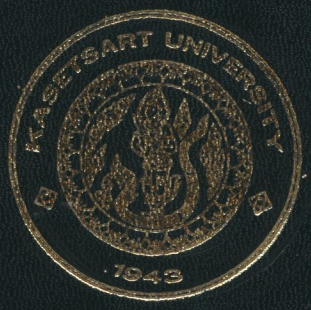


THESIS

TAXONOMIC REVISION OF GENUS BEILSCHMIEDIA NEES (LAURACEAE) IN THAILAND

NAIYANA TETSANA

Graduate School, Kasetsart University

2005

309/48

RECEIVED

BY | 16/5/48 DATE

โครงการพัฒนาองค์ความรู้และศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทย
c/o ศูนย์พันธุวิศวกรรมและเทคโนโลยีชีวภาพแห่งชาติ
อาคารสำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ
73/1 ถนนพระรามที่ 6 เขตราชเทวี
กรุงเทพฯ 10400

THESIS APPROVAL

GRADUATE SCHOOL, KASETSART UNIVERSITY

Master of Science (Forestry)
DEGREE

Forest Biology
FIELD

Forest Biology
DEPARTMENT

TITLE: Taxonomic Revision of Genus *Beilschmiedia* Nees (Lauraceae) in Thailand

NAME: Miss Naiyana Tetsana

THIS THESIS HAS BEEN ACCEPTED BY

K. Chayamarit — **THESIS ADVISOR**
(Mrs. Kongkanda Chayamarit, D.Sc.)

Suvit Sangtongpraow — **COMMITTEE MEMBER**
(Assistant Professor Suvit Sangtongpraow, Ph.D.)

Srunya Vajrodaya — **COMMITTEE MEMBER**
(Assistant Professor Srunya Vajrodaya, Dr.rer.nat.)

Uthaiwan Sangwanit — **DEPARTMENT HEAD**
(Ms. Uthaiwan Sangwanit, Ph.D.)

APPROVED BY THE GRADUATE SCHOOL ON 26 April 2005

Vinai Artkongharn — **DEAN**
(Associate Professor Vinai Artkongharn, M.A.)

THESIS

TAXONOMIC REVISION OF GENUS *BEILSCHMIEDIA* NEES (LAURACEAE) IN THAILAND

NAIYANA TETSANA

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Master of Science (Forestry)
Graduate School, Kasetsart University
2005

ISBN 974-9830-20-2

Naiyana Tetsana 2005: Taxonomic Revision of Genus *Beilschmiedia* Nees (Lauraceae) in Thailand. Master of Science (Forestry), Major Field: Forest Biology, Department of Forest Biology. Thesis Advisor: Mrs. Kongkanda Chayamarit, D.Sc. 91 pages. ISBN 974-9830-20-2

Taxonomic revision of genus *Beilschmiedia* Nees (Lauraceae) in Thailand was conducted between March 2002 to March 2005. Species diversity, morphological characters, distribution and ecological data were examined. Field collections and phenological observation of *Beilschmiedia* were made throughout the country. The herbarium specimens available in Thai herbaria were thoroughly studied and identified by consulting the taxonomic literatures and comparing with photographs of some type specimens from Thai and foreign herbaria.

Key to species based on flowering, fruiting and significance vegetative characters were constructed. Full descriptions of each species were provided supported by line drawings and photographs.

Sixteen species of Thai *Beilschmiedia* were enumerated namely *Beilschmiedia argentata* Kosterm., *B. assamica* Meisn., *B. brevipes* Ridl., *B. clarkei* Hook.f., *B. elegantissima* Kosterm., *B. gammieana* King ex Hook.f., *B. glauca* S.K. Lee & L.F. Lau, *B. inconspicua* Kosterm., *B. membranacea* Gamble, *B. palembanica* (Miq.) Kosterm., *B. roxburghiana* Nees, *B. velutinosa* Kosterm., *B. villosa* Kosterm., *B. wallichiana* (G. Don) Kosterm., *Beilschmiedia* sp.1 and *Beilschmiedia* sp.2. Eight species are newly recorded for Thailand. Two species can not be identified into specific epithets and expected to be new to science.

Naiyana Tetsana
Student's signature

K. Chayamarit
Thesis Advisor's signature

19 / 5 / 2005

ACKNOWLEDGEMENTS

I am deeply grateful to Dr. Kongkanda Chayamarit, my thesis advisor, for her valuable advices and providing me many useful things during the course of my thesis.

I wish to extend my thanks to Assistant Professor Dr. Suvit Sangtongpraow and Assistant Professor Dr. Srunya Vajrodaya, the thesis committee members, for their kind suggestions and encouragement. I wish to express my deep gratitude to Assistant Professor Surachet Chettamart, the Graduate School representatives, for his guidance and suggestions for my thesis.

I gratefully acknowledge Dr. Anak Patthanaviboon, Dr. Somran Suddee, Dr. Voradol Chamchumroon, Mr. Chatchai Ngernsaengsaruay for their support some literatures, photographs of type from other herbaria and field works, Miss Chantharot Rungruang, Miss Buppa Poolwongsa and Miss Nisa Leksungnoen for their kind help. Sincere thanks go to Miss Nantawan Suphuntee, Mr. Narong Koonkunthod, Mr. Thammarat Putthai and the staff in the Forest Herbarium, Bangkok for spending their time for me. Special thanks is extended to my family for their warm support and encouragement.

Lastly many thanks to Mr. Kamol Plongmai, Mr. Sukid Ruengrue, Mr. Aroon Sinbumroong and everyone in The Department of Forest Biology, Faculty of Forestry, Kasetsart University, for their fully supports for my work.

This work was supported by TRF/BIOTEC Special Program for Biodiversity Research and Training grants BRT T_145002.

Naiyana Tetsana

April, 2005

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	iv
INTRODUCTION	1
LITERATURE REVIEW	3
Meaning and Classification	3
The Characters of the Genus *Beilschmiedia* Nees	4
Distribution	5
Ecology	6
Uses	7
MATERIALS AND METHODS	8
Materials	8
Methods	8
PLACES AND DURATION	10
Places	10
Duration	10
RESULTS	11
Field and Morphological Characters	11
Habit	11
Habitat	11
Bark	11
Terminal Buds	12
Leaves	12
Inflorescences	12
Flowers and Floral Parts	13
Fruits	13
Taxonomic History of the Genus *Beilschmiedia* Nees	14
Key to species of the Genus *Beilschmiedia* Nees in Thailand	16

TABLE OF CONTENTS (Cont'd)

	Page
B. argentata Kosterm.	17
B. assamica Meisn.	21
B. brevipes Ridl.	24
B. clarkei Hook.f.	27
B. elegantissima Kosterm.	30
B. gammieana King ex Hook.f.	33
B. glauca S.K. Lee & L.F. Lau	37
B. inconspicua Kosterm.	41
B. membranacea Gamble	44
B. palembanica (Miq.) Kosterm.	47
B. roxburghiana Nees	50
B. velutinosa Kosterm.	54
B. villosa Kosterm.	57
B. wallichiana (G. Don) Kosterm.	60
Beilschmiedia sp. 1	64
Beilschmiedia sp. 2	67
DISCUSSION	72
CONCLUSION	76
RECOMMENDATION	77
LITERATURE CITED	78
APPENDIX	83

LIST OF TABLES

Table		Page
1	Study on genus *Beilschmiedia* in other countries	6
2	Distribution of *Beilschmiedia* in each regions of Thailand	70
3	Ecological distribution of *Beilschmiedia* spp. in Thailand	71

LIST OF FIGURES

Figure		Page
1	*B. argentata* Kosterm.	19
2	Photographs of *B. argentata* Kosterm.	20
3	*B. assamica* Meisn.	22
4	Photographs of *B. assamica* Meisn.	23
5	*B. brevipes* Ridl.	25
6	Photographs of *B. brevipes* Ridl.	26
7	*B. clarkei* Hook.f.	28
8	Photographs of *B. clarkei* Hook.f.	29
9	*B. elegantissima* Kosterm.	31
10	Photographs of *B. elegantissima* Kosterm.	32
11	*B. gammieana* King ex Hook.f.	35
12	Photographs of *B. gammieana* King ex Hook.f.	36
13	*B. glauca* S.K. Lee & L.F. Lau	39
14	Photographs of *B. glauca* S.K. Lee & L.F. Lau	40
15	*B. inconspicua* Kosterm.	42
16	Photographs of *B. inconspicua* Kosterm.	43
17	*B. membranacea* Gamble	45
18	Photographs of *B. membranacea* Gamble	46
19	*B. palembanica* (Miq.) Kosterm.	48
20	Photographs of *B. palembanica* (Miq.) Kosterm.	49
21	*B. roxburghiana* Nees	52
22	Photographs of *B. roxburghiana* Nees	53
23	*B. velutinosa* Kosterm.	55
24	Photographs of *B. velutinosa* Kosterm.	56
25	*B. villosa* Kosterm.	58
26	Photographs of *B. villosa* Kosterm.	59
27	*B. wallichiana* (G. Don) Kosterm.	62
28	Photographs of *B. wallichiana* (G. Don) Kosterm.	63

LIST OF FIGURES (Cont'd)

Figure		Page
29	*Beilschmiedia* sp. 1	65
30	Photographs of *Beilschmiedia* sp. 1	66
31	*Beilschmiedia* sp. 2	68
32	Photographs of *Beilschmiedia* sp. 2	69

TAXONOMIC REVISION OF GENUS *BEILSCHMIEDIA* NEES (LAURACEAE) IN THAILAND

INTRODUCTION

Thailand is located in a hot and humid climatic zone. The area is covered with various vegetation types ranging from the moist tropical evergreen forest in the south to the deciduous and upper montane forest towards the north. Thailand occupies the geographical center of the plants from Indo-Burmese elements, Indo-Chinese elements and Malesian elements, where the species richness is high of the estimated 10,000 species of vascular plants. Then, Thailand is one of the countries richest natural resources, supporting a huge diversity of plant and animal life, and providing forest products to support local livelihoods.

Currently, less than 50 percent of the plants of the whole country have been identified. For this reason, taxonomic revision is necessary to complete the Flora of Thailand, which will be enable to identify plants by using key and plant descriptions. The data which consists of botanical characteristics, distribution, ecology and utilization would aid successful study on conservation and plant resources management in Thailand.

Lauraceae is one of the important family, composed of about 35 genera and 2500 species throughout the world and 17 genera, ca. 136 species in Thailand. It consists of plants which have economic importance as agricultural and industrial products as well as the values in medicinal plants. As the study on Lauraceae has never been done in Thailand and there are some confusions of classification, taxonomic revision of the genera in this family is very necessary to support the taxonomic clarification.

Beilschmiedia is one of the genera in the family Lauraceae. It has an economic importance in forest products as timber, pharmaceutical products as herbal medicine etc.

At present, there is still no tool for identification the genus *Beilschmiedia* in Thailand. Therefore, taxonomic revision of *Beilschmiedia* in Thailand was considered to be done for constructing key for plant identification. Moreover, the result of this study can be supported the study of the family Lauraceae for the Flora of Thailand project and to other fields of ecology, forest production and for conservation planning.

The objectives of this study are:

1. To conduct taxonomic revision of the genus *Beilschmiedia* in Thailand including its distribution and ecology.
2. To construct a key to species of the genus *Beilschmiedia* in Thailand for plant identification.

LITERATURE REVIEW

Meaning and Classification

The name of the genus *'Beilschmiedia'* is in honour of a German botanist and pharmacist, Carl (Karl) Traugott Beilschmied (1793-1848) (Frans and Erik, 1993). The genus was first described by Christian Gottfried Daniel von Esenbeck Nees (1831). The type genus is *Beilschmiedia roxburghiana*. After Nees there were several other authors, such as; William Roxburgh (1832), Henri Ernest Baillon (1884), Paul Anguste Danguy, (1920) and André Joseph Guillaume Henri Kostermans (1939), who thought that they described a new genus, but all of them created synonyms only.

Takhtajan (1997) classified *Beilschmiedia* into Division Magnoliophyta, Class Magniliopsida, Subclass Magnoliidae, Superorder Lauranae, Order Laurales, Suborder Laurineae,Family Lauraceae, Subfamily Lauroideae because of the following characters: the plants are trees and shrubs with well-developed green leaves; tapetum amoeboid, endosperm nuclear and micropyle formed by both integuments.

In 1999, Judd *et al.* classified genus *Beilschmiedia* into Subfamily Lauroideae, Tribe Cryptocaryeae by using the inflorescences characters, i.e. *Beilschmiedia* has the lateral flowers of the three-flowered cymose units are not quite opposite, the inflorescences lacking involucral bracts and extrorse anthers of the third whorl. In this account, generic delimitation largely follows Takhtajan (1997) and Judd *et al.* (1999).

The important works on *Beilschmiedia* were those of Joseph Dalton Hooker, (1885) gave an account of *Beilschmiedia* in the Flora of British India, describing several species in the Malayan regions. During 1956-1973, Kostermans described many new taxa of *Beilschmiedia* from Malesiana, Malay Peninsular and Southern Thailand. Some specimens which he cited under the same name need further study as they appear to belong to several different species. Kochummen (1989) revised Lauraceae and published in Tree Flora of Malaya. Van der Werff studied An Annotated Key to The Genera of Lauraceae in The Flora Malesiana Region and A

synopsis of genus *Beilschmiedia* (Lauraceae) in Madagascar, published in Blumea (2001) and Adansonia (2003), respectively.

Apart from the list of species in Smitinand' s Thai Plant Names (The Forest Herbarium, 2001) knowledge of *Beilschmiedia* in Thailand is scant.

The Characters of the Genus *Beilschmiedia* Nees

Evergreen shrubs or trees (Hooker, 1885; Kochummen, 1989), terminal buds not perulate (Werff, 2001). *Leaves* simple, spiral (Kochummen, 1989), alternate, opposite (Hooker, 1885; Rohwer, 1993) or subopposite (Kostermans, 1957; Kochummen, 1989) sometimes grouped at a tips of branches (van der Werff, 2003); coriaceous (Long, 1984); margin entire (Kochummen, 1989); penninerve (Hooker, 1885; Rohwer, 1993), lateral nerves prominent (Long, 1984); exstipulate (Kochummen, 1989). *Inflorescences* raceme, panicle (Kochummen, 1989), thyrso-paniculate (Rohwer, 1993) or dense and fasicle-like, sessile or lax and pedunculate, young inflorescences sometimes covered with caducous imbricate scales (Hutchinson, 1964), axillary or subterminal (Kochummen, 1989). *Flowers* bisexual, small, actinomorphic, trimerous (Rohwer, 1993), floral tube short or lacking tepals 6 in 2 series of 3, very rarely 4 in 2 series of 2 (van der Werff, 2003), equal or subequal (Rohwer, 1993); fertile stamens 9, in 3 whorls of 3 (Bentham, 1965; Long, 1984), very rarely 6 in 3 whorls of 2, filaments variously developed, all anthers 2-celled (van der Werff, 2003), two outer whorls with cells introrse, third whorl with cells extrorse (Dassanayake, Fosberg and Clayton, 1995) and with 2 glands attached or near the base (van der Werff, 2003), sometimes irregularly disposed between the filaments of the second and the third whorl (Hutchinson, 1964), shorter than anthers (Rohwer, 1993), the forth whorl 3 staminodes (Allan, 1982) caudate, ovoid (Hooker, 1885; Kanjilal, 1940) or sagittate shaped (Rohwer, 1993); pistil ovoid, glabrous or pubescent, style and stigma variously developed (van der Werff, 2003); receptacle flatten or shallow cup-shaped (Rohwer, 1993). *Fruits* drupaceous (Allan, 1982), seated on the pedicel (van der Werff, 2003), ellipsoid oblong or globose, greenish with white mottle; perianth caducous when fruiting, remains narrow ring at base of fruit (Hooker, 1885;

Kochummen, 1989), sessile or pedicel not persistent (Dassanayake, Fosberg and Clayton, 1995); albuminous seeds (Kanjilal, 1940). *Pollen morphology* of *Beilschmiedia* and form that Tseng-Chieng (1972) study the pollen grains of Lauraceae were inaperturate, sphaeroidal to subsphaeroidal, 10-79 μm wide, exine 1 μm thick, spine 1-3 x 1-2 μm, sexine granulate, with LO-pattern, nexine thinner than sexine. *Beilschmiedia* species, such as *B. erythrophloia* Hay has grains of 20-25 μm wide, spines 2-3 x 1.5-2 μm (T. Suzki: 19557), *B. formosana* Chang has grains of 25-45 μm wide, spines 2-3 x 1.5-2 μm (Mutan, C.E. Chang: 4841).

The flowers of Lauraceae are insect-pollinated, with flies and bees being the most common pollinators (Judd *et al.*, 1999).

Distribution

Beilschmiedia is found mostly in the tropical zone in New World and Old World (Rohwer, 1993; Steenis, 1963) from America, Africa, Asia, Australia and New Zealand (Bentham, 1965). The genus can be found 280 species throughout the world (Govaert, 1996). In South-East Asia, the genus can be found in Myanmar, Vietnam, Cambodia, Thailand, Malaysia, Philippines, Indonesia and various islands, e.g. Sumatra, Java (Burkill, 1966).

Study on *Beilschmiedia* in Thailand are as follows; Govaert (1996) found 4 species which are *B. inconspicua* Kosterm., *B. lanatella* Kosterm., *B. velutinosa* Kosterm. and *B.villosa* Kosterm. Smitinand' s Thai Plant Names (the Forest Herbarium, 2001) reported that 5 species of *Beilschmiedia* can be found i.e. *B. assamica* Meisn., *B. fagifolia* Nees, *B. gammieana* King ex Hook.f., *B. globularia* Kurz and *B. palembanica* (Miq.) Kosterm. *Beilschmiedia* in other region were studied in the following table below. (Table 1).

Table 1 Study on genus *Beilschmiedia* in other countries.

Researcher / Year	Study site	Number of species
Hooker (1885)	India	14
Lecomte (1914)	Indo-China	4
Merrill (1934)	Sumatra	1
Kanjilal (1940)	Assam	4
Backer and Bakh.f. (1963)	Java	4
Ridley (1967)	Malay peninsula	15
Francis (1970)	Australia	2
Chang (1976)	Taiwan	2
Walker (1976)	Okinawa and The Ryukyu Islands	2
Kurz (1877)	British Burma	3
Allan (1982)	New Zealand	2
His-wen (1984)	China	35
Long (1984)	Bhutan	7
Kochummen (1989)	Malaya	18
Hô (1991)	Vietnam	23
Dassanayake, Fosberg and Clayton (1995)	Ceylon	1
van der Werff (2003)	Madagascar	9

Ecology

Beilschmiedia is forest trees and predominantly found in different types of forest from low to high elevation. *B. glauca* S.K. Lee & L.F. Lau is found in upper evergreen forest (Turner, 1995), rarely found in lowland evergreen forest (Kochummen, 1989). *B. maingayi* Hook.f. is found in upper evergreen forest, over 1,200 meter altitude (Kochummen, 1989), *B. membranacea* Gamble is found in montane evergreen forest and *B. palembanica* (Miq.) Kosterm. is found in lower evergreen forest to upper evergreen forest (Turner, 1995).

Many species of *Beilschmiedia* were reported in Bhutan and Sikkim, such as; *B. gammieana* Hook.f. in montane forest with oaks and broad leaves forest at 1,750-2,050 m. altitude, *B. assamica* Meisn. in subtropical forest and broad leaves forest and in temperate zone at 300-1,800 m altitude and *B. roxburghiana* Nees in subtropical forest at 200-400 m altitude (Long, 1984).

In Thailand, ecological data was rarely recorded.

Uses

Beilschmiedia is used most as timber for example *B. roxburghiana* Nees is used to build houses and tea boxes in Bhutan (Long, 1984). In India, Malaysia and Java used *B. kunstleri* Gamble to build houses (Burkill, 1966). Some species of this genus are used as herb such as the bark of *B. sphaerocarpa* Lec. is used to cure pustule in Indochina, leaves of *B. tonkinensis* (Lec.) Ridl. is used for medicinal purposes to make medicine for easing the pain, inflammation and broken bone and the bark of *B. pahangensis* Gamble is made medicine for curing stomachache, dysentery (Perry, 1980).

MATERIALS AND METHODS

Materials

1. Plant press, pruning knife, plastic bags, newspapers, corrugated cardboards, rope, tags, field book, pencil, altimeter, camera, color films of both printing and slides.

2. Materials for preserving and mounting specimens comprised of alcohol 70%, various sizes of bottles, deep freezer for preserving specimens from insects and fungi, mounting papers (papers of 300 gram of 42 x 26.5 cm, covers of 42 x 27 cm, brown covers of 42 x 27.5 cm), needle and thread, labels of 13.5 x 10 cm and glue.

3. Instruments for identifying specimens comprised of stereo microscope together with scale, ruler, calipers, petri dish, dissecting needles and razor blade.

Methods

1. Data of *Beilschmiedia* from literatures, such as floras, journals and reports on the survey of this genus in various sites were collected and compiled. The herbarium specimens deposited in the Forest Herbarium (BKF), National Park Wildlife and Plants Conservation Department and Bangkok Herbarium (BK), Department of Agriculture were also studied.

2. Collections of *Beilschmiedia* were made in sets of five to ten, from the natural habitats in various regions of Thailand. Photograph and notes were also taken. The specimens were mounted as in herbarium sheet and some of flowers and fruits were preserved in alcohol 70 % for further study.

3. Morphological characteristics of genus *Beilschmiedia* were observed from the fresh materials and several herbarium specimens deposited in the Forest Herbarium (BKF), National Park Wildlife and Plants Conservation Department and

Bangkok Herbarium (BK), Department of Agriculture as well as other herbaria, i.e. The herbarium of Faculty of Science, Chiang Mai University, Prince Songkhla Nakharin University and Khon Kaen University. Flowers were dissected and examined under stereo microscope and also photographs as well as measurement of various parts of plants were taken.

4. Identification of plants into species were done by observing morphological characteristics, checking references and comparing with herbarium specimens at BKF and BK. Then, the names were verified to the correct botanical names by way of taxonomic study. The detailed description of each species as well as line drawing were done, followed by the construction key to species.

5. The identified specimens were kept as references at BKF and BK for future study and research.

PLACES AND DURATION

Places

This studies covered several places as follows;

1. Natural forests in various regions of Thailand.

2. Forest Biology Department, Faculty of Forestry and Botany Department, Faculty of Science, Kasetsart University.

3. Faculty of Science and Faculty of Pharmacy, Chiang Mai University.

4. Biology Department, Faculty of Science, Prince Songkhla Nakharin University.

5. Forest Herbarium, National Park Wildlife and Plants Conservation Department, BKF.

6. Bangkok Herbarium, Department of Agriculture, BK.

Duration

The studies was done from March 2002 to March 2005.

