

CENTRES OF DEVELOPMENT AND PATTERNS OF DISTRIBUTION OF
THE FAMILY MELASTOMATACEAE IN INDO-MALESIA

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A B S T R A C T

1. The Melastomataceae is a homogeneous family of about 220 genera and 5300 species and is generally confined to the tropical and subtropical regions, avoiding arid conditions and attaining prolific developments in the rain forests between the tropic of cancer and the tropic of capricorn. More than one half of the World's melastomataceous genera (about 120) and two-thirds of the total number of species (about 3353) are confined to the New World. The melastomataceous flora of Indo-Malesia consists of 64 genera and about 1300 species. In the Old World the incidence of melastomataceous species for Indo-Malesia and Africa is in the ratio of 2 : 1.

2. The present distribution of Melastomataceae in both the New World and the Old World is discussed on the basis of Wegener's hypothesis of "Continental Drift". Instead of considering the island of Madagascar as the centre of origin of the family in a restricted way, it is considered that "Gondwanaland" was ideally suited for the melastomataceous flora and those blocks that moved away after the breaking up of this huge continental mass in the Late Cretaceous, each carried their own share of melastomataceous species which, after gradual establishment in new situations during a long span of time and space, proliferated into several new taxa by an intensive process of evolution.

3. The Deccan Peninsula + Ceylon block in drifting over the Indian Ocean must have carried the original Gondwanaland stock and gene-pool of the Melastomataceae which later—when this block was fused with Laurasia and the Tethys Sea had disappeared—became the centre of development of the family in continental Asia. Then Melastomataceae could further develop on the southern part of Laurasia and from there migrate eastward to the Malesian islands, the Western Pacific and northern Australia.

This implies the conclusion that, though Australia also formed part of the ancient Gondwanaland, this cannot have carried part of the ancient Gondwanaland Melastomataceae when Australia drifted apart.

4. An attempt has been made to assess the centres of distribution of Indo-Malesian Melastomataceae and from this study the following four centres of development are proposed : (i) The Deccan-Ceylon centre, (ii) The Himalayan-Yunnan centre, (iii) The Sunda centre and (iv) The Philippine-Papuan centre.

5. The Island of Borneo is unique in having the largest number of genera—42 out of the Indo-Malesian total of 64 genera—and the largest number of species *i.e.* 257. Perhaps, it is due to the part played by the mountain of Kinabalu in enriching the floristic composition of Borneo. It is generally considered by phytogeographers that Kinabalu is a great sanctuary of flora, past and present, and a nursery of endemic elements.

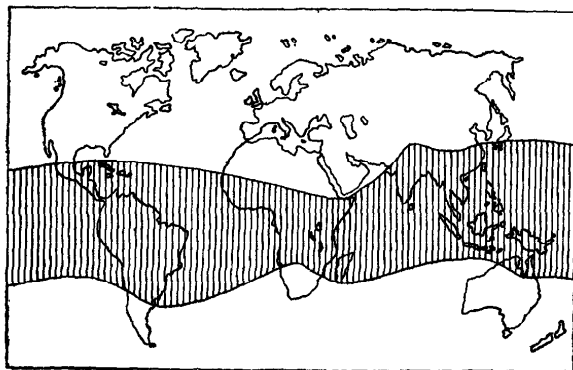
INTRODUCTION

The author has carried out detailed studies on the Melastomataceae of Asia during 1960-68 at the Central National Herbarium, Calcutta ; the Royal Botanic Gardens, Kew, U.K. ; the Royal Botanic Gardens, Edinburgh, U.K. ; the British Museum (Nat. History), London and the Rijksherbarium, Leiden, Netherlands.

The Melastomataceae is a homogenous

family of about 220 genera and 5300 species and is generally confined to the tropical and subtropical regions, avoiding arid conditions and attaining prolific growth in the rain forests between the tropic of cancer and the tropic of capricorn (Map I). More than one half of the World's melastomataceous genera (about 120) and two-thirds of the total number of species (about 3353) are confined to the New World occurring in the belt extending from

Brazil, Peru, Ecuador, Venezuela and Columbia to Central America, Mexico and Caribbean islands. The largest genus of the family Melastomataceae, *Miconia* Ruiz. et Pav., comprising more than 900 species, is confined to the New World. The New World species



Map I.

are exclusive to the region excepting the American species *Clidemia hirta* D. Don which has established itself as a cosmopolitan weed in many parts of Indo-Malesia (Nayar, 1966). In the Old World the relative incidence of melastomataceous species for Indo-Malesia and Africa is in the ratio of 2:1.

