



UNIVERSITI PUTRA MALAYSIA

**A SYSTEMATIC STUDY ON CALLICARPA L.
(VERBENACEAE) IN BORNEO**

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**A SYSTEMATIC STUDY ON *CALLICARPA* L.
(VERBENACEAE) IN BORNEO**

By

GLORIA ABRAHAM-OANES

**Thesis Submitted to the School of Graduate Studies,
Universiti Putra Malaysia, in Fulfilment of the Requirement
for the Degree of Doctor of Philosophy**

November 2002



To *PHILIP*, My husband

And to my Kids:

Yen-yen

Phee-em

Phi-ar

Phee-jay



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy.

**A SYSTEMATIC STUDY ON *CALLICARPA* L. (VERBENACEAE)
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Chairman: Assoc. Prof. Faridah Hanum Ibrahim, Ph.D.

Faculty: Forestry

A systematic study on the Bornean *Callicarpa* (Verbenaceae) was undertaken utilising more than 1, 200 collections from fourteen herbaria. A total of 37 taxa were recognised and twenty-two taxa are undoubtedly endemic to the island. Two new species namely, *C. hanumiae* and *C. argentii* were described and illustrated while two new records, i.e., *C. ramiflora* and *C. arborea* for Borneo were made. Five formerly recognised varieties such as *C. havilandii* var. *hispida*, *C. japonica* var. *rhombifolia*, *C. kinabaluensis* var. *endertii*, *C. kinabaluensis* var. *gibotii* and *G. hexandra* var. *macrophylla* while three forms viz. *C. longifolia* f. *floccosa*, *C. longifolia* f. *subglabrata* and *C. pentandra* var. *typica* f. *hexandra* were raised to species and variety levels, respectively. The other two forms, *C. pentandra* var. *typica* f. *farinosa* and *C. pentandra* var. *paloensis* f. *apoensis* were likewise raised to distinct varieties. All Bornean *Geunsia* reduced to *Callicarpa* by Lam and Bakhuizen van den Brink (1921) is basically supported by the present study. Several approaches such as morphology, anatomy, palynology, ecology and phytogeography were employed to



species delimitation. Many characters obtained from these lines of evidences were proven to have taxonomic value. The leaf shape, margin, size of the lamina, degree of hairiness of leaf surfaces and petioles and leaf base, were among the diagnostic vegetative morphological characters. Taxonomically valuable reproductive characters include the point of insertion of the inflorescence, type of the inflorescence's indumentum, length of the peduncle, the colour of the corolla, the hairiness of the outside lobe of the calyx and calyx margin. The patterns of the vascular bundles in the petiole, the minor leaf venation patterns and the cuticular ornamentation were acknowledged as new diagnostic anatomical characters in species identification and delimitation in addition to other useful characters such as stomata and trichomes. The stomata are anomocytic in most species and mostly hypostomatic in its orientation. The orientation of the guard cells relative to epidermis provides a valuable taxonomic character. Trichomes display a substantial variation among species and are taxonomically significant in species identification. The presence of domatia in *C. saccata* is unique which makes this species very distinct from the rest. The pollen grains are medium-sized, solitary, isopolar and elliptic in equatorial view and amb rounded in polar view. They are prolate spheroidal shaped in most of the species and 3-colpate with microreticulate exine structure. However, the pollen morphology is less significant in the taxonomy at the species level, but taxonomically valuable at the generic level. The majority of the species occur at lower elevations (up to 1200 m. a.s.l), and are found in both primary and secondary forests, usually in mixed dipterocarp forest. *C. longifolia* is the most widespread species. Generally, *Callicarpa* has a disjunct distribution within its geographical range. In Borneo, the centre of distribution and species preponderance is in Sabah comprising a total of 27 taxa, 9 of which are endemic. The numerical analysis does not support the

division of the genus into two sections by Briquet (1895) and Moldenke (1971). Instead, it grouped the species into 10 clusters. A systematic treatment was presented comprising the morphological description of the genus and species, keys to individual taxa, ecology and distribution, illustration for new species, maps indicating the species distribution in Borneo, vernacular names, phenology and some uses. The specimens examined and seen were cited in every species description including the locality and date of collection, name of the collector and the name of the herbaria where the specimens were seen and studied.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KAJIAN SISTEMATIK TERHADAP *CALLICARPA* L. (VERBENACEAE)
DI BORNEO**

Oleh

GLORIA ABRAHAM-OANES

November 2002

Pengerusi: Prof. Madya Faridah Hanum Ibrahim, Ph.D.

