Systematic Relationships within the *Litsea* Complex (*Lauraceae*)

by

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This thesis is dedicated to my father.

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Abstract

Lauraceae contains many species that are important constituents in tropical and sub-tropical forests, both ecologically and economically. This importance makes studying its diversity, taxonomy, and evolution essential. Currently, no widely accepted phylogenetic classification of the family and adequate circumscriptions of many genera exist. Essentially the same set of characters has been used in nearly all systems proposed thus far. The *Litsea* complex is a prime example of a poorly understood and controversial generic grouping within the family.

The *Litsea* complex consists of ten genera with 500-700 species, which are concentrated in tropical to subtropical Asia. Although four modern *Lauraceae* classifications show strong consistency in recognizing the *Litsea* complex, the generic and infrageneric systematic relationships within the complex are unclear and controversial. This study revises the *Litsea* complex, based on a sample of 339 species, with general descriptions of anatomy, palynology, karyology, embryology and distribution, and additionally employs leaf cuticle and molecular systematic data (*mat*K sequences). The study includes morphological data as a bridge to connect its new data with past research results, using cladistic analysis to investigate potential monophyly and to reconstruct the phylogeny of the complex.

As a result, several well supported monophyletic groups have been found, including: *Litsea-Aperula* clade characterized by a long peduncle in the racemiform inflorescence, a *Cylicodaphne–Cupuliformes* clade with cup-shaped fruit cupules, a *Uniumbellatae-Daphnidium* clade with trinerved leaves, a *Parasassafras–Sinosassafras* clade with minute involucral bracts and *a Tomingodaphne–Palminervia–Sphaerocarpae–Lindera* clade characterized by a deciduous habitat. A revised classification of the *Litsea* complex is presented; several sections previously included under *Litsea* and *Lindera* are restored or combined owing to the disappearance of the previous generic delimitation. The fasciculate pseudo-umbel group in *Actinodaphne* is recognized as a new genus *Actinodaphnopsis.* Finally, a key to the revised genera based on morphological characters is presented.

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Chapter One
General introduction

Lauraceae is a plant family which is pantropical, concentrated in the tropics of Asia and America, and including about 50 genera, 2500-3000 species (Li, 1979; Werff & Richter, 1996).

Lauraceae is very important, both economically and ecologically. Many *Lauraceae* species yield high-quality timber (nanmu), others are the source of spices (cinnamon, bay leaves) or aromatic oils (camphor, rosewood oil), and *Persea americana* Miller (avocado) is cultivated worldwide for its edible fruits (Werff & Richter, 1996). Ecologically, in the Old World *Lauraceae* is one of the five dominant families in the vast subtropical evergreen forest of China; meanwhile in the New World, this group of plants is present in wet forests at all elevations and is frequently the most common, or one of the most common tree families, especially in the foothills and at middle elevation of the Andes (Werff & Richter, 1996). This importance makes studying its diversity, taxonomy, and evolutionary essential.

The main hindrances to systematic studies of *Lauraceae* are the absence of a generally accepted, phylogenetical classification of the family and the inadequate circumscription of many genera. Essentially the same set of characters has been used in nearly all systems proposed so far (Nees, 1836; Meissner, 1864; Bentham & Hooker, 1880; Mez, 1889; Pax, 1889; Kostermans, 1957; Hutchinson, 1964; Rohwer, 1993). Werff and Richter (1996) stated that these classifications are strongly influenced by the choice of the most important character, and the differences between the classifications are a result of such choices. It seems unlikely that a thorough re-examination of floral and fruit characters will yield data with which a more robust

classification can be constructed. Incorporating new data sets in building a classification looks like a more promising approach. In 1992, such a project was proposed by Hyland and van der Werff (pers. comm.), and will incorporate data from DNA studies, wood and bark anatomy, leaf oils, leaf venation and leaf cuticle, fruit anatomy, pollen, inflorescence type, and the traditional flower and fruit morphology into a new classification. As a result of such an international collaboration, the great contributions towards a better understanding of *Lauraceae* in recent decades came from the addition of entirely new set of characters, i.e., from wood anatomy (Richter, 1981), and an improved classification of *Lauraceae* based on the combined data from classical morphology and wood anatomy (Werff & Richter, 1996).

As one part of such an international, multidisciplinary study, this project emphasizes the *Litsea* complex. The *Litsea* complex is a subset of *Lauraceae* consisting primarily of the genera *Litsea, Lindera, Neolitsea* and *Actinodaphne*. Owing to the instability of the genera, the complex should contain another four monotypic or oligotypic genera, *Parasassafras, Sinosassafras, Dodecadenia* and *Iteadaphne*, which were previously treated as species or subgenera (Kostermans, 1957; Long, 1984; Li, 1985). Additionally, the genera *Laurus* and *Umbellularia* are also included in the *Litsea* complex because of their sharing the same inflorescence and flower structures as above taxa (Rohwer, 1993; Werff & Richter, 1996). The five modern *Lauraceae* classifications (Kostermans, 1957; Hutchinson, 1964; Richter, 1981; Rohwer, 1993; Werff & Richter, 1996) show strong consistency in recognition of the *Litsea* complex; the complex is considered as a natural group or a monophyletic group (Li, 1995; Li, 1998, personal communication).

Systematic relationships within the complex are still confusing, with the two core genera *Litsea* and *Lindera* being considered as polyphyletic groups (Rohwer, 1993). The number of anther cells, which is the only difference between several genus pairs (*Litsea* vs. *Lindera; Sinosassafras* vs. *Parasassafras; Iteadaphne* vs. *Dodecadenia*), was doubted for the purpose of generic delimitation by more researchers (Werff & Richter,1996; Rohwer, Richter & Werff 1991). This study aims at providing a

phylogenetic classification and workable generic keys of the *Litsea* complex on a global scale by means of leaf cuticle study and molecular systematics. Morphological study will be used as a bridge to connect my research with the past research results, using the cladistic analysis to reconstruct the phylogeny of the complex.

This study begins with a general description of taxonomic history, embryology, palynology, karyology, anatomy and distribution about the *Litsea* complex in the first chapter. In the second chapter I review the morphological characters, especially those being of importance for generic and infra-generic circumscription. The leaf cuticle study in the third chapter is the basis of better understanding of systematic relationships within the *Litsea* complex. A cladistic analysis based on morphological and leaf cuticular data was undertaken to determine monophyletic groups in the complex, and is presented in chapter four. This is followed by a phylogenetic analysis of the complex based on molecular data from *mat*K sequences. Finally, an improved classification for the complex and a key to the revised genera are provided based on the cladistic analysis of the combined data.

1.1 Taxonomic history

Previously in *Lauraceae* classifications, although many differing systems were produced as a result of the weighted choice of the most important characters (Werff & Richter, 1996), most of them have recognized the *Litsea* complex to be characterized by involucrate inflorescences. In Meissner's early monography (1864), *Lauraceae* were actually divided into 3 suborders (equivalent to subfamilies): the "*Laurineae*", woody plants with normal leaves, the "*Gyrocarpeae*", now excluded from *Lauraceae* and the "*Cassytheae*", leafless parasitic vines. The "*Laurineae*" was divided into two groups based on inflorescence structure (inflorescence paniculate, racemose, or spicate, with an involucre lacking vs. inflorescence umbellate or glomerulate, with an involucre present). The second group with involucrate inflorescence is comprised solely of the tribe "*Litseaceae*", which was further subdivided into subtribus *Tetranthereae* and subtribus *Daphnidieae* based on the number of anther cells.

Bentham and Hooker (1880) recognized three tribes in the *Lauraceae*: "*Perseaceae*" without involucre, "*Litseaceae*" with involucre and leafless vines "*Cassytheaceae*". The "*Litseaceae*" have all stamens with introrse anther cells, and the inflorescence is short, dense and sub-sessile (except in *Sassafridium*), and was comprised of *Sassafridium, Sassafras, Actinodaphne, Dodecadenia, Litsea, Umbellularia, Iteadaphne, Lindera* and *Laurus*.

The most dubious system was certainly the one by Pax (1889), who took the number of pollen sacs as the only criterion for the delimitation of subfamilies (four in "*Persoideae*", two in "*Lauroideae*"). The "*Persoideae*" were subdivided into the "*Cinamomeae*"(stamens of whorl III with extrorse cells; stamens nine), the "*Eusideroxyleae*" (stamens of whorl III with extrorse cells, stamens three) and the "*Litseae*" (all stamens with introrse cells). The "*Lauroideae*" are subdivided into "*Cassytheae*" (leafless vines), the "*Laureae*" (all stamens with introrse cells), the "*Acrodiclidieae*" (stamens of whorl III with extrorse cells; fertile stamens three), the "*Apollonieae*" (stamens of whorl III with extrorse cells; fertile stamens six or nine; cupule lacking) and the "*Cryptocaryeae*" (stamens of whorl III with extrorse cells; fertile stamens six or nine; cupule present). In Pax's system, the members of the *Litsea* complex can be found in the "*Litseae*" and the "*Laureae*".

In the Mez' system of American *Lauraceae* (1889), the family *Lauraceae* was divided into two suborders: *Laureae* and *Cassytheae.* The *Laureae* was subdivided into two tribes: *Perseae* and *Litsaeeae*, differing by the absence or presence of an involucrum.

At present, although most scholars basically agree on the classification of Kostermans (1957) at the subfamily level (i.e. *Lauraceae* is divided into parasitic subfamily *Cassythoideae* and woody subfamily *Lauroideae*), many different opinions about classification within subfamily *Lauroideae* still exist.

Kostermans (1957) divided subfamily *Lauroideae* into five tribes: the *Perseeae* (cupule lacking; inflorescences exinvolucrate), the *Cinnamomeae* (cupule present, but not fully enclosing the fruit; inflorescences exinvolucrate), the *Litseeae* (cupule as in *Cinnamomeae*, inflorescence involucrate), the *Cryptocaryeae* (fruit fully enclosed in cupule; inflorescence exinvolucrate) and the *Hypodaphneae* (ovary inferior; inflorescences exinvolurate). The tribe *Litseeae* was divided into the 4-celled anther subtribe *Litseineae* and the 2-celled anther subtribe *Lauriineae*, the former including *Litsea* and *Neolitsea*, the latter consisting of *Lindera* and *Laurus*. In this system, Kostermans treated *Dodecadenia* and *Iteadaphne* as subgenera in *Litsea* and *Lindera* respectively according to their involucre with only one flower.

Hutchinson (1964) divided *Lauraceae* into 6 tribes based on inflorescence (involucrate or not), the number and position of the anther cells (all introrse or at least one whorl extrorse). This classification is largely an improved version of Bentham and Hooker's system. Tribe 3 --- *Sassafrideae* is characterised by 4-locellate anthers, which are all introrse, and consists of *Sassafras, Sassafridium* (now included in *Ocotea*) and *Actinodaphne*. Tribe 5 --- *Litseae* is characterized by inflorscence being enclosed by an involucral bract and consists of *Dodecadenia, Umbellularia, Litsea, Neolitsea, Lindera, Laurus, Iteadaphne* and *Valvanthera.*

Richter's (1981) system, which was completely different from previous systems based on floral and fruit morphological characters, was based on the anatomical features of wood and bark. In this system, the subfamily *Lauroideae* was separated into three groups of genera, all the taxa of the *Litsea* complex were contained in the second group of genera, as was *Sassafras*.

Using the same morphological characters as Kostermans (1957), but weighted differently, Rohwer (1993) proposed a classification of subfamily *Lauroideae*. In his system, the subfamily *Lauroideae* was divided into two tribes: *Perseeae* and *Laureae*. The contents of the latter was completely consistent with Richters' (1981) second generic grouping.

Recently, Werff and Richter (1996) produced a new classification of the subfamily *Lauroideae* based on the combined characters of gross morphology and wood anatomy. It should be noted that their classification included geographical distribution. The subfamily *Lauroideae* was divided into the Tribe *Laureae*, concentrated in the Northern Hemisphere, Tribe *Perseeae* appearing mostly in the neotropical area, and Tribe *Cryptocaryeae* which is best represented in the Southern Hemisphere. The composition of their *Laureae* is also consistent with that in Rohwer's system and that of the second generic grouping in Richter's system.

As seen above, the five modern classifications show strong consistency in recognizing the *Litsea* complex, even though there are many differences in the classifications within the subfamily *Lauroideae*. The *Lisea* complex is characterized by a series of morphological characters: basically racemose inflorescences, the inflorescence appearing umbellate owing to the shortened inflorescence axis, an inflorescence with involucral bracts and anther-cells of the third whorl basically introrse (Werff & Richter, 1996; Rohwer, 1993). Therefore, the complex is considered to be natural (Li, 1995).

1.2 Embryology

Embroylogy of the genera *Actinodaphne, Laurus, Lindera, Litsea, Neolitsea* and *Umbellularia* in the *Litsea* complex was summarized by Heo, Werff and Tobe (1998) on the basis of their investigations and the literature.

In staminal development, anthers are bisporangiate or tetrasporangiate depending on the genus; the wall formation of the anther conforms to the basic type. An amoeboid tapetum can be found in almost all observed genera. Successive cytokinesis in meiosis is observed in all. At maturity, the anther wall is composed of persistent epidermis and fibrous endothecium and pollen grains are two-celled.

For the gynoecium, the ovule is anatropous and crassinucellate. Three to six cell layers of parietal cells above the megaspore mother cell can be seen in the genera *Actinodaphne, Lindera* and *Neolitsea*; but 14-15 cells layers of parietal cells are found in the genus *Laurus*. The shape of the megaspore tetrad is linear. The mode of embryo sac formation is of the *Polygonum* type with the mature embryo sac positioned within the nucellus and not protruding. In all the genera investigated the mature ovule has a single embryo sac. The ovule is bitegmic, fertilization is porogamous as in the other genera in *Lauraceae*. Endosperm formation is of nuclear type in the genera *Laurus* and *Litsea*. However, cellular endosperm is observed in the genus *Umbellularia*. The Onagrad-type of embryogeny is seen in the genera *Laurus* and *Litsea*. (Heo, Werff & Tobe, 1998).

1.3 Palynology

In a comprehensive study, Merwe, Wyk and Kok (1990) distinguished four pollen types in *Lauraceae*: Pollen type A (grains spheroidal, apolar, spinulose) occurs only in the tribes *Perseeae*, *Cinnamomeae*, *Litseeae* and *Hypodaphneae*; pollen type B (oblate / peroblate, isopolar, slightly to strongly verrucate) occurring only in the *Cryptocaryeae*; pollen type C (spheroidal, apolar, strongly verrucate / spinuloid) is characteristic of the subfamily *Cassythoideae*, and pollen type D (spheroidal, para-isopolar, striate) occurring only in monotypic genus *Dahlgrenodendron*. The pollen morphology of all components of the *Litsea* complex belongs to type A according to this system.

Tang & Shang (1995) also presented a palynological classification in *Lauraceae* on the basis of a comprehensive and systematic study of the pollen morphology of more than 150 species (22 genera), and most from China.

Table 1-1. Pollen types in Tang & Shang's (1995) classification.

Pollen type	Characters	Taxa
Cryptocarya type	The exine smooth or scabrate, without spines	*Cryptocarya, Neocinnamomum,* etc.
Caryodaphnopsis type	The exine without spines, but with dense verrucae on the surface	*Caryodaphnopsis*
Litsea type	The exine with distinct spines, without mat-shaped thickening near the base of spines, usually with perforation or tenuity	*Litsea, Lindera, Neolitsea,* etc.
Laurus type	The exine with coarse triangular spines, with longitudinal streaks on the surface of spines, and with mat-shaped thickening near the base of spines.	*Laurus*
Persea type	The exine with distinct spines and tenuity or perforation, usually the spines very small and dense, without mat-shaped thickening at the base of spines.	*Persea, Machilus, Phoebe, Nothaphoebe, Alseodaphne, Sydiclis* and *Octea*
Sassafras type	The exine with or without perforation; spines smooth, with circular mat-shaped thickening at the base of spines.	*Sassafras, Dehaasia, Cinnamomum, Umbellullaria* and *Actinodaphne etc.*
Cassytha type	The exine smooth or scabrate, without spines, similar to *Cyptocarya* type but pollen grains very small	*Cassytha*

Therefore, in Tang & Shang's pollen morphological system the *Litsea* complex has three pollen types including the *Laurus, Litsea* and *Sassafras* types.

Although there are differences in the classification of pollen types in the *Lauraceae* in the above two pollen morphological systems, the components of the *Litsea* complex show some consistent characters: pollen grains usually spheroid, 30-50 um diameter,

apolar, inapertuate; exine with perforation or tenuity in the genera *Litsea, Lindera* and *Neolitsea*; exine surface sparsely to densely spinulose; spinules, 0.5-1 um high, triangular, somewhat elevated with a basal circular, cushion-like form in genera *Umbellularia*, *Actinodaphne* and some species in *Litsea* and *Lindera*, or elevated with a basal circular, minute granules encircling the base of each spinule in the genus *Laurus*, or with a basal rim, smaller and not elevated in the some species of the genera *Lindera, Litsea* and *Neolitsea*.

1.4 Karyology

Karyological studies in *Lauraceae* have been done by Chen et al. (1998), Morawetz (1986), Okada & Tanaka (1975), Mehra (1972), Mehra & Bawa (1969), Mehra & Bawa (1968), Mehra & Gill (1968), Ehrendorfer et al., (1968), (see table 1-2). The chromosome numbers of 3 *Actinodaphne* species, 2 *Laurus* species, 7 *Lindera* species, 18 *Litsea* species, 3 *Neolitsea* species and *Umbellularia californica* from the *Litsea* complex have been reported in their studies. The chromosome number 2n = 24 has been found in most species in the complex. Polyploid numbers have been seen in *Laurus nobilis* (2n = 48), *Laurus canariensis* (2n = 36), *Litsea glutinosa* (2n = 48), *Neolitsea aciculata* (2n = 72) and *Neolitsea zeylanica* (2n = 48). The three chromosome numbers 36, 48 and 72 were considered to be resulted from irregular meiosis and hybrids (Ehrendorfer et al., 1968).

Table 1-2. The chromosome numbers in the *Litsea* Complex.

Taxon	Chromosome number	Source
Actinodaphne cupularis	2n = 24	Chen et al, 1998
Actinodaphne reticulata	2n = 24	Mehra & Bawa, 1969
Actinodaphne speciosa	2n = 24	Morawetz (1986)
Laurus nobilis	2n = 48	Okada &Tanaka (1975)
Laurus canariensis	2n = 36	Ehrendorfer et al., 1968
Lindera assamica	2n = 24	Mehra & Bawa, 1969

Lindera benzoin	2n = 24	Okada & Tanaka (1975)
Lindera citriodora	2n = 24	Okada & Tanaka (1975)
Lindera communis	2n = 24	Chen et al, 1998
Lindera megaphylla.	2n = 24	Chen et al, 1998
Lindera pulcherrima	2n = 24	Chen et al, 1998; Mehra & Bawa, 1969
Lindera umbellata subsp. *membranacea*	2n = 24	Okada & Tanaka (1975)
Litsea amara	2n = 24	Mehra & Bawa, 1969
Litsea citrata	2n = 24	Mehra & Bawa, 1969
Litsea cubeba	2n = 24	Chen et al, 1998
Litsea elongata	2n = 24	Mehra & Bawa, 1969
Litsea elongata var. latifolia	2n = 24	Mehra & Bawa, 1969
Litsea gardneri.	2n = 24	Morawetz (1986)
Litsea glabrata	2n = 24	Mehra & Bawa, 1969
Litsea glutinosa	2n = 48 (tet.)	Mehra & Bawa, 1969; Mehra & Gill, 1968
Litsea japonica	2n = 24	Okada & Tanaka (1975)
Litsea kingii	2n = 24	Mehra & Bawa, 1969
Litsea lancifolia	2n = 24	Mehra & Bawa, 1969
Litsea monopetala	2n = 24	Mehra & Bawa, 1969
Litsea multiumbellata	2n = 24	Morawetz (1986)
Litsea oreophila	2n = 24	Mehra & Bawa, 1969
Litsea panamonja	2n = 24	Mehra & Bawa, 1969
Litsea salicifolia	2n = 24	Mehra & Bawa, 1969
Litsea semicarpifolia	2n = 24	Mehra & Bawa, 1969
Litsea sericea	2n = 24	Mehra & Bawa, 1969
Litsea umbrosa var. consimilis	N = 12	Mehra, 1972
Neolitsea aciculata	2n = 72	Okada & Tanaka (1975)
Neolitsea sericea	2n = 24	Okada & Tanaka (1975)
Neolitsea zeylanica	2n = 48 (tet.)	Mehra & Bawa, 1969; Mehra & Bawa, 1968; Mehra, 1972
Umbellularia californica	2n = 24	Ehrendorfer et al, 1968

1.5 Anatomy

Werff & Richter (1996) recorded that the wood and bark of the *Litsea* complex is characterized by the absence of marginal parenchyma and, in most instances, and of septate fibers. Conversely, phloem fibers are always present.

1.6 Distribution

The modern distribution of the *Litsea* complex is briefly recorded in the Table 1-3 and Figure 1-1.

Table 1-3. The geographical distribution of the *Litsea* complex (from Li. 1995).

Genera	Species	Geographical distribution
Litsea	200 spp.	Subtropical to Tropical Asia (N to North Korea and Japan), Australasia (Australia 11 spp., New Zealand 2 spp.), N America to C America (S America, Mexico and Costa Rica 5 spp.)
Lindera	100 spp.	Tropical to subtropical Asia (N to North Korea and Japan, Tropical Australia (Queensland 1 sp.), E North America
Actinodaphne	100 spp.	Tropical to Subtropical Asia
Neolitsea	80 spp.	Tropical to subtropical Asia (N to Japan), Tropical Australia (3 spp.)
Laurus	2 spp.	Mediterranean Region and the Canary Islands, Madeira and the Azores
Iteadaphne	2 spp.	Tropical Asia
Dodecadenia	1 sp.	India, Bhutan, Nepal, SW China.
Parasassafras	1 sp.	Bhutan, N Burma, SW China
Sinosassafras	1 sp.	SW China
Umbellularia	1 sp.	Western N America

From the above distribution, it is clear that the complex is concentrated in tropical to subtropical Asia, with a decrease in species number with higher latitudes. Limited species are found in the Pacific Region and in America; no species occur in Africa although *Laurus nobilis* is found around the Mediterranean and *Laurus canariensis* occurs in Canary Islands. On the basis of a large number of species found in tropical - subtropical Asia with most of them being considered as endemic and original, Li (1995) inferred that the complex originated in the southern part of Laurasia, northern part of Gondwana and the tropical coast area of Tethys Sea not earlier than mid-Cretaceous. Particularly for *Litsea* and *Lindera,* which are the core genera in the complex, the range from South China to Indo-Malaysia is proposed as the centre of origin and speciation, and from there it is assumed that they migrated into tropical America and Australasia.

1.7 Purpose of this study

In spite of the defining features of the *Litsea* complex such as possession of basically racemose inflorescences with involucral bracts, the generic and infra-generic relationships within the complex are unclear. Li (1985) noticed that "besides the difference in the anther cell, the genera *Lindera* and *Litsea* simply seem to be a natural group due to their similarities of morphology, distribution, origin and evolution". Hyland (1989) also noted that "if only female flowers or fruits are available, distinguishing Australian *Litsea* and *Lindera* is somewhat more difficult and on a world-wide basis may be almost impossible". Rohwer (1993) confirmed that the genera *Lindera* and *Litsea* are polyphyletic, and are composed of both anatomically and morphologically different groups which might need to be separated.

The genera *Dodecadenia* and *Iteadaphne* were treated as subgenera of genera *Litsea* and *Lindera* respectively in the Kostermans' classification, but now they are widely regarded as independent genera because of their pseudo-umbel containing only one flower (Rohwer, 1993; Li, 1995; Werff and Richter, 1996). The difference between them is only the number of anther cells. The genera *Parasassafras* and *Sinosassafras*

were restated from the species of *Actinodaphne confertiflora* and *Lindera flavinervia* respectively because of their minute involucral bracts by Long (1984) and Li (1985), they differ from each other also only in the number of anther cells.

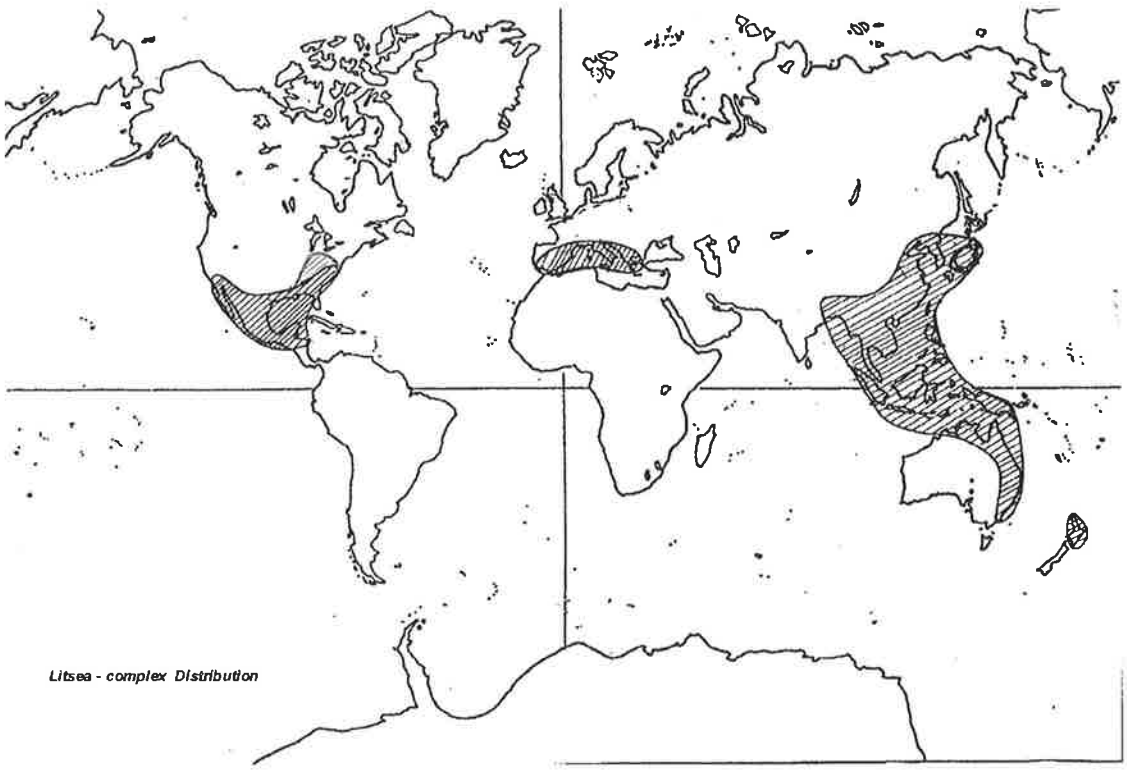
The genera *Actinodaphne* and *Umbellularia* were placed in the Tribe *Cinnamomeae* rather than in the Tribe *Litseeae* by Kostermans (1957) because of their imbricate, early caducous involucral bracts and the position of the anther cells (extrorse found in *Umbellularia*). The systematic position of the genus *Neolitsea* with dimerous flower is uncertain, it should be close to *Actinodaphne* (Hyland, 1997, personal communication.) or *Litsea* (Rohwer, 1993).

The subdivision of the complex has always been problematic, the point at issue was whether we should keep or discard two-locular vs. four-locular anthers as the important character to define genera. Recently, Werff & Richter (1996) and Rohwer, Richter & Werff (1991) found that the androecial characters are often variable even within genera, and proposed that the distinction between 2-thecous and 4-thecous anthers should be eliminated for the purpose of generic delimitation.

Thus, despite a great deal of research having been done in the family *Lauraceae*, no in depth research has been done specifically on the *Litsea* complex, and that which has been done was confined to floral morphology. In addition, owing to the instability of the morphological characters and the different weighting of individual morphological characters by different scholars, the delimitation of genera and supra-generic taxa is far from stable, and the systematic relationships within the complex are unclear.

This Ph.D. project has as an aim not only provision of a phylogenetic classification, but also production of a practical key to the genera within the *Litsea* complex worldwide. This study includes combined analyses of flower & fruit morphology, leaf cuticle and molecular systematics, together with a cladistic analysis incorporating all data to reconstruct the phylogeny of the *Litsea* complex.

Figure 1-1. *Litsea* complex distribution.



Chapter Two
Morphology

2.1 Introduction

Traditionally, *Lauraceae* classification has been mainly dependent upon comparative external morphological characters. The classifications by Nees (1836), Meissner (1864), Bentham and Hooker (1880), Pax (1889), Mez (1889), Kostermans (1957), Hutchinson (1964) and Rohwer (1993) were all based on floral and fruit morphology, with only the classification of Richter (1981) being based on wood and bark anatomy. In 1996, Werff & Richter published an improved *Lauraceae* classification based on the combined data from morphological characters and wood and bark anatomical characters. In spite of the "synthetic" approach, which requires evaluation of all types of characters in plant classification, this traditional morphological character will be very helpful to provide the link with older classifications and the basic knowledge of the research groups.

The generic and infrageneric systems in the *Litsea* complex are all based on morphological characters including the following: ecological habit, leaf arrangement, inflorescence arrangement, flower number per inflorescence, arrangement, size and habit of involucral bracts, flower sex, basic flower number, number of anther cells, perianth segment presence, shape of fruit cupule etc. It is unlikely that in the course of this study important new morphological characters will be found, but it is likely that the results of research in the other disciplines included in this study will suggest which morphological characters are important to investigate the monophyly of the *Litsea* complex and identify morphological synapomorphies useful in classification of the complex.

2.2 Materials and methods

All available herbarium collections from BO, KUN, QRS, SING and TAIF were examined. Measurements of vegetative, floral and fruit characters were taken from herbarium materials.

BO: Herbarium Bogoriense, Bogor, Indonesia.
KUN: Herbarium of Kunming Institute of Botany, the Chinese Academy of Sciences, China, Kunming, China.
QRS: Herbarium, Queensland Regional Station, CSIRO, Division of Forest Research, Atherton, Australia.
SING: Herbarium and Library, Botanic Gardens, Singapore.
TAIF: Herbarium, Taiwan Forestry Research Institute, Taipei, Taiwan.

2.3 Notes on morphology and characters of taxonomic importance

2.3.1 Vegetative morphology

Habit

Most species in the *Litsea* complex are trees of 3 - 15 meters height; some species are trees of 20+ meters such *as Actinodaphne maingayi, Litsea magnoliifolia, Neolitsea levinei, Lindera megaphylla*. Some species are shrub or shrub-like treelets of less than 2 meters like *Litsea pittosporifolia, Neolitsea pingbienensis, Lindera tienchuanensis*.

The boles or trunks are usually smooth, ranging from less than 10 centimeters diameter up to 60 centimeters such as *Actinodaphne pilosa, Litsea baviensis*. The colour of bark varies among dark, grey, brown, white and green.

Most species in the complex are evergreen, but deciduous species are seen in *Litsea* Section *Tomingodaphne*, in *Lindera* Sections *Lindera*, *Sphaerocarpae*, *Palminervia*. This character is very important for infrageneric system in the *Litsea* complex. Tsui

(1987) discussed this character when publishing his *Lindera* system, stating " as a result of the tropical origin of the lauraceous plants, it is no doubt that the evergreen habit is more primitive, deciduous habit is derived due to its adaptation to cold climate in the temperate zone". He and Li (1985) observed the phenomenon that dead leaves are retained on the tree in winter in some species such as *Lindera angustifolia, Lindera glauca, Lindera praecox* and *Litsea cubeba*. Li (1985) called this semi-evergreen or semi-deciduous, and both Li (1985) and Tsui (1987) agreed that it reflected a more primitive state than being deciduous.

Twigs

Twigs are usually terete, stout or slender, glabrous or hairy, covered or not covered with lenticels based on different species. The different kinds of indument on the twig are very helpful to delimitate species.

Phyllotaxis

Alternate leaves are more common than verticillate ones in *Litsea* complex. The genus *Actinodaphne* is as a rule characterized by verticillate leaves, but verticillate leaves also can be seen in *Litsea* species such as *Litsea verticillifolia, Litsea verticillata* and *Neolitsea* species such as *Neolitsea cambodiana, Neolitsea confertifolia, Neolitsea levinei*. Opposite or sub-opposite leaves are occasionally found in *Litsea* species such as *Litsea ferruginea, Litsea griffithii, Litsea sarawacensis, Litsea lancifolia, Litsea gracilipes, Litsea ujongensis, Litsea sessilliflora.*

Leaves

Leaves are usually entire, but lobed leaves can be found in the species of *Lindera* Section *Palminervia*. The monotypic genera *Sinosassafras* and *Parasassafras* are reported to bear juvenile foliage in which the leaves are lobed towards the apex (Long, 1984; Li, 1985). Their texture variesfrom characteous to coriaceous, their size varies from small

such as *Litsea chunii* (5 x 1.5 cm) to large such as *Neolitsea levinei* (30 x 10 cm) and *Litsea dilleniifolia* (50 x 15 cm). The indumentum on the adaxial surface or abaxial surface is a very important character for distinguishing the species. Liao (1995) grouped the Taiwan species from genus *Neolitsea* based solely on the convex or concave nature of the midrib and lateral veins on the leaf adaxial surface. I found this character to be variant among the same species from different locations and hence questionable.

Venation

Leaf venation is an important character for the generic and infrageneric system in the *Litsea* complex. Three kinds of leaf venation can be found in the complex: penninerved, triplinerved and trinerved. The genera *Litsea, Laurus, Dodecadenia, Umbellularia, Lindera* Sections *Cupuliformes, Lindera, Aperula, Polyadenia* and some species from *Actinodaphne* and *Neolitsea* are dominated by penninerved leaves; The genera *Parasassafras, Sinosassafras, Iteadaphne* and some species from *Neolitsea* are characterized by triplinerved leaves; Trinerved leaves are found in the *Lindera* sections *Daphinidium, Palminervia* and *Uniumbellatae*. However, the transition among the three kinds of leaf venation can be found in some species, for example, the leaves of *Lindera fragrans* growing at higher altitudes are penninerved, the basal pair of lateral veins become more and more robust towards the lower altitudes, and finally trinerved leaves occur (Tsui, 1987).

The evolutionary direction among three kinds of leaf venation proposed by Li (1985) differed from that by Tsui (1987). Li considered that the trinerved leaf evolved into a penninerved leaf via a triplinerved leaf. However, as the penninerved leaf also appeared in the primitive tribe *Perseeae*, Tsui (1987) inferred that the penninerved leaf was more primitive and the trinerved leaf was derived.

2.3.2 Reproductive Morphology

Inflorescence

The *Litsea* complex is characterized by a basically racemose inflorescence. Most scholars agree that the frequently appearing pseudo-umbel in the complex is the result of the shortening of the inflorescence axis (Li, 1985; Tsui, 1987; Rohwer, 1993; Werff & Richter, 1996). According to the growth position of the pseudo-umbel in the larger genera *Litsea* and *Lindera*, Li (1985) and Tsui (1987) suggested an evolutionary series for the inflorescence, mainly upon which Tsui (1987) published his *Lindera* infrageneric system. In the primitive stage, the pseudo-umbel with a long peduncle is solitary in the axil of a normal leaf, seen in the *Lindera* section *Uniumbellatae* (only one species *Lindera tienchuanensis*, endemic to SW China). At second stage, due to the transformation of normal leaves into bracts, the axillary pseudo-umbels on the shortened branchyblast assume a racemiform arrangement, seen in genera *Umbellularia, Laurus, Iteadaphne, Litsea* species such as *Litsea glutinosa, Litsea liyuyingi, Litsea dilleniifolia, Litsea panamonja, Litsea magnoliifolia, Litsea machilifolia, Litsea curtisii, Litsea nidularis, Litsea megacarpa, Litsea sebifera, Litsea maingayi Litsea noronhae, Litsea robusta*, *Lindera* species such as *Lindera metcalfiana, Lindera foveolata* and *Actinodaphne* species such as *Actinodaphne obovata* and *Actinodaphne pilosa*. At the final stage, the fascicled pseudo-umbels, which appear in most species of the complex, are the result of an undeveloped terminal bud and shortening of internodes.

Peduncle

Length of peduncle is very important for the infrageneric classification in *Litsea* and *Lindera*. *Lindera* section *Aperula* is separated from other sections on the basis of its longer peduncle (>1 cm) in Tsui's (1987) *Lindera* system, but after examining *Lindera* specimens, the species with long peduncle are not solely restricted to this section, they also can be found in the other species such as *Lindera tienchuanensis*

from Section *Uniumbellatae*, *Lindera megaphylla* from Section *Cupuliformes*. The longer peduncle also can be found in *Actinodaphne* including *Actinodaphne henryi*, *Actinodaphne pilosa*, and *Litsea* species such as *Litsea glutinosa*.

Flower number per inflorescence

According to Li (1985) and Tsui (1987), in the process of the transformation of the racemose inflorescence into a pseudo-umbel by shortening the inflorescence axis, the flower number in each involucrum becomes smaller and smaller. Finally, a single flower occurs in the involucrum as seen in *Dodecadenia* and *Iteadaphne*.

Involucral bracts

The bracts under the flowers aggregate to form the involucral bracts in the *Litsea* complex due to the shortening of the inflorescence axis, by which the *Litsea* complex is distinguished from other groups in *Lauraceae*. Its size, arrangement and habit are very important for the systematic study of the complex.

As *Actinodaphne* differs from *Litsea* and *Lindera* by the presence of early caducous, imbricate involucral bracts, it was placed instead into the Tribe *Cinnamomeae* by Kostermans (1957), whereas it was treated as a subgenus of *Litsea* by Liao (1995). The same characters can be found in genus *Umbellularia*. In addition, based on its possession of minute and early caducous involucral bracts, Long (1984) separated *Actinodaphne confertiflora* as the new genus *Parasassafras*. Similarly, Li (1985) erected *Sinosassafras* for the 2-celled anther specimens within *Parasassafras*. Early caducous involucral bracts can also be found in *Lindera* species such as *Lindera communis* and *Lindera thomsonii*; the character is not limited to the above four genera. The importance of this character have been emphasised on the different levels *i.e.* it can be used to define genera or define species.

Flower structure

In the basic flower structure of the complex there are two equal whorls of three tepals each, followed by three whorls of fertile stamens. The anthers open by means of two or four valves, and if the anthers are four-locular, the pollen sacs are arranged in two pairs above each other. The pollen sacs of all whorls are basically introrse and the stamens of the third whorl bear a pair of glands at their base. The gynoecium consists of a single carpel containing a single ovule.

The complex contains numerous deviations from above general plan, however. Unisexual flowers occur in most genera in the complex: *Actinodaphne, Iteadaphne, Lindera, Neolitsea, Parasassafras* and *Sinosassafras*. Apparently bisexual flowers with one sex non-functional flower can be seen in the genera *Laurus, Dodecadenia* and *Litsea*. Bisexual flowers are found in the genus *Umbellularia* (only one species *Umbellularia californica*, endemic to N. America). In addition, trimerous flowers are found in most genera in the *Litsea* complex; dimerous flowers are limited to species from genera *Neolitsea* and *Laurus*.

Perfect perianth segments are found in all the species of the complex, but imperfect or missing perianth segments can be found in few species such as *Litsea glutinosa* and *Litsea tomentosa*. Based on this, Hyland (1989) doubted whether *Litsea glutinosa* was congeneric with other species of *Litsea*.

The anther locule is a character widely used to distinguish the different genera, especially in the classification of Kostermans (1957). A 2-celled anther is definitive for *Lindera, Laurus, Sinosassafras* and *Iteadaphne*; 4-celled anthers are restricted to *Litsea, Actinodaphne, Parasassafras, Dodecadenia* and *Umbellularia*. Based solely on this character, many new taxa were published one after another. For example, Hyland (1989) distinguished the specimens with 2-celled anther as *Lindera queenslandica* from the 4-celled anther specimens of *Litsea glutinosa*. After observation of the anther cell across the family, Rohwer (1993) considered that "two-

locular anthers obviously have originated from four-locular ones in different ways: by reduction of the upper pollen sacs, as can be observed, e.g. in *Persea*, by reduction of the lower pollen sacs, e.g. in *Urbanodendron*, or by lateral fusion of adjacent pollen sacs, as in *Brassiodendron* and a few species of *Endiandra*".

As mentioned above, the *Litsea* complex is basically characterized by introrse pollen sacs. However, the lower extrorse pollen sacs in the third whorl can be found in the American endemic *Umbellularia*; latrorse ones occur in the *Iteadaphne* and *Dodecadenia*.