RESULTS

Field and Morphological Characters

Habit

All plants in the genus *Beilschmiedia* in Thailand are usually small to medium size trees except *B. velutinosa* and *B. glauca* which occasionally are shrubs. The trunks are often straight and sometimes small buttresses are found in *B. gammieana* and *B. palembanica.*

Branching modes are mostly sympodial but in some species are monopodial branching (terminalia branching), such as *B. argentata* and *B. velutinosa.*

Habitat

The ecological range of plants in this genus is widely from peat swamp forest, dry dipterocarp forest, mixed deciduous forest, dry evergreen forest, lowland evergreen forest to hill evergreen forest (montane forest). Most species occur in hill evergreen forest, such as *B. gammieana, B. assamica, B. clarkei, B. elegantissima* and *B. glauca.* Some species are found in lowland evergreen forest, such as *Beilschmiedia* sp.1, *B. brevipes*, *B. wallichiana* and *B.* sp.2, in dry evergreen forest, such as *B. velutinosa* and *B. argentata.* Some grow in mixed deciduous forest such as *B. villosa*, some species grow in peat swamp forest, such as *B. palembanica.* While *B. roxburghiana* can be found from dry dipterocarp forest to dry evergreen forest, mostly throughout the country.

Bark

The bark of *Beilschmiedia* is generally nearly smooth, brown to greyish-brown and occasionally lenticellate, but *B. roxburghiana* is scaly, blackish-light brown bark.

Inner bark is creamy to pink with clearly exudate is occasionally found in the genus *Beilschmiedia.*

Terminal Buds

Characteristics of terminal buds in this genus can be separated into two groups. The first group is the species with small to large terminal buds enclosing in coriaceous glabrous scales which are ovoid to lanceolate shape and acute apex, such as *B. assamica, B. gammieana, B. glauca* and *Beilschmiedia* sp.1. The second group is tomentose terminal buds, not enclosing in coriaceous scales, such as *B. argentata, B. brevipes, B. clarkei, B. elegantissima, B. roxburghiana, B. wallichiana* and *Beilschmiedia* sp.2.

Leaves

The leaves are simple; alternate, spiral, opposite or subopposite, coriaceous to membranous in texture and usually shining, petiolate. The leaves are peninnerves, midrib and secondary veins arching toward margins and distinct on both surfaces. The tertiary veins are usually lax reticulate, except in *B. glauca* which is finely reticulate.

Inflorescences

The inflorescences of *Beilschmiedia* are panicles or racemes, arising at the terminal, subterminal and/or at the upper leaves axils or leaves axils. Terminal, subterminal and/or upper leaf axils inflorescences are encountered in the following species: *B. argentata, B. elegantissima, B. gammieana, Beilschmiedia* sp.1 and *Beilschmiedia* sp.2, while axillary inflorescences are found in *B. brevipes, B. glauca, B. membranacae, B. palembanica, B. roxburghiana, B. velutinosa, B. villosa, B. wallichiana,* and *Beilschmiedia* sp. 1. Fasciculate inflorescences with tomentose or pilose orbicular bracteoles are found in *B. argentata, B. brevipes, B. villosa* and *B. wallichiana.*

Flowers and Floral Parts

Flowers of the genus *Beilschmiedia* are apparently all alike. They are about the same size, usually 2-5 mm in diameter, number of tepals usually 6, arranged in 2 whorls of 3, in some species are 6-8 tepals arranged in 2 whorls of 3(-5), such as *B. roxburghiana* which was collected at Huai Kaeo Arboretum and *B. argentata*; tepals yellowish to whitish, glabrous to pubescent, ovate, oblong or lanceolate, apex acute.

Most species in the genus have 9 fertile stamens arranged in 3 whorls of 3. In this case, the 1st whorl, or the outermost one and the 4th whorl or the innermost one, stamens can be assigned to the 1st or the 2nd whorled by their position: stamens of the 1st whorl are opposite the outer tepals and those of the 2nd whorl opposite the inner tepals. The cells of the 1st and the 2nd whorls are introrse, while the cells extrorse or latrorse in the 3rd whorl two glands attached at or near the base. The 4th whorl are 3 staminodes, heart, ovoid, triangular or saggittate shape, with acute or obtuse apex, except *B. roxburghiana* which was collected from Huai Kaeo Arboretum. This species occasionally has 6 fertile stamens arranged in 2 whorls of 3 and 6 staminodes in the 3rd and the 4th whorl. The anthers are basifixed with 2-celld, valve dehiscence, usually obtuse or acute apex. Almost all species of *Beilschmiedia*, the filaments are slender, glabrous to villose.

Pistil is ovoid, globose, glabrous, pubescent or villose, and inconspicuously stigma. The receptacle is flatten or shallow cup-shaped, glabrous to villose.

Fruits

The fruits of *Beilschmiedia* are drupe, the shapes vary from ellipsoid to globose. Color of young fruit is light to dark green, slightly shining, with white mottles. The ripening fruit is dark purplish to blackish. The pericarp can be divided into three parts: exocarp, mesocarp and stone or crustose endocarp with albuminous seeds. Perianths which is caducous when fruiting, leave narrow ring at base of the fruits. The fruit is sessile or not persistent stalk when mature.

Taxonomic History of the Genus *Beilschmiedia* Nees

The genus *Beilschmiedia* was first described in 1831 by Christian Gottfried Daniel von Esenbeck Nees. Since then the genus was studied by several authors. Some taxa were merged to be synonyms. The following is the genus description which cited with a full references from the earliest legitimate description publication. The type, specimens which the authors had when he described the species, are cited. Later published names for the same taxon are called synonyms and are not considered to be the correct name for the species.

Beilschmiedia **Nees**, Wall., Pl. Asiat. Rar. 2: 61, 69. 1831; Brandis, Indian trees 528. 1906; Kurz, Prelim. rep. forest Pegu 72. 1875; Forest. fl. Burma 2: 293. 1877; Benth. & Hook.f., Gen. pl. 3: 152. 1880; Hook.f., Fl. Brit. India 5: 121. 1886; Gamble, Man. Ind. Timb. ed. 2: 558. 1902; in J. Asiat. Soc. Bengal 75(1): 51. 1912; in Fl. Madras 2(7): 1220. 1925; Lecompte, Fl. Indo-chine 5: 148. 1914; Ridl., Fl. Mal. Pen. 3: 82. 1967; Liou Ho, Laur. Chine et Indochine. 102. 1932 (reprint 1934); Backer & Bakh.f., Fl. Java (emergency ed.), Fam. 27: 26. 1941; Allen, J. Arnold Arbor. 19: 31. 1938; in J. Arnold Arbor. 26. 414. 1945; U.N. Kanjilal in P.C. Kanjilal, R.N. De, and A. Das, Fl. Assam 4: 51. 1940; Kosterm., Reinw. 4(2): 229. 1957; in Bibliogr. Laur. 113. 1964; Long, Fl. Bhutan 1, 2: 253. 1984; Rohwer in Kubitzki, Fam. Gen. Vas. Pl. 2: 385. 1993; van der Werff, Blumea 46(1): 134. 2001; in Adansonia 25(1): 79. 2003. Type: *Beilschmiedia roxburghiana* Nees.

Synonyms:

-*Laurus* Roxb., Fl. Ind. ed. 2, 2: 311. 1832. Type: *Laurus bilocularis* Roxb.

-*Bernieria* Baill., Bull. Mens. Soc. Linn. Paris 1: 434. 1884. Type: *Bernieria madagascariensis* Baill.

-*Thouvenotia* Danguy, Bull. Mus. Hist. Nat. (Paris) 26: 652. 1920. Type: *Thouvenotia madagascariensis* Danguy.

-*Apollonias* sensu Kosterm., Notul. Syst. (Paris) 8: 67.1939; in Fl. Madagascar, Fam. 81: 2. 1950.

-*Lauromerrillia* Allen, J. Arnold Arbor. 23: 460. 1942. Type: *Lauromerrillia appendiculata* Allen.

Trees or shrubs, trunk straight, occasionally small butresses, branches round or slightly angled, glabrous or pubescent. Outer bark nearly smooth, light greyish to brownish, occasionally lenticellate, inner bark creamy, pink to red with clearly exudate. Terminal buds small, appressed pubescent enclosed in coriaceous, glabrous, ovoid-acute to lanceolate-acute scales, or no scales. *Leaves* simple, alternate, spiral, opposite or subopposite, sometimes grouped at tips of branches; coriaceous to membranous; peninnerves, midrib and lateral nerves distinct on both surfaces, margin entire, petiolate. *Inflorescences* terminal, subterminal, in the upper leaves axils or axillary, few to many-flowered, paniculately, cymosely or racemosely arranged along the ultimate branchlets, fasciculate panicle or raceme; bracteoles orbicular pillose. *Flowers* small, globose or flattened or disc like, usually 2-5 mm in diam., bisexual, greenish; tepals incurved rarely spreading, usually 6 arranged in 2 whorls of 3, or 6-8, arranged in 2 whorls of 3(-5), very rarely 4, in 2 whorl of 2; fertile stamens usually 9 arranged in 3 whorls of 3, sometimes not distinctly arranged appears to be the outermost and the innermost, 1st whorl stamen opposite the outer tepals, 2nd whorl opposite the inner tepals; anthers 2-cells, dehiscence by valves, 1st and 2nd whorls introrse, 3rd whorl extrorse or latrorse, with 2 glands at or near base, basifixed, obtuse or acute apex, filaments slender or broad, glabrous to villose, staminodes 3, heart-shaped, ovoid, triangular or saggittate, acute or obtuse, arranged as the 4th whorl, *B. roxburghiana* (Huai Kaeo) occasionally fertile stamens 6 arranged in 2 whorls of 3, staminodes 6 in 3rd and 4th whorl; ovary ovoid or globose, glabrous, pubescent or villose, short style, inconspicuously stigma; receptacle flatten or shallow cup-shaped, glabrous to villose. *Fruits* drupe, ellipsoid to globose, light to dark green when young, later dark purplish to blackish, slightly shining, occasionally white mottles. Seeds hard albuminous, ring at the base remnant of the falling perianths, sessile or fruiting pedicels not persistent.

A dichotomous key to species of the genus *Beilschmiedia* Nees in Thailand was constructed from this study for plant identification.

Key to species of the Genus *Beilschmiedia* Nees in Thailand

1. Terminal buds enclosed in glabrous, coriaceous scale, ovoid to lanceolate shape
   2. Terminal buds ovoid, mature fruits globose, 2.0-4.0 by 2.0-5.3 cm _____ **6. *B. gammieana***
   2. Terminal buds lanceolate, mature fruits ellipsoid
      3. Leaves ovate or elliptic, apex shortly caudate or acuminate, base rounded, lower surface glaucous, finely reticulate _____ **7. *B. glauca***
      3. Leaves elliptic to oblong, apex acute, base cuneate or attenuate, lower surface not glaucous, lax reticulate
         4. Infructescences erect, fruiting pedicel enlarged, fruits obovoid to ellipsoid, 4.0-4.5 by 2.5- 2.7 cm, medium- sized tree _____ **2. *B. assamica***
         4. Infructescences pendulous, fruiting pedicel slender, fruits ellipsoid, 1.8-3.0 by 0.9-1.35 cm, small sized tree _____ **15. *Beilschmiedia* sp.1**
1. Terminal buds not enclosed in coriaceous scale, tomentose or pubescent
   5. Leaves glabrous on both surface
      6. Leaves coriaceous
         7. Flower buds cover with bracteoles _____ **8. *B. inconspicua***
         7. Flower buds not cover with bracteoles
            8. Fruiting pedicels green, slender, 0.8-2.2 cm long, bark greyish-white, nearly smooth, inner bark brown _____ **16. *Beilschmiedia* sp.2**
            8. Fruiting pedicels brown, thick, 1.0-3.5 cm long, bark greyish-black, scaly to fissure or nearly smooth, inner bark pinkish-brown to dull red _____ **11. *B. roxburghiana***
      6. Leaves membranaceous or chartaceous
         9. Inflorescences reduced to very short raceme, like a single flower, fruits ellipsoid-oblong, 1.5-2.2 by 0.5-1.0 cm, fruiting pedicels enlarged like thicken disc shape, short, 0.5-1.0 cm long, small tree about 12 m _____ **3. *B. brevipes***
         9. Inflorescences not reduced, fruits ellipsoid-oblong, 3.5-4.5 by 2.0-2.2 cm, fruiting pedicels enlarged to 3.0-3.5 cm long, medium- sized tree up to 30 m _____ **4. *B. clarkei***
   5. Leaves pubescent to villose on lower surface (or along midrib and petioles)

10. Leaves coriaceous

11. Inflorescences raceme, covered with bracteoles_____**13. *B. villosa***

11. Inflorescences panicle, not covered with bracteoles

12. Inflorescences at upper leaf axils, leaves silvery grey when dry

_____**10. *B. palembanica***

12. Inflorescences terminal, leaves not silvery grey when dry

_____**5. *B. elegantissima***

10. Leaves membranaceous or chartaceous

13. Flower buds cover with bracteoles, inflorescences racemose

14. Tepals inner surface glabrous, outer surface pilose_____**14. *B. wallichiana***

14. Tepals pubescent on both surface _____**1. *B. argentata***

13. Flower buds not cover with bracteoles, inflorescences panicle or cymose

15. Inflorescences panicle, fruits ellipsoid-clavate, smooth, 3.0-4.0 by 1.8-2.0 cm, fruiting pedicels enlarged, 2.5-4.5 cm long, pilose, small to medium-size tree, 7-22 m _____**12. *B. velutinosa***

15. Inflorescences cymose, fruits oblong, 1.25-1.5 by 0.7-1.0 cm, fruiting pedicels hardly enlarged, c. 1.0 cm long, small tree, about 6 m

_____**9. *B. membranacea***

1. Beilschmiedia argentata Kosterm., Reinw. 6(3): 284. 1962. - *Daphnidium argenteum* Kurz, J. Asiat. Soc. Bengal 42(2): 103. 1873; in Forest Fl. Burma 2: 307. 1877; Gamble, Man. Ind. Timb. 312. 1881; Hook.f., Fl. Brit. India 5(13): 187. 1886; Kosterm., Bibliogr. Laur. 458. 1964. - *Benzoin argenteum* (Kurz) O. Kuntze, in Rev. Gen. Pl. 2: 569. 1891; Kosterm., Reinw. 6: 284. 1962; in Bibliogr. Laur. 160. 1964. - *Beilschmiedia argentea* Kosterm., Reinw. 4(1): 20. 1956; in Bibliogr. Laur. 116. 1964. Type: Burma, Insein, Myanklaing, *Pokhant* 149, 196 (DD). Figure 1, 2.

Small to medium- sized trees, 18-30 m high; trunk straight, branches round, greyish- brown, pubescent when young. Outer bark brownish-grey, slightly fissure, inner bark creamy. Terminal buds 0.4-0.6 cm long. *Leaves* alternate or subopposite; blade elliptic-obovate or oblanceolate, 10.0-18.0 by 3.0-7.0 cm, apex acuminate, base attenuate or acute, chartaceous, slightly pubescent, glabrous above, pubescent along

midrib and margins, velutinous to pubescent beneath, raised on the lower surface, pubescent, secondary veins arching toward margins, conspicuous beneath, irregular, 6-8 (-10) on each side, tertiary veins prominent areolate on both surfaces; petioles 1.0-1.2 cm, pubescent. *Inflorescences* racemes in suborbicular perulate, bracteoles oblong, c. 3.0 mm long, terminal or arising from upper leaf axils, 1.5-3.0 cm long, peduncles 0.6-0.7 cm long, flower buds cover with bracteoles, bracteoles oblong, c. 3.0 mm long. *Flowers* c. 4.0 mm in diam., yellowish-green; tepals 6 (-7) in 2 whorls of 3 (-4), equal, oblong, acute, c. 4.5 mm long, pubescent on both surface; fertile stamens 9 (-10), anthers ovoid, obtuse, filament narrower than anther, pubescent, outer stamens 6 (-7), 2.3-2.5 mm long, anthers introrse, inner stamens 3, 2.8-3.0 mm long, anthers latrorse to extrorse, filament with 2 large globose glands at base; staminodes 3, 1.0-1.5 mm long, broadly heart- shaped, filaments, c. 0.5 mm long, pubescent; pistil glabrous, 3.0-3.5 mm long, ovary ovoid-oblong, style longer than ovary, stigma recurve; receptacle shallow, glabrous. *Fruits* green when young, infructescences panicle.

Thailand.-- SOUTH- WESTERN: Uthai Thani (Huai Kha Khaeng).

Distribution.-- Myanmar (type).

Ecology.-- Scattered in dry evergreen forest, c. 500 m altitude. Flowering January- February; fruiting March-June.

Vernacular.-- Kam Kung (ก้ามกุ้ง) (The name is given by the author).

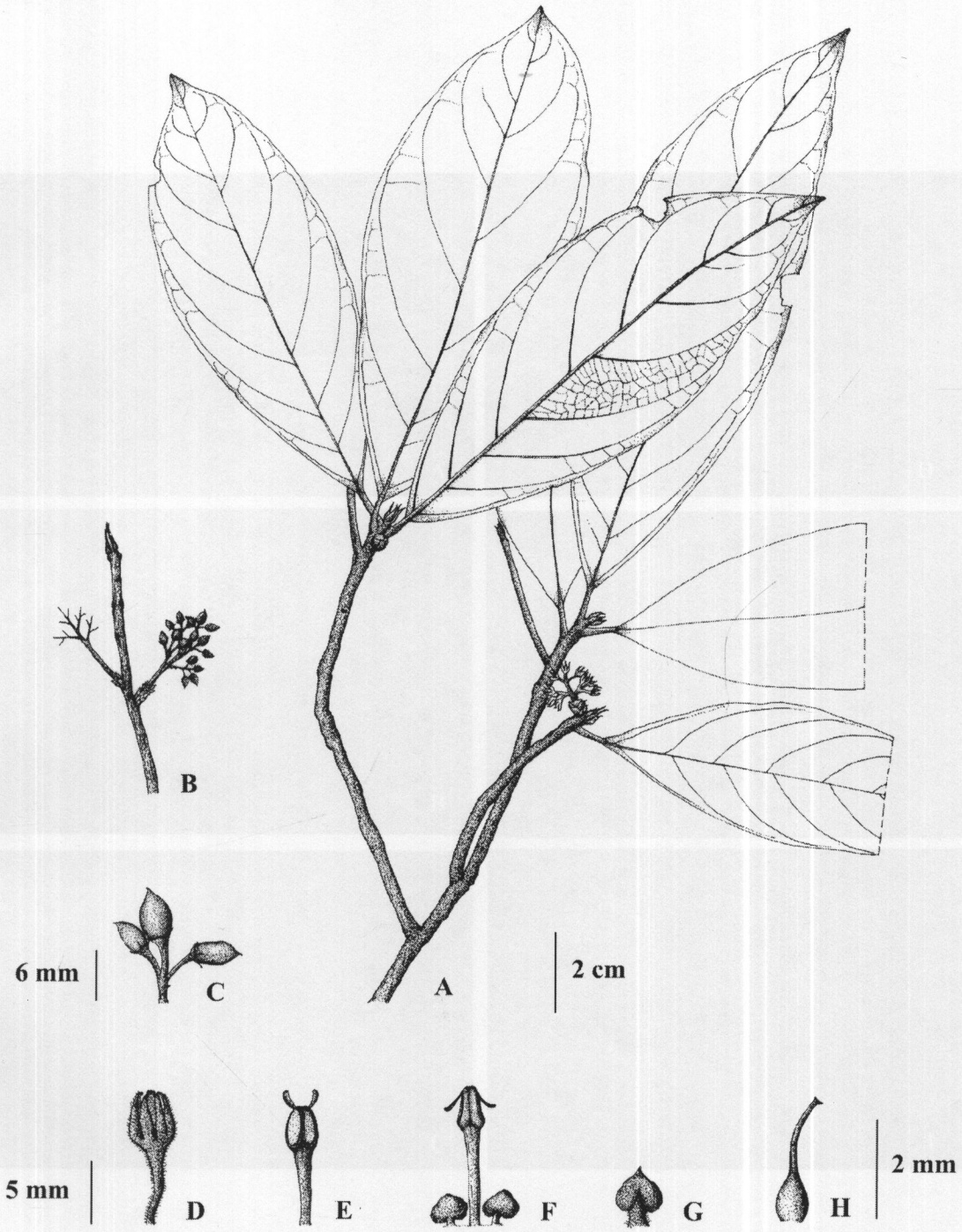


Figure 1 *B. argentata* Kosterm.: A, flowering twig; B, fruiting twig; C, young fruits; D, flower; E, outer stamen; F, inner stamen with 2 glands; G, staminode; H, pistil.

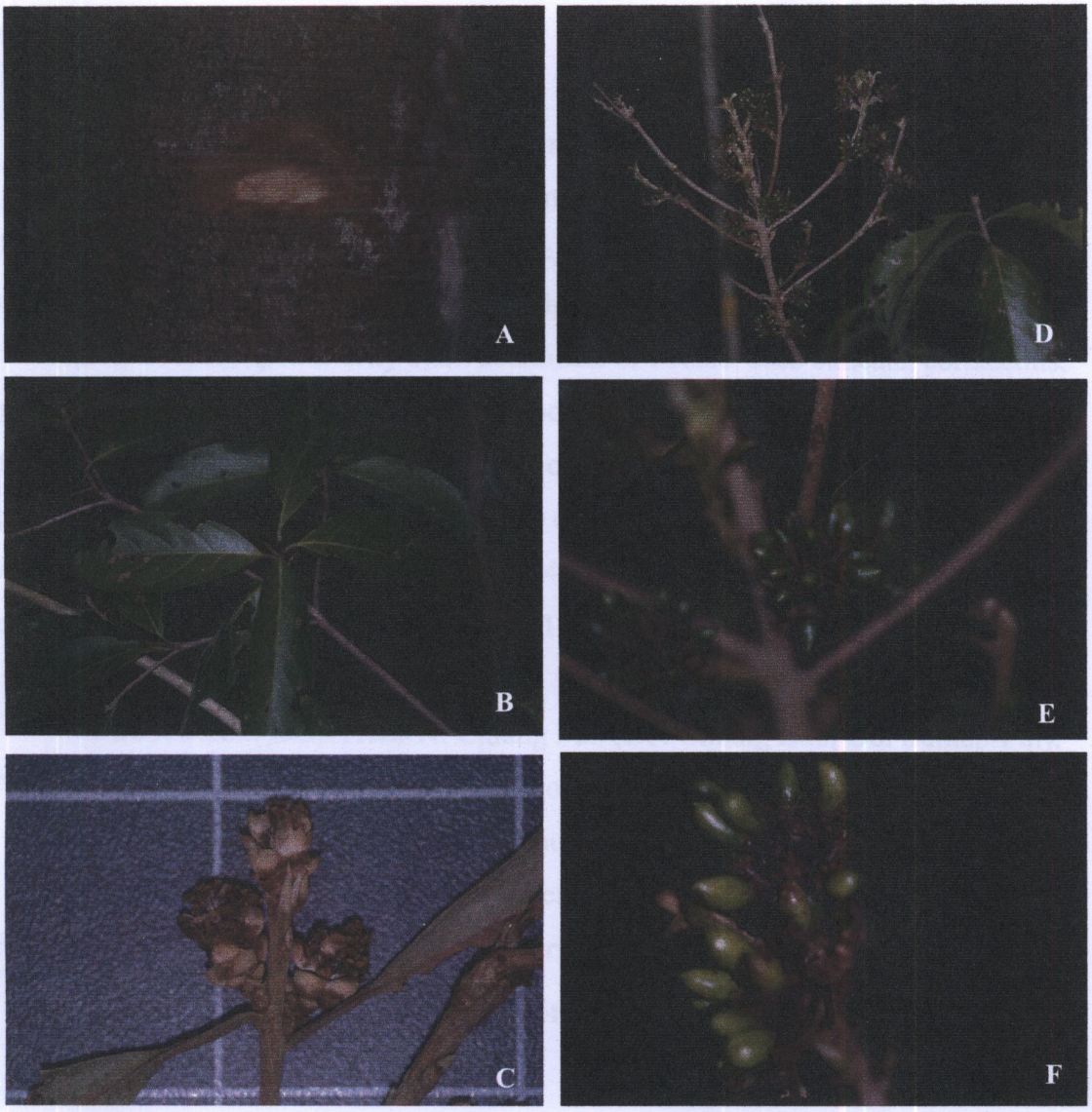


Figure 2 Photographs of *B. argentata* Kosterm.: A, outer and inner bark; B, leafy twig; C, flowering twig; D, fruiting twig; E –F, young fruit.