MELASTOMATACEAE AND THE HYPOTHESIS OF CONTINENTAL DRIFT

Among the living Melastomataceae no genus occurs both in the New World and the Old World.

At the tribal level this same situation prevails, but for the tribe *Memecyleae* which occurs in the tropics of all continents. Of this tribe the genus *Mouriri* Aubl. is allied to the Old World genus *Memecylon* L.

Within the Old World Melastomataceae the situation is different as several genera and 5 out of 8 tribes are shared by the tropics of Africa and Asia.

From this it is evident that there are three centres of the living Melastomataceae, for which I refer to Table I.

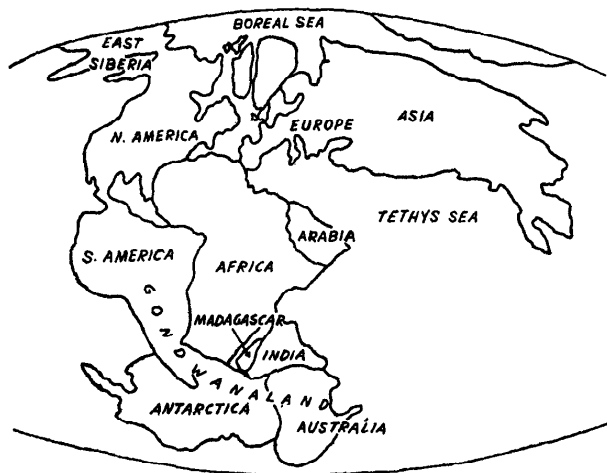
TABLE I

Primary centres	Name of Tribes present	Number of genera	Number of species
1. South and Central America	Tribe Microlicieae, Tibouchineae, Rhexieae, Merianieae, Bertolonieae, Blakeae, Miconieae, Memecyleae	120	3353
2. Africa	Tribe Osbeckieae, Oxyporeae, Sonerileae, Dissochaeteae, Memecyleae	39	647
3. Indo-Malesia	Tribe Osbeckieae, Oxyporeae, Sonerileae, Dissochaeteae, Memecyleae, Astronieae, Kibessieae, Axinandreae	64	1300

The tribes Astronieae, Kibessieae and Axinandreae are exclusive to Indo-Malesia. While the tribes Osbeckieae, Oxyporeae, Sonerileae, Dissochaeteae and Memecyleae occur both in Indo-Malesia and Africa. The only genera that occur both in Indo-Malesia and Africa are, *Osbeckia* L., *Medinilla* Gaudich., *Dissotis* Hook. f. and *Memecylon* L.

Though the separation of New World and Old World Melastomataceae is very clear among the living members of the family, the family is systematically so coherent, distinct and homogenous in many aspects, that it must have a common origin in the geological past, although this cannot be proved by fossil evidence. It cannot be assumed that the present Melastomataceae have originated quite independently in the tropics of the three continents; they must have been derived from a common ancient stock or matrix. The possible explanation is the theoretical existence of the land mass which has been named "Gondwanaland" (comprising S. America, Africa, Madagascar, India, Australia and Antarctica) based on Wegener's hypothesis of the Continental Drift

(Map II). According to A. & R. Fernandes (1954) the family Melastomataceae might have originated in the Gondwanaland and



Map II.

with the subsequent breaking of Gondwanaland mass, each block brought its own components. However, A. & R. Fernandes (1954) considered the Island of Madagascar and the adjacent regions as the centre of origin and dispersion of the family. Of about 647 species in Africa, nearly 282 species occur in Madagascar (Perrier de Bathie, 1951). The flora of Madagascar is unique in having high percentage of endemic Melastomataceae, i.e. out of 282 species 276 are endemics. This is probably due to isolation caused by the sea barrier. There are two views on the present day concentration of endemic species in Madagascar: (i) Fortified by its insularity, the melastomataceous flora of Madagascar might have undergone an evolution giving rise to numerous endemic species; (ii) Protected by the sea barrier, the island of Madagascar escaped the onslaught of the encroaching Kalahari desert from S. W. Africa. The second view means that the species of Madagascar are relics which escaped extinction, while their counterparts in S. Africa became extinct with the onset of desiccation. The first view supports the contention that islands are nurseries of speciation. While the second view considers the Island floras to be

