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Subject: Comparison of Different Classifications on the Celastraceae in Africa with Discussions on the Status of Gymnosporia and Other Genera

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Currently, the taxonomy of the Celastraceae is in a state of confusion. A few recent revisions limited mostly to political boundaries, have helped to clarify the systematics in a few genera; however, the continued disagreement among generic relationships seems to make it more difficult for the non-specialist. Because of special efforts to procure plant samples in this family, frequent synonomy has led to confusion as well as duplication, especially in Africa where a number of samples have been received from floristically related countries in which different authorities are recognized for the Celastracean Flora. This report, primarily, will deal with the systematic problems of the African Celastraceae.

Until recently, the Hippocrateaceae was treated as a separate family from the Celastraceae (Smith, 1940; Loesener, 1942; Wilczek, 1960; Hallee, 1962). Robson (1965, 1966), Ding Hou (1963, 1964), Blakelock (1958), and Codd (1972) have united the Hippocrateaceae with the Celastraceae; but, their reasons for uniting the two families are not in agreement. The Celastraceae is believed by Codd and Robson to comprise about 60 to 70 genera, but Ding Hou has indicated that there are about 90 genera. For the purpose of identifying two major complexes, which taxonomists are not in agreement, I will refer to the Celastraceae and Hippocrateaceae as two separate families.

The Celastraceae is cosmopolitan with two major centers of distribution - southeast Asia and northern South America. In Africa, the Celastraceae appears to reach its greatest diversity in South Africa. Many of the African species have distribution ranges that extend throughout tropical and south Africa with some species extending through the Mediterranean to India. Pleurostylia opposita (Wall.) Alston in Trimen and Gymnosporia montana (Roth.) Benth. (= Maytenus senegalensis (Lam.) Exell?, Maytenus emarginata (Willd.) Ding Hou?, or Maytenus diversifolia (Maxim) Ding Hou?) are two species which occur in Africa, Madagascar, India, southeast Asia, and throughout the south Pacific, including New Caledonia and Australia.

The distribution of the Hippocrateaceae is primarily pantropical with a major center in west tropical Africa (Cameroons) and secondary centers in southeast Asia and northern South America. As in the Celastraceae, many of

the African species of the Hippocrateaceae are widespread in Africa. Reissantia indica (Willd.) Halle = Hippocratea indica Willd. occurs in Africa, India, Ceylon, Burma, Thailand, Indochina, south China, Philippines, and Java.

Since Robson is being considered by this laboratory as a basis for nomenclature, documenting all samples of the Celastraceae and Hippocrateaceae, a chart was prepared to compare Robson's classification with other specialists of these families. Robson's classification follows more closely to that of Loesener (1942) than to the other, more recent, concepts of Ding Hou, Codd, Davison, Blakelock, and Wilczek. Robson's classification may be the most natural one; but, unfortunately, his publications (at the present) are limited to Flora Zambesiaca and Flora Mocambique (Robson and Sousa). From a practical point of view, we should not use Robson for generic names of the Celastraceae. His concept of species (as in Maytenus) are likely to be followed by future taxonomists with minor modifications, and we should follow Robson in this manner. Also, Robson's treatment of the Hippocrateaceae, which parallels that of Blakelock in Hutchinson and Dalzeil, Flora of West Tropical Africa (1958), remains as a good option, even though it appears to conflict with Ding Hou, who seems to have been influenced by A. C. Smith (1940), Halle and Wilczek.