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Suatu kajian sistematik ke atas *Callicarpa* (Verbenaceae) di Borneo telah dijalankan dengan menggunakan lebih daripada 1, 200 koleksi spesimen dari 14 herbarium. Sejumlah 37 takson telah dicamkan dan dua puluh dua daripadanya adalah endemik kepada Borneo. Dua spesies baru, *C. hanumiae* dan *C. argentii* telah dihurai dan diilustrasikan manakala dua rekod baru dicatatkan bagi Borneo iaitu *C. ramiflora* dan *C. arborea*. Lima varieti dan tiga forma dinaikkan taraf ke peringkat spesies iaitu *C. havilandii* var. *hispida*, *C. japonica* var. *rhombofolia*, *C. kinabaluensis* var. *endertii*, *C. kinabaluensis* var. *gibotii*, *G. hexandra* var. *macrophylla*, manakala *C. longifolia* f. *floccosa*, *C. longifolia* f. *subglabrata* dan *C. pentandra* var. *typica* f. *hexandra* telah dinaikkan taraf ke pangkat varieti. Dua lagi forma, *C. pentandra* var. *typica* f. *farinosa* dan *C. pentandra* var. *paloensis* f. *apoensis* telah dinaikkan taraf ke pangkat varieti. Kesemua spesies *Geunsia* yang telah dimasukkan ke genus *Callicarpa* oleh Lam & Bakuizen van den Brink telah disokong oleh kajian ini. Beberapa pendekatan seperti



dan juga pembatasan spesies dan takson infraspecies. Banyak sifat yang dijanakan melalui pendekatan ini telah didapati bernilai kepada taksonomi. Bentuk daun, tepi daun, saiz lamina, darjah berbulu bagi permukaan daun dan petiol dan bes daun adalah di antara sifat diagnosis vegetatif. Sifat reproduktif yang bernilai taksonomi termasuk peletakan infloresens, jenis indumentum infloresens, panjang pedunkel, warna korola, bulu cuping luar kaliks dan tepi kaliks. Corak berkas vaskular petiol, corak peruratan daun kecil dan perhiasan kutikel juga telah dibuktikan sebagai sifat anatomi diagnosis dalam pengcaman dan pembatasan spesies di samping sifat lain yang berguna seperti stomata dan trikum. Stomata adalah anomositik dalam kebanyakan spesies dan orientasinya hipostomatik. Orientasi sel rakan bila dibandingkan dengan epidermis memberikan suatu sifat taksonomi yang bernilai. Trikum menunjukkan suatu variasi yang baik di kalangan spesies dan berguna untuk pengcaman spesies. Kewujudan domatia pada *C. saccata* adalah unik dan membuat spesies ini berbeza daripada yang lain. Debunga adalah bersaiz sederhana, tunggal, isokutub dan eliptik pada pandangan khatulistiwa dan bulat pada pandangan kutub. Mereka adalah berbetuk subsfera prolat sfera dalam kebanyakan spesies dan semua adalah 3-kolpat dengan struktur eksin mikroreticulat. Walau bagaimanapun, morfologi debunga adalah kurang signifikan dalam taksonomi di tahap spesies, tetapi bernilai pada tahap genus. Kebanyakan spesies wujud di tanah rendah sehingga 1,200 m atas paras laut, di kedua-dua hutan primer dan sekunder, biasanya dalam hutan dipterokarpa campuran. *C. longifolia* adalah yang paling luas taburannya. Amnya, *Callicarpa* mempunyai taburan disjung dalam julat geografinya. Di Borneo, pusat taburan dan kepelbagaian adalah di Sabah yang mempunyai sejumlah 27 takson, 13 adalah endemik. Analisis numerikal tidak menyokong pembahagian genus ini kepada seksu seperti dicadangkan oleh

