THE GENUS CRATEVA (CAPPARACEAE)

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HISTORY AND TYPIFICATION

The first concept of the genus *Crateva* [1]) was published by Linnaeus, Gen. Pl. ed. 1 (1737) 113 (*n.v.*). Presumably there is little difference with the text in the Hortus Cliffortianus (1738) 484. The protologue (here abbreviated and translated from the latter work) contains the following elements.

	CRATEVA, Gen. Pl. 320.
American elements (our species number 1)	Tapia arborea ... PLUM., Gen. 22. Tapia MARCGR., Bras. 98; PIS. Bras. 68, t. 69. Apioscorodon sive ... PLUK., Alm. 34, t. 137 f. 7. Anona trifolia ... SLOAN., Flor. 205; Hist. 2, p. 169; RAJ., Dendr. 79. Arbor americana ... KIGG., Beaum. 10.
Indian element (our species number 4)	Niirvala RHEED., Mal. 3, p. 49, t. 42. Distr.: Jamaica, Malabar, & c.
Remark:	Plumier depicted 8 stamens, Rheede several, in a dried specimen (the only flower) I counted 10; it is up to observers to determine the actual number.

The figure of Plumier's, to which Linnaeus referred without citing it, is found in the former's Nova Pl. Amer. Gen. (1703) 22, t. 21, according to Urban, Fedde Rep. Beih. 5 (1920) 154. In the Flora Zeylanica (1748) 94, Linnaeus adopted the above concept almost unaltered, but added to the two elements incorporated in it a third one, namely a reference to a plate by Hermann which depicts a *C. adansonii* (our species 5b) from Ceylon, and gave the binomial *Crateva inermis* to the whole lot. Linnaeus added a second species, *C. spinosa*, which does not belong in the family.

In the Species Plantarum (1753) 444, Linnaeus altered the name of his former *C. inermis* into *C. tapia*. Of his references, he retained those to the Flora Zeylanica, the Hortus Cliffortianus, to Plukenet's Apioscorodon, and to Rheede's Niirvala. As the distribution he gave "India utraque", i.e. both East and West Indies.

In the second edition, Sp. Pl. 1 (1762) 636, Linnaeus transferred the genus from the *Polyandria Monogynia* to the *Dodecandria Monogynia*, and added *C. gynandra* as a new species, from Jamaica. *Crateva tapia* [2]) remained essentially the same as it had been,

[1]) Only in Syst. Nat. ed. 10 (1759) 1044 do we read *Crataeva*. Gomez, Lilloa 26 (1953) 336, traced and corrected this long-perpetuated error. The genus was named after the Greek herbalist Κρατευας (132–63 B.C.), regularly transcribed Krateuas or Kratevas.

[2]) The name *Tapia* can be traced back to Piso, Ind. Utr. Nat. Med. (1648) 140, to whom Plumier referred. Linnaeus rejected *Tapia* as a generic name because it was of 'barbarous' origin, not derived from Greek or Latin (cf. Critica Botanica no. 229. 1737), but he accepted Plumier's generic concept, and later was able to preserve the continuity by accepting *Tapia* as a specific epithet. I thankfully owe this interesting bit of information to Dr W. T. Stearn of the British Museum.

including the reference to Sloane in the Hortus Cliffortianus, which had been left out in the first edition of 1753.

In the Linnean Herbarium there are four sheets, 619.1—4. Sheet 619.2 has been inscribed "*inermis*" and "*Tapia*" by Linné himself, and it is the only one that could be regarded as the type specimen. Unfortunately, this plant does not belong to the American species in which the petals are narrow, the limb being lanceolate (like in 619.1, the type of *C. gynandra*, reduced to *C. tapia* in 1937 by Johanna Went), whereas this specimen has wide petals, the limb being elliptic, which means that it must belong to one of the Old World species. The material is so bad, however, that it is not possible to make out the identity; its origin is unknown, either.

For lack of material with Linnaeus, the type of *C. tapia* — which is the type species of *Crateva* — is to be sought with Plumier, to whom Linnaeus referred. Under the name *Tapia triphylla arborea*, Plumier gives indeed a plate with a description, of unambiguous identity, although the location went no further than "America". In the Paris Herbarium there is more unpublished Plumier material, viz. a plate of the inflorescence, a plate of the fruit and leaves, and a page of manuscript, all dealing with *C. tapia* [1]).

When Vahl in 1794 extracted the Indian "Niirvala" from *C. tapia*, he placed the former under *C. religiosa* Forst., described from the Pacific in 1786; this concept was retained by Willdenow in his edition of the Species Plantarum (1799).

Crateva spinosa L., Fl. Zeyl. (1748) 94, had been renamed *C. marmelos* in the Species Plantarum of 1753. Roxburgh, Hort. Beng. (1814) 41, removed it from *Crateva*; it is now known as *Aegle marmelos* (L.) Corr. of the Rutaceae. Roxburgh also extracted the Indian *Niirvala* from *C. tapia* in the original sense, but he placed it under his *Capparis trifoliata*. This binomial was by that time not based on a description; Roxburgh merely referred to a specimen, later incorporated in the Wallich Herbarium, where it was identified by me as *C. adansonii*. Roxburgh did not live to see his *Capparis trifoliata* validated in the Flora Indica 2 (1832) 571; Carey, the editor, had, however, removed the reference to *Nürvala*. For this reason, *Capparis trifoliata* Roxb. is a perfectly homogeneous species, validly published and typified, although actually a *Crateva*.

In the meantime Robert Brown, in Denh. & Clapp., Narr. Trav. Disc. Afr., App. (1826) 224, had recognised *C. adansonii* DC. 1824 (to which he reduced *C. laeta* DC. 1824) as the only species on the African continent, and suggested its being conspecific with the species of India which he knew from Roxburgh's MS., although he did not refrain from giving the latter a provisional name, *C. roxburghii*. Unfortunately, Brown's suggestion was never taken up; instead of, Oliver, Fl. Trop. Afr. 1 (1868) 99, placed *C. adansonii* as a synonym under *C. religiosa*. The latter species does not occur West of Assam in northeastern India, but the confusion has persisted up till the present.

Robert Brown's nomen novum *C. roxburghii* was, by the time of its publication, based on a very meagre protologue. On p. 206 it has been explained that it remains doubtful which subspecies of *C. adansonii* (which name has priority anyway) Robert Brown intended to deal with.

The name *Nürvala*, so often referred to by Linnaeus and others, was based on a plate in Rheede, Hort. Malab. 3 (1682) t. 42; the identity with our *C. nurvala* is clear. It was not before 1827 that this name was validated by Buchanan-Hamilton, who was also the first and only author to distinguish between *C. nurvala* and *C. unilocularis*. He did not give any data to define the taxa against one another, the character at which the

[1]) Dr. H. Heine of the Paris Herbarium is here remembered for his kind efforts to find these materials and to put them at my disposal.

epithet hints is a spurious one, and later authors failed to recognize *C. unilocularis*, which became a sort of doubtful species.

Besides *C. nurvala* and *C. unilocularis*, Hamilton had two more species. One of these he cited as *C. religiosa* Willdenow, who had not described such a species, but had cited the original author's name Forster for a mixture to which the specimen that Hamilton identified with it, did not even belong, being our *C. adansonii* ssp. *odora*. A plant of the same subspecies was described by Hamilton as a new species *C. odora*; this is the oldest legitimate name for the Asiatic material as far as it is now regarded as conspecific with *C. adansonii*.

Wight & Arnott, Prodr. (1834) 23, recognized two species, *C. nurvala* and *C. roxburghii*, but under the latter name they listed so many synonyms as to comprise the American *C. tapia sensu* Vahl (who had specifically excluded *Nürvala*), *C. odora* Ham. (in fact, Hamilton had cited Willdenow as the author, and that for a mixture of two species to which he had added a third one himself), and "*Caparis trifolia* Roxb."

Like in the Flora of Tropical Africa, *C. religiosa* was in the Flora of British India 1 (1872) 172 accepted as the only species. It was subdivided into two varieties, *nurvala* and *roxburghii*. The var. *nurvala* tallies with our *C. nurvala*, the var. *roxburghii* did no longer embody the American *Crateva* (since the reference to Vahl was left out), but comprised the four remaining SE. Asian taxa: our *C. adansonii* ssp. *odora*, ssp. *trifoliata*, *C. unilocularis*, and *C. religiosa* in the proper sense, which had been collected by Hooker in the Himalayas, but assigned by himself to *C. roxburghii*. Now having been introduced by works of so great an authority, the confusion was perpetuated in the local Indian Floras which all adopted *C. religiosa* with two varieties.

There have been many other misinterpretations, but only the perpetuated ones have here been referred to under the synonymies.

All names based on the same type specimen have been cited in one paragraph, together with their type. Subsequent literature has been selected for citation.

Since the distribution of a taxon is defined through the delimitation of that taxon, such specimens which have the most significance for the definition of the area have been cited, that is for each province or island all collections up to 3; 4—10 have been denoted as 'several', over 10 as 'many'. As there is no point in adopting such a method for continents where only one taxon is acknowledged, represented by many specimens, no collections have here been cited from Africa and America. A full account of all specimens examined will be published in the series 'Identification Lists of Malesian plants'.

Thanks are due to the Directors of the following Herbaria for kindly enabling me to consult their materials: Arnold Arboretum (A), Bailey Hortorium (BH), Bangkok, Royal Forestry Department (BKF), Blatter Herbarium (BLAT), British Museum (BM), Bogor (BO), Calcutta (CAL), Dehra Dun (DD), Edinburgh (E), Florence (FI), Geneva (G), Gray Herbarium (GH), Kew (K), Kepong (KEP), Leiden (L), Lae (LAE), Manila (PNH), Paris (P), Singapore (SING), Tokyo (TI), Utrecht (U), Berkeley (UC), Washington (US), Vienna (W), and Wageningen (WAG).

THE ORGANS AND THEIR TAXONOMIC SIGNIFICANCE

The well-known fact that in trees the leaves produced by purely vegetative branches like innovation and sucker shoots are larger than those found in the neighbourhood of flowers, holds also good in *Crateva*. In *C. tapia*, young treelets may produce extremely large leaves, which are but so seldom collected, that they make a surprising effect in the herbarium among those of the reproductive shoots which we have learnt to recognize as 'normal'.

Crateva nurvala, *religiosa*, and *tapia*, which grow under more or less everwet conditions, keep most of their leaves throughout the year. A few records have it that *C. tapia* is deciduous in some areas; *C. unilocularis* seems to be leafless during the cold season in the northern part of its area, but both are in full leaf by the time of flowering. The taxa in sect. *Siccorubra* which all grow under more or less seasonal conditions, are largely or completely bare while in flower, the new foliage cropping out just before or just after the blossom. It is therefore sometimes extremely difficult to correlate fruiting and flowering material even when it is from the same tree, the leaves getting considerably more coriaceous and changing in aspect during the development of the fruits. Collections of vegetative material in various stages of development from one and the same tree in any taxon, would make a fine contribution.

The central leaflet is generally widest about the middle, except sometimes in *C. obovata*. The lateral leaflets are asymmetric, having a sort of obliquely rectangular shape with the midrib diagonally. The degree of asymmetry varies largely with the leaf index; the wider the leaflet, the more asymmetric. For measurements in the descriptions below, always the central leaflet has been taken, which is approximately rhombic and easier to measure.

The undersurface of the leaves shows sometimes a glaucous or pallid tinge, always in *C. nurvala*, mostly in *C. adansonii* ssp. *odora*, more or less in *C. unilocularis*, and occasionally in *C. tapia*. As the late Dr C. A. Backer observed, this is due to microscopical whitish papillae of various size or clavate hairs, not soluble in chloroform and hence not waxy.

The inflorescences are racemose and corymbose. The flowers open at a very young stage, and develop while open towards their anthesis (fig. 2). There is no principal segregation of the flower-bearing and the leafy part of a twig. All species produce specimens wherein a twig bears a few flowers in the higher leaf-axils, yet each species largely follows one of the five inflorescence patters shown in fig. 1. Growth is nearly always sympodial, only in *C. adansonii* does the inflorescence mostly grow through. This casts a shade of relativity on the definition that an inflorescence in a ligneous plant is a flower-bearing structure that does not take part in the later vegetative body.

Such an inflorescence (as I shall remain to term it, for the sake of convenience) can be subtended by a certain amount of leaves, or not. In *C. nurvala* the twig which ends in a flowering rhachis generally bears leaves over a distance as long as the rhachis proper; eventually the whole structure dies off. In *C. excelsa*, *unilocularis*, *religiosa*, and *tapia* the same is found, although the structure is smaller and flowers and leaves are not so neatly apart. In *C. greveana*, the inflorescences come out of the 1—2 year old branches, and are almost not subtended by leaves and never grow through, most of the leaves being borne on innovation shoots. So both *C. adansonii* and *greveana* are monopodial in their growth, if in a very different way.

While in *C. tapia* the dense inflorescence and narrow petals are main characteristics, the flowers in Old World species are worthless for identification, except for the orangish tinge in the dried state and a sometimes slightly smaller size they have in sect. *Siccorubra*. The pedicels vary considerably in length, the sepals and petals in size, the stamens in number and in length, the gynophore in length. The torus which is nectariferous during anthesis and dish-shaped, grows occasionally out to a larger diameter in fruit, in *C. tapia* somewhat more than in others. In the same species the sepals are mostly long-persistent, which seems also the case in the Micronesian population of *C. religiosa*, but also this feature is by no means an absolute character.

