

## A DELIMITATION OF MAMMEA L.

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### I. CLASSIFICATION OF MAMMEA L. AND OCHROCARPOS THOU. (GUTTIF.)

LINNAEUS published the genus *Mammea* in 1754. He derived the name from Mamei or Mamey, a West Indian vernacular name for *Mammea americana* L., as recorded by PLUMIER (1703). The oldest reference in print was probably made by OVIEDO (1535).

Linnaeus described the genus:

„Mammea. † Mamei Plum. 4. Cal. Perianthium diphyllum: foliolis ovatis, concavis, parvis, deciduis. Cor. Petala quatuor, subrotunda, concava, patentia, majora calyce. Stam. Filamenta plurima, simplicia, subulata. Antherae subrotundae. Pist. Germen subrotundum. Stylus conicus, longitudine staminum. Stigma simplex, persistens. Per. Bacca carnosa, maxima, stylo acuminata, sphaerica, unilocularis. Sem. quatuor (vel unum), callosa, subovata”.

Two species were referred to the genus, *M. americana* L. and *M. asiatica* L., both already appearing in *Species Plantarum* (1753).

MIERS (1875) declared that *M. asiatica* L. was wrongly identified by Linn. f. with *Barringtonia speciosa* Linn. f. from which a general confusion arose among the 19th century authors.

KNUTH, in his revision of *Barringtoniaceae* (1939) accepted Miers's views insofar, as he placed *M. asiatica* L. as synonymous with *Barringtonia asiatica* (L.) Kurz. For this reason it is best to accept *M. americana* L. as the type species (cf. also HITCHCOCK and GREEN, 1935).

A survey of literature demonstrates that after Linnaeus about 20 spp. of *Mammea* were described, the majority of which, however, were at various times transferred to *Ochrocarpos* Thouars or switched back again.

The first study of importance to the problem of delimiting *Mammea* against allied Guttiferous taxa was published by PLANCHON and TRIANA (1861). These authors recognized 7 spp. in *Mammea*.

KOSTERMANS (1956) stated, that *Ochrocarpos* Thou. was published for the first time in A. A. DU PETIT-THOUARS, „Histoire des Végétaux recueillis dans les isles australes d'Afrique”, in 1804, for some reason deducing this from a paper by WOODWARD (1900). Actually, Woodward's paper contains no statement leading to this, erroneous, conclusion. The work by Du Petit-Thouars of 1804 contains no reference to

*Ochrocarpos*, as is shown by the copy present in the British Museum library. Neither is there in the 1806 re-issue of the same work any reference to *Ochrocarpos*. There is, however, an 1805 copy at Kew, which contains a plate to which the name *Ochrocarpos* was added (see SPRAGUE, 1934).

In 1806 the genus *Ochrocarpos* was described and validly published by A. A. DU PETIT-THOUARS. As, afterwards, the genus *Calysaccion* WIGHT (1840) has been generally declared to belong in *Ochrocarpos*, it might be asked why Planchon and Triana l.c. did not state their views regarding a possible merging of the genera *Mammea* and *Ochrocarpos*, as they accepted *Calysaccion* as part of *Mammea*. It would appear that the problem did not occur to them because *Mammea* and *Ochrocarpos* were placed by them in different tribes, *Mammea* in *Calophylleae* and *Ochrocarpos* in *Garcinieae*, following CHOISY's arrangement in DE CANDOLLE (1824).

The tribes *Calophylleae* and *Garcinieae* as proposed by CHOISY (l.c.), were accepted by PLANCHON and TRIANA (1861), but they changed their delimitation.

A comparison of their new delimitation of the tribes *Calophylleae* and *Garcinieae* shows that the only differentiating characteristic is in the embryo; whether it has thick cotyledones (*Caloph.*) or is without or with minute cotyledones (*Garc.*), and for this reason it seems warranted to infer that they took *Mammea* as having a Calophyllaceous embryo and *Ochrocarpos* as having a Garcineaceous embryo. Also, that *Calysaccion* had a Calophyllaceous embryo and, at any rate, they explicitly stated that they were unable to keep *Calysaccion* apart from *Mammea* on account of the ovarial characters which, at first, had been supposed to be suitable to separate them.