Briquet (1895) dan Moldenke (1971). Bagaimanapun ia mengumpulkan spesies kepada sepuluh kumpulan. Suatu perlakuan sistematik telah dibentangkan yang mengandungi penghuraian genus dan spesies, kekunci kepada takson, ekologi dan taburan, ilustrasi bagi spesies baru, peta bagi menunjukkan taburan spesies di Borneo, nama tempatan, fenologi dan kegunaan yang diketahui. Spesimen yang diteliti telah diberikan bagi setiap spesies termasuk lokaliti, tarikh pengutipan dan nama pengutip dan juga nama herbarium bagi semua spesimen yang diperhati dan dikaji.



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I certify that an Examination committee met on 1st November 2002 to conduct the final examination of Gloria Abraham-Oanes on her Doctor of Philosophy thesis entitled " A Systematic Study on *Callicarpa* L. (Verbenaceae) in Borneo" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows

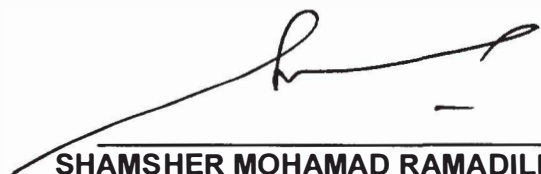
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DECLARATION FORM

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degrees at Universiti Putra Malaysia or other institutions.


GLORIA ABRAHAM-OANES

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TABLE OF CONTENTS

	Page
DEDICATION.....	ii
ABSTRACT	iii
ABSTRAK	vi
ACKNOWLEDGEMENTS.....	ix
APPROVAL SHEETS.....	xii
DECLARATION FORM.....	xiv
LIST OF TABLES	xix
LIST OF FIGURES	xxi
CHAPTER	
1 GENERAL INTRODUCTION	
1.1. Introduction	1
1.2. Objectives of the Study	6
1.3. Economic Uses	7
1.4. Significance of the Study.....	9
2 REVIEW OF RELATED STUDIES	
2.1. Taxonomic History	10
2.2. Affinities of the Genus <i>Callicarpa</i>	15
2.3. Anatomical Studies	17
2.4. Pollen Studies	20
3 MATERIALS AND METHODS	
3.1. Morphological Studies	23
3.2. Anatomical Studies.....	26
3.2.1. Petiole Anatomy	26
3.2.2. Leaf Venation	27
3.2.3. Epidermal Anatomy	28
3.2.4. Scanning Electron Microscope (SEM) Studies of Leaf Surface	29
3.3. Pollen Studies	30
3.4. Numerical Analysis.....	30



4	GENERAL MORPHOLOGY	
4.1.	Growth Form, Bark and Twig Characteristics.....	34
4.2.	Leaves	37
4.3.	Inflorescences	53
4.4.	Bracts and Bracteoles	57
4.5.	Flower	58
	4.5.1. Calyx	58
	4.5.2. Corolla	60
	4.5.3. Androecium.....	61
	4.5.4. Gynoecium	62
4.6.	Fruit	62
4.7.	Taxonomic Implication of Morphological Characters	63
5	ANATOMY	
5.1.	Petiole	70
	5.1.1. Vascular Bundles	71
	5.1.1.1. The O-shaped Vascular Bundles	76
	5.1.1.2. The U-shaped Vascular Bundles	76
5.2.	Midrib	86
5.3.	Leaf Venation Patterns	91
	5.3.1. Major Venation Patterns	91
	5.3.2. Minor Venation Patterns	96
5.4.	Stomata	105
	5.4.1. Classification of Stomata	106
	5.4.2. Guard Cells	114
	5.4.3. Stomatal Density	114
5.5.	Cuticular Ornamentation	119
5.6.	Domatia	123
5.7.	Trichomes	123
5.8.	Taxonomic Significance of Anatomical Characters	135
6	POLLEN MORPHOLOGY	
6.1.	Size and Shape of the Pollen Grains	140
6.2.	Colpus and Exine Structure	144
6.3.	Taxonomic Implications	148