The number of fertile stamens is variable in the complex. The flowers in most species of the complex usually have 9 fertile stamens arranged into 3 whorls. Six fertile stamens can be found in species of *Neolitsea;* increased numbers of stamens are found in *Actinodaphne* species such as *Actinodaphne omeiensis* (9-12), *Actinodaphne paotingensis* (9-15) and *Litsea* species such as *Litsea glutinosa* (15), *Litsea foveolata* (9-12), *Litsea dilleniifolia* (16-17), *Litsea liyuyingi* (26-32), *Litsea magnoliifolia* (12-14), *Litsea akoensis* (9-16).

The shape of the gland born at the base of the third whorl stamens is kidney-shaped in most species of the complex. However, funnel-shaped glands are unique to three species of the *Lindera* Section *Cupuliformes* endemic to China. Stalked glands and sessile glands can be found within the complex.

Fruit

The fruit of the *Litsea* complex is a one seeded berry or a drupe. Although its shape and size were used to delimitate the different species, the more useful character for systematic study in the *Litsea* complex is the fruit cupule, which is a differential development of the receptacle and the tepals. There are transitional forms ranging from a berry on a discoid cupule to a cup-shaped cupule. The latter was used to define the *Litsea* Section *Cylicodaphne* and *Lindera* Section *Cupuliformes;* besides the

above two sections, it also can be found in some *Actinodaphne* species such as *Actinodaphne obscurinervia*, *Actinodaphne forrestii*, *Actinodaphne lecomtei*, *Actinodaphne cupularis*, *Actinodaphne paotingensis* and *Neolitsea* species such as *Neolitsea undulatifolia*, *Neolitsea howii*.

2.4 Infrageneric system within the *Litsea* complex.

Three infrageneric systems have been erected within the *Litsea* complex. An infrageneric system for *Neolitsea* was produced by Liao(1995). It seems to be unnatural since it is based solely on the character of leaf venation being concave or convex on the adaxial surface. The system is as follows:

Sect. *Retisupraplana* Liao

Networks of veinlets of old leaf flattened or rarely concaved on the adaxial surface

Sect. *Retisupraelevata* Liao

Networks of veinlets of old leaf usually elevated, rarely flattened on the adaxial surface

The classification within the genus *Litsea* is mainly based on morphological characters discussed above (Li et al., 1984):

Sect. *Tomingodaphne* (Bl.) Hook.f.

Deciduous; leaves alternate, penninerved; perianth segments 6; non-enlarged perianth tubes.

Sect. *Litsea*

Evergreen; leaves alternate, penninerved, perianth segments imperfect or lacking; non-enlarged perianth tubes; racemiform inflorescence.

Sect. *Conodaphne* (Bl.) Benth. et Hook. f.

Evergreen; leaves alternate or opposite, penninerved; non-enlarged or enlarged slightly into perianth tubes.

Sect. *Cylicodaphne* (Nees) Hook.f.

Evergreen; leaves alternate, penninerved; enlarged perianth tube; cup-shaped fruit cupule.

The establishment of the infrageneric system in *Lindera* is considered to be the result of the parallel evolution between *Litsea* and *Lindera*, which not only occurred at the generic level but also at the infrageneric level (Figure 2-1.). *Lindera* is divided into eight sections (Tsui, 1987).

Sect. *Daphinidium* (Nees) Benth.

Evergreen; leaves trinerved; non-developed terminal buds on shortened brachyblasts.

Sect. *Uniumbellatae* Tsui

Evergreen; leaves trinerved; the pseudo-umbel with a long peduncle solitary in the axil of a normal leaf.

Sect. *Lindera*

Deciduous; leaves penninerved; developed terminal buds on shortened brachyblasts.

Sect.*Sphaerocarpae* Tsui

Deciduous; leaves triplinerved or trinerved; developed terminal buds on shortened brachyblasts.

Sect. *Palminervia* Meissn.

Deciduous; leaves lobed, trinerved; developed terminal buds on shortened brachyblasts.

Sect. *Cupuliformers* Tsui

Evergreen; leaves penninerved; the glands on the third whorl funnel-shaped; enlarged perianth tubes forming cup-shaped fruit cupule.

Sect. *Aperula* (Bl.) Benth.

Evergreen; leaves penninerved; developed terminal buds on shortened brachyblasts; inflorescence with long peduncle racemiform.

Sect. *Polyadenia* Nees

Evergreen; leaves penninerved; developed terminal buds on shortened brachyblasts.

2.5 Specimens checked

The checked specimens are listed in the Appendix I.

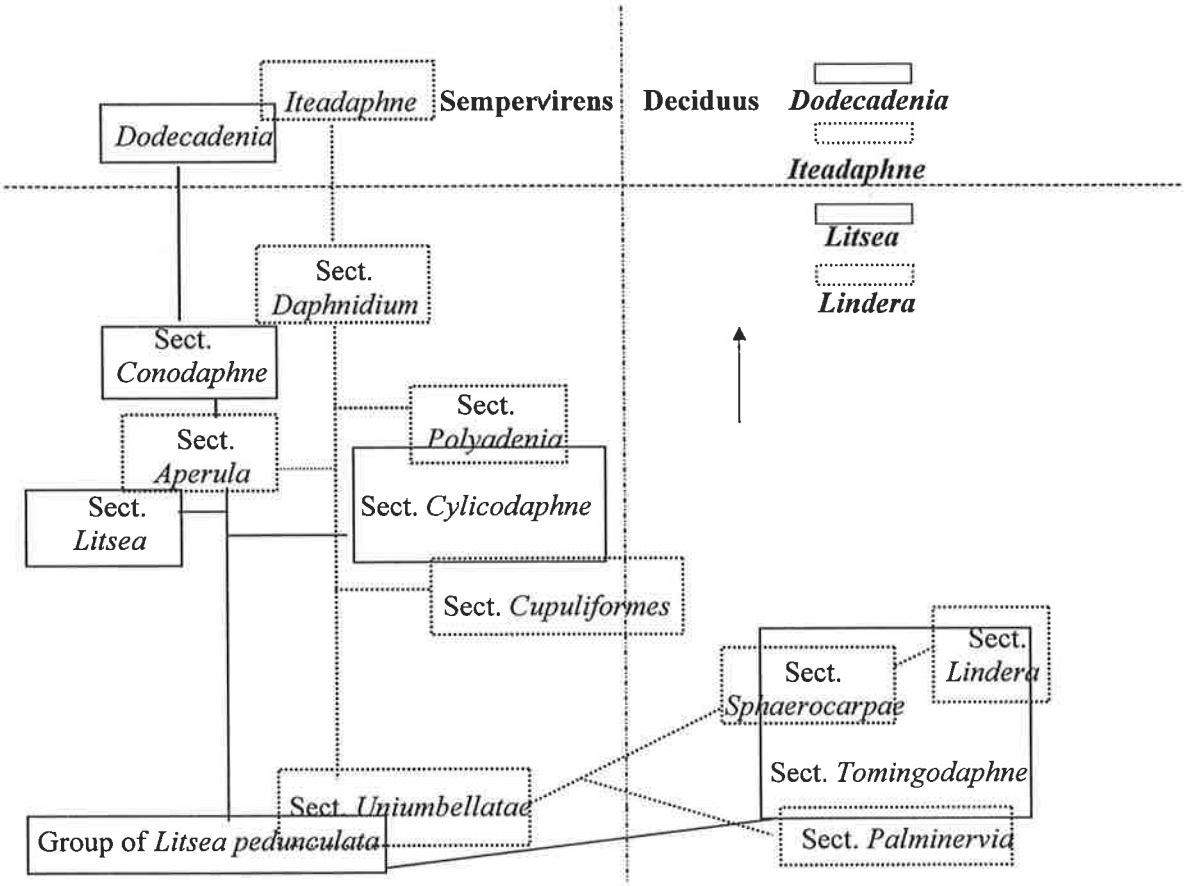


Figure 2-1. A schema showing the infrageneric and generic parallel evolution in *Lindera* and *Litsea* (from Li, 1985)

Chapter Three
Leaf cuticle study

3.1 Introduction

The existing generic and infrageneric classifications in the *Litsea* complex are largely based on floral characters, especially based on androecial characters. This is confirmed to be variable within genera and unreliable for the purpose of generic delimitation (Rohwer, Richter & Werff, 1991). Werff & Richter (1996) stated: "it seems unlikely that a thorough reexamination of floral and fruit characters will yield data with which a more robust classification can be constructed, incorporating new data sets in building a classification looks like a more promising approach". I agree with this statement.

On the basis of their investigation of the Australian *Lauraceae* species Christophel et al. (1996) demonstrated that the use of a suite of leaf cuticular characters applied to a global range of genera and species within *Lauraceae* had great promise, and found that there was little difficulty separating the three genera *Litsea*, *Neolitsea* and *Lindera* based entirely on Australian material. Unfortunately, as they stated, those species represent only a small proportion of the total for the three genera, and lacked outstanding features to separate them. They suggested that the *Litsea* complex could provide a challenge on a global level.

3.2 Materials and methods

The specimens used for this study are loaned from BO, KUN, QRS, SING and TAIF. Most of leaf samples have had their identifications confirmed by several *Lauraceae* specialists such as Hsi-wen Li (Kunming Institute of Botany, the Chinese Academy of Sciences), A.J.G.H. Kostermans (Herbarium Bogoriense, Forest Research Institute) and B.P.M. Hyland (Herbarium Australiense-Atherton). Forty of approximately 100 species in *Actinodaphne*, 52 of approximately 100 species in *Neolitsea*, 61 of about

100 species in *Lindera*, 156 of approximately 200 species in *Litsea* and one species from each oligo- and mono-typic genera have been examined.

The methods of preparing material, making slides and recording characters used by Christophel et al. (1996) were followed in this study. The $1cm^2$ samples were taken from the near base margin on the left-hand side of the mature leaf with the adaxial surface upward. They were put into test tubes and soaked in 80% ethanol overnight. The ethanol was decanted off and ca. 1 ml of 30% H_2O_2 and ca. 0.5 ml of fresh 80% ethanol was added. The test tubes were heated in a boiling water bath for 3 to 10 hours. When the sample turned light yellow to white, it was transferred from the tube to a petri dish with water. The cellular materials of the sample were brushed away with fine artists' brushes. If required, the sample was returned to a test tube and soaked in ethanol following the peroxide heating to complete cleaning the cellular contents. The cuticles were then rinsed in water to adjust pH and then stained with 1.0% Crystal Violet for 10-40 seconds. The stained cuticles were mounted in phenol glycerin jelly. After cleaning excess jelly, the coverslips were ringed with clear nail varnish to retard dehydration.

All leaf cuticular photographs (Plates 1-678) were taken using an Olympus digital camera (DP10) on an Olympus microscope (AX70) with a 40X objective and 10X eyepiece.

Leaf cuticle, which is an inert, extra-cellular secretion of the epidermis, is a protective structure composed of lipids, waxes and cutin, the last being a bipolymer comprising fatty and hydroxy-fatty acids (Wilkinson, 1979). The cuticles studied here are in fact the cuticular membrane on the epidermis or the stomatal complex that remained through the preparation, and the cuticular characters recorded are actually those of epidermis cells or the stomatal complex whose impression is preserved in the membrane. An exception to this is the description of stomatal ledges, which protrude from the cuticular membrane and are often referred to as cuticular ledges (Christophel & Rowett, 1996).

3.3 Leaf cuticle characters

In the following subsections, the descriptions of cuticles of the species studied are presented. Shorthand notation similar to that employed in the formal description is followed here.

3.3.1 Leaf cuticle features in *Actinodaphne*

Actinodaphne acuminata Meissn. (Plate 1, 2)

Publication: in DC. Prod. xv. I. 211. 1864.

Distribution: Japan, Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 12-21 um long, 7-12 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded, becoming elongate over veins, 11-16 um long, 8-10 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall apparently papillate; trichomes very common, simple, unicellular, over veins, c. 50 um long, with apex acute.

Stomates paracytic, S.I. 16.7, 11-14 um long, 10-12 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, very narrow or linear, granulate.

Reference: Slide No. 024(Col. No. 14, QRS-030516).

Actinodaphne albifrons Kostermans (Plate 3, 4)

Publication: in Ceylon J. Sci., Biol. Sci., 9(2): 53 (1971).

Distribution: Sri Lanka.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 12-19 um long, 8-14 um wide; anticlinal wall irregularly thickened, thick, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 14-20 um long, 9-12 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, with 5-8 surrounding cells, with cuticular thickening around pore

Stomates paracytic, S.I. 17.4, 13-15 um long, 10-12 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales double; outer scalesprominent, narrow; inner scales prominent, narrow, granulate.

Reference: Slide No. 025(Waas 1686, QRS-???).

Notes: This species is very different from other *Actinodaphne* species in it s granulate periclinal wall and it s double stomatal scales.

Actinodaphne angustifolia Nees (Plate 5, 6)

Publication: in Wall. Pl. As. Rar. iii. 34.

Distribution: Ind. or Malaya. (Java)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 11-15 um wide; anticlinal wall irregularly thickened, thick; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 16-20 um long, 7-17 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 14.4, 15-17 um long, 14-19 um wide, uniformly distributed; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall irregularly thickening, thin and beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 325 (W.F. Winckel 2348, BO-0104377).

Actinodaphne areolata Blume (Plate 7, 8)

Publication: Mus. Bot. Lugd. Bot. i. 334.

Distribution: Malay Peninsula, state of Johore.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 20-25 um long, 11-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with cuticular

thickening around pore extending along the radial walls of surrounding cells, with 3-5 surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 15-28 um long, 8-17 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 3-5 radially arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 16.7, 10-16 um long, 12-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 240 (E.J.H. Corner 29270, SING-079726).

Actinodaphne bor-neensis Meissn. (Plate 9, 10)

Publication: in DC. Prod. xv. I. 213.

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 11-18 um long, 9-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells undulate, 15-24 um long, 7-12 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; trichome bases common, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.5, 10-12 um long, 14-17 um wide; guard cells sunken; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 316 (Absn Gibot 37056, BO-0104369).

Actinodaphne brassii C.K. Allen (Plate 11, 12)

Publication: in Journ. Arn. Arb. xxiii. 116 (1942).

Distribution: Ins. Solomon.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cell sinuous, 16-25 um long, 12-19 um wide; anticlinal wall thin, smooth, periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous, 15-20 um long, 7-13 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.0, 14-19 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 241 (T.C. Whitemore BSIP 2592, SING-510052).

Actinodaphne conferta Merrill (Plate 13, 14)

Publication: Enum. Philip. Fl. Pl. ii. 190 (1923).

Distribution: Malay.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous (angular to undulate in Slide No. 244), 9-20 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells undulate; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common to very common, trichome simple unicellular, 50-100 um long.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.

References: Slide No. 243 (Austin Guadra A1309, SING-079738); Slide No. 244 (A. Kostermans & Anta 1231, SING-079741).

Actinodaphne cupularis (Hemsl.) Gamble (Plate 15, 16)

Publication: in Kew Bull. 1910. 314.

Distribution: China [Hunan, Hubei, Guangxi (Tianlin), Yunnan (Funing), Guizhou].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 9-15 um long, 5-10 um wide; anticlinal wall thin (irregularly thickened, thick in Slide No. 029), smooth to finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 12-18 um long, 6-11 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 5-8 radial arranged surrounding cells, with cuticular

thickening around pore; trichome simple, unicellular, 30 um long (up to 120 um long inSlide No. 029), with apex acute.

Stomates paracytic, S.I. 12.5, 11-14 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wallfinely papillate; stomatal scales prominent, very narrow or linear.

References: Slide No. 028 (G.F. Li 60116, KUN-0047062); Slide No.029 (G.F. Li 61151, KUN-0047075).

Actinodaphne diversifolia Merrill (Plate 17, 18)

Publication: in Journ. As. Soc. Straits, lxxxv. 191 (1922).

Distribution: Borneo, Sabah.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cell angular to undulate, becoming elongate over veins, 16-23 um long, 12-19 um wide; anticlinal wall thin, smooth to slightly beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore extending along radial walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, becoming elongate over vein, 15-25 um long, 12-15 um wide; anticlinal wall irregularly thickened, finely beaded; periclinal wall irregularly thickened, finely papillate; trichome bases very common, poral, over veins, with 7-9 radially arranged surrounded cells, with cuticular thickening around pore, dark staining; trichomes simple, unbranched, unicellular, to 250 um long, with apex acute.

Stomates paracytic, S.I. 14.3, 15-22 um long, 14-16 um wide, uniformly distributed within areoles, randomly oriented; guard cells sunken, with pore thickening; subsidiary 2; anticlinal wall irregularly thickened, finely beaded; periclinal wall granulate, dark-staining; stomatal scales prominent, narrow, finely papillate.

References: Slide No. DCC-245; Slide No. 246 (W.L. Chow, E.J.H. Corner & A. Stainton 1251, SING-514717); Slide No. 323 (M. Ramos 1838, BO-0104367).

Actinodaphne dolichophylla Merrill (Plate 19, 20)

Publication: Enum. Philip. Fl. Pl. ii. 190 (1923).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 13-19 um long, 10-13 um wide; anticlinal wall irregularly thickened, thin; periclinal wall granulate; trichome bases common, poral, with 4-6

surrounding cells, with cuticular thickening around the pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, 15-25 um long, 7-16 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate, convex, bubble-like; trichome bases common, poral, with cuticular thickening around the pore and extending along the walls of 6-11 surrounding cells.

Stomates paracytic, S.I. 18.4, 14-20 um long, 10-18 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 322 (C.A. Wenzel 7598, BO-0104371).

Notes: this species with convex, bubble-like periclinal wall on abaxial epidermis seems to be unique in genus *Actinodaphne.*

Actinodaphne forrestii (Allen) Kostermans (Plate 21, 22)

Publication: in Reinwardtia, 9(1): 97 (1974).

Distribution: China (Yunnan, SW Guizhou, SW Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 8-10 um long, 5-7 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells sinuous, 10-13 um long, 4-9 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 7-9 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20-100 um long, with apex acute (trichome very common, up to 200 um long in Slide No. 030, 031).

Stomates paracytic, S.I. 13.7, 10-13 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales evident, narrow, finely papillate.

References: Slide No. 030 (KUN-0164074); Slide No. 031 (T.T. Yu 16476, KUN-0047107); Slide No. 032 (C.W. Wang 82744, KUN-0047114).

Actinodaphne foxworthyana L.S. Gibbs (Plate 23, 24)

Publication: in Journ. Linn. Soc., Bot. xlii. 129 (1914).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cell angular, 11-17 um long, 9-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cell, with cuticular thickening around pore and extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular, 12-17 um long, 7-13 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 5-8 radially surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 18.5, 13-18 um long, 15-21 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow to slight wide.
Reference: Slide No. 321 (J. & M.S. Clemens 29247, BO-0104372).

Actinodaphne glabra Blume (Plate 25, 26)
Publication: Mus. Bot. Lugd. Bot. i. 344.
Distribution: Java (E. Borneo).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cell sinuous, 12-22 um long, 10-15 um wide; anticlinal wall irregularly thickening, thin; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular, 15-23 um long, 9-16 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 16.5, 13-15 um long, 12-19 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales narrow, prominent, finelypapillate.
Reference: Slide No. 326 (A. Kostermans 4888, BO-0104380).

Actinodaphne glaucina Allen (Plate 27, 28)
Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 410 (1937).
Distribution: China (Hainan).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular to undulate, 9-15 um long, 7-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, with 4-5

surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, 9-17 um long, 4-7 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, over veins, with 4-7 radial arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 20.0, 9-10 um long, 7-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales evident, linear.

Reference: Slide No. 033 (N.J. Chen 44045, KUN-0047141-Isotype)

Actinodaphne glomerata Nees (Plate 29, 30)

Publication: Syst. Laurin. 597.

Distribution: Java, Sumatra. (Sabah, Singapore, Johore, Borneo).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, undulate to sinuous (slide No. 249), 12-21 um long, 7-20 um wide; anticlinal wall irregular thickened, thin, periclinal wall granulate; trichome bases common, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 13-20 um long, 5-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.1, 12-15 um long, 14-16 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 247 (W.L. Chaw & E.J.H. Corner 4567, SING-515647); Slide No. 248 (J. Sinclair 10846, SING-079742); Slide No. 249 (P.S. Ashton S. 17624, SING-079746); Slide No. 320 (A. Kostermans 5285, BO-0104373).

Actinodaphne henryi Gamble (Plate 31, 32)

Publication: in Kew Bull. 1913, 265.

Distribution: China (S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 7-12 um long, 6-9 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-5 surrounding

cells, with cuticular thickening around pore, sometimes extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, 9-11 um long, 4-9 um wide; anticlinal wall thin, smooth; periclinal wall smooth or granulate; trichome bases common, pore, with 7-9 radial arranged surrounding cells, with cuticle thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 7-10 um long, 6-8 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-557; Slide No. 034 (S.W. Zhao 0240, KUN-0047156); Slide No. 035 (Sino-Russ. Exped. 5883, KUN-0047144).

Actinodaphne hullettii Gamble (Plate 33, 34)

Publication: in Kew Bull. 1910, 314.

Distribution: Peninsula Malaya.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 10-15 um long, 9-13 um wide; anticlinal wall irregularly thickened, thin; periclinal wall granulate; trichome bases common, poral, with 4-5 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, 13-18 um long, 9-17 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, with 5-7 radially arranged surrounding cells, with cuticular thickening along the pore, trichome simple, unicellular, up to 150 um long, with acute apex.

Stomates paracytic, S.I. 17.8, 11-14 um long, 10-15 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 250 (SING-063414)

Actinodaphne koshepangii Chun ex H.T. Chang (Plate 35, 36)

Publication: in Acta Sci. Nat. Univ. Sunyatsenii, 1960(1): 24(1960).

Distribution: China (NW Guangdong, W Hunan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 10-15 um long, 6-9 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall finely papillate.
Abaxial epidermis: epidermal cells sinuous, 12-16 um long, 7-10 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases very rare, with 5-7 surrounding cells, with cuticular thickening around pore; trichome 20-50 um long.
Stomates paracytic, S.I. 11.1, 10-13 um long, 10-12 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.
Reference: Slide No. 038 (L.H. Liu 15428, KUN-0106632).

Actinodaphne kweichowensis Yang et P.H. Huang (Plate 37, 38)
Publication: in Acta Phytotax. Sin., 16(4): 61(1978).
Distribution: China (SW Guangxi, SW Guizhou).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells undulate, 7-12 um long, 5-10 um wide; periclinal wall irregularly thickened, thin, finely beaded; periclinal wall finely papillate.
Abaxial epidermis: epidermal cells sinuous, 8-24 um long, 5-10 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, pore, with 8-10 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 80-200 um long, with apex acute.
Stomates paracytic, S.I. 16.0, 10-16 um long, 10-12 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.
References: Slide No. 036 (H.C. Li 40210, KUN-0106644); Slide No. 037 (Guizhou Exped. 2421, KUN-0104787).

Actinodaphne lancifolia Meissn. (Plate 39, 40)
Publication: in DC. Prod. xv. I. 211.
Distribution: Japan.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 6-12 um long, 6-8 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.
Abaxial epidermis: epidermal cells sinuous, 10-18 um long, 5-8 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate.

Stomates paracytic, S.I. 13.5, 9-11 um long, 5-8 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; stomatal scales prominent, linear.

Reference: Slide No. 039 (H. Ohashi & K. Sohma 10586, KUN-0047168).

Actinodaphne lecomtei Allen (Plate 41, 42)

Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 399, 413(1937).

Distribution: China [Sichuan, Guizhou, Guangdong (Luyuang)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 8-15 um long, 6-10 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells undulate to sinuous, 10-14 um long, 5-7 um wide; anticlinal wall thin finely beaded; periclinal wall finely papillate; trichome bases common, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20-40 um long, with apex acute.

Stomates paracytic, S.I. 17.4, 10-12 um long, 8-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

References: Slide No. 040 (G.H. Yang 57479, KUN-0047165); Slide No. 041 (G.H. Yang 57471, KUN-0047175).

Actinodaphne macrophylla (Bl.) Nees (Plate 43, 44)

Publication: Sys. Laurin. 598.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 17-20 um long, 13-15 um wide; anticlinal wall irregularly thickening, smooth to beaded; periclinal wall granulate; trichome bases common, poral, over veins, with cuticle thick around pore and sometimes extending along the radial walls of the surrounding cells, with 4-6 surrounding cells.

Abaxial epidermis: epidermal cells rounded to angular, 15-20 um long, 8-15 um wide; anticlinal wall irregularly thickening, finely beaded; periclinal wall finely papillate; trichome bases rare to very common (in Slide No. 251), poral, with 5-7 surrounding cells, with cuticle thickening around pore, trichome simple, unicellular, up to 300 um long, with acute apex.

Stomates paracytic, S.I. 14.3, 15-22 um long, 13-18 um wide; guard cell sunken; subsidiary cells 2; anticlinal wall irregularly thickened, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 270 (Hyland. B. 14202, QRS-?); Slide No. 251 (SING-081755); Slide No. 319 (BO-0104382).

Actinodaphne macroptera Miq. (Plate 45, 46)

Publication: Fl. Ind. Bot. i. I. 970.

Distribution: Sumatra (SW Java).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 11-20 um long, 9-14 um wide; anticlinal wall irregularly thickened, thin; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-20 um long, 8-14 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.5, 14-16 um long, 15-17 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 318 (Kostermans 101, BO-0104374).

Actinodaphne maingayi Hook. f. (Plate 47, 48)

Publication: Fl. Brit. Ind. v. (1886) 151.

Distribution: Malaya (Borneo).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 13-16 um long, 8-13 um wide; anticlinal wall irregularly thickened; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular (Slide No. 265, 317) to undulate, 14-22 um long, 8-15 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common to very common (in Slide No. 265), poral, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.7, 12-15 um long, 10-16 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 252 (F.H. Endert 3330, SING-079757); Slide No. 253 (Kostermans 6954, SING-079758); Slide No. 317 (BO-0104383); Slide No. 265 (Ngaviman s.n., SING-079753).

Actinodaphne malaccensis Hook. f. (Plate 49, 50)

Publication: Fl. Brit. Ind. V. (1886) 145.

Distribution: Malacca (Borneo).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 20-26 um long, 15-19 um wide; anticlinal wall irregularly thickening; periclinal wall granulate; trichome bases rare, poral, with 46 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 16-25 um long, 9-17 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases rare, poral, with 46 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.0, 15-19 um long, 14-17 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 254 (Daud & Tachun 36060, SING-079748).

Actinodaphne montana Gamble (Plate 51, 52)

Publication: in Kew Bull. 1910, 132.

Distribution: Peninsula Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 12-22 um long, 10-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 radially arranged surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate to sinuous, 15-17 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 58 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Stomates paracytic, S.I. 16.8, 12-14 um long, 12-14 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow to slightly wide.
Reference: Slide No. 255 (Kiah 35069, SING-063397).

Actinodaphne multiflora Benth. (Plate 53, 54)
Publication: in Hook. Lond. Journ. Bot. ii. (1843): 230.
Distribution: Island Fiji.
Leaf cuticle:
Adaxial epidermis: epidermal cells sinuous, 15-20 um long, 10-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular to undulate, 13-18 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 19.2, 13-15 um long, 14-16 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales narrow, prominent.
Reference: Slide No. 315 (D.R. Pleyte 855, BO-0034461).

Actinodaphne myriantha Merrill (Plate 55, 56)
Publication: in Univ. Calif. Publ. Bot. xv. 78 (1929).
Distribution: Borneo, Sarawak.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 12-21 um long, 10-18 um wide; anticlinal wall irregularly thickened, thin; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with some cuticular thickening around pore, dark-staining.
Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 15-18 um long, 10-14 um wide; anticlinal wall irregularly thickened, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.
Stomates paracytic, S.I. 16.3, 10-15 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall irregularly thickened, finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. DCC-587.

Actinodaphne nitida Teschn. (Plate 57, 58)

Publication: in Engl. Jahrb. lviii. 384 (1923)

Distribution: New Guinea.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 15-25 um long, 12-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 3-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate or angular (Slide No. 259), 12-22 um long, 10-18 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, with cuticular thickening around pore, with 4-6 surrounding cells.

Stomates paracytic, S.I. 21.1, 14-16 um long, 12-17 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow.

References: Slide No. 256 (n-7728, SING-79761); Slide No. 314 (LAE 52149, BO-0104366).

Actinodaphne obovata (Nees) Bl. (Plate 59, 60)

Publication: Mus. Bot. Lugd. Bot. 1: 342. 1851.

Distribution: China (S to SE Yunnan, ES Tibet), India.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-12 um long, 4-10 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, pore, with 4-6 surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate (delimitation among cells unclear); anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, pore, with cuticular thickening around pore; trichome simple, unicellular, 50-120 um long, with apex acute.

Stomates: guard cells sunken; subsidiary cells 2, anticlinal wall beaded; periclinal wall irregularly thickened, finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 042 (K.M. Feng 5138, KUN-0047197); Slide No. 234 (Jie Li 007); Slide No. 235 (P.Y. Mao 653)

Actinodaphne oleifolia Gamble (Plate 61, 62)

Publication: in Kew Bull. 1910. 313.

Distribution: Penins. Mal.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate (Slide No. 259), 23-30 um long, 14-21 um wide; anticlinal wall irregularly thickened, thin; periclinal wall granulate; trichome bases common, poral, with 3-6 surrounding cell, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous, angular seen in Slide No. 259; anticlinal wall thin, beaded, (smooth in Slide No. 259); periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.1, 13-15 um long, 13-19 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

References: Slide No. 257 (L. Moysey & Krah 31822, SING-063420); Slide No. 258 (R.E. Horhum 20725, SING-063419); Slide No. 259 (13720, SING-079763); Slide No. 313 (H. Hallier 2899, BO-23938).

Actinodaphne omeiensis (Liou) Allen (Plate 63, 64)

Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 411 (1937).

Distribution: China [Sichuan, Guizhou (Fangjin Mt.)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 8-13 um long, 6-8 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 8-12um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases rare, pore, with 5-7 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 11.8, 10-11 um long, 8-10 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, linear.

References: Slide No. 043 (Zhao 183, KUN-0047238); Slide No. 044 (G.H. Yang 55580, KUN-0047253).

Actinodaphne pilosa (Lour.) Merr. (Plate 65, 66)

Publication: in Trans. Am. Phil. Soc. n.s. xxiv. II. 165 (1935)

Distribution: China (Guangdong, S Guangxi), Vietnam, Laos.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-10 um long, 6-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, pore, with 4-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells

Abaxial epidermis: epidermal cells angular to undulate, 9-12 um long, 5-8 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, pore, with 6-8 surrounding cells, with cuticular thickening around pore, dark-staining; trichome simple, unicellular, 60-150 um long, with apex acute.

Stomates paracytic, S.I. 20.0, 8-10 um long, 7-8 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales doubles, outer scales prominent, narrow; inner scales prominent, narrow, granulate.

References: Slide No. 045 (Xuwen Exped. 82, KUN-0047267); Slide No. 046 (Z.B. Zhang 13000, KUN-0047270).

Actinodaphne pruinosa Nees (Plate 67, 68)

Publication: in Wall. Pl. As. Rar. ii. 68.

Distribution: Indonesia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular or undulate, becoming elongate over veins, 14-21um long, 10-15um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cell angular, becoming elongate over veins, 10-27um long, 10-13 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, over veins, with 4-7 surrounding cells, with cuticular thickening around the pore extending along the radial walls of surrounding cells

Stomates paracytic, S.I. 17.0, 13-17um long, 11-13um wide, uniformly distributed within areoles, randomly oriented; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow.

References: Slide No. DCC-584; Slide No. 312 (J.A.R. Anderson S. 25437, BO-0104546).

Actinodaphne ridleyi Gamble (Plate 69, 70)

Publication: in Kew Bull. 1910, 312.

Distribution: Peninsular Malaysia; Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 20-36 um long, 15-24 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-5 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 17-26 um long, 11-18 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-7 radially arranged surrounding cell, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.5, 12-15 um long, 15-18 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 261 (12165, SING-079768).

Actinodaphne sesquipedalis Hook.f. (Plate 71, 72)

Publication: Fl. Brit. Ind. V. (1886) 151.

Distribution: Malaya.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 11-22 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 3-5 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate (sinuous in Slide No. 263), anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like (flattened in Slide No. 263), finely papillate; trichome bases common, poral, with 6-8 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I., 14-16 um long, 10-14 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall finely papllate, stomatal scales narrow, prominent.

References: Slide No. 263 (Md. Shah & Noor 714, SING-501526); Slide No. 264 (J. Sinchair 39330, SING-079770); Slide No. 311 (J. Sinchair 40098, BO-0104504).

Notes: there are many differences among the three slides, especially on the abaxial periclinal wall. Convex periclinal wall can be seen in Slide No. 311, 264, but cannot be found in slide No. 263. It is reasonable to doubt whether they belong to the same species because of its convex periclinal walls.

Actinodaphne sphaerocarpa Nees (Plate 73, 74)

Publication: Syst. Laurin. 605.

Distribution: Java, Selangor (Malaysia).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 13-22 um long, 8-15 um wide; anticlinal wall thin, irregularly thickened; periclinal wall granulate; trichome bases common in slide No. 10, with 4-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 10-17 um long, 7-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common in slide No. 10, poral, over veins, with 4-6(7) surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.6, 10-15 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2, anticlinal wall thin, finely beaded; periclinal wall granulate, stomatal scales prominent, narrow.

References: Slide No. DCC-10; Slide No. 310 (Kds 38941, BO-0034535).

Actinodaphne tayabensis Merrill (Plate 75, 76)

Publication: Enum. Philipp. Fl. Pl. ¡i. 191 (1923).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular or undulate, 12-20 um long, 10-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 8-14 um long, 10-12 um wide; anticlinal wall thin, finely beaded; periclinal wall slightly convex, finely papillate, trichome bases common, poral, with 6-8 radially arranged surrounding cells, with cuticular thickening and extending along the walls of the surrounding cells.

Stomates paracytic, S.I., 10-13 um long, 10-13 um wide; guard cells sunken, with poral thickening; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 262 (M.D. Soltis s.n., SING-079782).

Actinodaphne trichocarpa Allen (Plate 77, 78)

Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 402 (1937).

Distribution: China (Sichuan, Guizhou, NE to E Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 6-14 um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells angular to undulate, 8-11 um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 14.3, 10 um long, 7-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate;stomatal scales prominent, linear.

References: Slide No. 047 (S.L. Sun 1571, KUN-0047298); Slide No. 048 (Water Exped. 00557, KUN-0164247).

Actinodaphne tsaii Hu (Plate 79, 80)

Publication: in Bull. Fan Mem. Inst. Biol. v. 307 (1934).

Distribution: China (S to SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 6-10 um long, 5-7 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, pore, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surround cells.

Abaxial epidermis: epidermal cells undulate to sinuous, 8-12 um long, 4-6 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases common, pore, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 15.4, 9-11 um long, 5-8 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. 049(K.M. Feng 13881, KUN-0047312); Slide No. 050(K.M. Feng 22638, KUN-0047318).

3.3.2 Leaf cuticle features in *Neolitsea*

Neolitsea aciculata Koidz (Plate 81, 82)

Publication: in Bot. Mag., Tokyo, 1918, xxxii.258

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 17-32 um long, 15-21 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with some cuticular around pore.

Abaxial epidermis: epidermal cells undulate to sinuous, elongate over veins, 15-24 um long, 7-14 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 5-7 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 16.7, 15-23 um long, 14-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall irregularly thickened, granulate; stomatal scale double, outer scales prominent, narrow, granulate, inner scales prominent, narrow, granulate.

Reference: Slide No. DCC-001.

Neolitsea acuminatissima (Hay.) Kanehira & Sasaki (Plate 83, 84)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1930. 20: 381.

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 13-19 um long, 10-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along radial walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, becoming elongate over veins, 11-22 um long, 6-13 um wide; anticlinal wall thin and finely beaded; periclinal wall granulate; trichome bases very common, poral, with 5-8 radially arranged surrounded cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 16.0, 15-20 um long, 15-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall irregularly thickening, granulate; Stomatal scales prominent, double, granulate.

References: Slide No. DCC-480; Slide No. 285 (C.M. Wang 001020, TAIF- 077926).

Neolitsea acutotrinervia (Hay.) Kanehira et Sasaki (Plate 85, 86)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1930, 20: 381.

Distribution: C to N Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 11-17 um long, 9-14 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, 12-17 um long, 6-13 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases very common, poral, with 5-8 surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, 50-150 um long, with acute apex.

Stomata paracytic, S.I. 22.2, 14-16 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double.

Reference: Slide No. 284 (Chuoh-Chang Chen s.n., TAIF- 077286)

Neolitsea australiensis Kosterm. (Plate 87, 88)

Publication: in Brunonia, 2(1): 93 (1979)

Distribution: Australia (Queensland, N. Territory., New South Wales).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to sinuous, becoming elongate over veins, 18-22 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 13-22 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Stomates paracytic, S.I. 15.0, 14-16 um long, 10-13 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, butterfly-shaped, granulate.

References: Slide No. DCC-005; Slide No. 016(Jone s.n., QRS-082304); Slide No. 017(N.S.W. 151982, QRS-?); Slide No. 018(P.I. Forster 2132, QRS-?); Slide No. 019(P.R. Sharpe 3663, QRS-?).

Neolitsea brassii C.K. Allen (Plate 89, 90)

Publication: in Journ. Arn. Arb. xxiii. 118 (1942).

Distribution: New Guinea and Australia (N and NE Australia).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded, 14-36 um long, 14-20 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 18-28 um long, 8-20 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Stomates paracytic, S.I. 17.2, 12-21 um long, 12-22 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, butterfly-shaped.

References: Slide No. DCC-1252; Slide No. 020(B. Gray 869, QRS-???); Slide No. 021(B. Gray 1294, QRS-???); Slide No. 022(B. Gray 4030, QRS-???); Slide No. 023(B. Gray 4175, QRS-???).

Neolitsea buisanensis Yamamoto & Kamikoti (Plate 91, 92)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1932, 22: 411.

Distribution: S China (S Taiwan, Hainan, and S Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to angular, 15-25 um long, 11-15 um wide; anticlinal wall thick, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 11-20 um long, 10-16 um wide; areoles evident; anticlinal wall irregularly thickened, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 18.2, 15-20 um long, 13-15 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; stomatal scales prominent, double; granulate.

References: Slide No. DCC-478; Slide No. 282 (Chiou W.L. 015, TAIF-077275); Slide No. 283 (Sheng-Chieh Wu 1235, TAIF-083597).

Neolitsea cambodiana Lecomte (Plate 93, 94)

Publication: in Lecomte, Not. Syst. ii. 335 (1913).

Distribution: China (Fujian, S Jiangxi, Hunan, Guangxi, Guangdong); Cambodia; Laos.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 21-23 um long, 14-21 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases rare, pore, with 4-6 surrounding cells, with cuticle thickening around pore, the surrounding cells angular to rounded.
Abaxial epidermis: epidermal cells sinuous, 18-26 um long, 10-17 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 7-9 surrounding cells, with cuticle thickening around pore; trichome simple, unicellular, 150-200 um long, with apex acute.
Stomates paracytic, S.I. 16.0, 16-20 um long, 15-19 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.
Reference: Slide No.105 (P.X. Tan 60071, KUN-106410).

Neolitsea cambodiana var. *glabra* Allen (Plate 95, 96)
Publication: in Ann. Miss. Bot. Gard. 25: 418. 1938.
Distribution: China (Fujian, Guangxi, Guangdong).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 18-26 um long, 14-18 um wide; anticlinal wall thick, smooth; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular to undulate, 19-32 um long, 12-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.
Stomates paracytic, S.I. 19.4, 16-20 um long, 12-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.
Reference: Slide No.106 (S.Q. Chen 16035, KUN-0106434).

Neolitsea cassia (L.) Kosterm. (Plate 97, 98)
Publication: in Journ. Sci. Res., Indonesia, i, 85 (1952).
Distribution: Ceylon.
Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 15-19 um long, 13-17 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells rounded to angular, becoming elongate over veins, 15-29 um long, 10-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, over veins, with 5-7 surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 12.6, 11-16 um long, 10-15 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth; stomatal scales prominent, double.
Reference: Slide No. DCC-835.