2. Beilschmiedia assamica Meisn., in A.P. de Candolle, Prodr. 15(1): 64. 1864; Hook.f., Fl. Brit. India 5(13):124. 1886; Gamble, Man. Ind. Timb., ed. 2: 559. 1902; U.N. Kanjilal in P.C. Kanjilal, R.N. De and A. Das, Fl. Assam. 4: 53. 1940; Bor, Man. Ind. for. bot. 51. 1953; Kosterm., Bibliogr. Laur. 117. 1964; Brand., Ind. trees. 529. 1978; Long, Fl. Bhutan 1, 2: 256. 1984. Type: India, Assam, unknown s.n. (holotype K!). Figure 3, 4.

Small to medium- sized tree, 14-22 m high. Outer bark greenish to brownish-grey, nearly smooth, inner bark creamy. Terminal buds lanceolate, up to 1.25 cm long, enclosed in linear-oblong or lanceolate, glabrous, coriaceous scale. *Leaves* alternate or subopposite; blade oblong to elliptic-lanceolate or elliptic-oblong, 5.0-14.0 by 1.5-5.0 cm, apex shortly blunt acuminate or obtuse, base cuneate, coriaceous, glabrous on both surfaces, midrib sunken above, raised beneath, secondary veins sunken above, raised beneath, slender, 6-12 on each side, tertiary veins reticulate, prominent on both surfaces; petioles 1.5-2.0 cm long. *Inflorescences* not seen. *Flowers* not seen. *Fruits* obovoid-ellipsoid, 4.0-4.5 by 2.5-2.7 cm, dark green, turning purplish-black when ripe; fruiting pedicels, 1.0-2.0 cm long, dark brown.

Thailand.-- NORTHERN: Chiang Mai (Doi Chiang Dao, Doi Suthep-Pui), Nan (Doi Phuka), Kamphaeng Phet (Mae Wong); EASTERN: Loei (Phu Luang).

Distribution.-- Assam (type), Bhutan, India, Myanmar.

Ecology.-- Hill evergreen forest, scattered on slope, 1,000-1,275 m altitude. Flowering February-April; fruiting June- April.

Vernacular.-- Chan dong (จันทน์ดง), Tit (ตีด) (Trang).

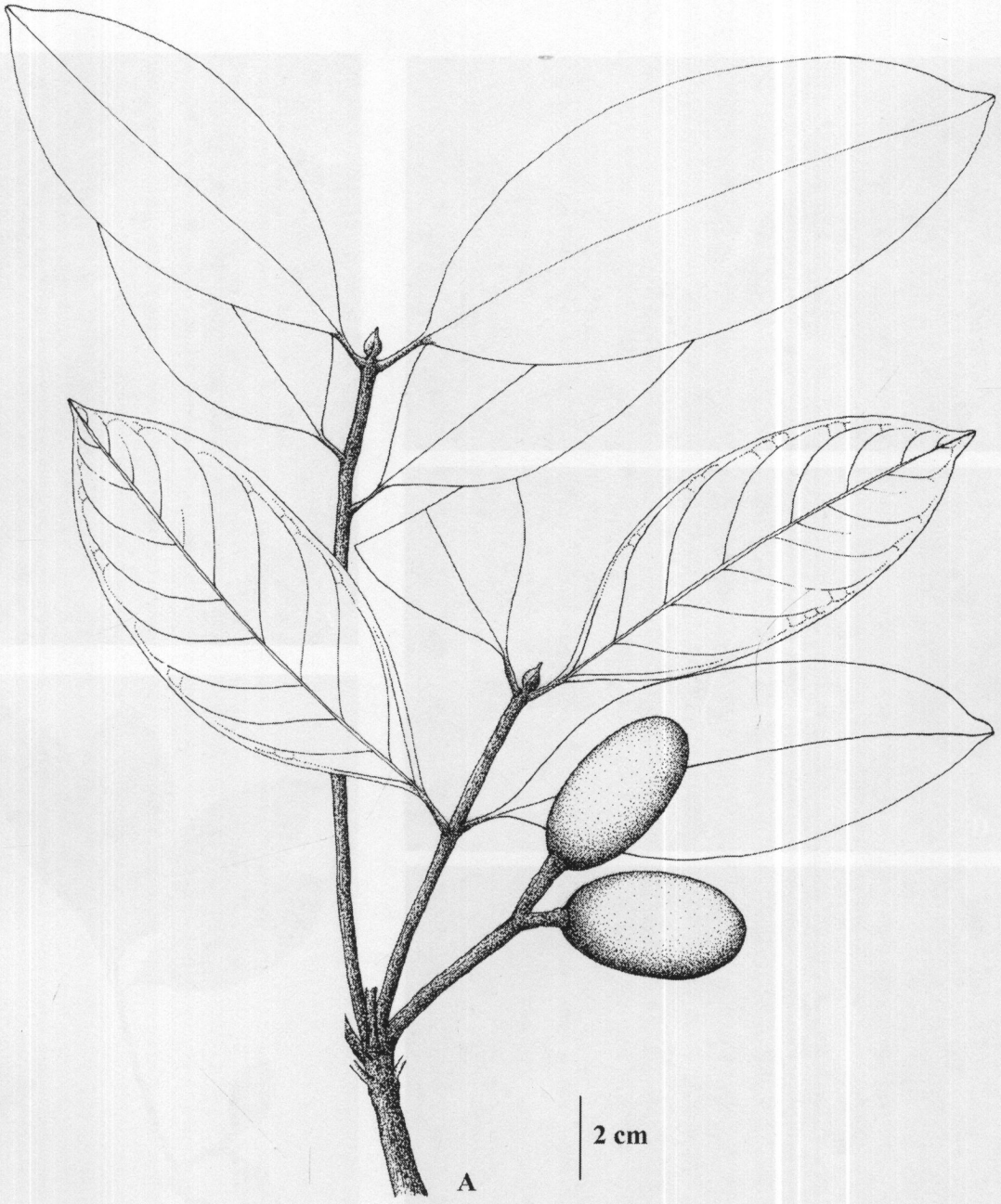


Figure 3 *B. assamica* Meisn.: A, fruiting twig.

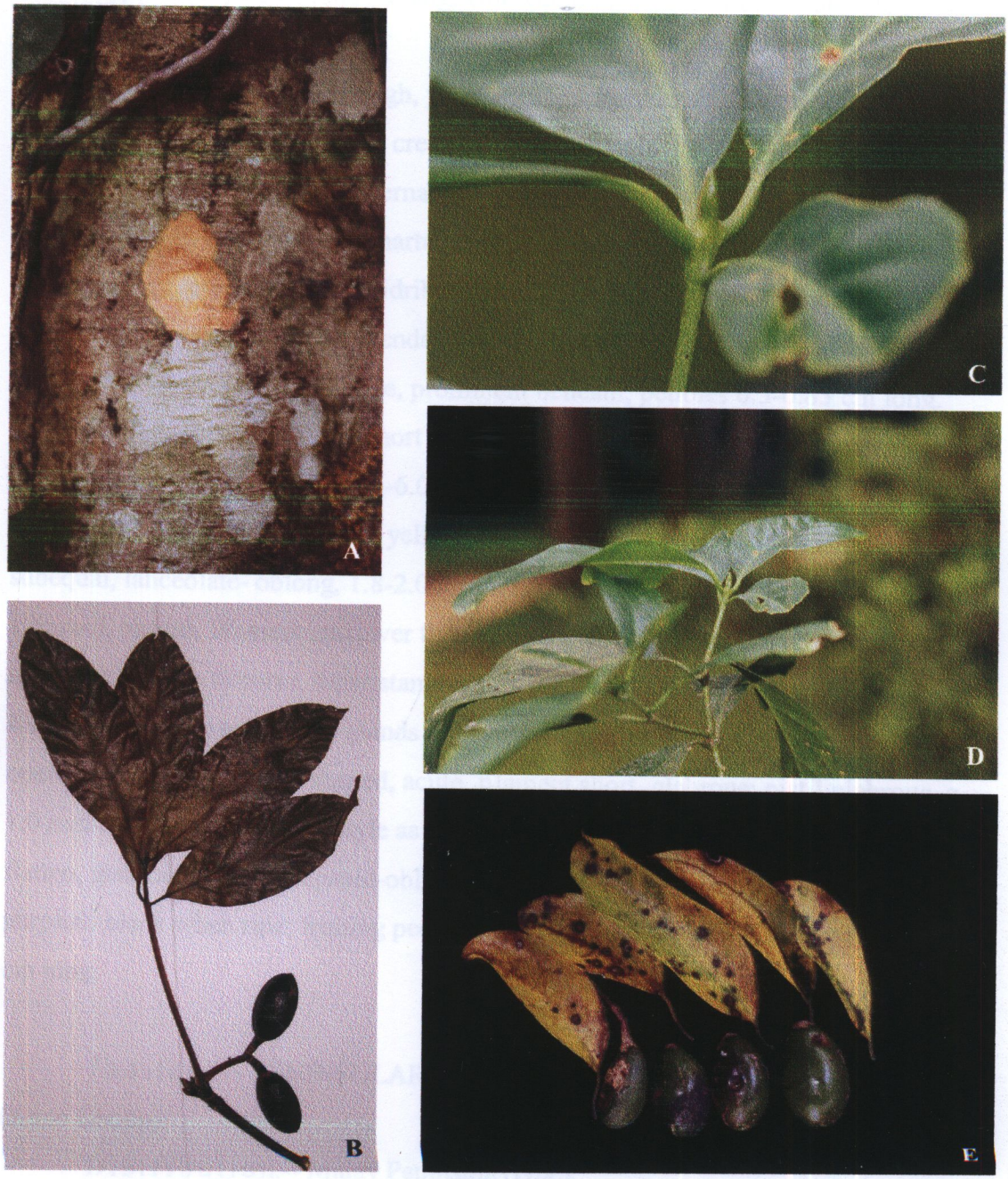


Figure 4 Photographs of *B. assamica* Meisn.: A, outer and inner bark; B, fruiting twig; C, terminal bud; D, leafy twig; E, fruit.

3. Beilschmiedia brevipes Ridl., Fl. Mal. Pen. 3: 86. 1924; in Fl. Mal. Pen. 3: 86. 1967; Kosterm., Bibliogr. Laur. 120. 1964; Kochummen in Ng, Tree Fl. Mal. 4: 118. 1989. Type: Malay Peninsula, Pahang, Ulu Rumpin, *Kep* 3181 (?). Figure 5, 6.

Small tree about 12 m high, young branches pubescent. Outer barks greyish-white, nearly smooth, inner bark creamy. Terminal buds up to 0.5 cm long, appressed, pubescent. *Leaves* opposites, alternate or spiral; blade elliptic, 7.0-13.5 by 3.0-6.0 cm, apex acuminate, base cuneate, chartaceous, glabrous on both surface, dark green and shining above, green beneath, midrib sunken above, raised beneath, secondary veins sunken above, raised beneath, slender, 8-10 on each side, arching and joining near margin, tertiary veins, faint above, prominent beneath; petioles 0.5-0.85 cm long. *Inflorescences* reduced to very short axillary racemes like a single flower, enclosed in glabrous ovate papery bracts, 4.5-6.0 mm long, peduncles c. 2.5 mm long. *Flowers* small, 2.0-2.5 mm in diam., pale yellowish-green; tepals 6 in 2 whorls of 3, equal to subequal, lanceolate- oblong, 1.8-2.0 mm long, glabrous; fertile stamens 9, anthers ellipsoid, obtuse, filament narrower than anther, glabrous, outer stamens 6, 0.7-1.0 mm long, anthers introrse, inner stamens 3, 1.0-1.2 mm long, anthers extrorse, filament with 2 large globose glands at base; staminodes 3, c. 0.5 mm long, 1-2 opening with valve, heart- shaped, acute, filament short, glabrous; pistil glabrous, c. 1.0 mm long, ovary globose, style as long as ovary, stigma inconspicuous; receptacle flatten, glabrous. *Fruits* ellipsoid-oblong, 1.5-2.2 by 0.5-1.0 cm, dark green turning purplish-black when ripe; fruiting pedicels enlarged like thicken disc shape, 0.5-1.0 cm long.

Thailand.-- PENINSULAR: Nakhon Si Thammarat (Khao Luang), Trang (Khao Chong).

Distribution.-- Malay Peninsula (type).

Ecology.-- At the edge of primary evergreen forest, along the river or rocky place, 100-150 m altitude. Flowering April-May; fruiting May-June.

Vernacular.-- Thang maeng da bai lek (ทังแมงดาใบเล็ก), Than (ทัน) (The name is given by the author).

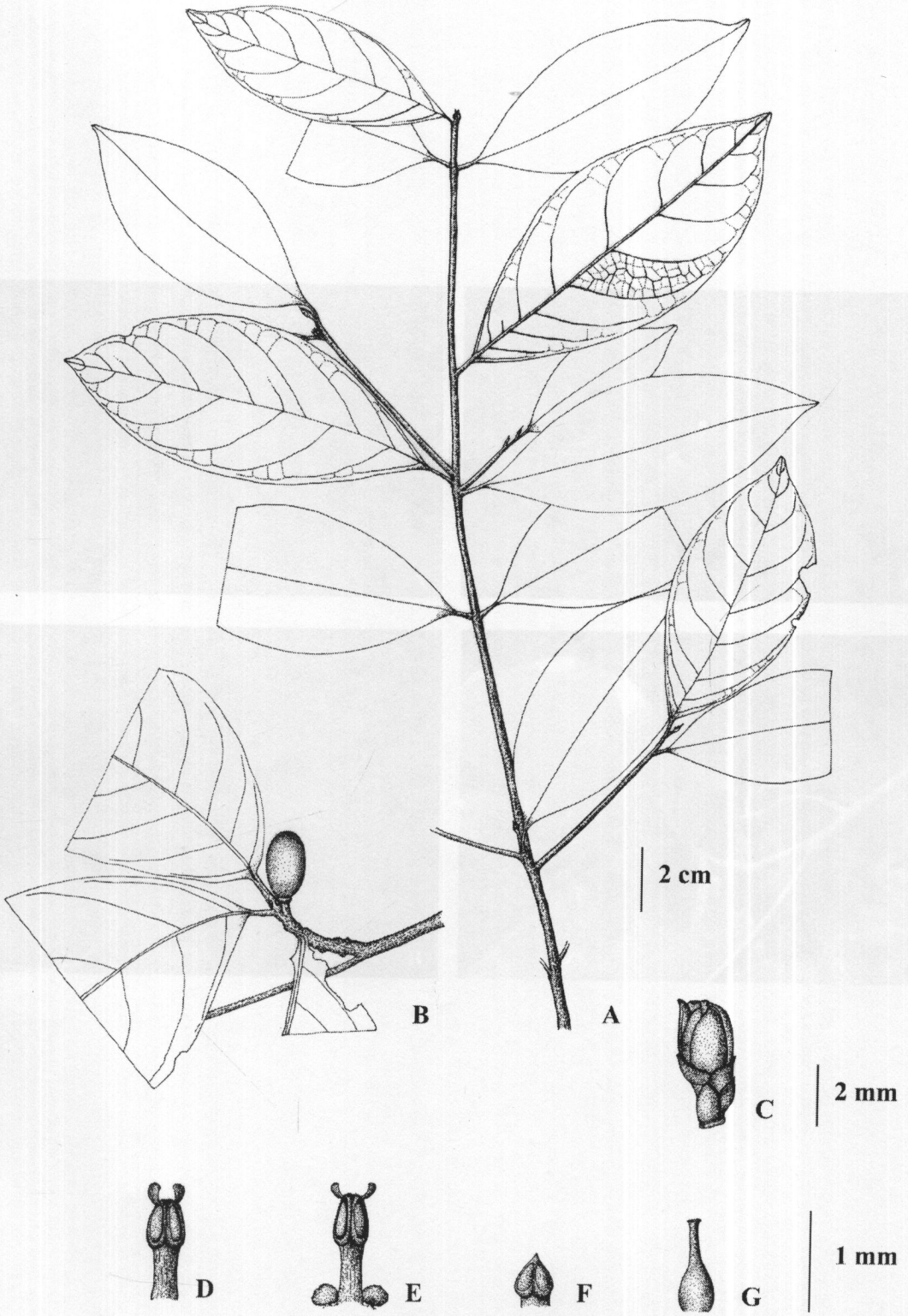


Figure 5 *B. brevipes* Ridl.: A, leafy twig; B, fruiting twig; C, inflorescences reduced to short raceme; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

Figure 6 Photographs of *B. brevipes* Ridl.: A, outer and inner bark; B, leafy twig; C, flowering twig; D, fruiting twig.

4. Beilschmiedia clarkei Hook.f., Fl. Brit. India 5: 122. 1886; Gamble, Man. Ind. Timb., ed. 2: 559. 1902; in Ind. trees 529. 1978; Bor, Man. Ind. For. Bot. 51. 1953; Kosterm., Bibliogr. Laur. 121. 1964. Type: Sikkim, Reinak, *Clarke* 27925 (K!). Figure 7, 8.

Small to medium- sized trees, 8-28 m high, occasionaly small buttresses, branches round, glabrous with densely lenticel when young. Outer barks brown slightly fissure, inner barks reddish-pink. Terminal buds ovate-lanceolate, up to 0.65 cm long, appressed pubescent. *Leaves* spiral, alternate or opposite, crowded at tip of branches; blade elliptic-lanceolate, 9.5-18.0 by 3.0-7.0 cm, apex acute to acuminate, base acute to cuneate, chartaceous or membranous, glabrous on both surfaces, midrib sunken above, raised beneath, secondary veins sunken above, raised beneath, slender, 9-12 on each side, curving and joining near margin, tertiary veins lax reticulate; petioles 1.0-2.0 cm long. *Inflorescences* lax panicles at terminal or arising from leaf axils, 8.0-10.0 cm long; peduncles 2.0-2.5 cm long. *Flowers* c. 6.0 mm in diam., tomentose. *Fruits* ellipsoid-oblong, 3.5-4.5 by 2.0-2.2 cm, dark green, turning purplish-black when ripe, glaucous; fruiting pedicels enlarged, 3.0-3.5 cm long, brown.

Thailand.-- NORTHERN: Chiang Mai (Doi Inthanon).

Distribution.-- Himalaya, India, Myanmar, Sikkim (type).

Ecology.-- Scattered in montane forest, 1,700-2,200 m altitude. Flowering May-July; fruiting August-April.

Vernacular.-- Nuai nok ngum bai chan (หน่วยนกงุมใบชัน) (The name is given by the author).

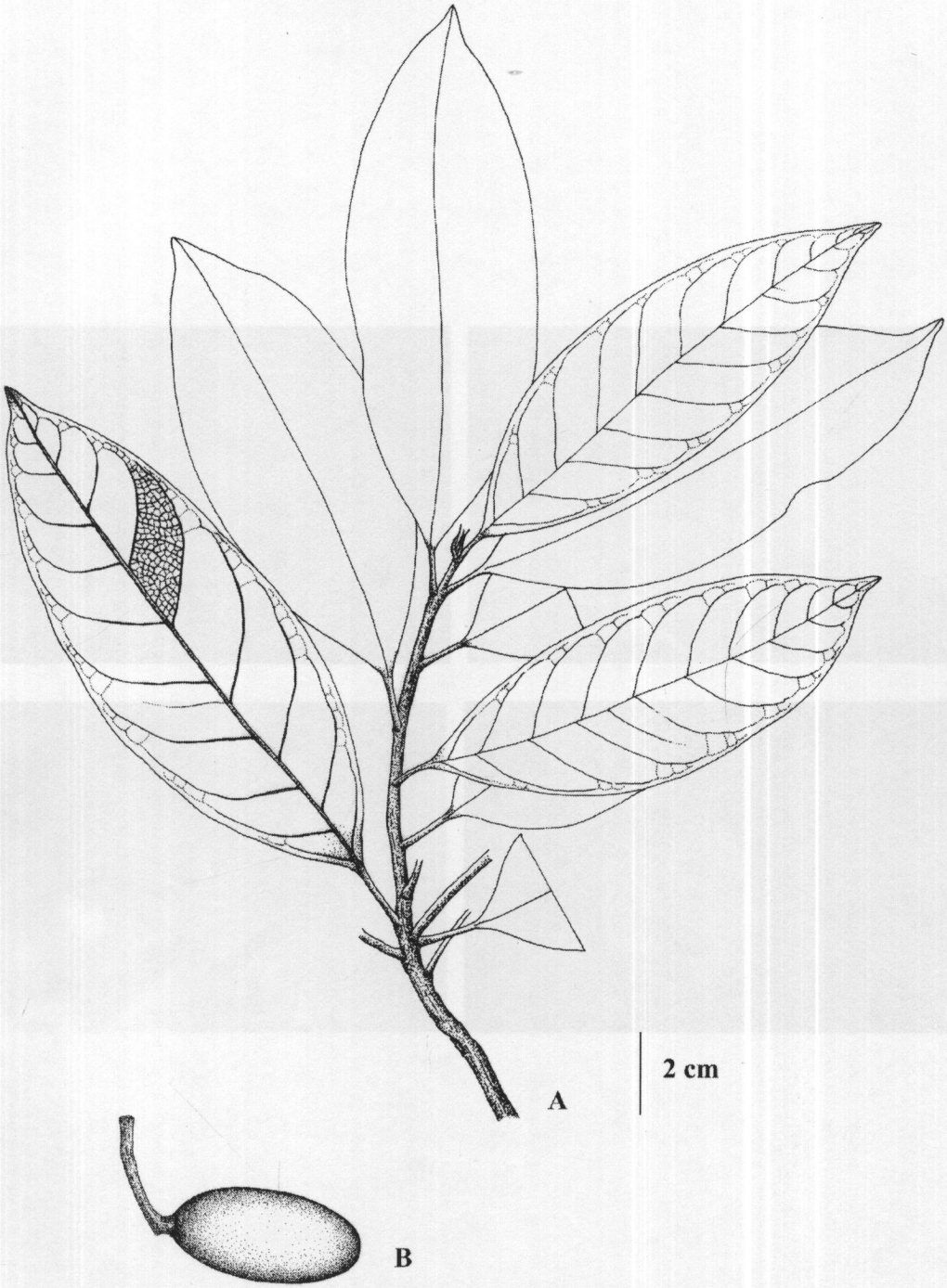


Figure 7 *B. clarkei* Hook.f.: A, leafy twig; B, fruit.

