandy plains. Pantropical.

2. *Merremia semisagitta* (Peter) Dandy in F. W. Andrews, Fl. Pl. Sudan 3: 125 (1956).

Syn. *Ipomoea semisagitta* Peter in Engl. & Prantl, Natürl. Pflanzenfam. IV, 3A: 31 (1891).

Glabrous perennial, with a woody rootstock and tuberous roots; stems 0.8-2 m, slender, climbing, glabrous; leaves 4-11 cm, palmatisect, with narrowly linear lobes; lobes 1-5 cm long, 0.5-1 mm broad, unequal, pedately arranged, not joined at the base; flowers 1-3, in axillary cymes; peduncle 1-1.8 cm; bracts small, ovate; sepals 0.8-1 x 0.3-0.5 cm, unequal, the 2 outer ovate and shorter than the inner lanceolate sepals; corolla 2.2-2.5 cm, white streaked with mauve; capsule 0.8-1 cm, globose, smooth; seeds c. 3 x 4 mm, clothed with fine short white hairs, brownish.

GE; sandy plains. Southeast Egypt, Sudan, Somalia, Eritrea, Saudi Arabia.

NOTE: According to Verdcourt, Kew Bull. 24: 171-177 (1970), three subspecies and three varieties of *Merremia semisagitta* are known. The Egyptian plant is subsp. *semisagitta* var. *semisagitta*. Among the specimens cited by him: Elba, Wadi Seramitai (Sarenta ?), 14 January 1928, Newberry 199 (BM).

5. *Ipomoea* L., nom. conserv.

Annuals, perennials or shrubs; stems prostrate, twining or erect; leaves simple or rarely compound, entire or lobed; flowers axillary, solitary or in few- or many-flowered cymes;

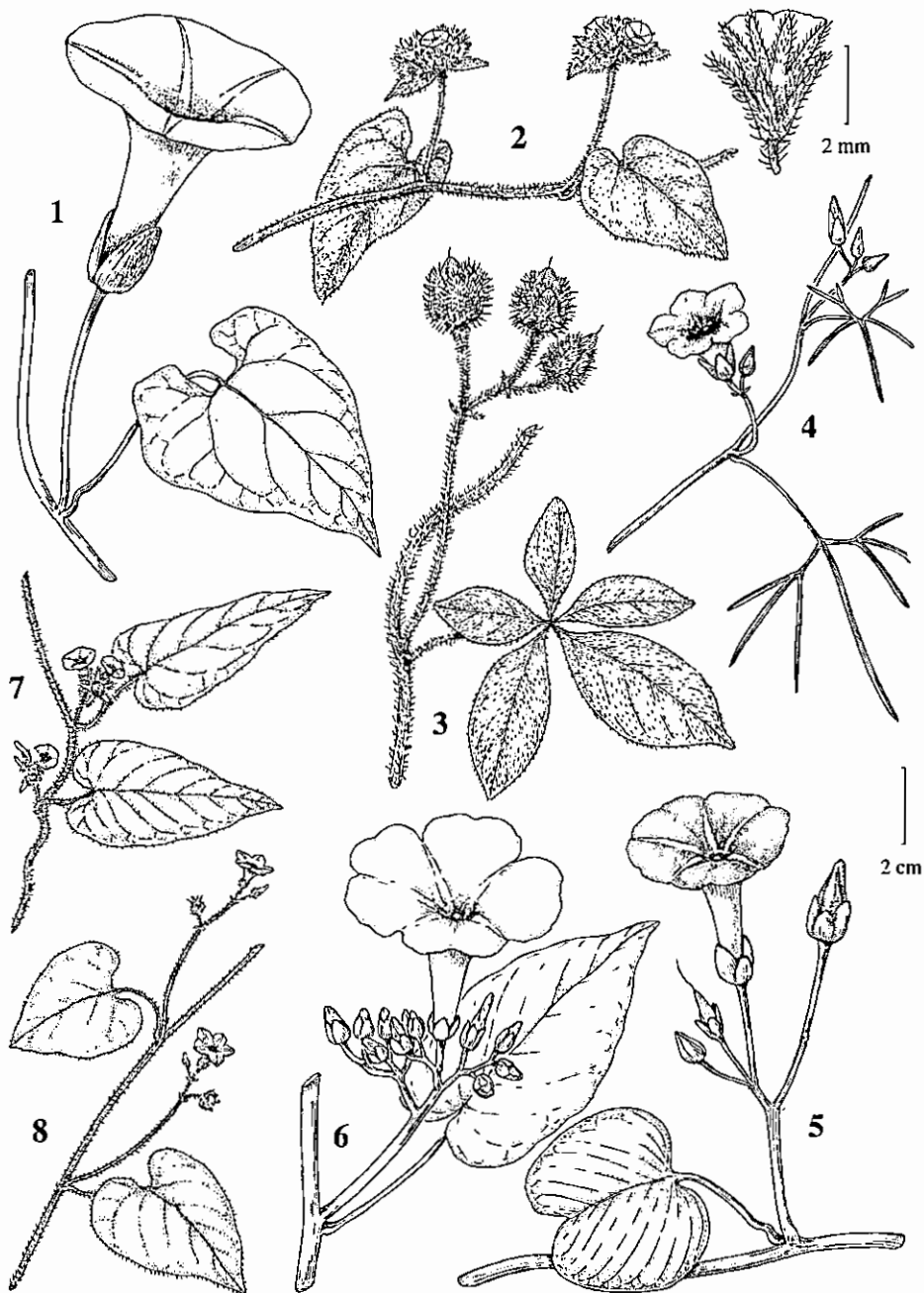


Plate 63. CONVULVULACEAE: *Calystegia silvatica* subsp. *silvatica* 1, flowering branch. *Jacquemontia tannifolia* 2, flowering branch; flower (right). *Merremia aegyptia* 3, fruiting branch. *Merremia semisagitta* 4, flowering branch. *Ipomoea pes-caprae* 5, flowering branch. *Ipomoea carnea* 6, flowering branch. *Ipomoea eriocarpa* 7, flowering branch. *Ipomoea sinensis* subsp. *blepharosepala* 8, flowering branch. All drawings to the same scale, except the enlarged part (scale given).

sepals often unequal, foliaceous or ± coriaceous; corolla regular, funnel-shaped, rarely trumpet-shaped, variously coloured, the limb usually not conspicuously lobed; pollen spinose or spinulose; ovary 2-4(-5)-locular, usually 4-ovulate; style filiform; stigmas globose; capsule usually 3-valved, ovoid or globose; seeds usually 4, glabrous, pubescent or clothed with long hairs. About 650 species, tropical and warm temperate regions.

- | | |
|--|--------------------------|
| 1. Shrub 1.5-3.5 m; stems 1-2 cm diam., erect or spreading | 3. I. carnea |
| + Herbaceous annual or perennial; stems 1-4 mm diam., twining, climbing or trailing | 2 |
| 2. Leaf-blade palmately divided almost to base, 5-7-lobed | 7. I. cairica |
| + Leaf-blade undivided or shallowly 3-lobed | 3 |
| 3. Plant glabrous; stems creeping, often rooting at the nodes (sandy and saline littoral zones) | 4 |
| + Plant hairy; stems twining, climbing or trailing, not rooting at the nodes (cultivated and waste land) | 5 |
| 4. Leaf-blade 2.5-4.5 x 3.5-6 cm, broader than long; flowers 2-5, in pedunculate cymes; corolla pink or red-purple, with a darker centre | 1. I. pes-caprae |
| + Leaf-blade 1.5-2 x 0.6-1 cm, longer than broad; flowers solitary; corolla yellowish-white | 2. I. stolonifera |
| 5. Corolla 4-5 cm | 9. I. purpurea |
| + Corolla 1-3 cm | 6 |
| 6. Sepals 1.8-2.5 cm, the basal part densely covered with long patent yellow hairs to 4 mm | 8. I. hederacea |
| + Sepals 0.5-1 cm, glabrous, thinly pilose, or pilose only along the margin | 7 |
| 7. Capsule pilose | 4. I. eriocarpa |
| + Capsule glabrous | 8 |
| 8. Sepals distinctly cordate at the base, accrescent in fruit; corolla pink with dark centre | 5. I. sinensis |
| + Sepals broadly ovate, not accrescent in fruit; corolla pale yellow | 6. I. obscura |

1. **Ipomoea pes-caprae** (L.) R. Br. in Tuckey, Narr. Exped. Zaïre 477 (1816).
 Syns. *Convolvulus pes-caprae* L., Sp. Pl., ed. 1, 159 (1753).
Ipomoea biloba Forssk., Fl. Aegypt.-Arab. 44 (1775).

Glabrous perennial; stems 1-5 m or more, hollow, creeping; leaf-blade 2.5-4.5 x 3.5-6 cm, broader than long, oblong-quadrangular to suborbicular, the apex notched, the base rounded; petiole 3-8 cm, with 2 glands at the apex; flowers 2-5 in axillary pedunculate cymes, usually exceeding the leaves; peduncle 3-6 cm; pedicel 1.5-3.5 cm; sepals 0.5-1 x 0.4-0.6 cm, ovate, obtuse; corolla 4-5 cm, funnel-shaped, pink or reddish-purple, with a darker centre; capsule 1.2-1.5 cm, globose, glabrous; seeds 5-8 mm, brownish, tomentose.

Two subspecies are known, of which one occurs in Egypt:

subsp. **pes-caprae**

Leaves deeply bilobed. Not known from Egypt.

subsp. **brasiliensis** (L.) Ooststr., Blumea 3: 533 (1940).

Syns. *Convolvulus brasiliensis* L., Sp. Pl. 159 (1753).

Ipomoea maritima R. Br., Prodr. 486 (1810).

Convolvulus bilobatus Roxb., Fl. Ind., ed. Carey & Wall. 2: 73 (1824).

Convolvulus rotundifolius Schumach. & Thonn., Beskr. Guin. Pl. 102 (1827).

Ipomoea pes-caprae (L.) Sweet var. *emarginata* Hall. f., Bull. Soc. Roy. Bot. Belge 37: 98 (1898).

For full synonymy see Verdcourt in Hubbard & Milne-Redhead (eds.), Convolvulaceae, Fl. Trop. E. Afr. 121-122 (1963).

Leaf-blade oblong-quadrangular to suborbicular, the apex notched, not deeply bilobed.

De (Suez Canal), S; sandy seashores, saline maritime soils. Pantropical.

2. ***Ipomoea stolonifera*** (Cyr.) J. F. Gmel. in L., Syst. Nat., ed. 13, 2 (1): 345 (1791).

Basionym. *Convolvulus stolonifer* Cyr., Pl. Rar. Regn. Neap., fasc. prim. 14, t. 5 (1788).

Syns. *Convolvulus littoralis* L., Syst. Nat., ed. 10, 924 (1759).

Convolvulus imperati Vahl, Symb. Bot. 1: 17 (1790).

Ipomoea imperati (Vahl) Griseb., Cat. Pl. Cub. 203 (1866).

Ipomoea littoralis (L.) Boiss., Fl. Orient. 4: 112 (1875), non *Ipomoea littoralis* Blume, Bijdr. 713 (1826), nom. illeg.

Glabrous perennial; stems 1-3 m or more, trailing; leaf-blade 1.5-2 x 0.6-1 cm, broadly oblong, the apex notched; flowers solitary, axillary; peduncle 1.5-3 cm; sepals 1-1.2 x 0.4-0.6 cm, oblong, obtuse, mucronate, glabrous; corolla 1.8-2.2 cm, funnel-shaped, yellowish-white; capsule 1.2-1.4 cm, globose, glabrous, enclosed by the persistent calyx-lobes; seeds c. 6.5 x 5.5 mm, broadly ovoid, clothed with brownish hairs.

M, S; sandy littoral zone. South Italy, West Crete, North Africa, Palestine, Syria, Cyprus, Turkey; naturalized in many tropical and subtropical coastal regions.

3. ***Ipomoea carnea*** Jacq., Enum. Pl. Carib. 13 (1760).

Shrub 1.5-3.5 m; stems 1-2 cm diam., erect or spreading; leaf-blade 5-12 x 4-7 cm, ovate-lanceolate, the apex acute, the base shallowly cordate; flowers in dichasial cymes; sepals 4-5 x 3.5-4 mm, broadly ovate, coriaceous, puberulent, the margin narrowly scarious; corolla 5.5-7.5 cm, pink or deep pink to purplish; capsule 2-2.2 cm, subglobose to broadly ovoid; seeds clothed with brownish hairs.

N; canal banks, moist waste ground. Native to tropical South America, sometimes cultivated as an ornamental, naturalized in many warm regions of the world.

4. ***Ipomoea eriocarpa*** R. Br., Prodr. 484 (1810).

Syns. *Convolvulus hispidus* Vahl, Symb. Bot. 3: 29 (1794).

Ipomoea hispida (Vahl) Roem. & Schult. Syst. 4: 238 (1819), non Zucc. (1806), nom. illeg.

Ipomoea sessiliflora Roth, Nov. Pl. Sp. 116 (1821).

Ipomoea trematosperma Choisy in DC., Prodr. 9: 367 (1845).

Pubescent hispid annual; stems 0.5-1.5 m, twining, covered with short appressed and long patent hairs; leaf-blade 3-6.5 x 1-3.5 cm, ovate-cordate to lanceolate, the apex acute, the base cordate, sparsely hairy along the veins and margin; petiole 1-3.5 cm; flowers 2-6 in axillary, short-pedunculate cymes; peduncle 0.2-1 cm; pedicel 3-5 mm; sepals 3-3.5 x 2.5-3 mm, broadly ovate, acute, thinly pilose; corolla 7-9 mm, mauve to whitish-pink; capsule 5-6 mm, subglobose, pilose; seeds 2-2.5 mm, glabrous, black.

N; weed of cultivation. Egypt, Madagascar, tropical Africa and Asia, North Australia.

5. *Ipomoea sinensis* (Desr.) Choisy, Mém. Soc. Phys. Genève 6: 439 (1833)

subsp. *blepharosepala* (A. Rich.) Meeuse, Bothalia 6: 729 (1958).

Syns. *Ipomoea blepharosepala* A. Rich., Tent. Fl. Abyss. 2: 72 (1851).

Ipomoea cardiosepala Baker & C. H. Wright, Fl. Cap. 4 (2): 61 (1904),
pro parte, non Meisn. (1869).

Pilose annual; stems 0.5-2 m, prostrate or twining; leaf-blade 2-5 x 1.5-3 cm, ovate, the apex acute, the base broadly cordate, the margin pilose; petiole 1.5-4 cm, pilose; flowers 1-3 in axillary pedunculate cymes; peduncle 3-5 cm, hairy; pedicel 0.8-1.5 cm; bracts minute; sepals in flower with the basal part 2-3 x 2-2.5 mm, distinctly cordate, the apical part 3-4 x 0.5-1 mm, the margin pilose, narrowly acuminate; fruiting sepals with basal part *c.* 7 x 4 mm, accrescent, the apical part 2-3 x 1-1.5 mm; corolla 1.1-1.3 cm, pink with a dark centre; capsule 0.8-1 cm, globose, glabrous; style-base persistent, indurate; seeds *c.* 2.5 mm, pubescent.

De, GE; stony moist soils. Southeast Egypt, Sudan, tropical East Africa, Ethiopia, Eritrea, Somalia, Angola, Namibia, Socotra, Arabia.

6. *Ipomoea obscura* (L.) Ker Gawl., Bot. Reg. 3, t. 239 (1817).

Syns. *Convolvulus obscurus* L., Sp. Pl., ed. 2, 220 (1762).

Ipomoea luteola R. Br., Prodr. 485 (1810).

Ipomoea fragilis Choisy in DC. Prodr. 9: 372 (1845).

Ipomoea acutiflora A. Rich., Tent. Fl. Abyss. 2: 71 (1851).

Glabrescent perennial; stems 0.5-1.2 m, prostrate or twining; leaf-blade 2.5-6 x 0.8-4.5 cm, ovate, the apex apiculate, the base cordate; petiole 1-3.5 cm; flowers 1-5, in axillary pedunculate cymes; peduncle 3-4 cm; pedicel 1.5-3.5 cm; sepals 5-8 x 2.5-4 mm, broadly ovate, the apex acute; corolla 1.5-2.2 cm, pale yellow; capsule 1-1.2 cm, ovate-globose, glabrous; style-base persistent; seeds 4-5 x 3-3.5 mm, ovoid, black, appressed-hairy.

GE; hillsides. Southeast Egypt, throughout tropical Africa and Asia, Madagascar, Mascarene, Seychelles, China, Taiwan, Fiji, Australia (Queensland).

7. *Ipomoea cairica* (L.) Sweet, Hort. Brit. 287 (1827).

Syns. *Convolvulus cairicus* L., Syst. Nat., ed. 10, 922 (1759).

Ipomoea palmata Forssk., Fl. Aegypt.-Arab. 43 (1775).

Convolvulus tuberculatus Desr. in Lam., Encycl. 3: 545 (1791).

Ipomoea senegalensis Lam., Illustr. 1: 464 (1793).

Ipomoea vesiculosa P. Beauv., Fl. Owar. 2: 73, t. 106 (1819).

Ipomoea tuberculata (Desr.) Roem. & Schult., Syst. 4: 208 (1819).



Plate 64. CONVOLVULACEAE: *Ipomoea obscura* 1, flowering branch. *Ipomoea cairica* 2, flowering branch. *Ipomoea hederacea* 3, flowering and fruiting branch. *Ipomoea purpurea* 4, flowering branch. *Ipomoea stolonifera* 5, flowering branch; fruit (right). *Evolvulus alsinoides* 6, flowering branch. *Evolvulus nummularis* 7, flowering branch. *Seddera latifolia* 8, flowering and fruiting branch. *Seddera arabica* 9, flowering and fruiting branch. All drawings to the same scale, except the enlarged part (scale given).

Glabrescent perennial; rootstock tuberous; stems 1-2.5 m, twining or trailing, villous at the nodes; leaf-blade 3-6 x 3.5-7 cm, palmately divided almost to base, 5-7-lobed; lobes 1.5-5 x 0.5-1.8 cm, elliptic, the apex acute and mucronate, the outer lobes often 2-fid; petiole 1.5-5 cm; flowers 1-9 in lax axillary cymes; peduncle 1-6 cm; pedicel 1-2.5 cm; sepals 4-5.5 x 2.5-4 mm, broadly ovate, glabrous, the apex mucronate, the margin scarious; corolla 4.5-6 cm, funnel-shaped, purple; capsule 1-1.2 cm, subglobose, glabrous; seeds 4-5 mm, broadly ovoid, densely covered with short hairs, the edges with long silky hairs.

N, M, D; canal banks, edges of cultivation. East Mediterranean region, throughout Asia and tropical Africa; cultivated and naturalized in many warm temperate and tropical regions.

NOTE: The plant is also widely cultivated in Egypt especially in the countryside; its thick growth provides shade for the cottages between fields and along irrigation canals.

8. *Ipomoea hederacea* Jacq., Icon. Pl. Rar. 1, t. 36 (1786).

Pubescent annual; stems 0.5-1.2 m, twining, climbing or trailing; leaves 3-10 x 2-8 cm, cordate-ovate, entire or 3-lobed, the apex acuminate or acute, the base cordate; flowers 1-3 in axillary cymes; peduncle 0.3-1.5 cm; pedicel 2-5 mm; sepals 1.8-2.5 cm, elongate-lanceolate, the basal part densely covered with long patent yellow hairs to 4 mm, recurved after anthesis; corolla 2-3 cm, bluish to purplish; capsule 1-1.2 cm, globose, glabrous, partly enclosed by the persistent calyx; seeds c. 4 x 3 mm, brown, sparsely covered with very short white hairs.

N; weed of summer crops, especially maize fields. Native to U.S.A.; widely introduced and naturalized in warm regions of the world.

9. *Ipomoea purpurea* (L.) Roth, Bot. Abh. 27 (1787).

Syn. *Convolvulus purpureus* L., Sp. Pl., ed. 2, 219 (1762).

Pubescent annual; stems 0.5-1.5 m, twining or trailing; leaf-blade 4-10 x 4-9 cm, broadly ovate-cordate, entire (3-lobed specimens known from other countries), the apex acuminate, the base cordate; petiole 5-11 cm; flowers 1-4 in axillary long-pedunculate cymes; peduncle to 18 cm; pedicel 1.5-2.5 cm; peduncles and pedicels accrescent in fruit; calyx 1.2-1.5 x 0.3-0.4 cm, broadly lanceolate, the apex acute, hairy at the base, the margin scarious; corolla 4-5 cm, funnel-shaped, purple; corolla-tube white towards the base; capsule c. 1 cm, crowned by the persistent basal part of the style, partly enclosed by the accrescent persistent calyx, glabrous; seeds c. 4 x 3.5 mm, finely tuberculate, black.

N (Faiyum); orchards, cultivated ground. Egypt, tropical Africa, Pakistan. Native to tropical America, widely naturalized in many tropical regions.

NOTE: I have seen only 2 specimens from Egypt, both collected by Monier Abd El-Ghani from Faiyum in 1982 (K!). The species is probably more widespread in the Nile valley.

6. *Evolvulus* L.

Annuals, perennials or low shrubs; leaves simple, usually small, entire; flowers small, in axillary cymes or spike-like inflorescences; sepals free, subequal, not accrescent; corolla

funnel-shaped, campanulate or rotate, the limb entire or lobed; ovary ovoid or globose, 1-2-locular; ovules 1-4; styles 2, filiform, free or united at the base, each 2-fid; stigmas filiform or \pm clavate; capsule globose or ovoid, 1-4-seeded. 98 species, warm and tropical America, few Old World.

1. Leaf-blade elliptic or oblong-linear; corolla shallowly lobed, blue, rarely white; capsule 2-locular, 4-valved 1. *E. alsinoides*
+ Leaf-blade \pm orbicular; corolla deeply lobed, white; capsule 1-locular, 2-valved 2. *E. nummularius*

1. *Evolvulus alsinoides* (L.) L., Sp. Pl., ed. 2, 392 (1762).

Syns. *Convolvulus linifolius* L., Amoen. Acad. 4: 306 (1759).

Evolvulus linifolius (L.) L., Sp. Pl., ed. 2, 392 (1762).

Evolvulus azureus Schumach. & Thonn., Beskr. Guin. Pl. 166 (1827).

Evolvulus fugacissimus A. Rich., Tent. Fl. Abyss. 2: 75 (1851).

Variable annual, or perennial with woody base, 10-30 cm, densely covered with patent silky hairs; stems trailing, prostrate or ascending; leaf-blade 0.5-2.5 x 0.2-0.8 cm, elliptic or oblong-linear, subsessile or short-petiolate, the apex acute or obtuse and mucronate; the base \pm rounded; petiole 0-2.5 mm; flowers 1-4, in axillary pedunculate cymes; peduncle 0.5-3 cm; bracts 2-4 x 0.5 mm; sepals 2-3 x 1 mm, ovate-lanceolate, acute; corolla 5-6 mm, funnel-shaped, shallowly lobed, blue, rarely white; capsule c. 3 mm, \pm globose, 2-locular, 4-valved, 4-seeded, glabrous; seeds c. 1.5 mm, ovoid, blackish-brown.

GE; sandy plains. Tropical and subtropical regions of the world.

2. *Evolvulus nummularius* (L.) L., Sp. Pl., ed. 2, 391 (1762).

Syns. *Convolvulus nummularius* L., Sp., Pl., ed. 1, 157 (1753).

Evolvulus dichondroides Oliv., Trans. Linn. Soc., Bot. 29: 117, t. 786 (1875).

Volvuopsis nummularius (L.) Roberty, Candollea 14: 28 (1952).

Perennial; stems 10-30 cm, prostrate, rooting at the nodes; leaf-blade 0.5-1.2 cm, \pm orbicular, the apex retuse, the base rounded or slightly cordate; petiole 2-5 mm; flowers axillary, usually solitary, rarely 2; peduncle 1-2 mm; sepals c. 2 x 1 mm, ovate-elliptic, acute; corolla c. 4 mm, subrotate, deeply lobed, white, the lobes c. 1.5 x 1 mm, obovate; capsule c. 3 mm, globose, 1-locular, 2-valved, 4-seeded, glabrous; seeds c. 1.5 mm, subglobose, brownish-black.

GE; stony ground, hillsides. Southeast Egypt, Sudan, Ethiopia, tropical East Africa to Zimbabwe, Angola, Ivory Coast, tropical America.

7. *Seddera* Hochst.

Herbs or low shrubs; stems erect or prostrate, intricately branched, sometimes spinescent; leaves small, variable, usually with medifixed hairs; flowers 5-merous, axillary or in terminal spikes, or dense few-flowered cymes; sepals subequal; corolla small, funnel-shaped, the lobes usually short; ovary 2-locular, 4-ovulate; style 2-fid, usually to base; stigmas \pm peltate, sometimes 2-lobed; capsule 4-valved. 15 species, tropical and warm Africa, Madagascar, Arabia, Pakistan.

1. Stems and leaves densely covered with appressed silvery-grey hairs; flowers solitary, subsessile in the leaf-axils; capsule 2-3 mm, ovoid 1. **S. latifolia**
 + Stems and leaves green, pubescent with spreading hairs; flowers in 1-flowered pedunculate cymes; peduncle 0.5-2 cm; capsule c. 4 mm, globose to broadly ovoid 2. **S. arabica**

1. **Seddera latifolia** Hochst. & Steud., Flora 27: Bes. Beil 8, t. 5 (1844) var. **latifolia**

Low shrub 20-30 cm, densely covered with appressed silvery-grey hairs; old stems woody, the young herbaceous, terete, spreading; leaves 0.5-1.5 x 0.2-0.5 cm, elliptic, the apex and base rounded; petiole 1-2 mm; flowers solitary, subsessile in the leaf-axils; bracts minute; sepals c. 4 x 1.5 mm, unequal, ovate, acute or short-acuminate, densely appressed silvery-pubescent; corolla 4-5 mm, white; ovary obovoid, hirsute at the apex; capsule c. 2.5 x 2 mm, ovoid; seeds c. 1.5 mm, ovoid, glabrous, blackish.