The androphore should perhaps be termed androgynophore, but the shorter word is here preferred, and not only for those flowers which are male by reduction. Both the

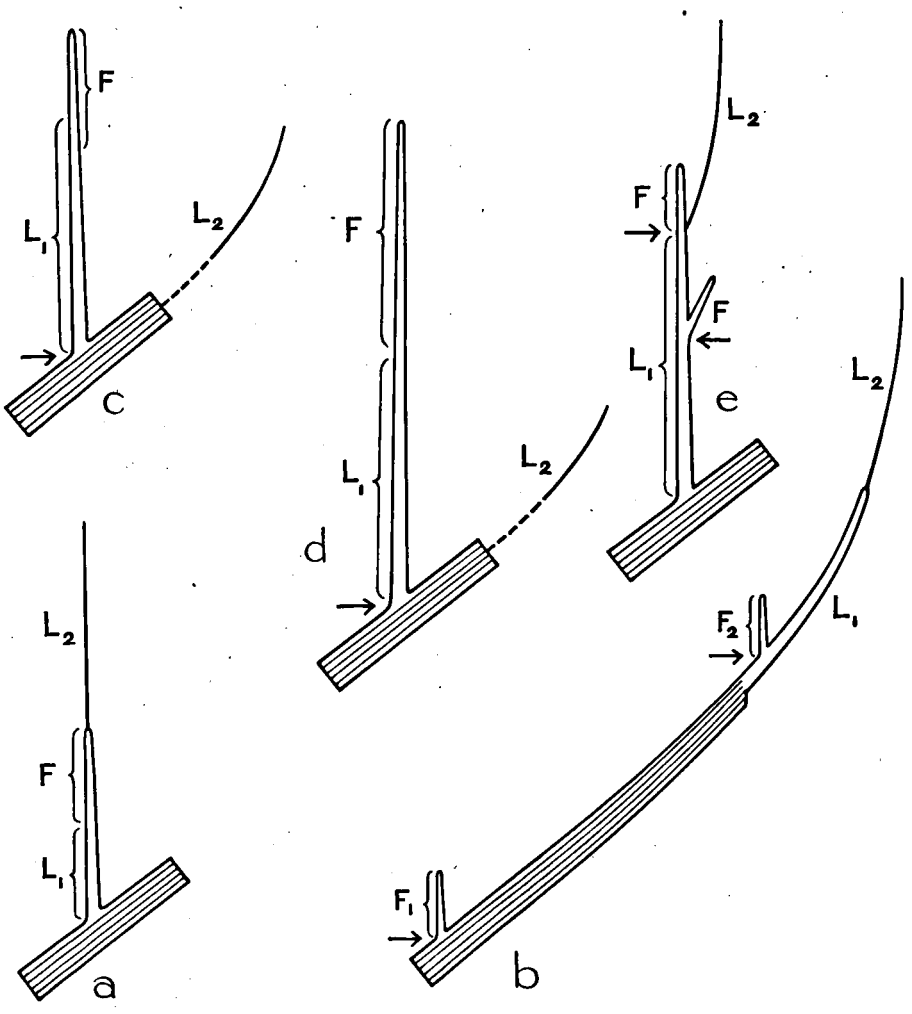


Fig. 1. Inflorescence types in *Crateva*, schematic. The one-year old branchlets are thick and hatched, the recent twigs not hatched, the future innovations have been indicated by a line. The arrow indicates the place where after fruiting an axis eventually will break off. F marks the flower-bearing part, L the leaf-bearing part, L_1 standing for the present flush of leaves, L_2 for the subsequent one. — a. *C. adansonii*, the inflorescence grows through; b. *C. greveana*, the flowering axes appear from one-year old branchlets while the twigs grow on monopodially; c. *C. excelsa*, *religiosa*, *tapia*, *unilocularis*, the flowering part of the lateral axis is short and overlapped by the leafy part; d. *C. nurvala*, the raceme is longer and not leafy as compared with the former; e. *C. obovata* (probably) and *tapia*, an innovation will appear just below the former flower-bearing axis.

Fig. 2. *Crateva nurvala* Buch.-Ham. Flowers in subsequent stages of development. — a–e. dorsally; a'–e'. laterally, a–b × 2, c–d × 1, e × $^{2}/_{3}$; f. length-section through basal part of the flower, × 2; g. bract with stipules, × 8; h. flower past anthesis, with staminal scars, × 2 (from living material in Bogor Botanic Garden, *IV F 76*).

androphore and the gynophore are measured from their common base at the torus, but their length has not much taxonomic value; only in *C. tapia* is the androphore sometimes far longer than in the Old World species, and in *C. religiosa* the gynophore may attain a greater length than in any other species.

Like in almost all Capparaceae, there is in *Crateva* a tendency to unisexuality by reduction. In part of the flowers, the gynoecium is reduced; the gynophore is then a few mm long and the ovary a fraction of the fertile ones in size. Mostly this miserable structure remains during anthesis, but in *C. nurvala* all gynoeciums were observed (Note 4.5) *) to grow out before part of them were shed before anthesis; then a scar remains amid the stamens. The way of reduction might be specific, but this is not at all certain and will require much live counting on flowering trees. It has, in my opinion, not yet been proved that there is a genuine reduction in the androecium by shedding part of the anthers; see Note 1a.2.

The ovary is, in principle (see Note 5b.4) 2-carpellary, and always 1-locular. If it seems 2-locular, like Hamilton and Kurz supposed, this is due to the intrusion of the placentas.

The fruit, although it varies much in size, has now been found to yield the best taxonomic characters, together with the leaves. In its early stages, the surface is always smooth, and so it remains in sect. *Siccorubra*, where the fruit is always globose, too. In sect. *Crateva*, the surface becomes roughish in the middle of its development, often crust-like with dry, flat papillae which may partly peel off again at maturity. The pericarp, initially ½ cm thick or more, becomes thinner and softer-leathery at maturity, just like in *Capparis*.

The seeds are smooth and comparatively small in sect. *Siccorubra*, in sect. *Crateva* they are smooth in *C. unilocularis* (which also in this respect takes a 'neutral' position); in *C. nurvala* they always have a distinct dorsal crest which gives the seed a resemblance to a bomb-splinter, in *C. religiosa* there are more and less sculptured seeds. In *C. tapia*, there is a fine radial sculpture (see Eichler t. 59).

Although the data are by no means complete, the genus seems remarkable for its colours. Throughout the plants of sect. *Siccorubra* a chemical component seems present in larger or smaller quantities, which causes the typical reddish-purplish-brownish tinges in the herbarium, particularly in the basal parts of the flower and in the fruits. The petals seem, in all species, to become white while anthesis begins, then to turn cream-coloured before they fall off, although there is quite some variation in pinkish shades, especially in sect. *Siccorubra*. The stamens always seem to be violet or purplish, anyway towards the top. In the present descriptions colour observations refer to the fresh state, unless stated otherwise.

SUBDIVISION, DISTRIBUTION, RELATIONSHIPS

A subdivision of the genus has never been made. The present study has led me to distinguish two sections, here compared.

1. Plant during anthesis in full foliage. Flowers and fruits in the herbarium pale brownish, greenish, yellowish, greyish, or whitish, only seldom tinged towards orange or violet. Inflorescence not growing through and eventually shed. Stamens (8—)15—50. Fruit when submature (mostly also when ripe) rough with dry flat papillae, globose to elongated. *Crateva nurvala, religiosa, unilocularis, tapia.*
sect. 1. **Crateva**

* Notes have been numbered under the number of each species or infraspecific taxon. For instance, Note 5b. 3 is found as Note 3 under species number 5, *C. adansonii*, ssp. b. *odora*.

1. Plant during anthesis bare, or the leaves at that time very young; rarely in full foliage. Flowers and fruits in the herbarium with a tinge towards orange-brownish, and sometimes also the vegetative parts. Inflorescence sometimes growing through. Stamens 8—25. Fruit throughout smooth and always globose. *Crateva adansonii, excelsa, greveana*, and (as far as known) *obovata* . . . sect. **2. Siccorubra**

The region where the two sections occur together is southeastern Asia, where the greatest number of taxa is found, too (fig. 3, 4). This region coincides with the area of *C. unilocularis*, a species worth of being examined with regard to the differentiation that seems to have developed from this centre. The species is not bare while flowering like *C. adansonii*, it lacks the elongated inflorescences, the narrow leaflets, and the crested seeds of *C. nurvala*. Thus missing those characters of other species which could be hailed to be 'specialized', it seems at the same time the most 'intermediate' species between all others, although its thicker and stalked leaflets and occasionally brownish colour in the dried state make it closer resembling *C. adansonii* than *C. religiosa*. It is also the species closest to *C. tapia* from which its specimens with exceptionally narrow petals, and most of its specimens in fruit, are hard to distinguish. Its ecological claims are neither definitely everwet, nor outspokenly seasonal. All these facts point to a 'central' position of *C. unilocularis* in the genus. If this be true, from it either section may have developed in a different way, sect. *Crateva* seeking the everwet, sect. *Siccorubra* the monsoon conditions.

Being aware that now the threshold of speculation has been crossed, I venture to add a few more hypothetical thoughts, outlined in fig. 5. First, the true rain forest species, *C. nurvala, religiosa*, and *tapia*, can be derived from *C. unilocularis*. *Crateva nurvala* has many specialized characters as compared with *C. unilocularis*, also in its rheophytic adaptations. *Crateva religiosa* possesses in its thin leaf texture an adaptation to higher humidity. *Crateva tapia* has no recognizeable adaptation, but its narrow petals look more 'advanced' than the more leaf-like petals in the Asiatic species.

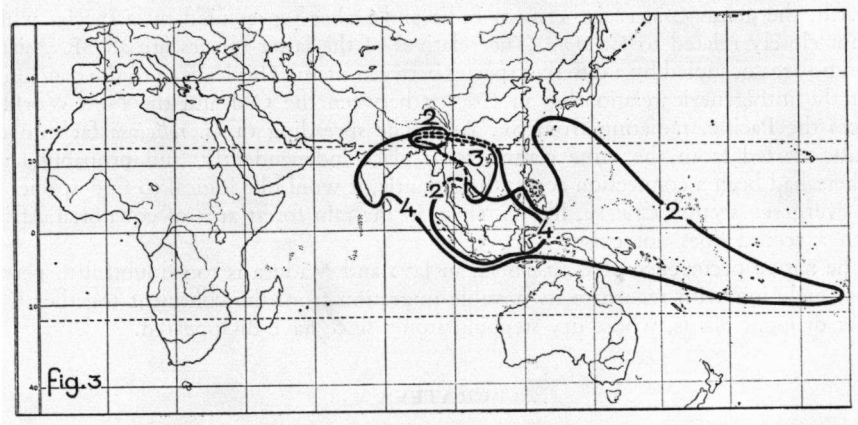
Second, *Crateva*, generally regarded as the genus in the *Capparaceae* with the most *) primitive characters (the family itself conceivable as the tropical counterpart of the *Cruciferae*), seems to have originated under seasonal rather than under everwet conditions. Observations made during a study of the (less 'primitive') genus *Capparis*, strengthened the idea that the family as a whole originated in drier regions and penetrated the rain forests afterwards.

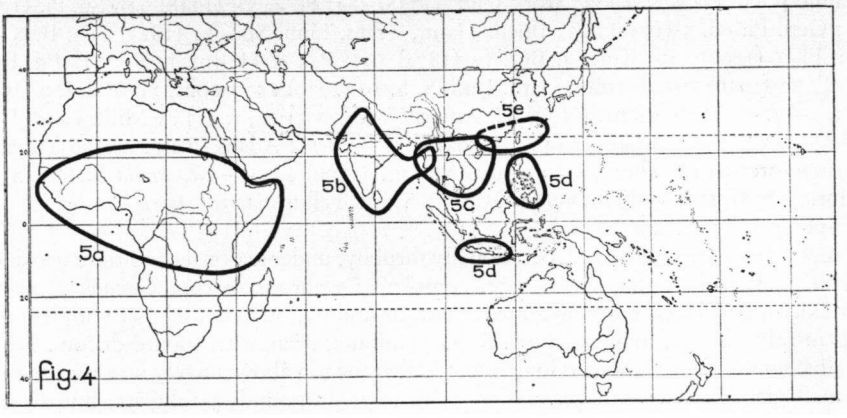
Third, a 'secondary' centre of differentiation is Madagascar, with 3 endemic species of indeed a certain taxonomic standing as it seemed to me, related rather to *C. adansonii* than to any species in sect. *Crateva*. From the centre in southeastern Asia they can only have arrived in Madagascar by way of Gondwanaland. It seems likely that the Asiatic centre of speciation formerly extended into Gondwanaland towards Madagascar. From this centre, *C. adansonii* might have produced its subspecies *adansonii* towards the West and its subspecies *odora* towards the North.

Fourth, the genera closest to *Crateva: Ritchiea, Euadenia, Bachmannia*, and *Cladostemon*, are taxonomically well-separated. They are all African, none of them occurring in Madagascar. The uniformity of the only African *Crateva* seems to rule out the possibility that there has been any centre of speciation on that continent which exerted influence on *Crateva*. If all these genera would have a common origin, this would therefore not have to be sought in Africa, perhaps somewhere in Gondwanaland.

The absence of a reference to DeWolf's remarks on the relationships of *Crateva* (Kew Bulletin 1962: 75—76) is connected with a feeling that a number of theoretical aspects involved have by him been left out of consideration.

* The gynoecium in the *Stixeae* seems to be more 'primitive' than that in *Crateva*.





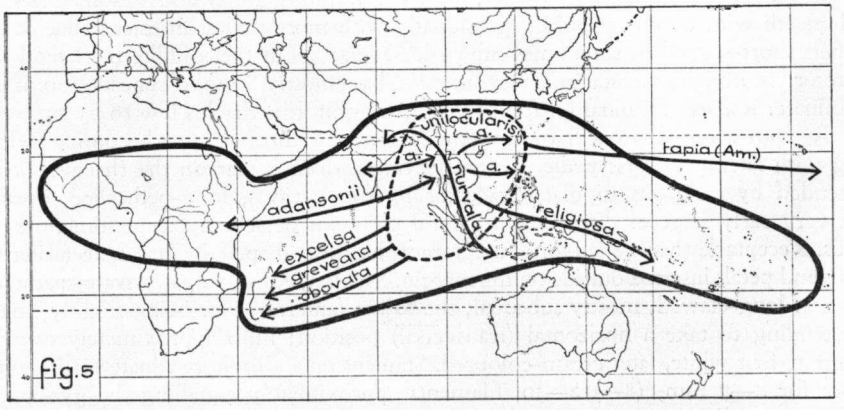


Fig. 3. Area of *Crateva religiosa* (2), *C. unilocularis* (3), and *C. nurvala* (4).

Fig. 4. Area of *Crateva adansonii* with its subspecies *adansonii* (5a), *odora* (5b), *trifoliata* (5c), *axillaris* (5d), and *formosensis* (5e).

Fig. 5. Area of *Crateva* in the Old World, with supposed centre of speciation (— — —).

Fifth, the genus *Crateva* is between India and Dakar represented by a species which is not closely related to *C. tapia*. The relatives of the latter species are all SE. Asiatic, with no area occupied by a different species between them. This leads us to the conclusion that the intrageneric relationship in *Crateva* between the Old and the New World is across the Pacific, radiating from SE. Asia. The spreading of *C. religiosa* far into the Pacific started from the same centre, took place independently, and probably later. If there had been a connection across the Atlantic, it would be logical to find species of the evergreen section *Crateva*, like *C. tapia*, in the rain forest area of equatorial Africa. Such a record does not exist.

The native occurrence of *C. adansonii* in Java and Madura is too doubtful to permit any conclusion with regard to its possible migration from the continent together with other drought plants, whose dry stepping stones since have disappeared.

CRATEVA

Linné [Gen. Pl. (1737) 113; Hort. Cliff. (1738) 484; Fl. Zeyl. (1748) 94], Sp. Pl. (1753) 444; Gen. Pl. ed. 5 (1754) 203; Buch.-Ham., Trans. Linn. Soc. 15 (1827) 116; B. & H., Gen. Pl. 1 (1862) 110; Kurz, J. Bot. 12 (1874) 193; Pax & Hoffm. in E. & P. Pfl. Fam. ed. 2, 17b (1936) 167; Corner, Gard. Bull. S. S. 10 (1939) 15; Jacobs, Fl. Mal. I, 6 (1960) 63, f. 1—4. — *Tapia* Plum. [Nova Pl. Amer. Gen. (1703) 22, t. 21] *ex* Mill., Gard. Dict. Abbr. ed. 3 (1754); Adans., Fam. 2 (1763) 407. — *Belou* Adans., Fam. 2 (1763) 408. — *Othrys* Noronha *ex* Thou., Gen. Nov. Madag. (1806) 13. — *Nevosmila* Rafin., Sylva Tellur. (1838) 107. — *Triclanthera* Rafin., Sylva Tellur. (1838) 108.