CELASTRACEAE

Robson	Loesener	Hallee Wilczek	Codd	Davison Blakelock	Ding Hou
Allocassine	Cassine	Cassine	Allocassine Cassine	Cassine	Cassine
Cassine	Cassine	Cassine	Cassine	Cassine	Cassine
Catha	Catha	Catha	Catha	Catha	Catha
Crocoxylon	Cassine-1892 Elaeodendron-1942	Cassine	Cassine	Cassine	Cassine
Hartogia	Hartogia		Hartogia		
Lydenburgia			Catha		
Maurocenia	Maurocenia		Maurocenia	Maurocenia	
Maytenus	Gymnosporia Moya Maytenus	Maytenus	Maytenus	Maytenus(Blakelock)	Maytenus & Gymnosporia-1955 Maytenus-1962
Mystroxylon	Cassine-1892 Mystroxylon-1942	Cassine	Cassine	Cassine	Cassine
Pleurostylia	Pleurostylia	Pleurostylia	Pleurostylia	Pleurostylia	Pleurostylia
Pterocelastrus	Pterocelastrus	Pterocelastrus	Pterocelastrus	Pterocelastrus	
Putterlickia	Putterlickia		Putterlickia	Gymnosporia Putterlickia	
Elaeodendron	Cassine-1892 Elaeodendron-1942 Lauridia-1942 Cassine-1942	Cassine	Cassine	Cassine	Cassine

HIPPOCRATEACEAE					
Robson Campylostemon	Loesener Tristemonanthus Campylostemon	Hallee Wilczek Tristemonanthus Bequaertia Campylostemon	Codd	Davison Blakelock Campylostemon	Ding Hou Campylostemon
Hippocratea	Hippocratea	Hippocratea	Hippocratea	Hippocratea	Hippocratea
Hippocratea	Hippocratea	Apodostigma		Hippocratea	
Hippocratea		Cuervea		Hippocratea	Cuervea?
Hippocratea	Hippocratea	Elachyptera			
Hippocratea	Hippocratea	Helictonema		Hippocratea	
Hippocratea	Hippocratea	Loeseneriella		Hippocratea	Loesneriella
Hippocratea	Hippocratea	Reissantia		Hippocratea	Reissantia
Hippocratea	Hippocratea	Simirestis		Hippocratea	
Salacia	Salacia	Salacia	Salacia	Salacia	Salacia
(?)	Salacia	Salacighia		Salacighia	

The Cassine Complex

The genera allied to Cassine L. (sensuo stricto, e.g. - Robson) are Allocassine N. Robson, Crocoxylon Eckl. & Zeyh., Elaeodendron Jacq. f. ex Jacq., Hartogia L. f., Lauridia Eckl. & Zeyh., Mystroxylon Eckl. & Zeyh., Pseudocassine Bredell, and possibly Pseudosalacia Codd. This complex has its center in South Africa. Ding Hou has presented a good historical summary on part of this complex in Flora Malesiana (1963).

> "There has been some disagreement about the status between Cassine, Elaeodendron, Mystroxylon, and two other genera (Hartogia, Lauridia). Sonder (Fl. Cap 1, 1860, 451-452) had them as five different genera; in Cassine the drupe was defined as juicy with a thin crust-like putamen, in Elaeodendron it being rather dry, with a very hard ligneous putamen. Bentham & Hooker (Gen Pl. 1, 1862, 363, 367) kept Cassine and Elaeodendron separate, but Baillon (Hist. Pl. 1, 1877, 33) recognized only the latter. In 1892 Loesener reduced Elaeodendron to Cassine and distinguished them as two different sections of Cassine subg. Elaeodendron, adding that sect. Elaeodendron would have vessels with scalariform, rarely also simple perforations, and Cassine, simple, round or elliptic perforations. Later, however, he reinstated Cassine, Elaeodendron, and Mystroxylon as distinct genera (in E. & P. Pfl. Fam. Nachtr. 1897, 223; Bot. Johrb. 28, 1900, 154; in E & P. Pfl. Fam. ed. 2, 20b, 1942, 110).
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> In 1927 Davison (Bothalia 2, 289) merged Elaeodendron and some other genera with Cassine concluding that there are no generic differences between them. Perrier de la Bathie, though agreeing that these two genera cannot be distinguished, arranged all species of Madagascar under Elaeodendron (Not. Syst. 10, 1942, 196-200). Recently also, Blakelock followed Davison (Kew Bull. 1956, 556), especially because Metcalfe and Chalk (Anat. Dic. 1, 1950, 393) had found that the anatomical characters of the vessels do not hold in conjunction with the other characters. The recognition of only one genus, Cassine, seems therefore to be final."