stabilised and relatively free from at least some of the climatic changes and biological instabilities which affect larger land masses. However it is suggested that, instead of considering Madagascar as the centre of origin of the family Melastomataceae in a restricted way, the Gondwanaland mass was ideally suited for the melastomataceous flora and those blocks that moved away after the breaking each carried their own share of melastomataceous species which after gradual establishment in new situations during a long span of time and space proliferated into several new taxa and the present day world melastomataceous flora is the summation of all the factors causing the process of species-formation or species-extinction after the breaking of the Gondwanaland.

As suggested by A. & R. Fernandes (1954) the transformation of a part of S. Africa into the Kalahari desert resulted in the extinction of all the African types allied to those of S. America. The advent of the Sahara desert in the north and the Kalahari desert in the south acted as barriers to the spread of Melastomataceous species northwards and southwards respectively. During the beginning of the Tertiary period, Madagascar along with the Comora islands became isolated from the mainland and thus insulated itself from the vagaries of climatic changes that occurred in the mainland.

During the Cretaceous or in the beginning of the Eocene, the Indian portion of the Gondwanaland moved north-eastwards taking its own share of species. In India the family Melastomataceae developed further and after it became attached to the Asian mainland the melastomataceous species spread to new areas. With the raising of the Himalayan chain of mountains from the Tethys sea, species of this family underwent a process of evolution in the sanctuaries of the Himalayan Ranges. Later on, with the formation of the Thar desert in N.W. India and with the onset of desiccation in the eastern portion of

the Peninsular India, it is thought that the Indian portion of the original Gondwanaland melastomataceous flora underwent a process of degeneration. At present the number of melastomataceous species in Peninsular India is 61 which is equal to that of Ceylon. While protected by its insular nature, the species of Melastomataceae in Ceylon must have largely escaped extinction. The Peninsular Indian and Ceylon types are more related to each other than to their counterparts in N.E. India. It is interesting to note the occurrence of the monotypic genus *Kendrickia* in the Anamallais in S. India and Adam's Peak in Ceylon.

During the Tertiary the Melastomataceae spread eastwards into the Malesian tropics where they successfully developed into an important secondary centre, even leading to two distinct new tribes (Kibessieae and Astro-nieae). The variety of geographical conditions (great elevation and isolation through the island nature of Malesia) led to a high development of endemism. This development and distribution went far into the east, penetrating into the West Pacific (Fiji, Samoa, Tonga).

In Australia there are only five genera (*i.e.* *Osbeckia*, *Melastoma*, *Otanthra*, *Medinilla* and *Memecylon*) with a total of 9 species. This paucity is ascribed to the arid conditions prevailing in the West and North-West Australia. It must be added that 5 genera of tropical Australia belong to the Malesian secondary centre and cannot be derived from the ancient primary Gondwana stock. It follows that when Gondwanaland broke up and Australia drifted apart, this continent did not carry a part of the Melastomataceous matrix of the primary centre of the family.

The family Melastomataceae is represented in Japan by four genera (*i.e.* *Osbeckia*, *Melastoma*, *Blasts* and *Bredia*) and each with a single species. The limiting factor that restricts the extension of the family in Japan is apparently one of climate.