Type species: *C. tapia* L.

Trees small to medium-sized, occasionally shrubby, under seasonal conditions deciduous and then often flowering when bare, completely glabrous (except *C. tapia* f. *palmeri* in Mexico). Branchlets terete, with some pith or hollow, often densely set with lenticels; buds mostly distinct, small, globose. Stipules minute, triangular, soon caducous. Petiole straight, sulcate above, about as long as the leaf, at the top above mostly bearing a number of small gland-like appendages. *Leaves* palmately compound, 3-foliolate, initially thin in texture, becoming gradually firmer, mostly dull, rarely glossy above, sometimes pale underneath with minute papillae, occasionally with more or less distinct pellucid dots. Leaflets short-stalked to sometimes subsessile, widest about the middle, the lateral ones more or less obliquely rectangular asymmetric, base mostly acute to cuneate, top mostly acuminate. *Racemes* terminal on fresh twigs, corymbiform, rhachis few to 25 cm, erect, mostly with arrested growth or sometimes growing through and becoming a leafy twig with lateral flowers; pedicels often leaving a distinct scar on the rhachis. *Flowers* subtended by caducous stipulate bracts or by small leaves, long-pedicelled, opening in a very early stage of development; floral parts not persistent except sometimes the sepals. Receptacle (here called torus) actinomorphic, dish-shaped, incurved, nectariferous; sepals and petals inserted outside on the margin. Sepals 4, equal, valvate, ovate-spathulate. Petals 4, long-clawed, mostly subequal, the lower (anterior) pair being slightly smaller and tending to take a horizontal (transversal) position; limb approximately ovate to rhombic, first white, later cream-coloured. Stamens on androphore adnate to the gynophore for 1—7 mm, (8—)12—50, filaments approximately equalling the gynophore, filiform, spreading; anthers subbasifixed, introrse. Gynophore slender, (1¾—)2½—6(—14) cm, in some flowers reduced or shed; ovary 1-locular, placentas 2, the ovules in 4 or more rows; stigma distinct, soon after anthesis obsolete, sometimes on a subpersistent style 1 mm. In fruit the pedicel, torus, and gynophore woody and somewhat thickened.

Fruit a berry 1½—6(—20) cm long, globose to elongated, pericarp soft-leathery, smooth or papillate-scabrid. Seeds *c.* 1 cm, dull brown, densely packed in pulp, horseshoe-shaped, smooth or dorsally crested; cotyledons semicylindric, applicative, radicle shorter, conical.

Distribution. Eight species and 4 subspecies, pantropical although not in Australia and New Caledonia, and not in desert areas. On the northern hemisphere extending to southern Japan, on the southern hemisphere to northern Argentina. In Central and S. America 1 species, in Africa 1, in Madagascar 3, in SE. Asia 4 and 3 subspecies, in Malesia 3 with 1 subspecies, in the Pacific 1 species. Frequently species are also planted within their area.

Ecology. Everwet or periodically dry tropical areas, in the lowlands, with a preference for watercourses, seldom up to 1500 m.

Notes. 1. *Othrys* was published without an epithet or a reference to a specimen, and no sheet thus named was found. It is certainly a *Crateva*, probably *obovata*.

2. According to the Kew Index, *Farquharia* was published by Bojer, Ann. Sci. Nat. ii 20 (1843) 57. This name has never been valid; "*Farquharia excelsa* Hils. & Boj. MS. 1824" was merely mentioned in the synonymy by Bojer under *C. excelsa*, when he described that species, l.c.

3. In Fl. Mal. I, 6 (1960) 66, I referred to a statement by Burkill in connection with occult power ascribed to *Crateva* in India and Polynesia, the name *C. religiosa* pointing to the same. In the meantime, I have tried to obtain information from India, where the indigenous *Cratevas* are also, on a small scale, widely planted, but several correspondents declared not to be aware of religious or occult significance attributed to any species. Thus remain several notes in literature unexplained, where it is stated that *Crateva* is often planted on graveyards and near temples. See also Note 4.2.

4. Parker, Common Indian Trees (1933) 32, pl. 26, said that the seed takes one year to germinate. I could not make out the identity, but think it is *C. adansonii* ssp. *odora*; see there, and also Note 1a.6.

5. Mani, Agra Univ. J. Res., Sci. 8 (1959) 100, described and figured several common galls in leaves, buds, and flowers of *C. "religiosa"* from India. The proper identity is probably either *C. adansonii* ssp. *odora*, or *C. nurvala*.

The wood of Indian species was described by Chowdhury & Ghosh, Indian Woods 1 (1954) 40—41.

6. Masamune, Mem. Fac. Sc. Agr. Taihoku Univ. 11 (1934) 212, recorded *C. "religiosa"* from Yakusima I., 30°15'N 136° E. It is not known to me whether this is *C. religiosa* proper or *C. adansonii*.

7. Phytochemically, the genus might be interesting because of the very bitter taste of the leaves in *C. nurvala*, and of the red-brown tinge in the herbarium of species in the sect. *Siccorubra*.

8. The following aberrations are noted: leaves 4—5-foliolate, Note 3.3; leaves hairy beneath, Note 1b.1; calyx 5-merous, Note 5a.2; more sepals, petals, carpels, Note 5b.4; petaloid sepals, Note 3.3; jointed stamens, Note 3.5; petals wanting, Note 1a.4; anthers partly wanting, Note 1a.2.

KEY TO THE SPECIES AND SUBSPECIES

The following key should not be expected to work in all cases. The more collections are available for comparison, the better. The taxa here distinguished are polymorphic as well as variable, and our knowledge of the vegetative parts is very partial. This key deals with reproductive shoots only.

The subdivision of 5. *C. adansonii* most be considered as tentative, while of 8. *C. obovata* from Madagascar

the fruit is but defectively known. One species, 9. *C. hygrophila* from Lower Burma and Malaya is remarkable for its dark elongated fruits but otherwise insufficiently known; it has been omitted from this key.

1. Petals 1—7 mm wide. Sepals persistent for some time after anthesis. Stigma on a distinct style *c.* 1 mm long which often remains on the fruit. Inflorescence dense, pedicels in flower making an angle of *c.* 45° with the rhachis; many flowers open at the same time. Stamens up to 50, on androphore to 7 mm long. New World . . . . . **1. C. tapia**
1. Petals at least 5 mm wide. Sepals caducous soon after anthesis. Stigma (sub)sessile. Inflorescence lax (as far as the flowers are open), pedicels patent. Stamens up to 30, on androphore to 3 mm long. Old World.
2. Leaflets nearly always (sub)acuminate, 4—30 cm long.
3. Fruit greyish, anyway when dried, mostly roughish with dry flat papillae. Tree in full foliage during anthesis. Flowers not orange-brown in the herbarium.
4. Leaflets very thin, even when mature, mostly (sub)sessile, concolorous or almost so, dull above, nerves 7—11 pairs. Twigs mostly straw-coloured when dried. Fruit subglobose to elongated, (3—) 6—20 by (3—) 5½—9½ cm; seeds sometimes dorsally crested. . . . **2. C. religiosa**
4. Leaflets subcoriaceous when mature, at least 3 mm stalked, the undersurface paler, more or less glossy above. Twigs mostly brownish when dried.
5. Seeds smooth; fruits (as far as known) globose, 2½—4 cm. Leaflets *c.* 2—2½ times as long as wide, slightly paler beneath, nerves 5—10 pairs. Inflorescence: rhachis a few cm, flowers up to 40. . . . . **3. C. unilocularis**
5. Seeds dorsally crested; fruits (as far as known) elongated, to *c.* 5—5½ by 4—4½ cm. Leaflets *c.* 2—4 times as long as wide, distinctly discolorous, nerves distinct, 7—22 pairs. Inflorescence: rhachis to 10—16 cm, flowers up to 100; pedicel scars very distinct . **4. C. nurvala**
3. Fruit red-violet-brownish tinged, anyway when dried, throughout smooth. Tree during anthesis bare or the foliage at that time very young; seldom (in *C. excelsa*) in full foliage. Flowers, especially their basal parts, orange-brown tinged in the herbarium.
6. Inflorescences (at least many of them) growing through after anthesis. Fruiting gynophore 1½—4 mm thick. (Continue for subspecies) . . . . . **5. C. adansonii**
7. Leaflets green-brownish when dried, rarely with a glaucous tinge, tip generally not exceeding 1½ cm.
8. Leaflets acuminate with an acute tip.
9. Leaflets shorter than 10 cm.
10. Twigs long and straight, like the petiole dark-coloured when dried. Leaflets 5½—10 cm long. Flowers with a few ones axillary, or with many on a rhachis to 10 cm long. Western and southern Malesia. . . . . **5d.** ssp. **axillaris**
10. Twigs shorter and less vigorous, like the petiole red-brownish or greyish when dried. Leaflets 4—6¾ cm long. Flowers with *c.* 10—15 neatly arranged on a short rhachis. Africa. . . . . **5a.** ssp. **adansonii**
9. Leaflets longer than 10 cm, gradually acuminate. China, Formosa. **5e.** ssp. **formosensis**
8. Leaflets obtuse to rounded, sometimes subacuminate with a blunt tip, 4¾—8½ cm long, SE. Asia. . . . . **5c.** ssp. **trifoliata**
7. Leaflets greyish green when dried, 7½—11 cm long, abruptly acuminate, tip 1½—2½ cm, acute. India, Burma . . . . . **5b.** ssp. **odora**
6. Inflorescences not growing through after anthesis, and eventually shed.
11. Leaflets 1¾—3½ cm wide. Inflorescences generally terminal, the flowers crowded near the top of leafy twigs. Fruiting gynophore slender, at most 1½ mm thick . . . **6. C. excelsa**
11. Leaflets 1—2 cm wide. Inflorescences generally lateral and practically leafless. Fruiting gynophore 2½—4 mm thick. . . . . **7. C. greveana**
2. Leaflets with rounded top, 4—7 cm long. Inflorescence terminal, not growing through after anthesis, the rhachis vigorous and short, dull purple-violet tinged . . . . . **8. C. obovata**

Sectio 1. **Crateva**

Planta sub anthesi bene foliata. Flores fructusque in sicco nunquam aurantiaco suffusi. Infructescentiae haud excrescentes. Stamina ad 50. Fructus submaturi papillis scabridiusculi, globosi ad elongati.

Species typica: *C. tapia* L.

Plant during anthesis in full foliage. Flowers and fruits in the herbarium pale brownish or greenish or yellowish or greyish or whitish, not tinged towards orange or violet. Inflorescence after anthesis not growing through and eventually shed. Stamens (8—) 15—50. Fruits in the later stages before maturity (mostly also when ripe) rough with dry flat papillae, globose to elongated.

Distribution. Old World: Northeastern and southern India, and further to the East; New World.

Ecology. Everwet regions - often in rain forest - and under slightly seasonal conditions. In the latter case deciduous, but never while in flower.

1. Crateva tapia Linné, Sp. Pl. (1753) 444, as for America only [*C. inermis* L., Hort. Cliff. (1737) 184]; ed. 2, 1 (1762) 637; Vell., Fl. Flum. (1825) 200, idem 5 (1835) t. 3; Griseb., Fl. West Ind. (1864) 17; Eichl. in Mart., Fl. Bras. 13, 1 (1865) 264, t. 59; Fawc. & Rendle, Fl. Jamaica 3 (1914) 235, f. 97; Standley, Cont. U. S. Herb. 23 (1922) 305; Standley & Record, Field Mus. Nat. Hist. Bot. 12 (1936) 146; Went in Pulle, Fl. Surin. 2, 1 (1937) 403; Gómez, Lilloa 26 (1953) 237, f. 12, map 4c. — Type: Plumier, Nova Pl. Amer. Gen. (1703) 22, descr., t. 21, fig. No material extant.

C. gynandra L., Sp. Pl. ed 2, 1 (1762) 636; H. B. K., Nov. Gen. Sp. Pl. 5 (1821) 67; Griseb., Fl. West Ind. (1864) 17; Fawc. & Rendle, Fl. Jamaica 3 (1914) 236. — Type: *J. E. Smith s.n.* (LINN! sh. 619.1) from Jamaica, fl.

Cleome arborea Schrad., Goett. Gel. Anz. (1821) 707; DC., Prod. 1 (1824) 242. — Type: *Prince Maximilian von Neuwied (n. v.)* from Brazil, Paraiba, fl.

C. acuminata DC., Prod. 1 (1824) 243. — Type: *Perrottet s.n.* (G-DC!) from Guyana, fl. 1820.

C. radiatiflora DC., Prod. 1 (1824) 243. — Type: "Capparis radiatiflora fl. per. 5. t. 433 ined. ex Pav. in litt." *(n. v.).*

C. tapioides DC., Prod. 1 (1824) 243. — Type: m. *Balbis* anno 1822 (G-DC!) from Central America, fl.

C. benthamii Eichl. in Mart. Fl. Bras. 13, 1 (1865) 265. — Type: *Spruce s.n.* (K, *n. v.)* from Brazil, unlocated, inscribed "C. tapioides Benth."

C. benthamii var. *leptopetala* Eichl. in Mart. Fl. Bras. 13, 1 (1865) 265. — Type: *Spruce 1791* (K! P!) from Brazil, Barra, fl.

C. bahiana Ule, Bot. Jahrb. 42 (1908) 202. — Type: *Ule 7076* (K! L!) from Brazil, Tamburi, fl. X. 1906.

C. coriacea Herzog, Fedde Rep. 7 (1909) 52. — Type: *Herzog 597* (ZT? *n. v.)* from Paraguay? Mattogrosso, Rio Paraguay near Medanos, fr. III. 1907.

C. apetala Urban, Symb. Antill. 7 (1913) 508. — Type: *Fuertes 1438* (K! U!) from Hispaniola, Barahona, fl. II. 1912.

C. glauca Lundell, Bull. Torrey Club 69 (1942) 389. — *C. tapia* var. *glauca* (Lundell) Standl. & Steyerm., Fieldiana, Bot. 23 (1944) 55. — Type: *Matuda 3863* (MICH, *n. v.)* from Mexico, Campeche, Palizada, 25/28.VII.1939.

