THE FLOWERING PLANTS
OF THE
ANGLO-EGYPTIAN SUDAN

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VOLUME I
(CYCADACEAE—TILIACEAE)

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PREFACE

THE first descriptive flora of the plants of the Sudan founded on a catalogue of Sudan plants compiled by A. F. Broun was written by Broun and Massey and published in 1929[1]. This excellent little book served a very useful purpose in making available short descriptions of the then known plants of the Sudan.

By 1940, however, the need was felt for an enlarged flora containing the many additions discovered since 1929.

The then Director of Agriculture, Dr. J. D. Tothill, C.M.G., therefore set up a committee, consisting of Dr. John Smith (then Chief Conservator of Forests, now Director of Agriculture) as chairman, Mrs. B. H. Tothill and Dr. F. W. Andrews, to consider the preparation and publication of a new and enlarged flora. Dr. Andrews was entrusted with the task of writing the flora.

In compiling this flora much use has been made of the work of various observers who have collected in the Sudan since 1929. Among these may be mentioned the late Dr. J. G. Myers, who made a pioneer survey of the flora of Equatoria Province; Major J. W. G. Wyld, D.S.O., O.B.E., M.C., who collected extensively in the Zande district of Equatoria; Major G. Aylmer, who concentrated on the trees and shrubs of the Sudan; Mr. B. Kennedy-Cooke, who compiled an excellent detailed list of the trees and shrubs of Kassala Province; Mr. Lewis Turner, Conservator of Forests, who added considerably to our knowledge of the forests of Equatoria; Mr. A. S. Thomas of Uganda, who collected plants on the Imatong Mountains; and many others of the Veterinary, Medical, Political, Agricultural and Forest services of this country who by their work have added to the botanical knowledge of the Sudan. To all these our thanks are due.

The work of these collectors would have been of little value had we not had the kind assistance of the Director and staff, especially Mr. E. Milne-Redhead, of the Royal Botanic Gardens, Kew, and the Keeper of Botany, British Museum (Natural History), in the identification of the plants, and we record our grateful thanks to them.

Mr. J. E. Dandy of the British Museum has made a special study of the plants of the Sudan. He has very generously placed his notes at our disposal, and has assisted materially in the compilation of this flora. We gratefully acknowledge our indebtedness to him.

[1] *Flora of the Sudan*, by A. F. Broun and R. E. Massey: Sudan Govt.

By kind permission of the authors, descriptions of the plants have been taken where required from works bearing on the Sudan flora, including Eggeling's *The Indigenous Trees of the Uganda Protectorate*[2], but in particular we have quoted extensively from Hutchinson and Dalziel's *Flora of West Tropical Africa*[3]. Much use has also been made of the *Flora of Tropical Africa,* by D. Oliver *et al.*[4] The Outlines of Plant Description and notes on aberrations have been adapted from Bentham and Hooker's *Handbook of the British Flora*[5].

The system of classification of the families is that originated by Dr. J. Hutchinson, F.R.S., and the key to them has been adapted from his key to the families of the world[6].

Most of the illustrations have been taken from Mrs. Crowfoot's *Flowering Plants of the Northern and Central Sudan*[7], Hutchinson and Dalziel's *Flora of West Tropical Africa,* and Hutchinson's *The Families of Flowering Plants.* Our thanks are due to the authors and the publishers for permission to use these illustrations. The remaining illustrations have come from Thonner's *Die Blütenpflanzen Afrikas* and Engler's *Die Pflanzenwelt Afrikas.* We also thank Mrs. W. Ruttledge for assistance in the typing and Mrs. F. W. Andrews for help in correcting the typescript, preparing the index and doing other tedious but necessary work in the preparation of this flora.

Finally, we gratefully acknowledge our indebtedness to Dr. George Taylor of the British Museum, who has assisted us not only in the text but also in guiding this flora through the press. Without his generous help much time would have been wasted in getting this compilation through the press. The author, however, takes full responsibility for the final form and contents of this flora.

J. SMITH.
B. H. TOTHILL.
F. W. ANDREWS.

[2]*The Indigenous Trees of the Uganda Protectorate*, by W. J. Eggeling: Govt. Printer, Entebbe, Uganda.

[3]*Flora of West Tropical Africa*: 2 Vols. by J. Hutchinson and J. M. Dalziel: Crown Agents for the Colonies, London.

[4]*Flora of Tropical Africa*, 10 Vols.: L. Reeve & Co., London and Ashford, Kent.

[5]*Handbook of the British Flora*, by G. Bentham and J. D. Hooker, 7th Edition: L. Reeve & Co., London.

[6]*The Families of Flowering Plants*, 2 Vols. by J. Hutchinson: Macmillan & Co., London.

[7]*Flowering Plants of the Northern and Central Sudan*, by Grace M. Crowfoot: Orphans' Printing Press, Leominster.

INTRODUCTION

THIS flora has been arranged on somewhat different lines from that of Broun and Massey. Apart from additions to the latter flora, many of the plant names have been changed, some because they were inaccurate, others because recent research has shown the more correct name. Fuller descriptions are given in the text and keys have been provided for all genera and for species numbering more than seven in a genus. Distinguishing plant characters in the keys are shown under single or double letters: thus, under "A" will be found one or more characters, and the contrast will be under "AA"; similarly, the opposite to "(b)" will be "(bb)". Occasionally there are three or more contrasts, the letters being multiplied accordingly. The genera in each family are arranged in alphabetical order.

Some of the plants included in Broun and Massey's flora were from localities in the Belgian Congo and Uganda, outside the boundary of the Anglo-Egyptian Sudan. These have been omitted from the present work unless they have since been found within the Sudan border.

An attempt has been made to limit the use of technical terms to a minimum. That they must be used to some extent is obvious or the book would become too bulky. The technical expressions used in the text have been listed under the Index of Botanical Terms and their definitions will be found under the relevant numbers in the Outlines of Plant Description.

Vernacular names have been omitted principally because the inclusion of all of them would have made the book unwieldy, but also because the checking of their accuracy would have delayed indefinitely the publishing of this book. A supplement containing vernacular names and their botanical equivalents is being prepared and will be printed separately.

Detailed place names of the habitats of the plants have in most cases been omitted, and the habitat has been indicated in a general manner only.

Very little information of the conditions of growth, viz., type of soil, high land or low land, forest, woodland or desert, time of flowering and fruiting, and other characters of a plant's habit of growth has been included in the text. This information about the plants of the Sudan is, in general, unrecorded and it is hoped that by the aid of this flora interested persons will be encouraged to note the facts required. For this purpose blank pages have been inserted at the back of the book on which observers can

record their observations on the plants in their districts. By this means we shall gradually accumulate knowledge of the living habits of Sudan plants, and this knowledge can then be utilized to explain the why and wherefore of the Sudan's vegetation.

The author will be glad to receive any information concerning the life habits of any plant and this information can then be incorporated in later editions of this flora.

F. W. ANDREWS.

Gezira Research Farm,
Wad Medani,
June 1947.

OUTLINES OF PLANT DESCRIPTION

1. *PLANTS* are: *annuals*, which flower in the same year in which they are raised from seed; *biennials*, which only flower in the year following that in which they are sown; herbaceous *perennials*, in which the greater part of the plant dies after flowering, leaving only a small perennial portion called the *stock* or *caudex*, close to or within the earth; *undershrubs* (*suffruticose* or *suffrutescent* plants), in which the flowering branches, forming a considerable portion of the plant, die down after flowering, but leave a more or less prominent perennial and woody base; *shrubs* (*frutescent* or *fruticose* plants), in which the perennial woody part forms the greater part of the plant, but branches near the base, and does not much exceed a man's height; and *trees* (*arboreous* or *arborescent* plants), when the height is greater and forms a woody *trunk*, scarcely branching from the base. *Bushes* are low much-branched shrubs. Plants are usually *terrestrial*, i.e. growing on earth; or *aquatic*, i.e. growing in water; but sometimes they may be found attached by their roots to other plants, in which case they are *epiphytes* when simply growing upon other plants without penetrating into their tissue, *parasites* when their roots penetrate into and derive more or less nutriment from the plant to which they are attached. *Xerophytes* are plants living where the water-supply is limited, e.g. in deserts, on rocks, etc.; they nearly all have thick or leathery leaves. *Saprophytes* are plants living on decayed organic matter, absorbing the products of decay.

2. The simplest form of the perfect plant consists of:
   The *root*.
   The *stem* and *branches*.
   The *leaves*.
   The *flowers*, usually placed at or towards the extremities of the branches; they are destined to form the future *seed*. When perfect and complete they consist:—(1) of a *pistil* in the centre, consisting of one or more *carpels* each containing the germ of one or more seeds; (2) of one or more *stamens* outside the pistil, whose action is necessary to *fertilize* the pistil or enable it to ripen its seed; (3) of a *perianth* or floral envelope, which usually encloses the stamens and pistil when young, and expands and exposes them to view when fully formed. The complete perianth is double; the outer series, called the *calyx*, is usually more green and leaf-like, the inner one, called the

corolla, more conspicuous and variously coloured. It is the perianth, and especially the corolla, as the most showy part, that is generally called the flower in popular language.

The *fruit*, consisting of the pistil or its lower portion, which persists or remains attached to the plant after the remainder of the flower has withered and fallen off. It enlarges and alters more or less in shape or consistence, becomes a seed-vessel enclosing the seed until it is ripe, when it either opens to discharge the seed or falls to the ground with the seed. In popular language the term fruit is often limited to such seed-vessels as are or look juicy and eatable. Botanists give that name to all seed-vessels.

3. *ROOTS* are:

fibrous, when they consist chiefly of slender fibres.

tuberous, when either the main root or its branches are thickened into one or more short fleshy or woody masses called *tubers*.

taproots, when the main root descends perpendicularly into the earth, emitting only very small fibrous branches.

adventitious, when they arise abnormally.

4. The stock of an herbaceous perennial, or the lower part of the stem of an annual or perennial, or the lowest branches of a plant, are sometimes underground and assume the appearance of a root; they then take the name of *rhizome*. The rhizome may always be distinguished from the true root by the presence or production of one or more buds, or leaves, or scales.

5. The term *tuber* is applied to a short, thick, more or less succulent rhizome, as well as to a root of that shape. A potato is an annual tuberous rhizome, formed entirely from an underground portion of the stem, with several buds (the eyes).

6. A *bulb* is a rhizome of a shape approaching to globular, usually rather conical above and flattened underneath, in which the bud or buds are concealed, or nearly so, under *scales*. These scales are the more or less thickened bases of the decayed leaves of the preceding year, or of the undeveloped leaves of the future year, or of both. Bulbs are usually underground or close to the ground, but occasionally buds in the axils of the upper leaves become transformed into bulbs. Bulbs are said to be *scaly* when their scales are thick and loosely imbricated, *tunicated* when the scales are thinner, broader, and closely rolled round each other in concentric layers. A *bulbil* is a large and fleshy axillary bud which may fall and produce a new plant.

7. A *corm* is a tuberous rhizome, usually annual, shaped like a bulb, but in which the bud or buds are not covered by scales, or of which the scales are very thin and membranous.

8. *STEMS* are:

erect, when they ascend perpendicularly from the root or stock; *virgate*, when at the same time they are slender, stiff and scarcely branched.

decumbent or *ascending*, when they spread horizontally, or nearly so, at the base, and then turn upwards and become erect.

procumbent, when they spread along the ground the whole or the greater portion of their length; *diffuse*, when at the same time they are very much and rather loosely branched.

prostrate, when they lie still closer to the ground.

creeping, when they emit roots at their nodes. This term is also frequently applied to any rhizomes or roots which spread horizontally.

tufted, when very short, close, and many together from the same stock.

9. Weak climbing stems are said to *twine*, when they support themselves by winding spirally round any object. When they simply climb without twining, they support themselves by their leaves, or by special clasping organs called *tendrils*, or sometimes by hooks or prickles or, as in ivy, by small adventitious roots.

10. *Suckers* are young plants formed at the end of creeping underground rootstocks. *Scions*, *runners* and *stolons* are names given to young plants formed at the end or at the nodes of branches or stocks creeping wholly or partially above ground, or sometimes to the creeping branches or stocks themselves.

11. A *node* is a point of the stem or its branches at which one or more leaves, branches or leaf-buds are given off. An *internode* is the portion of stem comprised between two nodes.

12. *BRANCHES* or *LEAVES* are:

opposite, when two proceed from the same node on opposite sides of the stem.

whorled or *verticillate* (in a *whorl* or *verticil*), when several proceed from the same node, arranged regularly around the stem.

alternate, when only one proceeds from each node, one on one side and the next above or below on the opposite side of the stem; *decussate*, when opposite, but each pair placed at right-angles to the next pair above or below it; *distichous*, when regularly arranged one above another in two opposite rows, one on each side of the stem; *tristichous*, when in three rows, etc.; *scat-*

tered, when apparently irregularly arranged round the stem; usually, however, botanists apply the term alternate to all branches or leaves that are neither opposite nor whorled.

secund, when all start from or are turned to one side of the stem.

13. *BRANCHES* are *dichotomous*, when several times forked, the two branches of each fork being nearly equal; *trichotomous*, when there are three nearly equal branches at each division instead of two; but when the middle branch is evidently the principal one, the stem is usually said to have two opposite branches. If, however, the central branch is larger than the two or more lateral ones, the stem is said to have opposite or whorled branches as the case may be.

Culm is a name often given to the stem of *Gramineae*, *Cyperaceae* and some other *Monocotyledones*.

14. *LEAVES.*

The ordinary or perfect leaf consists of a flat *blade* or *lamina*, usually green, and more or less horizontal, attached to the stem by a stalk called a *petiole*. When the form or dimensions of a leaf are spoken of, it is generally the blade that is meant, without the petiole or stalk.

The end by which a leaf, a part of the flower, a seed, or any other organ, is attached to the stem or other organ, is called its *base*, the opposite end its *apex*.

When leaves (or any other organs) are shed at the end of the growth period or at maturity they are said to be *deciduous*: the opposite to deciduous is *persistent*.

15. Leaves are:

sessile, when the blade rests on the stem without the intervention of a petiole.

amplexicaul or *stem-clasping*, when the sessile base of the blade clasps the stem horizontally.

perfoliate, when the base of the blade not only clasps the stem, but closes round it on the opposite side, so that the stem appears to pierce through the blade.

decurrent, when the edges of the leaf are continued down the stem so as to form raised lines or narrow appendages, called *wings*.

sheathing, when the base of the blade, or of the more or less expanded petiole, forms a vertical sheath round the stem for some distance above the node.

16. Leaves and flowers are called *radical*, when inserted on a rhizome or stock, or so close to the base of the stem as to appear to proceed from the root, rhizome or stock; *cauline*, when inserted on a distinct stem. Radical leaves are *rosulate*, when they are spread in a circle on the ground.

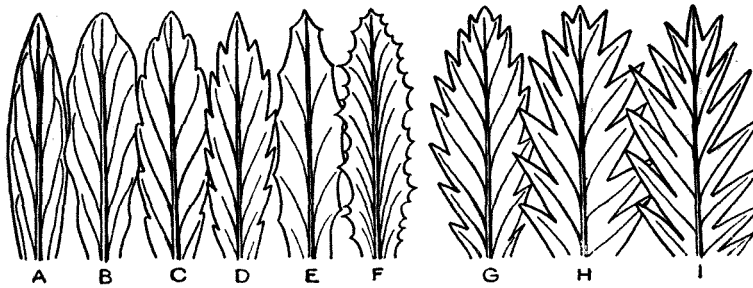


Fig. 1—DESCRIPTION OF LEAF-MARGINS.
A, entire. B, undulate. C, crenate. D, serrate. E, dentate. F, doubly dentate. G, pinnatifid. H, pinnatilobed. I, pinnatipartite.

17. Leaves are:

simple and *entire*, when the blade consists of a single piece, with the margin nowhere indented, simple being used in opposition to compound, entire in opposition to dentate, lobed, divided, etc.

ciliate, when bordered with hairs or fine hair-like teeth.

dentate or *toothed*, when the margin is only cut a little way in, into what have been compared to teeth; *denticulate*, when only very slightly dentate; *serrate*, when the teeth are regular and pointed like the teeth of a saw; *crenate*, when regular and blunt or rounded; *serrulate*, or *crenulate*, when the serratures, or crenatures, are small; *sinuate*, when the teeth are broad, shallow and irregular (compared to bays of the coast); *wavy* or *undulate*, when the edges are not flat, but bent up and down (compared to the waves of the sea); *repand-dentate*, when varying between undulate and dentate.

lobed or *cleft*, when more deeply indented or divided, but so that the incisions do not reach the midrib or petiole. The portions thus divided off take the name of *lobes*. When the lobes are narrow and very irregular, the leaves are said to be *laciniate*.

divided or *dissected*, when the incisions reach the midrib or petiole, but the parts so divided off, called *segments*, do not separate from the midrib or petiole, even when the leaf falls, without tearing.

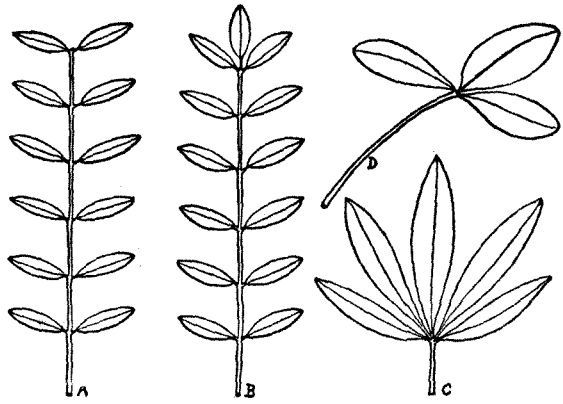


Fig. 2—COMPOUND LEAVES.
A, abruptly pinnate. B, imparipinnate. C, digitate. D, trifoliolate.

compound, when divided to the midrib or petiole, and the parts so divided off, called *leaflets*, separate, at least at the fall of the leaf, from the midrib or petiole, as the whole leaf does from the stem, without tearing. A common stalk along which the leaflets are inserted is called a *common petiole* or a *rhachis*. The separate stalk of each leaflet is a *petiolule*. There is always a bud (or outgrown bud) attached to the stem in the angle formed by the petiole and the stem. The presence or absence of this bud is the criterion to use to decide if a "leaf" is a true leaf or only a leaflet. There is no bud in the angle formed by the petiolule and the common petiole or rhachis.

18. Leaves are more or less marked by *veins*, which, starting from the petiole, diverge or branch as the blade widens, and spread all over it more or less visibly. The principal ones, when prominent, are usually called *nerves* or *ribs*, the smaller branches only then retaining the name of veins, or the latter are termed *veinlets*. The smaller veins are often connected together like the meshes of a net, and the leaf is said to be *reticulate* or *net-veined*. When one principal vein runs direct from the base towards the apex of the leaf, it is called the *midrib*. When several start from the petiole, diverge slightly without branching, and converge again towards the apex, they are said to be *parallel*, although not mathematically so. When 3 or 5 or more ribs or nerves diverge from the base, the leaf is said to be *3-nerved*, *5-nerved*, etc. The arrangement of the veins of a leaf is called the *venation*.

19. The leaflets, segments, lobes, veins of leaves are:
pinnate (feathered), when there are several succeeding each other on each side of the midrib or petiole, compared to the branches

of a feather. A pinnately lobed or divided leaf is called *lyrate* when the terminal lobe or segment is much larger and broader than the lateral ones, compared, by a stretch of imagination, to a lyre; *runcinate*, when the lateral lobes are curved backwards towards the base of the leaf; *pectinate*, when the lateral lobes are numerous, narrow and regular, like the teeth of a comb; *partite*, when cleft nearly to the base.

palmate or *digitate*, when several diverge from the same point, compared to the fingers of the hand.

ternate, when three only start from the same point, in which case the distinction between the palmate and pinnate arrangement often ceases, or can only be determined by analogy with allied plants. A leaf with ternate lobes is called *trifid*. A leaf with three leaflets is *trifoliolate*; *pedate*, when the division is at first ternate, but the two outer branches are forked, the outer ones of each fork again forked, and so on, and all the branches are near together at the base, compared vaguely to the foot of a bird.

20. Leaves with pinnate, palmate, pedate, etc., leaflets are usually for shortness called *pinnate*, *palmate*, *pedate*, etc., leaves. If they are so cut into segments only, they are usually said to be *pinnatisect*, *palmatisect*, *pedatisect*, etc. If the leaves are so cut only into lobes, they are said to be *pinnatifid*, *palmatifid*, *pedatifid*, etc.

21. The teeth, lobes, segments or leaflets may be again toothed, lobed, divided or compounded. Some leaves are even three or more times divided or compounded. When twice or thrice pinnate (*bipinnate* or *tripinnate*) each primary or secondary division, with the leaflets it comprises, is called a *pinna*, while the small leaflets are called *pinnules*. When the pinnae of a leaf or the leaflets of a pinna are in pairs, without an odd terminal pinna or leaflet, the leaf or pinna so divided is said to be *abruptly pinnate*; if there is an odd terminal pinna or leaflet, the leaf or pinna is *unequally pinnate* (*imparipinnate*).

22. The number of leaves or their parts is expressed adjectively by the following numerals, derived from the Latin:—

uni-	bi-	tri-	quadri-	quinque-	sex-	septem-	octo-	novem-
1-,	2-,	3-,	4-,	5-,	6-,	7-,	8-,	9-,
				decem-	multi-			
				10-,	many-,			

prefixed to a termination, indicating the particular kind of part referred to. Thus:—

unidentate, *bidentate*, *multidentate* mean one-toothed, two-toothed, many-toothed.

bifid, *trifid*, *multifid* mean two-lobed, three-lobed, many-lobed.

unifoliolate, bifoliolate, multifoliolate mean having one leaflet, two leaflets, many leaflets.

unifoliate, bifoliate, multifoliate mean having one leaf, two leaves, many leaves.

biternate and *triternate* mean twice and thrice ternately divided.

unijugate, bijugate, multijugate pinnae or leaflets mean that they are in one, two, many pairs (*jugae*).

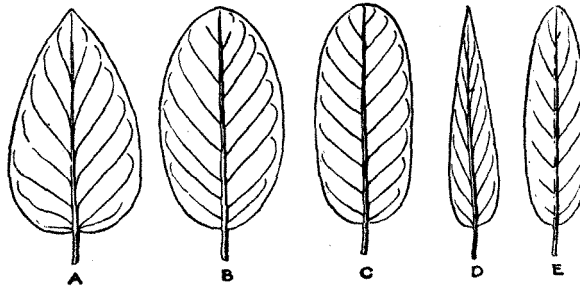


Fig. 3—SHAPES OF LEAVES.
A, ovate. B, elliptic. C, oblong. D, lanceolate. E, oblong-lanceolate.

23. Leaves or their parts, when flat, or any other flat organs in plants, are:

linear, when long and narrow, at least four times as long as broad, falsely compared to a mathematical line, for a linear leaf has always a perceptible breadth.

lanceolate, when about three or more times as long as broad, broadest below the middle, and tapering towards the apex, compared to the head of a lance.

cuneate, when broadest above the middle, and tapering towards the base, compared to a wedge with the point downwards; when very broadly cuneate and rounded at the top, they are often called *flabelliform* or fan-shaped.

spathulate, when the broad part near the top is short, and the narrow tapering part long, compared to a spathula or flat ladle.

ovate, when scarcely twice as long as broad, and rather broader below the middle, compared to the longitudinal section of an egg; *obovate* is the same form, with the broadest part above the middle.

orbicular, oblong, elliptic or *oval, rhomboid*, etc., when compared to the corresponding mathematical figures.

falcate, when curved like the blade of a scythe.

Intermediate forms between any two of the above are expressed by combining two terms. Thus, a *linear-lanceolate* leaf is long and narrow, yet broader below the middle, and tapering to the apex; a *linear-oblong* one is scarcely narrow enough to be called linear, yet too narrow to be strictly oblong, and does not conspicuously taper either towards the apex or towards the base.

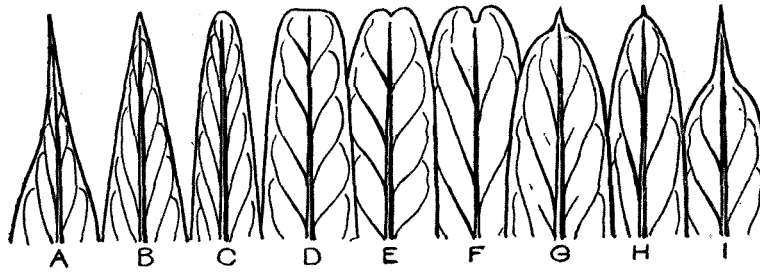


Fig. 4—DESCRIPTION OF LEAF-TIPS.
A, acuminate. B, acute. C, obtuse. D, truncate. E, retuse. F, emarginate. G, apiculate. H, mucronate. I, cuspidate.

24. The apex of a leaf is:

acute or *pointed*, when it forms an acute angle or tapers to a point.

obtuse or *blunt*, when it forms a very obtuse angle, more generally when it is more or less rounded.

acuminate, when suddenly narrowed, and then more or less prolonged into an *acumen* or point, which may be acute or obtuse, linear or tapering.

truncate, when cut off square.

retuse, when very obtuse or truncate, and slightly indented.

emarginate or *notched*, when more decidedly indented at the end of the midrib; *obcordate*, if at the same time approaching the shape of the top of a heart with its point downwards.

apiculate, when narrowing abruptly to a small tip.

mucronate, when the midrib is produced beyond the apex in the form of a small point.

cuspidate, when the point is relatively long.

aristate, when the point is fine like a hair.

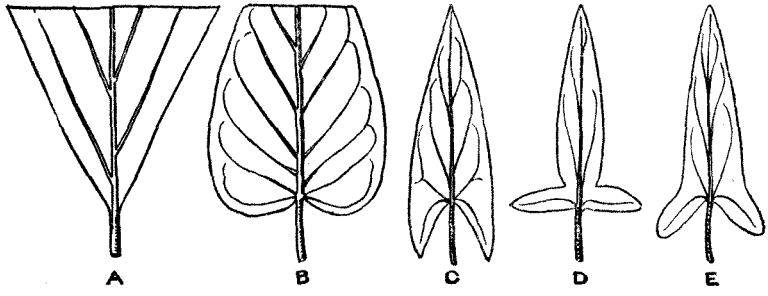


Fig. 5—BASES OF LEAVES.
A, cuneate. B, cordate. C, sagittate. D, hastate. E, auriculate.

25. The base of a leaf is liable to the same variations of form as the apex, but the terms more commonly used are *tapering* or *narrowed* for acute and acuminate, *rounded* for obtuse, and *cordate* for emarginate. In all cases the petiole or point of attachment prevents any such absolute termination at the base as at the apex. A leaf may be cordate at the base whatever be its length or breadth, or whatever the shape of the two lateral lobes, called *auricles* (or little ears), formed by the indenture or notch; but the term *cordiform* (heart-shaped) is restricted to an ovate and acute leaf, cordate at the base, with rounded auricles. The term auricles is more particularly used as applied to sessile and amplexicaul leaves. If the auricles are pointed, the leaf is more particularly called *auriculate*; it is, moreover, said to be *sagittate*, when the points are directed downwards, compared to an arrow-head; *hastate*, when the points diverge horizontally, compared to a halberd. A *reniform* leaf is broader than long, slightly but broadly cordate at the base, with rounded auricles, compared to a kidney. In a *peltate* leaf, the petiole, instead of proceeding from the lower edge of the blade, is attached to the under-surface, usually near the lower edge, but sometimes in the very centre of the blade (as in a leaf of *Tropaeolum*). The peltate leaf has usually several principal nerves radiating from the point of attachment, being, in fact, a cordate leaf with the auricles united.

All these modifications of division and form in the leaf pass so gradually one into the other that it is often difficult to say which term is the most applicable—whether the leaf be toothed or lobed, divided or compound, oblong or lanceolate, obtuse or acute, etc. The choice of the most apt expression will depend on the skill of the describer.

26. Leaves, when solid, or stems, fruits, tubers and other parts of plants, when not flattened like ordinary leaves, are:

setaceous, when very slender and bristle-like.

acicular, when very slender, but stiff and pointed like a needle.

subulate, when rather thicker and firmer like an awl.

linear, when at least four times as long as thick; *oblong*, when from about two to about four times as long as thick; these terms having the same sense as when applied to flat surfaces.

ovoid, when egg-shaped, with the broad end downwards; *obovoid*, if the broad end is upwards; these terms corresponding to ovate and obovate shapes in flat surfaces.

globose or *spherical*, when corresponding to orbicular in a flat surface. *Round* applies to both.

turbinate, when shaped like a top.

conical, when tapering upwards; *obconical*, when tapering downwards; if in both cases a transverse section shows a circle.

pyramidal, when tapering upwards; *obpyramidal*, when tapering downwards; if in both cases a transverse section shows a triangle or polygon.

fusiform, or spindle-shaped, when tapering at both ends; *cylindric*, when not tapering at either end; if in both cases a transverse section shows a circle, or sometimes irrespective of the transverse shape.

terete, when the transverse section is not angular; *trigonous*, *triquetrous*, if the transverse section shows a triangle, irrespective in both cases of longitudinal form.

compressed, when more or less flattened laterally; *depressed*, when more or less flattened vertically, or at any rate at the top.

articulate or *jointed*, if at any period of their growth (usually when fully formed and approaching their decay, or in the case of fruits when quite ripe) they separate, without tearing, into two or more pieces placed end to end. The joints where they separate are called *articulations*.

moniliform, or beaded, when much contracted at regular intervals, but not separating spontaneously.

In their consistence leaves or other organs are:

fleshy, when thick and soft; *succulent* is generally used in the same sense, but implies the presence of more juice.

coriaceous, when firm and dry, or very tough, of the consistence of leather.

membranous, when thin and not stiff.

scarious or *scariose*, when very thin, more or less transparent and not green, yet rather stiff.

27. The mode in which unexpanded leaves are disposed in the leaf-bud is called their *vernation* or *praefoliation*.

28. *Scales* are leaves very much reduced in size, usually sessile, seldom green or capable of performing the normal functions of leaves. In other words, they are organs resembling leaves in their position on the plant, but differing in size, colour, texture and functions. They are most frequent on the stock of perennial plants, or at the base of annual branches, especially on the buds of future shoots, when they serve to protect the shoot from the rigours of the climate. In the latter case they are usually short, broad, close together and more or less *imbricate*, that is overlapping each other like the tiles of a roof. It is this arrangement as well as their usual shape that has suggested the name of scales, borrowed from the scales of a fish.

Sometimes, however, most or all the leaves of the plant are reduced to small scales, in which case they do not appear to perform any particular function.

The name of scales is also given to any small broad scale-like appendages or reduced organs, whether in the flower or any other part of the plant.

29. *Bracts* are the upper leaves of a plant in flower (either all those of the flowering branches, or only one or two immediately under

the flower), when different from the stem leaves in size, shape, colour or arrangement. They are generally much smaller and more sessile. They often partake of the colour of the flower, although they very frequently also retain the green colour of the leaves. When small they are often called *scales*. *Floral leaves* or *leafy bracts* are generally the lower bracts or the upper leaves at the base of the flowering branches, intermediate in size, shape or arrangement between the stem-leaves and the upper bracts. (Strictly speaking, a bract is the leaf in the axil of which arises a flower or a branch of an inflorescence.) *Bracteoles* are the one or two last bracts under each flower; they may differ materially in size, shape or arrangement from the other bracts.

30. *Stipules* are leaf-like or scale-like appendages at the base of the petiole, or on the node of the stem. When present they are generally two, one on each side of the leaf, and they sometimes appear to protect the young leaf before it is developed. They are, however, exceedingly variable in size and appearance, sometimes exactly like the true leaves (except that they have no buds in their axils) or looking like the leaflets of a compound leaf, sometimes apparently the only leaves of the plant; generally small and narrow, sometimes reduced to prickles or to minute scales, spots or scars, sometimes united into one opposite the leaf, or more or less united with, i.e. *adnate* to, the petiole, or quite detached from the leaf and forming a ring or sheath round the stem in the axil of the leaf. In a great number of plants they are entirely wanting.

Stipellae, or secondary stipules, are similar organs, sometimes found on compound leaves at the points where the leaflets are inserted.

When scales, bracts or stipules, or almost any part of the plant besides leaves and flowers, are stalked, they are said to be *stipitate*, from *stipes*, a stalk.

31. The *INFLORESCENCE* of a plant is the arrangement of the flowering branches, and of the flowers upon them. An inflorescence is a flowering branch, or the flowering summit of a plant above the last stem-leaves, with its branches, bracts and flowers.

32. A single flower, or an inflorescence, is *terminal* when at the summit of a stem or leafy branch, *axillary* when in the axil of a stem-leaf.

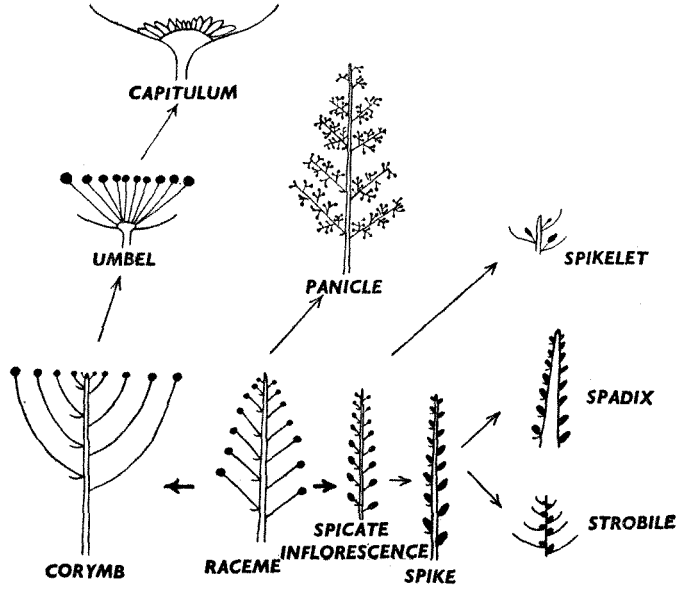
33. A *peduncle* is the stalk of a solitary flower, or of an inflorescence; that is to say, the portion of the flowering branch from the last stem-leaf to the flower or to the base of the inflorescence. The axis of an inflorescence, extending from the first to the last ramification or flower, is often distinguished under the name of *rhachis*.

INFLORESCENCES

Fig. 6.

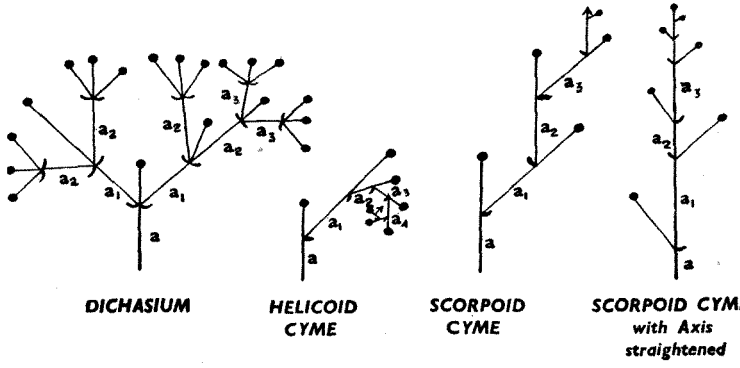
A. Racemose Inflorescences

Bracts are omitted on the right hand of most of the types: either condition, with bracts or without bracts, may occur



B. Cymose Inflorescences

Note that the terminal or central flower opens first, while in racemose inflorescences the terminal flower is the youngest



34. A *scape* is a leafless peduncle proceeding from the stock or from near the base of the stem, or apparently from the root itself.

35. A *pedicel* is the last branch of an inflorescence, supporting a single flower.

36. The branches of inflorescences may, like those of stems, be opposite, alternate, etc., but very often their arrangement is different from that of the leafy branches of the same plant.

37. An inflorescence is:
centrifugal, when the terminal flower opens first, and those on the lateral branches are successively developed.
centripetal, when the lowest flowers open first, and the rhachis continues to elongate, developing fresh flowers.

38. A centripetal inflorescence is:
a *spike*, or *spicate*, when the flowers are sessile along a simple undivided rhachis. In *Gramineae* and *Cyperaceae* the small spikes of flowers are called *spikelets*.
a *raceme*, or *racemose*, when the flowers are borne on pedicels along a single undivided rhachis.
a *panicle*, or *paniculate*, when the rhachis is divided into branches bearing two or more flowers.
a *head*, or *capitate*, when several sessile or nearly sessile flowers are collected into a compact head-like cluster. The short flat, convex or conical axis on which the flowers are seated is called the *receptacle*, a term also used for the torus of a single flower. The very compact heads of *Compositae* are often termed *compound flowers*.
an *umbel*, or *umbellate*, when several branches or pedicels appear to start from the same point and are nearly of the same length. It differs from the head, as the raceme from the spike, in that the flowers are not sessile. An umbel is said to be *simple*, when each of its branches or *rays* bears a single flower; *compound*, when each ray bears a *partial umbel* or *umbellule*.
a *corymb*, or *corymbose*, when the branches or pedicels, although starting from different points, all attain the same level, the lower ones being longer than the upper.

39. A *catkin* is a closely packed bracteate pendulous spike usually composed of small inconspicuous unisexual flowers.

40. A *spadix* is a spike with a fleshy or thickened axis as in arum-lilies and some palms.

41. An inflorescence is a *cyme*, or *cymose*, when branched and centrifugal. It is a centrifugal panicle, and is often corymbose. The central flower opens first. The lateral branches successively developed are usually forked (dichotomous or trichotomous), but sometimes after the first forking the branches

are no longer divided, but produce a succession of pedicels on their upper side forming apparently unilateral centripetal racemes; whereas, if attentively examined, it will be found that each pedicel is at first terminal but becomes lateral by the development of one outer branch only, immediately under the pedicel. Such branches, when in bud, are generally rolled back at the top, like the tail of a scorpion, and are hence called *scorpioid*.

It is a *thyrsus*, or *thyrsoid*, when cymes usually opposite are arranged in a narrow pyramidal panicle.

There are numerous cases where the inflorescences are intermediate between some two of the above, and are called by different botanists by one or the other name, according as they are guided by apparent or by theoretical similarity.

42. Bracts are generally placed singly under each branch of the inflorescence, and under each pedicel; *bracteoles* are usually two, one on each side, on the pedicel or close under the flower, or even upon the calyx itself; but bracts are also frequently scattered along the branches without axillary pedicels.

When several bracts are collected in a whorl or are so close together as to appear whorled or are closely imbricated round the base of a head or umbel, they are collectively called an *involucre*. The bracts composing an involucre are described under the names of *leaves*, *leaflets*, *bracts* or *scales*, according to their appearance; those surrounding the heads of *Compositae* are frequently called *phyllaries*.

An *involucel* is the involucre of an umbellule.

An *epicalyx* is an involucre of bracts below the flower resembling an extra calyx, e.g. in some *Malvaceae*.

A *spathe* is an envelope of one or more bracts or floral leaves enclosing the inflorescence of some *Monocotyledones*.

Paleae (sing. *palea*) or *pales* are the inner bracts or scales in *Compositae*, *Gramineae* and some other plants, when of a thin yet stiff consistence, usually narrow and of a pale colour.

Glumes are the bracts enclosing the flowers of *Cyperaceae* and *Gramineae*.

43. A *complete* flower is one in which the calyx, corolla, stamens and pistil are all present; a *perfect* flower, one in which all these organs, or such of them as are present, are capable of performing their several functions. Therefore, properly speaking, an *incomplete* flower is one in which any one or more of these organs is wanting; and an *imperfect* flower one in which any one or more of these organs is so altered as to be incapable of properly performing its functions. These imperfect organs are said to be *abortive* if much reduced in size or efficiency, *rudimentary* if so much so as to be scarcely perceptible. But, in many works, the term incomplete is

specially applied to those flowers in which the perianth is simple or wanting, and imperfect to those in which either the stamens or pistil are imperfect or wanting.

44. A *FLOWER* is:

actinomorphic, when it can be divided into two equal halves by more than one vertical plane.

zygomorphic, when it can be divided into two equal halves by only one vertical plane.

asymmetrical, when it cannot be divided into two equal halves.

asepalous, when there is no calyx.

apetalous, when there is no corolla.

naked, when there is no perianth at all.

hermaphrodite, when both stamens and pistil are present and perfect.

male or *staminate*, when there are one or more stamens, but either no pistil at all or only an imperfect one.

female or *pistillate*, when there is a pistil, but either no stamens at all or only imperfect ones.

neuter, when both stamens and pistil are imperfect or wanting.

barren or *sterile*, when from any cause it produces no seed.

fertile, when it does produce seed.

The flowers of a plant or species are said collectively to be:

unisexual, when the flowers are all either male or female.

monoecious, when the male and female flowers are distinct but on the same plant.

dioecious, when the male and female flowers are on distinct plants.

polygamous, when there are male, female and hermaphrodite flowers on the same or on distinct plants.

45. As the scales of buds are leaves undeveloped or reduced in size and altered in shape and consistence, and occasionally altered in colour, and bracts are leaves likewise modified, so the parts of the flower are modified leaves which vary in shape, colour and arrangement round the axis, and are often more or less combined with each other.

To understand the arrangement of the floral parts, let us take a complete flower, in which moreover all the parts are free from each other, *definite* in number, i.e. always the same in the same species, and *symmetrical* or *isomerous*, i.e. each whorl consisting of the same number of parts.

Such a complete symmetrical flower consists usually of either four or five whorls, placed immediately one within the other.

46. The *CALYX* forms the outer whorl. Its parts are called *sepals*.

47. The *COROLLA* forms the next whorl. Its parts, called *petals*, usually alternate with the sepals; that is to say, the centre of each petal is immediately over or within the interval between two sepals.

48. The *STAMENS* (*androecium*) form one or two whorls within the petals. If in two whorls, those of the outer one (the outer stamens) alternate with the petals, and are consequently opposite to, or over the centres of, the sepals; those of the inner whorl (the inner stamens) alternate with the outer ones and are therefore opposite to the petals. If there is only one whorl of stamens, they most frequently alternate with the petals; but sometimes they are opposite the petals and alternate with the sepals.

49. The *PISTIL* (*gynoecium*) forms the inner whorl; its carpels usually alternate with the inner row of stamens.

50. In an axillary or lateral flower, *upper* or *adaxial* parts of each whorl (sepals, petals, stamens or carpels) are those which are next to the main axis of the stem or branch, *lower* or *abaxial* parts those which are furthest from it; the intermediate ones are said to be *lateral*. The words *anterior* (front) and *posterior* (back) are often used for lower and upper respectively. *Posticous* means nearest the main axis.

51. Flowers are *irregular* when the parts of any one of the whorls are unequal in size, dissimilar in shape, or do not spread regularly round the axis at equal distances. It is, however, more especially irregularity of the corolla that is referred to in description. A slight inequality in size or direction in the other whorls does not prevent the flower being classed as *regular*, if the corolla or simple perianth is conspicuous and regular.

52. The *CALYX* is usually green, and smaller than the corolla; sometimes very minute, rudimentary or wanting, sometimes very indistinctly whorled, or not whorled at all, or in two whorls, or composed of a large number of sepals, of which the outer ones pass gradually into bracts and the inner ones into petals. It is *accrescent* when it continues to grow after pollination.

53. The *COROLLA* is usually coloured and of a more delicate texture than the calyx, and in popular language is often more specially meant by the flower. Its petals are more rarely in two whorls or indefinite in number. *Double flowers* are in most cases an accidental deformity or monstrosity in which the ordinary number of petals is multiplied by the conversion of stamens, sepals, or even carpels, into petals, by the division of ordinary petals, or simply by the addition of supernumerary ones. Petals are also sometimes very small, rudimentary or entirely absent.

In very many cases, a so-called *simple perianth* (of which the parts are usually called *leaves* or *segments*) is one in which the sepals and petals are similar in form and texture, and present apparently a single whorl. But if examined in the young bud, one half of the parts will generally be found to be placed

outside the other half, and there will frequently be some slight difference in texture, size or colour, indicating to the close observer the presence of both calyx and corolla. Hence much discrepancy in descriptive works. Where one botanist describes a simple perianth of six segments, another will speak of a double perianth of three sepals and three petals.

54. The following terms, expressive of the modifications of form and arrangement of the corolla and its petals, are equally applicable (with any necessary modification of suffix) to the calyx and its sepals, and to the simple perianth and its segments.

The corolla is said to be *gamopetalous* when the petals are united, either entirely or at the base only, into a cup, tube or ring; *polypetalous* when they are all free from the base.

When the petals are partially united, the lower entire portion of the corolla is called the *tube*, whatever be its shape, and the free portions of the petals are called the *teeth*, *lobes* or *segments*, according as they are short or long in proportion to the whole length of the corolla; these together form the *limb*. When the tube is excessively short, the petals appear at first sight free, but their slight union at the base must be carefully attended to, being of importance in classification.

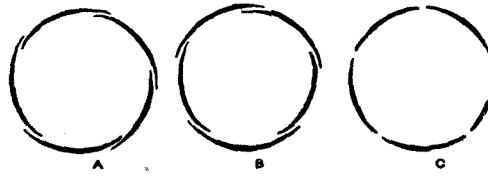


Fig. 7—TYPES OF AESTIVATION.
A, contorted. B, imbricate. C, valvate.

55. The *aestivation* of a corolla or calyx is the arrangement of the petals or sepals, or of such portion of them as is free, in the unexpanded bud. It is:

valvate, when they are strictly whorled in their whole length, their edges being placed against each other without overlapping.

imbricate, when the whorl is more or less broken by some of the parts being outside the others, or by their overlapping each other at least at the top.

twisted, contorted or *convolute*, when each part overlaps an adjoining one on the side, and is overlapped by the other adjoining one on the other side.

In general shape the corolla or calyx is:

tubular, when the whole or the greater part of it is in the form of a tube or cylinder.

campanulate, when approaching in some measure the shape of a cup or bell.

urceolate, when the tube is swollen or nearly globular, contracted at the top, and slightly expanded again in a narrow rim.

rotate or *stellate*, when the parts or lobes are spread out horizontally from the base, or nearly so, like a wheel or star.

56. Irregular corollas and calyces have received various names according to the more familiar forms with which they have been compared. Some of the most important terms are:

bilabiate, or *two-lipped*, when in a four- or five-lobed corolla or calyx the two or three upper lobes stand obviously apart, as an upper *lip*, from the two or three lower ones or under lip. In *Orchidaceae* and some other families the name of lip, or *labellum*, is given to one of the parts or lobes of the perianth.

spurred, when the tube or the lower part of a petal or sepal has a conical hollow projection, compared to the spur of a cock; *saccate*, when the projection is short and round like a little bag; *gibbous*, when projecting at any part into a slight swelling.

57. Most of the terms used for describing the forms of leaves are also applicable to those of individual petals and sepals; thus the flat expanded portion of a petal or sepal, corresponding to the blade of a leaf, is called its *lamina*. Its stalk, corresponding to the petiole, is, however, called its *claw* (*unguis*). The stalked petal or sepal is said to be *unguiculate*.

58. Although in a few cases the outer stamens may gradually pass into petals, yet, in general, *STAMENS* are very different in shape and aspect from petals or sepals. It is only from a theoretical point of view that they can be called modified leaves.

Their usual form is a stalk, called the *filament*, bearing at the top an *anther* divided into two pouches or *loculi* (sing. *loculus*). These anther-loculi are filled with *pollen*, consisting of minute grains, usually forming a yellow dust, which when the flower expands is scattered from an opening in each loculus. When the two loculi are not closely contiguous, the portion of the anther that unites them is called the *connective*.

59. The filament is often wanting, and the anther *sessile*, yet still the stamen is perfect; but if the anther, which is the essential part of the stamen, is wanting or does not contain pollen, the stamen is imperfect and is then said to be *barren* or *sterile* (without pollen), *abortive* or *rudimentary* according to the degree to which the imperfection is carried. Imperfect stamens are often called *staminodes*.

In zygomorphic or asymmetrical flowers the stamens of each whorl are often reduced in number below that of the petals or sepals, even to a single one; and in several families they are multiplied indefinitely.

60. The terms *monandrous* and *polyandrous* are restricted to flowers which have really but one stamen, or an indefinite number, respectively. Where several stamens are united into one, the flower is said to be *synandrous*.

61. Stamens are:

monadelphous, when united by their filaments into one cluster. This cluster either forms a tube round the pistil, or, if the pistil is wanting, occupies the centre of the flower.

diadelphous, when so united into two clusters. The term is more especially applied to certain *Papilionaceae* in which nine stamens are united in a tube slit open on the upper side, and a tenth, placed in the slit, is free. In some other plants the stamens are equally distributed in two clusters.

didynamous, when (usually in a bilabiate flower) there are four stamens in two pairs, those of one pair longer than those of the other.

exserted, when longer than the corolla or even when longer than its tube, if the limb be very spreading.

epipetalous, when inserted on the corolla.

62. An anther is:

adnate, when continuous with the filament, the loculi appearing to lie their whole length along the upper part of the filament.

innate, when firmly attached by its base to the filament. This is an adnate anther when rather more distinct from the filament.

versatile, when attached by its back to the very point of the filament, so as to swing loosely.

Anther-loculi may be *parallel* or *diverging* at a less or greater angle; or *divaricate*, when placed end to end so as to form one straight line.

Anthers have often, on their connective or loculi, appendages termed *bristles* (*setae*, sing. *seta*), *spurs*, *crests*, *points*, *glands*, etc., according to their appearance.

Anthers have occasionally only one loculus; this may take place either by the disappearance of the partition between two closely contiguous loculi, when these are said to be *confluent*; or by the abortion or total deficiency of one of the loculi, when the anther is said to be *dimidiate*.

Anthers will open or *dehisce*, to let out the pollen, by *valves*, *pores* or *slits*. Their *dehiscence* is *introrse*, when the opening faces the pistil; *extrorse*, when towards the circumference of the flower.

Pollen is not always in the form of dust. It is sometimes collected in each loculus into one or two little wax-like masses. Special terms used in describing these masses or other modifications of the pollen will be explained under the families where they occur.

63. The carpels of the *PISTIL*, although they may occasionally assume the appearance and colour of ordinary leaves, are still more different in shape and structure. They are usually sessile.

A carpel (or pistil, when formed of united carpels) consists usually of three parts:

(1) the *ovary*, or enlarged base, which includes one or more cavities or *loculi*, containing one or more small bodies called *ovules*. These are the earliest condition of the future seeds.

(2) the *style*, proceeding from the summit of the ovary and supporting

(3) the *stigma*, which is sometimes a point (a *punctiform* stigma) or small head (a *capitate* stigma) at the top of the style or ovary, sometimes a portion of its surface more or less lateral and variously shaped, distinguished by a looser texture, and covered with minute protuberances called *papillae*.

The style is often wanting, and the stigma is then *sessile* on the ovary. If the style apparently arises from the base of the ovary (as in *Boraginaceae* and *Labiatae*) it is called *gynobasic*. In the perfect pistil there is always at least one ovule in an ovary, with some stigmatic surface. Without these the pistil is imperfect, and said to be *barren* (not setting seed), *abortive* or *rudimentary* according to the degree of imperfection.

64. The ovary being the essential part of the carpel, most of the terms relating to the number, arrangement, etc., of the carpels apply specially to their ovaries. When the ovaries are at all united, they are commonly termed collectively a compound ovary. The number of carpels in a flower is frequently reduced below that of the parts of the other floral whorls, even in flowers otherwise symmetrical. In some genera, however, the carpels are more numerous than the petals, or indefinite. They are in that case either arranged in a single whorl or form a head or spike in the centre of the flower.

65. A pistil (or a flower) is:

monocarpellary, when the pistil consists of a single simple carpel.

bi-, *tri-*, etc., to *poly-carpellary*, when the pistil consists of two, three, etc., to an indefinite number of carpels, whether separated or united.

syncarpous, when the carpels or their ovaries are more or less united into one compound ovary.

apocarpous, when the carpels are all free and distinct.

A compound ovary is:

unilocular, when there are no partitions (*dissepiments*) between the ovules, or when these partitions do not meet in the centre so as to divide the cavity into several loculi.

bi-, *tri-*, etc., to *multi-locular*, according to the number of loculi (two, three, etc., to many).

In general the number of loculi, or of dissepiments, complete or partial, or of rows of ovules, corresponds with that of the carpels of which the pistil is composed. But sometimes each carpel is divided completely or partially into two loculi, or has two rows of ovules, so that the number of carpels appears double what it really is. Sometimes again the carpels are so completely combined and reduced as to form a single loculus, with a single ovule, although there are really several carpels. But in these cases the ovary is usually described as it appears as well as such as it is theoretically supposed to be.

In apocarpous pistils the styles are usually free, each bearing its own stigma. Very rarely the greater part of the styles, or the stigmas alone, are united, whilst the ovaries remain distinct.

66. Syncarpous pistils are said to have:

several styles, when the styles are free from the base.

one style with several branches, when the styles are united at the base, but separate below the point where the stigmatic surfaces commence.

one simple style with several stigmas, when united up to the point where the stigmas or stigmatic surfaces commence, these then separating.

one simple style with a branched, lobed, toothed, notched or entire stigma (as the case may be), when the stigmas also are more or less united.

In general the number of styles, or branches of the style or stigma, is the same as that of the carpels, but sometimes that number is doubled, especially in the stigmas, and sometimes the stigmas are dichotomously or pinnately branched, or *penicillate*, that is, divided into a tuft of hair-like branches. All these variations sometimes make it a difficult task to determine the number of carpels forming a compound ovary.

67. The *placenta* is the part of the inside of the ovary to which the ovules are attached, sometimes a mere point or line on the inner surface, often more or less thickened or raised. *Placentation* is therefore the indication of the part of the ovary to which the ovules are attached.

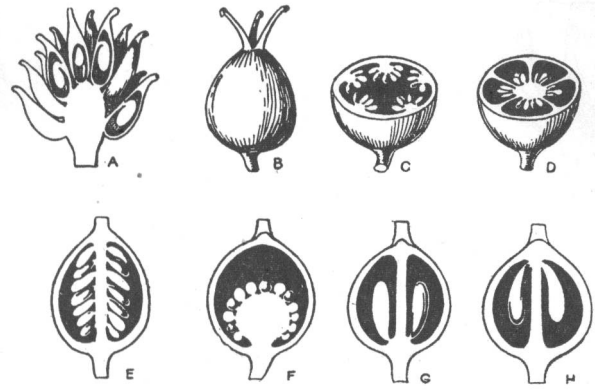


Fig. 8—OVARY DETAILS.
A, apocarpous pistil. B, syncarpous pistil. C, parietal placentation. D, axile placentation. E, free-central placentation. F, free-basal placentation. G, basal erect ovules. H, apical pendulous ovules.

Placentas are:

axile, when the ovules are attached to the axis or centre; but when the ovules are attached to a central column rising up from the base of the cavity and reaching the top of the cavity the placenta is said to be *free-central*; and when the central column does not reach the top of the cavity the placenta is said to be *free-basal*.

parietal, when the ovules are attached to the inner wall of the cavity of a unilocular ovary. Parietal placentas are usually slightly thickened or raised lines, sometimes broad surfaces nearly covering the inner wall of the cavity, sometimes projecting far into the cavity, and constituting partial dissepiments, or even meeting in the centre, but without cohering there. In the latter case the distinction between the unilocular and the several-locular ovary sometimes almost disappears.

68. The *RECEPTACLE*, *thalamus* or *torus* is the extremity of the peduncle or pedicel upon which the perianth, stamens and pistil are inserted. It is sometimes little more than a mere point or minute hemisphere, but it is often more or less elongated, thickened or otherwise enlarged. It must not be confounded with the receptacle of an inflorescence.

When the pistil is at the top of the receptacle, and sepals, petals and stamens are placed successively beneath it, the pistil is *superior* and the other members of the flower are *hypogynous* (i.e. beneath the ovary); the whole flower is also termed hypogynous. In other cases the receptacle is cup-shaped, the outer members (sepals, petals and stamens) are borne at the edge

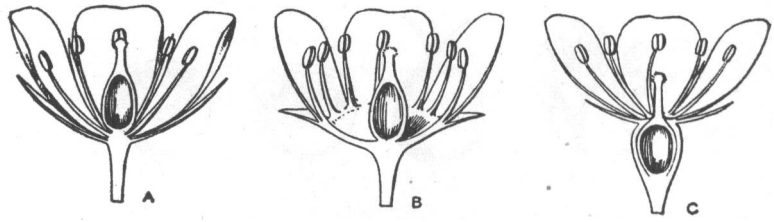


Fig. 9—TYPES OF FLOWERS.
A, hypogynous, i.e. ovary superior; sepals, petals and stamens *below* the ovary.
B, perigynous, i.e. ovary superior; sepals, petals and stamens *around* the ovary.
C, epigynous, i.e. ovary inferior; sepals, petals and stamens *above* the ovary.

of the cup, while the pistil, though still occupying the true apex of the receptacle, occupies the centre of the cup; the sepals, petals and stamens are then *perigynous* (i.e. around the ovary) and the whole flower is also called perigynous; the pistil is still termed superior. The concavity of the receptacular cup varies greatly; it may be very shallow, or at the other extreme the edges, as in the rose flower, may almost meet at the top, but the carpels are still free from the inner wall of the receptacle. In other cases the outer wall of the carpels has become indistinguishable from the inner wall of the receptacle, and the other members of the flower appear to spring from the top of the ovary, which is then *inferior*, while the other members are *epigynous* (i.e. upon the ovary); the whole flower is also termed epigynous.

69. A *disk*, or *disc*, is a circular enlargement of the receptacle, usually in the form of a cup (*cupular*), of a flat disk, or quoit, or of a cushion (*pulvinate*). It is either immediately at the base of the ovary within the stamens, or between the petals and stamens, or bears the petals or stamens or both on its margin. It may be entire, or toothed or lobed, or divided into a number of parts, usually equal to or twice that of the stamens or carpels.

70. A *corona* is a circle of appendages between the corolla and stamens, often united in a ring or crown (as in *Passifloraceae* and *Asclepiadaceae*).

71. *Nectaries* are either the disk, or small deformed petals, or abortive stamens, or appendages at the base of petals or stamens, or other small nectar-secreting bodies within the flower.

72. In hypogynous flowers, when there are both petals and stamens, the petals and stamens are usually free from each other, but sometimes they are combined at the base. In that case, if the petals are distinct from each other, and the stamens are monadelphous, the petals are often inserted on or combined with the

staminal tube; if the corolla is gamopetalous and the stamens distinct from each other, the latter are commonly inserted on the tube of the corolla.

In perigynous flowers, the stamens are usually inserted immediately within the petals, or alternating with them on the edge of the receptacle, but occasionally much lower down within the receptacle.

In epigynous flowers, when the petals are distinct, the stamens are usually inserted as in perigynous flowers; when the corolla is gamopetalous, the stamens are either free, or combined at the base with (inserted on) the tube of the corolla.

73. When the receptacle is distinctly elongated below the ovary, the elongated part is called a *gynophore* (as in *Capparidaceae*). If the elongation takes place below the stamens or below the petals, these stamens or petals are then said to be inserted on the gynophore.

74. An epigynous disk is either the thickened summit of the ovary in epigynous flowers, or the real disk or enlargement of the receptacle closing over the ovary.

75. In the relative position of any two (or more) parts of the flower, whether in the same or different whorls, they are:

coherent, when united together, but so slightly that they can be separated with little or no laceration; and one of the two coherent parts (usually the smaller or less important) is said to be *adherent* to the other. Grammatically speaking, these two terms convey nearly the same meaning, but require a different form of phrase; practically, however, it has been found more convenient to restrict *cohesion* to the union of parts of the same whorl, and *adhesion* to the union of parts of different whorls.

connate, when so closely united that they cannot be separated without laceration.

76. The *FRUIT* consists of the ovary and whatever other parts of the flower are persistent (i.e. persist at the time the seed is ripe), usually enlarged, and more or less altered in shape and consistence. It encloses or covers the seed or seeds till the period of maturity, when it either opens for the seed to escape or falls to the ground with the seed.

77. The *pericarp* is the portion of the fruit formed of the ovary and whatever adheres to it exclusive of and outside of the seed or seeds. It varies very much in consistence.

The *endocarp* is the innermost layer of the pericarp, usually hard and stony as in drupaceous fruits.

78. Fruits have often external appendages called *wings*, *beaks*, *crests*, *awns*, etc., according to their appearance. They are either formed by persistent parts of the flower more or less altered, or grow out of the ovary or the persistent part of the calyx. If the appendage be a ring of hairs or scales round the top of the fruit, it is called a *pappus*. A fruit is *torulose* when it is cylindrical with contractions and swellings at intervals.

79. Fruits are generally divided into succulent (including fleshy, pulpy and juicy fruits) and dry. They are *dehiscent* when they open at maturity to let out the seeds, *indehiscent* when they do not open spontaneously but fall off with the seeds. Succulent fruits are usually indehiscent.

80. The principal kinds of succulent fruit are:
the *berry*, in which the whole of the substance of the fruit is fleshy except for the outer skin. The seeds are usually immersed in the pulp, as in the grape, and the fruit is described as *baccate*.
the *drupe* or stone-fruit, in which the fruit consists of an outer succulent portion and an inner hard woody portion (stone) which contains the seed, e.g. plum, cherry. If the hard woody portion consists of several distinct stones each enclosing a seed, these are called *pyrenes*.

81. The principal kinds of dry fruit are:
the *capsule*, which is dehiscent. When ripe the pericarp usually splits longitudinally into as many or twice as many pieces, called *valves*, as it contains loculi or placentas; if these valves separate at the line of junction of the carpels, that is, along the line of the placentas or dissepiments, either splitting them or leaving them attached to the axis, the dehiscence is termed *septicidal*; if the valves separate between the placentas or dissepiments, the dehiscence is *loculicidal*, and the valves either bear the placentas or dissepiments along their middle line, or leave them attached to slits, chinks or pores, more or less regularly arranged. The pericarp may, however, burst irregularly, or separate into two parts by a horizontal line; in the latter case the capsule is said to be *circumscissile*.
the *achene*, which is indehiscent and contains but a single seed; when the pericarp is hard and woody the fruit is termed a *nut*. When the pericarp is thin in proportion to the seed it encloses, the whole fruit has the appearance of a single seed, and is so called in popular language. A *samara* is a nut or achene with a wing at its upper end.

82. When the carpels of the pistil are distinct they may severally become as many distinct berries, drupes, capsules or achenes. Separate carpels are usually more or less compressed laterally, with more or less prominent inner and outer edges, called

sutures, and, if dehiscent, the carpel usually opens at these sutures. A *follicle* is a carpel opening usually at the inner suture only. In some cases where the carpels are united in the pistil they will separate when ripe; they are then called *cocci* (sing. *coccus*) if one-seeded; in *Labiatae* and *Boraginaceae* the separating one-seeded lobes of the fruit are termed *nutlets*.

83. The peculiar fruits of some of the large families have received special names, which will be explained under each family. Such are the *siliqua* and *silicule* of *Cruciferae*, the *legume* or *pod* of *Papilionaceae* and allies, the *grain* or *caryopsis* of *Gramineae*.

84. The *SEED* is enclosed in the pericarp in the great majority of flowering-plants, called therefore Angiosperms or *angiospermous* plants. In *Coniferae* and allied groups, called Gymnosperms or *gymnospermous* plants, the seed is naked, without any real pericarp. These truly gymnospermous plants must not be confounded with *Labiatae*, *Boraginaceae*, etc., which have also been falsely called gymnospermous, their small nutlets having the appearance of seeds.

The seed when ripe contains a young plant or *embryo*, either more or less filling the inside of the seed but not attached to its outer coat, or more or less immersed in a mealy, oily, fleshy or horny substance called *endosperm*. The embryo or endosperm can often only be found or distinguished when the seed is quite ripe, or sometimes only when it begins to germinate.

85. The shell of the seed consists usually of two separable coats. The outer coat, called the *testa*, is usually the principal one, and in most cases the only one attended to in descriptions. It may be hard and *crustaceous*, woody or bony, or thin and *membranous* (skin-like), dry or rarely succulent. It is sometimes expanded into *wings*, or bears a tuft of hair, cotton or wool.

86. The *funicle* is the stalk by which the seed (and the ovule) is attached to the placenta. It is occasionally enlarged into a membranous, pulpy or fleshy appendage, sometimes spreading over a considerable part of the seed or nearly enclosing it, called an *aril*. A *strophiole* or *caruncle* is a similar appendage, proceeding from the testa, by the side of or near the funicle.

87. The *hilum* is the scar left on the seed where it separates from the funicle.

88. A *cotyledon* is a seed-leaf, which emerges from the seed on germination. The two big divisions of Angiosperms are the *Dicotyledones* (having two seed-leaves) and the *Monocotyledones* (having one seed-leaf only).

89. *ACCESSORY ORGANS.*
These may be classed under four heads: *tendrils* and *hooks*, *thorns* and *prickles*, *hairs* and *glands*.

90. *Tendrils* are usually modified petioles, or peduncles, or branches. They are simple or more or less branched, flexible, and coil more or less firmly round any objects within their reach, in order to support the plant to which they belong. *Hooks* are similar holdfasts, but of a firmer consistence, not branched and less coiled.

91. *Thorns* and *prickles*. A *thorn* or *spine* is the strongly pointed extremity of a branch, or abortive petiole, or abortive peduncle. A *prickle* is a sharply pointed excrescence from the epidermis, sometimes including also the underlying cells, and is usually produced on a branch, on the petiole or veins of a leaf, or on a peduncle, or even on the calyx or corolla. When the teeth of a leaf or the stipules are *pungent*, i.e. sharp, they are called prickles, not thorns. A plant is *spinous* if it has thorns, *aculeate* if it has prickles.

92. *Hairs* in the general sense, or the *indumentum* (or clothing) of a plant, include all those productions of the epidermis which have, by a more or less appropriate comparison, been termed bristles, hairs, down, cotton or wool. Hairs are often branched. *They are said to be medifixed, if parted from the base*, and the forks spread along the surface in opposite directions; *plumose*, if the branches are arranged along a common axis, as in a feather; *stellate*, if several branches radiate horizontally. These stellate hairs have sometimes their rays connected together at the base, forming a little flat circular disk attached by the centre, and are then called *scales*, and the surface is said to be *scaly* or *lepidote*.

93. The *EPIDERMIS*, or outer skin of an organ, as to its surface and indumentum, is:

smooth, when without any protuberance whatever.

glabrous, when without hairs of any kind.

striate, when marked with parallel longitudinal lines either slightly raised or merely discoloured.

furrowed (*sulcate*) or *ribbed* (*costate*) when the parallel lines are more distinctly raised.

rugose, when wrinkled or marked with irregular raised or depressed lines.

umbilicate, when marked with a small round depression.

viscous, *viscid* or *glutinous*, when covered with a sticky or clammy exudation.

scabrous, when rough to the touch.

pustulate, when having slight elevations like pimples or blisters.

tuberculate or *warted*, when covered with small obtuse wart-like protuberances.

muricate, when the protuberances are more raised and pointed but yet short and level.

echinate, when the protuberances are longer and sharper, almost prickly.

setose or *bristly*, when bearing very stiff erect straight hairs (*setae*); *setulose*, when slightly setose.

glandular-setose, when the setae terminate in a minute resinous head or drop.

glochidiate, when the setae are hooked at the top.

pilose, when thinly sprinkled with rather long simple hairs.

hispid, when more thickly covered with rather stiff hairs.

hirsute, when the hairs are dense and not so stiff.

downy or *pubescent*, when the hairs are short and soft; *puberulous*, when shortly pubescent.

strigose, when the hairs are rather short and soft, and lie close along the surface all in the same direction; *strigillose*, when slightly strigose.

tomentose or *cottony*, when the hairs are very short and soft, rather dense and more or less intricate; *tomentellous*, when shortly tomentose.

woolly (*lanate*), when the hairs are long and loosely intricate, like wool. The wool or tomentum is said to be *floccose* when closely intricate and readily detached, like fleece.

mealy (*farinose*), when the hairs are excessively short, intricate and white, and come off readily, having the appearance of meal or dust.

canescent or *hoary*, when the hairs are so short as not readily to be distinguished by the naked eye, and yet give a general whitish hue to the epidermis.

villous, when covered with shaggy hair.

glaucous, when of a pale bluish-green, often covered with a fine bloom.

The meanings here attached to the above terms are such as appear to have been most generally adopted, but there is much vagueness in the use practically made of many of them by different botanists.

CYSTOLITHS are crystals of calcium oxalate which often show as a lighter dot or line when held up to the light.

The name of *GLANDS* is given to several different productions, and principally to the four following:

(1) Small wart-like or shield-like bodies, either sessile or sometimes stalked, of a somewhat fleshy consistence, occasionally secreting a small quantity of oily or resinous matter, but more frequently dry. They are generally few in number, often definite in their

position and form, and occur chiefly on the petiole or principal veins of leaves, on the branches of inflorescences, or on the stalks or principal veins of bracts, sepals or petals.

(2) Minute raised dots, usually black, red or dark-coloured, of a resinous or oily nature, always superficial, and apparently exudations from the epidermis. They are often numerous on leaves, bracts, sepals and green branches, and occur even on petals and stamens, more rarely on pistils. When raised upon slender stalks they are called *pedicellate* (or *stipitate*) glands, or *glandular hairs*, according to the thickness of the stalk.

(3) Small globular, oblong or even linear vesicles, filled with oil, embedded in the substance itself of leaves, bracts, floral organs, or fruits. They are often very numerous like transparent dots, sometimes few and determinate in form and position. In the pericarp of *Umbelliferae* they are remarkably regular and conspicuous and take the name of *vittae*.

(4) Lobes of the disk or other small fleshy excrescences within the flower, whether from the receptacle, calyx, corolla, stamens or pistil.

INDEX OF BOTANICAL TERMS

The numbers refer to the paragraphs of Outlines of Plant Description in which the terms are explained. Many of the adjectives formed from nouns of plant description have been omitted from this index. These should be looked for under the corresponding nouns: e.g. corymbose under corymb, -nerved under nerve.

HINTS ON PLANT COLLECTING

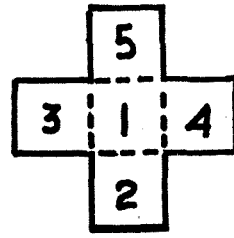
APPARATUS.

(a) *Presses* should be of such a type as to allow access of air to the plants, at least to those at the top and bottom of the press: consequently the frames of the press should be perforated. A simple and effective press can be made from laths of 3-ply wood 17 in. × 1 in. × ¼ in. arranged parallel to give, with gaps between the laths, a total width of 11 in. Two or three cross-strips will fasten the laths together. Two of these frames will be required, and the drying paper will lie between them, the whole being strapped together with two stout straps or pieces of tape to obtain the pressure.

(b) *Drying-paper* of a size to fit the above press (which is of standard size) may consist of any *unglazed* paper, e.g. newspaper or blotting-paper, the former preferable to the latter.

(c) *Paper folders* will be required for keeping the specimens after drying and removal from the press, unless it is intended to mount them; then rather stiff white or dark-brown paper can be used and the specimens attached to the mounting-paper by narrow straps of transparent gummed tape.

(d) *Small envelopes* made by folding thin paper, cut as in the diagram below, may be required for seeds, delicate flowers, etc. The specimen is placed on 1 and the wings 2, 3, 4, 5 are folded over in order: 2 must be the same size as 1.



(e) *Bottles*, preferably of the wide-mouthed jam-jar type, for preserving delicate specimens; *neckless glass tubes* with corks, of various sizes.

(f) *Alcohol* for preserving: ordinary methylated spirit is best for most things.

(g) *Formalin solution* for preserving specimens in water. A few drops should be added to the specimen in water.

(h) *Muslin* for wrapping alcohol or formalin specimens, particularly fruits. Each should be wrapped with its label (in lead-pencil not copying-ink, or better in Indian ink) in a piece of muslin and packed in a bottle or tin, either dry or in methylated spirit; the specimens cannot then become mixed together, and can be closely packed.

(j) *Notebooks.*

2. *COLLECTING AND PRESERVING.*

Collect specimens as typical as possible.

Collect entire plant if possible including root. In shrubs and trees, twigs with leaves in all stages, portion of stem-bark, and anything else necessary for a complete description. Do not forget radical leaves, buds, flowers, ripe and unripe fruit, seeds.

Do not collect herbarium material in wet weather.

Large flowers or heads (e.g. thistles), fruits, roots, tubers, etc., may be sliced in half before pressing, or the surface only sliced off. Notes and if possible sketches should be made of the original appearance.

Leaves of conifers, heaths, succulents, etc., fall off when dried unless previously immersed for a few seconds in boiling water. Do not immerse flowers.

Thorny and prickly plants should first be placed between boards and pressed down with the feet; the prickles would otherwise tear the paper.

Delicate water-plants should be arranged upon sheets of white paper under water, and always remain on these sheets while drying.

It saves time in drying delicate specimens to keep each always in a folded sheet of very thin paper.

Place extra flowers, small fragments, seeds, etc., in small envelopes, numbered to correspond with the specimens; do not have any small parts loose, or confusion may result.

Place all specimens in the press the day they are collected. Withered plants may be soaked in water; if the stem be cut 2-3 in. above the former cut and *under* water they will often revive quickly.

Label every specimen with its consecutive number in such a way that the number cannot be lost. Punched labels are best tied on with thread. See that all envelopes, etc., have the corresponding number.

Spread out the specimens naturally. If many flowers, etc., overlap, place bits of drying-paper between. If stems have to be cut, mark the corresponding ends by stars on the paper. Spread out some flowers, leave others unspread, and cut some in half. Divide some fruits lengthwise and others crosswise.

Arrange the specimens on the sheets so that they form a steady pile without lumps in the middle. When all are ready place in the press and draw the straps tight or, better, place about 10 lb. weight upon it. Tighten the straps as the plants shrink. It should be remembered that the object of pressing plants is to prevent

their curling and shrinking more than needful while they are drying and no more pressure should be given than is necessary for this purpose. Excessive pressure deforms the plants, smashes soft tissues, and often causes the plants to stick to the drying-paper.

Change drying-paper at least once daily; dry used paper in the sun or by the fire; use warm driers where possible. See that petals, etc., do not stick to the paper; if necessary put slips of tissue-paper underneath.

In changing the papers, put the outer specimens inside, so that all shall dry evenly. *Drying should be as rapid as possible* to prevent loss of colour, blackening, etc.

Fully dried plants no longer feel cold on the cheek, are stiff and brittle and when held in a horizontal position the leaves remain horizontal.

Dried specimens should be poisoned by a brief immersion in 2% solution of mercuric chloride in alcohol. They should then be dried in the air, mounted, or laid between sheets of paper, and tied up in wax-cloth with a little naphthalin to keep out insects.

3. *RECORDING.*

Make all notes immediately upon observation of the facts; never trust to memory, nor delay recording.

Make all notes about individual specimens upon detachable sheets, numbered to correspond with the specimens; never describe two or more on the same sheet; never use the same number twice.

Make no record till satisfied of its truth and accuracy.

Accompany all notes with maps, drawings or photographs as far as possible.

Sketch and photograph all peculiarities of habit, characteristic forms of vegetation, and other features of interest. Mark all plants in such pictures with numbers corresponding to their numbers in your collection, and write a full description of each picture before leaving the spot. If a photograph is taken, make a rough sketch (from the picture on the focussing screen or finder) of the scene and put numbers to the plants.

Label all specimens as collected with *consecutive* numbers.

As each specimen is gathered record whether herb (annual or perennial), shrub, tree or climber (giving rough height in the first three cases), date, exact locality, elevation above sea-level, colour of flower and fruit, scent. If a tree, record the colour and roughness of the bark, and also growth habit. Note the type of soil, e.g. sand, river silt, heavy clay soil, etc., on which the specimen is growing. Record whether the plant is rare or abundant in the district in which you found it, and also native names (question several persons before deciding) and economic uses, and points of general or ethnological interest. Endeavour to note the chief general forms of vegetation and local grouping of plants in districts studied. Pay particular attention to ecological and geographical questions. All this information is later recorded on the label of the *mounted* specimen.

KEY TO THE PRINCIPAL GROUPS OF PLANTS IN THIS FLORA

GYMNOSPERMAE.—Ovules not enclosed in an ovary; plants dioecious or monoecious; apparent flowers arranged in cones or slender spikes; no perianth; pollen-sacs ("anther-cells") ovoid, closely set on the lower face of the cone-scales or (when flowers spicate) borne on free or fused filaments; female cone-scales imbricate, stipitate and peltate, bearing a pair of sessile inverted ovules on the lower side; seeds drupe-like, with a fleshy outer coat or sometimes an aril; cotyledons 2:

Tall evergreen trees, growing often in dense forests ..... CONIFERAE[1].

Shrubs or small trees with a thick simple stem, crowned with a terminal tuft of pinnate parallel-nerved leaves which are coiled in the bud ..... CYCADALES[1].

Whip-like shrubs, with more or less whorled branches with opposite connate leaves reduced to scales; flowers unisexual, spicate; the seed is enclosed in the perianth which becomes woody, and fleshy bracts over this again ..... GNETALES[1].

ANGIOSPERMAE.—Ovules enclosed in an ovary; flowers not or very rarely arranged in cones; stamens usually differentiated into filament and anther; cotyledons 2 or 1; herbs, shrubs or trees, with simple or compound leaves which are not (or very rarely) coiled in the bud:

Leaves usually net-veined, alternate, or opposite; floral parts mostly in fours or fives, or in multiples of these numbers, very rarely in threes or sixes; cotyledons 2, rarely more; herbs, shrubs or trees ..... DICOTYLEDONES.