BENTHAM AND HOOKER (1862) at first followed the delimitation of *Garcinieae* and *Calophylleae* as proposed by Planchon and Triana and applied the appearance of the embryo (cotyledones) as the distinguishing character. They accordingly placed *Calysaccion* as synonymous with *Mammea*. However, in 1867, in the Addenda and Corrigenenda to vol. I of the Genera they changed their view, shifting *Calysaccion* to the synonymy of *Ochrocarpos* Thouars.

They declared that *Calysaccion* and *Ochrocarpos* were certainly to be united having both the same essential characters viz the calyx of *Mammea* and an embryo and stigma as in *Garcinieae*. They added that the spp. of *Mammea* of the Old World, recognized by Planchon and Triana had to be included in *Ochrocarpos*. It is evident, that to distinguish *Mammea* and *Ochrocarpos* the only characters thought to be at their disposal were: 1. a difference in the embryo (cotyledons), 2. a difference in the style or stigma, and 3. the distribution. The geographical argument (3), of course, only holds, if the other characters appear to be constant differences. As regards the 2nd differing character, Bentham and Hooker admitted that they had no certainty while remarking that various authors described the style differently.

As regards the embryo, supposed to show the first difference referred to by Bentham and Hooker, ENGLER (1895 and 1925) suggested that

the fleshy part of the embryo of *Ochrocarpos*, which had been regarded as the "tigella" (hence its classification in *Garcinieae*), was actually the result of connate fleshy cotyledons and he therefore removed *Ochrocarpos* to *Calophylleae*.

PIERRE (1883), who was in a position to examine fresh materials, had supplied the data on which Engler's opinion was based.

BRANDZA (1908) again investigated the embryo's of some Guttiferous genera, among them *Mammea* and *Ochrocarpos*. He investigated only *M. americana* L. and *O. siamensis* T. Anders. and concluded that *Ochrocarpos* ought to be placed in *Calophylleae* on account of the characters of the embryo (large, fleshy cotyledons). He supported therefore, the view of Engler and also of Van Tieghem who had arrived at the same conclusion. VAN TIEGHEM (1885) had found the resin ducts distributed in the root and bark of *O. siamensis* in the manner characteristic of *Calophylleae*.

As a result of his anatomical research Van Tieghem stated: „il en faut conclure que ce genre (*Ochrocarpos*) appartient à la tribu des Calophyllées, non à celle des Garciniées”.

It might be objected that both Brandza and Van Tieghem investigated only a single, and the same, species of *Ochrocarpos*: *O. siamensis* T. Anders. Obviously, it would be preferable to have a wider range of species investigated but the opinion of PERRIER DE LA BÂTHIE (1948) might be added to their conclusion. As a result of his research in Madagascar species of *Ochrocarpos*, after having examined the embryo's of many spp., Perrier de la Bâthie denied all value to embryonal characters if it were desired to place the genus *Ochrocarpos* into *Calophylleae* as the embryo's appeared to possess in the various spp. all characteristics ascribed to *Calophylleae* or *Garcinieae*. His evidence and opinion therefore do not contradict the view that *Mammea* and *Ochrocarpos* belong in the same tribe, whatever its name should be. In PERRIER DE LA BÂTHIE's revision of *Guttiferae* for Madagascar (1950), no tribes are indicated.

It appears, therefore, that all the evidence found so far goes to show that the first essential character employed in separating *Mammea* and *Ochrocarpos* by Bentham and Hooker, as referred to above, does not hold, like the other characters employed.

As regards the wood anatomical evidence, METCALFE and CHALK (1950) appear to have knowledge only of *M. africana*. They find it different from all other genera of *Calophylloideae* in having diffuse parenchyma.