The genus Cassine remained "final" for only two years. In 1965 Robson, again, reinstated these genera and others, and created another combination; the genus Allocassine. Also, Robson combined Lauridia with Elaeodendron and Pseudocassine with Crocoxylon. In 1966, Codd criticized Robson for splitting up the Cassine complex and Codd then made two new combinations in Cassine, Cassine reticulata (Eckl. & Zeyh.) Codd (= Elaeodendron reticulatum (Eckl. & Zeyh.) Ettingshousen in Denkschr.) and Cassine transvaalensis (Burtt Davy) Codd (= Crocoxylon (Burtt Davy) Robson. Codd also feels that Hartogia (agrees with Ding Hou) should be included in Cassine; but to this

day Hartogia, like Putterlickia and Denhamia, which are thought not to be kept separate from Maytenus, has been retained. In the Trees of Southern Africa by Palmer & Pitman (1972), Codd recognized only one species in Allocassine (Robson has described two species) with the other, Allocassine tetragona, listed as a synonym under Cassine. Finally Codd has recently described a new genus Pseudosalacia, which he feels is intermediate between Cassine and Salacia (Hippocrateaceae).

At the present, the Cassine complex can be viewed from either Robson or Codd who follows Ding Hou. In the genus Cassine, Robson recognizes two species from the Cape Peninsula of South Africa with four genera endemic to Africa, and Elaeodendron being pantropical in distribution. From the other point of view, all of Robson's genera (except possibly Allocassine) are placed into Cassine, thus making Cassine the pantropical genus. Recent floras outside of Africa have used Cassine over Elaeodendron. An anatomical study recently published by a woman reached conclusions that were contradictory - she supports both Robson and Smith (who I assume to be similar to Davison & Blakelock in this case); Robson, personal communication, 1973.

The Genus Lydenburgia

Robson in Bot. Soc. Brot. 39: 34-36 (1965) described a new genus, Lydenburgia from South Africa. Apparently, Codd was independently describing Robson's new genus as a new species of Catha (a montypic genus found in Arabia, Ethiopia, East Africa to Cape Province). After seeing Robson's publication, Codd in Bothalia 9, 124 (1966) transferred Lydenburgia cassinoides Robson to Catha cassinoides (Robson) Codd. It seems that Codd neglected to check Index Kewensis upon publishing his new combination because Catha cassinoides (Robson) Codd is a homonym of Catha cassinoides Webb. & Benth. It was later corrected and renamed as Catha transvaalensis Codd.

The Hippocratea Complex

The genus Hippocratea has been interpreted to comprise about 150 species or subdivided into as many as 16 genera, each with various numbers of species. Wilczek (1960), in Flora du Congo Belge et du Ruanda-Urundi, who parallels very closely to Halle (1958, 1960 and 1962), recognized eight genera: Hippocratea, Apodostigma, Cuervea, Elachyptera, Helictonema, Loesneriella, Reissantia and Simirestis. Robson (1965, 1966) and Blakelock (1958) have lumped these all into Hippocratea. Ding Hou (1964) seems to follow Hallee and Wilczek since he has listed species of Reissantia and Loesneriella in Flora Malesiana. Also, Wilczek (1960) and Halle (1962) recognized two genera, Cuervea and Elachyptera, which occur in Central and South America and West Indies (but not Asia), probably based upon Smith (1940).

Another complex of the Hippocrateaceae, which seems to parallel the genus Hippocratea is Campylostemon and its allies Bequaertia and Tristemonanthus. Wilczek recognizes three genera and Robson only one, Campylostemon.

In summary, the African Hippocrateaceae comprises four genera (including Salacia and Salacighia?) from Robson's point of view, or 13 genera as treated by Wilczek (1960) and Halle (1962), Monographie des Hippocrateaceae d'Afrique Occidentale; Inst. Franc. d'Afrique Noire Mem. 64.