De, GE, S; rocky wadis and hillsides. Egypt, Sudan, Ethiopia, Eritrea, Kenya, Tanzania, Somalia, Socotra, Arabia, Pakistan, India.

NOTE: According to Verdcourt in Hubbard & Milne-Redhead (eds), two varieties are known: var. *latifolia* and var. *argentea* (Terracc.) Capua, Ann. Ist. Bot. Roma 8: 221 (1903). The latter variety is restricted to Ethiopia and Eritrea.

2. **Seddera arabica** (Forssk.) Choisy in A. DC., Prodr. 9: 441 (1845).

Syns. *Cressa arabica* Forssk., Fl. Aegypt.-Arab. 54 (1775).

Breweria oxycarpa A. Rich., Tent. Fl. Abyss. 2: 76 (1851).

Low shrub 20-35 cm, pubescent with spreading hairs; old stems woody; the young herbaceous, green; leaves 0.5-1.5 x 0.3-0.8 cm, elliptic, the apex obtuse and mucronate, the base rounded; petiole 1-2 mm; flowers in 1-flowered pedunculate cymes; peduncle 0.5-2 cm; sepals 3-4 x 1.5-2 mm, ovate to elliptic, the apex acute, the base coriaceous, pubescent; corolla 5-6 mm, white; capsule c. 4 mm, globose to broadly ovoid, glabrous; seeds c. 2 mm, ovoid, black.

GE; stony hillsides. Southeast Egypt, Sudan, Ethiopia, Eritrea, Somalia, Uganda, Arabia.

8. **Cressa** L.

Perennial herb; leaves small, sessile, entire; flowers small, subsessile, in bracteate clusters at the tips of the branches; sepals subequal, imbricate; corolla campanulate, 5-lobed; stamens and styles exserted; filaments filiform; ovary 2-locular, 4-ovulate; styles 2, distinct to base; stigmas capitate; capsule 2-4-valved, 1(-2)-seeded; seeds glabrous, brown. 1 species, tropical and warm regions.

1. **Cressa cretica** L., Sp. Pl., ed. 1, 223 (1753).

Short-lived perennial, 10-30 cm, greyish appressed-hairy, with patent hairs; stems much-branched from a ± shrubby base, ascending or prostrate; leaves 2-8 x 1-3.5 mm, ovate-lanceolate, sessile, the apex acute, the base rounded to cuneate; calyx 3-3.5 x 1.5 mm, broadly elliptic, acute, pubescent; corolla 4-5 mm, white, pilose, the lobes ± as long as the tube; stamens and styles exserted for 2-3 mm; capsule c. 3 x 2 mm, ovoid; seeds c. 2.5 x 1 mm, ovoid, brown, glabrous.

N, O, M, D, R, GE, S; edges of coastal and inland salt marshes, alluvial moist salty soils, edges of cultivated moist ground. Distribution as for the genus.

9. *Dichondra* J. R. Forst. & G. Forst.

Perennial herbs; stems prostrate; leaves cordate-orbicular or reniform, entire, petiolate; flowers inconspicuous, solitary, axillary, pedicellate; sepals connate at the base; corolla shorter than the calyx, campanulate, deeply lobed, the lobes imbricate, spreading; stamens and styles exerted; filaments filiform; ovary deeply 2-lobed, 4-ovulate; styles 2, gynobasic; stigmas capitate; capsule 2-lobed, usually 1-seeded. 9 species, tropical and warm regions.

1. *Dichondra micrantha* Urb., Symb. Antill. 9: 243 (1924).

Syn. *Dichondra repens*, sensu Täckholm, Stud. Fl. Egypt, ed. 2, 435 (1974).

Perennial herb; stems 10-30 cm, slender, prostrate, rooting at the nodes; leaf-blade 0.5-1.5 x 0.6-1.8 cm, reniform; petiole 0.5-3 cm; flowers solitary, minute, axillary; calyx c. 2.5 mm; corolla c. 2 mm, whitish, deeply 5-lobed; capsule c. 2 mm, 2-lobed; seeds c. 1 mm, globose, brown.

N (Cairo); on lawns. Native to East Asia; naturalized in many temperate and warm regions.

10. *Cuscuta* L.

Annual twining parasites with haustoria, rarely perennial in host-tissues, free-living after germination until attachment to the host is attained; leaves reduced to scales; plant ± devoid of chlorophyll; flowers sessile or short-pedicellate, in cymose clusters; sepals 4-5, connate at the base; corolla-lobes 4-5, united at the base into a tube; stamens 4-5, inserted at the throat, usually with a whorl of fringed scales opposite to and below the stamens; ovary 2-locular, 4-ovulate; styles 2, free or united; stigmas capitate or linear; capsule dehiscent round the base or indehiscent; seeds ± globose, granular. About 145 species, cosmopolitan.

- | | | |
|--|--------------------------|---|
| 1. Style 1 | 1. <i>C. monogyna</i> | 2 |
| + Styles 2 | | |
| 2. Stigmas capitate | | 3 |
| + Stigmas elongate | | 4 |
| 3. Perianth forming a basal cup; infrastaminal scales extending beyond sinuses of the corolla; capsule exposed | 3. <i>C. campestris</i> | |
| + Perianth not forming a basal cup; infrastaminal scales included; capsule enclosed within the persistent perianth | 2. <i>C. chinensis</i> | |
| 4. Corolla lobes 4, rarely 3 or 5 | | 5 |
| + Corolla lobes 5, rarely 4 | | 6 |
| 5. Flowers 2-3 mm, distinctly pedicellate, umbellate | 4. <i>C. pedicellata</i> | |
| + Flowers 1.5-2 mm, sessile or subsessile, in compact globose glomerules | 5. <i>C. palaestina</i> | |

6. Calyx 1.5-2 mm, fleshy
+ Calyx 2.5-3 mm, membranous

7. **C. planiflora**
7

7. Calyx-lobes not overlapping at the base, acute;
corolla urceolate; infrastaminal scales 2-fid, not reaching
the stamens (on cultivated flax)
+ Calyx-lobes overlapping at the base, with rounded
sides and apical, short obtuse fleshy appendage;
corolla campanulate; infrastaminal scales not 2-fid,
reaching the stamens (on various hosts)

6. **C. epilinum**

8. **C. approximata**

1. **Cuscuta monogyna** Vahl, Symb. Bot. 2: 32 (1791).

Syn. *Monogynella monogyna* (Vahl) Hadač & Chrtek, Folia Geobot. Phytotax.
Bohem. 5: 444 (1970).

Stems rather thick, making a few spirals around the host stem; flowers 5-merous, 3-4.5 mm, in spicate cymes, sessile or short-pedicellate; bracts leaf-like; calyx 2-2.5 x 1 mm, campanulate, the lobes overlapping, orbicular-ovate, the margin scarious, the apex obtuse; corolla 3-4 mm, the tube 2-3 mm; lobes 1-1.5 mm, ovate, the margin crenulate, the apex obtuse; stamens included; infrastaminal scales dentate; ovary 1.5-2 mm, globose-conical; style short; stigmas 2, \pm as long as the style, globose; capsule 5.5-6.5 x 4.5-5.5 mm, conical, circumscissile near the base, bearing the withered corolla at the apex; seeds c. 3 mm, papillate.

N, usually on *Citrus*, also other trees and shrubs. South Europe, Mediterranean region, West and Central Asia.

2. **Cuscuta chinensis** Lam., Encycl. 2: 229 (1786).

Stems slender, pale yellow, glabrous, smooth; flowers in dense clusters; pedicel \pm as long as the calyx; bracts narrowly triangular, scarious, entire; calyx slightly shorter than the corolla, the lobes 2-2.5 mm, deltoid-ovate; corolla \pm globose, the lobes \pm as long as the tube, ovate to oblong-ovate, spreading; stamens c. 1.25 mm; filaments flattened; anthers reaching the base of the filaments; ovary \pm globose; styles 2, slightly longer than the ovary; stigmas capitate; capsule c. 3 mm, subglobose, dehiscent at the base by a transverse suture, the withered corolla and styles persistent; seeds c. 1.25 mm, brownish.

GE; on *Vigna*, *Bidens* and other herbaceous plants. Southeast Egypt, Sudan, Ethiopia Arabia, Socotra, Afghanistan, Pakistan, China, Sri Lanka, Australia.

3. **Cuscuta campestris** Yunck., Mem. Torrey Bot. Club 18: 138 (1932).

Syn. *Grammica campestris* (Yunck.) Hadač & Chrtek, Folia Geobot. Phytotax.
Bohem. 5: 445 (1970).

Stems of medium thickness, branched; flowers c. 2.5 mm, 5-merous, in compact clusters; pedicel 1.5-2.5 mm; calyx-lobes 1-1.5 x 1.5 mm, broadly ovate to orbicular, fleshy; corolla-lobes 1-1.5 x 0.8-1.2 mm, \pm as long as the tube, deltoid; perianth forming a basal cup; stamens exerted; infrastaminal scales extending beyond sinuses of the corolla, fimbriate; styles 2, 1-1.2 mm, slender; stigmas capitate; ovary 1-1.2 mm, globose; capsule c. 2.5 mm, exposed; seeds 1-1.5 mm, ovoid, brownish.

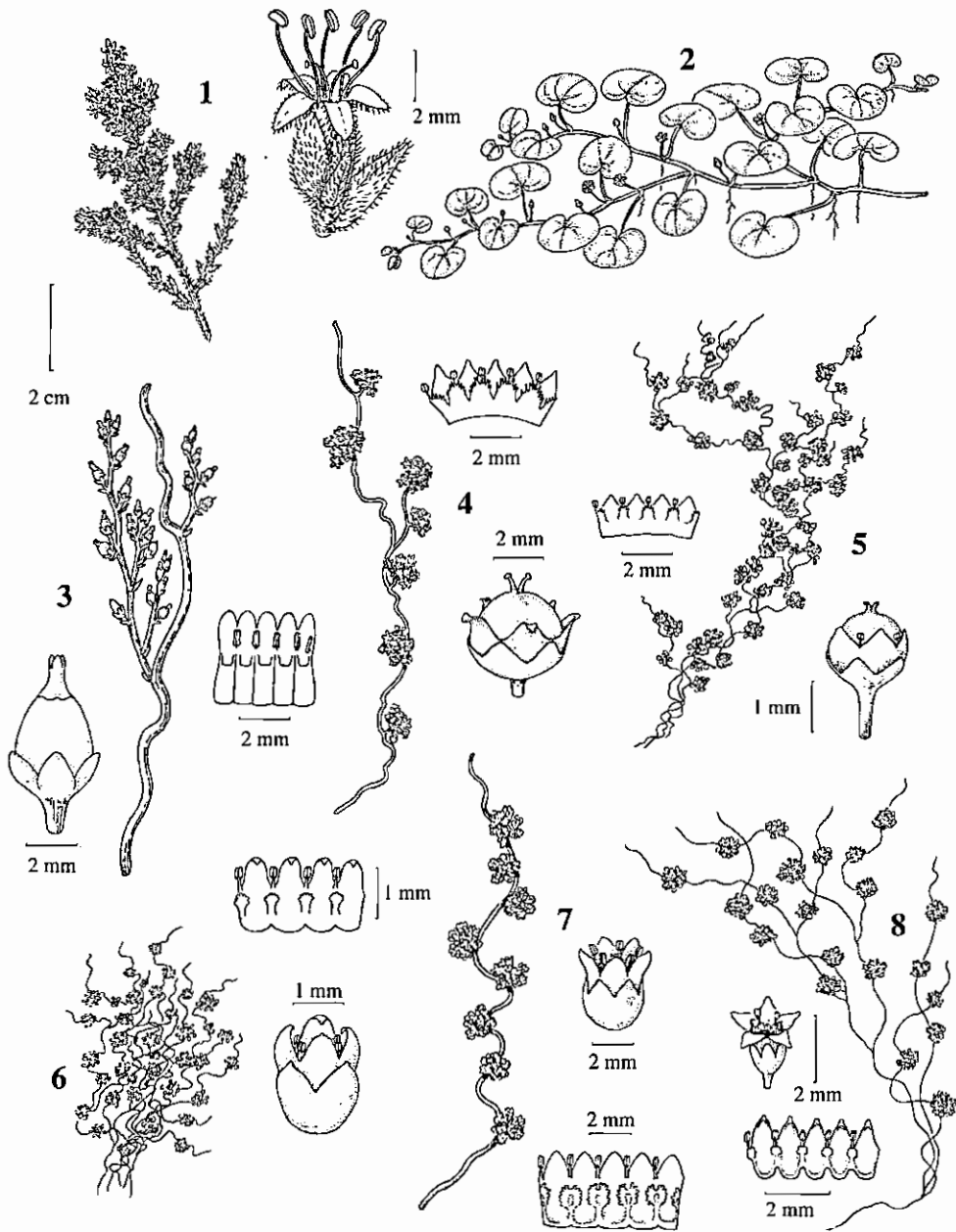


Plate 65. CONVULVULACEAE: *Cressa cretica* 1, flowering branch; flower (right). *Dichondra micrantha* 2, flowering branch. *Cuscuta monogyna* 3, flowering and fruiting branch; corolla (right); fruit (left). *Cuscuta campestris* 4, corolla (up right); fruit (down right). *Cuscuta pedicellata* 5, flowering and fruiting branch; corolla (left); fruit (down right). *Cuscuta palaestina* 6, flowering and fruiting branch; corolla (up right); flower (down right). *Cuscuta epiliman* 7, flowering and fruiting branch; flower (up right); corolla (down right). *Cuscuta planiflora* 8, flowering and fruiting branch; flower (up left); corolla (down left). All drawings to the same scale, except the enlarged parts (scale given).

N, O; on *Sonchus*, *Capsicum*, *Duranta*, *Clerodendrum* and other genera. Native to North America, naturalized in many regions of the world, almost cosmopolitan.

4. ***Cuscuta pedicellata*** Ledeb., Fl. Altaica 1: 293 (1829).

Syn. *Cuscuta arabica* Fresen., Mus. Senckenb. 1: 165 (1834).

Stems slender, yellowish to reddish; flowers 2-3 mm, in umbellate 3-7-flowered inflorescences, 4-merous, rarely 5-merous; pedicel 2-3 mm; calyx *c.* 1 mm, cup-shaped, the lobes deltoid, acute, not overlapping; corolla-lobes ovate-triangular, acute, about as long as the corolla-tube; infrastaminal scales reaching the stamens, the apex dentate; stamens not exceeding the corolla-lobes; ovary *c.* 2 mm, globose-conical; styles *c.* 0.5 mm; stigmas slender; capsule *c.* 2.5 mm, globose; seeds *c.* 1.25 mm, ovoid to suborbicular.

N, O, M, D, GE, S; on *Galium*, *Eruca*, *Artemisia*, *Trifolium*, *Alhagi*, *Trigonella* and other genera. North Africa, Southwest and Central Asia to Siberia.

5. ***Cuscuta palaestina*** Boiss., Diagn. Pl. Orient., ser. 1, 11: 86 (1849).

Syn. *Cuscuta globularis* Bertol., Fl. Ital. 7: 625 (1851)

Stems very slender, much-branched, purplish-red; flowers 1.5-2 mm, sessile or subsessile; in compact globose glomerules, usually 4-merous, rarely 1 or a few flowers in some glomerules 3- or 4-merous; calyx *c.* 1.8 mm, rather fleshy, usually purplish, the lobes deltoid; corolla-lobes 0.8-1 mm, broadly ovate, the apex hooded; corolla-tube 1-1.2 mm; infrastaminal scales hardly reaching the stamens, the apex fimbriate; styles 0.25 mm; stigmas 0.25 mm, elongate; capsule *c.* 2 mm, globose, seeds *c.* 1 mm.

M, De, S; on *Thymus*, *Euphorbia* and other genera. East Mediterranean region, Sinai.

6. ***Cuscuta epilinum*** Weihe in Boenn., Prodr. Fl. Monast. Westphal. 75 (1824).

Stems slender to medium, simple or branched; flowers 3-4 mm, 5-merous, sessile, in dense glomerules 1-1.25 cm diam.; calyx 2.5-3 mm, the lobes deltoid, acute, not overlapping at the base; corolla 4-4.5 mm, urceolate, the tube *c.* 2.5 mm; lobes *c.* 1.5 mm, broadly ovate, acute; infrastaminal scales 2-fid, short-fimbriate, not reaching the stamens; styles very short; stigmas 0.5 mm, elongate, thick; capsule 2 x 2.5 mm, depressed-globose; seeds 1-1.25 mm.

N; on cultivated flax. Europe, East Mediterranean region, introduced into flax crops in many parts of the world.

7. ***Cuscuta planiflora*** Ten., Fl. Napol. 3: 250 (1824-1829).

Stems slender, much-branched; flowers 1.75-2.5 mm, sessile, 5-merous, white, in compact globose glomerules 4-6 mm diam.; calyx 1.5-2 mm; the tube *c.* 0.5 mm; lobes *c.* 1 mm, oblong, fleshy; corolla 2-2.5 mm, the lobes \pm as long as the tube, the apex acute or hooded; stamens exerted; staminal scales reaching the stamens, the margin short-fimbriate; stigmas *c.* 1 mm, elongate, longer than the styles; capsule 1.2-1.6 mm, depressed-globose; seeds *c.* 0.75 mm, ovoid.

N, M, D, R, GE, S; on various host plants. Canary Islands, Mediterranean region, Sinai, Arabia, Iraq, Iran, Afghanistan.

8. **Cuscuta approximata** Bab., Ann. Mag. Nat. Hist. 13: 253 (1844).
 Syns. *Cuscuta calliopes* Boiss., Fl. Orient. 4: 115 (1875).
Cuscuta schiraziana Boiss., Diagn. Pl. Orient., ser. 1, 11: 86 (1849).
Cuscuta urceolata Kunze, Flora (Regensburg) 29: 651 (1846).

Stems of medium thickness; flowers 3-4 mm, 5-merous, in dense many-flowered glomerules 1-1.5 cm diam.; calyx 1.5-2 mm, turbinate, golden-yellow; lobes deltoid, overlapping at the base, with rounded sides and apical short obtuse fleshy appendages; corolla 3-4 mm, campanulate, the lobes ovate, shorter than the tube; stamens exerted; infrastaminal scales 2-fid, reaching the stamens, the apex irregularly dentate; styles \pm as long as the elongate stigmas; ovary 1-1.25 mm, globose; capsule 1.75-2.5 mm, depressed-globose; seeds 1-1.25 mm, ovoid, finely scabrous.

N, S; on shrubs. Mediterranean region, Sinai, Arabia, Iran.

BORAGINACEAE
 (incl. Ehretiaceae and Cordiaceae)

Azza El-Hadidy & L. Boulos

Annual, biennial or perennial herbs, low shrubs, woody climbers or trees; leaves simple, alternate, rarely opposite, exstipulate, often with a setose indumentum of tubercle-based bristles, glochidia or hairs; inflorescence cymose, scorpioid or of cincinni, or rarely thyrsoid, spike-like or raceme-like; flowers actinomorphic, rarely zygomorphic, generally 5-merous, bisexual, rarely unisexual; calyx mostly divided to base, generally persistent, often accrescent after anthesis; corolla rotate, hypocrateriform (salver-shaped), infundibular (funnel-shaped), campanulate or tubular, glabrous inside or with 5 scales, invaginations or tufts of hairs; stamens mostly 5, rarely 4 or 6, epipetalous and alternating with the corolla lobes; anthers sometimes with apical or basal appendages; ovary superior, (2-)4-locular by a false partition; style 1 (or 2, *Coldenia*), gynobasic, rarely terminal (*Heliotropium*); stigma usually capitate, rarely 2-lobed; fruit drupe-like with 1, 4-celled endocarp or 1-4-seeded nutlets; nutlets borne on a flat or pyramidal gynobase; the areole (attachment area of the nutlet to the gynobase) with or without a sub-basal ring; endosperm absent or scanty. 154 genera, 2500 species, tropical and temperate regions.

- | | |
|---|------------------------|
| 1. Tree; fruit drupe-like | 1. Cordia |
| + Shrub or herb; fruit 1-4 nutlets or 4-locular with a woody endocarp | 2 |
| 2. Styles 2, \pm joined at base | 2. Coldenia |
| + Style 1 | 3 |
| 3. Corolla actinomorphic; style terminal | 4 |
| + Corolla actinomorphic or zygomorphic; style gynobasic | 5 |
| 4. Fruit breaking into four 1-seeded nutlets or cohering in pairs, or reduced to 1 nutlet by abortion | 3. Heliotropium |
| + Fruit 4-locular, with a woody endocarp, not splitting into nutlets | 4. Nogalia |
| 5. Leaves opposite, subopposite and alternate; anthers contorted, with long apical appendages | 7. Trichodesma |
| + Leaves alternate; anthers not contorted, entire or with short apical appendages | 6 |

6. Corolla zygomorphic, limb oblique 7
+ Corolla actinomorphic, limb not oblique 8
7. Herb; 1 or more stamens exerted from the corolla; filaments much longer than the anthers; nutlet straight; areole basal 18. **Echium**
+ Shrub; all stamens inserted; filaments shorter than the anthers; nutlet sway-backed; areole ventral 19. **Echiochilon**
8. Calyx-lobes dentate; fruiting calyx a folded leaf-like sheath 10. **Asperugo**
+ Calyx-lobes entire; fruiting calyx not as above 9
9. Dwarf shrublet; old stems with white bark; fruiting calyx caducous; nutlets exposed 15. **Moltkiopsis**
+ Herb; old stems without bark; fruiting calyx persistent; nutlets enclosed 10
10. Base of nutlets hollow, usually with an incrassate collar-like ring surrounding a \pm fleshy caruncle 11
+ Base of nutlets solid, without an incrassate ring 12
11. Corolla-throat with conspicuous scales; scales longer than broader or of equal length; nutlets glabrous, granulate to verrucate between the reticulate-ribbed surface 16. **Anchusa**
+ Corolla-throat with a hairy ring, tufts of hairs or inconspicuous, scales broader than longer; nutlets puberulent, colliculate between the reticulate-ribbed surface 17. **Nonea**
12. Corolla-tube with appendages (scales, invaginations, tufts or bands of hairs) 13
+ Corolla-tube without appendages 17
13. Corolla-throat with scales; areole ventral 14
+ Corolla-throat with invaginations, tufts or bands of hairs; areole basal 16
14. Flowers bracteate; nutlets ovoid or triquetrous-pyramidal, the ventral surface keeled, wingless 9. **Lappula**
+ Flowers ebracteate; nutlets spherical, the ventral surface flat, winged 15
15. Cymes many-flowered, dense; ventral areole lanceolate, conspicuous, occupying almost the whole surface 5. **Paracaryum**
+ Cymes few-flowered, lax; ventral areole ovate, occupying only the upper part 6. **Brandella**
16. Perennial with glandular hairs; anthers whorled; nutlets strongly curved; areole ovate, concave, inconspicuous 13. **Alkanna**
+ Annual without glandular hairs; anthers spirally arranged; nutlets erect or divergent, ovoid or pyriform; areole triangular or flabellate, flat, conspicuous 11. **Buglossoides**
17. Plant with glandular hairs; corolla-throat poorly defined; corolla-lobes reflexed; anthers exerted from the corolla-throat, usually joined laterally; nutlets strongly curved, conspicuously stipitate, attached to the gynobase by a small areole 14. **Podonosma**

- + Plant without glandular hairs; corolla throat well-defined; corolla-lobes not reflexed; anthers inserted, not joined; nutlets not as above 18
18. Annual or herbaceous perennial; corolla 0.7-1.5 cm; style forked; fruiting calyx crested or tuberculate at the base; areole basal, lobed or rounded 12. **Arnebia**
- + Delicate annual; corolla 2-3 mm; style simple; fruiting calyx slightly accrescent, not crested or tuberculate at the base; areole ventral, linear or oblong with a horizontal base 8. **Ogastemma**

1. **Cordia L.**

Trees or shrubs; leaves alternate or subopposite, simple, petiolate, entire or crenate-dentate; flowers bisexual or unisexual, white, yellow or orange; calyx tubular or campanulate, mostly 5-lobed, sometimes 3-8-lobed; corolla infundibular or salver-shaped, mostly 5- but sometimes 3-8-lobed; corolla-lobes spreading or reflexed; stamens exerted or included; ovary 4-locular with 1 erect ovule in each locule; style terminal, twice 2-fid; stigmas 4, linear or capitate; fruit a drupe included within the persistent accrescent cupuliform calyx; endocarp bony; seeds without endosperm. About 320 species, tropical regions, but mainly American.

1. **Cordia sinensis** Lam., Tabl. Encycl. 1: 423 (1792).

Syns. *Cordia reticulata* Roth in Roem. & Schult., Syst. Veg. 4: 798 (1819).

Cordia rothii Roem. & Schult., Syst. Veg. 4: 798 (1819).

Cordia subopposita A. DC., Prodr. 9: 480 (1845).

Cordia gharaf Asch., Sitz. Ges. Nat. Freunde Berlin 1879: 46 (1879), nom. inval.

Tree or shrub 2-6 m; young stems with smooth bark, the old stems with rough longitudinally fissured bark; leaves 2-8 x 0.5-3.5 cm, oblong-elliptic, oblanceolate to oblanceolate-obovate, the apex rounded, the base cuneate to rounded, scabrid on the upper surface, slightly pubescent on the lower; flowers sweet-scented; peduncle 1.5-2.5 (-3) cm; pedicel 1-2 mm; calyx-tube c. 4 mm, campanulate; calyx-teeth 0.5-1 mm; corolla white; *male flowers*: corolla lobes 4-5 mm; filaments 3-4 mm, exerted; *female flowers*: corolla-lobes 3-4 mm; filaments 2 mm; style 2-3 mm; stigmatic branches 2-4 mm; fruit 0.8-1.2 x 0.6-0.8 cm, ovoid, orange-yellow, mucilaginous.