Leaves usually parallel-veined, mostly alternate; floral parts usually in threes or sixes; cotyledon 1; mostly herbs, except palms, bamboos, *Dracaena*, etc. ..... MONOCOTYLEDONES.

[1]This description applies only to Sudan plants of the group.

ARTIFICIAL KEYS TO THE FAMILIES OF ANGIOSPERMAE REPRESENTED IN THIS FLORA

HINTS FOR USING THE KEYS TO THE BEST ADVANTAGE.

Do not start to use the keys before you have examined your plant thoroughly. If you do you may easily go wrong. Make out whether the carpels are free from each other or united; if they are united, then try to decide whether the ovules are on the wall (parietal placentation) or at the apex, base or centre of the ovary (apical, basal or axile placentation respectively). It is often easier to use an immature fruit to decide the position of the ovules. The position of the ovules in relation to the ovary wall is the most important while often the most difficult portion of the keys on which to make a decision. It should be remembered that parietal placentation usually (but not always) occurs in a unilocular ovary. The pea pod is an example of the fruit of an ovary with parietal placentation. A longitudinal, i.e. lengthwise, as well as a transverse section of the ovary should be examined. Then note the number of stamens, and if few, whether opposite to or alternate with the petals. Then see whether there are stipules. The stipules may have fallen off; if so, you will be able to detect a scar, and then the leaves are stipulate. You must use a lens for these characters, and a razor, razor-blade or sharp pen-knife for the ovary. A used Gillette or similar razor-blade in one of the many holders on the market provides a very useful ready-made razor for the dissection of the flower. The blade can be replaced when it becomes blunt, and the continual sharpening necessary with the long razor is avoided. Do not, in using a key, read only the paragraph which seems to fit the plant you wish to determine. You will be much more sure if you read also the contrasting paragraph or paragraphs. Do not always blame a key if you cannot arrive at the family readily. You may have misread it, or your own observation may be at fault. The keys are not infallible and any suggestion for their improvement would be welcome.

It may however happen that the specimen examined presents some occasional or accidental anomalies peculiar to that single one, or to a very few individuals, which may prevent the species from being at once recognized by its technical characters. It may be useful here to point out a few of these anomalies which are most likely to be met with. For this purpose we may divide them into two classes, viz.:—

(1) *Aberrations from the ordinary type or appearance of a species for which some general cause may be assigned.*

A bright light and an open situation, particularly at considerable elevations above the sea, or at high latitudes, without too much wet or

drought, tend to increase the size and heighten the colour of flowers, in proportion to the stature and foliage of the plant. Shade, on the contrary, especially if accompanied by richness of soil and sufficient moisture, tends to increase the foliage and draw up the stem, but to diminish the number, size and colour of the flowers.

A hot climate and dry situation tend to increase the hairs, prickles and other productions of the epidermis, to shorten and stiffen the branches, rendering thorny plants yet more spinous. Moisture in a rich soil has a contrary effect.

The neighbourhood of the sea, or a saline soil or atmosphere, imparts a thicker and more succulent consistence to the foliage and almost every part of the plant, and appears not infrequently to enable plants usually annual to live through the winter. Flowers in a maritime variety are often much fewer, but not smaller.

The luxuriance of plants growing in a rich soil, and the dwarf stunted character of those crowded in poor soils, are too well known to need particularizing. It is also an everyday observation how gradually the specimens of a species become dwarf and stunted as we advance into the cold damp regions of the summits of high mountain-ranges. Luxuriance entails not only an increase in the size of the whole plant, or of particular parts, but often also an increase of number in branches, in leaves, or leaflets of a compound leaf; or it may diminish the hairiness of the plant, induce thorns to grow out into branches, etc.

Capsules which, while growing, lie close upon the ground will often become larger, more succulent and less readily dehiscent than those which are not so exposed to the moisture of the soil.

Herbs eaten down by sheep or cattle, or crushed underfoot, or otherwise checked in their growth, or trees or shrubs cut down to the ground, or subject to periodic fire, if then exposed to favourable circumstances of soil and climate, will send up luxuriant side-shoots, often so different in the form of their leaves, in their ramification and inflorescence as to be scarcely recognizable for the same species.

Annuals which have germinated and flowered without check will often be very different in aspect from individuals of the same species, which, having germinated later, are stopped by drought or cold, and only flower the following season upon a second growth. The latter have often been mistaken for perennials.

Hybrids, or crosses between two distinct species, come under the same category of anomalous specimens from a known cause. Frequent as they are in gardens, where they are artificially produced, they also occur in nature. Absolute proof of the origin of a plant found wild is of course impossible; but it is fairly generally agreed that the following particulars are to be expected of a *wild hybrid*. It partakes of the characters of its two parents; it is usually to be found isolated, or almost isolated, in places where the two parents are abundant; if there are two or three individuals of it they will generally be dissimilar from each other, one partaking more of one parent, another of the other; it seldom ripens good seed; it will rarely be found where one of the parents grows alone, or where they are both absent.

(2) *Accidental aberrations from the ordinary type, that is, those of which the cause is unknown.*

These require more attention, as they may sometimes lead the beginner far astray in his search for the genus or family, whilst the aberrations above-mentioned as reducible more or less to general laws affect chiefly the distinction of species.

Almost all species with coloured flowers are liable to occur occasionally with them all white.

Many may be found even in a wild state with double flowers, that is, with a multiplication of petals.

Plants which have usually conspicuous petals will occasionally appear without any at all, either in the flowers produced at particular seasons, or in all the flowers of individual plants; or the petals may be reduced to narrow slips.

Flowers usually very irregular may, on certain individuals, lose more or less of their irregularity, or appear in some very different shape. Spurs, for instance, may disappear, or be produced on all instead of one only of the petals.

One part may be occasionally added to, or subtracted from, the usual number of parts in each floral whorl, more especially in regular polypetalous flowers.

Plants usually monoecious or dioecious may become occasionally hermaphrodite, or hermaphrodite plants may produce occasionally unisexual flowers by the abortion of the stamens or of the pistils.

Leaves cut or divided where they are usually entire, variegated or spotted where they are usually of one colour, or the reverse, must also be classed amongst those accidental aberrations against which the botanist must always be on his guard.

It should be noted that the keys and the description of a family in the text are designed to contain the characters of those plants of the family which are indigenous to the Sudan. They should not necessarily be considered as giving the characters of all plants in the family.

The number following the family name shows its position in the sequence of families in this flora.

Each page of the Descriptive Systematic List is headed with the family name and its number.

KEY TO THE FAMILIES OF DICOTYLEDONES

Gynoecium (pistil) composed of 2 or more separate or nearly quite separate carpels with separate styles and stigmas (rarely the free carpels immersed in the expanded torus):

Petals present, free from each other, sometimes considerably modified ..... Group 1. See p. liv.

Petals present, more or less united ..... Group 2. See p. lv.

Petals absent ..... Group 3. See p. lv.

Gynoecium (pistil) composed of 1 carpel or of 2 or more united carpels with free or united styles, or if carpels free below then the styles or stigmas united:

Ovules 2 or more, attached to the wall of the ovary:

Ovary superior:

Petals present, free from each other ... Group 4. See p. lv.
Petals present, more or less united ... Group 5. See p. lviii.
Petals absent ..... Group 6. See p. lviii.

Ovary inferior:

Petals present, free from each other ... Group 7. See p. lix.
Petals present, more or less united ... Group 8. See p. lix.
Petals absent ..... Group 9. See p. lix.

Ovules 1 or more, if more than 1 then attached to the central axis or the base or apex of the ovary:

Ovary superior:

Petals present, free from each other ... Group 10. See p. lx.
Petals present, more or less united ... Group 11. See p. lxvii.
Petals absent ..... Group 12. See p. lxxiii.

Ovary inferior:

Petals present, free from each other ... Group 13. See p. lxxvii.
Petals present, more or less united ... Group 14. See p. lxxix.
Petals absent ..... Group 15. See p. lxxx.

GROUP I.—*Two or more separate carpels; petals present, free from each other.*

A. Leaves opposite, without stipules; herbs, often succulent; stamens and carpels as many as the petals ..... CRASSULACEAE. 25.

AA. Leaves alternate, sometimes all radical:

B. Leaves with stipules:

Leaves pinnate or 3-foliolate; fruiting-carpels indehiscent; herbs, shrubs or trees ..... ROSACEAE. 77.

Leaves simple; fruiting-carpels dehiscent; trees with stellate hairs ..... TILIACEAE. 70.

BB. Leaves without stipules:

C. Carpels immersed in the tissue of the large expanded torus; aquatic plants with floating leaves and showy flowers .... NYMPHAEACEAE. 11.

CC. Carpels not sunk in the tissue of the torus; plants not aquatic:

Herbs; leaves lobed or much divided; calyx sometimes small, sometimes petaloid and spurred; fruit of achenes or follicles ..... RANUNCULACEAE. 9.

Trees, shrubs or woody climbers:

Leaves pinnate or 3-foliolate; stamens twice as many as the petals; carpels usually 5 ..... CONNARACEAE. 105.

Leaves simple:
Flowers dioecious, small; mostly twiners ..... MENISPERMACEAE. 12.
Flowers hermaphrodite:
Anthers with a broadly and more or less truncately produced connective; flowers solitary or in axillary clusters ..... ANNONACEAE. 5.
Anthers small, with convergent loculi and no production of the connective; flowers in panicles; leaves with prominent parallel lateral nerves ..... DILLENIACEAE. 51.

GROUP 2.—*Two or more separate carpels; petals present, more or less united.*

A. Herbs or undershrubs; leaves opposite or the lower ones peltate, usually fleshy; petals often united into an elongated tube ..... CRASSULACEAE. 25.

AA. Trees, shrubs or woody climbers; leaves alternate, not peltate nor fleshy; petals only shortly united at the base:
Leaves simple; petals 6 ..... ANNONACEAE. 5.
Leaves pinnate or 3-foliolate; petals 5 ... CONNARACEAE. 105.

GROUP 3.—*Two or more separate carpels; petals absent.*

A. Flowers unisexual or polygamous; stamens with the filaments more or less united into a column; trees or woody climbers:
Trees; calyx valvate; staminal column with 10-15 anthers ..... STERCULIACEAE. 71.
Climbers; calyx imbricate; staminal column with 6 anthers; flowers dioecious ..... MENISPERMACEAE. 12.

AA. Flowers hermaphrodite; stamens free; herbs or soft-wooded climbers:
Leaves entire, opposite or subopposite; flowers small, in cymes, sometimes paniculate; herbs ..... MOLLUGINACEAE. 31.
Leaves toothed, lobed or deeply divided:
Calyx petaloid; stamens 5 or more; erect or climbing plants, often with opposite leaves ... RANUNCULACEAE. 9.
Calyx herbaceous; stamens 4 or fewer; herbs, with alternate digitately lobed leaves ..... ROSACEAE. 77.

GROUP 4.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary superior; petals present, free from each other.*

A. Stamens 6, 4 long and 2 short; sepals and petals 4; herbs, sometimes shrubby; leaves without stipules ... CRUCIFERAE. 21.

AA. Stamens not as above, very rarely 6 and then not 4 long and 2 short; sepals and petals rarely 4:

B. Ovary of 1 carpel, i.e. with only 1 placenta; fruit a legume; leaves usually with stipules; trees, shrubs or herbs, sometimes climbing:

Flowers actinomorphic, in spikes or heads; petals valvate; leaves 2-pinnate ..... MIMOSACEAE. 80.

Flowers zygomorphic; petals imbricate or sometimes reduced to 1; leaves simple or compound:

Corolla papilionaceous, i.e. shaped as in a pea flower, the uppermost (adaxial) petal outside the others ..... PAPILIONACEAE. 81.

Corolla not papilionaceous, the uppermost (adaxial) petal inside the others or sometimes only the uppermost petal present ..... CAESALPINIACEAE. 79.

BB. Ovary of 2 or more carpels, i.e. with 2 or more placentas; fruit not a legume:

C. Leaves opposite or verticillate, simple:

Connective of the anthers produced above the loculi into an appendage; style 1, simple; herbs, shrubs or trees ... VIOLACEAE. 22.

Connective of the anthers not produced above the loculi:

Stamens more or less united into 3 or more separate bundles; leaves often gland-dotted or lined with resin ..... HYPERICACEAE. 68.

Stamens free or shortly united at the base, not in separate bundles; leaves not gland-dotted nor lined with resin:

Terrestrial herbs; leaves opposite, small and more or less heath-like; style 1 ... FRANKENIACEAE. 56.

Aquatic herbs; leaves verticillate, bladdery; styles 5 ... DROSERACEAE. 27.

CC. Leaves alternate or all radical:

D. Ovary borne on a long gynophore; sepals usually 4; leaves simple or digitately compound ..... CAPPARIDACEAE. 19.

DD. Ovary sessile or shortly stalked:

E. Leaves digitate, 3-7-foliolate; herbs, sometimes shrubby; sepals 4 ..... CAPPARIDACEAE. 19.

EE. Leaves simple or pinnately compound:

F. Flowers zygomorphic:

Trees; leaves 2-3-pinnate, sometimes scanty and minute; flowers in axillary panicles; stamens 5, alternating with 5 staminodes ..... MORINGACEAE. 20.

Herbs; leaves simple, sometimes 3-fid:

Connective of the anthers produced above the loculi into an appendage; capsule loculicidally dehiscent; flowers mostly solitary ..... VIOLACEAE. 22.

Connective of the anthers not produced above the loculi; capsule gaping at the apex; flowers in racemes or spikes ..... RESEDACEAE. 23.

FF. Flowers actinomorphic or almost so:

G. Stamens more numerous than the petals, or as many as and opposite to them:

Anthers opening at the apex by short pore-like slits; stems annual from a woody rootstock with coloured juice; leaves palmately lobed; seeds covered with long cottony hairs ..... COCHLOSPERMACEAE. 53.

Anthers opening by longitudinal slits:

Trees or shrubs:

Ovary partly adnate to the calyx-tube; stamens perigynous, arranged singly or in bundles opposite the petals ..... SAMYDACEAE. 55.

Ovary free from the calyx; stamens hypogynous, numerous, not arranged in bundles ... FLACOURTIACEAE. 54.

Herbs, sometimes shrubby; sepals 2-4:

Sepals 2-3; leaves pinnately lobed; fruit a capsule opening by 4-6 short valves at the top; plants prickly ..... PAPAVERACEAE. 16.

Sepals 4; leaves not pinnately lobed; fruit capsular (opening through its full length into 2 valves) or winged and indehiscent ... CAPPARIDACEAE. 19.

GG. Stamens as many as and alternating with the petals, sometimes accompanied by staminodes:

H. Flowers unisexual; climbing plants; petiole glandular at the top ... PASSIFLORACEAE. 58.

HH. Flowers hermaphrodite; plants not climbing:

I. Trees or shrubs:

Connective of the anthers produced above the loculi into an appendage ..... VIOLACEAE. 22.

Connective of the anthers not produced above the loculi ..... PITTOSPORACEAE. 52.

II. Herbs, sometimes shrubby:

Styles 2-5 (generally 3):

Leaves with sticky stipitate glands; sepals only shortly united at the base; petals pink or mauve to white ..... DROSERACEAE. 27.

Leaves without stipitate glands; sepals united into a tube; petals yellow ..... TURNERACEAE. 18.

Style 1 or absent:
Sepals 4; fruit a capsule opening through its full length into 2 valves ..... CAPPARIDACEAE. 19.
Sepals 5; fruit a capsule opening septicidally by 3 valves; stipules pectinate, persistent; stamens accompanied by staminodes ..... OCHNACEAE. 62.

GROUP 5.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary superior; petals present, more or less united.*

A. Stamens free from the corolla:
Flowers zygomorphic; corolla papilionaceous, i.e. shaped as in a pea flower, the uppermost (adaxial) petal outside the others; ovary of 1 carpel; fruit a legume; herbs, shrubs or trees, sometimes climbing ..... PAPILIONACEAE. 81.
Flowers actinomorphic:
Leaves 2-pinnate, with stipules; flowers small, in spikes or heads; trees, shrubs or herbs, sometime climbing; fruit a legume ..... MIMOSACEAE. 80.
Leaves simple, without stipules; flowers large, solitary; trees or shrubs; fruit large, globose or ovoid ..... ANNONACEAE. 5.

AA. Stamens inserted on the corolla-tube, sometimes near its base:
Leaves pinnate; trees; stamens 4; fruit large, subcylindric, pendulous ..... BIGNONIACEAE. 133.
Leaves simple, sometimes reduced to scales; herbs or woody climbers:
Plants parasitic on roots, the leaves reduced to scales; flowers zygomorphic; stamens 4, one fewer than the 5 corolla-lobes ..... OROBANCHACEAE. 131.
Plants not parasitic, the leaves normally developed; flowers actinomorphic; stamens as many as the corolla-lobes:
Woody climbers; leaves opposite; fruit a large berry ..... APOCYNACEAE. 115.
Herbs; leaves opposite or alternate; fruit a capsule, septicidal or bursting irregularly ..... GENTIANACEAE. 120.

GROUP 6.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary superior; petals absent.*

A. Moss-like or liverwort-like aquatic herbs with small inconspicuous flowers; stamens 1-2; fruit a capsule ..... PODOSTEMACEAE. 28.

AA. Plants terrestrial, not moss-like nor liverwort-like:
B. Leaves pinnate; fruit a legume; trees:
Stamens numerous (more than 10) ... PAPILIONACEAE. 81.
Stamens 2-10 ..... CAESALPINIACEAE. 79.
BB. Leaves simple; fruit not a legume:
Flowers in catkins, dioecious; calyx absent; trees or shrubs with stipulate leaves; seeds with a tuft of long fine hairs ..... SALICACEAE. 82.
Flowers not in catkins; calyx present:
Ovary borne on a long gynophore; sepals 4; trees or shrubs ..... CAPPARIDACEAE. 19.
Ovary sessile or subsessile:
Flowers in spikes; leaves narrow-linear; shrubs, often spinescent and at length leafless ..... RESEDACEAE. 23.
Flowers solitary or in clusters; leaves broad:
Flowers hermaphrodite, clustered; unarmed trees ..... SAMYDACEAE. 55.
Flowers dioecious, the males clustered, the females solitary; spiny shrubs ..... FLACOURTIACEAE. 54.

GROUP 7.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary inferior; petals present, free from each other.*

A. Flowers unisexual; stamens 3 or 5, the anthers often twisted or folded together lengthwise; mostly climbing or prostrate plants with tendrils ..... CUCURBITACEAE. 59.
AA. Flowers hermaphrodite; stamens with small straight anthers:
Trees with well-developed leaves; stamens arranged singly or in bundles opposite the petals ..... SAMYDACEAE. 55.
Fleshy often epiphytic shrubs with reduced scale-like leaves; stamens numerous, not arranged in bundles ..... CACTACEAE. 61.

GROUP 8.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary inferior; petals present, more or less united.*

A. Flowers hermaphrodite; leaves opposite or verticillate, entire, with interpetiolar or intrapetiolar stipules; trees or shrubs, sometimes climbing but without tendrils ... RUBIACEAE. 117.
AA. Flowers unisexual; leaves alternate, often lobed or digitately divided; mostly climbing or prostrate plants with tendrils .... CUCURBITACEAE. 59.

GROUP 9.—*One carpel or two or more united carpels; ovules two or more, on the wall of the ovary; ovary inferior; petals absent.*

Only family ..... ARISTOLOCHIACEAE. 13.

GROUP 10.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary superior; petals present, free from each other.*

A. Ovary 1-locular or incompletely septate:
B. Sepals 2, often deciduous:
Flowers actinomorphic; ovary with numerous ovules; fruit a capsule; herbs or shrubby plants with fleshy entire leaves ..... PORTULACACEAE. 33.
Flowers zygomorphic; ovary with a solitary ovule; fruit a nut; annual herbs with much-divided leaves .....
FUMARIACEAE. 17.
BB. Sepals (or calyx-lobes) 3 or more:
C. Leaves opposite or verticillate:
Ovary with 2 or more ovules on a free-basal or free-central placenta:
Petals and stamens perigynous, inserted on the calyx-tube; herbs ..... LYTHRACEAE. 45.
Petals and stamens hypogynous or only slightly perigynous; herbs or rarely undershrubs .....
CARYOPHYLLACEAE. 30.
Ovary with a solitary basal or apical ovule:
Ovule apical, pendulous; flowers in terminal clusters or bracteate heads; stamens twice as many as the petals, inserted on the elongated calyx-tube; herbs, shrubs or trees ..... THYMELAEACEAE. 48.
Ovule basal; flowers in axillary cymes or panicles; stamens as many as the petals; trees:
Stamens opposite the petals .... RHAMNACEAE. 96.
Stamens alternate with the petals .....
SALVADORACEAE. 90.
CC. Leaves alternate, sometimes radical:
D. Leaves compound:
Leaves 2-pinnate; trees or shrubs with hermaphrodite flowers; fruit a winged legume .....
CAESALPINIACEAE. 79.
Leaves simply pinnate or 3-foliolate; trees or shrubs with polygamous or dioecious flowers; fruit drupaceous ....
ANACARDIACEAE. 104.
DD. Leaves simple:
E. Ovary with a solitary ovule:
F. Flowers zygomorphic, the inner 2 sepals larger than the others, the lower petal keel-like, the upper 2 petals rudimentary or absent; fruit long-winged, indehiscent; trees or shrubs .....
POLYGALACEAE. 24.
FF. Flowers actinomorphic; fruit unwinged but sometimes surrounded by persistent wing-like sepals:
G. Flowers in bracteate heads; stamens twice as many as the petals, inserted on the elongated calyx-

tube; herbs, shrubs or trees ..... THYMELAEACEAE. 48.

GG. Flowers not in bracteate heads:

Stamens united into a column; leaves often peltate; climbing or scrambling shrubs with dioecious flowers ..... MENISPERMACEAE. 12.

Stamens free:

Flowers polygamous or dioecious; stamens 1-10; fruit drupaceous; trees or shrubs ..... ANACARDIACEAE. 104.

Flowers hermaphrodite; stamens as many as and opposite to the petals:

Herbs or undershrubs with fleshy leaves and paniculate-spicate flowers; ovule arising from the base of the ovary ..... PLUMBAGINACEAE. 122.

Trees or shrubs, sometimes climbing; fruit drupaceous:

Ovule pendulous from the apex of the ovary; leaves without stipules ..... OPILIACEAE. 92.

Ovule arising from the base of the ovary; leaves with stipules ..... RHAMNACEAE. 96.

EE. Ovary with 2 or more ovules:

H. Leaves minute, scale-like; trees or shrubs; flowers in racemes or spikes; ovary with numerous ovules on basal placentas ..... TAMARICACEAE. 57.

HH. Leaves well developed, not scale-like:

I. Leaves with stipules:

Stamens 5, opposite the petals, united at the base; herbs or undershrubs with stellate hairs ..... STERCULIACEAE. 71.

Stamens 10 or more, free; trees:

Sepals enlarged and persistent in fruit, 2 of them becoming wing-like and one of these much larger than the other; petals and stamens hypogynous; ovary with a terminal style ..... OCHNACEAE. 62.

Sepals not becoming wing-like in fruit; petals and stamens perigynous, inserted at the mouth of the calyx-tube; ovary with a terminal or basal style ..... ROSACEAE. 77.

II. Leaves without stipules:

Petals imbricate, glabrous; stamens as many as and opposite to the petals; ovules numerous on a free-basal placenta; trees, often with gland-dotted leaves ... MYRSINACEAE. 112.

Petals valvate, bearded inside; stamens all or one series alternate with the petals; ovules 2-4:
Stamens twice as many as the petals; ovules 3-4, pendulous from the apex of a free-basal placenta; trees or shrubs, often spiny ..... OLACACEAE. 91.

Stamens as many as the petals; ovules 2, apical, pendulous; shrubs or undershrubs, sometimes climbing ..... ICACINACEAE. 89.

AA. Ovary completely 2- or more-locular:
J. Stamens as many as and opposite to the petals:
Filaments of the stamens more or less united into a tube or cup, sometimes with alternating staminodes; herbs, shrubs or trees, often with stellate hairs; calyx-lobes valvate ..... STERCULIACEAE. 71.
Filaments of the stamens free, not alternating with staminodes:
Flowers in leaf-opposed inflorescences; herbaceous or woody plants, often climbing and with tendrils; leaves simple (often lobed or divided) or digitately compound; fruit baccate ..... AMPELIDACEAE. 97.
Flowers in axillary cymes; trees or shrubs, often aculeate; leaves simple, undivided; fruit drupaceous ..... RHAMNACEAE. 96.

JJ. Stamens as many as and alternate with the petals, or more numerous or fewer:
K. Leaves compound, with 2 or more leaflets:
L. Leaves opposite (but sometimes unequal in a pair), with stipules; herbs or shrubs ... ZYGOPHYLLACEAE. 41.
LL. Leaves alternate, sometimes all radical:
M. Inflorescences bearing tendrils; climbing plants; leaves pinnate or 2-ternate ..... SAPINDACEAE. 102.
MM. Inflorescences without tendrils:
N. Leaves digitately 5-15-foliolate; stamens 15 or more, with 1-locular anthers and with the filaments united below; sepals valvate; trees ..... BOMBACACEAE. 72.
NN. Leaves pinnate or 2-3-foliolate; stamens with 2-locular anthers:
O. Herbs; leaves 3-foliolate or pinnate; stamens 10; styles 5 ..... OXALIDACEAE. 43.
OO. Trees or shrubs, sometimes climbing:
P. Filaments of the stamens united in a tube; ovary with 2 or more ovules in each loculus; trees; leaves pinnate, 2-pinnate or 3-foliolate ..... MELIACEAE. 101.
PP. Filaments of the stamens free or only slightly united at the base; ovary with 1 or 2 ovules in each loculus:

Q. Leaflets dotted with pellucid glands; trees or shrubs with pinnate or 3-foliolate leaves ..... RUTACEAE. 98.

QQ. Leaflets without pellucid glands:

R. Ovary with 2 ovules in each loculus:

Leaves abruptly pinnate; fruit capsular, loculicidal; trees ..... SAPINDACEAE. 102.

Leaves imparipinnate or 3-foliolate; fruit drupaceous, the exocarp sometimes dehiscent; trees or shrubs, secreting resin ..... BURSERACEAE. 100.

RR. Ovary with a solitary ovule in each loculus:

Styles 3-5, free and separated; trees or shrubs with imparipinnate leaves; flowers polygamous or dioecious ..... ANACARDIACEAE. 104.

Style or styles central or terminal, not separated:

Ovules pendulous; trees or shrubs with imparipinnate or 2-foliolate leaves ... SIMAROUBACEAE. 99.

Ovules erect or ascending:

Stamens 4; leaves imparipinnate, with intrapetiolar stipules; flowers more or less zygomorphic, in racemes .... MELIANTHACEAE. 103.

Stamens 6 or more; leaves abruptly pinnate or 2-3-foliolate, without stipules; flowers actinomorphic or slightly zygomorphic ..... SAPINDACEAE. 102.

KK. Leaves simple or 1-foliolate:

S. Perianth strongly zygomorphic; sepals 3 or rarely 5, the posticous one spurred; petals 3; stamens 5, the anthers united round the ovary; fruit an elastically dehiscent capsule; succulent herbs .... BALSAMINACEAE. 44.

SS. Perianth actinomorphic or only slightly zygomorphic:

T. Leaves opposite or verticillate:

U. Stamens more than twice as many as the petals:

Leaves with stipules:

Stipules interpetiolar; trees; petals fringed at the apex; stamens 20, the filaments not united into bundles ..... RHIZOPHORACEAE. 67.

Stipules not interpetiolar; herbs; petals not fringed; stamens 15, the filaments united below into 5 bundles ..... GERANIACEAE. 42.

Leaves without stipules, often gland-dotted or with resinous lines:

Styles 3-5, elongated, free or united below; flowers hermaphrodite; stamens united into 3-5 bundles; ovules 1 or more in each loculus; trees, shrubs or herbs ..... HYPERICACEAE. 68.

Style very short or absent, the stigma broadly peltate; flowers polygamous or dioecious; stamens free or variously united into bundles; ovules 1 in each loculus; trees ... GUTTIFERAE. 69.

UU. Stamens up to twice as many as the petals:

V. Sepals united into a tube; petals perigynous, inserted at the mouth of the calyx-tube; ovules numerous in each loculus:

Anthers opening by apical pores; leaves with longitudinally parallel nerves; herbs or shrubs ..... MELASTOMATACEAE. 65.

Anthers opening by longitudinal slits; leaves not longitudinally parallel-nerved; herbs, shrubs or trees ..... LYTHRACEAE. 45.

VV. Sepals free or only slightly united; petals hypogynous or only slightly perigynous:

Leaves lobed or deeply divided; ovary beaked; herbs, sometimes shrubby ..... GERANIACEAE. 42.

Leaves not lobed nor divided; ovary not beaked:

Styles 3-5, free:

Ovules numerous in each loculus; fruit a septicidal capsule; herbs or undershrubs ..... ELATINACEAE. 29.

Ovules solitary in each loculus (sometimes 1 or 2 of the loculi empty); fruit indehiscent, with a broad cordate-orbicular wing; climbing shrubs ..... MALPIGHIACEAE. 74.

Style 1; ovules usually few in each loculus:

Stamens twice as many as the petals; herbs .... ZYGOPHYLLACEAE. 41.

Stamens as many as or fewer than the petals; trees or shrubs, sometimes climbing:

Stamens 4-5, i.e. as many as the petals ..... CELASTRACEAE. 87.

Stamens 3, i.e. fewer than the petals ..... HIPPOCRATEACEAE. 88.

TT. Leaves alternate, sometimes all radical:

W. Ovary with 1 ovule in each loculus, sometimes 1 or 2 of the loculi empty:

X. Flowers unisexual; herbs, shrubs or trees, often with stellate hairs or scales ..... EUPHORBIACEAE. 76.

XX. Flowers hermaphrodite:

Y. Sepals valvate; stamens numerous, the filaments more or less united into a tube; anthers 1-locular; herbs or undershrubs, often with stellate hairs ..... MALVACEAE. 73.

YY. Sepals imbricate:

Z. Leaves without stipules; fruit indehiscent, winged or separating into 2 cocci:

Herbs; ovary 2-locular; style short; stamens 5-10 ..... MOLLUGINACEAE. 31.

Shrubs, often scrambling or climbing; ovary 3-locular or 2-locular by abortion; styles 2, much elongated; stamens 10 ..... MALPIGHIACEAE. 74.

ZZ. Leaves with stipules; fruit drupaceous; trees or shrubs:

Ovary lateral, inserted on one side of the calyx-tube; style arising laterally from the base of the ovary; stamens perigynous, inserted at the mouth of the calyx-tube ..... ROSACEAE. 77.

Ovary central, not inserted on the calyx; style or styles central or terminal; stamens hypogynous:

Ovary deeply lobed, the carpels becoming separate in fruit; stamens twice as many as the petals or more numerous ... OCHNACEAE. 62.

Ovary entire, the carpels not becoming separate in fruit; stamens twice as many as the petals:

Filaments of the stamens united into a cup at the base; ovary with 1 1-ovulate loculus and 2 empty loculi; styles 3 ... ERYTHROXYLACEAE. 75.

Filaments of the stamens free; ovary with 2-5 1-ovulate loculi; style 1 ..... SIMAROUBACEAE. 99.

WW. Ovary with 2 or more ovules in each loculus:

(a) Stamens as many as or fewer than the petals; ovary with 2 ovules in each loculus:

Ovary 5-locular; stamens usually accompanied by staminodes; herbs, sometimes shrubby:

Leaves broad, more or less lobed or divided; ovary and fruit beaked ..... GERANIACEAE. 42.

Leaves narrow, entire; ovary and fruit unbeaked ..... LINACEAE. 40.

Ovary 2-4-locular:
Petals 2-lobed; shrubs or trees ..... CHAILLETIACEAE. 78.
Petals not 2-lobed:
Flowers hermaphrodite; trees or shrubs ..... CELASTRACEAE. 87.
Flowers unisexual; trees, shrubs or herbs ..... EUPHORBIACEAE. 76.

(aa) Stamens more numerous than the petals:
(b) Herbs, sometimes shrubby:
(c) Leaves dotted with pellucid glands, narrow; stamens twice as many as the petals ..... RUTACEAE. 98.
(cc) Leaves without pellucid glands:
Sepals valvate; plants often with stellate hairs:
Stamens united into a tube, numerous; anthers 1-locular ..... MALVACEAE. 73.
Stamens free, twice as many as the petals or more numerous; anthers 2-locular ..... TILIACEAE. 70.
Sepals imbricate:
Flowers racemose; ovary of 6 carpels united only at the base ... RESEDACEAE. 23.
Flowers solitary, paired or umbellate; ovary of usually 5 carpels united completely or high up:
Sepals petaloid; ovary unbeaked, with free styles; ovules numerous in each loculus; leaves much divided ..... RANUNCULACEAE. 9.
Sepals herbaceous; ovary beaked; ovules 2 in each loculus; leaves often lobed or deeply divided, sometimes unlobed .... GERANIACEAE. 42.

(bb) Trees or shrubs:
(d) Leaves without stipules; stamens twice as many as the petals, not accompanied by staminodes:
Filaments of the stamens united into a tube; petals elongated; ovary with 5 or more 2-ovulate loculi ..... MELIACEAE. 101.
Filaments of the stamens free:
Leaves dotted with pellucid glands; ovary with numerous ovules in each loculus ... RUTACEAE. 98.
Leaves without pellucid glands; ovary with 2 ovules in each loculus ..... BURSERACEAE. 100.

(dd) Leaves usually with stipules; stamens twice as many as the petals or more numerous, often accompanied by staminodes:
Fruit surrounded by the persistent accrescent wing-like calyx-lobes; stamens numerous, free; ovary 3-locular with 2 ovules in each loculus ..... DIPTEROCARPACEAE. 63.
Fruit not surrounded by persistent wing-like calyx-lobes:
Sepals imbricate; stamens 10, united at the base; ovary 5-locular with 2 ovules in each loculus; styles 5, free ..... LINACEAE. 40.
Sepals valvate; plants often with stellate hairs:
Stamens free or almost so ..... TILIACEAE. 70.
Stamens more or less united:
Anthers 2-locular ..... STERCULIACEAE. 71.
Anthers 1-locular .. MALVACEAE. 73.

GROUP 11.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary superior; petals present, more or less united.*

A. Stamens as many as and opposite to the corolla-lobes; flowers actinomorphic:
Ovary 2- or more-locular with 1 ovule in each loculus; trees or shrubs:
Leaves 2-pinnate; corolla-lobes valvate; filaments of the stamens united into a tube .... AMPELIDACEAE. 97.
Leaves simple; corolla-lobes imbricate; staminodes sometimes present, occasionally petaloid ..... SAPOTACEAE. 111.
Ovary 1-locular; leaves simple:
Ovule solitary; herbs or undershrubs with alternate leaves ... PLUMBAGINACEAE. 122.
Ovules 2 or more:
Trees; leaves alternate, often gland-dotted ..... MYRSINACEAE. 112.
Herbs; leaves opposite or alternate ..... PRIMULACEAE. 121.

AA. Stamens as many as and alternate with the corolla-lobes, or more numerous or fewer:

B. Corolla-lobes numerous (10 or more), sometimes in more than 1 series; stamens 6 or more; flowers actinomorphic:
Herbs; ovary with 5 styles; fruit a 5-valved capsule; sepals 5; leaves alternate, fleshy ..... MOLLUGINACEAE. 31.

Trees or shrubs; ovary with a single style; fruit a berry:
Leaves alternate; corolla-lobes imbricate, in more than 1 series; stamens fewer than the corolla-lobes and opposite those of the inner series; ovary with a solitary ovule in each loculus ..... SAPOTACEAE. 111.

Leaves opposite; corolla-lobes contorted, in 1 series; stamens as many as the corolla-lobes; ovary with numerous ovules in each loculus .....
LOGANIACEAE. 113.

BB. Corolla-lobes few (less than 10):
C. Stamens more numerous than the corolla-lobes:
Flowers zygomorphic, the lower petals united to form a keel; filaments of the stamens more or less united into a sheath split on the upper side; herbs or low shrubs:
Leaves with stipules; ovary 1-locular, with a solitary ovule; fruit a legume; upper stamen free, the filaments of the others united into a sheath .....
PAPILIONACEAE. 81.

Leaves without stipules; ovary 2-locular; fruit a loculicidal capsule; filaments of all the stamens united into a sheath ..... POLYGALACEAE. 24.

Flowers actinomorphic; trees or shrubs, sometimes climbing:
Ovary 1-locular, with numerous ovules on basal placentas; leaves minute, scale-like; flowers hermaphrodite, in racemes or spikes ..... TAMARICACEAE. 57.

Ovary 2- or more-locular, with 1 or more ovules in each loculus:
Flowers hermaphrodite; leaves small, heath-like .....
ERICACEAE. 109.

Flowers unisexual; leaves well developed:
Leaves with stipules, sometimes lobed or digitately compound; flowers in cymes or panicles, dioecious or monoecious ... EUPHORBIACEAE. 76.

Leaves without stipules, simple and unlobed; flowers solitary or in clusters or racemes, dioecious .....
EBENACEAE. 110.

CC. Stamens as many as or fewer than the corolla-lobes:
D. Ovary 1-locular:
E. Flowers strongly zygomorphic, the corolla spurred; herbs (usually aquatic), the leaves often bearing bladders; stamens 2; ovary with numerous ovules on a free-basal placenta ..... LENTIBULARIACEAE. 132.

EE. Flowers actinomorphic or only slightly zygomorphic, the corolla not spurred; leaves not bearing bladders:
F. Leaves minute, scale-like; ovary with numerous ovules on basal placentas; trees or shrubs; flowers in racemes or spikes ..... TAMARICACEAE. 57.

FF. Leaves well developed, not scale-like; ovary with 1-4 ovules:

Leaves opposite; stamens 4; trees or shrubs:

Ovary with a solitary basal erect ovule; fruit a drupe ..... SALVADORACEAE. 90.

Ovary with 4 ovules on a free-basal placenta; fruit a capsule ..... VERBENACEAE. 137.

Leaves alternate:

Flowers hermaphrodite; stamens free, inserted on the corolla-tube; leaves not peltate:

Ovary with 2 apical pendulous ovules; fruit a drupe; trees or shrubs ..... ICACINACEAE. 89.

Ovary with 4 basal ovules; fruit a capsule; herbs, often twining or shrubby ..... CONVOLVULACEAE. 129.

Flowers dioecious; stamens united into a column; ovary with a solitary ovule; climbers; leaves often peltate ..... MENISPERMACEAE. 12.

DD. Ovary 2- or more-locular:

G. Stamens fewer than the corolla-lobes, 2-4:

H. Ovary with few (1-4) ovules in each loculus:

Leaves alternate; stamens 3; peduncle adnate to the petiole of the subtending leaf; trees or shrubs ... CHAILLETIACEAE. 78.

Leaves opposite or verticillate; stamens 4 or 2:

Flowers actinomorphic; stamens 2; trees or shrubs, sometimes climbing; leaves simple, 3-foliolate or pinnate ..... OLEACEAE. 114.

Flowers more or less zygomorphic:

Ovary more or less deeply 4-lobed and 4-locular, the style gynobasic; herbs or shrubs, often aromatic; leaves simple ... LABIATAE. 138.

Ovary not deeply 4-lobed, the style not gynobasic:

Fruit a loculicidal capsule, the seeds often on hook-like funicles; ovary 2-locular with 2-4 ovules in each loculus; herbs or undershrubs with simple leaves ..... ACANTHACEAE. 135.

Fruit drupaceous or separating into 2 or 4 pyrenes, the seeds not on hook-like funicles; ovary 2-8-locular with usually 1 ovule in each loculus; herbs, shrubs or trees with simple or digitately compound leaves ..... VERBENACEAE. 137.

HH. Ovary with several or numerous (usually more than 4) ovules in each loculus or in some of the loculi:

Leaves pinnate, opposite or ternate; trees or shrubs; flowers zygomorphic; stamens 4 ..... BIGNONIACEAE. 133.

Leaves simple, sometimes deeply divided; herbs or undershrubs:

Ovary 2-4-locular, the loculi becoming completely or incompletely divided into 2 chambers; flowers zygomorphic; stamens 4; leaves opposite or alternate .... PEDALIACEAE. 134.

Ovary 2-locular, the loculi not becoming divided into chambers; stamens 4 or 2:

Ovules in 1 or 2 series on each placenta; fruit a loculicidal capsule, the seeds often on hook-like funicles; flowers zygomorphic; leaves opposite, rarely alternate and subradical ... ACANTHACEAE. 135.

Ovules usually in several or many series on each placenta; fruit a capsule, variously dehiscent, the seeds not on hook-like funicles:

Corolla-lobes valvate, minute, alternating with entire or 2-lobed appendages; flowers actinomorphic; leaves alternate ..... SOLANACEAE. 128.

Corolla-lobes imbricate, not alternating with appendages; flowers zygomorphic or sometimes almost actinomorphic; leaves alternate, opposite or verticillate ..... SCROPHULARIACEAE. 130.

GG. Stamens as many as the corolla-lobes, 4 or more:

I. Leaves opposite or verticillate:

J. Corolla-lobes imbricate:

Fruit drupaceous or splitting into pyrenes or nutlets; ovary with 1 or rarely 2 ovules in each loculus:

Ovary deeply 4-lobed and 4-locular, the style gynobasic; fruit of 4 nutlets; herbs, strongly aromatic ..... LABIATAE. 138.

Ovary not deeply 4-lobed, the style not gynobasic; fruit drupaceous or of 2 pyrenes; herbs, shrubs or trees ..... VERBENACEAE. 137.

Fruit a capsule:

Trees or shrubs; flowers in panicles or cymes sometimes enclosed by 2 large involucral bracts ..... LOGANIACEAE. 113.

Herbs; flowers not in panicles nor cymes:

Flowers in head-like spikes; capsule circumscissile, 2-seeded ..... PLANTAGINACEAE. 123.

Flowers solitary or paired in the axils of the leaves; capsule septicidal, many-seeded ... SCROPHULARIACEAE. 130.

JJ. Corolla-lobes contorted or valvate:

K. Anthers opening by apical pore-like slits; stamens hypogynous; low heath-like shrubs with small leaves and flowers ..... ERICACEAE. 109.

KK. Anthers opening by longitudinal slits; stamens inserted on the corolla-tube:

L. Ovary 4-lobed and 4-locular, with 1 ovule in each loculus; fruit of 4 nutlets; herbs, often with hispid bulbous-based hairs ..... BORAGINACEAE. 127.

LL. Ovary not 4-lobed, usually 2-locular with 2 or more ovules in each loculus:

Flowers with a corona; stamens often united and with the pollen agglutinated into masses; herbs, shrubs or small trees, often climbing ..... ASCLEPIADACEAE. 116.

Flowers without a corona; pollen not agglutinated into masses:

Corolla-lobes valvate; trees or shrubs, sometimes climbing and often with axillary hooked spines or tendrils; leaves 3-5-nerved from the base ..... LOGANIACEAE. 113.

Corolla-lobes contorted:

Herbs; fruit a septicidal capsule ..... GENTIANACEAE. 120.

Trees or shrubs, often climbing; fruit a berry or drupe, or the carpels becoming separate:

Corolla-lobes and stamens 5 ..... APOCYNACEAE. 115.

Corolla-lobes and stamens 6 or more, the filaments united ..... LOGANIACEAE. 113.

II. Leaves alternate or absent, sometimes all radical:

M. Leaves absent or reduced to scales:

Slender parasitic twiners; ovary with 2 ovules in each loculus; fruit a capsule; corolla with or without infrastaminal scales ..... CONVOLVULACEAE. 129.

Shrubs or succulent plants, not parasitic; ovary with numerous ovules in each loculus; fruit of 2 separated carpels; flowers with a corona .... ASCLEPIADACEAE. 116.

MM. Leaves normally developed:

N. Leaves all radical; flowers very small, in pedunculate spikes or heads; fruit a circumscissile capsule; herbs ... PLANTAGINACEAE. 123.

NN. Leaves not all radical:

O. Ovary with 1-2 ovules in each loculus:

Filaments of the stamens united into a sheath split on the upper side and enclosed by the keel-like lower corolla-lobe; flowers strongly zygomorphic; shrubs or trees ..... POLYGALACEAE. 24.

Filaments of the stamens not united into a sheath:

Corolla-tube split down the front, with 4 lobes; anthers 1-locular; ovary 2-locular with 1 ovule in each loculus; herbaceous or shrubby plants with spicate flowers ... SELAGINACEAE. 136.

Corolla-tube not split down the front; anthers 2-locular:

Fruit a capsule or indehiscent with a crustaceous rind; corolla-lobes usually folded in bud, rarely imbricate; herbs or shrubs, often twining or trailing ... CONVOLVULACEAE. 129.

Fruit drupaceous or separating into nutlets (usually 4); corolla-lobes usually imbricate or contorted; herbs, shrubs or trees ..... BORAGINACEAE. 127.

OO. Ovary with several or numerous (more than 2) ovules in each loculus:

P. Stamens free from the corolla; corolla-lobes valvate or induplicate-valvate; fruit a capsule; herbs, sometimes shrubby ..... CAMPANULACEAE. 124.

PP. Stamens inserted on the corolla-tube:

Corolla-lobes contorted; fruit of 2 separated carpels; fleshy shrubs or trees ..... APOCYNACEAE. 115.

Corolla-lobes not contorted; fruit a capsule or berry:

Ovary with 2-3 free styles; corolla-lobes imbricate; fruit a capsule; herbs ..... HYDROPHYLLACEAE. 126.

Ovary with a single style:

Corolla-lobes valvate or folded in bud; herbs or shrubs; fruit a berry or capsule ..... SOLANACEAE. 128.

Corolla-lobes imbricate:
Fruit a septicidal capsule; filaments of the stamens bearded; herbs .... SCROPHULARIACEAE. 130.
Fruit a circumscissile capsule or a berry; filaments of the stamens not bearded; herbs or shrubs ..... SOLANACEAE. 128.

GROUP 12.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary superior; petals absent.*

A. Ovary with 2 or more ovules in each loculus:
B. Moss-like or liverwort-like aquatic herbs; stamens 1-2; flowers small and inconspicuous; ovules numerous; fruit a capsule ..... PODOSTEMACEAE. 28.
BB. Plants not moss-like nor liverwort-like; stamens 3 or more:
C. Leaves opposite or verticillate or all radical; fruit a capsule:
Ovary with a single style; sepals more or less united into a tube; stamens more or less perigynous:
Capsule 1-2-seeded, circumscissile; herbs with fleshy leaves ..... FICOIDACEAE. 32.
Capsule many-seeded, variously dehiscent; herbs, shrubs or small trees ..... LYTHRACEAE. 45.
Ovary with 2-5 free styles; herbs:
Ovary 2-locular with 2 styles; capsule circumscissile; stamens more or less perigynous ..... FICOIDACEAE. 32.
Ovary 3-5-locular with 3-5 styles; capsule loculicidal; stamens hypogynous ..... MOLLUGINACEAE. 31.
CC. Leaves alternate, not all radical:
D. Ovary 1-locular:
Herbs; flowers hermaphrodite; fruit a circumscissile capsule ..... AMARANTHACEAE. 38.
Trees or shrubs; flowers dioecious; fruit a drupe ..... EUPHORBIACEAE. 76.
DD. Ovary 2- or more-locular:
Carpels almost free from each other; trees with unisexual or polygamous flowers; stamens united into a column; calyx-lobes valvate ..... STERCULIACEAE. 71.
Carpels completely united:
Ovary borne on a long gynophore; shrubs ..... CAPPARIDACEAE. 19.
Ovary not borne on a long gynophore:
Leaves with stipules; flowers unisexual; ovary with 2 ovules in each loculus; herbs, shrubs or trees ... EUPHORBIACEAE. 76.

Leaves without stipules:
Herbs with simple leaves; flowers hermaphrodite; ovary with 4-5 free styles; fruit a star-shaped capsule, dehiscing at the apex, not winged .... FICOIDACEAE. 32.
Trees or shrubs with simple or pinnately compound leaves; flowers unisexual or polygamous; ovary with a single style; fruit winged or indehiscent ..... SAPINDACEAE. 102.

AA. Ovary with a solitary ovule in each loculus:
E. Ovary with 2-5 loculi:
F. Leaves compound:
Leaves opposite, 3-foliolate, with stipules; herbs; ovary 5-locular ..... ZYGOPHYLLACEAE. 41.
Leaves alternate, pinnate, without stipules; trees or shrubs; ovary 2-3-locular ..... SAPINDACEAE. 102.
FF. Leaves simple or absent, sometimes lobed or deeply divided:
Flowers unisexual; calyx present or absent, the male flowers sometimes reduced to a single stamen and arranged in a common involucre with a stalked female flower in their midst; herbs, shrubs or trees, sometimes climbing; leaves alternate, opposite or absent ..... EUPHORBIACEAE. 76.
Flowers hermaphrodite; calyx always present:
Trees or shrubs; fruit a drupe:
Stamens twice as many as the calyx-lobes, inserted on *the more or less elongated calyx-tube; leaves pinnately nerved; stipules absent* ..... THYMELAEACEAE. 48.
Stamens as many as the calyx-lobes and alternate with them; leaves 3-5-nerved from the base; stipules present, often spinose ..... RHAMNACEAE. 96.
Herbs; fruit not drupaceous:
Fruit separating into 2 cocci, winged or unwinged; leaves alternate or opposite ..... MOLLUGINACEAE. 31.
Fruit a circumscissile capsule, not winged; leaves opposite ..... FICOIDACEAE. 32.

EE. Ovary with a single loculus:
G. Leaves with stipules, these sometimes minute or sometimes forming a sheath surrounding the stem:
H. Ovule pendulous from the apex or near the apex of the ovary:
Flowers unisexual, the males densely spicate or capitate or densely crowded along with female flowers on an open flattened receptacle or inside a hollow almost closed receptacle (fig); calyx (especially in the female flowers) often much reduced or absent; ovary sometimes sunk in the tissue of the receptacle; trees, shrubs or herbs ..... MORACEAE. 84.

Flowers unisexual or polygamous, all or at least the males cymose or paniculate; female flowers sometimes solitary in the leaf-axils or enclosed by bracts:

Herbs; leaves opposite or alternate, mostly palmately divided; flowers dioecious; fruit an achene ..... CANNABINACEAE. 86.

Trees or shrubs; leaves alternate, undivided; flowers usually monoecious or polygamous; fruit a drupe or samara ..... ULMACEAE. 83.

HH. Ovule arising from the base or near the base of the ovary:

I. Leaves opposite or verticillate:

Flowers unisexual; shrubs; leaves more or less toothed or crenate-serrate, marked with cystoliths ..... URTICACEAE. 85.

Flowers hermaphrodite or in groups of 3 with the middle one hermaphrodite; herbs; leaves entire ..... ILLECEBRACEAE. 35.

II. Leaves alternate:

Calyx absent; flowers minute, in dense spikes; shrubs or climbers ..... PIPERACEAE. 15.

Calyx present (rarely absent in female flowers):

Stamens 6-8; stipules forming a sheath (ocrea) surrounding the stem; fruit a small nut; herbs or shrubs ..... POLYGONACEAE. 34.

Stamens 5 or fewer; stipules not forming a sheath:

Flowers unisexual; herbs or shrubs, often nettle-like, the leaves usually 3-nerved from the base ..... URTICACEAE. 85.

Flowers hermaphrodite; herbs:

Flowers actinomorphic; calyx with a tubular base and 8-10 lobes; stamens perigynous, inserted at the mouth of the calyx-tube; leaves digitately lobed ..... ROSACEAE. 77.

Flowers zygomorphic; calyx with the upper sepal free, the 3 lower ones united to form a 3-lobed lower lip; stamens hypogynous; leaves unlobed; flowers in racemes ..... PHYTOLACCACEAE. 36.

GG. Leaves without stipules, or sometimes absent:

J. Trees, sometimes shrubby:

Leaves pinnate or 3-foliolate; flowers dioecious; fruit a drupe ..... ANACARDIACEAE. 104.

Leaves simple:

Stamens 6-15:

Anthers opening by valves; calyx 6-lobed; flowers in panicles or racemes; stamens 6-9 ..... LAURACEAE. 7.

Anthers opening by longitudinal slits; calyx 3-5-lobed; flowers in dense racemes, dioecious; stamens 10-15 ..... MONIMIACEAE. 6.

Stamens 2-4, the anthers opening by longitudinal slits; calyx 2-4-lobed, the lobes valvate:

Flowers dioecious, in small paniculate heads; stamens 2-4, united into a column; fruit fleshy, usually dehiscing by 2 valves; seed arillate ..... MYRISTICACEAE. 8.

Flowers hermaphrodite, in large bracteate heads or in elongated spikes; stamens 4, free, inserted on the calyx-lobes; fruit a nut; seed not arillate .... PROTEACEAE. 50.

JJ. Herbs or low shrubs, sometimes climbing:

K. Submersed aquatic herbs with verticillate deeply divided leaves; flowers unisexual, solitary at the nodes, sessile; fruit a nut ..... CERATOPHYLLACEAE. 10.

KK. Plants not aquatic:

L. Calyx absent; flowers minute, in dense spikes; leaves alternate, opposite or verticillate; herbs, sometimes creeping or climbing ... PIPERACEAE. 15.

LL. Calyx present (rarely absent in female flowers):

M. Leaves absent; fleshy herbs or undershrubs with jointed branches; flowers spicate, more or less sunk in the rhachis ..... CHENOPODIACEAE. 37.

MM. Leaves present:

N. Leaves opposite:

Calyx 3-toothed; stamens 1-2; leaves minute, fleshy ..... CHENOPODIACEAE. 37.

Calyx 4-5-lobed:

Sepals united into a tube constricted above the ovary, the lower portion persistent and enclosing the fruit; upper portion of calyx more or less petaloid ..... NYCTAGINACEAE. 49.

Sepals not united into a tube constricted above the ovary; calyx not petaloid:

Stamens opposite the calyx-segments, these more or less dry and scarious; fruit indehiscent or rarely circumscissile ..... AMARANTHACEAE. 38.

Stamens arranged singly or in groups alternate with the calyx-segments, these more or less herbaceous; fruit circumscissile ..... FICOIDACEAE. 32.

NN. Leaves alternate:

O. Leaves 2-4-pinnate; herbs; fruit stipitate and beaked ..... RANUNCULACEAE. 9.

OO. Leaves simple, sometimes pinnately lobed:

Stamens twice as many as the calyx-lobes, inserted on the calyx-tube; flowers in brac-

teate heads; undershrubs with narrow leaves ..... THYMELAEACEAE. 48.

Stamens as many as the calyx-lobes or fewer:

Twining plants; calyx with a distinct tube and 2 adnate bracteoles outside; flowers in axillary spikes ..... BASELLACEAE. 39.

Plants not twining; calyx without adnate bracteoles:

Calyx-lobes valvate; flowers polygamous, in sessile cymes or clusters in the leaf-axils; small herbs; leaves entire, 3-nerved from the base ..... URTICACEAE. 85.

Calyx-lobes imbricate:

Calyx more or less dry and scarious; flowers often in spikes or heads ..... AMARANTHACEAE. 38.

Calyx more or less herbaceous (sometimes absent in female flowers); flowers small or minute ..... CHENOPODIACEAE. 37.

GROUP 13.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary inferior; petals present, free from each other.*

A. Parasitic shrubs, growing on other shrubs or trees; ovary with the ovule or ovules scarcely distinguishable from the surrounding tissue; calyx truncate or shortly toothed; stamens opposite to and inserted on the petals; leaves simple, opposite or alternate ..... LORANTHACEAE. 93.

AA. Plants not parasitic; ovary with the ovule or ovules clearly distinguishable from the ovary-wall:

B. Ovary 1-locular:

Ovules arising from the base of the ovary or from a free-central placenta; sepals 2, often deciduous; fruit a circumscissile capsule; herbs ..... PORTULACACEAE. 33.

Ovule or ovules pendulous from the apex of the ovary or on pendulous apical placentas; sepals or calyx-lobes usually more than 2; fruit not circumscissile:

Trees or shrubs, sometimes climbing; ovary with a single style:

Ovules 2 or more; fruit with 4-6 angles or wings, sometimes narrowly cylindric; flowers in racemes, spikes or heads ..... COMBRETACEAE. 66.

Ovule 1; fruit not angled nor winged, ellipsoid; flowers in axillary cymes ..... ALANGIACEAE. 106.

Herbs; ovary with 2-4 styles:

Leaves opposite; sepals and petals 5; ovules numerous on pendulous placentas; flowers hermaphrodite, solitary or paired in the axils of the leaves ..... SAXIFRAGACEAE. 26.

Leaves alternate, sometimes radical; sepals and petals 4 or fewer; ovules 1-4; flowers monoecious, paniculate-spicate or in axillary clusters ..... HALORAGACEAE. 47.

BB. Ovary 2-10-locular:

C. Leaves opposite:

Anthers opening by apical pores; leaves with longitudinally parallel nerves; ovules numerous in each loculus of the ovary; herbs or shrubs ... MELASTOMATACEAE. 65.

Anthers opening by longitudinal slits; leaves not longitudinally parallel-nerved:

Trees; leaves with interpetiolar stipules; ovules 2 in each loculus of the ovary ..... RHIZOPHORACEAE. 67.

Herbs, sometimes aquatic; leaves without stipules; ovules 1 or many in each loculus of the ovary ..... ONAGRACEAE. 46.

CC. Leaves alternate:

D. Ovary with numerous ovules in each loculus; herbs:

Flowers hermaphrodite; stamens as many or twice as many as the petals; leaves without stipules ..... ONAGRACEAE. 46.

Flowers monoecious; stamens numerous; leaves with stipules, often unequal-sided ..... BEGONIACEAE. 60.

DD. Ovary with 1-2 ovules in each loculus:

E. Flowers in umbels, racemes, panicles or spikes; stamens as many as the petals; ovules solitary in each loculus:

Stamens opposite the petals; climbing shrubs; fruit 3-winged ..... RHAMNACEAE. 96.

Stamens alternate with the petals:

Trees or shrubs; flowers in spikes, racemes or umbels; fruit drupaceous; leaves pinnate, digitate or digitately divided ..... ARALIACEAE. 107.

Herbs, rarely arborescent; flowers in umbels; fruit separating into 2 indehiscent cocci, sometimes winged; leaves usually much divided or compound, rarely undivided and then sometimes peltate ..... UMBELLIFERAE. 108.

EE. Flowers axillary, solitary or in clusters; herbs:

Ovary 10-locular; stamens 10; fruit a prickly capsule ..... ROSACEAE. 77.

Ovary 2-4-locular; stamens 8 or fewer; fruit a nut:

Flowers hermaphrodite, solitary; fruit woody, 2-horned; aquatic plants ... ONAGRACEAE. 46.

Flowers monoecious, in clusters; fruit minute, not horned; swamp plants ... HALORAGACEAE. 47.

GROUP 14.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary inferior; petals present, more or less united.*

A. Parasitic shrubs, growing on other shrubs or trees; ovary with the ovule or ovules scarcely distinguishable from the surrounding tissue; calyx truncate or shortly toothed; stamens opposite the corolla-lobes; leaves opposite or alternate ..... LORANTHACEAE. 93.

AA. Plants not parasitic; ovary with the ovule or ovules clearly distinguishable from the ovary-wall:

B. Leaves opposite or verticillate:

Stamens numerous, more than twice as many as the petals; petals connivent in a mass and falling off together; leaves gland-dotted; trees or shrubs ..... MYRTACEAE. 64.

Stamens as many as the corolla-lobes or fewer; petals more or less united into a tube, not connivent in a mass:

Leaves with interpetiolar or intrapetiolar stipules, entire; ovary 2- or more-locular; herbs, shrubs or trees, sometimes climbing ..... RUBIACEAE. 117.

Leaves without stipules; ovary 1-locular with a solitary ovule; flowers in bracteate heads:

Stamens free; ovule pendulous from the apex of the ovary; herbs ..... DIPSACACEAE. 118.

Stamens with the anthers united into a tube surrounding the style; ovule erect from the base of the ovary; herbs, undershrubs or climbers; corolla of the outer (ray) flowers often differing from that of the inner flowers ..... COMPOSITAE. 119.

BB. Leaves alternate, sometimes all radical:

C. Flowers in bracteate heads; ovary 1-locular with a solitary ovule; stamens with the anthers united into a tube surrounding the style; corolla of the outer (ray) flowers often differing from that of the inner flowers; herbs, shrubs or trees ..... COMPOSITAE. 119.

CC. Flowers not in bracteate heads; ovary 1- or more-locular with more than 1 ovule in each loculus:

Stamens as many as and opposite to the corolla-lobes; ovary 1-locular with a free-basal placenta:

Trees; leaves often gland-dotted ... MYRSINACEAE. 112.

Herbs; leaves not gland-dotted ... PRIMULACEAE. 121.

Stamens as many as and alternate with the corolla-lobes or fewer; ovary 2-5-locular:

Flowers unisexual; stamens usually 3; mostly prostrate or climbing plants with tendrils ..... CUCURBITACEAE. 59.

Flowers hermaphrodite; stamens as many as the corolla-lobes, 3-5; herbs, sometimes shrubby, without tendrils:

Stamens with the anthers united into a tube surrounding the style; flowers more or less zygomorphic ..... LOBELIACEAE. 125.

Stamens with the anthers free; flowers actinomorphic ..... CAMPANULACEAE. 124.

GROUP 15.—*One carpel or two or more united carpels; ovules one or more, if more than one then attached to the central axis or the base or apex of the ovary; ovary inferior; petals absent.*

A. Ovary with 2-6 loculi:

Leaves with stipules, often unequal-sided; flowers monoecious; stamens numerous; herbs ..... BEGONIACEAE. 60.

Leaves without stipules; flowers usually hermaphrodite:

Calyx-lobes 5; anthers 5, free from the style, opening inwards; herbs ..... CAMPANULACEAE. 124.

Calyx-lobes 3 or fewer; anthers adnate to the style, opening outwards; plants trailing or climbing, herbaceous or woody ..... ARISTOLOCHIACEAE. 13.

AA. Ovary with a single loculus:

B. Ovule solitary; flowers unisexual:

Fleshy herbs, parasitic on roots; leaves reduced to scales; flowers in bracteate heads ..... BALANOPHORACEAE. 95.

Plants not parasitic; leaves normally developed, sometimes solitary:

Trees or shrubs; flowers densely spicate or capitate or arranged in an open receptacle, or the females sometimes solitary in a receptacle ..... MORACEAE. 84.

Herbs, sometimes shrubby:

Flowers arranged on an open flattened receptacle often with one or more linear arms on its margin ..... MORACEAE. 84.

Flowers paniculate-spicate, female in the lower spikes, male in the upper ..... HALORAGACEAE. 47.

BB. Ovules 2 or more; flowers mostly hermaphrodite:

Plants leafless, fungus-like, parasitic on roots; flowers solitary; ovules very numerous on pendulous apical placentas ..... HYDNORACEAE. 14.

Plants with leaves, these sometimes reduced and very small; flowers axillary or in racemes, spikes or heads; ovules 2-4:

Herbs or shrubs often parasitic on roots; stamens as many as and opposite to the calyx-lobes ..... SANTALACEAE. 94.

Trees, not parasitic; stamens twice as many as the calyx-lobes ..... COMBRETACEAE. 66.

KEY TO THE FAMILIES OF MONOCOTYLEDONES

Ovary or ovaries superior:

Perianth present, or if absent or much reduced or modified then flowers not arranged in spikelets with scale-like bracts:

Gynoecium (pistil) composed of 2 or more separate or almost separate carpels with separate styles and stigmas; plants mostly aquatic, sometimes marine ..... Group 1. See p. lxxxi.

Gynoecium (pistil) composed of 1 carpel or of 2 or more united carpels with free or united styles:

Perianth composed of separate calyx and corolla, the former often green, the latter usually petaloid, both series sometimes dry or transparent but never united into a single perianth-tube ..... Group 2. See p. lxxxii.

Perianth composed of similar or subsimilar segments in 2 series, usually conspicuous and petaloid, sometimes (when inflorescence a spadix) very small and inconspicuous, if united then forming a single perianth-tube ..... Group 3. See p. lxxxii.

Perianth sepaloid or dry and glumaceous, usually very small, or much reduced or absent; flowers mostly small and inconspicuous, usually arranged in spadices or panicles often subtended by large spathaceous bracts, rarely solitary ..... Group 4. See p. lxxxiii.

Perianth absent or represented by "hypogynous setae" or "scales" or "lodicules"; flowers minute, arranged in spikelets with scale-like bracts (glumes or lemmas); sedges and grasses ..... Group 5. See p. lxxxiv.

Ovary inferior:

Perianth composed of separate calyx and corolla, remaining in 2 distinct series, the calyx often green or different from the inner petaloid series ..... Group 6. See p. lxxxiv.

Perianth-segments more or less alike and mostly petaloid, usually 6, sometimes 3, free or united into a single perianth-tube ..... Group 7. See p. lxxxv.

GROUP 1.—*Ovaries superior; perianth present, or if absent or much reduced or modified then flowers not arranged in spikelets with scale-like bracts; gynoecium of two or more separate or almost separate carpels.*

A. Palms; leaves pinnate ..... PALMAE. 162.

AA. Aquatic or marsh herbs; leaves simple:

B. Perianth absent or cupular; stamens 1-2; marine or fresh-water plants with narrow leaves; flowers unisexual, axillary, solitary or in cymes ..... ZANNICHELLIACEAE. 144.

BB. Perianth present, composed of 1-6 free segments; stamens 3 or more, their anthers free from each other; fresh-water or terrestrial plants:

Flowers with bracts, in whorls or in simple or compound umbels, rarely spicate; plants aquatic or terrestrial; perianth usually composed of 3 sepals and 3 petals:

Ovules numerous on the walls of each carpel; carpels arranged in a single whorl; flowers in simple umbels, hermaphrodite ..... BUTOMACEAE. 139.

Ovules solitary in each carpel; carpels arranged spirally or in 1 or more whorls; flowers in whorls or in simple or compound umbels, rarely spicate, hermaphrodite or unisexual ..... ALISMATACEAE. 141.

Flowers without bracts, in spikes; plants aquatic; perianth composed of 1-4 similar segments:

Leaves radical; spikes simple or 2-fid on elongated peduncles, at first enclosed in a spathe; perianth usually composed of 2 segments; stamens 6, with elongated filaments; ovules 2 or more in each carpel ..... APONOGETONACEAE. 142.

Leaves on elongated stems; spikes simple on axillary peduncles, without a spathe; perianth usually composed of 4 segments; stamens usually 4, with sessile anthers; ovules solitary in each carpel ... POTAMOGETONACEAE. 143.

GROUP 2.—*Ovary superior, of one carpel or two or more united carpels; perianth composed of separate calyx and corolla, the former often green, the latter usually petaloid, both series sometimes dry or transparent but never united into a single perianth-tube.*

A. Palms with pinnate or fan-shaped leaves ..... PALMAE. 162.

AA. Herbs with simple, not fan-shaped, leaves:

Ovary 1-locular with parietal placentas bearing numerous ovules; leaves narrow, mostly radical; flowers in heads on elongated peduncles; corolla usually yellow ..... XYRIDACEAE. 147.

Ovary 2-3-locular with axile or apical placentas bearing 1 to few ovules:

Flowers monoecious, small and actinomorphic, in bracteate heads on elongated peduncles; petals membranous or hyaline, not brightly coloured; style branched; leaves narrow, radical or crowded ..... ERIOCAULACEAE. 148.

Flowers hermaphrodite, actinomorphic or zygomorphic, in open or congested cymes or panicles often subtended by folded or boat-shaped bracts; petals usually brightly coloured, often blue or yellow; style unbranched; leaves broad or narrow ..... COMMELINACEAE. 146.

GROUP 3.—*Ovary superior, of one carpel or two or more united carpels; perianth composed of similar or subsimilar segments in two series, usually conspicuous and petaloid, sometimes (when inflorescence a spadix) very small and inconspicuous, if united then forming a single perianth-tube.*

A. Aquatic herbs; flowers solitary or in racemes or spikes, with a spathe, the latter often enclosed in the subtending leaf-sheath; fruit a many-seeded capsule ..... PONTEDERIACEAE. 153.

AA. Plants not aquatic:

B. Inflorescence a spadix enclosed in a spathe; flowers very small, monoecious, female at the bottom of the spadix, male above;

ovary 1-4-locular; herbs with radical leaves ..... ARACEAE. 155.

BB. Inflorescence not a spadix; flowers hermaphrodite or dioecious; ovary 3-locular:

Leaves reduced to scales or spines, their function fulfilled by linear or acicular branches (cladodes); flowers small; fruit a berry; herbs or undershrubs, often climbing ..... LILIACEAE. 152.

Leaves normally developed, occasionally solitary, sometimes appearing after the flowers:

Flowers dioecious, small; leaves 3-nerved from the base with reticulate venation, usually with stipular tendrils; flowers in axillary umbels; fruit a berry; climbing shrubs, usually with prickly stems ..... SMILACACEAE. 154.

Flowers hermaphrodite; leaves with parallel nerves and veins and without stipular tendrils:

Fruit a berry or with a thin pericarp falling away from the berry-like seeds; trees, shrubs or thick-leaved plants; perianth-segments more or less united into a tube ..... AGAVACEAE. 161.

Fruit a loculicidal capsule:

Flowers in umbels subtended by 1 or more spathaceous bracts and borne on naked peduncles; herbs with radical leaves and a bulbous rootstock ..... AMARYLLIDACEAE. 158.

Flowers solitary or in racemes, spikes or panicles; herbs or thick-leaved plants, sometimes climbing by means of prehensile leaf-tips ... LILIACEAE. 152.

GROUP 4.—*Ovary superior, of one carpel or two or more united carpels; perianth sepaloid or dry and glumaceous, usually very small, or much reduced or absent; flowers mostly small and inconspicuous, usually arranged in spadices or panicles often subtended by large spathaceous bracts, rarely solitary, never arranged in spikelets.*

A. Leaves absent; minute aquatic plants, the plant-body reduced to a thallus-like "frond" with or without one or more pendent rootlets ..... LEMNACEAE. 156.

AA. Leaves present, sometimes solitary:

B. Leaves pinnate or fan-shaped; palms ..... PALMAE. 162.

BB. Leaves simple, sometimes deeply divided but not fan-shaped:

C. Leaves opposite or ternate, linear; aquatic plants with elongated stems; flowers unisexual, axillary ..... NAJADACEAE. 145.

CC. Leaves alternate, sometimes radical or crowded:

Plants aquatic, floating, stemless with a rosette of sessile leaves ..... ARACEAE. 155.

Plants not aquatic and floating:

Flowers hermaphrodite, in paniculate clusters; perianth

composed of 6 glumaceous segments; herbs (rushes) with narrow leaves ..... JUNCACEAE. 168.

Flowers unisexual; perianth absent or reduced to hairs or to a small cup:

Trees or shrubs, often with aerial roots; leaves sword-like, sharply toothed ..... PANDANACEAE. 163.

Herbs or climbers; flowers in dense spikes or spadices:

Leaves narrow, linear; flowers in dense cylindric spikes, with female flowers below, male flowers above; ovary 1-locular with a solitary ovule pendulous from the apex ..... TYPHACEAE. 157.

Leaves broad, often deeply divided; flowers in spadices subtended by or enclosed in a spathe, with female flowers below, male flowers above, and frequently with a terminal sterile appendage; ovary 1-4-locular with 1 or more ovules on basal or parietal placentas; herbs or climbers ..... ARACEAE. 155.

GROUP 5.—*Ovary superior; perianth absent or represented by "hypogynous setae" or "scales" or "lodicules"; flowers minute, arranged in spikelets with scale-like bracts (glumes or lemmas).*

A. Flowers each enclosed by a single bract (glume), without a bracteole; leaves usually with closed sheaths; stems mostly solid and usually more or less triangular in cross-section; sedges .... CYPERACEAE. 169.

AA. Flowers each enclosed by a bract (lemma) and a bracteole (palea), the spikelet usually having 2 empty bracts (glumes) below the flowers; leaves usually with open sheaths; stems mostly with hollow internodes and usually circular in cross-section; grasses, including bamboos ..... GRAMINEAE. 170.

GROUP 6.—*Ovary inferior; perianth composed of separate calyx and corolla, remaining in two distinct series, the calyx often green or different from the inner petaloid series.*

A. Aquatic herbs; flowers actinomorphic, hermaphrodite or dioecious, solitary or 2 or more together in a tubular spathe; spathes sessile or borne on elongated peduncles ..... HYDROCHARITACEAE. 140.

AA. Plants not aquatic; flowers more or less zygomorphic or asymmetrical:

Fertile stamens 5; flowers usually unisexual; tall plants with gigantic leaves ..... MUSACEAE. 149.

Fertile stamen 1; flowers hermaphrodite; herbs:

Stamen not accompanied by petaloid staminodes; pollen agglutinated into masses (pollinia); ovary 1-locular with numerous ovules on parietal placentas; flowers zygomorphic, the median petal (lip) more or less different from the lateral ones; plants terrestrial or epiphytic ..... ORCHIDACEAE. 167.

Stamen accompanied by 1 or more petaloid staminodes; pollen not agglutinated into masses:
Sepals united into a tube; anther 2-locular; ovary 3-locular with numerous ovules in each loculus; flowers zygomorphic ..... ZINGIBERACEAE. 150.
Sepals free; anther 1-locular; ovary 3-locular with a solitary ovule in each loculus, or with only 1 fertile loculus; flowers asymmetrical ..... MARANTACEAE. 151.

GROUP 7.—*Ovary inferior; perianth-segments more or less alike and mostly petaloid, usually six, sometimes three, free or united into a single perianth-tube.*

A. Aquatic herbs, sometimes marine; flowers actinomorphic, dioecious, solitary (or the males sometimes many together) in a tubular or 2-lobed spathe; spathes sessile or pedunculate ..... HYDROCHARITACEAE. 140.

AA. Plants not aquatic:
B. Flowers unisexual, small; twining plants; leaves reticulately veined, simple or digitately compound; fruit a 3-winged or 3-angled capsule ..... DIOSCOREACEAE. 160.
BB. Flowers hermaphrodite; plants not twining:
C. Leaves deeply divided with pinnatipartite segments, radical; flowers in bracteate umbels, the outer bracts broad, the inner ones long and thread-like; herbs with a tuberous rootstock ..... TACCACEAE. 166.
CC. Leaves simple and undivided, or sometimes absent:
Stamen 1; pollen agglutinated into masses (pollinia); ovary 1-locular with numerous ovules on parietal placentas; median inner segment (lip) of the perianth more or less different from the other segments; terrestrial or epiphytic herbs ..... ORCHIDACEAE. 167.
Stamens 3 or 6; pollen not agglutinated into masses; ovary 3-locular:
Stamens 3; flowers actinomorphic or zygomorphic, spicate or sometimes solitary or few together in a spathe; herbs with narrow leaves; rootstock usually a corm or bulb ..... IRIDACEAE. 159.
Stamens 6:
Flowers in umbels (sometimes 1-flowered) subtended by 1 or more spathaceous bracts; peduncle naked; herbs with radical leaves; rootstock a bulb ..... AMARYLLIDACEAE. 158.
Flowers solitary or in racemes or corymbs not subtended by spathaceous bracts; rootstock not a bulb:
Plants with a woody stem densely clothed with the persistent bases of the old leaves; flowers solitary ..... VELLOZIACEAE. 165.
Plants without a woody stem; flowers solitary or in racemes or corymbs .... HYPOXIDACEAE. 164.

SEQUENCE OF FAMILIES CONTAINED IN VOLUME I

DESCRIPTIVE SYSTEMATIC LIST

GYMNOSPERMAE

CYCADALES

1. *CYCADACEAE*

1. **ENCEPHALARTOS** Lehm.

Encephalartos septentrionalis Schweinf.

Palm-like undershrub; stem fusiform-globose, up to 2 ft. high. Leaves up to 5 ft. long, pinnatisect; segments up to 50 pairs, ovate-lanceolate, falcate, 4-5 in. long, with 3-8 teeth in the basal half, densely tomentose in the young leaves.

Equatoria.

CONIFERAE

2. *PODOCARPACEAE*

1. **PODOCARPUS** L'Hérit. ex Pers.

Podocarpus milanjianus Rendle.

Evergreen forest-tree up to 80 ft. high; bark thin, pale- to dark-brown, fibrous, cracking and peeling in long narrow strips. Leaves linear-oblong, smelling strongly of yew. Male cones catkin-like, flesh-pink, about 1 in. long. Seeds usually 2 together, glaucous, globose, ¼-½ in. long, attached to a large fleshy scarlet receptacle.

Equatoria: *Imatong Mountains*, between 7000 and 9000 ft.

P. gracilior Pilg.

Evergreen forest-tree up to 100 ft. high; bark pale-grey to pale-brown, horizontally and longitudinally fissured, scaling in squares. Leaves linear to linear-oblong, confined to the ends of the branches. Male cones axillary, solitary or 2-3 together, catkin-like, pinkish-purple, about 1 in. long. Seeds green to purplish with a glaucous bloom, ovoid, ½-¾ in. long, about ½ in. in diameter; shell hard and woody.