1a. forma **tapia.**

Tree *c.* 3—15(—24) m high, trunk 10—15(—60) cm ∅, occasionally shrubby; in full foliage during anthesis. Twigs sometimes comparatively thick, with many long lenticels, green to dull violet-brown when dried. Petiole 4½—14(—18) cm, often with dark-coloured base and top, glands none or small. *Leaflets* thin on the flowering twigs, (sub) coriaceous when older, in various shades of green when dried, mostly dull, more or less concolorous but occasionally glaucous beneath, 4—9 mm stalked, 1.8—2.6(—3.0) times

as long as wide, (5—)7—14(—16) by (3—)4—6(—7) cm, generally rounded in the lower half, top with a short acute acumen, midrib brownish, nerves 4—7 pairs. Sterile shoots largely similar to the fertile ones, but in juvenile specimens the petiole to 18 cm, leaflets 9—12 mm stalked, to 21—23 by 12—14½ cm, nerves 5—7 pairs. *Inflorescences* terminal on leafy twigs to *c.* 30 cm long, mostly separated by a leafless part *c.* 2½ cm, rhachis 4—10 cm, not growing through, bearing (10—)20—60 flowers in the axils of caducous bracts 1—2 mm clawed, the limb 4—5 by 1—1½ mm, rarely the basal flowers in leaf axils; pedicels 2½—4 cm, leaving distinct scars. Torus 4—7 mm diameter, mostly wider than in other species. Sepals persistent, sometimes till the time of fruiting, 5—9 by 3—4 mm. Petals 4—13 mm clawed, limb 6—17 by (1—)2—7 mm, sometimes the upper pair larger than the lower pair, greenish white, turning cream-coloured. Stamens on androphore (1—)2—7 mm, inserted at various heights, pink, (8—)16—43(—50), *c.* 3¼—4½ cm. Gynophore 1¾—6¼ cm; ovary 2—5 by 1½—3 mm, stigma flat, ½—1 mm, mostly distinct on a style 1 mm long. In ♂ flowers the gynoecium is reduced to a few mm in length, or is shed completely. *Fruit* on gynophore 3—4 mm thick (apparently not longer than in flower), globose to ellipsoid, (2?—)6½ by (2?—)6 cm, pericarp 3 mm thick, smooth when young, later scurfy with papillae, a style rest often remaining, yellow-brown (orange; Eichler); seeds in insipid, stinking pulp, *c.* 12 by 12 by 6 mm, smooth (or with slight radiating sculpture; Eichler). Several authors noted the stench of *Allium* of the whole plant.

Distribution (compiled from literature and specimens). NORTH AMERICA. Mexico (according to Standley, S of a line between Sinaloa and Tamaulipas Provinces, i.e. approximately the parallel of 25°N, nearly throughout the lower parts of Mexico; Yucatan) and further southwards over the Isthmus of Panama. CENTRAL AMERICA. Jamaica, Hispaniola, all the Lesser Antilles, Trinidad. SOUTH AMERICA. Colombia (northern, anyway), the Guyanas, Brazil (throughout the country to the frontier of Peru; southwards to the Capricorn), E. Bolivia (Prov. Chiquito, unlocated), Paraguay (Central), N. Argentina (Prov. Formosa, Chaco, and Santa Fé, i.e. along the Paraná at *c.* 58°W 28°S), and, according to Eichler p. 291, also "Peru/Chile."

Ecology. Mostly rain forest, swamp forest, at low altitudes. For flowering seasons, see the local Floras.

Notes. 1a.1. As far as I could trace, *C. gynandra* was not reduced to *C. tapia* until in 1937 by Miss J. Went in the Flora of Suriname; this was followed by subsequent authors. Grisebach and Fawcett & Rendle kept the two species carefully apart, the main point of distinction being the width of the petals, 4—7 mm in *tapia*, 1—2 mm in *gynandra*. This is in agreement with the specimens in Linnaeus's herbarium. In the type of *C. tapia* the petals are even wider. This is, however, a bad specimen, and its origin seems not beyond doubt. In a Bonpland specimen (P), detached flowers are found with the petals 5—7 mm clawed, the limb 19—24 by 14—15 mm. In no specimen from the neotropics I have found not-detached flowers with petals over 7 mm wide.

1a.2. In the bisexual flowers the stamens may be exceeded by the gynoecium. In *Sagot 28* it is noted that the flowers in some racemes are all ♂, in others all ♀; this is not entirely true. He also remarks that in the 'female' flowers part of the stamens shed their anthers. Gomez, l.c., stated that there are 5—10 staminodes, but to me it seems that the lacking of anthers is simply due to damage.

1a.3. The species is homogeneous in several characteristic features (inflorescence, narrow petals, persistent sepals, rounded base of leaflets) but varies enough to have brought about confusion. The leaves at fruiting time are thicker in texture than at

flowering time (*'C. coriacea'*), the lower surface is sometimes glaucous (*'C. glauca'*), the number of stamens and the length of the androphore varies much from plant to plant. The fruit, which sometimes bears a style rest, varies somewhat in size and shape, but the greatest differences are those between its own stages of development.

1a.4. In the type specimen of *C. apetala* there are indeed no petals. The flowers are already old and it seems possible that the petals were present in an earlier stage. The inflorescence rhachis is very short and the flowers are not well developed either, stamens 8—11, filaments 11 mm long, gynophore 6 mm (in the U-duplicate). It is, however, conceivable that the petals are lacking as a consequence of the trend observed in this species to reduce the petals, sometimes the limb being equal in size to the sepals. In some flowers, an occasional petal seems actually missing at that.

1a.5. The inflorescence gives a characteristic impression during anthesis. The pedicels then make an angle of *c.* 45° with the rhachis, whereas in other species they are more patent. Most flowers open simultaneously, contrary to *C. nurvala* and *C. unilocularis*, where a limited number of flowers is open near the top of the steadily lengthening rhachis.

1a.6. Seedlings, 2—10 days old, are known from the Promenade Gardens in Georgetown, Br. Guyana, *For. Dept. 6782* (K! U!), beneath a cultivated parent tree. Germination epigeic, hypocotyle 6—7 cm. Cotyledons opposite, stalked 3—4 mm, the limb fleshy, 17—23 mm long, 4 mm wide when dried, triangular, top blunt; with a small axillary bud. Epicotyledon 17—29 mm, the first two leaves subopposite, central leaflet 37—40 by 14—16 mm, lateral ones 39—44 by 15—17 mm, paler beneath.

1a.7. *Stahel & Gonggrijp 3053* (U) from Suriname is a remarkable collection. Leaves *c.* 6½—9½ cm petioled, 6½—8 by 3—3½ cm, olive-green glossy above, dull green beneath. Fruits green when fresh, but apparently ripe, on gynophore 26—31 mm, 1 mm thick, globose, 16—17 mm diameter, pericarp thin-coriaceous, smooth; seeds 7 by 7 by 3 mm. For the glossy leaves and the fruit it falls out of the variability of *C. tapia*; it might approach Eichler's *C. benthamii*, but I must see fruiting material studied by that author, before a conclusion can be made.

1b. forma **palmeri** (Rose) Jacobs, *stat. nov.* — *C. palmeri* Rose, Cont. U. S. Herb. 1 (1895) 301; Standley, Cont. U. S. Herb. 23 (1922) 305; Standl. & Steyerm., Fieldiana, Bot. 24, 4 (1946) 391. — Type: *Palmer 1285* (US, *holo, n.v.*; K! U!) from Mexico, Armeria, fl. 15.II.1891.

Leaves beneath fairly densely set with small single or irregularly branched or grouped hair-like appendages.

Distribution. NORTH AMERICA. Mexico (Sinaloa and Durango to Guerro — Standley).

Notes. 1b.1. The hairs, macroscopical in size, insoluble in chloroform and hence not waxy, are unique in the genus. I have not seen another specimen but the type, but since Standley defines a distributional area of *C. palmeri* he must have seen more specimens.

2. Crateva religiosa Forst. *f.*, Pl. Escul. Ins. Oc. Austral. (1786) 45; Fl. Ins. Austral. Prod. (1786) 35; Drake del Cast., Fl. Polyn. Fr. (1893) 6; Jacobs, Fl. Mal. I, 6 (1960) 65, f. 2a; Pacif. Pl. Areas 1 (1963) map 24; not, or partly, of authors on Asia, not of authors on Africa. — Type: *Forster s.n.* (K!) from Pacific, Society Is, fl.

C. magna (Lour.) DC., Prod. 1 (1824) 243, as currently interpreted; see under Doubtful Species.

C. membranifolia Miq., Sum. (1861) 387, 158. — Type: *Teijsmann 461 HB* (U! *holo*; BO!) from Sumatra, West Coast, Saruma Tinggi, fl.

C. brownii Korth. *ex* Miq., Illustr. (1870) 21. — Type: *Korthals s.n.* (L! sh. 899.54.241) from Borneo, Banjarmasin, fr.

C. macrocarpa Kurz, J. Bot. 12 (1874) 195, t. 148 f. 8—10; Gagn., Fl. Gén. I.-C. 1 (1908) 180; Corner, Gard. Bull. S. S. 10 (1939) 16 ("*Crateva* B"). — Type: *Maingay 125* (CAL! *holo*; K!) from Malaya, fl., fr.

C. hansemannii K. Sch., Bot. Jahrb. 9 (1888) 201. — Type: *Hollrung s.n.* (probably lost in B) from New Guinea, fr. only.

C. speciosa Volkens, Bot. Jahrb. 31 (1901) 463. — Type: *Volkens 100* (BO! SING!) from Pacific, Carolines, Yap, fl. XI.1899/VI.1900.

C. nurvala (*non* Buch.-Ham.) Kanj. & Das, Fl. Assam 1 (1934) 74.

Tree (1—)5—15(—30) m, in foliage during anthesis. Twigs comparatively thick, pithy, mostly light greenish or yellow-green when dried, with many large lenticels; branchlets mostly hollow. Petiole (3½—)6½—10 cm, glands minute triangular, or wanting. *Leaflets* mostly subsessile, sometimes stalked to 5(—13) mm, thin-herbaceous and often broken in the herbarium, dull green and very concolorous when dried, variable in size on the same tree, 5½—16 by 2½—7 cm, top rather abruptly acuminate, the tip acute, short, rarely up to 2½ cm, nerves 7—11 pairs, thin. On sterile twigs, the petiole up to 22 cm, the leaflets to 27 by 10½ cm. *Flowers* with few to *c.* 25 towards the end of leafy twigs which do not grow through, just above the axils of smaller leaves, or subtended by a bract 10—15 mm long; pedicels 2—9 cm, the rachis a few cm long, left without distinct scars. Torus 4—7 mm wide. Sepals 4—10 by 1½—3 mm. Petals 5—20 mm stalked, limb 2—3(—4½) by 1—2(—3) cm in the upper pair, 1½—3 by 1—1½ cm in the lower pair, reported white turning creamy, sometimes orangish. Stamens on androphore 1—4 mm, (10—)13—18(—30), dark red or violet, to 11½ cm long with anthers up to 6 by 1½ mm. Gynophore 4—7 cm (often longer in fruit); ovary subcylindrical to ovoid, 4—6 by 1½—2½ mm, stigma subsessile above a slight constriction, flat, 1½ mm diameter. In the ♂ flowers the gynoecium (always?) remains abortive and is then shed. *Fruit* on gynophore 5½—14 cm, 3—5 mm thick all over, or gradually thickened to 10 mm just under the fruit; mostly elongated to subglobose, (3—)6—20 by (3—)5½—9½ cm, pericarp at maturity probably not thicker than 1—1½ mm, greenish or whitish, smooth when young but soon covered with flat, pale, dry papillae which sometimes give the impression of a thin, dull, yellowish grey crust; seeds in cream-coloured pulp, *c.* 10—19 by 5—17 by 4—8 mm, dorsally with a keel rather narrow and sparsely tuberculate to very wide and more or less densely tuberculate.

INDIA. Sikkim: 1000 ped. *Hooker f.*, fl. fr. (*"C. roxburghii"*). — Bhutan: *Gamble 10302.* — E. Himalaya: *Biswas 4779.* Locality uncertain: *Gamble 629A, 3909A.* — Assam: N. Cachar hills: *Kanjilal 5687.*

BURMA. Upper Burma: 24° 25′ N *c.* 97° E: *Forrest 13692.* — Amherst: *Falconer 10.* — Mergui: several.

SIAM. Central: *Marcan 507, 1635*; *Put 3655.* — SE.: several. — SW.: *Ladell 271.* — Peninsular; Chumpawn, *Kerr 11629.*

INDO-CHINA. Annam; Hue, *Harmand hb. Pierre 1913.* — Cochin-China: several.

SUMATRA. East Coast: Asahan, *Yates 963, 1376.* — West-Coast: *Korthals*, fl.; *Teijsmann HB 461, 2482.* — Indragiri uplands: *Buwalda 6972.* — Lampongs: *Den Hoed*, fr. II. 1927.

MALAYA. many, all provinces.

JAVA, West. Bantam: *Van Steenis 12571.* — Priangan: Tasikmalaya, *Kostermans KKSS 347A.*

LESSER SUNDA ISLANDS. Tanimbar Is: Otimmer, *Buwalda 169 = bb. 24388*; Jamdena, *Pleyte exp. Tanimbar 75.*

BORNEO. All provinces: several each.

PHILIPPINES. Palawan: *Cenabre c.s. FB 27861.* — Sulu Arch., Tawitawi: *Ramos & Edaño BS 44294.*

CELEBES. Northern arm: *Kjellberg 828*; *bb. 21753.* — Kabaena I.: *Elbert 3330.* — Muna I.: *bb. 4993.*

MOLUCCAS. Talaud: *Fairchild 417*; *Lam 3081.* — E. Ceram: *Rutten 2164.* — Ambon: several. — Kai Is.: *Jaheri 239* (or *131*?).

NEW GUINEA: many, all provinces.

MICRONESIA. Marianas: *Gaudichaud 56*; *Kanehira 1106*. — Carolines: many.
MELANESIA. Solomons: many.
POLYNESIA. Fiji, Laukota: *Greenwood 413*. — Samoa, Upolu: *Rechinger 262, 835*. Ulawa: *Brass 2984*. — Society Is: *Forster f.*, fl. Tahiti: several. — Tuamotu Is, Gambier: *Beechey*, fl.

Ecology. Evergreen forest on river banks, flooded plains, and swamp edges, rarely in dryland forest or jungle, rarely coastal. Lowlands, sometimes up to 700 m. Fertility irregular. Fruits floating.

Notes. 2.1. The only record from Upper Burma, *Forrest 13692*, is a bad specimen. The leaflets are somewhat discolorous and suggestive of *C. unilocularis*, but subsessile and thin, and the twig bears long lenticels, suggestive of *C. religiosa*.

2.2. In the material from the Carolines, '*C. speciosa*', the sepals are unusually wide (7—10 by 5—7 mm) and subpersistent, a feature they have in common with *C. tapia*. The petals in the herbarium have a creamy or pale brown-yellow colour, as though they are yellow when fresh, and so they were indeed reported by *Takamatsu 1854*.

2.3. In the western parts of the area the fruits tend to be globose and smaller, in the eastern parts they are generally larger and elongated.

Some other particulars are given in the Flora Malesiana revision.