O, GE; moist ground (Oases) and open desert scrub (Gebel Elba). Egypt, Sudan, tropical East and West Africa, Palestine, Arabia, Pakistan, India, Sri Lanka.

NOTE: This tree is often cultivated in parks and gardens; the fruit is edible.

2. **Coldenia L.**

Syn. *Lobophyllum* F. Muell.

Procumbent herbs; stems often with adventitious roots; leaves alternate, sessile or petiolate; flowers solitary, 4-merous; calyx deeply lobed; corolla small; stamens 4, inserted in the tube; ovary 2-locular, each locule with 2 ovules, or with four 1-ovulate locules; styles 2, terminal; fruit 4-lobed, dividing into four 1-seeded nutlets. 1 species, Old World tropics and warm regions.

1. *Coldenia procumbens* L., Sp. Pl., ed. 1, 125 (1753).

Procumbent annual 10-40 cm, often forming mats to 80 cm diam.; stems branched, ascending; leaves 0.5-3 x 0.2-2 cm, oblong, elliptic or obovate, asymmetric, crenate, strigose between the nerves on the upper surface, with spreading hairs beneath; petiole 0.2-1.8 cm; flowers subsessile; calyx 2-2.5 mm, persistent; corolla c. 1.5 mm, white, caducous; stamens 4, filaments 0.2-0.4 mm; ovary 0.4-0.6 mm, conical, glandular-hairy; styles ± 0.2 mm; fruit 3-4 mm, glandular-hairy, dividing into 4 nutlets; seeds 2 x 1.2 mm, flattened.

Dw (Giza-Faiyum desert). Distribution as for the genus.

3. *Heliotropium* L.

Annuals, perennials or low shrubs; leaves attenuate, rarely opposite; cymes unilateral, spike-like, usually scorpioid, terminal, simple or branched, bracteate or ebracteate; flowers bisexual; calyx-lobes 5; corolla white, yellow, cream or blue, salver- or funnel-shaped, the throat often pubescent, usually without scales; corolla-lobes spreading, imbricate, often with teeth between; stamens 5 (our species), rarely 6, included, the filaments short or 0; ovary 4(-5)-locular, often encircled by a basal disc; style terminal, often 0; stigma depressed, conical or discoid; fruit dry or slightly fleshy, breaking into four, 1-seeded nutlets, or cohering in pairs, or reduced to 1 by abortion; seeds straight or curved, with endosperm. About 250 species, tropical and temperate regions.

- | | |
|---|----------------------------|
| 1. Calyx divided to $1/4$ of its length, caducous; fruit of 1 nutlet | 16. <i>H. supinum</i> |
| + Calyx divided almost to base, persistent; fruit of 4 or 2 nutlets | 2 |
| 2. Plant glabrous, halophytic | 9. <i>H. curassavicum</i> |
| + Plant variously hairy, not halophytic | 3 |
| 3. Leaves to 3 mm broad; flowers bracteate, distinctly pedicellate | 10. <i>H. strigosum</i> |
| + Leaves over 3 mm broad; flowers ebracteate, sessile or subsessile | 4 |
| 4. Corolla 5-9 mm | 5 |
| + Corolla 2-5 mm | 9 |
| 5. Corolla over 3 times as long as the calyx; corolla-lobes acuminate at the caudate apex | 1. <i>H. zeylanicum</i> |
| + Corolla \pm twice as long as the calyx; corolla-lobes without caudate apex | 6 |
| 6. Annual; stigma conical; nutlets 2, laterally winged or with protrusions | 13. <i>H. pterocarpum</i> |
| + Perennial; stigma cap-shaped; nutlets 4 or 2, without wings or protrusions | 7 |
| 7. Corolla glabrous inside; nutlets 4 | 8. <i>H. arbainense</i> |
| + Corolla uniformly hairy inside or with villose ribs; nutlets 4 or 2 | 8 |
| 8. Plant dark grey, glandular-hairy; leaves 3-8 mm broad, linear-lanceolate; corolla blue with purple spots, without villose ribs internally; nutlets 2 | 12. <i>H. amplexicaule</i> |

- + Plant yellowish-green, not glandular-hairy; leaves 0.6-3 cm broad; ± ovate; corolla white, with 5 dark villose ribs internally; nutlets 4 7. *H. hirsutissimum*
- 9. Calyx-lobes unequal; corolla appressed-hairy inside at tops of the anthers 11. *H. ovalifolium*
- + Calyx-lobes equal; corolla glabrous inside 10
- 10. Leaves lanceolate, ± twice as long as broad, margin undulate; nutlets 4 or 2, with or without dermal appendages 11
- + Leaves orbicular to ovate or elliptic, less than twice as long as broad, margin not undulate; nutlets 4, without dermal appendages 12
- 11. Flowers in 1 rank, swollen at the base; nutlets 4 15. *H. ramosissimum*
- + Flowers in 2 ranks, swollen at the middle; nutlets 4 or 2 14. *H. bacciferum*
- 12. Corolla-lobes deltoid, with inflexed apices 13
- + Corolla-lobes ovate or oblong, apex never inflexed 14
- 13. Leaves ± ovate; corolla yellow; style present 2. *H. digynum*
- + Leaves ± orbicular; corolla white; style 0 3. *H. rotundifolium*
- 14. Nutlets pubescent 4. *H. lasiocarpum*
- + Nutlets glabrous 15
- 15. Stamens inserted at the middle of the tube; anthers almost reaching the throat; nutlets ± trigonous, finely rugose 5. *H. aegyptiacum*
- + Stamens inserted below the middle of the tube; anthers much below the throat; nutlets ± ovate, tuberculate 6. *H. bovei*

1. *Heliotropium zeylanicum* (Burm. f.) Lam., Encycl. 3: 94 (1789).

Syns. *Heliotropium curassavicum* L. var. *zeylanicum* Burm. f., Fl. Ind. 41, t. 16, f. 2 (1768).

Heliotropium subulatum (A. DC.) Vatke, Linnaea 43: 316 (1882).

Heliotropium zeylanicum (Burm. f.) Lam. var. *subulatum* (A. DC.) Chiov., Fl. Somalia 3: 140 (1936).

Perennial with a woody base, 30-60 cm, covered with appressed hairs intermixed with long patent setae; leaves 1-10 x 0.2-2.5 cm, lanceolate to linear, entire, acute; petiole 0.3-1.5 mm; inflorescences terminal and axillary, spike-like; flowers sessile, ebracteate; calyx 1.75-2.75 mm, persistent, the lobes acute; corolla 7-9 mm, white, hypocrateriform, swollen and inflated below the constricted throat; tube 3-5 mm; lobes 3-4 mm, acuminate at the caudate apex; stamens inserted near the throat; anthers 1-1.5 mm, lanceolate, bidentate; ovary c. 0.75 mm; style 1.75-2.25 mm; stigma 1-1.25 mm, the apex 2-fid, hairy; fruit c. 1.5 x 2.5 mm, subglobose; breaking into 4 nutlets; nutlet ovoid, brown, glabrous, striate on the upper surface and rugose below.

GE; deep sandy soil near water courses and around wells. Southeast Egypt, tropical Africa, Arabia, Socotra, Comoro Islands, India.

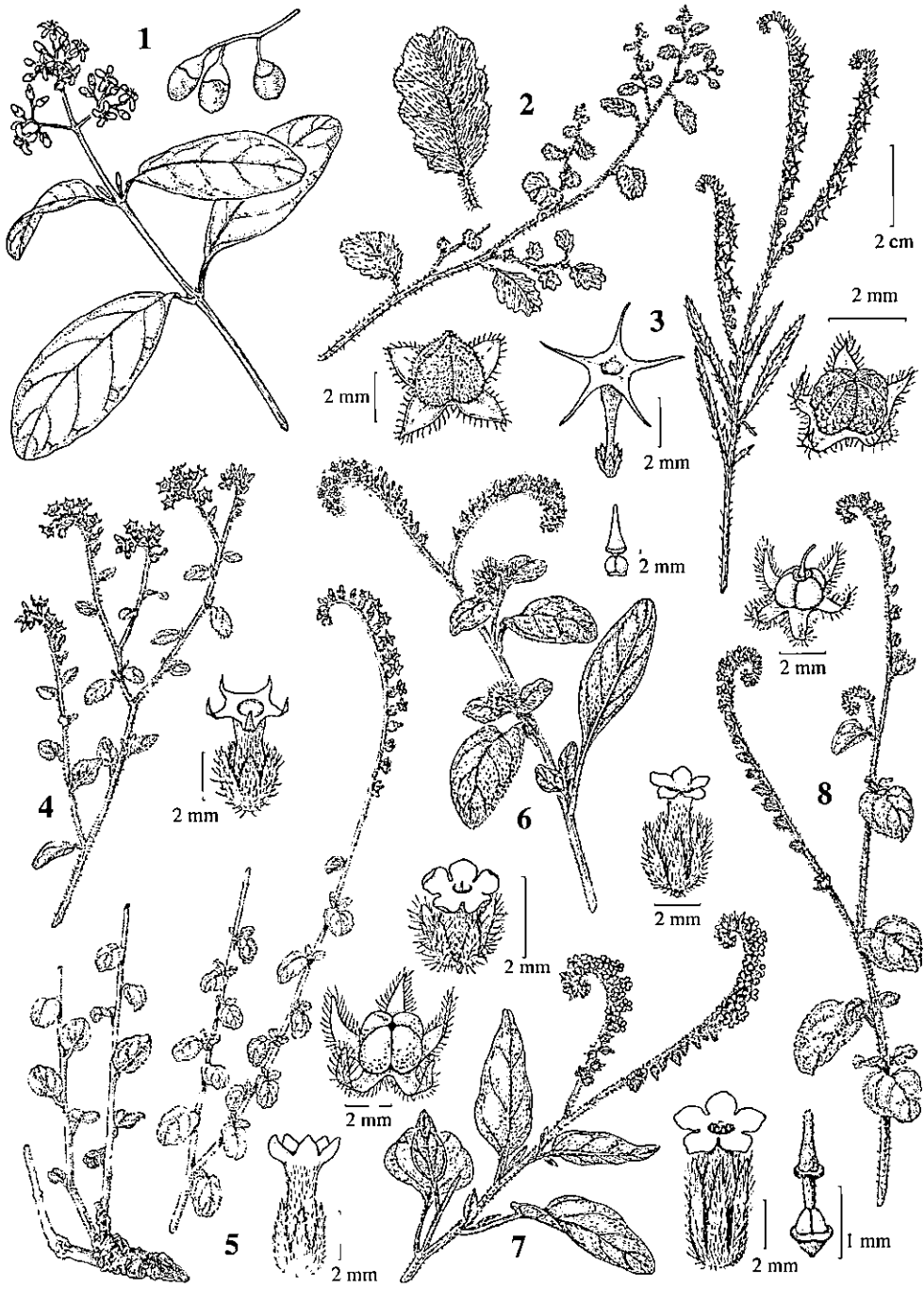


Plate 66. BORAGINACEAE: *Cordia sinensis* 1, flowering and fruiting branches. *Coldenia procumbens* 2, flowering branch; leaf (up); fruit (down). *Heliotropium zeylanicum* 3, flowering and fruiting branch; flower (left); fruit (right). *Heliotropium digyuum* 4, flowering and fruiting branch; flower (right). *Heliotropium rotundifolium* 5, flowering and fruiting branch; basal branches (left); flower (down right). *Heliotropium lasiocarpum* 6, flowering and fruiting branch; pistil (up right); flower (down left). *Heliotropium aegyptiacum* 7, flowering and fruiting branch; flower and pistil (right); fruit (left). *Heliotropium bovei* 8, flowering and fruiting branch; flower (left); fruit (up). All drawings to the same scale, except the enlarged parts (scale given).

2. **Heliotropium digynum** (Forssk.) Asch. ex C. Chr., Dansk Bot. Ark. 4 (3): 14 (1922).
Syns. *Lithospermum digynum* Forssk., Fl. Aegypt.-Arab. 40 (1775).
Heliotropium luteum Poir. in Lam., Encycl. Suppl. 3: 22 (1813), nom. illeg.

Perennial with a woody base, 20-50 cm; stems erect or ascending, terete, canescent; leaves 1-2 x 0.5-1 cm, ± ovate, the margin undulate, the apex obtuse to acute, shortly cuneate at the base; petiole 2-5 mm; inflorescence terminal, spike-like, simple or forked; cymes lax in fruit; flowers ebracteate, subsessile; calyx 2-3 mm, persistent, lobed almost to base, the lobes equal, tomentose; corolla 3.5-5.5 mm, yellow, urceolate-tubular, silky outside, glabrous inside; lobes 0.8-1.5 mm, acute, inflexed; anthers 1-1.2 mm, oblong, sessile; ovary 0.5-0.8 mm, glabrous; style 1.2-1.5 mm; stigma 0.8-1 mm, ± conical or obscurely 2-lobed, hairy; fruit ovoid, usually of 4 nutlets; nutlet 2.5-4 mm, brown, silky.

N, M, D, R, S; Sandy desert plains and wadis. North Africa, East Mediterranean region, Sinai, Arabia to Afghanistan.

3. **Heliotropium rotundifolium** Sieb. ex Lehm., Icon. Descr. Nov. Stirp. 19, t. 30 (1821).

Softly tomentose perennial 30-60 cm, woody at the base; stems erect or ascending, terete; leaves 0.5-2.5 x 0.5-2 cm, ± orbicular, the margin revolute, apiculate, the base cuneate; petiole 0.5-1.5 cm; inflorescence terminal, spike-like, simple or branched; flowers ebracteate, sessile or subsessile; calyx 2.5-4 cm, lobed almost to base, the lobes equal, ovate-elliptic to deltoid, acute; corolla 4-6 mm, white, silky outside, glabrous inside; tube 3-4.5 mm; limb 1.5-2 mm; lobes 1.25-2 mm, deltoid, the apex inflexed; stamens inserted slightly below the middle of the corolla-tube and reaching the throat; anthers 1.5-2 mm, lanceolate; ovary 0.5 mm, glabrous; style 0, stigma 1 mm, ± conical, obscurely 4-lobed at the apex; fruit of 4 nutlets; nutlet 1.5 mm, ovoid, glabrous, minutely tuberculate.

De, S; calcareous hills and sandy desert plains. Egypt, Palestine, Syria, Lebanon.

4. **Heliotropium lasiocarpum** Fisch. & C. A. Mey., Ind. Sem. Horti Petrop. 4: 38 (1837).

Syns. *Heliotropium tenuifolium* Bunge, Bull. Soc. Naturalistes Moscou 42: 293 (1869), non Guss. (1842).

Heliotropium europaeum L. var. *tenuiflorum* Boiss., Fl. Orient. 4: 130 (1875).

Yellowish, appressed-hairy annual, 10-45 cm, slightly woody at the base; stems erect or ascending, terete; leaves 1-7 x 0.5-5 cm, ovate or broadly-elliptic, the apex retuse, truncate or apiculate, the base cuneate or short-attenuate; petiole 0.5-4 cm; inflorescence terminal or axillary, spike-like, branched; flowering cymes dense, elongate and lax in fruit; flowers ebracteate, sessile, in 2 ranks; calyx 2-3 mm, slightly accrescent in fruit, the lobes lanceolate to linear-lanceolate; corolla 2.5-3.5(-4) mm, white, hairy outside, glabrous inside; tube 2-2.5 mm, constricted at the throat; lobes 1-1.5 mm, spatulate to broadly ovate; stamens inserted slightly below the middle of the corolla-tube; anthers c. 1 mm, sessile, lanceolate; ovary ± globose; style 0.25 mm, glabrous; stigma c. 1 mm, elongate, conical, with distinct stigmatic ring, the apex 2-4 lobed; fruit subglobose, of 4 nutlets; nutlet 1.5-2.25 mm, pubescent, smooth or rugose.

N, O, M, S; sandy and clayey moist ground, especially in orchards and edges of rice fields. Egypt, southwest and Central Asia.

5. **Heliotropium aegyptiacum** Lehm., Ind. Sem. Hort. Hamb. 20 (1824).

Syns. *Heliotropium pallens* Delile, Cent. Pl. Afr. 69, t. 3, f. 4 (1826).

Heliotropium cinerascens DC. & A. DC. in A. DC., Prodr. 9: 534 (1845).

Erect softly velvety annual or short-lived perennial, 10-40 cm; stems simple or branched, ± terete or angular, with spreading hairs; leaves 1-10 x 0.5-7 cm, broadly ovate to elliptic, the margin entire or undulate-crenate, the apex acute or retuse, the base shortly cuneate; petiole 0.5-5 cm; inflorescence terminal, spike-like; cymes dense, elongate in fruit; flowers sessile; calyx 3-4 mm, lobed almost to base, the lobes oblong-lanceolate to linear, acute; corolla 4-6 mm, white, infundibular; tube constricted at the throat, hairy outside, glabrous inside; limb spreading; lobes ovate; stamens inserted ± at the middle of the tube, almost reaching the throat; anthers 1.5-2.25 mm, lanceolate; ovary c. 0.4 mm, ovoid; style 0.7-1 mm, with deflexed hairs; stigma 0.5-1 mm, ± conical, 2-fid or obscurely 4-lobed at the apex, hispid; fruit ovoid, of 4 nutlets; nutlet 1.5-2.5 mm, ± trigonous, glabrous, finely rugose, the margins slightly winged.

N, GE; Nile banks, moist stony ground. Egypt, Sudan, Ethiopia, Djibouti, Somalia, Arabia.

6. **Heliotropium bovei** Boiss., Diagn. Pl. Orient., ser. 1, 11: 87 (1849).

Appressed-hairy canescent annual, 25-40 cm; stems erect or ascending, terete, branched from the base; leaves 0.5-2.5 x 0.5-1.5 cm, broadly ovate to elliptic, the apex obtuse, mucronate, the base cordate; petiole 3-8 mm; inflorescence lax; flowers ebracteate, sessile; calyx 3.5-4 mm, pubescent, often caducous in fruit, lobed almost to base; lobes linear-lanceolate, acute, hairy outside; corolla 4-5 mm, cylindrical, hairy outside, glabrous inside, the lobes 1.2 x 0.8 mm, deltoid; anthers 1.5-1.75 mm, inserted below the middle of the tube and much below the throat; style very short; stigma conical; fruit usually of 4 nutlets; nutlet 1.75-2 mm, glabrous, tuberculate.

S (northern coastal region); fields, roadsides. Sinai, Palestine, Lebanon, Syria, Turkey, Iraq.

7. **Heliotropium hirsutissimum** Grauer in Weber, Pl. Min. Dec. no. 1 (1784).

Syn. *Heliotropium villosum* Willd., Sp. Pl., ed. 4, 1: 741 (1798).

Yellowish-green appressed-hairy annual, 10-50 cm, usually branched from the base; stems terete, erect or ascending, with long patent hairs intermixed with the short appressed; leaves 1-5 x 0.6-3 cm, ± ovate, the apex obtuse to acute, the base rounded; petiole 0.5-2.5 cm; inflorescence terminal, spike-like, simple or forked; cymes dense, lax in fruit; flowers ± sessile, ebracteate; calyx 3-4.5 mm, the lobes deltoid to linear-lanceolate, accrescent in fruit; corolla 5-9 mm, white, infundibular, hirsute outside; tube 3.5-5 mm, with 5 dark villose ribs overtopping the anthers; limb 3-4 mm; lobes 2-3 mm, oblong or broadly ovate; stamens inserted below the middle of the tube; anthers c. 1 mm, sessile, lanceolate; ovary 0.5-1 mm, ovate; style very short, glabrous; stigma c. 1 mm, cap-shaped, hairy; fruit ovoid of 4 nutlets; nutlet 1.5-2 mm, brownish, glabrous, densely tuberculate.

M (Alexandria); waste ground, cultivated and fallow fields. Libya, Egypt, East Mediterranean region to Greece.

8. **Heliotropium arbainense** Fresen., Mus. Senckenb. 1: 168 (1834).

Softly tomentose, slightly glandular-hairy, yellowish-green perennial, with woody base, 20-50 cm; stems much-branched from the base, erect or ascending; leaves 1-3 x 0.5-1.5 cm, ovate to elliptic, the margin \pm undulate, the apex obtuse to acute, the base cuneate; petiole 0.2-1 cm; inflorescence terminal, spike-like, simple or forked; cymes dense, elongate and lax in fruit; flowers \pm sessile, in 1 rank; calyx 3-5 mm, persistent, lobed almost to base, the lobes linear-lanceolate, with spreading hairs; corolla 5-8 mm, white, infundibular, hairy outside, glabrous inside, with 5 prominent glabrous ribs at the throat alternating with the lobes; lobes c. 2 mm, ovate, rounded at the apex; anthers 1.25-2 mm, sessile, acute; ovary 0.5-0.75 mm; style 0.25-0.5 mm, ligulate, glabrous; stigma 0.75-1 x 1-1.5 mm, cap-shaped, hairy; fruit ovoid, of 4 nutlets; nutlet 2-2.25 mm, glabrous, tuberculate-rugose.

N, O, M, D, R, S; sandy and stony desert wadis and plains, edges of cultivated ground. Egypt, Palestine, Arabia, Sudan, Madagascar, Mascarene Islands.

9. **Heliotropium curassavicum** L., Sp. Pl., ed. 1, 130 (1753).

Syns. *Heliotropium glaucum* Salisb., Prodr. 113 (1796).

Heliotropium glaucophyllum Moench, Math. Suppl. 147 (1802).

Heliotropium chenopodioides Willd., Enum. Pl. Hort. Berol. 175 (1809).

Glabrous halophytic perennial, 30-80 cm; stems terete, much-branched from the base, turning greyish-black when dry; leaves 1-5 x 0.2-1 cm, narrowly spatulate to oblong-linear, entire, the apex obtuse to acute, the base attenuate; petiole 1-5 mm; inflorescence terminal, simple or forked, spike-like; cymes dense, elongate, lax in fruit; flowers sessile, ebracteate; calyx 1-2 mm, divided almost to base, not accrescent in fruit; corolla 1.5-2.5 mm, white, urceolate, glabrous outside; tube 1-1.5 mm; lobes 0.5-0.75 mm, broadly ovate, the middle nerve terminating below the rounded apex; stamens inserted \pm at the middle of the corolla-tube; anthers 0.75 mm, ovate, shortly apiculate; ovary 0.5 mm; style 0; stigma 0.5 mm, appressed-conical, glabrous; fruit subglobose, of 4 nutlets; nutlet 1.5-2 mm, ovoid, sulcate, brown, glabrous.

N (Heliopolis, Cairo, Ain Helwan, Burg El-Burollos), De (Wadi Digla, southeast of Cairo); edges of salt marshes and saline soils. Native to tropical America, widely introduced and naturalized in the Old World.

NOTE: *Heliotropium curassavicum* is probably more widespread in Egypt than the available records suggest. According to Täckholm, Stud. Fl. Egypt, ed. 2, 1974, and Boulos, Fl. Egypt Checklist, 1995, the plant is known from a few localities: Heliopolis, Cairo; Ain Helwan, south of Cairo and Wadi Digla, Eastern Desert southeast of Cairo. It was collected, however, in 1998 from Burg El-Burollos, northern Nile Delta, over 200 km from any of its previously known localities which extends its previously known distribution to an area far away from the Cairo region. Since our species is halophytic, and its growth is confined to salt marshes and saline soils, it is recommended to look for this species in similar habitat types in other parts of the country.

10. **Heliotropium strigosum** Willd., Sp. Pl., ed. 4, 1: 743 (1798) var. **brevifolium**

(Wall.) C. B. Clarke in Hook., Fl. Brit. Ind. 4 (1): 151 (1883).

Syns. *Heliotropium bicolor* DC. & A. DC. in DC., Prodr. 9: 546 (1845).

Heliotropium kordofanum DC. & A. DC. in DC., Prodr. 9: 546 (1845).

Heliotropium longifolium Klotzsch in Peters, Reise Mossamb., Bot. 251 (1861).

Heliotropium pygmaeum Klotzsch in Peters, Reise Mossamb., Bot. 252 (1861).

Heliotropium senense Klotzsch in Peters, Reise Mossamb., Bot. 253 (1861).

Heliotropium strigosum Willd. var. *bicolor* (DC. & A. DC.) Schwartz, Mitt. Inst. Bot. Hamburg 10: 209 (1939).

Heliotropium strigosum Willd. subsp. *brevifolium* (Wall.) Kazmi, J. Arnold Arbor. 51: 153 (1970).

Strigose annual or short-lived perennial, 15-40 cm, often woody at the base; juvenile stems erect, terete, with appressed silvery hairs, the old stems with brownish peeling bark; leaves 0.5-2.5 x 0.04-0.3 cm, linear-lanceolate, the margin revolute, the apex acute; petiole very short or 0; inflorescence terminal; cymes spike-like, lax; flowers bracteate, distinctly pedicellate; bracts deltoid, conspicuous; pedicel elongate in fruit; calyx 1.5-2.5 mm, the lobes unequal, strigose outside, glabrous or with few hairs inside; corolla 2.5-4 mm, white, densely strigose outside, the throat minutely glandular and with tufts of hairs inside; tube 2-3 mm; limb 0.5-1 mm; lobes minute; stamens inserted at the middle of the corolla-tube; anthers 1 mm, ovate-lanceolate, coherent by the thickened tips in juvenile stages, the apex acuminate, hairy; filaments 0.5 mm; ovary 0.75, globose, glabrous; style 0.5-4 mm, slender; stigma 0.5 mm, conical, papillose, 2-fid at the apex, with a distinct stigmatic ring at the base; fruit of 4 nutlets, usually coherent; nut 1-1.5 mm, ovate, brown, appressed-hairy, internal faces with a circular depression.