The Status of Gymnosporia

The taxonomy and history of three closely related genera: Celastrus, Gymnosporia, and Maytenus is discussed by Ding Hou in his revision of the genus Celastrus (Ann. Missouri Bot. Gard. 42: 217-218, 1955) and in Flora Malesiana Ser. I: 238-240 (1962). Until recently, Gymnosporia was regarded as a large genus mostly in the Old World Tropics (three species of Gymnosporia, in Latin America, were transferred to Moya by Loesener, 1942, and then to Maytenus by Lourteig and O'Donell, 1955); Maytenus, with more than 100 species, was restricted to the New World and Celastrus, following Ding Hou's revision, remains in Asia, North America, and Madagascar. Although Celastrus presently does not occur in Africa, many of the African species of Gymnosporia (now Maytenus) were described in Celastrus. In Ding Hou's revision of Celastrus (1955), he maintained Gymnosporia, Maytenus, and Celastrus; but, pointed out that the distinction between Gymnosporia and Maytenus will need further study. Gymnosporia has not received recognition in the more recent floras or revisions.

The transfer of Gymnosporia to Maytenus appears to have originated with Exell (Bot. Soc. Brot. II, 26, 1952 and Kew Bull., 1953, 103). Exell's recognition of only Maytenus was followed by other botanists: Exell and Mendoca, 1954 (Consp. Fl. Angol., 2); Blakelock, 1954 (Taxon 3, 1961), Kew Bull. (2) 237-247), 1957 (Kew Bull. (1) 37-39); Hutchinson and Dalziel with Blakelock, 1958 (Fl. W. Trop. Africa ed. 2, 1 (2), 23-624); Marais, 1960 (Bothalia 7: 381-386); Wilzcek, 1960 (Fl. Cong. Belg., 114-125); Ding Hou, 1963 (Fl. Malesiana, Ser. 1: 238-243); Robson, 1965 (Soc. Broth. Biol. 39 (2): 5-56), 1966 (Fl. Zambesiaca 2 (2): 355-417), and Palmer E. and N. Pitman, 1972 (Trees of Southern Africa II, 1973-1287). All of the African and Malaysian species of Gymnosporia are now combined under Maytenus.

Although Gymnosporia is not used in current floras, some Asian species, which fall outside areas of recent floristic studies, may continue to be treated as Gymnosporia. Some of these species eventually may be included in the present African or Malaysian species of Maytenus. One particular species, Gymnosporia montana, originally described from India as Celastrus montanus, has a long history of being included in the African, Asian, and Australasian literature and deserves special attention, since it is a confirmed active in our program.

Gymnosporia montana is cited as a synonym in the genus Maytenus under M. senegalensis (Lam.) Exell by Robson (Soc. Brot. Biol. 39 (Ser. 2): 14, 1965; and Flora Zambesiaca 2 (2): 368, 1966), Maheshwari (the flora of Delhi: 101, 1963), Breitenbach (The Indigenous Trees of Ethiopia: 198, 1963), and as a synonym of M. emarginata (Willd.) Ding Hou by Ding Hou (Flora Malesiana, 6 (1): 241, 1963) and by Backer and Bakhuizen van den Brink (Flora of Java: 55, 1965).

Citations of authorities for Gymnosporia montana include: G. montana Roxb. (Lawson in Hooker, F.B.I. (1): 621, 1875), G. montana Benth. (Fl. Aust. (1), 1863) G. montana (Roxb.) Benth. (Loesener, 1942). Ding Hou, in Flora Malesiana (pp. 241-242), elaborated on this confusion which involves Roxburgh's naming of Celastrus montanus Roxb. as a homonym of Celastrus montanus Roth. According to Ding Hou, later authors have not always realized that Roth's publication preceeded that of Roxburgh. The correct citation for this name, which is now conserved, is Gymnosporia montana (Roth ex Roem. & Schult.) Benth. (= Celastrus montanus Roth ex Roem. & Schult.).