Figure 8 Photographs of *B. clarkei* Hook.f.: A, outer and inner bark; B, leafy twig; C, terminal bud; D, fruit.

5. Beilschmiedia elegantissima Kosterm., Reinw. 5(4): 392, 404. 1961; in Bibliogr. Laur. 125. 1964. Type: Burma, Amherst, Mekhrein Chaungkya, Dawna Range, *Parkinson* 5261 (K). Figure 9, 10.

Small tree about 12 m high, young branches groove, villose. Terminal buds ovoid, up to 0.8 cm long, acute, villose, not enclosed in coriaceous scales. *Leaves* alternate to subopposite,; blade elliptic, oblong, 6.0- 17.0 by 2.5-7.5 cm, apex round to acuminate, base acute to cuneate, coriaceous, mostly glabrous except base of midrib on lower surface, dark green and shining above, pale green beneath, midrib sunken above, raised beneath, secondary veins slender, 8-13 on each side, tertiary veins conspicuous reticulate; petioles 1.0-2.1 cm long, grooves, villose. *Inflorescences* panicle at terminal, up to 20 cm long, peduncles 1.5-4.5 cm long, densely minutely villose. *Flowers* 2.5-3.0 mm in diam., creamy; tepals 6 in 2 whorls of 3, equal, ovate-elliptic, 1.5-2.0 mm long, acute, outside glabrous, inside glabrescent; fertile stamens 9, anthers obtuse, tomentose, the outer 6, c. 1.0 mm long, anthers ovoid, introrse, filaments narrower and shorter than anther, inner 3, c. 1.0 mm long, anthers ovoid-oblong, extrorse, filaments narrower than anther and longer than the outer stamens, 2 large globose glands at base; staminodes 3, 0.5-0.6 mm long, broadly heart- shaped, acute, filament tomentose; pistil glabrous, c. 1.0 mm long, ovary globose, style as long as ovary, stigma inconspicuous; receptacle shallow cup- shaped, silky pilose. *Fruits* ellipsoid, c. 3.3 by 2.2 cm, green with white mottle, turning purplish-black when ripe, glaucous; fruiting pedicels, c. 3.0 cm long, red.

Thailand.-- NORTHERN: Kamphaeng Phet (Chong Yen, Mae Wong NP.); SOUTH-WESTERN: Kanchanaburi (Sangkhlaburi).

Distribution.-- Myanmar (type).

Ecology.-- Dry and hill evergreen forests, 1,250-1,300 m altitude. Flowering October; fruiting March-May.

Vernacular.-- Nuai nok ngum bai na (หน่วยนกงุมใบหนา) (The name is given by the author).

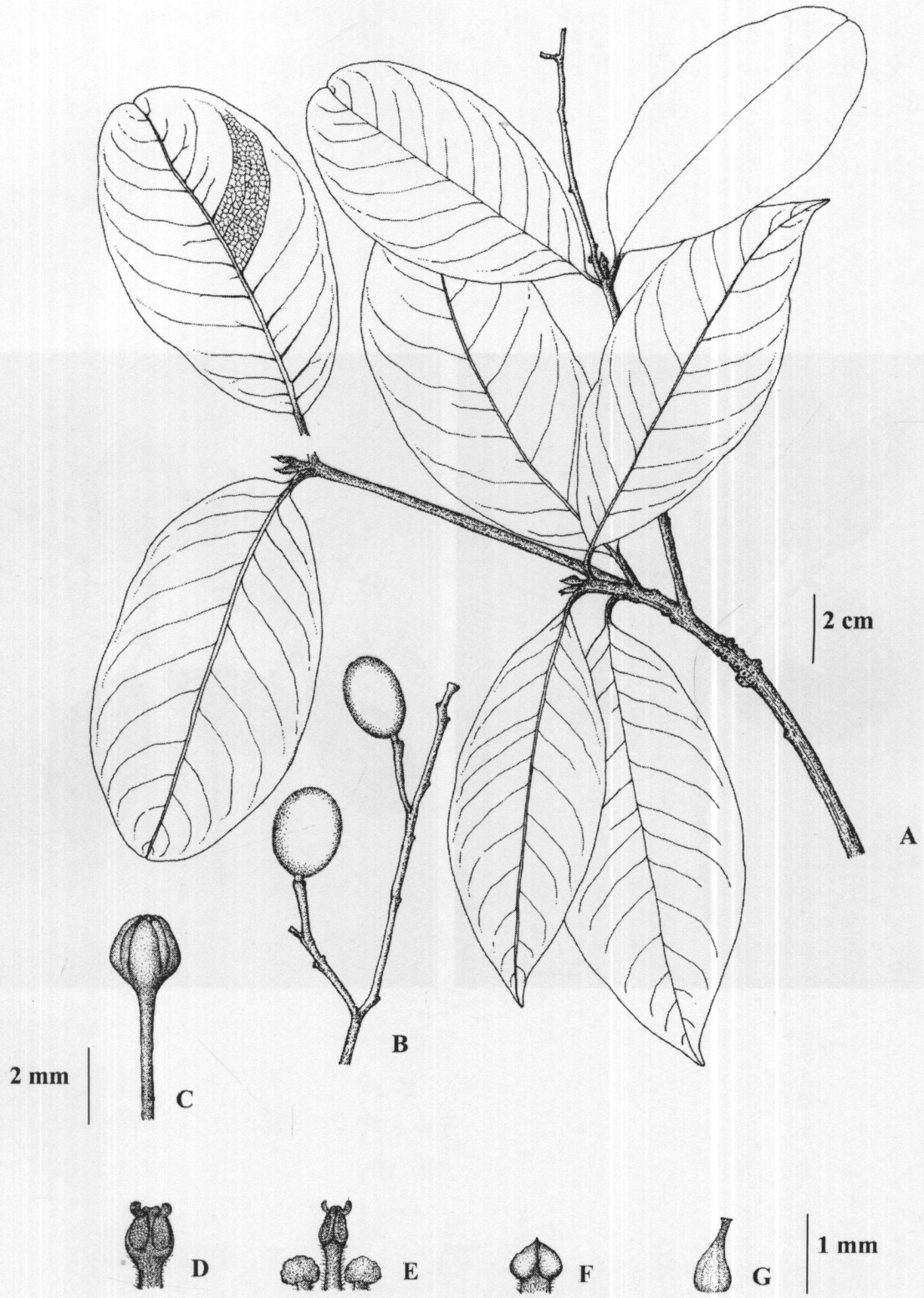


Figure 9 *B. elegantissima* Kosterm.: A, leafy twig; B, fruiting twig; C, flower; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

Figure 10 Photographs of *B. elegantissima* Kosterm.: A, flowering twig; B, fruiting twig.

6. Beilschmiedia gammieana King ex Hook.f., Fl. Brit. India 5: 124.1886; Gamble, Man. Ind. Timb., ed. 2: 559. 1902; U.N. Kanjilal in P.C. Kanjilal, R.N. De and A. Das, Fl. Assam 4: 53. 1940; Kosterm., Bibliogr. Laur. 128. 1964; Brand., Ind. trees 529. 1978; Long, Fl. Bhutan 1,2: 254. 1984. Type: East Nepal, Phulloot, *J.D.H.* s.n. (?). Figure 11, 12.

Small to medium- sized tree, 5-25 m high, occasionally small buttresses, branches round or slightly angled, glabrous. Outer bark greyish-green to brown, nearly smooth, inner bark pink to red. Terminal buds ovoid, up to 1 cm long, acute, enclosed in coriaceous glabrous scales. *Leaves* opposite or subopposite; blade elliptic, oblong or oblong-lanceolate, 8.0-13.0 by 2.7-6.0 cm, apex shortly acuminate, base cuneate, coriaceous, glabrous on both surfaces, midrib sunken above, raised beneath, secondary veins sunken above, raised beneath, slender, 8-10 (-11) on each side, tertiary veins reticulate, prominent on both surfaces; petioles 1.3-3.0 cm long. *Inflorescences* panicles or racemes arising from terminal or clustered at base of new shoot, up to 2.5 cm long; peduncles 0.6-0.8 cm long. *Flowers* 3.0-4.0 mm in diam., pale whitish- yellow; tepals 6 in 2 whorls of 3, equal, ovate-elliptic, 2.0-3.5 mm long, inner surface pubescent, outer surface glabrous; fertile stamens 9, anthers ovoid, obtuse, filaments as wide as or narrower than anther, pubescent, the outer 6, c. 1.5-2.0 mm long, anthers introrse, inner 3, c. 1.5-2.5 mm long, anthers extrorse to latrorse, filaments with 2 large globose glands at base; staminodes 3, 0.5-2.0 mm long, broadly heart- shaped, acute, sessile, pubescent; pistil glabrous, 1.3-2.3 mm long, ovary ellipsoid, style as long as ovary, stigma inconspicuous; receptacle flatten, pubescent. *Fruits* globose, 2.0-4.0 by 2.0-5.5 cm, green with white dots, turning purplish-black when ripe, glaucous; fruiting pedicels, 1.2-3.0 cm long, stout and curved not swollen, woody, dark brown.

Thailand.-- NORTHERN: Chaing Mai (Doi Chiang Dao, Doi Suthep-Pui, Doi Ang Khang), Chiang Rai (Doi Tung); NORTH-EASTERN: Loei (Phu Luang), Chaiyaphum (Phu Khiao), Phetchabun (Nam Nao); SOUTH-WESTERN: Uthai Thani (Huai Kha Khaeng), Kanchanaburi (Thong Pha Phum, Thung Yai Naresuan); PENINSULAR: Trang (Khao Chong), Surat Thani.

Distribution.-- Assam, Bhutan, India, Myanmar, East Nepal(type), Sikkim.

Ecology.-- Scattered on ridge and slopes in lower montane forest, (100-) 350-2,150 m altitude. Flowering October-February; fruiting March-October.

Vernacular.-- Nuai nok ngum (หน่วยนกงุม) (Chiang Mai).

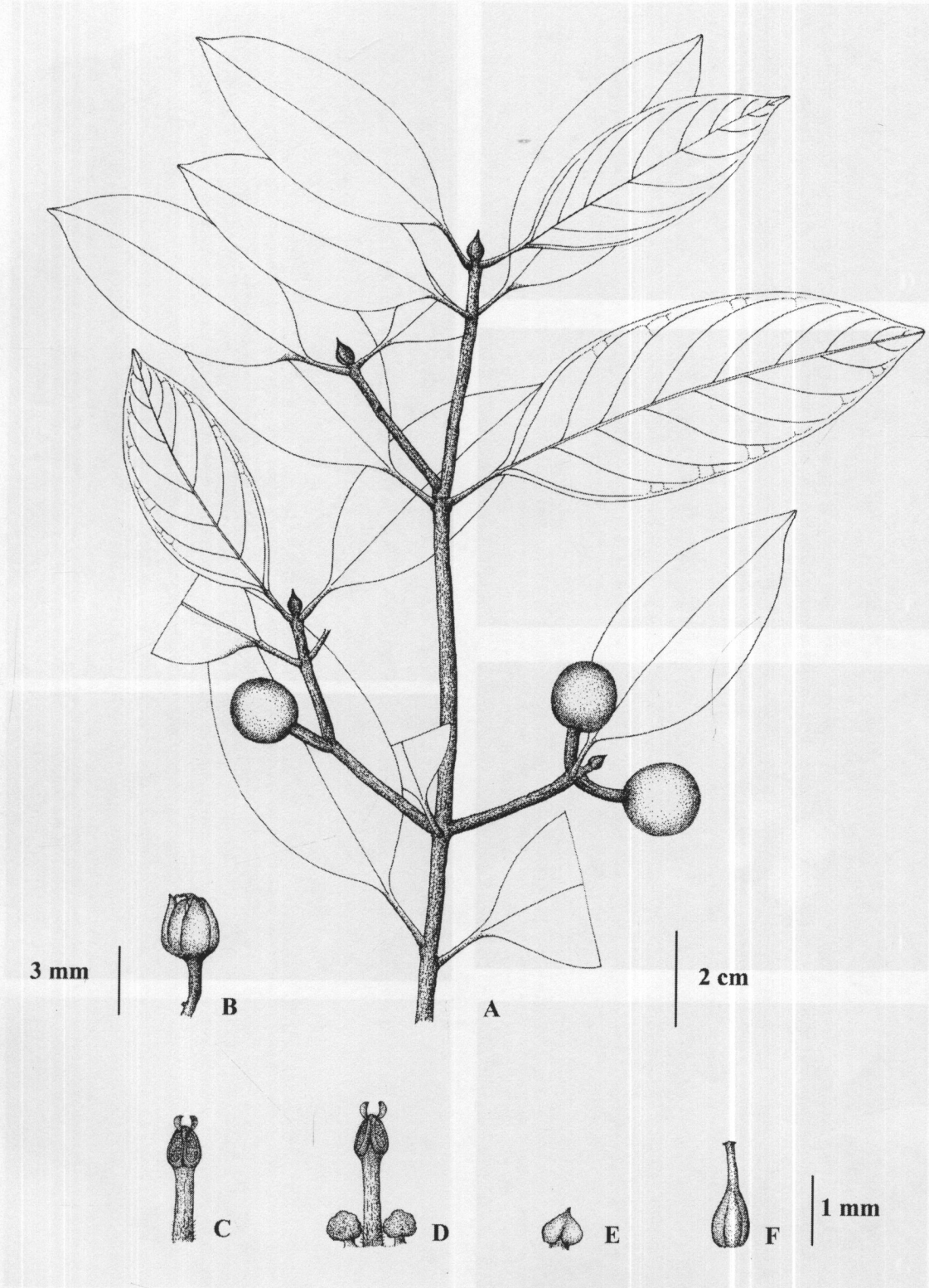


Figure 11 *B. gammieana* King ex Hook.f.: A, fruiting twig; B, flower; C, outer stamen; D, inner stamen with 2 glands; E, staminode; F, pistil.

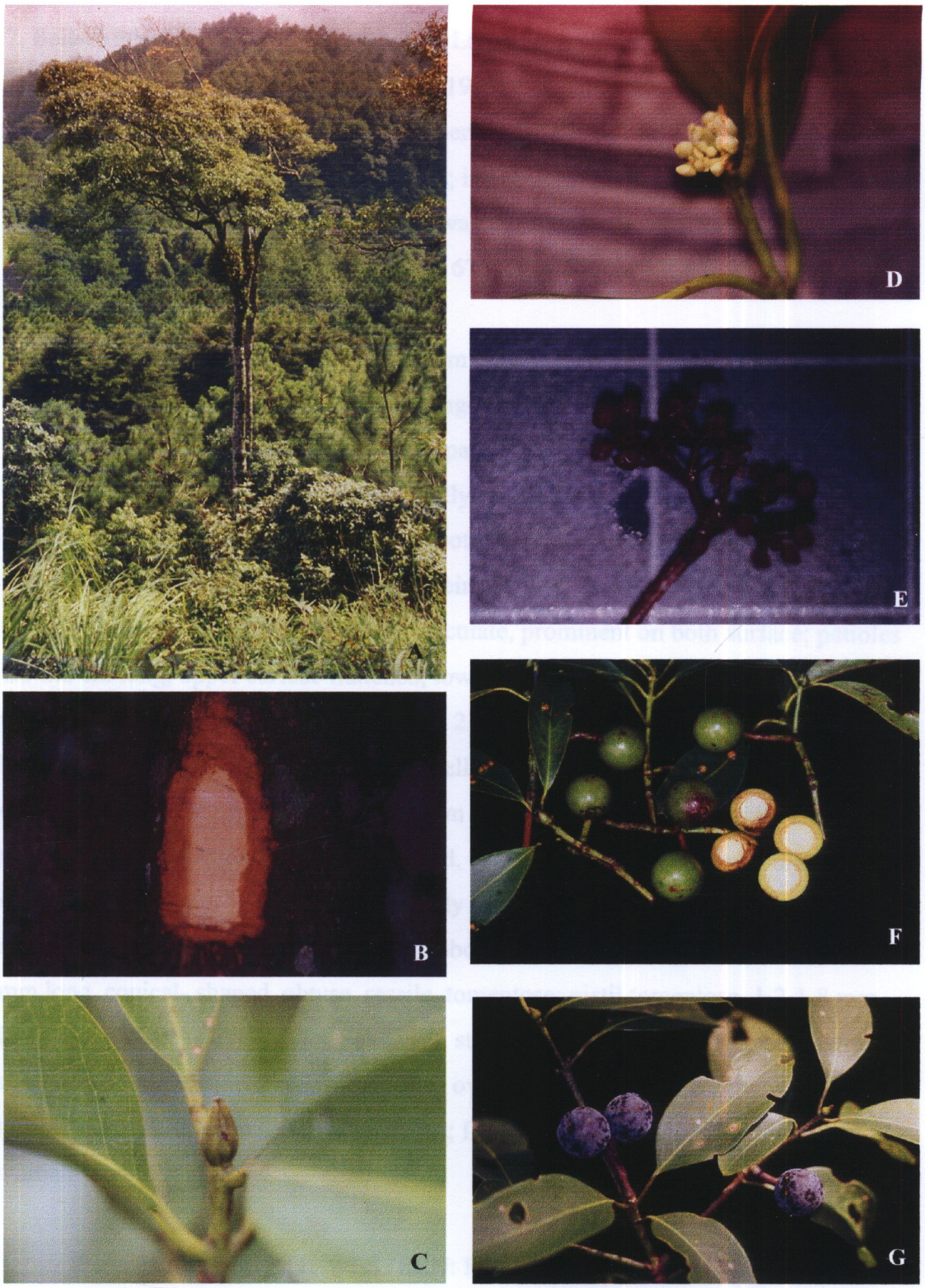


Figure 12 Photographs of *B. gammieana* King ex Hook .f.: A, tree shape; B, outer and inner bark; C, terminal bud; D-E, flowering twig; F-G, fruiting twig.

7. Beilschmiedia glauca S.K. Lee & L.F. Lau, in Acta Phytotax. Sin. 8(3): 193. 1963; Kochummen in Ng, Tree Fl. Mal. 4: 119. 1989; P.H. Hô, Câyco Viêtnam. 1: 474. 1991. - *Beilschmiedia endiandrifolia* Kosterm., Commun. For. Res. Inst. Bogor 57: 38. 1957 (nomen); in Reinw. 4: 229. 1957; in Bibliogr. Laur. 125. 1964; nom. nud., in J.A.R. Anderson, Checklist of Trees Sarawak 221. 1980. Type: China, Hainan, Peisha Hsien, Yingge Shan, 1956 *Hainan Exped.* 676 (HC). Figure 13, 14.

Small to medium- sized tree, 4-20 m high, branches round or slightly angled, glabrous, red when young. Outer bark orange-brown, rough, inner bark red. Terminal buds up to 1.2 cm long, lanceolate, acute, pale green. *Leaves* alternate; blade ovate or elliptic, 7.0-13.5 by 3.5-8.0 cm, apex shortly caudate to acuminate, base round to broadly cuneate, coriaceous, glabrous on both surfaces, dark green above, light green, glaucous beneath, midrib and secondary veins sunken above, raised beneath, slender, 8-13 on each side, tertiary veins finely reticulate, prominent on both surface; petioles 1.8-2.8 cm long, upper surface flattened, lower surface rounded. *Inflorescences* panicle arising from upper leaf axils, up to 2.0-3.3 cm long; peduncles 1.2-1.6 cm long. *Flowers* 2.0-3.5 mm in diam., pale yellow-green; tepals 6 in 2 whorls of 3, equal, ovate-elliptic, tomentose, 1.5-2.5 mm long; fertile stamens 9, anthers obtuse, the outer 6, 0.7-1.0 mm long, anthers ovoid, introrse, filaments narrower than anther, inner 3, 0.5-0.75 mm long, anthers narrowly ovoid, extrorse, filaments as wide as anther, densely tomentose, with 2 large globose glands at base; staminodes 3, c. 0.5 mm long, conical- shaped, obtuse, sessile, tomentose; pistil tomentose, 1.2-1.8 mm long, ovary globose, style as long as ovary, stigma inconspicuous; receptacle shallow cup- shaped, tomentose. *Fruits* ellipsoid to ovoid, 3.8-5.5 by 1.5-2.5 cm, green, turning purplish-black when ripe, glaucous; fruiting pedicels, 2.5-3.3 cm long, whitish-brown.

Thailand.-- SOUTH-WESTERN: Petchaburi (Kaeng Krachan); PENINSULAR: Ranong (Khlong Nakha).

Distribution.-- China (holotype), Malaya.

Ecology.-- Scattered on ridges in evergreen forest, 1,000-1,300 m altitude. Flowering December; fruiting March-May.

Vernacular.-- Nuai nok ngum bai nuan (หน่วยนกงุมใบนวล) (The name is given by the author).