GE; mountain slopes, stony wadis. Southeast Egypt, tropical Africa, Arabia, Afghanistan to tropical Asia, China and Australia.

11. ***Heliotropium ovalifolium*** Forssk., Fl. Aegypt.-Arab. 38 (1775).

Syns. *Heliotropium kunzeii* Lehm., Icon. & Descr. Stirp. 19, t. 29 (1821).

Heliotropium brochianum Vis., Pl. Aegypt. Nub. 8, no. 23, t. 2, f. 1 (1836).

Heliotropium villosum Sieb. ex DC., Prodr. 9: 541 (1845), non Willd. (1798).

Heliotropium niloticum A. DC., Prodr. 9: 541 (1845).

Heliotropium phyllosepalum Baker, Kew Bull. 1894: 30 (1894).

Greyish appressed-hairy annual or short-lived perennial, 10-60 cm, woody at the base; stems much-branched, procumbent or erect, terete; leaves 0.5-3.5 x 0.3-1.5 cm, ovate to elliptic, the margin entire, the apex obtuse, or less often acute, sometimes apiculate, attenuate at the base; petiole 0.5-2 cm; inflorescence terminal; cymes scorpioid, spike-like; flowers in 2 ranks, ebracteate; pedicel 0.5-2 cm, accrescent in fruit; calyx 1.5-3.5 mm, deeply divided into unequal lobes; corolla 2.25-3.5 mm, strigose-pubescent outside, appressed-hairy inside at apices of the anthers; tube cylindrical, dilated in the middle; lobes 0.5-1 mm, ovate to elliptic; stamens inserted below the middle of the tube; anthers c. 0.5 mm, ovate-elliptic; the apex apiculate, hairy; filaments very short; ovary c. 0.5 mm, subglobose, glabrous or hairy at the tip; stigma 0.5-0.7 mm, sessile, conical, truncate or slightly 2-fid at the apex; fruit 1.8-2 mm, subglobose, of 4 nutlets; nutlet 1-1.5 x 0.8 mm, the external face white appressed-hairy.

N, O, (Bahariya), M (Alexandria); cultivated and moist waste ground. Egypt, East to West tropical Africa, Angola, South Africa, Madagascar, Arabia, India, Pakistan; introduced elsewhere.

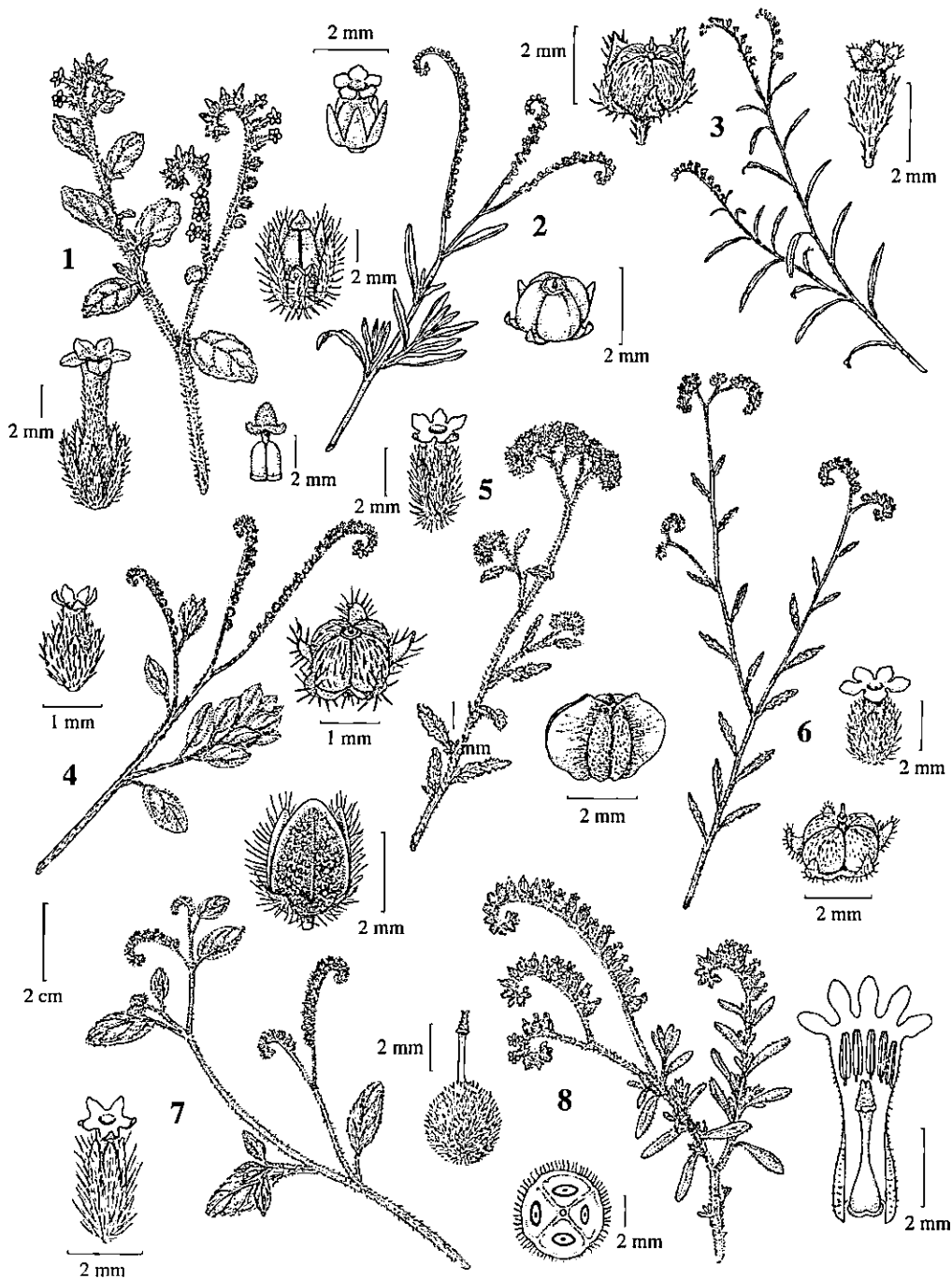


Plate 67. BORAGINACEAE: flowering and fruiting branches of: *Heliotropium arbainense* 1; flower (down left); fruit (right); pistil (down right). *Heliotropium curassavicum* 2; flower (up left); fruit (right). *Heliotropium strigosum* 3; fruit (up left); flower (right). *Heliotropium ovalifolium* 4; flower (left); fruit (right). *Heliotropium pierocarpum* 5; flower (up left); fruit (right). *Heliotropium bacciferum* subsp. *bacciferum* 6; flower (right); fruit (down right). *Heliotropium supinum* 7; flower (left); fruit (up). *Notalia drepanophylla* 8; flower (right); pistil and T.S. in the fruit (left). All drawings to the same scale, except the enlarged parts (scale given).

NOTE: The flower of *Heliotropium ovalifolium* was considered by some authors to be bracteate. In fact, the calyx consists of 3 equal sepals and 2 others, one longer than the 3 equal sepals. The longest sepal was erroneously regarded as a bract.

12. **Heliotropium amplexicaule** Vahl, Symb. Bot. 3: 21 (1794).

Dark grey, pubescent, glandular-hairy perennial, 20-60 cm, woody at the base; stems branched, ascending or decumbent, sometimes sparsely villous or hispid, the juvenile glandular; leaves 2-9 x 0.3-0.8 cm, linear-lanceolate, the margin entire, the apex \pm undulate, acute to obtuse, the base cuneate; lower leaves petiolate, the upper sessile; inflorescence terminal, forked; cymes spike-like, dense, elongate and lax in fruit; flowers sessile, in 1 rank, ebracteate; calyx 2.5-4 mm, lobed almost to the base, accrescent in fruit; corolla 4.5-6 mm, blue with purple spots, hypocrateriform, hairy outside; corolla-tube 2.5-5 mm; stamens inserted near the base of the tube; anthers 1-1.25 mm, sessile, unequal, lanceolate, acuminate; ovary c. 0.5 mm; stigma cap-shaped, with a distinct paler ring at the base; fruit of 2 nutlets, enclosed by the persistent calyx; nutlet 1.5-2.5 mm, ovoid, apex retuse or notched, rugose-tuberculate.

N (Cairo); garden weed. Native to South America, introduced and naturalized in many tropical and subtropical regions.

13. **Heliotropium pterocarpum** (DC.) Hochst. & Steud. ex Bunge, Bull. Soc. Imp.

Naturalistes Moscou 42: 331 (1869).

Syns. *Heliophytum pterocarpum* DC. in A. DC., Prodr. 9: 552 (1845).

Heliotropium kassasii Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 9, f. 2 (1974).

Bristly white-hairy annual, 10-40 cm; stems simple or branched, terete, densely clothed with whitish, soft, deflexed hairs; leaves 0.5-3.5 x 0.4-1.5 cm, lanceolate to elliptic, the margin crenate or crisped, the apex obtuse to acute, the base cuneate or attenuate; petiole 2-5 mm; inflorescence terminal, simple or forked; cymes dense, becoming lax in fruit; flowers in 1 rank, ebracteate, \pm sessile; calyx 3.5-4.5 mm, lobed almost to the base, hispid outside, hairy inside; corolla 4-7 mm, white, hypocrateriform, hairy outside, glabrous inside; tube slender; lobes 0.8-1.8 mm; stamens inserted \pm at the middle of the tube; anthers 1.25-1.5 mm, sessile, oblong, apiculate; ovary c. 0.5 mm, ovate; style 0.5-0.75 mm, ligulate, glabrous; stigma c. 0.5 mm, conical, glabrous; fruit subglobose, of 2 nutlets; nutlet 2-2.75 x 4-5.5 mm, laterally winged or with 4 protrusions, glabrous or hairy.

De. R, GE; sandy desert plains and edges of littoral salt marshes. Egypt, Sudan, Ethiopia, Socotra, Arabia.

14. **Heliotropium bacciferum** Forssk., Fl. Aegypt.-Arab. 38 (1775).

Pubescent white-bristly perennial, 20-50 cm, woody at the base; stems terete, much branched from the base, procumbent or ascending; leaves 0.5-2.5 x 0.2-1.6 cm, linear-lanceolate, the apex acute or obtuse, the margin revolute, the base tapering; petiole 0.2-1 cm; inflorescence terminal, forked; cymes spike-like, dense; flowers sessile or subsessile, in 2 ranks, ebracteate; calyx 2-3.25 mm, persistent; corolla 2.5-4.5 mm, white, hypocrateriform; tube 2.25-4 mm, cylindrical, dilated in the middle, narrowed towards the throat; limb 0.5-1.5 mm; lobes 0.5-0.75 mm, suborbicular; stamens inserted at or slightly below the middle of the tube; anthers 0.75-1.25 mm, subsessile, lanceolate, acute or

apiculate; ovary 0.5-1.25 mm, ovate, glabrous; style 0.5-1.5 mm, ligulate or slender, glabrous or sparsely hairy; stigma 0.5-1.5 mm, conical, with a stigmatic ring at the base, apex 2-4-lobed or 2-fid; fruit subglobose, of 4 or 2 nutlets; nutlet 1.5-2.5 x 0.8-3 mm, free or connate in pairs, all fertile or 2 abortive, the dorsal surface with or without dermal appendages, the apex acute (when nutlets 4), retuse or notched (when nutlets 2), the margins narrow or wing-like, glabrous or hairy, rugose or minutely tubercled.

Two varieties of subsp. *bacciferum* occur in Egypt:

subsp. **bacciferum** var. **bacciferum**

Syns. *Heliotropium undulatum* Vahl, Symb. Bot. 1: 13 (1790), nom. illeg.

Heliotropium crispum Desf., Fl. Atlant. 1: 151, t. 41 (1798).

Heliotropium marocanum Lehm., Pl. Asperif. Nucif. 56 (1818).

Heliotropium nubicum Bunge, Bull. Soc. Nat. Moscou 42 (1): 330 (1869).

Heliotropium makallense O. Schwartz, Fl. Trop. Arabien, Mitt. Inst. Allgem. Bot. Hamburg 10: 207(1939).

Nutlets 4, 1.5-2.25 x 0.5-1.5 mm, all fertile or 2 fertile and 2 sterile, free or connate in pairs, elliptic to ovoid, the apex acute or slightly obtuse, the base rounded, glabrous or hairy; dorsal surface without grooves, depressions or lines; dermal appendages absent or present; margins narrow, never winged.

N, D, R, GE, S; sandy desert wadis and plains. Sudan, North Africa, Sinai, East Mediterranean region, Arabia, Iran, Pakistan, Afghanistan.

subsp. **bacciferum** var. **erosum** Hadidy in Boulos, Fl. Egypt Checklist 118 (1995).

Syns. *Heliotropium erosum* Lehm., Pl. Asperif. 54 (1818).

Bourjotia kralikii Pomel, Nouv. Mat. Fl. Atlant. 1: 89 (1874).

Bourjotia erosa (Lehm.) Pomel, Nouv. Mat. Fl. Atlant. 1: 90 (1874).

Heliotropium undulatum Vahl subsp. *erosum* (Lehm.) Maire, Bull. Soc. Hist. Nat. Afr. Nord 22: 306 (1931).

Heliotropium undulatum Vahl subsp. *erosum* (Lehm.) Maire var. *kralikii* (Pomel) Maire, Bull. Soc. Hist. Nat. Afr. Nord 22: 306 (1931).

Heliotropium undulatum Vahl subsp. *erosum* (Lehm.) Maire var. *monodianum* Maire, Bull. Soc. Hist. Nat. Afr. Nord 28: 369 (1937).

Nutlets 2, 1.75-2.5 x 1.75-3.25 mm, ovoid to broadly elliptic, the apex retuse to deeply notched, the base flat, cordate or more commonly depressed, glabrous or hairy; dorsal surface usually with 1 or few lines; dermal appendages absent or present; margins narrowly or broadly winged.

N, D, R, GE; sandy and calcareous desert wadis and plains, edges of cultivation. Senegal, Canary Islands, North Africa, Sinai, ? Northeast Sudan.

15. **Heliotropium ramosissimum** (Lehm.) Sieb. ex A. DC., Prodr. 9: 536 (1845).

Syns. *Heliotropium undulatum* Vahl var. *ramosissimum* Lehm., Icon. Descr.

Stirp. 1, Icon. Asperif. 24, t. 40 (1831).

Heliotropium ramosissimum (Lehm.) Sieb. ex A. DC. var. *trichocarpum* DC. in A. DC., Prodr. 9: 537 (1845).

Like *Heliotropium bacciferum*, but flowers in 1 rank, dilated at the base; nutlets 4.

N, O, D, R, GE, S; sandy desert wadis and plains calcareous ridges. North Africa, Sinai, Arabia, Iran, Afghanistan.

NOTE: The type was collected by Sieber from Wadi Gmuhs, Egypt (K!).

16. **Heliotropium supinum** L., Sp. Pl., ed. 1, 130 (1753).

Syns. *Lithospermum heliotropioides* Forssk., Fl. Aegypt.-Arab. 39 (1775).

Heliotropium malabarica Retz., Obs. Bot. 2: 24 (1781).

Heliotropium cormandelianum Raddi ex DC., Prodr. 9: 533 (1845).

Heliotropium supinum L. var. *malabarica* (Retz.) Clarke in Hook. f., Fl. Brit. Ind. 4 (1): 49 (1885).

Appressed-hairy annual, 5-45 cm; stems terete, much-branched, erect or decumbent, densely clothed with short appressed deflexed hairs intermixed with long patent ones; leaves 0.7-4 x 0.5-2 cm, ovate or broadly elliptic, pubescent on both surfaces, the margin entire or slightly revolute, the apex acute or apiculate, the base \pm rounded; petiole 0.4-3 cm; inflorescence terminal and axillary, simple or forked; cymes spike-like, lax and elongate in fruit; flowers sessile or subsessile, ebracteate, in 1 or 2 ranks; calyx 2-3 mm, becoming 0.5 mm, accrescent and caducous in fruit, divided to $\frac{1}{4}$ of its length, lobes oblong-lanceolate; corolla 2-3.5 mm, white, covered externally with short deflexed hairs, glabrous inside; tube c. 2 mm, cylindrical; lobes minute; stamens inserted \pm at the middle of the tube; anthers 0.75-1.25 mm, sessile, lanceolate; ovary c. 1 mm; style 0.3-0.6 mm; stigma 0.4-0.6 mm, conical, pubescent; fruit of 1 nutlet, 3-4 mm, ovoid, dark brown with paler margins, glabrous, rugose, tuberculate.

N, M, O, D, S; sandy and alluvial plains, waste ground, roadsides, edges of cultivation. Canary Islands, South Europe, North Africa, Sinai, Palestine, Syria, Arabia, Iran, Pakistan, India, tropical East and West Africa, Namibia, South Africa.

NOTE: According to Verdcourt in Polhill (ed.), Fl. Trop. East Afr., Boraginaceae 76 (1991), there are two \pm distinct regional variants of *Heliotropium supinum*. He adds: "In Europe the fruit is practically invariably reduced to 1 nutlet whereas in tropical Asia and Africa there are usually 4 but sometimes 2 or 3 and occasionally 1." In Egypt, as in Europe, the fruit is mostly of 1 nutlet.

4. **Nogalia** Verdc.

Perennials, woody at the base; leaves alternate, sessile, linear-subcylindrical; inflorescence terminal, simple or forked; cymes \pm scorpioid; flowers actinomorphic; stamens 5, inserted on the upper part of the corolla-tube; anthers \pm sessile; fruit 4-locular, with a woody endocarp, not breaking into nutlets. 1 species, Southeast Egypt, Somalia, Yemen, Oman.

1. **Nogalia drepanophylla** (Baker) Verdc., Kew Bull. 43: 432 (1988).

Syn. *Heliotropium drepanophyllum* Baker, Bull. Misc. Inform., Kew 1894: 336 (1894).

Pubescent perennial herb 20-35 cm; stems erect or decumbent, terete; leaves 0.3-1.5 x 0.2-0.4 cm, linear-subcylindrical, alternate, sessile, densely arranged in axillary pseudo-fascicles; inflorescence terminal, simple or forked; cymes \pm scorpioid; flowers actinomorphic; calyx 3-4 mm, lobed to $\frac{1}{3}$ of its length, the lobes ovate; corolla 4.5-6

mm, infundibular, pubescent, yellow; lobes oblong, the apex obtuse, the margin revolute; stamens 5, inserted on the upper part of the corolla-tube and exerted from the throat; ovary c. 3 mm, subglobose, pubescent, 4-locular; style 2-2.5 mm; stigma c. 1 mm, conical, with a basal annual ring, the apex truncate; fruit c. 2.5 mm, subglobose, 4-locular, with a woody endocarp, not breaking into nutlets.

Two subspecies are known, of which one occurs in Egypt:

subsp. **drepanophylla**

Calyx lobed almost to base, lobes oblong-linear; corolla more glabrescent outside; anthers not or obscurely exerted.

This subspecies is known from Yemen and Oman.

subsp. **suaediformis** Verdc., Kew Bull. 43: 434 (1988).

Calyx lobed to $1/3$ - $2/3$ of its length, lobes ovate; corolla more pubescent outside; anthers distinctly exerted.

GE; rocky hillsides. Southeast Egypt, ?Northeast Sudan, Somalia.

5. **Paracaryum** (A. DC.) Boiss.
Syn. *Mattiastrum* (Boiss.) Brand

Annuals, biennials or herbaceous perennials; leaves basal and cauline, the basal often forming rosettes and the cauline alternate; inflorescence terminal; flowering cymes short, elongate in fruit; flowers ebracteate (our species) or bracteate, pedicellate; calyx 5, divided \pm to base, \pm accrescent in fruit; corolla actinomorphic, infundibular, campanulate or rotate, blue, violet or purple-brown, with 5 scales of variable shapes in the throat; stamens 5, inserted, rarely exerted; anthers longer than the filaments; ovary 4-lobed; style included or exerted; stigma capitate; fruit sessile or on a recurved pedicel, of 2-4 nutlets; nutlet ovoid or subglobose, with a central smooth or appendiculate disc and a flat or incurving denticulate to subentire wing not or partly covering the disc; gynobase pyramidal; areole ventral. 20 species, Mediterranean region to Central Asia.

- | | |
|--|----------------------------|
| 1. Biennial or herbaceous perennial; corolla 4-6 mm;
nutlets homomorphic | 1. P. rugulosum |
| + Annual; corolla 1.5-3 mm; nutlets heteromorphic or homomorphic | 2 |
| 2. Nutlets with flat wings | 3. P. bungei |
| + Nutlets with curved wings | 3 |
| 3. Nutlets 4, \pm of equal sizes, 3-4 nutlets winged; wing 1 mm broad,
partly covering the disc; outer margins smooth-undulate,
not glochidiate | 2. P. intermedium |
| + Nutlets 3-4, of equal sizes if 3, unequal if 4, either with rim-like
narrow wings or wings 1.5-3 mm and covering most of the disc;
outer margins glochidiate | 4. P. calathicarpum |

1. **Paracaryum rugulosum** (DC.) Boiss., *Diagn. Pl. Orient.*, ser. 1, 11: 129 (1849).
Syns. *Omphalodes rugulosa* DC. in A. DC., *Prodr.* 10: 160 (1846).
Paracaryum persicum (Boiss.) Boiss., *Diagn. Pl. Orient.*, ser. 1, 11: 129 (1849).
Cynoglossum rugulosum (DC.) Greuter & Burdet, *Willdenowia* 11: 36 (1981).

Canescent biennial or herbaceous perennial, 10-40 cm; stems simple or branched, erect, covered with appressed deflexed setulose hairs; basal leaves 2.8-12(-17) x 0.5-1.5 cm, oblong-lanceolate, entire, the apex obtuse to acute, the base attenuate; petiole 0.5-4 cm; cauline leaves 0.5-3.5 x 0.1-0.5 cm, oblong-linear, sessile, entire, acute; inflorescence raceme-like, simple or forked; flowers ebracteate, pedicellate; pedicel 4-6 mm and spreading in fruit; calyx 2.5-4 mm, the lobes unequal, elongating to 7 mm and \pm accrescent in fruit, with deflexed setulose hairs; corolla 4-6 mm, cylindric-campanulate, violet-blue, glabrous; tube 2.5-3.5 mm; scales 0.5 mm, trapeziform, blue or violet; lobes 1.5 mm, oblong, the apex truncate; stamens inserted near the apex of the tube; anthers 0.5-0.75 mm, apiculate; filaments very short; style 2 mm, inserted; stigma 2-lobed; nutlets 4, 4-6 mm, subglobose, homomorphic; disc smooth; wings 1.5-2.5 mm broad, membranous, usually strongly curved and partly covering the disc; outer margins smooth, undulate, or \pm entire; inner margins dentate-undulate.

S; limestone hillsides, sandy and stony wadis. Sinai, Southwest Asia.

NOTE: The type was collected by Aucher-Eloy 1820, from Sinai, at M. Horeb, Arabia Petrea (G).

2. **Paracaryum intermedium** (Fresen.) Lipsky, *Acta Hort. Petrop.* 26: 487 (1910).
Syns. *Cynoglossum intermedium* Fresen., *Mus. Senckenb.* 1: 169 (1834).
Cynoglossum linifolium Bové ex A. DC., *Prodr.* 10: 159 (1846).
Paracaryum micranthum Boiss., *Diagn. Pl. Orient.*, ser. 1, 11: 129 (1849),
nom. illeg.
Paracaryum boissieri Schweinf. in Asch. & Schweinf., *Mém. Inst. Egypt.*
2, Suppl. 769 (1889).

Appressed-setulose delicate annual, 5-30 cm; stems simple or branched from the base, terete, erect or ascending; basal leaves 2-4.5 x 0.3-0.6 cm, \pm in a rosette, oblong-lanceolate, entire, the apex obtuse, the base attenuate; petiole 1.5-4 cm; cauline leaves 1-2.5 x 0.2-0.4 cm, sessile, the apex acute to obtuse, the base attenuate; inflorescence terminal, raceme-like, simple or forked; flowers ebracteate, pedicellate; pedicel 1-4 mm, elongate and recurved in fruit; calyx 1-1.75 mm, the lobes linear, not or slightly accrescent in fruit; corolla 1.5-2.5 mm, campanulate-cylindric, blue; stamens inserted at the middle of the tube; anthers 0.5-0.75 mm; filaments very short; style c. 0.5 mm; stigma capitate; fruit of 4 nutlets \pm of equal sizes; nutlet 2.5-4 mm, subglobose to broadly ovoid; wing 1 mm broad, partly covering the disc, strongly curved in 3-4 nutlets, or rim-like in 1 nutlet; outer margins smooth-undulate, not glochidiate; the inner dentate or smooth.

N (Aswan province and Nubia), De, S; calcareous hillsides and desert wadis. Egypt, Palestine, Arabia, Iran, Afghanistan, Pakistan.

3. **Paracaryum bungei** (Boiss.) Brand in Engl., *Pflanzenr.* 78 (IV, 252): 47 (1921).
Syns. *Echinosperrum bungei* Boiss., *Fl. Orient.* 4: 252 (1875).