Both Ding Hou and Robson cite the same references for Celastrus montanus (under Maytenus emarginata in Fl. Malesiana and M. senegalensis in Fl. Zambesiaca). Ding Hou distinguished between Celastrus senegalensis (= Maytenus senegalensis) and C. montanus on the basis that C. senegalensis always has a two-celled ovary. Ding Hou made one reference on Maytenus senegalensis to Hutchinson and Dalzeil, Flora of West Tropical Africa, ed. 2, 1958, which may be Ding Hou's concept of M. senegalensis, and is not the same as that of Robson. It appears to me that Robson should have commented on Ding Hou's interpretation when he included C. montanus with M. senegalensis; and, since Robson has not commented it is difficult to determine whether he was aware of Ding Hou's inclusion of C. montanus under M. emarginata. Robson has also communicated to me personally, that C. montana is equivalent to M. senegalensis; but, at the time of my visit (March 1973) I did not have my notes with me and could not remember the details concerning these taxa.

Ding Hou did not clearly state that the type specimen of Celastrus montanus contains a three-celled ovary, but this is definitely inferred by the following: (1) citing C. montanus as a synonym of M. emarginata (2) stating that Loesener (1942) in recording Gymnosporia senegalensis (= Maytenus senegalensis) as distributed from Africa to Asia to Australia was induced by Bentham's remark and probably confused this with his species - Maytenus diversifolia (Maxim.) Ding Hou which is characterized by a two-celled ovary, and (3) stating that he cannot uphold Roxburgh's distinction between C. montanus and C. emarginata on the minor basis of leaf and inflorescence characters.

Since Robson also characterizes Maytenus senegalensis by a usually two-celled ovary (character used by Robson in his key used to separate M. senegalensis from M. heterophylla) and includes C. montanus Roth as a synonym - it would indicate some confusion on whether the type specimen of C. montanus is a plant with a two-celled or three-celled ovary. The distribution of M. senegalensis is widespread in Africa to India and M. emarginata occurs from India, Ceylon to Australia. Except for the uncertain relationship of C. montanus, one might regard M. emarginata of Malaysia equivalent to

the confusion over M. heterophylla in Africa and the M. diversifolia of Malaysia equivalent to M. senegalensis of Africa. Also, it would be interesting to know the differences between the species just mentioned.

Maytenus and Related Genera, Celastrus, Putterlickia, and Denhamia

The genus Maytenus includes from 150-200 species and less than one-fifth of these occur in Asia and Africa. The major center for this genus is in South America. Robson will describe 14 species of Maytenus for the Flora of Tropical East Africa, which will include one new species from Tanzania (personal communication, March 1973); and he, personally, feels that the Maytenus species in Africa are not well-defined, but represent aggregates that overlap and integrade throughout Africa (personal communication, 1973).

Ding Hou has listed five species in the Flora Malesiana; and since Malaysia covers a vast amount of territory, the number of species in Asia remaining to be described or combined from Gymnosporia, appear to be few in number (mostly in India).

The need for revision of the American species of Maytenus has been expressed by Macbride (Flora of Peru, Vol. 13, part 3A (1); p. 260; 1951):

> "It has not been practical for me to attempt evaluation of the many species proposed in this group; the key is only suggestive and some of the characters indicated for reasons of expediency will prove, it seems to me, to be less significant when a comprehensive study is possible."

The genera allied to Maytenus include Celastrus (Asia, Madagascar and North America), Putterlickia (South Africa), and Denhamia (Australia). Robson has made the comment that Mystroxylon (in the Cassine complex) is a Maytenus with an indehiscent fruit (personal communication, 1973).