THE CENTRES OF INDO-MALESIAN MELASTOMATACEAE

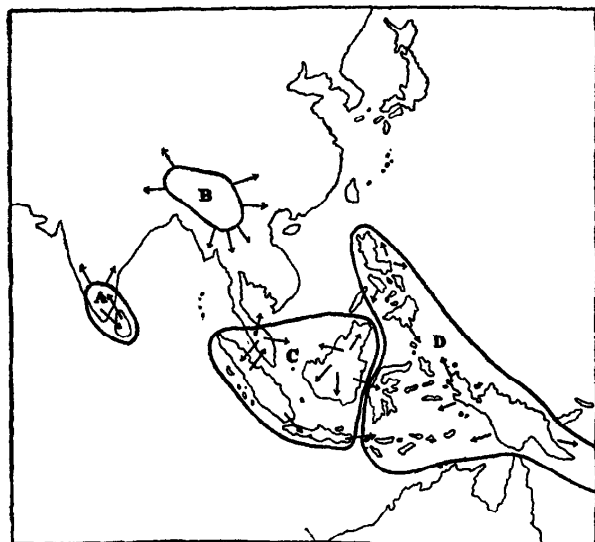
The melastomataceous flora of Asia & Malesia consists of 64 genera and about 1300 species. The five largest genera in Indo-Malesia are as follows: *Medinilla* Gaud. (300 species), *Memecylon* L. (180 species), *Sonerila* Roxb. (160 species), *Melastoma* L. (79 species) and *Osbeckia* L. (58 species). Of the endemic genera, the Island of Borneo claims the largest number *i.e.* 9 genera. The Island of Borneo is unique in having the largest number of melastomataceous genera (*i.e.* 42) and species (*i.e.* 257). The number of genera and species present in each region is given in Table II.

TABLE II

Region	Number of genera	Endemic genera	Number of species	Endemic species
Borneo	42	9	257	191
Sumatra	29	—	154	58
Malaya	29	1	181	97
Thailand	22	—	110	35
Philippines	21	2	255	227
Java	20	—	78	15
Burma	19	—	64	10
New Guinea	19	—	171	143
China	19	2	99	62
Moluccas & Celebes	17	—	69	23
Indo-China	17	—	83	32
Banka & Linga Is.	13	—	27	4
India	11	—	95	48
Formosa	9	—	18	7
Lesser Sunda Is.	8	—	21	7
Ceylon	7	—	61	43
Polynesian Is.	5	—	64	32
Australia	5	—	9	4
Japan	4	—	4	—
Andamans & Nicobars	4	—	11	4

On an analysis of the distribution patterns of asiatic melastomataceae it is possible to discern four centres of species-formation.

(Map III). *i.e.* 1. The Deccan-Ceylon centre (Peninsular India and Ceylon); 2. The Himalayan-Yunnan centre (N. E. India, Burma, Mainland Thailand, S. China, Indo-China



Map III

and Formosa); 3. The Sunda centre (Peninsular Thailand, Malaya, Sumatra, Java, Borneo, Lesser Sunda Islands and Andaman & Nicobar Island); 4. The Philippine-Papuan centre (Philippines, Celebes, Moluccas, New Guinea and Polynesia).

1. *The Deccan-Ceylon centre:* *Osbeckia* L., *Melastoma* L., *Medinilla* Gaud., *Sonerila* Roxb., *Kendrickia* Hook. f., *Axinandra* Thw. and *Memecylon* L. are the seven genera found in the Deccan-Ceylon centre. (Table III). Excepting the genera *Kendrickia* Hook. f.

TABLE III

Distribution patterns of the family Melastomataceae in the Deccan-Ceylon centre

Genera	S. India		Ceylon	
	Number of species	Number of endemic sp.	Number of species	Number of endemic sp.
<i>Osbeckia</i>	21	12	12	6
<i>Melastoma</i>	1	—	1	—
<i>Medinilla</i>	2	2	2	2
<i>Sonerila</i>	17	14	13	10
<i>Kendrickia</i>	1	—	1	—
<i>Axinandra</i>	—	—	1	1
<i>Memecylon</i>	19	12	31	24

and *Axinandra* Thw., all the other genera occurring in this centre are panasiatic. The genus *Kendrickia* Hook. f. is confined to Anamallai hills in S. India and Adam's peak in Ceylon. While *Axinandra* Thw. occurs in Ceylon, Malacca and Borneo. The Malayan elements in the melastomataceous flora of Ceylon are *Sonerila linearis* Hook. f. and *Axinandra zeylanica* Thw. In Peninsular India there are no Malayan species of this family. *Medinilla malabarica* Bedd. growing in the Anamallai hills of S. India and *Medinilla maculata* Gardn. occurring in Ceylon are more related to the *Medinillas* of Madagascar than to those of Malesia. This suggests an isthmian connection between Madagascar and Ceylon over the Seychelles-Comores bank and agrees with the Land-Bridge Theory of van Steenis (1962). In this centre *Memecylon* L. has the largest number of species (about 43) and is followed by *Sonerila* Roxb. with 28 species and *Osbeckia* L. with 27 species. In this centre there are about 115 species and this contributes only 8% to the total melastomataceous species of Indo-Malesia.