Equatoria: *Dongotona Mountains*, between 7000 and 9000 ft.

3. *CUPRESSACEAE*

1. **JUNIPERUS** L.

Juniperus procera Hochst. ex Endl. African Pencil Cedar.

Evergreen dioecious timber-tree up to 120 ft. high but often smaller; crown pyramidal in youth, spreading in age; bark pale-brown, thin, fibrous, cracking and peeling in long narrow strips. Foliage of two types—juvenile and adult; leaves on young trees needle-like, about 1 in. long; leaves on adult trees paired, scale-like, triangular, sharp-pointed. Cones small, solitary, terminal. Fruit waxy, blue-grey, berry-like, the size of a pea, containing 2-3 seeds.

Red Sea Hills: *Dris Pass, near Erkowit*, 6400 ft.

GNETALES

4. *EPHEDRACEAE*

1. **EPHEDRA** L.

Ephedra aphylla Forsk.

E. alte C. A. Mey.

Dioecious shrub, erect or climbing; branches long, tortuous; twigs whorled. Leaves short, linear, in whorls of 2-3, connate at the base. Male catkins sessile or short-pedunculate, few-flowered, crowded at the ends and nodes of the branches, with 3-4 anthers sessile on a long exserted column. Female catkins 1-3 in a cluster, short-pedicellate, 1-2-flowered. Sheaths of the involucre 3, ciliate, the lower cup-shaped, the upper shorter than the fruit.

North-eastern Sudan: *21° N.*

ANGIOSPERMAE

DICOTYLEDONES

5. *ANNONACEAE*

Trees, shrubs or climbers, aromatic. Leaves alternate, entire, without stipules. Flowers terminal, leaf-opposed or axillary, solitary or crowded, hermaphrodite. Sepals 3 or rarely 2, free or united into a 3-lobed calyx, valvate or rarely imbricate, persistent or deciduous. Petals generally 6 in 2 series, valvate or slightly imbricate, rarely in 2 series of 2 or the inner series absent, free or sometimes more or less united. Stamens generally numerous, hypogynous. Carpels numerous or rarely few or solitary, free or more rarely united; ovules 1 or more.

The following introduced plants are often cultivated in the Sudan: *Annona squamosa* L., Sugar-apple or Sweetsop; *A. reticulata* L., Custard-apple or Bullock's-heart; *A. cherimola* Mill., Cherimoya.

A. Carpels spirally arranged, free, or if united then forming a multilocular syncarp; stigmas erect; petals free or united at the base:

(a) Petals in 2 more or less similar series, all or only the inner series imbricate; ovules numerous; hairs stellate ..... UVARIA. 7.

(aa) Petals in 2 distinct series, all valvate, usually 6:

(b) Carpels not united, or if slightly so then always free in fruit:

(c) Ovules numerous (more than 2) in each carpel:

(d) Leaves covered with dense scales ..... MEIOCARPIDIUM. 4.

(dd) Leaves not covered with dense scales:

(e) Petals of the 2 series similar and of approximately equal size, the inner ones spreading or erect:

(f) Anthers not transversely septate; styles deeply 2-lobed, the lobes club-shaped ..... HEXALOBUS. 3.

(ff) Anthers transversely septate; styles uniting with a central column ..... XYLOPIA. 8.

(ee) Petals of the 2 series somewhat dissimilar, the inner ones converging over the stamens and carpels; stigmas 2-lobed ... POPOWIA. 6.

(cc) Ovules 1-2 in each carpel ..... POPOWIA. 6.

(bb) Carpels united into a fleshy mass (syncarp) in fruit ..... ANNONA. 1.

(aaa) Petals 6 in a single series, united at the base to form a short tube ..... ENNEASTEMON. 2.

AA. Carpels in a single whorl, united into a 1-locular ovary with parietal placentas; stigmas radiating; petals more or less united into a tube ..... MONODORA. 5.

1. ANNONA L.

Annona senegalensis Pers. Fig. 10.

Savannah-shrub or tree up to 20 ft. high; bark smooth, silver-grey; slash pink. Leaves broadly ovate, rounded at both ends, 3-7 in. long, 1¼-4 in. broad, blue-green and glabrous above, paler and softly pubescent beneath, fragrant when crushed; petiole ½-¾ in. long. Sepals 3, small, green. Petals 6 in 2 series, the outer buff, the inner cream-yellow. Stamens numerous. Fruit more or less globose, 1-2 in. in diameter, green at first with paler reticulations corresponding to the carpels, ripening to orange-yellow, edible.

Central and Southern Sudan.

Fig. 10—ANNONA SENEGALENSIS Pers.
A, stamen. B, style.

2. **ENNEASTEMON** Exell

Enneastemon schweinfurthii (Engler & Diels) Robyns & Ghesq.
Popowia schweinfurthii Engler & Diels.

Climbing shrub or small tree; branchlets pubescent, brown. Leaves up to 5 in. long and 3½ in. broad, ovate, subacuminate at the apex, grey-brown beneath. Flowers very small, axillary in pairs on slender pedicels.

Equatoria.

3. **HEXALOBUS** A.DC.

Hexalobus monopetalus (A. Rich.) Engler & Diels.

Savannah-tree about 20 ft. high, attaining larger size on the edge of streams or gallery-forests. Leaves subsessile, oblong-lanceolate, up to 6 in. long, ¾-2 in. broad, pubescent beneath. Flowers sessile, axillary, solitary or 2-3 together. Sepals 3, rusty-brown, silky-pubescent. Petals 6, canary-yellow, falling early, about ¾ in. long. Fruiting-carpels 2-3 together, subsessile, 1¾-2 in. long, about 1 in. broad; seeds bright-red when ripe, the juice staining the fingers yellow.

Equatoria.

H. crispiflorus A. Rich.

H. grandiflorus Benth.

Tree about 40 ft. high but sometimes growing up to 80 ft., buttressed at the base. Leaves acutely acuminate at the apex, up to 8 in. long and 2½ in. broad, glabrous and shiny above, shortly pubescent or glabrescent beneath. Flowers pale-yellow, conspicuous, fragrant, pendent. Sepals ovate, thick, about ½ in. long, silky-tomentose. Fruit like a small fat sausage, reddish-brown, velvety, woody, 2-4 in. long, 1½-2 in. broad, borne on the stem.

Equatoria: *Kagelu, in gallery-forest.*

4. **MEIOCARPIDIUM** Engler & Diels

Meiocarpidium lepidotum (Oliv.) Engler & Diels.

Tree up to 30 ft. high. Leaves oblong, long-acuminate at the apex, up to 8 in. long, densely scaly beneath. Flowers covered with scales. Petals up to 1½ in. long and ¾ in. broad. Fruit up to 2 in. long and ¾ in. broad, cylindric, silver-grey.

Equatoria.

5. **MONODORA** Dunal

Monodora myristica (Gaertn.) Dunal. Calabash-nutmeg.

Deciduous forest-tree up to 80 ft. high; bark grey; slash white. Leaves obovate-elliptic, up to 2 ft. long and 1½ in. broad on flowering shoots, glaucous, paler beneath; petiole thick, purplish, ½ in. long. Flowers handsome, 4-5 in. in diameter, borne singly on short flowering branches; peduncle slender, up to 8 in. long, with an ovate leafy bract up to 1 in. long in the upper half. Sepals 3, green with reddish spots, 1-1½ in. long. Petals 6 in 2 series; outer up to 4 in. long, curly, greenish-yellow, spotted with purple-red and brown; inner much shorter than the outer, not curly, greenish-white with purple-brown spots. Fruit smooth, green, globose, woody, up to 6 in. in diameter, containing numerous edible inch-long seeds embedded in a fragrant pulp.

Equatoria.

M. angolensis Welw.

Small tree up to 20 ft. high. Leaves oblong-elliptic or obovate-oblong, membranous at first, at length more or less leathery, 2-6 in. long, 1-2¼ in. broad. Flowers 1½-3 in. in diameter. Inner petals rose-coloured or pink at least on the margins; outer variegated with deep red, brown or purplish-black. Fruit ovoid-ellipsoid, 4 in. long, 2½-3 in. in diameter, marked with faint longitudinal ridges.

Equatoria: *Lotti Forest*, 4000 ft.

M. gibsonii Bullock ex Burtt Davy.

Understorey tree or shrub up to 20 ft. high. Leaves on flowering branchlets obovate-elliptic, obtusely acuminate at the apex, cuneate at the base, 2-5 in. long, ¾-2 in. broad. Flowers 1½-3 in. in diameter, smaller than but otherwise very similar to those of *M. myristica*, borne singly on short branchlets which thicken later to support the fruit. Fruit more or less globose, about 2 in. in diameter, deeply wrinkled.

Equatoria: *near Iwatoka, in gallery-forest.*

6. **POPOWIA** Endl.

Popowia djurensis Engler & Diels.

Shrub or small tree about 15 ft. high, often growing in pure stands, covering large areas and killing out the grass. Leaves oblong, up to 3½ in. long and 1 in. broad. Flowers yellow, about ¼ in. long, in short-stalked axillary clusters. Fruit small, berry-like, red when ripe.

Equatoria: *dominant on summit of Mount Baraka, near Loka; very abundant under Anogeissus on sandy stretches at Wadi, near River Yei.*

7. **UVARIA** L.

Uvaria bukobensis Engler.

Climbing shrub or occasionally straggling tree up to 20 ft. high. Leaves obovate, 2-4 in. long, ¾-1½ in. broad, almost glabrous beneath, leaden-coloured; lateral nerves prominent beneath (reddish in dried specimens), impressed above; petiole ¼ in. long. Flowers greenish, rusty-pubescent in bud, in axillary clusters of 1-3. Sepals 3, not meeting over the top of the bud (so that a small circular patch of petal is exposed), ¼-⅓ in. long and broad. Petals 6, fleshy, ½-¾ in. long. Stamens numerous. Fruiting-carpels elongate, cinnamon-pubescent, 1-2 in. long, ½ in. in diameter.

Equatoria.

U. schweinfurthii Engler & Diels.

Half-climbing shrub or tree up to 20 ft. high. Leaves oblong, subacutely acuminate at the apex, softly pubescent beneath with scattered stellate hairs visible to the naked eye among the simple pubescence, 3-5 in. long, up to 2 in. broad. Flowers yellow, small. Fruiting-carpels cylindric, ½-¾ in. in diameter, regularly banded with shallow rings about $\frac{1}{10}$ in. apart, rusty-hairy.

Equatoria: *Yei valley.*

8. **XYLOPIA** L.

Xylopia acutiflora (Dunal) A. Rich.

Shrub or medium tree, growing tall and straight, with smooth grey bark. Leaves oblong-lanceolate, obtusely acuminate at the apex, rounded at the base, 2-4 in. long, 1 in. broad, appressed-pilose beneath. Flowers solitary; peduncle very short. Fruit scarlet.

Equatoria: *near Iwatoka, in gallery-forest.*

X. vallotii Hutch. & Dalziel.

Shrub or straight graceful tree up to 50 ft. high. Leaves oblong-lanceolate, obtuse or slightly acuminate at the apex, rounded at the base, up to 3 in. long and 1½ in. broad. Peduncle slender, about ½ in. long. Fruit short and thick.

Nuba Mountains.

6. *MONIMIACEAE*

Trees or shrubs. Leaves opposite or rarely alternate, without stipules, entire or serrate, coriaceous, sometimes with pellucid dots. Flowers actinomorphic, rarely oblique, unisexual, cymose or racemose, rarely solitary; inflorescences axillary or rarely terminal. Calyx 4-6-lobed, sometimes 1 lobe produced into a long tongue-like process. Petals absent. Male flowers: stamens numerous or few, in 2-3 rows; filaments very short, often flattened, with or without glands at the base; anthers erect, opening by valves or by longitudinal slits. Female flowers: staminodes present or absent; carpels several or rarely solitary, sunk in the disk; ovule 1. Fruiting-carpels enclosed by the calyx or the latter deciduous, indehiscent, often drupaceous.

1. **XYMALOS** Baill.

Xymalos monospora (Harv.) Baill. ex Warb.

Understorey tree or shrub usually less than 30 ft. high, occasionally attaining 90 ft.; bark rough. Leaves elliptic to oblanceolate, shortly acuminate at the apex, attenuate at the base, coarsely serrate, the main nerves looping well inside the leaf margin, 4-6 in. long, 1¼-1½ in. broad; petiole up to 1 in. long. Flowers greenish-white, dioecious, in grey-pubescent inflorescences 1-2 in. long. Fruit ovoid or ellipsoid, ½-¾ in. long.

Equatoria: *Imatong Mountains, Jebel Baghanj,* 6000-7000 ft.

7. *LAURACEAE*

Trees or shrubs or very rarely leafless twining parasites, all parts with aromatic glands. Leaves (except in parasites) alternate, coriaceous and evergreen, without stipules. Flowers small, hermaphrodite, polygamous or dioecious, actinomorphic. Calyx usually 6-lobed. Petals absent. Stamens typically in 4 whorls, the fourth row often suppressed or reduced to staminodes; anther continuous with the filament. Ovary superior or rarely inferior, 1-locular. Fruit baccate or drupaceous.

A. Anthers 2-valved ..... TYLOSTEMON. 2.
AA. Anthers 4-valved ..... OCOTEA. 1.

1. **OCOTEA** Aubl.

Ocotea viridis Kosterm.

Tree up to 60 ft. high; bark reddish-grey, peeling off in large irregular scales; branchlets with conspicuous leaf-scars. Leaves rigid-coriaceous, elliptic or broadly elliptic or rarely ovate-elliptic, acute or obtusely acuminate at the apex, shortly cuneate or acute at the base, 4-8 in. long, up to 4 in. broad, glossy and obscurely reticulate above, dull and paler and prominently reticulate beneath. Flowers whitish, in few-flowered axillary panicles clustered near the ends of the branchlets. Berry ellipsoid, smooth, up to $\frac{4}{5}$ in. in diameter.

Equatoria: *Imatong Mountains, Itobol*, 6400 ft.

2. **TYLOSTEMON** Engler

Tylostemon ugandensis (Rendle) Stapf.

Forest-tree up to 90 ft. high. Leaves elliptic, obtuse to obscurely acuminate at the apex, obtuse or rounded at the base, 3-4 in. long, $1\frac{1}{2}$-2 in. broad; petiole shallowly channelled above. Flowers small, fleshy, pinkish-brown, crowded in axillary panicles up to 4 in. long and $2\frac{1}{2}$ in. broad. Fruit purple-brown, ellipsoid, about 1 in. long, with dark red-purple juice.

Equatoria: *Kagelu, in gallery-forest.*

8. *MYRISTICACEAE*

Trees, often large and frequently aromatic. Leaves alternate, without stipules, entire, often with translucent dots. Flowers small, dioecious, clustered, racemose or umbellate or capitate. Calyx 3- (rarely 2-5-) lobed, funnel-shaped to globose or saucer-shaped. Petals absent. Male flowers: stamens 2-30; filaments united into a column. Female flowers: staminodes absent; ovary superior, sessile, 1-locular; stigma subsessile; ovule 1. Fruit fleshy, usually dehiscing by 2 valves; seed erect, with a thin or fleshy sometimes laciniate often coloured aril.

1. **PYCNANTHUS** Warb.

Pycnanthus angolensis (Welw.) Exell. False or African Nutmeg. Fig. 11.

Forest-tree up to 90 ft. high, with straight slender cylindric bole rarely over 8 ft. in girth; bark grey or reddish-grey, regularly but

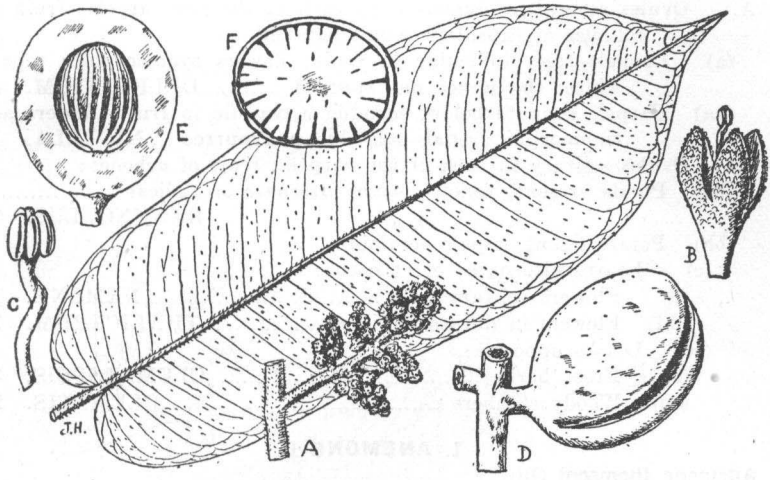


Fig. 11—PYCNANTHUS ANGOLENSIS (Welw.) Exell.
A, portion of male inflorescence. B, male flower. C, staminal column. D, fruit. E, fruit in longitudinal section showing seed and aril. F, cross-section of seed.

shallowly fissured; slash granular, reddish, exuding a honey-coloured juice which soon darkens to blood-red; all young parts covered with an orange-brown velvety tomentum of branched hairs. Leaves oblong, abruptly acuminate at the apex, cordate at the base, usually 5-8 in. long and 1½-2½ in. broad (sometimes as much as 12 in. long and 4 in. broad). Male panicles 2-6 in. long, axillary or from the axils of fallen leaves; flowers small, brownish-orange, borne in clusters on the short secondary branches of the panicles. Fruit brownish-orange, densely clustered, ovoid, 1-1¾ in. long, ¾-1¼ in. in diameter, dehiscing longitudinally; kernel longitudinally ribbed, brown outside, white in cross-section with a few brown lines, enclosed in a fleshy pink aril; both seed and aril aromatic.

Equatoria.

9. *RANUNCULACEAE*

Perennial (or rarely annual) herbs or more rarely shrubs or climbers; indumentum of simple hairs. Leaves alternate or more rarely opposite, without stipules. Flowers hermaphrodite, hypogynous, actinomorphic or zygomorphic. Perianth usually of calyx and corolla, or sometimes the calyx petaloid and the petals absent; petals when present free, often with a nectariferous claw. Stamens numerous, free. Carpels numerous or few (rarely 1), free or rarely united; ovules 1 or more. Fruit of follicles or of dry achenes often tailed with the persistent elongated style, rarely capsular or baccate; seeds small, usually smooth.

A. Ovules several or numerous in each of the few carpels; fruit of follicles or capsular; sepals petaloid:
(a) Carpels free, follicular in fruit; flowers zygomorphic; sepals white, the upper one spurred ..... DELPHINIUM. 4.
(aa) Carpels connate below, forming a capsule in fruit; flowers actinomorphic; sepals pale-blue, not spurred ... NIGELLA. 5.
AA. Ovules solitary in each of the carpels; fruit of achenes:
(b) Petals present, yellow; leaves alternate or radical ..... RANUNCULUS. 6.
(bb) Petals absent; sepals petaloid:
(c) Leaves alternate; erect herbs:
(d) Flowers solitary ..... ANEMONE. 1.
(dd) Flowers in diffuse panicles ..... THALICTRUM. 7.
(cc) Leaves opposite:
(e) Erect herbs ..... CLEMATOPSIS. 3.
(ee) Woody climbers ..... CLEMATIS. 2.

1. **ANEMONE** L.

Anemone thomsoni Oliv.

Small herb. Leaves palmately dissected, sparsely ciliate. Flowers pink and white, solitary. Carpels densely hirsute.

Equatoria: *Imatong Mountains, rocky summit of Mount Kineti*, 14,000 ft.

2. **CLEMATIS** L.

Clematis inciso-dentata A. Rich. Fig 12.

C. grata (non Wall.) Broun & Massey.

Climber, with pubescent branches. Leaves pinnately divided; leaflets 3-7, ovate, acute or obtuse at the apex, cordate at the base, crenate-serrate, pubescent or at length glabrescent above, silky-tomentose or pubescent beneath. Panicles many-flowered. Flowers ¾ in. in diameter. Sepals silky outside, pubescent or nearly glabrous within. Fruit of silky white achenes.

Red Sea Hills: *Erkowit*.

C. simensis Fresen.

Woody climber, with glabrous branches. Leaves pinnately divided; leaflets 1-5, ovate to ovate-lanceolate, crenate-serrate, 2-4 in. long, 1-2 in. broad. Panicles many-flowered. Flowers white, ¾ in. in diameter. Sepals short-silky within. Fruiting-carpels hairy; tail 1 in. or more long.

Darfur: *Jebel Marra*, up to 9500 ft.

C. glaucescens Fresen.

Weak woody climber. Leaves ternately divided, softly hairy beneath. Flowers creamy-white, in short terminal and axillary panicles. Sepals very silky. Fruit of shortly tailed silky achenes.

Kassala: *Gallabat*. *Darfur*: *Kulme*. *Equatoria*.

Fig. 12—CLEMATIS INCISO-DENTATA A. Rich.

3. **CLEMATOPSIS** Boj. ex Hutch.

Clematopsis oliveri Hutch.

Erect herb from an underground woody rhizome. Upper leaves mostly 3-foliolate, the lower often 1-foliolate; leaflets obovate to linear-oblong. Flowers white to dirty-pink, resembling *Anemone*, usually 3 to each shoot, with a pair of small foliaceous bracts about 1¼ in. long below the calyx. Achenes silky, with long plumose tails.

Equatoria.

4. **DELPHINIUM** L.

Delphinium leroyi Franch. ex Huth.

Dwarf slightly hairy perennial herb; branches usually 3-flowered. Leaves palmately 5-lobed, the largest 4-5 in. broad; lobes broad, usually 3-lobulate and toothed; petiole of lower leaves 8-15 in. long. Flowers sweet-scented, white with purple anthers, about 2½ in. in diameter. Sepals ¾-1 in. broad, each with a thickened green spot near the top on the underside; spur slender, 1½-2½ in. long. Carpels 3, densely hairy, shorter than the stamens.

Equatoria: *Imatong Mountains.*

D. dasycaulon Fresen.

Erect branched or simple herb ½-3 ft. high; stems shortly pilose with spreading hairs or glabrescent. Radical leaves roundish-reniform or -cordate, broadly and deeply 5-lobed, 3-6 in. broad; cauline leaves deeply 5-partite, the segments acutely 3-lobed, more or less pilose on both surfaces. Flowers blue; racemes rather loose, hairy, with linear bracts. Sepals hairy outside, especially towards the slightly recurved obtuse spur.

Red Sea Hills: *Karora Hills.*

5. **NIGELLA** L.

Nigella sativa L.

Erect herb. Leaves much divided. Sepals petaloid, pale-blue. Carpels connate below, diverging above into 5 styles.

Northern Sudan. Darfur: *Melit and Jebel Marra*, 5500 ft.

6. **RANUNCULUS** L.

Ranunculus multifidus Forsk.

R. pubescens Thunb.

Herb, with fleshy erect stems 1-2 ft. high. Lowest pinnae usually petiolulate; lobes 3-fid or 3-partite; uppermost leaves sessile, 3-fid or rarely entire. Petals 5, yellow.

Darfur: *Jebel Marra*, 6000-9000 ft. *Equatoria*: *Imatong Mountains.*

R. oreophytus Del.

Herb 2-3 in. high. Leaves radical, pinnatipartite; lateral segments in 3-4 pairs, more or less ovate, each usually with a lateral tooth on each side, subsessile; hairs few and long or none. Peduncle very short, not exceeding the leaves. Petals 5, obovate-oblong, yellow.

Equatoria: *Imatong Mountains, Kippia, in meadow.*

7. THALICTRUM L.

Thalictrum rhynchocarpum Dill. & Rich.

Erect glabrous herb 4-10 ft. high. Leaves with sheathing bases, 2-4-pinnate; leaflets usually ovate to orbicular, 3-lobed or broadly 3-7-toothed, cordate at the base, up to ½ in. broad, glabrous. Flowers greenish, small, numerous, on hair-like pedicels which elongate after flowering up to 6 in. in length. Achenes strongly 3-ribbed on each side, tapering below into a slender stipe, above into the elongate persistent style, up to ¼ in. long.

Equatoria: *Imatong Mountains, nr. Jebel Garia*, 6000-7000 ft.

10. *CERATOPHYLLACEAE*

Submerged aquatic herbs with leafy branches. Leaves verticillate, variously divided with thread-like or linear segments. Flowers monoecious, solitary, axillary, sessile, males and females at separate nodes. Calyx thinly herbaceous, many-parted into narrow subvalvate segments often dentate or lacerate at the apex. Petals absent. Male flowers: stamens 10-12, crowded on a flat torus; connective produced beyond the loculi, thick and often coloured. Female flowers: ovary sessile, ovoid, 1-locular; ovule 1. Fruit a nut, ovoid or ellipsoid.

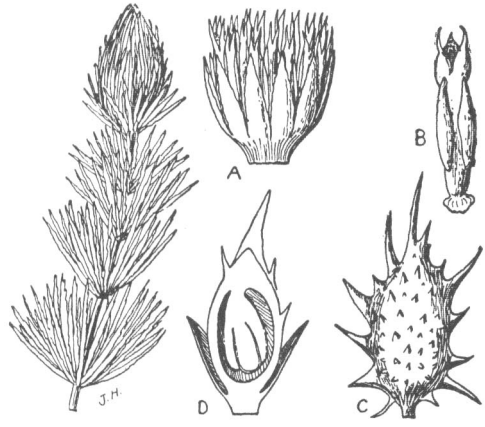


Fig. 13—CERATOPHYLLUM DEMERSUM L.
A, male flower. B, stamen. C, fruit. D, vertical section of same.

1. **CERATOPHYLLUM** L.

Ceratophyllum demersum L. Hornwort. Fig. 13.

Glabrous perennial herb, with elongated branches. Leaves in whorls of 5-12, more or less deeply divided. Flowers small. Calyx-segments oblong. Fruit about $\frac{1}{8}$ in. long, broadly ellipsoid, strongly warted and crowned with a long beak.

Widespread in rivers.

11. *NYMPHAEACEAE*

Aquatic herbs (water-lilies) with peltate or cordate leaves arising from a submerged prostrate rhizome. Flowers solitary, large and showy, often sweet-scented. Sepals 4-6, free or adherent to the receptacle. Petals numerous, free, imbricate, sometimes gradually passing into stamens. Stamens numerous. Carpels 8 or more, free and immersed in the receptacle or more or less united into an ovary of as many loculi, inferior or semi-inferior; ovules numerous. Receptacle large, fleshy, surrounding the ovaries or ovary and with the petals and stamens inserted on its side. Fruit multilocular, indehiscent, fleshy.

1. **NYMPHAEA** L.

Nymphaea lotus L.

Leaves sharply toothed, often hairy beneath, with many strong nerves. Flowers white, sometimes bluish or purple-tinged or yellowish. Sepals pure-green on the back, white at the base, with white prominent veins. Anther-connective blunt and very shortly produced.

The Nile Rivers and tributaries south of Khartoum.

N. micrantha Guillem. & Perrott.

Leaves entire or slightly undulate, glabrous or nearly so beneath and marked with violet-black dots, bearing a cluster of bulbils at the top of the petiole, 4-6 in. long, $3\frac{1}{4}$-$4\frac{1}{2}$ in. broad. Flowers white to bluish, about 4-$4\frac{3}{4}$ in. in diameter when spread out. Sepals marked with violet dots. Anther-connective shortly produced, conical.

The Nile Rivers and tributaries south of Khartoum.

N. caerulea Savigny.

N. nubica Lehm.

Leaves entire or slightly undulate at the base, orbicular or ovate-orbicular, narrowly peltate, up to 16 in. broad, green beneath with small dark-purple spots, purplish all round near the margin, not bearing a cluster of bulbils. Flowers light-blue above, dull-white below. Sepals thickly marked with black lines. Anther-connective long-produced, slender, pale-blue.

The Nile Rivers and tributaries south of Khartoum.

12. *MENISPERMACEAE*

Twining shrubs, with bitter roots. Leaves alternate, without stipules, usually simple, rarely 3-foliolate or palmately lobed and nerved. Inflorescences cymose, paniculate, in clusters, or rarely the flowers solitary, axillary, or borne on the older wood; flowers small, inconspicuously coloured, dioecious, actinomorphic. Sepals in 2-4 series, imbricate, the outer smaller. Petals usually smaller than the sepals, minute, or absent, free or united. Male flowers: stamens usually 6 or 3, or indefinite, free or variously united. Female flowers: staminodes present or absent; carpels 1 or several (usually 3 or 6), free, sessile; ovules 2, soon reduced to 1 by abortion. Fruiting-carpels drupaceous, often horseshoe-shaped.

A. Carpels 3 or more; leaves not peltate:

(a) Inflorescences simple, of axillary flowers or axillary clusters or capitula, never branched; leaves small, never lobed; stamens 6-9, free; carpels 3-6 ..... COCCULUS. 3.

(aa) Inflorescences of simple racemes (rarely slightly branched) or racemes of clusters:

(b) Stamens 6, free; flowers 2 or more in a cluster on the axis of the racemes; petals present ..... TINOSPORA. 7.

(bb) Stamens connate:

(c) Stamens 6:

(d) Petals present; flowers in clusters on the axis of the racemes ..... CHASMANTHERA. 1.

(dd) Petals absent; flowers solitary on the axis of the racemes ..... DIOSCOREOPHYLLUM. 5.

(cc) Stamens 3 ..... DESMONEMA. 4.

AA. Carpel solitary; leaves often peltate:

(e) Bracts minute, not enlarged in fruit; male sepals 6-8; petals free ..... STEPHANIA. 6.

(ee) Bracts conspicuous, membranous or leafy in fruit; male sepals 4; petals united into a tube ..... CISSAMPELOS. 2.

1. **CHASMANTHERA** Hochst.

Chasmanthera dependens Hochst. Fig. 14.

Twiner, with softly pubescent stems. Leaves broadly ovate-rotund, long-mucronate at the apex, widely cordate at the base, entire or shortly 3-7-lobed, up to 7¼ in. long and broad, thinly papery, thinly pilose on both surfaces, about 7-nerved at the base. Inflorescences very slender, drooping, axillary, pubescent, up to 8 in. long; flowers greenish-yellow. Fruiting-carpels scarlet, angular when dry, ellipsoid, about ½ in. long.

Southern Sudan.

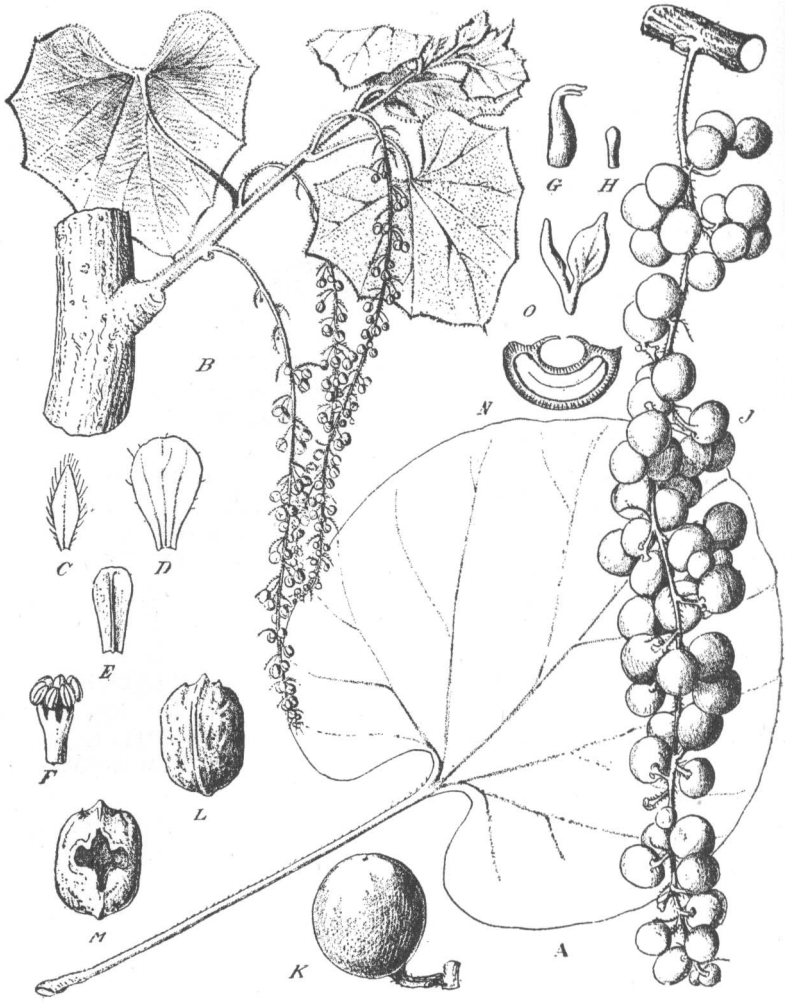


Fig. 14—CHASMANTHERA DEPENDENS Hochst.

A, leaf. B, branch with male flowers. C, D, E, sepals. **F**, stamens. **G**, carpel. **H**, staminode. J, fruiting branch. K, fruiting-carpel. L, M, seeds. N, transverse section of seed. O, embryo.

2. **CISSAMPELOS** L.

Cissampelos macrosepala Diels.

Low scrambling reddish-pubescent bush. Leaves peltate, up to 4¾ in. long and broad; petiole up to 5½ in. long. Inflorescences about 4 in. long.

Southern Sudan.

C. mucronata A. Rich.

C. pareira (non L.) Broun & Massey.

Twiner over shrubs, with a thickened root. Leaves not or only slightly peltate, entire, thickly papery, softly tomentose beneath, up to 3½ in. broad. Flowers greenish; male inflorescences short, corymbose; female inflorescences with small leafy bracts. Fruit red.

Central and Southern Sudan.

C. rigidifolia (Engler) Diels.

Climber. Leaves very broadly ovate, peltate, about 3 in. long, softly tomentose beneath. Flowers greenish, the male in long slender racemes of umbels.

Equatoria.

3. COCCULUS DC.

Cocculus pendulus (J. R. & G. Forst.) Diels. Fig. 15.

C. leaeba (Del.) DC.

Prostrate or straggling and climbing shrub; branches elongate, slender, glabrous. Leaves variable, ovate to lanceolate, entire or obscurely lobed, ½ to 1½ in. long, subglaucous, glabrous. Male flowers in axillary clusters. Female flowers solitary or paired. Fruiting-carpels red, subglobose, ¼ in. in diameter.

Widespread.

C. hirsutus (L.) Diels.

C. holopeira-torrida Broun & Massey.

Pubescent woody climber. Leaves very variable, from hastate-lanceolate to deltoid-rotundate or hastately 3-7-lobed, ¾-2 in. long, ⅓-1½ in. broad, more or less pilose or softly pubescent when young. Male flowers clustered, sessile or shortly pedicellate. Female flowers usually clustered or solitary, subsessile.

Central and Southern Sudan.

4. DESMONEMA Miers

Desmonema mucronulatum Engler.

Semi-woody climber. Leaves ovate-cordate, acuminate at the apex, up to 3½ in. long and broad and with a ¼-in. acumen. Male inflorescences 8 in. long with lateral branches 1½-2 in. long. Fruiting-carpels ovoid, nearly ¼ in. long.

Equatoria.

5. DIOSCOREOPHYLLUM Engler

Dioscoreophyllum sp.

Climber, with hairy stems. Flowers yellow.

Equatoria: Li Yubu, in gallery-forest.

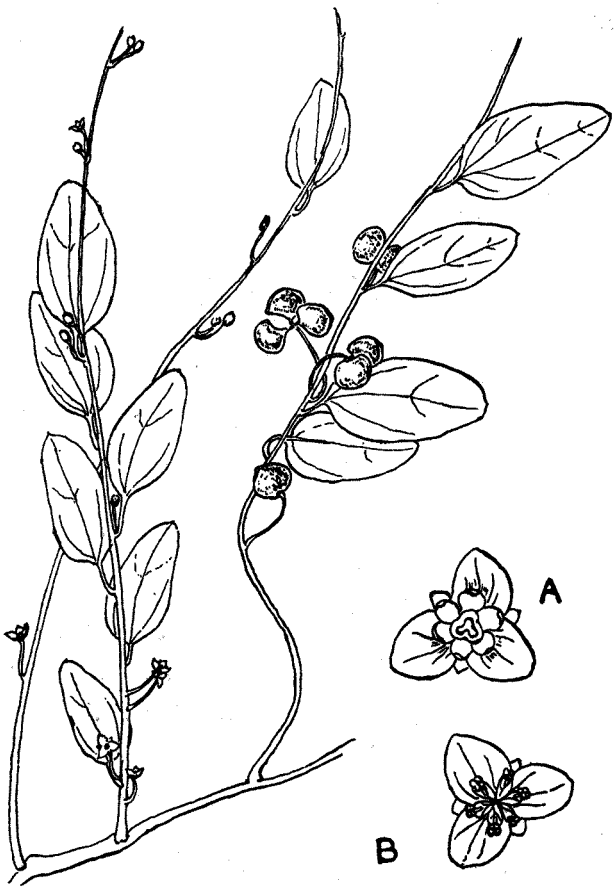


Fig. 15—COCCULUS PENDULUS (J. R. & G. Forst.) Diels.
A, female flower. B, male flower.

6. **STEPHANIA** Lour.

Stephania abyssinica (Dill. & Rich.) Walp.

Wiry climbing plant 6-30 ft. high. Leaves broadly ovate, peltate, rounded at the base, entire, glabrous, glaucous, strongly reticulate, up to 3½ in. long. Inflorescences up to 2½ in. long, axillary; flowers small, green.

Equatoria.

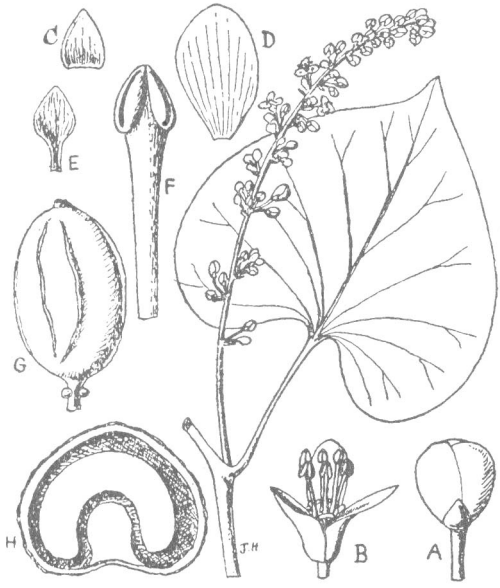


Fig. 16—TINOSPORA BAKIS (A. Rich.) Miers.

A, flower-bud. B, male flower. C, outer sepal. D, inner sepal. E, petal. F, stamen. G, fruiting-carpel. H, cross-section of same.

7. **TINOSPORA** Miers

Tinospora bakis (A. Rich.) Miers. Fig. 16.

Slender glabrous twiner, with thick fleshy bark. Leaves broadly ovate, shortly acuminate at the apex, widely cordate at the base, 2-3¼ in. long and broad, thinly papery, glabrous, digitately 7-nerved at the base; petiole 1¼-3¼ in. long, slender. Male inflorescences axillary, racemose, slender, up to 3½ in. long; pedicels clustered, up to ½ in. long; flowers about ½ in. in diameter.

Central Sudan.

13. *ARISTOLOCHIACEAE*

Climbing or trailing herbs or shrubs. Leaves alternate, petiolate, simple, without stipules, mostly entire. Flowers solitary or racemose, axillary or in clusters on the older wood, pedicellate, hermaphrodite, zygomorphic or rarely actinomorphic. Calyx often enlarged and petaloid, variously produced above the ovary, often tubular, the limb either

Fig. 17—ARISTOLOCHIA BRACTEOLATA Lam.

symmetrically 3-lobed or unilateral and entire or lobed, usually highly coloured and foetid. Petals absent. Stamens 6 or more, in 1-2 series round the apex of the ovary or stylar column; filaments short, thick, free or scarcely distinguishable from the column. Ovary inferior or rarely semi-superior, 4-6-locular or imperfectly divided; styles thick, short, united into a column divided into 3-8 stigmatic lobes; ovules numerous in each loculus. Fruit capsular or rarely indehiscent, sometimes dehiscing from the base upwards and hanging like an inverted parachute; seeds numerous, 3-sided or flattened.

A. Calyx-limb actinomorphic, 3-lobed; fruit elongated, indehiscent, strongly ribbed ..... PARARISTOLOCHIA. 2.

AA. Calyx-limb zygomorphic, often obliquely enlarged and petaloid, entire or unilaterally 1-3-lobed or tailed; fruit usually short and dehiscent ..... ARISTOLOCHIA. 1.

1. **ARISTOLOCHIA** L.

Aristolochia bracteolata Lam. Fig. 17.

A. bracteata Retz.

Trailing glaucous perennial herb or sometimes undershrub, glabrous except inside the perianth. Leaves alternate, ovate, subcordate at the base, crenulate-undulate, ¾-2 in. long. Flowers solitary, axillary, yellow-brown with a purple lip. Calyx-tube with short reflexed hairs inside, dilated and globose at the base, tubular above, about ½ in. long. Capsule subglobose, about ½ in. in diameter.

Widespread.

A. bongoensis Engler.

Glaucous twining herb. Leaves obtuse at the apex, cordate at the base, about 1½ in. long and broad; basal nerves about 8; petiole 1 in. long. Inflorescences elongated; bracts cordate-ovate, amplexicaul. Capsule obovoid, about 2 in. long, 1 in. in diameter.

Equatoria.

2. **PARARISTOLOCHIA** Hutch. & Dalziel

Pararistolochia triactina (Hook. f.) Hutch. & Dalziel. Fig. 18.

Woody climber 25 ft. or more long. Leaves shallowly 3-lobed, deeply cordate-auriculate at the base, 3-5 in. long and broad. Calyx-tube about 3¼ in. long, with a large pouch at the base; lobes red-purple, darker than the tube. Fruit indehiscent, elongate, cucumber-like, pendulous, about 10 in. long, 6-ribbed.

Equatoria.

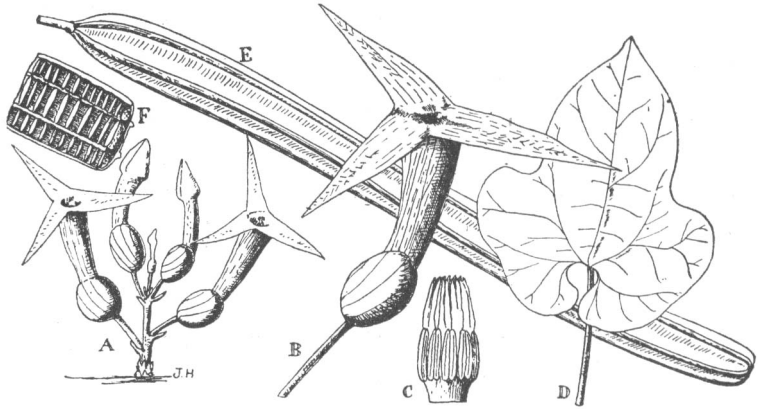


Fig. 18—PARARISTOLOCHIA TRIACTINA (Hook. f.) Hutch. & Dalziel. A, inflorescence. B, flower. C, anthers and stigmas. D, leaf. E, fruit. F, longitudinal section of portion of fruit.

14. *HYDNORACEAE*

Leafless fleshy purplish-brown fungus-like plants with fleshy warted subterranean rhizomes, parasitic on the roots of various trees and shrubs. Flowers large, arising singly from the rhizome, hermaphrodite, subsessile. Calyx very thick, valvately 3-4-lobed. Petals absent. Anthers numerous, sessile in a single or double series on the tube of the calyx. Ovary inferior, 1-locular, crowned by the sessile stigma; ovules very numerous on parietal or apical placentas.

1. **HYDNORA** Thunb.

Hydnora abyssinica A. Braun.

Parasitic on roots of *Acacia*; rhizome cylindric or slightly angular, pink inside, changing on exposure to red. Calyx wide-tubular; lobes 4, the lower third of the margin bearded. Androecium 4-lobed, inserted at the middle of the calyx-tube. Ovary subglobose, warted; stigma 4-lobed.

Central Sudan.

15. *PIPERACEAE*

Herbs or shrubs, erect or climbing. Leaves usually alternate, rarely opposite or whorled, entire, petiolate; stipules adnate to the petiole or absent. Flowers minute, hermaphrodite or unisexual, usually densely spicate. Perianth absent. Stamens 2-6, hypogynous. Ovary superior, 1-locular; stigmas 1-5; ovule 1. Fruit baccate, small.

A. Shrubs; stamens 2-6; stigmas 2-5; stipules adnate to the petiole; leaves alternate ..... PIPER. 2.

AA. Herbs; stamens 2; stigma single; stipules absent; leaves alternate or sometimes opposite or whorled ..... PEPEROMIA. 1.

1. **PEPEROMIA** Ruiz & Pav.

Peperomia reflexa (L. f.) A. Dietr.

Herb, occasionally epiphytic on trees; stems creeping, tufted, 3-6 in. long, once or twice dichotomously forked, tetragonal. Leaves usually 4 in a whorl, obovate, obtuse at the apex, ¼-½ in. long, bright-green. Spikes terminal, solitary, ½-1½ in. long. Fruit oblong, narrowed to a point, deeply immersed in the pits of the rhachis.

Equatoria: *Imatong Mountains, Itobol, in forest.*

P. bagroana C.DC.

Annual herb, with thread-like finely pubescent creeping stems. Leaves alternate, orbicular, about ½ in. broad, pilose on both surfaces, ciliate on the margin, rather rigid. Inflorescences terminal and axillary; bracts round, peltate, shortly stalked. Ovary deeply immersed in the pitted rhachis.

Equatoria: *near Iwatoka, in gallery-forest.*

P. knoblecheriana Schott.

Succulent glabrous annual herb 1-2 ft. high. Leaves (except the 2 lowest) alternate, rotundate-ovate, subcordate at the base, ⅓ in. long. Spikes solitary and terminal, lax, ¼ in. long; flowers 8-12. Fruit subglobose, minute, blackish.

Banks of the Bahr el Jebel (5°-7° *N.*).

P. holstii C.DC.

Herb, epiphytic on trees; stems creeping, rooting at the nodes. Leaves alternate, membranous, petiolate, elliptic-lanceolate to broadly ovate, obtusely acuminate at the apex, cuneate at the base, up to 2¾ in. long, 1½ in. broad, glabrous. Spikes solitary, terminal, up to 4 in. long.

Equatoria: *Imatong Mountains*, 6000-7000 ft.

2. **PIPER** L.

Piper umbellatum L. Fig. 19.

Shrub 4-6 ft. high, in moist shady places; branches jointed at the nodes. Leaves reniform, cuspidate at the apex, deeply cordate at the base, 3-12 in. broad; basal nerves 11-13; petiole sheathing at the base. Umbels of 2-7 spikes on short axillary peduncles. Stamens about 3. Stigmas 3. Fruit trigonous.

Equatoria.

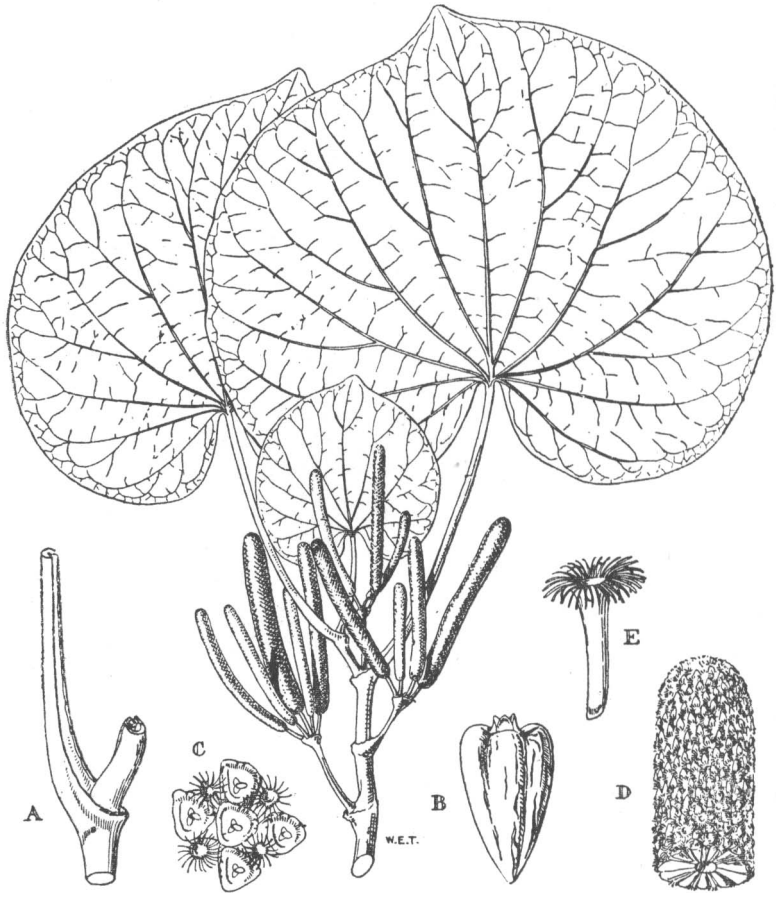


Fig. 19—PIPER UMBELLATUM L.
A, base of petiole. B, ovary. C, portion of spike showing flowers and bracts. D, portion of spike. E, bract.

P. capense L. f.

Shrub, erect or more or less climbing; branches swollen at the nodes. Leaves ovate, shortly acuminate at the apex, cordate or rounded at the base, about 4 in. long, pellucid-dotted, 5-7-nerved. Spikes solitary at the ends of short lateral branches, appearing to spring from the middle of the petioles, about 2 in. long; peduncle about ¾ in. long; bracts peltate. Stamens 2-3. Stigmas 2. Fruit obtuse, compressed, sessile.

Equatoria.

Fig. 20—PIPER GUINEENSE Schumach.
A, branch in fruit. B, part of spike with two female flowers and their bracts. C, longitudinal section of a female flower.

P. guineense Schumach. Fig. 20.

Climber 30-40 ft. long, on trees, climbing by means of densely hairy adventitious rootlets. Leaves ovate, acuminate at the apex, cordate to cuneate at the base, 4-5 in. long. Spikes solitary, leaf-opposed, in fruit up to 4 in. long. Stigmas 3. Fruit red or red-brown when ripe, black when dry, about $\frac{1}{8}$ in. in diameter.

Equatoria.

16. *PAPAVERACEAE*

Annual or perennial herbs or rarely shrubs, with coloured juice, often glaucescent and prickly; stock often a rhizome or tuber. Leaves alternate, much divided or rarely entire, without stipules. Flowers hermaphrodite, actinomorphic, hypogynous or rarely perigynous, usually solitary. Sepals 2 or rarely 3, green, falling off separately on the opening of the flower or united into a deciduous cap. Petals showy, 4-6 or rarely 8 or 12, free, imbricate and often crumpled in bud, deciduous. Stamens numerous, with thread-like filaments; anthers usually nearly as long as the filaments. Ovary superior, of 2 or more united carpels, 1-locular with parietal placentas or divided into several loculi by the placentas reaching to the middle; ovules numerous. Fruit a capsule, opening by valves or pores.

1. **ARGEMONE** L.

Argemone mexicana L. Mexican Poppy. Fig. 21.

Prickly glaucous erect herb, with yellow juice. Leaves semi-amplexicaul, pinnately lobed. Flowers bright-yellow. Petals 4-6. Stigmas radiating. Capsule smooth or setose, 1½-1½ in. long; seeds pitted, reticulate.

Northern Sudan. Introduced into Africa from America and now naturalized.

17. *FUMARIACEAE*

Delicate glabrous herbs. Leaves much divided into distinct segments, without stipules. Flowers zygomorphic. Sepals 2, small. Petals 4 in 2 pairs, the 2 outer larger and one or both spurred or gibbous, the 2 inner narrow with their crested tips united over the stigma. Stamens 6, hypogynous. Ovary superior, 1-locular with 2 parietal placentas and 1 or more ovules. Fruit a capsule or nut.

1. **FUMARIA** L.

Fumaria officinalis L.

Pale-green annual herb, with weak trailing stems 1-3 ft. long. Flowers in racemes of 1-2 in. either terminal or leaf-opposed. Sepals small, white. Petals white to rose or purple.

White Nile District. Possibly introduced, or wrongly identified.

Fig. 21—ARGEMONE MEXICANA L.

Fig. 22—WORMSKIOLDIA LOBATA Urb.

A, whole plant. B, longitudinal section of flower. C, transverse section of ovary. D, seed. E, longitudinal section of seed.

18. *TURNERACEAE*

Herbs or undershrubs. Leaves alternate, entire or lobed, without stipules. Flowers hermaphrodite, actinomorphic, yellowish. Calyx tubular, 5-toothed, the teeth imbricate. Petals 5, free, inserted on the calyx-tube. Ovary superior, 1-locular with 3 parietal placentas; styles 3; stigmas fringed; ovules numerous. Fruit a capsule, opening loculicidally by 3 valves; seeds arillate, pitted.

1. **WORMSKIOLDIA** Thonn.

Wormskioldia lobata Urb. Fig. 22.

Herb 18 in. high; stems not bristly. Leaves lanceolate or oblong-lanceolate, 2½-4½ in. long. Flowers pale-yellow. Petals clawed. Stamens 5, unequal. Capsule linear, almost moniliform.

Southern Sudan.

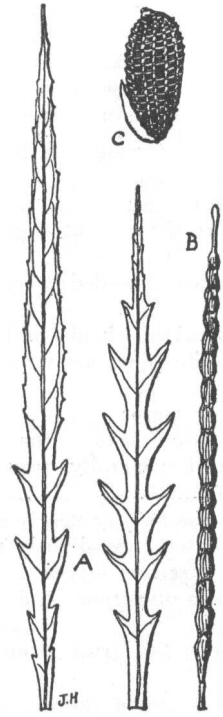


Fig. 23—WORMSKIOLDIA PILOSA (Willd.) Schweinf. ex Urb.
A, leaves. B, fruit. C, seed.

W. pilosa (Willd.) Schweinf. ex Urb. Fig. 23.

Branched herb about 1 ft. high; stems with numerous purplish bristles. Leaves linear or linear-lanceolate, entire or denticulate or pinnatilobed, up to 7¼ in. long. Peduncles axillary, about 5-flowered; flowers yellow. Capsule slender, slightly torulose, about 2 in. long, shortly stipitate, beaked; seeds about 20, straw-coloured, conspicuously pitted.

Central and Southern Sudan.

19. *CAPPARIDACEAE*

Herbs, shrubs or trees, sometimes climbing. Leaves alternate or rarely opposite, simple or digitately 3-7-foliolate; stipules when present minute or spiny. Flowers mostly hermaphrodite, actinomorphic or rarely zygomorphic, hypogynous, axillary or terminal, variously arranged. Sepals free or partially united, imbricate or valvate, usually 4. Petals 4 to many or fewer or absent, free. Torus short or more or less elongated into a gynophore. Stamens few to many, free or attached to the gynophore, sometimes some of them without anthers; anthers 2-locular, longitudinally dehiscent. Ovary superior, sessile or more usually supported on a long or short gynophore, 1-locular with parietal placentas or divided into 2 or more loculi by spurious division; ovules few to many. Fruit a capsule or berry or winged and indehiscent, sometimes elongate or torulose; seeds usually reniform or angular.

A. Fruit a capsule, splitting through its full length into 2 valves; mostly herbaceous annuals:
  (a) Stamens free, 4 to numerous ..... CLEOME. 4.
  (aa) Stamens attached to the elongated gynophore, usually 6 ..... GYNANDROPSIS. 8.

AA. Fruit indehiscent, winged, 1-seeded; shrubby herbs ..... DIPTERYGIUM. 7.

AAA. Fruit a berry, often torulose; shrubs or trees or rarely plants in which the branches die down after flowering but leave a more or less perennial base:
  (b) Petals present, 1 or more:
    (c) Sepals united into a tube at the base, valvate in a single series; fruit generally torulose; leaves simple or 3-foliolate ..... MAERUA. 9.
    (cc) Sepals free to the base or nearly so, or if in 2 series then only the outer ones slightly united:
      (d) Sepals in 2 series; leaves simple:
        (e) Stamens numerous; fruit not torulose ..... CAPPARIS. 3.
        (ee) Stamens 4-8; fruit often subtorulose ..... CADABA. 2.
      (dd) Sepals in a single series, imbricate; leaves 3-foliolate ..... CRATEVA. 6.
      (ddd) Sepals in a single series, valvate; leaves 3-5-foliolate ..... RITCHIEA. 10.

(bb) Petals absent:
(f) Fruit torulose; seeds numerous ..... MAERUA. 9.
(ff) Fruit globose; seeds few:
(g) Flowers racemose or subpaniculate; ovary 1-locular ... BOSCIA. 1.
(gg) Flowers solitary, axillary; ovary 2-3-locular ..... COURBONIA. 5.

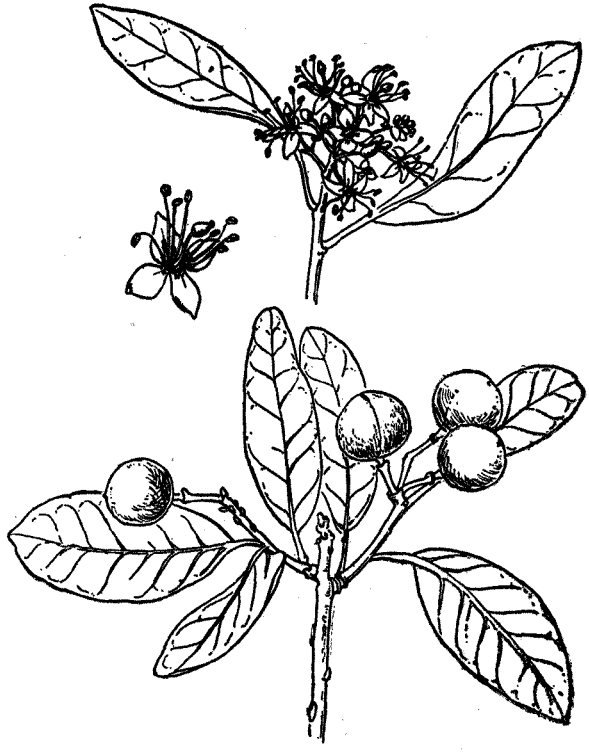


Fig. 24—BOSCIA SENEGALENSIS (Pers.) Lam. ex Poir.

1. **BOSCIA** Lam.

Boscia senegalensis (Pers.) Lam. ex Poir. Fig. 24.
B. octandra Hochst. ex Radlk.

Shrub or small tree. Leaves elliptic or ovate-elliptic, obtuse or mucronate at the apex, up to 3½ (or very rarely 5½) in. long and 1½ in. broad, glabrous or more usually finely pubescent, with about 5-6 lateral nerves raised on both surfaces and prominently looped. Inflorescences accompanied by the leaves, short, crowded, corymbose; flowers scented. Fruit globose, up to ½ in. in diameter, warted, edible.

Widely distributed south of 16° N.

Fig. 25—BOSCIA SALICIFOLIA Oliv.

B. salicifolia Oliv. Fig. 25.

Tree up to 40 ft. high, with graceful drooping foliage. Leaves elongate-lanceolate or linear, willow-like, very acute at the apex, up to 4¾ in. long, ½ in. broad, the midrib prominent beneath and often straw-coloured. Inflorescences usually leafless, densely racemose, shortly tomentose. Fruit smooth and shining, up to ¾ in. in diameter, shortly stipitate.

Central and Southern Sudan.

B. angustifolia A. Rich. **Fig. 26.**

Shrub or small tree, with glabrous branches. Leaves shortly lanceolate or oblong-lanceolate, mucronate to retuse at the apex, up to 2 in. long and ½ in. broad, very finely and closely reticulate, glabrous. Inflorescences accompanied by the leaves, shortly racemose, terminating short leafy branches; flowers greenish, fragrant. Fruit pitted and wrinkled, globose, up to ¾ in. in diameter.

Central and Southern Sudan.

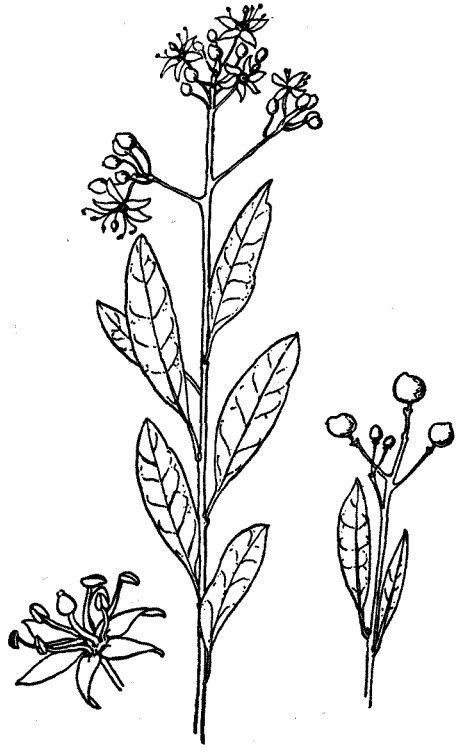


Fig. 26—BOSCIA ANGUSTIFOLIA A. Rich.

B. firma Radlk.

Shrub. Leaves crowded, clustered, narrowly oblong-elliptic, 1½ in. long, ½ in. broad, very strongly reticulate beneath. Racemes very short. Fruit subglobose, very small.

Central Sudan.

2. **CADABA** Forsk.

Cadaba glandulosa Forsk. Fig. 27.

Low much-branched shrub. Leaves more or less orbicular, up to 1½ in. broad, closely packed on the branches and (like the latter) glandular-setose, distinctly petiolate. Petal 1, clawed, oblong, about ⅔ in. long. Fruit about ½ in. long, glandular-bristly.

Throughout the Northern and Central Sudan.

Fig. 27—CADABA GLANDULOSA Forsk.

C. farinosa Forsk. **Fig. 28.**

Hoary shrub, branched from the base, erect or scrambling amongst other shrubs or trees. Leaves oblong or elliptic, up to 1 in. long and ½ in. broad, often in clusters and (like the branchlets) mealy-puberulous, very shortly petiolate. Petals 4, greenish, clawed, linear or narrowly elliptic. Fruit subtorulose, 1½-2½ in. long, with a bright-orange inner membrane covering the seeds.

Northern and Central Sudan.

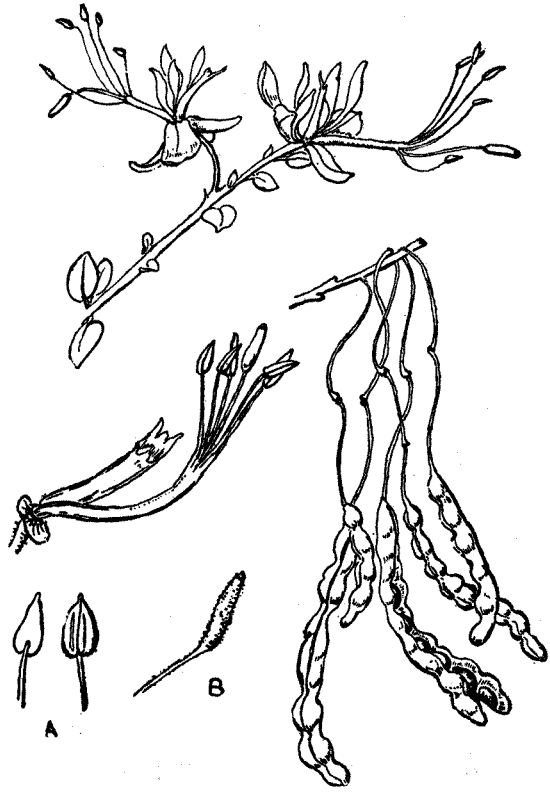


Fig. 28—CADABA FARINOSA Forsk.
A, stamens. B, pistil.

C. rotundifolia Forsk. Fig. 29.

Shrub. Leaves coriaceous, orbicular, glabrous, about 1½ in. broad. Flowers in terminal racemes. Petal 1, green with a yellow tubular nectary. Stamens 5. Fruit linear, about 1½ in. long.

Northern and Central Sudan.

Fig. 29—CADABA ROTUNDIFOLIA Forsk.

C. longifolia DC. Fig. 30.

Shrub, glabrous or with the extremities mealy. Leaves rather coriaceous, linear-oblong or lanceolate or elongate-elliptic, rather obtuse or subacute at the apex, 1-2½ in. long, up to ½ in. broad. Flowers in short terminal corymbs. Petals 4, narrow-elliptic or lanceolate, with long claws rather exceeding the sepals. Stamens 4. Ovary minutely glandular, 2-locular or at least partially so. *Red Sea District.*

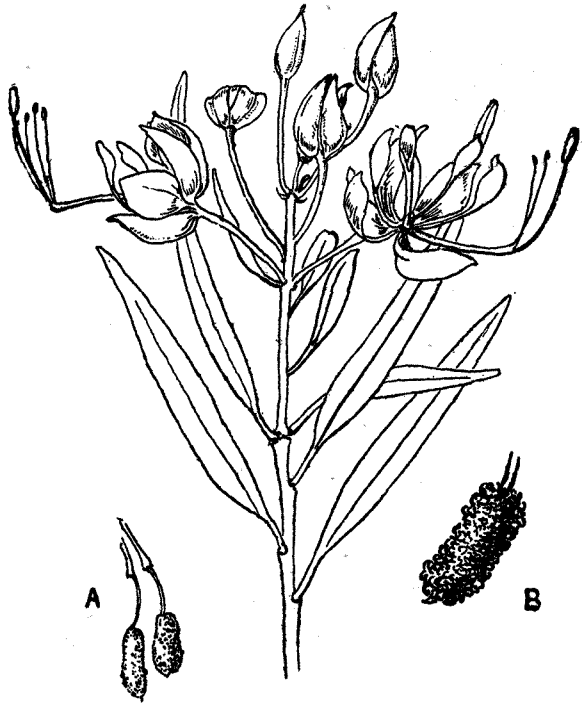


Fig. 30—CADABA LONGIFOLIA DC.
A, fruits. B, fruit (magnified).

3. CAPPARIS L.

A. Extremities usually armed with short stipular spines:
(a) Sepals equal or nearly equal in length, the two outer sometimes broader or more deeply concave:
(b) Plant leafless at time of flowering ..... *C. decidua.*
(bb) Plant leafy at time of flowering:
(c) Leaves orbicular ..... *C. spinosa.*
(cc) Leaves ovate to orbicular with a curved stiff point; anterior sepal helmet-shaped ..... *C. galeata.*

(ccc) Leaves ovate to ovate-oblong or elliptic:
(d) Sepals usually tomentose or pubescent outside:
(e) Flowers about 1¼ in. or more long ..... *C. tomentosa.*
(ee) Flowers about ½ in. long ..... *C. rothii.*
(dd) Sepals glabrous outside:
(f) Flowers about ½ in. long; pedicels more than ½ in. long ..... *C. corymbosa.*
(ff) Flowers more than ½ in. long; pedicels less than ½ in. long ..... *C. djurica.*
(cccc) Leaves oblong-lanceolate, obtuse and emarginate, glaucescent; flowers small ..... *C. micrantha.*
(aa) Two outer sepals much shorter than the two inner (which are petaloid) after expansion; leaves more or less rhomboid-elliptic ..... *C. erythrocarpos.*
AA. Extremities without short stipular spines; leaves obovate to oblong-oblanceolate ..... *C. duchesnei.*

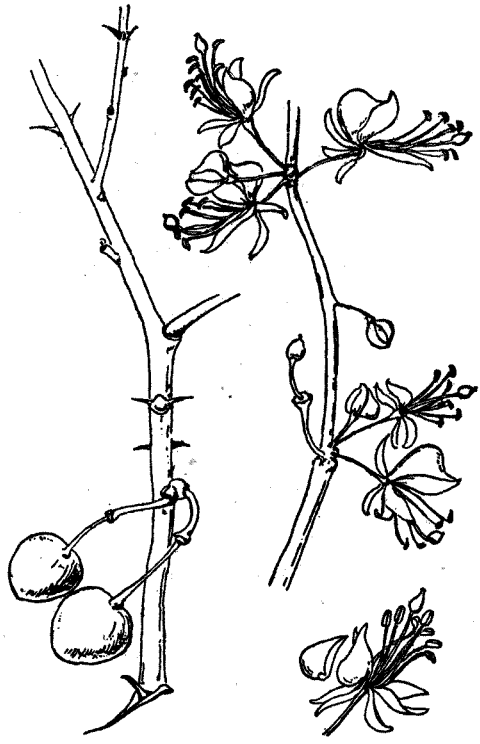


Fig. 31—CAPPARIS DECIDUA (Forsk.) Edgew.

Capparis decidua (Forsk.) Edgew. **Fig. 31.**

C. aphylla Heyne ex Roth.

Shrub or small tree of dry regions, much branched, glabrous, often leafless except on young shoots and barren branches. Flowers pink. Fruit as large as a small cherry, edible.

Widely distributed except in the extreme south.

C. spinosa L. Caper-bush. **Fig. 32.**

Trailing shrub, with recurved or nearly straight stipular spines. Leaves coriaceous, pale-green or glaucescent, ½-1½ in. broad. Flowers white, 1-3 in. in diameter, axillary, solitary or in loose unilateral leafy racemes. Fruit ellipsoid-oblong, on a strong gynophore.

Kordofan.

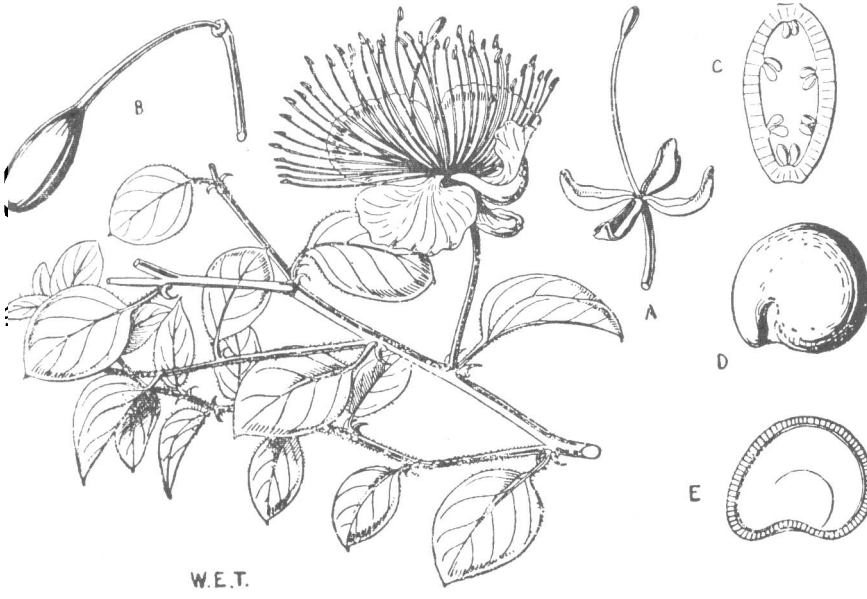


Fig. 32—CAPPARIS SPINOSA L.

A, calyx with stipitate ovary. B, fruit. C, ovary in section. D, seed. E, seed in section.

C. galeata Fresen.

Glaucous diffuse trailing shrub up to 6 ft. high; bark light-green. Leaves cartilaginous, 1-3 in. long, ¾-2 in. broad. Flowers white, large, axillary, solitary. Fruit somewhat pear-shaped, 3-4 in. long, on a gynophore up to 2 in. long.

Northern Sudan.

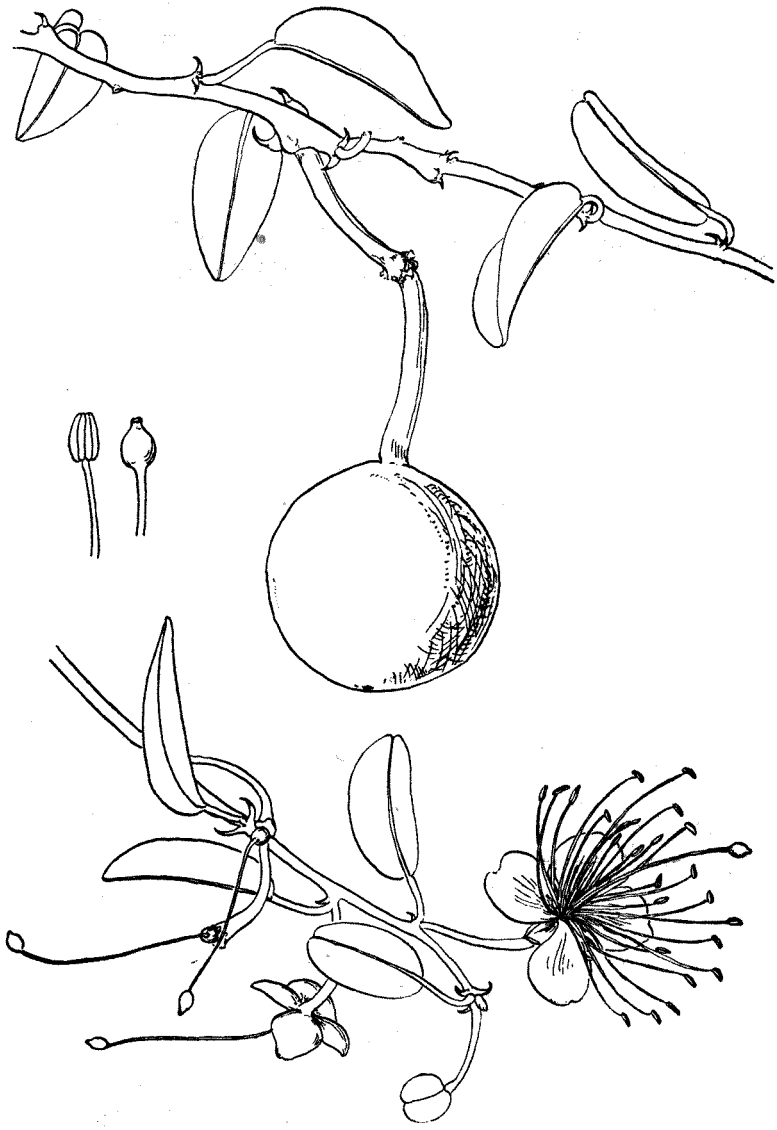


Fig. 33—CAPPARIS TOMENTOSA Lam.

C. tomentosa Lam. **Fig. 33.**

C. persicifolia A. Rich.

Climbing shrub. Leaves elliptic, velvety. Flowers white, sweet-scented, about 1¼ in. or more long, solitary and axillary or in terminal racemes and corymbs. Stamens numerous, pink. Fruit orange-red, globose, 1-2 in. in diameter.

Widely distributed in the Northern and Central Sudan.

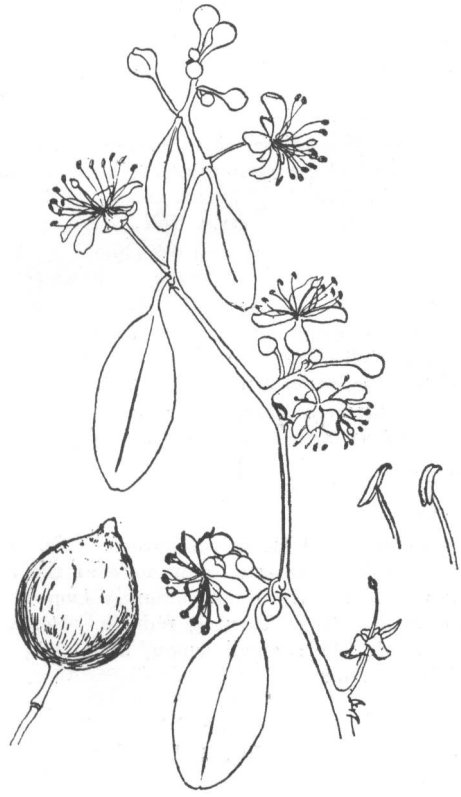


Fig. 34—CAPPARIS ROTHII Oliv.

C. rothii Oliv. **Fig. 34.**

C. jodotricha Gilg & Bened.

Scrambling shrub. Flowers about 4 in a cluster. Calyx shortly silky-pubescent. Fruit about 1½ in. in diameter, orange when ripe.

Southern Sudan.

C. corymbosa Lam.

Scrambling shrub. Leaves 1¼-2 in. long, more or less tomentose, with a prominent midrib. Flowers white, fragrant, about ½ in. long, clustered at the ends of short shoots. Fruit globose, yellow.
Central Sudan.

C. djurica Gilg & Bened.

Shrub, with densely pilose branches. Leaves ovate or ovate-oblong, emarginate at the apex, about 1¼ in. long and ½ in. broad. Flowers in rather dense racemes. Sepals glabrous. Fruit globose, about ½ in. in diameter.
Equatoria.

C. micrantha A. Rich.

Straggling shrub, with pilose branchlets. Leaves elongate, oblong-lanceolate, obtuse and emarginate at the apex, obtuse at the base, 2 in. long, ¾-1½ in. broad. Flowers small, white. Sepals deeply concave, glabrous. Fruit green, edible.
Southern Sudan.

C. erythrocarpos Isert.

Shrub, usually climbing, or sometimes a small tree. Leaves more or less rhomboid-elliptic, pointed at the apex, 1¼-3¼ in. long. Flowers axillary, solitary, 2 in. in diameter, white, often pink at the base of the stamens. Anthers slate-coloured. Fruit scarlet, hexagonal, about as large as a walnut, edible, tasteless.
Equatoria.