Mr. C. H. Japing, of the Div. of Forest Exploitation and Forest Economics in the Institute of Forestry at Wageningen, was kind enough to investigate a specimen of wood of *M. americana* L., and he informed me that the anatomy, especially as regards diffuse parenchyma strikingly resembled that of *M. africana* Sabine. This anatomical character supports Van Tieghem's results and stresses both the affinity of *M. americana* L. and *M. africana* Sabine and their isolated position in *Guttiferae*.

A. ENGLER (1925) wrote the most recent general revision of *Gutti-*

*ferae*. In his key he placed *Mammea* and *Ochrocarpos* side by side. *Mammea* is characterized by a 4-2 loculed ovary, the locules containing in total 4 ovulac. The flower is axillary. The stigma is 2-4-lobed. *Mammea* occurs in tropical America and Africa. Engler opposed *Ochrocarpos* by means of the following characters: 2-loculed ovary, each locule with 2 ovulac. Flowers in fascicles. Stigma peltate. Distributed in the tropics of the Old World.

These characters are for differential purposes of no value. From Engler's description of the genera no new possibilities of separating *Mammea* and *Ochrocarpos* appear.

The suggested difference in number of loculi in the ovary is, actually, nonexistent. A 4-loculed ovary appears to be brought about by a retarded emerging of a (mostly only partial) sept (cf. VIGUIER and HUMBERT (1914). PERRIER DE LA BÂTHIE (1950), also, described *Ochrocarpos* as occurring in Madagascar as having an ovary with 4 uniovulate loculi, "complètes ou incomplètes". There is, evidently, no difference here.

Engler stated that the female flower of *Mammea* was solitary (l.c., p. 190), whereas he described *Ochrocarpos* (in the key and in the description) as having fascicled flowers. This also is no real difference as e.g. *O. eugenioides* (Pl. and Tr.) Vesque and *O. punctatus* H. Perr. have solitary female flowers. All *Ochrocarpos* spp. have axillary flowers, though this character is used by Engler to characterize *Mammea* (in the key).

As regards the suggested difference in the appearance of the stigma (*Mammea*: 2-4-lobed, *Ochrocarpos*: peltate), it suffices to examine Engler's plate illustrating the genus *Ochrocarpos* (l.c. p. 193) where a perfectly 4-lobed stigma is figured.

STANER (1934) also considered the problem of separating the genera *Mammea* and *Ochrocarpos*. He limited his investigations to taxa occurring in the Belgian Congo which implies that he considered a single species, viz *Mammea africana* Sabine (other described *Mammea*'s for this region proved to be conspecific). He found that the flowers of *M. africana* Don (sic) might occur in fascicles or be solitary. Staner tried to separate *Mammea* and *Ochrocarpos* on the presence (O.) or absence (M.) of a so-called "boutonnière", a small gap present between the cotyledons becoming visible in a transverse section of the embryo.

Whatever the meaning of this observation may be, no later author has attached any importance to it and Staner himself finished by stating: "Il est même vraisemblable qu'une étude complète des deux genres amènerait à ne plus considérer *Ochrocarpos* que comme un sous-genre de *Mammea*".

KOSTERMANS (1956), in his above-mentioned recent paper proposed to extend the limits of *Mammea* considerably. He wished to characterize *Ochrocarpos* by fascicled stamens and non-areolate leaves, and *Mammea* by free or nearly free stamens and, "areolate" or distinctly reticulate leaves. This implies that the section *Euochrocarpos* Vig. et Humb., as regards the Madagascar spp. is added to *Mammea* and also all E Asia

and S Pacific spp. so far accepted as *Ochrocarpos*. The genus *Ochrocarpos* is limited to Madagascar and *Mammea* also occurs on that island, according to Kostermans.

As a result of the survey of literature given above and my own study I am in favour of widening the limits of *Mammea* so as to include *Ochrocarpos* entirely and I, therefore, am not prepared to maintain the latter genus, not even in the restricted sense proposed by Kostermans, which I find untenable for the following reasons.