Neolitsea cassiaefolia Merrill (Plate 99, 100)
Publication: Interpr. Rumph. Herb. Amboin. 237 (1917).
Distribution: Ins. Phillip. (Palawan)
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 17-26 um long, 11-17 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells undulate, 16-22 um long, 8-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate.
Stomates paracytic, S.I. 16.7, 13-16 um long, 14-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, butterfly-shaped.
Reference: Slide No. 333 (Kostermans 11138, BO-004522).

Neolitsea chrysotricha H.W. Li (Plate 101, 102)
Publication: in Acta Phytotax. Sin., 16(4): 40 (1978).
Distribution: China (W Yunnan).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 18-26 um long, 12-15 um wide; anticlinal wall thick, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 3-6 surrounding cells, with cuticle thickening around pore.

Abaxial epidermis: epidermal cells angular, 11-19 um long, 9-13 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 16.7, 14-17 um long, 15-18 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 107 (S.G. Wu 7095, KUN-0106438).

Neolitsea chuii Merr. (Plate 103, 104)

Publication: in Lingnan Sci. Journ. 7: 306 (1930).

Distribution: China (Guangdong, Guangxi, Hunnan, Jiangxi, SE Yunnan)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-25 um long, 10-17 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticle thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 17-25 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.4, 14-18 um long, 12-19 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded, irregularly thickened; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 108 (P.X. Tan 58740, KUN-0106484).

Neolitsea coccinea B. C. Stone (Plate 105, 106)

Publication: in Malaysian Forester, 43(2): 245 (1980).

Distribution: Malaya.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 8-15 um wide; anticlinal wall thick, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-26 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases very common, poral, with 46 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomata paracytic, S.I. 19.3, 14-18 um long, 12-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales prominent, wide, double.

Reference: Slide No. 266 (H.C. Roberison s.n., SING-059817).

Neolitsea confertifolia (Heml.) Merr. (Plate 107, 108)

Publication: in Lingnan Sc. Journ. 1936, xv. 419.

Distribution: China (N Guangdong, NE Guangxi, Sichuan, Guizhou, SE Shangxi, SW Henan, Hubei, S Hunnan, W Jiangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 20-24 um long, 12-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded, 12-20 um long, 10-14 um wide; anticlinal wall thin, finely beaded; periclinal wall apparently papillate; trichome bases common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.6, 13-15 um long, 14-15 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall apparently papillate;stomatal scales prominent, narrow, papillate.

Reference: Slide No. 109 (X.P. Gao 53971, KUN-0106507).

Neolitsea daibuensis Kamikoti (Plate 109, 110)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1932, xxii. 411.

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 14-21 um long, 8-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 46 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate to sinuous, 17-21 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.3, 13-18 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, butterfly-shaped.

Reference: Slide No. 281 (Kuoh-Chang Chen 358, TAIF-077254).

Neolitsea ellipsoidea Allen (Plate 111, 112)

Publication: in Ann. Missouri Bot. Gard. 1938. xxv. 428 (1937).

Distribution: China (Hainan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 17-22 um long, 10-15 um wide; anticlinal wall thick, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 12-16 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 17.1, 15-18 um long, 12-15 um wide; uniformly distributed within areoles; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 110 (N.J. Chen 44131, KUN-0106562).

Neolitsea fuscata (Thwait.) Alston (Plate 113, 114)

Publication: in Trimen, Handbook Fl. Ceylon, vi. Suppl., 248 (1931).

Distribution: Ceylon.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 13-18 um long, 8-11 um wide; anticlinal wall irregularly thickened, thick, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with some cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 10-22 um long, 6-10 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome

bases common, poral, over veins, with 5-7 radially arranged surrounding cells and cuticular thickening around pore, trichome simple, unicellular, 100-200 um long, with acute apex.
Stomates paracytic, S.I. 17.9, 14-19 um long, 13-15 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall irregularly thickened, finely papillate; stomatal scales prominent, narrow, granulate.
References: Slide No. DCC-629; Slide No. 332 (Kostermans 23395, BO-0104524).

Neolitsea gilva Koids (Plate 115, 116)
Publication: in Bot. Mag., Tokyo, 1918. xxxii: 257.
Distribution: Bonin Islands or Ogasawara Islands (Japan)
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 12-20 um long, 10-14 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular to ungulate, becoming elongate over veins, 15-25 um long, 6-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 5-7 radially arranged surrounding cells and cuticular thickening around pore extending along the radial walls of surrounding cells.
Stomates paracytic, S.I. 14.3, 13-18 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.
Reference: Slide No. DCC-624.

Neolitsea hainanensis Yang et P.H. Huang (Plate 117, 118)
Publication: in Acta Phytotax. Sin., 16(4): 43 (1978).
Distribution: China (Hainan).
Leaf cuticle: Amphistomatic.
Adaxial epidermis: epidermal cells angular, 15-25 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular, 18-21 um long, 12-18 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 18.5, 15-18 um long, 12-15 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent; butterfly-shaped, granulate.

Reference: Slide No. 111(X.Q. Liu 27249, KUN-0106559).

Notes: few stomates are distributed on the adaxial epidermis.

Neolitsea hiiranensis Liu & Liao (Plate 119, 120)

Publication: in Quart. J. Taiwan Mus., 24(3-4): 411 (1971).

Distribution: S Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 11-18 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall irregularly thickened, granulate; trichome bases rare, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 12-16 um long, 10-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 5-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 15.8, 13-16 um long, 10-15 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales, prominent, narrow.

References: Slide No.DCC-494; Slide No.280 (Shu-Mei Liu 246, TAIF-075902)

Neolitsea homilantha Allen (Plate 121, 122)

Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 419 (1937).

Distribution: China (Yunnan, Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-17 um long, 8-16 um wide; anticlinal wall thick, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells, surrounding cells light-staining.

Abaxial epidermis: epidermal cells angular to undulate, 12-18 um long, 10-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticle thickening around pore and extending along the walls of surrounding cells; trichome simple, unicellular, 150 um long, with apex acute.

Stomates paracytic, S.I. 16.3, 14-19 um long, 12-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.
Reference: Slide No. 112 (H.T. Tsai 58-8514, KUN-0106573).

Neolitsea hsiangkweiensis Yang et P.H. Huang (Plate 123, 124)
Publication: in Acta Phytotax. Sin., 16(4): 41 (1978).
Distribution: China (W Guangxi, S Hunnan).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 17-24 um long, 13-32 um wide; anticlinal wall irregularly thickened, thin, finely beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells undulate; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, trichome simple, unicellular, 50 um long.
Stomates paracytic, guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.
Reference: Slide No. 113 (L.H. Liu 9756, KUN-0106604).

Neolitsea incana Elmer (Plate 125, 126)
Publication: Leaflets Phillip. Bot. v. 1794 (1913).
Distribution: Ins. Phillip. (Palawan)
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 18-26 um long, 14-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular to undulate; anticlinal wall thin, smooth; periclinal wall granulate; trichome common, poral, with cuticular thickening around pore.
Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow or linear.
Reference: Slide No. 331 (A.D.E. Elmer 13184, BO-0104525).

Neolitsea intermedia Elmer (Plate 127, 128)
Publication: Leaflets Phillip. Bot. ii. 382 (1908).
Distribution: Ins. Phillip.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 19-23 um long, 10-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 3-5 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-23 um long, 8-16 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 21.1, 13-16 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate;stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 334 (A.D.E. Elmer 17231, BO-0104526).

Neolitsea kedohensis Gamble (Plate 129, 130)

Publication: in Kew Bull. 1911. 172.

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 22-33 um long, 16-25 um wide; anticlinal wall irregularly thickening, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells rounded, 11-21 um long, 7-15 um wide; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, granulate; trichome bases common, poral ,with 5-8 surrounding cells and cuticular thickening around pore, trichome simple, unicellular, 50-100 um long, with acute apex.

Stomata paracytic, S.I. 21.7, 12-16 um long, 7-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow.

References: Slide No. 267 (Evan & Gorden 30, SING-063371); Slide No. 268 (T. Thppenice s.n., SING-063370).

Neolitsea konishii (Hay.) Kanehira & Sasaki (Plate 131, 132)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1930. xx: 381

Distribution: Taiwan; Ryokyu Islands (Japan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 15-23 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells.

Abaxial epidermis: epidermal cells undulate; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases rare, poral.

Stomates paracytic; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales linear.

References: Slide No. DCC-437; Slide No. 279 (Kuoh-Chang Chen 327, TAIF-077230).

Neolitsea lancifolia Kostermans (Plate 133, 134)

Publication: in Ceylon J. Sci., Biol. Sci., 9(2): 55 (1971).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 11-16 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 11-16 um long, 7-12 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.7, 12-14 um long, 11-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 330 (Kostermans & Wirawan 830, BO-0104528).

Neolitsea latifolia S. Moore (Plate 135, 136)

Publication: in Journ. Bot. 1925. lxiii. Suppl. 89.

Distribution: Ins. Phillipines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-19 um long, 11-15 um wide; anticlinal wall thick, smooth; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 13-19 um long, 9-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, with 4-6 radially

arranged surround cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Stomates paracytic, S.I. 19.3, 12-15 um long, 15-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 329 (BO-0104530).

Neolitsea levinei Merrill (Plate 137, 138)

Publication: in Philipp. Journ. Sc., Bot. 1918, xiii: 138.

Distribution: China (Guangdong, Guangxi, Hunan, Hubei, Jiangxi, Fujian, Sichuan, Guizhou and Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 14-18 um long, 9-13 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 17-20 um long, 8-14 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, wit h5-7 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 5-200 um long, with apex acute.

Stomates paracytic, S.I. 16.2, 14-17 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 237 (K.M. Feng 1298, KUN-01006608).

Neolitsea lunglingensis H.W. Li (Plate 139, 140)

Publication: in Acta Phytotax. Sin., 16(4): 40 (1978).

Distribution: China (W Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 14-22 um long, 10-17 um wide; anticlinal wall thick, finely beaded; periclinal wall granulate; trichome bases rare, with 5-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 11-21 um long, 9-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, with 5-7 radial

arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 12-16 um long, 12-17 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 114 (W.Q. Ying 60-1234, KUN-0108291).

Neolitsea novo-guinensis (Teschn.) Merrill (Plate 141, 142)

Publication: in Journ. Arn. Arb. xxix. 201 (1948).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-22 um long, 12-17 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 17-22 um long, 11-14 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 18.4, 10-12 um long, 11-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

References: Slide No. 328 (E.F. de Vogel 4157, BO-0104531); Slide No. 327 (L.J. Bras & Versteegh 11155, BO-0104532).

Neolitsea oblongifolia Merr. et Chun (Plate 143, 144)

Publication: in Sunyatsenia, ii. 234 (1935).

Distribution: China [Hainan, Guangxi (Ningming, Gongmu Mt.)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 13-21 um long, 11-17 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 13-18 um long, 9-12 um wide; anticlinal wall thin, beaded; periclinal wall bubble-like, convex; trichome bases common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickened around pore extending along the radial walls of surrounding cells.

Stomates S.I. 15.4, 14-19 um long, 13-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 115 (L. Deng 3070, KUN-0108298).

Neolitsea obtusifolia Merr. (Plate 145, 146)

Publication: in Lingnan Sc. Journ. xiv. 6 (1935).

Distribution: China (Hainan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-25 um long, 10-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 13-20 um long, 9-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 15.4, 14-19 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales double, granulate.

Reference: Slide No. 116(S.Q. Chen 10437, KUN-0108306).

Neolitsea ovatifolia Yang et P.H. Huang var. *puberula* Yang et P.H. Huang (Plate 147, 148)

Publication: in Acta Phytotax. Sin., 16(4): 44 (1978).

Distribution: China (SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 17-19 um wide; anticlinal wall thick, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 10-17 um long, 10-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 12-15 um long, 12-14 um wide; uniformly distributed within areoles; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales butterfly-shaped, granulate.

Reference: Slide No. 117 (P.Y. Mao 3875, KUN-0108307).

Neolitsea pallens (D. Don) Momiyama & Hara (Plate 149, 150)

Publication: in J. Jap. Bot. 47(9): 269 (1972).

Distribution: China (S Tibet, Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 11-20 um long, 10-12 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 11-22 um wide; 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.9, 13-15 um long, 15-22 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 119 (Qing & Tibet Exped. 6053, KUN-0108359).

Neolitsea parvigemma (Hay.) Kanehira et Sasaki (Plate 151, 152)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1930, xx: 381

Distribution: S & C Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 14-20 um long, 10-13 um wide; anticlinal wall thin and finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 14-20 um long, 9-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 17.4, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall irregularly thickened, granulate; stomatal scales prominent, butterfly-shaped, granulate.

References: Slide No. 277 (Kuoh-Chang Chen 335, TAIF-077713); Slide No. 278 (Chi-shou Yang 236, TAIF-071636).

Neolitsea phanerophlebia Merr. (Plate 153, 154)

Publication: in Lingnan Sc. Journ. vii. 305 (1931).

Distribution: China (Guangdong, Guangxi, Hunan, Jiangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 13-22 um long, 12-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases very rare, with 3-5 surrounding cells, cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 12-20 um long, 11-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, with 5-7 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 16.7, 15-17 um long, 14-16 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall irregularly thickened, thin, finely beaded; periclinal wall flange (cuticular collar surrounding guard cells); stomatal scales prominent, narrow, granulate.

Reference: Slide No. 118 (Z.F. Wei 120137, KUN-0108339).

Notes: This species is characterised by its flanged stomatal periclinal wall.

Neolitsea pingbiensis Yang et P.H. Huang (Plate 155, 156)

Publication: in Acta Phytotax. Sin., 16(4): 38 (1978).

Distribution: China (SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 14-23 um long, 10-16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 16-25 um long, 9-13 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 21.2, 14-20 um long, 13-18 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 121(P.Y. Mao 4139, KUN-0108220).

Neolitsea pinninervis Yang et P.H. Huang (Plate 157, 158)

Publication: in Acta Phytotax. Sin., 16(4): 38 (1978).

Distribution: China (N Guangdong, Guangxi, Hunan, Guizhou).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-28 um long, 12-18 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 13-22 um long, 8-17 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 16.7, 12-15 um long, 15-22 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 120(S.Q. Chen 10635, KUN-0108231).

Neolitsea polycarpa H. Liou (Plate 159, 160)

Publication: Laurac. Chine et Indochine, 150 (1932).

Distribution: China (SE Yunnan); Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 12-23 um long, 10-20 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 12-20 um long, 16-25 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, with 5-7 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells..

Stomates paracytic, S.I. 17.4, 15-22 um long, 14-23 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 122 (H.T. Tsai 51551, KUN-0108237).

Neolitsea pulchella (Meissn.) Merr. (Plate 161, 162)

Publication: in Philipp. Journ. Sc., Bot. 1918, xiii, 137.

Distribution: China [Guangdong, Guangxi (Ningming, Gongmu Mt.), Fujian (Nanjin)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 16-22 um long, 10-15 um wide; anticlinal wall thick, smooth to finely beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 12-24 um long, 9-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 13.8, 14-17 um long, 15-19 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 123 (P.X. Tan 58699, KUN-0108204).

Neolitsea sericea (Bl.) Koidz. (Plate 163, 164)

Publication: in Bot. Mag., Tokyo, 1926, xl. 343.

Distribution: China [Zhejiang (Zhoushan), Shaihai (Chongming)]; Korea; Japan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 11-16 um long, 9-14 um wide; anticlinal wall thick, smooth to finely beaded; periclinal wall granulate; trichome bases very common, poral, with 5-7 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-18 um long, 9-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases very common, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.7, 11-14 um long, 12-15 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wal granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. 124 (H. Migo s.n., KUN-0108209); Slide No. 275 (Kuoh-Chang Cheng 353, TAIF-077423); Slide No. 276 (Kuoh-Chang Cheng s.n., TAIF-077411)

Neolitsea sericea (Bl.) Koidz. var. *aurata* (Hay.) Hatusima (Plate 165, 166)

Publication: Fl. Ryukyu: 289 (1971).

Distribution: China (Fujian, Jiangsu, Jiangxi, Hunan, Hubei, Guangdong, Guangxi, Sichuan, Guizhou, Yunnan, Taiwan) and Japan

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 10-20 um long, 11-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with cuticular thickening around pore sometimes extending along radial walls of surrounding cells, with 4-6 radially arranged surrounding cells.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 14-18 um long, 6-10 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases very common, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 20.0, 14-18 um long, 11-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall irregularly thickened, granulate; stomatal scales prominent, slightly broad, granulate.

References: Slide No. DCC-492; Slide No. 274 (S.Y. Lu 10136, TAIF-067550).

Neolitsea shiangningensis Yang et P.H. Huang (Plate 167, 168)

Publication: in Acta Phytotax. Sin., 16(4): 44 (1978).

Distribution: China (Hunan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 18-27 um long, 13-20 um wide; anticlinal wall thick, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 15-28 um long, 10-13 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall convex, granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.8, 10-13 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; periclinal wall smooth; stomatal scales double, granulate.

Reference: Slide No. 125 (S.Q. Chen 17137, KUN-0108175).

Neolitsea sutchuanensis Yang (Plate 169, 170)

Publication: in Journ. W. China Border Research Soc., Ser. B. xv. 82 (1945).

Distribution: China (Sichuan, Guizhou, Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 15-27 um long, 9-13 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 15-25 um long, 9-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 16.7, 14-18 um long, 14-19 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, outer and inner scales narrow, granulate.

Reference: Slide No. 126 (K.M. Feng 24342, KUN-0108130).

Neolitsea sutchuanensis Yang var. *gongshanensis* H.W. Li (Plate 171, 172)

Publication: in Acta Phytotax. Sin., 1694): 44(1978).

Distribution: China (SW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 14-19 um long, 8-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, 15-21 um long, 10-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 16.7, 14-18 um long, 15-19 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, outer scales narrow, granulate, inner ones narrow, granulate.

Reference: Slide No. 127 (K.M. Feng 7458, KUN-0108145).

Neolitsea tomentosa H. W. Li (Plate 173, 174)

Publication: in Acta Phytotax. Sin., 16(4): 41 (1978).

Distribution: China (SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 16-30 um long, 10-15 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-9 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded, 13-18 um long, 8-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.8, 14-19 um long, 15- 20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 128 (H.T. Tsai 61952, KUN-0108144).

Neolitsea undulatifolia (Levl.) Allen (Plate 175, 176)

Publication: in Journ. Arn. Arb. 1936, xvii, 328.

Distribution: China (Guizhou, SE Yunnan, SW Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 9-19 um long, 8-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate; trichome bases rare, poral, with 5-7 surrounding cells, with cuticular thickening round pore.

Stomates paracytic, S.I. 18.5, 15-18 um long, 13-19 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate;stomatal scales prominent, narrow, granulate.

Reference: Slide No. 129 (K.M. Feng 12754, KUN-0108164).

Neolitsea variabillima (Hay.) Kanehira & Sasaki (Plate 177, 178)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1930, 20: 382.

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 15-25 um long, 8-15 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; trichome bases very common (rare in Slide No. 288), poral, with 4-5 surrounding cells, with cuticular thickening around pore (extending along the walls of surrounding cells in Slide Mo. 288).

Abaxial epidermis: epidermal cells undulate, 13-24 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases very common but rare in Slide No. 288, with 4-6 surrounding cells and cuticular thickening around pore (extending along the walls of surrounding cells in Slide No. 288).

Stomates paracytic, S.I. 20.7, 15-18 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, slightly broad, granulate.

References: Slide No. DCC-491; Slide No. 288 (Ching-Kuoh Liou 83, TAIF-076567).

Neolitsea velutina W.T. Wang (Plate 179, 180)

Publication: in Acta Phytotax. Sin., vi. 216 (1957).

Distribution: China (SE Yunnan, Guangxi, Guangdong).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 14-19 um long, 8-15 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases common, poral,

with 5-6 radial arranged surrounding cells, with cuticular thickening around pore and extending along the radial walls of surrounding cells; surrounding cells light-staining.

Abaxial epidermis: epidermal cells angular, 10-12 um long, 6-10 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases very common, poral, with 9-11 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, up to 250 um long, with apex acute.

Stomates paracytic, S.I. 16.1, 12-15 um long, 11-13 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 130 (C.W. Wang 85866, KUN-0108186).

Neolitsea vidalii Merrill (Plate 181, 182)

Publication: in Phillip. Journ. Soc. i. Suppl. 56 (1906).

Distribution: Ins. Phillipines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 22-33 um long, 16-25 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 13-18 um long, 6-14 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 5-7 surrounding cells, with cuticular thickening along the pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.5, 12-15 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

Reference: Slide No. 269 (M. Ramos 1352, SING-079841).

Neolitsea villosa (Bl.) Merrill (Plate 183, 184)

Publication: in Philipp. Journ. Soc. ¡. Suppl. 56 (1906).

Distribution: Philippines to Malay Peninsula.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-15 um long, 8-15 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, elongate over veins, 12-22 um long, 7-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 19.0, 16-18 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-625; Slide No. 270 (G. Edano 78516, SING-079846); Slide No. 271 (SING 079844); Slide No. 286 (Kuoh-Chang Chen 369, TAIF-076995).

Neolitsea wushanica (Chun) Merr. (Plate 185, 186)

Publication: in Sunyatsenii, iii. 250 (1937).

Distribution: China (Hubei, Sichuan, Guizhou, Shangxi, Guangdong, Fujian).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 13-34 um long, 15-24 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, with 4-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate; 17-25 um long, 13-15 um wide; anticlinal wall thin, finely beaded; periclinal wall convex (bubble-like in Slide No. 131), granulate; trichome bases rare, with 4-5 surrounding cell, with cuticular thickening round pore.

Stomates paracytic, S.I. 21,2, 13-18 um long, 15-17 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall smooth, periclinal wall smooth; stomatal scales prominent, narrow (double in slide No. 132), granulate.

References: Slide No. 131(L. Deng 1528, KUN-0108201); Slide No. 132(W.P. Fang 14260, KUN-0108196).

Neolitsea zeylanica Merrill (Plate 187, 188)

Publication: H. Liou. Lour. Chine et Indochine, 153, descr. ampl.

Distribution: Indo-China.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 14-17 um long, 7-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 14-20 um long, 6-12 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cell, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.7, 10-13 um long, 12-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double.

References: Slide No. 272 (SING-079852); Slide No. 273 (Joseph Lai LJ 158, SING-079856).

3.3.3 Leaf cuticle features in *Lindera*

Lindera aggregata (Sims.) Kostermans (Plate 189, 190)

Publication: in Reinwardtia, 9(1): 98 (1974).

Distribution: China (Zhejiang, Jiangxi, Fujian, Anhui, Funan, Guangdong, Guangxi, Taiwan); Vietnam; Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 14-25 um long, 12-18 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate to sinuous (angular to rounded in Slide No. 054, 053), becoming elongate over veins, 11-24 um long, 8-15 um wide; anticlinal thin, finely beaded; periclinal wall finely papillate; trichome bases rare, poral, over veins, with 4-7 surrounding cells, with cuticular thickening around pore; areoles evident in Slide No. 054, 053.

Stomates paracytic, S.I. 18.1, 12-14 um long, 9-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales evident, linear.

References: Slide No. 458 (Taiwan); Slide No. 054 (L. Deng 3999, KUN-0049242); Slide No. 053 (L. Deng 6086, KUN-0049243).

Lindera akoensis Hay. (Plate 191, 192)

Publication: in Journ. Coll. Sc. Tokyo, xxx. Art. 1, 252 (1911).

Distribution: S Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins; 15-33 um long, 14-20 um wide; anticlinal wall thin, smooth to slightly beaded; periclinal granulate; trichome bases rare, poral, over veins, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins; anticlinal wall thin, smooth; periclinal wall granulate, convex; trichome bases common, poral, with 5-7 surrounding cells.

Stomates paracytic; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. DCC-429.

Lindera angustifolia Cheng (Plate 193, 194)

Publication: in Contrib. Biol. Lab. Sc. Soc. China, Bot. Ser., viii. 294 (1933).

Distribution: China (Shandong, Zhejiang, Fujian, Anhui, Jiangxi, Jiangsu, Henan, Shangxi, Hubei, Guangdong, Guangxi); Korea.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 28-48 um long, 15-25 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases very rare, poral, over veins, with 4-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 50 um long, with apex acute.

Abaxial epidermis: epidermal cells sinuous, 28-48 um long, 15-25 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate; trichome bases common, poral, over veins; trichomes simple, unicellular, up to 50 um long, with apex acute.

Stomates paracytic, S.I. 21.7, 20-27 um long, 18-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-540; Slide No. 055 (Hanzhou Exped. 2008, KUN-0106718); Slide No. 056 (Hanzhou Exped. 2334, KUN-0106716).

Lindera apoensis Elmer (Plate 195, 196)

Publication: Leaflets Philipp. Bot. ii. 714 (1910).

Distribution: Ins. Philppines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 8-15 um wide; anticlinal wall irregularly thickened; periclinal wall granulate; trichome bases rare, with 5-7 irregularly arranged surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 13-31 um long, 9-17 um wide; anticlinal wall irregularly thickened; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.1, 14-16 um long, 13-17 um wide; guard cells sunken, with poral thickening; anticlinal wall irregularly thickened; periclinal wall granulate; stomatal scales prominent, slightly broad.

Reference: Slide No. 352 (BO-0104506)

Lindera assamica (Meissn.) Kurz. (Plate 197, 198)

Publication: in For. Fl. Brit. Burma, ii. 308.

Distribution: Reg. Himalaya; Burma.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 20-28 um long, 10-26 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 50 um long, with apex acute.

Abaxial epidermis: epidermal cells angular to rounded, 17-36 um long, 9-16 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall slightly convex, granulate; trichome bases common, poral, over veins, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.4, 13-16 um long, 13-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double, outer scales narrow, granulate; inner ones narrow, granulate.

References: Slide No. 057 (H. Ohashi et al. 771048, KUN-0049329); Slide No. 351 (BO-0104506).

Lindera bibracteata Boerl (Plate 199, 200)

Publication: Handl. Fl. Ned. Ind. iii. 146.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-26 um long, 12-19 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate (finely papillate on slide No. 346); trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular to undulate, 11-18 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.
Stomates paracytic, S.I. 18.2, 14-17 um long, 11-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.
References: Slide No. 346 (J. & M.S. Clemens 32686, BO-0104507); Slide No. 349 (W. Meijer 2727, BO-0104549).

Lindera ceridifolia Hemsl. (Plate 201, 202)
Publication: in Journ. Linn. Soc. xxvi. (1891) 387.
Distribution:
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells undulate, 22-35 um long, 14-18 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.
Abaxial epidermis: epidermal cells rounded 15-35 um long, 13-24 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall slightly convex, granulate.
Stomates paracytic, S.I.15.7, 13-15 um long, 13-15 um wide; guard cells sunken; subsidiary cells 2; firmly cellular remnants attached to inner ledge; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, double, granulate.
References: Slide No. 062 (G.F. Li 62412, KUN-015460); Slide No 063 (G.F. Li 61704, KUN-0151453).

Lindera chienii Cheng (Plate 203, 204)
Publication: in Contrib. Biol. Lab. Sc. Soc. China, Bot. Ser., ix, 193 (1934).
Distribution: China (Jiangsu, Zhejiang, Anhui, Henan).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 19-30 um long, 14-18 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 18-30 um long, 14-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, over veins, with6-8 surrounding cells, with cuticular thickening around pore; areoles evident.

Stomates paracytic, S.I.20.0, 15-18 um long, 15-22 um wide; uniformly distributed within areoles; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales evident, double, outer scales narrow, granulate, inner ones narrow granulate.

Reference: Slide No. 066 (Y.B. Deng 3663, KUN-0049601).

Lindera chunii Merrill (Plate 205, 206)

Publication: in Lingnan Sc. Journ. Vii. 307 (1931); H. Liou, Laurac. Chine et Indochine, 134 (1932), descr. ampl.

Distribution: China (Guangdong, Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 24-30 um long, 19-27 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells angular to rounded, 16-28 um long, 14-20 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases very common, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, up to 200 um long, with apex acute.

Stomates paracytic, S.I. 22.2, 11-15 um long, 13-15 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thick, beaded; periclinal wall granulate; stomatal scales prominent narrow, granulate.

References: Slide No. 064 (L. Deng 8359, KUN-0049607); Slide No. 065 (X.P. Gao 50136, KUN-0049608).

Lindera citriodora Hemsl. (Plate 207, 208)

Publication: in Journ. Linn. Soc. xxvi (1891) 387.

Distribution: Japan., Ins. Loo Choo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 19-32 um long, 15-18 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, over veins, poral, with 4 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded, becoming elongate over veins, 15-23 um long, 14-22 um wide; anticlinal wall irregularly thickened, smooth to beaded; periclinal wall slightly convex, granulate.

Stomates paracytic. S.I. 20.0, 17-30 um long, 11-17 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales double, outer scales prominent, narrow; inner scales prominent, narrow, granulate.

Reference: Slide No. DCC-987.

Lindera communis Hemsl. (Plate 209, 210)

Publication: in Journ. Linn. Soc. xxvi. (1891) 387.

Distribution: China (Shangxi, Gansu, Hunan, Hubei, Jiangxi, Zhejiang, Fujian, Taiwan, Guangdong, Guangxi, Yunnan, Guizhou, Sichuan) and SE Asia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 20-28 um long, 10-18 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous, 21-26 um long, 10-15 um wide; anticlinal wall thin, buttressed; periclinal wall papillate; trichomes bases common, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, c. 50 um long, with apex acute.

Stomates paracytic, S.I.19.1, 15-19 um long, 13-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, beaded to buttressed; periclinal wall papillate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-597 (China); Slide No. 069 (S.G. Xu 3411, KUN-0049630); Slide No. 070 (S.G. Xu 5131; KUN-0049629); Slide No. DCC-457 (Taiwan).

Lindera concinna Rialey (Plate 211, 212)

Publication: in Journ. As. Soc. Straits, lxxxii. 192 (1920).

Distribution: Peninsular Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded, 13-20 um long, 9-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 20-25 um long; 10-16 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 23.8, 12-17 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 347 (SFN 7996, BO-0104508).

Lindera cuspidata Boerl. (Plate 213, 214)

Publication: Handl. Fl. Ned. Ind. iii. 147.

Distribution: Celebes.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 20-32 um long, 15-26 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 25-40 um long, 8-16 um wide; anticlinal wall finely beaded; periclinal wall granulate to papillate; trichome bases common, poral, with5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.4, 15-20 um long, 14-18 um wide; guard cells sunken, with poral thickening; polar rods present; subsidiary cells 2; anticlinal wall thick, with raised ledge forming prominent collar around stomata; periclinal wall papillate; stomatal scales prominent, narrow.

Reference: Slide No. 350 (L.L. Farman 339, BO-0104547).

Notes: the leaf cuticle features are very similar to those of the species *Litsea fawcettiana.*

Lindera dictyophylla C.K. Allen (Plate 215, 216)

Publication: in Journ. Arn. Arb. xxii, 5 (1941).

Distribution: China (Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 18-31 um long, 13-21 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, with 5-7 surrounding cells (just appeared in Slide No. 067).

Abaxial epidermis: epidermal cells angular, 18-30 um long, 14-20 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, with 5-6

surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 20-40 um long, with apex acute.

Stomates paracytic, S.I.24.4, 15-16 um long, 15-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

References: Slide No. 067 (Sino-Russ Exped. 5055, KUN-0150218); Slide No. 068 (Sino-Russ. Exped.9691, KUN-0150214).

Lindera erythrocarpa Makino (Plate 217, 218)

Publication: in Bot. Mag. Tokyo, 1897, 219.

Distribution: China (Shangxi, Henan, Jiangsu, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, Fujian, Taiwan, Guangdong, Guangxi, Sichuan); Korea; Japan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-20 um long, 9-13 um wide (20-35 um long, 17-23 um wide); anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 18-25 um long, 15-18 um wide; anticlinal wall thin, finely beaded; periclinal wall papillate.

Stomates paracytic, S.I.19.1, 20-25 um long, 18-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall papillate; stomatal scales prominent, double, granulate.

References: Slide No. DCC-986; Slide No. 071 (L.H. Liu & G.Z. He 016255, KUN-0150340); Slide No. 072 (S.Y Zhang 5594, KUN-0106776).

Lindera floribunda (Allen) H.P. Tsui (Plate 219, 220)

Publication: in Acta Phytotax. Sin., 16(4): 68 (1978).

Distribution: China (Sichuan, Guizhou, Gansu, Shangxi, Hunan, Hubei, Guangdong).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 16-28 um long, 12-18 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases rare, with 5-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 15-22 um long, 10-14 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, with 5-7 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.14.3, 12-14 um long, 10-13 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, beaded; periclinal wallfinely papillate; stomatal scales prominent, narrow or linear, granulate.

References: Slide No. 075 (B.Q. Tsong 844, KUN-0106778); Slide No. 076 (L.H. Liu 15540, KUN-0106777).

Lindera foveolata H.W. Li (Plate 221, 222)

Publication: in Acta Phytotax. Sin., 16(4): 64(1978).

Distribution: China (SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 25-41 um long, 18-40 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 32-37 um long, 15-25 um wide; anticlinal wall thin, beaded; periclinal wall slightly convex, papillate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.21.0, 22-25 um long, 20-22 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall papillate; stomatal scales prominent, narrow, papillate.

Reference: Slide No. 077 (S.Z. Wang 382, KUN-0150424).

Lindera fragrans Oliv. (Plate 223, 224)

Publication: in Hook. Icon. Pl. xvii. (1888) t. 1788.

Distribution: China (Shangxi, Hubei, Sichuan, Guizhou, Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 16-25 um long, 10 -16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, 14-25 um long, 9-13 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 6-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 150-200 um long, with apex acute.

Stomates paracytic, S.I.18.2, 12-13 um long, 13-14 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, double.

References: Slide No. 078 (F.T. Wang 22675, KUN-0150430); Slide No. 079 (Y.Z Liu 386, KUN-0104948).

Lindera fruticosa Hemsl. (Plate 225, 226)

Publication: in Journ. Linn. Soc. xxvi. (1891) 388.

Distribution: China (Henan, Shangxi, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, Guizhou, Sichuan, Yunnan, Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 23-38 um long, 18-31 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall smooth.

Stomates: guard cells sunken; subsidiary cells 2,anticlinal wall thin, smooth; periclinal wall smooth; stomatal scales double.

Reference: Slide No. 170 (G.F. Li 63966, KUN-0104915)

Lindera glauca (Sieb. et Zucc.) Bl. (Plate 227, 228)

Publication: in Mus. Bot. Lugd. Bot. i. 325. 1851.

Distribution: China; Indochina; Korea; Japan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 28-30 um long, 13-23 um wide; anticlinal wall slightly buttressed; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 23-32 um long, 15-22 um wide; anticlinal wall thin, smooth to buttressed; periclinal wall granulate.

Stomates paracytic, S.I.17.3, 15-20 um long, 17-21 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, butterfly-shaped.

Reference: Slide No. 080 (P.Y. Li 1770, KUN-0150510).

Lindera gracilipes H.W. Li (Plate 229, 230)

Publication: in Acta Phytotax. Sin., 16(4): 64 (1978).

Distribution: China (Yunnan, SE Tibet); N Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-28 um long, 12-20 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 50-120 um long, with apex acute.

Abaxial epidermis: epidermal cells angular, 21-27 um long, 16-22 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 50 um long, with apex acute; areoles evident.

Stomates paracytic, S.I.20.0, 15-18 um long, 14-16 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 082 (P.Y. Mao 03923, KUN-???); Slide No. 083 (K.M. Feng 5110, KUN-???).

Lindera heterophylla Meissn. (Plate 231, 232)

Publication: in DC. Prod. xv. I. 246.

Distribution: China (WN Yunnan, Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-40 um long, 15-23 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 21-24 um long, 10-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I.17.6, 18-28 um long, 10-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.

References: Slide No. 084 (J.S. Yang s.n., KUN-0100013); Slide No. 085 (Zhongtian Exped. 1125, KUN-0100026); Slide No. 169 (W.T. Wang 239, KUN-0100006, KUN-0100008).

Lindera kariensis W.W. Smith (Plate 233, 234)

Publication: in Notes Bot. Gard. Edin. Xiii. 165 (1921).

Distribution: China ($_{N}$W Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 30-38 um long, 25-28 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6

surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30 um long, with apex acute.

Abaxial epidermis: epidermal cells angular, 19-33 um long, 10-23 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 50 um long, with apex acute.

Stomates paracytic, S.I.16.7, 13-17 um long, 17-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.

References: Slide No. 086 (Feng 1771, KUN-0150764); Slide No. 087 (Feng 4546, KUN-0150767).

Lindera kariensis W.W. Smith f. *glabrescens* H.W. Li (Plate 235, 236)

Publication: in Acta Phytotax. Sin., 16(4): 63 (1978).

Distribution: China (NW to N Yunnan)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 22-27 um long, 9-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome, simple, unicellular, 30 um long, with apex acute.

Abaxial epidermis: epidermal cells angular, 22-25 um long, 11-17 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate; trichome bases common, simple, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 40 um long, with apex acute.

Stomates paracytic, S.I.17.4, 10-12 um long, 17-18 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.

References: Slide No. 088 (Feng 7650, KUN-0150808); Slide No. 089 (Feng 4351, KUN-0150814).

Lindera kwangtungensis (Liou) Allen (Plate 237, 238)

Publication: in Journ. Arn. Arb. xxii. 2 (1941).

Distribution: China (Guangdong, Guangxi, Fujian, Jiangxi, Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-25 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with 3-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 15-21 um long, 9-15 um wide; anticlinal wall thin, finely beaded; periclinal wall apparently papillate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-50 um long, with apex acute.

Stomates paracytic, S.I. 21.0 11-13 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall apparently papillate; stomatal scales prominent, narrow.

References: Slide No. 090 (X.R. Liang 64753, KUN-0150832); Slide No. 091 (Z. Huang 31772, KUN-0150833).

Lindera latifolia Hook. f. (Plate 239, 240)

Publication: Fl. Brit. Ind. v. (1886): 183.

Distribution: China (W, NW to SE Yunnan, SE Tibet); India; Bangladesh; Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-16 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 9-14 um long, 6-9 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, over veins, wit h5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 150 um long, with apex acute.

Stomates paracytic; subsidiary cells 2, anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, double, granulate.

References: Slide No. 093 (R.C. Qing 50501, KUN-0150851); Slide No. 094 (Z.H. Yang 101439, KUN-0150843).

Lindera limprichtii H. Winkler (Plate 241, 242)

Publication: in Fedde, Repert. Beih. $_{X}$ii. 382 (1922).

Distribution: China (Sichuan, Shangxi, Gansu).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-14 um long, 6-10 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular to undulate, 8-14 um long, 6-10 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore and over arched.
Stomates paracytic, S.I. 20.3, 7-9 um long, 9-11 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall smooth to beaded; periclinal wall smooth to granulate; stomatal cells prominent, narrow, granulate.
References: Slide No. 097 (Z.Y. Zhang 965, KUN-0150992); Slide No. 098 (F.T. Wang 21967, KUN-0151002).

Lindera longipedunculata Allen (Plate 243, 244)
Publication: in Journ. Arn. Arb. xxii: 6 (1941).
Distribution: China (NW Yunnan, SE Tibet).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 15-18 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall smooth; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular, 11-18 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases rare, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore; areoles evident.
Stomates paracytic, S.I. 17.3, 10-13 um long, 12-15 um wide; uniformly distributed within areoles; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.
Reference: Slide No. 099 (S.G. Wu 7082, KUN-0151026).

Lindera lucida (Bl.) Boerl. (Plate 245, 246)
Publication: Handl. Fl. Ned. Ind. iii. 147.
Distribution: Singapore; Java.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 23-34 um long, 18-20 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, with 4-5 surrounding cells, with slightly cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 24-37 um long, 15-22 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, c. 50 um long, with apex acute.

Stomates paracytic, S.I. 20.0, 20-27 um long, 16-21 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, granulate.

References: Slide 276 (Singapore); Slide No. 585 (Sarawak); Slide No. 348 (J.A. Lorzing 6904, BO-0104510).

Lindera lungshengensis S. Lee (Plate 247, 248)

Publication: in Acta Phytotax. Sin., 16(4): 67 (1978).

Distribution: China (Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-17 um long, 6-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 5-8 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 10-13 um long, 6-8 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases very rare, poral.

Stomates paracytic, S.I. 22.3, 7-9 um long, 8-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 100 (Z.Z. Chen S1083, KUN-0164506).