2. *The Himalayan-Yunnan centre:* This centre represents 18% of Asian Melastomataceae and consists of about 30 genera and 242 species (Table IV). The following genera are exclusive to this centre: *Pseudodissochaeta*, *Scorpiothyrsus*, *Fordiophyton*, *Staphiophyton*, *Oxyspora*, *Bredia*, *Cyphotheca*, *Barthea*, *Plagiopetalum*, *Styrophyton* and *Sporoxeia*.

The largest genus in this centre is *Sonerila* with 36 species and this is followed by *Memecylon* and *Osbeckia* with 30 sp. and 25 sp. respectively. Most of the species of *Osbeckia* of this centre have large showy flowers with prominent calyx appendages and large rotate stamens in comparison with their counterparts in the Deccan-Ceylon centre. *Osbeckia cochinchinensis* Cogn. occurring in Cambodia, Peninsular Siam and Malaya with short pedoconnectives shows a stage in the

TABLE IV

Distribution pattern of the family Melastomataceae in the Himalayan-Yunnan centre

Genera	N. India		Burma		Siam		China		Indo-China		Formosa		Japan	
	sp	e	sp	e	sp	e	sp	e	sp	e	sp	e	sp	e
<i>Osbeckia</i>	14	3	7	—	13	6	5	1	10	2	2	—	1	—
<i>Disotis</i>					1	—			2	1				
<i>Melastoma</i>	4	—	7	2	8	1	8	1	16	6	4	—	1	—
<i>Otanthra</i>			1	—							1	1		
<i>Pogonantha</i>			1	—										
<i>Pachycentria</i>			1	—										
<i>Diplectria</i>			1	—										
<i>Pseudodissochaeta</i>	1	—	2	—	2	1	2	1						
<i>Medinilla</i>	2	—	2	—			8	4	4	2	3	3		
<i>Sonerila</i>	7	4	12	4	11	6	9	4	9	4				
<i>Sarcopyramis</i>	3	1	3	1	1	—	5	2			1	—		
<i>Phyllagathis</i>			1	—			6	6	3	3				
<i>Scorpiothyrsus</i>							5	5	1	1				
<i>Fordiophyton</i>							8	6	1	1				
<i>Staphiophyton</i>							2	2						
<i>Bredia</i>							15	9			4	2	1	—
<i>Ochthocharis</i>			1	—					1	—				
<i>Blastus</i>	1	—	1	—	1	—	15	9	6	4	1	1	1	—
<i>Oxyspora</i>	3	—	4	1	1	—	3	2	1	—				
<i>Allomorpha</i>					3	3	4	2	5	3				
<i>Cyphotheca</i>							2	2						
<i>Barthea</i>							1	—			1	1		
<i>Plagiopetalum</i>	1	—	2	—			2	—						
<i>Anerincleistus</i>			2	1					4	—				
<i>Styrophyton</i>							1	1						
<i>Sporoxeia</i>			1	—					1	—				
<i>Astronia</i>											1	—		
<i>Pternandra</i>			1	—					2	—				
<i>Memecylon</i>	6	—	13	1	12	4	8	5	15	4				

sp = number of species ; e = number of endemic species.

process of evolution from *Osbeckia* to *Dissotis*. This also explains the distribution pattern of the genus *Dissotis* with two species *D. pellegriniana* and *D. orientalis* in Indo-Malesia. The genus *Otanthera* is represented in this centre by the following species: *O. bracteata* and *O. scaberrima*. The occurrence of *O. bracteata* in Burma represents a "spill-over" from its gravity centre in Siam and Sumatra. While the occurrence of *O. scaberrima* in Formosa extends the northern limit of the distribution belt of the genus *Otanthera* from New Guinea through the Philippines.