1. A new combination by KOSTERMANS (1956) is *Mammea glaucifolia* (H. Perr.) Kosterm. The flowers of this species are unknown and so are the characters of the stamens. The leaves are leathery, the nerves are certainly not characteristic of *Mammea* sensu Kosterm., but suggest strongly the kind of nervation commonly met with in *Garcinia*. (cf. Ursch 143, type, in Herb. Mus. Paris).

2. The same question can be raised for *Mammea cerasifer* (H. Perr.) Kosterm., from which I saw the type (Decary 5659, Herb. Mus. Paris). Again the flowers are unknown, but the nervation is without doubt that of *Ochrocarpos* sensu Kosterm. PERRIER DE LA BATHIE (1948) alluded to the secretory canals which were more oblique than usual and crossing more or less the secondary nerves. This and the drawing in the Flore de Madagascar (1950) may have led Kostermans to assume that the leaves would match what he believes to be characteristic for *Mammea* L. but the type material has leaves which, as to their nervation, are indistinguishable from *Garcinia*.

3. No mention is made by Kostermans of *O. sessiliflorus* Vesque (in DC., 1893). The stamens in this species are free (PERRIER, 1950) and so it should belong in *Mammea* according to Kostermans. The leaves, however, are as regards the nerves, uncertain to place, perhaps slightly more like *Garcinia* sensu Kostermans, but ultimately it remains largely a matter of taste (cf. the syntype Martin No. 3, "Madagascar" in Herbar Delessert, Genève). It is again a transitional taxon, if considered in the light of Kostermans's suggestions.

4. *O. decaryanus* H. Perr. has an "androcée en colonne cylindrique centrale" and so is referable to *Ochrocarpos* sensu Kosterm. Perrier's (1950) description leaves no doubt that the leafcharacters are like *Mammea* sensu Kosterm., which could be confirmed by examination of the type (Decary 5161, Herb. Mus. Paris) and of Alleizette s.n. X-1905, Analamazaotra (Herb. Leyden).

5. *O. bongo* Vig. et Humb. (1914) of which I examined the type (Vig. et Humb. 849 in Herbar Delessert, Genève) shows leaves which are obviously, as regards the nerves, referable to *Ochrocarpos* sensu Kosterm. However, Kostermans refers the species to *Mammea* (l.c. p. 12), while admitting that: "the stamens.... are grown together more at the base than is found in the other known species", which stresses the occurrence of intermediate stages between united and free stamens.

The picture of the stamens of *O. bongo* Vig. et Humb. presented by PERRIER (1950) clearly demonstrates an intermediate position between free- and fascicled (connate) stamens. This again is a transitional taxon.

In conclusion I feel it is justified to say that there is no sharp demarcation as regards the stamens, whether they are free, partly connate or fascicled among the species ascribed either to *Mammea* or *Ochrocarpos*. Secondly, there is also no clear demarcation as regards an areolate ("reticulate") nervation, as found in *Mammea* L., and the nerves as usually seen in the section *Paragarcinia* Baillon (1876), (cf. Kostermans l.c. p. 11); on examining a number of specimens and trying to sort them out, one is very soon entirely at a loss to separate them on the strength of leaf-nerivation.

Both these characters of the leaves and the stamens, seen separately, appear to be present in various intermediate degrees between two extremes. It might be suggested that, though being unsatisfactory as characteristics by themselves they could be correlated to such an extent that a satisfactory systematy could be based on this correlation. Although they are somewhat correlated — as was correctly observed by Kostermans — this correlation is certainly too laxly maintained to be decisive in separating *Mammea* and *Ochrocarpos* (cf. notes 1-5) and already led to unsatisfactory decisions as regards the placing of species in the supposed genera by the proposer himself.

A final point to be made is that Kostermans (l.c.) separated *O. perrieri* Vig. et Humb. and *O. punctatus* H. Perr. from both *Mammea* and *Ochrocarpos*, on account of dehiscent fruits. For that reason these species "apparently belong to another genus" (l.c. p. 15). To me, this seems a suggestion to be taken up with caution as in many, perhaps the majority, of species referred to *Ochrocarpos* or *Mammea* the characters of the (mature) fruit are unknown.