3. Crateva unilocularis Buch.-Ham., Trans. Linn. Soc. 15 (1827) 121. — Type (?): *Hamilton hb. Wallich 6973G* (K!) from India, Assam, fl. 30-3-1808; see Note 3.1.

C. religiosa (non Forst. *f.)* Merr., Lingn. Sc. J. 5 (1927) 83.

"*C. roxburghii* R. Br." Kanj. & Das, Fl. Assam 1 (1934) 73.

Tree 5—12 (to 30; Kanj. & Das) m tall, in full foliage during anthesis; branchlets grey-brownish. Petiole (3¾—)5½—12 cm, with distinct glands. *Leaflets* 4—12 mm stalked, thin-coriaceous, brown-greenish when dried, faintly glossy above, slightly paler and dull underneath, the lateral ones asymmetric; *c.* 2—2½ times as long as wide, (5—)7—14 by (2½—)3—7 cm, with a short acute acumen, midrib reddish, nerves 5—10 pairs, reticulation distinct. *Inflorescence* terminal on leafy twigs to *c.* 12 cm, not growing through after anthesis, rhachis *c.* 3—6 cm (the flowering and leafy part not much overlapping), bearing *c.* 10—40 flowers; pedicels 3½—7 cm, sometimes leaving a very distinct scar after anthesis. Torus 3—5 mm wide. Sepals 7—12 by 2½—3 mm. Petals 7—18 mm clawed, the limb 12—25 by (3—)7—20 mm. Stamens 15—22; androphore *c.* ½ mm. Gynophore 3½—6½ cm; ovary 3—4 by 1—2 mm, stigma subsessile 1 mm wide; in the ♂ flowers the gynoecium reduced. *Fruit* on gynophore 4—7 mm thick, globose, 2½—4 cm diameter, pericarp *c.* 2 mm thick, rough with minute flat papillae, dull greyish brown when dried; pulp orange; seeds smooth, 8—12 by 4—10 by 3—6 mm, dull brown.

INDIA. Nepal: near Pokhara, *Stainton, Sykes & Williams*, fl. 4 1954. — Sikkim: Darjeeling Terai, *Gamble 1046A*; Pankabari (cultivated?), *Lacaita 26* (or *15465*). — Bengal: Kurseong Div., Sukna, *Chatterjee 49K*; Jalpaiguri Distr. 26° 30′ N 88° 50′ E, *Parker 3197*. — Assam: several. — Silhet: *hb. Wallich 6973C*. — Chittagong: *Gamble 6818A, 7967*; *hb. Wallich 6973D*.
BURMA. Pymmana: *Gamble*, fl 2; yfr. 4 - 1913. — Upper B.: 24° N, *Forrest 12195, 13623*; Myitkyina Distr., *E. M. Buchanan 43*. — SE. B.: Dawna Range, Thaton, *Lace 4594*.
CHINA (northern limit uncertain due to difficulties in location). Yunnan: several. — Fukien: Dingloh and vic., *Metcalf 2071*. — Kwangtung, incl. Hong Kong: several.
HAINAN: several.
INDO-CHINA. Tonkin: near Hanoi, *Pételot 5681*; western T., *Bon 5330*. — Annam: northern A., Vinh Prov., *Donnat hb. Chevalier 38126*; southern A., Dalat, *Squires 854*. — Cambodia: *Bejaud 401*; *Duquesnoy 1*; *Pierre 793*. — Isle of Lincon (*n.v.*): *Balansa 4077*.

Ecology. Mixed dry plains forest, waste places, lower hill forest, to 1500 m. Flowers March-April, fruits July-August (according to Kanjilal & Das, November-January).

Notes. 3.1. The supposed type specimen bears the inscription "?Crataeva unilocularis Hb Ham. e Rungpur". Rangpur is in Assam West of Shillong; under his description, Hamilton cited "Camrupa" as the locality. If this means Kamrup, it is a different district of Assam, N of Shillong. As no specimen from such a locality and collected before 1827 was found by me, the cited one is, for the time being, regarded as the type.

3.2. The vegetative shoots are not sufficiently known. In *Donnat hb. Chevalier 38126* from northern Annam the petiole is 12 cm, the leaflets 9 mm stalked, 16—21 by 8½—9 cm, 9—10-nerved on both sides, but its identity is not quite certain; it might belong to *C. religiosa.*

3.3. In *Chatterjee 49K* from Assam, Kurseong Div., the petals are 3—5 mm wide. This is exceptional in Old World material.

Parker 3197 adds "leaflets sometimes 4- or 5-digitate."

In *Tsang 29786* the sepals are like the petals, but smaller. This occurs in a few more cases.

3.4. This species is so near *C. nurvala* that for a time I considered to place it there as a variety; it is also near *C. religiosa* but the leaflets are longer stalked, firmer in texture, and not quite concolorous, the fruit globose, the inflorescence richer.

3.5. In *Bodinier 988*, cultivated at Hong Kong, some flowers are aberrant. The stamens seem to be jointed with short outgrowths of the receptacle; the filament is detachable at a sort of collar, so that the base of the latter remains. In most flowers, only part of the stamens are like that. I could not find a trace of insect eggs or larvae.

3.6. *Levine 1779* from Canton shows some characters suggestive of *C. adansonii* ssp. *axillaris*, namely the dark twigs with brownish leaflets, still young at blossom time.

4. Crateva nurvala Buch.-Ham., Trans. Linn. Soc. 15 (1827) 121; Kurz, J. Bot. 12 (1874) 195; Koord. & Valet., Bijdr. 4 (1896) 266; Koord., Atlas (1918) t. 795 *("C. narvala")*; Jacobs, Fl. Mal. I, 6 (1960) 68, f. 1, 2c, 4 *(C. nurvala* var. *nurvala)*. — *C. religiosa* var. *nurvala* (Buch.-Ham.) Hook. *f.* & Th. *in* Hook. *f.*, Fl. Br. Ind. 1 (1872) 172, and subsequent Indian Floras. — Type: *Hamilton hb. Wallich 6973 A 1* (K!) from India, Korajiwori, fl. 11-8-1809.

Nurvala Rheede, Hort. Malab. 3 (1682) 49, t. 42.

C. lophosperma Kurz, J. Bot. 12 (1874) 195, t. 147 f. 4—6; Merr., Lingn. Sc. J. 5 (1927) 83; Kanj. & Das, Fl. Assam 1 (1934) 74; Corner, Gard. Bull. S. S. 10 (1939) 16 (*Crateva* "A"). — Type: *Gustav Mann* (probably lost) from India, Assam, Kamroop, banks of the Koolsee River, fr. VII. — **Fig. 2.**

Tree, 4—20 m, to 40 cm ∅, (rarely a shrub 3½ m), during anthesis in full foliage. Branchlets greyish brown when dried. Petiole 3½—11(—14) cm, vigorous, with a distinct knob consisting of glands to *c.* 1 mm. *Leaflets* on both the fertile and the sterile shoots chartaceous to thinly coriaceous, 3—6(—10) mm stalked, rarely subsessile, *c.* 2.2—4.4 (—4.9) times as long as wide, 8¾—17½(—28) by 1½—6½(—7½) cm, top gradually acuminate with an acute tip; midrib reddish tinged, nerves (7—)10—15(—22) pairs, distinct, prominent beneath, especially near their insertion; surface above glossy brown-greenish, underneath dull glaucous-greyish. *Inflorescence* terminal on leafy twigs to *c.* 12 cm, rhachis growing through for a time while producing flowers to *c.* 100, eventually (3—)10—25 cm long, covered with distinct scars left by the pedicels 4—7 cm long. Torus 3—5 mm diameter. Sepals 2—3½ by 1¼—1½ cm. Petals 5—12 mm clawed, limb (8—)15—30 by (5—)15—22 mm. Stamens on androphore 1—2 mm, 15—25. Gynophore 3½—6½(—10) cm; ovary ellipsoid to cylindric, *c.* 5—6 by 2½ mm, stigma flat sessile, more or less distinct. In the ♂ flowers the gynoecium is shed. *Fruit* on gynophore 3—5 mm

thick, ellipsoid, rarely (ob)ovoid or globose, 4¾—6¼ by 4—5¼ cm, pericarp 4—5 mm thick (perhaps less when fully ripe) covered with a thin, dull, yellow-greyish crust breaking into minute particles which seem to peel off sooner or later, leaving the surface smoothish; seeds 6—15 by 6—11 by 2—3 mm, dull dark brown, dorsally with a crest of sharp irregular protrusions.

INDIA. Deccan Peninsula: mainly in Eastern and Western Ghats, several. — Gangetic Plain: Gorakhpur 26° 45′ N 83° 23′ E., *Kanjilal 73*; *Osmaston 3082*. — Bihar: *Haines 3721*; *Mukerjee 339* — Bengal: several. — Assam (all provinces): many.

BURMA. Upper B.: many. — Shan States: several. — Lower B.: several. — Tenasserim: many.

CHINA. Yunnan: Manpan 22° 97′ E., *Henry 10597A*. — Kwangsi: Tai Ching Shan, *Ko 55296*.

HAINAN: many.

INDO-CHINA. Tonkin: several. — Laos: several. — Annam: many. — Cambodia: many. — Cochin-China: several.

SIAM. North S.: several. — Northeast S.: Loei, Wang Saphung, several. — South-east S.: Chantabun, *Lakshnakara 566*; *Vesterdal 40*. — Central S.: several. — Southwest S.: Pran, *Ladell 226*; *Marcan 2605*; Kanburi, *Bunnak 809* = *RFD 23911*. — Peninsular S.: many.

SUMATRA. *Korthals s.n.* — East Coast: Priaman, *Diepenhorst 2482 HB*; Serdang, *Lörzing 11699*. — Palembang Res.: Rupit, *Forbes 3013*. — Isle of We: *Koorders 10576*.

MALAYA. Kinta River: *King's coll. 818*. — Perak: *Hose 34*; *Wray 3602*. — Kelantan: *Haniff & Nur SF 10194*; *Henderson SF 19624*, *SF 29613*. — Trengganu: *Holttum SF 15226*. — Pahang: several. — Malacca?: *Alvins s.n.*, fl.

JAVA. West: many. — Central: several. — East: Surabaja, *Dorgelo 1698*; Kediri Res., Prigi, *Backer 11832*; *Teijsmann s.n.*

BORNEO, all provinces: several each.

Ecology. Forests, often along streams, edges of swamps, sometimes beyond the seashore, rarely on ridges; in everwet and not too dry seasonal climates, up to *c.* 1000 m. Fertility irregular.

Notes 4.1. There is but one specimen labelled Sikkim; it was collected by *Hooker* at 10,000 feet. Both the locality and the altitude seem out of the range of this species, so a mistake with the labels is suspected.

4.2. Dr P. S. Ashton told me that the nearly ripe fruit reeks of asparagus. During the drying process the fruit breaks open irregularly, producing an unbearable stench of cadavers. It seems not unlikely that there is a connection between this property and the habit of planting *Cratevas* on graveyards and near temples.

4.3. In the majority of the material from the mainland, the inflorescence rhachis is not so long and strong as in most of the plants from Malesia. The leaflets are generally narrower in Malesia than in Asia, especially in the plants from streambeds. The difference between the two leaf surfaces, the many nerves, and the crested seeds, however, are constant characters.

4.4. *Lörzing 11699* from NE. Sumatra is remarkable for its variability, supposed that all the material is from one plant. In the Bogor duplicate there are two branches, one being typically *C. nurvala*, the other different and matching the Leyden duplicate. Herein the twigs are yellow-brown, straight, angular, with long internodes, a short, slender raceme with few flowers. The leaflets are 6—7-nerved on either side, dark greenish, and almost concolorous. Lörzing also noticed that a plant which grew in a streambed, produced fresh sprouts from its damaged roots, and that the flowers have an unpleasant odour.

4.5. The only living plant examined by myself was the one cultivated in the Bogor Gardens, under number IV F 76 (fig. 2). It was over 113 years old (cf. Douglas & Baas Becking, Bull. Bot. Gard. Buit. III, 17: 286. 1947). Height 20 m, bole 7 by 0.40 m, crown hollow, wood brittle. Twigs initially green, with many lenticels and small, glossy buds.

Petioles and basal part of the midrib red-tinged. The glands are especially distinct in young leaves. The inflorescence had *c.* 90 flowers and was *c.* 12 cm wide; bracts caducous, 5—6 by 1—1½ mm, with 2 longer persistent minute stipules at the base. The flowers open already in a very young stage, all parts being still green. First the filaments stretch and the anthers become purple-tinged. Soon the gynophore grows out, the flower becoming more zygomorphic, and the petals assume a whitish colour. In some flowers the gynoecium is then shed. The filaments turn purple when they have reached their full length of 5½—6 cm, the anthers open introrsely, elliptic, 2½ by 1½ mm, with orange pollen. Hereafter the petals turn cream-coloured, and fall off like the stamens, leaving distinct scars on the green torus. The flowers are odourless. The ovary has two distinct nerves, a flat stigma dark purple, above a slight constriction, no septum but two intruded placentas bearing many ovules. Fruits were never produced by this tree. It flowered in October 1955 and December 1957.

Sectio 2. **Siccorubra** Jacobs, *sect. nova*

Planta sub anthesi efoliata vel foliis valde juvenilibus tantum praedita. Flores fructusque in sicco aurantiaco-suffusi vel violacei. Inflorescentiae post anthesin intercalares, i.e. interdum apice excrescentes. Stamina ad 25. Fructus semper laeves atque globosi.

Species typica: *C. adansonii* DC.

Plant during anthesis bare, or the foliage at that time very young; rarely in full foliage. Flowers and fruits, and to a lesser degree mostly the twigs and the leaves, in the herbarium with a tinge towards orange-brownish or dull violet. Inflorescence after anthesis sometimes growing through. Stamens 8—25. Fruit throughout smooth and globose.

Distribution. Old World: Africa, Madagascar, India, eastwards to the Ryukyu Is, Formosa, the Philippines, and Sumbawa.

Ecology. Drier regions, not in rain forest.

5. Crateva adansonii DC., Prod. 1 (1824) 243. — *C. laeta* DC. 1824 (ssp. a). — *C. roxburghii* R. Br. 1826 (ssp. uncertain; see Doubtful Species). — *C. odora* Buch.-Ham. 1827 (ssp. b). — *C. guineensis* Schum. & Thonn. 1827 (ssp. a). — *Capparis trifoliata* Roxb. 1832 (ssp. b). — *C. axillaris* Presl 1835 (ssp. d). — *C. tumulorum* Miq. 1870 (ssp. d). — *C. religiosa* var. *roxburghii* (R. Br.) Hook. *f.* & Th. 1872 (ssp. uncertain; see under Doubtful Species). — *C. religiosa* var. *brevistipitata* De Wildem. 1902 (ssp. a). — *C. erythrocarpa* Gagn. 1908 (ssp. c). — *C. roxburghii* var. *erythrocarpa* (Gagn.) Gagn. 1939 (ssp. c). — *C. odora* f. *axillaris* (Presl) Jacobs 1960 (ssp. d).