Ding Hou distinguishes Celastrus from Maytenus (in Flora Malesiana) on the basis of habit, degree of adnation of ovary and disk, and fruit structure. Celastrus is scandent; the ovary is free from the disk except at the base; and after dehiscence of the fruit, the central axis splits close to the insertion of the seeds and after the seeds and valves have been dropped, the thickened placenta can still be observed on the pedicel. In Maytenus, the plants are erect trees or shrubs (except M. buchananii - not noted by Ding Hou); the ovary is partly or entirely (rarely) immersed in the disk; and the central axis splits to the very base, and after the seeds and valves have fallen, almost nothing can be discerned on the top of the pedicels. In view of recent publications and floras on the Celastraceae, which have continued to recognize Celastrus, this genus will probably be maintained.

Denhamia and Putterlickia are two genera which are separated from Maytenus by possessing more than two ovules per cell. Ding Hou (Fl. Malesiana, p. 240, 1962) has noted that Denhamia parviflora L. S. Smith and D. pittosporoides F. & M. normally have two ovules per cell and represent a transition from other species of Denhamia to Maytenus. Ding Hou feels that Denhamia should be reduced to Maytenus. Robson has made similar

comments about Putterlickia, which is nothing more than a Maytenus with usually more than two ovules per cell, and like the genus Denhamia, it may have to be eventually included in Maytenus (Bol. Soc. Brot.: 5, 1965). Except for geographical distribution, I am not certain what separates Denhamia from Putterlickia. Robson intends to maintain the genus Putterlickia (Robson, personal communication, 1973).

Summary and Conclusions

A major reason for reviewing the literature on the Celastraceae is to adopt a uniform systematic treatment that can be used to document plant samples collected for anticancer research.

There exist, in most cases, two possibilities for correct names for each of the species which fall into the complexes discussed in this paper (e.g. *Elaeodendron buchananii* Loes. = *Cassine buchananii* Loes., *Mystroxylon aethiopicum* (Thunb.) Loes. = *Cassine aethiopica* Thunb., *Lydenburgia cassinoides* N. Robson = *Catha transvaalensis* Codd., *Hippocratea ritschardii* (Wilczek) N. Robson = *Simirestis ritschardii* (Wilczek) Halle, *Hippocratea africana* (Willd.) Loes. = *Loesneriella africana* (Willd.) Wilczek). Our choice in selecting names can be approached from several points of view. We could rely on the concept of one particular specialist (e.g. Robson in Fl. Zambesiaca, Ding Hou in Fl. Malesiana, or Blakelock in Fl. West Tropical Africa); or a combination of specialists or decide whether we prefer to be lumpers or splitters. The Celastraceae in the Flora of West Tropical Africa represents completely a conservative approach. The floras published for the French colonies lump the genera in the *Cassine* complex and divide the *Hippocratea* complex (which parallels Ding Hou). On the other hand, Robson splits the *Cassine* complex, but is conservative in his treatment of *Hippocratea*. No one, to my knowledge, has been a splitter for both the *Cassine* and *Hippocratea* complexes; however, this option is possible if we utilize both Robson and Wilczek (Robson for the Celastraceae excluding Hippocrateaceae, and Wilczek for the Hippocrateaceae).

It should be also realized that the taxonomic confusion of the Celastraceae is not just limited to Africa. An understanding of the generic concepts for the New World Tropics will require more time, due to the lack of studies. Currently, there are no specialists in this family for Latin America (Robson, personal communication, 1973).

The major weakness of taxonomists in their revisions on the Celastraceae is limiting their studies to specific geographical areas. Also, it seems that those taxa which received more intensive study has led to more splitting, where as the broader the study, the reverse is true. The confusion on the generic and species concepts and the distribution of genera and species suggests that this family has evolved very slowly since its first appearance (in the Jurassic or Cretaceous periods?).

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Literature Cited

Backer, C. A. and R. C. Bakhuizen van den Brink. 1965. Flora of Java II. Groningen, Netherlands. p. 55. NAL: 460.21 B12FE.

Bentham. 1863. Flora Australensis, 1: 400.

Blakelock, R. A. 1954. Nomina generica conservanda propoista. Taxon 3: 196. NAL: 450 T192.