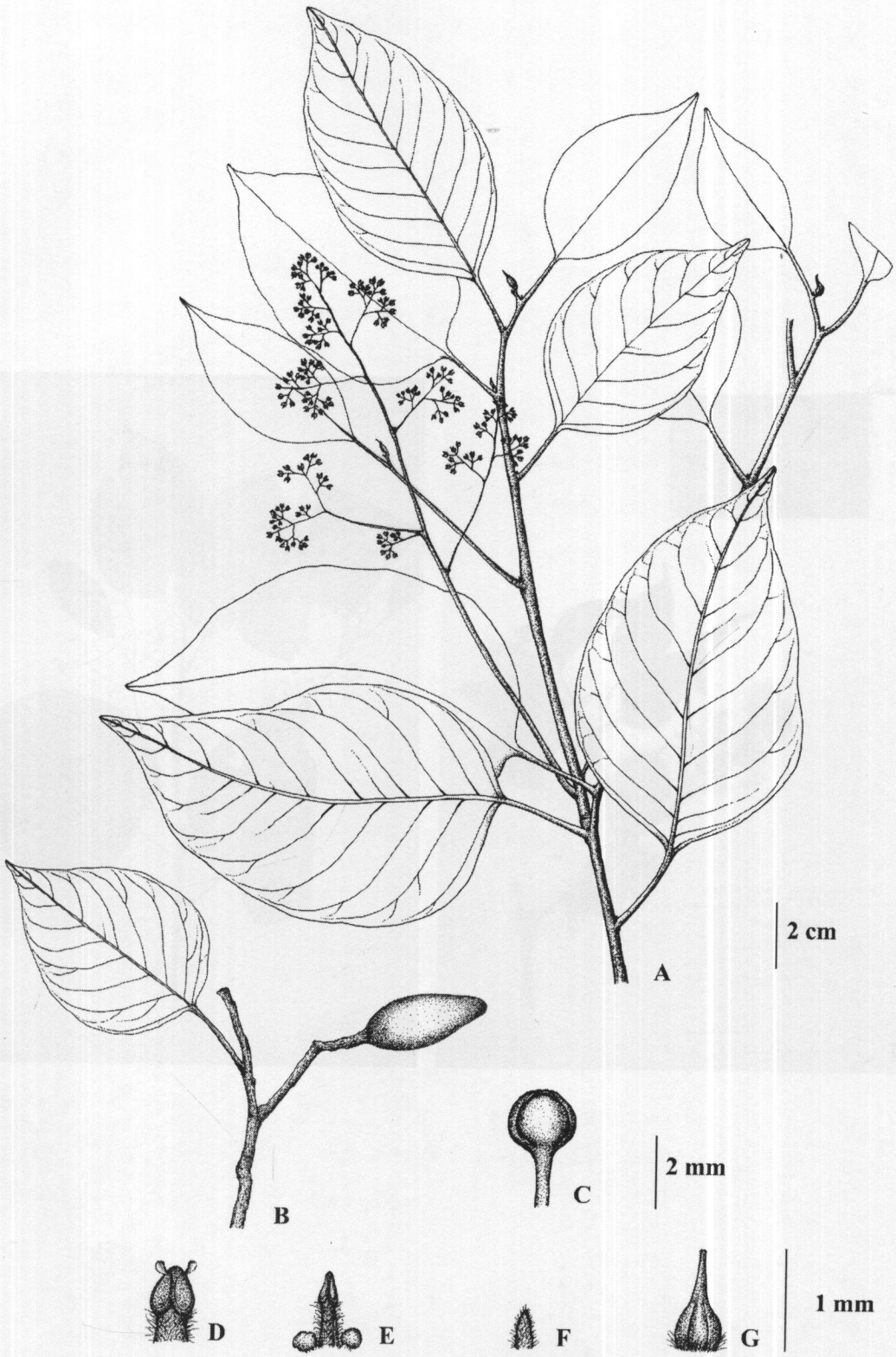


Figure 13 *B. glauca* S.K. Lee & L.F. Lau: A, flowering twig; B, fruiting twig; C, flower; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

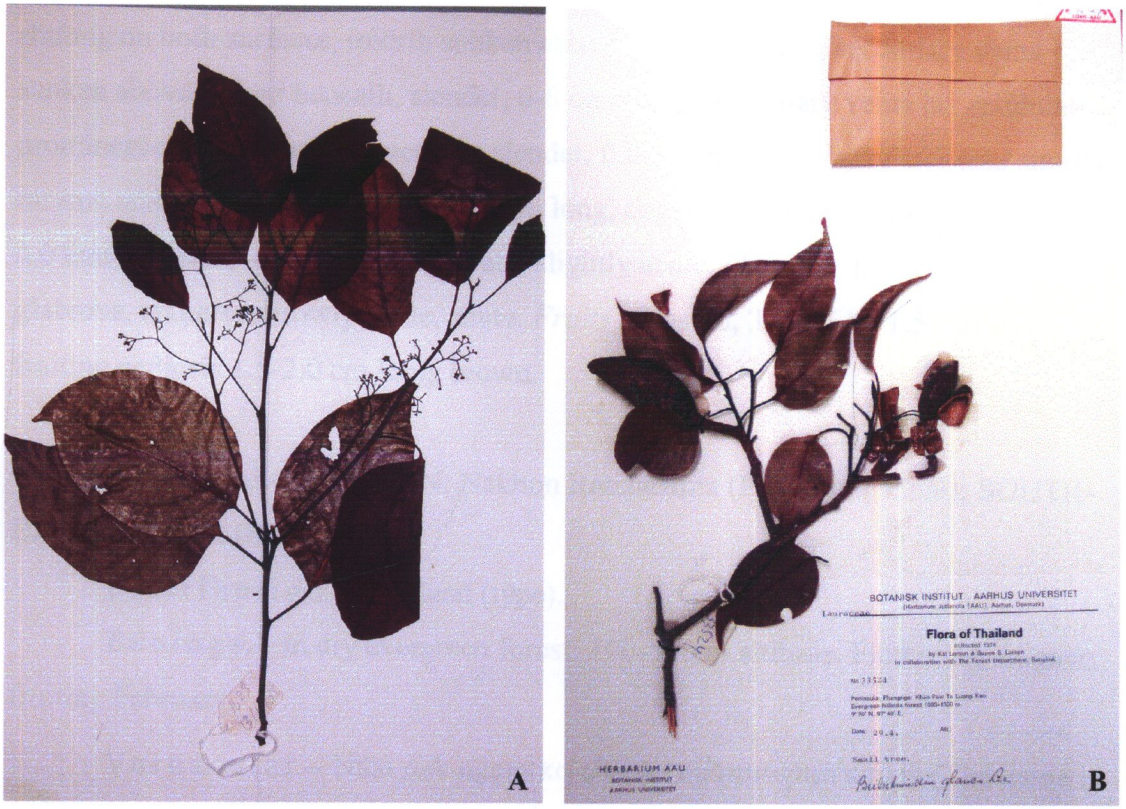


Figure 14 *B. glauca* S.K. Lee & L.F. Lau: A, flowering twig; B, fruiting twig.

8. Beilschmiedia inconspicua Kosterm., Nat. Hist. Bull. Siam Soc. 25(3-4): 30. 1975. Type: Thailand, Nakhon Ratchasima, Pak Thong Chai, *Larsen, Santisuk & Warncke* 3141(AAU!, BKF!, K!). Figure 15, 16.

Small to medium- sized tree 2- 20 m high, branches slender, glabrous. Outer bark greyish, nearly smooth, inner bark whitish to creamy. Terminal buds c. 0.5 cm long, pubescent. *Leaves* alternate; blade subobovate, sublanceolate or elliptic, 6.0-10.0 by 2.5-4.5 cm, apex shortly acuminate, base acute, chartaceous, glabrous and shining on both surfaces, midrib sunken above, raised beneath, secondary veins sunken above, raised beneath, slender, 6-8 on each side, tertiary veins lax reticulate, prominent on both surfaces; petioles slender, 0.8-1.0 cm long. *Inflorescences* shortly raceme arising from leaf axils, c. 4.0 mm long, covered with large bracts. *Flowers* c. 3.0 mm in diam.; tepals narrowly ovate, slightly acute, glabrous; fertile stamens glabrous, anthers narrowly ovate, acute. *Fruits* ellipsoid, 3.0-3.5 by 1.5-2.0 cm; fruiting pedicels 1.5-2.0 cm long, brown.

Thailand.-- EASTERN: Nakhon Ratchasima (Pak Thong Chai); SOUTH-EASTERN: Trat (Koh Chang).

Distribution.-- Thailand (type).

Ecology.-- In dry evergreen forest; 100-500 m altitude. Flowering August; fruiting February.

Vernacular.-- Nuai nok ngum ko chang (หน่วยนกงุมเกาะช้าง) (The name is given by the author).

Notes.-- Description of this species was refered to Kosterm. in Nat. Hist. Bull. Siam Soc. 25(3-4): 30. 1975.

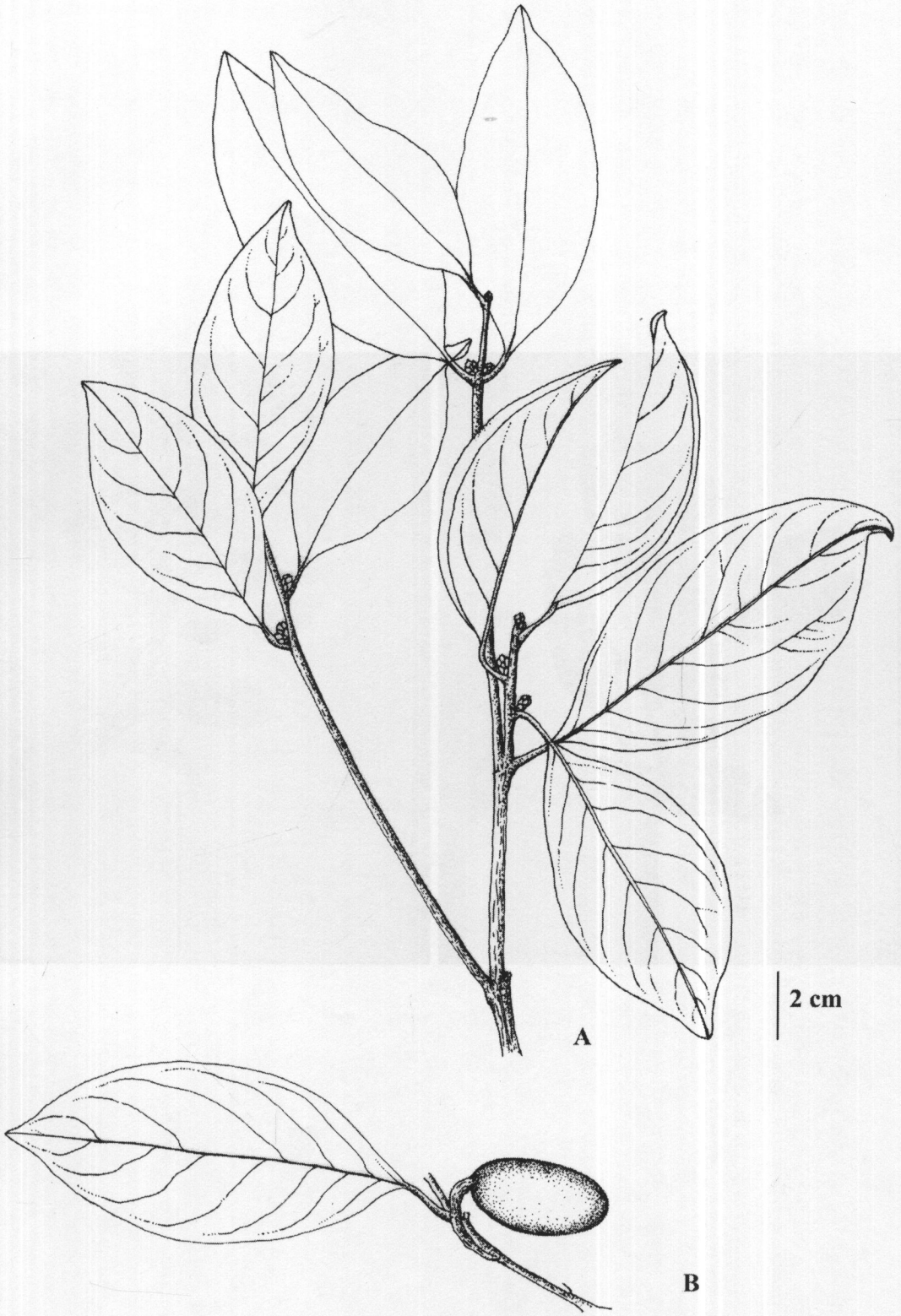


Figure 15 *B. inconspicua* Kosterm.: A, flowering twig; B, fruiting twig.

Figure 16 Photographs of *B. inconspicua* Kosterm.: A, flowering twig; B, fruiting twig.

9. Beilschmiedia membranacea Gamble, Bull. Misc. Inform. Kew 1910: 150. 1910; Ridl., Fl. Mal. Pen. 3: 86. 1924; in Fl. Mal. Pen. 3: 87. 1967; Kosterm., Bibliogr. Laur. 138. 1964; Kochummen in Ng, Tree Fl. Mal. 4: 121. 1989. Type: Malay Peninsula, Perak, *King's collector* 10928 (K!). Figure 17, 18.

Small tree, 4.5- 6 m high, branches whitish, pubescent. Terminal buds acute, pubescent. *Leaves* alternate; blade elliptic to elliptic-ovate, 8.5-15 by 5-8 cm, base round, cuneate or oblique, apex obtuse, acuminate, membranaceous, both surface glabrous, except midrib and nerves of lower surface, secondary veins 9-11 on each side, more or less curve, out spreading, upper surface sunken, raised on lower surface, tertiary veins scalariform reticulate; petioles 0.5-1.0 cm long, densely minutely pilose. *Inflorescences* short cymose, axillary. *Flowers* not seen. *Fruits* oblong, 1.25-1.5 by 0.7-1.0 cm, dark purple to black when ripe; fruiting pedicels hardly enlarged, c. 1.0 cm long.

Thailand.-- PENINSULAR: Pattani (Bacho).

Distribution.-- Malaya (type).

Ecology.-- Scattered in evergreen forest, c. 100 m altitude. Flowering unknown; fruiting July.

Vernacular.-- Nuai nok ngum bai bang (หน่วยนกงุมใบบาง) (The name is given by the author).

Notes.-- Description of this species was refered to Kochummen in Ng, Tree Fl. Mal. 4: 121. 1998; Gamble, in Bull. Misc. Inform. Kew 1910: 150; Ridl., Fl. Mal. Pen. 3: 87. 1967.

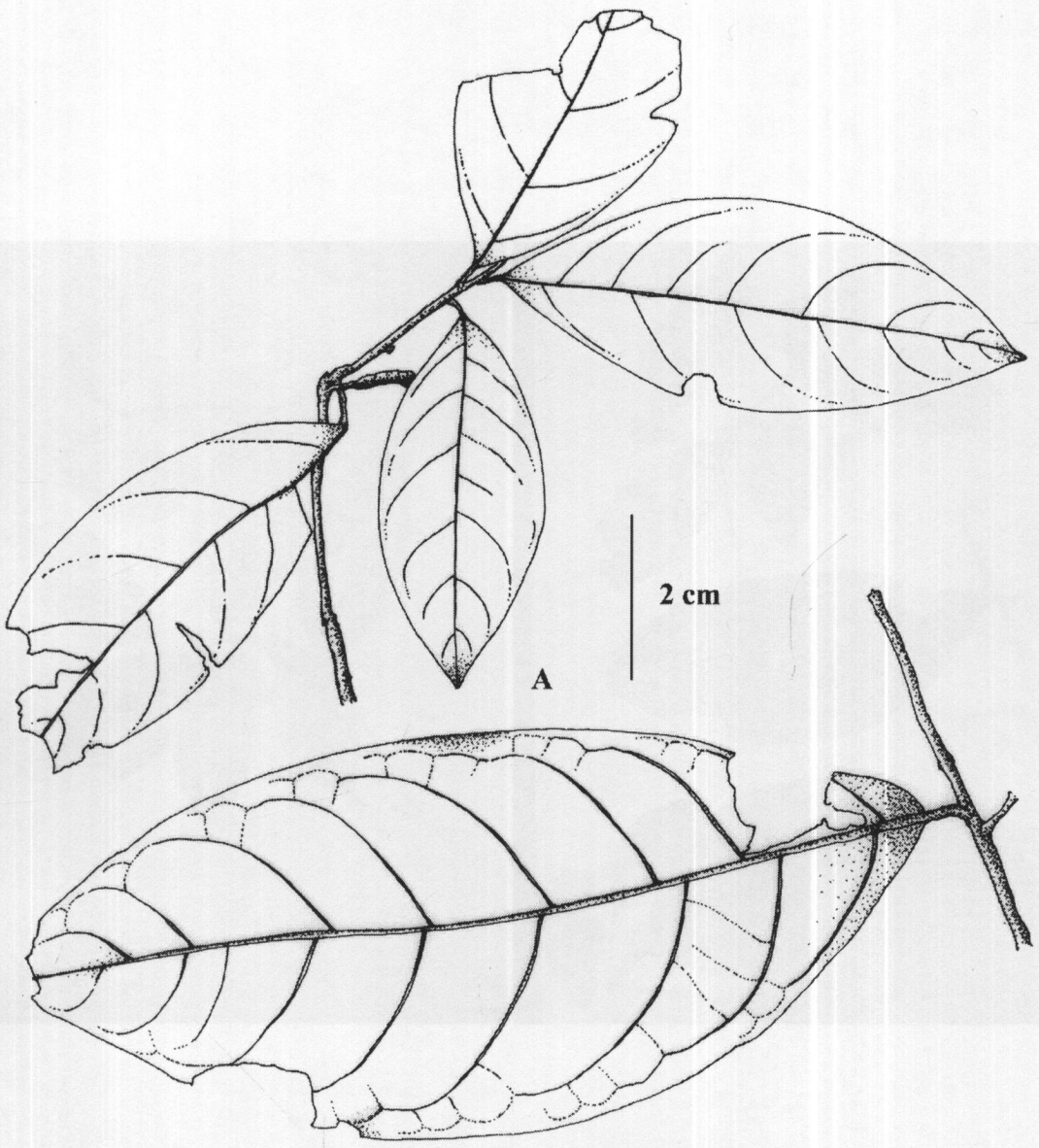


Figure 17 *B. membranacea* Gamble: A, leafy twig.

Figure 18 Photographs of *B. membranacea* Gamble: A, leafy twig.

10. Beilschmiedia palembanica (Miq.) Kosterm., in New Crit. Mal. Pl. 4: 31. 1955; in Reinw. 4(1): 31. 1956; Kochummen in Ng, Tree Fl. Mal. 4: 121. 1989; Lemmens, Plants Resources of South-East-Asia 5(2): 83. 1995. - *Cryptocarya palembanica* Miq., Fl. Ind. Bat., Suppl. Sumatra. 144. 1860; 359. 1861. Type: Malay Peninsula, Sumatra, *Teijsmann* s.n. (U). - *Beilschmiedia longipes* Hook.f., Fl. Brit. Ind. 5: 123. 1886; Ridl., Fl. Mal. Pen. 3: 85. 1924; in Fl. Mal. Pen. 3: 85. 1967.; Burkill & Handerson, Gard. Bull. Singapore 3: 413. 1925; Kosterm., New Crit. Mal. Pl. 4: 31. 1955; in Bibliogr. Laur. 143. 1964. Type: Malay Peninsula, Malacca, *Maingay* 1248 (K). - *Beilschmiedia sumatrensis* Ridl., J. Asiat. Soc. Mal. 1: 89. 1923 (sphalm. Beilschmiedia); Kosterm., New Crit. Mal. Pl. 4: 31. 1955. Type: Malay Peninsula, Berastagi, *Ridley* s.n.(K). Figure 19, 20.

Medium- sized tree, up to 30 m high. Stem with buttresses up to 1 m high, crown pagoda-like. Outer bark grey, smooth, lenticellate, inner bark chocolate brown. Terminal buds 0.5-0.7 cm long, ellipsoid, acute, light brown, scurfy hair. *Leaves* alternate; blade elliptic to oblong, 10.0-25.0 by 4.0-9.0 cm, coriaceous, apex acute to acuminate, base cuneate, upper surface glabrous, lower surface glabrescent, midrib sunken and covered with powdery hairs above, secondary veins 10-13 on each side, tertiary veins prominently reticulate, distinct below, petioles 1.0-2.5 cm long. *Inflorescences* in axillary raceme or panicles, 3.5-6.0 cm long. *Flower* greenish 2.0-3.0 mm in diam., filaments pubescent, glands sessile, staminodes minute. *Fruits* ellipsoid, subglobose, 1.5-1.0 cm.

Thailand.-- PENINSULAR: Pattani.

Distribution.-- India, Malaya, Malay Peninsula (type).

Ecology.-- Scattered in peat swamp and lowland forest up to lower montane forest, up to 1400 m altitude. Flowering December-March; fruiting unknown.

Vernacular.-- Tit (ตีด) (Narathiwat).

Notes.-- Description of this species was refered to Kochummen in Ng, Tree Fl. Mal. 4: 121. 1989.

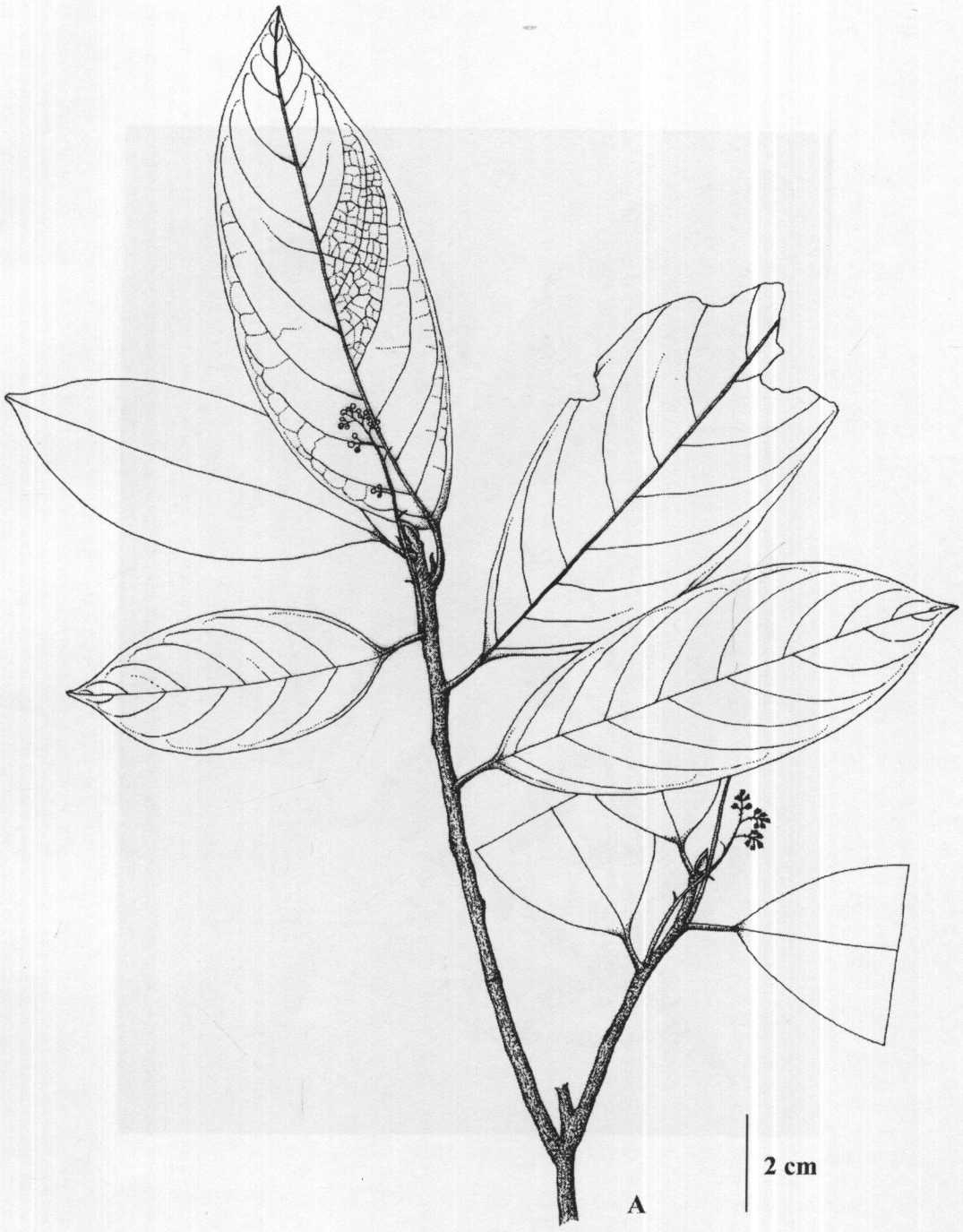


Figure 19 *B. palembanica* (Miq.) Kosterm.: A, flowering twig.