C. duchesnei De Wild.

Shrub or small tree, with smooth red-brown bark. Leaves shining, obovate to oblong-oblanceolate, acuminate at the apex, 3¼-4¾ in. long, 1¼-2 in. broad, with 10 prominently looped lateral nerves. Flowers white, sometimes turning reddish. Petals shorter than the sepals. Fruit like a small lemon, hard, 1-1½ in. long, on a gynophore 1½-2 in. long.
Equatoria.

4. CLEOME L.

A. Leaves simple:

B. Stamens 4-6:

(a) Leaves ovate to orbicular, up to 1 in. long, setose-pilose, the marginal hairs gland-tipped; capsule sickle-shaped, slightly recurved, about 1 in. long ..... *C. scaposa.*

(aa) Leaves broadly ovate-orbicular, up to ½ in. broad, hispid-setose; capsule ellipsoid, up to ½ in. long ..... *C. droserifolia.*

(aaa) Leaves lanceolate or linear-lanceolate, up to 2½ in. long, setulose on the nerves beneath; capsule nearly

straight, ascending, about 2½ in. long, strigose-pubescent ..... *C. monophylla.*

BB. Stamens 10-14; leaves oblong to orbicular-ovate, about ½ in. long ..... *C. chrysantha.*

AA. Leaves (at least some of them) digitately compound:

C. Anther-bearing stamens about 6 or fewer:

(b) Capsule sessile or subsessile:

(c) Leaflets usually oblanceolate or linear; seeds cottony-pilose ..... *C. arabica.*

(cc) Leaflets 3, oblanceolate or oblong; seeds nearly smooth ..... *C. brachycarpa.*

(ccc) Leaflets and branches filiform ..... *C. tenella.*

(bb) Capsule distinctly stipitate:

(d) Leaflets linear-lanceolate; capsule linear, about 4¾ in. long; seeds shortly pilose ..... *C. paradoxa.*

(dd) Leaflets very narrow-linear; capsule narrow-linear, 2-3 in. long; seeds pitted, shortly hairy ..... *C. diandra.*

(ddd) Leaflets oblong; capsule broadly linear, about 2½ in. long; seeds cottony-pilose ..... *C. schweinfurthii.*

(dddd) Leaflets obovate or obovate-oblong to rhomboid, about 1¼ in. long, ⅓ in. broad ... *C. coeruleo-rosea.*

CC. Anther-bearing stamens 8-20:

(e) Capsule sessile; plant glandular-pubescent; leaflets 3-6 (often 5), obovate to lanceolate ..... *C. viscosa.*

(ee) Capsule distinctly stipitate:

(f) Leaflets 3-5, obovate, rounded or obtuse at the apex, glandular-pilose; capsule 2-2½ in. long, striate, glandular-puberulous; flowers up to ¾ in. long ... *C. foliosa.*

(ff) Leaflets usually 3, ovate-lanceolate, acute at the apex; capsule 1½-2¼ in. long, striately nerved, glabrous ..... *C. ciliata.*

(fff) Leaflets 3, linear; capsule 1¼-2¼ in. long; erect herb 1-2 ft. high ..... *C. polyanthera.*

(ffff) Leaflets 3, filiform; capsule up to 1 in. long; low herb up to 7 in. high ..... *C. niamniamensis.*

(fffff) Leaflets 5, elliptic-lanceolate; capsule 3½ in. long ..... *C. hanburyana.*

Cleome scaposa DC.

Erect slender branched herb, roughly setose. Flowers pink. Stamens 6. Seeds minutely pitted.

Generally distributed.

C. droserifolia (Forsk.) Del.

Low much-branched shrubby glandular-hispid herb 3-10 in. high. Flowers axillary, pedicellate. Stamens 4. Capsule with setose-hispid concave valves.

North-eastern Sudan.

C. monophylla L.

Erect herb, branching up to 2 ft. Flowers white to pink and deep-violet.

Central and Southern Sudan.

C. chrysantha Decne.

Aromatic herb up to 18 in. high, sometimes flowering as a seedling of 1-2 in. Flowers in the axils of the upper leaves. Capsule ellipsoid-oblong, about ¼ in. long.

Northern Sudan.

C. arabica L.

Erect herb, rough to the touch, with a disagreeable smell. Lower leaves 3-foliolate. Capsule linear-ellipsoid, often pendulous.

Northern Sudan.

C. brachycarpa Vahl ex DC.

Low diffuse herb 4-8 in. high, with numerous branches from a woody rhizome. Leaflets up to ¾ in. long. Pedicels slender, up to ½ in. long in fruit. Capsule ellipsoid, ½ in. long, capped by the slender style.

Northern Sudan.

C. tenella L. f.

Erect herb 1-2 ft. high, glabrous, glaucescent, with abundant forking branching. Flowers about ½ in. long. Capsule linear, 1-2 in. long.

Central Sudan.

C. paradoxa R. Br. ex DC. Fig. 35.

Shrubby herb 2-3 ft. high. Leaves 3-6-foliolate. Flowers conspicuous, bright-yellow or rose, 1¼ in. long.

Northern and Central Sudan.

C. diandra Burch.

Erect herb up to 3 ft. high, sometimes woody below, simple or branched, glabrous or thinly glandular, sometimes glaucous. Leaflets 3-7. Perfect stamens 2.

Central Sudan.

C. schweinfurthii Gilg.

Erect herb; stems like the petioles pilose-glandular. Leaves 3-foliolate; leaflets sessile or very shortly petiolate, oblong, entire, up to 1½ in. long, subglabrous on both surfaces, the margin laxly and minutely glandular-pilose. Flowers yellow with purple lines, unpleasant-smelling, axillary and arranged towards the ends of the stems. Capsule deflexed, about 2½ in. long, shortly stipitate, glandular but glabrous when mature.

Red Sea Hills: Erkowit.

Fig. 35—CLEOME PARADOXA R. Br. ex DC.
A seed.

C. coeruleo-rosea Gilg & Bened.

Strong-smelling annual herb up to 15 in. high. Flowers mauve. Capsule 1½-1¾ in. long.

Upper Nile Province: *Pibor River.*

C. viscosa L.

Erect herb 1-2 ft. high. Leaflets about 1¼ in. long. Flowers yellow; pedicels up to 2½ in. long. Capsule about 3½ in. long.

Northern and Central Sudan.

C. foliosa Hook. f.

Branched herb 1 ft. or more high, erect from a woody sometimes prostrate stem. Flowers rose.

Southern Sudan: *Meshra Zeraf.*

C. ciliata Schumach.

Weed of waste places and cultivated fields, 2-3 ft. high, suffrutescent. Flowers white or lilac or pink, about ¼ in. long.

Equatoria.

C. polyanthera Schweinf. & Gilg.

Erect slender branched herb 1-2 ft. high, somewhat glandular. Flowers pink or white or purplish, up to ½ in. long, in lax racemes; pedicels very slender.

Southern Sudan.

C. niamniamensis Schweinf. & Gilg.

Low lax herb up to 7 in. high. Flowers small, subsolitary, white. Capsule up to 1 in. long.

Equatoria.

C. hanburyana Penzig.

Rank herb; stems covered with glandular hairs. Leaves glabrescent, gradually merging into the bracts. Flowers pink, racemose-corymbose. Capsule glandular-puberulous.

Red Sea District: between sea-level and 3-4000 ft.

5. **COURBONIA** Brongn.

Courbonia virgata Brongn.

Glabrous glaucous small shrub, with tuberous root and twiggy leafy branches. Leaves narrowly elliptic or lanceolate, acute at the apex, coriaceous, ¾-1½ in. long, up to ¼ in. broad; petiole 1/12 in. long. Flowers numerous, axillary, solitary. Fruit globose, about 1 in. in diameter.

Generally distributed.

6. **CRATEVA** L.

Crateva adansonii DC. Fig. 36.

Small to medium-sized tree up to 30 ft. high, with a loose crown and light-grey smooth bark. Leaves 3-foliolate; leaflets ovate-lanceolate, acutely long-acuminate at the apex, about 3½ or rarely up to 4½ in. long, 1¼-2 in. broad, thinly papery, glabrous. Flowers white, scented, with the stamens and sometimes the tips of the petals lilac. Fruit subglobose, about 2 in. in diameter, on a long stout gynophore.

Generally distributed south of 14° N.

Fig. 36—CRATEVA ADANSONII DC.
A, calyx. B, seed.

7. **DIPTERYGIUM** Decne.

Dipterygium glaucum Decne. Fig. 37.

Shrubby herb, with numerous straight rigid branches, glabrous or glandular-scabrid. Leaves oblong or ovate, up to ½ in. long, glabrous or rough with glands. Flowers yellow, in narrow small rather distant-flowered bracteolate racemes. Fruit elliptic, with a membranous wing, 1-seeded, strongly net-veined.

Northern Sudan.

Fig. 37—DIPTERYGIUM GLAUCUM Decne.

8. **GYNANDROPSIS** DC.

Gynandropsis gynandra (L.) Briq. Fig. 38.

Erect herb up to 2 ft. high. Leaves 5-foliolate. Flowers white or purplish. Stamens long, attached to the gynophore. Capsule linear, slightly curved, 2-3 in. long.

Widespread: a weed of waste places and fields.

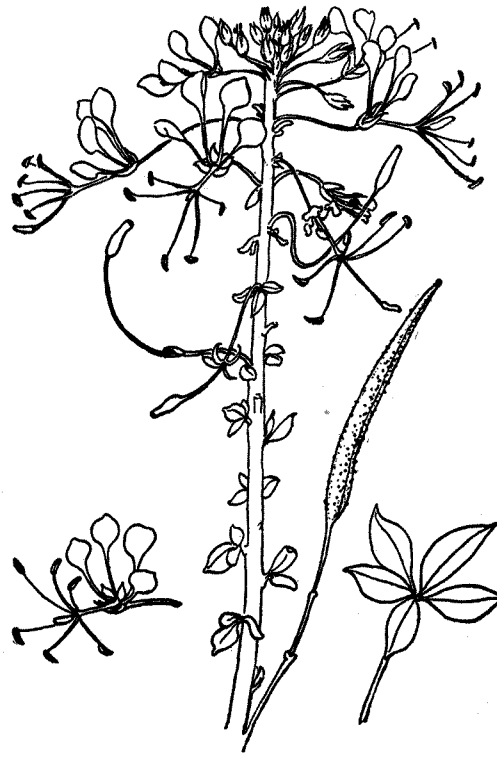


Fig. 38—GYNANDROPSIS GYNANDRA (L.) Briq.

9. **MAERUA** Forsk.

A. Leaves (at least some of them) 3-foliolate:
  (a) Leaves glabrous ..... *M. jasminifolia.*
  (aa) Leaves pubescent ..... *M. triphylla.*

AA. Leaves simple:
  (b) Leaves very small (up to ¾ in. long), in clusters:
    (c) Flowers ½ in. long; stamens more than ½ in. long; shrub ..... *M. harmsiana.*
    (cc) Flowers ¼ in. long; stamens up to ½ in. long; tree ..... *M. crassifolia.*
  (bb) Leaves larger, never clustered:
    (d) Fruit subglobose ..... *M. aethiopica.*
    (dd) Fruit more or less elongated:
      (e) Leaves with a petiole ½-1 in. long ... *M. angolensis.*
      (ee) Leaves with a very short petiole:
        (f) Flowers in elongated many-flowered lax racemes:
          (g) Flowers small; stamens up to ½ in. long ..... *M. virgata.*
          (gg) Flowers larger; stamens ¾-1 in. long ..... *M. dolichobotrys.*
        (ff) Flowers in short few-flowered racemes ..... *M. oblongifolia.*

Maerua jasminifolia Gilg & Bened.

Shrub about 2 ft. high. Leaves 3-foliolate or simple towards the ends of the branches, ovate-oblong, acute at the apex. Flowers greenish-white. Fruit oblong or rarely globose-oblong, up to ½ in. long.

Equatoria.

M. triphylla A. Rich.

M. variifolia Gilg & Bened.

Shrub; branchlets softly pubescent. Leaves 3-foliolate; leaflets elliptic, fine-pointed at the apex, 1½ in. long, softly pubescent. Flowers subcorymbose; pedicels ¾ in. long. Petals small, with crinkled margins. Fruit torulose, about 1 in. long.

Southern Sudan.

M. harmsiana Gilg.

Grey-tomentose shrub. Leaves ovate-oblong, rounded at the apex, up to ½ in. long, coriaceous. Flowers axillary, solitary, ¼ in. long; peduncle and calyx hispid or pubescent.

Equatoria: near Aweil.

M. crassifolia Forsk.

Tree up to 20 ft. high, often with twisted branches and smooth grey bark; crown usually rounded. Leaves elliptic to ovate-lanceolate, rounded or emarginate at the apex, cuneate at the base, ¼-¾ in. long, ⅓ in. broad; petiole very short. Flowers green or white, sweet-scented. Stamens white. Fruit up to 3 in. long, containing up to 10 seeds; gynophore ½ in. long or less.

Northern and Central Sudan: in very dry savannah.

M. aethiopica (Fenzl) Oliv.

Twiggy shrub. Leaves lanceolate-oblong to elliptic, glabrous except on the midrib above, the larger 3-4 in. long. Flowers corymbose in lax leafy panicles; pedicels and calyx densely hairy. Petals 4, roundish. Stamens numerous, 2-2½ times longer than the calyx. Fruit coriaceous, subglobose.

Central and Southern Sudan.

Fig. 39—MAERUA ANGOLENSIS DC.

M. angolensis DC. Fig. 39.

Savannah shrub or tree usually less than 15 ft. high but occasionally attaining 30 ft.; bark dark-grey, smooth; branchlets spotted with small white dots. Leaves very variable in size and shape, usually elliptic to ovate-lanceolate, rounded or emarginate and usually mucronate at the apex, 1-2½ in. long, ½-1½ in. broad; petiole ½-1 in. long. Flowers in leafy corymbose racemes; pedicels thick, less than ½ in. long. Calyx-lobes 4, reflexed, about ½ in. long; tube ½ as long as the lobes. Stamens numerous, white, about 1 in. long. Fruit yellow, elongate, up to 10 in. long, moniliform, containing up to 40 seeds; gynophore 1-3 in. long.

Widespread.

M. virgata Gilg.

Low twiggy shrub. Leaves lanceolate to oblong-lanceolate, 1½-2¾ in. long. Flowers axillary, small. Fruit torulose, about 1 in. long and ⅓ in. thick.

Central Sudan.

M. dolichobotrys Gilg & Bened.

Woody shrub 3 ft. high. Leaves lanceolate or oblong-lanceolate, about 2 in. long, ⅓ in. broad, glabrous. Flowers in elongate leafy racemes. Petals shortly clawed, rather thick. Fruit very small, cylindric.

White Nile District.

M. oblongifolia (Forsk.) A. Rich.

Low straggling shrub. Leaves linear-oblong, up to 3¼ in. long and ⅓ in. broad. Flowers fragrant. Calyx-lobes 4, pale-green. Petals 4, whitish-green. Gynophore white. Fruit about 1 in. long, very torulose or moniliform, edible.

Widespread.

10. **RITCHIEA** R. Br.

Ritchiea pentaphylla Gilg & Bened.

Shrub or small tree. Leaves mostly 5-foliolate; leaflets oblong-lanceolate, acutely acuminate at the apex, gradually narrowed to the base, 4-8 in. long, 2-3½ in. broad. Inflorescences very many-flowered, the pedicels closely arranged on the axis and leaving conspicuous and numerous scars. Petals 2½ in. long. Stamens numerous, 2-2½ in. long.

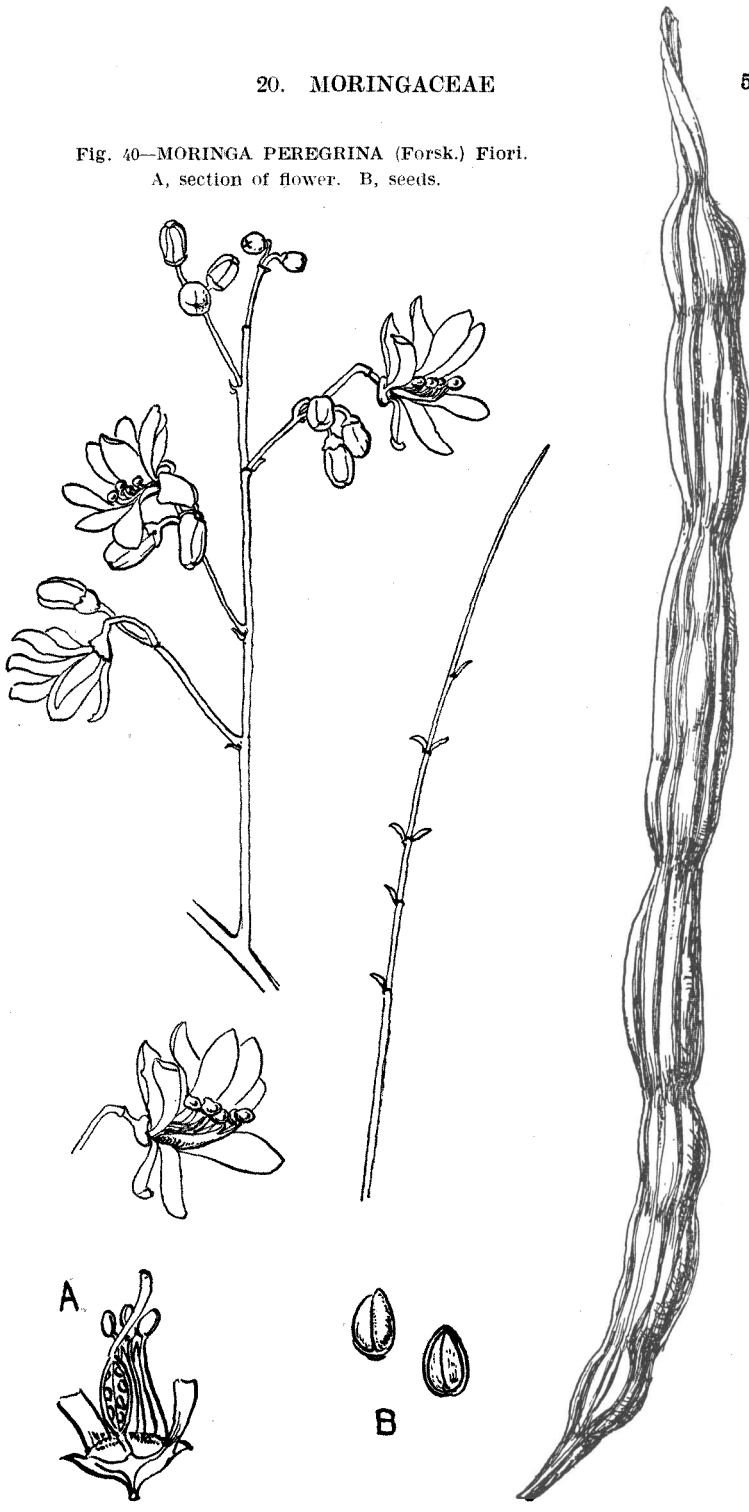
Equatoria: Imatong Mountains.

R. albersii Gilg.

Forest shrub or tree up to 20 ft. high. Leaves usually 3-foliolate; leaflets narrowly elliptic to obovate-oblong, up to 6 in. long and 2 in. broad, with a very short petiolule; petiole up to 3 in. long. Flowers large, in few-flowered terminal corymbs. Petals greenish-white, 1 in. long. Stamens numerous, white, 1¼ in. long. Fruit green, plum-like, on a long gynophore.

Equatoria: Imatong Mountains.

Fig. 40—MORINGA PEREGRINA (Forsk.) Fiori.
A, section of flower. B, seeds.



20. *MORINGACEAE*

Trees, with gummy bark. Leaves alternate, 2-3-pinnate, the pinnae opposite. Flowers in axillary panicles, hermaphrodite, zygomorphic. Calyx-tube short, with 5 unequal spreading or reflexed imbricate lobes. Petals 5, free. Disk lining the calyx-tube, with a short free margin. Stamens inserted on the margin of the disk, 5 perfect alternating with 5 staminodes. Ovary superior, stipitate, terete, 1-locular with 3 parietal placentas; style 1; ovules numerous in 2 series on each placenta. Fruit capsular, long, beaked, 3-6-angled, torulose, 3-valved; seeds 3-winged or unwinged.

1. **MORINGA** Adans.

Moringa oleifera Lam. Horseradish-tree.

M. pterygosperma Gaertn.

Tree, with soft wood and pale bark. Leaves 2-3-pinnate; leaflets opposite, up to about 5 pairs, the terminal one longer, all more or less elliptic, ½-1 in. long, glaucous beneath. Flowers strongly scented. Petals white with yellow dots at the base. Fruit 3-angled, elongate-linear, about 1 ft. long; seeds winged.

Northern and Central Sudan. Introduced into Africa from India and now naturalized.

M. peregrina (Forsk.) Fiori. Fig. 40.

M. aptera Gaertn.

Moderate-sized to small tree, with whip-like branches. Leaves scanty, minute. Flowers pink. Fruit ridged, about 1 ft. long and ½ in. broad; seeds unwinged.

Red Sea Hills. Kordofan.

21. *CRUCIFERAE*

Annual or perennial herbs, with watery juice; indumentum (when present) of simple or 2-armed or stellate hairs, rarely glandular. Leaves alternate or rarely opposite, without stipules. Flowers hermaphrodite, mostly actinomorphic, usually racemose, rarely bracteate. Sepals 4, free, imbricate in 2 series or rarely valvate. Petals 4 or rarely absent, free, usually equal, often long-clawed. Torus usually with glands which are often opposite the sepals. Stamens 6 (4 longer and 2 shorter) or rarely more or fewer, free or partly connate. Ovary superior, sessile or rarely stipitate, 1-locular with 1-2 parietal placentas and divided by a spurious membranous septum or sometimes transversely several- or many-locular; stigmas 2, free or united; ovules numerous or more rarely few or solitary. Fruit elongated (siliqua) or short and broad (silicule), 2-valved or indehiscent, sometimes transversely jointed.

The following species of this family are cultivated in the Sudan: *Raphanus sativus* L., Radish; *Brassica oleracea* L., varieties of which are the Cabbage, Cauliflower, Broccoli, Kale and Brussels Sprouts.

A. Plants with branched (stellate or 2-armed) hairs:
B. Fruit short, with 2 large transverse ear-like appendages near the apex; branches in fruit incurving when dry to form a ball which expands again when moist ..... ANASTATICA. 1.
BB. Fruit without ear-like appendages; branches not incurving to form a ball:
C. Seeds compressed, often margined or winged:
D. Hairs stellate:
E. Outer sepals not saccate at the base; fruit becoming more or less strongly curved; plants without glandular tubercles ..... MORETTIA. 11.
EE. Outer sepals saccate at the base; fruit much elongated; plants with glandular tubercles ... MATTHIOLA. 10.
DD. Hairs 2-armed, medifixed, appressed; leaves linear or linear-lanceolate, entire ..... FARSETIA. 7.
CC. Seeds thick, not margined nor winged; fruit $\frac{1}{2}$ in. long and $\frac{1}{20}$ in. broad; stigmas connate, often forming a conic-subulate beak ..... MALCOLMIA. 9.
AA. Plants glabrous or with simple hairs:
F. Fruit elongated (more than 4 times as long as broad):
G. Fruit dehiscent:
(a) Seeds in 1 row in the fruit:
(b) Fruit much elongated, $\frac{3}{4}$-2 in. long, more or less spreading or horizontal ..... SISYMBRIUM. 15.
(bb) Fruit shorter, seldom more than $\frac{1}{2}$ in. long, erect and appressed to the axis of the raceme ..... BRASSICA. 2.
(aa) Seeds in 2 rows in the fruit:
(c) Fruit with a long compressed seedless sword-like beak ..... ERUCA. 6.
(cc) Fruit unbeaked or with a 1-seeded beak:
(d) Fruit compressed; flowers white or purplish ..... DIPLOTAXIS. 4.
(dd) Fruit terete:
(e) Flowers white ..... NASTURTIUM. 12.
(ee) Flowers yellow ..... RORIPPA. 13.
GG. Fruit indehiscent, biarticulate and more or less nodulose; flowers yellowish, streaked with purple ..... ENARTHROCARPUS. 5.
FF. Fruit short (less than 4 times as long as broad):
(f) Fruit distinctly compressed; herbs without spines:
(g) Fruit with 4 or more seeds; flowers purplish ..... SCHOUWIA. 14.
(gg) Fruit 2-seeded; flowers white, small:
(h) Fruit dehiscent ..... LEPIDIUM. 8.

(hh) Fruit indehiscent, 2-coccous ..... CORONOPUS. 3.

(ff) Fruit not distinctly compressed, 2-seeded, indehiscent; spiny shrubby herbs; flowers white or violet ..... ZILLA. 16.

1. **ANASTATICA** L.

Anastatica hierocuntica L. Rose-of-Jericho.

Stellate-canescent prostrate woody annual herb, the fruiting branches incurving when dry to form a ball which expands again when moist. Leaves obovate, tapering into a short petiole. Flowers small, white. Fruit very short, bearing a large transverse ear-like appendage on each side near the broad apex, from the centre of which projects the persistent subulate style.

Red Sea District: between sea-level and 4000 ft.

2. **BRASSICA** L.

Brassica nigra (L.) Koch. Black Mustard.

Herb 2 ft. or more high, somewhat hairy or sometimes entirely glabrous. Leaves mostly deeply divided with a large terminal ovate or oblong lobe and a few small lateral lobes, the upper leaves often small and entire. Flowers yellow. Fruit on a short pedicel, erect and appressed to the axis of the long slender racemes, glabrous, seldom more than ½ in. long, with a slender persistent style slightly conical at the base.

Northern Province. Kordofan.

3. **CORONOPUS** Boehm.

Coronopus niloticus (Del.) Spreng.

Senebiera nilotica (Del.) DC.

Glabrous riverside herb. Radical leaves linear-lanceolate or oblanceolate, pinnatisect, toothed or nearly entire; cauline leaves entire, linear or oblong, or pinnately toothed. Flowers very small, white, in lateral and terminal racemes. Fruit more or less cordate-reniform.

Northern Sudan: *banks of the Nile.*

4. **DIPLOTAXIS** DC.

Diplotaxis erucoides (L.) DC.

Erect annual herb 1-2 ft. high, sparingly papillose-hairy; stems branched from the base and above. Leaves runcinate-lyrate, dentate, the uppermost ones oblong. Flowers white or purplish, in racemes without bracts; pedicels about as long as the flowers. Fruit 1 in. long, ascending; seeds in 2 rows.

Red Sea District: *Erkowit, Karora Hills.*

5. **ENARTHROCARPUS** Labill.

Enarthrocarpus lyratus (Forsk.) DC.

Erect or ascending more or less branched herb, more or less pilose-hirsute below. Basal leaves lyrate-pinnatifid, the lobes spreading and toothed; cauline leaves lyrately or pinnately toothed, more or less hirsute. Flowers yellowish, streaked with purple, in terminal elongate bracteate racemes; bracts oblong or oblanceolate, toothed or the lower lyrate. Fruit erect or curved, biarticulate and more or less nodulose, longitudinally striate, glabrate or scabrid or pilose, obtusely acuminate with the persistent style.

Northern Province.

6. **ERUCA** Mill.

Eruca sativa Mill. Rocket-salad.

Erect branched glabrous or more or less hispid herb up to over 2 ft. high. Leaves lyrate-pinnatifid or obovate to oblanceolate, more or less pinnately toothed or sinuate; upper leaves petiolate, usually toothed. Flowers tolerably large, white or yellow, dark-veined, in racemes without bracts. Fruit erect, on a short pedicel; valves about 1¼ in. long, exceeding or equalling the beak.

Northern Province.

7. **FARSETIA** Turra

Farsetia aegyptia Turra.

Shrubby herb up to 2 ft. high, with repeatedly forking rigid terete branches, hoary with closely appressed hairs. Leaves linear. Flowers subdistant in racemes; pedicels up to ⅛ in. long. Sepals ⅛ in. long, somewhat converging above. Fruit broadly oblong-elliptic, hoary, ascending, about ¾ in. long.

Northern Sudan.

F. longisiliqua Decne.

Suffruticose herb, hoary with closely appressed white hairs; branches slender, rather rigid, divaricate. Leaves very narrow-linear. Flowers white to pale-orange, rather distant in narrow spikelike racemes. Fruit about 1 in. long, slightly curved outwards, linear; valves hoary, undulate, with a faint midrib; persistent style about ⅛ in. long.

Northern and Central Sudan.

F. stenoptera Hochst.

F. grandiflora Fourn.

Stems woody, covered with closely appressed hairs. Leaves linear-lanceolate, entire, 1-3 in. long. Flowers rather large, in elongated racemes. Sepals about ⅛ in. long, with membranous

margins. Petals about ¾ in. long. Fruit linear, with nearly straight margins, distinctly 1-nerved, 1¼ in. long, rather thinly pubescent, beaked.

Central Sudan.

F. longistyla Bak.

Low-growing shrubby annual herb. Leaves 1½-2 in. long. Flowers white. Fruit ¾-1 in. long, ⅛ in. broad; persistent style ⅛ in. long. Differs from *F. stenoptera* by the smaller flowers and longer style.

Red Sea Hills.

Fig. 41—FARSETIA RAMOSISSIMA Hochst. ex Fourn.
A, winged seed.

F. ramosissima Hochst. ex Fourn. Fig. 41.

Suffruticose twiggy herb of pale-green colour, hoary with closely appressed white hairs; branches divaricate. Leaves linear-lanceolate. Flowers orange-yellow, in spikelike racemes. Fruit short, appressed, more or less slightly curved outwards; valves hoary.

Northern and Central Sudan.

8. **LEPIDIUM** L.

Lepidium sativum L. Garden Cress.

Erect glabrous annual herb. Leaves entire or variously lobed or pinnatisect, often with linear segments; lower leaves petiolate; upper leaves linear or linear-oblong, sessile. Flowers small, white, shortly racemose. Fruit obovate to nearly orbicular, emarginate, slightly but thickly winged above, ¼ in. long; seeds ellipsoid, smooth.

Central Sudan.

9. **MALCOLMIA** R. Br.

Malcolmia aegyptiaca Spreng.

Annual herb 4-12 in. high, prostrate or ascending, compact. Leaves sessile, oblong to oblong-linear, entire, grey-pubescent. Flowers ¼ in. long, in dense many-flowered racemes. Fruit ½ in. long, $\frac{1}{20}$ in. broad.

Libyan and Nubian Deserts. Kordofan.

Fig. 42—MATTHIOLA ELLIPTICA R. Br. ex DC.

10. **MATTHIOLA** R. Br.

Matthiola elliptica R. Br. ex DC. Fig. 42.

Diffuse or bushy herb, hard-woody and branching below, 1-2 ft. high. Leaves elliptic or ovate-lanceolate, rather acute or obtuse at the apex, obscurely dentate-sinuate or entire, narrowed into a long slender petiole, hoary with a short stellate tomentum, ¾-1½ in. long, up to ¾ in. broad. Flowers white. Stigmas converging, forming a triangular unappendaged tip to the ovary. Fruit nearly terete, hoary, with a raised line on each side.

Northern Sudan.

11. **MORETTIA** DC.

Morettia philaeana (Del.) DC.

Stiff erect hispid herb. Leaves linear to lanceolate, hoary or hispid, up to ¾ in. long. Petals pinkish-white, slightly longer than the very hairy sepals. Fruit strongly curved, ½ in. long.

Northern and Central Sudan.

M. canescens Boiss.

Herb, with woody branched stems. Leaves scattered, petiolate, obovate-oblanceolate, subacute at the apex, entire, ½-¾ in. long, scabrid-pubescent on both surfaces with stellate hairs. Flowers small, in short racemes. Fruit becoming curved, about ½ in. long, stellate-pubescent, tipped by the hardened 2-fid persistent style.

Northern and Central Sudan.

12. **NASTURTIUM** R. Br.

Nasturtium officinale R. Br. Watercress.

Herb; stems much branched, sometimes very short and creeping, or floating in shallow water, or ascending to 1-2 ft. or more when luxuriant or supported by other plants. Leaves pinnate, the upper ones with 3-7 pairs of pinnae and a terminal leaflet, the latter usually larger, varying from roundish to ovate or lanceolate, obtuse at the apex, sinuate or dentate. Flowers small, white, in short racemes. Fruit ½-¾ in. long, on a spreading pedicel.

Darfur: *Jebel Marra*, 6500 ft.

N. brachypus Webb.

Glabrous herb. Lower leaves lyrate; upper leaves pinnate, the pinnae crenate-dentate. Flowers minute. Fruit oblong-compressed, on a somewhat thick spreading pedicel; seeds ovoid, somewhat compressed, tuberculate, reddish.

Central Sudan.

13. **RORIPPA** Scop.

Rorippa indica (L.) Hiern.

Nasturtium indicum (L.) DC.

Glabrous branching herb. Upper leaves sessile, lyrately pinnatifid; segments various, obtusely or acutely toothed or incised.

Flowers yellow, in small lax racemes, without bracts. Fruit nearly ¾ in. long, cylindric, with smooth valves.
Northern and Central Sudan.

Fig. 43—SCHOUWIA SCHIMPERI Jaub. & Spach.

14. **SCHOUWIA** DC.

Schouwia schimperi Jaub. & Spach. Fig. 43.

S. arabica (non DC.) Broun & Massey.

Woody glabrous herb, branching from the base. Cauline leaves sessile, oblong-lanceolate, acute at the apex, amplexicaul and deeply cordate-auriculate at the base, up to 3½ in. long, papery. Flowers racemose, purplish. Fruit compressed, winged, broadly elliptic, 1 in. long, tipped by the persistent acute style about ¼ in. long.

Khartoum North. Gash Valley.

15. **SISYMBRIUM** L.

Sisymbrium erysimoides Desf.

Erect annual herb 6-18 in. or more high, nearly glabrous. Leaves runcinate-pinnatifid; lobes oblong, dentate. Flowers small,

yellow. Fruit linear, ¾-1½ in. long, horizontal, glabrous.
Red Sea District: between sea-level and 4000 ft.

S. pinnatifidum Forsk.

Erect more or less branched herb, with smooth stems, glabrous or sparsely pilose. Radical leaves oblanceolate, pinnatipartite with spreading rather acute segments; cauline leaves narrow-lanceolate, the segments or teeth near the base usually larger and deeper. Fruit very narrow-linear, spreading, 1½-2 in. or more long, on a pedicel ¼-½ in. long.
Red Sea District.

16. **ZILLA** Forsk.

Zilla spinosa (L.) Prantl.
Z. myagrioides Forsk.

Glaucous spiny shrubby herb, the spines terminating the branches. Leaves oblong or linear, entire or toothed, rather fleshy. Flowers white or violet, solitary or racemose. Fruit ovoid, with a conical subulate beak, nearly smooth or reticulate-rugose.
Nubian Desert.

22. *VIOLACEAE*

Herbs, shrubs or trees. Leaves alternate or rarely opposite, with stipules. Flowers actinomorphic or zygomorphic, varying from solitary to paniculate. Sepals 5, imbricate. Petals 5, free, nearly equal or the lower larger and often clawed. Stamens 5, hypogynous, alternating with the petals. Ovary superior, sessile, 1-locular with usually 3 parietal placentas each with 1 or more ovules. Fruit an elastic loculicidal capsule, 1- or more-seeded.

A. Trees or shrubs; flowers more or less actinomorphic; petals subequal ..... RINOREA. 2.
AA. Herbaceous or suffrutescent; flowers zygomorphic:
(a) Lower petal conspicuously larger than the rest and clawed, saccate or gibbous at the base; sepals not produced below the base ..... HYBANTHUS. 1.
(aa) Lower petal spurred or saccate at the base but not clawed; sepals produced below the base ..... VIOLA. 3.

1. **HYBANTHUS** Jacq.

Hybanthus enneaspermus (L.) F. Muell. Fig. 44.

Erect perennial herb, simple or often with numerous vertical branches from the base, up to 18 in. high. Leaves scattered, lanceolate or linear-lanceolate, acute at the apex, remotely denticulate, up to 2¾ in. long, with distinct lateral nerves. Peduncles longer than the lilac or bluish flowers.
Central Sudan.

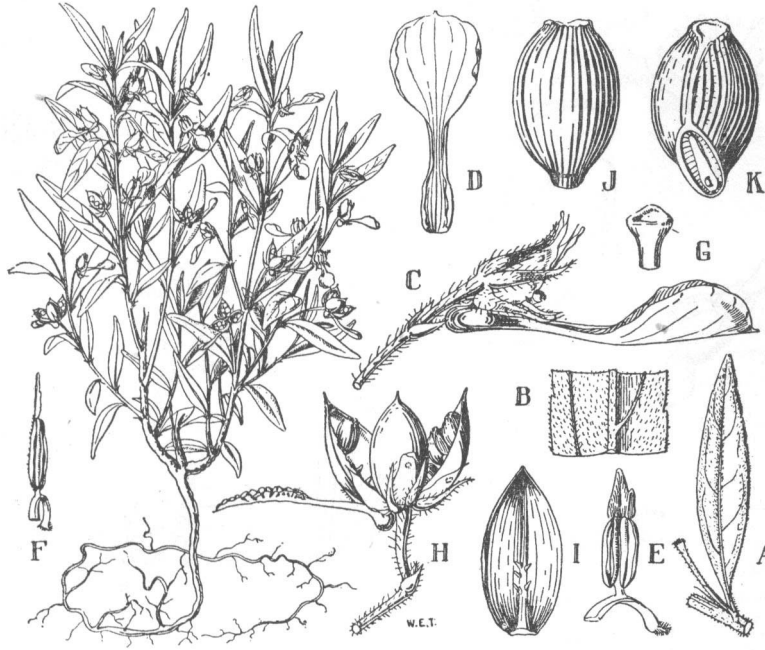


Fig. 44—HYBANTHUS ENNEASPERMUS (L.) F. Muell.
A, portion of stem with leaf and peduncle. B, portion of leaf, under-surface. C, flower. D, lower petal. E, stamen, front view. F, stamen, side view. G, style. H, capsule open. I, valve of capsule from within. J, K, seeds.

2. **RINOREA** Aubl.

Rinorea ilicifolia (Welw.) Kuntze.

Glabrous shrub or small sturdy tree up to 25 ft. high. Leaves strongly spinose-serrate, coriaceous, shining above, 6-9 in. long. Flowers yellowish-white, in narrow terminal racemose panicles. Capsule 3-valved, rough, dark-reddish-purple.

Equatoria.

R. poggei Engler.

Small tree up to about 25 ft. high or straggling undershrub. Leaves stiff, not spinose, obovate-lanceolate, narrowed from the upper $\frac{1}{3}$ to a cuneate base, shortly obtuse-acuminate at the apex, crenate or serrate, 3-6 in. long, $1\frac{1}{4}$-$2\frac{1}{2}$ in. broad. Flowers yellowish, in panicles up to 5 in. long; panicle-branches spreading, less than $\frac{1}{2}$ in. long.

Equatoria: *Laboni Forest.*

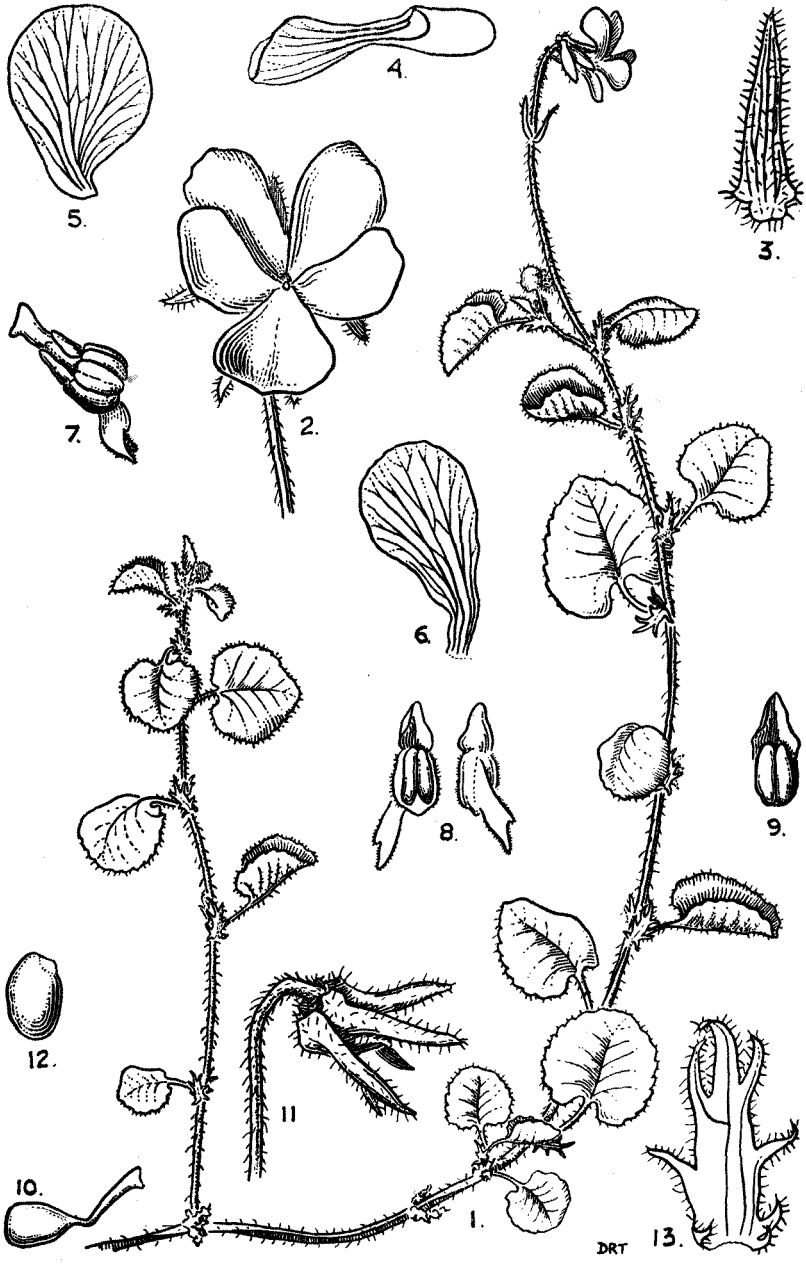


Fig. 45—VIOLA EMINII (Engler) R.E.Fr.

1, habit. 2, flower. 3, sepal. 4, lower petal. 5, 6, lateral petals. 7, stamens and pistil. 8, stamens. 9, anther with produced connective. 10, ovary and style. 11, fruit enclosed by calyx. 12, seed. 13, stipule.

R. oblongifolia (C. H. Wright) Marquand.

Understorey shrub or tree up to 50 ft. high, with glabrous or pubescent branchlets. Leaves elliptic or oblong, up to 10 in. long, 3¼ in. broad. Flowers yellow (the outside of the petals plum-coloured), in much-branched panicles up to 5 in. long; lower branches of panicle ascending, at least 1 in. long. Capsule ½-¾ in. long, rather woody.

Equatoria.

3. VIOLA L.

Viola etbaica Schweinf.

V. nubica Hutch.

Small annual herb 4 in. high. Leaves long-petiolate, spathulate-lanceolate, acute at the apex, 1¼ in. long, nearly ¼ in. broad, very thin, subentire, glabrous; stipules subulate, thread-like, entire, ⅛ in. long. Sepals broadly lanceolate, long-acuminate. Petals ⅓ in. long; spur short and blunt. Capsule ¼ in. long.

Red Sea District: between sea-level and 3-4000 ft.

V. eminii (Engler) R.E.Fr. Fig. 45.

Creeping herb; stems up to 2 ft. long, pubescent to glabrous. Leaves ovate or ovate-orbicular, subacute to rounded at the apex, widely cordate at the base, up to 1 in. long, crenate, sometimes with scattered dark-coloured linear resinous bodies beneath; stipules foliaceous, deeply divided into lanceolate acute segments, nearly half as long as the petiole. Flowers purple to mauve-blue, solitary on long slender peduncles.

Equatoria: *Imatong Mountains, Mount Kineti.*

23. *RESEDACEAE*

Annual or perennial herbs or sometimes shrubs. Leaves alternate, simple or pinnately divided; stipules small, gland-like. Flowers usually zygomorphic, hermaphrodite or rarely unisexual, racemose or spicate. Calyx persistent, 4-8-partite, imbricate. Petals small and inconspicuous or absent, free or slightly coherent, often laciniate. Disk usually present, often dilated on the adaxial side. Stamens 3-40, perigynous or on the disk, not covered by the petals in bud. Carpels superior, 2-6, free or connate, closed or gaping at the top; ovules 1 to numerous on parietal placentas or at the base of the ovary. Fruit a capsule (often gaping) or berry or of free carpels.

A. Fruit a gaping capsule; petals 2-7:
  (a) Petals 4-7 of which some at least are 2- or more-fid; stamens 10 or more:
    (b) Ovary and capsule of 6 carpels ..... CAYLUSEA. 1.
    (bb) Ovary and capsule of 3 carpels ..... RESEDA. 4.
  (aa) Petals 2, entire; stamens 3-8; ovary and capsule of 4 carpels ..... OLIGOMERIS. 3.

AA. Fruit a closed berry; petals absent ..... OCHRADENUS. 2.

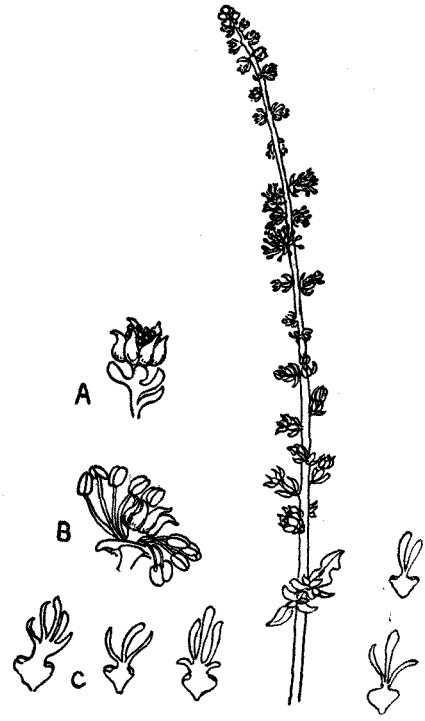


Fig. 46—CAYLUSEA HEXAGYNA (Forsk.) Dandy.
A, capsule opening showing seeds. B, stamens and carpels. C, the five petals.

1. **CAYLUSEA** St.-Hil.

Caylusea hexagyna (Forsk.) Dandy, comb. nov. Fig. 46.

Reseda hexagyna Forsk.; *C. canescens* St.-Hil.

Diffuse or ascending more or less pilose herb, with sometimes (in dry situations) rather rigid divaricate branches. Leaves linear-lanceolate to lanceolate, undulate. Flowers small, in terminal bracteate racemes.

Red Sea District.

C. abyssinica (Fresen.) Fisch. & Mey.

Erect herb up to 3 ft. high, glabrous or thinly scabrid towards the inflorescences. Leaves linear-lanceolate or linear, entire or 3-partite, narrowed to the base. Flowers small, numerous, in elongate many-flowered terminal spike-like racemes up to 1 ft. or more long.

Red Sea District: between sea-level and 4000 ft.

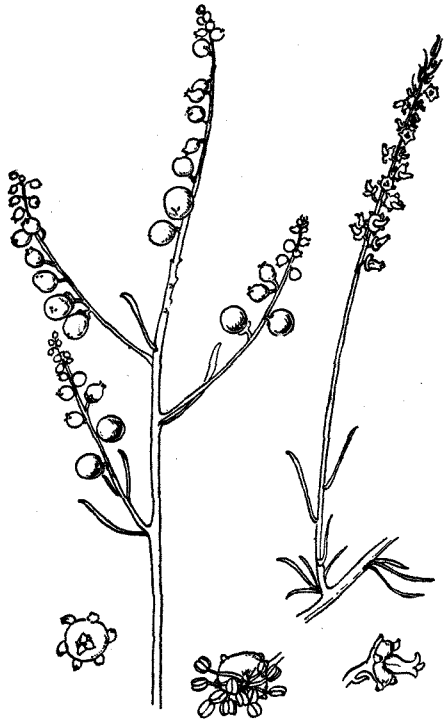


Fig. 47—OCHRADENUS BACCATUS Del.

2. **OCHRADENUS** Del.

Ochradenus baccatus Del. Fig. 47.

Much-branched shrub, with virgate bright-green branches often spinescent and at length leafless. Leaves narrow-linear. Flowers small, spicate, greenish-yellow with red sepals. Berry white, ¼ in. in diameter.

Northern Sudan.

3. **OLIGOMERIS** Cambess.

Oligomeris linifolia (Vahl) J. F. Macbr. Fig. 48.

O. glaucescens Cambess.

Erect or decumbent glabrous more or less glaucous annual herb. Leaves in clusters, narrow-linear, entire. Flowers small, in loose elongate terminal spikes. Capsule globose, minute.

Northern and Central Sudan.

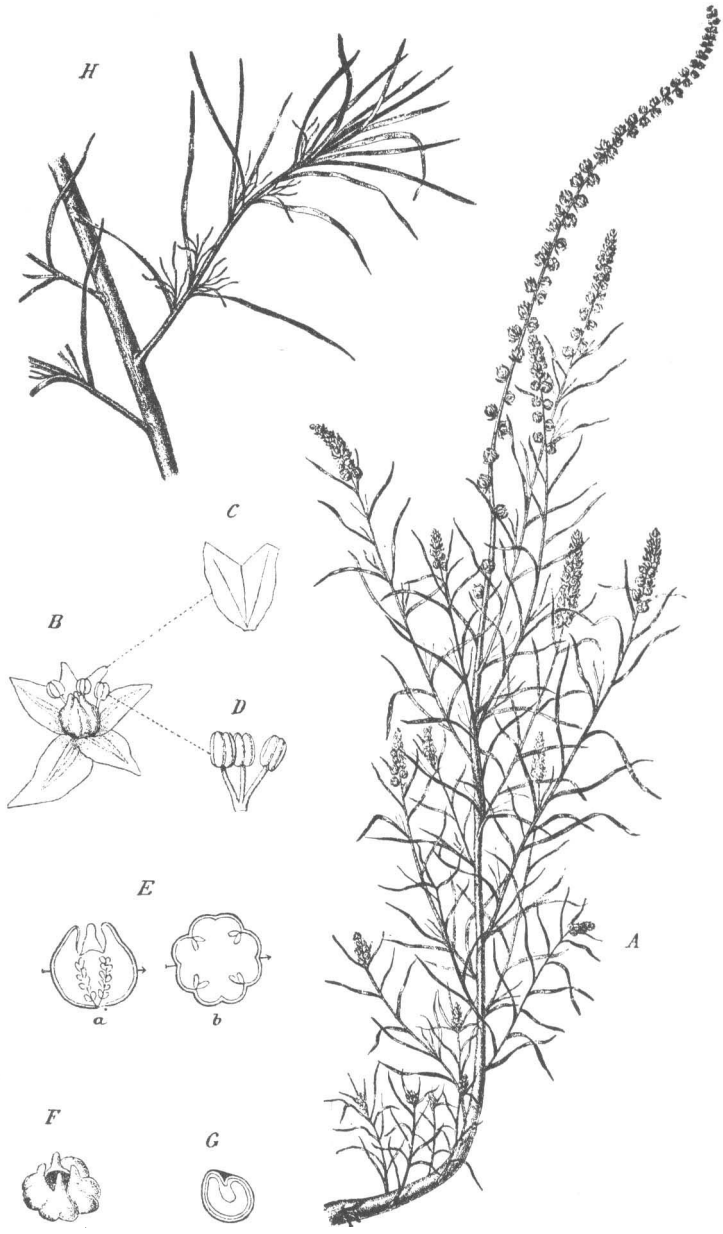


Fig. 48—OLIGOMERIS LINIFOLIA (Vahl) J. F. Macbr.
A, branch with inflorescences. B, flower. C, petal. D, stamens. E, longitudinal and transverse sections of ovary. F, fruit. G, longitudinal section of seed. H, twig with leaf clusters.

4. **RESEDA** L.

Reseda pruinosa Del.

Erect biennial or perennial herb up to 3 ft. high, woody below, covered with a whitish bloom. Leaves narrow-lanceolate or elliptic, entire or 3-fid. Flowers in long many-flowered spicate racemes. Capsule obovoid-oblong.

Nubia and Red Sea District: between sea-level and 3000-4000 ft.

24. *POLYGALACEAE*

Herbs, shrubs, climbers or rarely small trees. Leaves alternate or rarely opposite, simple, without stipules. Flowers hermaphrodite, zygomorphic, the pedicel often articulated. Sepals 5, usually free, imbricate, the 2 inner larger and often petaloid and wing-like. Petals 3-5, hypogynous; outer 2 free or united with the lowermost which forms a keel; upper 2 free or united at the base with the others, often minute or absent. Stamens 8 or rarely 5 or 4, united beyond the middle (forming a sheath split above and often adnate to the petals) or rarely free. Ovary superior, 1-5- (usually 2-) locular; ovules solitary in each loculus or rarely more. Fruit a capsule, samara or drupe; seeds often pilose with a strophiole.

A. Petals 5, united at the base; stamens 5; fruit drupaceous, fleshy, yellow or red; seeds very densely villous; shrubs or trees ..... CARPOLOBIA. 1.

AA. Petals 3 or the remainder minute; stamens 8; fruit not drupaceous:

(a) Fruit a samara, 1-locular and 1-seeded; lateral petals free from the keel; shrubs or trees ..... SECURIDACA. 3.

(aa) Fruit a capsule, 2-locular, compressed; lateral petals united with the keel which is often crested; herbs or more rarely shrubs ..... POLYGALA. 2.

1. **CARPOLOBIA** Don

Carpolobia sp.

Shrub or small tree 20-30 ft. high. Fruit dark-red, 3-angled and 3-seeded.

Equatoria: *Imatong Mountains.*

2. **POLYGALA** L.

A. Style ribbon-shaped, the apex recurved and often unequal-sided:

B. Upper sepals joined:

(a) Keel crested:

(b) Leaves acicular, mostly in clusters ..... *P. acicularis.*

(bb) Leaves narrowly linear, not in clusters ... *P. liniflora.*

(aa) Keel not crested:

(c) Leaves linear, about 1-2 in. long and up to ⅛ in. broad ..... *P. petitiana.*

(cc) Leaves very narrowly linear, about ½ in. long and up to $\frac{1}{16}$ in. broad ..... *P. nilotica.*

BB. Upper sepals not joined ..... *P. abyssinica.*

AA. Style long, thread-like; stigma unequal:

(d) Rather wiry or rigid puberulous herb or undershrub ..... *P. senensis.*

(dd) More or less glabrous shrubs or herbs:

(e) Racemes never dense-flowered, mostly terminal; leaves up to 3½ in. long and ¾ in. broad ... *P. persicariifolia.*

(ee) Racemes dense-flowered, sometimes surrounded by leaves:

(f) Racemes capitate, subsessile ..... *P. arenaria.*

(ff) Racemes densely cylindric, large ..... *P. schweinfurthii.*

(fff) Racemes elongated ..... *P. stanleyana.*

(eee) Racemes comparatively few-flowered, on very short lateral branches; flowers small:

(g) Annual herb ..... *P. erioptera.*

(gg) Low wiry shrub ..... *P. irregularis.*

Polygala acicularis Oliv.

Low glabrous shrub about 2 ft. high, with stout rigid branches; stems densely leafy. Leaves mostly in clusters, acicular, up to 2 in. long. Inflorescences dense, mostly branched; flowers whitish to blue-purple, about ⅛ in. long. Wing-sepals deciduous in fruit. Capsule deeply notched.

Equatoria.

P. liniflora Boj. ex Chod.

Erect grass-like glabrous herb, with elongated branches. Leaves narrowly linear, slightly decurrent, up to 2 in. long and $\frac{1}{12}$ in. broad. Flowers in lax terminal racemes. Wing-sepals elliptic, clawed, with few nerves, persistent.

Darfur: plains N.E. of El Fasher.

P. petitiana A. Rich.

Glabrous erect leafy usually branching annual herb 6-12 in. high. Leaves membranous, linear, narrowed to each end and finely pointed at the apex, 1-2 in. long, ⅛ in. broad. Flowers in terminal erect racemes. Upper petals pinkish-mauve; keel blue. Capsule oblong-elliptic, broadly emarginate, as long as and broader than the wing-sepals.

Equatoria.

P. nilotica Chod.

Annual herb, with glabrous stems up to 20 in. high. Leaves very narrowly linear, acute at the apex, glaucescent, about ½ in. long and up to $\frac{1}{16}$ in. broad. Flowers about ⅛ in. long, in very slender lax racemes about 2-3 in. long. Wing-sepals elliptic. Keel not crested.

Equatoria: *Bongoland.*

P. abyssinica R. Br. ex Fresen.

Erect or ascending annual or perennial herb ½-2 ft. high. Leaves linear to elliptic, tapering to a fine point at the apex or apiculate, ½-1½ in. long, up to ¼ in. broad. Flowers white to magenta-pink, secund in terminal racemes. Wing-sepals ovate to obovate, 3-nerved. Capsule obovate, emarginate, narrowly winged in front.

Darfur: *Jebel Marra*, 7000 ft. and over. *Equatoria*: *Imatong Mountains, Kippia, in grassland.*

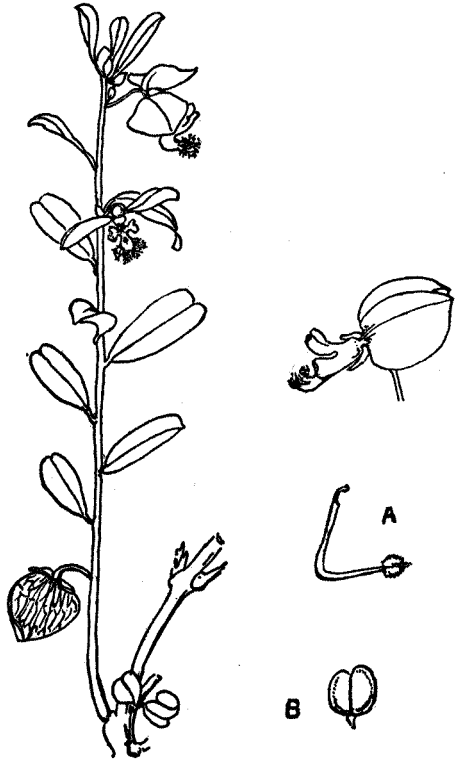


Fig. 49—POLYGALA SENENSIS Klotzsch.
A, pistil. B, fruit.

P. senensis Klotzsch. Fig. 49.

Rather wiry or rigid puberulous herb or undershrub 1-2 ft. high. Leaves oblanceolate to oblong, obtuse to rounded or emarginate at the apex, usually ½-1½ in. long, up to ⅛ in. broad. Flowers in very short lateral racemes or axillary clusters. Wing-sepals orbicular-ovate, $\frac{5}{12}$ in. long, with numerous radiating looping minute nerves. Capsule quadrate-orbicular, retuse, minutely pubescent, scarcely or not at all winged, enclosed by the wing-sepals.

Red Sea District: *Sinkat*.

P. persicariifolia DC.

Erect or decumbent annual herb 1-3 ft. high. Leaves membranous, elliptic to linear-lanceolate, acute or acuminate or rather obtuse at the apex, 1-3½ in. long, up to ¾ in. broad. Flowers pink, in extra-axillary or terminal racemes or from the forks, growing out to 2-4 in., or the lower flowers clustered in the axils of the leaves. Wing-sepals orbicular-ovate, obtuse, with 3-5 looping nerves, glabrous or nearly so. Lateral petals semi-hastate or hooked at the base inside. Capsule narrowly winged, ciliolate.

Central and Southern Sudan.

P. arenaria Willd. Fig. 50.

Annual herb, erect or diffuse and much branched, from a few inches to 1 foot or more high. Leaves very variable, linear to oblanceolate, up to 2¾ in. long and ⅛ in. broad, slightly pubescent. Flowers in terminal dense capitate racemes. Wing-sepals becoming whitish in fruit, pubescent. Lateral petals yellowish; keel pink to purple. Capsule elliptic, glabrous; seeds oblong, long-pilose all over.

Central and Southern Sudan.

P. schweinfurthii Chod.

Pubescent annual herb up to 12 in. high. Leaves variable in size, ½-2½ in. or more long, the margin ciliate. Flowers large, pale, slightly bluish-pink, in solitary dense racemes up to 2¾ in. long.

Equatoria.

P. stanleyana Chod.

Erect slightly pubescent annual herb. Leaves linear or linear-lanceolate, acute at the apex, up to 4½ in. long. Flowers in dense terminal or axillary racemes up to 2½ in. long and ⅛ in. broad. Wing-sepals elliptic, subacute, ciliate. Upper petals subtriangular, cuneate at the base.

Equatoria.

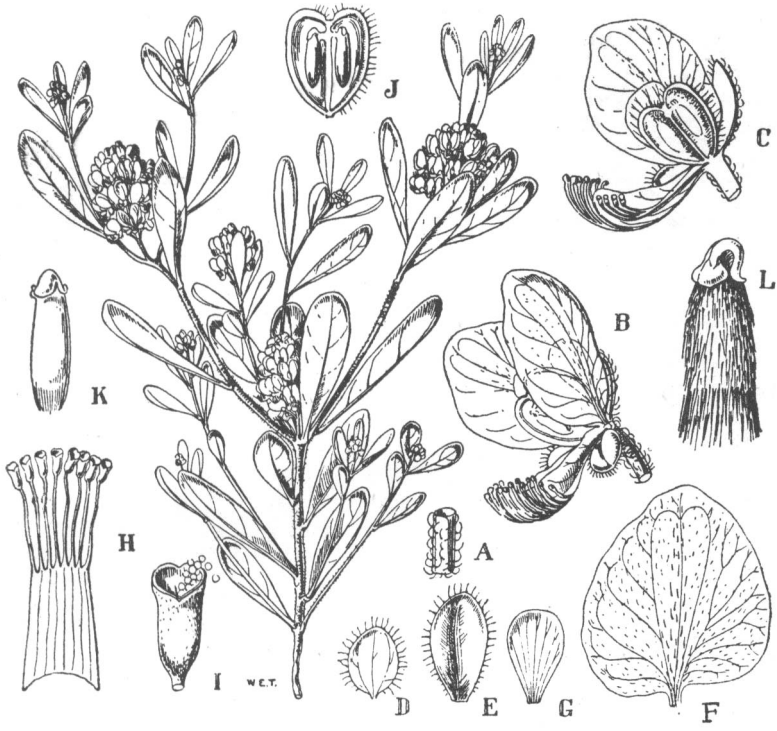


Fig. 50—POLYGALA ARENARIA Willd.

A, portion of stem showing curved hairs. B, flower. C, longitudinal section of flower. D, E, outer sepals. F, wing sepal. G, lateral petal. H, staminal sheath. I, anther with terminal pore. J, longitudinal section of ovary. K, ovule. L, seed.

P. erioptera DC.

Annual herb, erect, 1-2 ft. high, or diffuse and much branched, grey-pubescent or the stems and leaves at length glabrous. Leaves linear to lanceolate, obtuse at the apex, shortly pubescent, up to 1 in. long. Wing-sepals pubescent. Capsule oblong-obovate, ciliate; seeds narrow, long-pilose all over.

Widespread.

P. irregularis Boiss.

Low spreading shrub, with wiry branches 1½-2 ft. high. Leaves linear-oblanceolate, obtuse at the apex, puberulous, up to ½ in. long. Flowers in lax racemes. Wing-sepals becoming membranous. Capsule almost orbicular, distinctly winged; seeds silky-pilose, penicillate at the end.

Central Sudan.

Fig. 51—SECURIDACA LONGEPEDUNCULATA Fresen.
A, branch with flower-buds. B, flower (after removal of a side sepal). C, longitudinal section of flower without perianth. D, fruits. E, fruit in longitudinal section.

3. **SECURIDACA** L.

Securidaca longepedunculata Fresen. Fig. 51.

Shrub or small tree up to 20 ft. high, with pale smooth bark; branchlets softly pubescent. Leaves oblong-lanceolate, rounded at the apex, up to 2 in. long and ½ in. broad. Flowers fragrant, red to purple, in simple racemes. Fruit about 2 in. long, with a wing ½-¾ in. broad and sometimes with a very small second imperfect wing.

Central and Southern Sudan.

25. *CRASSULACEAE*

Herbs or undershrubs, usually succulent. Leaves opposite or alternate, without stipules. Flowers actinomorphic, hermaphrodite, usually cymose. Sepals free or united into a tube, often 4 or 5. Petals as many as the sepals, free or variously connate, hypogynous. Stamens as many or twice as many as the petals; filaments free; hypogynous scales present within the stamens. Carpels superior, as many as the petals, free or united at the base; ovules numerous or rarely few, inserted on the ventral suture. Fruit of membranous or leathery follicles, often surrounded by the persistent membranous corolla; seeds minute.

Sempervivum molle Vis. is recorded from Nubia but apparently by error.

A. Stamens as many as the petals; petals free or scarcely united at the base ..... CRASSULA. 2.

AA. Stamens twice as many as the petals; petals united nearly to the middle or beyond:

(a) Calyx shortly 4-fid, large, becoming inflated and membranous .. BRYOPHYLLUM. 1.

(aa) Calyx 4-5-partite or rarely 4-fid, not becoming inflated nor membranous:

(b) Leaves opposite, not peltate; inflorescence cymose; calyx and corolla with 4 segments ..... KALANCHOE. 3.

(bb) Leaves alternate, the lower ones peltate, orbicular; inflorescence a simple or somewhat branched raceme; calyx and corolla with 5 segments ..... UMBILICUS. 4.

1. **BRYOPHYLLUM** Salisb.

Bryophyllum pinnatum (Lam.) Kurz. Air-plant.

B. calycinum Salisb.

Fleshy undershrub 2-4 ft. high, branched from the base. Leaves opposite, petiolate, simple and obovate to obovate-orbicular or 3-foliolate, coarsely crenate (the teeth sometimes bearing bulbils in their axils), about 4 in. long and 2½ in. broad, glabrous. Flowers drooping, in lax panicles. Calyx inflated, tubular, shortly 4-fid,

1¼ in. long, greenish-yellow and purplish at the base; lobes triangular, very acute. Corolla gamopetalous, tubular, contracted above the base, a little longer than the calyx, 4-lobed, reddish-purple in the upper part. Stamens 8, a little exerted. Fruit of 4 follicles.

Equatoria. Probably native of tropical Asia and introduced into Africa.

2. **CRASSULA** L.

Crassula pentandra (Royle) Schoenl.

Tillaea pentandra Royle ex Edgew.

Small herb. Leaves opposite, fleshy, lanceolate, acute at the apex, broadened towards the base, about ¼ in. long. Flowers sessile, small, white, axillary, solitary or 2-3 together. Fruit of 4-5 follicles.

Red Sea Hills: *Erkowit.* *Darfur*: *Jebel Marra.*

C. alsinoides (Hook. f.) Engler.

Prostrate herb; stems with a longitudinal line of hairs. Leaves broadly ovate, subacute at the apex, abruptly narrowed into a claw-like base, up to ½ in. long and ¼ in. broad. Pedicels about ¼ in. long. Petals white.

Equatoria: *Imatong Mountains, Kippia, in scrub.*

C. alba Forsk.

Fleshy herb up to 12 in. high from a fleshy root. Leaves opposite, lanceolate, with cartilaginous-ciliate margins. Peduncles terminal; flowers white, pedicellate, corymbose.

Equatoria: *Imatong Mountains, rocky summit of Mount Kineti,* 10,400 ft.

3. **KALANCHOE** Adans.

Kalanchoe petitiana A. Rich.

Herbaceous plant 4-6 ft. high; stems like the pedicels and calyx glabrous. Calyx divided to the base; segments linear-lanceolate, acutely acuminate, ¼ in. long. Corolla yellow; lobes ovate-lanceolate, acute.

Equatoria: *Imatong Mountains, summit of Mount Kineti.*

K. glaucescens Britten. Fig. 52.

K. crenata (non Haw.) Broun & Massey.

Tall succulent perennial herb from a thick root. Leaves opposite, fleshy, crenate, glabrous. Calyx divided to the base. Corolla yellow.

Red Sea Hills: *Erkowit, Karora Hills.*

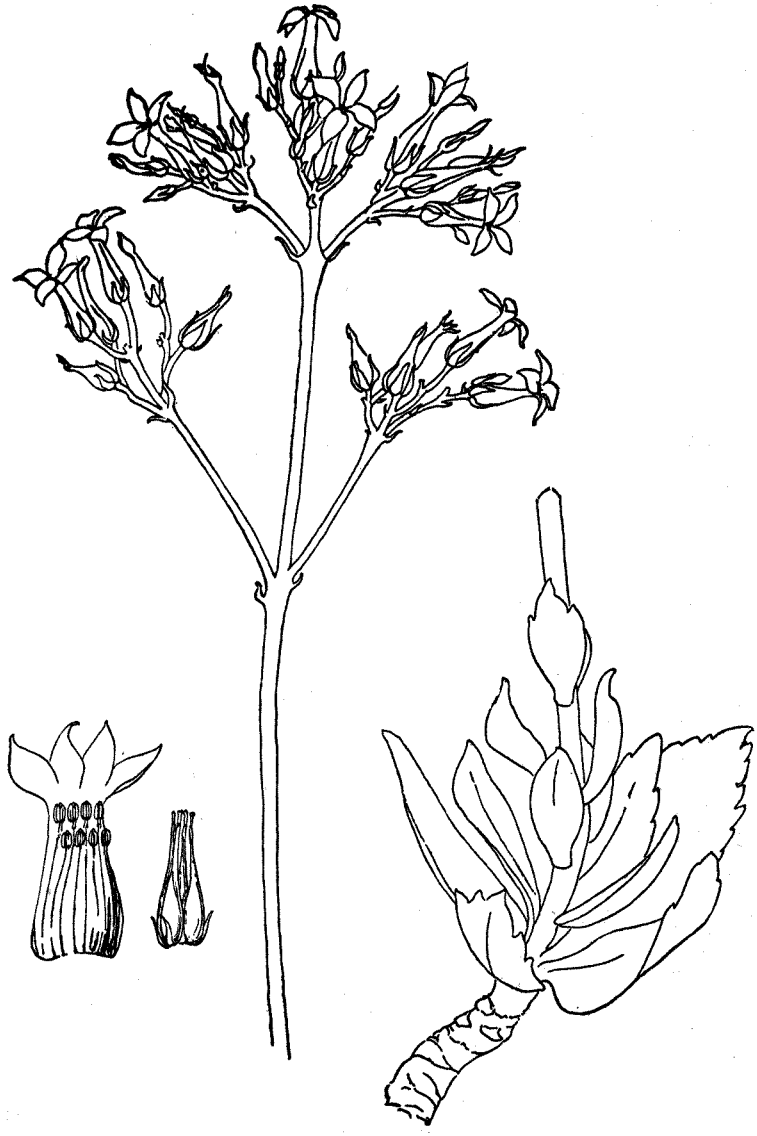


Fig. 52—KALANCHOE GLAUCESCENS Britten.

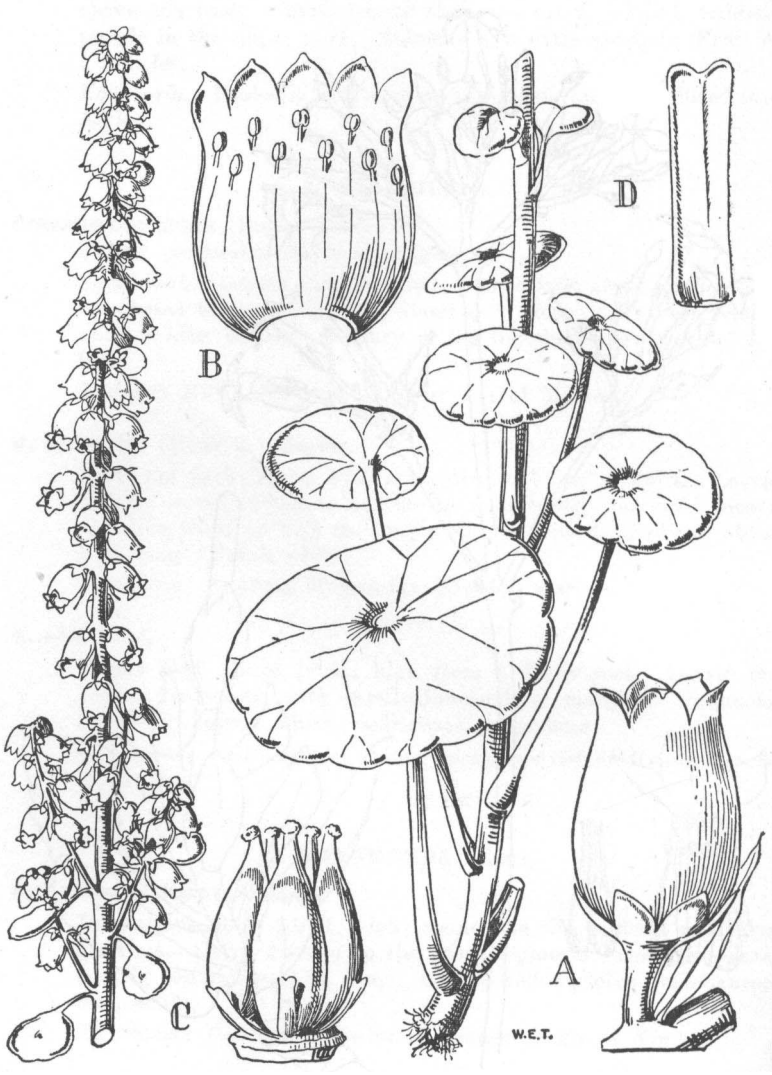


Fig. 53—UMBILICUS BOTRYOIDES Hochst. ex A. Rich.
A, flower. B, corolla laid open. C, carpels and hypogynous scales. D, one of the scales.

K. modesta Kotschy & Peyr.

Erect herb 1 ft. or more high; stems branched and slightly angular above, shortly glandular-pubescent. Leaves glabrous; lower ones obovate, obtuse at the apex, 2 in. long and ¾ in. broad, the margin crenate in the upper half; upper ones smaller, acute at the apex. Cymes much branched, many-flowered. Calyx ⅛-⅙ in. long; segments ovate-lanceolate, acute, glandular-pilose, three times as long as the tube. Corolla orange-yellow; tube twice as long as the calyx; lobes ovate-oblong, obtuse and mucronate, ¼ in. long, ⅛ in. broad.

Equatoria: *Bahr el Ghazal region.*

K. lanceolata (Forsk.) Pers.

Succulent herb up to 5 ft. high; stems more or less quadrangular. Branches of the inflorescence crowded, usually with the flowers borne to one side. Calyx divided hardly down to the middle; segments triangular, acute, densely glandular-pilose. Corolla yellow to salmon-pink.

Equatoria: *Imatong Mountains, Katire, in scrub among rocks.*

4. **UMBILICUS** DC.

Umbilicus botryoides Hochst. ex A. Rich. Fig. 53.

Erect simple or slightly branched glabrous fleshy herb up to about 1 ft. high. Lower leaves peltate, long-petiolate, orbicular, slightly crenate, 1¼ in. broad, the upper ones more or less basifixed and more shortly petiolate. Flowering stems usually about 6 in. long, bearing a simple or somewhat branched raceme of pale pendulous flowers; bracts often foliaceous and then larger than the flowers.

Red Sea Hills: *Erkowit.* *Darfur*: *Jebel Marra*, 9600 ft.

26. *SAXIFRAGACEAE*

Herbs, not or only slightly succulent. Leaves usually alternate (opposite in *Vahlia*), without stipules. Flowers usually actinomorphic and hermaphrodite, rarely solitary. Sepals free or united, usually 5. Petals as many as the sepals or rarely absent, free, often clawed, perigynous or rarely epigynous. Stamens as many or twice as many as the sepals or rarely fewer; filaments free. Ovary superior to inferior, 1-3-locular; styles 1-3; ovules numerous in each loculus. Fruit a capsule.

1. **VAHLIA** Thunb.

Vahlia digyna (Retz.) Kuntze. Fig. 54.

V. viscosa Roxb.

Very viscous often prostrate herb, with gland-tipped hairs. Leaves ovate or ovate-lanceolate or rarely linear-lanceolate. Flowers yellow, subsessile, in axillary pairs or solitary. Filaments 5,

Fig. 54—VAHLIA DIGYNA (Retz.) Kuntze.

thread-like, ciliate, with a small hairy appendage at the base. Ovary inferior, 1-locular.

Widespread on river-banks and swampy meadows. This and the following species of *Vahlia* may be mistaken for species of *Oldenlandia* in *Rubiaceae*, but can at once be distinguished by the free petals and absence of stipules.

V. dichotoma (Murr.) Kuntze. Fig. 55.

V. oldenlandioides Roxb.

Herb, not or only slightly viscous. Leaves linear. Flowers numerous, paired on axillary peduncles. Filaments about twice as long as the anthers, not ciliate nor appendaged.

Central and Southern Sudan.