7	ECOLOGY AND GEOGRAPHIC DISTRIBUTION	
7.1.	Introduction	155
7.2.	Vegetational and Vertical Distribution of the Species	156
7.2.1.	Mixed Dipterocarp Forest (MDF).....	156
7.2.2.	Lower Montane Rain Forest	160
7.2.3.	Upper Montane Forest	160
7.2.4.	Heath Forest	161
7.2.5.	Peat Swamp Forest	161
7.2.6.	Limestone Forest	162
7.2.7.	Beach Forest	162
7.3.	Soil Preference of <i>Callicarpa</i>	162
7.4.	Habitat Diversity of the Species in Borneo	165
7.5.	Geographical Distribution of <i>Callicarpa</i>	173
8	NUMERICAL TAXONOMY	
8.1.	Numerical Analysis	178
8.2.	Sub-grouping of Taxa	180
8.3.	New Taxa	184
8.4.	Taxonomic Significance	193
9	TAXONOMIC TREATMENT	
9.1.	Description of the Genus	197
9.2.	Key to Species of <i>Callicarpa</i> in Borneo.....	202
9.3.	Enumeration of Species.....	209
9.4.	Incompletely Known Taxa	310
10	SUMMARY AND CONCLUSIONS	
10.1	Morphological Evidences	318
10.2	Anatomical Evidences	320
10.3	Palynological Evidences	322
10.4	Ecology and Geographic Distribution	323
10.5	Conclusion	324
	REFERENCES	329



APPENDICES.....	
A. List of Materials Used in Anatomical Studies	344
B. List of Materials Used for Pollen Studies.....	349
C. Character –State Codes	351
BIO-DATA OF THE AUTHOR.....	355



LIST OF TABLES

Table		Page
1.1	Summary of recognised taxa in Borneo before and after the present treatment.....	5
2.1	Comparison of Classification of the family Verbenaceae.....	16
3.1	List of herbaria whose specimens were studied	24
4.1	Habit and bark characteristics of <i>Callicarpa</i> and <i>Geunsia</i>	35
4.2	Main characteristics of the leaf of <i>Callicarpa</i> and <i>Geunsia</i>	39
4.3	Main characteristics of the the inflorescence of <i>Callicarpa</i> and <i>Geunsia</i>	54
4.4	Main characteristics of the flower and fruit of <i>Callicarpa</i> and <i>Geunsia</i>	64
5.1	Patterns of the vascular bundles in the petiole and midrib of <i>Callicarpa</i> and <i>Geunsia</i>	72
5.2	Patterns of leaf venation in <i>Callicarpa</i> and <i>Geunsia</i>	92
5.3	Distribution of stomata and cuticular ornamentation in <i>Callicarpa</i> and <i>Geunsia</i>	117
5.4	Variations of trichomes in <i>Callicarpa</i> and <i>Geunsia</i>	127
6.1	Morphological characteristics of the pollen grains of <i>Callicarpa</i> and <i>Geunsia</i>	146
7.1	Species distribution based on vegetation type	157



Table (continued)	Page
7.2 Soil preference of individual species.....	163
7.3 Distribution of <i>Callicarpa</i> and <i>Geunsia</i> in Borneo	176
8.1 Character comparison between <i>C. pentandra</i> var. <i>pentandra</i> and <i>G. hexandra</i> var. <i>macrophylla</i> ; and <i>C. pentandra</i> var. <i>farinosa</i> and <i>C. pentandra</i> var. <i>apoensis</i>	186
8.2 Similarities and differences of characters between <i>C. pentandra</i> var. <i>pentandra</i> , <i>C. hexandra</i> and <i>C. pulveracea</i>	189
8.3 Differences and similarities of characters between <i>C. longifolia</i> , <i>C. mollisimplicata</i> and <i>C. subglabrata</i>	191
8.4 Differences and similarities of characters between <i>C. kinabaluensis</i> var. <i>kinabaluensis</i> , <i>C. gibotii</i> and <i>C. endertii</i>	194