Figure 20 *B. palembanica* (Miq.) Kosterm.: A, flowering twig.

11. Beilschmiedia roxburghiana Nees, Wall., Pl. Asiat. Rar. 2: 69. 1831; Kurz, Forest Fl. Burma 2: 293. 1877; Gamble, Man. Indian Timb. 309. 1881; ed. 2:559. 1902; in Fl. Madras 2(7): 1221. 1925; Bentham & Hook.f., Gen. Pl. 3: 152. 1880; Hook.f., Fl. Brit. Ind. 5: 121. 1886; Merrill, J. Arnold Arbor. 19: 30. 1938; Allen, J. Arnold. Arbor. 19: 31. 1938; in J. Arnold Arbor. 23: 451. 1942; Kosterm., Commun. For. Res. Ints. Bogor 57: 8, 15, 16, 37. 1957; in Reinw. 4: 200, 207, 208, 209, 229. 1957; in Bibliogr. Laur. 147. 1964; Bor, Ind. For. Rec., N.S. 1(4): 146. 1938; U.N. Kanjilal in P.C. Kanjilal, R.N. De and A. Das, Fl. Assam 4: 51. 1940; Bor, Man. Indian Forest Botany 51. 1953; Brand., Indian trees 528. 1978; Long, Fl. Bhutan 1, 2: 256.1984. Type: India, Tenasserim, *Helfer* 4335 (K). - *Beilschmiedia fagifolia* Nees, Wall., Pl. Asiat. Rar. 2: 69. 1831; Hook.f., Fl. Brit. Ind. 5: 122. 1886; U.N. Kanjilal in P.C. Kanjilal, R.N. De and A. Das, Fl. Assam 4: 52. 1940; Bed., Fl. Sylv. t. 263. 1872; Brand., Indian trees 528. 1978. - *Laurus bilocularis* Roxb., Fl. India ed. 2, 2: 311. 1832. Figure 21, 22.

Small to medium- sized tree 3- 25 m high, young branches pubescent. Outer bark greenish to grayish-black, scaly to fissure or nearly smooth, inner bark pinkish-brown to dark dull red. Terminal buds 0.2-0.35 cm long, appressed pubescent. *Leaves* alternate or subopposite; blade oblong to elliptic-lanceolate or elliptic-oblong, 5.0-17.0 by 1.5-6.0 cm, apex shortly acuminate or obtuse, narrower at base into the petiole, coriaceous, glabrous on both surfaces, midrib sunken above, raised beneath, secondary veins 6-12 on each side, sunken above, raised beneath, tertiary veins reticulate, prominent on both surfaces; petioles 0.8-2.0 cm long. *Inflorescences* raceme at subterminal and arising from upper leaf axils, 2.5-3.0 cm long; peduncles 0.5-1.3 cm long. *Flowers* 2.8-5.0 mm in diam., pale yellowish- green; tepals 6 in 2 whorl of 3, oblong-acute, 2.5-3.0 mm long, pubescent on both surfaces; fertile stamen 9, anthers ovoid, obtuse, filament narrower than anthers, pubescent, outer stamens 6, 1.5-2.5 mm long, anthers introrse, inner stamens 3, 1.0-1.5 mm long, anthers extrorse, filament with 2 large globose glands at base; staminodes 3, c. 1.0 mm long, narrowly flatten heart-shaped, sessile, pubescent; pistil pubescent, 2.0-2.5 mm long, ovary globose, style longer than ovary, stigma inconspicuous; receptacle shallow cup-shaped, pubescent. *Fruits* obovoid- oblong, 1.5-2.5 by 0.8-1.8 cm, green with white

mottles, turning purplish-black and glaucous when ripe; fruiting pedicels, 1.0-3.5 cm long, thick, brown, turning red when ripe.

Thailand.-- NORTHERN: Phrae Lampang Nan, Chiang Mai; EASTERN: Chaiyaphum, Si Sa Ket, Ubon Ratchathani; CENTRAL: Saraburi, Nonthaburi; SOUTH-EASTERN: Chon Buri, Trat; SOUTH-WESTERN: Uthai Thani (Huai Kha Khaeng); PENINSULAR: Ranong, Songkhla, Krabi.

Distribution.-- Assam, Bhutan, China, Myanmar, India (type), Indonesia.

Ecology.-- Scattered on slope in dry evergreen, mixed deciduous and dry dipterocarp forests, 50-350 m altitude. Flowering February- June; fruiting June-September.

Vernacular.-- Fi Mop (ฝีหมอบ) (Nonthaburi), Ma duk (มะดูก) (Trat).

Uses.-- Bark used in the remedy of tuberculosis.

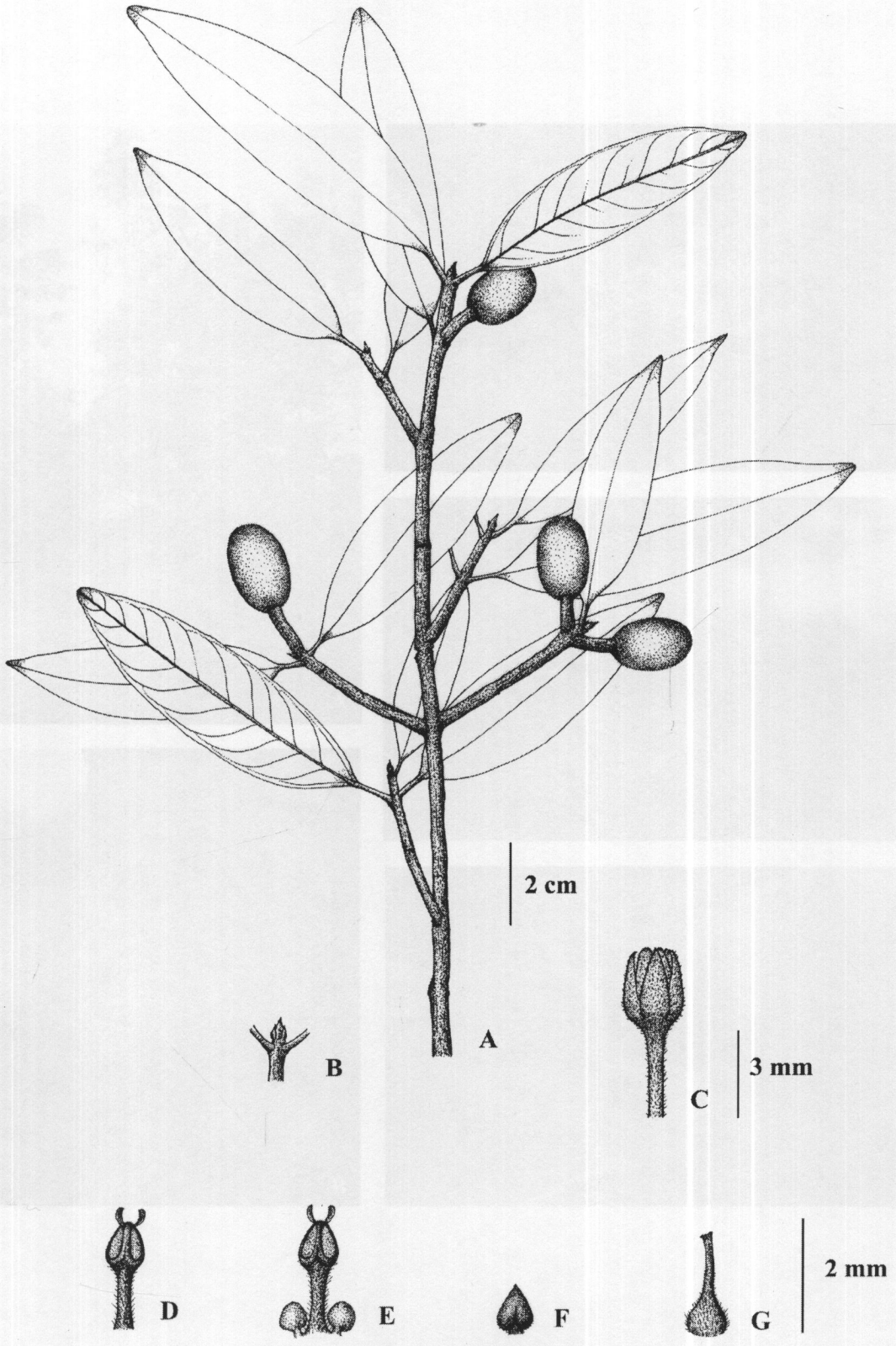


Figure 21 *B. roxburghiana* Nees: A, fruiting twig; B, terminal bud; C, flower; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

Figure 22 Photographs of *B. roxburghiana* Nees: A, tree shape; B, outer bark; C, flowering twig; D-E, fruiting twig.

12. Beilschmiedia velutinosa Kosterm., Nat. Hist. Bull. Siam Soc. 25(3-4): 30. 1974. publ. 1975. Type: Thailand, Chaing Mai, Doi Chiang Dao, *Kerr* 5532 (BK!).
- *Beilschmiedia lanatella* Kosterm., Reinw. 5(4): 392, t. 8 (1960). 1961; in Bibliogr. Laur. 133. 1964. **syn. nov.** Figure 23, 24.

Small to medium- sized tree, 7-22 m high, branches slender, grey, densely brown pilose when young. Outer bark greyish-brown, smooth to rough, inner bark unknown. Terminal buds elliptic, pubescent, 0.5-0.7 cm long. *Leaves* alternate; blade obovate- elliptic, 8-15 by 3-7 cm, apex acuminate with acute tip, base shortly cuneate, chartaceous, glabrous, glossy above, sparsely to densely pilose below, midrib conspicuously below, secondary veins slightly sunken above, 8-9 on each side, prominent, curved near margin, tertiary veins obscure; petioles 1-1.5 cm long, densely pilose to glabrescent. *Inflorescences* axillary below the new flush, lax paniculate, 1.0-3.0 cm long, densely pilose; peduncles 1.0-1.5 cm long. *Flowers* pale yellow, c. 3.0 mm in diam., about 2.5 mm long, densely sericeous, tube shallow, short; tepals 6 in 2 whorls of 3, equal, ovate-obtuse or acute, densely sericeous to pilose, 1.5-2.0 mm long; fertile stamens 9, anthers ovate-acute, the outer 6, c. 1.5 mm long, anthers introrse, filaments as long as the anthers, inner 3, c. 1.5 mm, anthers extrorse, filaments slender and longer than anther, with 2 large sessile, globose glands at base; staminodes 3, c. 0.75 mm long, saggittate or cordate, acute, filament short; pistil pilose, c. 1.0 mm long, ovary subglobose, tapering to a long style, stigma inconspicuous; receptacle shallow, pilose. *Fruits* ellipsoid or clavate, 3-4 by 1.8-2.0 cm, smooth, dark purple to black when ripe; fruiting pedicels 2.5-4.5 cm long, pilose, red when ripe.

Thailand.-- NORTHERN: Chiang Mai (Chiang Dao), Lampang (Mae Ping river).

Distribution.-- Thailand (type).

Ecology.-- Scattered in evergreen forest, 120-900 m altitude. Flowering May-June; fruiting September-January.

Vernacular.-- Nuai nok ngum bai khon (หน่วยนกงุมใบขน) (The name is given by the author).

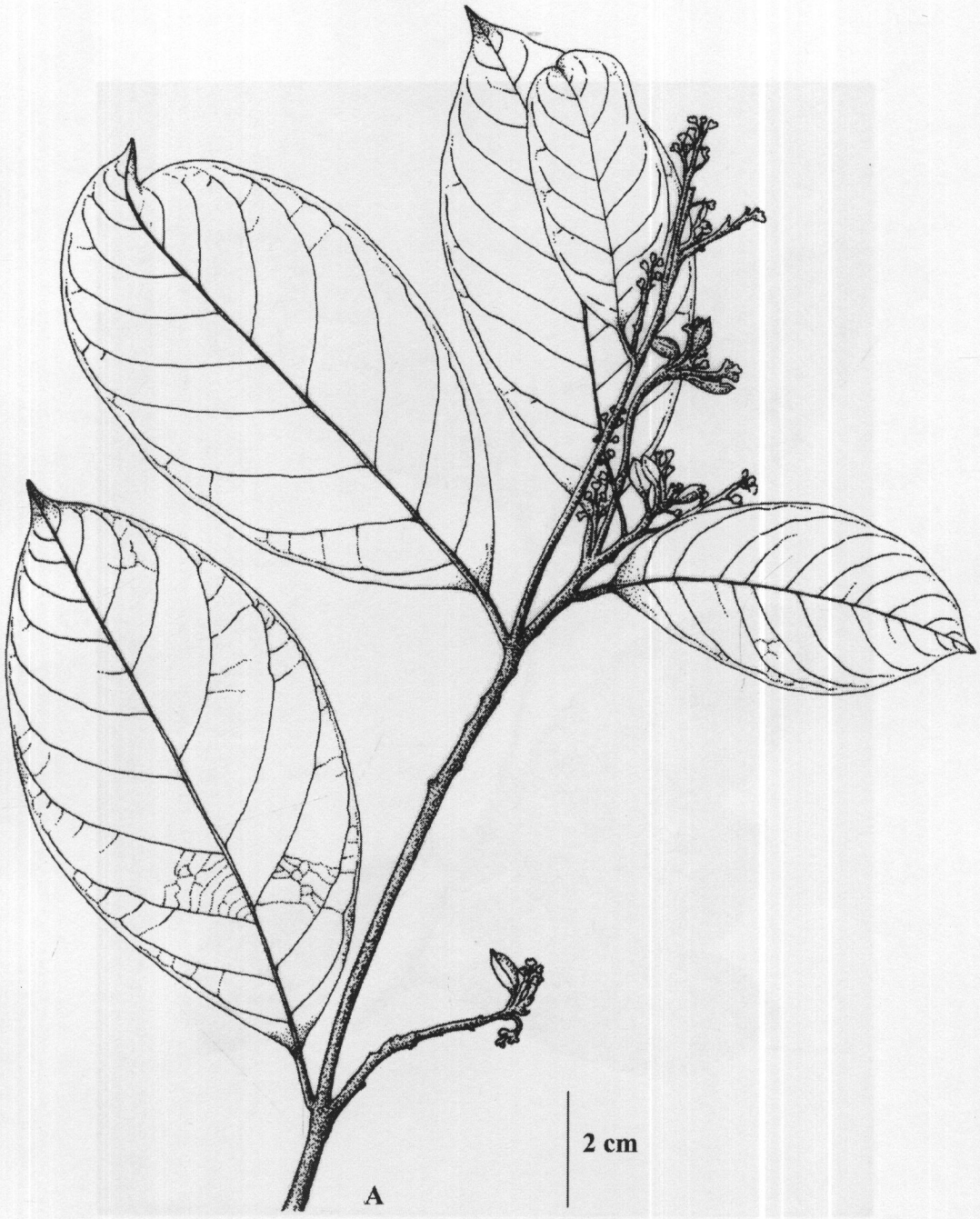


Figure 23 *B. velutinosa* Kosterm.: A, flowering twig.

Figure 24 Photographs of *B. velutinosa* Kosterm.: A, flowering twig.

13. Beilschmiedia villosa Kosterm. Nat. Hist. Bull. Siam Soc. 25(3-4): 31. 1975. Type: Thailand, Mae Hong Son, Pang Mapha, *Hansen & Smitinand* 12753 (AAU!, BKF!, C!, K!). Figure 25, 26.

Small tree 10-15 m high, branches grey, densely fine tomentose. Outer bark grey, furrowed, lenticellate, inner bark purplish brown, granulate. Terminal buds 0.5-0.7 cm long, villose. *Leaves* subopposite or alternate; blade elliptic, 7.5-11.5 by 3.5-5.5 cm, apex obtuse or apiculate, base acute, coriaceous, glabrous above, densely fine tomentose beneath, midrib slightly raised on both surfaces, outspread, slender, secondary veins flattened, slightly sunken above, slender, 6-7 on each side, tertiary veins prominent lax minute reticulate above, finely reticulate beneath; petioles 1.0-1.2 cm long, pilose. *Inflorescences* short axillary, raceme, covered with densely fine greyish pilose bracteoles, caducous, 1.0-2.5 cm long. *Flowers* pale yellow, c. 3.0 mm in diam., densely sericeous, tube shallow; tepals 6 in 2 whorls of 3, equal, angust ovate, acute, villose, 2.5-3.0 mm long; fertile stamens 9, anthers ovoid, acute, filaments slender and longer than anther, villose, the outer 6, 1.8-2.0 mm long, anthers introrse, inner 3, c. 2.0 mm long, anther extrorse, filaments with 2 small sessile, globose, glands at the base; staminodes 3, 0.8-1.5 mm long, heart- shaped, sessile, villose; pistil pilose, 2.0-3.0 mm long, ovary subglobose, style as long as ovary; receptacle shallow, pilose. *Fruits* ellipsoid-clavate, smooth, 3.0-4.0 by 1.8-2.0 cm, dark purple to black when ripe; fruiting pedicels 2.5-4.5 cm long, pilose, red when ripe.

Thailand.-- NORTHERN: Mae Hong Son (Pang Mapha); NORTH-EASTERN: Nakhon Ratchasima (Khao Yai); Peninsular: Ranong (Khlong Na kha).

Distribution.-- Thailand (type).

Ecology.-- Uncommon in mixed deciduous to evergreen forest, c. 600-900 m altitude. Flowering November-February; fruiting February-April.

Vernacular.-- Phi phuan bai khon (พิพวนใบขน) (The name is given by the author).

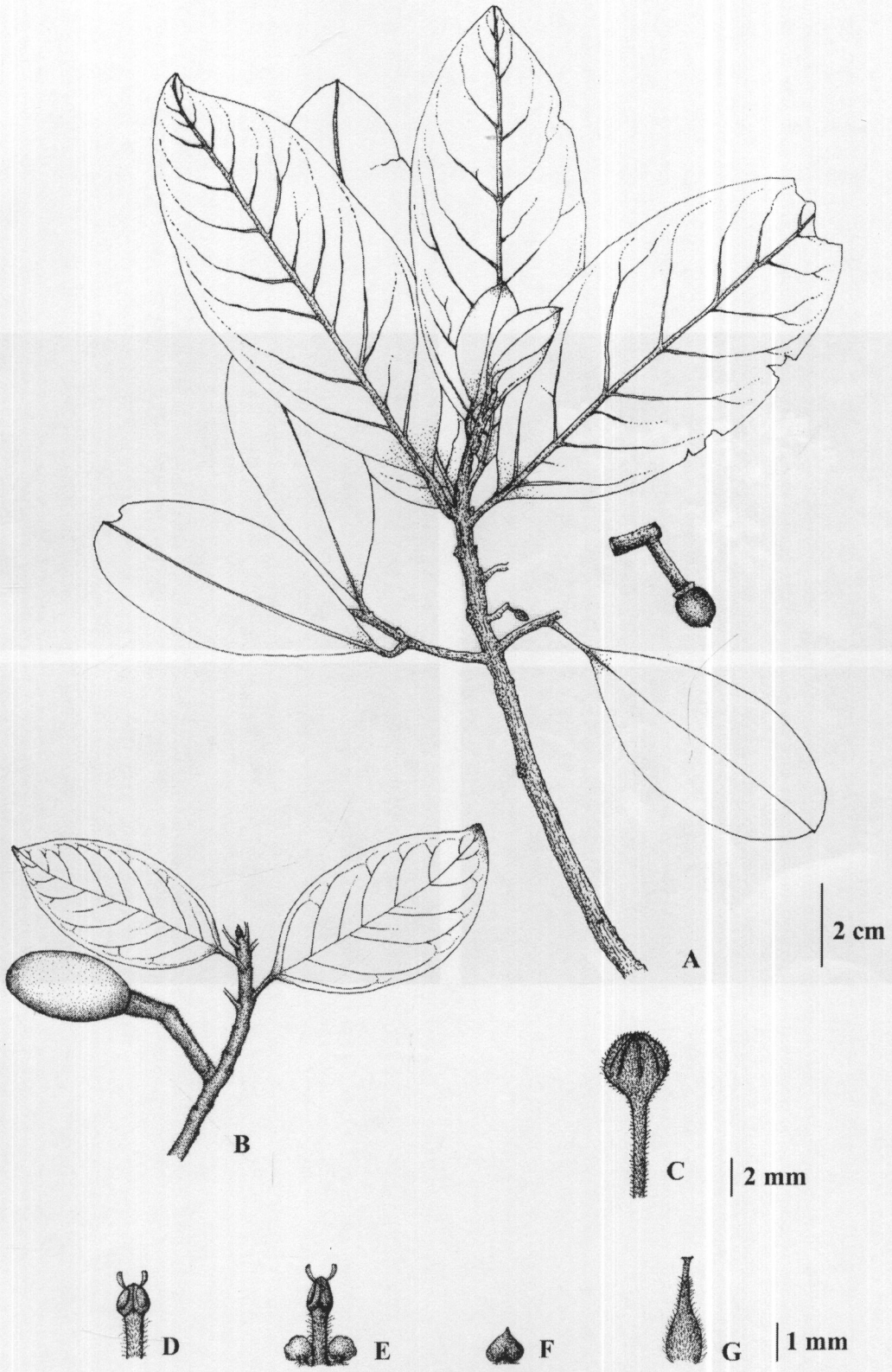


Figure 25 *B. villosa* Kosterm.: A, leafy twig; B, fruiting twig; C, flower; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

Figure 26 Photographs of *B. villosa* Kosterm.: A, outer and inner bark; B, leafy twig; C, flowering twig; D, fruiting twig.

14. Beilschmiedia wallichiana (G. Don) Kosterm., Reinw. 5(4): 391, t. 6 (1960). 1961; in Bibliogr. Laur. 154. 1964; Kochummen in Ng, Tree Fl. Mal. 4: 122. 1989. - *Sideroxylon wallichiana* G. Don, Gen. Hist. Dichlamydeous Pl. 4: 28. 1838; Hook.f., Fl. Brit. India 5: 180. 1886; Kurz, Forest Fl. Burma 30(55): 172. 1872; Kosterm., Reinw. 5(4): 391 (1960). 1961; in Bibliogr. Laur. 1351. 1964. Type: Malay Peninsula, Penang, *Wallich* 4158 (K); Thailand, Kuan Po, Satul, *Kerr* 13820 (BKF! K!). Figure 27, 28.