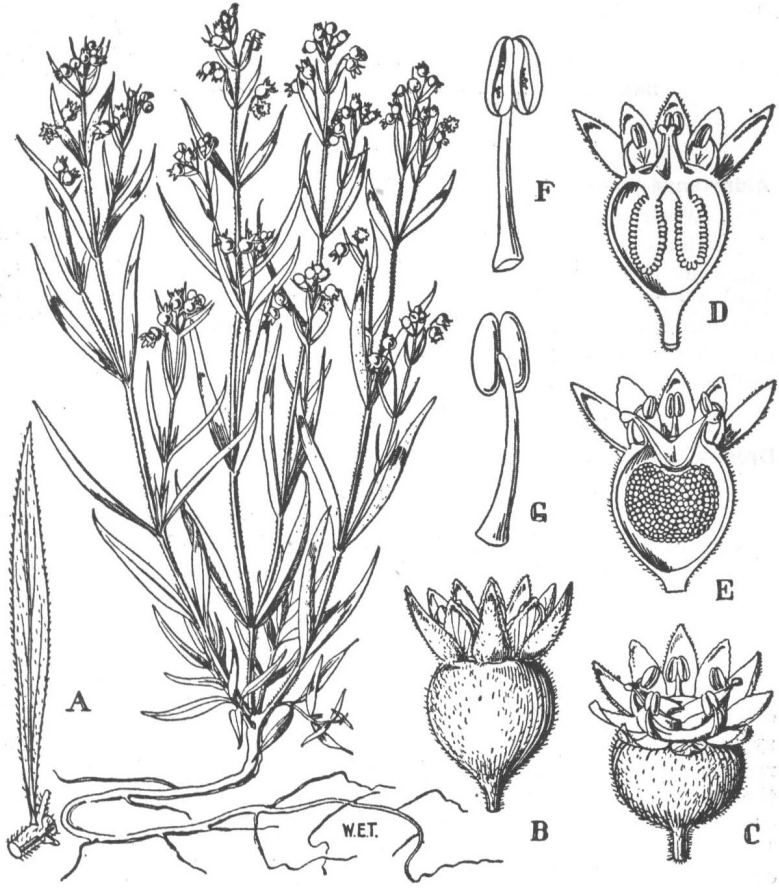


Fig. 55—VAHLIA DICHOTOMA (Murr.) Kuntze.
A, leaf. B, flower. C, the same open. D, longitudinal section of flower showing pendulous placentas. E, the same showing the face of a placenta. F, stamen. G, the same from behind.

27. *DROSERACEAE*

Herbs, often stemless with a rosette of leaves, the latter usually with sticky stipitate glands which entrap insects. Flowers actinomorphic, hermaphrodite, usually in simple curled cymes. Sepals 4-8 (usually 5), more or less connate at the base, imbricate, persistent. Petals as many as the sepals, free, hypogynous or very rarely perigynous, nervose. Stamens 4-20 (often 5), hypogynous. Ovary superior, 1-locular; styles 2-5; ovules numerous or rarely few. Fruit a loculicidal capsule; seeds usually numerous.

A. Styles 5; glabrous aquatic plants; leaves verticillate ..... ALDROVANDA. 1.

AA. Styles 2-5 (generally 3); glandular terrestrial plants; leaves alternate ..... DROSERA. 2.

1. **ALDROVANDA** L.

Aldrovanda vesiculosa L.

Weak succulent diaphanous glabrous herb, floating in water; stems articulated. Leaves verticillate, spathulate-orbicular, ⅛-¼ in. broad, contorted, bladdery. Flowers pedunculate, axillary, solitary. Petals converging into a cap. Stamens 5. Styles 5 with terminal branching stigmas. Capsule globose, 5-valved.

White Nile River: *Sudd area*

2. **DROSERA** L.

Drosera indica L.

Small herb, with sticky glandular hairs. Leaves alternate, narrowly linear, the lower part glabrous, the upper part heavily fringed with sticky stipitate glands. Flowers pink or mauve to white; pedicels up to about ⅓ in. long in fruit.

Equatoria.

28. *PODOSTEMACEAE*

Submerged aquatic herbs on rocks or stones in rapidly flowing water, often resembling mosses or liverworts. Flowers small, solitary or cymose, zygomorphic, hermaphrodite. Calyx 3- (or occasionally 4-) phyllous or rudimentary (consisting of 2 minute subulate segments) in which case the flower is enclosed within a spathaceous bract which ruptures irregularly at the apex on emergence of the flower. Petals absent. Stamens 1-2, hypogynous. Ovary superior, sessile or shortly stipitate, 1-3- (or occasionally 4-) locular; styles 2-3 (or occasionally 4); ovules numerous. Fruit a septicidal capsule.

A. Flowers with a calyx of 3 (or occasionally 4) equal usually more or less connate 1-nerved segments; stamen 1 ..... TRISTICHA. 3.

AA. Flowers enclosed in a nerveless spathaceous bract (spathella) which ruptures irregularly at the apex on emergence of the flower:

(a) Stamens 2, the filaments connate up to above the middle ..... INVERSODICRAEA. 1.

(aa) Stamen 1 ..... SPHAEROTHYLAX. 2.

1. **INVERSODICRAEA** Engler

Inversodicraea sp.

In masses on rocks in streams, olive-green when under water, flowering just above water-level.

Equatoria: *Imatong Mountains, River Narije.*

2. **SPHAEROTHYLAX** Bisch.

Sphaerothylax sp.

On rocks under rapidly flowing water.

Equatoria: *River Sue.*

3. **TRISTICHA** Thou.

Tristicha trifaria (Bory) Spreng.

T. hypnoides (St.-Hil.) Spreng.

Submerged moss-like herb attached to rocks, fruiting above water-level. Leaves very small, ovate to lanceolate, acute, keeled. Flowers terminal on very short leafy branchlets towards the apex of the stem; peduncle slender, up to nearly 1 in. long. Capsule ellipsoid with longitudinal nerves, about $\frac{1}{12}$ in. long, dry and submembranous.

Central and Southern Sudan.

29. *ELATINACEAE*

Herbs or low shrubs. Leaves opposite or verticillate, simple, with paired stipules. Flowers small, actinomorphic, hermaphrodite, axillary, solitary or cymose. Sepals 2-5, free, imbricate. Petals as many as the sepals, free, hypogynous, imbricate, persistent. Stamens as many or twice as many as the petals, free, hypogynous. Ovary superior, 2-5-locular; styles 2-5; ovules numerous in each loculus. Fruit a septicidal capsule.

1. **BERGIA** L.

Bergia capensis L.

B. verticillata Willd.

Glabrous procumbent herb $\frac{1}{2}$-1 ft. high, aquatic, usually with procumbent branches rooting at the nodes; stems succulent, pink. Leaves nearly sessile, lanceolate, tapering at both ends, 1-2 in. long, up to $\frac{3}{8}$ in. broad. Flowers in sessile or subsessile few- or many-flowered axillary clusters. Stamens 10.

Kordofan.

B. suffruticosa (Del.) Fenzl. Fig. 56.

Deep-rooted heather-like undershrub, rooting again where the branches touch the ground; bark deciduous in papery rust-coloured flakes. Leaves rather thick, sessile, varying from broadly elliptic to elliptic, obtuse or subacute at the apex, up to $\frac{1}{3}$ in. long, shortly hispid on both surfaces and often glandular, often clustered in the axils. Flowers white, small, solitary or in clusters of 2 to 6 or 8.

Northern and Central Sudan.

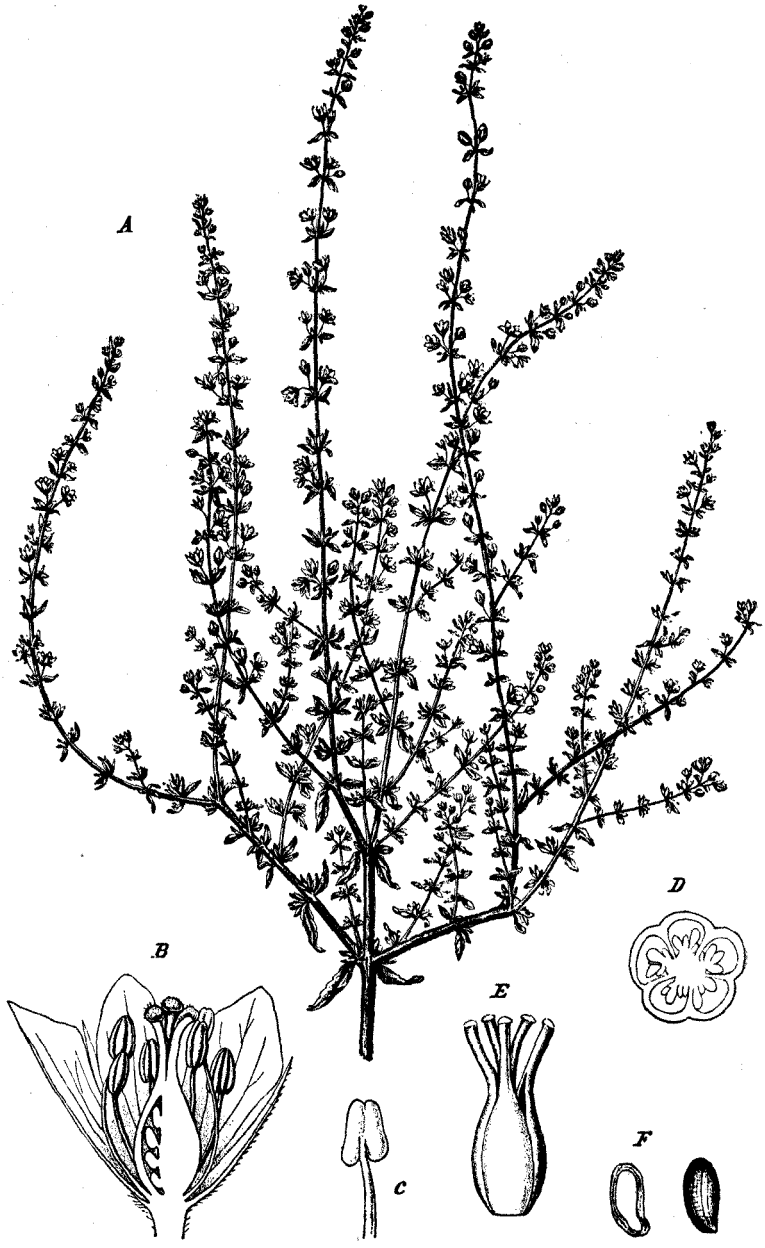


Fig. 56—BERGIA SUFFRUTICOSA (Del.) Fenzl.
A, branch with flowers. B, longitudinal section of flower. C, anther. D, transverse section of ovary. E, fruit. F, seeds.

B. ammannioides Heyne ex Roth.

Erect or decumbent more or less thinly pilose or shortly hispid annual herb a few inches to 1 ft. high, often growing near water. Leaves varying from oblanceolate to linear-elliptic, sharply and distinctly serrulate or nearly entire, ¼-1 in. long. Flowers small, in dense often many-flowered verticillate clusters. Stamens 5, occasionally varying to fewer or more.

Kordofan.

30. *CARYOPHYLLACEAE*

Herbs or rarely undershrubs. Leaves opposite, simple, with or without stipules. Flowers actinomorphic, hermaphrodite or sometimes unisexual, solitary or cymose. Sepals 4-5, free or connate into a tube, imbricate, often with membranous margins. Petals as many as the sepals or sometimes absent, free. Stamens 8-10 or fewer, free or slightly united at the base. Ovary superior, sessile or shortly stipitate, usually 1-locular with a free-central or basal placenta; styles 2-5, free or united below; ovules numerous or more rarely few or solitary. Fruit a capsule (opening by valves or apical teeth) or rarely baccate or indehiscent.

A. Styles free:
  B. Sepals connate into a tube ..... SILENE. 9.
  BB. Sepals free:
    (a) Leaves without stipules:
      (b) Styles 4-5:
        (c) Capsule opening by 5 valves ..... SAGINA. 8.
        (cc) Capsule opening by 8-10 apical teeth ... CERASTIUM. 2.
      (bb) Styles 3:
        (d) Capsule opening by 3 entire valves ... MINUARTIA. 4.
        (dd) Capsule opening by 3 2-fid valves ..... ARENARIA. 1.
    (aa) Leaves with small scarious stipules:
      (e) Seeds winged; leaves apparently verticillate ..... SPERGULA. 10.
      (ee) Seeds not winged; leaves opposite ... SPERGULARIA. 11.

AA. Styles united below:
  C. Ovary with numerous ovules; fruit a 3-valved capsule:
    (f) Petals deeply 2-fid ..... DRYMARIA. 3.
    (ff) Petals entire or 2-toothed:
      (g) Sepals keeled ..... POLYCARPON. 6.
      (gg) Sepals not keeled:
        (h) Petals clawed, with ovate or cordate limb, about as long as the obtuse sepals; inflorescences lax ..... ROBBAIREA. 7.
        (hh) Petals much shorter than the acute sepals; inflorescences generally dense ..... POLYCARPAEA. 5.
  CC. Ovary with 2 ovules; fruit indehiscent, 1-seeded ..... SPHAEROCOMA. 12.

1. **ARENARIA** L.

Arenaria leptoclados (Reichb.) Guss.

Much-branched annual herb up to 6 in. high, pubescent. Leaves subsessile, ovate, ¼-⅓ in. long. Flowers about ⅛ in. in diameter, in leafy cymes. Petals white, entire, shorter than the sepals. Styles 3, free. Capsule opening by 3 2-fid valves.

Red Sea Hills.

2. **CERASTIUM** L.

Cerastium vulgatum L. Common Mouse-ear Chickweed.

Downy perennial herb, branching at the base, the stems mostly procumbent. Leaves subsessile, oblong to ovate, up to ½ in. long. Flowers small, in terminal cymes. Sepals with broad membranous margins. Petals white, 2-fid. Styles 5. Capsule curved, opening by 10 apical teeth.

Darfur: Jebel Marra, 6500-9300 ft.

C. octandrum Hochst. ex A. Rich.

Erect branched glandular-villous annual herb. Leaves lanceolate-oblong, acute at the apex, up to ¾ in. long. Stamens 8. Capsule opening by 8 apical teeth.

Darfur: Jebel Marra, 10,200 ft. *Equatoria: Imatong Mountains, summit of Mount Kineti,* 10,400 ft.

3. **DRYMARIA** Willd.

Drymaria cordata (L.) Willd. Fig. 57.

Weak straggling herb up to 3 ft. high, glabrous or nearly so; stems quadrangular. Leaves petiolate, broadly ovate, rounded or subcordate at the base, ½-1 in. long, up to ¾ in. broad, papery, 3-5-nerved. Flowers in terminal few-flowered cymes. Sepals oblong-lanceolate, about ¼ in. long, with a distinct midrib and 2 lateral nerves, becoming dry and membranous in fruit.

Equatoria: Imatong Mountains, Atiaro.

4. **MINUARTIA** L.

Minuartia filifolia (Forsk.) Mattf.
Arenaria schimperii (Hochst.) Oliv.

Procumbent diffuse or tufted perennial herb, with a branching woody stock; flowering stems erect or decumbent, 2 in. or more high. Leaves finely subulate, spreading, about ½-½ in. long, often appearing tufted. Flowers in lax forking cymes. Petals white. Capsule opening by 3 entire valves.

Darfur: Jebel Marra, above 9000 ft.

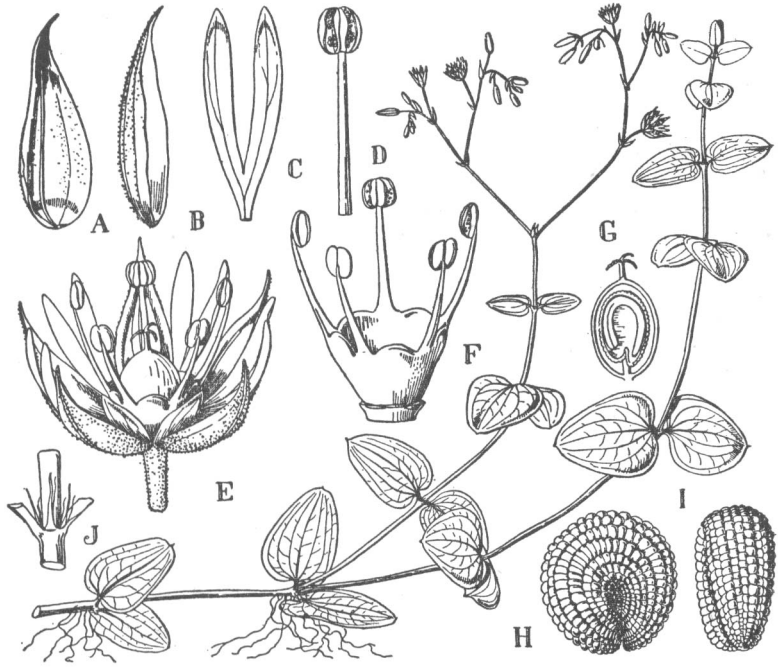


Fig. 57—DRYMARIA CORDATA (L.) Willd.
A, B, sepals. C, petal. D, stamen. E, flower. F, stamens united at the base. G, longitudinal section of ovary. H, I, seeds. J, stipules.

5. **POLYCARPAEA** Lam.

Polycarpaea corymbosa (L.) Lam. Fig. 58.

P. linearifolia (DC.) DC.

Herb 2-12 in. high, with a somewhat Amaranthaceous appearance. Leaves sessile, linear, finely bristle-pointed. Flowers small, numerous, rather laxly cymose or more or less congested into cymose heads; bracts scarious, silvery, bristle-pointed.

Widespread in sandy places and dry fields.

P. eriantha Hochst. ex A. Rich.

Dwarf and very diffuse slender herb. Leaves linear, about ½ in. long, finely bristle-pointed. Flowers pink-tinged, numerous, in lax cymes spreading all over the plant, opening only in sunshine. Sepals loosely pubescent.

Central and Southern Sudan.

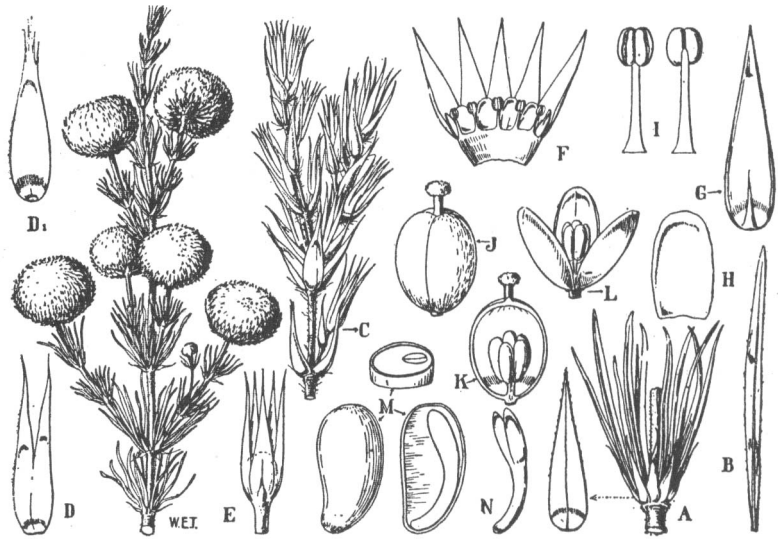


Fig. 58—POLYCARPAEA CORYMBOSA (L.) Lam.

A, node showing leaves and stipules, one stipule detached. B, leaf. C, a branch from the inflorescence, enlarged. D, D1, bracts from the inflorescence. E, calyx. F, flower laid open. G, sepal. H, petal. I, stamens, front and back. J, ovary. K, the same in vertical section. L, capsule opening by 3 valves. M, seed, with longitudinal and transverse sections. N, embryo.

P. spicata Wight ex Arn.

Glabrous herb 2-6 in. high, with straight spreading branches from the radical leaves, each bearing a leafy tuft. Leaves oblanceolate-spathulate, acute or obtuse at the apex. Peduncles umbellate, terminating in dense little clusters of flowers.

Red Sea District.

P. repens (Forsk.) Aschers. & Schweinf.

P. fragilis Del.

Hoary or tomentose herb 3-12 in. high, with numerous spreading branches usually from a woody stock. Leaves linear-lanceolate, the margins rolled outwards. Flowers in small densely clustered cymes. Sepals ovate-elliptic, apiculate, with broadly membranous margins.

Red Sea District: between sea-level and 4000 ft.

P. stellata (Willd.) DC.

Erect or diffuse herb. Leaves spreading, narrow-linear or linear-lanceolate, fine-pointed, usually with axillary leafy tufts. Flowers congested into rather few-flowered cymose heads about ¼ in. in diameter, on widely divaricate branching peduncles. Sepals acutely long-acuminate.

Red Sea Hills: *Erkowit.*

6. **POLYCARPON** L.

Polycarpon prostratum (Forsk.) Aschers. & Schweinf.

P. loeflingii Benth.; *P. memphiticum* (Del.) Fenzl ex Broun & Massey.

Diffuse wiry herb, prostrate or ascending, up to 8 in. high, sparsely or densely clothed with branched hairs. Leaves sessile, linear to spathulate-oblanceolate, ¼-¾ in. long. Flowers small, very numerous, in paniculate bracteate cymes. Sepals 5, with a thick keel and broad membranous margins, minutely ciliolate. Petals small, linear.

Widespread on river-banks and mud-flats.

P. tetraphyllum (L.) L. Four-leaved Allseed.

Diffuse forking annual herb, erect or procumbent, 3-4 in. high, glabrous. Leaves obovate-oblanceolate, narrowed into the petiole, ¼-½ in. long, usually appearing to be in whorls of 4 owing to the juxtaposition of pairs. Flowers very small, in dense or loose terminal cymes. Sepals strongly keeled, boat-shaped, acutely apiculate.

Red Sea Hills: Erkowit.

7. **ROBBAIREA** Boiss.

Robbairea delileana Milne-Redh.

Polycarpaea prostrata Decne. p.p.

Diffuse herb 3-8 in. high, glabrous, rather glaucous, the lateral branches prostrate. Leaves narrowly linear-spathulate or the upper ones linear. Flowers solitary in the forks or somewhat clustered towards the extremities. Sepals ovate-lanceolate, with broad membranous margins.

Northern Sudan.

8. **SAGINA** L.

Sagina abyssinica Hochst. ex A. Rich.

Glabrous perennial herb with numerous weak decumbent stems up to 8 in. long, much shorter with more tufted habit in exposed situations. Leaves linear, ⅜-½ in. long, each pair united at the base into a short sheath. Flowers solitary in the axils of the upper leaves on peduncles up to ½ in. long. Sepals 5, lanceolate, acute, about ¼ in. long, green with hyaline margins. Petals 5, white, much shorter than the sepals. Stamens 10. Styles 5. Capsule dividing into 5 separate valves on dehiscence.

Equatoria: Imatong Mountains, Kippia, 8000 ft.

9. **SILENE** L.

Silene macrosolen Steud. ex A. Rich.

Glabrous pale or somewhat glaucous viscid perennial herb, branching from the base; flowering stems erect, 2-3 ft. high. Leaves nar-

row-linear, tapering to a fine point, scarcely ⅛ in. broad, the midrib prominent beneath. Flowers pinkish, in forking panicles. Calyx 5-toothed, up to 1½ in. long.

Darfur: *Jebel Marra*, 6500-9300 ft.

S. chirensis A. Rich.

Erect puberulous or scabrid-pubescent perennial herb 1-2 ft. high. Lower leaves linear-lanceolate to elliptic, more or less scabrid-pubescent, ciliate beneath; upper leaves linear, tapering at each end, acute at the apex. Flowers usually 3-9, white, in erect unilateral spicate racemes. Calyx ¼-¾ in. long, with acute teeth and more or less dark-coloured nervation.

Red Sea Hills. *Equatoria*: *Imatong Mountains, summit of Mount Kineti*.

S. lynesii Norman.

Perennial glandular-pilose herb; stems erect or suberect. Leaves sessile, broadly linear or narrowly oblanceolate, obtuse at the apex. Flowers without bracts; peduncles long, solitary, axillary or terminal. Calyx long-cylindric, 10-nerved, the margins of the lobes hyaline. Petals red. Capsule ellipsoid.

Darfur: *Jebel Marra*.

10. **SPERGULA** L.

Spergula fallax (Lowe) E. H. L. Krause.

S. arvensis (non L.) Broun & Massey.

Small annual herb 4-6 in. high, glaucescent. Leaves apparently verticillate, narrow-linear. Petals lanceolate, acute at the apex. Seeds flattened, with a broad hyaline wing, radiate-striate.

Red Sea District.

11. **SPERGULARIA** (Pers.) J. & C. Presl

Spergularia rubra (L.) J. & C. Presl. Red Sandwort.

Much-branched decumbent herb 3-6 in. high. Leaves very narrow-linear, rather fleshy, often with tufted secondary leaves in their axils. Flowers white or pink, in forked or racemose cymes. Sepals oblong or lanceolate, rather obtuse at the apex, exceeding the petals.

Red Sea Hills: *Karora Hills*.

12. **SPHAEROCOMA** T. Anders.

Sphaerocoma hookeri T. Anders.

S. aucheri (non Boiss.) Broun & Massey.

Much-branched glaucous undershrub 1-2 ft. high; branches glabrous or pubescent. Leaves fleshy, terete, linear, clustered. Flowers small, in capitate pedunculate cymes. Stamens 5. Ovary with 2 ovules. Fruit indehiscent, 1-seeded.

Red Sea District.

31. *MOLLUGINACEAE*

Herbs. Leaves simple, alternate or opposite, with or without stipules. Flowers actinomorphic, usually hermaphrodite, solitary or cymose, usually small and inconspicuous. Sepals 5 or rarely 4, free or rarely united at the base, imbricate, usually persistent. Petals small or absent, free or united at the base. Stamens 3-20, hypogynous or slightly perigynous, free or connate at the base or grouped in bundles. Ovary superior, syncarpous (or of 3-5 free carpels in *Gisekia*), 1-7-locular; styles as many as the loculi; ovules 1 or more in each loculus. Fruit a loculicidal capsule or more rarely indehiscent, sometimes 2-coccous or apocarpous.

A. Carpels 3-5, free; leaves opposite or subopposite; petals absent .... GISEKIA. 2.

AA. Carpels united into a single ovary:

(a) Ovary 2-locular; fruit 2-coccous, rugose or tuberculate or broadly winged ..... LIMEUM. 4.

(aa) Ovary 3-5-locular; fruit a loculicidal capsule:

(b) Petals present, united at the base; leaves alternate ..... CORBICHONIA. 1.

(bb) Petals absent; leaves opposite or verticillate:

(c) Seeds with a conspicuous strophiole; diffuse or ascending herbs, tomentose or pubescent, without radical leaves ... GLINUS. 3.

(cc) Seeds without a strophiole; erect herbs, glabrous, often glaucous, with radical leaves differing from the cauline leaves or all the leaves radical ..... MOLLUGO. 5.

1. **CORBICHONIA** Scop.

Corbichonia decumbens (Forsk.) Exell. Fig. 59.

Orygia decumbens Forsk.

Diffuse decumbent herb from a few inches to 2 ft. high. Leaves fleshy, glaucous, obovate or orbicular, cuneate at the base, ½-1 in. broad or occasionally smaller, the radical leaves sometimes 1-1½ in. Flowers about ⅛ in. in diameter. Fruit a 5-valved capsule.

Widespread.

2. **GISEKIA** L.

Gisekia pharnacioides L.

Rather variable plant, diffuse or decumbent, often subject to a blight which renders it pink or wine-red. Leaves opposite or subopposite, varying from oblanceolate to linear, up to 1¼ in. long and ⅛ in. broad, thickly covered beneath with numerous conspicuous minute crystals. Flowers in sessile or pedunculate often many-flowered cymes at the nodes; pedicels up to ⅛ in. long. Sepals elliptic, rounded, 3-nerved, with hyaline margins. Petals absent. Carpels free.

Northern and Central Sudan.

Fig. 59—CORBICHONIA DECUMBENS (Forsk.) Exell.

G. rubella Hochst. ex Moq.

Much like *G. pharnacioides*. Leaves linear or linear-elliptic, 1½-2 in. long. Cymes umbelliform, at length pedunculate, forming lax diffuse panicles; peduncle 2 in. long or shorter, very slender; pedicels ¼-½ in. long.

Central and Southern Sudan.

3. GLINUS L.

Glinus lotoides L.

Annual herb up to 2 ft. high. Leaves obovate, slightly apiculate at the apex, about 1¼ in. long including the petiole, ⅓ in. or more broad, densely stellate-tomentose to almost glabrous. Flowers in axillary clusters, subsessile, the pedicel shorter than the calyx. Seeds granular-tuberculate.

Widespread in moist sandy places.

G. oppositifolius (L.) Aug. DC. Fig. 60.

Mollugo spergula L.

Diffuse decumbent herb. Leaves oblanceolate, slightly toothed towards the apex, up to 1¼ in. long and ¼ in. broad, glabrous or nearly so, rather fleshy, 3-9 in a whorl. Flowers clustered, the pedicel much longer than the calyx. Seeds as in *G. lotoides*.

*W*1

Fig. 60—GLINUS OPPOSITIFOLIUS (L.) Aug. DC.
A, branch. B, longitudinal section of flower. C, fruit opened. D, seed with funicle and strophiole.

4. LIMEUM L.

Limeum diffusum (Gay) Schinz.

L. linifolium (C. Presl) Fenzl.

Glabrous diffuse annual herb. Leaves alternate, linear, acute at the apex, up to ¾ in. long. Flowers in leaf-opposed subsessile or pedunculate clusters. Sepals oblong-elliptic, very acute at the apex, with a broad green midrib and hyaline margins. Petals absent. Fruit rugose, not winged.

Central Sudan.

L. kotschyi (Moq.) Schellenb.
L. viscosum (non Fenzl) Broun & Massey.

Annual diffuse or ascending glandular-viscid herb. Leaves alternate, petiolate, obovate or spathulate, rounded and mucronate at the apex, about ¾ in. long and ⅓ in. broad. Flowers small, in leaf-opposed cymes terminating short leafy lateral branchlets. Sepals broadly elliptic, obtuse at the apex, with paler margins. Petals 5. Fruit tuberculate, not winged.

Central Sudan.

L. indicum Stocks ex T. Anders.

Diffuse glandular puberulous or glabrate herb, divaricately branched. Leaves opposite or subopposite, broadly elliptic or orbicular, mucronate at the apex, entire, ⅛-⅓ in. long. Cymes few- or several-flowered, sessile or subsessile at the nodes. Petals absent. Fruit minute, bony, not winged.

Nubia.

L. pterocarpum (Gay) Heimerl.
Semonvillea pterocarpa Gay.

Erect or rather diffuse nearly glabrous herb 1-2½ ft. high. Leaves fleshy, linear or linear-lanceolate, subacute at the apex, up to 2 in. long and ¼ in. broad. Flowers greenish, small, few, in pedunculate subcapitate cymes. Fruit orbicular, puberulous, separating into 2 broadly winged cocci about ⅛ in. in diameter, the wings with radiating forked nerves and a very narrow membranous margin.

Kordofan.

5. MOLLUGO L.

Mollugo cerviana (L.) Ser.

Erect glaucous herb 2-6 in. or more high, often much branched. Leaves radical and cauline; radical leaves spathulate-obovate, up to ¾ in. long, soon disappearing; cauline leaves pseudo-verticillate, linear-acicular, obtuse at the apex. Inflorescences leafy, subumbellate; flowers white. Seeds pale-brown, smooth, triangular.

Widespread in sandy places, river-beds, etc.

M. nudicaulis Lam.

Erect glabrous twiggy annual herb 3-10 in. high. Leaves all radical, crowded, persistent, spathulate-oblanceolate, up to 2½ in. long and ¾ in. broad. Inflorescences cymose-corymbose, lax; peduncle 4-6 in. long, leafless, trichotomously branched. Flowers white. Seeds minutely and closely muricate.

Widespread.

32. *FICOIDACEAE*

Herbs or low shrubs, often fleshy. Leaves simple, alternate or opposite, sometimes very small, with or without stipules. Flowers actinomorphic, usually hermaphrodite. Calyx gamosepalous; tube free or adnate to the ovary; lobes 4-8, imbricate or rarely valvate. Petals numerous or absent, free, 1- or more-seriate, inserted in the calyx-tube. Stamens 4 to many or rarely 1, perigynous, free or united at the base or grouped into bundles. Ovary superior to inferior, 1-multi-locular; styles 1 or more; ovules 1 or more in each loculus. Fruit a capsule or nut-like and drupaceous, often clasped by the persistent calyx.

A. Styles 1-2; leaves opposite, conspicuously unequal in each pair; fruit membranous or coriaceous, dehiscing transversely by a circular split ..... TRIANTHEMA. 2.

AA. Styles 4-5; leaves alternate, pubescent; fruit woody at the top, dehiscing by apical valves ..... AIZOON. 1.

1. AIZOON L.

Aizoon canariense L.

Dense spreading hairy herb closely appressed to the soil, woody at the base. Leaves alternate, spathulate, up to 3 in. long, pitted when dry and more or less pilose. Flowers sessile, solitary or clustered in the axils of the leaves. Fruit woody at the top, star-shaped, $\frac{1}{8}$ in. long; seeds black.

North-eastern Sudan.

Fig. 61—TRIANTHEMA PENTANDRA L.

2. TRIANTHEMA L.

Trianthema pentandra L. Fig. 61.

Diffuse prostrate herb; branches setulose-pubescent. Leaves opposite, oblong-obovate, rounded at the apex, expanded at the base, up to 2 in. long and 1 in. broad. Flowers clustered, axillary, almost sessile. Sepals green with whitish edges and a small dorsal horn below the apex. Petals absent. Styles 2. Capsule membranous or coriaceous.

Widespread.

T. polysperma Hochst. ex Oliv.

Prostrate herb. Leaves opposite, fleshy, elliptic or oblanceolate, obtuse at the apex, narrowed into the petiole, about ¾ in. long. Flowers axillary, dichotomously cymose. Calyx 5-lobed, with petaloid pink margins. Ovary 2-locular; styles 2. Capsule narrowed above, obtuse or umbilicate at the apex.

Central Sudan.

T. salsoloides Fenzl ex Oliv.

Hairy herb. Leaves opposite, fleshy, linear, mucronate at the apex, dilated at the base with membranous stipuliform teeth, ½-1 in. long. Flowers axillary, clustered or on short lateral leafy shoots. Petals absent. Style 1. Capsule 1-seeded.

Central Sudan.

T. crystallina (Forsk.) Vahl. Fig. 62.

Ascending or diffuse herb, with spreading or prostrate branches, repeatedly di- or tri-chotomous from the base; branches (at least from the extremities) like the leaves cellular-papillose. Leaves fleshy, oblanceolate or obovate or orbicular, ¼-¾ in. long, much reduced and often roundish and subcordate at the base on profusely flowering branches. Flowers in axillary few- or many-flowered often dense clusters. Ovary truncate, 1-locular; style 1. Seeds 2.

Northern and Central Sudan.

T. sedifolia Vis.

T. triquetra (non Willd.) Broun & Massey.

Procumbent or prostrate herb, with slender papillose alternate or more rarely opposite distichous branches. Leaves fleshy, nearly linear, obtuse at the apex, ⅓-½ in. long, the short petiole membranously dilated. Flowers in sessile axillary small compact clusters of 2-3 or more. Style 1. Seeds 2.

Central Sudan.

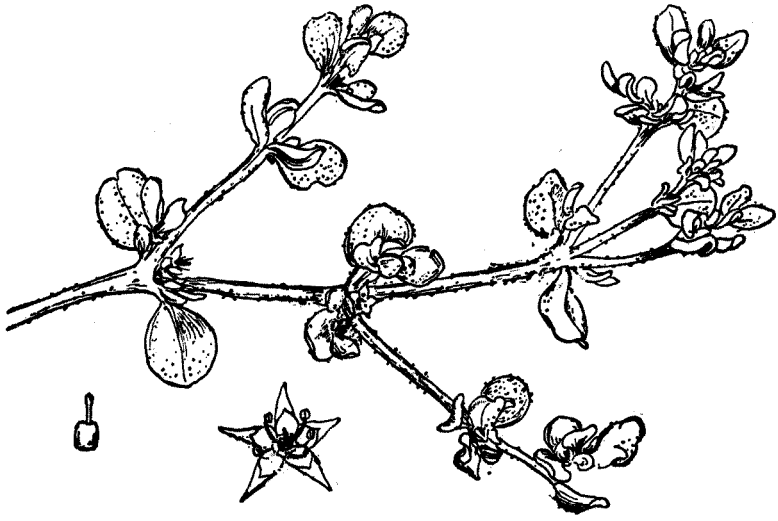


Fig. 62—TRIANTHEMA CRYSTALLINA (Forsk.) Vahl.

33. *PORTULACACEAE*

Herbs or undershrubs, often succulent. Leaves simple, alternate or opposite, with scarious or setose stipules or rarely without stipules. Flowers actinomorphic or almost so, hermaphrodite, solitary or variously cymose or racemose. Sepals 2 or rarely more, imbricate, free or united at the base. Petals 4-6, imbricate, free or connate at the base, soon falling. Stamens as many as and opposite the petals or fewer or more numerous, free or united in bundles opposite the petals. Ovary superior or more or less inferior, 1-locular; style usually variously divided; ovules 1 to many. Fruit a capsule or rarely a nut; seeds globose-reniform.

A. Ovary superior; capsule opening by valves; seeds radiate-striate; flowers in lax inflorescences ..... TALINUM. 2.

AA. Ovary more or less inferior; capsule circumscissile; seeds tuberculate; flowers solitary or clustered ..... PORTULACA. 1.

1. **PORTULACA** L.

Portulaca oleracea L.

Annual herb, with spreading or prostrate succulent branches. Leaves alternate, fleshy, flat, spathulate-oblanceolate, rounded at the apex; stipules minute. Flowers yellow, sessile in clusters, few together, opening for a short time in the morning, surrounded by a few membranous scales and 2 or more involucral leaves.

Widespread.

P. foliosa Ker-Gawl.

Erect or decumbent herb, often woody below. Leaves terete, succulent; stipular setae confined or almost confined to around the flowers. Flowers yellow, solitary or in small heads.

Equatoria.

P. quadrifida L.

Prostrate or decumbent succulent annual herb, conspicuously woolly at the nodes. Leaves fleshy, opposite, numerous, very variable in size and shape, often lanceolate or ovate-lanceolate to obovate. Flowers yellow, smallish.

Widespread.

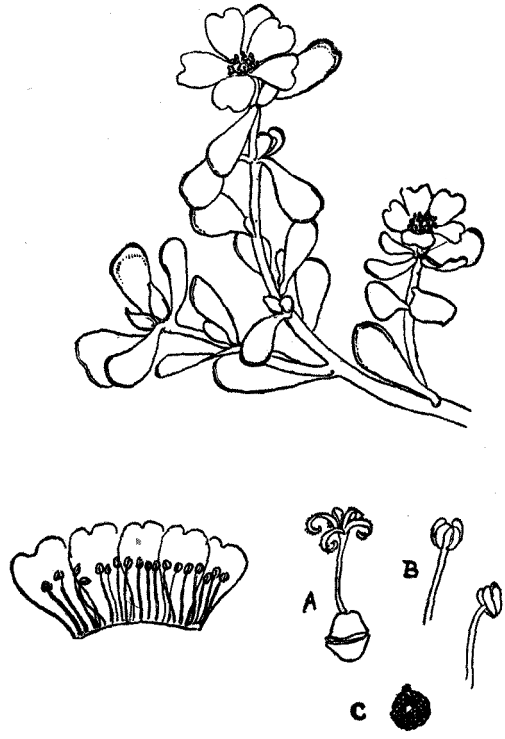


Fig. 63—PORTULACA ERYTHRAEAE Schweinf.
A, pistil. B, stamens. C, seed.

P. erythraeae Schweinf. Fig. 63.

Fleshy herb. Leaves obovate-cuneate, about 1 in. long. Flowers axillary, solitary, sessile.

Red Sea Hills: Erkowit.

Fig. 64—TALINUM PORTULACIFOLIUM (Forsk.) Aschers. ex **Schweinf.**
A, branch with flowers. B, longitudinal section of flower. **C**, fruit. **D**, seed.

2. **TALINUM** Adans.

Talinum caffrum (Thunb.) Eckl. & Zeyh.

Succulent leafy biennial or perennial herb from a thick often several-headed rootstock; branches glabrous. Leaves fleshy, lanceolate to elliptic or nearly linear, mucronate at the apex, 1-1½ in. long, ¼-½ in. broad. Flowers yellow, axillary, usually solitary; peduncle with one or more pairs of subulate bracts, occasionally 2- or even 3-flowered, decurved above in fruit.

Equatoria.

T. portulacifolium (Forsk.) Aschers. ex Schweinf. Fig. 64.

T. cuneifolium Willd.

Glabrous shrubby plant attaining several feet in height, with erect rod-like branches leafy below and terminating in long racemes or racemose panicles of flowers. Leaves fleshy, alternate, obovate or orbicular, mucronate or apiculate at the apex, entire, rounded above, 1-2 in. long, ½-1 in. broad. Racemes erect; flowers 1-4, carmine to purple, scattered. Capsule globose, about the size of a pea, crustaceous.

Central and Southern Sudan.

T. triangulare (Jacq.) Willd.

T. crassicaule (Jacq.) Willd.

Succulent erect herb, woody at the base. Leaves alternate, obovate-oblanceolate, emarginate and mucronate at the apex, 1¼-2¾ in. long, rather fleshy and glabrous. Flowers pink to red, in lax forked inflorescences. Sepals ovate, acuminate at the apex, with 3 main green nerves and membranous margins. Petals about twice as long as the sepals. Capsule straw-coloured, about ¼ in. long, smooth.

Red Sea District: *coast*. Introduced into Africa from tropical America.

34. *POLYGONACEAE*

Herbs, shrubs, climbers or rarely trees. Leaves simple, alternate or rarely opposite, with stipules which are often dilated into a membranous tubular sheath (ocrea). Flowers hermaphrodite or unisexual, actinomorphic, small. Sepals 3-6, imbricate, often enlarged and becoming membranous in fruit. Petals absent. Stamens 6-9 or rarely more, free or united at the base. Disk annular or central. Ovary superior, sessile, 1-locular; styles 2-4, usually free; ovule solitary, basal. Fruit a 3-angled or 2-sided nut.

A. Base of calyx accrescent and becoming nut-like ..... OXYGONUM. 1.

AA. Base of calyx not accrescent:

(a) Sepals more or less equal; stipules forming a tubular sheath (ocrea) within the petiole, often with long bristles at the apex ..... POLYGONUM. 2.

(aa) Inner sepals much enlarged and membranous in fruit; stipules more or less adnate to the petiole, not bristly ..... RUMEX. 3.

1. **OXYGONUM** Burch.

Oxygonum atriplicifolium (Meisn.) Martelli.

Herb, with slender stems pubescent on one side. Leaves deltoid to lanceolate, entire or slightly lobed, ¾ in. long, ½ in. broad. Flowers pale-pink, becoming 3-spined in fruit; racemes lax, slender, about 6 in. long; bracts similar to the ocreae, enclosing 2-3 flowers.

Northern and Central Sudan.

Var. **sinuatum** (Steud. & Hochst.) Bak.
Leaves ovate, pinnatisect.
Widespread.

2. **POLYGONUM** L.

A. Flowers in small heads or axillary clusters; ocrea more or less laciniate, white; plant prostrate ..... *P. plebeium.*

AA. Flowers in spikes, racemes or panicles:

(a) Racemes elongated, slender, the clusters of flowers not congested; nut usually 3-angled ..... *P. salicifolium.*

(aa) Racemes elongated, more robust, the clusters of flowers congested:

(b) Ocrea with an herbaceous spreading ciliate limb ..... *P. limbatum.*

(bb) Ocrea without an herbaceous limb:

(c) Nut 3-angled ..... *P. barbatum.*

(cc) Nut usually 2-sided:

(d) Leaves densely hairy beneath:

(e) Cilia at the apex of the ocrea absent or very small and weak; leaves gradually narrowed into the petiole, white beneath with a woolly indumentum ..... *P. lanigerum.*

(ee) Cilia at the apex of the ocrea very large and conspicuous; leaves abruptly narrowed into the petiole, not quite white beneath with a pilose indumentum ..... *P. tomentosum.*

(dd) Leaves glabrous or rather sparingly pubescent beneath:

(f) Ocrea without or with very small and few cilia at the apex:

(g) Peduncles and leaves quite glabrous; leaves acute or shortly acuminate at the apex ..... *P. glabrum.*

(gg) Peduncles finely glandular-puberulous; leaves long-tailed-acuminate at the apex ..... *P. senegalense.*

(ff) Ocrea with distinct long cilia at the apex; leaves more or less pubescent or bristly beneath; inflorescences with rather dense clusters of flowers ..... *P. acuminatum.*

Polygonum plebeium R. Br.

Prostrate herb. Leaves subsessile, linear-oblong, acute at the apex, ¼-½ in. long; ocrea white. Flowers 2-5-clustered. Calyx white, 5-lobed. Nut 3-angled, smooth, shining.

Northern and Central Sudan.

P. salicifolium Brouss. ex Willd.

P. serrulatum Lag.

Slender procumbent glabrescent herb 2-3 ft. high, often in marshy places. Leaves subsessile, linear-lanceolate, acuminate at the apex, up to 4¾ in. long, glabrous beneath except on the midrib and margin. Inflorescences lax and slender, on slender glabrous peduncles, several to a stem, 1½-2 in. long. Calyx pink, minute.

Central and Southern Sudan.

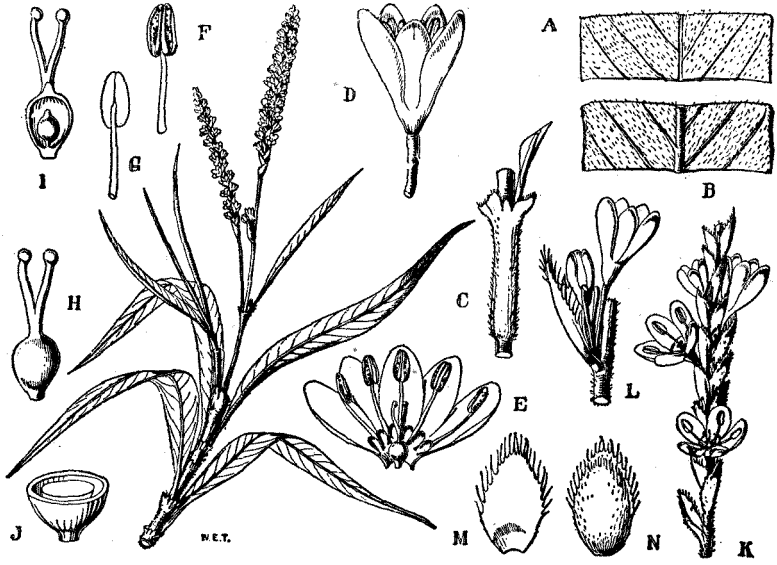


Fig. 65—POLYGONUM LIMBATUM Meisn.

A, portion of leaf, upper surface. B, lower surface of same. C, ocrea. D, flower. E, flower laid open. F, G, stamens, front and back. H, ovary with styles. I, vertical section of ovary. J, cross-section of ovary. K, portion of inflorescence. L, portion of same, enlarged. M, N, bracts, inner and outer face.

P. limbatum Meisn. Fig. 65.

Perennial herb 3-4 ft. high, in swamps and ditches. Leaves linear-lanceolate, up to 4 in. long and ¾ in. broad, pubescent on the nerves beneath or glabrous. Racemes 3 to a branch, 2-3 in. long. Calyx pink, minute. Styles 2. Nut black, glossy.

Central and Southern Sudan.

P. barbatum L.

Perennial herb, with slender erect stems, hairy upwards or throughout. Leaves lanceolate, acuminate at the apex, usually hairy on both surfaces, the lower ones 4-6 in. long. Spikes cylindric, slender, 2-3 in. long; peduncles hairy; bracts conspicuously ciliate with rigid bristles. Calyx pink. Styles 3. Nut small, 3-angled.

Central and Southern Sudan.

P. lanigerum R. Br.

Aquatic perennial herb 5-6 ft. high. Leaves lanceolate, up to 9 in. long. Racemes dense, 1-3 in. long; bracts orbicular. Styles 2. Nut black.

Southern Sudan.

P. tomentosum Willd.

Aquatic perennial herb, with a long rhizome; stems 4-5 ft. long. Leaves oblong-lanceolate, 6-8 in. long. Spikes dense, cylindric, 2-3 in. long.

Central and Southern Sudan.

P. glabrum Willd.

Erect glabrous perennial herb 3-4 ft. high.
late, up to 8 in. long; ocrea large, membranous. Spikes dense, 2 in. long. Calyx pink. Styles 2. Nut orbicular.

Widespread.

P. senegalense Meisn.

Perennial erect or semi-decumbent herb 4-5 ft. high or more, almost glabrous, in river-beds and swamps. Leaves distinctly petiolate, oblong-lanceolate, 2-8 in. long. Racemes 2-3 in. long; bracts ovate. Calyx pale-pink, minute. Styles 2. Nut blackish, orbicular, shining.

Darfur: *Jebel Marra*, 6500 ft.

P. acuminatum Kunth.

Stout erect or semi-decumbent pubescent herb up to 3-4 ft. high, in moist places. Leaves lanceolate or linear-lanceolate, acuminate at the apex, the upper ones 3-4 in. long, the lower up to much larger. Spikes dense, cylindric, 2-3 in. long, 2-4 to a stem. Calyx pink. Styles 2. Nut black, glossy.

Darfur. Equatoria.

3. **RUMEX** L.

Rumex abyssinicus Jacq.

Tall herb, with a perennial rootstock 1 in. in diameter; stems hollow, reddish. Leaves hastate, more or less triangular, acuminate at the apex, up to 8 in. long and 3¼ in. broad; petiole up to 4 in. long. Flowers in much-branched panicles 1 ft. long. Sepals red, persistent, enlarged in fruit, entire, membranous, reticulate.

Darfur: *Jebel Marra*, 6000-8000 ft. *Equatoria*: *Imatong Mountains*, 6000-9000 ft.

R. vesicarius L. Fig. 66.

Branched herb. Leaves ovate or ovate-deltoid, obtuse to rounded at the apex, cordate at the base, rather fleshy, about 1¼ in. long and 1 in. broad. Inflorescence a small panicle; flowers 1-2 on jointed pedicels. Sepals reddish, in fruit woody in the centre, persistent, membranous, conspicuously reticulate, notched. Nut cream-coloured, almost winged.

Red Sea District: *littoral*. *Darfur*: *Jebel Meidob*, 4000 ft.

Fig. 66—RUMEX VESICARIUS L.

R. nepalensis Spreng.

Stout perennial herb 3-4 ft. high. Leaves lanceolate or elongate-lanceolate, acute at the apex, crenulate or subentire, up to 12 in. long and 2 in. broad. Inflorescence an elongated raceme of clusters. Sepals persistent, pectinate with hooked teeth.

Darfur: *Jebel Marra, Guloberi Wadi*, 8000 ft.

R. nervosus Vahl.

Much-branched shrub up to 6 ft. high. Leaves often crowded on short striate lateral branchlets, oblong or the upper ones lanceolate, 2-3 in. long, glabrous. Flowers dioecious, 2-5 in a cluster, forming lax or dense terminal panicles, the lower branches only subtended at the base by reduced leaves. Outer sepals reflexed; inner sepals in fruit cordate-orbicular, ¼ in. broad, scarious, reticulate.

Red Sea Hills: *Erkowit*. *Southern Sudan*.

35. *ILLECEBRACEAE*

Annual or perennial herbs or rarely small shrubs. Leaves entire, usually opposite and with stipules. Inflorescence usually a congested cyme. Flowers minute, usually green, actinomorphic, usually hermaphrodite, subtended by large or small scarious bracts and bracteoles. Sepals 5 or rarely 4, free, herbaceous, finally coriaceous, persistent. Petals present or absent, free. Stamens 5 or sometimes fewer, perigynous, sometimes alternating with staminodes. Ovary superior, sessile, 1-locular; ovules 1-4 (usually solitary); stigmas 2-3. Fruit usually a nut with a thin loose pericarp, enclosed in the persistent calyx.

A. Flowers in threes, the 2 outer imperfect; bracts compound ..... COMETES. 1.

AA. Flowers all perfect; bracts ovate, white-scarious ..... PARONYCHIA. 2.

1. **COMETES** L.

Cometes abyssinica R. Br. Fig. 67.

Erect perennial herb 6-12 in. high; stems pubescent, many times dichotomously branched. Leaves opposite or verticillate, sessile, spreading, lanceolate, the lower ones 1-1½ in. long. Clusters of flowers very numerous, terminal on the branchlets; bracts at first comparatively small, silky, finally overtopping the flowers, with many pungent divisions, so that the clusters look like prickly balls about 1 in. in diameter. Sepals green, oblong, ⅛ in. long, tipped with a spreading point which becomes as long as the blade.

Red Sea Hills: *Erkowit*. *Darfur*: *Jebel Marra*, 6500 ft. and over.

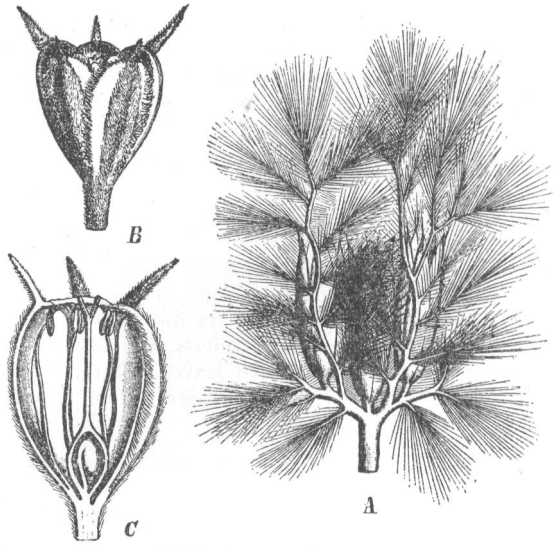


Fig. 67—COMETES ABYSSINICA R. Br.
A, flower-cluster. B, single flower. C, longitudinal section of flower.

2. **PARONYCHIA** Mill.

Paronychia argentea Lam.

Densely tufted perennial herb; stems slender, wiry, pubescent, 3-6 in. long. Leaves opposite; lower ones oblanceolate, mucronate at the apex; upper ones shorter, oblong, acute at the apex; stipules ovate, white-scarious. Flowers in dense terminal clusters; bracts white-scarious, numerous, ovate, $\frac{1}{8}$-$\frac{1}{6}$ in. long, quite hiding the flowers. Sepals green with narrow white borders, oblong, hooked at the apex, $\frac{1}{16}$ in. long, pubescent.
Northern Sudan.

36. *PHYTOLACCACEAE*

Herbs, shrubs or trees. Leaves alternate, simple, entire; stipules absent or minute. Flowers hermaphrodite or unisexual, actinomorphic or nearly so, hypogynous, in simple or compound terminal or axillary racemes or spikes. Sepals usually 4-5, free or partly connate, imbricate, equal or unequal. Petals usually absent. Stamens 3 to many, free or united, often inserted on an hypogynous disk. Ovary superior or rarely inferior, composed of 1 or more free or variously connate carpels; style almost none or short; ovules usually solitary in each carpel. Fruit apocarpous or syncarpous, fleshy or dry.

Phytolacca dodecandra L'Hérit. has recently been found in Equatoria (Imatong Mountains, Gilo). It has dioecious flowers and free carpels

Fig. 68—HILLERIA LATIFOLIA (Lam.) H. Walt.
A, flowering branch. B, part of inflorescence. C, flower. D, fruit. E, seed. F, embryo. G, longitudinal section through the ovary and the ovule. H, stamens.

1. **HILLERIA** Vell.

Hilleria latifolia (Lam.) H. Walt. Fig. 68.

Mohlana nemoralis Mart.

Herb up to 4 ft. high. Leaves ovate-elliptic, acutely acuminate at the apex, obtuse or subacute at the base, up to 6 in. long and 2½ in. broad, with numerous short lines of crystals resembling appressed hairs on the lower surface; lateral nerves about 6 on each side of the midrib; petiole long, with setulose hairs on the upper surface. Racemes slender, up to 4¾ in. long. Fruit ellipsoid-globose, about ⅛ in. in diameter, reticulate, glabrous.

Equatoria. Introduced into Africa from South America.

37. *CHENOPODIACEAE*

Annual or perennial herbs or shrubs, often glaucous; stems sometimes jointed. Leaves alternate or rarely opposite, without stipules, simple, sometimes absent. Flowers often green, small or minute, hermaphrodite

or unisexual, usually actinomorphic, often bracteate. Calyx 3-5-lobed or rarely absent in the female flowers, often accrescent in fruit. Petals absent. Stamens often as many as the calyx-lobes and opposite to them, hypogynous or inserted on a disk or on the calyx; staminodes rare. Disk present or absent. Ovary superior or immersed in the base of the calyx, 1-locular; styles solitary or 2-3, terminal; ovule solitary. Fruit a nut, rarely circumscissile.

A. Leaves when young ending in a rigid spiny point, alternate, with a transparent margin towards the base and a tuft of woolly hairs inside the base ..... CORNULACA. 4.

AA. Leaves not ending in a spine:

B. Stems and branches not jointed:

(a) Leaves flat, fairly large (mostly over 1 in. long):

(b) Leaves mealy or glandular, often toothed or divided; flowers bisexual ..... CHENOPODIUM. 3.

(bb) Leaves covered with scales, entire; flowers unisexual ..... ATRIPLEX. 2.

(aa) Leaves thick and fleshy or very small (under 1 in. long):

(c) Leaves thick and fleshy, ⅛-1 in. long ... SUAEDA. 9.

(cc) Leaves oblong or narrowly elliptic, up to ½ in. long, very hairy ..... KOCHIA. 6.

(ccc) Leaves obovate or orbicular, $\frac{1}{10}$ in. long, glabrous ..... HALOPEPLIS. 5.

BB. Stems and branches distinctly jointed:

(d) Leaves ovate or orbicular ..... SALSOLA. 8.

(dd) Leaves absent:

(e) Seeds with rich lateral endosperm ..... ARTHROCNEMUM. 1.

(ee) Seeds without or almost without endosperm ..... SALICORNIA. 7.

1. **ARTHROCNEMUM** Moq.

Arthrocnemum glaucum (Del.) Ung.-Sternb.

A. fruticosum Moq. p.p.

Glabrous erect branched woody herb or undershrub 6-20 in. high; branches short, jointed. Leaves absent. Flowers very small, partially sunk in dense cylindric spikes 1½-2½ in. long.

Red Sea District: saline marshes.

2. **ATRIPLEX** L.

Atriplex farinosa Forsk.

Undershrub 3 ft. high. Leaves short-petiolate, lanceolate-oblong, some cordate or auriculate (sometimes with acute auricles) at the base, 1½ in. long, densely white-tomentose beneath. Flowers unisexual, in terminal spikes or panicles. Male flowers with a 5-lobed calyx and 3-5 stamens. Female flowers enclosed in 2 orbicular tomentose bracts ⅛ in. broad in fruit; calyx absent; style 2-branched.

Red Sea District: littoral.

3. **CHENOPODIUM** L.

Chenopodium murale L. Nettle-leaved Goosefoot.

C. album (non L.) Broun & Massey.

Erect herb up to about 3 ft. high but usually smaller, eglandular, sparsely whitish-mealy on the young shoots and inflorescence. Leaves rhombic-ovate or -elliptic (the upper ones often grading to lanceolate), acute or subacute at the apex, the margin with several coarse teeth on each side. Inflorescence a terminal panicle, often rather small and irregular with small clusters of flowers. Sepals slightly keeled. Seed black, slightly shining, sharply keeled, closely and very minutely pitted, not marked with radial lines.

Northern and Central Sudan.

C. mucronatum var. **subintegrum** Aellen.

Erect herb up to about 2½ ft. high, eglandular, more or less whitish-mealy, densely so on the young shoots and inflorescence. Leaves ovate-elliptic, obtuse at the apex (or the uppermost ones acute), the margin subentire or with a single slight cusp on each side or sometimes obscurely dentate above. Inflorescence a many-flowered terminal panicle. Sepals keeled. Seed black, shining, bluntly keeled, marked with radial lines but not pitted.

Equatoria: *Didinga Mountains, near Nagichot*, 6700 ft.

C. schraderianum Schult.

Erect herb up to about 6 ft. high, clothed all over with plentiful shortly stipitate glands, not white-mealy. Leaves deeply pinnately lobed. Inflorescences along the main stem and branches, elongate-cylindric, up to about 18 in. long, 2 in. broad, composed of short lax lateral cymes. Seed reddish-black, dull.

Darfur: *Jebel Marra*, 6500 ft. *Equatoria*: *Imatong Mountains, Itobol.*

4. **CORNULACA** Del.

Cornulaca monacantha Del. Fig. 69.

Undershrub, with thick twisted branches covered with brownish bark; branchlets about 4 in. long, pale, glabrous. Leaves nearly encircling the stem, triangular-lanceolate, about ⅛ in. long, ending in a rigid spiny point, with a transparent margin towards the base and a tuft of woolly hairs inside the base; leaf-spine often dropping off when old, the base of the leaf on the old branches becoming a cushion. Flowers polygamous, axillary, clustered, buried in wool, ⅛ in. long. Calyx-lobes 5, one or more spinescent in fruit.

Northern Sudan.

Fig. 69—CORNULACA MONACANTHA Del.
A, branch. B, flower with bracts. C, the adaxial sepal. D, half-ripe fruit, opened.

C. ehrenbergii Aschers.

Densely branched undershrub. Leaves lanceolate, mucronate at the apex, $\frac{1}{8}$-$\frac{1}{4}$ in. long, densely imbricate, curved outwards. Flowers solitary in the leaf-axils, not immersed in wool.

Red Sea District: *coast.*

5. **HALOPEPLIS** Bunge ex Ung.-Sternb.

Halopeplis perfoliata (Forsk.) Bunge ex Aschers. & Schweinf.

Woody branched glabrous undershrub 1-2 ft. high; branches with closely placed not jointed nodes. Leaves sessile, obovate or orbicular, $\frac{1}{10}$ in. long. Spikes of flowers small, dense; floral bracts similar to the leaves, usually 3-flowered. Calyx 3-toothed.

Red Sea District: *littoral.*

6. **KOCHIA** Roth

Kochia cana Bunge ex Boiss.

Branched undershrub; branches white, obscurely silky. Leaves oblong or narrowly elliptic, ⅛ in. long or less, very hairy. Flowers very small; inflorescences subglobose, axillary or terminal, embedded in long brown hairs. Calyx-lobes 5, incurved and enlarged in fruit.

Red Sea District: *littoral.*

7. **SALICORNIA** L.

Salicornia fruticosa (L.) L.

Shrubby fleshy leafless herb 12-16 in. high; stems and branches often rooting below. Spikes cylindric or cylindric-club-shaped; flowers sunk by threes in the rhachis of the jointed spikes, in the axils of cup-shaped bracts.

Red Sea District: *coast.*

8. **SALSOLA** L.

Salsola baryosma (Schult.) Dandy, comb. nov.

Chenopodium baryosmon Schult.; *S. foetida* Del. ex Spreng., non Pall. ex Vest.

Shrub 1-4 ft. high, with an odour of decaying fish; branchlets many, pallid, slender, woody. Leaves minute, orbicular, fleshy, with membranous margins. Flowers in very short dense cylindric solitary spikes in the axils of broad ovate imbricate leaves; bracteoles similar to the leaves. Calyx-lobes white, winged in fruit. Anthers with a small appendage.

Northern Sudan.

S. vermiculata L.

Much-branched undershrub; branches alternate, pubescent. Leaves alternate or clustered, ovate, keeled at the base, ⅛-½ in. long, more or less hairy. Flowers in dense spikes. Calyx-lobes 5, ovate-triangular, winged below the middle. Wings of fruiting calyx about ¼ in. long.

Halfa: *banks of the Nile.*

9. **SUAEDA** Forsk.

Suaeda fruticosa Forsk.

Glabrous much-branched undershrub 1-2 ft. high. Leaves alternate, scattered, fleshy, linear, those on the branches usually ¼-½ in. long, the lower ones longer. Flowers bisexual, very small, axillary, many solitary, some in few-flowered clusters. Calyx broadly cylindric in bud, hardly at all pentagonal.

Red Sea District: *Suakin and littoral.*

S. monoica Forsk.

Similar to *S. fruticosa*, but with leaves up to 1 in. long and flowers larger and mostly unisexual.

Northern Sudan. Kordofan.

S. volkensii C. B. Clarke.

Glabrous succulent shrubby herb. Leaves oblong-lanceolate, rounded at the apex, thick, fleshy, up to ⅓ in. long. Flowers crowded along the branchlets into nearly continuous spikes. Calyx larger than in *S. fruticosa*, somewhat pentagonal, swollen in fruit.

Red Sea District: coast.

S. vermiculata Forsk.

Much-branched spreading white-tomentose shrub sometimes 18 in. high. Leaves ovate to suborbicular, ⅛-¼ in. long, mealy, glandular-tubercled at the base. Flowers in dense spikes; bracts spirally placed, suborbicular, whitened on the margins. Filaments conspicuously exserted.

Red Sea District: coast.

S. schimperi (Moq.) Ulbr.

S. vermiculata var. *puberula* C. B. Clarke.

Branches with white tomentum, but scarcely pubescent at the tips. Leaves nearly linear, up to ⅓ in. long.

Red Sea District: coast.

38. *AMARANTHACEAE*

Annual or perennial herbs or rarely undershrubs. Leaves alternate or opposite, without stipules, simple. Flowers actinomorphic, usually hermaphrodite, small, in spikes or heads or racemes; bracts and bracteoles often scarious, sometimes hooked. Sepals usually 5, free or more or less connate, more or less dry and membranous. Petals absent. Stamens hypogynous, usually 5 opposite the sepals; filaments free or united into a short tube, often with staminodes between. Ovary superior, 1-locular; ovules 1 or more. Fruit indehiscent or circumscissile.

A. Leaves alternate:
  B. Ovary with several ovules ..... CELOSIA. 5.
  BB. Ovary with 1 ovule:
    (a) Flowers nearly glabrous; staminodes absent:
      (b) Fertile flowers supported by 2 sterile ones ..... DIGERA. 8.
      (bb) Fertile flowers not supported by sterile ones ..... AMARANTHUS. 4.
    (aa) Flowers full of fine hairs; staminodes present:
      (c) Stamens 4-5 ..... AERVA. 2.

(cc) Stamens 1-2 ..... NOTHOSAERVA. 9.

AA. Leaves opposite:

C. Anthers 2-locular:

(d) Bracts of sterile flowers ending (some of them) in hooked spines:

(e) Staminodes present ..... CYATHULA. 7.

(ee) Staminodes absent ..... PUPALIA. 12.

(dd) Bracts of sterile flowers not ending in hooked spines:

(f) Staminodes absent ..... PSILOTRICHUM. 11.

(ff) Staminodes present:

(g) Leaves petiolate; flowers soon becoming sharply bent back and down:

(h) Bracteoles ending in a long spine ..... ACHYRANTHES. 1.

(hh) Bracteoles not ending in a long spine ..... CENTROSTACHYS. 6.

(gg) Leaves sessile or subsessile .... PANDIAKA. 10.

CC. Anthers 1-locular; fruit very flat, winged ..... ALTERNANTHERA. 3.

1. **ACHYRANTHES** L.

Achyranthes aspera L. Fig. 70.

Erect or straggling woody herb; stems like the leaves pubescent or silky especially when young. Leaves ovate or ovate-lanceolate, acute at the apex, 2-4 in. long. Spikes often much elongated in fruit, with the flowers sharply bent back and down.

Widespread.

2. **AERVA** Forsk.

Aerva javanica (Burm. f.) Juss. ex Schult.

A. tomentosa Forsk.

Hoary-white erect or suberect undershrub 2-4 ft. high, occurring in arid localities; stems densely covered with stellate hairs. Leaves lanceolate or sometimes almost linear, up to 2¾ in. long, flat. Flowers in a terminal panicle of dense leafless long-cylindric spikes about 2 in. long. Calyx 5-fid, ⅛ in. long. Fruit 1-seeded.

Widespread.

Var. **bovei** Webb.

A. tomentosa var. *bovei* (Webb) C. B. Clarke.

More tawny. Leaves oblong or obovate, 1 in. long. Flowers smaller; spikes more slender and interrupted.

Northern Province.

A. ruspolii Lopr.

Bushy tawny-woolly herb; stems covered with stellate hairs. Leaves yellow-brown, oblong or obovate, ½ in. long. Spikes small, interrupted.

Northern Province.

Fig. 70—ACHYRANTHES ASPERA L.

A. lanata (L.) Juss. ex Schult.

Straggling woolly undershrub 1-4 ft. high, occurring in waste places in villages, etc.; stems villous, without stellate hairs. Leaves ovate-elliptic, acute at the apex, about 1½ in. long, hairy like the stems. Spikes axillary and terminal, ¼-½ in. long.

North-eastern Sudan. Equatoria.

Var. **oblongata** Aschers.

Leaves thick, very woolly. Spikes in a dense narrow panicle 1 ft. long, continuous.

North-eastern Sudan.

3. **ALTERNANTHERA** Forsk.

Alternanthera nodiflora R. Br. Fig. 71.

Procumbent herb 6-24 in. long, often occurring in moist places; rhizome often woody. Leaves linear-lanceolate, acute at the apex, up to 2¾ in. long, glabrous or nearly so. Heads white, axillary, ⅓ in. in diameter. Calyx-segments ⅛ in. long. Stamens 5; filaments united into a cup with alternate notched teeth.

Central and Southern Sudan.

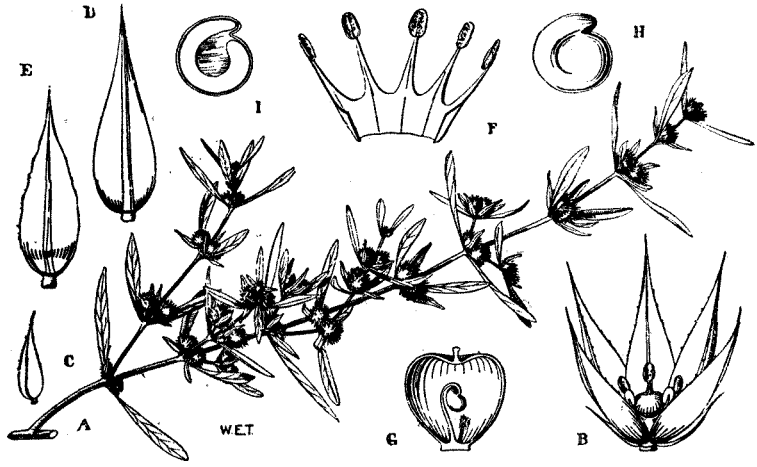


Fig. 71—ALTERNANTHERA NODIFLORA R. Br.

A, portion of the plant. B, flower. C, bracteole. D, E, calyx-segments. F, stamens. G, ovary in longitudinal section. H, seed. I, seed in longitudinal section.

A. sessilis (L.) R. Br. ex Roth.

A. achyranthoides Forsk.

Decumbent herb of moist places, stream-beds, etc. Leaves oblanceolate, minutely toothed, up to 2½ in. long and nearly ¾ in. broad (usually much smaller), with about 5 lateral nerves on each side

of the midrib, glabrous or nearly so, often with small blisters. Calyx-segments acute, hardly acuminate at the apex, $\frac{1}{12}$ in. long, not prickly in fruit.

Widespread.

A. repens (L.) Link.

Procumbent sparingly pubescent herb. Leaves obovate or rounded-obovate, mucronate at the apex, entire, up to $1\frac{1}{2}$ in. long and $\frac{3}{4}$ in. broad, about 2-nerved on each side of the midrib, with slight elevations resembling blisters. Calyx-segments over $\frac{1}{4}$ in. long, acutely acuminate at the apex, becoming prickly in fruit.

Blue Nile Province: Sennar. Equatoria.

4. AMARANTHUS L.

Amaranthus spinosus L.

Erect herb 1-3 ft. high. Leaves (some of them) with a pair of large axillary spines. Spikes elongated, mostly paniculate at the ends of the branches, with often globose clusters of flowers in the leaf-axils. Calyx-segments with sharp spiny tips. Fruit membranous, irregularly and imperfectly circumscissile.

Blue Nile Province.

A. caudatus L.

Herb 1-3 ft. high; stems as well as the main axis of the inflorescences pubescent. Leaves narrow-elliptic, up to about 12 in. long. Spikes yellowish-red, becoming brown in fruit; axillary spikes rare; bracts like the calyx-segments with sharp spiny tips. Calyx-segments 5, overlapping. Fruit smooth, membranous, circumscissile.

Central and Southern Sudan. Wild and cultivated.

A. hybridus L.

Herb 1-3 ft. high, less erect and more branched than *A. caudatus*. Leaves ovate, narrowed towards the apex, $2\text{-}3\frac{1}{2}$ in. long. Spikes cylindric, $\frac{1}{4}$ in. broad, the terminal one often 3-4 in. long; axillary spikes frequent; bracts ovate, spine-tipped. Calyx-segments 5, not overlapping. Fruit thin, circumscissile.

Equatoria.

A. tricolor L.

Erect annual herb 1-5 ft. high. Leaves spathulate-ovate, acuminate at the apex, up to 4 in. long; petiole $1\text{-}2\frac{1}{2}$ in. long. Axillary spikes frequent; bracts long-awned, longer than the flowers. Calyx-segments 3. Style 3-branched. Fruit membranous, circumscissile.

Kassala.

A. viridis L.

A. oleraceus (non L.) Broun & Massey.

Erect herb 1-3 ft. high. Leaves long-petiolate, ovate or elliptic, 1-3 in. long. Spikes linear, the terminal 2-4 in. long, panicled towards the ends of the branches, the pedicels visible. Fruit as long as the perianth, herbaceous not membranous, wrinkled.

Red Sea District. Khartoum.

A. lividus L.

Prostrate or ascending herb 1-2 ft. high, occurring as a weed of cultivation. Leaves long-petiolate, ovate-elliptic, 2 in. long. Spikes axillary, running into a simple oblong dense spike. Calyx very minute; segments 3. Fruit membranous, smooth.

Blue Nile Province.

A. graecizans L.

A. blitum (non L.) Broun & Massey; *A. polygamus* (non L.) Broun & Massey.

Much-branched annual herb, erect or decumbent, up to 1 ft. or more high, occurring as a weed of cultivation. Leaves narrow-oblong to obovate, ½-2½ in. long including the petiole, often pale beneath. Spikes all axillary. Calyx-segments 3. Fruit rugose.

Northern and Central Sudan.

5. CELOSIA L.

Celosia argentea L. Fig. 72.

Erect branched annual herb 1-4 ft. high. Leaves linear to linear-lanceolate, 1-5 in. long. Spikes silvery-white, often pink-tinged, simple, continuous, very dense-flowered, elongated or narrowly pyramidal, up to 6 in. long. Calyx-segments about ½ in. long. Style very shortly 3-fid at the apex, as long as the calyx.

Central and Southern Sudan.

C. laxa Schumach.

Herb 2-4 ft. high, erect or decumbent. Leaves more or less ovate, up to 3 in. long. Inflorescences crowded, often interrupted, ½-¾ in. broad, much looser than in *C. argentea*. Calyx-segments ¼ in. long. Style 3-fid.

Equatoria.

C. trigyna L.

Straggling herb 1-4 ft. high. Leaves more or less ovate, acuminate at the apex, 1-5 in. long, the lower ones long-petiolate. Inflorescences pink to silvery-white, rather lax, interrupted, rarely over ¼ in. broad. Calyx-segments up to ⅛ in. long. Style 3-fid.

Widespread.

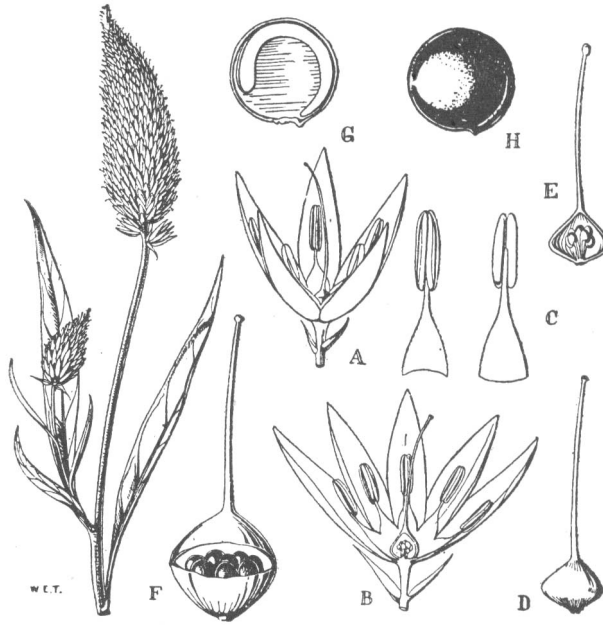


Fig. 72—CELOSIA ARGENTEA L.

A, flower. B, the same opened out with ovary in vertical section. C, stamens, front and back. D, ovary with style. E, the same in section. F, fruit showing dehiscence. G, seed cut lengthwise. H, seed.

C. schweinfurthiana Schinz.

Nearly glabrous scrambler up to 4 or 5 ft. high. Leaves long-petiolate, ovate-lanceolate, 3 in. long. Flowers in linear panicles attaining 10 in. long and 1 in. broad or in elongate simple interrupted spikes. Calyx-segments $\frac{1}{10}$ in. long. Style 2-fid.

Equatoria.

C. populifolia Moq.

Straggling undershrub 2-3 ft. high. Leaves petiolate, ovate-lanceolate, rounded at the base, 3 in. long. Panicles straw-coloured when young, later dark-coloured, linear, 4-7 in. long, in a copious thyrsus. Calyx-segments white with a dark mark down the back, $\frac{1}{10}$ in. long, scarious. Style 2-fid.