Lindera malaccensis Hook. f. (Plate 249, 250)

Publication: Fl. Brit. Ind. v. (1886) 183.

Distribution: Peninsular Malaysia, Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 16-25 um long, 15-20 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 23-27 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-5 radially

arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 16.2, 16-20 um long, 20-22 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate (granulate in Slide No. 344); stomatal scales prominent, narrow.

References: Slide No. 344 (M.C. Donald & Ismail 4000, BO-0104511); Slide No. 345 (A.D.E. Elmer 20352, BO-0104509).

Lindera megaphylla Hemsl. (Plate 251, 252)

Publication: in Journ. Linn. Soc. xxvi. (1891) 389.

Distribution: China (Shangxi, Gansu, Sichuan, Yunnan, Guizhou, Hubei, Hunan, Anhui, Jiangxi, Fujian, Guangdong, Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 21-31 um long, 10-22 um wide; anticlinal wall thick, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded, 8-16 um long, 7-14 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall convex, granulate; trichome bases very common, poral, over veins, with 5-7 surrounding cells and cuticular thickening around pore; trichome simple, unbranched, unicellular, to 100 um long, with apex acute.

Stomates: sunken and encircled by surrounding cells with extending periclinal wall; stomatal scales double.

References: Slide No. 455; Slide No. 101 (Sino-Amer$_{ican}$. Exped.1900, KUN-0151131).

Lindera melastomacea Villar (Plate 253, 254)

Publication: in Blanco, Fl. Philipp. ed. III. Nov. App. 181.

Distribution: Region Himalayas.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 20-25 um long, 10-17 um wide; anticlinal wall thin, beaded, irregularly thickened; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, anticlinal wall thin, beaded; periclinal wall granulate.

Stomates paracytic, S.I. 19.3, 15-18 um long, 17-22 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double.

Reference: Slide No. 343 (BO-0104512).

Lindera metcalfiana Allen (Plate 255, 256)

Publication: in Journ. Arn. Arb. xxii: 3 (1941).

Distribution: China (Yunnan, Guangdong, Guangxi, Fujian).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 16-26 um long, 14-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; areoles evident; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 17-27 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, with 4-7 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-50 um long, with apex acute.

Stomates paracytic, S.I.18.7, 10-12 um long, 9-12 um wide; guard cells thin, smooth; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, broad, finely papillate.

Reference: Slide No. 102 (L. Deng 3195, KUN-0151305).

Lindera nacusua (D. Don) Merrill (Plate 257, 258)

Publication: in Lingnan Sc. Journ. 1936, xv. 419.

Distribution: China (Guangdong, Guangxi, Fujian, Jiangxi, Sichuan, Yunnan, SE Tibet); Nepal; India; Burma; Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 9-14 um long, 5-10 um wide; anticlinal wall thick, smooth to finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 11-17 um long, 7-10 um wide; anticlinal wall thin, buttressed; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, up to 150 um long, with apex acute.

Stomates paracytic, S.I.19.4, 8-12 um long, 10-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, buttressed; periclinal wall finely papillate; stomatal scales prominent, narrow or linear, granulate.

Reference: Slide No. 103 (H.T. Tsai 36582, KUN-0151350).

Lindera nacusua (D. Don) Merr. var. *menglungensis* H.P. Tsui (Plate 259, 260)

Publication: in Acta Phytotax. Sin., 16(4): 65 (1978).

Distribution: China (S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 11-13 um long, 6-9 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore; areoles evident.

Abaxial epidermis: epidermal cells sinuous, 12-18 um long, 7-10 um wide; anticlinal wall thin, buttressed; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 170 um long, with apex acute; areoles evident.

Stomates paracytic, S.I.19.7, 8-14 um long, 10-13 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, buttressed; periclinal wall finely papillate; stomatal scales prominent, narrow or linear, granulate.

Reference: Slide No. 171 (Y.H. Li 1425, KUN-0151387).

Lindera obtusiloba Blume (Plate 261, 262)

Publication: Mus. Bot. Lugd. Bot. i. 325.

Distribution: China; Korea; Japan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 15-27 um long, 12-17 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded, 11-20 um long, 7-12 um wide; anticlinal wall irregularly thickened, thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 140 um long, with apex acute; areoles evident.

Stomates paracytic, S.I.21.1, 9-12 um long, 12-16 um wide; guard cells sunken; subsidiary cells 2; uniformly distributed within areoles; anticlinal wall irregularly thickened, thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

References: Slide No. 172 (Y.C. Zhu 741, KUN-0151422); Slide No. 173 (Sino-Amer. Exped. 1308, KUN-0151469).

Lindera pedicellata Kostermans. (Plate 263, 264)

Publication: in Reinwardtia, viii. 83 (1970).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 23-38 um long, 17-25 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 25-36 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Stomates paracytic, S.I. 16.4, 20-23 um long, 20-25 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double.

Reference: Slide No. 342 (J. & M.S. Clemens 26849, BO-0104513).

Lindera pipericarpa Boerl. (Plate 265, 266)

Publication: Handl. Fl. Ned. Ind. iii. 147.

Distribution: Sumatra; Thailand.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 16-30 um long, 13-19 um wide; anticlinal wall irregularly thickened, thick, finely beaded; periclinal wall granulate; trichome bases very rare, poral, over veins, with 4-5 surrounding cells and slightly cuticular thickening around pore

Abaxial epidermis: epidermal cells angular, 11-34 um long, 10-20 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall convex, granulate.

Stomates paracytic, S.I. 17.9, 18-41 um long, 15-23 um wide; subsidiary cells 2, anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall granulate; stomatal scales double, granulate.

References: Slide No. DCC-591 (Thailand); Slide No. 341 (Othman et al. 37545 (BO-0104548).

Lindera polyantha Boerl. (Plate 267, 268)

Publication: Handl. Fl. Ned. Ind. iii. 147.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-22 um long, 10-17 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, with 4-5 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 17-25 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.

Stomates paracytic, S.I. 18.2, 13-15 um long, 15-17 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double.

Reference: Slide No. 340 (Ja 2202, BO-0104514).

Lindera pomiensis (Tsui) H.P. Tsui (Plate 269, 270)

Publication: in Acta Bot. Yunnanica 10(1): 124 (1988).

Distribution: China (W Sichuan, SE Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 20-32 um long, 12-20 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore sometimes extending along the radial walls of surrounding cells; trichome simple, unicellular, 40 um long, with apex acute.

Abaxial epidermis: epidermal cells angular to rounded 15-30 um long, 10-22 um wide; anticlinal wall thin, smooth; periclinal wall smooth.

Stomates paracytic; subsidiary cells 2, anticlinal wall thin, smooth; periclinal wall smooth; stomatal scales double, granulate.

Reference: Slide No. 174 (C.Y. Wu 5722, KUN-???).

Lindera praecox Blume (Plate 271, 272)

Publication: Mus. Bot. Lugd. Bot. i. 324.

Distribution: China (Zhejiang, Anhui, Hubei).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 13-18 um long, 9-11 um wide; anticlinal wall thick, finely beaded; periclinal wall granulate; areoles evident.
Abaxial epidermis: epidermal cells angular to undulate, 21-37 um long, 10-15 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall finely papillate.
Stomates paracytic, S.I.16.7, 8-11 um long, 10-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; stomatal scales prominent, double, granulate.
Reference: Slide No. 175 (H. Migo s.n., KUN-0100101).

Lindera prattii Gamble (Plate 273, 274)
Publication: in Sagent. Pl. Wilson. ii. 83 (1914).
Distribution: China (Sichuan, Guizhou).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 10-12 um long, 7-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular to undulate, 9-13 um long, 6-8 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.
Stomates paracytic, S.I.19.3, 8-10 um long, 7-10 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.
Reference: Slide No. 176 (W Sichuan Econ$_{\text{omical}}$ Plant Exped. 4463, KUN-0100093).

Lindera pulcherrima (Wall.) Benth. (Plate 275, 276)
Publication: in Benth & Hook.f. Gen. Pl. 3: 163. 1880
Distribution: Tibet.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 9-13 um long, 7-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cell angular, 7-15 um long, 6-10 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, with 5-7 radial

arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 10-12 um long, 8-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 177 (H. Ohba et al. 8310196, KUN-0100154).

Lindera pulcherrima (Wall.) Benth. var. *attenuata* Allen (Plate 277, 278)

Publication: in Journ. Arn. Arb. 22: 21. 1941.

Distribution: China (Guangdong, Guangxi, Hunan, Hubei, Yunnan, Guizhou, Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 11-16 um long, 8-12 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 4-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 8-11 um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases common, poral, over veins, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Stomates paracytic, S.I.20.8, 8-10 um long, 6-9 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall, granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 178 (F.H. Xue 3804, KUN-0164469).

Lindera pulcherrima (Wall.) Benth. var. *hemsleyana* (Diels) H.P. Tsui (Plate 279, 280)

Publication: in Acta Phytotax. Sin., 16(4): 67 (1978).

Distribution: China (Shangxi, Sichuan, Hubei, Hunan, Guangxi, Guizhou, Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-12 um long, 6-9 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 6-10 um long, 4-7 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases very common, poral, with

4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; areoles evident.

Stomates paracytic, S.I.20.7, 6-8 um long, 7-9 um wide; guard cells sunken, subsidiary cells 2; uniformly distributed within areoles; anticlinal wall thin, smooth to finely beaded; periclinal wall smooth to granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 179 (S.Y. Hu s.n., KUN-0164179).

Lindera queenslandica B.P.M. Hyland (Plate 281, 282)

Publication: in Austral. Syst. Bot., 2(2-3): 252 (1989).

Distribution: Australia (Northern Queensland).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 15-27 um long, 10-19 um wide; anticlinal wall thin, smooth; periclinal wall irregularly thickened, smooth to granulate.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 12-35 um long, 10-16 um wide; anticlinal wall irregularly thickened, buttressed (more pronounced over veins); periclinal wall granulate

Stomates paracytic, S.I.17.4, 17-22 um long, 10-16 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, beaded to buttressed; periclinal wall smooth; stomatal scales double; outer scales prominent, narrow; inner scales prominent, narrow, granulate.

References: Slide No. DCC-L310; Slide No. DCC-1406; Slide No. 449 (BE 3721); Slide No. 450 (BE 3353); Slide No. 451 (BE 934).

Lindera reflexa Hemsl. (Plate 283, 284)

Publication: in Journ. Linn. Soc. xxvi. (1891) 391.

Distribution: China (Henan, Jiangxi, Anhui, Zhejiang, Jiangxi, Hunan, Hubei, Guizhou, Yunnan, Guangxi, Guangdong, Fujian)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells rounded, 16-28 um long, 13-19 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; areoles evident.

Abaxial epidermis: epidermal cells undulate, 11-27 um long, 8-16 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall smooth; trichome bases very common, poral, with 5-7 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 120 um long, with acute apex; areoles evident.

Stomates paracytic, S.I.24.2, 9-10 um long, 9-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth; periclinal wall smooth; stomatal scales prominent, double, granulate.

References: Slide No. 180 (H. Migo s.n., KUN-0100167); Slide No. 181 (M.Q. Nie et S.K. Lai 3768, KUN-0100201).

Lindera robusta (Allen) H.P. Tsui (Plate 285, 286)

Publication: in Acta Phytotax. Sin., 16(4): 64 (1978).

Distribution: China (Hainan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-21 um long, 9-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; 9-17 um long, 7-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate, dark staining; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 10-20 um long, with apex acute.

Stomates paracytic, S.I.19.2, 10-12 um long, 8-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate, light staining; stomatal scales prominent, narrow.

Reference: Slide No. 182 (L. Deng 3356, KUN-0100240).

Lindera rubronervia Gamble (Plate 287, 288)

Publication: in Sargent, Fl. Wilson. ii. 84 (1904).

Distribution: China (Henan, Anhui, Jiangsu, Zhejiang, Jiangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 9-15 um long, 7-9 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 5-7 surrounding cells, with cuticular thickening around pore; areoles evident.

Abaxial epidermis: epidermal cells undulate 13-21 um long, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic, S.I.23.5, 9-11 um long, 8-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 183 (H. Migo s.n., KUN-0100273).

Lindera rufa Boerl. (Plate 289, 290)

Publication: in Journ. As. Soc. Beng. ıxxv. 200 (1912).

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-18 um long, 10-15 um wide; anticlinal wall thin, irregularly thickened; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 18-24 um long, 10-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.

Stomates paracytic, S.I. 19.2, 13-17 um long, 15-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 339 (Aderson & Ilias S. 26475, BO-0104515).

Lindera selangorensis Rialey (Plate 291, 292)

Publication: in Journ. Fed. Mal. States Mus. $_{V}$. 44 (1914).

Distribution: Peninsular Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-18 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 21-30 um long, 14-18 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.7, 17-20 um long, 13-21 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.
Reference: Slide No. 338 (BO-0104516).

Lindera sericea (S. et Z.) Blume (Plate 293, 294)
Publication: Mus. Bot. Lugd. Bot. i. 324.
Distribution: Japan.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells undulate, 14-23 um long, 9-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, 80 um long, with apex acute; areoles evident.
Abaxial epidermis: anticlinal wall thin, smooth; periclinal wall smooth; trichome bases common, poral, over veins; trichome simple, unicellular, 100 um long, with apex acute.
Stomates: paracytic; stomatal scales prominent, double, granulate.
Reference: Slide No. 184 (M. Tokapashi 1081, KUN-0100620).

Lindera setchuenensis Gamble (Plate 295, 296)
Publication: in Sargent, Pl. Wilson, ii. 82 (1914)
Distribution: China (Sichuan, Guizhou).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 11-15 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells; areoles evident.
Abaxial epidermis: epidermal cells rounded; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate, convex; trichome bases very common, with 4-6 surrounding cells; trichome simple, unicellular, up to 60 um long, with apex acute; areoles evident.
Stomates: sunken and circled by surrounding cells with extending periclinal wall.
Reference: Slide No. 185 (KUN-0100646).
Notes: It is very similar to *L. megaphylla.*

Lindera subcaudata (Merr.) Merr. (Plate 297, 298)

Publication: in Philipp. Journ. Sc. 1919, xv. 237.

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-18 um long, 8-12 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 10-13 um long, 7-11 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases rare, poral, over veins, with 5-7 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I.18.2, 8-11 um long, 7-9 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 186 (N.J. Chen 41044, KUN-01006111).

Lindera subumbelliflora (Blume) Kostermans. (Plate 299, 300)

Publication: in Journ. Sci. Res., Indonesia, i. 127 (1952).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 20-25 um long, 10-17 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 20-26 um long, 18-22 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with cuticular thickening around pore.

Stomates paracytic, S.I. 22.2, 12-15 um long, 10-16 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear.

References: Slide No. 336 (W. Meijer 1898, BO-0104519); Slide No. 337 (Tantra 1786, BO-0104517).

Lindera supracostata Lecomte (Plate 301, 302)

Publication: in Nauv. Arch. Mus. Hist. Nat., Paris, Ser. v. 112 (1913).

Distribution: China (M to NW Yunnan, W Sichuan, W Guizhou).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 10-12 um long, 8-10 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular to undulate, 10-16 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.
Stomates paracytic, S.I.21.4, 9-11 um long, 8-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.
Reference: Slide No. 187 (NE Yunnan Exped. 688, KUN-0101144).

Lindera thomsonii Allen (Plate 303, 304)
Publication: in Journ. Arn. Arb. 22: 22 (1941).
Distribution: China (W to SE Yunnan, Guangxi, Guizhou); India; Burma, N Vietnam
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 11-14 um long, 7-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells angular, 9-13 um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, with 5-6 surrounding cells, with cuticular thickening around pore; areoles evident.
Stomates paracytic, S.I.21.7, 7-8 um long, 8-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow to linear, granulate.
Reference: Slide No. 188 (J.S. Xing 682, KUN-0101212, KUN-0101213).

Lindera thomsonii Allen var. *vernayana* (Allen) H.P. Tsui (Plate 305, 306)
Publication: in Acta Phytotax. Sin., 16(4): 68 (1978).
Distribution: China (M to W Yunnan); N Burma
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 8-15 um long, 7-11 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular, 8-12 um long, 5-8 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radial

arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 18.5, 8-9 um long, 6-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales narrow, granulate.

Reference: Slide No. 189 (M.K. Li 3019, KUN-0101361, KUN-0101360).

Lindera tienchuanensis W.P. Fang & H.S. Hung (Plate 307, 308)

Publication: in Acta Phytotax. Sin., 16(4): 66 (1978).

Distribution: China (Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 11-14 um long, 5-9 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 7-12 um long, 6-9 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.20.7, 7-9 um long, 6-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 190 (W Sichuan Econ. plant Exped. 2258, KUN-0101388).

Lindera tonkinensis Lec. (Plate 309, 310)

Publication: in Nouv. Arch. Mus. Hist. Nat. Paris, Ser. 5: 112. 1913.

Distribution: China (SE Yunnan, S Guangxi and Hainan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 15-24 um long, 10-15 um wide; anticlinal wall thick, finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells undulate, 15-23 um long, 11-17 um wide; anticlinal wall irregularly thickened, thin, smooth, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 16.8, 11-13 um long, 12-14 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 191 (W.X. Liu, 00729, KUN-0103002, KUN-0103001).

Lindera tonkinensis Lec. var. *subsessilis* H.W. Li (Plate 311, 312)

Publication: in Acta Phytotax. Sin., 16(4): 66 (1978).

Distribution: China (C.S. Yunnan, N Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 12-24 um long, 15-21 um wide, anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, 18-31 um long, 12-19 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal granulate; trichome bases very rare, poral, over veins, with 6-8 radially arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 16.0, 18-21 um long, 15-20 um wide (S.I.17.3, 10-12 um long, 10-11 um wide in 192); guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

References: Slide No. DCC-607; Slide No. 192 (S.G. Wu 273, KUN-0103020, KUN-0103021).

Lindera turfosa Kosterm. (Plate 313, 314)

Publication: in Reinwardtia, vii, 497 (1969).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-27 um long, 10-16 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, with 5-7 surrounding cells, with cuticular thickening around pore extending along the walls of the surrounding cells.

Abaxial epidermis: epidermal cells angular, 22-28 um long, 12-18 um wide; anticlinal wall thin, beaded; periclinal wall papillate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 100-150 um long, with acute apex.

Stomates paracytic, S.I. 17.6, 14-16 um long, 12-15 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 335 (BO-24044).

Lindera umbellata Thunb. (Plate 315, 316)

Publication: in Fl. Jap. 145. T. 21

Distribution: Japan

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 16-29 um long, 13-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 15-22 um long, 10-17 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic, 15.7, 12-14 um long, 11-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent,double, granulate.

Reference: Slide No. 193 (H. Migo s.n., KUN-0103157).

Lindera villipes H.P. Tsui (Plate 317, 318)

Publication: in Acta Phytotax. Sin., 16(4): 68 (1978).

Distribution: China (W Yunnan, SE Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-18 um long, 10-17 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 5-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 13-20 um long, 7-12 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate.

Stomates paracytic, S.I.18.2, 8-12 um long, 10-14 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall smooth; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 194 (C.W. Wang 67069, KUN-0103140).

3.3.4 Leaf cuticle features in *Litsea*

Litsea accedens Boerl. (Plate 319, 320)

Publication: Handl. Fl. Ned. Ind. iii. 145.

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded; anticlinal wall thick, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, buttressed; periclinal wall finely papillate.

Stomates: paracytic and sunken; guard cells sunken; subsidiary cells2; anticlinal wall thin, buttressed; periclinal wall finely papillate; stomatal scales linear.

Reference: Slide No. 416 (SAN. 26719, BO-0119383).

Litsea accedentoides Koord. & Volet. (Plate 321, 322)

Publication: in Meded.'s Lands Plantent. Ixviii.166.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-16 um long, 7-12 um wide; anticlinal wall thin, smooth; periclinal wal granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate, convex, bubble-like.

Stomates paracytic and sunken; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 417 (Kds 32437, BO-0119392).

Litsea acuminata (Blume) Kurrata (Plate 323, 324)

Publication: Illustri. Imp. For. Trees Jap. ii. 48 (1968).

Distribution: Japan. Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate or sinuous (No. 433; 435), 12-21 um long, 6-14 um wide; anticlinal wall irregularly thickened, thin and beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded; 9-16 um long, 7-12 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall apparently papillate; trichome bases common, poral, over veins, with 5-8 surrounding cells and cuticular thickening around pore; areoles evident.

Stomates paracytic; S.I. 15.6, 11-14 um long, 10-12 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, very narrow, sometimes linear.

References: Slide No. DCC-435; Slide No. DCC-433; Slide No. DCC-468; Slide No. 133 (N. Fukuoku & M. Ito 251, KUN-0103130); Slide No. 308 (Ching-Kuoh, Liu 611, TAIF-084458); Slide No. 309 (Ching-Kuoh, Liu 255, TAIF-081006).

Litsea acutivena Hayata (Plate 325, 326)

Publication: Ic. Pl. Formos. v. 163 (1915).

Distribution: S China (Taiwan, Fujian, Guangdong, Guangxi, Hainan) and Indo-China.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 10-18 um long, 9-12 um wide; anticlinal wall irregularly thickened, smooth to finely beaded; periclinal wall granulate; areoles evident; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells rounded to angular, becoming elongate over veins, 13-20 um long, 8-15 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall papillate; trichome bases common, poral, over veins, with 4-6 surrounding cells, thick cuticular thickening around pore extending along radial walls of surrounding cells; trichome simple, unicellular, up to c. 200 um long, with apex acute.

Stomates paracytic, S.I. 18.5, 13-16 um long, 10-13 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-467; Slide No. 134 (Deng L. 916, KUN-0103132); Slide No. 306 (Kuoh-Chang Chen 190, TAIF-077037); Slide No. 307 (Sheng-You, Lu 17251, TAIF-076294).

Litsea akoensis Hayata (Plate 327, 328)

Publication: in Journ. Coll. Sc. Tokyo, xxx. Art. L, 245 (1911).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 8-14 um long, 6-11 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells.

Abaxial epidermis: epidermal cells sinuous; anticlinal wall thin, beaded; periclinal wall convex, papillate; trichome bases very common, poral; trichome simple, unicellular, up to 50 um long, with apex acute; areoles evident.

Stomates: sunken and cycled by surrounding cells.

References: Slide No. DCC-183; Slide No. 303 (Kuoh-Chang Chen 187, TAIF-076695); Slide No. 304 (Sheng-You, Lu 16776, TAIF-076328); Slide No. 305 (Sheng-You Lu 16812, TAIF-068252).

Litsea alveolata C.K. Allen (Plate 329, 330)

Publication: in Journ. Arn. Arb. xxiii. 121 (1942).

Distribution: N$_{ew}$ Guin$_{ea}$.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-16 um long, 6-12 um wide; anticlinal wall thick; periclinal wall granulate; trichome bases common, poral, irregularly thicken, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells angular, 14-20 um long, 9-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 18.5, 12-15 um long, 13-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 414 (L.J. Brass 11466, BO-0104328).

Litsea ampla Merrill (Plate 331, 332)

Publication: in Philipp. Journ. Sc., Bot. 1917, xii. 133.

Distribution: Philippines (S$_{a}$mar. Luzon).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 9-18 um log, 7-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, with cuticular thickening around pore. *Stomates* paracytic, 14-16 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 413 (BW 9576, BO-0104329).

Litsea angulata Blume (Plate 333, 334)

Publication: Bijdr. 563.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-15 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 12-23 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 22.8, 14-16 um long, 14-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow but double in Slide No. 411.

References: Slide No. 412 (D. Darnaedi D. 457, BO-0104326); Slide No. 411 (Ilias Paie S. 27924, BO-0104327).

Litsea artocarpifolia Gamble (Plate 335, 336)

Publication: in Kew Bull. 1910, 316.

Distribution: Penisular Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-28 um long, 10-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 16-24 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate, slightly convex; trichome bases common, poral, with 6-9 radially arranged surrounding cells with convex periclinal wall, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 21.4, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, broad.

Reference: Slide No. 415 (A. Kostermans 82057, BO-0113274).

Note: radially arranged surrounding cells with convex periclinal wall surround trichome bases.

Litsea atrata S.K. Lee (Plate 337, 338)

Publication: in Acta Phytotax. Sin., viii. 195 (1963).

Distribution: China (Guangdong, Guangxi, Guizhou, S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 9-15 um long, 8-10 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells angular, 13-15 um long, 9-10 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 16.3, 8-11 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall smooth to granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 136 (Sino-Rus$_S$. Exp. 9803, KUN-0103111).

Litsea aurea Kosterm. (Plate 339, 340)

Publication: in Reinwardtia, viii. 86 (1970).

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-12 um long, 7-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 46 surrounding cells, with cuticular thickening along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-25 um long, 7-10 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 16.3, 13-15 um long, 15-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 410 (Sibat ok Luang S. 21863, BO-0104325).

Litsea auriculata Chien & Cheng (Plate 341, 342)

Publication: in Contrib. Biol. Lab. Sc. Soc. China, Bot. Ser., vi. 59 (1931).

Distribution: China [Zhejiang (Tianmu Mt. and Tiantai Mt.), S Anhui]

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 18-32 um long, 12-21 um wide; areoles evident; anticlinal wall irregularly thickened, smooth to beaded; periclinal wall finely papillate; trichome bases rare, over veins, poral, with 5-7 surrounding cell, with cuticular thickening around pore; trichome simple, unicellular, 70-100 um long ,with apex acute.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins; anticlinal wall thin, smooth; periclinal wall granulate; trichome very common, over veins, simple, unicellular, c. 200 um long.

Stomates: guard cells sunken; subsidiary cells 2, anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales evident, broad, granulate.

References: Slide No. DCC-539; Slide No. 138 (H. Migo s.n., KUN-0103159).

Litsea balansae Lecomte (Plate 343, 344)

Publication: Fl. Gen. Indo-Chine, v. 135 (1914).

Distribution: China (S Yunnan); Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 9-15 um long, 7-12 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 9-11 um long, 7-10 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases rare, over veins, poral, with 7-9 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.6, 7-9 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent; narrow, granulate.

Reference: Slide No. 137 (Liu W.X. 250, KUN-0103203)

Litsea barringtonioides Kosterm. (Plate 345, 346)

Publication: in Reinwardtia, vii. 345 (1968).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells epidermal cells angular, 12-24 um long, 8-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surround cells.

Abaxial epidermis: epidermal cells angular, 15-28 um long, 10-16 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 5-8 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 15.4, 12-15 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 408 (M. Leighton 57, BO-0104385).

Litsea baviensis Lecomte. (Plate 347, 348)

Publication: in Nouv. Arch. Mus. Hist. Nat. Paris, v. ser. v. 87 (1913)

Distribution: China [Hainan, Guangxi (Tianlin), SE Yunnan].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 8-12 um long, 5-7 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate to finely papillate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate to sinuous, 11-15 um long, 6-8 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, over veins.

Stomates paracytic, S.I. 23.5, 6-8 um long, 5-9 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, linear, granulate.

Reference: Slide No. 139 (Liang X.R. 64323, KUN-0102157).

Litsea beilschmiediifolia H.W. Li (Plate 349, 350)

Publication: in Acta Phytotax. Sin., 16(4): 50. 1978.

Distribution: China (SE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-15 um long, 7-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 13-18 um long, 6-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 40-80 um long, with apex acute; areoles evident.

Stomates paracytic, S.I. 18.2, 12-15 um long, 11-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 140 (Mao P.Y. 04368, KUN-0102003).

Litsea brachystachya Villar (Plate 351, 352)

Publication: in Blanco, Fl. Philipp. ed. III. Nov. App. 180.

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 16-25 um long, 12-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 20-35 um long, 10-15 um wide; anticlinal wall thin, smooth, irregularly thickened; periclinal wall granulate; trichome bases common, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 19.3, 15-18 um long, 14-16 um wide; guard cell sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, double.

Reference: Slide No. 407 (Kds 40252, BO-0119428).

Litsea caesifolia Elmer (Plate 353, 354)

Publication: Leaflets Philipp. Bot. ii. 722 (1910).

Distribution: Ins. Philippines, Mindanao.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, beaded; periclinal wall finely papillate.

Stomates sunken; stomatal scales linear.

Reference: Slide No. 404 (J. & M.S. Clemens 34148, BO-0104330).

Notes: this species resembles Slide No. 444, 428, 417, 416.

Litsea calophyllantha K. Schum. (Plate 355, 356)

Publication: in K. Schum. & Lauterb. Fl. Deutsch. Sudsee, 331.

Distribution: New Guinea.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 15-22 um long, 9-17 um wide; anticlinal wall thin, smooth; periclinal wall striate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded to angular, 15-25 um long, 10-17 um wide; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, granulate; trichome bases very common, poral, with 5-8 radially arranged surround cells, trichome simple, unicellular, up to 50 um long, with apex acute.

Stomates paracytic, S.I. 17.4, 12-15 um long, 13-17 um wide; distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 403 (BO-0119427).

Litsea cassiaefolia Blume (Plate 357, 358)

Publication: Mus. Bot. Lugd. Bot. i. 348.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 14-26 um long, 10-16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 15-24 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Stomates paracytic, S.I. 18.7, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 406 (Kds 3639, BO-0119426).

Litsea castanea Hook. f. (Plate 359, 360)

Publication: Fl. Brit. Ind. V. (1866) 171.

Distribution: Malay Peninsula [Malacca (Maingay), Bukit Bruang; Brisu (Derry); Selangor, Kwala Lumpur; Perak, Sungei Larut and Kota (Wray); Ulu Bubong and Larut (Kunstler)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 15-20 um long, 8-15 um wide; anticlinal wall thin, smooth; periclinal wall striate (granulate in Slide No. 12); trichome bases rare, poral, with 4-6 surrounding cell, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, 22-27 um long, 10-16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate to finely papillate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 24.4, 13-16 um long, 16-20 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall smooth; stomatal scales prominent, narrow.

References: Slide No. DCC-12; Slide No. 405 (Muchtor 87A, BO-0118974).

Litsea caulocarpa Merrill (Plate 361, 362)

Publication: in Journ. As. Soc. Straits, lxxxv. 193 (1922).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 17-22 um long, 12-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells and cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 24-36 um long, 11-20 um wide; anticlinal wall thin, smooth, irregularly thickened; periclinal wall irregularly thickened, granulate; trichome bases common, poral, with 5-7 radially arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, c. 150 um long, with apex acute.

Stomates paracytic, S.I. 18.6, 19-23 um long, 16-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. DCC-589; Slide No. 402 (Ilias Paie S15867, BO-0118975).

Litsea chinensis Blume (Plate 363, 364)

Publication: Bijdr. 565.

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-32 um long, 13-19 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 18-25 um long, 13-16 um wide; anticlinal wall buttressed; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells, trichome simple, unicellular, up to 200 um long, with apex acute.

Stomates paracytic, 13-15 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, buttressed; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 401 (Kds 38739, BO-0118973).

Litsea chingpingensis Yang et P.H. Huang (Plate 365, 366)

Publication: in Acta Phytotax. Sin., 16(4): 57 (1978).

Distribution: China (S to NW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-17 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 9-12 um long, 7-11 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20 um long, with apex acute.

Stomates paracytic, S.I.17.2, 9-10 um long, 8-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, linear, granulate.

Reference: Slide No. 141 (K.M. Feng 8112, KUN-0102015).

Litsea chunii Cheng (Plate 367, 368)

Publication: in Contrib. Biol. Lab. Sc. Soc. China, Bot. Ser., ix. 196 (1934).

Distribution: China (W Sichuan, NW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-18 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases very rare, poral, over veins, with 5-7 surrounding cells; with cuticular thickening around pore; trichome simple, unicellular, up to 130 um long, with apex acute.

Abaxial epidermis: epidermal cells angular to rounded, 10-17 um long, 7-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 50-70 um long.

Stomates paracytic, S.I. 15.4, 9-11 um long, 10-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 142 (W.T. Wang 312, KUN-0102048).

Litsea chunii Cheng var. *latifolia* (Yang) H.S. Kung (Plate 369, 370)

Publication: in Acta Phytotax. Sin., 16(4): 46, 1978.

Distribution: China (W to N Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-22 um long, 10-13 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded, 10-15 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I.17.6, 9-10 um long, 8-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 144 (W Sichuan Exp_{end}.(59) 1322, KUN-0102228).

Litsea chunii Cheng var. *likiangensis* Yang et P.H. Huang (Plate 371, 372)

Publication: in Acta Phytotax. Sin., 16(4): 46, 1978.

Distribution: China (NW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with cuticular thickening around pore.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 143 (K.M. Feng 22453, KUN-0102247).

Litsea collina S. Moore (Plate 373, 374)

Publication: in Journ. Bot. 1923, lxi. Suppl. 43.

Distribution: New Guinea.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 25-32 um long, 13-18 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 15-22 um long, 10-16 um wide; anticlinal wall thin, beaded; periclinal wall granulate, convex, bubble-like; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.4, 12-15 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 400 (BO-0119425).

Litsea confusa Koord. & Valet. (Plate 375, 376)

Publication: in Meded.'s Lands Plantent. lxviii. 161.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 10-15 um wide; anticlinal wall thin , smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 5-11 um long, 4-8 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, up to 50 um long.

Stomates paracytic, S.I. 16.1, 10-13 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.
References: Slide No. 397 (BO-0119423); Slide No. 398 (BO-0119422); Slide No. 399 (Ju 3061, BO-0119424).

Litsea cordata Hook.f. (Plate 377, 378)
Publication: Fl. Brit. Ind. V. (1886) 177.
Distribution: As. Trop. (Borneo, Sumatra).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with cuticular thickening around pore.
Abaxial epidermis: delimitation among the cells unclear; periclinal wall granulate, heavily convex, bubble-like; areoles evident
Stomates; paracytic; guard cells sunken; subsidiary cells 2; periclinal wall granulate; stomatal scales narrow.
Reference: Slide No. 396 (Veldkamp 8576, BO-24047).

Litsea coreana Leville (Plate 379, 380)
Publication: in Fedde, Repert. x. 370 (1912).
Distribution: Japan (the Ryukyu Is.), South Korea and C. Taiwan.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells undulate to sinuous, 12-18 um long, 9-15 um wide; anticlinal wall thin, apparently beaded; periclinal wall granulate; trichome base rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 12-23 um long, 8-15 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate;trichome bases common in Slide No. 301, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.
Stomates paracytic, S.I. 16.7, 11-17 um long, 10-12 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, linear.
References: Slide No. DCC-465; Slide No. 301 (S.Y. Lu 19421, TAIF-065348).

Litsea coreana Leville var. *lanuginosa* (Migo) Yang et P.H. Huang (Plate 381, 382)

Publication: in Acta Phytotax. Sin., 16(4): 50. 1978.

Distribution: China (Zhejiang, Anhui, Henan, Jiangsu, Fujian, Jiangxi, Hunan, Hubei, Sichuan, N Guangdong, Guangxi, Guizhou, Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-12 um long, 8-10 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cell undulate to sinuous, 12-14 um long, 6-12 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, over veins, with 5-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 100-150 um long, with apex acute.

Stomates paracytic, S.I. 20.7, 9-11 um long, 7-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear, granulate.

Reference: Slide No. 145 (P.Y. Qiu 55509, KUN-0102172).

Litsea coreana Leville var. *sinensis* (Allen) Yang et P.H. Huang (Plate 383, 384)

Publication: in Acta Phytotax. Sin., 16(4): 49, 1978.

Distribution: China (Zhejiang, Jiangsu, Anhui, Henan, Hubei, Jiangxi, Fujian).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 9-12 um long, 6-10 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells undulate, 9-15 um long, 6-13 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 18.2, 9-11 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear, granulate.

Reference: Slide No. 146 (M.Q. Nie & S.K. Lai 4172, KUN-0102286).

Litsea costalis (Nees) Kosterm. (Plate 385, 386)

Publication: in Reinwardia, vii. 501 (1969).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-20 um long, 7-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 12-24 um long, 11-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases very common, poral, with 3-6 surrounding cells and cuticular thickening around pore; trichome simple, unicellular, c. 40 um long, with apex acute.

Stomates paracytic, S.I. 11.5, 17-20 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-190.

Litsea cubeba (Lour.) Pers. (Plate 387, 388)

Publication: Syn. ii. 4 (1807).

Distribution: China (Guangdong, Guangxi, Fujian, Taiwan, Zhejiang, Jiangsu, Anhui, Hunan, Hubei, Jiangxi, Guizhou, Sichuan, Yunnan, Tibet); Cochinch.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells rounded, becoming elongate over veins, 20-32 um long, 16-27 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded, becoming elongate over veins, 14-22 um long, 8-13 um wide; anticlinal wall irregularly thickened, beaded; periclinal wall granulate, convex.

Stomates paracytic, S.I. 18.2, 15-18 um long, 10-16 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double; outer scales prominent, narrow; inner scales prominent, narrow, granulate.

References: Slide No. DCC-415; Slide No. DCC-464; Slide No. DCC-247; Slide No. DCC-246; Slide No. DCC-440; Slide No. 302 (Shu-Mei Liu 7, TAIF-075922); Slide No. 147 (C.Y. Wu 82090, KUN-0103376).

Litsea cuprea Merrill (Plate 389, 390)

Publication: in Journ. As. Soc. Straits, lxxxv. 192 (1922).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-18 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular, 20-32 um long, 9-17 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 22.2, 14-16 um long, 14-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.
Reference: Slide No. 395 (Amdjah 669, BO-0118972).

Litsea cylindrocarpa Gamble (Plate 391, 392)
Publication: in Kew Bull. 1910. 318.
Distribution: Malaysia.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells undulate, 25-32 um long, 17-25 um wide; anticlinal wall thin, smooth; periclinal wall striate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.
Abaxial epidermis: epidermal cells angular, 16-32 um long, 10-17 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.
Stomates paracytic, S.I. 20.1, 12-15 um long, 14-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.
References: Slide No. 394 (Kostermans 23003, BO-0118971).

Litsea densiflora (Teschn.) Kosterm. (Plate 393, 394)
Publication: in Reinwardtia, viii. 91 (1970).
Distribution:
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 11-18 um long, 8-17 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate.
Abaxial epidermis: epidermal cells angular, 14-25 um long, 9-13 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases very common, poral,

with 4-6 surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, up to 80 um long, with apex acute.

Stomates paracytic, S.I. 18.2, 10-14 um long, 9-12 um wide; subsidiary cells 2, anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 393 (W. Meijer 10027, BO-0118970).

Litsea dilleniifolia P.Y. Pai & P.H. Huang (Plate 395, 396)

Publication: in Acta Phytotax. Sin., 16(4): 51 (1978).

Distribution: China (S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 5-10 um long, 5-8 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, over veins, with 5-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 10-14 um long, 6-10; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.17.4, 7-10 um long, 7-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, finely papillate.

References: Slide No. 148 (Y.H. Li 2274, KUN-0101514); Slide No. 233 (J. Li 006).

Litsea diversifolia Blume (Plate 397, 398)

Publication: Bijdr. 564.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 16-32 um long, 9-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 16-25 um long, 10-16 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 18.2, 13-15 um long, 11-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 392 (Kostermans s.n., BO-0118969).

Litsea elliptica Blume (Plate 399, 400)

Publication: Bijdr. 563.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 16-25 um long, 10-17 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate, trichome bases rare, poral ,with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, finely papillate.

Stomates paracytic, 12-15 um long, 11-15 um wide; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 391 (S. Sudin & J. Mayer 055, BO-0032403).

Litsea elongata (Wall. ex Nees) Benth. et Hook.f. (Plate 401, 402)

Publication: Gen. iii. 163.

Distribution: China (Guangdong, Guangxi, Hunan, Hubei, Sichuan, Guizhou, Yunnan, Tibet, Anhui, Zhejiang, Jiangsu, Jiangxi, Fujian)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 9-15 um long, 6-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 5-8 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, 7-10 um long, 4-6 um wide; areoles evident; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 5-7 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 30-40 um long, with apex acute.

Stomates paracytic, S.I.24.2, 8-10 um long, 7-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 149 (S.G. Wu 61-3834, KUN-0101517).

Litsea elongata var. *faberi* (Hemsl.) Yang et P.H. Huang (Plate 403, 404)

Publication: in Acta Phytotax. Sin., 16(4): 59, 1978.

Distribution: China (Sichuan, Guizhou, NE Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-20 um long, 7-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 6-8 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, 9-14 um long, 7-9 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases very common, over veins, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-50 um long, with apex acute.