Low tree or shrub, deciduous about flowering time. Plant in the dried state generally with a red-brownish tinge; flushes seldom exceeding a length of *c.* 10 cm. *Leaflets* distinctly stalked, small to medium-sized, mostly acuminate, generally dull. *Inflorescence* mostly growing through, rhachis short, with *c.* 10—20(—30) flowers; stamens 8—25. Gynophore in fruit *c.* 1¾—4 mm thick. Gynoecium in the ♂ flowers reduced. *Fruit* globose, *c.* 1½—4(—6) cm diameter, smooth, red-brown-violet tinged anyway in the herbarium; seeds smooth, dull mahogany-brown, comparatively small.

Distribution. Africa, Asia, and Malesia (E of the Indus to the Ryukyu Is, Formosa, the Philippines, and Sumbawa). Details under the subspecies. — **Fig. 4.**

Ecology. Forest edges, savannahs, shrubbery in regions with approximately 1—1½ m rainfall. Frequently planted on a small scale within the area.

The leaflets (all on reproductive shoots) in the various subspecies are compared below.

a. Leaflets *c.* 4—6¾ by 1½—3 cm, tip ½—1½ cm, acute. Africa. . . . . ssp. **adansonii**
b. Leaflets *c.* 7½—11 by 4—7 cm, greyish green when dried, abruptly acuminate, tip 1½—2½ cm, acute. India, Burma.. . . . . ssp. **odora**
c. Leaflets *c.* 4¾—8½ by 2¾—5½ cm, obtuse to rounded, sometimes subacuminate with a blunt tip. Southeast Asia. . . . . ssp. **trifoliata**
d. Leaflets *c.* 5½—10 by 2½—5 cm, fairly abruptly acuminate, tip 1—1½ cm, acute. Twigs and petiole very dark-coloured when dried. Malesia.. . . . . ssp. **axillaris**
e. Leaflets *c.* 10—11½ by 4—5 cm, gradually acuminate, tip acute. China, Formosa. ssp. **formosensis**

5a. ssp. **adansonii** — *C. adansonii* DC., Prod. 1 (1824) 243; R. Br. in Denh. & Clapp., Narr. Trav. Disc. Afr., App. (1826) 223; Deless., Ic. Pl. 3 (1837) t. 7. — Type: *hb. Adanson 62A* (P-JU, cat. 11286!) from Senegal, fl.

C. laeta DC., Prod. 1 (1824) 243. — Type: *Gay s.n.* (G-DC!) from Senegal, fl. 1821.

C. guineensis Schum. & Thonn. in Schum., Beskr. Guin. Pl. (1827) 240; reprint 2 (1829) 14. — Type: lost (see Note 5a.1).

C. religiosa (non Forst. *f.)* Oliv., Fl. Trop. Afr. 1 (1868) 99, and subsequent African Floras.

C. religiosa var. *brevistipitata* De Wildem., Ann. Mus. Congo, Bot. 4 (1902) 35, t. 15 (see Note 5a.2). — Type: *Verdick 94* (BR, *n.v.*) from Lukafu, fl. August 1899.

Tree or shrub, *c.* 5—9 m. *Leaves* appearing just before, or just after anthesis. Petiole 2½—6½ cm, glands (always?) wanting. Leaflets 3—7 mm stalked, firmly herbaceous, concolorous to slightly discolorous when dried, the lateral ones asymmetric, widest about the middle, *c.* 4—6¾ by 1½—3 cm, top contracted into a slender acute acumen, ½—1½ cm long, nerves 4—5 pairs. In vegetative shoots the petiole to 10 cm, leaflets to 8 mm stalked, up to 11—12 by 3—5 cm, nerves 7 pairs. *Inflorescence* axis a few cm long, bearing up to 10—15 flowers of which the lower ones are mostly subtended by more or less reduced leaves; pedicels 2—3(—5) cm. Torus 4—6 cm diameter. Sepals 3—9 by 1½—3 mm. Petals white, sometimes lilac-tipped, claw 4—5 mm, limb 10—17 by 5—10 mm. Stamens *c.* 16—20, purplish. Gynophore 2¼—5¼ cm; ovary 2 by 1½ mm, stigma knob-shaped, ½ mm long and wide. In the ♂ flowers the gynoecium reduced. *Fruit* to 4—5(—6) cm diameter, yellow or red; seeds *c.* 8—9 by 7 by 6 mm.

Distribution (compiled from specimens and literature). AFRICA: tropical, from West to East (S of a line from the Senegal River, via Kankan at 10°22′N 9°11′W, and the northern frontier of Nigeria along the 13th parallel, through the Sudan and Ethiopia to Eritrea; N of a line that approximately coincides with the southern frontier of Congo, via Lukufu at 10°28′S 27°32′E and Mporokoso at 9°30′S 30°05′E, eastwards to Tanganyika).

Ecology. Drier areas, riverine forest, forest edges, sometimes on periodically inundated land, or on termitaries, savannahs, up to 1400 m. Flowers December—May.

Uses. Hardly important; see Dalziel, Useful Pl. W. Trop. Afr. (1955) 21.

Notes. 5a.1. According to Junghans, Bot. Tidsskr. 57 (1961) 328, the type of *C. guineensis* got probably lost in a bombardment of Copenhagen by the English in 1807. The description is sufficient to exclude doubts of the identity.

5a.2. De Wildeman gives a fine plate of his *C. religiosa* var. *brevistipitata*; the name refers to the reduced gynoecium. More peculiar is the sometimes 5-merous calyx, which I regard as a mere aberration.

5a.3. Wild's statement, Fl. Zambes. 1 (1960) 242, that the petals are often much reduced or absent in female flowers, sounds strange to me. An occasional reduction of petals occurs indeed in several species, but I do not remember to have seen any female flowers.

5b. ssp. **odora** (Buch.-Ham.) Jacobs, *stat. nov.* — *C. odora* Buch.-Ham., Trans. Linn. Soc. 15 (1827) 118. — Type: *Hamilton, hb. Wallich 6972B* (K! E?) from India, Dhorhora (in Bihar?), fl. 12-4-1812.

C. roxburghii R. Br. in Denh. & Clapp., Narr. Trav. Disc. Afr., App. (1826) 224, as interpreted by W. & A., Prod. (1834) 23; Wight in Hook., Ic. Pl. 2 (1837) t. 137; see p. xxx.

C. religiosa var. *roxburghii* (R. Br.) Hook. *f.* & Th. in Hook. *f.* Fl. Br. Ind. 1 (1872) 172, and subsequent Indian Floras; based on the former.

C. religiosa (non Forst. *f.)* Kanj., For. Fl. Siwalik & Jaunsar (1911) 45.

C. "roxburghiana" Worth., Ceylon Trees (1959) 16, phot.

C. nurvala (non Buch.-Ham.) Blatter, J. Bomb. Nat. Hist. Soc. 35 (1931) 293, pl. 14, 15; McCann, Trees of India (no date) 45, plate.

Small tree *c.* 6—10 m. Petiole 7—9(—10½) cm, with small glands above at the top. *Leaflets* firmly herbaceous, *c.* 5(—10) mm stalked, *c.* 1.6—2.0 times as long as wide, widest about the middle, the lateral ones asymmetric, *c.* 7½—11 by 4—6(—7) cm, base and top abruptly narrowed, top 1½—2½ cm acuminate, the tip acute; nerves 4—5 pairs; surfaces when dried dull greyish green, slightly or hardly discolorous. On vegetative shoots the petiole 10—15 cm, leaflets to 10 mm stalked, 10½—14 by 6—7½ cm, 5—6 nerved. Rhachis of the *inflorescence* sometimes soon growing through and then producing a few axillary flowers; sometimes growing through later, in that case, *c.* 2½—7 cm long and producing up to 12—20 flowers; pedicels 3—5(—7) cm. Torus 5—6 mm wide. Sepals elliptic, 4—5(—11) by 2—3(—4½) mm, often orangish in the dried state. Petals initially green, later white-yellowish or pale pink, 3—7 mm clawed, elliptic, blade 12—18(—25) by 8—15 mm. Stamens 15—26, initially white, later lilac or purplish. Gynophore 2¾—5 cm, lilac; ovary ellipsoid, 2½—3 by 2 mm, stigma small, knob-shaped. *Fruit* globose, on a stipe to 3½ mm thick, 2½—3½ cm ∅.

INDIA. Gujarat: *Santapau 15239, 15240.* — Punjab: Delhi, *O. E. White 400*; Saharanpur, *Buysman*, fr. 1889; *Kanjilal 977, 978*; *Jacquemont*, fr.; Dehra Dun, *Bukhari*, fl. 4-1929; *Bahadur 2818.* — Upper Gangetic Plain: Bahraich 27° 35′ N 81° 36′ E, *Harsukh 21392.* — Orissa: Delta of the Cuttack River, *Mooney 3398.* — South of the line between the above stations: many. Cultivated in Jammu town 32° 43′ N 74° 54′ E, *Keshavanand 1.*

CEYLON. *Thwaites 1067*; *Worthington 525, 667.*

BURMA. (see Note 5b. 3). Upper B. Meiktila Distr.: 20° 53′ E 95° 54′ E, *Rogers 546.* — Shan States: *Abdul Huk 83.* — Lower B.: Tharrawaddy Distr., *Smales 36, 37*; Bassein, *Lace 3002.*

Ecology. Wild and cultivated in strongly seasonal climates, light-loving. Grows in loose deep alluvial soil near streams, also on deep boulder formations where water is at some depth; to *c.* 600 m alt. Bare in the cold season. Flowers beginning in March, full in April—May, the whole tree then in blossom, bearing but a few leaves; fruits mostly July—August. Swarms of various honey-bees are attracted by the nectar in the flowers. Germination takes at least 9 months. Rootsuckers are produced freely.

Vernacular. Barna, and derived forms.

Uses. Blatter gives a fine coloured plate, many first-hand observations, and several medicinal applications.

Notes. 5b.1. Presumably owing to the wetter climate in Assam and Bengal, these provinces seem to form an empty pocket in the area of this species.

5b.2. On Wallich's sheet 6972A there are two branchlets marked "B", one with flowers only and one with young leaves only; on the latter the identification could be satisfactorily based. Hamilton mentioned an apparently ripe fruit. This was not found at Kew, nor was it among the material I had on loan from Edinburgh, where Hamilton is known to have sent material. At Edinburgh there is a sheet inscribed "Hort. Bot.

Calcutt. E.I.C. Wall. Cat. 6972(G). Herb. Ham." This specimen bears adult leaves and also belongs here.

5b.3. Most of the specimens from Burma do not resemble the Indian material completely, but deviate towards the SE. Asian subspecies.

5b.4. V. Puri, Amer. J. Bot. 37 (1950) 363—370, devoted an important paper to a *C. "religiosa"* from Meerut, near Delhi. He did not cite specimens, but Dr Y. S. Murti of Meerut College kindly sent me material (which appeared to belong here) with the assurance that it is the only species in that region. He also took considerable pains to gather the data here recorded. "I could not procure ripe fruits for a long time. Generally the fruits fall off very early even when they are green. Rarely a fruit is left to be ripened on the tree. The fruits when fully ripe are almost globose, apple-coloured, but partly ripened ones are yellow. The pulp in all the cases examined is yellow, tasteless and odourless. The pericarp is thick and smooth but cannot be described as stony. It appears to be brittle and on pressing it gives a sandy touch. In a ripe fruit the pericarp becomes loose and on just pressing a depression is formed. The unripe one was somewhat rough with white specks. Seeds almost fill up the space inside. A section of the fruit could not be cut because of the hard seeds and loose pericarps. Within a few hours after preservation the reddish colour of the fruits almost vanished."

5b.5. The paper by Puri gives figures of deviations in number of the floral parts; sepals are found up to 5, petals up to 6, carpels up to 4 in one flower. The number of stamens varies irregularly between 16 and 26. Insects can cause a hypertrophy in the flowers; then the receptacle swells and produces many stunted conical staminodes up to 60 in number, instead of normal stamens and gynoecium. The hypertrophied receptacle contains eggs and small larvae in its interior.

5c. ssp. **trifoliata** (Roxb.) Jacobs, *stat. nov.* — *Capparis trifoliata* Roxb., Hort. Beng. (1814) 41, name; Fl. Ind. ed. Carey 2 (1832) 571, descr. — Type: *Roxburgh hb. Wallich 6972 C 1* (K!) from "India", fl.

C. erythrocarpa Gagn., Bull. Soc. Bot. Fr. 55 (1908) 322; Fl. Gén. I.-C. 1 (1908) 179, t. 15C. — *C. roxburghii* var. *erythrocarpa* (Gagn.) Gagn., Fl. Gén. I.-C. Suppl. 1 (1939) 517. — Type: *Harmand 608* (P!) from Indo-China, Me Không delta, fr. 7.1876.

Shrub 1½ m to tree 30 m. Branchlets slightly cork-ribbed. Petiole red-brown when dried, 4—7 cm. *Leaflets* subcoriaceous, mostly concolorous or slightly paler beneath, dull olive-brown in the dried state, 3—7 mm stalked, the lateral ones asymmetric, widest about the middle to somewhat above, 4¾—8½ by 2¾—5½ cm; top blunt to obtuse or rounded, seldom subacuminate with a blunt tip; nerves reddish, 5—7 pairs. Leaflets on vegetative shoots 10—10½ by 4½—5¾ cm, nerves 5—7 pairs; petiole 7—8 cm. Flowering twigs dull dark purplish, to 5—15 cm, towards the top bearing a few axillary flowers to *c.* 12 more or less distinctly arranged into an *inflorescence* with a rhachis up to 5 cm long; pedicels *c.* 3—7 cm, under an angle of *c.* 45° which seems somewhat more appressed than in the other subspecies. Torus 4—5 mm wide. Sepals *c.* 3—5 by 2—3 mm, mostly orange when dried. Petals white turning yellow, 4—8 mm clawed, limb 15—24 by 11—13 mm, mostly somewhat more rounded at the top than in other subspecies. Stamens 15—26, purple. Gynophore 13—45 mm; ovary 2½—3 by 1½—2 mm, stigma knob-shaped. *Fruit* globose to ellipsoid, 2¾—4 by 2½—3½ cm, red when ripe, also reported orange, and white.

CHINA. Yunnan: *Bons d'Anty*, fl. — Kwangsi: *Wang 41278.* — Kwangtung: Heungshan, *McClure 6267* (identity not quite certain).

HAINAN: many.

BURMA. Upper B.: Yindaw, *Collett 523*. — Lower B.: several. — South B.: Mergui, *Griffith*, fl.
SIAM. *Mrs. Collins 935*; Kantra-Luk, *Phloenchit 1523 = RFD 22991*. — North S.: Me Ya, Chawng Tawng, *Kerr*, fr. 6-5-1921; Sun Pa Tawng, *Winit 90*; Raheng, *Winit 98*. — Central S.: Hau Hin, *Lakshnakara 77*; Bangkok, *Kerr 4103*; *Zimmerman 124*. — Southeastern S.: Sriracha, *Mrs. Collins 92*. — Southwestern S.: Kanburi, Sai Yok, *Kerr 10554*; Bawng Ti, *Kerr 10598*; Hua Hin, *Marcan 388*.
INDO-CHINA. Laos: Sikhay, *J. Vidal 2340*. — Annam: many. — Cambodia: many. — Cochin-China: *Thorel 2042*; Delta Me Khong, *Harmand 608*; Chandoi, *Harmand 509 hb. Pierre 4029*.