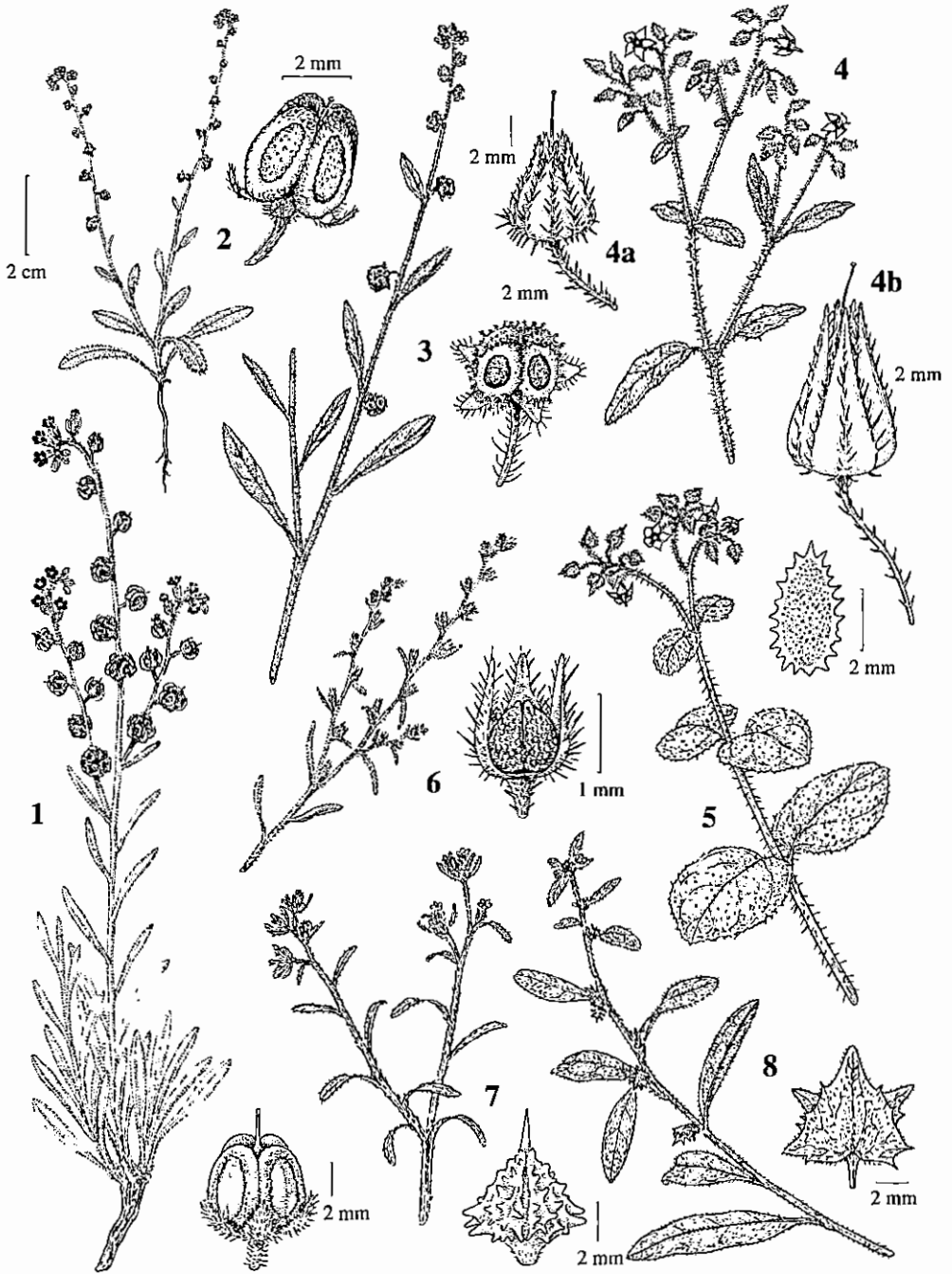


Plate 68. BORAGINACEAE: *Paracaryum rugulosum* 1, habit; fruit (down right). *Paracaryum intermedium* 2, habit; fruit (right). *Brandella erythraea* 3, flowering and fruiting branch; fruit showing the nutlets and persistent calyx. *Trichodesma africanum* 4, flowering and fruiting branch; persistent calyx enclosing the fruit of var. *africanum* 4a; var. *abyssinicum* 4b. *Trichodesma eherenbergii* 5, flowering and fruiting branch; nutlet (right). *Ogastemma pusillum* 6, flowering and fruiting branch; fruit (right). *Lappula spinocarpos* 7, flowering and fruiting branch; fruit (down right). *Asperugo procumbens* 8, flowering and fruiting branch; fruiting calyx enclosing the nutlets (right). All drawings to the same scale, except the enlarged parts (scale given).

Paracaryum bornmuelleri Brand, Feddes Repert. 14: 149 (1915).
Mattiasstrum bungei (Boiss.) Rech. f. & Riedl in Kôie & Rech. f., Biol. Skr.
13 (4): 209 (1963).

Appressed-hairy annual, 10-35 cm; stems usually branched from the base, terete, erect, ascending; basal leaves 1-1.5 x 0.15-0.25 cm, spatulate, petiolate; cauline leaves 1-1.5 x 0.2-0.5 cm, oblong-lanceolate, ± sessile; inflorescence terminal, raceme-like, lax; flowers short-pedicellate, the pedicel elongate in fruit; calyx 1-1.5 mm, accrescent in fruit, lobed almost to base, the lobes oblong-lanceolate, hispid; corolla 1.5-2 mm, blue, campanulate-tubular; tube 0.75-1 mm; lobes 0.5 mm, scales 0.25-0.4 mm, trapeziform; stamens c. 0.5 mm, inserted above the middle of the tube, filaments very short; style 0.5 mm; stigma capitate; fruit of 4 homomorphic nutlets; nutlet 2-3 x 2-2.5 mm, broadly ovoid; disc densely glochidiate; wings flat, glochidiate, tuberculate or dentate; areole lanceolate.

De, S; stony and sandy desert wadis. Egypt, Arabia, Iran, Afghanistan, Pakistan, Central Asia.

4. **Paracaryum calathicarpum** (Stocks) Boiss., Fl. Orient. 4: 254 (1875).
Syn. *Echinosperrum calathicarpum* Stocks, Hook. Kew J. 4: 175 (1852).

Delicate annual 10-25 cm; stems much-branched from the base, erect or ascending, covered with strigose hairs; basal leaves 2-4 x 0.4-0.8 cm, ± in a rosette, oblong-lanceolate, the apex obtuse, the base attenuate; petiole 1-3 mm; cauline leaves much shorter and narrower, sessile; inflorescence terminal, simple or forked; flowers ebracteate; pedicel 1-2.5 mm, elongate in fruit; calyx 1-2 mm, slightly accrescent in fruit; corolla 1.5-2.5 mm, blue, campanulate, the tube longer than the limb; scales c. 0.5 mm, glabrous, the apex truncate or 2-lobed; stamens inserted in the middle of the tube; anthers 0.5-0.75 mm, apiculate; filaments very short; ovary 4-lobed; style c. 0.5 mm, inserted; stigma capitate; fruit of 3-4 nutlets, of equal sizes if 3, unequal if 4; nutlet 4-5 x 4-6.5 mm, subglobose to broadly ovoid, either with rim-like narrow wings or wings 1.5-3 mm, and covering most of the disc; outer margins glochidiate, the inner dentate.

S; stony wadis. Sinai, Afghanistan, Pakistan.

6. **Brandella** R. R. Mill

Annuals or perennials; leaves in a basal rosette, and cauline; flowers ebracteate; calyx 5, divided almost to the base, not or slightly accrescent in fruit; corolla blue, actinomorphic, cylindric-campanulate, with 5 scales in the throat; stamens 5, spirally arranged, inserted in the middle of the tube or near the throat; filaments shorter than the anthers; ovary 4-lobed; style usually persistent in fruit; stigma capitate; fruit of 4 homomorphic nutlets; nutlet subglobose, dorsiventrally compressed, with a central aculeate or glochidiate disc; wings strongly curved inwards, glochidiate and aculeate. 1 species, Southeast Egypt, Sudan, Eritrea, Saudi Arabia.

1. **Brandella erythraea** (Brand) R. R. Mill, Notes Roy. Bot. Gard. Edinb. 43: 478 (1986).
Syn. *Adelocaryum erythraeum* Brand in Engl., Pflanzenr. 78 (IV, 252): 78 (1912).

Hirsute robust annual 10-40 cm; stems simple, erect, terete, covered with long setae intermixed with short appressed hairs; basal leaves 2-6 x 1-2 cm, spatulate, the apex

acute, the base attenuate; petiole 0.5-2.5 cm; cauline leaves shorter than the basal, oblong-lanceolate, acuminate, the uppermost clasping; inflorescence terminal, raceme-like; cymes 3-8-flowered, elongate and lax in fruit; flowers pedicellate, the pedicel elongating in fruit; calyx 5-lobed, the lobes 2-3 mm, lanceolate, acute, hispid; corolla 2.5-4 mm, cylindric-campanulate, bluish; tube 1-1.5 mm; limb 1.5-2 mm, deeply lobed; lobes c. 1 mm oblong, the apex obtuse or rounded; stamens inserted in the middle of the tube; anthers c. 0.5 mm; ovary c. 0.5 mm, ovoid, 4-lobed; style c. 0.25 mm, glabrous; stigma capitate; fruit of 4 homomorphic nutlets; nutlet c. 5 mm, subglobose; disc flat, glochidiate-aculeate, glochidia in 2-3 rows; wings membranous, strongly incurved; areole short, ovate, occupying the upper part.

GE; stony hillsides. Distribution as for the genus.

7. *Trichodesma* R. Br., nom. conserv.

Annuals, perennials or low shrubs, covered with tubercle-based prickles or hairy, sometimes glabrescent; leaves opposite, subopposite or alternate; inflorescence cymose, terminal or axillary; flowers pedicellate; calyx 5- (our species) or 6-lobed; lobes imbricate, ovate to lanceolate, often winged, narrowed at the apex, rounded to cordate at the base; corolla campanulate or funnel-shaped, blue or white; tube with naked throat; lobes ovate, cuspidate at the apex; stamens 5 (our species) or 6; filaments very short; anthers linear-lanceolate, ± pubescent on the back, usually forming a cone with twisted awns; ovary ovoid, 4-lobed; style gynobasic or terminal, long, subulate; stigma subglobose; fruit of 4 nutlets; nutlet 3-angled, with a disc and a rim-like margin, smooth, rugose or hairy; seeds subglobose or ovoid. 45 species, tropical and warm regions of the Old World.

1. Leaves oblong-lanceolate; calyx 1-1.5 cm in fruit 1. *T. africanum*
+ Leaves broadly ovate to suborbicular; calyx 6-7 mm in fruit 2. *T. ehrenbergii*

1. *Trichodesma africanum* (L.) R. Br., Prodr. Fl. Nov. Holl. 1:496 (1810).

Syns. *Borago africana* L., Sp. Pl., ed. 1, 138 (1753).

Borago verrucosa Forssk., Fl. Aegypt.-Arab. 412 (1775).

Boraginella africana (L.) Kuntze, Revis. Gen. 2: 435 (1891).

Annual or short-lived perennial, 0.2-1 m; stems branched mainly from the base, erect or ascending, densely covered with stiff and rigid tubercle-based prickles, glabrous or pubescent between the prickles; leaves 1.5-8.5 x 0.3-3.5 cm, opposite, the upper often subopposite or alternate, oblong-lanceolate, covered with erecto-patent prickles on both surfaces; petiole 0.5-2 cm; inflorescence terminal and axillary, paniculate; cymes elongate and lax in fruit; flowers bracteate; pedicel recurved and elongate to 1.2 cm in fruit; calyx 4-6 mm in flower, 1-1.5 cm and accrescent in fruit; lobes broadly lanceolate, the apex acute, the base truncate, hispid along the margin; corolla 0.5-1(-1.2) cm, blue, campanulate, glabrous outside and inside; tube 0.75-1.5 mm, yellow with purple spots; limb 4.5-7 mm; lobes 3.5-4.5 mm, broadly ovate; stamens inserted at the throat, exerted; anthers 4.5-6 mm, with glabrous appendages to 4.5 mm; filaments c. 1.5 mm; ovary 3-4.5 mm, ovate; style 5-9 mm; stigma capitate; nutlets 4, 4-5 mm, ovoid, dorsally compressed; disc ovoid, keeled, densely covered with deflexed bristles; wing narrow, rim-like, glochidiate-dentate.

Three varieties occur in Egypt:

1. Stems and leaves pubescent between the prickles
+ Stems and leaves glabrous between the prickles

var. **heterotrichum**
2

2. Calyx in fruit 0.6-1 cm, apex glabrous
+ Calyx in fruit 1-1.5 cm, apex lacinate

var. **africanum**
var. **abyssinicum**

var. **africanum**

N, O, M, D, R, GE, S; sandy and gravelly wadis, sandy desert plains, edges of cultivation. North Africa, Sinai, Palestine, Arabia, Iran, Afghanistan, India.

var. **heterotrichum** Bornm. & Kneuck., Allgem. Bot. Zeitschr. 22: 3 (1916).

De, R, S; stony wadis and sandy desert plains. North Africa, Sinai, Palestine, Arabia, Iran, Afghanistan, India, tropical and South Africa.

var. **abyssinicum** Brand in Engl., Pflanzenr. 78 (IV, 252): 30 (1921).

GE; stony hillsides. Southeast Egypt, Sudan, Eritrea, Ethiopia.

NOTE: The type of var. *heterotrichum* was collected from Sinai, Wadi Hebran, 14. 4. 1835, Schimper 226 (K, lectotype !).

2. **Trichodesma ehrenbergii** Schweinf., Zeitschr. Ges. Erkunde 4: 337 (1869).

Syns. *Borago arabica* Boiss., Fl. Orient. 4: 281 (1879).

Trichodesma africanum (L.) R. Br. var. *ehrenbergii* (Schweinf.) Post, Fl.

Syr. Pal. Sinai 535 (1896).

Annual 10-80 cm; stems simple or branched, erect or ascending, angular, covered with prickles and deflexed hairs; leaves 1.5-12 x 1-10 cm, opposite, broadly ovate to suborbicular, the indumentum similar to that of the stems, the apex rounded to subacute, sometimes apiculate, the base truncate or rounded; petiole 1-5 cm; inflorescence terminal and axillary; cymes lax and elongate in fruit; flowers bracteate; pedicel to 1 cm in fruit, densely hispid with yellowish bristles; calyx 4-5 mm in flower, 6-7 mm, accrescent and inflated in fruit, pubescent outside, glabrous inside; corolla 5.5-7 mm, campanulate-rotate, pale violet, with 5 brown spots at the throat, glabrous outside and inside; tube 1-1.5 mm; limb c. 4.5 mm; lobes 3-3.5 mm, broadly ovate; stamens inserted at the apex of the tube, exerted; anthers 4-4.25 mm, villose; awns 1.5-2 mm, twisted, glabrous; ovary 0.5-1 mm, 4-lobed, glabrous; style c. 4 mm, gynobasic, subulate; stigma capitate; nutlets 4, 4-5 mm, erect, ovoid; disc granulose to verrucose-gluchidiate; margins narrow, slightly incurved, glochidiate-dentate.

N (Aswan), De, R, GE, S; rocky hillsides and stony wadi beds. Egypt, Sudan, Arabia.

NOTE: The type of was collected from Egypt: Aegyptische Küste zwischen Kosser "Quseir" and Ras Benas, Wadi Etit bei Mirsa Wadi Lechuma, 10. 4. 1864, Schweinfurth 2081 (BM, syntype !).

8. **Ogastemma** Brummitt

Syn. *Megastoma* (Benth. & Hook. f.) Coss. & Durieu ex Bonnet & Barratte

Small appressed-strigose annuals; stems much-branched; leaves all cauline; flowers bracteate; calyx divided almost to base; corolla white; tube short, naked; annulus absent;

limb rotate; stamens 5, included; anthers longer than the filaments; ovary 4-lobed; style gynobasic, short, included in the corolla-tube; stigma 2-lobed; nutlets 4, ovate; areole narrowly triangular. 1 species, Canary Islands, Mauritania, North Africa, Sinai, Arabia.

1. **Ogastemma pusillum** (Coss. & Durand ex Bonnet & Barratte) Brummitt, Kew Bull. 36: 680 (1982).

Syns. *Megastoma pusillum* Coss. & Durieu ex Balansa, Pl. Algérie 1035 (1853), nom. nud., ex Bonnet & Barratte, Ill. Phan. Tunis., t. 11, f. 4-11 (1895).

Eritrichium sventenii Sunding, Bull. Jard. Bot. Macaronés. 3: 81 (1977).

Appressed-strigose annual, 3-15 cm; stems much-branched, erect or ascending, terete, covered with densely appressed setae; leaves 2.5-5 x 1-2.5 mm, sessile, linear-lanceolate, covered with tubercle-based setae, the apex acute to obtuse; inflorescence terminal, raceme-like, forked; flowers bracteate; pedicel 0.5-1.5 mm; calyx-lobes 2-4 mm, linear, unequal, slightly accrescent and to 5.5 mm in fruit, hispid; corolla c. 2.5 mm, campanulate, white, glabrous or sparsely hairy; tube 1-1.25 mm; limb c. 1 mm; lobes 0.5-0.8 mm, ± ovate; stamens included; anthers c. 0.25 mm, inserted at the middle of or slightly below the tube; filaments c. 0.2 mm; ovary 4-lobed, subglobose; style c. 0.25 mm; stigma 2-lobed; nutlets 4, 1.25-2 x 0.75-1 mm, ovoid, the apex acute, coherent, later free, granulose or verrucate; areole ventral, narrowly triangular.

De, S; desert wadis, alluvial and sandy plains. Distribution as for the genus.

9. **Lappula** Moench

Syns. *Echinosperrum* Sw. ex Lehm., *Sclerocaryopsis* Brand

Hispid annuals, biennials or herbaceous perennials; leaves sessile or subsessile; inflorescence spike-like; flowers sessile or short-pedicellate; calyx divided almost to base, accrescent in fruit; corolla blue or white, campanulate or salver-shaped, with 5 scales at the throat; stamens 5, included, inserted; anthers longer than the filaments; ovary 4-lobed; style short, overtopping the nutlets in fruit; stigma capitate or 2-lobed; nutlets 4, erect, free or adnate, pyriform, ovoid or trigonous, muricate, tuberculate or glochidiate; glochidia, if present, in 1 or 2 rows along the margin; gynophore pyramidal; areole oblong or linear. 40 species, temperate regions, but especially in Central Asia.

1. Pedicel c. 1 mm in fruit; nutlet 3-5 mm, triquetrous-pyramidal, whitish-grey, glossy

1. **L. spinocarpos**

+ Pedicel 3-5 mm in fruit; nutlet 2-3 mm, ovoid-pyriform, brownish

2. **L. sinaica**

1. **Lappula spinocarpos** (Forssk.) Asch. ex Kuntze, Acta Hort. Petrop. 10: 215 (1887).

Syns. *Anchusa spinocarpos* Forssk., Fl. Aegypt.-Arab. 40 (1775).

Myosotis spinocarpos (Forssk.) Vahl, Symb. Bot. 2: 32 (1791).

Echinosperrum vahlianum Lehm., Pl. Asperif. 1: 132 (1818).

Echinosperrum spinocarpos (Forssk.) Boiss., Fl. Orient. 4: 249 (1875).

Canescent annual, 5-25 cm; stems much-branched, erect or procumbent; leaves 1.5-3.5 x 0.1-0.3 cm, narrowly spatulate to linear, appressed-setulose; inflorescence terminal, forked; cymes lax; flowers bracteate; pedicel c. 1 mm, accrescent in fruit; sepals 3-4 mm, becoming 6-8 mm, accrescent and persistent in fruit; petals 2.5-4 mm, sky blue; tube 1-1.5 mm; stamens inserted at the apex, the anthers 0.6-1 mm, lanceolate; ovary c. 0.5 mm; disc undulate; style 0.5-1.25 mm, included, overtopping the nutlets; stigma obscurely 2-lobed, papillose; fruit of 4 nutlets, ovate-rhombic; nutlet 3-5 mm, triquetrous-pyramidal, emarginate, rugose or smooth, whitish-grey, glossy.

Two varieties occur in Egypt:

var. **spinocarpos**

Nutlets rugose, aculeate-tuberculate along the edges.

N, M, D, S; sandy desert wadis and plains, edges of cultivation.

NOTE: The type was collected by Forsskål from Alexandria, Egypt (C).

var. **inermis** Botsch., Bull. Acad. Sci. SSSR, Bot. 1: 364 (1964).

Nutlets smooth.

N (Cairo), D; sandy plains, edges of cultivation.

Area of the species: North Africa, Sinai, Palestine, Syria, Turkey, Iraq, Iran, Afghanistan, Pakistan to Central Asia.

NOTE: The type was collected by Botschantzev from the desert between Mersa Matruh and Siwa Oasis, 23. 4. 1962 (LE).

2. **Lappula sinaica** (DC.) Asch. & Schweinf., Mém. Inst. Egypte. 2: 111 (1887).

Syns. *Echinosperrum sinaicum* DC. in A. DC., Prodr. 10: 141 (1846).

Echinosperrum kotschyi Boiss., Diagn. Pl. Orient., ser. 1, 7: 29 (1846).

Echinosperrum divaricatum Bunge, Beitr. Kenntn. Fl. Russl. 410 (1851).

Appressed-setulose annual, 5-30 cm; stems simple or branched at the base, erect or ascending; leaves 1.5-4 x 0.3-1.5 cm, mainly basal, narrowly ovate, the apex obtuse to acute, sessile, patent-hairy; inflorescence terminal, raceme-like, forked; cymes lax; flowers bracteate; pedicel 3-5 mm in fruit; calyx-lobes 1-2 mm, oblong-lanceolate, slightly accrescent in fruit, hispid; corolla 2-3.5 mm, blue, campanulate, glabrous; tube c. 1 mm, the apex enclosed by ± oblong scales with obtuse apex; limb 1.5-2 mm; lobes c. 1 mm; stamens included, inserted near the throat; anthers c. 0.5 mm, obtuse; filaments very short; ovary c. 0.4 mm, globose, 4-lobed; style c. 0.5 mm; stigma capitate; nutlets 4, 2-3 mm, ovoid-pyriform; disc ovoid, tuberculate; margin narrow, rim-like, with 1 row of glochidiate prickles; areole ventral.

S; rocky wadis and mountain slopes. Sinai, Palestine, Turkey, northern Iraq, Iran, Afghanistan, Pakistan, Central Asia.

NOTE: The type was collected from Sinai by Aucher-Eloy 118 (G-DC).

10. **Asperugo** L.

Hispid annuals; stems ridged, flaccid; lower leaves alternate, petiolate, the upper opposite, sessile; flowers solitary or few in the axils of the foliaceous bracts; calyx divided to almost 1/2, dentate between the lobes, conspicuously accrescent in fruit; corolla infundibular, blue; throat with small white scales; stamens 5; anthers subsessile, included; style included; stigma capitate; fruit entirely enclosed by the accrescent folded calyx; nutlets 4, erect, ovoid-pyriform, laterally compressed. 1 species, temperate regions, but especially Europe, North Africa, Asia; introduced into North America.

1. **Asperugo procumbens** L., Sp. Pl., ed. 1, 138 (1753).

Hispid annual; 10-60 cm; stems procumbent, flaccid, ridged; basal leaves 2-8 x 0.5-4 cm, elliptic to lanceolate, petiolate, the apex acute, subacute or apiculate; upper cauline leaves smaller, sessile; flowers axillary, bracteate, solitary, 2 or more, subsessile; calyx lobed, the lobes 1.5-2.5 mm, unequal; fruiting calyx to 1.2 cm, accrescent, folded and clasped around the nutlets; corolla 2-3 mm, blue, becoming purplish; tube c. 1 mm, the throat with trapeziform hairy scales c. 0.3 mm; limb 1-1.5 mm; stamens inserted in the middle of the tube; anthers 0.5-0.75 mm, acute; filaments very short; ovary c. 0.4 mm, 4-lobed; style 0.3-0.4 mm; stigma 2-lobed; nutlets 4, 2.5-3 mm, erect, ovate-pyriform, laterally compressed, attached to the pyramidal-columnar gynobase; areole ± elliptic, above the middle of the nutlet.

S; sheltered, moist rocky crevices. Distribution as for the genus.

11. **Buglossoides** Moench

Hispid annuals; leaves usually alternate; inflorescence terminal, spike- or raceme-like; flowers bracteate; calyx divided almost to base, accrescent in fruit; corolla white or blue, the throat with 5 vertical bands of hairs; stamens inserted below middle of the tube, the anthers included; style short, included; stigmas 2; nutlets 4 or fewer by abortion, erect or divergent, ovoid or pyriform, beaked, with dorsal and ventral keels in the upper half, tuberculate-rugose; areole usually conspicuous; gynobase almost flat or pyramidal. 15 species, temperate Europe, Mediterranean region, Asia.

1. Pedicel very short in fruit, not thickened; calyx and bracts covered with yellowish hairs; corolla infundibular; tips of nutlets equal, ventral keels parallel; areole 0.5-0.75 mm broad, not extending to the dorsal side 1. **B. tenuiflora**
+ Pedicel 2-3 mm in fruit, thickened, obconical; calyx and bracts covered with whitish hairs; corolla hypocrateriform; tips of nutlets unequal, ventral keels never parallel; areole c. 1 mm, extending to the dorsal side 2. **B. incrassata**

1. **Buglossoides tenuiflora** (L. f.) I. M. Johnst., J. Arnold Arbor. 35: 42 (1954).

Syns. *Lithospermum tenuiflorum* L. f., Suppl. Pl. 130 (1781).

Myosotis tenuiflora (L. f.) Viv., Fl. Libyc. Spec. 9 (1824).

Appressed-setulose annual, 5-30 cm; stems simple or much-branched, erect or ascending; leaves 0.5-1.8 x 0.2-0.4 cm, narrowly elliptic to linear, obtuse, sessile; inflorescence terminal, forked; cymes dense in flower, elongate in fruit; flowers bracteate, sessile or subsessile; pedicel very short and not thickened in fruit; calyx 3-4 mm, covered by yellowish hairs, accrescent in fruit to 8 mm, the lobes linear-lanceolate; corolla 4-6 mm, pale blue, infundibular; tube 2.5-4 mm; limb 1.5-2 mm, appressed-hispid outside, with 5 bands of pilose hairs inside, associated with glands extending to the apex of the anthers; stamens included, inserted near the base of the tube; anthers 0.5-0.75 mm; ovary ovate, glabrous; style 0.5-1 m, glabrous; stigma obscurely 2-lobed; fruit of 4 nutlets, enclosed by the accrescent calyx; nutlets 2-2.5 x 1.5-2.25 mm, erect or slightly divergent, pyriform, tips equal, warty or verruculose, ventral keels parallel; beak incurved; areole 0.5-0.75 mm broad, not extending to the dorsal side; gynobase shortly pyramidal.