Central Sudan.

6. **CENTROSTACHYS** Wall.

Centrostachys aquatica (R. Br.) Wall.

Achyranthes aquatica R. Br.

Rather stout sparsely hairy herb, rooting from the lower nodes, 3-4 ft. high, occurring in marshy places; stems conspicuously

grooved, stout. Leaves lanceolate to ovate, 3-4 in. long, appressed-pilose beneath when young. Spikes up to 4 (at length up to 8) in. long; bracteoles ¼-⅓ as long as the calyx. Calyx straw-coloured.

Central and Southern Sudan.

7. **CYATHULA** Bl.

Cyathula prostrata (L.) Bl.

Erect or suberect herb 1-3 ft. high. Leaves ovate or obovate, 1-4 in. long. Spikes terminal, 2-6 in. long, ¼ in. broad. Calyx-segments 5, 1/12 in. long, blunt or spinose. Stamens 5, alternating with staminodes. Fruit in prickly burrs.

Equatoria.

C. cylindrica Moq.

C. schimperiana Moq.

Stout herb or shrub up to 10 ft. high. Leaves petiolate, broadly elliptic, 1½-5 in. long, softly hairy. Inflorescences terminal, 3-4 in. long, 1 in. broad, dense, shining-white; partial inflorescences ½-¾ in. long; sterile or rudimentary flowers ending in strong hooked spines. Calyx nearly ⅛ in. long, hairy.

Equatoria: *Imatong Mountains, Mount Kineti*, 9000 ft.

8. **DIGERA** Forsk.

Digera alternifolia (L.) Aschers.

D. arvensis Forsk.

Branched nearly glabrous herb 8-20 in. high. Leaves lanceolate or ovate, 2 in. long; petiole 1 in. long. Spikes axillary, red-pink, changing to almost white, 1-4 in. long, sometimes interrupted; peduncle 1-3 in. long. Calyx ⅛ in. long. Style 2-fid. Fruit 1-seeded.

Widespread.

9. **NOTHOSAERVA** Wight

Nothosaerva brachiata (L.) Wight.

Aerva brachiata (L.) Mart.

Erect or straggling undershrub. Leaves lanceolate or oblong-lanceolate, 1½ in. long, very thin, like the stems glabrous or nearly so. Spikes small and slender, hardly 1/12 in. broad.

Central Sudan.

10. **PANDIAKA** (Moq.) Hook. f.

Pandiaka elegantissima (Schinz) Dandy, comb. nov.

Achyranthes elegantissima Schinz; *P. cylindrica* Hook. f. ex Bak. & Clarke.

Hairy herb, much branched at the top. Leaves subsessile, oblong-elliptic, 1¼ in. long. Spikes pinkish-straw-coloured, 1½ in.

long; bracteoles with very long points, adorned with some very long white hairs, exceeding the hairy calyx. Stamens 5, connate at the base, with alternating hairy staminodes.

Equatoria.

P. heudelotii (Moq.) Benth. & Hook. ex B. D. Jackson.

Hairy long-branched herb 2-3 ft. high. Leaves linear or narrow-oblong, 2-3 in. long. Spikes greenish-white, ultimately straw-coloured, 1 in. long; bracteoles short-pointed, about ¾ as long as the calyx, forming an involucre at the base. Calyx ⅛ in. long, hairy. Staminodes glabrous. Anthers as well as the tips of the calyx often crimson.

Central and Southern Sudan.

P. schweinfurthii (Schinz) C. B. Clarke.

Herb 1-2 ft. high. Leaves yellow-green, broad-elliptic or oblanceolate, thinly hairy. Spikes straw-coloured, 1½ in. long, terminal; bracts hairy. Calyx-segments lanceolate, thickened at the base, hairy. Staminodes with long-fringed margins.

Equatoria.

P. oblanceolata (Schinz) C. B. Clarke.

Erect sparsely hairy herb. Leaves oblanceolate, 1-2 in. long. Spikes pale-brown, 2 in. long, ¾ in. broad; bracteoles ⅛ in. long, bristle-pointed. Calyx ⅛ in. long; segments oblong, ending in a bristle, glabrous. Staminodes raggedly cut.

Equatoria.

11. **PSILOTRICHUM** Bl.

Psilotrichum gnaphalobryum (Hochst.) Schinz.
P. cordatum Moq.

Herb 2-4 ft. high. Leaves ovate, 1½ in. long, hairy. Panicles terminal, 1-2 ft. long; spikes 4-12-flowered, ½-1½ in. long, very loose; bracteoles 2, ⅓ as long as the calyx. Calyx-segments 5, green, ⅛ in. long, strongly 3-nerved, hairy. Stamens 5; filaments connate into a cup at the base.

Red Sea District: Soturba.

P. schimperi Engler.

Herb 18 in. high, repeatedly branched, glabrous. Leaves subsessile, linear-oblong, 2 in. long. Spikes at the ends of the branches, 1-2 in. long, lengthening in fruit to 5 in. Calyx green.

Central Sudan.

Fig. 73—PUPALIA LAPPACEA (L.) Juss.
A, flower. B, flower-cluster showing hooked prickles.

12. **PUPALIA** Juss.

Pupalia lappacea (L.) Juss. Fig. 73.

Hairy herb 2-4 ft. high. Leaves elliptic-lanceolate, 2-6 in. long, velvety-pubescent when young. Flowers whitish, small, about 3 together enclosed by 2 bracts and 4 bracteoles covered with white woolly hairs and hooked and barbed spines; inflorescences 2-4 (sometimes up to 10) in. long, usually interrupted especially in fruit. Stamens yellow or red.

Widespread.

39. *BASELLACEAE*

Twining herbs with slender stems. Leaves alternate, without stipules, simple, entire, petiolate, often fleshy. Flowers small, actinomorphic, usually hermaphrodite, in spikes or racemes; bracts small; bracteoles 2, often united to the base of the calyx. Sepals 5, almost free or more or less united at the base, often coloured, persistent in fruit. Petals absent. Stamens 5, free, short, opposite the sepals. Ovary superior, 1-locular; styles 3 or 1; ovule solitary, basal, shortly stalked. Fruit drupaceous or baccate, surrounded by the persistent often fleshy calyx; seed solitary, almost spherical.

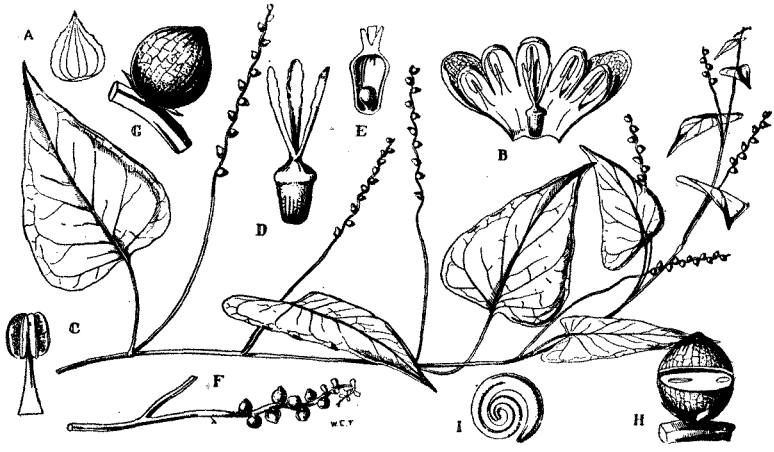


Fig. 74—BASELLA RUBRA L.

A, bract. B, flower laid open. C, stamen. D, ovary. E, the same in vertical section. F, flowering and fruiting spike. G, fruit. H, the same half-cut transversely.

1. **BASELLA** L.

Basella rubra L. **Fig. 74.**

B. alba L.

Glabrous much-branched twining herb, almost leafless in the dry season. Leaves long-petiolate, ovate or cordate, 2-4 in. long. Flowers in axillary spikes; bracteoles fleshy, united to the base of the calyx. Calyx fleshy, shortly 5-lobed. Styles 3. Fruit red or white or black, globose, enclosed in the enlarged calyx, ½ in. in diameter.

Equatoria. Cultivated as a spinach.

40. *LINACEAE*

Herbs, shrubs or trees. Leaves alternate or opposite, simple; stipules present or absent, sometimes gland-like. Flowers hermaphrodite, actinomorphic. Sepals 4-5, free or partially united, imbricate. Petals free, contorted, often clawed, usually falling early. Stamens as many or twice as many as the petals, sometimes with alternating small staminodes; filaments connate at the base. Ovary superior, 3-5-locular, the loculi often again subdivided nearly to the placentas; styles 3-5, free, thread-like, with simple subcapitate stigmas; ovules 2 in each loculus. Fruit a septicidal capsule or a drupe.

A. Shrubs or trees, often climbing; stamens 10; fruit a drupe ..... HUGONIA. 1.

AA. Herbs; stamens 5; fruit a capsule ..... LINUM. 2.

1. **HUGONIA** L.

Hugonia platysepala Welw. ex Oliv.

Scrambling or erect shrub or sometimes small tree. Leaves obovate or oblanceolate, acute or very shortly acuminate at the apex, distinctly narrowed to the base, 4-5½ in. long, up to 2¾ in. broad, slightly pubescent beneath, with numerous rather close lateral nerves. Flowers yellow, over 1 in. in diameter, 3-4 on a common peduncle. Fruit orange, globose, ½ in. in diameter.

Equatoria.

2. **LINUM** L.

Linum strictum L.

Erect herb. Leaves linear, small, scabrid on the margin and often on the under-surface, 1-nerved. Flowers yellow, small, in forking or more usually rather closely clustered cymose corymbs. Sepals with an elongate green point from an ovate base, in fruit considerably exceeding the capsule. Capsule splitting into 5 2-seeded or 10 1-seeded valves.

North-eastern Sudan.

41. *ZYGOPHYLLACEAE*

Shrubs or herbs, rarely trees; branches often jointed at the nodes. Leaves opposite or alternate, 2-foliolate or pinnate or rarely 3-foliolate; stipules persistent, often spinescent. Flowers hermaphrodite, actinomorphic or zygomorphic. Sepals 5 or rarely 4, free or rarely connate at the base. Petals 4-5 or rarely absent, free, hypogynous, imbricate or contorted or rarely valvate. Disk usually present. Stamens often unequal in length, as many to three times as many as the petals; filaments free, often with a scale at the base. Ovary superior, sessile or rarely stipitate, usually 4-5-locular; ovules 1 or more in each loculus. Fruit various.

A. Petals present; stamens 10 or rarely 5:
  (a) Leaves pinnate, of different sizes in a pair; filaments without a scale at the base; fruit spiny or muricate or winged, depressed ..... TRIBULUS. 3.
  (aa) Leaves 1-3-foliolate:
    (b) Herbs or shrubs with fleshy leaves; filaments with a scale at the base; fruit sharply 5-angled, ellipsoid, opening lengthwise ..... ZYGOPHYLLUM. 4.
    (bb) Diffuse woody spiny annuals; filaments without a scale at the base; fruit pyramidal, tipped by the hard persistent style, splitting from below into 5 cocci ... FAGONIA. 1.

AA. Petals absent; stamens 5; leaves 3-foliolate; filaments without a scale at the base; fruit broadly ellipsoid, the carpels separating and exposing the smooth crustaceous endocarp ..... SEETZENIA. 2.

1. **FAGONIA** L.

Fagonia cretica L. Fig. 75.

Diffuse woody spiny annual desert herb, puberulous-glandular or nearly glabrous. Leaves opposite, very variable, 1-3-foliolate; leaflets bright-green, linear to lanceolate, acute at the apex with a callous tip, up to ¾ in. long; stipules spinescent, often longer than the leaves, very acute at the apex. Flowers solitary, axillary. Petals rose or lilac, more than twice as long as the sepals, narrowly clawed. Fruit about ¼ in. long.

Northern and Central Sudan.

2. **SEETZENIA** R. Br.

Seetzenia orientalis Decne.

Prostrate herb from a woody base; branches glabrous except for the slightly hairy nodes. Leaves opposite, 3-foliolate; leaflets obovate, the lateral ones oblique, callous-mucronate at the apex, about ⅛ in. long, glaucous and rather fleshy; stipules small, interpetiolar, reflexed. Flowers solitary, axillary. Fruit about ⅓ in. long.

Northern Sudan.

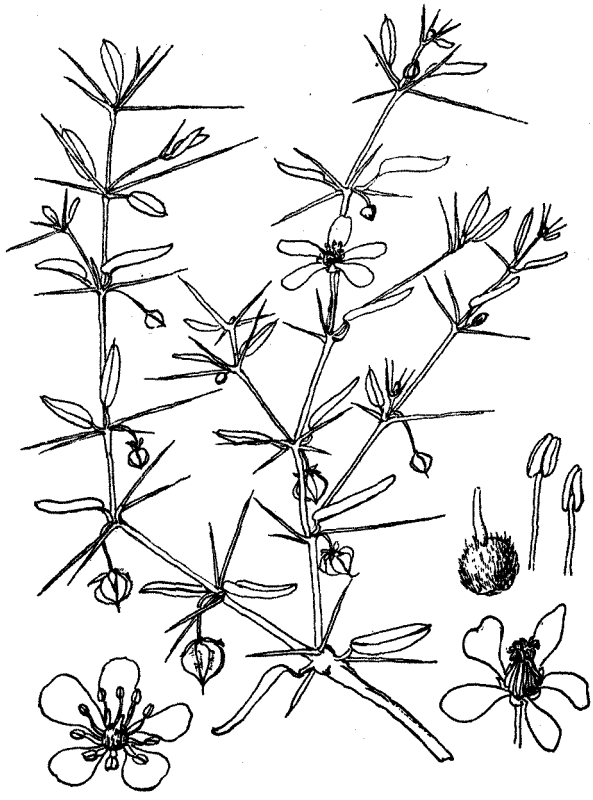


Fig. 75—FAGONIA CRETICA L.

3. **TRIBULUS** L.

Tribulus terrestris L.

Spreading herb, woody below, occurring in waste places. Leaves opposite, unequal, the larger ones with 6-8 pairs of leaflets, the smaller with usually 5 pairs, thinly villous-pilose. Flowers yellow, small. Stamens 10. Fruit depressed, each carpel with 2 large rigid divergent spines and a few tubercles, not winged; pedicel stout, about ½ in. long.

Widespread.

T. pentandrus Forsk.

Closely resembling *T. terrestris* in general appearance, but flowers with only 5 stamens. Fruit with spines as in *T. terrestris*, not winged.

Red Sea District.

Fig. 76—TRIBULUS LONGIPETALUS Viv.

T. longipetalus Viv. Fig. 76.

T. alatus Del. p.p.

Like *T. terrestris*, but the leaves more thickly villous-pilose, and the fruit pilose and with sharply toothed wings.

Northern Sudan.

T. mollis Ehrenb. ex Schweinf.

Like *T. terrestris*, but the fruit broadly pyramidal-ovoid, as broad as long, somewhat pointed, with small toothed wings towards the base and the carpels pilose on the back.

Northern Sudan.

T. pterocarpus Ehrenb. ex Koern.

Like *T. terrestris*, but the branches somewhat hispid-pilose with unequal spreading short hairs. Fruit roundish or roundish-ovoid, winged, emarginate at the apex and base, up to ¼ in. long and broad; wings crenulate, about $\frac{1}{12}$ in. broad.

Northern Sudan.

T. macropterus Boiss.

T. ehrenbergii Aschers.

Densely villous herb. Leaves with 6 pairs of leaflets, 1½ in. long. Fruit large, 4-angled, winged, shortly and densely pubescent or pilose; wings rigid, ⅓-½ in. long, irregularly and deeply toothed.

Northern Province.

4. ZYGOPHYLLUM L.

Zygophyllum simplex L. Fig. 77.

Much-branched diffuse decumbent or ascending herb. Leaves unequal, 1-foliolate, the larger ones ¼-½ in. or more long, fleshy. Flowers yellow, small, on very short peduncles. Fruit deeply 5-lobed, about $\frac{1}{16}$ in. long.

Northern and Central Sudan.

Fig. 77—ZYGOPHYLLUM SIMPLEX L.

Z. album L. f.

Hoary decumbent irregularly branched shrub. Leaves 2-foliolate; leaflets oblanceolate to obovate, up to ⅓ in. long, fleshy; petiole thick, fleshy, up to ½ in. long. Fruit deeply 5-lobed, obcordate or turbinate-spherical, usually ¼-⅓ in. long, the lobes occasionally produced and divergent above.

Northern Sudan: common on the coast.

Z. coccineum L.

Like *Z. album*, but glabrous. Leaflets club-shaped, usually ¼ in. long; petiole fleshy, ¼-½ in. long. Fruit acutely 5-angled, up to ½ in. long.

Northern Sudan.

Z. decumbens Del.

Glabrous much-branched herb or undershrub. Leaves 2-foliolate; leaflets obovate to oblanceolate, up to ½ in. long, fleshy. Flowers numerous; peduncle up to ½ in. long, at length deflexed. Staminal scales deeply 2-fid with acute teeth. Fruit deeply 5-lobed, turbinate.

Northern Sudan.

42. *GERANIACEAE*

Herbs or undershrubs. Leaves alternate or opposite, with stipules, mostly lobed, dissected or compound. Flowers often handsome, hermaphrodite, actinomorphic or slightly zygomorphic, axillary, solitary or subumbellate. Sepals persistent, 4-5, free or connate to the middle, imbricate or rarely valvate, the dorsal one sometimes spurred. Petals 5 or rarely 4, free, hypogynous or subperigynous, imbricate or rarely contorted. Stamens 2-3 times as many as the sepals, sometimes

some without anthers; filaments usually more or less connate at the base. Ovary superior, 3-5-locular; ovules pendulous, 1-2 or rarely more in each loculus. Fruit lobed, often beaked, opening from the base upwards, the lobes 1- or rarely more-seeded.

A. Flowers actinomorphic; sepals not spurred:
  (a) Fertile stamens 15 ..... MONSONIA. 3.
  (aa) Fertile stamens 10 ..... GERANIUM. 2.
  (aaa) Fertile stamens 5 ..... ERODIUM. 1.
AA. Flowers slightly zygomorphic; dorsal sepal spurred, the spur adnate to the pedicel ..... PELARGONIUM. 4.

1. **ERODIUM** L'Hérit.

Erodium malacoides (L.) L'Hérit.

Perennial herb 8-12 in. high, stemless or with weak grey-pubescent decumbent or descending branches. Leaves ovate-oblong, more or less 3-5-lobed, crenate, the lower ones cordate at the base, up to 1¼ in. long. Flowers small; peduncle 4-6-flowered. Petals dull-purple, usually with 2 small oblong dark spots at the base. Fertile filaments purple, winged, alternating with as many staminodes. Fruit beaked, up to 1½ in. long.

Red Sea Hills. Darfur: *Jebel Marra*, 9000 ft.

2. **GERANIUM** L.

Geranium simense Hochst. ex A. Rich. Fig. 78.

Perennial herb, with decumbent or scrambling branches up to 2 ft. high; stems pubescent with short simple reflexed appressed hairs. Leaves 5-lobed, the lobes again lobed with lanceolate or ovate acute segments, sparsely pubescent above, pilose beneath especially on the nerves. Peduncles 2-flowered, like the pedicels shortly appressed-pubescent. Sepals oblong-lanceolate with a rather long point. Petals pinkish with darker veins or sometimes white, entire, about twice as long as the sepals. Fruiting-carpels smooth, shortly pilose, remaining attached to and carried upwards with part of the style on dehiscence.

Equatoria: *Imatong Mountains.*

G. aculeolatum Oliv.

Perennial herb, with branches decumbent and rooting below or ascending (up to 2 ft. high); stems like the peduncles with prickle-like hairs mixed with spreading gland-tipped hairs. Leaves 5-lobed, the lobes deeply incised with acute teeth, 1½-2½ in. broad or sometimes larger, sparsely pilose beneath. Peduncles 2-flowered, exceeding the leaves. Sepals oblong-lanceolate with a rather long point. Petals pale-mauve with red veins, entire, about twice as long as the sepals, ciliate at the base. Fruiting-carpels smooth, shortly pilose, remaining attached to and carried upwards with part of the style on dehiscence.

Equatoria: *Imatong Mountains.*

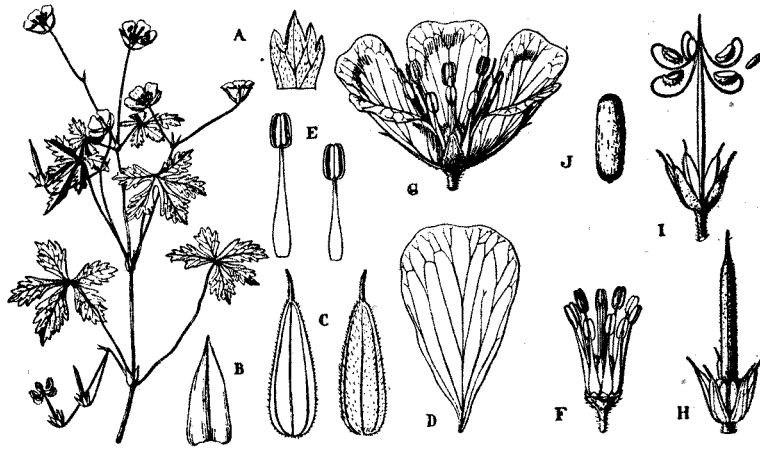


Fig. 78—GERANIUM SIMENSE Hochst. ex A. Rich.

A, segment of leaf. B, stipule. C, sepals, inner and outer face. D, petal. E, stamens. F, flower with sepals and petals removed. G, flower. H, ovary with sepals. I, fruit open. J, seed.

G. favosum Hochst. ex A. Rich.

Annual herb, ascending, more or less branched, up to 4 ft. high; branches with spreading mainly gland-tipped hairs above, glabrescent below. Leaves deeply 5-7-lobed, the lobes again lobed with linear-lanceolate acute toothed or entire segments. Flowers pale-purple with dark-purple centre; lower peduncles very short or absent; upper peduncles 2-flowered, 1-2 in. long. Sepals with spreading gland-tipped hairs. Petals exceeding or even about half as long again as the sepals. Fruiting-carpels grey or black, up to $\frac{1}{10}$ in. long, glabrous, deeply furrowed in transverse lines with irregular tubercles, separating from the style on dehiscence.

Darfur: *Jebel Marra.*

G. trilophum Boiss. Fig. 79.

G. favosum (non Hochst.) Broun & Massey.

Erect annual herb, sparsely branched; stems shortly pubescent. Leaves 5-7-lobed; lobes again lobed, the segments lanceolate or ovate with acute or rounded teeth. Flowers purplish with deep-purple centre. Fruiting-carpels brownish, up to $\frac{1}{5}$ in. long, with 2 dentate wing-like longitudinal dorsal crests, separating from the style on dehiscence.

Red Sea Hills: ***Erkowit.***

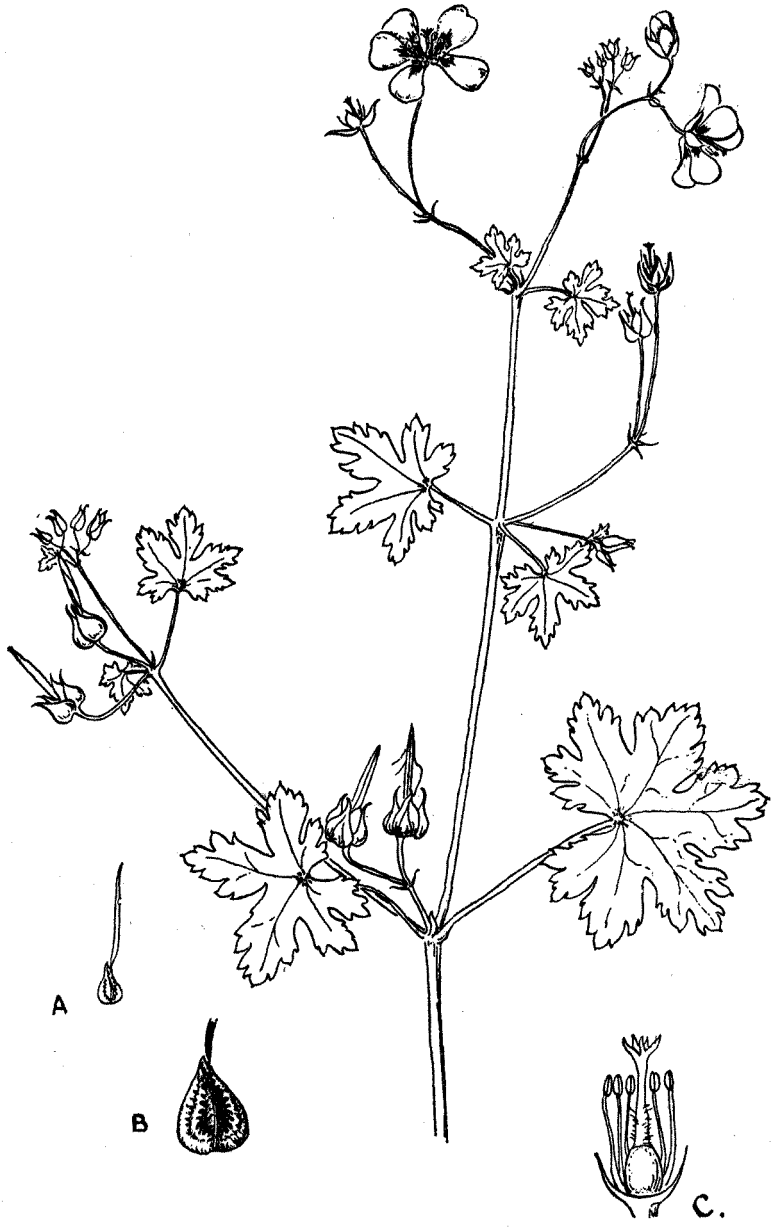


Fig. 79—GERANIUM TRILOPHUM Boiss.
A, fruiting-carpel. B, base of same (magnified). C, stamens and pistil.

3. **MONSONIA** L.

Monsonia senegalensis Guillem. & Perrott.

Herb, woody at the base. Leaves opposite, unequal, ovate, acute at the apex, cordate and 7-9-nerved at the base, denticulate, up to 1¼ in. long, pale and slightly pubescent on the nerves beneath; petiole about 1½ times as long as the lamina; stipules about ⅓ in. long. Flowers pink to purple, solitary; peduncle up to 2 in. long, with a pair of bracts at the middle and becoming sharply bent at that point in fruit. Sepals silky-pilose. Fruit beaked, the beak 3 in. long.

Central Sudan.

M. heliotropioides (Cav.) Boiss.

Herb, with a woody rhizome; stems like the pedicels sparingly hispid. Leaves long-petiolate, ovate, acute at the apex, denticulate, appressed-canescent. Peduncles long, many-flowered; bracts oblong-lanceolate, acuminate. Stamens shortly connate at the base.

Red Sea Hills.

M. nivea (Decne.) Decne. ex Webb.

Hoary herb, with a long woody underground stem. Leaves opposite, unequal, ovate-lanceolate, rounded at the base, crenate, about ½ in. long, villous on both surfaces, with prominent lateral nerves; stipules ⅓ in. long. Flowers pink, umbellate on long slender straight peduncles with several ovate bracts. Sepals mucronate, silky. Fruit with a beak up to 1½ in. long, splitting into slender plumose segments.

Red Sea District.

4. **PELARGONIUM** L'Hérit.

Pelargonium multibracteatum Hochst. ex A. Rich.

Shrubby herb 1-2 ft. high, thinly pilose or strigillose above, at length glabrous and shining, the older portions irregularly knotty. Leaves membranous, palmatifid or sub-7-fid with broadly oblong or ovate remotely serrate segments, 2-5 in. broad, more or less appressed-pilose especially beneath; petiole up to 6 in. long; stipules about ½ in. long. Umbels 6-10-flowered; peduncle 6-12 in. long; pedicels 1½-1¾ in. long; bracteoles lanceolate, acuminate. Calyx-spur adnate to the pedicel nearly to its base. Petals 5, twice as long as the sepals.

Red Sea Hills: Erkowit.

43. *OXALIDACEAE*

Herbs. Leaves alternate, without stipules, digitately or pinnately compound, sometimes 1-foliolate; leaflets spirally coiled when young, usually closing together at night. Flowers hermaphrodite, actinomor-

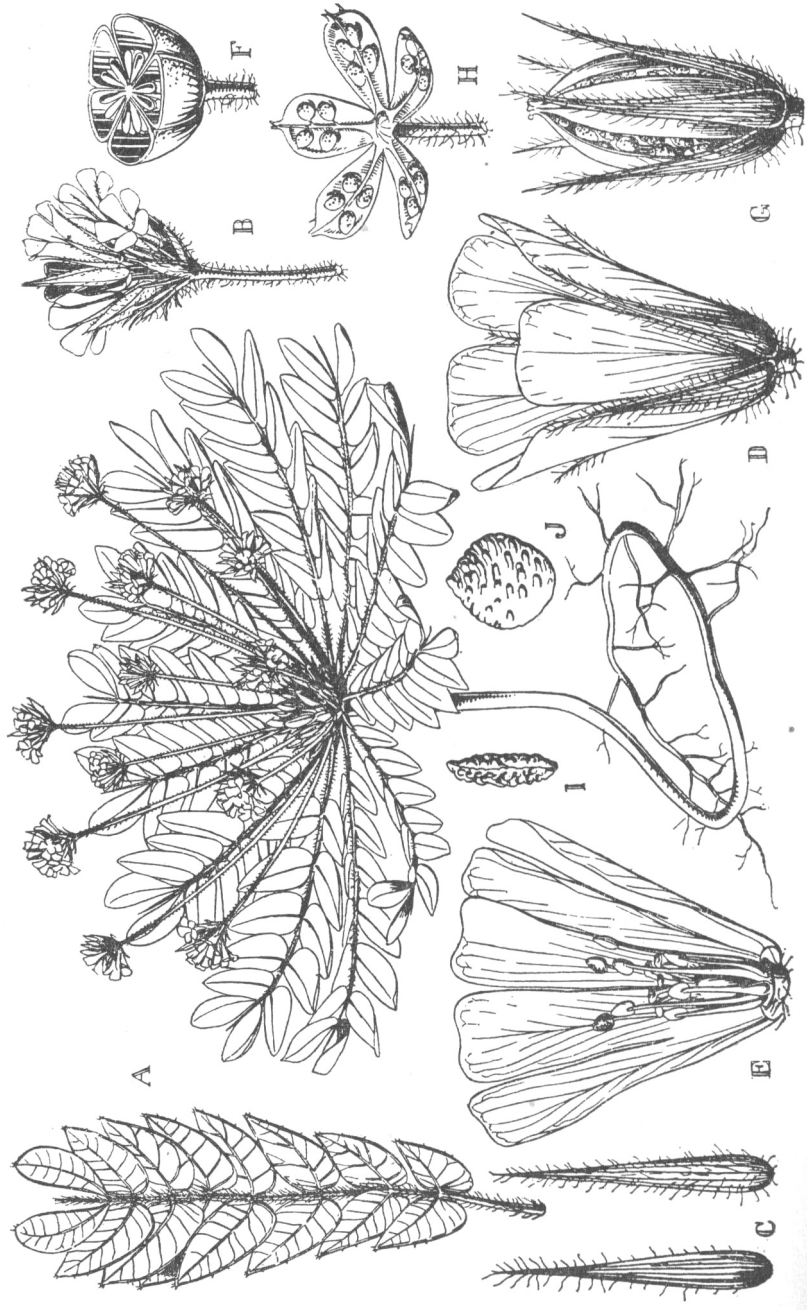


Fig. 80—BIOPHYTUM PETERSIANUM Klotzsch.
A, leaf. B, flower-cluster. C, sepals, inner and outer face. D, flower. E, the same opened out. F, cross-section of ovary. G, fruit with sepals. H, capsule open. I, seed from the side. J, the same, face view.

phic, sometimes of two kinds, some perfect and others minute and apetalous, solitary or subumbellate. Calyx 5-fid or 5-partite, imbricate. Petals 5, free or shortly connate at the base, contorted, shortly clawed. Stamens 10, hypogynous, connate at the base, sometimes 5 without anthers. Ovary superior, 5-locular; styles 5, free, persistent; ovules 1 or more in each loculus, axile. Fruit usually a capsule.

A. Leaves pinnate, sensitive to touch; leaflets not obcordate; valves of the fruit finally spreading ..... BIOPHYTUM. 1.

AA. Leaves 3-foliolate, not sensitive to touch; leaflets obcordate; valves of the fruit persisting around the central axis ..... OXALIS. 2.

1. BIOPHYTUM DC.

Biophytum petersianum Klotzsch. Fig. 80.

B. apodoscias (Turcz.) Edgew. & Hook.

Annual herb, with nude slender simple stems, very short or up to 1 ft. high. Leaves in a terminal crown, sensitive to weather and to touch; leaflets up to 10 pairs, obliquely oblong-obovate, rounded at each end, the largest about ⅛ in. long, with prominent lateral nerves spreading at right-angles. Flowers pale-orange to red, sometimes on simple very short peduncles, sometimes on a common peduncle a little longer than the leaves; bracts long-acuminate. Sepals ¼ in. long, prominently 5-nerved. Fruit hardly as long as the persistent calyx.

Central and Southern Sudan.

2. OXALIS L.

Oxalis corniculata L. Fig. 81.

Variable diffuse slender herb, with a taproot; stems pubescent. Leaves 3-foliolate, long-petiolate; leaflets deeply obcordate, slightly pubescent, about ⅛ in. long or less. Flowers yellow, usually paired on long peduncles often sharply bent towards the top in fruit. Fruit tomentellous, up to ¾ in. long; seeds purplish-brown, transversely rugose.

Red Sea Hills: *Erkowit*. *Darfur*: *Jebel Marra*, 7000 ft. *Southern Sudan*.

O. anthelmintica A. Rich. Fig. 82.

O. caprina (non L.) Broun & Massey.

Tuberous stemless herb. Leaves 3-foliolate, on petioles up to 6 in. long with short membranous sheaths; leaflets obcordate with broad rounded lobes. Flowers purplish, about ⅛ in. long, in 3-8-flowered umbels on elongate weak succulent peduncles exceeding the leaves. Petals 2-3 times as long as the sepals.

Red Sea Hills: *Erkowit*.

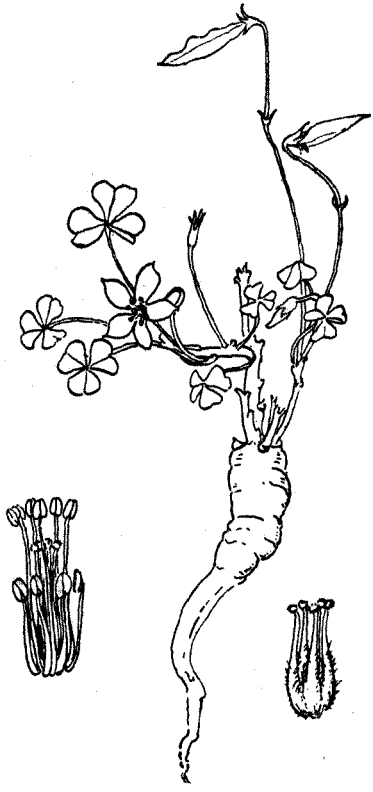


Fig. 81—OXALIS CORNICULATA L.

Fig. 82—OXALIS ANTHELMINTICA A. Rich.
A, tuber. B, pistil. C, stamens surrounding pistil.

O. obliquifolia Steud. ex A. Rich.

Stemless herb about 2½ in. high. Leaves radical, 4-10, spreading; petiole 1-1½ in. long; leaflets 3, glabrous, sometimes with very small dark-brown warts towards the margin. Flowers lilac to rose, solitary, on peduncles 1-3½ in. long.

Equatoria: *Imatong Mountains, Itobol*, 6400 ft.

44. *BALSAMINACEAE*

Succulent herbs. Leaves alternate or opposite, without stipules, simple. Flowers zygomorphic, hermaphrodite, brightly coloured, solitary to subumbellate. Sepals 3, rarely 5, coloured, imbricate, unequal, the lowermost hollowed out into a spur. Petals 3, free, the upper one outside, usually erect, concave, the lateral ones often 2-lobed. Stamens 5; anthers united round the ovary. Ovary superior, 5-locular with axile placentas; stigmas 1-5, more or less sessile; ovules numerous in each loculus. Fruit a succulent capsule, opening elastically into 5 twisted valves.

1. **IMPATIENS** L.

Impatiens niamniamensis Gilg.

Herb 1 ft. high. Leaves ovate-lanceolate, deeply crenate, up to 6½ in. long. Flowers with the upper petal green, the spur dull-purple.

Equatoria.

I. irvingii Hook. f. Fig. 83.

Herbaceous semi-aquatic plant 2-4 ft. high. Leaves peculiarly greyish-tinted beneath, short-petiolate, lanceolate, subacute at both ends, up to 6 in. long and 1½ in. broad, serrulate, the teeth extending to the petiole. Flowers uniformly red or pink; pedicels very slender, about 2 in. long, sometimes pubescent. Spur glabrous, slender, much longer than the limb of the flower, curved, about 1¼ in. long.

Equatoria.

I. elegantissima Gilg.

Tall herb. Leaves long-petiolate, sharply serrate, ovate or ovate-oblong or broadly ovate, acutely acuminate at the apex, unequally narrowed into the petiole at the base, 5-7 in. long, 2-3 in. broad, glabrous; lateral nerves in 13-17 pairs. Flowers white, fragrant, in 4-6-flowered racemes towards the top of peduncles 4½-12 in. long.

Equatoria: *Imatong Mountains, Jebel Garia*, 6000-7000 ft.

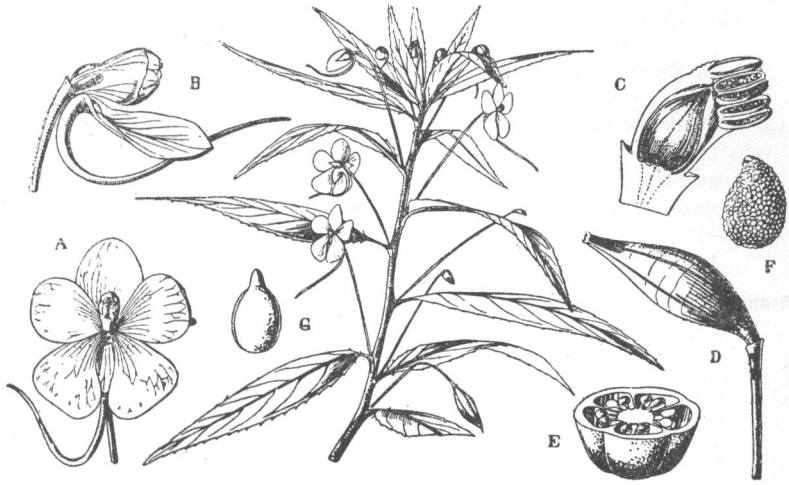


Fig. 83—IMPATIENS IRVINGII Hook. f.

A, flower. B, flower in partial longitudinal section. C, longitudinal section of flower with sepals and petals removed. D, young fruit. E, cross-section of ovary. F, seed. G, embryo.

I. hochstetteri Warb.

Erect herb, almost glabrous. Leaves membranous, ovate to obovate, acuminate at the apex, tapering at the base into a rather long slender petiole, crenate, up to 5 in. long, 1¼ in. broad. Flowers bluish-pink.

Equatoria: ***Lotti Forest and Imatong Mountains.***

45. *LYTHRACEAE*

Herbs, shrubs or trees. Leaves opposite or verticillate, rarely alternate; stipules absent or very small. Flowers usually actinomorphic, hermaphrodite, solitary or paniculate. Sepals valvate, united into a tube, sometimes with appendages between the lobes. Petals present or absent, free, inserted towards the top of the calyx-tube, crumpled in bud. Stamens usually 4 or 8 or rarely more, inserted below the petals; filaments usually inflexed in bud. Ovary superior, sessile or shortly stipitate, completely or incompletely 2-6-locular (rarely 1-locular); ovules numerous in each loculus. Fruit usually capsular, opening by a transverse slit or by valves or irregularly.

Punica granatum L., Pomegranate, belonging to the allied family *Punicaceae*, is cultivated in the Sudan.

A. Herbs:

(a) Calyx tubular; ovary 2-locular ..... **LYTHRUM. 3.**

(aa) Calyx campanulate (or if tubular then ovary 4-locular):

(b) Flowers usually solitary, sessile or subsessile; fruit septicidal ..... **ROTALA. 5.**

(bb) Flowers usually cymose and pedicellate; fruit opening by a transverse slit or irregularly ..... AMMANNIA. 1.
(bbb) Flowers usually crowded into heads subtended by leafy bracts; fruit loculicidal ..... NESAEA. 4.

AA. Shrubs or trees:
(c) Calyx with oblique mouth, scarlet ..... WOODFORDIA. 6.
(cc) Calyx straight; flowers white or yellow; branchlets often spiny ..... LAWSONIA. 2.

1. **AMMANNIA** L.

Ammannia senegalensis Lam. Fig. 84.

Variable and common herb in moist places, erect or procumbent, up to 2 ft. high; stems rather slender, wiry, 4-angled or narrowly winged. Leaves opposite, lanceolate to linear, auriculate and amplexicaul at the base, up to 2 in. long. Flowers in pedunculate cymes, axillary. Petals 4 or absent, pink, falling early.

Central and Southern Sudan.

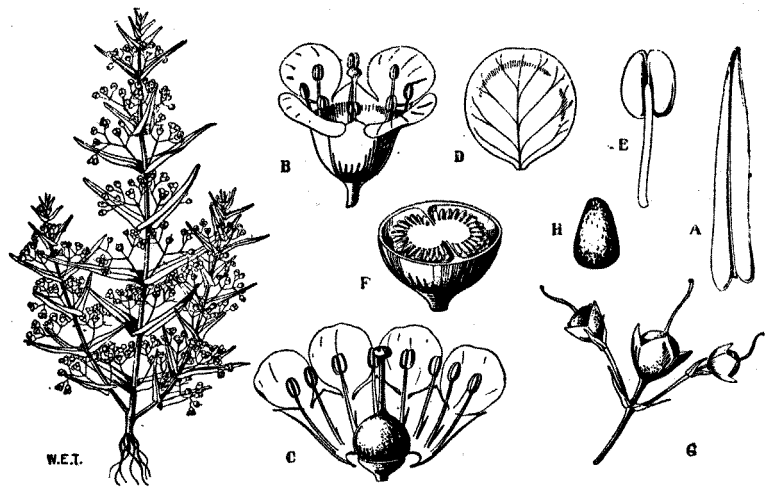


Fig. 84—AMMANNIA SENEGALENSIS Lam.
A, leaf. B, flower. C, flower laid open. D, petal. E, stamen from behind. F, cross-section of ovary. G, fruits. H, seed.

A. baccifera L.

Glabrous annual herb, with erect and spreading 4-angled stems up to 14 in. high, reddish at the base. Leaves linear-lanceolate, attenuate to the base, often shining, up to 2¼ in. long. Cymes 3-7-flowered, subsessile. Capsule globose.

Widespread.

A. aegyptiaca Willd.

A. salicifolia (non Monti) Broun & Massey.

Glabrous annual marsh herb up to 18 in. high; stems erect, terete at the base, with long 4-angled spreading branches. Leaves lanceolate, sessile, sometimes auriculate at the base but not amplexicaul nor attenuate, 1-nerved, ¼-1½ in. long. Flowers very shortly pedicellate, 4-9 in each axil, in sessile cymes, densely verticillate especially in fruit. Calyx with a short 4-cornered spreading limb, campanulate in flower and hemispherical in fruit. Petals absent or falling early. Capsule 1-locular.

Northern Sudan.

A. urceolata Hiern.

Erect annual herb 4-8 in. high; branches spreading and 4-angled. Leaves opposite, linear, sessile, not auriculate, 1-nerved, ½-2 in. long. Flowers about 6 in each axil, densely clustered. Calyx usually covered with numerous small scales. Petals absent. Capsule 1-locular, enclosed in the tube of the calyx which is constricted above it.

Central Sudan.

A. attenuata Hochst. ex A. Rich.

Erect shrubby herb up to 2 ft. high; stems and branches broadly winged. Leaves lanceolate or linear-lanceolate, ¾-3½ in. long and up to ½ in. broad. Flowers in axillary 7-12-flowered loose sessile or shortly pedunculate cymes. Capsule longer than the calyx.

Widespread.

A. apiculata Koehne.

Erect herb 3½-6 in. or more high; stems sharply quadrangular. Leaves linear to oblanceolate-linear, ½-1½ in. long, the midrib strongly thickened beneath. Flowers sessile in heads. Calyx campanulate-globose, accrescent in fruit. Petals absent. Stigma sessile. Capsule globose.

White Nile.

2. LAWSONIA L.

Lawsonia inermis L. Fig. 85.

L. alba Lam.

Shrub or small tree, the older branches often spinescent. Leaves opposite, elliptic or oblanceolate, acute at each end, up to about 1¼ in. long and ¾ in. broad, glabrous, the midrib impressed above. Flowers creamy-white, sweet-scented; panicle many-flowered with leafy bracts. Stamens 4-8. Fruit globose, about ¼ in. in diameter, with persistent style.

Northern and Central Sudan. Originally introduced but now almost naturalized.

Fig. 85—LAWSONIA INERMIS L.

3. **LYTHRUM** L.

Lythrum rotundifolium Hochst. ex A. Rich.

Succulent herb; stems creeping, terete, with short ascending branches 3 in. long. Leaves opposite, very shortly petiolate, orbicular-elliptic, ¼-⅓ in. long. Calyx with a wide 8-nerved scarcely ribbed tube, cylindric in fruit. Petals magenta, long, unguiculate. Stamens 8, exserted.

Equatoria: *Imatong Mountains, Mount Kineti, in swamps.*

4. **NESAEA** Commers. ex Kunth

Nesaea cordata Hiern.

Erect annual herb, with 4-angled branches up to 9 in. high, occurring in moist places. Leaves opposite, ovate to lanceolate, cordate at the base, sessile, ⅛-½ in. long. Flowers rose-coloured, small, subsessile, in numerous heads (about 5-flowered) surrounded at the base by 2 imbricate broadly cordate acuminate bracts. Calyx campanulate, with 8-12 ribs. Petals 4-6 or absent, larger than the calyx-lobes, falling early.

Equatoria.

N. erecta Guillem. & Perrott. Fig. 86.

Annual herb 2-10 in. high, often occurring on river-banks; branches 4-angled. Leaves linear-lanceolate, not cordate at the base, ¼-¾ in. long. Flowers lilac or magenta, 3-7 in solitary heads surrounded at the base by 2 imbricate broadly cordate acuminate bracts. Petals 4-6.

Equatoria.

N. icosandra Kotschy & Peyr.

Glabrous herb; stems somewhat woody at the base, erect, 4-sided, 3-8 in. high. Leaves opposite or the lower ones alternate, oblong-lanceolate, acute at the apex, rounded at the base, sessile, ¼-1 in. long, about ⅛ in. broad. Flowers red, minute, in 1-6-flowered cymes. Ovary 4-locular; style ⅛ in. long.

Equatoria.

5. **ROTALA** L.

Rotala tenella (Guillem. & Perrott.) Hiern.

Creeping marsh herb, with erect branches; stems low and rooting, scarcely 3 in. long. Leaves sessile, ovate-oblong, rounded at the apex, cordate and amplexicaul at the base, up to ⅛ in. long. Flowers minute, solitary. Calyx whitish. Petals white, falling early. Stamens 4; filaments concealed in longitudinal depressions of the ovary. Capsule globose, dehiscing at the apex by 4 valves, enclosed in the persistent calyx.

Equatoria.

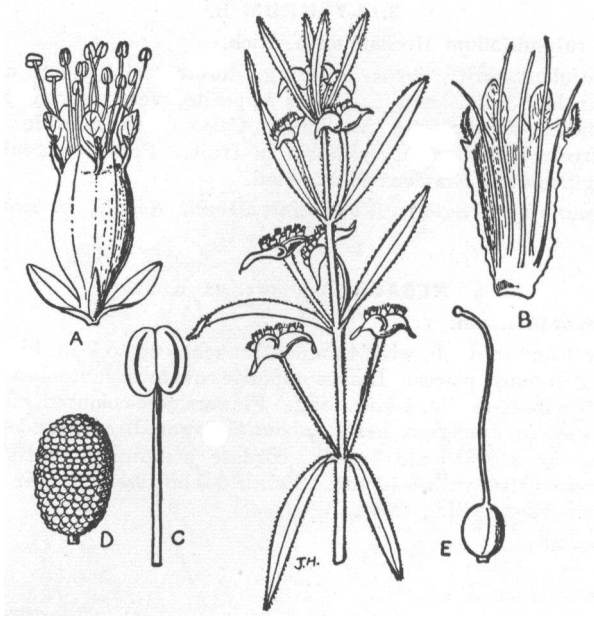


Fig. 86—NESAEA ERECTA Guillem. & Perrott.
A, flower. B, calyx laid open. C, stamen. D, seed. E, ovary.

R. mexicana Cham. & Schlecht.

R. verticillaris (non L.) Broun & Massey.

Prostrate herb, rooting and branched at the base, 1-4 in. long. Leaves 3-8 in a whorl, spreading, linear, truncate or bifid at the apex, 1-4 in. long. Flowers small, solitary. Petals absent or falling very early. Capsule dehiscing at the apex by 3 valves.

Equatoria.

R. serpiculoides Welw. ex Hiern.

Erect bright-green annual marsh herb 1-3½ in. high; stems 4-angled. Leaves linear, ⅛-⅝ in. long. Flowers 1-4 together, shortly peduncled. Calyx reddish at the apex. Petals reddish, rare. Stamens 1 or 2. Capsule reddish, 3-valved.

Equatoria.

R. densiflora (Roth) Koehne.

R. decussata (non DC.) Broun & Massey.

Much-branched annual marsh herb 1-9 in. high. Leaves decussate, elliptic-oblong or linear, rounded at the apex, up to ½ in. long. Flowers sessile, solitary. Petals 4 or absent. Stamens 2 or 3. Capsule 3-valved, exceeding and tearing the calyx.

Equatoria.

R. stagnina Hiern.

Erect marsh herb about 4 in. high; stems rooting at the base, 4-angled. Leaves opposite, ovate-oblong, obtuse at the apex, subcordate or subauriculate at the base, subsessile, 2 in. long. Flowers solitary, sessile. Stamens 2. Capsule 3-valved, dehiscing widely.

Equatoria.

6. **WOODFORDIA** Salisb.

Woodfordia uniflora (A. Rich.) Koehne.

W. floribunda (non Salisb.) Broun & Massey.

Much-branched shrub or small tree, with scattered minute black glands especially on the leaves. Leaves opposite or sometimes in whorls of 3, entire, subsessile, ovate-lanceolate, acuminate at the apex, paler beneath, up to 5 in. long, sometimes turning crimson. Flowers about ¾ in. long to the end of the stamens, arranged in axillary clusters or rarely solitary. Calyx scarlet, about ⅛ in. long. Petals 6 or absent, very small. Stamens 12, much exserted; anthers dark-red.

Central Sudan.

46. *ONAGRACEAE*

Herbs or rarely shrubs, sometimes aquatic. Leaves opposite or alternate; stipules usually absent or deciduous. Flowers hermaphrodite, usually actinomorphic, often solitary. Calyx-lobes 4-5, valvate. Petals 4-5, free, contorted or imbricate, rarely absent. Stamens as many or twice as many as the calyx-lobes. Ovary inferior or semi-inferior, 2-6-locular; ovules 1 to many in each loculus. Fruit a capsule or nut; seeds numerous or solitary.

A. Seeds indefinite:
  (a) Seeds with a tuft of hairs ..... EPILOBIUM. 1.
  (aa) Seeds without a tuft of hairs:
    (b) Stamens twice as many as the calyx-lobes, or if 4 then seeds enclosed loosely in segments of the endocarp ... JUSSIAEA. 2.
    (bb) Stamens as many as the calyx-lobes; seeds free, not enclosed in segments of endocarp .... LUDWIGIA. 3.

AA. Seed solitary; floating herbs; fruit a woody horned nut ..... TRAPA. 4.

1. **EPILOBIUM** L.

Epilobium hirsutum L. Great Hairy Willow-herb.

Erect herb 2-5 ft. high, hirsute. Leaves opposite or subopposite, linear-lanceolate, acuminate at the apex, serrulate with forward teeth, sessile, amplexicaul, pubescent or pilose, 1-5 in. long. Flowers sessile or very shortly pedunculate, ½-¾ in. in diameter. Stigma 4-cleft with linear or oblong at length revolute lobes. Capsule 2-3 in. long.

Darfur: Jebel Marra.

2. **JUSSIAEA** L.

Jussiaea diffusa Forsk.

Creeping or floating aquatic herb, rooting at the nodes and frequently with spindle-shaped pale-pinkish hairy floats. Leaves alternate, lanceolate, narrowed into the petiole, up to 3¼ in. long and ⅓ in. broad. Flowers bright-yellow, solitary, axillary; peduncle about as long as the ovary. Seeds fused with the endocarp.

Central and Southern Sudan.

J. leptocarpa Nutt.

J. pilosa Kunth.

Herb, more or less erect, up to 3 ft. or more high, more or less woody below; stems rather villous above. Leaves oblanceolate to obovate, acute at each end, up to 6 in. long and ¾ in. broad, hirsute when young, with numerous fairly conspicuous lateral nerves. Flowers lemon-yellow, solitary, axillary; peduncle shorter than the ovary. Sepals and petals 5. Capsule cylindric, 1-1½ in. long, on a peduncle $\frac{1}{16}$-½ in. long; seeds as in *J. abyssinica*.

Central and Southern Sudan.

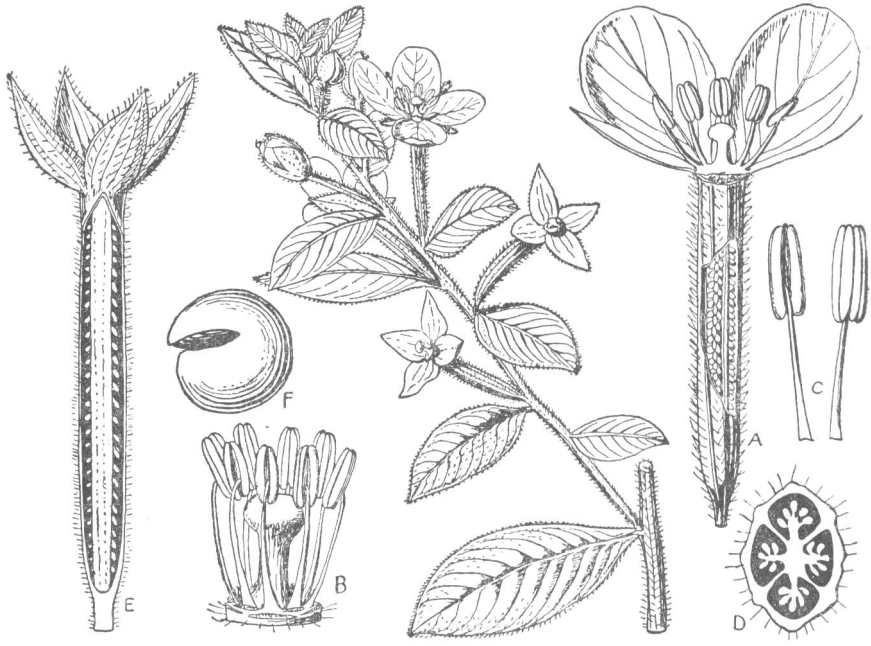


Fig. 87—JUSSIAEA SUFFRUTICOSA L.

A, flower dissected to show parts. B, stamens and style. C, stamens. D, cross-section of ovary. E, fruit in longitudinal section. F, seed.

J. abyssinica (A. Rich.) Dandy & Brenan, comb. nov.
Ludwigia abyssinica A. Rich.; *J. acuminata* (non Sw.) Broun & Massey.

Erect glabrous herb from a few inches to 2 ft. high. Leaves membranous, ovate-lanceolate or lanceolate, narrowed to an acute apex, entire, 3-4 in. long, 1-1⅓ in broad. Flowers yellow, about ¼ in. in diameter, mostly in bunches; pedicels with small bracteoles at the base. Sepals and petals 4. Stamens 4. Capsule up to ¾ in. long; seeds enclosed loosely in segments of the endocarp.

Central and Southern Sudan.

J. suffruticosa L. Fig. 87.
J. villosa Lam.

Erect branching herb up to 4-5 ft. high; stems usually pubescent. Leaves linear to linear-lanceolate, up to 5¼ in. long, usually without a distinct petiole. Flowers yellow, solitary, sessile, small. Sepals and petals 4. Capsule up to 2 in. long, the fibres of old capsules persistent; seeds smooth, rounded, free.

Central and Southern Sudan.

J. erecta L. Fig. 88.
J. linifolia (non Vahl) Broun & Massey.

Erect glabrous herb from a few inches to several feet high; stems red. Leaves broadly lanceolate to elliptic-lanceolate, ½-4 in. long, narrowed to the petiole or to the base. Flowers yellow, solitary. Sepals and petals 4. Capsule cylindric, ½-⅔ in. long, very shortly stalked; seeds free.

Widespread.

3. LUDWIGIA L.

Ludwigia jussiaeoides Desr.

Erect herb up to 3 ft. high, freely branched above. Leaves linear-elliptic or lanceolate, narrowed into the petiole, glabrous or scabrid on the nerves, the lamina and variable petiole together 1½-4 in. long. Flowers yellow, axillary, ½-1 in. in diameter. Capsule 1 in. long, subcylindric.

Equatoria.

L. parviflora Roxb.

Erect freely branching herb from a few inches to 3 ft. high. Leaves narrow-linear to linear-lanceolate, gradually narrowed into the petiole, 1-4 in. long. Flowers yellow, axillary, ¼ in. or less in diameter. Sepals and petals 4. Capsule narrowed below, ½-½ in. long, usually with a distinct short peduncle.

Central and Southern Sudan.

Fig. 88—JUSSIAEA ERECTA L.
A, flowering plant. B, branch of a larger example. C, longitudinal section of flower. D, transverse section of ovary. E, fruit. F, seed.

4. **TRAPA** L.

Trapa bispinosa Roxb.

Floating herb; stems ascending in water, giving off numerous pectinate roots. Leaves alternate, rhomboid-triangular, almost truncate at the base, coarsely dentate, about 1¼-1½ in. long and broad, strongly pinnately nerved and laxly tomentose beneath; petiole of the lower leaves elongated, dilated towards the top, pilose. Flowers solitary, axillary. Fruit woody, 2-horned, when ripe sinking to the bottom of the water.

Southern reaches of the White Nile and its tributaries.

47. *HALORAGACEAE*

Herbs or undershrubs, often aquatic. Leaves without stipules, alternate, opposite or verticillate, sometimes very large, the submersed ones often much divided. Flowers hermaphrodite or unisexual, solitary to paniculate or corymbose, often very small. Calyx-lobes 2-4 or absent. Petals 3-4 or absent, free. Stamens 2-8 or rarely 1, large; anther basifixed. Ovary inferior, 1-4-locular; styles 1-4; ovules 1-4. Fruit a small nut or drupe, sometimes winged, or rarely breaking up into cocci.

A. Ovary 4-ovulate, 2-4-locular when young; styles 4 ..... LAUREMBERGIA. 2.

AA. Ovary 1-ovulate, always 1-locular; styles 2 ..... GUNNERA. 1.

1. **GUNNERA** L.

Gunnera perpensa L.

Swamp herb, nearly stemless. Leaves radical; lamina 6-12 in. broad; petiole up to 18 in. long. Flowers minute, in spikes along a common peduncle, male in the upper, female in the lower. Fruit succulent, minute.

Equatoria: *Kippia.*

2. **LAUREMBERGIA** Berg.

Laurembergia engleri Schindl.

Low swamp herb, with reddish puberulous or glabrous stems. Leaves alternate, linear or linear-oblanceolate, slightly toothed, up to ½ in. long, glabrous or nearly so. Flowers sessile, minute, up to about 11 in each axil.

Equatoria.

48. *THYMELAEACEAE*

Trees, shrubs or rarely herbs. Leaves without stipules, opposite or alternate, entire, often small and heath-like. Flowers actinomorphic, usually hermaphrodite, sometimes capitate. Calyx tubular, more or less cylindric, sometimes long and slender; lobes 4-5, imbricate. Petals present or absent, free, sometimes very small, usually inserted at the mouth of the calyx-tube. Stamens 8 or 10, inserted on the calyx-tube. Disk hypogynous or absent. Ovary superior, 1-2-locular; ovules solitary in each loculus.

A. Flowers in racemes, umbels or ebracteate heads:
B. Petals present; ovary 1-locular ..... ENGLERODAPHNE. 1.
BB. Petals absent; ovary 2-locular ..... PEDDIEA. 3.
AA. Flowers capitate, surrounded by an involucre of bracts ..... GNIDIA. 2.

1. **ENGLERODAPHNE** Gilg

Englerodaphne leiosiphon Gilg.

Much-branched straggling glabrous shrub up to 5 ft. high. Leaves opposite and decussate, very shortly petiolate, membranous, ovate, acute to obtuse at the apex, entire, ½-1 in. long. Flowers white, somewhat fragrant, sessile in 4-6-flowered heads at the ends of the branchlets; peduncles short.

Equatoria: *Didinga Mountains, Iwowa*, 5300 ft.

2. **GNIDIA** L.

Gnidia chrysantha (Solms) Gilg.
Arthrosolen chrysanthus Solms.

Virgate bushy or heath-like undershrub up to 2 ft. high from a woody rootstock, occurring in damp places. Leaves linear-acicular with hard acute tips, up to ¾ in. long. Flowers numerous in solitary heads; involucral bracts ovate, acutely acuminate, shorter than the flowers. Calyx 4-lobed, shortly pubescent; tube ½ in. long. Petals absent. Stamens 8 in 2 rows, included in the calyx-tube.

Central and Southern Sudan.

G. macrorrhiza Gilg.
G. mittuorum Gilg.

Heath-like undershrub, glaucous, often purple-tinged; flowering stems often appearing after bush-fires, slender, unbranched, 4-angled, glabrous, 4-12 in. high from a stout rootstock. Leaves oblong-oblanceolate, obtuse at the apex, up to 1 in. long. Flowers brownish-yellow, in 7-10-flowered heads; pedicels minute, bearing a tuft of white hairs. Calyx 4-lobed, glabrous in the upper part. Petals present. Stamens 8 in 2 rows, sessile in the calyx-tube.

Equatoria.

G. schweinfurthii Gilg.

Herb 1-2 ft. high; flowering stems erect, laxly branched, stout, glabrous. Leaves scattered, narrowly lanceolate, acute at the apex, about ½ in. long. Flowers yellowish-brown, in terminal 15-25-flowered heads or in axillary 1-3-headed racemes. Calyx 4-lobed, pubescent in the upper part. Petals present.

Equatoria.

Fig. 89—GNIDIA KRAUSSIANA Meisn.
A, flower-bud. B, calyx-lobe. C, petal. D, flower. E, flower in longitudinal section. F, stamens. G, ovary with style.

G. apiculata (Oliv.) Gilg.

Low shrub 1½-3 ft. high; stems much branched, glabrous. Leaves alternate, crowded, linear or narrowly elliptic, acute at the apex, ½-¾ in. long, glabrous. Heads numerous, terminal and axillary, the lateral ones sessile, 10-15-flowered. Calyx 4-lobed, pubescent in the upper part. Petals present, minute.

Equatoria.

G. kraussiana Meisn. Fig. 89.

Lasiosiphon kraussii Meisn.; *L. kraussianus* (Meisn.) Hutch. & Dalziel.

Woody herb 4-24 in. high. Leaves lanceolate to oblanceolate, 1¼-1½ in. long, glabrous or pubescent. Flowering heads about 1¼ in. in diameter, solitary, terminal, many-flowered, on long peduncles, with lanceolate pubescent or glabrous bracts. Calyx 5-lobed; tube yellow, silky-pilose with longer whitish hairs towards the base. Petals present, membranous, often emarginate or lobed.

Central and Southern Sudan.

G. lamprantha Gilg.

Shrub up to 10 ft. high. Leaves oblong, acute at the apex, 1-1½ in. long, densely pubescent with long appressed silky hairs. Heads many- (50-70-) flowered; involucral bracts 7-10, ovate, densely pubescent, spreading during flowering, about ¾ as long as the flowers. Calyx 5-lobed; tube cylindric, ⅜-½ in. long, densely clothed with yellowish pubescence above the middle and with long stiff erect yellowish hairs below. Petals present, linear-subulate. Ovary glabrous below, bearing a tuft of erect white hairs at the summit.

Equatoria: *Imatong Mountains.*

G. glauca (Fresen.) Gilg.

Lasiosiphon glaucus Fresen.

Shrub or tree up to 30 ft. or more high, much branched; older branches marked by the scars of fallen leaves. Leaves oblanceolate, very acute at the apex, 2-4¼ in. long, glabrous, the margin recurved at the base. Flowers yellow; heads subsessile, about 2 in. in diameter, surrounded by large ovate glabrescent to softly tomentellous bracts. Calyx 5-lobed; tube tomentose and with a dense tuft of long silky golden hairs at the base. Petals present.

Equatoria: *Imatong Mountains, Itobol, also summit of Mount Kineti*, 10,414 ft.

3. **PEDDIEA** Harv.

Peddiea fischeri Engler.

Shrub up to 15 ft. high. Leaves dark-green, lanceolate, obtuse at the apex, 2¾-3½ in. long. Flowers pale-green, in terminal 8-10-

flowered inflorescences; peduncle ½-1 in. long, bearing numerous prominent bract-scars at the base and apex; pedicels about ½ in. long. Ovary deeply furrowed at the base.

Equatoria: *Laboni Forest.*

49. *NYCTAGINACEAE*

Herbs, shrubs or trees. Leaves alternate or opposite, without stipules, simple. Flowers actinomorphic, hermaphrodite or unisexual, usually cymose, sometimes surrounded by brightly coloured bracts, these occasionally simulating a calyx. Calyx tubular, often petaloid, valvate or folded in bud. Petals absent. Stamens 1 to many, hypogynous. Ovary superior, 1-locular; ovule solitary. Fruit indehiscent, enclosed in the persistent (often glandular) base of the calyx.

A. Bracts small and free, not resembling a calyx; fruiting calyx often glandular:

(a) Fruiting calyx with distinct longitudinal ribs, very finely glandular or sometimes glabrous but with no large wart-like glands ..... **BOERHAVIA. 1.**

(aa) Fruiting calyx with large wart-like subsessile or stalked glands, especially towards the apex ..... **COMMICARPUS. 2.**

AA. Bracts connate and forming a calyx-like involucre; fruiting calyx not glandular ..... **MIRABILIS. 3.**

1. **BOERHAVIA** L.

Boerhavia elegans Choisy.

Tall branched herb, woody at the base. Leaves broadly ovate, 1½ in. long, glabrous, whitish beneath. Flowers usually solitary, rarely in pairs; pedicels very short. Upper part of calyx very small, campanulate; lower part in fruit club-shaped, ⅛-⅛ in. long, pentagonal, viscid or glabrate. Stamens 2.

Red Sea District.

B. repens L.

More or less prostrate or spreading herb. Leaves in unequal pairs, shortly petiolate, lanceolate, about 1 in. long. Flowers in small 4-10-flowered umbels on short very slender mostly axillary peduncles.

Widespread.

Var. **diffusa** (L.) Boiss. Fig. 90.
B. adscendens Willd.

Ascending herb. Leaves long-petiolate, ovate, fairly large, glabrous or nearly so. Flowers in small umbels in lax terminal panicles.

Widespread: *a common weed of waste places.*

Fig. 90—BOERHAVIA REPENS var. DIFFUSA (L.) Boiss.

Var. **viscosa** Choisy.

Ascending herb; stems like the leaves densely viscous-pubescent. Leaves ovate or suborbicular, sinuate, up to 1½ in. long, rather thick. Flowers in small umbels in rather dense corymbose cymes.

Northern and Central Sudan.

2. **COMMICARPUS** Standl.

Commicarpus verticillatus (Poir.) Standl.

Boerhavia verticillata Poir.

Tall much-branched glabrous herb. Leaves broadly ovate, 2 in. long. Flowers in lax panicles of 3-5-flowered whorls above the leaves. Upper part of calyx widely funnel-shaped from above the ovary, about $\frac{1}{12}$ in. long. Stamens slightly exserted.

Northern and Central Sudan.

C. africanus (Lour.) Dandy, comb. nov. Fig. 91.

Boerhavia africana Lour.; *B. plumbaginea* Cav.; *B. pentandra* Burch.

Herb with tall erect or scrambling stems. Leaves broadly ovate. Flowers in whorls in a lax ample usually terminal panicle. Upper part of calyx white or lilac, narrowly tubular above the ovary but funnel-shaped in the upper half, up to about ⅓ in. long; lower part in fruit ⅓ in. long. Stamens long-exserted.

Northern and Central Sudan.

3. **MIRABILIS** L.

Mirabilis jalapa L. Four-o'clock; Marvel-of-Peru.

Erect herb. Leaves ovate-triangular, acutely acuminate at the apex, more or less truncate at the base, up to 4 in. long and 2½ in. broad, conspicuously marked with cystoliths; petiole rather long and slender. Flowers cymose, few; bracts connate in the lower part, forming a calyx-like involucre, puberulous. Calyx petaloid, long-tubular with an expanded 5-lobed limb, the tube 1½ in. long; lower part in fruit about as long as the involucre, ribbed, glabrous, black when dry.

Kassala. Equatoria: Kagelu. Introduced into Africa from tropical America and now established in many parts.

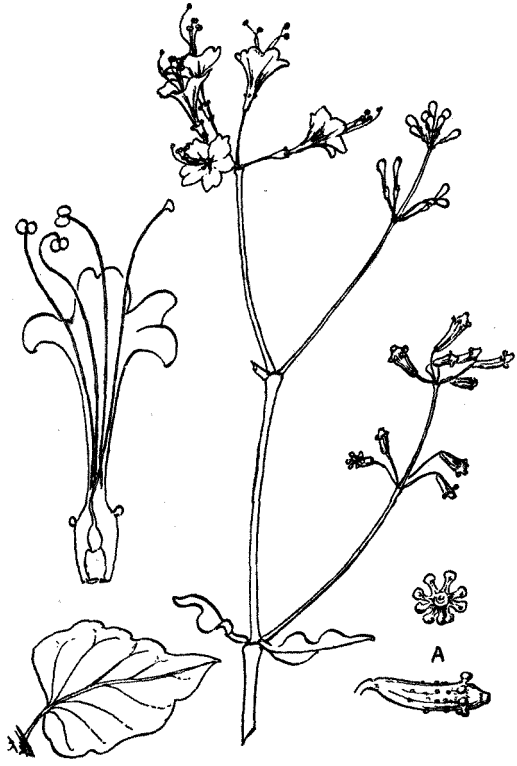


Fig. 91—COMMICARPUS AFRICANUS (Lour.) Dandy.
A, fruit enclosed in persistent base of calyx.

50. *PROTEACEAE*

Trees or shrubs. Leaves usually alternate, without stipules, simple or variously divided. Flowers hermaphrodite or unisexual, racemose to capitate. Calyx petaloid, 4-lobed; lobes valvate, connivent in bud, variously separating during flowering. Petals absent. Stamens 4. Hypogynous scales often present. Ovary superior, 1-locular; style long, simple; ovules 1 or more. Fruit a nut, drupe or capsule.

A. Flowers in elongated spikes without an involucre ..... FAUREA. 1.

AA. Flowers in heads surrounded by numerous bracts ... PROTEA. 2.

1. **FAUREA** Harv.

Faurea speciosa Welw.

Tree up to 30 ft. high. Leaves broadly elliptic-lanceolate, acute at each end, 4¾-6½ in. long, 1½-2¾ in. broad; lateral nerves numerous, very prominent beneath, branched or looped near the margin;

petiole ½-¾ in. long. Flowers about ½ in. long, curved before opening. Calyx reddish, softly tomentose.

Equatoria: *Imatong Mountains, Loyaru, in scrub.*

2. **PROTEA** R. Br.

Protea gaguedi J. F. Gmel.

P. abyssinica Willd.

Shrub or tree up to 30 ft. high, freely branching; branchlets pilose when young. Leaves lanceolate to narrowly oblong-lanceolate, obtuse at the apex, slightly tapered at the base, 4-6 in. long, about ¾ in. broad. Flower-heads up to 4 in. in diameter; largest bracts about 1½ in. long. Calyx white, ⅘ in. long, densely hairy. Stamens and styles pinkish-white.

Central and Southern Sudan.

P. madiensis Oliv.

Shrub or tree usually 5-10 ft. high but sometimes attaining 20 ft.; branchlets smooth; bark red-brown to orange-brown. Leaves broadly lanceolate-elliptic, obtuse at the apex, tapered to the base, 4-8 in. long, up to 3 in. broad, glabrous or finely appressed-hairy. Flower-heads up to 4 in. in diameter; bracts glabrescent, the upper ones reddish and up to 3 in. long, the lower ones green. Calyx white, up to 2 in. long, glabrous at the apex, usually villous at the base. Stamens pinkish-white.

Equatoria.

51. *DILLENIACEAE*

Shrubs or undershrubs (often climbing) or rarely trees. Leaves alternate, simple, entire or dentate (rarely divided); stipules absent or adnate to the petiole. Flowers yellow or white, hermaphrodite or polygamous, rarely dioecious. Sepals 5 or rarely fewer, imbricate, persistent. Petals 5 or fewer, free, imbricate, falling early. Stamens hypogynous, numerous or rarely 10 or fewer, free or variously united at the base. Carpels 1 to many, generally free; ovules 1 to many in each carpel. Fruit dehiscing by one or both sutures; seeds 1 or few, mostly with an aril.

1. **TETRACERA** L.

Tetracera potatoria Afz. ex Don.

T. alnifolia (non Willd.) Broun & Massey.

Twining shrub, bush or small tree. Leaves ovate to obovate, scabrid above, often loosely pilose beneath, 1½-3 in. long, 1-1½ in. broad. Flowers yellowish-white, scented. Sepals glabrous outside or with a few silky appressed hairs, covered with closely appressed silky hairs inside. Carpels covered with silky hairs when young, finely striate, glabrous or with a few hairs at the apex when mature.

Equatoria.

T. masuiana De Wild. & Dur.

T. strigillosa Gilg.

Undershrub about 2 ft. high from a woody rhizome. Leaves oblanceolate, dentate, 4-6 in. long, 1-2½ in. broad. Flowers white, very few together. Sepals glabrous inside.

Equatoria.

52. *PITTOSPORACEAE*

Trees or shrubs. Leaves alternate, without stipules, simple. Flowers actinomorphic, hermaphrodite. Sepals 5, imbricate, free or nearly so. Petals 5, longer than the sepals, imbricate, free or united from the base. Stamens 5, hypogynous, free. Ovary superior, 1-locular with parietal placentas or 2-5-locular through the placentas meeting in the middle, sessile or shortly stipitate; style simple, terminal; ovules numerous. Fruit a loculicidal capsule or indehiscent.

1. **PITTOSPORUM** Banks ex Soland.

Pittosporum abyssinicum Del.

Shrub or tree usually less than 30 ft. high but larger in mountain forest. Leaves oblanceolate, acuminate at the apex, long-cuneate at the base, 3-7 in. long, 1¼-2 in. broad. Flowers white or yellow-white, fragrant; inflorescences paniculate, up to 5 in. long, pubescent at first, finally glabrous. Capsule orange-yellow, opening into 2 spreading valves; valves orbicular, transversely rugose inside, up to ½ in. long; seeds with a gelatinous scarlet covering.

White Nile District.

53. *COCHLOSPERMACEAE*

Rhizomatous undershrubs, with coloured juice. Leaves alternate, with stipules, palmatilobed. Flowers hermaphrodite, showy. Sepals 5, imbricate, deciduous. Petals 5, free, imbricate or subcontorted. Stamens numerous, free, equal or some longer than the others. Ovary 1-locular with parietal placentas projecting into the loculus or perfectly 3-locular; ovules numerous. Fruit a 3-5-valved capsule.

Bixa orellana L., Annatto, belonging to the allied family *Bixaceae*, is cultivated in the Sudan.

1. **COCHLOSPERMUM** Kunth

Cochlospermum tinctorium A. Rich. Fig. 92.

C. niloticum Oliv.

Usually a dwarf plant but occasionally up to 3 ft. high. Leaves palmately lobed, variable. Flowers yellow, large, solitary, in dwarf plants appearing just above the ground. Fruit an obovoid often hairy capsule; seeds covered with long cottony hairs on a membranous outer testa, the inner testa hard and shining.

Kordofan. Equatoria.