Stomates paracytic, S.I.21.5, 8-11 um long, 10-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 150 (X.W. Li 222, KUN-0102399, KUN-0102340).

Litsea elongata (Wall. ex Nees) Benth. & Hook.f. var. *mushaensis* (Hay.) J.C. Liao (Plate 405, 406)

Publication: Taxon. Revis. Fam. *Lauraceae* in Taiwan: 92 (1988).

Distribution: Southern China and Indo-China, Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 13-20 um long, 10-13 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate; trichome bases rare, poral, over veins, with 6-8 radially arranged surrounding cells, with cuticular thickening around pore extending along radial wall of surrounding cells.

Abaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 9-15 um long, 7-10 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall granulate; trichome very common, poral, with 5-7 surrounding cells with cuticular thickening around pore; trichome simple, unicellular, c. 50-200 um long, with apex acute.

Stomates paracytic, S.I. 22.7, 10-12 um long, 9-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-410; Slide No. 299 (Kuoh-Chang Chen 83, TAIF-077035); Slide No. 300 (Chih-Hsiung Chen 1285, TAIF-080128)

Litsea elongata var. *subverticillata* (Yang) Yang et P.H. Huang (Plate 407, 408)

Publication: in Acta Phytotax. Sin., 16(4): 59 (1978).

Distribution: China (SW Hubei, W Hunan, W Guangxi, SW Guizhou, SE Yunnan)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 12-15 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30 um long, with apex acute.

Abaxial epidermis: trichome bases very common; trichome simple, unicellular, up to 200 um long.

Stomates: stomatal scales narrow, granulate.

Reference: Slide No. 151 (C.Y. Wu 63-33, KUN-0102499).

Litsea engleriana Teschn. (Plate 409, 410)

Publication: in Engl. Jahrb. lviii. 389 (1923).

Distribution: New Guinea.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-17 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 13-18 um long, 10-13 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate; trichome bases common, over veins, poral, with 6-8 surrounding cells, with thick cuticular thickening around pore; trichome simple, unicellular, c. 100-150 um long, with apex acute.

Stomates paracytic, S.I. 19.3, 14-20 um long, 10-15 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow or linear, granulate.

References: Slide No. DCC-622; Slide No. 390 (J.W. Womersley NGF 24901, BO-0119380).

Litsea erectinervia Kostermans. (Plate 411, 412)

Publication: in Reinwardtia, viii. 94 (1970).

Distribution: Malaya.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 11-16 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-25 um long, 8-15 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore and extending along the walls of surround cells.

Stomates paracytic, S.I. 19.1, 14-16 um long, 13-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 389 (BO-0119379).

Litsea euosma W.W. Smith (Plate 413, 414)

Publication: in Notes Bot. Gard. Edin. xiii. 166 (1921).

Distribution: China (NE Guangdong, Guangxi, Hunan, Jiangxi, Sichuan, Guizhou, Yunnan, Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-17 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 11-19 um long, 9-12 um wide; anticlinal wall thin, finely beaded or smooth; periclinal wall convex, bubble-like, granulate; trichome bases very common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20-30 um long.

Stomates paracytic, S.I.21.1, 11-16 um long, 10-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 152 (S.J. Pei 59-9481, KUN-0102530, KUN-0102531).

Litsea fenestrata Gamble (Plate 415, 416)

Publication: in Kew Bull. 1910, 360.

Distribution: Penins. & Arch. Mal.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-23 um long, 11-15 um wide; anticlinal wall thin, smooth, irregularly thickened; periclinal wall granulate to finely papillate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, 22-36 um long, 18-24 um wide; anticlinal wall thin, buttressed; periclinal wall finely papillate.

Stomates paracytic, S.I. 23.4, 14-18 um long, 11-16 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow or linear.

Reference: Slide No. 387 (San 40857, BO-0104535).

Litsea ferruginea Blume (Plate 417, 418)

Publication: Bijdr. 561.

Distribution: Malaya; Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 20-30 um long, 11-22 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall granulate; trichome bases common, poral, with 3-6 surrounding cells, with cuticular thickening around pore sometimes extending along wall of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 20-28 um long, 13-20 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along radial walls of surrounding cells; trichome simple, unicellular, c. 100-500 um long, with apex acute.

Stomates paracytic, S.I. 20.0, 12-15 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate, stomatal scales prominent, linear.

References: Slide No. DCC-532; Slide No. 386 (Paul Chia et al. 33214, BO-0118965).

Litsea firma Hook. f. (Plate 419, 420)

Publication: Fl. Brit. Ind. v. (1886) 162.

Distribution: Sumatra; Borneo; Celebes. (Asia Tropical)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 23-33 um long, 15-25 um wide; anticlinal wall thin, smooth to beaded irregularly thickened; periclinal wall striate; trichome bases rare, poral, with 4-7 radially arranged surrounding cell, with cuticular thickened extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 25-35 um long, 14-20 um wide; anticlinal wall thin, smooth of beaded; periclinal wall slightly convex, granulate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore; trichome simple, unicellular, c. 50-150 um long, with apex acute.

Stomates paracytic, S.I. 19.7, 13-15 um long, 10-14 um wide; uniformly distributed within areoles; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-272; Slide No. DCC-273; Slide No. 385 (Kostermans 587, BO-0119381).

Litsea formanii Kosterm. (Plate 421, 422)

Publication: in Reinwardtia. vii. 347 (1968).

Distribution: Celebes.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral.

Stomates paracytic and sunken; stomatal scales linear.

Reference: Slide No. 384 (L.L. Forman 271, BO-0104534).

Notes: it is close to Slide No. 404.

Litsea forstenii Boerl. (Plate 423, 424)

Publication: Handl. Fl. Ned. Ind. iii. 142.

Distribution: Celebes.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-19 um long, 8-12 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells undulate, 15-24 um long, 10-16 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 22.2, 11-13 um long, 13-15 um wide, uniformly distributed; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow

Reference: Slide No. 448 (Bo-0104539).

Litsea fulva Villar (Plate 425, 426)

Publication: in Blanco, Fl. Philipp. ed. III. Nov. App. 181.

Distribution: Ins. Phillipines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 19-35 um long, 11-25 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases common, with 3-5 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to undulate, 24-33 um long, 14-22 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.2, 13-15 um long, 15-17 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 447 (P. Chai & Ilias Paie S. 27932, BO-0104533).

Litsea garciae Vidal. (Plate 427, 428)

Publication: Revis. Pl. Vasc. Filip. (1886) 228.

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-21 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-7 radially arranged surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 18-23 um long, 12-16 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, up to 30-50 um long, with apex acute.

Stomates paracytic, S.I. 16.4, 12-15 um long, 15-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

References: Slide No. 298 (Sheng-You Lu 17512, TAIF-077323); Slide No. 446 (van Sloten 2273, BO-0119453).

Litsea garrettii Gamble (Plate 429, 430)

Publication: in Kew Bull. 1913, 204.

Distribution: China (S Yunnan); Thailand; Burma.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous (angular in Slide No. 153), becoming elongate over veins, 13-18 um long, 12-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate; (trichome bases common, poral, with 6-9 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells in Slide No. 153).

Abaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 15-24 um long, 9-12 um wide; anticlinal wall irregularly thicken, thin, beaded; periclinal wall granulate; trichome bases common, over veins, poral, with 6-8 surrounding cells, with cuticular thickening around pore, sometimes extending along the walls of surrounding cells.

Stomates paracytic, S.I. 20.1, 13-17 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-610; Slide No. 153 (S.G. Xu 4956, KUN-0100340, 0100341).

Litsea glaberrima (Thw.) Trimen (Plate 431, 432)

Publication: Cat. Pl. Ceyl. 76.

Distribution: Ceylon.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 15-30 um long, 15-20 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases rare, poral , with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 12-25 um long, 11-18 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate; trichome bases common, poral, with 5-6 surrounding cells and slightly cuticular thickened around pore; trichome simple, unicellular, c. 50-100 um long, with apex acute.

Stomates paracytic, S.I. 15.2, 16-20 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wallfinely papillate; stomatal scales prominent, linear, granulate.

Reference: Slide No. DCC-627

Litsea glaucescens H.B. & K. (Plate 433, 434)

Publication: Nov. Gen. et Sp. ii. 168.

Distribution: Mexic$_{O}$.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 12-17 um long, 5-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate;trichome bases rare, over veins, poral, with 5-7 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, 13-20 um long, 9-12 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate;trichome bases rare, poral, over veins, with 6-8 surrounding cells around pore, with cuticular thickening around pore.

Stomates paracytic, S.I.18.7, 9-10 um long, 8-10 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall, thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-134; Slide No. DCC-135; Slide No. 155 (B. Barthalemew 3305, KUN-0100416).

Litsea globosa Kostermans (Plate 435, 436)

Publication: in Reinwardtia, viii. 99 (1970).

Distribution: New Guin$_{ea}$.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 18-25 um long, 17-22 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 24-34 um long, 10-22 um wide; anticlinal wall thin, smooth to buttressed; periclinal wall thin, smooth to granulate.

Stomates paracytic, S.I. 15.0, 13-18 um long, 9-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, buttressed; periclinal wall smooth; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-623.

Litsea globosa Yang et P.H. Huang (Plate 437, 438)

Publication: in Acta Phytotax. Sin., 16(4): 58 (1978).

Distribution: China (S Hunan, N Guangdong).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 7-16 um long, 6-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, over veins, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 13-15 um long, 5-10 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, over veins, poral, with 5-8 surrounding cells; trichome simple, unicellular, 50-150 um long.

Stomates paracytic, S.I.23.1, 6-8 um long, 5-7 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 156 (P.Q. Tan 58843, KUN-0100556).

Litsea glutinosa (Lour.) C.B. Robinson (Plate 439, 440)

Publication: in Philipp. Journ. Sc., Bot. 1911, vi. 321.

Distribution: China (Guangdong, Guangxi, Fujian and S Yunnan); Vietnam; India; Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 15-26 um long, 13-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate; areoles evident; trichome bases common, poral, over veins, with 4-6 surrounding cells sometimes radially arranged, with cuticular thickening around pore; trichome simple, unicellular, c. 400-600 um long, with apex acute.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 16-30 um long, 10-15 um wide; anticlinal wall thin, buttressed; periclinal wall granulate; areoles evident; trichome bases common, poral, over veins, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, c. 500 um long, with apex acute.

Stomates paracytic, S.I. 21.1, 11-16 um long, 10-15 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, broad, granulate.

References: Slide No. DCC-549; Slide No. DCC-476; Slide No. DCC-267; Slide No. 231(Y.H. Li 01253, KUN-0100470); Slide No. 232(Jie Li 005); Slide No. 296 (Kuoh-Chang Chen 195, TAIF-071839); Slide No 297 (Kuo-Hwei Tai s.n., TAIF-070594).

Litsea glutinosa (Lour.) C.B. Rob. var. *brideliifolia* (Hay.) Merr. (Plate 441, 442)

Publication: in Lingnan Agr. Rev. 1: 84. 1923.

Distribution: China (Guangdong, Guangxi); Indochine.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 12-19 um long, 8-12 um wide; areoles evident; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 9-18 um long, 7-10 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 14.8, 9-11 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, broad, granulate.

Reference: Slide No. 154 (Xuwen Exp$_{ed}$. 234, KUN-0100563).

Litsea gongshanensis H.W. Li (Plate 443, 444)

Publication: in Acta Phytotax. Sin., 16(4): 56, 1978.

Distribution: China (NW Yunnan, Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-13 um long, 6-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, finely beaded; periclinal wall finely papillate, convex, bubble-like.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales linear.

Reference: Slide No. 157 (K.M. Teng 24398 (type), KUN-0100558, KUN-0100559).

Litsea gracilis Gamble (Plate 445, 446)

Publication: in Kew Bull. 1910, 317.

Distribution: Penins. Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous; anticlinal wall thin, beaded, buttressed; periclinal wall finely papillate; trichome bases common, poral.

Stomates sunken; stomatal scales linear.

Reference: Slide No. 444 (S. Kostermans 5068, BO-0118963).

Notes: this species resembles Slide No. 404 (*Litsea caesifolia*), Slide No. 428 (*Litsea hypophaea*), Slide No. 417 (*Litsea accedentoides*), Slide No. 416 (*Litsea accedens*).

Litsea grandis Hook. f. (Plate 447, 448)

Publication: Fl. Brit. Ind. v. (1886) 162.

Distribution: Asia Tropical.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 14-21 um long, 10-14 um wide; anticlinal wall thin, smooth; periclinal wall striate (granulate in slide No. 445); areoles evident; trichome bases common, poral, with 4-7 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded to angular, becoming elongate over veins, 15-30 um long, 7-15 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall granulate, slightly convex; trichome bases very common, over veins, poral, with 4-6 surrounding cells, with cuticular thickened around pore extending along the walls of surrounding cells; trichome simple, unicellular, c. 500 um long, with apex acute.

Stomates paracytic, S.I. 22.2, 14-18 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall smooth; stomatal scales prominent, narrow, granulate.

References: Slide No. 316 (Savawak); Slide No. 445 (BO-24058).

Litsea greenmaniana Allen (Plate 449, 450)

Publication: in Ann. Missouri Bot. Gard. 1938, xxv. 394 (1937).

Distribution: China (Guangdong, Guangxi, Fujian).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 8-13 um long, 5-8 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 7-11 um long, 5-8 um wide; areoles evident; anticlinal wall thin, beaded; periclinal wall apparently papillate; trichome bases common, over veins, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-50 um long, with apex acute.

Stomates paracytic, S.I.17.8, 8-10 um long, 9-10 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 158 (L. Deng 6198, KUN-0100766).

Litsea greenmaniana Allen var. *angustifolia* Yang et P.H. Huang (Plate 451, 452)

Publication: in Acta Phytotax. Sin., 16(4): 56, 1978.

Distribution: China (Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-17 um long, 6-11 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 10-15 um long, 8-12 um wide; areoles evident; anticlinal wall thin, smooth to beaded; periclinal wall apparently papillate, convex, bubble-like; trichome bases rare, over veins, poral, with 6-9 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.17.3, 8-10 um long, 7-9 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 159 (S.Q. Chen 16020, KUN-0100777, KUN-0100787).

Litsea guppyi (F. Muell.) F. Muell. ex Forman (Plate 453, 454)

Publication: in Kew Bull. xix. 462 (1965).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 17-25 um long, 10-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate to striate; trichome bases rare, poral,

with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 11-16 um long, 10-13 um wide; anticlinal wall thin, beaded; periclinal wall papillate, convex.

Stomates: circled by surrounding cells with extending periclinal wall and sunken in the middle.

Reference: Slide No. 443 (D. Fordin NGF 26674, BO-0114536).

Note: Stomata are very similar to that of *Lindera megaphylla.*

Litsea honghoensis Liou (Plate 455, 456)

Publication: in Bull. Soc. Bot. France, 1973, 80: 568.

Distribution: China (SE to S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-14 um long, 8-12 um wide; anticlinal wall thick, smooth to beaded; periclinal wall granulate; trichome bases rare, poral, with 5-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells sinuous, 16-22 um long, 15-18 um wide; anticlinal wall thin, buttressed; periclinal wall convex, bubble-like, granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-60 um long, with apex acute.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth, buttressed; periclinal wall granulate; stomatal scales prominent, very narrow, granulate.

Reference: Slide No. 160 (X.T. Tsai 58-8072, KUN-0100803, KUN-0100804).

Litsea hutchinsonii Merrill (Plate 457, 458)

Publication: in Philipp. Journ. Sci. iv. 259 (1909).

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-21 um long, 10-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-27 um long, 8-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6

surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 12-16 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded, with outer walls raised; periclinal wall ganulate; stomata scales prominent, narrow or linear.

Reference: Slide No. 442 (G.E. Edong 3328, BO-0118962).

Litsea hypophaea Hayata (Plate 459, 460)

Publication: Ic. Pl. Formos. v. 167 (1915).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, becoming elongate over veins, 12-28 um long, 6-15 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; areoles evident; trichome bases rare, poral, over veins, with 4-6 radially arranged surrounding cells, with cuticular thickened around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 12-30 um long, 9-12 um wide; anticlinal wall thin, beaded; periclinal wall granulate to finely papillate; trichome bases very common, poral, over veins, with 4-6 radially arranged surrounding cells, with cuticular thickened along the radial walls of surrounding cells.

Stomates paracytic, S.I. 13.3, 10-14 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-428; Slide No. 295 (S.Y. Lu 14045, TAIF-068253).

Litsea ichangensis Gamble (Plate 461, 462)

Publication: in Sargent, Pl. Wilson. ii. 77 (1914).

Distribution: China (W to SW Hubei, E to E Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded; 14-35 um long, 12-22 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 15-30 um long, 13-16 um wide; anticlinal wall thin, smooth; periclinal wall smooth to granulate.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; stomatal scales double.

Reference: Slide No. 161 (Sino-Amer. Exped. 631, KUN-???).

Note: it is unclear on the abaxial epidermis.

Litsea impressa Boerl (Plate 463, 464)

Publication: Handl. Fl. Ned. Ind. iii. 143.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-24 um long, 10-17 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 5-7 radially arranged surrounding cells.

Abaxial epidermis: epidermal cells angular, 21-28 um long, 14-18 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 5-8 radially arranged surrounding cells.

Stomates paracytic, S.I. 19.1, 13-15 um long, 15-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 441 (Housoorten van den Gadeh 34, BO-0118961).

Litsea insignis Boerl (Plate 465, 466)

Publication: Handl. Fl. Ned. Ind. iii. 142.

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-16 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 18-32 um long, 14-17 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 radially surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.1, 11-14 um long, 11-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 440 (Paul Chai & Ilias Paie S. 30678, BO-0118959).

Litsea irianensis Kostermans (Plate 467, 468)

Publication: Bilbiogr. Laurac. 833 (1964).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 13-24 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 14-28 um long, 9-15 um wide; anticlinal wall buttressed; periclinal wall granulate.

Stomates paracytic, 12-16 um long, 12-15 um wide; anticlinal wall buttressed; periclinal wall smooth; stomatal scales prominent, apparently double.

Reference: Slide No. 355 (A. Floyd 6688, BO-0118960).

Litsea japonica Mirb. (Plate 469, 470)

Publication: Hist. Nat. Pl. ed. II. xi .150; Juss. In Ann. Miss. Par. vi. (1805) 212.

Distribution: Japan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-20 um long, 8-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate.(trichome bases rare, with 5-6 surrounding cells, with cuticular thickening around pore in Slide No. 162).

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 10-15 um long, 7-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases very common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, c. 200 um long, with apex acute.

Stomates circled by the surrounding cells with extending periclinal wals and sunken in the middle.

References: Slide No. DCC-979 (ADEL. GDNS); Slide No. 162 (H.T. Im 16041, KUN-0100830).

Note: this species is very similar to *Lindera megaphylla.*

Litsea javanica Blume (Plate 471, 472)

Publication: Mus. Bot. Lugd. Bot. i. 348.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to sinuous, 10-14 um long, 8-11 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells

Abaxial epidermis: epidermal cells angular to sinuous, 10-15 um long, 7-12 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.7, 13-15 um long, 13-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow

References: Slide No. 438 (Kds 3289, BO-0119387); Slide No. 439 (Housoorten van der Gadeh 274, BO-0104527).

Litsea johorensis Gamble (Plate 473, 474)

Publication: in Kew Bull. 1910, 315.

Distribution: Penins. Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-21 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells

Abaxial epidermis: epidermal cells angular, 20-31 um long, 16-22 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.5, 16-20 um long, 19-25 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 437 (J. Sinclair 39896, BO-0119386).

Litsea kobuskiana Allen (Plate 475, 476)

Publication: in Journ. Arn. Arb. 1937, xviii, 290.

Distribution: China [S Guizhou, Guangxi (Lingui)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 15-22 um long, 8-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded; 15-25 um long, 11-14 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells and cuticular thickening around pore; trichome simple, unicellular, up to 40 um long.

Stomates paracytic, S.I.16.7, 13-15 um long, 9-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 163 (B.Q. Tsoong 1555, KUN-0105000).

Litsea kostermansii C.E. Chang (Plate 477, 478)

Publication: in Fl. Taiwan, 2: 441 (1976).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 15-20 um long, 10-15 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall granulate; trichome bases rare, over veins, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore, sometime extending along the radial walls of surrounding walls.

Abaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 12-20 um long, 8-13 um wide; anticlinal wall thin, smooth to beaded; periclinal wall slightly papillate to papillate; areoles evident; trichome bases common, poral, over veins, with 4-7 radial surrounding cells around pore, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, c. 50-100 um long, with apex acute.

Stomates paracytic, S.I. 15.1, 12-16 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall papillate; stomatal scales prominent, narrow, granulate.

References: Slide No. DCC-449 (Taiwan); Slide No. 164 (W.L. Wagner 6646, KUN-0100828).

Litsea krukovii Kosterm. (Plate 479, 480)

Publication: in Reinwardtia, 9(1): 108 (1974).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, beaded; periclinal wall papillate; trichome bases common, poral, with cuticular thickening around pore.

Stomates paracytic; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall papillate; stomatal scales narrow.

Reference: Slide No. 294 (Her-Long, Chiang 145, TAIF-080953).

Litsea kwangtungensis H.T. Chang (Plate 481, 482)

Publication: in Acta Sci. Nat. Univ. Sunyatsenii, 1960(1): 26 (1960).

Distribution: China (Guangdong).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 17-20 um long, 11-18 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate or angular, 12-23 um long, 10-15 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wallconvex, bubble, apparently papillate, dark staining.

Stomates paracytic, S.I.19.1, 8-11 um long, 10-13 um wide; uniformly distributed within areoles; anticlinal wall thin, finely beaded; periclinal wall granulate, light staining; stomatal scales prominent, double, granulate.

Reference: Slide No. 165 (Z.B. Zhang 12871, KUN-0100826).

Litsea lanceolata (Blume) Kosterm. (Plate 483, 484)

Publication: in B$_a$cker & Bakh. f. Fl. Java, iii. 643 (1968), et in Reinwardtia, vii. 348 (1968).

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-21 um long, 8-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 17-25 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 20.0, 12-17 um long, 11-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow or linear

Reference: Slide No. 436 (Saepadmo, Smith & Chais 27624, BO-0119385).

Litsea lancifolia (Roxb. ex Nees) Benth. et Hook.f. ex F.-Vill. (Plate 485, 486)

Publication: Fl. Brit. Ind. v. (1886) 159.

Distribution: China (Hainan, S Guangxi, S Yunnan); India; Bhutan; Vietnam; Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-12 um long, 5-8 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 7-14 um long, 6-9 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-7 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30 um long, with apex acute.

Stomates paracytic, S.I.19.2, 10-11 um long, 9-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate;stomatal scales prominent, narrow, granulate.

Reference: Slide No. 166 (Sino-Russ. Exped.9683, KUN-0100910, KUN-0100911).

Litsea lancifolia var. *ellipsoidea* Yang et P.H. Huang (Plate 487, 488)

Publication: in Acta Phytotax. Sin., 16(4): 49, 1978.

Distribution: China (S to W Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-15 um long, 6-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20 um long, with apex acute.

Abaxial epidermis: epidermal cells angular, 11-20 um long, 9-11 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, over veins, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular; 30 um long, with apex acute.

Stomates paracytic, S.I.18.7, 8-10 um long, 10-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 167 (Luchun Exped. 1942, KUN-0103712).

Litsea lancilimba Merrill (Plate 489, 490)

Publication: in Philipp. Journ. Sc. 1923, xxiii, 244.

Distribution: China (Guangdong, Guangxi, S Fujian, SE Yunnan); Vietnam; Laos.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-12 um long, 5-9 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 9-12 um long, 5-8 um wide; areoles evident; anticlinal wall thin, beaded; periclinal wall granulate, light staining.

Stomates paracytic, S.I.21.1, 7-10 um long, 7-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate, dark staining;stomatal scales prominent, narrow, granulate.

Reference: Slide No. 196 (K.M. Feng 4767, KUN-0103739, KUN-0103740).

Litsea ledermannii Teschn. (Plate 491, 492)

Publication: in Engl. Jahrb, lviii. 396 (1923).

Distribution: N_{ew} $Guin_{ea}$.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 16-21 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 11-21 um long, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate to papillate; trichome bases very common, poral, with 3-5 surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, 10-30 um long, with acute apex.

Stomates paracytic, S.I. 17.8, 13-20 um long, 10-15 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate to papillate; stomatal scales prominent, narrow.

Reference: Slide No. 435 (bb 14297, BO-0119384).

Litsea lii C.E. Chang (Plate 493, 494)

Publication: in Fl. Taiwan, 2: 441 (1976).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 5-7 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic; uniformly distributed within areoles; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thick, smooth, with raised ledge forming prominent collar around stomata; periclinal wall granulate; stomatal scales prominent, narrow.

References: Slide No. 292 (S.Y. Lu 14109, TAIF-068292); Slide No. 293 (Sheng-You Lu 14163, TAIF-076230).

Notes: this species is very similar to *Litsea fawcettiana.*

Litsea liniii C.E. Chang (Plate 495, 496)

Publication: in Fl. Taiwan, 2: 443 (1976)

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-20 um long, 8-13 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases rare, poral, with 5-9 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, 15-20 um long, 8-14 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall convex, bubble-like, apparently papillate; trichome bases common, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around the pore extending along the radial walls of surrounding cells; trichome simple, unicellular, c. 50 um long, with apex acute; hydathodes evident.

Stomates circled by surrounding cells with heavily extending periclinal wall, and deepened in the middle

Reference: Slide No. DCC-447 (Taiwan).

Notes: The characters of stomates also can be found in *Lindera megaphylla.*

Litsea liyuyingi Liou (Plate 497, 498)

Publication: in Bull. Soc. Bot. France, 1933, lxxx, 566.

Distribution: China (S Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 9-13 um long, 8-10 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 8-14 um long, 6-9 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate, dark staining; trichome bases very common, poral, with 3-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20 um long, with apex acute.

Stomates paracytic, S.I. 18.5, 8-10 um long, 9-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate, light staining;stomatal scales prominent, narrow.

References: Slide No. 197 (C.W. Wang 76389, KUN-0101823); Slide No. 198 (S.J. Pei 59-9349, KUN-0101844, KUN-0101945).

Litsea longistaminata (Liou) Kosterm. (Plate 499, 500)

Publication: in Reinwardtia, vii. 506 (1969).

Distribution: China (S Yunnan); Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 7-10 um long, 5-7 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: periclinal wall convex, granulate; trichome bases common; trichome simple, unicellular, up to 60 um long.

Stomates: subsidiary cells 2; periclinal wall finely papillate; stomatal scales linear.

Reference: Slide No. 195 (T.P. Zhu 453, KUN-0103794, KUN-0103793).

Notes: The delimitations between cells are unclear on the abaxial epidermis

Litsea lucida Blume (Plate 501, 502)

Publication: Bijdr. 562.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-23 um long, 10-18 um wide; anticlinal wall thin, apparently beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells undulate 15-30 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.3, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 434 (K. 44, BO-0104543).

Litsea luzonica Villar (Plate 503, 504)

Publication: in Blanco, Fl. Philipp. ed. III. Nov. App. 181.

Distribution: Insl. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 14-22 um long, 8-12 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 14-22 um long, 8-13 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall finely papillate;trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of radially arranged surrounding cells.

Stomates paracytic, S.I. 18.8, 11-15 um long, 12-15 um wide, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 433 (M.R. Henderson S.F. No. 38967, BO-0104537).

Litsea machilifolia Gamble (Plate 505, 506)

Publication: in Kew Bull. 1910, 320.

Distribution: Penins. Malaysia.

Species A:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 9-16 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 15-21 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall striate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 20.9, 12-14 um long, 11-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 432 (Nen 791, BO-0118968).

Species B:

Leaf cuticle: Hypostomatic. (Plate 507, 508)

Adaxial epidermis: epidermal cells angular, 11-18 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, granulate; trichome bases common, poral.

Stomates paracytic; sunken and circled by the surrounding epidermal cells; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 431 (Achmod 1042, BO-0118958).

Notes: the above two slides have totally different leaf cuticle features, although they share the same name.

Litsea machiloides Yang et P.H. Huang (Plate 509, 510)

Publication: in Acta Phytotax. Sin., 16(4): 60, 1978.

Distribution: China [Guangdong (Gaoyao)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 8-10 um long, 5-8 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 8-10 um long, 5-8 um wide; areoles evident; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, over veins, poral, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 70-150 um long, with apex acute.

Stomates paracytic, S.I. 17.3, 8-10 um long, 8-11 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 199 (C. Huang 162639, KUN-0103815).

Litsea magnoliifolia Yang et P.H. Huang (Plate 511, 512)

Publication: in Acta Phytotax. Sin., 16(4): 52 (1978).

Distribution: China (S to SW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-15 um long, 9-12 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with 5-8 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 7-12 um long, 6-9 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate;trichome bases common, over veins, poral, with 5-8 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, up to 150 um long, with apex acute.

Stomates paracytic, S.I. 16.8, 9-12 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent; narrow.

Reference: Slide No. 200 (Y.H. Li 2133, KUN-0103818, KUN-0103819).

Litsea mappacea Boerl (Plate 513, 514)

Publication: Handl. Fl. Ned. Ind. iii. 143.

Distribution: Java, Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-18 um long, 9-12 um wide; anticlinal wall thin, smooth to beaded, irregularly thickened; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells

Abaxial epidermis: epidermal cells rounded, 12-20 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic, S.I. 20.1, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 430 (Kostermans 3, BO-0104542).

Litsea megacarpa Gamble (Plate 515, 516)

Publication: in Kew Bull. 1910. 364.

Distribution: Penins. Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-21 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 12-25 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate, slightly convex; trichome bases very common, poral, with 3-6 surrounding cells, with cuticular thickening around pore, trichome simple, unicellular, up to 40 um long, with apex acute.

Stomates paracytic, S.I. 14.3, 15-17 um long, 13-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent narrow.

Reference: Slide No. 429 (Kodir A 2072, BO-0119389).

Litsea membranacea Elmer (Plate 517, 518)

Publication: Leaflets Philipp. Bot. ii. 380 (1908).

Distribution: Insl. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded; anticlinal wall thin, smooth; periclinal wall finely papillate.

Stomates sunken; stomatal scales linear.

Reference: Slide No. 428 (A.D.E. Elmer 8961, BO-0119388)

Notes: this species like Slide No. 444, 404, 417, 416.

Litsea meyeri Kosterm. (Plate 519, 520)

Publication: in Reinwardtia, vii: 348 (1968).

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-28 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 25-44 um long, 8-21 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 17.4, 14-16 um long, 15-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 426 (BO-0119390).

Litsea micrantha Merrill (Plate 521, 522)

Publication: in Philipp. Journ. Sc., Bot. 1917, xii. 136.

Distribution: Ins. Philippines.

Species A:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-25 um long, 12-17 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, granulate.

Stomates paracytic and sunken; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 424 (C.E. Ridsdale 1290, BO-0119392).

Species B:

Leaf cuticle: Hypostomatic. (Plate 523, 524)

Adaxial epidermis: epidermal cells angular, 20-26 um long, 10-17 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 20-31 um long, 14-21 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic, S.I. 16.8, 13-15 um long, 13-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate, stomatal scales prominent, narrow.

Reference: Slide No. 425 (R. Edano 49370, BO-0119391).

Notes: the above two slides belonged to the same species --- *Litsea micrantha*, but have totally different characters for lower periclinal wall and stomates.

Litsea mollis Hemsl. (Plate 525, 526)

Publication: in Journ. Linn. Soc. xxvi. (1891) 383.

Distribution: China (Guangdong, Guangxi, Hunan, Sichuan, Guizhou, Yunnan, E Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 15-26 um long, 10-14 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, with 5-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral; trichome simple, unicellular.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent; double; granulate.

Reference: Slide NO. 201 (G.X. Fu et Z.S. Zhang 1805, KUN-0106982).

Litsea monopetala (Roxb.) Pers. (Plate 527, 528)

Publication: Syn. ii. 4. 1807.

Distribution: China (Guangdong; Guangxi; SW Guizhou; S Yunnan); SE Asia; India; Pakistan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 10-17 um long, 7-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate; areoles evident; trichome bases common, poral, over veins, with 4-7 radial arranged surrounding cells, with cuticular thickening extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 13-17 um long, 5-13 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall convex, bubble-like, granulate; areoles evident; trichome bases common, poral, over veins, with 4-7 radial arranged surrounding cells, with cuticular thickening around poral extending along the radial walls of surrounding cells; trichome simple; unicellular, c. 50-150 um long, with apex acute.

Stomates paracytic, S.I. 16.7, 11-15 um long, 10-15 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; stomatal scales evident, slightly broad, granulate.

References: Slide No. DCC-606 (China); Slide No. 202 (Jiangxin 167, KUN-0101707); Slide No. 422 (J.A. Larzing 17364, BO-0119393); Slide No. 423 (BO-0118967).

Litsea morrisonensis Hayata (Plate 529, 530)

Publication: in Journ. Colt. Sc. Tokyo, xxx. Art. 1, 250 (1911).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 18-30 um long, 11-17 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 10-16 um long, 9-11 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall convex, bubble-like, papillate; trichome bases common, poral, over veins, with 5-7 radial arranged surrounding cells, with cuticular thickening along the radial walls of surrounding cells; trichome simple, unicellular, c. 50-100 um long, with apex acute.

Stomates uniformly distributed within areoles, circled by surrounding cells and sunken in the middle, hardly seen due to the extending periclinal wall of stomatal surrounding cells.

References: Slide No. DCC-446; Slide No. 291 (S.T. Chiu et al. 03379, TAIF-083578).

Notes: this species closely resembles *Lindera megaphylla.*

Litsea moupinensis Lec. var. *moupinensis* (Plate 531, 532)

Publication: in Bull. Soc. Bot. France, 1913, lx. 84.

Distribution: China (Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-22 um long, 9-15 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, 170 um long, with apex acute.

Abaxial epidermis: epidermal cells angular to rounded, 10-15 um long, 9-12 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall slightly convex, granulate; trichome bases common, poral, with 5-7 surrounding cells; with cuticular thickening around pore; trichome simple, unicellular, up to 200 um long, with apex acute.

Stomates paracytic, S.I.; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 203 (Z.P. Shong 38738, KUN-0101756, KUN-0101766).

Litsea moupinensis Lec. var. *szechuanica* (Allen) Yang et P.H. Huang (Plate 533, 534)

Publication: in Acta Phytotax. Sin., 16(4): 47, 1978.

Distribution: China (Sichuan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 10-20 um long, 7-12 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 40-70 um long, with apex acute.

Abaxial epidermis: epidermal cells angular, 7-12 um long, 5-9 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral; trichome simple, unicellular, up to 200 um long.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 204 (W Sichuan Exped. 59-0729, KUN-0101800).

Litsea nakii Hayata (Plate 535, 536)

Publication: Ic. Pl. Formos. V. 168 (1915).

Distribution: Taiwan.

Adaxial epidermis: epidermal cells sinuous or angular, 12-19 um long, 8-12 um wide; anticlinal wall irregularly thickened, thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded to angular, becoming elongate over veins, 14-18 um long, 9-14 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall apparently papillate, slightly convex; trichome bases common, poral, over vein, with 4-6 surround cells, with cuticular thickening around pore extending along radial walls of surrounding cells.

Stomates paracytic, S.I. 17.4, 14-18 um long, 8-14 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells; anticlinal wall irregularly thickened, beaded; periclinal wall granulate; stomatal scales prominent, narrow or linear.

References: Slide No. DCC-444; Slide No. DCC-445.

Litsea neesiana Boerl (Plate 537, 538)

Publication: Handl. Fl. Ned. Ind. iii. 145.

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 11-17 um long, 7-11 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 8-16 um long, 7-10 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall finely papillate;trichome bases common, poral, over veins; with 5-7 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-120 um long, with apex acute.

Stomates paracytic, S.I. 19.7, 10-12 um long, 9-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 205 (D.E. Breedlove 53056, KUN-0101825).

Litsea nidularis Gamble (Plate 539, 540)

Publication: in Kew Bull. 1910, 365.

Distribution: Peninsular Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-19 um long, 9-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 17-22 um long, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate.

Stomates paracytic, S.I. 18.2, 13-15 um long, 14-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 421 (Castro 4484, BO-0119431).

Litsea noronhae Gamble (Plate 541, 542)

Publication: Bijdr. 561.

Distribution: Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 17-28 um long, 13-18 um wide; areoles evident; anticlinal wall irregularly thickened, thin, smooth; periclinal

wall granulate; trichome bases common, poral, over veins, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore sometimes extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins; 13-25 um long, 10-18 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases very common, poral, with 5-8 radially arranged surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 14.3, 15-24 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall finely papillate; stomatal scales evident, narrow.

References: Slide No. DCC-240; Slide No. 427 (BO-0119429).

Litsea ochracea Boerl. (Plate 543, 544)

Publication: Handl. Fl. Ned. Ind. iii. 144.

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate; becoming elongate over veins, 14-23 um long, 9-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate; areoles evident; trichome bases common, poral, with 3-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 15-33 um long, 14-22 um wide; anticlinal wall irregularly thickened, buttressed; periclinal wall finely papillate.

Stomates paracytic, S.I. 18.6, 12-18 um long, 10-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, linear.

Reference: Slide No. DCC-527 (Sarawak).

Litsea oppositifolia L.S. Gibbs (Plate 545, 546)

Publication: in Journ. Linn. Soc., Bot. xlii. 130 (1914).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 12-21 um long, 11-16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 18-32 um long, 11-19 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases rare, poral, with 4-6 surrounding cells.

Stomates paracytic, S.I. 18.3, 11-14 um long, 12-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 420 (S. 28644, BO-0104387).

Litsea orientalis C.E. Chang (Plate 547, 548)

Publication: in Fl. Taiwan, 2: 446 (1976).

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 14-20 um long, 9-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, becoming elongate over veins, 18-22 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 22.7, 14-18 um long, 8-13 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-443 (Taiwan).

Litsea pallidifolia Merrill (Plate 549, 550)

Publication: in Univ. Calf. Publ. Bot. $_{x}$v. 81 (1929).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-25 um long, 10-19 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 18-40 um long, 15-25 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6

surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells; trichome simple, unicellular, up to 150 um long, with apex acute.
Stomates paracytic, S.I. 18.7, 14-16 um long, 11-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.
Reference: Slide No. 382 (Anthony A. 754, BO-0104375).

Litsea palustris Kosterm. (Plate 551, 552)
Publication: in Reinwardtia, vi. 157 (1962).
Distribution: Borneo (Sarawak).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 10-16 um long, 9-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate.
Abaxial epidermis: epidermal cells undulate, 13-28 um long, 12-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate to finely papillate, slightly striate.
Stomates paracytic, S.I. 14.3, 15-20 um long, 13-15 um wide; guard cells sunken; with poral thickening; subsidiary cells 2; anticlinal wall thick smooth, with raised ledge forming prominent collar around stomata; periclinal wall granulate; stomatal scales double.
Reference: Slide No. 388 (Haji Bujang 13032, BO-0119421).
Notes: this species has cuticle similar to *Litsea fawcettiana.*

Litsea panamonja (Nees) Hook. f. (Plate 553, 554)
Publication: Fl. Brit. Ind. v. (1886) 175.
Distribution: China (S Yunnan, SW Guangxi); India; N Vietnam.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular or sinuous, becoming elongate over veins, 12-34 um long, 9-18 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 10-22 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.
Stomates paracytic, S.I. 17.8, 15-22 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales prominent, narrow, granulate.
References: Slide No. DCC-605 (China); Slide No. DCC-599 (China).

Litsea parvifolia Mez (Plate 555, 556)

Publication: in Jahrb. Bot. Gart. Berlin, v. (1889) 481.

Distribution: Mexico.

Leaf cuticle: Hypostomatic

Adaxial epidermis: epidermal cells undulate to sinuous, 17-27 um long, 13-17 um wide; anticlinal wall thin, heavily beaded; periclinal wall finely papillate;trichome bases rare, poral, over veins, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 15-25 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-7 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Stomates S. I. 19.0, 10-15 um long, 9-14 um wide; subsidiary 2; anticlinal wall thick, beaded; periclinal granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-315 ($Mexic_O$).

Litsea pedunculata (Diels) Yang et P.H. Huang (Plate 557, 558)

Publication: in Act. Phytotax. Sin., 16(4): 52 (1978).