The tribe *Dissochaeteae* is chiefly composed of tropical climbers lianes, epiphytes and shrubs and is poorly represented in this centre. There are about 20 species distributed among the following genera: *Pogonanthera*, *Pachycentria*, *Diplectria*, *Pseudodissochaeta* and *Medinilla*. The tribe *Sonerileae* is fairly well represented with a total of 91 species and these are distributed among the following genera: *Sonerila*, *Sarcopyramis*, *Phyllagathis*, *Scorpiothyrsus*, *Fordiophyton*, *Staphiophyton* and *Bredia*. The tribe *Oxysporeae* is represented by about 49 species and distributed among the following genera: *Ochthocharis*, *Blastus*, *Oxyspora*, *Allomorpha*, *Cyphotheca*, *Barthea*, *Plagiopetalum*, *Styrophyton*, *Sporoxeia* and *Anerincleistus*.

On an analysis of the melastomataceous flora of the Himalayan-Yunnan centre it is possible to assume that a rapidly evolving *Sonerila-Oxyspora* stock might have developed in these Himalayan Ranges during the early stages of melastomataceous evolution in Asia. From such a stock, it is suggested the following genera might have branched later on: *Fordiophyton*, *Staphiophyton*, *Bredia*, *Barthea*, *Cyphotheca*, *Plagiopetalum*, *Allomorpha*, *Sporoxeia* and *Blastus*.

3. *The Sunda centre*: The Sunda centre, representing the land area adjacent to the Sunda sea i.e. Malaya, Peninsular Siam,

Sumatra, Borneo, Java and the Lesser Sunda Islands, contributes 555 species representing 40% of the melastomataceous flora of Indo-Malesia (Table V). In this centre there are about 49 genera and of which the following genera are exclusive to the region: *Plethiandra*, *Dalenia*, *Enchosanthera*, *Cyanandrium*, *Brittenia*, *Enaulophyton*, *Hylocharis*, *Creaghiella*, *Krassera*, *Pomatostoma*, *Oritrephes*, *Perilimnastes*, *Campimia*, *Triuranthera*, *Neodriessenia*, *Tayloriophyton* and *Dactylocladus*. The largest genus in this centre is *Sonerila* (92 sp.) and this is followed by *Memecylon* (63 sp.) and *Medinilla* (62 sp.).

The Sunda centre is the primary area of origin of the genus *Melastoma* with about 40 species. On the other hand this centre has a very poor representation of the genus *Osbeckia* (8 sp.).

The tribe *Dissochaeteae* originated and attained its climax in the tropical rain forests of this region and consists of about 17 genera and 165 species. They are well suited to a humid tropic flora and occur in the form of lianes, climbers, epiphytes and scandent shrubs and all of which contribute their share in the making of a dense luxuriant tropical rain forest. Noteworthy genera in the tribe *Dissochaeteae* are as follows: *Plethiandra* occurring near swampy tidal forests is characterised by its 20-30 inappendiculate stamens. The presence of a calyptriform calyx tube is a diagnostic character for the large leaved tropical liane *Dalenia*. The bullate another with laminate staminal appendage is a unique feature seen in the genus *Omphalopus*. Other genera of the tribe *Dissochaeteae* occurring in this region are *Pogonanthera*, *Pachycentria*, *Diplectria*, *Macrolenes*, *Dissochaeta*, *Catanthera*, *Backeria*, *Neodissochaeta*, *Medinilla*, *Enchosanthera*, *Creochiton*, *Eisocreo-chiton* and *Hypenanthus*. They are distinguished from each other by different combination of characters based on the presence or absence of extra-ovarial chambers, the degree of concrescence of the ovary with the

Distribution patterns of Melastomataceae in the Sunda centre

[illegible]

Genera	Andamans sp e	Malaya sp e	Pen. Siam sp e	Sumatra sp e	Lingga Is. sp e	Borneo sp e	Java sp e	Lesser Sunda Is. sp e
<i>Krassera</i>						2 2		
<i>Pomatostoma</i>						5 5		
<i>Oritrephes</i>		4 4						
<i>Perilimnastes</i>		1 1				1 1		
<i>Anerincleistus</i>		6 5	2 2	2 2		16 16		
<i>Campimia</i>		1 1				1 1		
<i>Driessenia</i>						8 7		
<i>Triuranthera</i>				2 1		3 2	1 —	
<i>Neodriessenia</i>						9 9		
<i>Tayloriophyton</i>		1 1				1 1		
<i>Astronia</i>		1 —		1 —		4 1	2 —	1 —
<i>Beccarianthus</i>						1 1		
<i>Pternandra</i>		4 —		5 —	2 —	19 15	1 —	
<i>Dactylocladus</i>						1 1		
<i>Axinandra</i>		1 1				4 4		
<i>Memecylon</i>	6 2	30 13	18 2	25 7	3 —	19 8	15 4	

sp = number of species ; e = number of endemic species.

calyx tube and the nature of the staminal appendages.