Small tree, 5-15 m high, branches grey, densely pale brown, shortly pilose. Terminal buds acute, up to 0.7 cm long, densely appressed strigose. *Leaves* alternate or crowded at tip of branches; blade subobovate- elliptic, 18- 30 by 7-10 cm, base acute, apex acuminate, chartaceous, glabrous except minutely appressed strigose on midrib, more or less dense raised reticulate on both surfaces, secondary veins 9-12 on each side, slightly raised on lower surface, rather curved, out spread, above rather hash to touch; petioles densely shortly pilose, 1.0-1.5 cm long. *Inflorescences* fasciculate of raceme in orbicular perulate, minutely adpressed strigose; bracteoles more or less orbicular, 1.0-2.0 mm long, concave, axillary below the new flush, up to 2 cm long; peduncles up to 1.0 cm long. *Flowers* whitish sparsely, minutely pilose, 3.0-4.0 mm in diam; tepals 6 in 2 whorls of 3, equal to subequal, lanceolate-oblong, c. 3.0 mm long, acute, inner surface glabrous, outer surface pilose; fertile stamens 9, anther ovoid or ellipsoid, obtuse, filaments narrower than the anther, pubescent, the outer 6, 2.0-2.5 mm long, anthers introrse, inner 3, 2.0-2.5 mm long, anthers extrorse, filament with 2 sessile, globose glands at the base; staminodes 3, c. 1.0 mm long, heart- shaped, acute, almost sessile, glabrous; pistil glabrous, c. 2.0 mm long, ovary globose, style as long as ovary, stigma inconspicuous; receptacle shallow cup-shaped, pilose. *Fruits* not seen.

Thailand.-- PENINSULAR: Satun (Kuan Po, Kuan Kalong); Phangnga (Sra Nang Manora)

Distribution.-- Malay Peninsula (type).

Ecology.-- Scattered in evergreen forest, 20-300 m altitude. Flowering January; fruiting unknown.

Vernacular.-- Nuai nok ngum bai yai (หน่วยนกงุมใบใหญ่) (The name is given by the author).

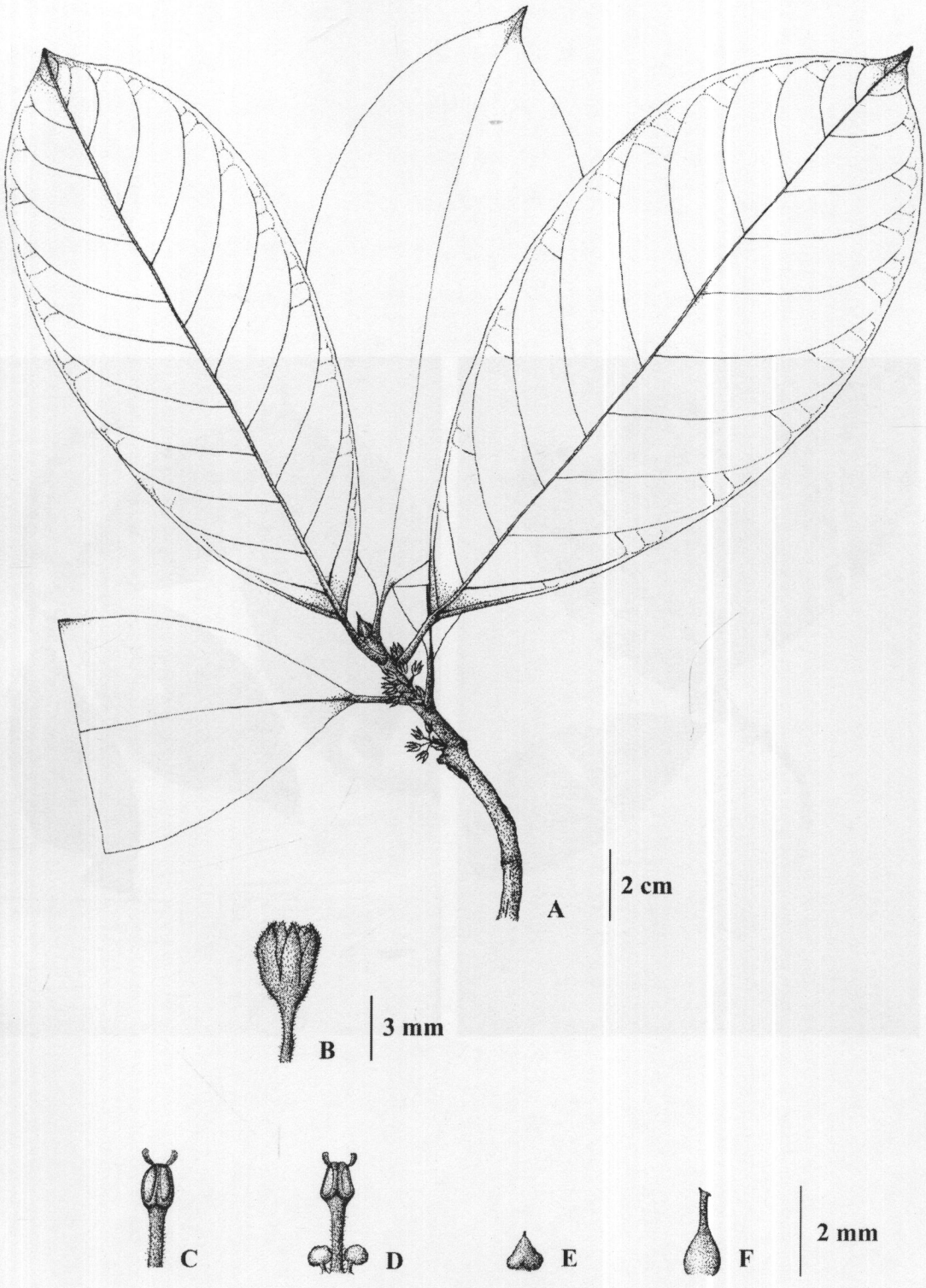


Figure 27 *B. wallichiana* (G. Don) Kosterm.: A, flowering twig; B, flower; C, outer stamen; D, inner stamen with 2 glands; E, staminode; F, pistil.

Figure 28 Photographs of *B. wallichiana* (G. Don) Kosterm.: A, flowering twig.

15. Beilschmiedia sp. 1. Figure 29, 30.

Small tree, 7-15 m high, branches round or slightly angled, glabrous. Outer bark light or greenish-grey to yellow brown, nearly smooth. Terminal buds lanceolate, acute, enclosed in coriaceous glabrous scales, up to 0.7 cm long. *Leaves* opposite or subopposite; blade ovate, ovate-lanceolate, oblong-lanceolate or elliptic-oblong, 8-15.3 by 1.8-6.7 cm, apex shortly caudate, base cuneate or attenuate, coriaceous, glabrous on both surfaces, midrib and secondary veins sunken above, raised beneath, slender, 8-12 on each side, tertiary veins reticulate; petioles 0.8-2.3 cm long. *Inflorescences* panicle, terminal and from upper leaf axils, 2.0-5.0 cm long; peduncles 1.5-3.5 cm long. *Flowers* 1.5-2.0 mm in diam., pale yellowish-green; tepals 6 in 2 whorls of 3, equal, ovate-elliptic, 1.5-2 .0 mm long, glabrous; fertile stamens 9, filaments as wide as anther, glabrous, the outer 6, 1.25-1.5 mm long, anthers ovoid, acute, introrse, inner 3, c. 1.0 mm long, anthers narrowly ovoid or oblong, extrorse-latrorse, filaments with 2 large globose glands at base; staminodes 3, c. 0.5 mm long, heart-shaped, glabrous; pistil glabrous, c. 1.25 mm long, ovary globose, tapering to a short style; receptacle shallow cup-shaped, glabrous. *Fruits* ellipsoid, 1.8-3.0 by 0.9-1.35 cm, light green, shining; fruiting pedicels, 0.7-1.5 cm long, green when young.

Thailand.-- NORTH-EASTERN: Nong Khai (Phu Wua).

Distribution.-- Thailand.

Ecology.-- Scattered in lowland evergreen forest, on sandstone by streams, 150-200 m altitude. Flowering May-June; fruiting July-April.

Vernacular.-- Nuai nok ngum phu wua (หน่วยนกงุมภูวัว) (The name is given by the author).

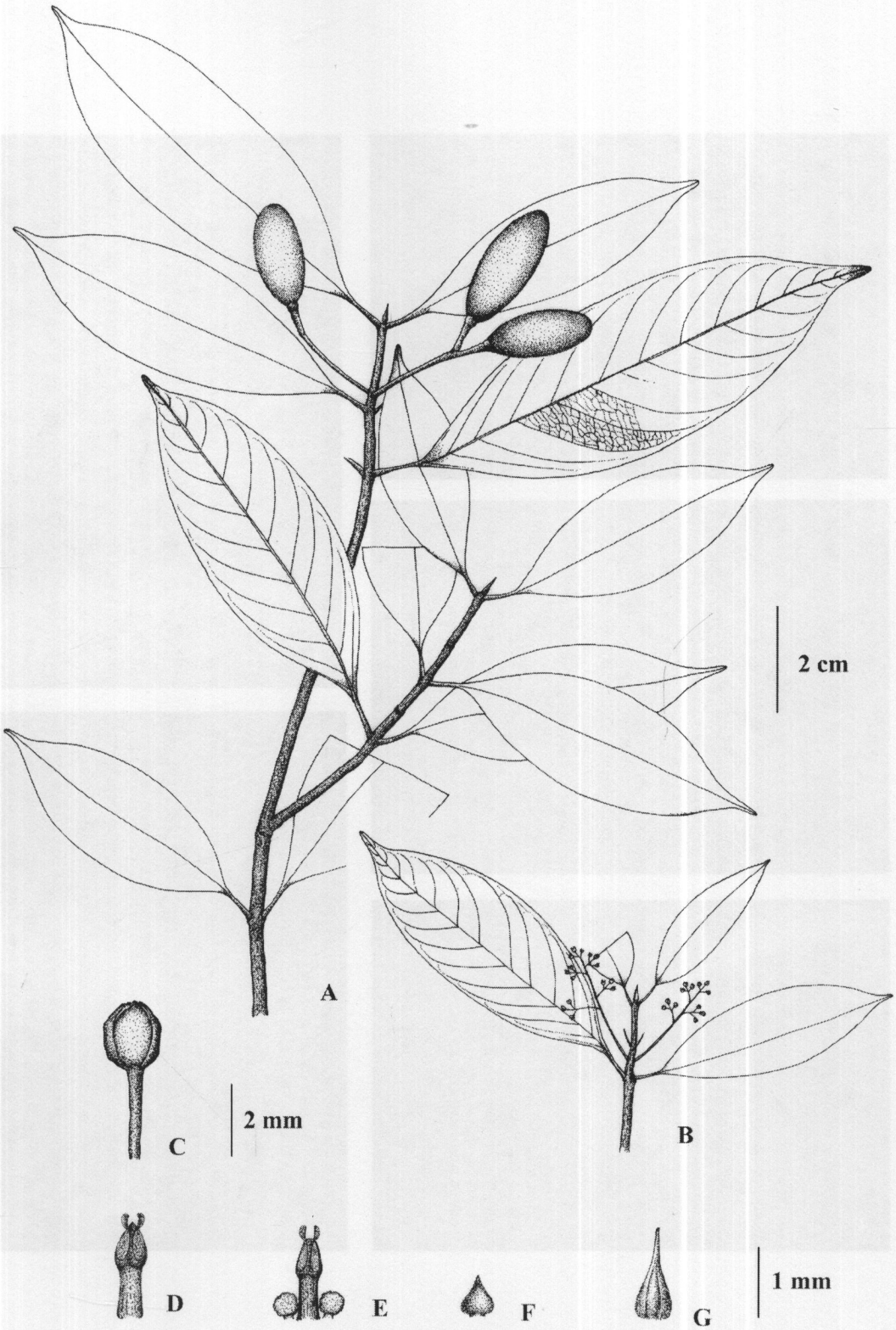


Figure 29 *Beilschmiedia* sp.1: A, fruiting twig; B, flowering twig; C, flower; D, outer stamen; E, inner stamen with 2 glands; F, staminode; G, pistil.

Figure 30 Photographs of *Beilschmiedia* sp. 1: A, tree shape; B, outer bark; C-D, flowering twig; E, fruiting twig.

16. Beilschmiedia sp. 2. Figure 31, 32.

Small tree, about 12 m high, branches terete or flatten, brown, pubescent. Outer bark greyish-white, nearly smooth, inner bark brown. Terminal buds appressed pubescent, up to 0.5 cm long. *Leaves* opposites to spiral; blade elliptic, 8.5-9.0 by 2.8-6.8 cm, apex acuminate, base cuneate, coriaceous, glabrous on both surfaces, dark green, shining above, light green beneath, midrib and secondary veins sunken above, raised beneath, slender, (8-)10-19 on each side, curving and joining near margin, tertiary veins lax reticulate, prominent on both surfaces; petioles 0.5-1.0 cm long. *Inflorescences* not seen. *Fruits* ellipsoid-oblong, 1.7-2.2 by 0.85-1.1 cm, shining, dark green then blue and glaucous; fruiting pedicels 0.8 - 2.2 cm long, green.

Thailand.-- PENINSULAR: Trang (Khao Chong), Surat Thani (Khlong Phanom).

Distribution.-- Malaya.

Ecology.-- In evergreen forest, 100-150 m altitude. Flowering unknown; fruiting March-April.

Vernacular.-- Thang maeng da bai yao (ทังแมงดาใบยาว) (The name is given by the author).

Figure 31 *Beilschmiedia* sp. 2: A, fruiting twig.

Figure 32 Photographs of *Beilschmiedia* sp. 2: A-B, outer and inner bark; C-E, fruiting twig.

Geographical and ecological distributions of *Beilschmiedia* spp. in each regions and different forest types in Thailand are presented in table 2 and table 3, respectively.

Table 2 Distribution of *Beilschmiedia* in each regions of Thailand.

Species	N	NE	E	SW	C	SE	PEN
Beilschmiedia argentata	/			/			
B. assamica	/		/				/
B. brevipes							/
B. clarkei	/						
B. elegantissima	/			/			
B. gammieana	/	/		/			
B. glauca				/			/
B. inconspicua			/			/	
B. membranacea							/
B. palembanica							/
B. roxburghiana	/	/	/	/	/		/
B. velutinosa	/						
B. villosa	/	/					/
B. wallichiana							/
Beilschmiedia sp.1		/					
Beilschmiedia sp.2							/

Note: Northern (N), North-Eastern (NE), Eastern (E), South-Western (SW), Central (C), South-Eastern (SE), Peninsular (PEN).

Table 3 Ecological distribution of *Beilschmiedia* spp. in Thailand.

Species	PSF	EF	DDF	MDF	DEF	MF
Beilschmiedia argentata					/	
B. assamica						/
B. brevipes		/			/	
B. clarkei						/
B. elegantissima					/	/
B. gammieana						/
B. glauca						/
B. inconspicua					/	
B. membranacea		/			/	
B. palembanica	/		/			/
B. roxburghiana			/	/	/	
B. velutinosa		/		/		
B. villosa		/				
B. wallichiana		/				
Beilschmiedia sp.1		/				
Beilschmiedia sp.2		/				

Note: Peat Swamp Forest (PSF), Evergreen Forest (EF), Dry Dipterocarp Forest (DDF), Mixed Deciduous Forest (MDF), Dry Evergreen Forest (DEF), Montane Forest (MF).

DISCUSSION

The circumscriptions of the genus *Beilschmiedia* were considered on the basis of morphological characters, and another data supported from the literatures. Sixteen species of the genus *Beilschmiedia* in Thailand were recognized as followed:

B. gammieana King ex Hook.f. is more similar to *B. globularia* Kurz in the position of inflorescences, leaves, terminal buds and fruit characters. The mature fruits are different in size, the mature fruits of *B. globularia* are globose and more larger than *B. gammieana*. The specimens of *B. gammieana* in Thailand were compared to the herbarium specimens of *K. M. Matthew* 49152, 10 April 1987, Kodaikanal, India (AAU) and *K.M. Matthew & K.T. Mathew* 52642, 26 March 1988, Kodaikanal, India (AAU).

In this study found one specimens collected from Huai Kaeo Arboretum, which is more or less resembled *B. roxburghiana* but differs in the number of tepals, fertile stamens and its arrangement and shape of staminodes, i.e. *B. roxburghiana* Nees has 6 tepals, 9 fertile stamens arranged in 3 whorls of 3, the 4th whorl are 3 staminodes of narrowly heart-shaped, while 6-7 tepals, 6 fertile stamens arranged in 2 whorls of 3, the 3rd whorl are 3 staminodes, broader heart-shaped with stalk and basal glands at base, and additional 4th of 3 staminodes which shape are narrower than the 3rd in Huai Kaeo specimen. The other characters such as fruits, leaves, terminal buds, bark and tree crown of the former are the typical of *B. roxburghiana*. Unfortunately, only one tree was found in the study, meanwhile I decided to put this specimens under *B. roxburghiana*.

B. assamica Meisn. is similar to *Beilschmiedia* sp. 1. in the lanceolate terminal buds. According to Backer, Fl. Java 1: 130. 1963, *B. assamica* has pubescent inside the tepals but this character does not present in *Beilschmiedia* sp.1. The tepals of *Beilschmiedia* sp.1 are glabrous on both surfaces. The fruits of *B. assamica* are large ellipsoid, with long fruiting pedicels, and erect infructescences while in *Beilschmiedia*

sp.1. has small ellipsoid fruits and pendulous infructescences. I decided *Beilschmiedia* sp.1 is a new species. The naming will be done later on.

B. clarkei Hook.f. is similar to *B. assamica* in fruit size and shape but they are different in leave textures and the characters of the terminal buds. *B. assamica* has coriaceous leaves and the terminal buds covered with lanceolate glabrous scales while *B. clarkei* has chartaceous or membranaceous leaves, the terminal buds are without scales, but shortly hairs all over.

B. villosa Kosterm. is closed to *B. argentata* Kosterm. by the subcoriaceous, perulate bracteoles and inflorescences do not reduce to short raceme and the terminalia branching. The differences are the occasionally villose and very coriaceous leaves in *B. villosa* while tomentose to pubescent and chartaceous leaves in *B. argentata.*

B. villosa is closed to *B. velutinosa* Kosterm. by the villose to pilose hair underneath the leaves. The difference is the perulate bracteoles covered the inflorescences of *B. villosa* while there are none in *B. velutinosa.*

B. brevipes Ridl. is closed to *B. penangiana* Gamble in perulate bracteoles and inflorescences reduce to short raceme, but differs from the latter by the glabrous, papery bracteoles.

Beilschmiedia sp. 2 cannot be identified to species because of the incomplete specimens.

B. velutinosa Kosterm., *B. villosa* Kosterm., *B. glauca* S.K. Lee& L.F. Lau, *B. wallichiana* (G. Don) Kosterm. and *B. elegantissima* Kosterm., were described by comparing with the herbarium sheets in the Forest Herbarium and also the descriptions in the literatures. Photographs, morphological and ecological data from fresh materials are scant.

B. palembanica (Miq.) Kosterm., *B. membranacea* Gamble are described by comparing with the herbarium sheets in Kew herbarium, refered to *Kerr* 7096, 7 July 1923, Pattani (K) and *Kerr* 7220, 10 July 1929, Bachaw Pattani (K), including informations from first and other relevant publications because they were not found during the surveys but from the geographical distribution point of view it possibly occurs in Thailand.

This study proposed *B. lanatella* Kosterm. as the new synonym of *B. velutinosa* Kosterm. because the descriptions of both names were described by the same types i.e. *Kerr* 5532 (BK!). *B. lanatella* was first published in 1961 (Reinw. 5(4): 392, t.8) by Kosterman, with the mistaken of type number *Kerr* 5432 which Kosterman mentioned later when he published *B. velutinosa* in 1975 (Nat. Hist. Bull. Siam Soc. 25(3-4): 30). However *B. lanatella* has never been proposed as synonym of *B. velutinosa*. Therefore new synonym of *B. velutinosa* is presented in this study.

I disagreed with Smitinand' s Thai Plant Names (the Forest Herbarium, 2001) which changed the status of *B. roxburghiana* Nees to be the synonym of *B. fagifolia* Nees. Christian Gottfried Daniel von Esenbeck Nees (1831) named *B. roxburghiana* and *B. fagifolia* by using types: *Helfer* 4335, India, Tenasserim (K) and *Jenkins* 2539, India, Munnipore (K), respectively. According to Hooker (1885), *B. fagifolia* is very closely allied to *B. roxburghiana*, but it has smaller leaves and shorter petioles, smaller panicles, larger and broader bracts. Such as variations strengthen, that *B. fagifolia* and *B. roxburghiana* are forms of a widespread Indian species. In Beddome (1872) and Kosterman (1964) they both merged *B. fagifolia* to *B. roxbughiana*. I agreed with them because in my survey, leaf characters of *B. roxburghiana* are much varied, i.e. from lanceolate, elliptic to ovate and has widely range of distribution. According to the rule of the International Code of Botanical Nomenclature (ICBN), a name has priority, *B. roxburghiana* is the correct name.

Among plants in the same species, sometimes number of tepals and stamens are variable, which is difficult to identify the species. Therefore, additional characters

such as: habit, leaf arrangement, leaf shape, indumentum and fruit characters should be taken into consideration.

The difficulties in surveying and collecting plants in the fields are the habit of the genus *Beilschmiedia* is usually large trees, the specimens, therefore, lacked good flowers and fruits, only sterile materials were presented. The reproductive parts appeared to be far too high and sometimes hardly to distinguish the plant. If there were, sometimes the plants were collected under the tree or from the fallen branches. Thus, the remarkable observation of *Beilschmiedia* in the field are:

Trunk with lenticels and fragrant smell of essential oils.

Branching characters is sometimes easy to distinguish by the young branches growing with sharp angle to the tree trunk, sometimes as terminalia branching. Leave are arranged in opposite, alternate or spiral and with pagoda terminal buds.

The flowering twigs, the flowers are in small inflorescences of raceme, cyme and panicle. The flowers with 6-8 tepals, 9-10 fertile stamens, 3 staminodes, 1 ovary and superior ovary.

CONCLUSION

The present study is the first taxonomic revision of genus *Beilschmiedia* in Thailand. As a first result, fourteen species have been described and recorded, namely: *B. argentata, B. assamica, B. brevipes, B. clarkei, B. elegantissima, B. gammieana, B. glauca, B. inconspicua, B. membranacea, B. palembanica, B. roxburghiana, B. velutinosa, B. villosa* and *B. wallichiana. Beilschmiedia* sp. 1 and *Beilschmiedia* sp. 2 can not be identified into specific epithet due to the lack of data and incompleted specimens. These are probably new to science.

Two species may be new to science, *Beilschmiedia* sp. 1 is found at Phu Wua Wildlife Sanctuary, Nong Khai Province, *Beilschmiedia* sp. 2 is found at Krachong, Trang Province. Eight species (*B. argentata, B. brevipes, B. clarkei, B. elegantissima, B. glauca, B. membranacea* and *B. wallichiana*) are newly recorded for Thailand.

The study provides identification key to species based on flowering, fruiting materials and morphological characteristics of plants. Full descriptions of species, including the distribution range, ecology, vernacular names and uses are given, supported by line drawings and photographs of individual species.

RECOMMENDATION

Further study for *Beilschmiedia* sp.1 and *Beilschmiedia* sp.2 are needed in order to name plants or announcing new species. Moreover, intensive surveys of *Beilschmiedia* should be continued, which may be find more species than this study. The data gained from this study can be supported the diversity of the family Lauraceae under the Flora of Thailand project.

LITERATURE CITED

Allan, H.H. 1982. **Flora of New Zealand** Vol. 1. P.D. Hasselberg, Government Printer, Wellington, New Zealand.