Distribution: China (Hubei, Sichuan, Hunan, Jiangxi, Guangxi, Guizhou, Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous, 10-22 um long, 7-10 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, 9-15 um long, 6-9 um wide; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, apparently papillate; trichome bases common, poral, over veins, with 5-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 20 um long, with apex acute.

Stomates paracytic, S.I.23.4, 8-10 um long, 8-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate, dark staining; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 206 (P.Y. Mao 2820, KUN-0101880, KUN-0101881).

Litsea pedunculata (Diels) Yang et P.H. Huang var. *pubescens* Yang et P.H. Huang (Plate 559, 560)

Publication: in Acta Phytotax. Sin., 16(4): 53, 1978.

Distribution: China [Yunnan (Pingbian)].

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 9-13 um long, 5-10 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 7-11 um long, 6-10 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 18.6 (?), 7-10 um long, 6-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate, light staining; stomatal scales prominent, broad, granulate.

Reference: Slide No. 207 (C.W. Wang 82591, KUN-0101899, KUN-0101891).

Litsea perrottetii Villar (Plate 561, 562)

Publication: in Blanco, Fl. Philipp. ed. III. Nov. App. 180.

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate; anticlinal wall thick, beaded; periclinal wall granulate; trichome bases common, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, poral.

Stomates paracytic, subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.

References: Slide No. 289 (Kuoh-Chang Chen 222, TAIF-076523); Slide No. 290 (V. Velasco 2-26, TAIF_???); Slide No. 418 (H.T. Lam 2586, BO-0104384).

Litsea philippinensis Merrill (Plate 563, 564)

Publication: in Philipp. Journ. Sci. iv. 260 (1909).

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 18-22 um long, 15-19 um wide; anticlinal wall thin , smooth; periclinal wall striate.

Abaxial epidermis: epidermal cells sinuous, anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cell, with cuticular thickening around pore and extending along the walls of surrounding cells.
Stomates paracytic, S.I. 20.0, 15-17 um long, 13-15 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall smooth; stomatal scales broad.
Reference: Slide No. 381 (M. Ramos 30514, BO-0104376).

Litsea pierrei Lec. var. *szemois* Liou (Plate 565, 566)
Publication: Lour. Chine et Indoch. 174. 1932 et 1934.
Distribution: China (S Yunnan).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular, 18-27 um long, 12-20 um wide; anticlinal wall finely beaded; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate.
Stomates circled by surrounding cells with extending periclinal wall and deepened in the middle; stomatal scales prominent, double, granulate.
Reference: Slide No. 208 (Y.H. Li 1068, KUN-0101904, KUN-0101905).
Notes: it is very close to *Lindera megaphylla.*

Litsea pipericarpa (Miq.) Kosterm. (Plate 567, 568)
Publication: in Reinwardtia, viii. 104 (1970)
Distribution:
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells rounded or angular; anticlinal wall thin, smooth; periclinal wall heavily convex, bubble-like, granulate; trichome bases rare, poral.
Stomates: guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.
Reference: Slide No. 380 (W.J.J.O. der et al., 15939, BO-0119433).
Notes: it is close to Slide No. 396, 431, 432.

Litsea polyantha Juss. (Plate 569, 570)

Publication: in Ann. Mus. Par. vi. (1805) 211.

Distribution: N India; Burma; Java; China.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 16-30 um long, 12-15 um wide; anticlinal wall irregularly thickened, thick, finely beaded; periclinal wall granulate; areoles evident; trichome bases common, poral, over veins, with 5-7 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, becoming elongate over veins, 12-20 um long, 6-14 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate, slightly convex; trichome bases common, poral, over veins, with 4-6 surrounding cells and cuticular thickening around pore; trichome simple, unicellular, c. 100 um long, with apex acute.

Stomates paracytic, S.I. 13.3, 12-15 um long, 10-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; stomatal scales narrow, granulate.

Reference: Slide No. DCC-616 (Java).

Litsea populifolia (Hemsl.) Gamble (Plate 571, 572)

Publication: in Sargent, Pl. Wilson. Ii. 77 (1914).

Distribution: China (Sichuan, NE Yunnan, E Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to rounded, 13-17 um long, 10-14 um wide; anticlinal wall thick, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic; stomatal scales prominent, double, granulate.

Reference: Slide No. 209 (X.W. Li 193, KUN-0101907).

Notes: this species is unclear on the abaxial epidermis.

Litsea pruriens Kosterm. (Plate 573, 574)

Publication: in Reinwardtia, viii. 105 (1970).

Distribution: Borneo, Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-16 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall striate; trichome bases rare, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells angular to undulate, 12-20 um long, 7-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.8, 13-18 um long, 11-15 um wide; uniformly distributed within areoles; anticlinal wall thin, smooth; periclinal wall smooth; stomatal scales narrow.

Reference: Slide No. 379 (A. Kostermans 10147, BO-0119435).

Litsea pseudoelongata Liou (Plate 575, 576)

Publication: Laurac. Chine et Indochine, 179 (1932).

Distribution: China (S Guangdong, Guangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 9-12 um long, 5-8 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; trichome bases rare, poral, with 5-7 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 10-13 um long, 7-9 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, papillate.

Stomates paracytic, S.I.18.2, 8-10 um long, 9-10 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall papillate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 210(E Hainan Exped. 362, KUN-0101174).

Litsea pumila Kosterm. (Plate 577, 578)

Publication: in Reinwardtia, viii. 107 (1970).

Distribution: Borneo, Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 14-25 um long, 10-18 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 20-31 um long, 9-16 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases rare, poral, with 4-6

surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 17.9, 15-17 um long, 12-17 um wide; guard cells sunken; subsidiary cells 2, anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 378 (P. van Royen & H. Sleumer 7905, BO-0119434).

Litsea pungens Hemsl. (Plate 579, 580)

Publication: in Journ. Linn. Soc. xxvi. (1891) 383.

Distribution: China (Hubei, Hunan, N Guangdong, Guangxi, Sichuan, Guizhou, Yunnan, Tibet, Gansu, Shangxi, Henan, Shangxi, S Zhejiang).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-20 um long, 7-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 12-17 um long, 7-10 um wide; areoles evident; anticlinal wall thin, smooth to finely beaded; periclinal wall slightly convex, granulate; trichome bases very common, poral, over veins, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, up to 400 um long, with apex acute.

Stomates paracytic, S.I.20.0; 8-10 um long, 10-12 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 211 (G.F. Li 62590, KUN-0164166).

Litsea quercoides Elmer (Plate 581, 582)

Publication: Leaflets Philipp. Bot. ii. 378 (1908).

Distribution: Ins. Philippines.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-21 um long, 7-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-20 um long, 8-12 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, with 4-6 surrounding

cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.1, 14-16 um long, 14-16 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 377 (A. D.E. Elmer 14067, BO-0119430).

Litsea resinosa Blume (Plate 583, 584)

Publication: Bijdr. 562.

Distribution: Malaya.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-22 um long, 10-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate (striate seen in Slide No. 375); trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-22 um long, 10-19 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 20.7, 13-15 um long, 12-15 um wide; uniformly distributed within areoles; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow.

References: Slide No. 375 (A. Kostermans 1064, BO-0119418); Slide No. 376 (F.G. Rumbli 4977, BO-0119419).

Litsea robusta Blume (Plate 585, 586)

Publication: Bijdr. 560.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-17 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, 5-18 um long, 5-10 um wide; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, granulate; trichome bases very common, poral.

Stomates paracytic, S.I. 14.6, 15-17 um long, 13-16 um wide; uniformly distributed within areoles; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales broad.
Reference: Slide No. 374 (BO-0118128).

Litsea rotundifolia Hemsl. (Plate 587, 588)

Publication: in Journ. Linn. Soc. xxvi. (1891) 385.
Distribution: China (Guangdong, Guangxi).
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 10-13 um long, 8-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells sinuous, 12-15 um long, 8-12 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall apparently papillate; trichome bases common, poral, over veins, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 30-50 um long, with apex acute.
Stomates paracytic, S.I.17.7, 10-11 um long, 7-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall apparently papillate; stomatal scales prominent, narrow or linear.
Reference: Slide No. 212 (S.Q. Zhong A61966, KUN-0164305).

Litsea rotundifolia Hemsl. var. *oblongifolia* (Nees) Allen (Plate 589, 590)

Publication: in Ann. Missouri Bot. Gard. 25: 386, 1938.
Distribution: China (Guangdong, Guangxi, Hunan, Jiangxi, Fujian, Taiwan, Zhejiang); Vietnam.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 10-13 um long, 8-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-5 surrounding cells, with cuticular thickening around pore.
Abaxial epidermis: epidermal cells sinuous, 13-17 um long, 7-11 um wide; anticlinal wall thin, smooth; periclinal wall apparently papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30-50 um long, with apex acute.

Stomates paracytic, S.I.17.4, 8-10 um long, 5-8 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall apparently papillate; stomatal scales prominent, narrow or linear.

Reference: Slide No. 213 (Z.F. Wei 12157, KUN-0102781).

Litsea rubescens Lec. (Plate 591, 592)

Publication: in Nour. Arch. Mus. Hist. Nat. Paris, v. Ser. $_{V}$. 86 (1913).

Distribution: China (Hubei, Hunan, Sichuan, Guizhou, Yunnan, Tibet, S Shangxi).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 12-16 um long, 8-10 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells rounded, 12-14 um long, 6-10 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Stomates paracytic, S.I.14.6, 10-13 um long, 13-25 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 214 (X.T. Tsai 58-8021, KUN-0102823, KUN-0102824).

Litsea rubicunda Kosterm. (Plate 593, 594)

Publication: in Reinwardtia, vii. 351 (1968).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases rare, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, smooth; periclinal wall heavily convex, bubble-like, granulate.

Stomates paracytic and circled by the surrounding epidermal cells; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales double.

Reference: Slide No. 373 (A. Kostermans 21639, BO-0118127).

Notes: this cuticle is very similar to Slide No. 380, 396, 424, 431.

Litsea rufo-fusca Kosterm. (Plate 595, 596)

Publication: in Reinwardtia, vii. 352 (1968).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall striate; trichome bases common, poral, with 5-7 surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular; anticlinal wall thin, smooth; periclinal wall granulate; trichome common, poral, over veins, with cuticular thickening around pore; areoles evident.

Stomates paracytic, uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 368 (J.A.R. Aderson S. 26695, BO-0118126).

Litsea rumphii Boerl (Plate 597, 598)

Publication: Handl. Fl. Ned. Ind. iii. 142.

Distribution: Ins. $M_O$lucc.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-16 um long, 10-12 um wide; anticlinal wall thin, smooth, irregularly thickened; periclinal wall granulate; stomatal scales rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 15-24 um long, 11-15 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 29.1, 13-15 um long, 11-14 um wide; guard cells sunken; subsidiary cells anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 372 (Jaheri 78, BO-0118125).

Litsea salicifolia Hook.f. (Plate 599, 600)

Publication: Fl. Brit. Ind. $_V$. (1886) 167.

Distribution:

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 12-24 um long, 10-16 um wide; anticlinal wall thin, smooth, irregularly thickened; periclinal wall granulate; trichome bases common, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells angular, 15-20 um long, 11-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.6, 11-13 um long, 12-14 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 370 (BO-0118956).

Litsea sasakii Kamikoti (Plate 601, 602)

Publication: in Trans. Nat. Hist. Soc. Formosa, 1932. xxii. 412.

Distribution: Taiwan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 11-22 um long, 10-14 um wide; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 13-23 um long, 9-15 um wide; areoles evident; anticlinal wall irregularly thickened, thick, beaded; periclinal wall finely papillate; trichome bases very rare, poral, over veins, with 5-6 radially arranged surrounding cells, with cuticular thickened around pore extending along the radial walls of surrounding cells.

Stomates paracytic, S.I. 17.8, 13-15 um long, 10-15 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thick, beaded; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-452 (Taiwan).

Litsea schaffneri Bartlet (Plate 603, 604)

Publication: in Proc. Amer. Acad. xliv. 600 (1909).

Distribution: Mexico.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate to sinuous; 10-13 um long, 8-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate to sinuous, 10-17 um long, 7-11 um wide; areoles evident; anticlinal wall thin, smooth; periclinal wall granulate.

Stomates paracytic, S.I.17.3, 9-10 um long, 7-9 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 216(B. Bartholonew 3580, KUN-0106186).

Litsea sericea (Nees) Hook.f. (Plate 605, 606)

Publication: Fl. Brit. Ind. v. (1886) 156.

Distribution: China (W Sichuan, NW Yunnan, SE Tibet); India; Nepal.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 11-16 um long, 7-10 um wide; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded; 11-20 um long, 7-9 um wide; areoles evident; anticlinal wall thin, smooth to finely beaded; periclinal wall granulate, slightly convex; trichome bases rare, over veins, poral, with 6-8 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.13.4, 10-13 um log, 11-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall smooth to granulate; anticlinal wall thin, smooth to finely beaded; periclinal wall smooth to granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 215 (P.Y. Mao 25, KUN-0106140, KUN-0106139).

Litsea singaporensis Gamble (Plate 607, 608)

Publication: in Kew Bull. 1910. 358.

Distribution: Penins. & Arch. Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-28 um long, 11-16 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases rare, poral, with 46 surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells undulate, 23-37 um long, 14-27 um wide; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; trichome bases common, with 46 surrounding cells.

Stomates paracytic, S.I. 22.7, 13-16 um long, 11-15 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow or linear.

Reference: Slide No. 369 (E.J. Corner SFN 32286, BO-0118955).

Litsea spathacea Gamble (Plate 609, 610)

Publication: in Kew Bull. 1910, 358.

Distribution: Penins Malaysia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, becoming elongate over veins, 15-27 um long, 11-14 um wide; anticlinal wall penetration cuticle, i.e. cuticle wall going down between the anticlinal wall and periclinal wall, thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, becoming elongate over veins, 17-26 um long, 13-18 um wide; anticlinal wall irregularly thickened, thin, beaded; periclinal wall granulate; trichome bases common, poral, with 5-6 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, c. 50 um long, with apex acute.

Stomates paracytic, S.I. 16.7, 15-16 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. DCC-620 (Selangor).

Litsea subcoriacea Yang et P.H. Huang (Plate 611, 612)

Publication: in Acta Phytotax. Sin., 16(4): 55 (1978).

Distribution: China (N Guangxi, SE to S Guizhou, W Hunan, N Guangdong).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 7-13 um long, 5-8 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate; anticlinal wall thin, smooth; periclinal wall apparently papillate.

Stomates paracytic, S.I.; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall apparently papillate; stomatal scales prominent, narrow.

Reference: Slide No. 217(S.G. Xu 5395, KUN-0106185, KUN-0106193).

Litsea subovata (Miq.) Kosterm. (Plate 613, 614)

Publication: in Reinwardtia, viii. 112 (1970).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-22 um long, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases common, poral, with 4-6 radially arranged surrounding cells and cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 12-19 um long, 7-11 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-6 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 16.1, 15-18 um long, 15-18 um wide; guard cells sunken, with poral thickening; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 383 (BO-0118954).

Litsea sumatrana Boerl (Plate 615, 616)

Publication: Handl. Fl. Ned. Ind. iii. 145.

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-18 um long, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate to finely papillate; trichome bases rare, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells angular, 14-26 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 16.8, 13-15 um long, 15-17 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 371 (H.O. Forbes 2864, BO-0118953).

Litsea taronensis H.W. Li (Plate 617, 618)

Publication: in Acta Phytotax. Sin., 16(4): 47 (1978).

Distribution: China (NW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-20 um long, 11-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells undulate, 18-30 um long, 12-20 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate;trichome bases common, poral, over veins, with 6-8 radial arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells; trichome simple, unicellular, 60-110 um long, with apex acute.

Stomates paracytic, S.I.23.5, 12-15 um long, 10-17 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate;stomatal scales prominent, narrow.

Reference: Slide No. 218 (Dulongjiang Exped. 1884, KUN-0106213, KUN-0106214).

Litsea tibetana Yang et P.H. Huang (Plate 619, 620)

Publication: in Acta Phytotax. Sin., 16(4): 52, 1978.

Distribution: China (SE Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-25 um long, 8-16 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 5-7 radially arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 14-20 um long, 10-15 um long; areoles evident; anticlinal wall irregularly thickened, thin, smooth to beaded; periclinal wall granulate; trichome bases very common, with 5-8 radial arranged surrounding cells; with cuticular thickening around pore extending along the radial walls of surrounding cells; trichome simple, unicellular, 100-120 um long, with apex acute.

Stomates paracytic, S.I. 19.3, 13-15 um long, 10-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

Reference: Slide No. 219 (Qing-Tibet Exped. 74-1738, KUN-0106238, KUN-0106250).

Litsea timoriana Span. (Plate 621, 622)

Publication: in Hook. Comp. Bot. Mag. ¡. (1835) 350.

Distribution: Ins. Timor.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-20 um long, 8-16 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 18-26 um long, 8-14 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases very common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls.

Stomates paracytic, S.I. 22.7, 12-15 um long, 8-12 um wide; guard cells sunken, with poral thickening; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 367 (Kostermans & Wirawan 491, BO-0104541).

Litsea tomentosa Blume (Plate 623, 624)

Publication: Bijdr. 566.

Distribution: Java

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 18-27 um long, 12-16 um wide; anticlinal wall thin, beaded; periclinal wall granulate, slightly striate; trichome bases very common, over rein, with 7-9 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells rounded, anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, trichome simple, unicellular, up to 400 um long.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow.

Reference: Slide No. 365 (A. Dilmy 1249, BO-0118951).

Notes: cells are unclear on the abaxial epidermis.

Litsea trichophylla Kosterm. (Plate 625, 626)

Publication: in Reinwardtia, viii. 115 (1970).

Distribution: N_{ew} $Guin_{ea}$.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 8-17 um long, 6-11 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls.
Abaxial epidermis: epidermal cells angular, 8-15 um long, 7-11 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.
Stomates: paracytic, S.I. 17.7, 12-14 um wide, 10-13 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales narrow.
Reference: Slide No. 366 (W. Saegeng, Reksodihardjo 297, BO-0118950).

Litsea triflora Guillaumin (Plate 627, 628)
Publication: in Bull. Mus. Hist. Nat. Paris, 1920, xxvi. 179.
Distribution: N. Caled.
Leaf cuticle: Hypostomatic
Adaxial epidermis: epidermal cells angular, 14-23 um long, 8-16 um wide; anticlinal wall thin to thick, smooth; periclinal wall granulate.
Abaxial epidermis: epidermal cells angular, 15-24 um long, 10-19 um wide; anticlinal wall thin to thick, smooth or beaded; periclinal wall granulate.
Stomates paracytic, S.I. 17.6, 17-20 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thick, smooth; with raised ledge forming prominent collar around stomata, dark-staining; periclinal wall smooth to granulate; stomatal scales prominent, narrow, granulate.
References: Slide No. DCC-462 (New Caled.); Slide No. DCC-538 (New Caled.)
Notes: this cuticle is similar to *Litsea fawcettiana.*

Litsea triplinervia Blume (Plate 629, 630)
Publication: Bijdr. 559.
Distribution: Java.
Leaf cuticle: Hypostomatic.
Adaxial epidermis: epidermal cells sinuous, 17-26 um long, 14-20 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate.
Abaxial epidermis: epidermal cells undulate to sinuous, 14-22 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate.
Stomates paracytic, S.I. 21.0, 10-14 um long, 10-12 um wide; anticlinal wall thin, beaded; periclinal wall smooth; stomatal scales broad.

Reference: Slide No. 354 (Kostermans 7759, BO-0104529).

Litsea trunciflora Gamble (Plate 631, 632)

Publication: in Kew Bull. 1910, 316.

Distribution: Penins. Mal.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 13-25 um long, 9-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, with 5-8 radially arranged surrounding cells, with cuticular thickening around pore and extending along the walls.

Abaxial epidermis: epidermal cells angular to rounded, 12-22 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, with 7-9 radially arranged surrounding cells, trichome simple, unicellular, up to 150 um long, with apex acute.

Stomates paracytic, S.I. 20.8, 14-16 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 364 (Endert 4199, BO-0118949).

Litsea tuberculata Boerl. (Plate 633, 634)

Publication: Handl. Fl. Ned. Ind. Iii. 144.

Distribution: Sumatra.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-25 um long, 8-16 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate.

Abaxial epidermis: epidermal cells angular, 15-26 um long, 8-14 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 19.3, 14-16 um long, 12-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 363 (N.G.F. 4302, BO-0118948).

Litsea turfosa Kosterm. (Plate 635, 636)

Publication: in Reinwardtia, vii. 353 (1968).

Distribution: Borneo.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12-19 um log, 9-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 15-26 um long, 8-14 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases very rare, over vein, with 4-6 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 22.7, 15-17 um long, 14-15 um wide; uniformly distributed within areoles; anticlinal wall thin, smooth to beaded; periclinal wall granulate; stomatal scales narrow or linear.

Reference: Slide No. 362 (H. Hallier 2478, BO-24067).

Litsea umbellata (Lour.) Merrill (Plate 637, 638)

Publication: in Philipp. Journ. Sc. 1919, xiv. 242.

Distribution: China (S Guangxi, S Yunnan); Vietnam; Laos; Cambodia; Indonesia; Malaysia.

Leaf cuticle: Hypostomatic

Adaxial epidermis: epidermal cells angular, 12-25 um long, 10-15 um wide; anticlinal wall thin, smooth; periclinal wall papillate; trichome bases common, poral, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore extending along the radial walls of surrounding cells.

Abaxial epidermis: epidermal cells undulate, 14-20 um long, 8-12 um wide; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases common, poral, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 150 um long, with apex acute.

Stomates paracytic, S.I. 18.7, 13-15 um long, 12-14 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow (double in slide No. 360, 361), granulate

References: Slide No. 220 (Sino-Russ. Exped. 7542, KUN-0106289, KUN-0106288); Slide No. 360 (BO-0104540); Slide No. 361 (BO-0118457).

Litsea vang Lec. var. *lobata* Lect. (Plate 639, 640)

Publication: in Nouv. Arch. Mus. Hist. Nat. Paris 5 Ser. 5: 84. 1913.

Distribution: China (W Yunnan); Cambodia.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-26 um long, 10-19 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 12-20 um long, 10-12 um wide; anticlinal wall thin, smooth; periclinal wall convex, bubble-like, finely papillate; trichome bases very common, with 3-5 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30 um long, with apex acute.

Stomates paracytic, S.I.16.1, 13-15 um long, 18-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall finely papillate; stomatal scales narrow, finely papillate.

Reference: Slide No. 221(E.T.M. 1813, KUN-0106247, KUN-0106246).

Litsea variabilis Hemsl. (Plate 641, 642)

Publication: in Journ. Linn. Soc. xxvi. (1891) 386.

Distribution: China (Guangdong, S Guangxi); Vietnam; Laos.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 10-23 um long, 9-15 um wide; anticlinal wall thin, smooth; periclinal wall finely papillate; trichome bases rare, poral, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 14-25 um long, 10-12 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall finely papillate.

Stomates paracytic, S.I. 20.2, 13-16 um long, 10-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales prominent, narrow.

Reference: Slide No. 222 (L. Deng 3225, KUN-0106259).

Litsea varians Boerl. (Plate 643, 644)

Publication: Handl. Fl. Ned. Ind. iii. 143.

Distribution: Sumatra.

Leaf cuticle: Hypostomatic

Adaxial epidermis: epidermal cells angular to undulate (slide No. 359), 17-30 um long, 12-17 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases rare, poral, with 3-5 surrounding cells and cuticular thickening around the pore.

Abaxial epidermis: epidermal cells angular to undulate, becoming elongate over veins, 22-32 um long, 18-25 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate;

trichome bases common, poral, with 3-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.2, 9-10 um long, 7-14 um wide; uniformly distributed within the areoles; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth, dark-staining; periclinal wall finely papillate; stomatal scales prominent, narrow granulate.

References: Slide No. DCC-583 (Sarawak); Slide No. 359 (Talib Bidin SAN 84685, BO-0104324).

Litsea veitchiana Gamble (Plate 645, 646)

Publication: Laurac. Chine et Indochine, 182 (1932).

Distribution: China (Hubei, Sichuan, Guizhou, NW Yunnan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 15-35 um long, 12-20 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, finely beaded; periclinal wall slightly convex, granulate.

Stomates paracytic; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 223 (Sichuan Econ. Exped.59-5134, KUN-0106372).

Notes: the cuticle is unclear on the abaxial epidermis.

Litsea velutina Elmer (Plate 647, 648)

Publication: Leaflets Philipp. Bot. viii. 2726 (1915).

Distribution: Philipp. (Mindanao).

Leaf cuticle: Hypostomatic

Adaxial epidermis: epidermal cells angular, 12-15 um long, 7-11 um wide; anticlinal wall penetration cuticle, thin, smooth; periclinal wall granulate; trichome bases common, poral, with 4-6 radially arranged surrounding cells, with cuticular thickening around the pore and extending along the radially walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, angular to undulate (slide No. 356), 14-30 um long, 9-12 um wide; anticlinal wall thin, beaded; periclinal wall finely papillate; trichome bases very common, poral, with 4-7 surrounding cells and cuticular thickening around pore.

Stomates paracytic, S.I. 16.8, 10-15 um long, 8-15 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall finely papillate; stomatal scales narrow or linear.

References: Slide No. DCC-536 (Philippines); Slide No. 356 (Kds. 36763, BO-0104328).

Litsea verruculata Koord. & Valet. (Plate 649, 650)

Publication: in Meded.'s Lands Plantent, lxviii. 173.

Distribution: Java.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 16-37 um long, 15-25 um wide; anticlinal wall thin, smooth to beaded; periclinal wall striate; trichome bases rare, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular, 16-30 um long, 10-14 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 23.3, 15-18 um long, 15-17 um wide; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, narrow.

Reference: Slide No. 357 (Kostermans s.n., BO-0104322).

Litsea verticillata Hance (Plate 651, 652)

Publication: in Journ. Bot. xxi. (1883) 356.

Distribution: China (Guangdong, Guangxi, S Yunnan); Vietnam; Cambodia.

Leaf cuticle: Hypostomatic.

Species A:

Adaxial epidermis: epidermal cells undulate, 18-23 um long, 13-20 um wide; anticlinal wall thin, smooth to beaded; periclinal wall granulate; trichome bases common, with 4-6 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded; anticlinal wall thin, beaded; periclinal wall convex, bubble-like, papillate; trichome bases very common, poral.

Stomates: paracytic, stomatal scales narrow, granulate.

Reference: Slide No. 224 (Zhang Z.B. 12055, KUN 0106335).

Notes: this slide is unclear for the abaxial epidermis.

Species B:

Leaf cuticle: Hypostomatic. (Plate 653, 654)

Adaxial epidermis: epidermal cells sinuous 14-25 um long, 13-18 um wide; anticlinal wall thin, irregularly thickened; periclinal wall granulate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular, 13-25 um long, 7-12 um wide; anticlinal wall thin, beaded to smooth; periclinal wall finely papillate; trichome bases common, poral, with 5-8 surrounding cells, with cuticular thickening around pore and extending along the walls of surrounding cells.

Stomates paracytic, S.I. 18.6, 10-14 um long, 8-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth to beaded; periclinal wall finely papillate; stomatal scales narrow.

Reference: Slide No. 358 (Thomas & Borden 634, BO-0104321).

Litsea verticillifolia Yang et P.H. Huang (Plate 655, 656)

Publication: in Acta Phytotax. Sin., 16(4): 48 (1978).

Distribution: China (S Hainan).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 10-25 um long, 10-18 um wide; anticlinal wall irregularly thickened, thick, beaded; periclinal wall granulate; trichome bases rare, with 4-6 surrounding cells

Abaxial epidermis: epidermal cells sinuous, 17-38 um long, 13-25 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 5-7 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.20.8, 15-21 um long, 15-20 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

Reference: Slide No. 225 (X.Q. Liu 27383, KUN-0106396).

Litsea viridis Liou (Plate 657, 658)

Publication: Laurc. Chine et Indochine, 188 (1932).

Distribution: China (SE Yunnan); Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 15-22 um long, 12-16 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells undulate, 15-24 um long, 12-20 um wide; anticlinal wall thin, finely beaded; periclinal wall slightly convex, granulate; trichome bases very common, poral, with 5-6 surrounding cells, with cuticular thickening around pore; trichome simple, unicellular, 30 um long, with apex acute.

Stomates paracytic; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales narrow, granulate.

Reference: Slide No. 226 (K.M. Feng 4726, KUN-0106381, KUN-0106395).

Litsea walkeri Trimen (Plate 659, 660)

Publication: Cat. Pl. Ceyl. 76.

Distribution: Ceylon.

Leaf cuticle: Hypostomatic

Adaxial epidermis: epidermal cells angular, 10-15 um long, 9-15 um wide; anticlinal wall thin, smooth, irregularly thickened, thin, smooth to beaded; periclinal wall irregularly thickened, granulate.

Abaxial epidermis: epidermal cells angular, 12-18 um long, 6-10 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases common, poral, over veins, with 4-8 radial arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 17.4, 12-15 um long, 8-12 um wide; guard cells sunken, subsidiary cells 2; anticlinal wall irregularly thickened, thin, beaded; periclinal wall finely papillate; stomatal scales prominent, narrow or linear, granulate.

Reference: Slide No. DCC-617 (Ceylon).

Litsea wilsonii Gamble (Plate 661, 662)

Publication: in Sargent, Pl. Wilson. ii. 78 (1914).

Distribution: China (Sichuan, Guizhou)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-20 um long, 8-12 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate or very finely papillate; trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore.

Abaxial epidermis: epidermal cells angular to rounded; anticlinal wall thin, beaded; periclinal wall convex, bubble-like, granulate; trichome bases very common, poral; trichome simple, unicellular, 70-160 um long, with apex acute.

Stomates paracytic; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales narrow, granulate.

Reference: Slide No. 227 (S.L. Sun 97, KUN-0104049).

Litsea yunnanensis Yang et P.H. Huang (Plate 663, 664)

Publication: in Acta Phytotax. Sin., 16(4): 56 (1978).

Distribution: China (SE Yunnan, SW Guangxi); Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 12- 25 um long, 10-20 um wide; anticlinal wall thin, finely beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to undulate, 13-24 um long, 12-14 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate;trichome bases common, poral, over veins, with 5-8 radial arranged surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I. 22.2, 9-12 um long, 10-13 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall finely papillate; stomatal scales linear.

Reference: Slide No. 228 (P.Y. Mao 3230, KUN-0104041, KUN-0104043).

3.3.5 Leaf cuticle features in mono- or oligo-typic genera

Dodecadenia grandiflora Nees (Plate 665, 666)

Publication: in Wall. Pl. Asiat. Rar. 2: 63, 1831.

Distribution: China (Tibet, Yunnan); India; Bhutan; Nepal.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 13-32 um long, 10-14 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 18-25 um long, 8-16 um wide; areoles evident; anticlinal wall thin, finely beaded; periclinal wall granulate.

Stomates paracytic, S.I. 18.2, 15-21 um long, 17-20 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall smooth; stomatal scales double, granulate.

Reference: Slide No. 095 (C.Y. Wu 1048, KUN-0049206).

Dodecadenia grandiflora Nees var. *griffithi* (Hook.f.) Long (Plate 667, 668)

Publication: in Notes Roy. Bot. Gard. Edinb. 41(3): 507, 1984.

Distribution: China (Yunnan); India; Bhutan.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 13-22 um long, 9-13 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular, 15-25 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall convex, bubble-like, granulate.

Stomates paracytic, S.I. 16.8, 17-20 um long, 13-18 um wide; guard cells sunken; subsidiary cells 2; anticlinal wall thin, finely beaded; periclinal wall granulate; stomatal scales double, granulate.

Reference: Slide No. 096 (T.T. Yu 20204, KUN-0049210).

Itea daphne caudata (Nees) H.W. Li (Plate 669, 670)

Publication: in Acta Botanica Yunnanica 7(2): 129-135. 1985.

Distribution: China (S Yunnan, W Guangxi); India; Burma; Thailand; Laos; Vietnam.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular, 14-22 um long, 10-15 um wide; anticlinal wall thin, finely beaded; periclinal wall finely papillate; trichome bases common, poral, with 4-5 surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells rounded, 13-15 um long, 9-14 um wide; anticlinal wall irregularly thickened, thin, smooth; periclinal wall slightly convex, granulate; trichome bases common, poral; trichome simple, unicellular, up to 150 um long, with apex acute.

Stomates paracytic, S.I.; guard cells sunken; subsidiary cells 2; anticlinal wall irregularly thickened, thin, smooth; periclinal wall granulate; stomatal scales prominent, narrow, granulate.

References: Slide No. 059 (H. Peng & B. Bai 291, KUN-0049230); Slide No. 060 (Sino-Russ. Exped. 130, KUN-0049603); Slide No. 061 (Zhao 51, KUN-0049453); Slide No. DCC-502.

Laurus nobilis Linn. (Plate 671, 672)

Publication: in Sp. Pl. 369, 1753.

Distribution: Mediterranean Region and Canary Is.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous, 23-37 um long, 20-33 um wide; anticlinal wall thin, smooth; periclinal wall granulate.

Abaxial epidermis: epidermal cells sinuous, 25-35 um long, 19-25 um wide; areoles evident; anticlinal wall thin, buttressed; periclinal wall granulate.

Stomates paracytic, S.I. 20.7, 20-27 um long, 20-26 um wide; uniformly distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth, buttressed; periclinal wall granulate; stomatal scales narrow and granulate.

Reference: Slide No. DCC-225.

Parasassafras confertiflora (Meissner) Long (Plate 673, 674)

Publication: in Notes RBG Edinb. 41(3): 505-525 (1984).

Distribution: Bhutan; N Burma; W China.

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells undulate, 20-41 um long, 14-18 um wide; areoles evident; anticlinal wall thin, beaded; periclinal wall granulate, trichome bases rare, poral, with 4-6 radial arranged surrounding cells, with cuticular thickening around pore extending along the walls of surrounding cells.

Abaxial epidermis: epidermal cells angular to rounded, 12-20 um long, 10-15 um wide; anticlinal wall irregularly thickening, thin, beaded; periclinal wall granulate, trichome bases common, poral, with 4-6 surrounding cells, with cuticular thickening around pore; areoles evident.

Stomates paracytic, S.I. 20.0, 15-17 um long, 19-20 um wide; uniformly distributed within areoles; subsidiary cells 2; guard cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

References: Slide No. 229 (J. Chen 458, KUN-0104559); Slide No. 230 (Qian 682, KUN-0104558).

Sinosassafras flavinervia (Allen) H.W. Li (Plate 675, 676)

Publication: in Acta Botanica Yunnanica 7(2): 134-135, 1985.

Distribution: China (W Yunnan, SE Tibet).

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells angular to undulate, 16-25 um long, 12-18 um wide; anticlinal wall thin, beaded; periclinal wall granulate.

Abaxial epidermis: epidermal cells angular to rounded, 13-23 um long, 10-15 um wide; anticlinal wall thin, beaded; periclinal wall granulate; trichome bases rare, poral, with 6-7 surrounding cells, with cuticular thickening around pore.

Stomates paracytic, S.I.; guard cells sunken; subsidiary cells 2; anticlinal wall thin, beaded; periclinal wall granulate; stomatal scales prominent, double, granulate.

References: Slide No. 073 (Z.H. Yang 101437, KUN-0150376); Slide No. 074 (Q.A. Wu 9468, KUN-0150387).

Umbellularia californica (Hook & Arnott) Nuttall (Plate 677, 678)

Publication: N. Amer. Sylv. 1: 87. 1842.

Distribution: N America (Calif., Oreg., Mexico)

Leaf cuticle: Hypostomatic.

Adaxial epidermis: epidermal cells sinuous; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral.

Abaxial epidermis: epidermal cells sinuous; anticlinal wall thin, smooth; periclinal wall granulate; trichome bases rare, poral, with cuticular thickening around pore.

Stomates paracytic; distributed within areoles; guard cells sunken; subsidiary cells 2; anticlinal wall thin, smooth; periclinal wall granulate; stomatal scales narrow and granulate.

References: Slide No. DCC-226; Slide No. 238 (B. Bartholamew 2092, KUN-01162110); Slide No. 239 (B. Bartholamew 2251, KUN-0162111).

3.4 A cluster analysis of cuticular characters in the *Litsea* complex

Numerical taxonomy and cluster analysis have been used widely as tools for plant systematic investigations, e.g. Hill, 1980; Alvin, et al., 1982; Hilu, 1982. Distance metrics and cluster analysis were used by me to calculate resemblance between different operational taxonomic units, order them and group them into ranks.

The PATN package of computer programs (Belbin, 1993) was used to compare similarity between OTUs based on all leaf cuticular characters recorded for the analysis in previously sections. Dissimilarities between OTUs based on all characters were calculated using Gower's association measure.

Three hundred and thirty nine operational taxonomic units (OTUs) were selected (see previous sections). Included were representatives of all genera of the *Litsea* complex, including a selection of species and varieties of the larger genera. After preliminary examination of preparations representing all OTUs, 67 characters were selected (Table 3-1). All of these were binary qualitative characters (presence / absence) and entered using Microsoft Excel program to code characters.

Dendrograms have been produced using flexible unweighted–group mean association (flexible UPGMA or "group average") using arithmetic averages.

Table 3-1. List of the characters used in the analysis:

Adaxial epidermis:

1. Stomatal distribution: absent (0), present (1);
2. Rounded epidermal cells on adaxial epidermis: absent (0), present (1);
3. Angular epidermal cells on adaxial epidermis: absent (0), present (1);
4. Undulate epidermal cells on adaxial epidermis: absent (0), present (1);
5. Sinuous epidermal cells on adaxial epidermis: absent (0), present (1);
6. The ratio of length to width of epidermal cells on adaxial epidermis: 1 (0), >1 (1);

7. Small (<15 um long) epidermal cells on adaxial epidermis: absent (0), present (1);
8. Medium (15-30 um long) epidermal cells on adaxial epidermis: absent (0), present (1);
9. Large (>30 um long) epidermal cells on adaxial epidermis: absent (0), present (1);
10. Anticlinal wall of adaxial epidermis: thin (0), thick (1);
11. Smooth anticlinal wall on adaxial epidermis: absent (0), present (1);
12. Beaded anticlinal wall on adaxial epidermis: absent (0), present (1);
13. Buttressed anticlinal wall on adaxial epidermis: absent (0), present (1);
14. Smooth periclinal wall on adaxial epidermis: absent (0), present (1);
15. Granulate periclinal wall on adaxial epidermis: absent (0), present (1);
16. Finely papillate periclinal wall on adaxial epidermis: absent (0), present (1);
17. Papillate periclinal wall on adaxial epidermis: absent (0), present (1);
18. Striate periclinal wall on adaxial epidermis: absent (0), present (1);
19. Trichome bases on adaxial epidermis: absent (0), present (1);
20. Rare (1 trichome base / 400 X high power microscope field) trichome base on adaxial epidermis: absent (0), present (1);
21. Common (2-10 trichome bases / 400 X high power microscope field) trichome base on adaxial epidermis: absent (0), present (1);
22. Very common (>10 trichome bases / 400 high power microscope field) trichome base on adaxial epidermis: absent (0), present (1);
23. Trichomes on the adaxial epidermis: absent (0), present (1);
24. Areoles on the adaxial epidermis: absent (0), present (1);

Abaxial epidermis:

25. Rounded epidermal cells on abaxial epidermis: absent (0), present (1);
26. Angular epidermal cells on abaxial epidermis: absent (0), present (1);
27. Undulate epidermal cells on abaxial epidermis: absent (0), present (1);
28. Sinuous epidermal cells on abaxial epidermis: absent (0), present (1);
29. The ratio of length to width of epidermal cells on abaxial epidermis: 1 (0), >1 (1);
30. Small (<15 um long) epidermal cells on abaxial epidermis: absent (0), present (1);
31. Medium (15-30 um long) epidermal cells on abaxial epidermis: absent (0), present (1);

32. Large (>30 um long) epidermal cells on abaxial epidermis: absent (0), present (1);
33. Anticlinal wall on abaxial epidermis: thin (0), thick (1);
34. Smooth anticlinal wall on abaxial epidermis: absent (0), present (1);
35. Beaded anticlinal wall on abaxial epidermis: absent (0), present (1);
36. Buttressed anticlinal wall on abaxial epidermis: absent (0), present (1);
37. Periclinal wall of abaxial epidermis: flattened (0), convex (1);
38. Smooth periclinal wall on abaxial epidermis: absent (0), present (1);
39. Granulate periclinal wall on abaxial epidermis: absent (0), present (1);
40. Finely papillate periclinal wall on abaxial epidermis: absent (0), present (1);
41. Papillate periclinal wall on abaxial epidermis: absent (0), present (1);
42. Striate periclinal wall on abaxial epidermis: absent (0), present (1);
43. Trichome bases on abaxial epidermis: absent (0), present (1);
44. Rare (1 trichome base / 400 X high power microscope field) trichome base on abaxial epidermis: absent (0), present (1);
45. Common (2-10 trichome bases / 400 X high power microscope field) trichome base on abaxial epidermis: absent (0), present (1);
46. Very common (>10 trichome bases / 400 high power microscope field) trichome base on abaxial epidermis: absent (0), present (1);
47. Trichomes on the abaxial epidermis: absent (0), present (1);
48. Areoles on the abaxial epidermis: absent (0), present (1);

Stomata:

49. Small (<10 um long) stomata: absent (0), present (1);
50. Medium (10-20 um long) stomata: absent (0), present (1);
51. Large (>20 um long) stomata: absent (0), present (1);
52. Anticlinal wall of guard cells: thin (0), thick (1);
53. Smooth anticlinal wall of guard cells: absent (0), present (1);
54. Beaded anticlinal wall of guard cells: absent (0), present (1);
55. Buttressed anticlinal wall of guard cells: absent (0), present (1);
56. Smooth periclinal wall on abaxial epidermis: absent (0), present (1);
57. Granulate periclinal wall on abaxial epidermis: absent (0), present (1);
58. Finely papillate periclinal wall on abaxial epidermis: absent (0), present (1);

59. Papillate periclinal wall on abaxial epidermis: absent (0), present (1);
60. Narrow stomatal scale: absent (0), present (1);
61. Broad stomatal scales: absent (0), present (1);
62. Double stomatal scale: absent (0), present (1);
63. Butterfly-shaped stomatal scales: absent (0), present (1);
64. Normal stomata: absent (0), present (1);
65. Circled stomata: absent (0), present (1);
66. Sunken stomata: absent (0), present (1).
67. Cuticular collar around stomate: absent (0), present (1);

3.5 Results and Discussion

Cluster analysis results are shown in the dendrogram (Fig. 3-1). It shows that all OTUs merge together, no reasonably well marked clusters emerges which are meaningful in terms of accepted taxonomic groupings. The bigger genera such as *Litsea*, *Lindera, Neolitsea* and *Actinodaphne* comprise both anatomically and morphologically different groups, which are spread everywhere in the dendrogram. No uniformity of leaf cuticular characters can be found in a specific genus, the current generic delimitation within the *Litsea* complex is not supported by this leaf cuticle study.