Ecology. Sandy soil and limestone under seasonal conditions, deciduous forest, bamboo forest, etc., in the lowlands, also coastal. Flowers chiefly March—May, fruits chiefly August; occasional flowering in other months.

5d. ssp. **axillaris** (Presl) Jacobs, *stat. nov.* — *C. axillaris* Presl, Rel. Haenk. 2 (1835) 85. — *C. odora* f. *axillaris* (Presl) Jacobs, Fl. Mal. I, 6 (1960) 66, f. 2b, 3. — Type: *Haenke* (PR sh. 24283; A, phot.!; W! with coll. number 41), from Luzon, fl. and young fr. 1792.

C. tapia (*non* L.) Bl. Bijdr. 2 (1825) 85.

C. religiosa (*non* Forst. *f.*) Blanco, Fl. Filip. (1837) 399; ed. 3, 2 (1878) 154, t. 176; Merr., En. Philip. 2 (1923) 210.

Crataeva sp. Turcz., Bull. Soc. Nat. Moscou 27, 2 (1854) 320. — Based on *Cuming 961*, from Luzon.

C. tumulorum Miq., Illustr. (1870) 21, t. 11, and subsequent Floras of Java. — Type: *Blume 1545* (L! sh. 899.54.271, fr.; *s.n.* sh. 899.54.272, lvs.) from Java.

Small tree 3—10(—30?) m. Plants in the herbarium generally dark-tinged. Growth in long flushes; twigs dull violet-blackish when dried, especially in the specimens from Java. Petiole 4½—8¼ cm. *Leaflets* firmly herbaceous, dull brownish in various tinges, the lateral ones asymmetric, 4—6 mm stalked, widest about the middle to slightly above, 5½—10 by 2½—5 cm, top abruptly acuminate (if not so markedly as in ssp. *odora*), the tip acute, 1—1½cm, nerves 5—7 pairs. Vegetative shoots long and straight, the leaves up to 8—10 cm petiolate, to 10—11½ by 2—5½ cm. *Flowers* with a few axillary along the leafy twigs, or with up to *c.* 40 on a rhachis up to *c.* 10 cm long, its lower part sometimes leafy; pedicels 4—7¼ cm. Torus *c.* 5 mm. Sepals 4—6 by 1½—2½ mm. Petals 6—10 mm clawed, the limb 12—25 by 9—22 mm. Stamens 16—25. Gynophore 2—6½ cm; ovary 2—5 by 2 mm, stigma knob-shaped. *Fruit* globose, to 2½—4 cm diameter; seeds *c.* 6 by 2 mm.

MALAYA. Malacca (culta?): *Griffith*, fl.; *Ridley 3314*.
JAVA. *Blume 1545*. — East J.: several. — Kangean Is: several. — Madura: Sumenep, *Backer 21259*.
LESSER SUNDA Is. Sumbawa: central, *De Voogd 1911*; East, Bima, *Zollinger 1138*.
PHILIPPINES. Palawan: Taytay Bay, Pabellones Is: *Merrill, Sp. Blanc. 370*; *Merrill 9438*. — Mindoro: *Medina FB 25611*; *Merritt FB 8644*; Iriron: *Merritt FB 8816*.

Ecology. Dry, shrubby places; coral limestone cliffs, secondary forest. Although deciduous, the tree seems to be rather irregular in the production of flowers.

Note. 5d.1. If more knowledge on the variability of this species in SE. Asia and Malesia becomes available, it might appear that the Philippine population should be sunken into ssp. *trifoliata*, and that the plants from southern Malesia should be taken apart as a subspecies. For now, I do not wish to commit myself further.

5e. ssp. **formosensis** Jacobs, *ssp. nova*. — *C. religiosa* (non Forst.) Hayata, Ic. Pl. Formos. 1 (1911) 57; Kaneh., Formosan Trees (1936) 237, f. 178; Walker, Import. Trees Ryukyu (1954) 95, f. 45; H. L. Li, Woody Fl. Taiw. (1963) 236, f. 87.

Cratevae adansonii subspecies formosensis chinensisque, ramulis elongatis foliolis majoribus (usque 15 ad 6¾ cm) gradatim acuminatis lateralibus asymmetricis.

Typus. E. H. Wilson 11114 (K! *holo*; A! US!), collectus in insula Formosa, Karenko Prov., Nanwo, fr. 26-11-1918.

Shrub 2—6 m to tree 6—20 m. Branchlets and internodes averagely longer than in the other subspecies, slightly corky-ribbed. Petiole brown to dark-coloured when dried, 5¼—7 cm, glands distinct. *Leaflets* greyish green to brownish green when dried, thin but firm, 5—7 mm stalked, slightly discolorous, the lateral ones very asymmetric, *c.* 10—11½ by 4—5 cm, top gradually acuminate with an acute tip, nerves thin, *c.* 4—6(—7) pairs, red-brownish when dried. On vegetative shoots the leaflets to 13—15 by 6 cm, petiole 8—13 cm. Flowering twigs *c.* 10—15 cm long, the apical 3 cm bearing *c.* 10—15 flowers; pedicels 2½—4 cm. *Flowers* not sufficiently known (see Note 1). Gynophore 3¼—4½ cm. *Fruit* globose to ellipsoid, *c.* 3—5 by 3—4 cm, red.

CHINA. Kwangsi: San Chiang Hsien (= ? Sankiang 25°47'N 109°26'E), *Steward &Cheo 1012.*
FORMOSA: several.
PACIFIC NORTH. Riu Kiu Is: *Sakurai*, fl. 7-1910; South Okinawa: *Miyake*, fr. 9-1889 (see Note 5e.1).

Ecology. Forested ravines, to 300 m alt. Fruits September—November.

Note. 5e.1. The figure given by Walker, and most of his description, too, was copied from Kanehira. The Ryukyu *Cratevas* were originally assigned by Jacobs, Fl. Mal. I, 6 (1960) 66; Pac. Pl. Areas 1 (1963) map 24, to *C. religiosa.* Meanwhile, a closer study of the scanty material available *(Sakurai s. n.*, 5-7-1910; petals 4 mm clawed, *c.* 15 by 8 m; stamens 12?) has revealed the probability of its belonging here rather than to *C. religiosa*, which species does occur in the Marianas and Carolines. Walker described the fruits as purple-spotted berries 4½—7 cm long; this is very large for *C. adansonii*, but it seems not impossible.

6. Crateva excelsa Bojer, Ann. Sci. Nat. II, 20 (1843) 57; Baillon, Hist. Nat. Pl. 2, Atlas 1, in Grandidier, Hist. Phys. Nat. Pol. Madag. 28 (1886) t. 55. — Type: *Bojer s. n.* (K! P?) from prov. Emirne? Madagascar.

Shrub 3 m to tree 2—8 m by 10—15 cm (according to Bojer 24—30 m, the trunk at the base 1.20 to 1.75 m diameter), deciduous, the leaves appearing shortly before the flowers. Twigs mostly light brownish when dried, whether or not lenticelled. Petiole red when fresh, light brown when dried. *Leaflets* subcoriaceous, concolorous, greenish when dried, fairly equal, the lateral ones distinctly asymmetric, 1—8 mm stalked, 5—8 by 1¾—3(—3½) cm, widest about the middle to slightly above; base acute, top more or less distinctly acuminate with blunt to sometimes acute tip; midrib thin but prominent beneath, reddish tinged, nerves *c.* 6—7 pairs. *Flowers* pink to cream or white when fresh, yellow-grey to orange-brownish when dried, with *c.* 8—15 arranged towards the top of slender leafy shoots; pedicels (2½—)3—4(—7½) cm. Torus 2½—3½ mm wide. Sepals 2—5½ by 1—3 mm, mostly slightly narrowed at the base. Petals subequal, *c.* 5 mm clawed, the limb 12—15(—21) by 7—9(—11) mm. Stamens on androphore *c.* 1 mm, 10—15, filaments pink, anthers yellow or violet. Gynophore 1¾—5¾ cm, violet, ovary pinkish, 2—3 by 1—2 mm, stigma distinct, ½—1 mm wide, subsessile to 1 mm styled. In the ♂ flowers the gynoecium (always?) reduced. *Fruits* green-yellowish (to sordidly red when overripe?), on a very slender gynophore to 1½ mm thick at most, globose, 2—3 cm diameter, pericarp 1 mm thick, purplish when dried, smooth; seeds in white pulp, *c.* 7 by 6 by 4 mm.

Distribution. MADAGASCAR: many specimens.

Ecology. Light forest; deciduous forest; dry forest on rocky or limestone soil; also near a lagoon; up to 1200 m alt. Flowers October—November, rarely in other months; fruits December—January.

Notes. 6.1. Under the original description no specimen was cited, but it is implied that Bojer himself was the collector. A specimen that could be the type (probably bearing the MS. name *Farquharia excelsa* Hils. & Boj., and the indigenous name *Vouën pouën* from the province Emirne, as was mentioned beside the description) was not among the material I had on loan from Paris. At Kew there is a Bojer specimen, marked as a type if not further annotated, which was in flower and belongs here, although the leaflets are quite symmetric.

The illustration by Baillon in Grandidier's work is good.

6.2. The MS. name *C. anjouanae* Hadj-Moustapha applies to a few specimens which mainly consist of sucker-shoots, olive-greenish tinged in the herbarium. Petiole *c.* 9—12 cm, leaflets to 5 mm stalked, *c.* 10 by 3½—4½ cm, with 7 pairs of nerves.

6.3. Like in all Madagascar material of *Crateva*, growth is usually meagre. There are, however, a number of sheets which have mutually a certain resemblance, but which altogether I have not ventured to place. These have in common a wealthy growth; the tinge of the dried leaves is deep-green, the leaves grow in denser tufts, the inflorescences are rich-flowered, the sepals are large, and the dried petals conspicuously orange. As there are no such specimens available in fruit, it is very hard to make out whether these plants jointly represent a separate, partly known, undescribed species, or that they are particularly well-developed forms, owing to favourable conditions for instance, of known species. This plural form relates to the fact that the leaflets are somewhat different in the various specimens. Those in *Bosser 6980*, *7112*, *7113*, and *RN 3185* (*c.* 5½—6 by 1.8—2 cm, top acute to obtuse) are suggestive of *C. greveana*; those of *Louvel 180* and *Allnand 37* (to 7½ by 3½ cm, obovate, top rounded) of *C. obovata*; those of *Perrier de la Bâthie 4993*, *4997*, *RN 3625*, and *Hildebrandt 3119* (to 9 by 3¾ cm, somewhat asymmetric and acuminate), of *C. excelsa*. The inflorescences are always of the *excelsa*-type: a dense corymb at the top of a leafy twig. The sepals in *Louvel 180* attain a size of 10 by 5 mm. In *C. excelsa*, however, the sepals are also rather long, and it is hard to find a distinction here. A number of specimens in fruit will be required to solve this problem.

7. Crateva greveana Baillon, Bull. Soc. Linn. Paris 1 (1885) 466. — Type: *Greve 180* (P! K!), from Bé-Kapaké, western Madagascar. — **Fig. 6, 7.**

Shrub 2 m to tree 10—20 m with a bole 3—6 m by 40 cm. Twigs mostly dull violet to light brown. Petiole (2—)5—8½ cm. *Leaflets* thin, concolorous, dull olive-greenish when dried, very equal (the lateral leaflets sometimes a bit longer) and symmetrical, *c.* 4—8 mm stalked, 4—6½(—8½) by 1—1½(—2.1) cm, widest about the middle; base cuneate, top obtuse to blunt, midrib thin but underneath very prominent, nerves 6—8 pairs. On vegetative shoots petiole to 6½ cm, leaflets 7 mm stalked, dark green above, greyish green beneath, 8½—10½ by 2¼—2½ cm, midrib and petiole grey-brownish, nerves 8—10 pairs. *Inflorescences* lateral, rhachis slender, *c.* 1½—2 cm, with *c.* 10—20 flowers and occasionally a few smaller leaves near the base, but otherwise the blossom on leafless twigs; rarely a vegetative shoot bearing *c.* 4—7 flowers near its top; pedicels 2—3¼ cm. *Flowers* (always?) yellowish when fresh, brown-yellowish to orange-brown when dried. Torus 3½—5 mm diameter, comparatively fleshy. Sepals 1—2(—5) by 1(—2) mm. Petals subequal, *c.* 5 mm clawed, the limb 12—18 by 5—8 mm. Stamens on a very short androphore, 11—16. Gynophore (1¾—)2¼—3(—4½?) cm; ovary ellipsoid,

Fig. 6. *Crateva greveana* Baill. — a. habit, × $^{2}/_{3}$; b. flower, × 2 (from *SFMad. 5887*).

2—3 by 1—2 mm, stigma small. In the ♂ flowers the gynoecium (always?) reduced. *Fruit* on a stipe 2½—4 mm thick, globose, *c.* 3½—4 cm diameter, pericarp 1 mm thick, smooth, purplish when dried; seeds *c.* 8—9 by 5—8 by 4—7 mm.

Distribution. MADAGASCAR: many specimens.

Ecology. Forest along calcareous coasts or on sandy lateritic or rocky or loamy soil in dry situations to *c.* 800 m alt. Flowers between half September and half November; fruits December.

The flowers appear on bare branches; meanwhile part of the leaves seem to persist on vegetative shoots.

Notes. 7.1. In *SFMad. 3131* and *6198*, both collected in fruit at Ankara-Diégo on 27-11-1952, the leaflets are 6—8 by 2½—2¾ cm, and the inflorescences terminal. As the gynophore is 4 mm thick, which is considered the most important character in *C. greveana*, the plants are placed under this species.