Apart from this, in *O. perrieri* Vig. et Humb. the stamens are entirely connate (cf. Perrier 1950), and in *O. punctatus* H. Perr. free (l.c. p. 74), which implies that one of the two essentials for distinguishing *Mammea* and *Ochrocarpos*, adopted by Kostermans, is already of no value in the most nearly allied taxon, the suggested new genus.

I conclude that the entire genus *Ochrocarpos* is to be united with *Mammea* L., there being no consistent characters or correlation of characters by which they could be distinguished.

It might further be pointed out that the two-valved calyx (resulting from fissure) is found in *Guttiferae* only in *Mammea* L. (and *Ochrocarpos* Thou.). There is no species known as an exception to this rule and so this peculiarity is an excellent character to keep a taxon apart in *Guttiferae*. Also, the wood anatomy, as far as is known, stresses a well-demarcated position in *Guttiferae* for a taxon composed of *Mammea* L. and *Ochrocarpos* Thou.

## II. MAMMEA DESCRIBED

A Guttiferous genus. Leaves: Blade coriaceous to chartaceous, often with pellucid glands or pellucid secretory canals, pinnately nerved, often reticulate, the reticulations lax and open to very densely crowded.

Flowers polygamous, sometimes dioecious, solitary or more numerous in axillary, short, cymes or apparently indefinite inflorescences, often cauliflorous. Calyx in bud without any trace of separate valves, at

anthesis tearing into two parts (very rarely into 3 parts), more or less persistent in fruit. Petals usually 4, sometimes 5 or 6, free, caducous. Stamens in male flowers numerous, free, at the base connate, or nearly entirely connate (forming a column) or in 4-5 phalanges; in the female or hermaphroditic flowers less numerous, free or only at the base shortly connate, or staminal.

Ovary generally with 4 ovules and 2-4- (or very rarely many) celled (septs complete or not). Style absent or short. Stigma peltate, 2-4-lobed or rather irregularly denticulate.

Fruit baccate or drupaceous, indehiscent or, perhaps, very rarely dehiscent by 2 or 3 valves. Seeds 1 to 4, very rarely more.

Evergreen trees or shrubs in rain forests, or in deciduous forests, containing abundant yellow or white latex. Flowers white or pink. In Madagascar spp. the closed calyx is mostly apiculate.

Distribution: Circumtropical. America: West-Indies, Central America, northern part of S America. Africa: Tropical (West) Africa between about 10° N.L. and 10° S.L., and Tropical East Africa very locally (Usambaras). Madagascar. Asia: SE Asia and into the SW Pacific.

Note: The genus is generally found in the lowland, but in Madagascar also frequent in the mountains, up to about 2400 m. In East Africa it was found at 2000 m. At present 38 spp. are referable to *Mammea*, the majority already published as such; some spp. of *Ochrocarpos* are to be renamed in accordance with the systematy proposed here but I have refrained from publishing the required new combinations pending a monograph dealing with the species in detail (cf. Code, Rec. 17A, and Kostermans l.c. p. 11).

The record of a finding locality in E Africa at 2000 m is based on a specimen present in the Kew Herbarium (R. B. Drummond and J. H. Hemsley 2727). The collectors found it in the Western Shagai Forest, Usambaras, 2000 m, dominant in certain small areas, otherwise scattered in *Ocotea-Podocarpus* forest.

The fruits of this specimen are very much smoother than the warty and rough skinned fruits known from the type locality of *M. africana* Sabine (Sierra Leone, Kew Herb., or also de Wit, coll. no. 896, Bot. Gard. Bingerville, Herb. Wageningen) and it deserves further research whether a new species of *Mammea* is at hand and also whether there could be some connection with ENGLER's (1925) remark on the occurrence of *Mammea* in E Africa and the cultivation of a species in the Botanic Garden at Victoria.

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