According to Christophel et al. (1996), useful cuticle characters in the taxonomy of the *Lauraceae* are 1) ornamentation on the periclinal walls of the epidermal cells, 2) uniformity of thickness of the anticlinal wall, 3) straightness of the anticlinal wall, 4) uniformity of cell size and maximum dimension of the epidermal cells, 5) variation in cell size and shape between the adaxial and abaxial cuticles, 6) cell size and subsidiary cells, 7) the nature of the stomatal ledges and 8) presence/absence and characters of various specialized cells. After comparing the cuticle features in *Litsea* complex, I find that most useful taxonomic information is contained in the nature of the stomates including subsidiary cells and stomatal ledges, the ornamentation on the

periclinal wall especially on abaxial epidermis. Other cuticular characters are either too restrictive or too variable.

The leaf cuticle features in *Actinodaphne* show that most of species (78%) have finely papillate periclinal walls and narrow or linear stomatal scales on the abaxial epidermis. A granulate periclinal wall can be found in a few species, among of them some species are characterized by a racemiform inflorescence. These include *A. sphaerocarpa, A. montana, A. henryi* and *A. pilosa*. Convex, bubble-like periclinal walls on abaxial epidermis are seen in a few species such as *A. sesquipedalis, A. tayabensis* and *A. dolichophylla*. A papillate periclinal wall only occurs in *Actinodaphne acuminata*. Double stomatal scales are found in *A. pilosa* and *A. albifrons*.

On the basis of floral morphology, *Actinodaphne* seems to be divided into two groups. One group is characterized by fasiculate pseudo-umbellate inflorescence, which appears in most species, another group by racemiform inflorescence. From the leaf cuticle data, such a division is supported. However, some species with fascicled pseudo-umbellate inflorescence also have granulate periclinal walls such as *A. tsaii* and *A. ridleyi*.

In *Neolitsea*, the leaf cuticle features appear more diverse than those of *Actinodaphne*. Most species are characterized by a granulate periclinal wall on both surfaces, only a few species have a finely papillate periclinal wall including *N. vidalii, N. undulatifolia* and *N. konishii*. Among the species with a granulate periclinal wall, three kinds of stomatal scales can be found: double stomatal scales, butterfly-shaped stomatal scales and narrow stomatal scales. A convex, bubble-like periclinal wall on the abaxial epidermal cells can be observed in *N. kedohensis, N. oblongifolia* and *N. confertifolia*. *N. hainanensis* is amphistomatic. According to leaf venation in *Neolitsea*, the genus should be divided into two groups: one characterized by penninerved leaves, another by triplinerved or trinerved leaves. But based on cuticular features, no evidence can be found to support the separation. The species with penninerved leaves have various kinds

of leaf cuticle features: a granulate periclinal wall in *N. pinninervis* and *N. cambodiana*; convex and bubble-like periclinal walls are found in *N. wushanica* and *N. oblongifolia*; finely papillate are found in *N. undulatifolia*; a convex and apparently papillate periclinal wall in *N. confertifolia*. Double stomatal scales occur in *N. acuminatissima*.

In Tsui's *Lindera* classification (Tsui, 1987), *Lindera* was divided into eight sections. Section *Cupuliformes* is defined by the presence of cup-shaped fruit cupules and funnel-shaped glands on third whorl. This section, which consists of *L. megaphylla, L. setchuenensis* and *L. chienii*, is well supported by the leaf features studied here. The stomates are sunken and circled by surrounding cells with extending periclinal wall in *L. megaphylla* and *L. setchuenensis*.

However, no consistent cuticular characters are restricted to any other sections. Three kinds of ornamentation on periclinal walls can be found in all sections: granulate, finely papillate, papillate. Convex, bubble-like periclinal walls can be seen in several species belonging to different sections including *L. longipedunculata* from Section *Aperula, L. villipes* from Section *Daphnidium* and so on. Although most species have narrow stomatal scales, double stomatal scales appeare in other species from different sections such as *L. reflexa* from Section *Lindera*, *L. latifolia* from Section *Aperula*, *L. obtusiloba* from Section *Palminerviae*, *L. tonkinensis* from Section *Daphnidium*. Buttressed anticlinal walls are observed in L. *communis, L. nacusua* and *L. queenslandica*. Butterfly-shaped stomatal scales can be seen in *L. glauca*.

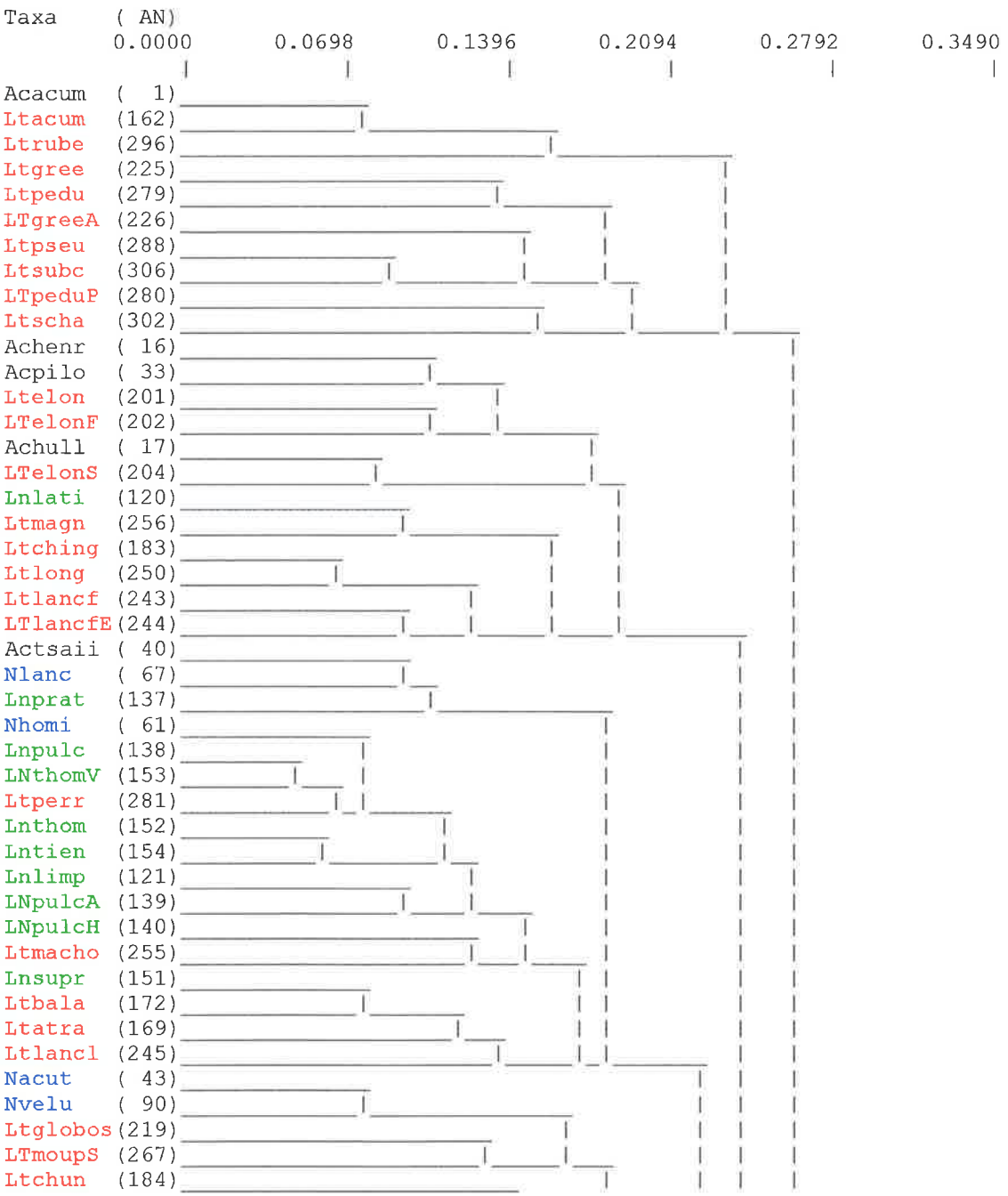
The leaf cuticle features in *Litsea* show the same diversity as in *Lindera*. Especially, the leaf cuticle features found in *Lindera* Section *Cupuliformes*, are found again in *Litsea* species such as *L. linii, L. morisonensis* and *L. akoensis*. Besides the leaf features appearing in *Lindera*, striate periclinal walls occur in several *Litsea* species such as *L. firma, L. phillipinensis, L. resinosa, L. pruriens, L. verruculata* and *L. calophyllantha*. Heavy cuticular rings around the stomatal complex can be seen in *L. fawcettiana* (Christophel & Rowett, 1996), *L. triflora* and *L. lii*. According to floral

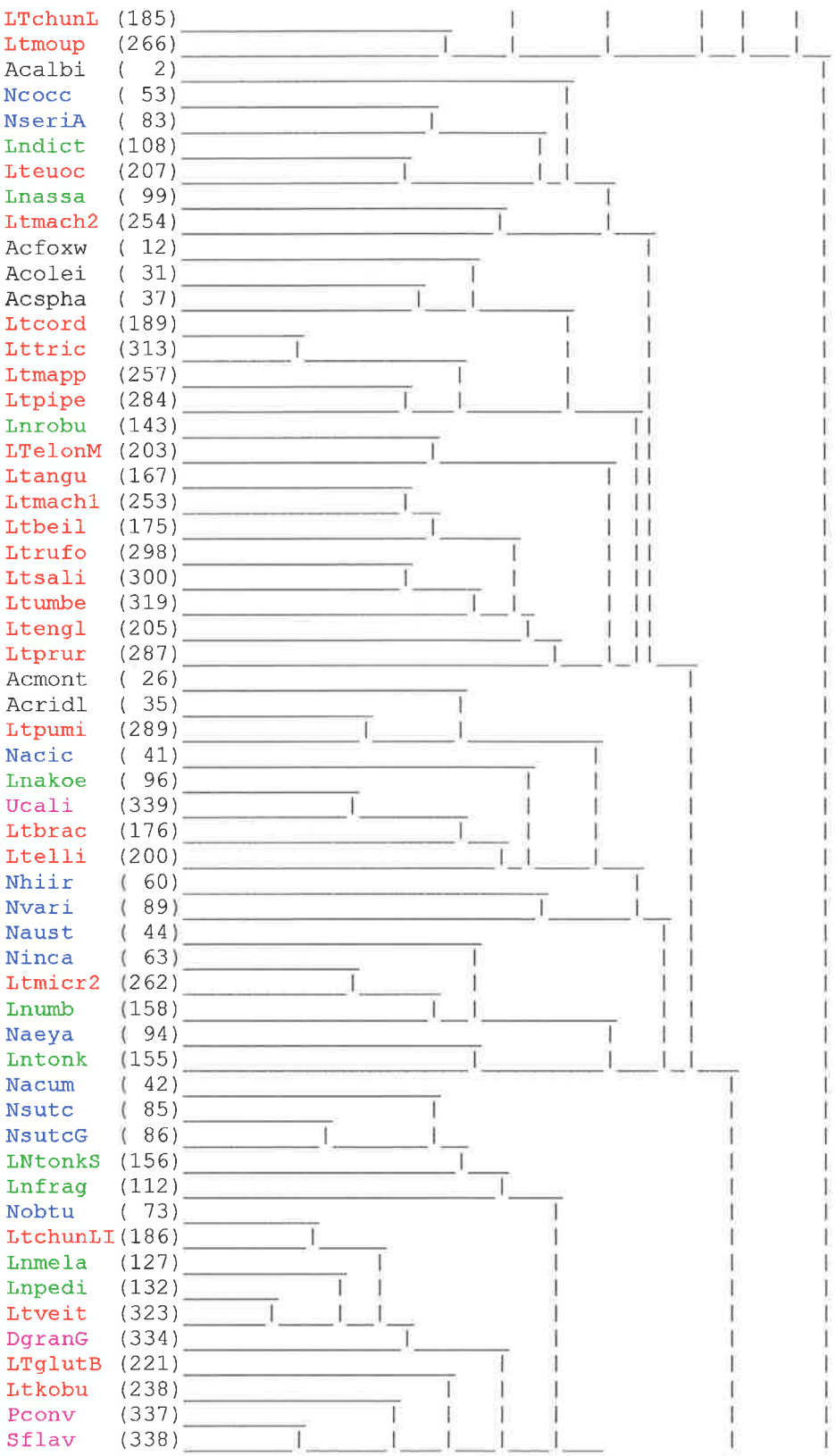
and fruit morphology, *Litsea* is divided into four sections, but no leaf data can define any section.

The leaf cuticle features of monotypic *Sinosassafras* are almost identical to those in *Parasassafras,* which supports the treatment by Rohwer (1993). However, no leaf cuticles characters are restricted to either genus. The cuticular characters recorded from these mono- or oligo-typic genera seem to be no different from those appearing in other members in the complex. In particular, the American endemic *Umbellularia* has no definitive features.

In the *Litsea* complex, I conclude that leaf cuticle data have not enough power to define genera or sections in larger genera. The groupings based on leaf cuticle features are not supported by floral morphological characters. These reflect a reticulate variation within the *Litsea* complex or even the family *Lauraceae*. For example, the double stomatal scales, which were used to define the genus *Endiandra* by Christophel et al. (1996), are seen in some *Litsea* complex species. The above conclusion, however, assumes that some floral characters should be consistent with taxonomic groupings. It is important to compare leaf cuticular results with wood anatomy and palynological results before eliminating cuticular characters as being taxonomically useful in the complex.

Figure 3-1. Cluster analysis dendrogram based on 67 leaf cuticular characters using UPGMA. Taxon Name = Abbreviation of genus name + four characters of species name. Ac = *Actinodaphne* ; D = *Dodecadenia*; I = *Iteadaphne*; L = *Laurus*; Ln = *Lindera*; Lt = *Litsea*; N = *Neolitsea*; P = *Parasassafras*; S = *Sinosassfras*; U = *Umbellularia*; AN = Arranged number in the sections of leaf cuticle description).

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Acalbi (2)
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NseriA (83)
Lndict (108)
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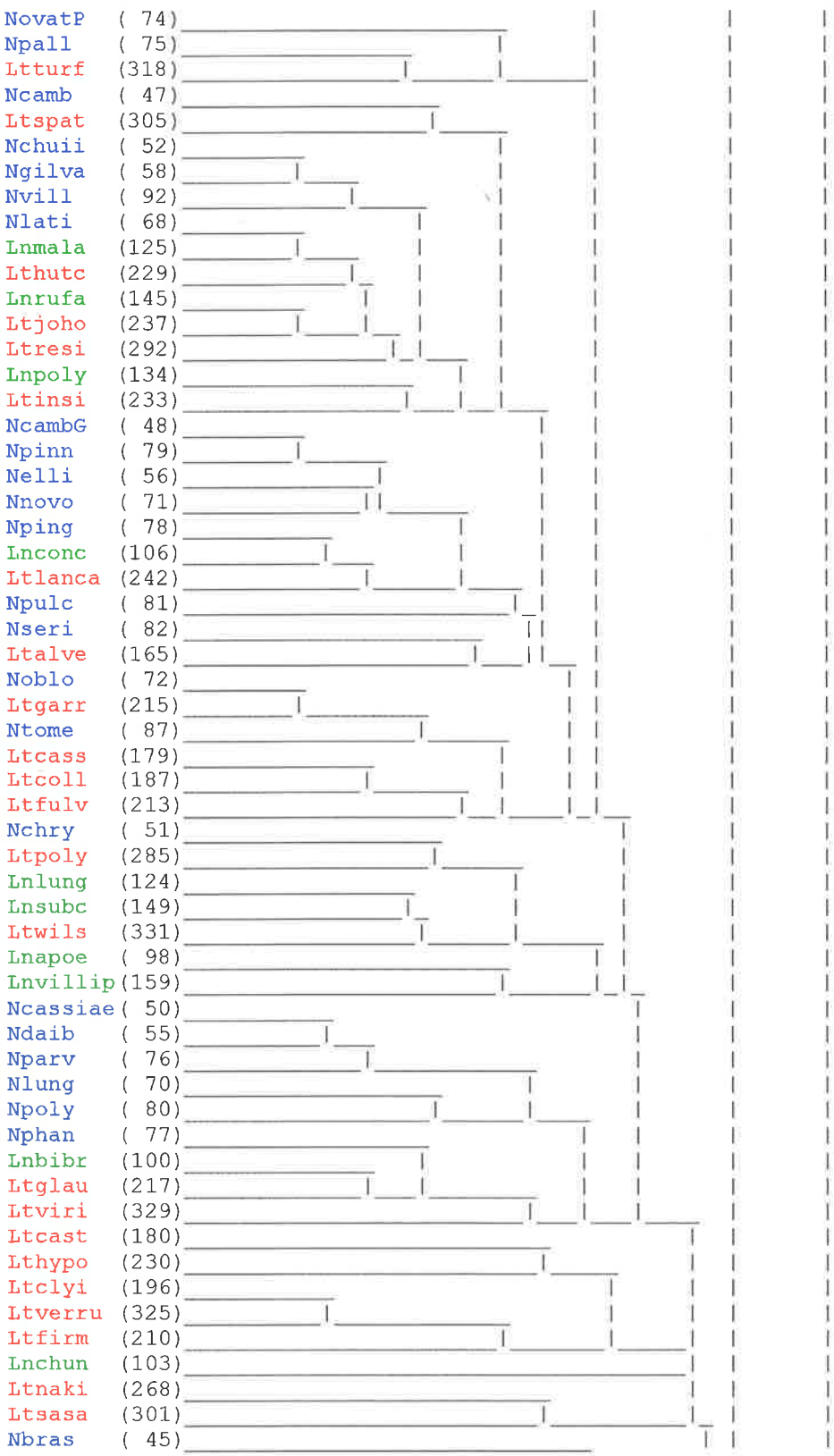
Lnassa (99)
Ltmach2 (254)
Acfoxw (12)
Acolei (31)
Acspha (37)
Ltcord (189)
Lttric (313)
Ltmapp (257)
Ltpipe (284)
Lnrobu (143)
LTelonM (203)
Ltangu (167)
Ltmach1 (253)
Ltbeil (175)
Ltrufo (298)
Ltsali (300)
Ltumbe (319)
Ltengl (205)
Ltprur (287)
Acmont (26)
Acridl (35)
Ltpumi (289)
Nacic (41)
Lnakoe (96)
Ucali (339)
Ltbrac (176)
Ltelli (200)
Nhiir (60)
Nvari (89)
Naust (44)
Ninca (63)
Ltmicr2 (262)
Lnumb (158)
Naeya (94)
Lntonk (155)
Nacum (42)
Nsutc (85)
NsutcG (86)
LNtonkS (156)
Lnfrag (112)
Nobtu (73)
LtchunLI (186)
Lnmela (127)
Lnpedi (132)
Ltveit (323)
DgranG (334)
LTglutB (221)
Ltkobu (238)
Pconv (337)
Sflav (338)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Npall (75)
Ltturf (318)
Ncamb (47)
Ltspat (305)
Nchuii (52)
Ngilva (58)
Nvill (92)
Nlati (68)
Lnmala (125)
Lthutc (229)
Lnrufa (145)
Ltjoho (237)
Ltresi (292)
Lnpoly (134)
Ltinsi (233)
NcambG (48)
Npinn (79)
Nelli (56)
Nnovo (71)
Nping (78)
Lnconc (106)
Ltlanca (242)
Npulc (81)
Nseri (82)
Ltalve (165)
Noblo (72)
Ltgarr (215)
Ntome (87)
Ltcass (179)
Ltcoll (187)
Ltfulv (213)
Nchry (51)
Ltpoly (285)
Lnlung (124)
Lnsubc (149)
Ltwils (331)
Lnapoe (98)
Lnvillip(159)
Ncassiae(50)
Ndaib (55)
Nparv (76)
Nlung (70)
Npoly (80)
Nphan (77)
Lnbibr (100)
Ltglau (217)
Ltviri (329)
Ltcast (180)
Lthypo (230)
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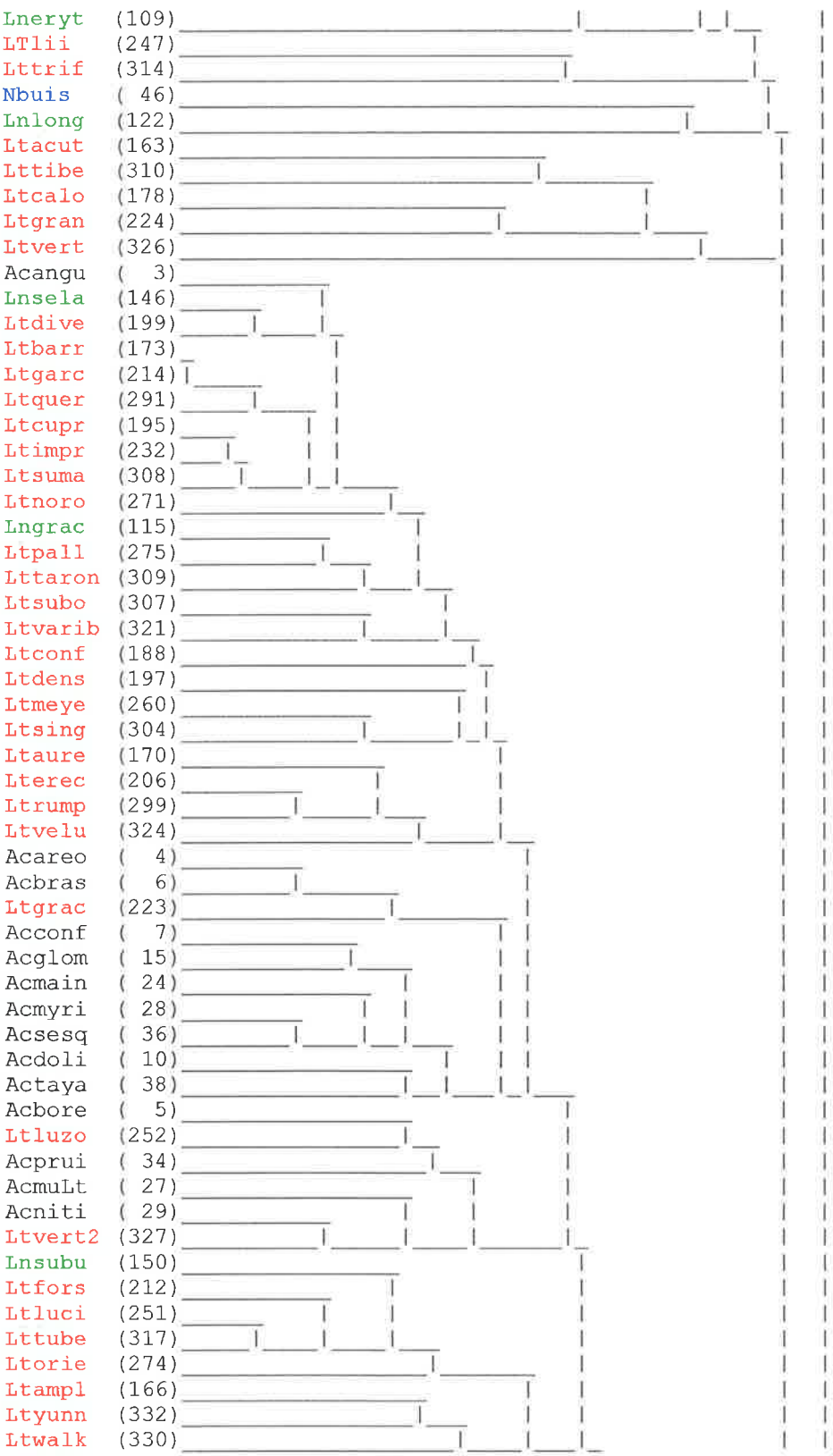
Ltverru (325)
Ltfirm (210)
Lnchun (103)
Ltnaki (268)
Ltsasa (301)
Nbras (45)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Nbuis (46)
Lnlong (122)
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Lttibe (310)
Ltcalo (178)
Ltgran (224)
Ltvert (326)
Acangu (3)
Lnsela (146)
Ltdive (199)
Ltbarr (173)
Ltgarc (214)
Ltquer (291)
Ltcupr (195)
Ltimpr (232)
Ltsuma (308)
Ltnoro (271)
Lngrac (115)
Ltpall (275)
Lttaron (309)
Ltsubo (307)
Ltvarib (321)
Ltconf (188)
Ltdens (197)
Ltmeye (260)
Ltsing (304)
Ltaure (170)
Lterec (206)
Ltrump (299)
Ltvelu (324)
Acareo (4)
Acbras (6)
Ltgrac (223)
Acconf (7)
Acglom (15)
Acmain (24)
Acmyri (28)
Acsesq (36)
Acdoli (10)
Actaya (38)
Acbore (5)
Ltluzo (252)
Acprui (34)
AcmuLt (27)
Acniti (29)
Ltvert2 (327)
Lnsubu (150)
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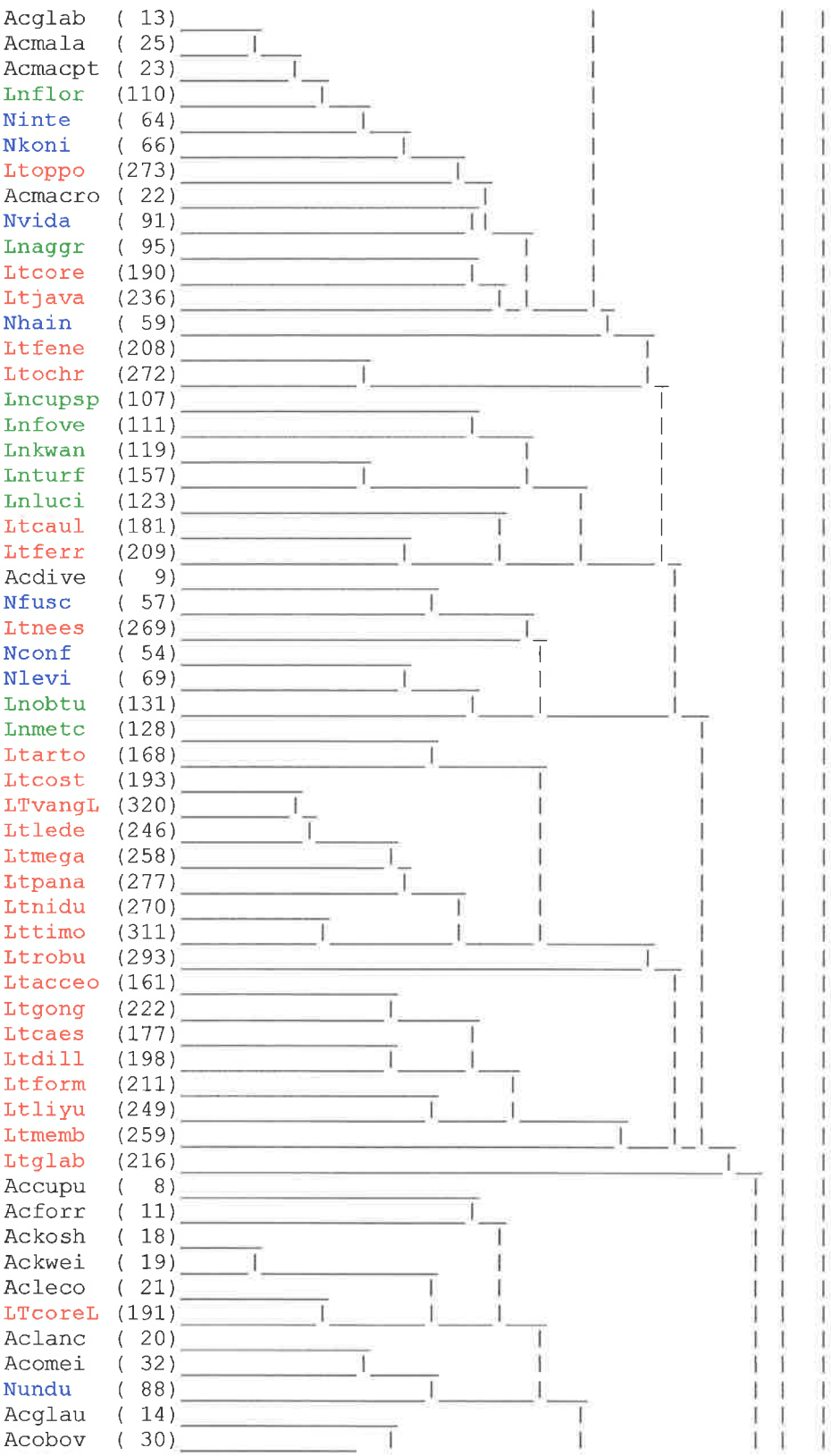
Ltluci (251)
Lttube (317)
Ltorie (274)
Ltampl (166)
Ltyunn (332)
Ltwalk (330)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Nvida (91)
Lnaggr (95)
Ltcore (190)
Ltjava (236)
Nhain (59)
Ltfene (208)
Ltochr (272)
Lncupsp (107)
Lnfove (111)
Lnkwan (119)
Lnturf (157)
Lnluci (123)
Ltcaul (181)
Ltferr (209)
Acdive (9)
Nfusc (57)
Ltnees (269)
Nconf (54)
Nlevi (69)
Lnobtu (131)
Lnmetc (128)
Ltarto (168)
Ltcost (193)
LTvangL (320)
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Ltmega (258)
Ltpana (277)
Ltnidu (270)
Lttimo (311)
Ltrobu (293)
Ltacceo (161)
Ltgong (222)
Ltcaes (177)
Ltdill (198)
Ltform (211)
Ltliyu (249)
Ltmemb (259)
Ltglab (216)
Accupu (8)
Acforr (11)
Ackosh (18)
Ackwei (19)
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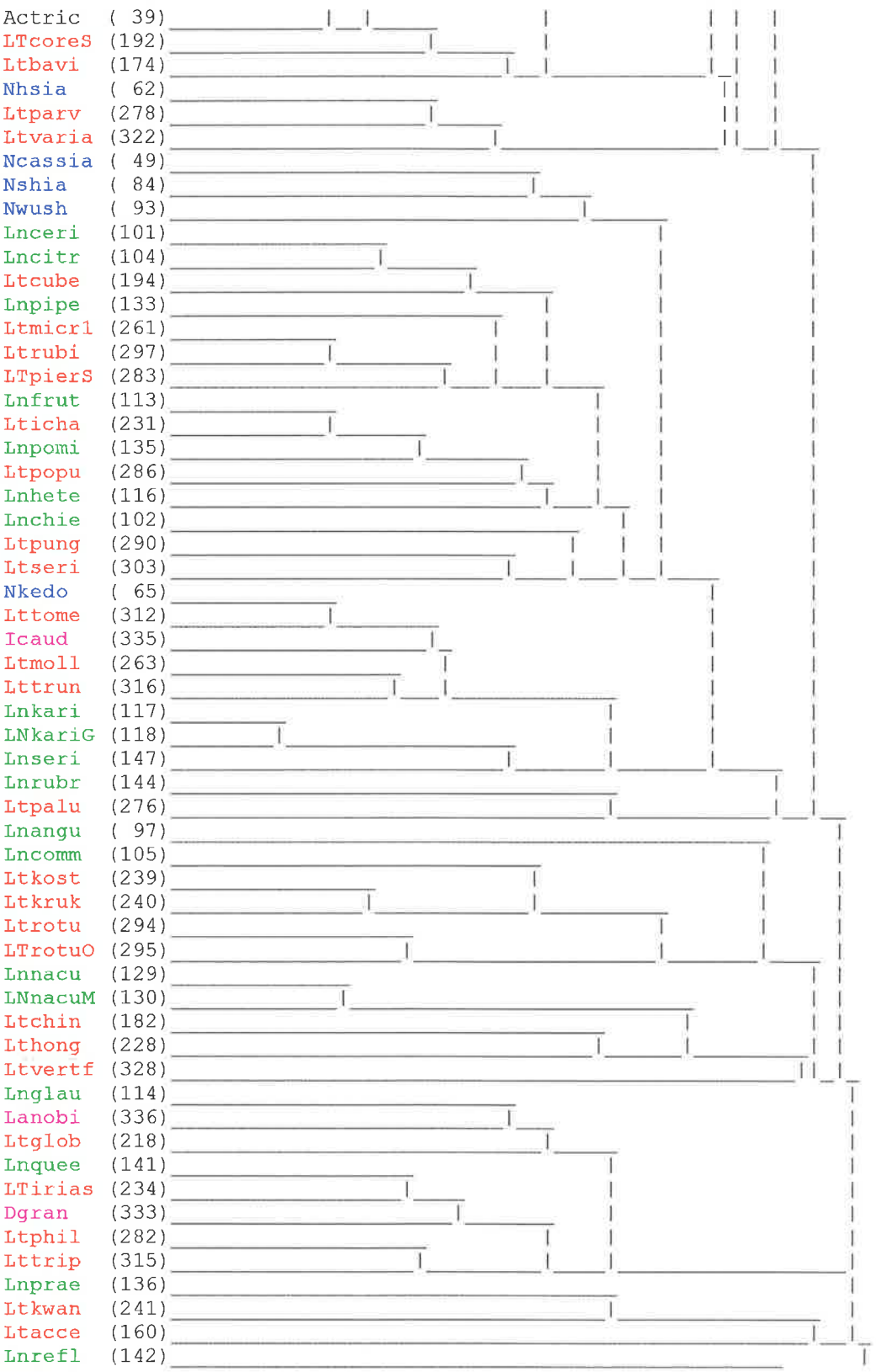
Aclanc (20)
Acomei (32)
Nundu (88)
Acglau (14)
Acobov (30)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Nshia (84)
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Lnceri (101)
Lncitr (104)
Ltcube (194)
Lnpipe (133)
Ltmicr1 (261)
Ltrubi (297)
LTpierS (283)
Lnfrut (113)
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Lnhete (116)
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Ltpung (290)
Ltseri (303)
Nkedo (65)
Lttome (312)
Icaud (335)
Ltmoll (263)
Lttrun (316)
Lnkari (117)
LNkariG (118)
Lnseri (147)
Lnrubr (144)
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Lnangu (97)
Lncomm (105)
Ltkost (239)
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Ltrotu (294)
LTrotuO (295)
Lnnacu (129)
LNnacuM (130)
Ltchin (182)
Lthong (228)
Ltvertf (328)
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Lanobi (336)
Ltglob (218)
Lnquee (141)
LTirias (234)
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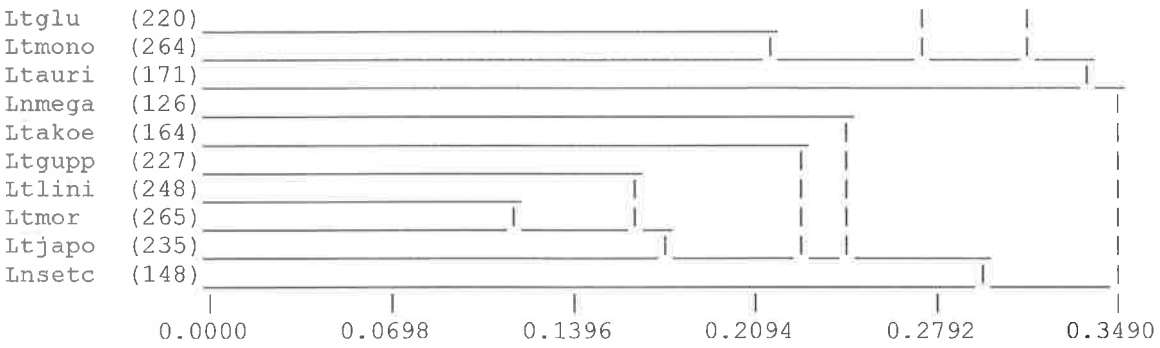
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Lnmega (126)
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Ltgupp (227)
Ltlini (248)
Ltmor (265)
Ltjapo (235)
Lnsetc (148)
0.0000
0.0698
0.1396
0.2094
0.2792
0.3490

Chapter Four*
A cladistic analysis based on morphological and leaf cuticle data

4.1 Introduction

According to the taxonomic review of the *Litsea* complex in chapter one, the past and modern *Lauraceae* classifications (Meissner, 1864; Bentham & Hooker, 1880; Pax, 1889; Mez, 1889; Kostermans, 1957; Hutchinson, 1964; Richter, 1981; Rohwer, 1993; Werff & Richter, 1996) show that the complex is well recognized and likely "natural" as a subdivision of *Lauraceae*. It is characterized by a series of distinctive morphological features: namely racemose inflorescences (the inflorescence appearing umbellate owing to the shortened inflorescence axis), inflorescences with involucral bracts and anther-cells of the third whorl usually introrse (Rohwer, 1993;Werff & Richter, 1996).

In spite of the above defining features, the generic and suprageneric delimitation within the *Litsea* complex is far from understood, and the systematic relationships within the complex are unclear. The two biggest genera *Litsea* and *Lindera* are considered as polyphyletic groups (Rohwer, 1993). More and more researchers have thrown doubt upon the importance of the anther cells as a unique character to distinguish the genera (Werff & Richter, 1996; Rohwer, Richter & Werff, 1991).

The purpose of this chapter is to consider relationships within the *Litsea* complex based on traditional morphological characters as well as new data from leaf cuticle features, by means of phylogenetic analysis and character evolution.

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* Much of the data presented in this chapter has been published as Li & Christophel (2000). This paper is bound in the appendix IV, but much of the data is repeated and expanded in this chapter to present an integrated thesis.

4.2 Materials and Methods

4.2.1 Terminal taxa

Ten genera are included in the *Litsea* complex, comprising about 500 species (700 spp. according to Kostermans). Three of four central genera, (*i.e. Litsea, Lindera, Neolitsea, Actinodaphne*), have their own published infrageneric classifications.

One species from each of the four sections in *Litsea* (Li et al., 1984) was chosen for inclusion in the cladistic analysis. Eight species are chosen to represent the eight sections in *Lindera* (Tsui, 1987).