M, S; hillsides and cultivated ground. South Russia, Caucasus, Balkans, North Africa, Sinai, Palestine, Syria, Turkey, northern Iraq, Iran, Afghanistan.

NOTE: The type was collected by Latourette from Egypt, specimen 181/13, Herb. LINN.

2. **Buglossoides incrassata** (Guss.) I. M. Johnst., J. Arnold Arbor. 35: 43 (1954).
 Syns. *Lithospermum incrassatum* Guss., Ind. Sem. Hort. Boccad. 5: 6 (1826).
Lithospermum gasparrinii Guss., Fl. Sic. Syn. 1: 217 (1843).

Like *Buglossoides tenuiflora*, but fruiting pedicels 2-3 mm, thickened, obconical, the upper end as broad as the calyx-base; calyx and bracts covered with whitish hairs; corolla hypocrateriform; tips of nutlets unequal, the ventral keels never parallel; areole c. 1 mm, extending to the dorsal side.

M; edges of cultivated ground. North Africa, East Mediterranean region.

12. **Arnebia** Forssk.

Hispid annuals (our species) or herbaceous perennials; roots yielding purple dye; stems simple or branched; leaves alternate, all cauline; inflorescence spike- or raceme-like; flowers bracteate, often dimorphic-heterostylous; calyx deeply divided into 5 lobes, sometimes accrescent in fruit; corolla yellow, blue, purple or pale violet, hypocrateriform or infundibular; throat without scales or hairs; annulus present or absent; stamens 5, included; style included, once or twice 2-fid; stigmas 2 or 4; nutlets 4, erect, subglobose or ovoid-pyramidal, with acute beak and ventral keel, glabrous, reticulate, muricate or rugose, rarely smooth; areole conspicuous, basal; gynobase flattened or pyramidal. 25 species, Mediterranean region, tropical Africa, Himalayas.

- | | |
|---|---------------------------|
| 1. Corolla pale violet or blue, glabrous; annulus 0; nutlets ± smooth,
not keeled ventrally | 1. A. tinctoria |
| + Corolla yellow, hairy outside, annulus present, nutlets mostly verrucate,
keeled ventrally | 2 |
| 2. Calyx hardly accrescent in fruit; corolla-tube hairy inside | 2. A. hispidissima |
| + Calyx strongly accrescent in fruit; corolla-tube glabrous inside | 3 |
| 3. Stigmas 4; fruiting calyx 1-1.8 x 0.05-0.2 cm; nutlets
2-2.25 x 1-1.5 mm | 3. A. decumbens |
| + Stigmas 2; fruiting calyx 2-2.5 x 0.3-0.45 cm; nutlets
2.5-3 x 2-2.5 mm | 4. A. linearifolia |

1. **Arnebia tinctoria** Forssk., Fl. Aegypt.-Arab. 63 (1775).
 Syn. *Arnebia tetrastigma* Forssk., Fl. Aegypt.-Arab. 62 (1775), nom. nud.

Appressed-setulose annual, 5-15 cm; stems branched from the base, erect or ascending; leaves 1.5-5 x 0.2-0.8 cm, oblong-lanceolate to linear, the apex obtuse, the base long-attenuate; petiole 0.5-3 cm; inflorescence terminal, spike-like, usually simple; cymes dense in flower and fruit; flowers bracteate, the bracts foliose, exceeding the calyx; calyx 0.4-1 cm, the lobes unequal, hirsute, accrescent in fruit to 1.5 cm; corolla 0.6-1.1 cm, pale violet or blue, glabrous; tube 4-8 mm; annulus 0; limb c. 2 mm; stamens inserted at the apex of the tube; anthers 0.5-0.75 mm, oblong-elliptic, obtuse; filaments very short; style 3.5-4.5 mm, included, slender, twice 2-fid; stigmas 4, reniform; nutlets 2 mm, cordate, ± smooth, not keeled ventrally.

D, S; alluvial and sandy desert soils. Libya, Egypt, Palestine, Arabia, Iraq.

2. **Arnebia hispidissima** (Lehm.) DC. in A. DC., Prodr. 10: 94 (1846).
 Syns. *Lithospermum hispidissimum* Lehm., Ic. Descr. Stirp. 23, t. 39 (1821).
Dioclea hispidissima Spreng., Syst. Veg., ed. 16, 1: 556 (1825).
Echiochilon hispidissima Tausch, Flora 12: 643 (1829).

Densely strigose annual, with tubercle-based bristles and deflexed hairs, 5-40 cm; stems mostly branched, erect or ascending; leaves 1.5-7.5 x 0.2-1 cm, linear-lanceolate, acute or obtuse, sessile or subsessile, inflorescence terminal, simple or forked, spike-like; cymes short and dense; flowers subsessile, bracteate, the bracts foliose, usually exceeding the calyx; calyx 5-8 mm, divided almost to base; lobes unequal, linear, acute, densely white-hispid, hardly accrescent in fruit; corolla 0.8-1.6 cm, yellow, infundibular; tube 0.6-1 cm, slightly swollen in the middle, hairy inside; limb 2.5-5 mm, spreading; lobes 1-2 mm; stamens included, inserted at or above the middle of the tube; anthers c. 1.5 mm, oblong-lanceolate, obtuse; filaments c. 0.5 mm; ovary 4-lobed, ovate, glabrous; style 1-1.2 cm, 2-fid; stigmas 2, reniform; nutlets 4, 1.5-2 mm, pyramidal, ventrally keeled, granulose to verrucate or smooth, greyish or yellowish-brown; areole triangular.

N, De, R, GE, S; sandy and stony wadis, desert plains, edges of cultivation. Egypt, Southwest Asia, Sudan, Chad, West tropical Africa.

3. **Arnebia decumbens** (Vent.) Coss. & Kralik, Bull. Soc. Bot. France 4: 402 (1857).
 Syns. *Lithospermum decumbens* Vent., Descr. Pl. Nov. Jard. Cels. 4, t. 37 (1801).
Onosma divaricata Lehm., Pl. Asperif. 372 (1818).
Lithospermum micranthum Viv., Fl. Libyc. Spec. 10, t. 1, f. 4 (1824).
Lithospermum cornutum Ledeb., Fl. Altaica 1: 175 (1829).
Arnebia cornuta (Ledeb.) Fisch. & C. A. Mey., Index Sem. Hort. Petrop. 1: 22 (1835).

Densely patent-hispid annual, 10-50 cm; stems branched, erect or ascending, covered with tubercle-based bristles and patent hairs; leaves 1-5 x 0.1-0.6 cm, linear-lanceolate, sessile or subsessile; inflorescence terminal, spike-like, forked or simple; flowers sessile, bracteate, the bracts equalling or exceeding the calyx, lanceolate to linear-lanceolate; calyx 0.6-1 cm, strongly accrescent in fruit to 1.8 cm, the apex acute, hispid; corolla 0.8-1.5 cm, yellow, hairy outside, glabrous inside; tube 0.6-1.2 cm; limb 2-3.5 mm; lobes 1-1.5 mm, broadly ovate; stamens inserted at the throat; anthers c. 1 mm, oblong-elliptic, the apex obtuse; filaments c. 0.25 mm; style c. 7 mm, slender, twice 2-fid; stigmas 4, globose; nutlets 2-2.25 x 1-1.5 mm, enclosed by the accrescent gibbous calyx, ovoid-triangular, beak acuminate, tuberculate-rugose.

Two varieties occur in Egypt:

var. **decumbens**

Syn. *Arnebia decumbens* var. *microcalyx* Coss. & Kralik, Bull. Soc. Bot. France 4: 402 (1857), nom. illeg.

Fruiting calyx 0.8-1.2 x 0.5-1 mm; lobes ± filiform, midrib conspicuous.

N (Aswan province), M, De, S; sandy deserts and plains, edges of cultivation.

var. **macrocalyx** Coss. & Kralik, Bull. Soc. Bot. France 4: 403 (1857).

Syns. *Arnebia decumbens* (Vent.) Coss. & Kralik subsp. *macrocalyx* (Coss. & Kralik) Riedl, Österr. Bot. Z. 109: 65 (1962).

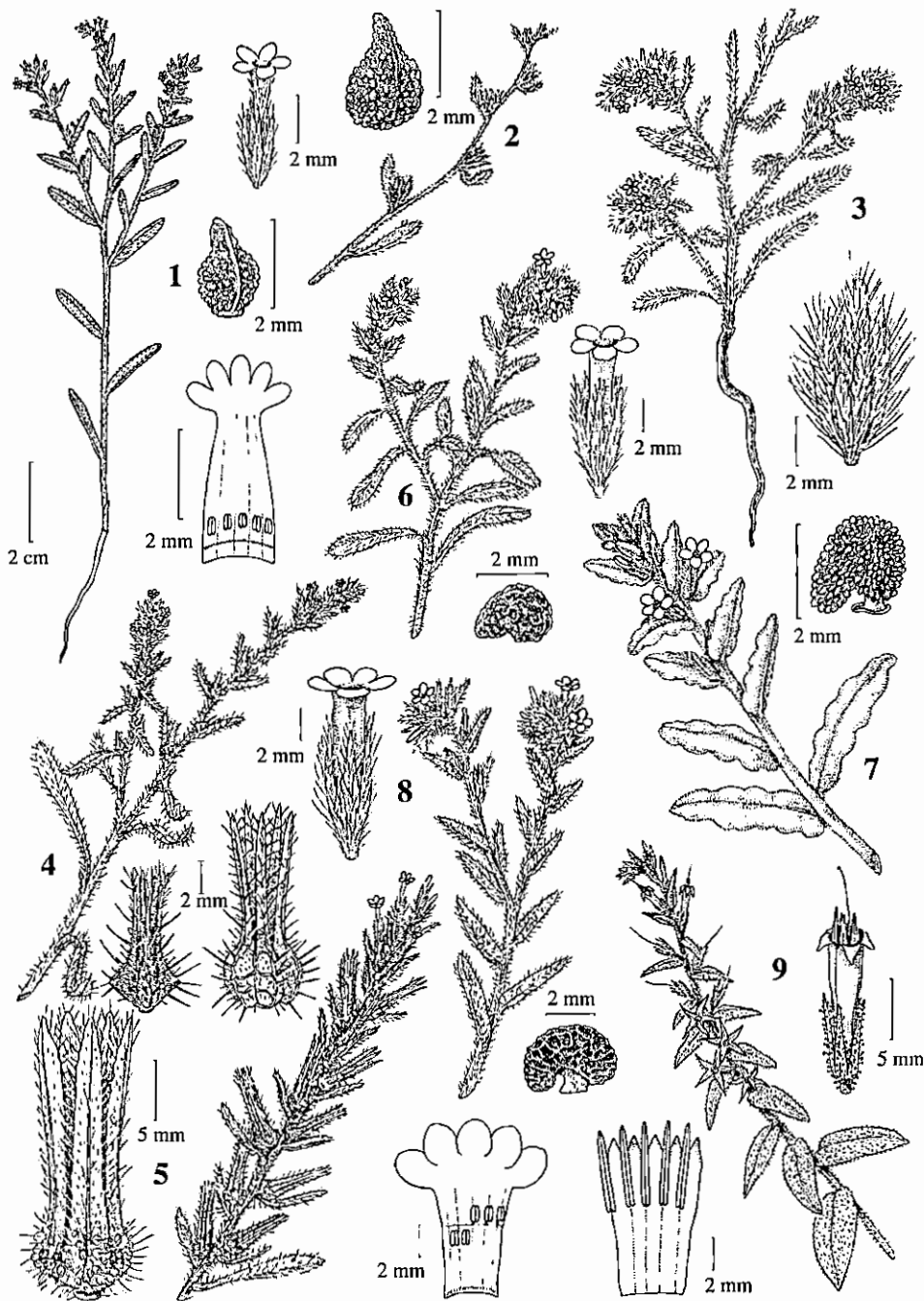


Plate 69. BORAGINACEAE: *Buglossoides tenuiflora* 1, habit; flower (up right); nutlet (middle right); corolla (down right). *Buglossoides incrassata* 2, flowering and fruiting branch; nutlet (left). *Arnebia hispidissima* 3, habit; fruiting calyx (right). *Arnebia decumbens* 4, flowering and fruiting branch; fruiting calyx of var. *decumbens* (down right); var. *macrocalyx* (down, further right). *Arnebia linearifolia* 5, flowering and fruiting branch; fruiting calyx (down left). *Alkanna lehmanii* 6, flowering and fruiting branch; flower (up right); nutlet (down right). *Alkanna orientalis* 7, flowering and fruiting branch; nutlet (right). *Alkanna strigosa* 8, flowering and fruiting branch; flower (up left); nutlet (down right). *Podonosma galalensis* 9, flowering and fruiting branch; flower (right); corolla (down left). All drawings to the same scale, except the enlarged parts (scale given).

Arnebia macrocalyx (Coss. & Kralik) Boulos, Candollea 32: 102 (1977).

Fruiting calyx 1.5-1.8 x 0.1-0.2 cm; lobes linear, midrib ± inconspicuous.

N, M, D, S; sandy deserts and plains, edges of cultivation.

Area of the species: North Africa, Sinai, Palestine, Syria, Turkey, Caucasus, Iraq, Arabia, Iran, Afghanistan, Pakistan, China.

4. *Arnebia linearifolia* A. DC., Prodr. 10: 95 (1846).

Syns. *Arnebia flavescens* Boiss., Diagn. Pl. Orient., ser. 1, 11: 117 (1849).

Echioides linearifolium (A. DC.) Rothm., Feddes Repert. 49: 56 (1940).

Like *Arnebia decumbens* var. *macrocalyx*, but plant shorter (in Egypt), 5-12 cm, sparsely adpressed-hispid; leaves adpressed-pilose; stigmas 2; fruiting calyx 2-2.5 x 0.3-0.45 cm; nutlets 2.5-3 x 2-2.5 mm, with a short acuminate beak.

N, M, D, S; sandy wadis, alluvial desert plains, edges of cultivation. North Africa, Sinai, Palestine, Arabia, Iraq, Iran, Afghanistan, Pakistan.

13. *Alkanna* Tausch, nom. conserv.

Syns. *Baphorhiza* Link, *Campylocaryum* DC. ex Meisn.,

Camptocarpus K. Koch, *Onochiles* Bubani

Perennial herbs; roots often containing red alkannin dye; leaves alternate, puberulent, pilose, glandular-hairy or setose; inflorescence terminal, raceme-like; cymes elongate and lax in fruit; flowers bracteate; calyx lobed almost to the base, slightly accrescent in fruit; corolla yellow, white or blue, infundibular or hypocrateriform, glabrous or hairy outside; throat with a ring of hairs and sometimes with small invaginations; annulus of separate lobes or rim-like, glabrous or ciliate; stamens 5, included; filaments very short; ovary 4-lobed; style included; stigma small, ± globose; nutlets 1-2(-4), subreniform or obliquely ovoid, strongly curved, tuberculate and/or reticulate, rarely smooth; beak straight, curved or deflexed, gynobase swollen; areole ovate or flattened. About 25 species, Mediterranean region to Iran.

1. Corolla deep blue; annulus rim-like, glabrous; nutlets 2.5-3 mm broad, tuberculate

1. *A. lehmanii*

+ Corolla yellow or pale blue; annulus lobed or rim-like, ciliate; nutlets 3-4 mm broad, tuberculate or strongly reticulate

2

2. Bracts 1-2 cm broad, ovate; corolla yellow; annulus of ovate or subquadrate lobes

2. *A. orientalis*

+ Bracts 2-4(-6) mm broad, lanceolate; corolla pale blue; annulus rim-like

3. *A. strigosa*

1. *Alkanna lehmanii* (Tin.) A. DC., Prodr. 10: 588 (1846).

Syns. *Lithospermum tinctorium* L., Sp. Pl., ed. 1, 132 (1753).

Anchusa tinctoria (L.) L., Sp. Pl., ed. 2, 192 (1762), quoad nom.

Anchusa tuberculata Forssk., Fl. Aegypt.-Arab. 41 (1775).

Alkanna tinctoria Tausch, Flora 7: 234 (1824), nom. illeg.

Lithospermum lehmanii Tin. in Guss., Fl. Sic. Syn. 2: 791 (1845).
Alkanna tuberculata (Forssk.) Meikle, Kew Bull. 34: 823 (1980),
non *Alkanna tuberculata* Greuter, Exsicc. Genav., Fasc. 3: 38
(1972), nom. illeg.

Pubescent herbaceous perennial, 10-40 cm; stems much-branched, procumbent to ascending, angular, densely clothed with short tomentellous hairs and long white setae; basal leaves 1-6 x 0.3-1 cm, oblong-lanceolate, entire or crisped; petiole 1-4 cm, upper leaves shorter, oblong-linear, sessile; inflorescence terminal, simple or forked, dense, becoming lax and elongate in fruit; bracts 0.5-2 x 0.2-0.6 cm, narrowly ovate; calyx 4-6.5 mm in flower, 7-9 mm in fruit; lobes linear-lanceolate, densely covered with setulose hairs; corolla 0.7-1 cm, deep blue, glabrous outside; tube 5-8 mm, straight; limb 3.5-5 mm; lobes 1.5-2.5 mm, broadly spatulate; annulus rim-like, glabrous; anthers 0.75-1.25 mm, oblong-elliptic, obtuse; filaments very short; style 4-5 mm, slender; stigma 2-lobed; nutlets 2-3 x 2.5-3 mm, obliquely ovoid, reticulate-tuberculate, the apex abruptly and strongly curved.

M, S; coastal calcareous and sandy orchards and roadsides. Mediterranean region.

NOTE: Meikle, in Kew Bull. 34: 821-824, 1980, discussed the nomenclatural tangle of *Alkanna tinctoria* Tausch, non L. He concluded that this taxon was from the outset illegitimate, and proposed the new combination *Alkanna tuberculata* (Forssk.) Meikle, based on *Anchusa tuberculata* Forssk. However, in Flora of Cyprus 2: 1139-1140, 1985, he states that *Alkanna tuberculata* is an illegitimate later homonym of *A. tuberculata* Greuter, and the combination *Alkanna lehmanii* (Tin.) A. DC. is adopted.

2. ***Alkanna orientalis*** (L.) Boiss., Diagn. Pl. Orient., ser. 1, 4: 46 (1844).

Syns. *Anchusa orientalis* L., Sp. Pl., ed. 1, 133 (1753).

Lithospermum orientale (L.) L., Syst. Nat., ed. 14, 145 (1767).

Viscid, glandular-hairy, yellowish-green perennial, often cushion-like, to 80 cm diam.; stems much-branched, erect or ascending, angular, densely glandular-hairy, with setiform hairs; basal leaves (5-)8-20 x 1-4 cm, oblong-lanceolate, the margin undulate, the apex acute, the base long-attenuate; petiole to 5 cm; cauline leaves 1-7 x 0.5-2 cm, oblong-elliptic, sessile, the margin slightly undulate, the apex acute; uppermost leaves ± clasping; inflorescence terminal, simple or forked; flowers bracteate, pedicellate; bracts 1-2 x 0.5-1 cm, ovate, sessile, acute, subcordate at the base; calyx 0.6-1 cm in flower, slightly accrescent and to 1.5 cm in fruit; corolla 1.2-1.5 cm, yellow, glabrous outside; tube 8-9 mm; lobes c. 2 mm, ovate; annulus of ovate or subquadrate ciliate lobes; stamens included; anthers c. 1.5 mm, oblong, obtuse; filaments very short; ovary 4-lobed; style c. 4 mm, with a distinct dark median nerve; nutlets 2, 2-2.5 x 3-3.5 mm, ovoid, with a strongly curved beak, reticulate-rugose, glabrous.

S; sandy and rocky wadis. Southern Greece, Turkey, Lebanon, Syria, Palestine, Sinai, Caucasus, northern Iran.

3. ***Alkanna strigosa*** Boiss. & Hohen. in Boiss., Diagn. Pl. Orient., ser. 1, 4: 46 (1844).

Syns. *Campylocaryum syriacum* Boiss. & Hohen. in DC., Prodr. 10: 101 (1846).

Alkanna syriaca (Boiss. & Hohen.) Boiss., Fl. Orient. 4: 226 (1875).

Canescent perennial 15-30 cm, with woody base; stems much-branched from the base, erect or ascending, densely covered with tubercle-based bristles and short glandular

hairs; leaves 1-6 x 0.2-0.6 cm, linear, rigid, the lower attenuate at the base, the upper ± clasping; inflorescence terminal and axillary, simple or forked; cymes dense in flower, lax and elongate in fruit; flowers bracteate, pedicellate; bracts 1-1.6 x 0.2-0.4(-0.6) cm, lanceolate, clasping; calyx 6-8 mm, strongly strigose, slightly accrescent in fruit; corolla 1-1.3 cm, pale blue, glabrous outside; tube 6-8 mm, orange-tinged near the throat; limb 6-8 mm broad; annulus rim-like; anthers c. 1 mm, oblong, filaments 0.5 mm, style included; stigma capitate; nutlets 2-3 x 3-4 mm, obliquely ovoid, strongly curved, reticulate-rugose, glabrous.

S; calcareous hillsides. Sinai, Palestine, Syria, Lebanon, Turkey.

14. *Podonosma* Boiss.

Herbaceous perennials; indumentum of glandular hairs and white tubercle-based bristles; leaves sessile, entire; inflorescence terminal, leafy, raceme-like; calyx divided almost to base, slightly accrescent in fruit; corolla pale blue or white; tube with a nectariferous ring at the base; lobes triangular, acute, deflexed; stamens 5, inserted ± at the middle of the tube; anthers elongate, sagittate, with exserted apical appendages; style filiform, glabrous; stigma indistinct; nutlets strongly incurved, ending in a horizontal beak; areole small, basal. 3 species, East Mediterranean region.

1. *Podonosma galalensis* Schweinf. ex Boiss., Fl. Orient. 4: 1199 (1879).

Syn. *Onosma galalensis* (Schweinf. ex Boiss.) Täckh. & Boulos, Publ. Cairo Univ. Herb. 5: 8 (1974).

Yellowish-green pubescent perennial, 15-40 cm; base woody, creeping; stems numerous, pendulous or ascending, leafy; leaves 1-4 x 0.2-1 cm, lanceolate, sessile, the margin entire, the apex acute, glandular-hairy intermixed with slender bristles; upper leaves ± clasping; inflorescence terminal; flowers bracteate, pedicellate; bracts 0.6-1.2 x 0.2-0.4 cm, narrowly lanceolate; pedicel 3-4 mm in fruit; calyx 3-5 mm in flower, 5-7 mm in fruit, the lobes linear-lanceolate, acute, stellate, spreading after nutlet dispersal; corolla 0.7-1 cm, pale blue, glabrous; tube 5-6 mm; annulus of 10 ovate lobes; limb 4-5 mm; lobes c. 1.5 mm, triangular, deflexed; stamens exserted; anthers c. 3.25 mm, apiculate; nutlets 2-2.5 mm, white-tuberculate, curved; beak obtuse; areole basal, ± rounded; gynobase 4-lobed.

De; stony walls, crevices in calcareous ground. Egypt, Palestine.

15. *Moltkiopsis* I. M. Johnst.

Dwarf hirsute shrublet, woody at the base; old stems with white bark; inflorescence short, spike-like, flowers bracteate; calyx divided almost to base; corolla blue, tubular, broadened above, hairy outside, with a hairy nectariferous ring near the base; stamens 5, slightly exserted; filaments unequal; style ± exserted; stigma obscurely 2-lobed or subglobose; gynobase depressed; nutlets 4, or 2-3 by abortion, triquetrous, acute, smooth, glossy; areole flattened. 1 species, North Africa, Sinai, Palestine, Arabia, Iraq, Iran.

1. *Moltkiopsis ciliata* (Forssk.) I. M. Johnst., J. Arnold Arbor. 34: 3 (1953).

Syns. *Lithospermum ciliatum* Forssk., Fl. Aegypt.-Arab. 39 (1775).

Lithospermum angustifolium Forssk., Fl. Aegypt.-Arab. 39 (1775).

Lithospermum callosum Vahl, Symb. Bot. 1: 14 (1790), nom. illeg.

Moltkia ciliata (Forssk.) Maire in Maire & Emb., Cat. Pl. Maroc 4: 1102 (1941).

Dwarf hirsute shrublet 10-40 cm, woody at the base, covered with white appressed hairs and longer tubercle-based bristles; stems much-branched from the base, erect or ascending, the old branches with white bark; leaves 1-2 x 0.3-0.5 cm, oblong- to ovate-lanceolate, sessile, the margin callous and ciliate, the apex acute; cymes simple, dense, elongate and lax in fruit; flowers bracteate, sessile or subsessile; bracts 6-8 x 2-3 mm narrowly lanceolate; calyx 4-6 mm, the lobes linear, hispid, circumscissile above the base at maturity and caducous, exposing the nutlets; corolla 1-1.5 cm, blue, turning violet after anthesis, hairy outside, glabrous inside; tube 6-8 mm; annulus well-developed, the lobes 2-3 mm; stamens inserted in the corolla throat, in 2 series, 3 upper and 2 lower with shorter filaments; anthers 1-1.5 mm, ovate; style c. 1 cm, ± exserted; stigma depressed-capitate or obscurely 2-lobed; nutlets 2-3 mm, ovoid-triquetrous, acute, dorsally rounded, ventrally keeled, laterally ± gibbous, glossy, smooth or faintly tuberculate; gynobase depressed.

N, M, D, S; sandy wadis and plains. North Africa, Sinai, Palestine, Arabia, Iraq, Iran.