The tribe *Sonerileae* consists of 131 species which are distributed among the following genera: *Sonerila*, *Sarcopyramis*, *Phyllagathis*, *Cyanandrium*, *Brittenia* and *Enaulophyton*. The genus *Sonerila* has undergone prolific development within this centre and there are about 92 species. Section *Sonerilopsis* and sect. *Hexadon* indicate different lines of evolution in the genus *Sonerila*. It is in this region that the pentamerous genera *Cyanandrium*, *Brittenia* and *Enaulophyton* originated and they are related to the pentamerous *Sonerilae* of tropical Africa and Madagascar, i.e. *Gravesia*, *Calvoa* and *Amphiblemma*.

While the tribe *Sonerileae* are usually herbs and undershrubs growing near water courses

and in damp situations among moss covered moist rocks and roots, the members of the tribe *Oxysporeae* are chiefly scandent shrubs or undershrubs found growing in primary and secondary forests. In this centre the tribe *Oxysporeae* is represented by 109 species which are distributed among the following genera: *Ochthocharis*, *Blastus*, *Poikilogyne*, *Allomorphia*, *Hylocharis*, *Creaghiella*, *Plagiopetalum*, *Krassera*, *Pomatostoma*, *Oritrephes*, *Perilimnastes*, *Anerincleistus*, *Campimia*, *Driessenia*, *Triuranthera*, *Neodriessenia* and *Tayloriophyton*.

In this centre there are only 5 species of *Astronia*, of which 4 are 'wide' elements and one an endemic. These are probably the 'spill-over' taxa from the *Astronia* gravity centre in the Philippine-Papuan area. *Bec-*

carianthus pulcher Cogn. occurring in the Sarawak region of Borneo, represents the "fringe species" of the essentially Philippine-Papuan genus *Beccarianthus*. It is considered that the genus *Pternandra* might have originated in Borneo and then the species have radiated to neighbouring regions. Out of the 21 species of *Pternandra* in this centre, all the 15 endemic species are in Borneo. The genus *Axinandra* links the Bornean and Malayan *Melastomataceae* to Ceylon through *Axinandra zeylanica* Thw. *Dactylocladus* is another interesting monotypic genus restricted to Borneo.

On studying the speciation and endemism in the *Melastomataceae* it is considered that the following genera might have originated or radiated from this centre: *Melastoma*, *Plethiandra*, *Dalenia*, *Omphalopus*, *Pachycentria*, *Pogonanthera*, *Diplectria*, *Macrolehes*, *Dissochaeta*, *Backeria*, *Neodissochaeta*, *Enchosanthera*, *Cyanandrium*, *Brittenia*, *Enaulophyton*, *Ochthocharis*, *Hylocharis*, *Craeghiella*, *Krassera*, *Pomatostoma*, *Oritrephes*, *Perilimnastes*, *Anerincleistus*, *Campimnia*, *Driessenia*, *Triuranthera*, *Neodriessenia*, *Tayloriophyton*, *Pternandra*, *Dactylocladus* and *Axinandra*.

The four main regions adjacent to the Sunda sea, Malaya, Sumatra, Java and Borneo—have a large number of genera in common. Ridley (1930) appropriately suggested that "at one period there must have been a land of 4000 to 4500 feet". On studying the mountain floras of Mt. Tahan in Malaya and Kinabalu in Sabah (Borneo), Ridley (1930) further suggested an isthmian connection between Malaya and Borneo.

The Island of Borneo is unique in having the largest number of genera—42 out of the Indo-Malesian total of 64—and the largest number of species, i.e. 257 species. The part played by the mountains of Kinabalu in enriching the floristic composition of Borneo is unparalleled, as Kinabalu is a great sanctuary

of floras, past and present, and a nursery of speciation and endemism.