Allen, C.K. 1942. Studies in the Lauraceae, V: Some Eastern Asiatic species of Belschmiedia and related genera. **J. Arnold Arbor.** 23: 444-463.

Backer, C.A. and R.C. Bakhuizen Van Den Brink. 1963. **Flora of Java** (Spermatophytes Only) Vol.1. N.P.V. Noordhoff-Groningen, Netherlands.

_____.1968. **Flora of Java** (Spermatophytes Only) Vol. 3. Wolters-Noordhoff-Groningen, Netherlands.

Bentham, G. 1965. Ordo. CXLIII. Laurineae, pp. 146-165. *In* G. Bentham & J.D. Hooker, eds. **Genera Plantarum** 3. L. Reeve & Co., London.

Bor, N.L. 1953. **Manual of Indian Forest Botany**. Oxford University Press, Amen House, London.

Burkill, I.H. 1966. **A Dictionary of The Economic Products of The Malay Peninsular** Vol. 1 (A-H). Art Printing Works, Kuala Lumpur.

Chang, C.E. 1976. Lauraeae, pp. 406-468. *In* H.L., Lee, T.S. Liu, T.C. Huang, T. Koyama and C.E. DeVol. **Flora of Taiwan** Vol.2. Epoch Publishing Co., Ltd., Taipei, Taiwan.

Dassanayake, M.D., F.R. Fosberg and W.D. Clayton. 1995. **A Revised Handbook to The Flora of Ceylon** Vol. 9. Amerind Publishing Co. Pvt. Ltd., New Delhi.

Francis, W.D. 1970. **Australian Rain-Forest Trees**. Australian Government Publishing Service, Canberra.

Frans, A.S. and A.M. Erik. 1993. **Taxonomic literature supplement** II (Be-Bo). Koeltz Scientific Books, Konigstein.

Gamble, J.S. 1910. New Lauraceae from the Malayan Region I. **Bull. Misc. Inform. Kew**. 1910: 142-153.

Govaerts, R. 1996. **World Checklist of Seed Plants** Vol.2(1-2). Continental Publishing, Lakborslei 114, Belgium.

His-wen, L. 1984. **Flora Reipublicae Sinicae** Tomus31. Science Press, China.

Hooker, J.D. 1885. **The Flora of British India** Vol. 5 (Chenopodiaceae to Orchideae). L. Reeve & Co., Ltd., London.

Hô, P.H. 1991. **Câyco Viêtnam** Quyen1 Tap1 (An Illustrated Flora of Vietnam). Mekong Printing, Vietnam.

Hutchinson, J. 1964. **The Genera of Flowering Plants (Angiospermae): Dicotyledones.** Vol. 1. Oxford University press, Great Britain.

Judd, W.S., C.S. Campbell, E.A. Kellogg and P.F. Stevens. 1999. **Plant Systematics** (A Phylogenetic Approach). Sinauer Associates, Inc. Publishers, Massachusetts.

Kanjilal, U.N., P.C. Kanjilal, R.N. De and A. Das. 1940. **Flora of Assam** Vol. 4. Prabasi Press, Calcutta.

Keng, H. 1969. **Order and Families of Malayan Seed Plants**. University of Malaya Press, Kuala Lumpur.

Kochummen, K.M. 1989. Lauraceae, pp. 98-178. *In* F.P.S.Ng, ed. **Tree Flora of Malaya, A Manual for Foresters** 4. Longman, Kuala Lumpur.

Kostermans, A.J.G.H. 1956. New Critical Malaysian Plants IV. **Reinw.** 4(1): 1- 40.

_____. 1957. Lauraceae. **Reinw.** 4(2): 193-256.

_____. 1957. Lauraceae. **Communication (Pengumuman) of The Forest Reseasch Institute, Indonesia** Nr 57: 1-64.

_____. 1961. Miscellaneous Botanical notes 2. **Reinw.** 5(4): 375-411.

_____. 1962. Lauraceae. **Reinw.** 6(3): 282-291.

_____. 1964. **Bibilographia Lauracearum**. P.T. Djulie Archipel, Bogor.

_____. 1975. New Species And Combinations of Lauraceae From Thailand. **Nat. Hist. Bull. Siam Soc.** 25(3-4): 29-44.

Kurz, S. 1877. **Forest Flora of British Burma** Vol. 2. The Superintendent of Government Printing, Calcutta.

Lecomte, M.H. 1914. **Flore Generale de L'Indo-Chine** Vol.5(2). Boulevard Saint-German, Paris.

Lee, S.K. 1963. Notes on Hainan Lauraceous Plants. **Acta Phytotax. Sin.** 8(3): 181-196.

Long, D.G. 1984. Lauraceae, pp. 250-281. *In* A.J.C. Grierson & D.G. Long, eds. **Flora of Bhutan** 1(2). Royal Botanic Garden, Edinburgh.

Merrill, E.D. 1934. An Enumeration of Plants Collected in Sumatra. *In* W.N. Bangham, C.M. Bangham. **Contributions from The Arnold Arboretum of Harvard University** Vol. 8. The Arnold Harvard University, Jamica Plain, Mass., USA.

Nishida, S. 2001. Notes on *Beilschmiedia* (Lauraceae) of Southeast Asia 1: Checklist of Bornean Species with the Description of a New Species. **Acta Phytotax. Geo.** 52 (2): 103-113.

Perry, L.M. 1980. **Medicinal Plants of East and Southeast Asia** (Attributed Propoties and Uses). The Massachusetts Institute of Technology Press, Cambridge, Massachusetts, London.

Ridley, H.N. 1967. **The Flora of the Malay Peninsula Vol. 3 (Apetalae).** A. Asher & Co., Amsterdam.

Rohwer, J.G. 1993. Lauraceae, pp. 366-391. *In* K. Kubitzki, ed. **The Families and Genera of Vascular Plants** (Flowering Plants, Dicotyledon, Magnoliid, Hamamelid and Caryophyllid Families) Vol. 2. Springer-Verlage, Berlin Heidelburg.

Steenis, C.G.G.J. Van. 1963. **Pacific Plant Areas** Vol. 1. Bureau of Printing, Manila.

Stearn, W.T. 1992. **Botanical Latin** 4th eds. A David & Charls Books, England.

Takhtajan, A. 1997. **Diversity and Classifiation of Flowering Plants**. Columbia University Press, New York.

The Forest Herbarium. 2001. **Thai Plant Names Tem Smitinand** (Revised Edition). Prachachon co. Ltd. Bangkok.

Tseng-Chieng, H. 1972. **Pollen Flora of Taiwan**. Ching-Hwa press co., Ltd., Taiwan.

Turner, I. M. 1995. A Catalogue of the Vascular Plants of Malaya. **Gard. Bull. Singapore** 45(1): 37-346.

van der Werff, H.. 2001. An Annotated Key to The Genera of Lauraceae in The Flora Malesiana Region. **Blumea** 46(1): 125-140.

_____. 2003. A synopsis of genus *Beilschmiedia* (Lauraceae) in Madagascar. **Adansonia** ser. 3. 25(1): 77-92.

Walker, E.H. 1976. **Flora of Okinawa and the Southern Ryukyu Islands**. Smithsonian Institution Press, Washington D.C.

APPENDIX

Appendix 1 Index to specimens examined.

1. *Beilschmiedia argentata* Kosterm.

Ruengrue 2, 18 February 2004, Huai Kha Kheang (BKF)

Tetsana 45, 24 March 2004, Huai Kha Khaeng (BKF)

Vanpruk 437, 26 May 1913, Phrae (K)

2. *B. assamica* Meisn.

Maxwell 95-249, 24 March 1995, Doi Suthep-Pui (BKF)

Tetsana 46, 7 April 2004, Mae Wong (BKF)

3. *B. brevipes* Ridl.

Maxwell 84-380, 31 October 1984, Khao Chong (BKF)

Maxwell 85-492, 17 May 1985, Khao Luang (BKF)

Tetsana 43, 18 March 2004, Khao Chong (BKF)

Tetsana 51, 23 April 2004, Khao Chong (BKF)

4. *B. clarkei* Hook.f.

Clarke 27925, 13 May 1876, Sikkim (K)

Kanzaki, Hara & Nogychi C598, 7 December 1998, Doi Inthanon (CMU)

Kerr 5410, 10 May 1921, Mae Cham (K)

Tetsana 31, 11 July 2003, Doi Inthanon (BKF)

Tetsana 47, 9 April 2004, Doi Inthanon (BKF)

Tetsana 48, 9 April 2004, Doi Inthanon (BKF)

Tetsana 49, 9 April 2004, Doi Inthanon (BKF)

5. *B. elegantissima* Kosterm.

Lace 5642, 29 January 1912, Burma (K)

Suddee 1630, 30 October 2002, Mae Wong (BKF)

van Beusekom & Phengkhlai 220, 30 March 1968, Sangkhlaburi (AAU, BKF, C, E, K, KYO, P)

6. *B. gammieana* King ex Hook.f.

Kerr 13299, 11 August 1927, Surat Thani (BK, K)

K. M. Matthew 49152, 10 April 1987, Kodaikanal, India (AAU)

K.M. Matthew & K.T. Mathew 52642, 26 March 1988, Kodaikanal, India (AAU)

Putthai 21, 29 June 2004, Thong Pha Phum (BKF)

Ruengrue 3, 21 February 2004, Huai Kha Khaeng (BKF)

Smitinand & Cheke 10793, 13 April 1970, Bo Luang (BKF)

Tetsana 35, 24 October 2003, Huai Kha Khaeng (BKF)

Tetsana 36, 24 October 2003, Huai Kha Khaeng (BKF)

Tetsana 37, 24 October 2003, Huai Kha Khaeng (BKF)

van Beusekom & Phengkhlai 1265, 16 June 1968, Doi Suthep-Pui (BKF, K, P, E, C, AAU, KYO)

7. *B. glauca* S.K. Lee & L.F. Lau

Balgooy, 2562, 28 April 1975, Pahang (AAU)

Larsen 33524, 29 April 1974, Khao Phota Luang Kaeo (AAU, BKF)

Niyomdham, Kubat & Ajchompoo 1428, 17 March 1987, Khao Phota Luang Kaeo (BKF)

Shimizu et al 26898, 10 December 1979, Khao Phota Luang Kaeo (BKF)

Suddee 1623, 13 December 2002, Kaeng Krachan (BKF)

8. *B. inconspicua* Kosterm.

Larsen, Santisuk & Warncke 3141, 8 August 1968, Pak Thong Chai (AAU, BKF, C, K)

Thaworn 16, 21 February 1955, Koh Chang (BKF, C)

9. *B. membranacea* Gamble

Kerr 7220, 10 July 1929, Pattani, Bacho (K)

10. *B. palembanica* (Miq.) Kosterm.

Kerr 7096, 7 July 1923, Pattani, Bukit (K)

11. *B. roxburghiana* Nees

Collins 1954, 11 January 1976, Sriracha (BK, K)

Greesink, Hattink & Mawell 6828, 18 May 1974, Sam Lan (BKF)

Hansen & Smitinand 12202, 10 February 1966, Satun, Kho Talibong (BKF, C)

Kerr 6033, 27 May 1922, Mae Wong (C)

Kerr 17924, 2 January 1930, Trat, Khao Saming (C)

Kerr 18639, 20 March 1930, Krabi (BK, C)

Maxwell 74-236, 31 March 1974, Sam Lan (AAU, BK)

Maxwell 74-562, 1 June 1974, Sam Lan (AAU, BK)

Maxwell 76-427, 10 July 1976, Sriracha (AAU, BK)

Maxwell 87-448, 24 May 1987, Songkhla, Mueang (AAU, BKF)

Nilviset 8, 13 February 1954, Buntharik (BKF)

Phengkhlai 944, 25 January 1965, Kantharalak (BKF)

Ruengrue 2, 10 February 2004, Huai Kha Kheang (BKF)

Sankhachad 423, 19 April 1955, Ko Chang (BKF)

Sankamethawee 25, 6 February 2000, Huai Kaeo (CMU)

Suphuntee 27/1, 19 May 2004, Huai Kaeo (BKF)

Tetsana 22, 3 July 2003, Nam Nao (BKF)

Tetsana 32, 2 July 2003, Pa Hin Ngam (BKF)

Vanpruk 214, without date, Song (K)

Vanpruk 483, 16 March 1970, Song (BKF)

Winit 1682, 27 March 1983, Mae Sai (BKF)

Winit 1903, 10 March 1986, Lampang (BKF)

Wongprasert 999-06, 2 September 1999, Nan (BKF)

12. *B. velutinosa* Kosterm.

Kerr 5532, 31 May 1921, Doi Chiang Dao (BK)

Winit 1711, 21 June 1926, Lampang (BK, K)

13. *B. villosa* Kosterm.

Hansen & Smitinand 12753, 28 February 1968, Pang Mapha (AAU, BKF, C, K)

Tetsana 56, 23 May 2004, Khao Yai (BKF)

14. *B. wallichiana* (G. Don) Kosterm.

Chayamarit et al. 2680, 23 February 2001, Sra Nang Manora (BKF)

Kerr 13820, 1 January 1928, Kuan Po (K, BKF)

Smitinand 7139, 10 February 1961, Kuan Kalong (BKF)

Wallich 4158, without date, no locality (K)

15. *Beilschmiedia* sp. 1

Tetsana 9, 21 May 2003, Phu Wua (BKF)

Tetsana 10, 21 May 2003, Phu Wua (BKF)

Tetsana 11, 21 May 2003, Phu Wua (BKF)

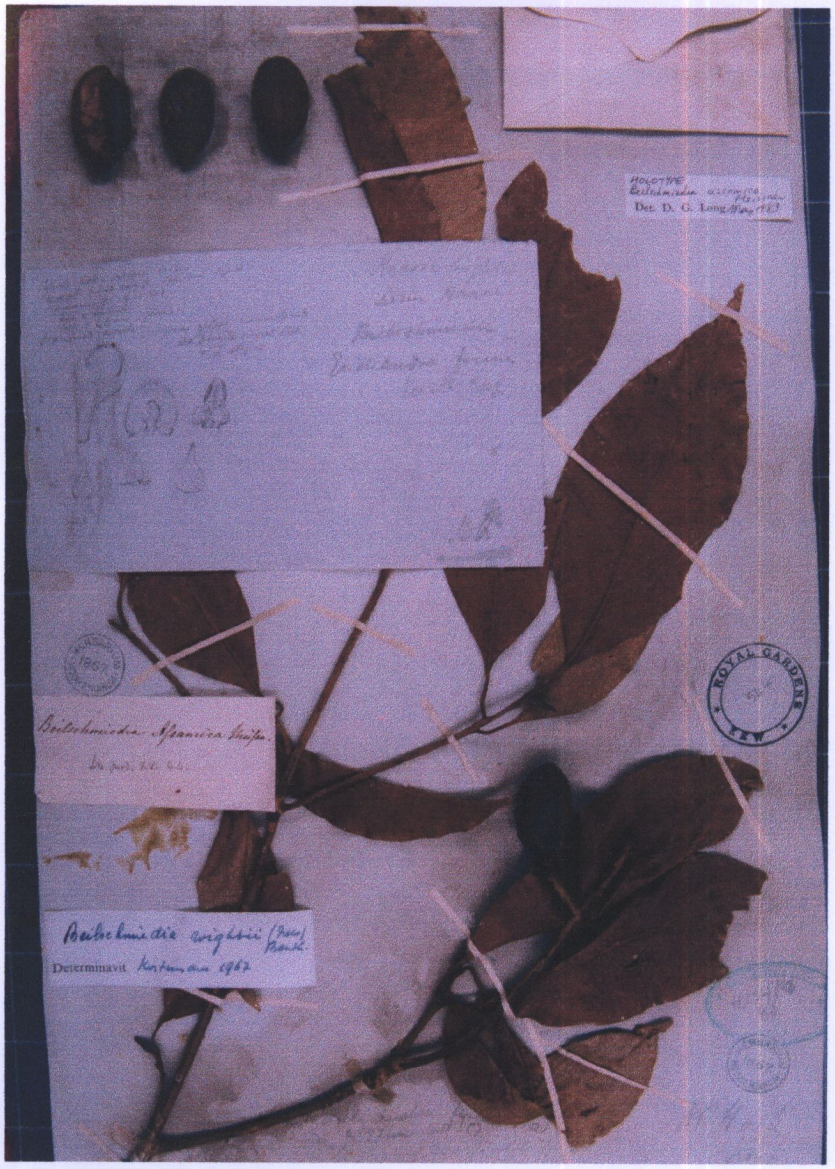
Tetsana 38, 10 December 2003, Phu Wua (BKF)

Tetsana 39, 10 December 2003, Phu Wua (BKF)

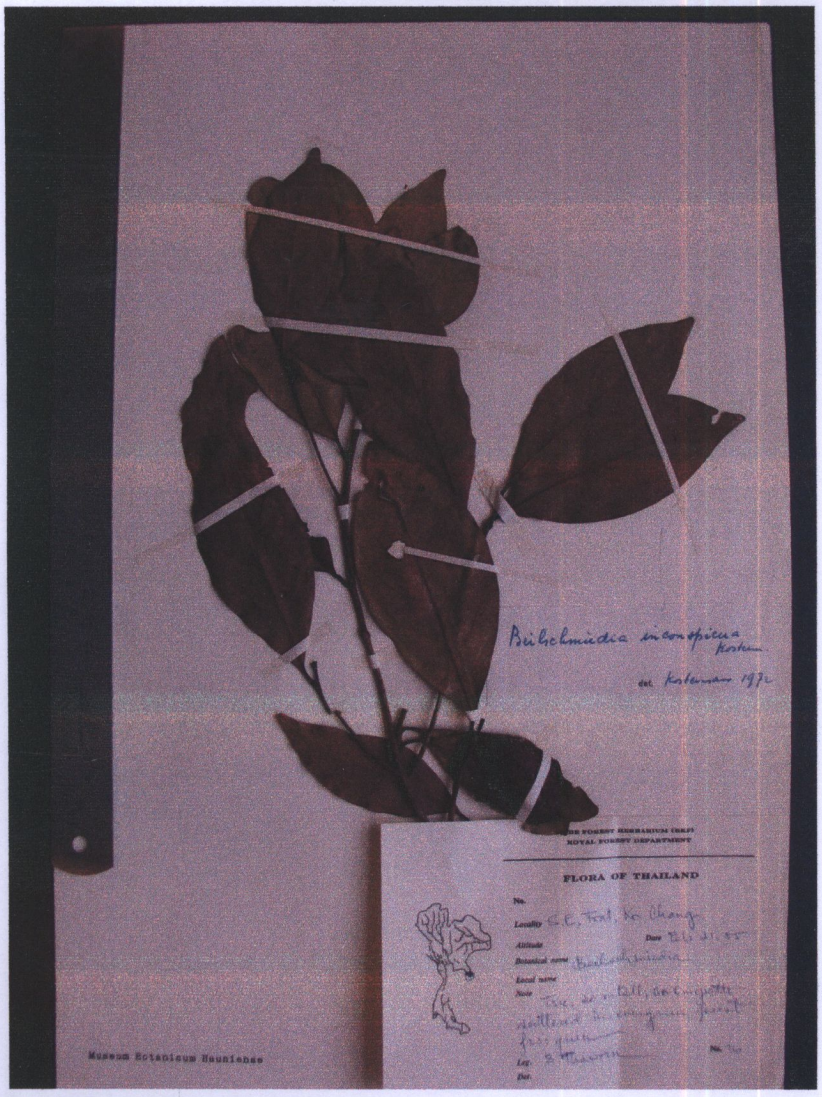
16. *Beilschmiedia* sp. 2

Middleton, Lindsay & Pooma 2128, 11 April 2003, Khlong Phanom (BKF)

Tetsana 52, 23 April 2004, Khao Chong (BKF)

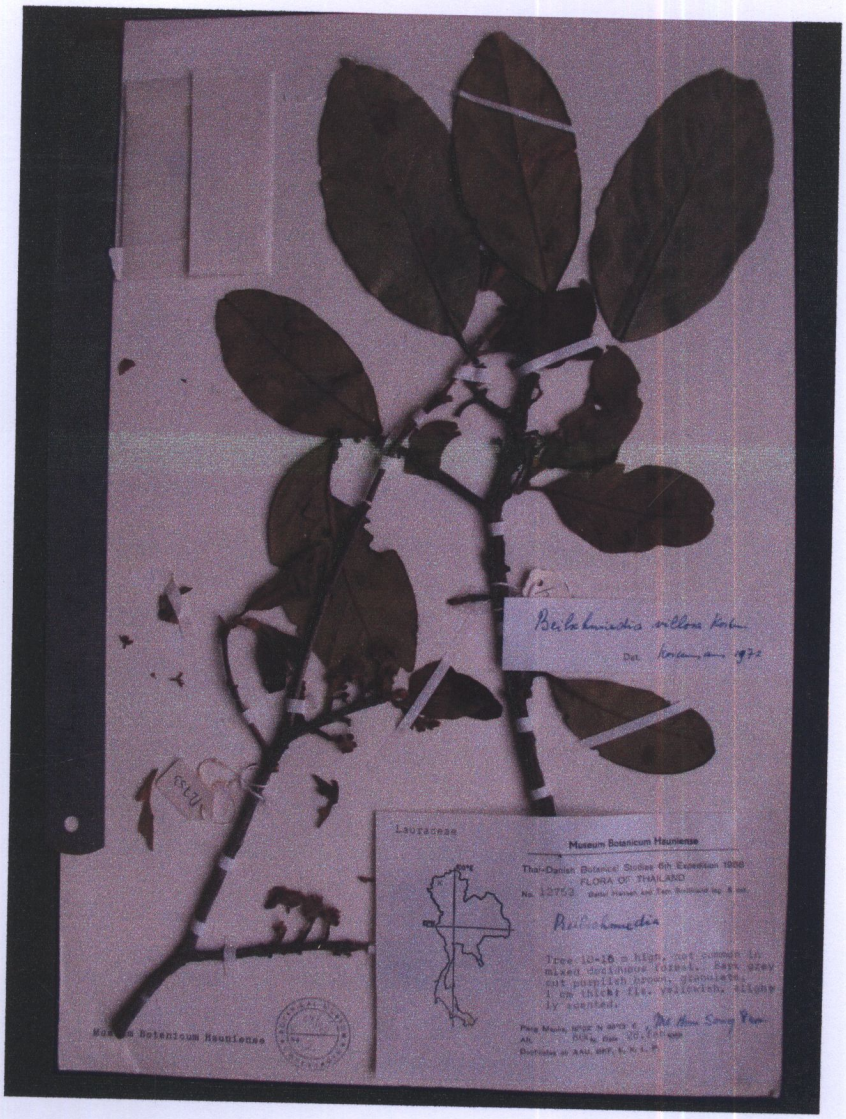


Appendix 2 Type photograph of *B. assamica* Meisn.
(From Royal Botanic Gardens, Kew)



Appendix 3 Type photograph of *B. inconspicua* Kosterm.
(From Copenhegen, Denmark)

Appendix 4 Type photograph of *B. roxburghiana* Nees
(From Copenhegen, Denmark)



Appendix 5 Type photograph of *B. villosa* Kosterm.
(From Copenhegen, Denmark)