LIST OF FIGURES

Figure		Page
4.1.1	Diagram showing the elliptic shape of the leaves of <i>Callicarpa</i> : (A) <i>C. longifolia</i> , (B) <i>C. havilandii</i> (C) <i>C. superposita</i>	43
4.1.2	Diagram showing the broadly elliptic shape of the leaves of <i>Callicarpa</i> : (A) <i>C. glabrifolia</i> , (B) <i>C. endertii</i> (C) <i>C. kinabaluensis</i>	44
4.2	Diagram showing the oblong to broadly oblong shapes of the leaves of <i>Callicarpa</i> . (A) <i>Callicarpa</i> Sp.4, x (.2); (B) <i>Callicarpa</i> sp. 2, x 1.25 (C) <i>C. pulveracea</i> , x 1.6.	45
4.3	Diagram showing the ovate shape of the leaves of <i>Callicarpa</i> : (A) <i>C. saccata</i> , (B) <i>C. badipilosa</i> , (C) <i>C. cana</i>	46
4.4	Diagram showing the obovate shape of the leaves of <i>Callicarpa</i> : (A) <i>C. fulvohirsuta</i> (B) <i>C. argentii</i>	47
4.5.1	Diagram showing the oblanceolate shape of the leaves of <i>Callicarpa</i> (A) <i>C. stapfii</i> , (B) <i>Callicarpa</i> sp. 3 (C) <i>C. involucreta</i> ..	48
4.5.2	Diagram showing the oblanceolate shape of the leaves of <i>Callicarpa</i> : (A) <i>C. woodii</i> (B) <i>C. anomala</i>	49
4.6	Diagram showing the rhomboid (A), ovate (B) and lanceolate (C) shapes of the leaves of <i>Callicarpa</i> : (A) <i>C. hanumiae</i> (B) <i>C. rhynchophylla</i> (C) <i>C. hexandra</i>	50
4.7	Diagram showing the position of the Inflorescence (A) <i>C. superposita</i> , (B) <i>C. pentandra</i> , (C) <i>C. involucreta</i> (D) <i>C. endertii</i> (E) <i>C. stapfii</i> (F) <i>C. havilandii</i> and (G) <i>C. kinabaluensis</i>	55
4.8	Diagram showing the characteristics of the fruiting calyx in <i>Callicarpa</i> : (A) <i>C. argentii</i> , (B) <i>C. glabrifolia</i> , (C) <i>C. hispida</i> , (D) <i>C. longifolia</i> , (E) <i>C. superposita</i> , (F) <i>C. kinabaluensis</i> and (G) <i>C. havilandii</i>	59

5.1	Diagram showing the various patterns of the vascular bundles in the petiole of <i>Callicarpa</i> and <i>Geunsia</i>	74
5.2	Micrographs showing the O-type outline of the vascular bundles in the petiole of <i>Callicarpa</i> : (A) <i>C. saccata</i> , (B) <i>C. anomala</i> , (C) <i>C. stapfii</i>	77
5.3	Micrographs showing the variation of the U-type vascular bundle outlines in the petiole of <i>Callicarpa</i> (A) <i>C. kinabaluensis</i> , (B) <i>C. glabrifolia</i> (C) <i>C. havilandii</i> , (D) <i>C. pentandra</i> , (E) <i>C. involucrata</i> , (F) <i>C. woodii</i>	79
5.4	Micrographs showing the variation of the U-type vascular bundle outlines in the petiole of <i>Callicarpa</i> and <i>Geunsia</i> (A) <i>C. endertii</i> ; (B) <i>C. rynchophylla</i> ; (C) <i>C. pulveracea</i> ; (D) <i>C. pentandra</i> var. <i>farinosa</i> ; (E) <i>C. hexandra</i> ; (F) <i>C. argentii</i> ; (G) <i>C. superposita</i> ; (H) <i>G. hexandra</i> var. <i>macrophylla</i> ; (I) <i>C. cana</i> ; (J) <i>C. longifolia</i> ; (K) <i>C. hispida</i> ..	82
5.5	Micrographs showing the variation of the U-type vascular bundle outlines in the petiole of <i>Callicarpa</i> and <i>Geunsia</i> . (A) <i>Callicarpa</i> sp.2; (B) <i>C. subglabrata</i> ; (C) <i>G. anisophylla</i> ; (D) <i>G. quaternifolia</i>	84
5.6	Micrographs showing the variation of the U-type vascular bundle outlines in the petiole of <i>Callicarpa</i> . (A) <i>C. arborea</i> ; (B) <i>C. hanumiae</i> ; (C) <i>Callicarpa</i> sp.3	85
5.7	Micrographs showing the patterns of the vascular bundles and vascular system in the midrib of <i>Callicarpa</i> and <i>Geunsia</i> . (A) <i>C. arborea</i> ; (B) <i>C. glabrifolia</i> (C) <i>G. hexandra</i> var. <i>macrophylla</i> ; (D) <i>Callicarpa</i> sp.2; (E) <i>C. involucrata</i> ; (F) <i>C. havilandii</i>	88
5.8	Micrographs showing the patterns of the vascular bundles and vascular system in the midrib of <i>Callicarpa</i> . (A) <i>C. barbata</i> ; (B) <i>C. kinabaluensis</i> ; (C) <i>Callicarpa</i> sp.1; (D) <i>C. pentandra</i> var. <i>apoensis</i> ; (E) <i>C. pulveracea</i>	89