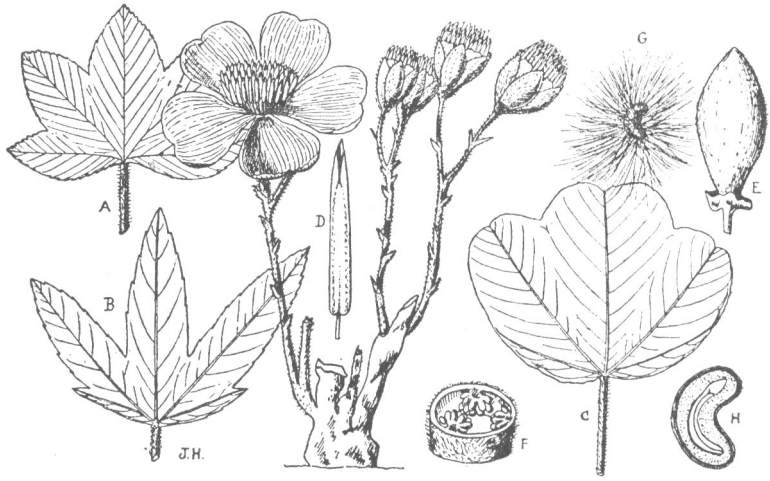


Fig. 92—COCHLOSPERMUM TINCTORIUM A. Rich.
A, B, C, leaves. D, anther. E, ovary. F, cross-section of ovary. G, seed. H, longitudinal section of seed.

54. *FLACOURTIACEAE*

Trees or shrubs. Leaves alternate, simple; stipules often soon falling off. Flowers hermaphrodite or unisexual, often dioecious or polygamous, variously arranged. Sepals sometimes not distinguishable from the petals, imbricate or open in bud. Petals present or absent, free, sometimes not arranged regularly in relation to the sepals, with or without an opposite scale inside the base, imbricate. Stamens numerous or rarely few, hypogynous, free. Ovary 1-locular with 1 or more parietal placentas or rarely with the placentas meeting in the middle; styles or stigmas as many as the placentas; ovules 2 or more on each placenta. Fruit usually a berry or a drupe, very rarely a capsule.

A. Petals present:
  (a) Branchlets armed ..... ONCOBA. 4.
  (aa) Branchlets unarmed:
    (b) Flowers small; fruit prickly; seeds 1 or few ..... LINDACKERIA. 3.
    (bb) Flowers large; fruit not prickly; seeds numerous ..... CALONCOBA. 1.
AA. Petals absent ..... DOVYALIS. 2.

1. **CALONCOBA** Gilg

Caloncoba schweinfurthii Gilg.

Deciduous shrub or tree up to 30 ft. high; bark smooth, grey. Leaves entire, elliptic, acuminate at the apex, rounded at the base, 5-7 in. long, 2¼-3¾ in. broad; midrib and lateral nerves

prominent beneath; petiole very variable, 1-4 in. long. Flowers white, fragrant, terminal or axillary, solitary or clustered, 3-4 in. in diameter, often borne while the plant is leafless. Sepals 3. Petals about 13. Stamens yellow, numerous. Fruit globose, beaked, about 2 in. in diameter, at first green mottled with white, turning orange on ripening, splitting into about 6 longitudinal segments; seeds white.

Equatoria: *gallery-forests.*

2. **DOVYALIS** E. Mey. ex Arn.

Dovyalis macrocalyx (Oliv.) Warb.

Dioecious shrub up to 12 ft. high, with spines up to 4 in. in length. Leaves ovate, 1½-2 in. long. Male flowers in clusters; female flowers solitary in the axils of the leaves. Calyx green. Disk-glands red. Filaments white; anthers yellow. Fruit bright-red, edible, surrounded by the large green calyx.

Equatoria: *Lotti Forest.*

3. **LINDACKERIA** C. Presl

Lindackeria schweinfurthii Gilg.

Shrub. Leaves oblanceolate, acuminate at the apex, serrate, 2½-3½ in. long. Flowers white, few, very small, in axillary cymes. Stamens yellow. Fruit small.

Equatoria.

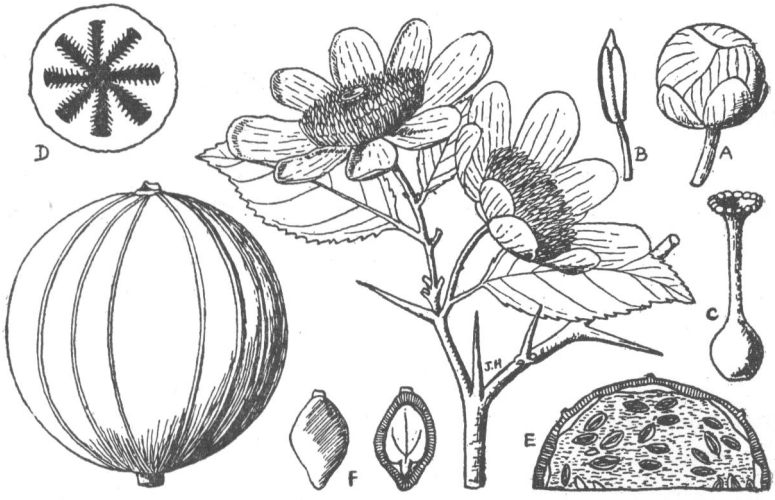


Fig. 93—ONCOBA SPINOSA Forsk.

A, flower-bud. B, stamen. C, ovary with style. D, cross-section of ovary. E, part of section of fruit. F, seed, entire and in longitudinal section.

4. ONCOBA Forsk.

Oncoba spinosa Forsk. Fig. 93.

Shrub or tree up to 20 ft. high; branchlets strongly armed with straight sharp spines up to 3 in. long. Leaves often wine-red when young, shortly acuminate at the apex, serrulate or crenate-serrate, up to 4 in. long and 2 in. broad. Flowers white, 2 in. in diameter, handsome, sweet-scented, somewhat resembling a wild rose. Calyx usually persistent. Fruit red-brown when ripe, woody, globose, 2-2½ in. in diameter, smooth with longitudinal rib-like markings.

Central and Southern Sudan.

55. *SAMYDACEAE*

Trees or shrubs. Leaves alternate, simple, often pellucid-dotted or -lined; stipules small and deciduous or absent. Flowers hermaphrodite, actinomorphic, perigynous. Sepals united in the lower part, persistent. Petals absent or as many as or more than the sepals, free, often persistent. Disk-glands alternate with the stamens. Stamens definite or indefinite in number in 1 or more rows, sometimes in bundles opposite the petals; staminodes often present. Ovary free or adnate to the calyx-tube, sessile, 1-locular with 3-5 parietal placentas often towards the top of the loculus; ovules few or numerous. Fruit capsular or indehiscent.

A. Petals present; ovary partly adnate to the calyx-tube ..... HOMALIUM. 2.

AA. Petals absent; ovary free from the calyx-tube ... CASEARIA. 1.

1. CASEARIA Jacq.

Casearia engleri Gilg.

Forest-tree up to 120 ft. high; bole long, clean, cylindric; branchlets zigzag, glaucous. Leaves entire, glossy above, ovate-elliptic to elliptic-oblong, obtuse to shortly and obtusely acuminate at the apex, unequal-cuneate to rounded at the base, 2½-4½ in. long, 1¼-2 in. broad; petiole about ½ in. long. Flowers green, clustered on small cushions a little above the leaf-axils; pedicels up to ¼ in. long. Fruit orange-yellow, ovoid-globose, ½-⅔ in. long.

Equatoria.

2. HOMALIUM Jacq.

Homalium abdessammadii Aschers. & Schweinf.

Tree 40 ft. high. Leaves broadly elliptic, crenate-dentate, 3 in. long, 2 in. broad. Flowers paniculate; branches of panicle catkin-like. Fruit pilose.

Equatoria.

56. *FRANKENIACEAE*

Herbs or shrublets. Leaves opposite, without stipules, often small and heath-like. Flowers small, actinomorphic, hermaphrodite, solitary or cymose. Sepals 4-6, connate, persistent. Petals as many as the sepals, free, clawed, with a scale-like appendage on the inside. Stamens usually 6, hypogynous, free or shortly connate at the base. Ovary superior, sessile, 1-locular with 2-4 parietal placentas; ovules numerous. Fruit a capsule enclosed in the persistent calyx.

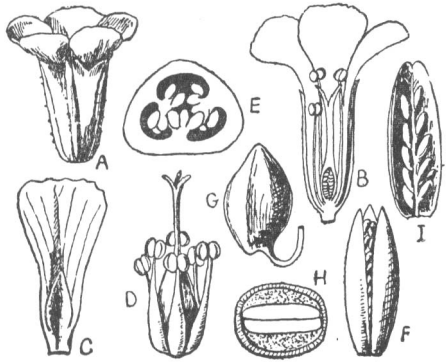


Fig. 94—FRANKENIA PULVERULENTA L.
A, flower. B, section of same. C, petal. D, stamens and pistil. E, cross-section of ovary. F, fruit. G, seed. H, section of same. I, valve of fruit.

1. FRANKENIA L.

Frankenia pulverulenta L. Fig. 94.

Diffuse much-branched herb often covering the ground or a few inches high. Leaves often clustered, petiolate, flat, obovate to almost orbicular, up to ¼ in. long, setulose-pubescent, often covered with salt crystals. Flowers rose to purple, sessile, solitary in the forks or clustered in leafy heads or cymes. Calyx tubular, 4-6-toothed. Petals 4-6.

Red Sea District: *Khor Gwob, Erkowit. Khartoum.*

57. *TAMARICACEAE*

Shrubs or trees with slender branches. Leaves alternate, without stipules, small, scale-like. Flowers very small, actinomorphic, usually hermaphrodite, in slender catkin-like spikes or racemes. Sepals 4-6, free. Petals 4-6, free or shortly connate at the base. Disk present. Stamens 5-10, hypogynous, free or connate at the base. Ovary superior, 1-locular with parietal or basal placentas; styles 3-4, free or united at the base; ovules numerous. Fruit a capsule; seeds with a tuft of hairs at the apex or all round.

Fig. 95—TAMARIX ORIENTALIS Forsk.
Below, flower, fruit and seed.

1. **TAMARIX** L.

Tamarix mannifera (Ehrenb.) Ehrenb. ex Bunge.

Small tree 9-15 ft. high or sometimes higher, glabrous, glaucous or white-powdery; branches rather rigid. Leaves half-clasping, ovate-deltoid, acute at the apex. Racemes rather short, dense, spreading; bracts acute, longer than the pedicels. Petals obovate-oblong, tapering at the base, inserted into the 5 retuse lobes of the disk.

Red Sea District: coastal and salty places.

T. nilotica (Ehrenb.) Bunge.

Riverside shrub or small tree 15-24 ft. high or sometimes higher, glabrous, glaucescent. Leaves half-clasping, ovate or deltoid, acute at the apex, cordate at the base. Flowers white or pinkish-white, crowded in panicled spikes at the ends of branches.
Northern and Central Sudan.

T. orientalis Forsk. Fig. 95.

T. articulata Vahl.

Shrub to large tree up to 50 ft. high and 8 ft. in girth; slender ultimate branchlets usually hoary with a saline efflorescence and closely jointed. Leaves reduced to a minute triangular tooth on a sheathing base. Flowers in spicate usually interrupted racemes.
Northern and Central Sudan.

58. *PASSIFLORACEAE*

Herbaceous or woody climbers bearing tendrils, or erect trees or shrubs. Leaves alternate, entire or lobed, often with a glandular petiole; stipules usually small and deciduous. Flowers hermaphrodite or unisexual. Sepals 5, imbricate, persistent, free or partially united. Petals 5 or rarely absent, free or shortly united, imbricate. Corona present, annular or of 1 or more rows of thread-like processes or scales. Stamens 5 or more, hypogynous or perigynous, shortly united or in bundles, sometimes arising from a gynophore. Ovary superior, 1-locular with 3 or rarely 4-5 parietal placentas; stigmas often capitate; ovules usually numerous. Fruit a loculicidal capsule or a berry; seeds with a pitted testa surrounded by a pulpy aril.

1. **ADENIA** Forsk.

Adenia venenata Forsk. Fig. 96.

Subarborescent climber, with glabrous glaucous stems. Leaves 3-5-lobed to about the middle, about 2-3¼ in. long, thin, glabrous, glaucous, the lobes rounded at the apex; petiole about as long as the lamina, the glands at the top connate and forming a peltate base. Inflorescences sessile; male flowers shortly pedicellate, ¼ in. long; female flowers much shorter with linear calyx-lobes. Fruit ellipsoid, 1¼-1½ in. long, distinctly nerved.
Widespread.

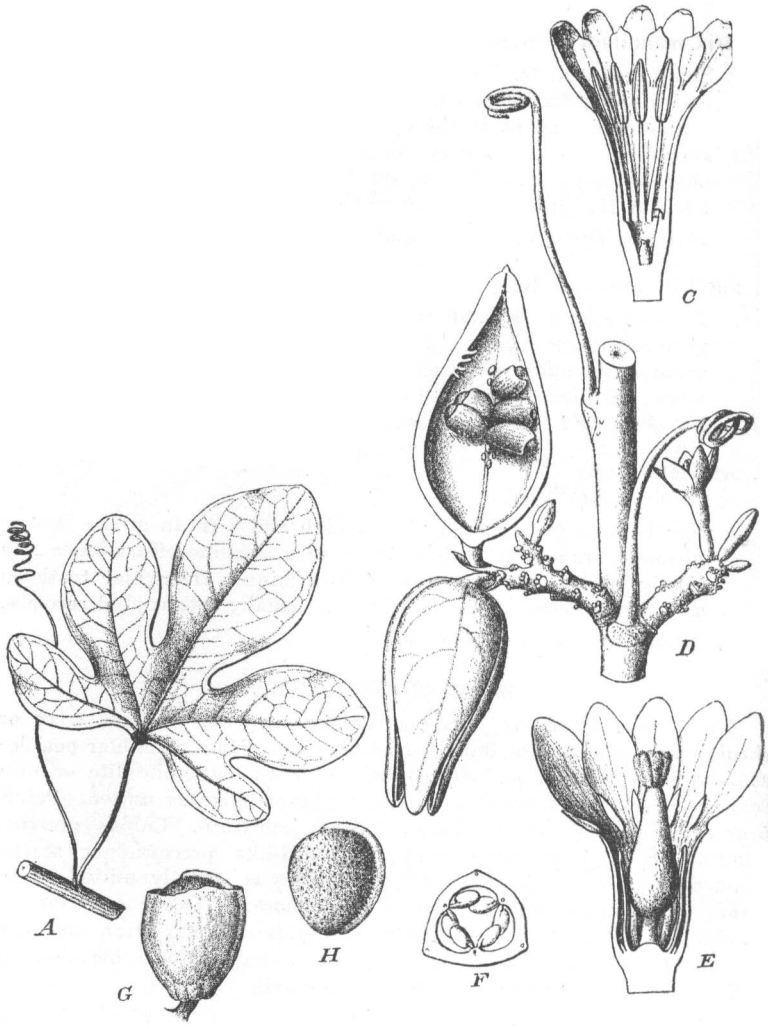


Fig. 96—ADENIA VENENATA Forsk.

A, leaf with tendril. C, longitudinal section of male flower. D, branch with flowers and fruits. E, female flower opened. F, transverse section of ovary. G, seed with aril. H, seed without aril.

A. schweinfurthii Engler.

Climber. Leaves ovate, rounded at the base, 4 in. long, with 2 very large glands at the top of the petiole. Flowers in short lateral cymes. Calyx tubular, ⅓ in. long; lobes lanceolate.

Equatoria.

A. lanceolata Engler.

Climber. Leaves linear-lanceolate to oblong-lanceolate, **obtuse at** the apex, up to 6 in. long and 1¾ in. broad, minutely **dotted** beneath. Flowers ⅛ in. long.

Equatoria.

59. *CUCURBITACEAE*

Herbs or rarely undershrubs, with watery juice, often scabrid; stems climbing or prostrate; tendrils usually present, spirally coiled. Flowers monoecious or dioecious or very rarely hermaphrodite, actinomorphic. Male flowers: calyx tubular, the lobes imbricate or open; corolla polypetalous or gamopetalous; stamens 1-5 (usually 3), free or variously united, 1 anther 1-locular, the others 2-locular, the loculi straight or often curved or flexuous, the connective often produced. Female flowers: calyx-tube often produced beyond the ovary; corolla polypetalous or gamopetalous; staminodes usually absent; ovary inferior or very rarely superior, with commonly 3 parietal placentas often meeting in the middle; styles 1 or rarely 3, with thick stigmas; ovules numerous, rarely few, arranged towards the wall of the ovary. Seeds various, often flattened.

The following plants of this family are cultivated in the Sudan: *Cucurbita maxima* Duchesne, Squash Gourd, Melon Pumpkin; *C. pepo* L. (*Cucumis pepo* (L.) Dumort.), Vegetable Marrow; *Cucumis sativus* L., Cucumber; *C. melo* L., Melon.

A. Filaments all united into a column ..... COCCINIA. 3.
AA. Filaments free or united at the base, or in pairs:
B. Anther-loculi straight or slightly curved, rarely shortly inflexed at the base or apex:
C. Disk at the base of the style distinctly developed ..... MELOTHRIA. 13.
CC. Disk at the base of the style indistinct or absent:
(a) Stamens inserted at the throat of the calyx-tube ... MOMORDICA. 14.
(aa) Stamens inserted in the calyx-tube:
(b) Male flowers solitary or in clusters or heads:
(c) Stigma 1, lobed; ovules few ..... CORALLOCARPUS. 5.
(cc) Stigmas 3-5; ovules numerous ..... CUCUMIS. 8.
(bb) Male flowers in racemes:
(d) Petiole with a small fringed stipule-like leaf at the base ..... CTENOLEPIS. 6.
(dd) Petiole without a stipule-like leaf at the base ..... KEDROSTIS. 10.
BB. Anther-loculi much curved or twisted, **U**- or **S**-shaped:
D. Corolla distinctly campanulate, lobed or cleft:
(e) Flowers monoecious ..... CUCUMEROPSIS. 7.
(ee) Flowers dioecious ..... COCCINIA. 3.

DD. Corolla more or less rotate:
E. Calyx-tube of male flowers long, cylindric or funnel-shaped:
F. Anthers connate; female flowers without staminodes:
(f) Flowers monoecious; anthers folded lengthwise ..... PEPONIUM. 15.
(ff) Flowers dioecious; anthers twisted transversely ..... ADENOPUS. 1.
FF. Anthers free or loosely cohering; female flowers with staminodes:
(g) Flowers small or medium-sized, yellow or red; stigma 1, 3-lobed ..... TROCHOMERIA. 16.
(gg) Flowers large; stigmas 3:
(h) Flowers monoecious, white, solitary; stigmas 2-lobed; tendrils 2-cleft ... LAGENARIA. 11.
(hh) Flowers dioecious, yellow; tendrils simple ..... EUREIANDRA. 9.
EE. Calyx-tube of male flowers short, turbinate or campanulate:
G. Stamens inserted at the throat of the calyx-tube; ovules numerous; stigmas 3 ..... MOMORDICA. 14.
GG. Stamens inserted in the calyx-tube:
H. Male flowers in racemes; tendrils cleft; leaves lobed; fruit dry ... LUFFA. 12.
HH. Male flowers solitary or in clusters, yellow:
(i) Male flowers without a rudimentary ovary; ovules few ..... BRYONOPSIS. 2.
(ii) Male flowers with a rudimentary ovary; ovules numerous:
(j) Connective of the stamens prolonged into a 2-cleft appendage at the apex; tendrils simple or rarely absent .... CUCUMIS. 8.
(jj) Connective of the stamens not prolonged at the apex; tendrils 2-3-cleft ... COLOCYNTHIS. 4.

1. **ADENOPUS** Benth.

Adenopus breviflorus Benth. Fig. 97.

Perennial, climbing high over trees; tendrils 2-branched. Leaves scabrid, mostly distinctly 5-lobed, cordate with a wide sinus and 5-nerved at the base, dentate, up to 6 in. broad; petiolar glands capped by a hardened cone with a pore at the tip. Flowers white with dark veins, closed by day. Male calyx-tube

up to 1 in. long; lobes subulate, nearly ½ in. long. Corolla-lobes obovate, about 1½ in. long, puberulous. Fruit oblong-ellipsoid, up to 6 in. long (usually the size of a large egg), mottled-green when young, scarlet when ripe, edible.

Central and Southern Sudan.

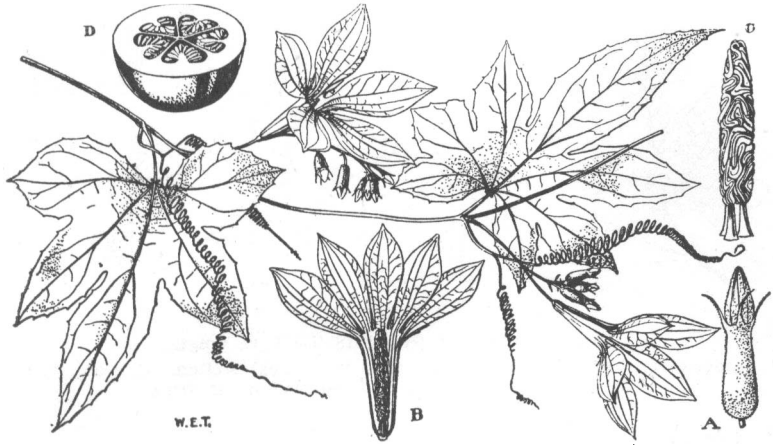


Fig. 97—ADENOPUS BREVIFLORUS Benth.
A, male flower-bud. B, male flower laid open. C, stamens. D, cross-section of fruit.

2. **BRYONOPSIS** Arn.

Bryonopsis laciniosa (L.) Naud.

Slender climber, with forked tendrils. Leaves 5-7-lobed, cordate at the base, serrate, scabrid, 5-7 in. broad. Male and female flowers in the same leaf-axil. Corolla yellow, campanulate, small. Fruit green, striped with yellow, globose, 1 in. in diameter.

North-eastern Sudan: 21° N.

3. **COCCINIA** Wight & Arn.

Coccinia grandis (L.) J. O. Voigt. Fig. 98.

Cephalandra indica Naud.; *C. moghadd* (Forsk.) Broun & Massey; *C. quinqueloba* (non Schrad.) Broun & Massey.

Slender twiner; stems angular, dotted. Leaves very variable, pentagonal and shortly lobed to deeply 3-5-lobed, rather thin, pustulate, scabrid on both surfaces, the lobes distantly denticulate; young leaves often with reddish glandular tips to the lobes and marginal teeth. Flowers white or yellowish-cream, solitary, pedicellate; male pedicels about ¾ in. long; female pedicels a little shorter. Calyx-teeth triangular-subulate. Fruit green with white mottling, scarlet when ripe, ellipsoid.

Widespread.

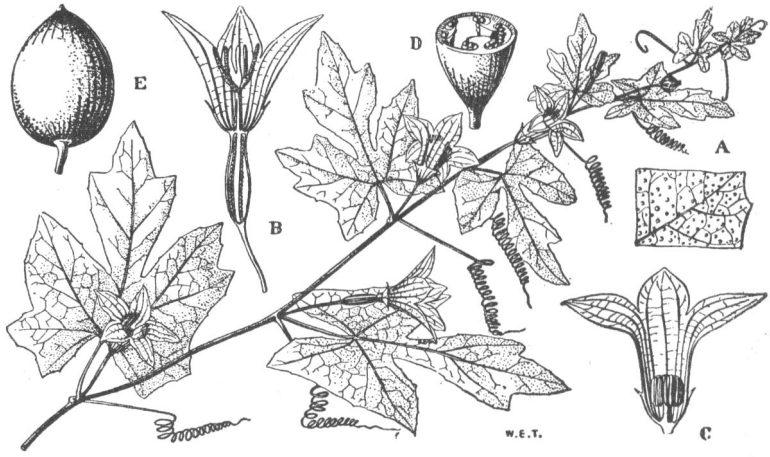


Fig. 98—COCCINIA GRANDIS (L.) J. O. Voigt.
A, under-surface of leaf. B, female flower in vertical section. C, male flower cut vertically. D, ovary in cross-section. E, fruit.

C. diversifolia (Naud.) Cogn.

Cephalandra diversifolia Naud.

Prostrate or climbing herb. Leaves hispid, 1-6 in. broad; upper ones ovate, acuminate at the apex, cordate at the base, toothed; lower ones palmately deeply 3-5-lobed. Male flowers: corolla broadly campanulate; stamens 3, the filaments partly free. Fruit marbled, red, yellow and white, ovoid.

Northern and Central Sudan.

C. djurensis Schweinf. & Gilg.

Perennial climbing herb, with a tuberous edible root; tendrils leaf-opposed. Leaves petiolate, pedately 3-7-lobed, rarely entire, cordate to emarginate at the base, 2¾-5 in. long; lobes lanceolate or linear-lanceolate, densely pustulate beneath. Male flowers orange, pedicellate, solitary or in axillary pairs. Fruit cylindric, about 2 in. long, ½ in. in diameter.

Equatoria.

4. **COLOCYNTHIS** Mill.

Colocynthis vulgaris Schrad. Fig. 99.

Citrullus colocynthis (L.) Schrad.

Climbing or more usually prostrate herb; stems scabrid with short hairs. Leaves thick, roughly scabrid, more or less ovate in outline, deeply and variously divided, up to about 4 in. long. Fruit globose, the size of a cricket-ball, intensely bitter.

Northern Sudan.

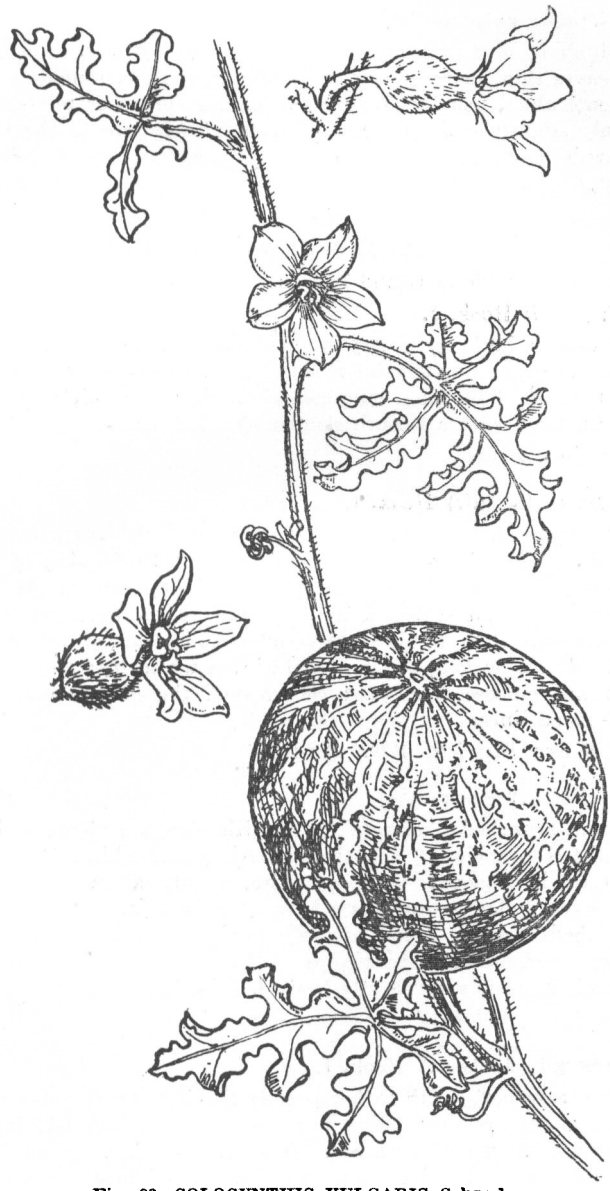


Fig. 99—COLOCYNTHIS VULGARIS Schrad.

C. citrullus (L.) Kuntze. Water-melon.

Citrullus vulgaris Schrad.

Climbing or trailing herb; stems villous with soft woolly hairs. Leaves thin, more or less triangular in outline, pinnately partite, denticulate, usually about 6 in. long, glabrous or pilose, at most only slightly scabrid. Fruit green, globose, up to the size of a man's head.

Widespread.

5. **CORALLOCARPUS** Welw. ex Hook. f.

Corallocarpus corallinus (Naud.) Cogn.

C. fenzlii Hook. f.

Prostrate herb, with very stout glabrous stems. Leaves orbicular in outline, palmately 3-5-lobed, 3-4 in. in diameter. Fruit scarlet, ovoid, ¾ in. long, long-beaked, fleshy; seeds dirty-grey-brown, ⅛ in. long, with a smooth slender elevated margin.

Central Sudan.

C. erostris (Schweinf.) Hook. f.

Prostrate herb; stems sparingly branched, angular, sparsely hairy; tendrils woody, pubescent. Leaves orbicular in outline, 5-angled, deeply sinuate-cordate at the base, scabrous above, ashy-tomentose and scabrous beneath, the nerves flattened. Flowers yellow-green. Fruit orange-yellow to scarlet, ovoid, hardly or not at all beaked, 4-6-seeded, resinous when dry; seeds yellow or brown, globose, somewhat compressed, the margin marked with elevated lines.

Red Sea District: Wadi Soturba.

C. gijef (Forsk.) Hook. f. Fig. 100.

Much-branched prostrate herb, with elongate stems and woody twisted branches ½ in. thick; bark yellow-white, thick, corky, grooved, smooth; tendrils white, stout, often almost corky. Leaves yellow-green, very broadly subreniform-ovate, obscurely 3-lobed, ½-¾ in. broad, densely papillose on both surfaces with depressed tuberculate glands. Flowers greenish-yellow, small. Fruit scarlet, very shortly beaked, ½ in. long.

Northern and Central Sudan.

C. ehrenbergii (Aschers.) Hook. f.

Prostrate herb, with rather slender shining stems, pubescent with scattered spreading hairs. Leaves green, 3-lobed, 1-1¼ in. broad, tomentose on both surfaces. Flowers greenish, very small. Fruit yellow, sessile, ½ in. long, ovoid, narrowed into a short slender beak; seeds dark-brown, $\frac{1}{10}$ in. long, oblong, smooth, with a slender raised margin.

Red Sea District: Suakin. White Nile.

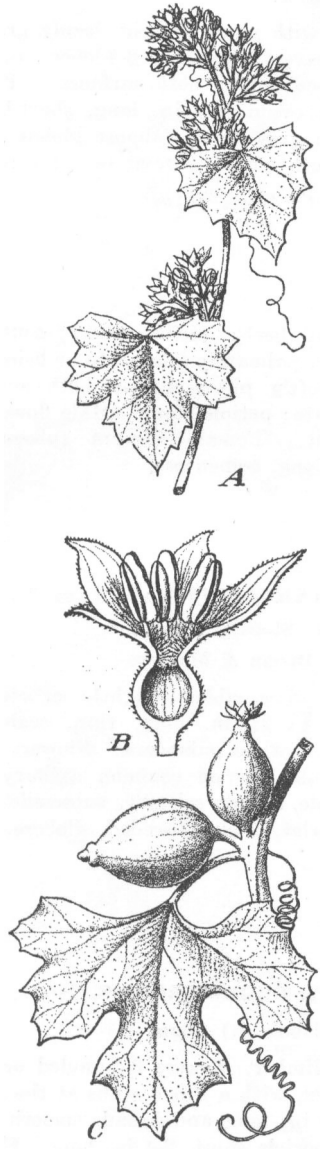


Fig. 100—CORALLOCARPUS GIJEF (Forsk.) Hook. f.
A, flowering branch. B, longitudinal section of male flower. C, fruiting branch.

C. velutinus (Dalz.) Hook. f.

C. etbaicus Hook. f.

Prostrate herb, with stout scabrid deeply grooved stems bent at the nodes. Leaves ashy-grey, 3-5-lobed, 1-2 in. broad, densely tomentose and scabrid on both surfaces. Flowers yellow-green. Fruit oblong or ovoid, ½-¾ in. long, short-beaked or apiculate, pubescent; seeds grey-brown, almost globose, ⅛ in. in diameter, faintly granulated, with a strong raised margin.

Red Sea District: *Wadi Soturba.*

C. schimperi Hook. f.

Prostrate scabrid herb; stems rather stout, angular, grooved. Leaves ashy-grey, palmately 5-lobed to or below the middle, 2-4 in. broad, rather softly pubescent on both surfaces; lobes broad, rounded, crenulate; petiole stout. Male flowers minute; peduncle stout, pubescent. Female flowers subsessile. Fruit ovoid, beaked, ½-½ in. long, tomentose.

Equatoria.

6. **CTENOLEPIS** Hook. f. ex Naud.

Ctenolepis cerasiformis (Stocks) Naud. Fig. 101.

C. fimbristipula Broun & Massey.

Slender twiner; stems ribbed, slightly scabrid. Leaves digitately 3-5-partite, up to 2¾ in. long, thin, scabrid-pubescent; lobes sharply toothed; petiole pubescent. Flowers creamy-white. Male flowers very small, few on common axillary peduncles up to 1 in. long. Female flowers solitary, subsessile or shortly pedunculate. Fruit scarlet, about 2-seeded, globose, up to ¾ in. in diameter, smooth.

Central Sudan.

7. **CUCUMEROPSIS** Naud.

Cucumeropsis edulis (Hook. f.) Cogn.

Strong coarse climber. Leaves 3-5-angled or more or less lobed, acute at the apex, with a broad sinus at the base, remotely denticulate, up to 6 in. long and broad, smooth or nearly so on the lower surface; petiole stout, 2-4 in. long. Flowers yellow. Male flowers umbellate on long peduncles. Fruit about 12 in. long, 4 in. in diameter, smooth, edible.

Equatoria.

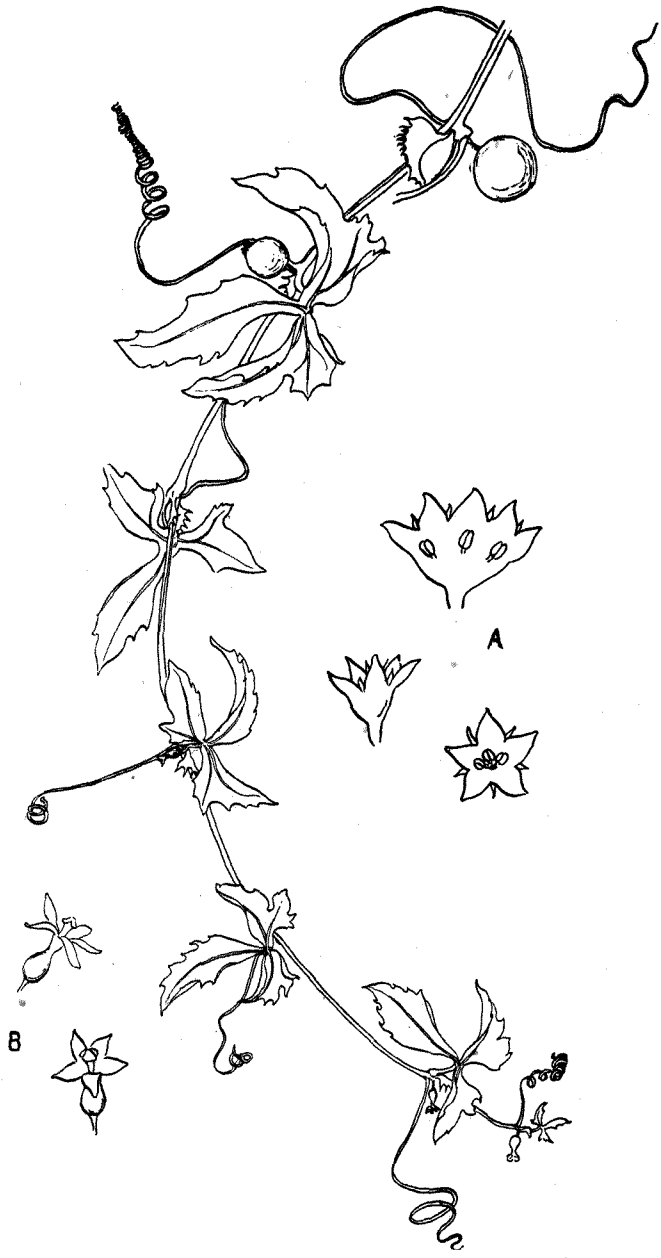


Fig. 101—CTENOLEPIS CERASIFORMIS (Stocks) Naud.
A, male flowers. B, female flowers.

8. **CUCUMIS** L

Cucumis hirsutus Sond.

Dioecious perennial herb, with a tuberous root, dark-greenish-brown when dry, hirsute all over; stems stiff, angular, like the petioles and peduncles hispid with long spreading slender stiff hairs. Leaves very variable, narrow-oblong or oblong-ovate or lanceolate, obtusely sinuate-lobed and denticulate with rounded or cordate base, or more rarely palmately deeply 3-5-lobed, usually 3-5 in. long, hirsute with appressed sometimes almost silky hairs on both surfaces. Male flowers very variable in size, ¼-1 in. in diameter; peduncle slender, long or short, 1-5-flowered; calyx villous with long soft spreading hairs; anthers ciliate. Female flowers solitary. Fruit on a stout peduncle, subglobose, 1½ in. in diameter, nearly smooth, with a few scattered hairs.

Equatoria.

C. melo var. **agrestis** Naud.

Prostrate trailer; stems and branches setose with long stiff jointed bristles. Leaves broadly ovate, 5-lobed or hardly lobed, widely cordate at the base, up to 4 in. long, scabrid; petiole nearly as long as the lamina. Flowers yellow. Fruit longitudinally striped with green, globose or obovoid, villous when young.

Central Sudan.

C. dipsaceus Ehrenb. ex Spach. Fig. 102.

Slender annual climber, with pale-green stems and branches with long stiff jointed bristles. Leaves rounded, obscurely toothed, 2-4 in. broad, scabrid. Fruit broadly ovoid, 4-4¾ in. long, densely bristly, the stalk up to ½ in. long.

Widespread.

C. metuliferus E. Mey. ex Naud.

Annual climber; stems and branches setose. Leaves acute at the apex, shortly dentate, setose on both surfaces. Flowers yellow. Fruit orange to scarlet when ripe, pendulous, 4-4¾ in. long, covered with stout scattered conical prickles.

Central and Southern Sudan.

C. pustulatus Hook. f.

C. figarei (non Del.) Broun & Massey p.p.

Ground trailer from a perennial base; stems and branches more or less shortly scabrid. Leaves thick, rarely divided below the middle, very harshly scabrid. Flowers yellow. Fruit uniformly grey-green, with stout short tubercles, oblong-ellipsoid, 2½-3¼ in. long.

Central and Southern Sudan.

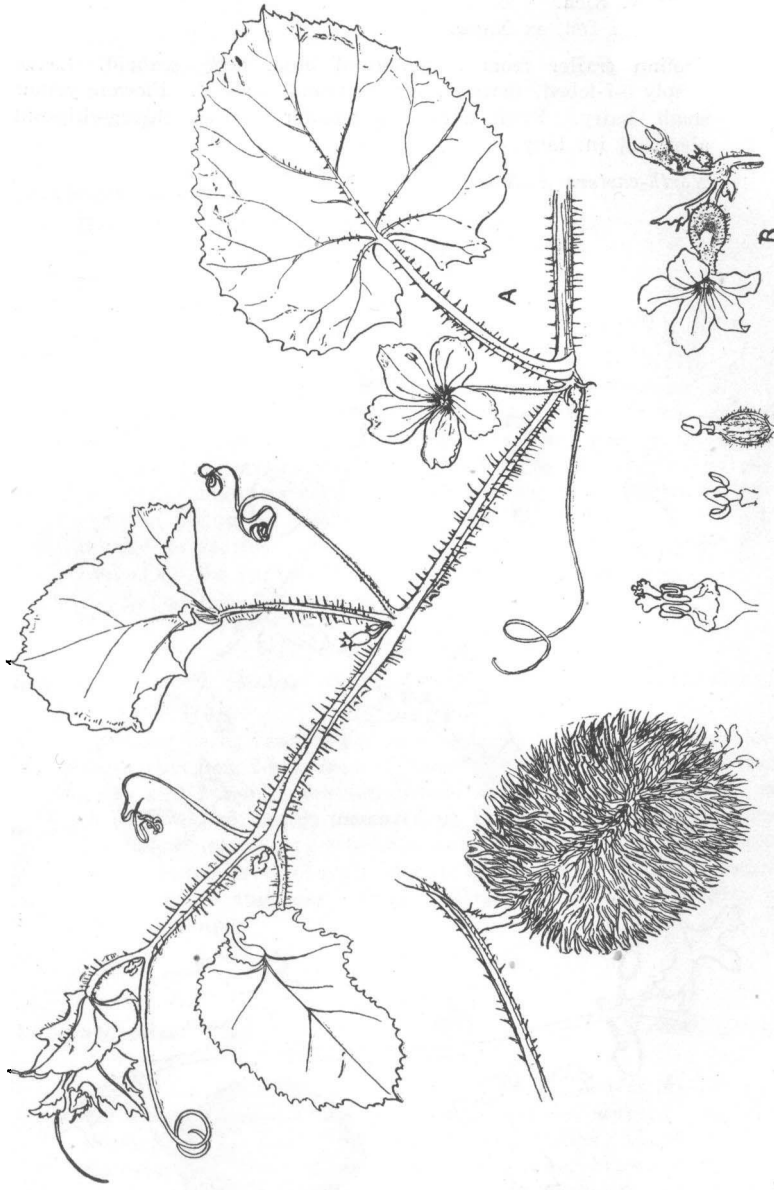


Fig. 102—CUCUMIS DIPSACEUS Ehrenb. ex Spach.
A, male flower. B, female flower.

C. ficifolius A. Rich.

C. figarei Del. ex Naud.

Ground trailer from a perennial base, laxly scabrid. Leaves deeply 5-7-lobed, toothed, 1-2 in. broad, scabrid. Flowers yellow, small, hairy. Fruit with long slender bristles, oblong-ellipsoid, about 1½ in. long.

North-eastern Sudan.

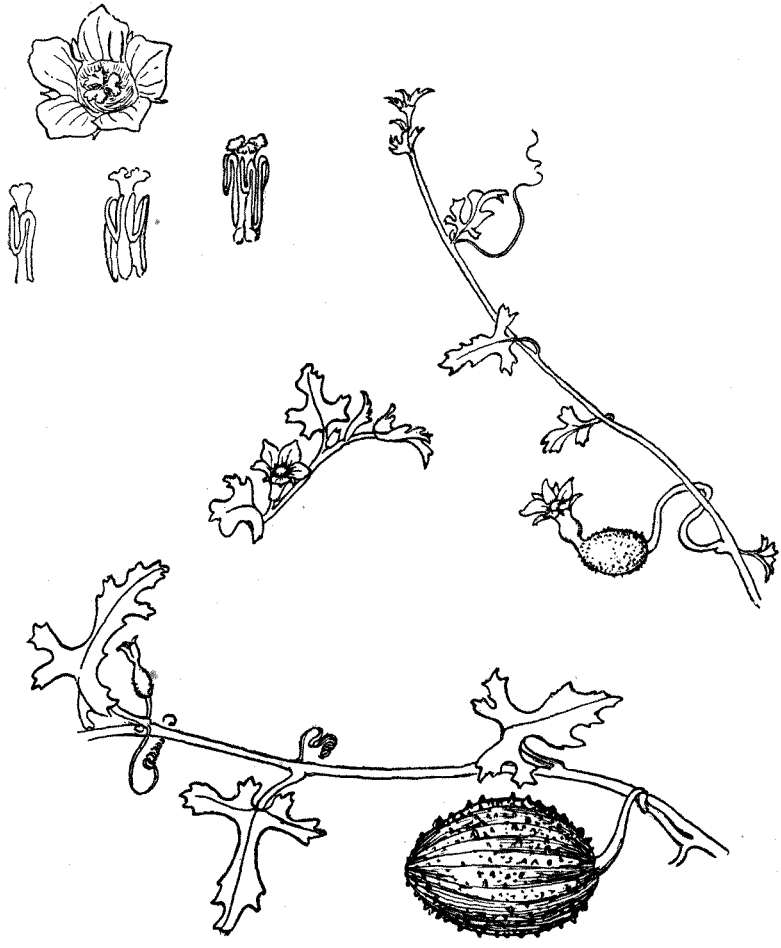


Fig. 103—CUCUMIS PROPHETARUM L.
Above, male flower and stamens.

C. prophetarum L. Fig. 103.

Ground trailer from a perennial base, canescent, densely scabrid. Leaves 3-5-lobed, 1¼ in. broad. Flowers yellow. Fruit with longitudinal coloured stripes, 1¼-1½ in. long, covered with very short bristles.

Widespread.

9. **EUREIANDRA** Hook. f.

Eureiandra schweinfurthii Cogn.

Herbaceous climber, with simple tendrils. Leaves deeply 3-5-lobed, about 3 in. broad, villous, scabrid. Fruit ovoid, 2 in. long.

Equatoria.

10. **KEDROSTIS** Medic.

Kedrostis foetidissima (Jacq.) Cogn.

Slender weakly pilose climber, with an unpleasant smell. Leaves ovate or ovate-triangular, subacute at the apex, deeply cordate at the base, sinuate-dentate, up to 4 in. long and 2½ in. broad, scabrid-pubescent; petiole about ⅓ as long as the lamina. Flowers yellowish, small, axillary. Male flowers pedicellate on a short common peduncle. Female flowers solitary, subsessile. Fruit orange to scarlet when ripe, about ½ in. long, ovoid-ellipsoid, beaked by the persistent style, rugose, long-pilose, foetid.

Central and Southern Sudan.

11. **LAGENARIA** Ser.

Lagenaria siceraria (Molina) Standl. Bottle Gourd.

L. vulgaris Ser.

Climbing herb; branches more or less densely pilose with jointed hairs; tendrils 2-branched. Leaves widely ovate with a broad sinus and 2 small pore-like glands at the base, denticulate, up to 8 in. broad, softly tomentellous beneath with spicular hairs. Flowers white. Calyx-tube campanulate, about ½ in. long, pubescent. Petals free, obovate, about 1½ in. long and 1¼ in. broad, pilose within the base. Ovary villous. Fruit very variable in size and shape.

Northern Sudan.

12. **LUFFA** Mill.

Luffa aegyptiaca Mill. Loofah Gourd.

L. cylindrica M. J. Roem.

Annual semi-woody climber; tendrils forked. Leaves often deeply digitately lobed, about 7-nerved at the base, scabrid, the lobes denticulate; petiole pubescent. Flowers yellow, about 2 in. in diameter. Fruit mottled-green when young, brown when ripe, woody, ellipsoid, with a dehiscing cap; seeds smooth, with a narrow wing.

Widespread.

Fig. 104—LUFFA ECHINATA Roxb.

L. echinata Roxb. Fig. 104.

Herbaceous climber, with 5-angled stems. Leaves orbicular-reniform, 5-7-lobed, with shallow teeth, 2-4 in. broad, scabrid. Flowers yellow to white, 1 in. in diameter. Fruit ¾-1 in. long, oblong or subglobose, terminated by the stout woody columnar style, densely covered with scabrid spreading soft ciliate spines hardening when dry, the conical apex naked.

Widespread.

13. **MELOTHRIA** L.

A. Flowers monoecious:
- (a) Seeds smooth:
  - (b) Fruit borne on a long slender peduncle:
    - (c) Male flowers in racemes ..... *M. peneyana.*
    - (cc) Male flowers solitary or in clusters:
      - (d) Seeds with a distinct margin ..... *M. deltoidea.*
      - (dd) Seeds without a distinct margin:
        - (e) Fruit spindle-shaped ..... *M. tridactyla.*
        - (ee) Fruit globose ..... *M. capillacea.*
  - (bb) Fruit borne on a short peduncle; leaves villous beneath, finally rough ..... *M. scrobiculata.*
- (aa) Seeds pitted; fruit subsessile ..... *M. maderaspatana.*

AA. **Flowers dioecious:**
- (f) Leaves acute at the apex ..... *M. longepedunculata.*
- (ff) Leaves obtuse at the apex ..... *M. cordata.*

Melothria peneyana (Naud.) Cogn.

Herbaceous climber; stems branched, furrowed, glabrous. Leaves deltoid, acute and mucronate at the apex, cordate at the base, undulate at the margin and minutely denticulate, 3½-4½ in. long, 2½-3¼ in. broad, membranous; petiole slender, striate, 1½-2 in. long. Male peduncles 1½-2¾ in. long, 4-5-flowered. Fruit spindle-shaped, 1¼-1½ in. long, ½ in. broad.

Kordofan.

M. deltoidea Benth.

Slender climber, with simple tendrils. Leaves acuminate at the apex, somewhat cordate at the base, almost entire, 2-2½ in. long, membranous, slightly scabrid. Flowers white; pedicels at length elongating and thread-like, up to 1 in. long. Fruit ellipsoid-globose, about ½ in. in diameter.

Southern Sudan.

M. tridactyla Hook. f.

Rather slender climber, with thread-like branches and tendrils. Leaves subsagittately lobed, 2 in. long and broad, very thin, scabrid-warted on both surfaces. Flowers yellow, very small. Fruit red when ripe, spindle-shaped, acute, 1 in. or more long, nearly glabrous.

Southern Sudan.

M. capillacea (Schumach.) Cogn.

Very slender climber; stems glabrous or nearly so; tendrils very slender. Leaves not or hardly lobed, truncate or nearly so at the base. Flowers white, on slender pedicels in axillary clusters Fruit reddish when ripe, globose.

Equatoria.

M. scrobiculata (Hochst.) Cogn.

Herbaceous climber. Leaves ovate, acute to obtuse at the apex cordate at the base, 2-3½ in. long, intensely green and white-punctate above, grey-green beneath. Male flowers in 6-25-flowered clusters. Fruit reddish, thinly pitted.

Kordofan.

M. maderaspatana (L.) Cogn.

Mukia scabrella (L.f.) Arn.

Prostrate or climbing annual, scabrid with small white almost prickly hairs. Leaves shortly subhastately lobed, subacute at the apex, deeply cordate at the base, denticulate or subentire, up to 4¾ in. long, usually very scabrid. Flowers yellow. Fruit scarlet when ripe, subsessile, globose, almost ½ in. in diameter, sparingly setulose.

Central and Southern Sudan.

M. longepedunculata (Hochst.) Cogn.

Slender herbaceous climber. Leaves ovate in outline, shallowly 3-5-lobed, acute at the apex, cordate at the base, 2-2¾ in. long, scabrid above. Male flowers racemose; peduncle 1¼-2 in. long, 10-20-flowered.

Kordofan.

M. cordata (Thunb.) Cogn.

Zehneria cordifolia Schweinf. ex Broun & Massey.

Graceful climber, sparsely pilose; tendrils glabrous. Leaves broadly triangular-cordate, obtuse at the apex, 1¼-2 in. long and broad; petiole ⅛-1¼ in. long. Male flowers minute, racemose; peduncle up to 1¼ in. long, 15-30-flowered. Female peduncle ⅛ in. long. Fruit globose, about ¼ in. in diameter.

Southern Sudan.

14. MOMORDICA L.

A. Leaves 3-9-foliolate:

(a) Male flowers more or less enclosed by bracts:

(b) Stems, petioles and peduncles glandular-pilose; bracts about 1½ in. long, 2 in. broad ..... *M. runssorica.*

(bb) Stems, petioles and peduncles glabrous or not glandular-pilose; bracts smaller than above ..... *M. cissoides.*

(aa) Male flowers not enclosed by bracts ..... *M. pterocarpa.*

AA. Leaves simple, sometimes lobed:
(c) Male peduncle 1-flowered:
(d) Bract of male flower at the middle or base of the peduncle .... *M. charantia.*
(dd) Bract of male flower at the apex of the peduncle ..... *M. balsamina.*
(cc) Male peduncle many-flowered:
(e) Male flowers with bracts ..... *M. schimperiana.*
(ee) Male flowers without bracts:
(f) Apex of sepals rounded, sometimes apiculate ... *M. foetida.*
(ff) Apex of sepals acute or acuminate:
(g) Leaf-margin entire ..... *M. multiflora.*
(gg) Leaf-margin deeply crenate ..... *M. tuberosa.*

Momordica runssorica Gilg.

Dioecious herbaceous creeper; tendrils bifid; stems like the petioles and peduncles more or less densely hispid-glandular. Leaves 5-7-foliolate; leaflets ovate to ovate-oblong, acutely acuminate at the apex, rounded to shortly cordate at the base, more or less spinulose-denticulate at the margin, 2-3 in. long, sparsely and minutely setulose above, more densely so beneath. Male flowers subumbellate, more or less enclosed in large bracts; peduncle up to 5½ in. long; sepals lanceolate, acute; corolla cream with dark-purple centre.

Equatoria: *Imatong Mountains*, 5000-6000 ft.

M. cissoides Planch. ex Benth.

Tall graceful climber; tendrils simple. Leaflets elliptic or obovate, often more or less rounded at the base, the lateral ones smaller, the middle one up to about 4 in. long, rather distantly mucronate-dentate, submembranous, glabrous or nearly so. Flowers white with a large black-purple spot at the base of each petal, subtended by a leafy or orbicular toothed bract. Male flowers crowded. Female flowers solitary; peduncle up to 2½ in. long. Fruit orange-yellow when ripe, 1½ in. long.

Equatoria.

M. pterocarpa Hochst. ex A. Rich.

Climbing herb, with spreading hairs; root a large oblong tuber. Leaves digitately 5-foliolate; leaflets ovate-lanceolate, acuminate at the apex, obliquely cordate at the base, 2-4 in. long. Male flowers crowded on a peduncle with a hooded green bract ¾ in. long; corolla yellow, 1 in. in diameter. Female flowers solitary, without bracts. Fruit red when ripe, 2-3 in. long, ovoid, pointed, with 8-10 short wings.

Equatoria.

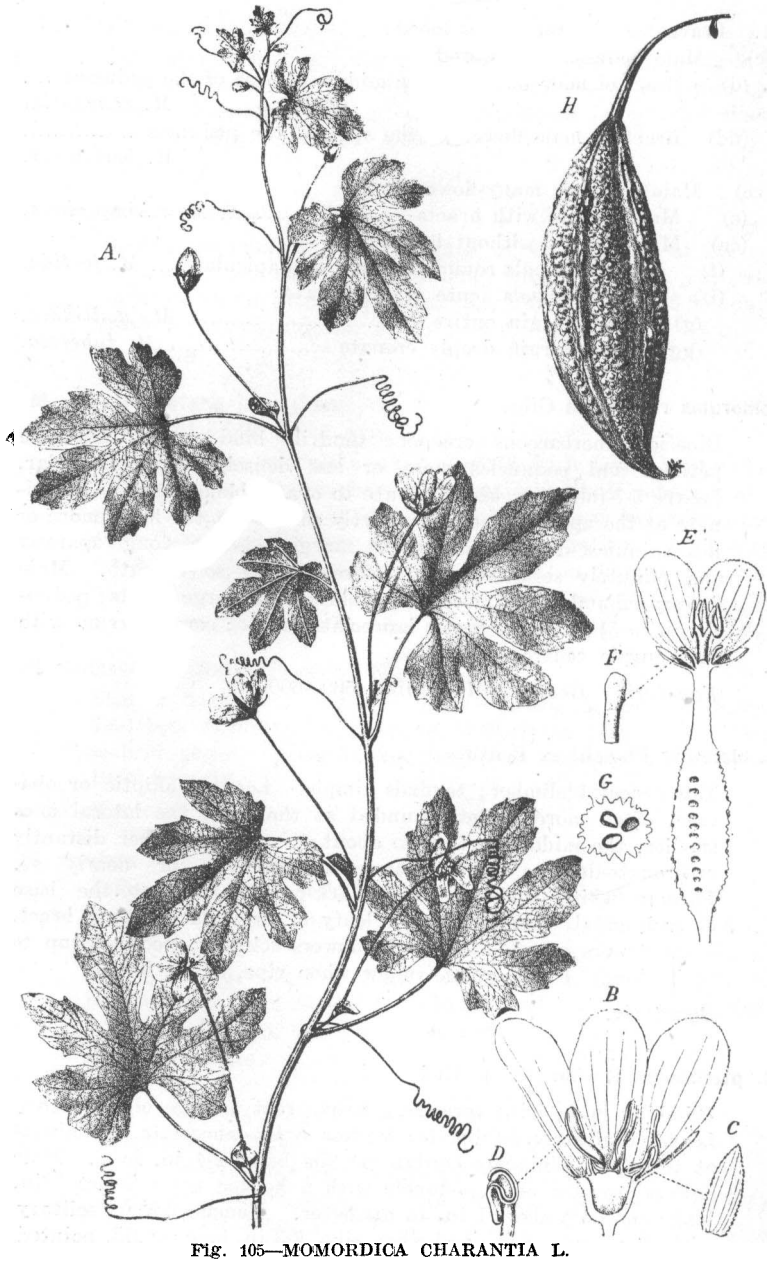


Fig. 105—MOMORDICA CHARANTIA L.
A, branch with flowers. B, longitudinal section of male flower. C, sepal. D, stamen. E, longitudinal section of female flower. F, staminode. G, transverse section of ovary. H, fruit.

M. charantia L. Fig. 105.

Herbaceous climber; tendrils simple. Leaves palmately 5-9-lobed, cordate at the base, 2-4½ in. long, the lobes more or less sinuate. Flowers yellow, on a long slender peduncle with a reniform bract at the base or towards the middle. Fruit orange when ripe, about 1½ in. long, ovoid-fusiform, with longitudinal tubercled lines, muricate when young, with a decurved beak; seeds enclosed in scarlet pulp.

Central and Southern Sudan.

M. balsamina L. Fig. 106.

Herbaceous climber. Leaves palmately 3-7-lobed, the lobes coarsely lobulate-dentate. Flowers yellow (sometimes white) with a dark centre. Fruit orange-yellow, warted when young, becoming smooth with age, beaked, 1-2½ in. long, bursting and exposing the red-brown seeds.

Northern and Central Sudan.

M. schimperiana Naud.

Herbaceous climber, with a tuberous root. Leaves ovate, cordate at the base, dentate, 4-8 in. long. Flowers yellow, 1¼ in. in diameter. Fruit scarlet when ripe, the size of an egg, covered with soft bristles.

Central and Southern Sudan.

M. foetida Schumach.

M. morkorra A. Rich.

Climber, with a stout perennial root. Leaves broadly ovate, widely cordate and shortly decurrent at the base, repand-dentate or denticulate, up to 4¾ in. long and broad, scabrid-puberulous beneath. Flowers white or sometimes yellowish, with blackish-green calyx. Male calyx bristly outside towards the base. Fruit yellow or pale-orange when ripe, about 3 in. long, covered with soft prickles, bursting and exposing the seeds in a red pulp.

Central and Southern Sudan.

M. multiflora Hook. f.

Slender climber. Leaves ovate, cordate at the base, very minutely denticulate, 2-6 in. long, scabrid beneath. Flowers yellow, ¾ in. in diameter. Male flowers numerous. Fruit red when ripe, ovoid, crowned with remains of the flower.

Equatoria.

Fig 106—MOMORDICA BALSAMINA L.

M. tuberosa (Roxb.) Cogn.

M. cymbalaria Fenzl ex Naud.

Slender climbing herb, with a woody tuberous root; tendrils simple. Leaves orbicular-reniform, obtusely 5-7-lobed, 1-2 in. broad, rather fleshy, glabrous or pilose. Flowers yellow. Male flowers racemose, hairy, ½ in. in diameter; peduncle ½-1 in. long. Fruit greenish, 1-1¼ in. long, spindle-shaped, narrowed into the short stout curved peduncle, fleshy, 8-ribbed.

Central Sudan.

15. **PEPONIUM** Engler

Peponium cienkowskii (Schweinf.) Engler.

Peponia cienkowskii (Schweinf.) Hook. f.

Prostrate or climbing herb. Leaves reniform or broadly ovate, cordate at the base, 5-7-lobed, 3 in. broad, the lobes obtusely ciliate-toothed. Flowers white or yellowish, large. Male peduncles shorter than the leaves, stout. Calyx-tube ⅛ in. long. Fruit ovoid or cylindric, fleshy.

Central Sudan. Equatoria.

16. **TROCHOMERIA** Hook. f.

Trochomeria djurensis Schweinf. & Gilg.

Slender climber, with a tuberous root; tendrils short. Leaves more or less pentagonal and 5-lobulate, acute at the apex, widely cordate at the base, scabrid. Male calyx tubular, up to ½ in. long, with minute lobes; corolla-lobes linear-lanceolate, ¾-1 in. long. Female flowers very small.

Equatoria.

60. *BEGONIACEAE*

Herbs or undershrubs, mostly succulent. Leaves alternate, simple, often unequal-sided or oblique; stipules free, deciduous. Flowers monoecious, actinomorphic or asymmetrical, usually in axillary cymes, showy. Male flowers: sepals 2 or rarely 5, valvate; petals 2, imbricate, rarely more or absent, free; stamens numerous, the filaments free or connate. Female flowers: perianth more or less as in the males; staminodes absent or very small; ovary inferior, 2-4- (rarely 1-) locular, mostly angled or winged; styles 2-5, free or connate; stigmas often twisted, papillose all over; ovules very numerous in each loculus. Fruit a capsule or berry.

The Papaw, *Carica papaya* L., belonging to the allied family *Caricaceae*, is cultivated in the Sudan.

1. **BEGONIA** L.

Begonia eminii Warb.

Scrambling reddish-tomentose herb. Leaves ovate-lanceolate, acute at the apex, cordate and often unequal at the base, up to 4¾ in. long and 2 in. broad. Flowers white, axillary. Fruit bright-scarlet, up to 1¼ in. long, fusiform-cylindric.

Equatoria: Lotti Forest.

61. *CACTACEAE*

Succulent herbs or shrubs. Leaves much reduced or absent. Flowers hermaphrodite, actinomorphic, often handsome but very small in the African genus (*Rhipsalis*). Calyx-tube often produced beyond the ovary; lobes few to many, or reduced to minute teeth. Petals 6 or more, free. Stamens numerous, free or joined to the base of the petals. Ovary inferior, 1-locular; stigma usually radiate. Fruit berry-like, many-seeded.

Opuntia dillenii (Ker-Gawl.) Haw., Prickly Pear, is cultivated in the Sudan.

1. **RHIPSALIS** Gaertn.

Rhipsalis cassutha Gaertn.

Shrub growing epiphytically or on rocks; stems cylindric, fleshy, jointed and sometimes rooting at the nodes, dichotomously or subverticillately branched, glabrous. Leaves scale-like, soon falling off. Flowers white, small, sessile. Petals 6-10, spreading, oblong. Stamens about 20. Berry yellowish-white, with viscous pulp and black shining seeds.

Equatoria.

62. *OCHNACEAE*

Trees, shrubs or rarely herbs. Leaves alternate, simple or very rarely pinnate, often with numerous pinnate nerves; stipules present, sometimes pectinate. Flowers hermaphrodite, actinomorphic, usually racemose or paniculate. Sepals 4-5 or rarely 10, free, imbricate or rarely contorted. Petals 4-10, free, subsessile, contorted or imbricate. Stamens few to many, free; filaments persistent; anthers linear, basifixed; staminodes sometimes present, subulate or petaloid, sometimes connate into a tube. Ovary superior, entire to deeply lobed, 1-10-locular; style simple or divided at the apex; ovules 1 to many in each loculus, axile, basal or parietal or attached to intrusive placentas. Fruit capsular or nut-like or the fruiting-carpels often drupaceous and becoming quite separate on the enlarged torus.

A. Trees or shrubs, with deciduous or inconspicuous stipules; fruit drupaceous or nut-like:
  (a) Sepals not or only slightly and equally enlarged and often red in fruit, the latter consisting of separate drupaceous carpels on an enlarged torus:
    (b) Stamens numerous; filaments often as long as or longer than the anthers, the latter dehiscing longitudinally or by pore-like slits ..... OCHNA. 2.
    (bb) Stamens 10; filaments much shorter than the anthers, the latter dehiscing by apical pores ..... OURATEA. 3.
  (aa) Sepals unequally enlarged and wing-like in fruit, the latter nut-like; stamens numerous; ovary 1-locular with a basal placenta ..... LOPHIRA. 1.

AA. Herbs, with persistent pectinate stipules; fruit a 3-valved septicidal capsule; stamens 5, accompanied by staminodes in 2 rows, the inner petaloid, the outer thread-like; ovary entire with parietal placentas ..... SAUVAGESIA. 4.

1. **LOPHIRA** Banks ex Gaertn. f.

Lophira alata Banks ex Gaertn. f. **Fig. 107.**

Medium to large tree. Leaves obovate-oblong to elongate-oblanceolate, rounded or emarginate at the apex, gradually or abruptly narrowed at the base into a short or long petiole, sometimes unequal-sided, up to about 24 in. long and 5 in. broad, glabrous, shining, finely reticulate; lateral nerves very numerous and close, spreading almost at right-angles. Flowers white or golden-yellow, fragrant, in lax terminal pyramidal panicles. Fruit bottle-shaped, 2-fid at the apex, about 1¼ in. long, surrounded by the persistent sepals, 2 of which are enlarged and wing-like, one much larger than the other and up to 4 in. long and ¾ in. broad.
Equatoria.

2. **OCHNA** L.

Ochna schweinfurthiana F. Hoffm.

Small tree or shrub, with grey-white bark. Leaves oblanceolate, widely emarginate at the apex, serrulate, about 3½ in. long and 1½ in. broad, many-nerved. Flowers bright-yellow, clustered; pedicels up to 1¼ in. long in fruit. Sepals ⅔ in. long. Fruiting-carpels about ½ in. long, ellipsoid, reticulate.
Equatoria.

O. afzelii R. Br. ex Oliv.

Glabrous shrub or small tree. Leaves oblanceolate, shortly acuminate at the apex, up to 2¾ in. long and 1 in. broad; lateral nerves very numerous and close, more prominent above than beneath. Flowers bright-yellow. Sepals less than ½ in. long in fruit. Fruiting-carpels subglobose, about ¼ in. long.
Equatoria.

O. micrantha Schweinf. & Gilg.

Low glabrous shrub up to about 3 ft. high, densely divaricately branched. Leaves subcoriaceous, obovate-oblong, rounded or more rarely somewhat acute at the apex, gradually narrowed towards the base into a petiole ⅛-⅓ in. long, dentate, many-nerved, 2¾-4 in. long, ⅔-1½ in. broad. Flowers in clusters of 2-3 terminating short shoots; pedicels in fruit about ¾ in. long, articulated at the base. Sepals in fruit red, about ½ in. long, ⅓ in. broad. Carpels 5-8.
Equatoria: *Dar Fertit.*

Fig. 107– LOPHIRA ALATA Banks ex Gaertn. f.
A, flower cut vertically. B, stamen. C, ovary. D, fruit with enlarged sepals. E, the same in vertical section. E1, fruit cut transversely. F, seed. G, seed cut vertically. H, seed cut transversely.

O. holstii Engler.

Large tree up to 80 ft. high and 2 ft. in girth; bark smooth. Leaves expanding as the tree flowers, short-petiolate, light-green, subcoriaceous, oblong-lanceolate, serrulate, 2½-2¾ in. long, ¾ in. broad, with numerous obvious lateral nerves. Flowers light-yellow; inflorescences terminal, corymbose, the branches very short. Fruiting-carpels oblong, slightly compressed.

Equatoria: *Imatong Mountains, growing with Podocarpus*, 6800 ft.

O. mossambicensis Klotzsch.

Tree up to 60 ft. high, in mountain forest; branchlets pendulous. Leaves apple-green, oblanceolate, 2¼-4½ in. long, ¾-1½ in. broad. Flowers in racemes ¾-1 in. long on the older wood; pedicels in fruit 1-1½ in. long, articulated about 3/16 in. from the base, leaving slender pegs on the rhachis. Sepals in fruit red, ½ in. long, ¼ in. broad. Fruiting-carpels black.

Equatoria: *Imatong Mountains.*

O. leucophloeos Hochst. ex A. Rich.

Tortuous shrub. Leaves rather coriaceous, oblanceolate- or oblong-elliptic, broadly acute at the apex, rather closely serrulate, 3-6 in. long. Flowers yellow, 3-10 from the axils of the leaves of the previous year. Sepals in fruit about ½ in. long. Carpels 5-6.

Central Sudan.

O. ardisioides Webb.

Small or medium-sized tree, allied to *O. leucophloeos*, but the leaves larger and crenate-serrate at the margin.

Kassala: *Gallabat. Fung District.*

3. OURATEA Aubl.

Ouratea reticulata (Beauv.) Engler.

Glabrous shrub or small tree up to about 20 ft. high. Leaves lanceolate or oblanceolate-oblong, 3-6 in. long, 1-2 in. broad. Racemes paniculate, the panicles 8-12 in. long; pedicels articulated almost at the base, leaving very short pegs.

Equatoria.

O. bukobensis Gilg.

Shrub 10-15 ft. high, sometimes forming dense thickets. Leaves almost sessile, ovate-lanceolate, acute at the apex, serrate, up to 7 in. long and 1½ in. broad. Flowers bright-yellow, ¼ in. in diameter, borne in many-flowered terminal panicles.

Equatoria.

O. calantha Gilg.

Glabrous shrub or tree up to about 30 ft. high. Leaves elongate-elliptic, minutely denticulate in the upper half or two-thirds, 8-10 in. long, 2-3¼ in. broad. Flowers yellow; inflorescences terminal, paniculate, laxly branched. Fruit scarlet.

Equatoria: *Imatong Mountains, Laboni Forest.*

O. flava (Schumach.) Hutch. & Dalziel ex Stapf.

Glabrous shrub 3-15 ft. high or small tree. Leaves short-petiolate, oblong or obovate-oblong, acute or shortly acuminate at the apex, conspicuously and rather closely spinulose-serrate from the apex to near the base, sometimes up to 10 in. long. Inflorescences terminal, paniculate, laxly branched.

Equatoria: *Azza Forest.*

O. densiflora De Wild. & Dur.

Shrub or small tree up to 20 ft. high. Leaves coriaceous, oblong-obovate, very shortly acuminate at the apex, rather closely serrulate, 4-8 in. long, 1½-3 in. broad, with rather distant lateral nerves. Flowers yellow, in large terminal racemes. Fruiting-carpels 4, turning black when ripe; torus and calyx bright-red.

Equatoria.

4. **SAUVAGESIA** L.

Sauvagesia erecta L.

Low decumbent or erect glabrous herb. Leaves oblanceolate, acute at the apex, narrowed to the base, serrulate, about ¾ in. long, with conspicuous parallel lateral nerves raised on the upper surface; stipules persistent, pectinate, about ¼ in. long. Flowers white to pink, solitary, axillary; peduncle becoming decurved in fruit and subarticulated towards the base. Capsule enclosed by the persistent green sepals.

Equatoria.

63. *DIPTEROCARPACEAE*

Trees, with resinous wood. Leaves alternate, entire, penninerved; indumentum of stellate hairs or rarely of peltate scales; stipules mostly small and deciduous, sometimes large. Flowers hermaphrodite, actinomorphic, fragrant, in axillary panicles. Calyx-tube short or well developed, free or adnate to the ovary; lobes 5, imbricate or valvate, in fruit usually greatly enlarged, wing-like and ascending and then strongly nervose, rarely small and reflexed or spreading. Petals 5, free, much contorted, often hairy and inconspicuous. Stamens usually numerous, hypogynous or subperigynous; filaments short; connective mucronate or aristate or club-shaped. Ovary inserted on the broad torus or slightly immersed in it, 3-locular; ovules 2 in each loculus. Fruit free from or included in the enlarged calyx-tube or rarely closely adnate to it, indehiscent, usually 1-seeded.

1. MONOTES A. DC.

Monotes kerstingii Gilg. Fig. 108.

Shrub or small tree, rarely up to 45 ft. high. Leaves elliptic or oblong-elliptic, obtuse or rounded and emarginate at the apex, slightly cordate at the base, 2¾-4¾ in. long, 1½-2¾ in. broad, glabrescent above and finely reticulate, softly tomentose beneath, with about 14-16 pairs of prominent lateral nerves. Flowers greenish, in short axillary cymes; inflorescences densely and softly tomentose. Fruit ovoid-globose, about ½ in. in diameter, pilose, surrounded by the dry reticulate ovate-oblong accrescent calyx-lobes about 1½ in. long.

Equatoria.

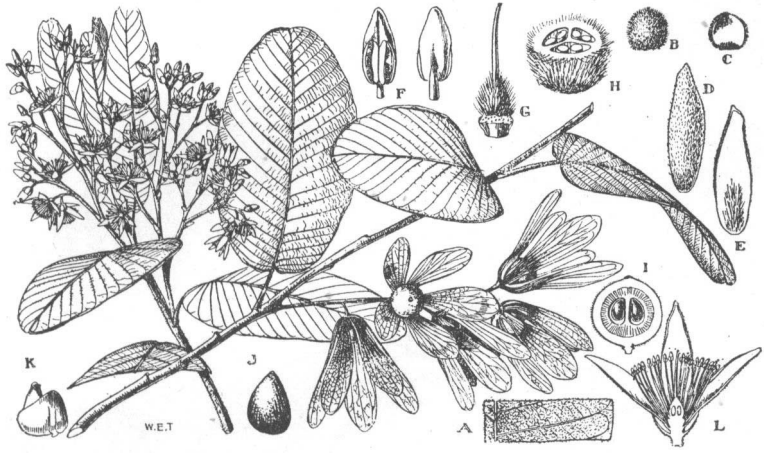


Fig. 108—MONOTES KERSTINGII Gilg.

A, under-surface of leaf. B, sepal, outer surface. C, sepal, inner surface. D, E, petals, outer and inner surface. F, stamens, from front and behind. G, ovary with style. H, cross-section of ovary. I, vertical section of fruit. J, seed. K, embryo. L, flower in vertical section.

64. *MYRTACEAE*

Trees or shrubs. Leaves opposite or rarely alternate, simple, usually entire, glandular-punctate; stipules absent or rarely very small. Flowers mostly actinomorphic, hermaphrodite or polygamous. Calyx-lobes 3 or more. Petals 4-5 or rarely 6 or absent, free or cohering in a mass, inserted on the margin of a disk lining the calyx-tube, imbricate. Stamens numerous or rarely few, inserted on the margin of the disk, 1- or more-seriate, inflexed in bud or twice folded or straight; filaments free or connate at the base into a short tube or in bundles opposite the petals. Ovary inferior, 1- or more-locular with axile or rarely parietal placentas; ovules numerous in each loculus or rarely few or solitary. Fruit loculicidally dehiscent or indehiscent.

The Guava tree, *Psidium guajava* L. (*P. pomiferum* L.), is cultivated in the Sudan.

1. **SYZYGIUM** Gaertn.

Syzygium guineense (Willd.) DC. Fig. 109.

Tree usually 20-35 ft. high but sometimes taller; bark dark-brown to almost black, fairly smooth, scaling in rectangular flakes; slash crimson, fibrous. Leaves opposite, waxy-grey-green, tough, smooth, fragrant when crushed, lanceolate to ovate-elliptic, shortly acuminate at the apex, cuneate or occasionally rounded at the base, 3-7 in. long, 1½-2½ in. broad. Flowers white, fragrant, shortly pedicellate, usually borne in terminal panicles in great profusion. Stamens numerous, about ¼ in. long. Fruit purple-black, ovoid, ½-1 in. long, 2-3-locular, carried in bunches of 20-30, juicy, edible.

Central and Southern Sudan.

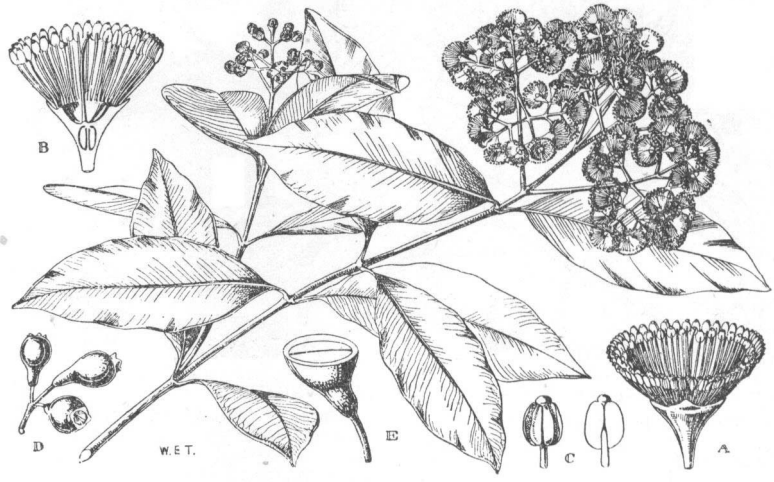


Fig. 109—SYZYGIUM GUINEENSE (Willd.) DC.

A, flower with corolla removed. B, the same in vertical section. C, anthers, front and back, showing gland at tip of connective. D, fruits. E, cross-section of fruit.

65. *MELASTOMATACEAE*

Herbs, shrubs or trees. Leaves opposite or verticillate, simple, usually with 3 to 9 longitudinal nerves. Flowers hermaphrodite, actinomorphic or somewhat zygomorphic, mostly very showy. Calyx tubular, free or adnate to the ovary or sometimes connected to it by septum-like strands; lobes imbricate or rarely valvate. Petals imbricate, free or rarely united at the base. Corona sometimes present. Stamens as many to twice as many as the petals; filaments free, often bent; connective often pro-

duced and appendaged at the base. Ovary superior or more or less inferior, 1- or more-locular; ovules numerous in each loculus, axile or rarely basal or parietal. Fruit a capsule or berry.

A. Stamens with equal and similar anthers; connective not or only shortly produced at the base:
  (a) Calyx-lobes with alternating supplementary lobes:
    (b) Flowers in close terminal clusters; connective conspicuously appendaged with 2 short lobes ..... ANTHEROTOMA. 1.
    (bb) Flowers paniculate; connective not conspicuously appendaged ..... OSBECKIA. 3.
  (aa) Calyx-lobes without alternating lobes; flowers capitate ..... TRISTEMMA. 4.