7.2. In *SFMad. 6292* two petals are occasionally reduced to sepal-size.

8. Crateva obovata Vahl, Symb. Bot. 3 (1794) 61. — Type: probably in C *(n.v.)*.

Shrub 2—3 m, or small tree, deciduous, the leaves appearing shortly before or after the flowers. Twigs mostly dull purplish. Petiole 1½—4½(—8) cm. *Leaflets* thin when

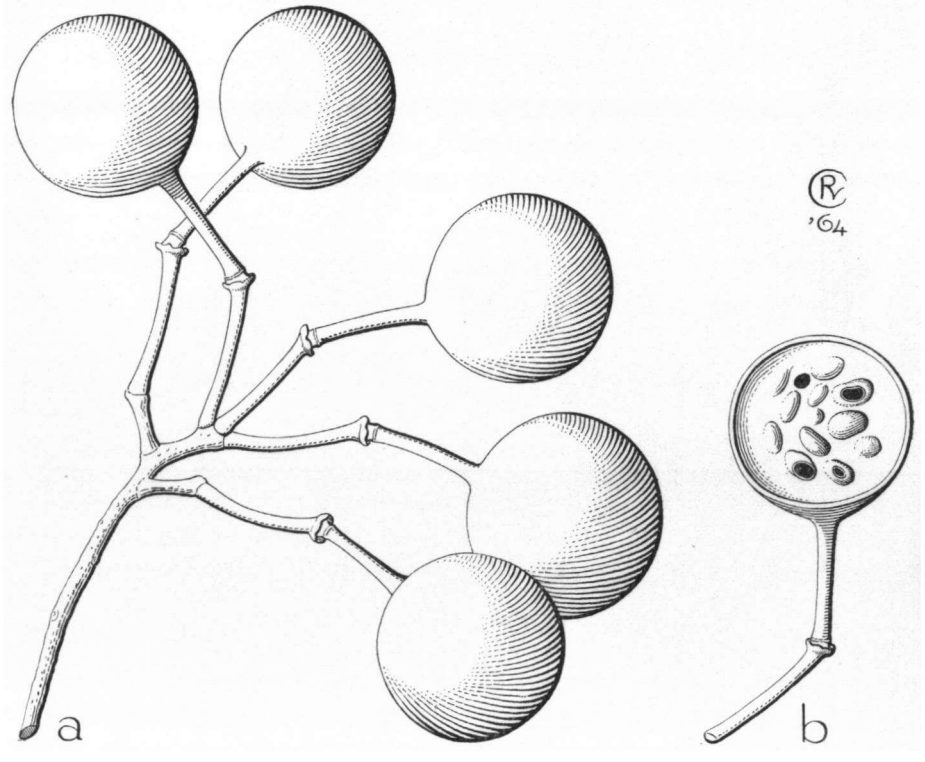


Fig. 7. *Crateva greveana* Baill. — a. infructescence, × ²/₃; b. length-section of fruit, × ²/₃ (from *Humbert 12592*).

young, coriaceous when older, concolorous, greenish when dried, very equal and symmetrical, sessile to 2 mm stalked, *c.* 4—7 by 2—3½ cm, obovate with rounded top, midrib thin and rather prominent underneath towards the base, nerves *c.* 5—6 pairs, thin. *Inflorescence* terminal (as far as known), rhachis rather vigorous, dull purple, *c.* 3 cm with 2—3 dozens of flowers but often reduced to a meagre sub-umbel bearing 4—7 flowers. Pedicels straight, radiating, straw-coloured, to 4—5 cm. Torus 3—4½ mm wide. Young flowers when dried greyish or yellowish brown, not or rarely orange-brown. Sepals 2—5 by 1—2 mm. Petals recorded pink or yellow, subequal, claw 4—8 mm, limb elliptic, 12—19 by 7—11 mm. Stamens red, on androphore 1—2 mm, *c.* 14—16 (according to Vahl 7—9). Gynophore (2¾—)4—6½ cm; ovary *c.* 2—4 by 1—1½ mm with sessile stigma ½—¾ mm wide. In the ♂ flowers the gynoecium is (always?) shed. *Fruit* only known in immature state, on a stipe 1¼ mm thick very shrivelled but apparently ellipsoid, 2¼ by 1½ cm, greyish, smooth.

Distribution. MADAGASCAR: many specimens.

Ecology. Coastal forest, forest fringes, ancient dunes. Flowers October—November.

Notes. 8.1. The leaflets are smaller than in *C. excelsa* and *greveana*, the petioles and pedicels sturdier, the flowers vary in size but are generally larger than in the two other species.

8.2. The MS. name "*Crataeva humbolti* (Baill.) H.-M." (for Hadj-Moustapha) might have been based on *Capparis humbloti* Baill., but according to the description the latter is indeed a *Capparis*. The collections labelled *Crateva humbolti* represent partly *C. excelsa* Note 3, partly poor-leaved *C. obovata*.

9. Crateva hygrophila Kurz, J. As. Soc. Beng. ii, 41 (1872) 292; J. Bot. 12 (1874) 196, t. 148 f. 6, 7; Jacobs, Fl. Mal. I, 6 (1960) 69. — Type: *Kurz 1804* (CAL!) from Burma, Pegu, Yenai Eng, fr. 14-1.

Leaves herbaceous, dull red-brownish in the herbarium, largest leaflet 12½ by 3½ cm; leaflets sessile, narrowed towards base and top; nerves *c.* 6—7 pairs, narrow like the midrib, prominent above. *Infructescence* rhachis practically none. *Flowers* unknown. Pedicels in fruit 5½—6½ cm, gynophore 4¾—5¾ cm, both blackish, woody, *c.* 2—2½ mm diameter. *Fruit* (immature) cylindrical, umbonate, *c.* 9 by 2½ cm, dull brown-purplish with numerous white lenticel-like specks, pericarp *c.* 1½ mm thick. Seeds irregularly horseshoe-shaped, *c.* 11 by 8 by 3 mm, dorsally with some coarse sculpture.

BURMA. Lower B.: *Kurz 1804*. — South B.: Mergui, *Parker 2596* (see Note 1).
MALAYA. Pahang: Trang, *King's Coll. Kunstler 1412*.

Note. 9.1. I have seen three sheets inscribed by Kurz himself. Besides the type, there are two sterile specimens, one located Irrawaddy and Sittang Valley, and also Yen nai Eng, pencilled on a scrap. They obviously belong to one collection, dated 20-1-1871. They have also been numbered *1804*, but their leaves are different from those on the fruiting branch collected 14-1; they are wider and might belong to *C. adansonii* ssp. *trifoliata*. The plant from Malaya, *Kunstler 1412*, was collected March 1881; it matches the type in both leaves and fruits. These plants come nearest to *C. religiosa* because of the sessile leaflets and elongated fruit, but the dark brown and violet hue is alien to the whole sect. *Crateva*, to which *C. religiosa* belongs. *R. N. Parker 2596* from Mergui is largely green-tinged, but has also the elongate fruit, and seems therefore intermediate.

DOUBTFUL SPECIES

Crateva falcata (Lour.) DC., Prod. 1 (1824) 243; Merr., Comm. Lour. (1935) 172. — *Capparis falcata* Lour., Fl. Coch. 1 (1790) 331. — *Triclanthera falcata* (Lour.) Rafin., Sylva Tell. (1838) 108.

Gagnepain, Fl. Gén. I.—C. 1 (1908) 179, placed it with doubt under *C. erythrocarpa* (our *C. adansonii* ssp. *trifoliata*). The red fruit to which Loureiro refers, together with the 'falcate' lateral leaflets (the latter also occurring in *C. unilocularis*, however) point to *C. adansonii*. The subspecies of it can, unfortunately, not be determined. Loureiro gives "Canton, cultivated" as the origin, but this leaves us in doubt that he may have had ssp. *trifoliata* as well as ssp. *formosensis*.

Merrill could not add to clear up the matter, as he confused the species involved with *C. religiosa* and *C. nurvala*. As far as we know no original material is extant.

Crateva magna (Lour.) DC., Prod. 1 (1824) 243; Merr., Comm. Lour. (1935) 172. — *Capparis magna* Lour., Fl. Coch. 1 (1790) 331. — *Triclanthera corymbosa* Rafin., Sylva Tell. (1838) 108, based on the former.

Gagnepain, Fl. Gén. I.—C. 1 (1908) 180, identified it with *C. macrocarpa* Kurz (here considered synonymous with *C. religiosa*). This may be so; Loureiro's description applies equally well to *C. nurvala* and *C. unilocularis*. Merrill considered "that there is no longer even reasonable doubt as to the identity", notably with *C. macrocarpa*, and he cited two recently collected specimens in addition. These belong, however, to *C. unilocularis*. De Candolle and also Gagnepain (quoted by Merrill) stated to have seen material in Paris, but the enquiries I made there as well as at the British Museum and at Geneva were in vain.

Crateva roxburghii R. Br. in Denh. & Clapp., Narr. Trav. Disc. Afr., App. (1826) 224. — *C. religiosa* var. *roxburghii* (R. Br.) Hook. *f.* & Th. in Hook. *f.*, Fl. Br. Ind. 1 (1872) 172.

Robert Brown, when dealing with *C. adansonii*, remarked that "it will be difficult to distinguish this African *Crateva* from a plant which seems to be the most general species in India; except that in the latter, as in all the other species of the genus, the inequality of the lateral foliola, which is also more marked, consists in the greater decurrence of the lamina being on the outer or posterior margin of the footstalk. This Indian species, which may be named *C. Roxburghii*, is the *Capparis trifoliata* of Dr. Roxburgh's manuscripts, but not Nürvala of Hortus Malabaricus (vol. 3, p. 49, t. 42) as he considers it."

These manuscripts are apparently those of the Flora Indica, posthumously published by Carey, vol. 2 (1832) 571. Under *Capparis trifoliata* R., we find the following text. "Arboreous, unarmed. Leaves terminal. Corol irregular. Berry spherical. Crateva religiosa Willd. 2. 853. Nurvala Rheed. Mal. 3 t. 42. Sans. Vuroona, also Tikta-shaka. Beng. Buroon. Teling. Tella woollee mera. Common everywhere throughout India, it flowers about the beginning of the hot season."

It is apparent that Robert Brown, who had correctly recognised the two common Indian *Cratevas*, wanted to place the hitherto unnamed one (our *C. adansonii* ssp. *odora*) better than Roxburgh had done, and therefore choose a new name, as in *Crateva 'trifoliata'* would not make sense. He did however not, as far as I a know, appoint a type specimen, and this finally caused the trouble.

The sole reference to a specimen is found in Roxburgh's Hortus Benghalensis (1814) 41, under *Capparis trifoliata* R. The specimen is denoted B. Buroon 10 (which means the vernacular name in Marhatta dialect), T (for tree), 1—2 (the months of flowering), R. S. (for fruiting in the rainy season). Neither this specimen, nor the reference has been

cited by Robert Brown. Two specimens have come to my hands that bear Roxburgh's name. One is in Geneva, inscribed "India or. Roxburgh. Capparis trifoliata. Crataeva Tapia." It is in flower but leafless, and, although it looks like *C. adansonii*, worthless for further identification. The other specimen is in Wallich's Herbarium under number 6972 C 1, bears Roxburgh's name as the collector, and "Capparis trifoliata" in the latter's own handwriting. Roxburgh's text, Wallich's Catalogue, and the inscription on the sheet agree on the point that it was collected in India, and nothing indeed suggests a provenance East of the Brahmaputra, except its identity, since it clearly belongs to the SE. Asiatic subspecies with obtuse leaflets, our *C. adansonii* ssp. *trifoliata*. No material of that subspecies has, as far as I am aware, been collected in India proper.

Robert Brown, however, stated expressly that he was dealing with a species from India, in concurrence with Roxburgh. Both this reference and his summary description mean that he can only have had one subspecies of *C. adansonii* in mind, namely the same that in 1827 was published by Hamilton under the name *Crateva odora*, together with a description and a type. It is held here that by that time no unambiguous reference had been published to a recognizable material basis of this taxon. As a consequence, Robert Brown's name must be rejected as doubtful, in favour of Hamilton's.

Crateva? suaresensis Baill., Bull. Soc. Linn. Paris 1 (1885) 466. — Type: *Richard 167* (P, *n. v.*) from Madagascar, in the plains near Diego-Suarès.

The description reads (transl.) "Small shrub, leaves like all other parts glabrous, long (4—5 cm) petiolate, leaflets 3, oblong-obovate (to 6 by 2 cm) the base narrowed into a short stalk, top rounded; subcoriaceous, nerves spaced. Flowers not known. Fruit short (1—2 cm) stalked, globose (2 cm diameter), pulpy inside; seeds few. — hardly this genus?"

Since an effort by Dr. R. C. Bakhuizen van den Brink in Paris to retrieve the material was futile, I cannot even make out the genus.

EXCLUDED

(mostly on authority of the Index Kewensis)

Crateva apetala Spreng. Syst. 2 (1825) 448 = **Maerua apetala** (Roth) Jacobs, *comb. nov.* — *Capparis apetala* Roth, Nov. Pl. Sp. Ind. Or. (1821) 238. — *Niebuhria linearis* DC. Prod. 1 (1824) 244. — *Maerua linearis* (DC). Pax in E. & P. Pfl. Fam. III, 2 (1891) 234. — *Niebuhria apetala* Dunn in Gamble, Fl. Madras 1 (1915) 41 (*Capparaceae*).

C. avicularis Burch. *ex* Harv. & Sond., Fl. Cap. 1 (1859—60) 60 = **Maerua triphylla** (Thunb.) Dur. & Schinz *(Capparaceae)*.

C. balangas Koen., Trans. Linn. Soc. 5 (1800) 224 = **Limonia acidissima** L. *(Rutaceae)*.

C. cafra Burch. *ex* Harv. & Sond., Fl. Cap. 1 (1859—60) 60 = **Maerua triphylla** (Thunb.) Dur. & Schinz *(Capparaceae)*.

C. capparoides Andr., Bot. Reposit. 3 (*c.* 1800) t. 176 = **Ritchiea fragrans** (Sims) R. Br. *(Capparaceae)*.

C. corniculatum Stickman, Herb. Amb. (1754) 13; in L., Amoen. Acad. 4 (1759) 139, is a printing error for *Rhizophora corniculatum* = **Aegiceras corniculatum** (L.) Blanco *(Myrsinaceae)*.

C. fragrans Sims, Bot. Mag. 16 (1802) t. 596 = **Ritchiea fragrans** (Sims) R. Br. *(Capparaceae)*.

C. gorarema Vell., Fl. Flum. (1825) 200; Ic. 5 (1835) t. 4 = **Gallesia scorododendrum** Casar. *(Phytolaccaceae)*.

C. marmelos Linné, Sp. Pl. (1753) 444 = **Aegle marmelos** (L.) Correa *(Rutaceae)*.

C. moschata Banks *ex* Sims, Bot. Magaz. 16 (1802) sub t. 596 = **Ritchiea fragrans** (Sims) R. Br. *(Capparaceae)*.

C. mucronulata O. Kuntze, Rev. Gen. (1891) 38 *(C. mucronata*, in Index Kewensis) = **Maerua siamensis** (Kurz) Pax *(Capparaceae)*. See also Merrill, Brittonia 2 (1936) 192.

C. oblongifolia Spreng., Syst. 2 (1825) 448 = **Maerua oblongifolia** (Forsk.) A. Rich. *(Capparaceae)*.

C. octandra Blanco, Fl. Filip. (1837) 400 = **Capparis floribunda** Wight *(Capparaceae)*.

C. religiosa (*non* Forst. *f.*) Ainslie, Mat. Med. Hind. (1813) 124=**Aegle marmelos** (L.) Correa *(Rutaceae)*.

C. vallanga Koen. *ex* W. & Arn. Prod. (1834) 96 = **Limonia acidissima** L. *(Rutaceae)*.

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