____. 1956. Notes on African Celastraceae: I. Kew Bull. 1956(2): 237-247. NAL: 451 K51B.

____. 1957. Notes on African Celastraceae: III. Kew Bull. 1957(1): 37-39. NAL: 451 K51B.

Breitenbach, F. Von. 1963. The indigenous trees of Ethiopia. pp. 198-200. NAL: 460.42 B74.

Codd, L. E. W. 1966 in New and Interesting Records of African Flowering Plants, by various authors. Bothalia 9, 1: 123-124.

Davison, J. D. 1927. Celastraceae, R. Br. Bothalia 2(1b): 289-346. NAL: 460.46 B65.

Exell, A. W. 1959. Additions to the flora of S. Tome and Principe. Inst. Franc d'Afrique Noire B, Ser. A, Sci. Nat. 21: 439-476. NAL: 515 D14.

____ and F. A. Mendonca. 1952. Novidades da flora de Angola. Bol. Soc. Broteriana 26: 221-235. NAL: 451 C66.

Exell, A. W. and F. A. Mendonca. 1954. Celastraceae. In A. W. Exell, F. Fernandes and E. J. Mendes, Conspectus Fl. Angol. 2: 1-10. SI: 581.9673 C27.

Halle, N. 1958. Hippocrateaceae nouvelles d'Afrique Occidentale Paris Mus. Natl. d'Hist. Nat. B. (ser 2)30(5): 464-471.

____. 1960. Hippocrateaceae nouvelles de Gabon Notulae System. 16(1/2): 127-135.

____. 1962. Monographie des hippocrateaceae d'Afrigue Occidentale Inst. Franc. d'Afrique Noire Mem. 64, 245 p.

Hooker, J. P. 1875. Flora of British India. 1:621.

Hou, Ding. 1955. A revision of the genus Celastrus. Ann. Missouri Bot. Gard. 42: 215-302. NAL: 451 M69.

continued---------

____. 1963. Celastraceae. Flora Malesiana Ser I, 6: 227-291. NAL: 460.21 F66.

____. 1963. Florae Malesianae precursores XXXLV. Notes on some genera of Celastraceae in Malaysia. Blumea 12(1):31-38.

____. 1964. Flora Malesiana Ser II, 6: 389-403.

Hutchinson, J. and J. M. Dalziel. 1954. Flora of West Tropical Africa (with Blakelock for the family, Celastraceae). Ed. 2 by R. W. J. Keay. 1: 624-625. NAL: 460.43 H97.

Loesener, T. 1899. Celastraceae africanae III. Eng. Bot. Jahrb. 28: 150-161. NAL: 450 EN3B.

____. 1942. Celastraceae. Nat. Pflanzenfam. 20B: 87-197. SI: 580.8 N29.

Maheshwari, J. K. 1963. The flora of Delhi. New Delhi. p. 101. NAL: 460.12 M27.

Marais, W. 1960. An enumeration of the Maytenus species of southern Africa. Bothalis 7: 381-386. NAL: 460.46 B65.

Palmer, E. and N. Pitman. 1972. Trees of Southern Africa II. Capetown. pp. 1271-1297. NAL: QK491.SBP3.

Robson, N. 1965. New and little known species from the flora Zambesiaca area. XVI. Taxonomic and nomenclatural notes on Celastraceae. Soc. Broteriana Biol. 39(ser. 2): 5-56. NAL: 451 C66.

____. 1966. Celastraceae. In A. W. Exell, A. Fernandes and H. Wild (Ed.), Flora Zambesiaca 2(2): 355-417.

Robson, N. and E. Sousa. 1969. Celastraceae. Flora de Mocambique, 48: 39 p.; Junta de Investigacones do Ultramar Centro de Botanica; Lisboa.

Smith, A. C. 1940. Hippocrateaceae. Brittonia 3: 341-555.

Stewart, R. R. 1972. An annotated catalogue of the vascular plants of West Pakistan and Kashmir. Karachi. p. 461.

Wilczek, R. 1960. Celastraceae. Flore du Congo Belge et du Ruanda Urundi 9: 113-125. NAL: 460.43 F662.