4. *The Philippine-Papuan centre*: The Philippine-Papuan centre has about 468 species which represents 34% of the melastomataceous flora of Indo-Malesia (Table VI). There is a high degree of endemism in the species of this centre (i.e. 90%) and this may be expected on account of the insular nature of the area. There are about 26 genera and the following are exclusive to this centre: *Carionia*, *Astrocalyx* and *Astronidium*. The largest genus of the centre is *Medinilla* (about 232 sp.) and this is followed by *Memecylon* (59 sp.) and *Astronia* (54 sp.).

The genus *Otanthera* is well represented in this centre (15 sp.) and probably this is the primary region of origin. Though the tribe *Dissochaeteae* attained its greatest generic diversity in the Sunda centre, the genus *Medinilla* has attained its most prolific development in this centre with about 232 species. Of the 16 species of *Catanthera*, 10 are represented in this region and are exclusive to New Guinea. The species of *Catanthera* are ivy-like climbers which festoon the tropical forests. In this centre the following genera, *Pogonanthera*, *Pachycentria*, *Dissochaeta* and *Neodissochaeta* have very few species and they represent a "spill-over" element from the Sunda centre. Noteworthy is the endemic genus *Carionia* occurring in the Philippines which is characterised by its 6-merous large showy flowers.

The tribe *Sonerilae* is only represented by the genus *Sonerila* with about 9 species. The tribe *Oxysporeae* has 27 species and is distributed among the following genera: *Ochthocharis*, *Blastus*, *Poikilogyne* and *Driessenia*. *Poikilogyne* is mainly a genus of New-Guinean origin and with the exception of *P. biporosa* Bakh. f., all the 21 species are endemic to this area.

If the Sunda centre is considered as the primary area of origin of the dissochaetaceous

TABLE VI

Distribution patterns of Melastomataceae in the Philippine-Papuan centre

Genera	Philippines		Moluccas & Celebes		New Guinea		Polynesia		N. Australia	
	sp	e	sp	e	sp	e	sp	c	sp	e
<i>Osbeckia</i>	2	1	2	—	2	1	1	—	4	3
<i>Melastoma</i>	15	10	9	3	6	4	6	3	2	—
<i>Otanthera</i>	5	5	3	1	8	6			1	1
<i>Pogonanthera</i>	1	—	1	—	1	—				
<i>Pachycentria</i>	1	—	1	—						
<i>Diplectria</i>	1	1	1	—	2	1				
<i>Carionia</i>	2	2								
<i>Dissochaeta</i>	1	—	1	—	2	—				
<i>Catanthera</i>					10	10				
<i>Neodissochaeta</i>	3	1	1	—	2	2				
<i>Medinilla</i>	135	131	21	3	71	63	27	26	1	1
<i>Creochiton</i>	2	2			4	4				
<i>Eisocreochiton</i>	1	1								
<i>Hypananthe</i>	2	—	1	—	3	3				
<i>Sonerila</i>	2	1	7	6	1	1				
<i>Sarcopyramis</i>	1	—								
<i>Ochthocharis</i>	1	—	1	—	3	1				
<i>Blastus</i>			1	—		—				
<i>Poikilogyna</i>					21	21				
<i>Driessenia</i>			1	—						
<i>Astrocalyx</i>	1	—								
<i>Astronia</i>	36	34	8	4	12	11				
<i>Astronidium</i>					5	4	27	20		
<i>Beccarianthus</i>	3	3			1	1				
<i>Pternandra</i>			2	1	3	—				
<i>Memecylon</i>	39	33	8	5	14	10	3	3	1	—

Sp = number of species ; e = number of endemic species.

genera in Asia, then the Astroneid group (*Astrocalyx*, *Astronia*, *Astronidium* and *Beccarianthus*) might have originated and radiated from the Philippine-Papuan centre. As-

trocalyx, a monotypic genus of small trees, endemic to the Island of Luzon in the Philippines, is unique in the melastomataceous flora of Asia in having the largest number

of stamens (about 65). Of the 56 species of *Astronia*, 54 are recorded from this centre. *Astronia cumingiana* Vidal extends the Philippine and Celebes distribution to Borneo. While in the north *Astronia ferruginea* Elm. extends the generic distribution to Formosa. *Beccarianthus*—a genus of small trees characteristically having large flowers and narrowly oblong anthers is recorded from the Philippines, New Guinea and Borneo. The genus *Astronidium* which is chiefly Polynesian, has about 27 species in Polynesia and 5 species in New Guinea.

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