NOTE: The type was collected in 1762 by Forsskål 282, from Cairo, Egypt, "ad canales Káhirensis" (C).

16. *Anchusa* L.

Syns. *Lycopsis* L., *Hormuzakia* Guşul., *Phyllocara* Guşul.

Hispid annuals, biennials or herbaceous perennials; inflorescence terminal, usually elongate and lax in fruit; calyx divided, often accrescent in fruit; corolla yellow, white, blue or violet, infundibular or hypocrateriform, actinomorphic or rarely zygomorphic, the throat with penicellate scales; stamens 5, inserted ± at the middle or top of the tube; style included; stigma capitate; nutlets 4, reticulate or tuberculate, glabrous, stipitate, hollow at the base, with a basal ring, erect or obliquely ovoid. About 35 species, Mediterranean region, West Asia, South Africa.

- | | |
|---|-------------------------|
| 1. Biennial or perennial; calyx divided to 1/2; corolla deep violet | 1. <i>A. undulata</i> |
| + Annual; calyx divided almost to base, corolla yellow, white or pink | 2 |
| 2. Corolla yellow, white or pink; scales curved outwards; anthers in 2 series; nutlet erect or slightly oblique | 3 |
| + Corolla blue or pale violet; scales straight; anthers in 1 series; nutlet horizontally curved | 4 |
| 3. Calyx 3-5 mm, accrescent in fruit to 7-8 mm ; corolla 6.5-9 mm, pale yellow; nutlets 4-5 x 3-4 mm | 2. <i>A. aegyptiaca</i> |
| + Calyx 5-7 mm, not accrescent in fruit; corolla 1-1.3 cm, white or pinkish; nutlets 3.5-4 x 2-2.5 mm | 3. <i>A. milleri</i> |
| 4. Flowers sessile; calyx 5-6 mm; nutlets hemispherical or helmet-shaped | 5. <i>A. humilis</i> |
| + Flowers pedicellate; calyx 2-4 mm; nutlets transversely ovoid | 4. <i>A. hispida</i> |

1. *Anchusa undulata* L., Sp. Pl., ed. 1, 133 (1753) subsp. *hybrida* (Ten.) Bég. in Bég. & Fiori, Nouvo Giorn. Bot. Ital., nov. ser., 17: 634 (1910).
Syns. *Anchusa hybrida* Ten., Prodr. Fl. Nap. 1: 45, t. 11, no. 1338 (1811).
Anchusa undulata L. var. *hybrida* (Ten.) Fiori & Bég. in Fiori & Paoletti,
Fl. Anal. Ital. 2: 376 (1902).

Tuberculate-hispid biennial or short-lived perennial, 10-50 cm; stems simple or branched from the base, erect, ascending or procumbent, angular; basal leaves 3-11 x 0.5-2 cm, oblong-lanceolate, the margin undulate, the apex obtuse or rounded, the base long-attenuate; petiole to 7 cm; cauline leaves 3-5.5 x 0.5-1.5 cm, narrowly lanceolate, acute, sessile; inflorescence raceme-like, much elongate in fruit; flowers pedicellate, bracteate; bracts ovate-lanceolate, acute, cordate at the base; calyx 0.6-1 cm, divided to 1/2 of its length, accrescent and inflated in fruit; corolla 0.8-1.5 cm, deep violet, infundibular; tube 0.6-1.2 cm; limb 5-7 mm; scales 1.5-3 mm, oblong-ovate, inserted at the top of the tube; stamens inserted \pm at the middle of the tube, not overlapping with the scales; anthers 1.5-2.5 mm, linear-lanceolate, apiculate; ovary c. 1 mm, 4-lobed, glabrous; style 0.9-1.1 cm, slender; stigma capitate to obscurely 2-lobed; nutlets 4, 2-2.5 x 3-4 mm, enclosed by the persistent accrescent calyx, obliquely ovoid, the apex blunt or slightly incurved, reticulate-ribbed, finely tuberculate.

N, M; sandy coastal plains, roadsides, waste ground. Mediterranean region, excluding Spain.

NOTE: The stamens are inserted well below the annular scales in the Egyptian material of *Anchusa undulata*, hence it belongs to subsp. *hybrida*. According to Chamberlain in Davis, Fl. Turkey 6: 389 (1978), subsp. *undulata*, in which the stamens are inserted at the top of the tube and overlap the scales, is restricted to the Iberian peninsula.

2. *Anchusa aegyptiaca* (L.) A. DC., Prodr. 10: 48 (1846).
Syns. *Lycopsis aegyptiaca* L., Sp. Pl., ed. 1, 138 (1753).
Asperugo aegyptiaca (L.) L., Sp. Pl., ed. 2, 198 (1762).
Anchusa flava Forssk., Fl. Aegypt.-Arab. 40 (1775).

Hispid white-warty annual, 10-50 cm; stems much-branched, erect, ascending or sprawling, angular; leaves 3-9 x 1.2-3 cm, oblong-lanceolate, the margin sinuate-denticulate or repand, the apex acute, the base attenuate; petiole 1.5-5 cm; upper leaves sessile; inflorescence leafy, few-flowered, lax in fruit; flowers bracteate, pedicellate; bracts 1-4 x 0.2-1.2 cm, oblong-lanceolate; pedicel 3-5 mm, elongate in fruit to 1 cm; calyx 3-5 mm, hispid, 7-8 mm and accrescent in fruit, the lobes lanceolate; corolla 6.5-9 mm, pale yellow, hypocrateriform; tube 5-6 mm; scales c. 1 mm exerted, oblong, velutinous, the tips curved outwards; limb 5-7 mm; lobes 1.5-2 mm, subrotundate; stamens inserted \pm at the middle of the tube, in 2 series of 2 and 3; anthers c. 1 mm, oblong-elliptic, obtuse; ovary ovate, glabrous; style 2-2.5 mm, slender, glabrous; stigma 2-lobed; nutlets 4, 4-5 x 3-4 mm, erect or slightly oblique, \pm ovoid, yellowish-brown, the inner face flat, the outer convex, reticulate-ribbed, glabrous, glossy.

N, M, De, S; cultivated and fallow fields, roadsides, coastal sandy and stony ground. Libya, Egypt, Palestine, Syria, Lebanon, Turkey, Aegean Islands, Greece, Crete, Cyprus, Arabia, Iraq, Iran.

NOTE: The type was collected from Egypt, specimen 189/5, Herb. LINN.

3. *Anchusa milleri* Spreng., Nachtr. Bot. Gart. Univ. Halle 10 (1801).

Hispid annual 10-50 cm; stems simple or branched, procumbent; leaves 2-16 x 0.5-3 cm, oblanceolate to oblong, covered with short hairs and long bristles, the margin entire or repand-denticulate, the apex obtuse to acute, the base attenuate; petiole 0.5-5 cm; upper leaves sessile; inflorescence leafy, raceme-like, lax in fruit; flowers bracteate, pedicellate; bracts foliose, sessile; pedicel 3-8 mm, elongate in fruit; calyx 5-7 mm, divided almost to base, the lobes linear, not accrescent in fruit; corolla 1-1.3 cm, white or pinkish; tube 7-9 mm, straight; scales c. 0.5 mm, inserted at the corolla-throat, exerted, oblong, velutinous, the tips curved outwards; limb 4-5 mm broad, slightly zygomorphic; lobes 1.5-2 mm, broadly obovate; stamens inserted \pm at the middle of the tube, in 2 series of 2 and 3; anthers c. 1 mm, oblong-elliptic, obtuse; ovary glabrous; style 2-2.5 mm, slender, glabrous; stigma 2-lobed; nutlets 4, 3.5-4 x 2-2.5 mm, erect or slightly oblique, the inner face flat, the outer \pm convex, reticulate-ribbed, the ribs smooth, yellowish-brown, glabrous.

N, M, De, S; sandy and calcareous desert wadis and plains. Egypt, Palestine, Syria, Lebanon, Saudi Arabia.

NOTE: The type was collected in June 1886, from Sinai by Hochstetter (K).

4. *Anchusa hispida* Forssk., Fl. Aegypt.-Arab. 40 (1775).

Syns. *Gastrocotyle hispida* (Forssk.) Bunge, Delect. Sem. Hort. Dorpat. 1849: 2 (1849).

Anchusa hispida Forssk. var. *songarica* Trautv., Bull. Soc. Naturalistes Moscou 39: 101 (1866).

Hispid annual 5-40 cm, covered with unequal tubercle-based bristles; stems branched, angular, procumbent; lower leaves 1.5-7 x 0.3-0.6 cm, linear-lanceolate, the margin repand or undulate, the apex obtuse to acute; petiole to 4.5 cm; upper leaves subsessile; inflorescence terminal and axillary; cymes lax, scarcely elongate in fruit; flowers bracteate, pedicellate; bracts 1-4 x 0.2-0.5 cm; calyx 2-4 mm, hispid; corolla c. 3 mm, pale violet or blue; tube 1-2 mm; lobes 1-2 mm; scales papillose; stamens inserted slightly below the middle of the tube; anthers c. 0.5 mm, oblong; ovary 4-lobed, glabrous; style short; stigma obscurely 2-lobed or subcapitate; nutlets 4, 2-2.5 x 3-4.5 mm, horizontally curved, transversely ovoid, rugose, reticulate-ribbed, hollow at the base, with a rugose-denticulate basal ring and a horizontal cleft above the ring.

N, M, D, S; sandy wadis and plains, edges of cultivation. North Africa, Sinai, Palestine, Lebanon, Syria, Arabia, Iraq, Iran, Afghanistan, Pakistan.

NOTE: The type was collected from Cairo, Egypt, 'In desertis Káhirinis', 1761-1762, by Forsskål 310 (C).

5. *Anchusa humilis* (Desf.) I. M. Johnst., Contr. Gray Herb. 73: 55 (1924).

Syns. *Echium humile* Desf., Fl. Atlant. 1: 165 (1798).

Anchusa aggregata Lehm., Pl. Asperif. 1: 219 (1818).

Hormuzakia aggregata (Lehm.) Guşul., Publ. Soc. Nat. Romania 6: 8, f. 2: 15 (1923).

White-hispid annual 5-50 cm, covered with tubercle-based bristles; stems branched, procumbent; basal leaves 4-10 x 0.5-2 cm, \pm in a rosette, oblanceolate, the apex obtuse, the margin repand or entire; petiole 1-1.5 cm; upper cauline leaves sessile; inflorescence

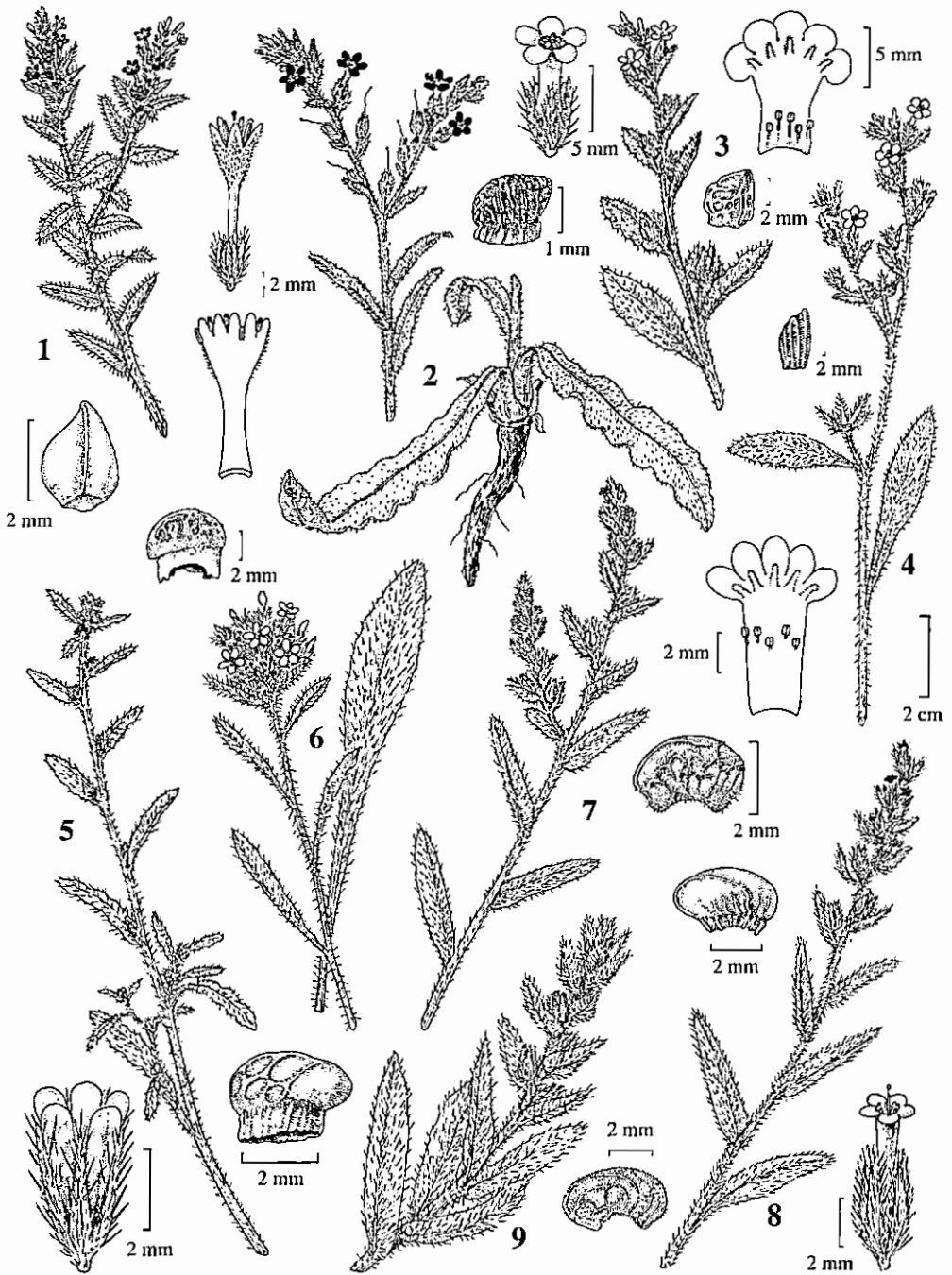


Plate 70. BORAGINACEAE: flowering and fruiting branches of: *Moltkiopsis ciliata* 1; flower (up right); corolla (down right); nutlet (down left). *Anchusa undulata* 2; basal part (down right); nutlet (right). *Anchusa aegyptiaca* 3; flower (up left); corolla (up right); nutlet (middle right). *Anchusa milleri* 4; nutlet (middle left); corolla (down left). *Anchusa hispida* 5; flower (down left); nutlet (down right). *Anchusa humilis* 6; nutlet (up left); basal leaf (right). *Nonea ventricosa* 7; nutlet (right). *Nonea vivianii* 8; nutlet (up left); flower (down right). *Nonea melanocarpa* 9; nutlet (right). All drawings to the same scale, except the enlarged parts (scale given).

dense, glomerulose, remaining dense in fruit; flowers bracteate, sessile; bracts 1-2 cm, oblong-linear; calyx 5-6 mm, divided almost to the base, accrescent in fruit to 8 mm, densely white-hispid; corolla 0.7-1 cm, pale blue; tube 4-7 mm, straight; limb 3-6 mm broad, actinomorphic; lobes 1.5-2 mm, broadly ovate; scales c. 0.5 mm, exserted, fimbriate or papillose at the subacute apex; stamens in 1 series, inserted about 1 mm below the scales and overlapping them; anthers c. 1 mm, oblong, apiculate; filaments c. 0.5 mm; ovary 4-lobed, glabrous; style 3-3.5 mm, slender; stigma 2-lobed; nutlets 2, 2.5-3 x 3-4.5 mm, horizontally curved, hemispherical or helmet-shaped, reticulate-ribbed, papillose between the ribs, with a dentate basal broad ring and a deep horizontal cleft above the ring.

N, O (Kharga), M, D, S; coastal sandy and stony ground, edges of cultivation. East Mediterranean region, Sinai.

17. *Nonea* Medik.

Strigose or glandular-pubescent annuals, biennials and herbaceous perennials; leaves entire or erose-dentate, the basal obscurely petiolate, the upper sessile or often amplexicaul or decurrent; inflorescence terminal; flowers bracteate, short-pedicellate; bracts foliaceous, conspicuous; calyx 5-lobed, accrescent, inflated and ventricose in fruit; corolla, infundibular or hypocrateriform, blue, purple, pink, red, yellow or white; limb actinomorphic or oblique; annular scales minute or reduced to a tuft of hairs; stamens 5, inserted near the throat; filaments short; style included; stigma clavate or capitate; nutlets 4, erect, oblique or horizontal, reticulate-rugose to almost smooth, hollow at the base, often with a basal ring. 35 species, Mediterranean region, West Asia.

1. Corolla white, sometimes with pink veins at the base; style 1-1.2 mm;
nutlet without a basal ring 1. *N. ventricosa*
+ Corolla dark purple or violet; style 4.5-7 mm; nutlet with a well-developed
basal ring 2
2. Style \pm 7 mm, exserted; nutlets 2-3 x 3.5-5 mm, transversely ovoid,
glabrous; basal ring strongly ribbed, denticulate 2. *N. vivianii*
+ Style \pm 4.5 mm, included; nutlet 1.5-2 x 3.5-4.5 mm, puberulent;
basal ring rugose 3. *N. melanocarpa*

1. *Nonea ventricosa* (Sm.) Griseb., Spic. Fl. Rum. Bith. 2: 93 (1844).

Syns. *Anchusa ventricosa* Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1: 117 (1806).

Nonea echioides acut. non (L.) Roem. & Schult., Syst. Veg. 4: 71 (1819).

Appressed-hairy annual 10-30 cm, with tubercle-based bristles; stems branched from the base, sprawling or ascending; leaves 2-8 x 0.5-1.2 cm, strigose, oblong-lanceolate, subacute, attenuate at the base; upper leaves sessile, \pm clasping; inflorescence terminal, simple, elongate in fruit; flowers sessile or short-pedicellate, bracteate; bracts 0.8-2 x 0.4-0.8 cm, lanceolate, persistent; calyx 4.5-5.5 cm, accrescent in fruit to 1.2 cm and becoming inflated and ventricose; lobes 1.5 x 1 mm, deltoid; corolla white, sometimes with pink veins at the base; tube 4-5 mm, straight; limb 2.5-4 mm, horizontal; scales reduced to a tuft of hairs; stamens inserted just below the throat; filaments very short; anthers c. 1.2 mm; ovary c. 1 mm, glabrous; style 1-1.2 mm, rather thick; stigma 2-lobed; nutlet 2-2.5 x 3-3.5 mm, transverse, reniform, glabrous or sparsely hairy, ridged, minutely verruculose, without a basal ring.

S (St. Katherine); sandy wadis. East Mediterranean region, Sinai, southern Europe.

2. *Nonea vivianii* A. DC., Prodr. 10: 31 (1846).

Hispid annual 10-40 cm, densely covered with tubercle-based hairs; stems branched from the base, decumbent or ascending; lower leaves 3-8 x 0.3-1.2 cm, oblong-elliptic, entire, subacute, attenuate at the base; upper leaves lanceolate, sessile, ± clasping; inflorescence terminal, mostly forked; flowers bracteate, short-pedicellate; bracts 1-3 x 0.5-1.25 cm, ovate-lanceolate, acute; calyx 4-6 mm, divided almost to base, lobes lanceolate, acute, accrescent in fruit to 1.2 x 0.5 cm; corolla 0.7-1.1 cm, violet, glabrous outside; tube 5-7 mm; scales c. 0.25 mm, oblong, velutinous; limb 2-3 mm; lobes c. 1 mm, broadly ovate; stamens inserted above the middle of the tube, included; anthers 1.5-2.25 mm, oblong-lanceolate, apiculate; filaments very short; style c. 7 mm, exserted; stigma subcapitate; nutlets 2, 2-3 x 3.5-5 mm, transversely ovoid, glabrous; basal ring strongly ribbed, denticulate; areole laterally basal.

M, S; coastal sandy soils and calcareous ridges. Egypt, Libya.

3. *Nonea melanocarpa* Boiss., Diagn. Pl. Orient., ser. 1, 11: 96 (1849).

Setulose annual 10-30 cm, with tubercle-based bristles; stems simple or branched, erect or ascending, angular; basal leaves 2-7.5 x 0.4-1.2 cm, oblong-lanceolate, the margin entire or repand, tapering at the base; upper cauline leaves sessile, ± clasping; inflorescence terminal, raceme-like, simple or forked; flowers bracteate; bracts 1.5-4 x 0.4-1 cm, acute; calyx 4.5-6.5 mm, divided to 1/3, inflated and accrescent to 1.5 cm in fruit; corolla 7-9 mm, purple; tube 4.5-7 mm, cylindrical; scales very short; limb 3-4.5 mm; lobes 1-1.25 mm, truncate; stamens inserted ± at the middle of the tube, included; anthers c. 2 mm, oblong, apiculate; filaments very short; ovary 4-lobed, style c. 4.5 mm, included; stigma subcapitate; nutlet 1.5-2 x 3.5-4.5 mm, puberulent all over; basal ring rugose, erose-denticulate, distinctly ribbed.

M; roadsides and edges of cultivation. Egypt, Palestine, Turkey, Caucasus, northern Iraq, northern Iran, Afghanistan, Pakistan.

18. *Echium* L.

Syn. *Megacaron* Boiss.

Hispid-setose annuals, biennials or herbaceous perennials; basal leaves usually forming a rosette, attenuate at the base, petiolate; cauline leaves sessile or short-petiolate; inflorescence terminal or axillary; cymes spike-like, paniculate or thyrsoid; flowers bracteate; calyx divided almost to base, ± accrescent in fruit; corolla blue, violet, purple, pink, yellow or white, zygomorphic, narrowly to broadly infundibular, tube tapering, limb oblique, usually hairy outside, throat without hairs or stipitate glands; annulus of 5-10 scale-like lobes or a lineate ring; stamens 5, included or some exserted, filaments inserted unequally in the tube; anthers small; ovary 4-lobed; style exserted, 2-lobed or 2-fid; stigmas 2; nutlets 4, erect or slightly divergent, ovoid-trigonal, subglobose or tetragonal, ventrally keeled, dorsally carinate, laterally ± compressed or gibbous, basically angulate or round; beak erect or incurved, smooth or rugose, tuberculate or reticulate; areole small, basal. 60 species, Macaronesia, Mediterranean region, West Asia, South Africa.

1. Indumentum homotrichous

2

+ Indumentum heterotrichous

3

2. Calyx-lobes unequal; corolla 1-1.5(-1.7) cm, white, yellow or pink, drying brownish; all stamens exserted 1. **E. rauwolfii**
 + Calyx-lobes equal; corolla 1.5-2.5 cm, blue or violet, drying purple; 2-4 stamens exserted 2. **E. horridum**
3. Corolla hispid outside only along the veins, otherwise glabrous 3. **E. plantagineum**
 + Corolla uniformly hairy outside 4
4. Stamens differently exserted 5
 + Stamens all included 10
5. Exserted stamens 1-2 6
 + Exserted stamens 3-5 8
6. Stems with under-layer of uniformly deflexed hairs; nutlets aculeate 4. **E. longifolium**
 + Stems with under-layer of antrorse or hirsute hairs; nutlets not aculeate 7
7. Calyx accrescent in fruit; corolla 1.2-2.2 cm, broadly infundibular; annulus of 10 separate lobes; 1-2 stamens long-exserted 5. **E. sabulicolum**
 + Calyx not accrescent in fruit; corolla 1-1.2 cm, narrowly infundibular, annulus of 5 united lobes; 1-2 stamens slightly exserted 6. **E. rubrum**
8. Annual; corolla broadly infundibular, red; 1-2 stamens long-exserted; nutlets aculeate 4. **E. longifolium**
 + Biennial or perennial; corolla \pm narrowly infundibular, not red; 3-5 stamens long-exserted; nutlets not aculeate 9
9. Stems simple; inflorescence unbranched; cylindric or spike-like; corolla pink or whitish with mauve spots 8. **E. glomeratum**
 + Stems numerous; inflorescence branched; corolla pink or violet 7. **E. angustifolium**
10. Stems and inflorescence with rough indumentum; fruiting calyx accrescent in fruit 5. **E. sabulicolum**
 + Stems and inflorescence with soft indumentum; fruiting calyx not accrescent in fruit 6. **E. rubrum**

1. **Echium rauwolfii** Delile, Descr. Egypte, Hist. Nat. 195, t. 19, f. 3 (1814).

Annual 10-40 cm; indumentum homotrichous, of stiff white tubercle-based bristles; stems branched, erect or ascending; basal leaves 3-15(-24) x 0.5-2.5 cm, oblong-lanceolate, the apex obtuse, the base attenuate; petiole 1.5-6 cm; cauline leaves 1-12 x 0.2-1.8 cm, narrowly spatulate, sessile; inflorescence terminal, spike-like, elongate and lax in fruit; flowers subsessile, bracteate; bracts 0.5-2 cm, lanceolate; calyx (0.5-) 0.8-1.2 cm, hispid, the lobes unequal; corolla 1-1.5(-1.7) cm, infundibular, white, yellow or pink, drying brownish, hairy especially at the tip; annulus of 10 hairy, \pm quadrate, broadly ovate lobes; stamens all exserted; anthers 0.8-1 mm, oblong; filaments glabrous; style c. 1.2 mm, densely pilose at the base, the apex 2-fid; fruiting calyx 0.8-1.3 cm, the lobes oblong-lanceolate; nutlets 3-4 x 2-2.5 mm, greyish-brown, glossy, \pm tuberculate or smooth.

N, M, De, S; roadsides, edges of cultivation, sandy and stony desert plains. Libya, Egypt, Palestine, Arabia.

NOTE: The type was collected from Egypt, in insulis niloticus prope Boulaq et Gyseh (Giza), Delile 219 (MPU).

2. **Echium horridum** Batt., Bull. Soc. Bot. France 39: 336 (1892).