5.9	Micrographs showing the patterns of the vascular bundle and vascular system in the midrib of <i>Callicarpa</i> . (A) <i>C. cana</i> ; (B) <i>C. argentii</i> ; (C) <i>C. erioclona</i> ; (D) <i>C. longifolia</i> ; (E) <i>C. pentandra</i> var. <i>farinosa</i> ; (F) <i>C. anomala</i>	90
5.10	Diagram showing the types of secondary veins: (A) craspedodromous-simple, x 0.8 (B) camptodromous-brochidromous, x 1.5	95
5.11	Diagram showing the six types of minor venation patterns in <i>Callicarpa</i>	97
5.12	Micrographs showing the minor venation patterns in <i>Callicarpa</i> and <i>Geunsia</i> (A) <i>C. fulvohirsuta</i> ; (B) <i>C. argentii</i> ; (C) <i>C. hispida</i> , (D) <i>G. hexandra</i> var. <i>macrophylla</i> ; (E) <i>C. arborea</i> ; (F) <i>C. erioclona</i>	98
5.13	Micrographs showing the minor venation patterns in <i>Callicarpa</i> . (A) <i>C. superposita</i> , (B) <i>C. rhynchophylla</i> , (C) <i>C. cana</i> (D) <i>C. subglabrata</i> , (E) <i>C. endertii</i> , (F) <i>C. longifolia</i>	100
5.14	Micrographs showing the minor venation pattern in <i>Callicarpa</i> (A) <i>C. pentandra</i> var. <i>apoensis</i> ; (B) <i>C. pulveracea</i> (C) <i>C. pentandra</i> var. <i>farinosa</i> (D) <i>C. pentandra</i> var. <i>pentandra</i> ; (E) <i>C. hexandra</i> ; (F) <i>C. badipilosa</i>	101
5.15	Micrographs showing the minor venation patterns in <i>Callicarpa</i> : (A) <i>C. stapfii</i> ; (B) <i>C. woodii</i> ; (C) <i>Callicarpa</i> sp.1; (D) <i>Callicarpa</i> sp.2	102
5.16	Micrographs showing the minor venation patterns in <i>Callicarpa</i> . (A) <i>C. anomala</i> , (B) <i>C. glabrifolia</i> , (C) <i>C. barbata</i>	103
5.17	Micrographs showing the minor venation patterns in <i>Callicarpa</i> . (A) <i>C. involucrata</i> , (B) <i>Callicarpa</i> sp.3.	104
5.18	Diagram showing the types of stomata in <i>Callicarpa</i>	107
5.19	Micrographs showing the types of stomata in <i>Callicarpa</i> . Anomocytic: (A) <i>C. argentii</i> , (B) <i>C. badipilosa</i> , (C) <i>C. barbata</i> , (D) <i>C. borneensis</i> , (E) <i>C. clemensorum</i> , (F) <i>Callicarpa</i> sp. 4. Actinocytic: (G) <i>C. glabrifolia</i> , (H) <i>C. involucrata</i> , (I) <i>C. endertii</i> , (J) <i>C. ramiflora</i> , (K) <i>C. woodii</i> (L) <i>Callicarpa</i> sp. 2.....	108