AA. Stamens with very unequal anthers, the connective of the larger ones always long-produced at the base ..... DISSOTIS. 2.

1. **ANTHEROTOMA** Hook f.

Antherotoma naudini Hook. f.

Annual herb up to 1 ft. high; stems 4-angled, appressed-setose. Leaves few, opposite, shortly petiolate, lanceolate, acute at the apex, crenate, 1¼-1½ in. long, 3-nerved, setose above and only on the nerves beneath. Flowers pink or mauve, in close terminal clusters subtended by leaves. Calyx-tube laxly setose; lobes narrowly lanceolate, stellate-bristly at the apex. Petals 4. Ovary bristly at the apex.

Equatoria.

2. **DISSOTIS** Benth.

A. Petals 4; flowers in dense heads:
  B. Stems densely villous with long spreading hairs ..... *D. phaeotricha.*
  BB. Stems pubescent with upward-directed bristly hairs ..... *D. debilis.*

AA. Petals 5:
  C. Calyx-tube glabrous:
    (a) Flowers in bracteate heads ..... *D. erecta.*
    (aa) Flowers solitary or in pairs ..... *D. petiolata.*
  CC. Calyx-tube more or less covered with simple or stellate bristles:
    (b) Calyx-tube densely covered with stalked stellate bristles; flowers cymose or paniculate:
      (c) Leaves ⅓-⅔ in. broad ..... *D. schweinfurthii.*
      (cc) Leaves 1¼-2½ in. broad ..... *D. scabra.*
    (bb) Calyx-tube with simple bristles:
      (d) Flowers enclosed by foliaceous bracts; calyx-tube densely bristly; small shrub ..... *D. macrocarpa.*
      (dd) Flowers not enclosed by foliaceous bracts; calyx-tube sparsely bristly; plant creeping ..... *D. decumbens.*

Dissotis phaeotricha (Hochst.) Triana.

Low branched herb 6-18 in. high. Leaves subsessile, lanceolate, subacute at the apex, 1½-2½ in. long, ½-¾ in. broad, 3-nerved, pilose. Flowers mauve or purple, small, in dense heads surrounded by the uppermost leaves. Calyx-lobes lanceolate, alternating with bristle-tipped appendages. Petals 4.

Equatoria.

D. debilis (Sond.) Triana.

Weak herb; stems somewhat quadrangular, 12-18 in. high. Differing from *D. phaeotricha* in being more glabrous and having narrower leaves and smaller flowers.

Equatoria.

D. erecta (Guillem. & Perrott.) Dandy, comb. nov. Fig. 110.

Melastoma capitatum Don, non Vahl; *Tristemma erectum* Guillem. & Perrott.; *Heterotis capitata* Benth.; *D. capitata* (Benth.) Hook. f.

Shrubby plant 3-6 ft. high; branches obtusely 4-angled; stems hirsute or strigose. Leaves ovate, acute at the apex, rounded at the base, 2½-3½ in. long, 1¼-1½ in. broad, 5-nerved, strigose or pubescent on both surfaces. Flowers bright-red, several in a head with a common involucre of bracts. Petals 5.

Equatoria.

D. petiolata Hook. f.

Undershrub. Leaves elliptic, 2½-6 in. long, 5-nerved, strigillose on both surfaces, paler beneath. Flowers pink or purple, solitary or 2 together, enclosed in leafy bracts. Petals 5. Capsule 5-valved, with a minute ring of bristles.

Equatoria.

D. schweinfurthii Gilg.

Small shrub 4 ft. or more high. Leaves lanceolate, acute at the apex, 1½-3 in. long, 5-nerved, somewhat hispid. Flowers maroon or pale-magenta, 2 in. in diameter. Petals 5. Stamens yellow.

Equatoria.

D. scabra Gilg.

Shrub up to 7 ft. high, with quadrangular stems. Leaves ovate-lanceolate, 5 in. long, scabrid above, scabrid-puberulous beneath. Flowers rose, in terminal cymes. Petals 5.

Equatoria.

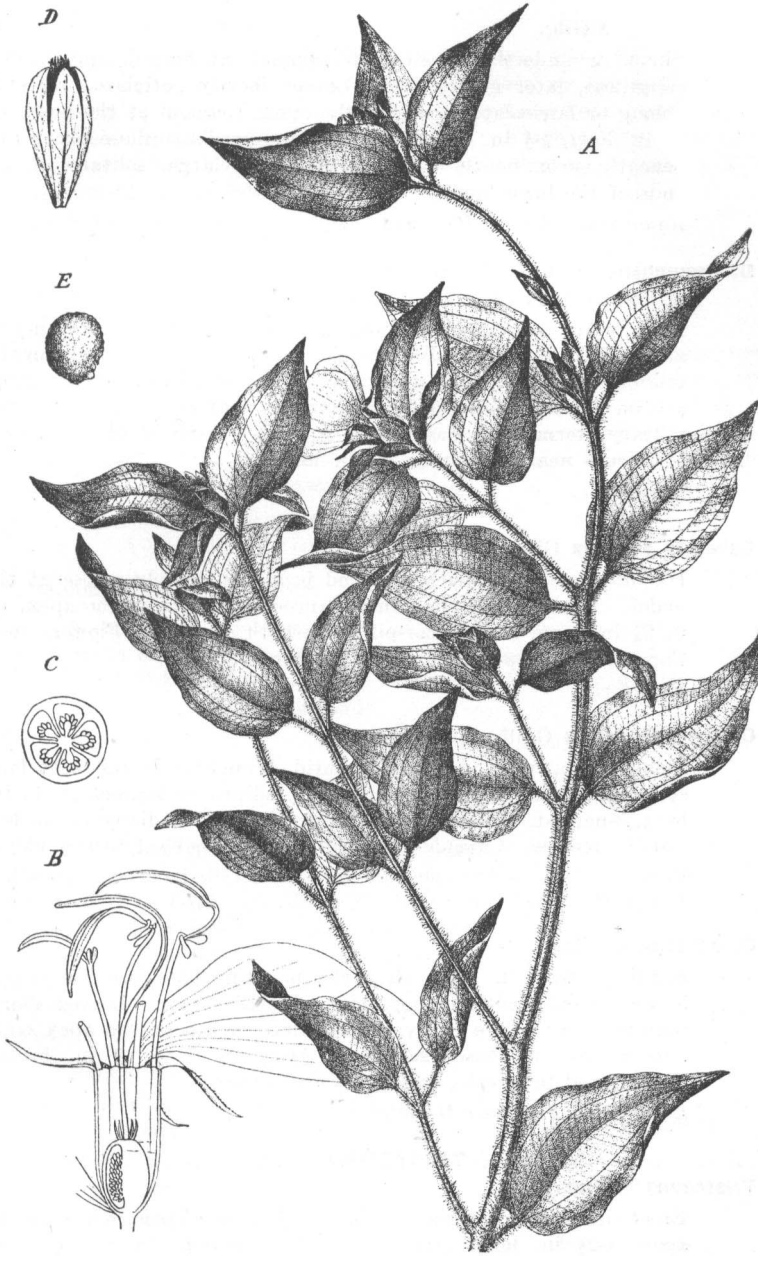


Fig. 110—DISSOTIS ERECTA (Guillem. & Perrott.) Dandy.
A, branch with flowers. B, longitudinal section of a flower (two stamens removed). C, transverse section of ovary. D, fruit. E, seed.

D. macrocarpa Gilg.

Shrub or undershrub; stems tetragonal, at first densely brown-strigillose, later glabrescent. Leaves shortly petiolate, narrowly oblong or lanceolate, acute at the apex, rounded at the base, 1¼-2½ in. long, ¼-½ in. broad, densely appressed-strigillose above and beneath, prominently 5-nerved. Flowers large, solitary at the ends of the branchlets.

Equatoria: *Aloma Plateau.*

D. decumbens (Beauv.) Triana.

D. rotundifolia (non Triana) Broun & Massey.

Herb, with creeping stems rooting at the nodes and erect branches, almost glabrous. Leaves rather long-petiolate, broadly ovate, triangular-acute at the apex, cuneate at the base, ¾-1¼ in. long, ½-1 in. broad, 3-5-nerved, glabrous or nearly so. Flowers rose, solitary, terminal. Calyx-tube sparsely bristly outside. Petals 5. Fruit nearly glabrous, ⅓ in. long.

Equatoria.

3. **OSBECKIA** L.

Osbeckia saxicola Gilg.

Hispid-pilose herb, with 4-angled branches densely setose at the nodes. Leaves subsessile, linear-lanceolate, acute at the apex, up to 2¾ in. long, long-setose-pilose on both surfaces. Flowers rose. Capsule urn-shaped, the calyx deciduous.

Equatoria.

O. senegambiensis Guillem. & Perrott.

Small shrub, with 4-angled scabrid branches; nodes with long spreading bristles. Leaves subsessile, elliptic to lanceolate, 1¼ in. long, 3-nerved. Flowers rose or purple, ¾ in. in diameter, in terminal racemes. Capsule enclosed in the 10-ribbed bristly calyx-tube.

Equatoria.

O. abyssinica Gilg.

Shrub up to 4 ft. high, all parts including both surfaces of the leaves covered with rather stiff yellowish hairs. Leaves short-petiolate, lanceolate or ovate-lanceolate, acute at the apex, subcuneate at the base, serrulate, 1½-2½ in. long, ⅜ in. broad. Flowers red to purple, in few-flowered cymes.

Equatoria: *Imatong Mountains.*

4. **TRISTEMMA** Juss.

Tristemma roseum Gilg.

Erect slender almost glabrous herb. Leaves elliptic, acute at the apex, 1-2½ in. long, ½-1½ in. broad, 5-nerved, slightly setulose. Flowers rose, 2 or 3 together, rarely solitary.

Equatoria.

T. incompletum R. Br.

Low undershrub, with strongly angled branches. Leaves broadly ovate-elliptic, rounded or shortly cuneate at the base, 4-6 in. long, 2-3½ in. broad, 5-nerved, appressed-setose above, nearly glabrous and often crimson beneath. Flowers pink to purple, several in a head. Calyx-tube with a single ring of hairs outside. Crown of the ovary bristly.

Equatoria.

T. littorale Benth.

T. papillosum Gilg.

Prostrate or suberect undershrub up to 3-5 ft. or more high; stems obtusely angled, often wiry, glabrous or nearly so. Leaves ovate-elliptic, rounded or subacute at the base, 2-6 in. long, 1½-2½ in. broad, 5-nerved, shortly appressed-setose above, almost glabrous beneath. Flowers pink to bluish-purple. Calyx-tube glabrous outside except at the base.

Equatoria.

T. grandifolium (Cogn.) Gilg.

Slender herb, with quadrangular slightly strigillose stems. Leaves ovate or ovate-oblong, 4¾-8¾ in. long, 2½-4¾ in. broad, 7-nerved, pubescent on both surfaces. Flowers 4-7 in a head. Calyx-tube with 2 rings of hairs outside.

Equatoria.

66. *COMBRETACEAE*

Trees or shrubs, sometimes climbing. Leaves opposite or more rarely alternate or verticillate, without stipules, simple. Flowers spicate or racemose or in heads, mostly small, hermaphrodite or rarely unisexual. Calyx 4-8-fid or -lobed; lobes valvate. Petals 4-5 or more or absent, free, small. Stamens 4-10, rarely more; filaments inflexed in bud; anthers versatile, opening lengthwise by slits. Ovary inferior or rarely semi-inferior, 1-locular; ovules 2-6, apical. Fruit often winged, rarely dehiscent.

A. Petals present:

(a) Fruit usually 4-5-angled or -winged, not densely clothed with long silky hairs ..... COMBRETUM. 2.

(aa) Fruit narrowly cylindric, not winged, densely clothed with long silky hairs ..... GUIERA. 3.

AA. Petals absent:

(b) Flowers arranged in spikes or racemes, never in heads ..... TERMINALIA. 4.

(bb) Flowers in heads ..... ANOGEISSUS. 1.

Fig. 111—ANOGEISSUS SCHIMPERI Hochst. ex Hutch. & Dalziel.
A, fruits. B, flower.

1. **ANOGEISSUS** (DC.) Wall.

Anogeissus schimperi Hochst. ex Hutch. & Dalziel. Fig. 111.
A. leiocarpus (non Guillem. & Perrott.) Broun & Massey.

Tall tree sometimes up to about 70 ft. high, with grey bark; branches often drooping; branchlets softly pubescent. Leaves alternate, lanceolate to ovate-lanceolate, acute at the apex, up to 3¼ in. long and 1½ in. broad, at length laxly pubescent beneath, light-green or ashen. Flower-heads yellow. Expanded part of calyx-tube glabrous outside. Fruit small, coriaceous, broadly 2-winged.

Widespread on the lighter soils.

2. **COMBRETUM** L.

A. Inflorescences not branched:

B. Climbing shrub; flowers yellowish or reddish-white; petioles persistent, forming decurved spines ..... *C. aculeatum.*

BB. Rhizomatous undershrub sometimes flowering on annual shoots; leaves oblong-lanceolate, abruptly mucronate at the apex, velvety- or silky-tomentose and very distinctly reticulate beneath ..... *C. sericeum.*

BBB. Trees or shrubs:

C. Leaves glabrous, glandular or scaly beneath but not pubescent:

D. Leaves (full-grown) usually 4 in. or more long:

(a) Leaves alternate or subopposite, more sharply narrowed at the base ..... *C. binderianum.*

(aa) Leaves opposite, narrowed equally at both ends ..... *C. collinum.*

DD. Leaves (full-grown) usually less than 4 in. long:

(b) Leaves glaucous, shining, reddish-brown and closely reticulate when dry, ovate or ovate-lanceolate; scales inconspicuous ... *C. elliotii.*

(bb) Leaves shining, very densely covered beneath with silvery white scales, ovate-lanceolate ... *C. bongense.*

(bbb) Leaves densely brown-scaly beneath, acuminate at the apex ..... *C. lepidotum.*

CC. Leaves pubescent or tomentose at least on the nerves, the hairs sometimes accompanied by glands or scales:

E. Leaves (full-grown) usually 4 in. or less long:

(c) Leaves oblong-elliptic, viscid-shining above; under-surface closely tomentose, the scales inconspicuous ..... *C. glutinosum.*

(cc) Leaves oblong to elliptic, acute or acuminate at the apex; under-surface of adult leaves covered with minute greenish-yellow scales ... *C. molle.*

(ccc) Leaves elliptic to narrowly elliptic or oblong-elliptic; under-surface tomentellous and scaly, the scales more or less hidden by the dense indumentum ..... *C. kabadense.*

(cccc) Leaves elliptic, acuminate at the apex, tomentose on both surfaces; scales few or absent ..... *C. laboniense.*

EE. Leaves (full-grown) usually more than 4 in. but less than 8 in. long:

(d) Leaves oblong to ovate, glabrescent above, more or less tawny-pubescent beneath; scales present and abundant ... *C. gueinzii.*

(dd) Leaves lanceolate to ovate, densely grey-tomentose beneath; scales absent; fallen leaves leaving deep scars ... *C. gallabatense.*

(ddd) Leaves oblong or ovate-oblong, softly tomentose beneath; scales absent ..... *C. cordofanum.*

EEE. Leaves (full-grown) usually 8 in. or more long:

(e) Leaves often in whorls of 4, glabrescent or pilose above, white-lepidote and more or less densely tawny-tomentose beneath; inflorescences supra-axillary ..... *C. verticillatum.*

(ee) Leaves not as above, acuminate at the apex, densely hairy beneath; scales few or absent ... *C. schweinfurthii.*

AA. Inflorescences branched, often paniculate:

F. Climbing shrubs:

G. Bracts large and coloured (white or pink), graduating from the leaves ..... *C. racemosum.*

GG. Bracts sharply differentiated from the upper leaves, or if not then comparatively small and inconspicuous:

H. Flowers small, in globose densely woolly many-flowered heads:

(f) Rhachis covered with a thick tawny-yellow tomentum ..... *C. capituliflorum.*

(ff) Rhachis sparsely pubescent; inflorescences shorter, less profusely branched ..... *C. undulato-marginatum.*

HH. Flowers not in globose heads:

(g) Flowers small, scarlet, in large panicles ..... *C. paniculatum.*

(gg) Flowers small, yellowish or creamy-white ..... *C. smeathmani.*

(ggg) Flowers large (up to 1 in. long), red ..... *C. platypterum.*

FF. Trees or shrubs:

(h) Leaves ovate, mostly acute at both ends but some rounded at the apex, tawny-pilose in the junctions of the nerves beneath, the remainder of the under-surface almost glabrous, alternate ..... *C. multispicatum.*

(hh) Leaves oblong-elliptic, undulate, finally glabrous with scattered minute white scales on the under-surface ..... *C. undulatum.*

(hhh) Leaves ovate to lanceolate, finally slightly pubescent, the younger ones with dense white scales on the under-surface; fallen leaves leaving deep scars ..... *C. adenogonium.*

(hhhh) Leaves subrhomboid-ovate, very long-acuminate at the apex, bright-green, shining, glabrous ..... *C. hartmannianum.*

(hhhhh) Leaves elliptic-lanceolate to ovate, sparsely white-pubescent over the whole of the under-surface, closely and finely reticulate, alternate or opposite ..... *C. ghasalense.*

Combretum aculeatum Vent. **Fig. 112.**

Shrub 10-15 ft. high, often climbing or with lax branches. Leaves ovate or elliptic, rounded to acutely acuminate at the apex, finely serrate, up to 1¾ in. long and 1¼ in. broad, glabrous. Calyx rather densely pubescent. Anthers orange. Fruit 4-5-winged.

Widespread.

C. sericeum Don.

C. parvulum Engler & Diels.

Undershrub from a woody rhizome. Leaves oblong-lanceolate, rounded and shortly mucronate at the apex, rounded at the base, up to 4 in. long and 1½ in. broad; young leaves silky. Spikes terminal or axillary, short, silky, the flowers clustered at the end of the peduncle. Fruit broadly elliptic with membranous wings, 1 in. long, puberulous.

Equatoria.

C. binderianum Kotschy.

C. populifolium Engler & Diels.

Savannah shrub or tree up to 30 ft. high; bark dark-grey, rough. Leaves opposite or in whorls of 3-4, obovate-elliptic to narrowly elliptic or oblong, subacute at the apex, unequal-cuneate at the base, usually 4-5 in. long and about 1½ in. broad (up to 6 in. long and 2½ in. broad), dark-green and sparingly lepidote above, grey-green and densely lepidote beneath. Flowers white, in axillary spikes 2-4 in. long towards the bases of the leafy branches. Fruit densely rusty-lepidote, 1-1½ in. long and broad.

Southern Sudan.

Fig. 112—COMBRETUM ACULEATUM Vent.

C. collinum Fresen.

Small tree. Leaves narrowly ovate or elliptic, 3-8 in. long, 1-2¾ in. broad, finely reticulate and covered with silvery scales beneath; petiole ¾ in. long. Flowers in weak simple axillary spikes shorter than the leaves. Fruit very broadly elliptic, 1 in. long, shortly tomentose towards the middle.

Central and Southern Sudan.

C. elliotii Engler & Diels.

C. lecananthum Engler & Diels; *C. brunneum* Engler & Diels.

Small tree up to 30 ft. high, with cinnamon-coloured branches. Leaves papery, ovate-lanceolate to oblong, obtuse-acuminate at the apex, rounded or subcordate at the base, 3-4 in. long, 1½-2½ in. broad, shining above, with inconspicuous scales beneath, strongly reticulate, glutinous when young. Inflorescences slender, up to 2 in. long, slightly lepidote. Fruit about ¾ in. broad, very sparingly glandular between the wings.

Equatoria.

C. bongense Engler.

Shrub or small tree. Leaves clustered, ovate-lanceolate, subacute at the apex, 3½ in. long, 1½ in. broad, with tufts of hairs in the axils of the nerves beneath. Flowers sweet-smelling; spikes simple, 3 in. long, tomentose. Fruit broadly elliptic, 1¼ in. long.

Equatoria.

C. lepidotum A. Rich.

Small tree, with compressed lepidote young branches. Leaves opposite, ovate, acute to acuminate at the apex, 2-4 in. long, viscid-glandular above, densely scaly beneath. Flowers in axillary spikes. Fruit narrow-oblong, lepidote.

Central Sudan.

C. glutinosum Perrott. ex DC.

Shrub or small tree 15-18 ft. high. Leaves rounded and mucronate at the apex, very shortly cuneate at the base, 2¼-3¼ in. long, 1¼-1¾ in. broad, the scales not visible on the younger leaves and never becoming prominent. Flowers greenish-white, small, pubescent, in small axillary spikes. Fruit 4-winged, about 1 in. broad.

Equatoria.

C. molle R. Br. ex Don.

C. trichanthum Fresen.

Tree up to 40 ft. high; bark smooth, grey. Leaves opposite or subopposite, elliptic to elliptic-lanceolate, acute or acuminate at the apex, rounded at the base, usually 2-4 in. long and 1-1½ in. broad (occasionally up to 6 in. long and 2 in. broad). Flowers yellow, in spikes 1½-2 in. long. Fruit ½-¾ in. long.

Southern Sudan.

C. kabadense Exell.

Small tree; branchlets at first tomentellous, finally glabrescent. Leaves opposite or alternate or usually in whorls of 3-4, usually rounded but sometimes obtuse or slightly acuminate at the apex, rounded to acute at the base, about 1-2¼ in. long, up to about 1 in. broad, tomentellous and scaly beneath. Flowers in dense axillary spikes about 1½-2¼ in. long, tomentellous, tending to appear before the leaves.

Equatoria: *Kabada Hills, near Loka.*

C. laboniense M. B. Moss.

Small tree; young branches softly pubescent. Leaves elliptic, acuminate at the apex, rounded or broadly cuneate at the base, about 3½ in. long and 1¼ in. broad, tomentose on both surfaces, at length glabrescent above. Inflorescences axillary, racemose, many-flowered, up to 2¾ in. long, pubescent.

Equatoria: *Imatong Mountains, near Laboni Forest.*

C. gueinzii Sond.

C. splendens Engler.

Savannah tree up to 20 ft. high; young branches tawny-pubescent. Leaves opposite or ternate, elliptic-oblong or occasionally ovate, acute or acuminate at the apex, unequal-rounded at the base, up to 7 in. long and 3 in. broad, glabrescent above except on the midrib and other main nerves, tawny-pubescent beneath. Flowers dark-yellow, fragrant, in tawny-pubescent spikes 2-4 in. long, usually appearing before the leaves. Fruit yellow-green, ¾-1 in. long.

Central and Southern Sudan.

C. gallabatense Schweinf.

Small tree up to 30 ft. high, with dark-grey branches. Leaves often ternate, ovate or lanceolate-oblong, up to 7 in. long and 3¼ in. broad, membranous, sparsely pilose above, softly grey-tomentose beneath, often clustered at the ends of the branches. Spikes solitary or somewhat clustered, axillary, covered with a light or dark tomentum, flowering before the leaves. Fruit 4-winged, elliptic, about 1 in. long, softly tomentose.

Kassala.

C. cordofanum Engler & Diels.

Small tree. Leaves subopposite, coriaceous or firmly membranous, up to 7 in. long and 3 in. broad. Fruit thinly winged, oblong, truncate at the base, 1 in. long, ¾ in. broad, lepidote.

Kordofan.

C. verticillatum Engler.

Savannah tree up to 15 ft. high; branchlets softly grey-pubescent. Leaves thick, tough, oblong-lanceolate to oblong, obtuse at the apex, broadly cuneate at the base, 4-8 in. long, 1½-2 in. broad, dull and scarcely shining above, prominently reticulate and grey- or tawny-puberulous beneath. Inflorescences supra-axillary, 2½ in. long. Fruit green at first, the wings changing to rich-ruby and the fruit-body to brownish-green tinged with red, 1-1¼ in. long.

Equatoria.

C. schweinfurthii Engler & Diels.

Bush or tree up to 15 ft. high. Leaves thick, tough, obtuse or apiculate at the apex, 5-9 in. long, 3-5 in. broad (up to 12 in. long and 6 in. broad on young plants), glabrescent above except on the midrib, white or buff-coloured with flannel-like tomentum beneath. Fruit 1-1½ in. long, the body pinkish-brown, the wings yellow.

Equatoria.

C. racemosum Beauv.

C. mittuense Engler & Diels.

Showy climber. Leaves elliptic to ovate, acute at the apex, 2-4 in. long, 1¼-2 in. broad, slightly pubescent on the nerves. Upper part of calyx glabrous. Stamens long-exserted. Ovary pubescent. Fruit obovate with membranous wings, about 1 in. broad.

Equatoria.

C. capituliflorum Fenzl ex Schweinf.

Woody climber. Leaves membranous or subcoriaceous, lanceolate, undulate, up to 6 in. long and 2 in. broad. Flowers dull-yellow; inflorescences rusty-pilose and lepidote. Fruit 1½ in. long, ovoid-conical, the wings narrow and woody.

Central and Southern Sudan.

C. undulato-marginatum De Wild. & Exell.

Climber, differing from *C. capituliflorum* in the characters given in the key, and the bracts in the latter species being shorter, stouter and much more thickly hairy.

Equatoria.

C. paniculatum Vent.

Shrub, usually climbing. Leaves broadly elliptic or nearly orbicular, up to 5 in. long, 2½ in. broad, glabrous but often softly pubescent when young, often with twisted petioles. Flowers scarlet, clustered in conspicuous terminal panicles. Fruit in very showy masses, suborbicular, glistening-greenish-white with a dark

central stripe and with broad membranous wings, about 1 in. broad.

Equatoria.

C. smeathmani Don.

Woody climber. Leaves oblong or obovate-oblong, up to 5½ in. long and 2½ in. broad, glabrescent above, pilose on the nerves beneath. Inflorescences variable but attaining 16 in. in length. Fruit up to ½ in. long and broad.

Equatoria.

C. platypterum (Welw.) Hutch. & Dalziel.

Climber. Leaves oblong, acutely acuminate at the apex, rounded at the base, 4-6 in. long, 1¼-2½ in. broad, glabrous. Flowers red, showy, in panicles; bracts large and subfoliaceous. Fruit orbicular-obovate, about 1½ in. broad, broadly winged, the wings often reddish.

Equatoria.

C. multispicatum Engler & Diels.

Small tree 20 ft. high. Leaves ovate to broadly oblong-elliptic, mucronate at the apex, up to 4 in. long, 1¾ in. broad, glossy when young. Flowers pubescent, small.

Equatoria.

C. undulatum Engler & Diels.

Tree up to 40 ft. high. Leaves opposite or in whorls of 3-4, oblong-elliptic, acute at the apex, up to 7¼ in. long and 3 in. broad, glossy or viscid when young. Flowers paniculate, small, hairy. Fruit broadly elliptic, 4-winged, 1½ in. long, 1¼ in. broad.

Central and Southern Sudan.

C. adenogonium Steud. ex A. Rich.

Small tree; flowering branches leafless. Leaves usually ternate, ovate to lanceolate, up to 5½ in. long and 2 in. broad. Flowers small, in short woolly spikes. Fruit 4-5-winged, about 1 in. long, shiny.

Central and Southern Sudan.

C. hartmannianum Schweinf. Fig. 113.

Small to fairly large tree. Leaves opposite or alternate or ternate, up to 10 in. long (usually smaller) and 2¾ in. broad, nearly half the lamina occupied by the long acumen, glabrous, minutely dark-punctate beneath. Flowers in axillary spikes. Fruit 4-winged.

Central Sudan.

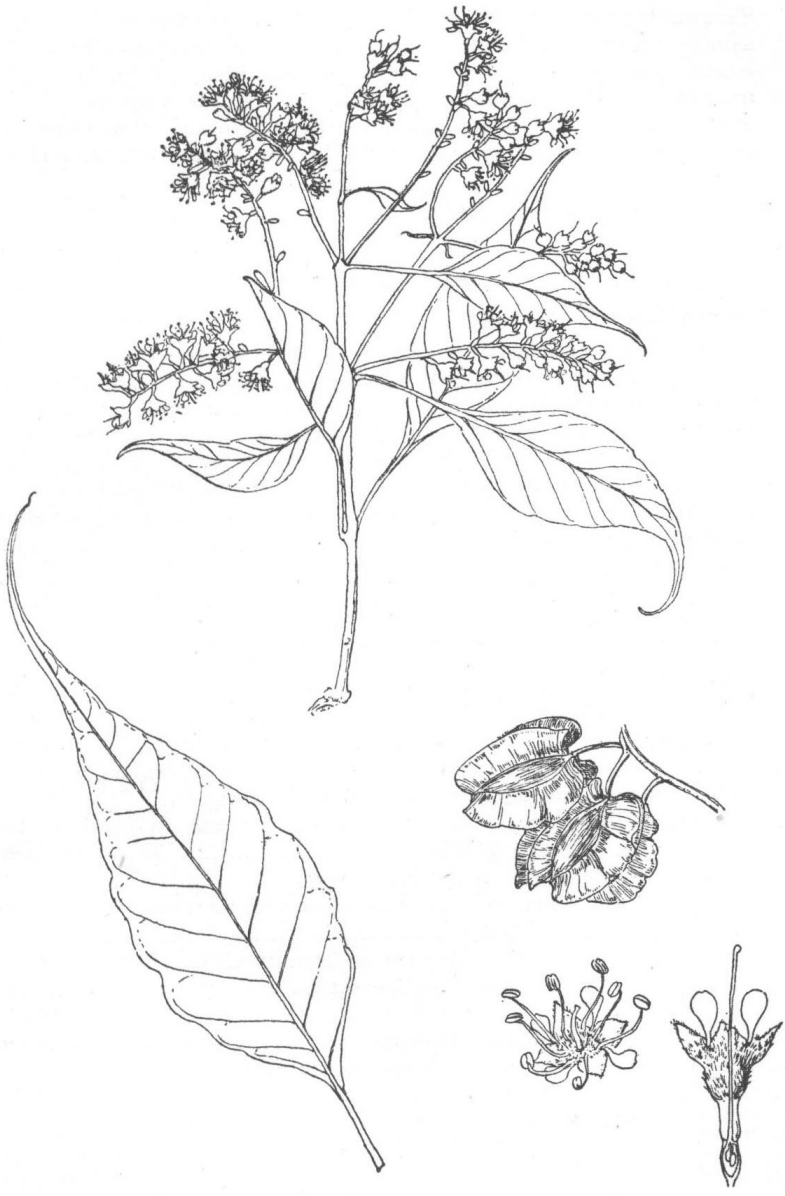


Fig. 113—COMBRETUM HARTMANNIANUM Schweinf.

C. ghasalense Engler & Diels.

Savannah tree up to 30 ft. high; branchlets orange-red. Leaves usually ternate, lanceolate-elliptic to oblanceolate-elliptic or ovate, tapered to the apex, cuneate at the base, 3-7 in. long, 1½-3 in. broad, finely glandular and finely reticulate beneath, glutinous when young; midrib compressed. Flowers creamy-yellow, sweet-scented, appearing before the leaves. Fruit yellow, 1-1¾ in. long.

Central and Southern Sudan.

3. **GUIERA** Juss.

Guiera senegalensis J. F. Gmel. Fig. 114.

Small shrub, with scattered black dots; branches downy. Leaves opposite or subopposite, oblong-elliptic, mucronate at the apex, rounded or slightly cordate at the base, 1¼-2 in. long, ½-1¼ in. broad, softly tomentose on both surfaces, with scattered black glands beneath. Flowers in dense shortly pedunculate involucrate heads about ⅓ in. in diameter. Fruit narrowly cylindric, radiating, 1¼-1½ in. long, densely clothed with very long silky hairs, making a fluffy head.

Central Sudan.

4. **TERMINALIA** L.

A. Branches with spines ..... *T. spinosa.*

AA. Branches without spines:

(a) Outline of fruit lanceolate-elliptic to oblong, 1½ or more times longer than broad:

(b) Fruit and usually the leaves glabrous:

(c) Petiole ½-¾ in. long, often narrowly winged by the base of the lamina ..... *T. macroptera.*

(cc) Petiole 1 in. or more long:

(d) Leaves narrow-lanceolate, acuminate at the apex ..... *T. salicifolia.*

(dd) Leaves obovate or broadly elliptic, obtuse at the apex, pubescent only on the nerves ..... *T. laxiflora.*

(ddd) Leaves obovate to obovate-oblong, narrowed to the base, softly tomentose beneath ..... *T. splendida.*

(dddd) Leaves obovate or elliptic, cuneate at the base, very unequal-sided, glabrous beneath ..... *T. schweinfurthii.*

(bb) Fruit and usually the leaves hairy:

(e) Leaf-lamina finally almost glabrous beneath or pubescent only on the nerves, rounded at the base ... *T. glaucescens.*

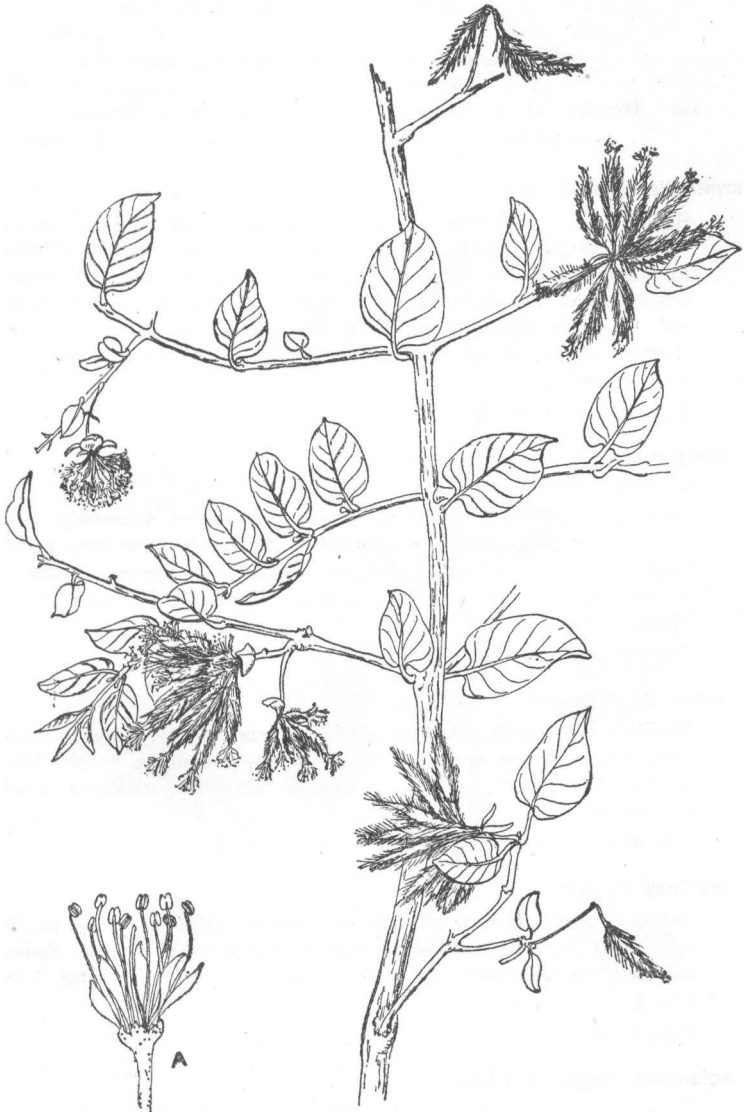


Fig. 114—GUIERA SENEGALENSIS J. F. Gmel.
A, flower.

(ee) Leaf-lamina finally densely hairy beneath:
(f) Lamina narrowed and often acuminate at the apex; leaves up to 7¼ in. long ..... *T. avicennioides.*
(ff) Lamina rounded or slightly pointed at the apex; leaves very large ..... *T. mollis.*
(aa) Outline of fruit broadly elliptic, almost orbicular; fruit purplish-brown when ripe ..... *T. brownii.*

Terminalia spinosa Engler.

Small tree, with whorled horizontal branches; stipular spines stout, straight, paired, ¼-½ in. long. Leaves obovate, truncate and emarginate at the apex, ¾-1½ in. long, up to 1 in. broad, clustered at the ends of short stout side-shoots; petiole short, red. Flowers pink and white; spikes up to 2 in. long in terminal clusters of 4-5 above the leaves. Fruit dark-brown, 1 in. long, ⅝ in. broad.

Equatoria: *Kapoeta.*

T. macroptera Guillem. & Perrott.

T. dawei Rolfe.

Tree up to about 60 ft. high. Leaves sometimes subsessile, more or less obovate, sometimes reflexed at the apex, attenuate at the base, up to 12 in. long, glabrous beneath. Flowers green or white, small, in lax axillary spikes. Fruit 3-4 in. long, 1½ in. broad.

Central and Southern Sudan.

T. salicifolia Schweinf.

Medium tree, with glaucous glabrous branchlets. Leaves lanceolate, acute at the apex, acute or obliquely cuneate at the base, up to 7½ in. long and 1¼ in. broad, glaucous, glabrous, finely reticulate.

Kassala.

T. laxiflora Engler.

Medium tree. Leaves obovate or broadly elliptic, obtuse at the apex, 6-10 in. long, pubescent only on the nerves beneath. Spikes axillary, very slender, up to 5 in. long. Fruit 3 in. long, 1 in. broad.

Equatoria.

T. splendida Engler & Diels.

Tree up to about 50 ft. high, with rough bark. Leaves leathery, obovate to obovate-oblong, narrowed at both ends, 4¾-6 in. long (sometimes larger), softly tomentose beneath. Spikes axillary, slender, more or less shortly appressed-pilose.

Equatoria.

Fig. 115—TERMINALIA BROWNII Fresen.

T. schweinfurthii Engler & Diels.

Tree up to 30 ft. or more high, with broad trunk and deeply ribbed bark. Leaves obovate or elliptic, narrowed at the apex, up to 12 in. long and 6 in. broad (sometimes larger). Spikes lax-flowered, up to 7 in. long. Fruit up to 3½ in. long and 1¼ in. broad.

Central and Southern Sudan.

T. glaucescens Planch. ex Benth.

Medium tree. Leaves more or less elliptic, obtuse or acute at the apex, up to 8 in. long and 3¼ in. broad, finely reticulate beneath, glaucous, usually puberulous. Spikes axillary. Fruit oblong, about 3 in. long and 1 in. broad, softly tomentellous.

Equatoria.

T. avicennioides Guillem. & Perrott.

Tree about 30 ft. high; branchlets like the inflorescences and under-surface of the leaves rusty- or pale-tomentose. Leaves elongate-oblong or oblong-elliptic, unequally rounded at the base, up to 7½ in. long and 2½ in. broad. Fruit lanceolate-elliptic, 2-2½ in. long, ¾-1 in. broad, softly tomentellous.

Equatoria.

T. mollis Laws.

T. torulosa F. Hoffm.; *T. spekei* Rolfe.

Tree up to 40 ft. high. Leaves elliptic, up to 16 in. long and 7½ in. broad, softly tomentose beneath and strongly nerved. Spikes axillary, up to 4 in. long, tomentose. Fruit oblong, up to 3 in. long, 1 in. broad, tomentellous.

Equatoria.

T. brownii Fresen. Fig. 115.

Tree up to 30-40 ft. high; young bark smooth, whitish; old bark rough. Leaves somewhat crowded at the ends of the branches, long-petiolate, broadly obovate-elliptic, shortly and obtusely apiculate at the apex, rounded to subacute at the unequal base, up to 4 in. long and 2¾ in. broad, finely reticulate beneath, finally almost glabrous. Fruit about 1½ in. broad.

Widespread.

67. *RHIZOPHORACEAE*

Trees or shrubs, frequently on maritime shores; branches swollen at the nodes. Leaves opposite with stipules or rarely alternate without stipules, coriaceous, simple; stipules interpetiolar, falling early. Flowers hermaphrodite, in axillary inflorescences. Calyx-lobes 3-14, persistent, valvate. Petals free, usually small, often notched or bifid or lacerate, convolute or inflexed in bud. Stamens as many as or usually more numerous than the petals, often in pairs opposite the petals, inserted on the

edge or at the base of a disk. Ovary inferior or more rarely superior, 2-6-locular or 1-locular by suppression of septa; ovules 2 in each loculus, rarely more. Fruit generally indehiscent, usually 1-seeded or the loculi 1-seeded.

A. Ovary inferior or ½-inferior; seeds germinating in the fruit before falling:
(a) Calyx-lobes 4; petals entire; anthers multilocular, subsessile ..... RHIZOPHORA. 3.
(aa) Calyx-lobes 8-14; petals 2-fid, with apical setae; anthers 2-locular, with thread-like filaments ..... BRUGUIERA. 1.
AA. Ovary superior; seeds not germinating in the fruit ..... CASSIPOUREA. 2.

1. **BRUGUIERA** Lam.

Bruguiera gymnorhiza (L.) Lam.

Tree, with smooth bark marked on young branches with scars of leaves and stipules. Leaves rather thick, elliptic, bright-green. Fruit scarlet, 1 in. long.

Muddy shores of the Red Sea south of Suakin.

2. **CASSIPOUREA** Aubl.

Cassipourea elliottii (Engler) Alston.

Slender understorey forest-tree. Leaves opposite, elliptic, obtuse at the apex, rounded or subcuneate at the base, dentate, 1¼-1⅔ in. long, ⅝-1 in. broad, coriaceous, glabrous; petiole ⅛ in. long. Flowers greenish, 1-3 together, axillary; pedicels ⅛-⅕ in. long, pubescent, articulated at the apex. Calyx deeply 5- or rarely 4-lobed, densely appressed-pilose outside; lobes lanceolate, ⅛ in. long. Petals narrow, fringed at the apex, glabrous. Stamens 20. Fruit ovoid, subglabrous.

Equatoria: *Didinga Mountains, Nagichot*, 6500 ft.

3. **RHIZOPHORA** L.

Rhizophora mucronata Poir. Mangrove.

Tree. Leaves elliptic or obovate-elliptic, broadly pointed at the apex, about 4½ in. long, 2 in. broad, coriaceous. Flowers few. Sepals oblong, coriaceous. Petals hairy inside.

Muddy shores of the Red Sea south of Suakin.

68. *HYPERICACEAE*

Herbs or shrubs or rarely trees or climbers, with resinous juice. Leaves opposite or verticillate, without stipules, simple, entire or glandular-dentate, usually marked with translucent or black dots or streaks, rarely small and scale-like; indumentum when present often stellate and rust-coloured. Flowers usually yellow or white, terminal or rarely axillary, hermaphrodite, actinomorphic. Sepals 4-5, imbricate. Petals 4-5, free, imbricate or contorted. Stamens numerous, hypo-

gynous, free or usually variously united into 3-5 or more bundles. Ovary superior, 1-locular or imperfectly or perfectly 3-5-locular; ovules numerous to few or solitary in each loculus. Fruit a capsule or a berry or drupe.

A. Petals glabrous inside; fruit a capsule with many seeds; stamens more or less united into bundles; leaves gland-dotted or -streaked ..... HYPERICUM. 2.

AA. Petals hairy inside; fruit a drupe or berry; stamens united into 5 bundles:

(a) Fruit a berry; leaves glabrous or softly tomentose beneath ... PSOROSPERMUM. 3.

(aa) Fruit a drupe with 2-4 seeds; leaves densely stellate-pubescent beneath ..... HARUNGANA. 1.

1. **HARUNGANA** Lam.

Harungana madagascariensis Lam.

Haronga madagascariensis (Lam.) Choisy.

Tree or shrub, clothed with fine stellate hairs; sap orange-coloured. Leaves opposite, ovate or ovate-elliptic, acute or shortly acuminate at the apex, rounded at the base, 4-8 in. long, 2½-4 in. broad, with rather numerous lateral nerves. Flowers whitish, fragrant, small, dotted with black glands; cymes terminal, corymbose, the branches covered with coarse rusty indumentum.

Equatoria.

2. **HYPERICUM** L.

Hypericum lalandii Choisy.

Small tufted herb under 10 in. high. Leaves lanceolate or linear-oblong, about ¼ in. long, gland-dotted. Flowers yellow, in dichotomous cymes. Sepals lanceolate, entire.

Equatoria: *Yei River.*

H. perforatum L. Dotted-leaved St. John's-wort.

Herbaceous plant, with a perennial rootstock and erect stems 1-1½ ft. high. Leaves sessile, oblong, ½-1 in. or more long, marked with pellucid dots and occasionally a few black ones on the under-surface. Flowers bright-yellow, in a handsome terminal corymb. Petals marked with black dots and streaks. Stamens numerous, united into 3 bundles.

Darfur: *Jebel Marra*, over 6000 ft.

H. peplidifolium A. Rich.

Procumbent glabrous wiry herb; branches elongate. Leaves subsessile, elliptic, obtuse at the apex, up to ½ in. long, punctate, paler and glaucous beneath. Flowers small, terminal, solitary on short peduncles. Sepals unequal, leafy.

Equatoria: *Imatong Mountains*, 8700 ft.

H. leucoptychodes Steud. ex A. Rich.

Shrub or tree up to 30 ft. high; branchlets quadrangular. Leaves narrowly lanceolate, acute at the apex, ¾-1 in. long. Flowers shortly pedunculate, about 2 in. in diameter, solitary at the ends of short leafy branches.

Equatoria: *Imatong Mountains*, *Mount Kineti*, 10,400 ft.

3. **PSOROSPERMUM** Spach

Psorospermum campestre Engler.

Shrub about 6 ft. high. Leaves variable in size and shape, oblanceolate or ovate-lanceolate to narrowly elliptic, subacute at the apex, 2-3¼ in. long, ¾-1¼ in. broad, glossy above, paler and finely reticulate beneath, glabrous, not or sparsely punctate. Flowers white, rather few, in small corymbs; pedicels about ½ in. long.

Equatoria: *Yei district*, *among rocks*.

P. suffruticosum Engler.

Undershrub up to about 2 ft. high. Leaves lanceolate-elliptic, obtuse at the base, 4-6 in. long, ½-2½ in. broad, glaucous-grey and rather sparsely punctate beneath. Inflorescences more than 20-flowered, slightly pubescent when young; pedicels usually not more than ¼ in. long.

Equatoria: *Said Bundas district*.

Fig. 116—PSOROSPERMUM TENUIFOLIUM Hook. f.
A, flower. B, ovary with styles. C, fruit. D, cross-section of fruit. E, seed. F, embryo. G, bundle of stamens.

P. tenuifolium Hook. f. Fig. 116.

Shrub 8-10 ft. high. Leaves oblong-elliptic, acuminate at the apex, shortly cuneate at the base, 2¾-4 in. long, 1¼-2 in. broad, glabrous. Flowers in terminal corymbs.

Central and Southern Sudan: *often common near swamps*.

P. guineense (L.) Hochr.

P. senegalense Spach.

Shrub; branchlets like the inflorescences, sepals and leaves softly woolly-pubescent or tomentose. Leaves elliptic, mostly subacute at the base, 2¾ in. long, 1½ in. broad. Flowers white, streaked with brown, in dense corymbs.

Equatoria.

P. salicifolium Engler.

Shrub. Leaves lanceolate, up to 2 in. long and 1 in. broad, glabrous. Flowers in lax 5-7-flowered cymes. Sepals and petals streaked with resin. Fruit subglobose, ¼ in. in diameter.

Equatoria.

69. *GUTTIFERAE*

Trees or shrubs, with resinous juice. Leaves opposite, without stipules, simple. Flowers actinomorphic, usually polygamous or dioecious, rarely hermaphrodite. Sepals 2-6 or rarely more, imbricate. Petals free, contorted or imbricate. Stamens mostly numerous, hypogynous, free or variously united in the lower part or in bundles opposite the petals; staminodes often present in the female flowers. Ovary superior, sessile, 1- or more-locular; ovules 1 to many on the inner angle of the loculi or erect from their base; rudimentary ovary sometimes present in the male flowers. Fruit dehiscent or indehiscent, sometimes large and globose; seeds often with an aril.

1. **GARCINIA** L.

Garcinia ovalifolia Oliv.

Tree up to 40 ft. high, with creamy sap. Leaves lanceolate or oblong-elliptic, gradually and obtusely acuminate at the apex, 4-6 in. long, rather rigidly coriaceous, with indistinct resinous lines. Flowers whitish, very few together, mostly on the young shoots. Fruit smooth.

Equatoria: Said Bundas district.

G. buchanani Bak.

Understorey tree up to 40 ft. high, with a thick evergreen crown casting a dense shade. Leaves elliptic-oblong to oblong-oblanceolate, obtusely acuminate at the apex, 3-5½ in. long, 1-1¾ in. broad. Flowers orange, clustered in the leaf-axils, polygamous, ½ in. in diameter when fully expanded. Stigma large, very sticky. Fruit orange-yellow, about 1 in. in diameter, edible.

Equatoria.

70. *TILIACEAE*

Trees or shrubs or rarely herbs, often clothed with stellate hairs. Leaves usually alternate, simple; stipules present or absent. Flowers actinomorphic, usually hermaphrodite, mostly cymose. Sepals valvate. Petals free or absent, contorted or imbricate or valvate. Stamens usually numerous, free or rarely connate into 5-10 bundles. Ovary

syncarpous or very rarely apocarpous, superior, 2-10-locular; ovules on axile placentas. Fruit baccate or drupaceous or variously dehiscent; seeds sometimes hairy.

A. Carpels free, usually 2-5 or rarely 1; sepals united into a campanulate 3-5-fid calyx; leaves large, cordate and 7-nerved at the base ..... CHRISTIANA. 1.

AA. Carpels united; sepals free or nearly so:

(a) Petals not glandular within the base:

(b) Trees; leaves 3-nerved at the base; flowers few in terminal or leaf-opposed cymes; fruit indehiscent, ribbed ..... GLYPHAEA. 4.

(bb) Herbs or undershrubs:

(c) Leaves not tailed at the base; fruit very bristly:

(d) Filaments of the outer stamens moniliform; fertile stamens numerous; fruit globose ..... SPARRMANNIA. 6.

(dd) Filaments of the outer stamens thread-like; fertile stamens few; fruit oblong ..... CLAPPERTONIA. 2.

(cc) Leaves often setose-tailed at the base; fruit usually smooth ..... CORCHORUS. 3.

(aa) Petals glandular within the base; torus more or less elongated:

(e) Fruit indehiscent, not prickly; trees or shrubs ..... GREWIA. 5.

(ee) Fruit usually dehiscent, prickly; shrubs or herbs ..... TRIUMFETTA. 7.

1. **CHRISTIANA** DC.

Christiana africana DC.

Tall tree; young parts like the petioles, calyx and carpels covered with dense yellow tomentum. Leaves broadly ovate, acuminate at the apex, cordate and 7-nerved at the base, about 8 in. long, 6 in. broad, entire; petiole 3-4 in. long. Flowers fragrant, in terminal corymbose cymes. Carpels 1-5, free, obovoid, about ½ in. long in fruit, splitting into 2 boat-shaped valves; seeds marbled. *Equatoria.*

2. **CLAPPERTONIA** Meisn.

Clappertonia ficifolia (Willd.) Decne. Fig. 117.

Honckenya ficifolia Willd.

Small erect shrub, often in marshy places; branches stellate-tomentose. Leaves more or less broadly ovate in outline, rounded or cordate at the base; variously 3-5-lobed or sometimes not lobed, serrate, up to 5¼ in. long and 2¾ in. broad, stellate-pubescent or -tomentose beneath; stipules persistent, lanceolate, about ½ in. long. Flowers conspicuous, red-purple (rarely white), 2-3 in. in diameter when expanded, few, in terminal leafy racemes. Fruit narrowly oblong, 1½-2½ in. long, very bristly, the bristles pilose. *Equatoria.*

Fig. 117—CLAPPERTONIA FICIFOLIA (Willd.) Decne.

3. **CORCHORUS** L.

Corchorus hochstetteri Milne-Redh.

Erect glabrous annual herb. Leaves petiolate, ovate-lanceolate to oblong, rather obtuse at the apex, serrate, the lowest pair of serratures bearing filiform tails. Flowers 1-3 on a very short common peduncle. Capsule ovoid-globose, ¼-½ in. long, densely covered with soft prickles.

Nuba Mountains. Kassala; Gallabat.

C. depressus (L.) Christens.

C. antichorus Raeusch.

Prostrate or decumbent perennial herb from a stout rootstock; branches tortuous, a few inches long. Leaves elliptic or obovate-elliptic, the lamina about as long as or shorter than the petiole. Flowers solitary or paired. Capsule subsessile, beaked, breaking into 4 valves, about ¾ in. long.

Northern and Central Sudan.

C. fascicularis Lam.

Annual or sometimes perennial herb; branches lax, about 1 ft. long. Leaves oblong or lanceolate, up to 4 in. long and ¾ in. broad, not tailed at the base. Capsule shortly beaked, about ½ in. long, borne in clusters.

Central and Southern Sudan.

C. aestuans L.

C. acutangulus Lam.

Annual or perennial herb, branched, erect or prostrate. Leaves ovate or ovate-lanceolate, 1¼-2½ in. long, ¾-1¼ in. broad, usually tailed at the base. Capsule ½-1 in. long, acutely winged, fairly stout, with 3 divergent beaks.

Central and Southern Sudan.

C. tridens L.

Annual herb 1-2 ft. high. Leaves lanceolate or linear-lanceolate, 1¼-3½ in. long, ⅓-½ in. broad, usually tailed at the base. Capsule 1-1½ in. long, faintly ridged, with 3 divergent beaks.

Widespread: a weed of cultivation.

C. olitorius L.

More or less glabrous herb, often woody at the base. Leaves lanceolate or ovate-lanceolate, up to 8 in. long and 2¾ in. broad, usually tailed at the base. Capsule 1¼-2½ in. long, stout, rather abruptly narrowed to an entire beak, usually 5-valved, the valves with distinct transverse ridges inside.

Widespread. Wild and cultivated.

C. trilocularis L.

Herbaceous or half-woody annual herb 1-2 ft. high. Leaves elliptic to oblong-lanceolate, gradually narrowed to the apex, 1½-3¼ in. long, ⅓-½ in. broad, usually tailed at the base. Capsule slender, 2-3½ in. long, with an entire beak, usually 3-valved, the valves with distinct transverse ridges inside.

White Nile District to Khartoum. Kordofan.

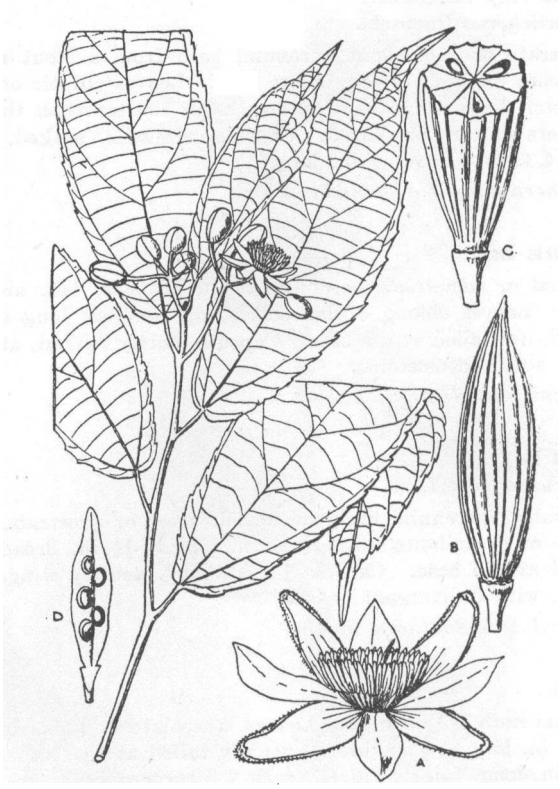


Fig. 118—GLYPHAEA LATERIFLORA (Don) Hutch. & Dalziel.
A, flower. B, fruit. C, cross-section of fruit. D, longitudinal section of fruit.

4. **GLYPHAEA** Hook. f. ex Planch.

Glyphaea lateriflora (Don) Hutch. & Dalziel. Fig. 118.
G. grewioides Hook. f. ex Planch.

Straggling shrub or tree up to 20 ft. high. Leaves oblong to oblong-ovate, caudate-acuminate at the apex, denticulate to subentire, 2½-5 in. long, ¾-3 in. broad; petiole dilated at the apex. Flowers few, in terminal or leaf-opposed cymes up to 2 in. long; pedicels slender in flower, thickened in fruit, up to 1½ in. long. Sepals 4, green, ½-¾ in. long. Petals 4, bright-golden-yellow. Stamens yellow, numerous. Fruit brown when ripe, spindle-shaped, beaked, longitudinally ridged, 2-3 in. long, about 1½ in. in diameter.

Equatoria.

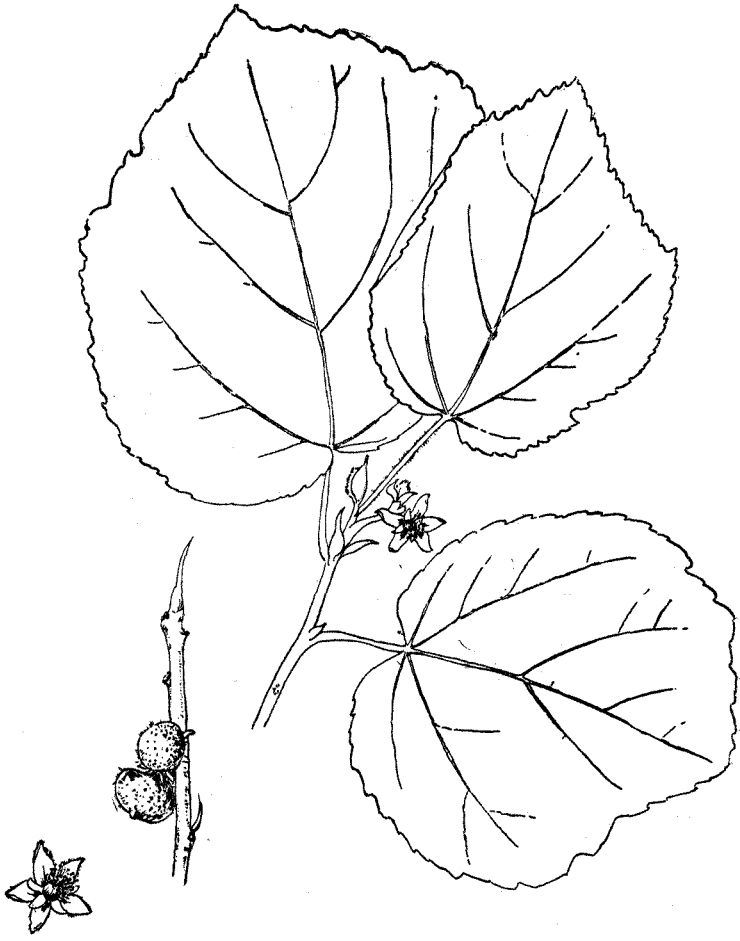


Fig. 119—GREWIA VILLOSA Willd.

5. GREWIA L.

A. Cymes axillary or subaxillary or opposite to the leaves:
  (a) Leaves more or less cordate at the base, nearly orbicular, usually as broad or nearly as broad as long ..... *G. villosa.*
  (aa) Leaves rounded or at most subcordate at the base, ovate to lanceolate, usually much longer than broad:
    (b) Lower surface of leaves completely hidden by the soft felt of heavy tomentum:
      (c) Leaves distinctly dentate, with prominent lateral nerves on the lower surface ..... *G. mollis.*
      (cc) Leaves minutely crenate, with very obscure lateral nerves on the lower surface ..... *G. bicolor.*
    (bb) Lower surface of leaves clearly visible between the more or less laxly arranged stellate hairs:
      (d) Flowers solitary:
        (e) Leaves broadly ovate, acute at the apex ... *G. tenax.*
        (ee) Leaves obovate, rounded at the apex ..... *G. erythraea.*
      (dd) Flowers few (2-6) in each inflorescence ..... *G. flavescens.*
      (ddd) Flowers numerous in each inflorescence; primary bracts pinnately divided ..... *G. oligoneura.*

AA. Cymes panicled at the ends of the branches, with or without axillary cymes also:
  (f) Young shoots, petioles and outer surface of calyx densely covered with stellate rusty tomentum ..... *G. ferruginea.*
  (ff) Young shoots and petioles not as above:
    (g) Leaves obovate or oblong-lanceolate, acuminate at the apex, undulate, 3-5 in. long ..... *G. floribunda.*
    (gg) Leaves ovate, acute at the apex, shallowly and sparingly crenate to serrate, up to 3 in. long; ovary-loculi 4-ovulate ..... *G. tembensis.*

Grewia villosa Willd. Fig. 119.

Small to large shrub; younger parts covered with long setaceous hairs. Leaves nearly orbicular, obliquely cordate at the base, serrate with ciliate serratures, 1-4 in. long, with 3-5 prominent nerves. Flowers dull-yellow to reddish, nearly sessile, in compact axillary clusters. Fruit globose, the size of a cherry, crustaceous, coppery, pilose, with four 1-2-seeded stones.

Central and Southern Sudan.

G. mollis Juss. Fig. 120.

G. venusta Fresen.

Shrub or tree up to 20 ft. high; bark black, rough, deeply fissured; branches twiggy at the ends, the twigs flattened, often drying purplish. Leaves oblong-lanceolate to oblong-elliptic, unequal-rounded at the base, 2-5 in. long, ¾-1¾ in. broad, pale-green above,

Fig. 120—GREWIA MOLLIS Juss.

hoary beneath. Peduncles 1-3 in the leaf-axils, each with 2-3 yellow flowers. Fruit black when ripe, globose, the size of a small pea.

Central and Southern Sudan.

G. bicolor Juss.

G. salvifolia Heyne ex Roth, non L. f.

Shrub or tree up to 40 ft. high. Leaves broadly lanceolate, very obtuse or slightly acuminate at the apex, minutely crenate, ¾-2 in. long, ½-¾ in. broad, glabrous or nearly so above. Flowers yellow, in axillary clusters.

Central Sudan.

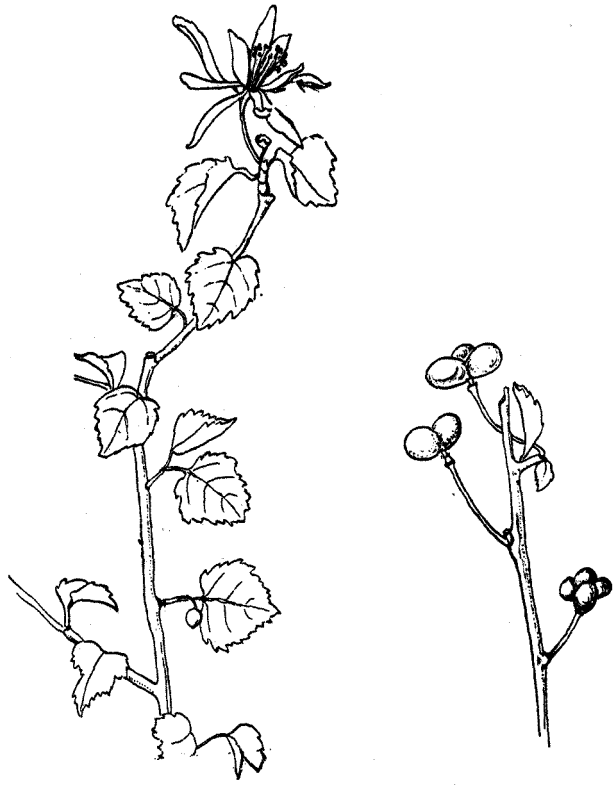


Fig. 121—GREWIA TENAX (Forsk.) Fiori.

G. tenax (Forsk.) Fiori. Fig. 121.

G. betulaefolia Juss.

Shrub, sometimes scrambling; bark dark-brown to grey, smooth, dotted with small white spots. Leaves broadly ovate, acute at

the apex, rounded at the base, dentate, ¾-1½ in. long, up to 1½ in. broad, strongly 5-nerved from the base, laxly stellate-pubescent beneath. Flowers white or occasionally yellow, scented, solitary. Fruit orange, 3-4-lobed, glabrous, edible.

Central and Southern Sudan.

G. erythraea Schweinf.

Shrub. Leaves rounded-obovate, cuneate at the base, dentate, about 1½ in. long, 3-5-nerved from the base, glaucous above, pallid and slightly stellate-pubescent beneath. Flowers solitary. Calyx ⅓ in. long.

Red Sea Hills. Kordofan-Darfur boundary: Jebel Sinin.

G. flavescens Juss.

Shrub, sometimes scrambling; stems dark-brown, fluted, 3-4-angled. Leaves ovate-oblong, subcordate at the base, coarsely serrate, 2-4 in. long, subcoriaceous, fairly densely pubescent beneath. Peduncles axillary, 2-3-flowered; flower-buds densely bristly-tomentose. Anthers pubescent. Berry 1-4-lobed, pilose, edible.

Central and Southern Sudan.

G. oligoneura Sprague.

Tree up to 30 ft. high. Leaves narrowly oblong-elliptic, gradually acuminate at the apex, unequal-sided at the base, 4¾-7¼ in. long, 1½-2¾ cm. broad, very minutely pubescent beneath and pilose on the midrib and petiole. Flowers numerous in each inflorescence, the primary bracts pinnately divided.

Equatoria.

G. ferruginea Hochst. ex A. Rich. Fig. 122.

Shrub or small tree; younger shoots like the petioles, pedicels and outer surface of the calyx densely covered with stellate rusty tomentum. Leaves obovate-elliptic, acute at the apex, closely crenulate, 4-5 in. long, about 2 in. broad, closely covered with short stellate hairs beneath. Flowers up to 1½-2 in. in diameter, in threes, the middle one opening first. Fruit fleshy, 4-lobed, each lobe the size of a large pea.

Rea Sea Hills: Erkowit. Kordofan. Blue Nile Province.

G. floribunda Mast.

Shrub or small tree. Leaves obovate to oblong-lanceolate, acuminate at the apex, rounded at the base, undulate, serrate, smooth on both surfaces. Flowers greenish-white, numerous in much-branched terminal leafless panicled cymes. Fruit the size of a small cherry, 4-locular.

Equatoria.

Fig. 122—GREWIA FERRUGINEA Hochst. ex A. Rich.

G. tembensis Fresen. Fig. 123.

G. occidentalis (non L.) Broun & Massey.

Scrambling shrub or small tree, with smooth grey rounded stems studded with white dots. Leaves ovate, acute at the apex, sparingly crenate to serrate, 2-3 in. long, 1-1¾ in. broad, glabrous. Flowers white, 3-4 together in very small umbels. Sepals mauve inside, ½ in. long.

Red Sea Hills.

6. SPARRMANNIA L. f.

Sparrmannia ricinocarpa (Eckl. & Zeyh.) Kuntze.

Shrub 2-6 ft. high. Leaves deeply 3-lobed, cordate at the base, 2-4 in. long, 2-3 in. broad, simply and stellately pubescent beneath. Flowers white or pinky-mauve, in umbels at the ends of the branches. Fruit about ½ in. in diameter, covered with straight bristles.

Equatoria: *Imatong Mountains, Mount Kineti.*

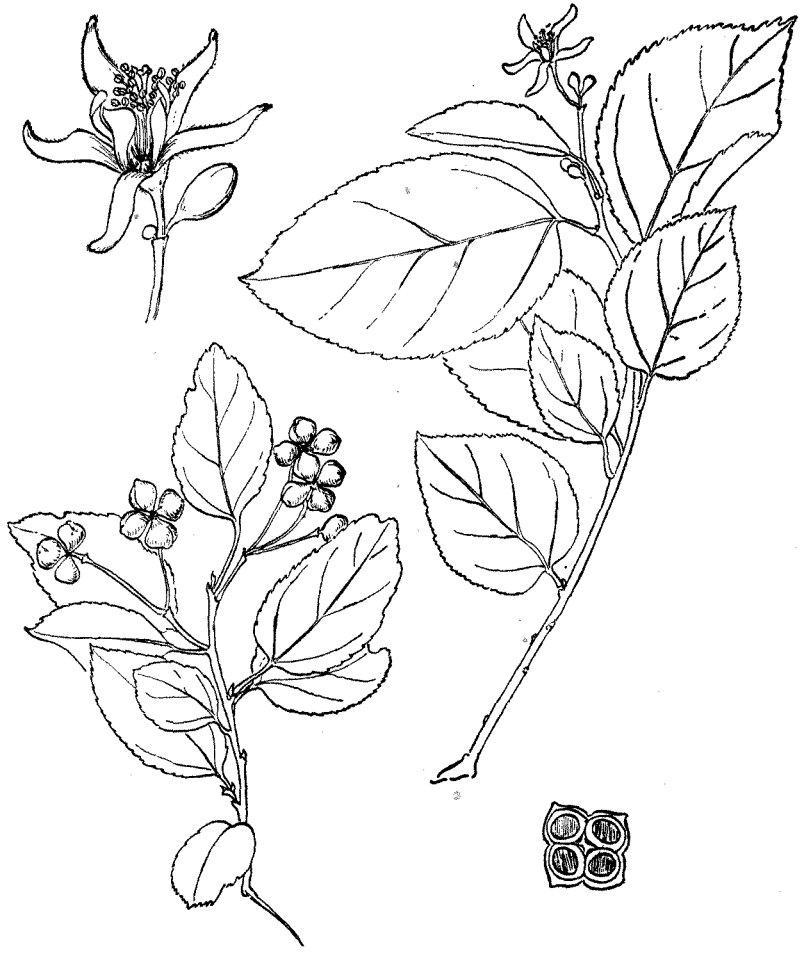


Fig. 123—GREWIA TEMBENSIS Fresen.

7. **TRIUMFETTA** L.

A. Sepals lepidote outside ..... *T. lepidota.*

AA. Sepals not lepidote:

(a) Prickles of the fruit terminating in a straight or curved but not hooked spine:

(b) Leaves densely tomentose on both surfaces, rounded or subcordate at the base ..... *T. tomentosa.*

(bb) Leaves almost glabrous above:
(c) Spines of fruit pubescent ..... *T. micrantha.*
(cc) Spines of fruit not pubescent ..... *T. buettneriacea.*
(aa) Prickles of the fruit terminating in a hooked or falcate spine:
(d) Fruit glabrous or nearly so:
(e) Leaves up to 5 in. long, almost glabrous above and beneath ..... *T. annua.*
(ee) Leaves up to 8 in. long, pubescent above, villous-tomentose beneath ..... *T. brachyceras.*
(dd) Fruit downy or villous:
(f) Prickles not ciliate ..... *T. rhomboidea.*
(ff) Prickles ciliate:
(g) Stamens 5-13; leaves very sparsely pubescent above and beneath ..... *T. pentandra.*
(gg) Stamens 20; leaves stellate-pubescent above, densely tomentose beneath ... *T. flavescens.*
(ggg) Stamens 10-12; leaves stellate-tomentellous on both surfaces ... *T. cordifolia* var. *tomentosa.*

Triumfetta lepidota K. Schum.

Shrub up to 4 ft. high. Upper leaves oblanceolate, the lower ones suborbicular and subtrilobed, up to 6 in. broad; petiolar glands 2-4 on each side. Flowers yellow; cymes 2-4 at each node. Fruit woody, globose, 8-10-locular, strongly tuberculate.

Equatoria.

T. tomentosa Boj.

Undershrub 2-3 ft. high, more or less tomentose all over. Leaves usually undivided, mostly ovate, acute at the apex, rounded or subcordate at the base, 2-4¾ in. long, 1-2¾ in. broad, tomentose on both surfaces but more densely beneath, passing gradually into bracts. Flowers yellow, small, numerous in terminal panicles. Fruit up to ¾ in. in diameter.

Equatoria.

T. micrantha K. Schum.

Shrub. Leaves lanceolate-oblong, serrulate, 2-3 in. long, ½-¾ in. broad, tomentose or pubescent beneath. Fruit prickly, with 2-8 terminal spinules.

Equatoria.

T. buettneriacea K. Schum.

Shrub. Leaves lanceolate or oblong-lanceolate, 2-3 in. long, ½-1½ in. broad, sparingly pilose on both surfaces. Fruit prickly, much broadened at the base, terminated by 1-4 spinules.

Equatoria.

T. annua L.

Erect annual herb 1-2 ft. high, somewhat pilose. Leaves ovate, acuminate at the apex, dentate, 3-nerved, 4-5 in. long, 2-4 in. broad, on very long petioles. Flowers bright-orange, very small; peduncles extra-axillary, 3-flowered, ½ in. long. Fruit the size of a pea, smooth between the glaucous hooked prickles.

Red Sea Hills. Darfur.

T. brachyceras K. Schum.

Shrubby herb. Leaves ovate or oblong-ovate, acuminate at the apex, cordate at the base, pubescent above, villous-tomentose beneath, the long petiole covered with golden-yellow hairs. Flowers yellow, showy.

Equatoria.

T. rhomboidea Jacq.

Weedy herb or undershrub, variable in habit. Leaves variable, irregularly serrate. Flowers yellow, small, in spicate inflorescences. Fruit ⅓ in. in diameter, tomentose between the prickles.

Widespread.

T. pentandra A. Rich.

Erect branched annual herb, slightly pubescent. Leaves rhomboid-orbicular to hexagonal, acute or subacute at the apex, broadly cuneate or truncate at the base, undivided or 3-lobed, coarsely serrate. Flowers minute, in lateral cymes. Fruit oblong-ovoid, about ¼ in. long.

Central and Southern Sudan.

T. flavescens Hochst. ex A. Rich. Fig. 124.

Shrub, with dark-red stems densely covered with black dots and whitish hairs. Lower leaves roundish, acute at the apex, truncate or cordate at the base, irregularly toothed, the petiole as long as the lamina. Flowers yellow, numerous in small clusters arranged along the sides and at the ends of the branches. Sepals rust-coloured. Fruit small.

Red Sea Hills. Kordofan. Equatoria: Imatong Mountains.

T. cordifolia var. **tomentosa** Sprague.

Shrub. Leaves usually suborbicular, 3-lobed or sub-5-lobed, stellate-tomentellous on both surfaces. Flowers brownish-yellow. Fruit over ⅔ in. in diameter including the prickles.

Equatoria.

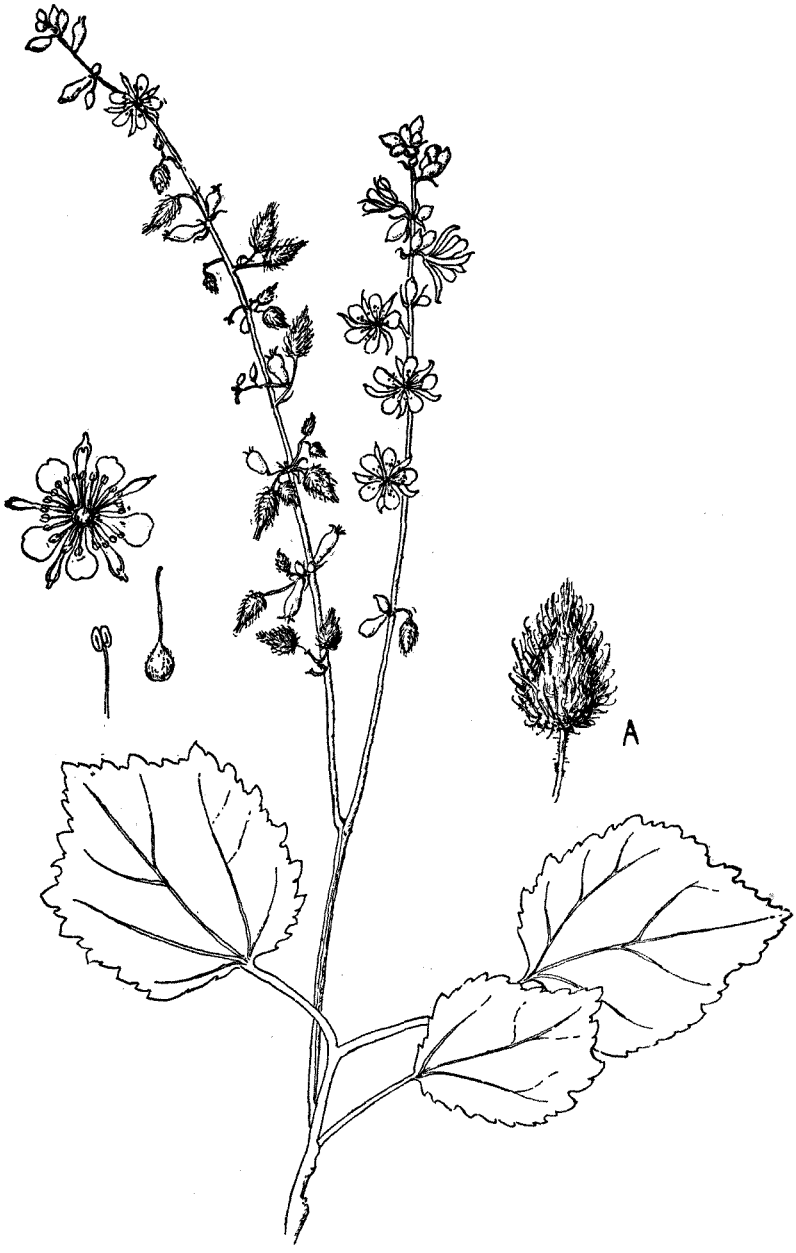


Fig. 124—TRIUMFETTA FLAVESCENS Hochst. ex A. Rich.
A, fruit.

INDEX TO BOTANICAL NAMES

Names of families and higher groups are in LARGE CAPITALS. Generic names are in SMALL CAPITALS. Synonyms are in *Italics*.

NOTES