Syns. *Echium maroccanum* Murb., Coutr. Fl. Tunis. 2: 12 (1898).

Echium milillense Pau, Bol. Soc. Esp. Hist. Nat. 24: 100 (1924).

Stout annual or short-lived perennial, 0.2-1.2 m; stems simple or much-branched; branches erect or ascending, angular; indumentum homotrichous, of yellowish-white erecto-patent, bulbous-based setae, glabrous between the setae; leaves (2-)4-11 x 0.5-3 cm, oblong-lanceolate, obtuse, attenuate at the base; petiole 1-3.5 cm; upper leaves sessile; inflorescence terminal, spike-like; flowers bracteate, subsessile; bracts 0.5-2 cm, narrowly lanceolate; calyx 0.7-1.6 cm, hispid, the lobes equal; corolla 1.5-2.5 cm, broadly infundibular, blue or violet, drying purple; tube \pm equaling the limb; annulus of 10 hairy subquadrate lobes; exerted stamens 2-4, the posterior inserted; anthers c. 1 mm; filaments unequal, glabrous; style 1.5-2 cm, filiform, appressed-hairy; apex 2-fid; fruiting calyx 1.1-2 cm; nutlets 4-angled, 4-5 x 3-3.5 mm, tuberculate-rugose, greyish or pale brown.

De, R, GE; sandy desert plains and stony wadis. North Africa, Arabia.

3. **Echium plantagineum** L., Mant. Alt. 202 (1771).

Annual or short-lived perennial, 20-70 cm; indumentum heterotrichous, of tubercle-based spreading setae and appressed hairs; stems branched; leaves 4-14 x 0.5-4 cm, oblong-lanceolate to linear, the lateral veins distinct, the base attenuate; upper leaves sessile with truncate base; inflorescences terminal and axillary, spike-like; flowers bracteate, subsessile; bracts foliar, ovate-lanceolate, exceeding the calyx at anthesis; calyx 0.6-1.2 cm, hispid, the lobes linear-lanceolate, accrescent in fruit to 1.5 cm; corolla 1.5-3 cm, infundibular, blue-violet, hispid outside along the veins, otherwise glabrous; exerted stamens 2, the anterior longest; anthers c. 1 mm; filaments 2-3 cm; style c. 2 cm, 2-fid, hispidulous at the base, included; nutlets 4, 2.5-3 x 2-2.5 mm, ovoid-pyramidal, tuberculate, greyish-brown.

M (Mersa Matruh); coastal sandy soil. Atlantic Islands, West Europe, Mediterranean region; naturalized in South Russia, Caucasus, East Africa, Australia.

4. **Echium longifolium** Delile, Descr. Egypte, Hist. Nat. 184, t. 16, f. 3 (1814).

Hispid annual 30-60 cm; stems branched, erect or ascending; indumentum heterotrichous, of hirsute tubercle-based setae and an under-layer of uniformly deflexed hairs; basal leaves 4-15(-18) x 0.5-2 cm, oblong-lanceolate, acute or obtuse, attenuate at the base; petiole 2.5-4 cm; cauline leaves 3-7 x 0.5-0.7 cm, linear-lanceolate, sessile; inflorescence terminal and axillary; flowers bracteate, short-pedicellate; bracts leaf-like, linear-lanceolate, clasping, longer than the calyx at anthesis; calyx 0.6-1 cm, the lobes unequal, linear-lanceolate, hispid, slightly accrescent in fruit; corolla 1.4-2 cm, infundibular, red, drying pink or purple, hairy outside; tube 5-7 mm; annulus of 10 pilose lobes; limb 0.8-1 cm; lobes c. 2 mm, broadly ovate; exerted stamens 2; anthers c. 1 mm,

blue; style 1.5-1.8 cm, hairy; stigma capitate; nutlets 4, 2-3 x 1.5-2 mm, ovoid-tetraquetrous, aculeate, slightly tuberculate, brownish.

N, D; sandy desert plains, fields and edges of cultivation. Libya, Egypt, Palestine, Arabia.

NOTE: The type was collected from Cairo, Egypt, "ad culta in Aegypto prope Kahiram", Delile 218 (MPU !).

5. **Echium sabulicolum** Pomel, Bull. Soc. Sci. Phys. Algérie 11: 90 (1874).

Hispid annual or short-lived perennial, 10-50 cm; stems procumbent or ascending, much-branched from the base; indumentum heterotrichous, of antrorse setae and an under-layer of patent hairs; basal leaves 2.5-6 x 0.5-1.5 cm, spatulate, obtuse, attenuate at the base, petiole 0.5-2 cm; cauline leaves 0.8-3 x 0.3-1 cm, linear-lanceolate, short-petiolate, the uppermost sessile; inflorescence terminal and axillary, spike-like; flowers bracteate, sessile; bracts foliar, ± equalling the calyx at anthesis, linear-lanceolate; calyx 0.6-1 cm, hispid, the lobes unequal, linear-lanceolate, accrescent in fruit to 1.5 cm; corolla 1.2-2.2 cm, broadly infundibular, blue, hairy outside, with antrorse setae along the nerves; tube shorter than the limb; annulus of 10 separate, unequal, subquadrate lobes; lobes 1.5-2 mm, ± rounded; exerted stamens 1-2, the anterior longer; anthers c. 0.5 mm; filaments glabrous; style 0.8-1.2 cm, hairy at the lower half, 2-fid; nutlets 2-3 x 1.5-2 mm, obovoid-triquetrous, keeled, granulose-tuberculate, brown or greyish.

Two varieties occur in Egypt:

var. **sabulicolum**

Calyx 0.6-1 cm at anthesis, conspicuously accrescent in fruit to 1.7 mm; corolla 1.5-2.2 cm.

M; coastal sandy soils. North Africa, West and South Europe from Spain to Italy.

var. **tenue** (Roth) Hadidy in Boulos, Fl. Egypt Checklist 123 (1995).

Syns. *Echium tenue* Roth, Catalecta Bot. 2: 16 (1800).

Echium micranthum Schousb., Kongel. Danske Vidensk.-Selsk. Skr. 1: 75 (1801).

Echium modestum Ball, J. Linn. Soc. 16 (96): 575 (1878).

Calyx 6-8 mm at anthesis, slightly accrescent in fruit to 1.2 cm; corolla 0.8-1.2 cm.

M; coastal sandy soils. North Africa, western Mediterranean region.

6. **Echium rubrum** Forssk., Fl. Aegypt.-Arab. 41 (1775).

Syns. *Echium setosum* Vahl, Symb. Bot. 2: 35 (1791).

Echium spathulatum Viv., Fl. Libyc. Spec. 8, t. 9, f. 1 (1824).

Echium verecundum Viv., Pl. Aegypt. 4: 20, t. 2, 14 (1830).

Annual 5-40 cm; stems much-branched from the base, rarely simple, the branches ascending or decumbent; indumentum heterotrichous, of patent setae and appressed hairs; basal leaves 2.5-16 x 0.5-2.5 cm, spatulate to broadly-linear, obtuse, long-



Plate 71. BORAGINACEAE: *Echium rauwolfii* 1, flowering and fruiting branches and basal leaf; nutlet (down right). *Echium horridum* 2, flowering and fruiting branch; nutlet (left). *Echium longifolium* 3, flowering and fruiting branch. *Echium sabulicolum* 4, flowering and fruiting branch; nutlet (right). *Echium rubrum* 5, flowering branch of a male plant; male flower (down); flowering and fruiting branch of a female plant (right to male plant); female flower (up right). *Echium angustifolium* subsp. *sericeum* 6, flowering and fruiting branch; nutlet (down right). *Echium glomeratum* 7, flowering and fruiting branch. *Echiochilon fruticosum* 8, flowering and fruiting branch and basal part; flower (left); nutlet (right). All drawings to the same scale; except the enlarged parts (scale given).

attenuate at the base; petiole to 8 cm; cauline leaves 1-9 x 0.3-2 cm, oblong, sessile; inflorescence terminal and axillary, spike-like; flowers bracteate, the bracts exceeding the calyx at anthesis, linear-lanceolate; calyx 0.5-1.3 cm, longer in male plants than in the females, linear-lanceolate, hirsute, not accrescent in fruit; corolla 0.6-1.2 cm, narrowly infundibular, blue, tinted with pink in male flowers, turning brownish on drying, hairy outside; tube shorter than the limb; annulus of 5 united lobes; all stamens inserted or 1-2 subexserted; anthers c. 0.5 mm oblong or ovate; filaments unequal; style filiform, 2-fid; nutlets 1.8-2.2 x 1.2 mm, ovoid-triquetrous, beaked, tuberculate.

Two forms of male and female plants occur in Egypt:

Male plants: calyx-lobes 0.6-1.3 cm; corolla blue, tinged with pink; 1-2 stamens subexserted; anthers oblong; style long- or short-exserted.

M, N; sandy and stony soils.

Female plants: calyx-lobes 5-8 mm; corolla blue; all stamens inserted; anthers ovate; style inserted or rarely slightly exserted.

M, N, S; sandy and stony ground.

Area of the species: Libya, Egypt, Syria.

NOTE: The type (male form) was collected from Alexandria; Egypt in 1761-1762, by Forsskål 297 (C).

7. *Echium angustifolium* Mill., Gard. Dict., ed. 8, no. 6 (1768).

Hispid perennial 20-80 cm; stems numerous from the base, erect, ascending or decumbent; indumentum heterotrichous, of white spreading tubercle-based setae and small appressed hairs; basal leaves 4-9 x 0.3-0.5 cm, linear-lanceolate, obtuse, attenuate at the base; petiole 2-4.5 cm; cauline leaves shorter, sessile; inflorescence terminal and axillary, branched, spike-like; flowers sessile or subsessile, bracteate, the bracts ± equalling the calyx at anthesis, ovate, acute; calyx 0.6-1 cm, the lobes linear-lanceolate; fruiting calyx to 1.5 cm; corolla 1.5-2.3 cm, infundibular, pink, red or violet, hairy especially along the veins; tube 6-1.1 cm; annulus of 10 hairy subquadrate lobes; limb 0.6-1.3 cm, lobes 2-2.5 mm, oblong-ovate; exserted stamens 3-5; anthers c. 1 mm, bluish; filaments reddish-violet, glabrous or sparingly hairy; style c. 2 cm, filiform, plumose at the base, 2-fid; nutlets 2.5-3 x 1.5-2 mm, ovoid-pyramidal, short-beaked, greyish-brown, slightly gibbous, tuberculate.

Two subspecies occur in Egypt:

subsp. *angustifolium*

Syns. *Echium pustulatum* Sm. in Sibth. & Sm., Fl. Graec. Prodr. 125 (1806).

Echium hispidum Sm. in Sibth. & Sm., Fl. Graec. Prodr. 125 (1806).

Echium diffusum Sm. in Sibth. & Sm., Fl. Graec. Prodr. 125 (1806).

Echium prostratum Delile, Descr. Egypte, Hist. Nat. 185, t. 17, f. 1 (1814).

Echium elegans Lehm., Pl. Asperif. 1: 459 (1818).

Echium sibthorpii Roem. & Schult., Syst. Veg., ed. 15, 4 (1): 26 (1819).

Plant green or yellowish-green; stems erect, ascending or decumbent; indumentum of dense erecto-patent setae; corolla pink or violet.

N, M, D, S; sandy and stony ground. Egypt, Palestine, Syria, Lebanon, Turkey, Greece, Aegean Islands, Crete.

subsp. **sericeum** (Vahl) Klotz, *Wiss. Zeitschr. Univ. Halle* 11 (2): 298 (1962).

Syns. *Echium sericeum* Vahl, *Symb. Bot.* 2: 35 (1891).

Echium distachum Viv., *Fl. Libyc. Spec.* 8, t. 5, f. 1 (1824).

Plant greyish; stems decumbent; indumentum of sparse, appressed setae; corolla red.

M; sandy and stony ground. Tunisia, Libya, Egypt, Arabia.

8. **Echium glomeratum** Poir. in Lam., *Encycl.* 8: 670 (1808).

Biennial or perennial 0.6-2.2 m; stems stout, simple, erect, terete, grooved; indumentum heterotricous, of long hispid tubercle-based bristles and short hairs; basal leaves 10-22 (-30) x 2-4.5 cm, lanceolate, obtuse to subacute, the base long-attenuate into the petiole; cauline leaves 1-8 x 0.5-1.5 cm, oblong-linear to narrowly elliptic, sessile; inflorescence unbranched, cylindric or spike-like, of numerous axillary cymes; flowers bracteate, sessile; bracts ± equalling the calyx, linear-lanceolate; calyx 7-9 mm, lobes linear-lanceolate, densely white-strigose; corolla 1-1.5(-2) cm, infundibular, oblique, pink or whitish with mauve spots, hairy outside; annulus of 10 separate lobes; exerted stamens 4, the anterior longest; anthers c. 0.75 mm; filaments glabrous; style 1.2-1.4 cm, 2-fid, hairy at the base; nutlets c. 3 x 2 mm, ovoid with a slightly incurved beak, greyish to pale brown, tuberculate.

M; calcareous ridges. Egypt, Palestine, Syria, Turkey.

19. **Echiochilon** Desf.

Syns. *Chilochium* Raf., *Exioxylon* Raf.,
Leurocline S. Moore, *Echiochilopsis* Caball.,
Tetraedrocarpus O. Schwartz

Herbaceous perennials or low shrubs, rarely annuals; stems branched; indumentum of bulbous-based hairs; leaves alternate; flowers pedicellate, in terminal cymes or not forming defined inflorescences; calyx 5-lobed, shorter than to equalling the corolla-tube, the lobes equal or unequal; corolla 5-lobed, actinomorphic or zygomorphic, the throat villose; limb spreading, bilabiate; stamens 5, included or exerted; filaments equal or unequal, flattened; anthers narrowly oblong; ovary deeply 4-lobed, with a narrowly pyramidal gynobase; style short, 2-fid; stigmas 2; nutlets ovoid to cordate, white, reddish or brownish, smooth to verrucose; areole rounded to triangular. 14 species, Mauritania, North Africa, Sinai, Palestine, Arabia, Iran, Sudan, Djibouti, Somalia, Ethiopia, Kenya.

1. **Echiochilon fruticosum** Desf., *Fl. Atlant.* 1: 167, t. 47 (1799).

Syns. *Lithospermum divaricatum* Sieber ex Spreng., *Syst. Veg.*, ed. 16, 1: 543 (1825).

Echiochilon fruticosum Desf. var. *sieberi* I. M. Johnst., *J. Arnold Arbor.* 38: 279 (1957).

Echiochilon fruticosum Desf. var. *marginatum* Buxb., *Verh. Zool.-Bot. Ges. Wien* 76: 61 (1927).

Hispid low shrub 15-60 cm, with white appressed bristles; stems much-branched, terete, the branches intricate; leaves 2.5-8 x 1-2 mm, oblong-linear, sessile; inflorescence terminal, lax; flowers bracteate, sessile; bracts 1-1.5 x 0.2-0.3 cm, foliose, oblong-linear; calyx 1.5-4.5 mm, the lobes unequal, oblong-linear, acute; corolla 0.6-1.2 cm, obliquely infundibular, sky-blue or violet-blue, whitish at the base, conspicuously hairy outside; tube 5-6 mm, curved; limb bilabiate; the upper lip 2-lobed, the lower 3-lobed; stamens all included, inserted \pm at the middle of the tube; anthers c. 1 mm, oblong-linear, with yellow hairs at the base; filaments shorter than the anthers; style 2-2.5 mm, slender, glabrous, 2-lobed; nutlets 4, 1.5-2.2 x 1-1.5 mm, ovoid or cordate, ventrally keeled; gynobase pyramidal, 4-winged; areole ventral, obliquely triangular, canaliculate.

N, M, De, S; sandy and stony ground. North Africa, Sinai, Palestine, Syria, Arabia.

Colour Plates



Erodium glaucophyllum



Fagonia indica



Erodium crassifolium



Fagonia schimperi



Fagonia mollis var. *mollis*



Fagonia scabra



Fagonia glutinosa



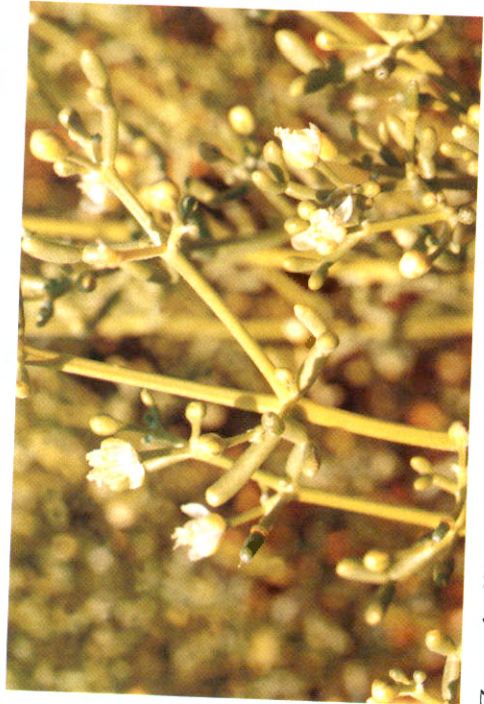
Fagonia mollis var. *hispida*



Zygophyllum simplex



Zygophyllum aegyptium



Zygophyllum coccineum



Zygophyllum album



Balanites aegyptiaca



Zygophyllum decumbens



Balanites aegyptiaca (fruit)



Zygophyllum dumosum



Chrozophora oblongifolia



Andrachne telephioides



Nitraria retusa



Peganum harmala



Ricinus communis (spontaneous)



Euphorbia hirta



Euphorbia consobrina



Euphorbia consobrina



Euphorbia heterophylla



Euphorbia dendroides



Euphorbia retusa



Euphorbia cuneata



Dodonaea viscosa



Pistacia khinjuk var. *glabra*



Euphorbia hierosolymitana



Euphorbia chamaepeplus



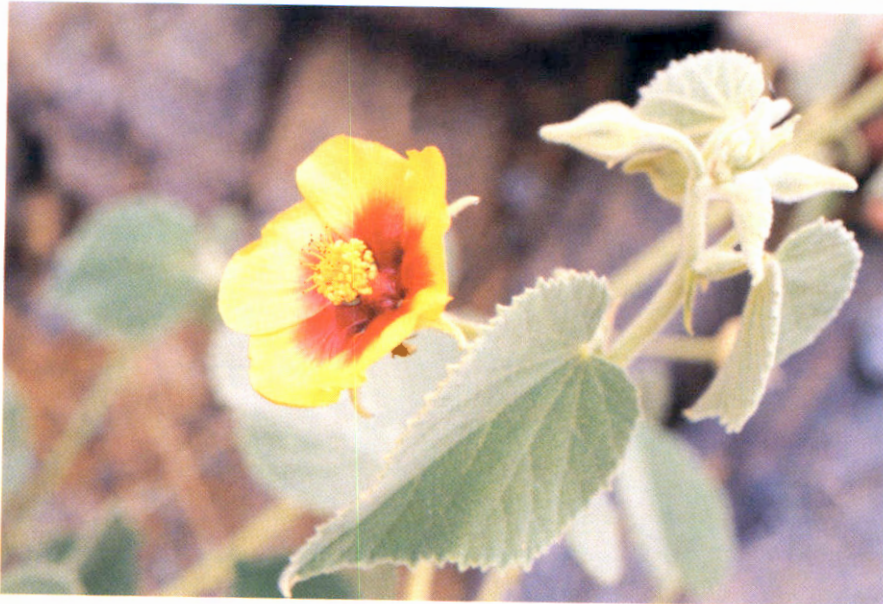
Salvadora persica



Sida alba



Corchorus olitorius



Abutilon pannosum



Hibiscus vitifolius



Hibiscus trionum



Abutilon fruticosum



Hibiscus sabdariffa



Melhania phillipsiae



Helianthemum salicifolium



Helianthemum ledifolium



Helianthemum stipulatum



Tamarix aphylla



Helianthemum kahiricum



Tamarix aphylla



Helianthemum lippii



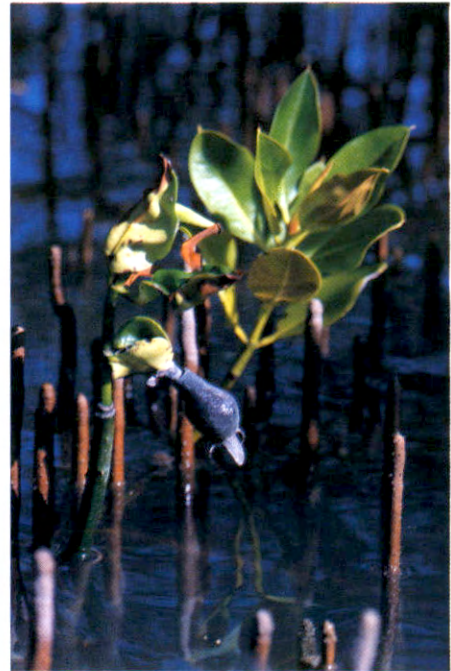
Citrullus colocynthis



Tamarix nilotica



Rhizophora mucronata



Rhizophora mucronata



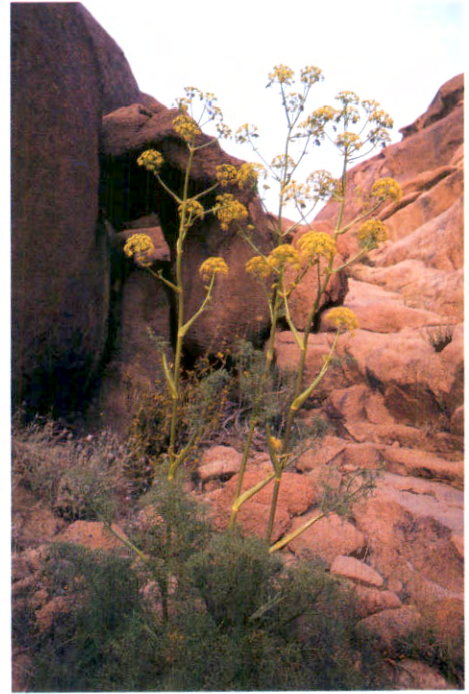
Foeniculum vulgare
subsp. *piperitum*



Ludwigia stolonifera



Deverra tortuosa



Ferula sinaica



Daucus syrticus



Anagallis arvensis



Limonium meyeri



Limonium tubiflorum



Asclepias sinaica



Solenostemma argel



Asclepias sinaica



Oxystelma esculentum



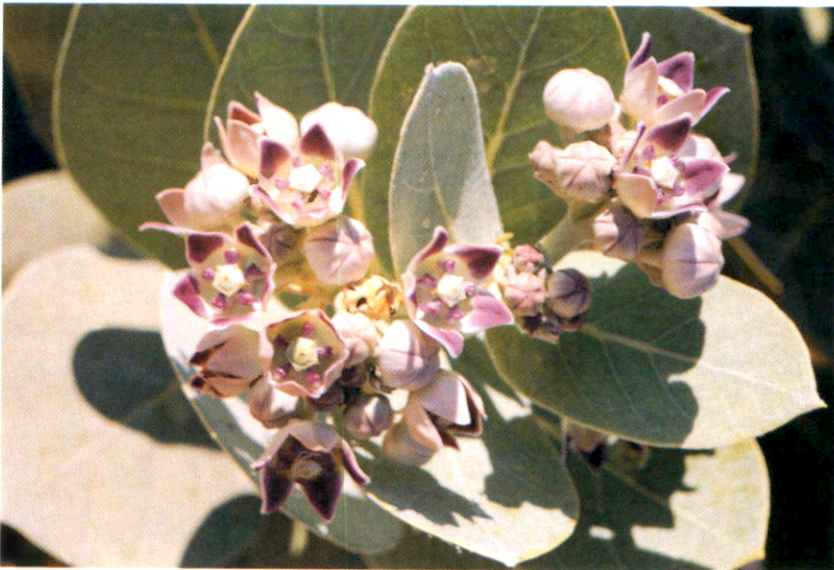
Periploca aphylla



Cynanchum acutum



Cynanchum acutum



Calotropis procera



Crucianella ciliata



Pergularia daemia



Pergularia tomentosa



Leptadenia pyrotechnica



Callipeltis cucullaris



Convolvulus hystrix



Convolvulus lanatus



Convolvulus althaeoides



Ipomoea pes-caprae



Ipomoea carnea



Ipomoea cairica



Cressa cretica



Cuscuta planiflora



Paracaryum intermedium



Heliotropium bacciferum



Trichodesma africanum
var. *africanum*



Lappula spinocarpos



Arnebia hispidissima



Arnebia decumbens var. *macrocalyx*



Alkanna lehmanii



Moltkiopsis ciliata



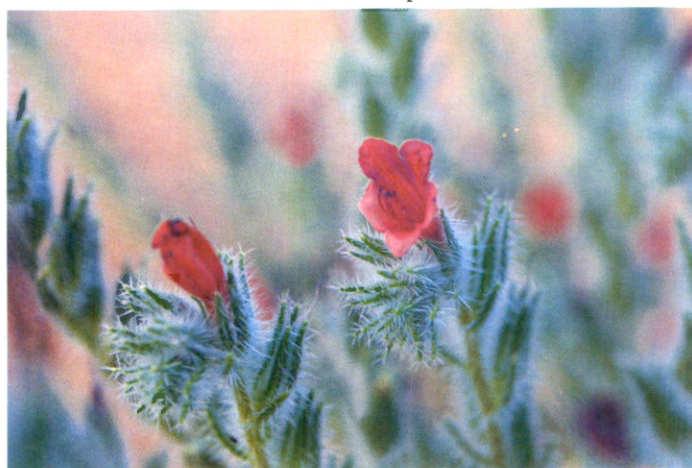
Alkanna orientalis



Anchusa milleri



Anchusa hispida



Echium horridum



Echium angustifolium subsp. *angustifolium*

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accepted names in **bold type**, synonyms in *italic type*

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