5.20	Micrographs showing the distribution of diacytic and paracytic stomata in some <i>Callicarpa</i> species. 1. Diacytic Stomata: (A) <i>C. arborea</i> ; (B) <i>C. kinabaluensis</i> ; (C) <i>C. superposita</i> . 2. Paracytic Stomata: (D) <i>C. hanumiae</i> (E) <i>C. fulvohirsuta</i> (F) <i>C. longifolia</i> (G) <i>C. havilandii</i> (H) <i>C. rynchophylla</i> (I) <i>C. subglabrata</i>	111
5.21	Micrographs showing the different orientation of stomata in some <i>Callicarpa</i> species. Sunken: (A) <i>Callicarpa</i> sp. 3 (B) <i>C. stapfii</i> (C) <i>C. glabrifolia</i> (D) <i>C. clemensorum</i> . Level oriented: (E) <i>C. superposita</i> (F) <i>Callicarpa</i> sp.2 (G) <i>C. havilandii</i> (H) <i>C. arborea</i> . Raised: (I) <i>C. argentii</i> (J) <i>C. hanumiae</i> (K) <i>C. subglabrata</i> (L) <i>C. longifolia</i>	113
5.22	Micrographs showing the distribution of stomata in <i>Callicarpa</i> and <i>Geunsia</i> . Densely randomised: (A) <i>C. enderti</i> (B) <i>C. involucrata</i> (C) <i>C. kinabaluensis</i> (D) <i>C. ramiflora</i> (E) <i>Callicarpa</i> sp.1. Sparsely randomised: (F) <i>C. glabrifolia</i> (G) <i>G. hexandra</i> var. <i>macrophylla</i> (H) <i>C. stapfii</i> . Clumped distribution: (I) <i>C. badipilosa</i> (J) <i>C. barbata</i> (K) <i>C. clemensorum</i> . Grouped distribution: (L) <i>Callicarpa</i> sp. 2 (M) <i>Callicarpa</i> Sp. 3 (N) <i>C. woodii</i>	119
5.23	Micrographs showing the different cuticular foldings in the adaxial leaf surface of <i>Callicarpa</i> . Randomly striated: (A) <i>C. hispida</i> . Radial reticulation: (B) <i>C. pentandra</i> var. <i>apoensis</i> . Fine and warty striae: (C) <i>C. rynchophylla</i> (D) <i>Callicarpa</i> sp. 3. Long and diagonal: (E) <i>C. barbata</i> . Course reticulate: (F) <i>C. endertii</i> . Coarse reticulate: (G) <i>C. kinabaluensis</i> (H) <i>C. ramiflora</i> . Roundish circumference: (I) <i>C. pentandra</i> var. <i>farinosa</i> (J) <i>C. stapfii</i> (K) <i>C. woodii</i> . Tall ridges: (L) <i>C. fulvohirsuta</i>	123
5.24	Diagram showing the different types of trichomes in <i>Callicarpa</i> . SU=short uniseriate; LU= long uniseriate: 2-A=two armed. ...	129
5.25	Types of simple trichomes in <i>Callicarpa</i> : Short-uniseriate type (SU) (A) <i>C. fulvohirsuta</i> , (B) <i>C. anomala</i> , (C) <i>C. badipilosa</i> , (D) <i>C. ramiflora</i> , (E) <i>C. superposita</i> . Long-uniseriate type (LU): (F) <i>C. barbata</i> , (G) <i>C. badipilosa</i> , (H) <i>C. argentii</i> , (I) <i>C. saccata</i> , (J) <i>C. endertii</i> , (K) <i>C. ramiflora</i> , (L) <i>C. mollisimplicita</i>	131
5.26	Distribution of two- to five-armed trichomes in <i>Callicarpa</i> Two-armed type (A) <i>C. ramiflora</i> , (B) <i>C. superposita</i> , (C) <i>C. superposita</i> . Three- to five armed type: (D) <i>C. havilandii</i> , (E) <i>C. ramiflora</i> , (F) <i>C. kinabaluensis</i>	134