The *Neolitsea* classification of Liao (1995), based solely on the convex or concave nature of the midrib and lateral veins on the leaf adaxial surface in the Taiwan species, seemed to be shallow and unnatural. I found instead that the genus can be divided into a trinerved group and a penninerved group based on leaf venation. Therefore, one species from each of these two groups was chosen for inclusion in the cladistic analysis.

The combinations of morphological characters and leaf cuticle features were used to choose the operational taxonomic units in *Actinodaphne*. I found that *Actinodaphne* should be separated into two groups according to inflorescence type: one characterised by a fascicled pseudo-umbel, and the other by a racemiform inflorescence. Furthermore, the two groups were characterised by different leaf cuticle features. Again, two species were chosen, one from each of in the two groups.

Species from the remaining monotypic or oligotypic genera were included. This resulted in 22 species being selected as OUTs in the cladistic analysis (Table 4-1). While this may seem a small number selected from the species available, it reflects a sampling strategy that can realistically be used in the molecular analysis presented in the following chapters.

Table 4-1. OTUs selected for cladistic analysis of the *Litsea* complex.

Litsea c. 200 spp.

Distributed in Trop.-Subtrop. Asia (N to Korea and Japan), the Pacific region (AUS 11 spp., NZ 2 spp.), N to C America (S America, Mexico and Costa Rica 5 spp.)

1. *L. cubeba*(Lour.) Pers. (of Sect. *Tomingodaphne*)
2. *L. glutinosa* (Lour.) C.B. Rob (of Sect. *Litsea*)
3. *L. umbellata* (Lour.) Merr. (of Sect. *Conodaphne*)
4. *L. dilleniifolia* P.Y. Pai et P.H. Huang (of Sect. *Cylicodaphne*)

Lindera c. 100 spp.

Distributed in Trop.-Subtrop. Asia (N to Korea and Japan), Trop. Australia (QLD 1 sp.), E North America (3 spp.)

5. *L. megaphylla* Hemsl. (of Sect. *Cupuliformes*)
6. *L. reflexa* Hemsl. (of Sect. *Lindera*)
7. *L. metcalfiana* Allen (of Sect. *Aperula*)
8. *L. communis* Hemsl. (of Sect. *Polyadenia*)
9. *L. fruticosa* Hemsl. (of Sect. *Sphaerocarpae*)
10. *L. obtusiloba* Bl. (of Sect. *Palminervia*)
11. *L. tienchuanensis* W.P. Fang et H.S. Kung (of Sect. *Uniumbellatae*)
12. *L. thomsonii* Allen (of Sect. *Daphnidium*)

Actinodaphne c. 100 spp.

Distributed in Trop.-Subtrop. Asia

13. *A. obovata* (Nees) Bl. (of racemiform inflorescence group, *Actinodaphne I*)
14. *A. forrestii* (Allen) Kosterm. (of fascicled pseudo-umbel group, *Actinodpahne II*)

Neolitsea c. 100 spp.

Trop.-Subtrop. Asia (N to Japan), Trop. Australia (3 spp.)

15. *N. confertifolia* (Hemsl.) Merr. (of penninerved group, *Neolitsea I*)
16. *N. levinei* Merr. (of trinerved group, *Neolitsea II*)

Iteadaphne 2 spp.

Distributed in Trop. Asia

17. *I. caudata* (Nees) H.W. Li

Laurus 2 spp.

Distributed in Mediterranean Region and Canary Is.

18. *L. nobilis* Linn.

Dodecadenia 1 sp.

Distributed in India, Bhutan, Nepal, SW China

19. *D. grandiflora* Nees

Parasassafras 1 sp.

Distributed in Bhutan, N Myanmar, SW China

20. *P. confertiflora* (Meissn.) Long

Sinosassafras 1 sp.

Distributed in SW China

21. *S. flavinervia* (Allen) H.W. Li

Umbellularia 1 sp.

Distributed in W North America to N Mexico

22. *U. californica* (Hooker & Arnott) Nuttall

4.2.2 Out-group

The genus *Sassafras* was included in the *Laureae* by Rohwer (1993) based on its botryoid inflorescences with involucral bracts and anther-cells of third whorl introrse; he considered it to be closely related to the *Litsea* complex.

In addition to the morphological characters, Werff & Richter (1996) also regarded *Sassafras* to be close to the *Litsea* complex based on wood anatomical features, such as the absence of marginal parenchyma and the presence of phloem fibres. Furthermore, they considered that *Sassafras* could be separated from the *Laureae* as a result of the formers unique accentuated growth ring structure in both secondary xylem and phloem.

Kostermans (1957) also regarded *Sassafras* to be near *Litsea* due to their shared possession of introrse anther-cells, although it was different from *Litsea* and seemed to be close also to *Actinodaphne* because of its imbricate, early caducous bracts.

For these reasons, *Sassafras tzumu*, common in S to SW China was chosen as the out-group in this cladistic analysis.

4.2.3 Characters

A total of 53 characters were chosen for this analysis, including 41 morphological characters and 12 leaf cuticle features (Table 4-2). Characters used in past classifications because of their importance are discussed in the chapter 2; leaf cuticle features of sampled species in the analysis are recorded in the chapter 3 (leaf cuticle features are recorded as bi-state characters in chapters 3, but they are recorded as multi-state characters in this chapter. The characters that do not occur in the sampled species are not recorded in this analysis).

Table 4-2. Characters and states used in the cladistic analysis

1. Habit: evergreen (0), deciduous (1);
2. Branchlet: without indument (0), with indument (1);
3. Branchlet: without lenticels(0), with lenticels(1);
4. Terminal buds: smaller (<1 cm) (0), larger (> 1cm) (1);
5. Leaf arrangement: alternate (0), verticillate (1);
6. Leaf venation: penninerved (0), triplinerved (1), trinerved (2);
7. Leaf margin: entire (0), lobed (1);
8. Leaf adaxial surface: without indumenta (0), with indumenta (1);
9. Leaf abaxial surface: without indumenta (0), with indumenta (1);
10. Petiole: without indumenta (0), with indumenta (1);
11. Midrib and lateral veins on the adaxial surface: elevated (0), flattened or concave (1);

12. Leaf texture: chartaceous (0), coriaceous (1);
13. Leaf apex: acute (0), acuminate (1), attenuate (2);
14. Leaf base: cuneate (0), acute (1), obtuse (2);
15. Leaf length: 5-15 cm (0), >15 cm (1);
16. Leaf width: <4 cm (0), >5 cm (1);
17. Petiole length: <1 cm (0), >1.5 cm (1);
18. Inflorescence: terminal, racemiferous (0), axillary, umbelliferous (1);
19. Inflorescence arrangement: solitary (0), raceme (1), fascicled (2);
20. Inflorescence peduncle length: >1 cm (0), 0.5-1.0 cm (1), <0.5 cm (2), 0cm (3);
21. Inflorescence peduncle: without indumenta (0), with indumenta (1);
22. Flower number per inflorescence: >8 (0), 4-6 (1), 1 (2);
23. Involucral bract: Large (0), minute (1);
24. Involucral bract: alternate (0), decussate (1);
25. Involucral bract: persistent (0), early caducous (1);
26. Flower sex: bisexual (0), unisexual (1);
27. Basic floral number: trimerous (0), dimerous (1);
28. Perianth segment: present, perfect (0), imperfect, lacking (1);
29. Anther locular: 4-celled (0), 2-celled (1);
30. The pollen sacs of the third whorl: latrorse (0), introrse (1), extrorse (2);
31. Fertile stamens number: 6 (0), 9-12 (1), >12 (2);
32. Gland shape: kidney-shaped (0), funnel-shaped (1);
33. Glands: stalked (0), sessile (1);
34. Filament: without indumenta (0), with indumenta (1);
35. Flower: with reduced or normal gynoecium (0), without reduced or normal gynoecium (1);
36. Reduced or normal gynoecium: without indumenta (0), with indumenta (1);
37. Stigma shape: lobed (0), disci-form (1), domed-peltate (2), capitate (3);
38. Fruit shape: spherical (0), ovoid (1);
39. Fruit diameter: <0.8 cm (0), >1 cm (1);
40. Fruit cupule shape: discoid (0), shallow cup-shaped (1), cup-shaped (2);
41. Fruit pedicel length: <0.8 cm (0), >1 cm (1);

42. Epidermal cells on adaxial epidermis: rounded (0), angular (1), undulate (2), sinuous (3);
43. Anticlinal wall of adaxial epidermis: thin-smooth (0), thin-beaded (1), thin-buttressed (2);
44. Periclinal wall of adaxial epidermis: granulate (0), finely papillate (1), papillate (2);
45. Trichome density on the adaxial epidermis: none (0), rare (1), common (2);
46. Epidermal cells on abaxial epidermis: rounded (0), angular (1), undulate (2), sinuous (3);
47. Anticlinal wall on abaxial epidermis: thin-smooth (0), thin-beaded (1), thin-buttressed (2), thick (3);
48. Periclinal wall of abaxial epidermis: flattened (0), convex (1);
49. Periclinal wall of abaxial epidermis: smooth (0), granulate (1), finely papillate (2), papillate (3);
50. Trichome density on abaxial epidermis: none (0), rare (1), common (2), very common (2);
51. Periclinal wall of stomata: smooth (0), granulate (1), finely papillate (2), papillate (3);
52. Stomatal scale: narrow (0), broad (1), double (2);
53. Stomata: normal (0), circled (1).

4.2.4 Cladistic analysis

53 characters (41 morphological characters and 12 leaf cuticle features) and 22 taxa were used in the cladistic analysis. *Sassafras tzumu* was chosen as the out-group OUT (see Table 4-3). Two analyses were done, one based solely on leaf cuticle data and another based on the combined data of morphological characters and leaf cuticle features.

Phylogenetic interpretations of the morphological and leaf cuticle data were undertaken with the PAUP program (Swofford, 1993) version 3.1.1 for Apple / Macintosh to perform a maximum parsimony analysis searching for shortest trees. As the data set was too large to be analysed by an exhaustive or branch and bound searches, an heuristic search for most-parsimonious trees was performed with 1000 replicates of stepwise random addition and Tree-Bisection-Reconnection (TBR) branch swapping. Characters were treated as unordered, and uninformative characters were deleted in all analyses, the MULPARS option was used to retain all equally parsimonious trees. Strict consensus was used to depict results whenever multiple minimal length trees occurred.

The a posteriori character weighting option was used on the results of the heuristic search in order to get the stable topology used in bootstrap analysis (Felsenstein, 1985). Bootstrap values were obtained from 1000 bootstrap replicates with heuristic analysis and stepwise addition and TBR branch swapping.

MacClade version 3.04 (Maddison & Maddison, 1992) was used to create and edit the data set analysed in PAUP. It was also used to trace the distribution of particular character state changes on tree topologies.

Table 4-3. Data matrix used in this cladistic analysis. See Tables 4-1 and 4-2 for more details about the included taxa and the selected characters. Characters are listed in the order presented in the Table 4-2. Missing data are designated as ?.

	1111111111222222222233333333334444444444555
Terminal taxon	12345678901234567890123456789012345678901234567890123
Sassafras tzumu	1001001000000011102010000100011001001001200220002020
Laurus nobilis	0100000001010000011101010110111010000000?300032010100
Umbellularia californica	0000000000010100011111001000021010002010130013001 1100
Sinosassafras flavinervia	0011010000011101112211101100111000002000012000 3011020
Parasassafras confertiflora	0000010000011101112201101100011000000000021112 1012120
Iteadaphne caudata	0110010111112100011302010100101011002000011120011 2100
Dodecadenia grandiflora	0101000101010000012312010100001011 00?1000200031010020
Actinodaphne obovata	0101110111011111111111001100011011010110011122102220 0
Actinodaphne forrestii	0101100011110110112311001100011000002102110103102220 0
Neolitsea confertifolia	0100100011010000012311010110010001000100021000113230 0
Neolitsea levinei	0101110011011011122110101100100000031100210221022200
Litsea cubeba	1000000000000000112101010100011001003000001000111012 0
Litsea glutinosa	0100000111011001111010010101012001002000030023201211 0
Litsea umbellata	0100000011110100012211010100011011 1??0000102220012100
Litsea dilleniifolia	0010000000111011111211010100012001000012010011102320 0
Lindera megaphylla	0011000000010010111010010100111101002112131000112012 1
Lindera reflexa	1100000111000201012211010100111000001000100022000302 0
Lindera metcalfiana	0100000111012100011011010100111001002000010011002221 0
Lindera communis	0100000011111200012311011100111011002100031013203230 0
Lindera fruticosa	1000010010000201111201010100111000002000011001000002 0
Lindera obtusiloba	1010021111000201112301010100111000002100121020101212 0
Lindera tienchuanensis	0100020111112200010011010100111011010100011011101210 0
Lindera thomsonii	0110020110002200012211011100111001012100111011101110 0

4.3 Results

The first analysis produced twenty-seven equally most parsimonious trees. Their length was 279, CI=0.269, RI=0.333. Their strict consensus tree is shown in Figure 4-1. Owing to limited leaf cuticle features used in the analysis, juxtaposed with the large numbers of OTUs, the relationships suggested were not clear.

The cladistic analysis based on combined data of morphological characters and leaf cuticle features produced three equally most parsimonious trees (Figure 4-2) of 254 steps, with a consistency index of 0.319, and a retention index of 0.435. The three cladograms were very similar, but differed only in the positions of the *Litsea cubeba* and *Lindera fruticosa.* Therefore, the strict consensus of the three maximally parsimonious trees yielded two trichomies (Figure 4-3).

The cladogram based on combined data showed that the central genera *Actinodaphne, Lindera, Litsea* and *Neolitsea* in the *Litsea* complex were all polyphyletic. The delimitations among the genera, especially between the genera separated only by the anther locule, were not supported. The bootstrap analysis further indicated that while some clades were strongly supported, others were not maintained by the data.

4.4 Discussion

There are two opposing viewpoints about the character of the anther cells. In the previous *Lauraceae* classifications, the number of anther cells was a critical character in distinguishing the different genera. Kostermans (1957) considered it as the third most important character next to the inflorescence type and fruit cupule shape. The Kostermans' viewpoint was supported by Li (1985, 1995), Tsui (1987) and Hyland (1989). Li (1985, 1995) considered that the classification structure of the anther 4-celled group and the anther 2-celled group in the family was the result of the parallel evolution between the two groups. Furthermore, Li (1985) suggested that there was an evolutionary series between them. *Litsea* and *Lindera* which were derived from

Parasassafras and *Sinosassafras*, evolved into *Dodecadenia* and *Iteadaphne* respectively. The recognition of *Sinosassafras* by Li (1985) and *Lindera queenslandica* by Hyland (1989) can be regarded as resulting from the influence of this theory.

Recently, however, researchers have increasing expressed doubt about this character. Rohwer, Richter and Werff(1991) found that some neotropical species of *Aiouea* and *Endlicheria* belonged to the same genus on the basis of the androecium characters solely, but they should be separated if all characters are considered. They suggested that the distinction between 2-celled and 4-celled anthers should be dropped for the purpose of generic delimitation. Li & Li (1991) also noticed the anther locule was not as stable as imagined in the species of *Caryodaphnopsis.* Werff & Richter (1996) also found the changes of the anther cells, both in 4-celled genera such as *Caryodaphnopsis* and in 2-celled genera such as *Potameia*, and listed many genus pairs in which species closely resembled each other and were distinguished only by the anther locule. They also indicated that the number of anther cells was unreliable in the classification at generic and higher levels.

The result of the cladistic analysis supports the viewpoint of Werff & Richter (1996), the 4-celled anther clade and the 2-celled anther clade were not distinguished in the cladogram. On the contrary, all the 4-celled and 2-celled anther species were intermingled. Furthermore, according to the leaf cuticle features in the *Litsea* complex, no supporting leaf cuticle features can be found for either those 2-celled or 4-celled anther groups. On addition to the differentiation between the 2-celled and 4-celled anther, these species with similar morphological characters also have more or less identical leaf cuticle features. For example, the cuticles of *Lindera queenslandica* are very similar to those in *Litsea glutinosa.* So the conclusion that the number of anther cells alone does not have a strong, genetic level phylogenetic value, despite its possibly being a valuable character for species identification, can be drawn.

Although the generic and the infrageneric relationships become confused in two genus pairs (*Litsea* and *Lindera, Sinosassafras* and *Parasassafras)* owing to the lack of the delimitation between the 2-thecous and 4-thecous anther, some "real" monophyletic groups occurred in the cladogram. In particular, there are two clades with high bootstrap support. One clade consisted of *Litsea* Sect. *Litsea* (*Litsea glutinosa*) and *Lindera* Sect. *Aperula* (*Lindera metcalfiana*). The other was composed of *Litsea* Sect. *Cylicodaphne* (*Litsea dilleniifolia*) and *Lindera* Sect. *Cupuliformes* (*Lindera megaphylla*). Li (1985) and Tsui (1987) proposed that parallel evolution between *Litsea* and *Lindera* not only occurred at the generic level, but also at the infrageneric level based on similarities seen between sections in the two genera (see Figure 2-1). They pointed out that *Litsea* Sect. *Litsea* had a closely relationship to *Lindera* Sect. *Aperula* owing to their similar inflorescence structure. *Litsea* Sect. *Cylicodaphne* was similar to *Lindera* Sect. *Cupuliformes* because of their cup-shaped fruit cupule. This supposition is supported by the present analysis: Sect. *Litsea* and Sect. *Aperula* form a monophyletic clade. Another clade consists of Sect. *Cylicodaphne* and Sect. *Cupuliformes*.

The cladogram also shows that all the deciduous species in *Litsea* Sect. *Tomingodaphne*, *Lindera* Sect. *Palminervia,* Sect. *Sphaerocarpae* and Sect. *Lindera* are sister groups to each other. The penninerved leaves can be found in first section, the trinerved leaves can be found in the latter three sections. This result is consistent with the proposals of Li (1985) and Tsui (1987).

The results also consistently support the existence of a monophyletic group composed of *Sinosassafras* and *Parasassafras* characterised by a minute involucral bracts, which conforms to the classification of Rohwer (1993). However, the cuticle data alone does not confirm this.

Iteadaphne with one flower per involucre is the sister-group to the clade composed of Sect. *Litsea* and Sect. *Aperula;* both of them have a close relation to *Litsea* Sect. *Conodaphne*.

In *Lindera,* the difference between the traditional classification and this cladistic result is that Sect. *Uniumbellatae* is a sister-group to Sect. *Daphnidium*; both of them contain trinerved leaves. Tsui (1987) thought that Sect. *Uniumbellatae* was a primitive group due to its solitary pseudo-umbel. Sect. *Polyadenia* is the sister group to the former two sections.

The cladogram indicates that the *Actinodaphne* and *Neolitsea* are also polyphyletic groups. The monophyletic clade consisting of *Actinodaphne I* (*Actinodaphne obovata*) and *Neolitsea II* (*Neolitsea levinei*) is the sister-group to *Actinodpahne II* (*Actinodaphne forrestii*). This result suggests that *Actinodaphne* is close to *Neolitsea* just as Hyland's supposition (personal communication). The penninerved *Neolitsea II* has an isolated systematic position as has *Dodecadenia* and *Umbellularia.*

From the above discussion some primary conclusions can be drawn. Although the *Litsea* complex is an apparently monophyletic group, the systematic relationships within the complex, especially between the two central genera *Litsea* and *Lindera,* become unclear due to the rejection of the distinction between 2-theocus and 4-thecous anthers for the purpose of generic delimitation. Most genera in the complex are polyphyletic groups in which many descendants from different ancestors are included, just as Rohwer (1993) comments "*Litsea* comprises both anatomically and morphologically different groups..., *Lindera* is almost certainly polyphyletic." However, some monophyletic groups are apparent from the cladogram, such as *Cylicodaphne-Cupuliformes* characterised by a cup-shaped fruit cupule, *Sinosassafras-Parasassafras* with minute involucral bracts, *Uniumbellatae-Daphnidium* by trinerved leaves and *Litsea-Aperula* by a racemiform inflorescence. Additionally, the cladistic result implied that some groups require further research. For example, the deciduous species groups in *Litsea* and *Lindera*, the penninerved species group in *Neolitsea* and the triplinerved and racemiform inflorescence group species in *Actinodaphne* must have further study. The last two genera mentioned, *i.e. Actinodaphne* and *Neolitsea* seem to have close relationships.

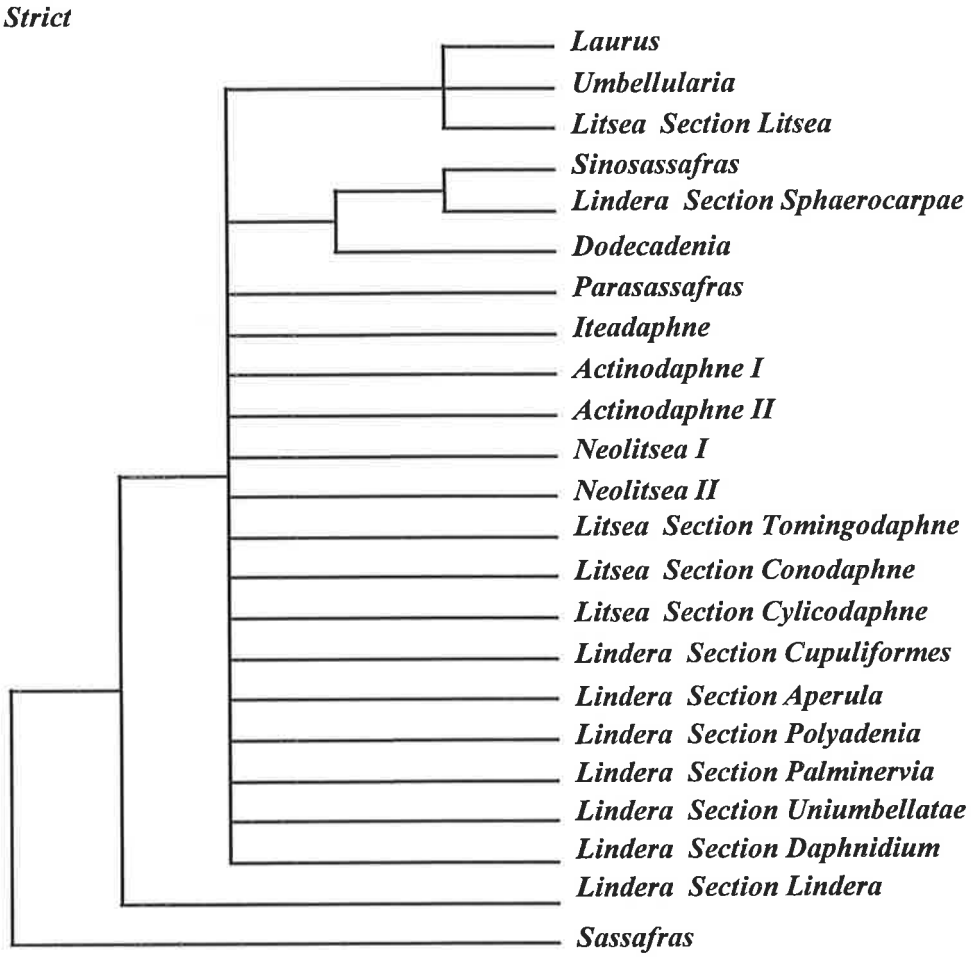
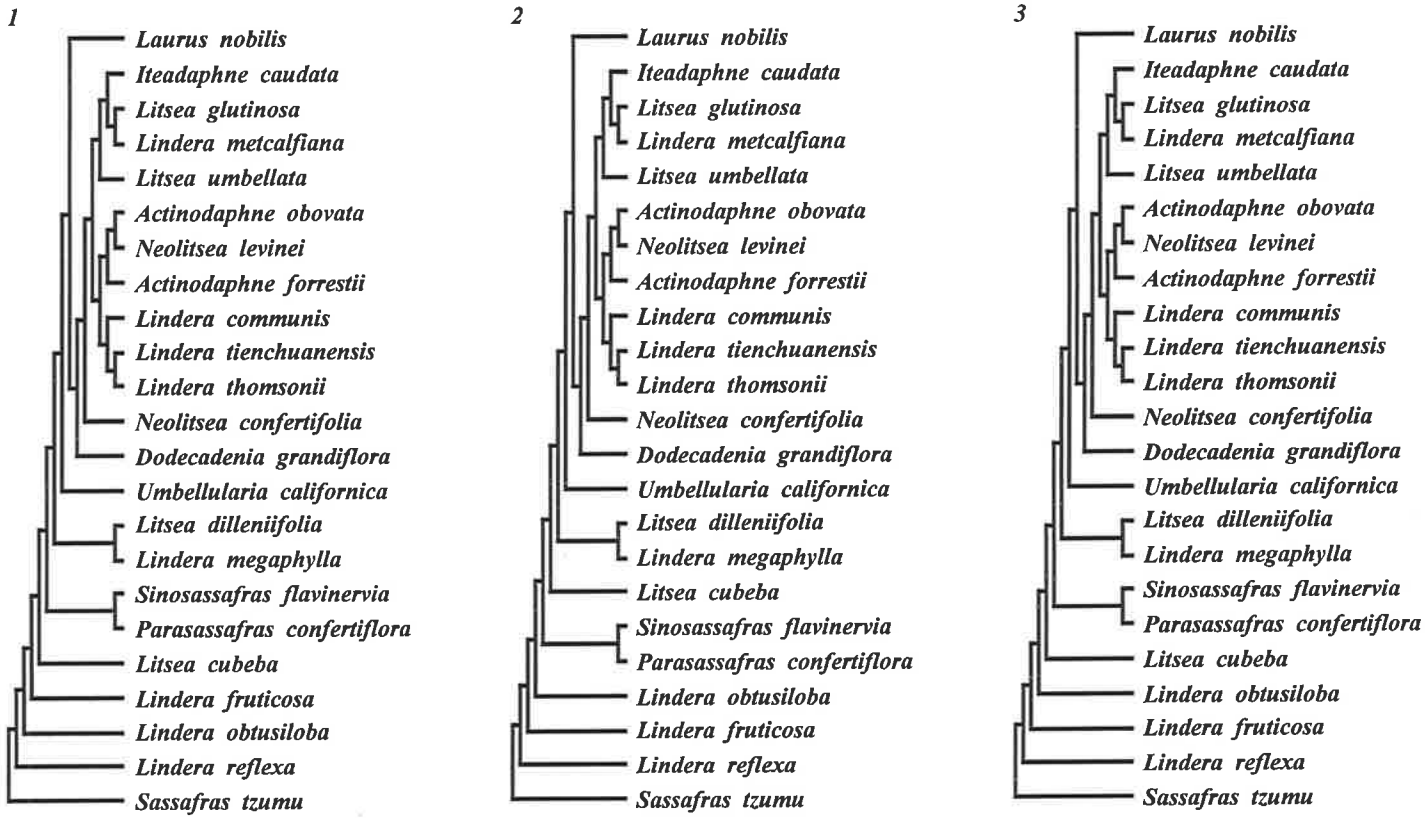


Figure 4-1. The strict consensus cladogram of the 27 equally most parsimonious cladograms solely on the basis of leaf cuticle features.

Figure 4-2. Three equally most parsimonious cladograms obtained through parsimony analysis of the combined data matrix of morphological characters and leaf cuticle features (table 4-3) using the Heuristic method in PAUP 3.1.1



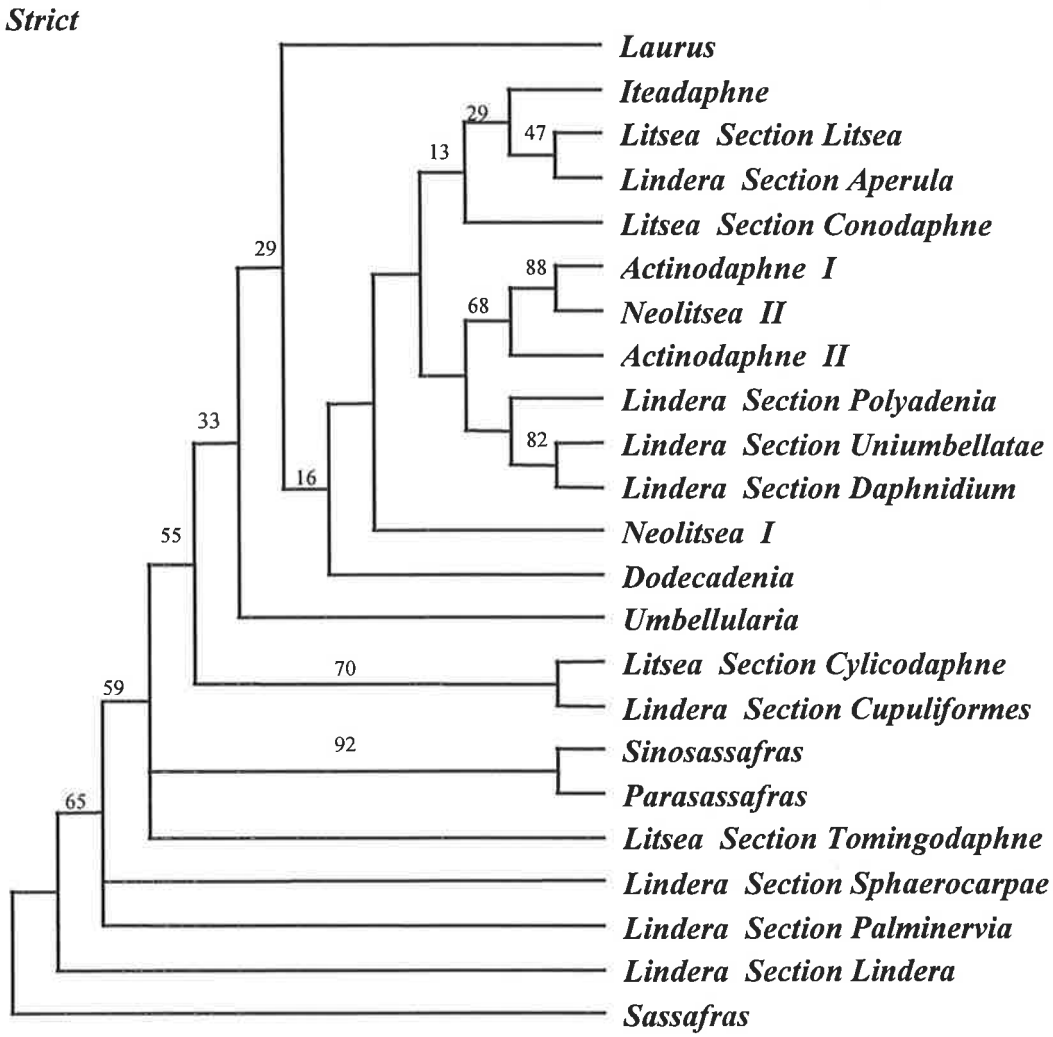


Figure 4-3. The strict consensus cladogram of the three equally most parsimonious cladograms. Boot strap value are represented above the branches.

Chapter Five
Molecular systematics in the *Litsea* complex

5.1 Introduction

The *Litsea* complex consists of ten genera with 500-700 species. The complex is concentrated in tropical-subtropical Asia, but also has representatives in Australasia, the Mediterranean regions, North America and Central America. The complex is considered to be well supported as monophyletic and is distinguished from other genera of *Lauraceae* by several characters including basically racemose inflorescences (the inflorescence appearing umbellate owing to the shortened inflorescence axis), inflorescences with involucral bracts and anther-cells of the third whorl normally introrse.

Nevertheless, the subdivision of the complex has always been problematic, the point at issue being whether to keep or discard two-locular vs. four-locular anthers as a major generic descriptor. A review of five modern *Lauraceae* classification systems (Kostermans, 1957; Hutchinson, 1964; Richter, 1981; Rohwer, 1993; Werff and Richter, 1996), found that progressively more researchers are discounting anther cell number for the purpose of generic delimitation (e.g. Rohwer, Richter and Werff, 1991).

In the preceding chapter, traditional morphological characters, as well as new data from leaf cuticle features, were incorporated in a phylogenetic analysis of the *Litsea* complex. The primary conclusion of this work was that the number of anther cells alone did not have a strong phylogenetic value at the generic level, despite its possibly being a valuable character for species identification. In addition, some novel monophyletic groups were apparent from the cladogram derived from the

morphological and leaf cuticle characters (see Figure 4-3). These include: *Cylicodaphne-Cupuliformes* characterised by a cup-shaped fruit cupule, *Sinosassafras-Parasassafras* by minute involucral bracts in the inflorescence, *Uniumbellatae-Daphnidium* by trinerved leaves and *Litsea-Aperula* by a racemiform inflorescence with a long peduncle. However, despite most segregate groups being upheld, some groups required further research, such as the deciduous species groups in *Litsea* and *Lindera* and the genera *Actinodaphne* and *Neolitsea*. Given these limitations in the morphological and leaf cuticle data, this current chapter aims to integrate a new set of molecular data, with the goal of providing a better resolved, more robust phylogenetic hypothesis for *Litsea* complex.

The extensive use of data from DNA sequencing in recent systematic studies of seed plants makes this technique the logical choice as a source of additional information. The *mat*K gene is considered to be a good candidate for examining phylogenetic studies of the *Litsea* complex. The *mat*K gene has been suggested to be the most rapidly evolving coding region found so far in the chloroplast genome (Olmstead and Palmer, 1994). The higher rate of synonymous and especially of non-synonymous substitutions within *mat*K means that comparative sequencing of *mat*K is considered appropriate for the reconstructing infrafamilial phylogenies (e.g. Johnson and Soltis, 1994, 1995; Steele and Vilgalys, 1994; Plunkett et al, 1996, 1997; Liang and Hilu, 1996; Gadek et al, 1996; Kron, 1996; Manos and Steele, 1997; Sang et al, 1997; Xiang et al, 1998; Denda et al., 1999). The *mat*K gene is approximately 1,500 base pairs (bp) in length, encodes an intron splicing maturase, and is generally located within the intron of the transfer RNA gene for lysine (*trn*K) (Neuhaus and Link, 1987; Liere and Link, 1995). In this study, by using *mat*K sequence data it was hoped to obtain independent evidence to assess the monophyly of the *Litsea* complex. In a study carried out concurrently with this one but already published, Rohwer (2000) found that the separation between taxa with involucrate and non-involucrate inflorescences is not supported by his data; the involucrate group "*Laureae*" (equal to present *Litsea* complex) becomes questionable because a very large terminal group is presented in his result.

5.2 Materials and methods

5.2.1 DNA sampling

Sampling of taxa for this analysis was designed for complete overlap between morphological plus leaf cuticle and *mat*K data matrices. Representation of species was thus nearly identical to the morphological plus leaf cuticle analysis, which included diverse representation of all pre-defined segregates in this complex, and with multiple species from sections in the larger genera such as *Litsea, Lindera.* A complete list of the species sampled, along with collection data and voucher information, is provided in Table 5-1.

Table 5-1. Species of the *Litsea* complex and outgroup taxa included in the molecular systematic analysis.

Taxon	Voucher	Source	Genbank number
Litsea			
Section *Tomingodaphne*			
Litsea cubeba (Lour.) Pers	Li H.W. 28(AD)	Yunnan, China	AF 244398
Section *Litsea*			
Litsea glutinosa (Lour.) C.B. Rob.	Li H.W. 21(AD)	Yunnan, China	AF 244396
Section *Conodaphne*			
Litsea umbellata (Lour.) Merr.	Li H.W. 24(AD)	Yunnan, China	AF 244395
Section *Cylicodaphne*			
Litsea dilleniifolia P.Y. Pai et P.H. Huang	Li H.W. 19(AD)	Yunnan, China	AF 244397
Lindera			
Section *Cupuliformes*			
Lindera megaphylla Hemsl.	Li H.W. 7(AD)	Yunnan, China	AF 244404
Section *Lindera*			
Lindera reflexa Hemsl.	Nei M.X. & Lai S.K. 3768 (KUN 0100201)	Jiangxi, China	AF 244401

Section *Aperula*			
Lindera metcalfiana Allen	Li H.W. 8(AD)	Yunnan, China	AF 244403
Section *Polyadenia*			
Lindera communis Hemsl.	Li H.W. 4(AD)	Yunnan, China	AF 244406
Section *Sphaerocarpae*			
Lindera fruticosa Hemsl.	Li G.F. 63966 (KUN 0104915)	Sichuan, China	AF 244405
Section *Palminervia*			
Lindera obtusiloba Bl.	Sino-Amer. Exped. 1308 (KUN 0151469)	Hubei, China	AF 244402
Section. *Uniumbellatae*			
Lindera tienchuanensis W.P. Fang et H.S. Kung	Sichuan Exped. 2258 (KUN0101388)	Sichuan, China	AF 244399
Section *Daphnidium*			
Lindera thomsonii Allen	Li H.W. 9(AD)	Yunnan, China	AF 244400
Actinodaphne			
I = Actinodaphne obovata (Nees) Bl.	Li H.W. 1(AD)	Yunnan, China	AF 244410
II = Actinodaphne forrestii (Allen) Kosterm.	Li H.W. 2(AD)	Yunnan, China	AF 244411
Neolitsea			
I = Neolitsea confertifolia (Hemsl.) Merr.	Gao X.P. 53971 (KUN 0106507)	Guangdong, China	AF 244394
II = Neolitsea levinei Merr.	Li H.W. 29(AD)	Yunnan, China	AF 244393
Iteadaphne			
Iteadaphne caudata (Nees) H.W. Li	Li H.W. 27(AD)	Yunnan, China	AF 244408
Dodecadenia			
Dodecadenia grandiflora Nees	Wu C.Y. et al 75-1048 (KUN 0049206)	Tibet, China	AF 244409
Parasassafras			
Parasassafras confertiflora (Meissn.) Long	Qian Y.Y. 682 (KUN 0104558)	Yunnan, China	AF 244392
Sinosassafras			
Sinosassafras flavinervia (Allen) H.W. Li	Yang Z.H. 101437 (KUN 0150376)	Yunnan, China	AF 244390
Laurus			
Laurus nobilis Linn.	Li H.W. 16(AD)	Yunnan, China	AF 244407

Umbellularia			
Umbellularia californica (Hooker et Arnott) Nuttall	Henk van der Werff s.n.	North America	AF 244389
Outgroup taxa: *Sassafras*			
Sassafras tzumu (Hemsl.) Hemsl.	Li H.W. 15(AD)	Yunnan, China	AF 244 391

5.2.2 DNA extraction

Total DNA was extracted using CTAB methods (Doyle and Doyle, 1987). Approximately 1 cm^2 leaf tissue was ground with a minute amount of sterile sand and 1 ml of warmed (60^0C) CTAB + BME in a warmed (60^0C) mortar and pestle; a additional 1 ml CTAB was added and mixed in a mortar; the slurry was poured into two 1.5 ml tubes which were incubated at 60^0C in water-bath for 45 minutes; then 2 volumes of 24:1 chloroform : isopropanol (1 ml) were added and the tubes rocked for at least 10 minutes and then microfuged for 10 minutes at 14,000 rpm. The aqueous phase was transferred to a fresh tube to which was added 1 ml cold 100% EtOH. This was then incubated at -20^0C for either 30 minutes or overnight to precipitate DNA. Following this, the tube was centrifuged for 10 minutes at 14,000 rpm, and the supernatant was decanted, the pellet was washed for 5 minutes using 500 *u*l wash buffer (70% EtOH, 10mM NH_4OAc), followed by centrifugation for another 10 minutes at 14,000 rpm, the supernatant was again decanted, the pellet was dried and resuspended in 100 *u*l ddH_2O (50 *u*l for herbarium materials).

Sometimes where DNA was difficult to cleanly extract by this method, the QIAquick spin column (QIAGEN, Clifton Hill, Victoria, Australia) was used to extract DNA (personal communications, Mark Chase, Jodrell Laboratory, KEW), 150 *u*l of the aqueous phase mentioned above was added to the column, after which the QIAquick protocol for cleaning PCR products was followed. This method avoided precipitating the DNA and it gave DNA within a few minutes.

5.2.3 PCR and sequencing

A standard protocol, the Polymerase Chain Reaction (PCR) was utilised for the amplification of *mat*K. To amplify the whole *mat*K gene, the primer combinations used were 909 and 2288. However, if they did not amplify, internal primer combinations were utilised, including: 909, 5500, 5400, 5300, 5200, 5200F, 1245, 4100, 5800 and 2288. The primer sequences and approximate positions are shown in table 5-2 and figure 5-1.

When the concentration of DNA from the extraction was very high, or if there were problems amplifying certain species, the DNA was diluted 10 and 100 fold.

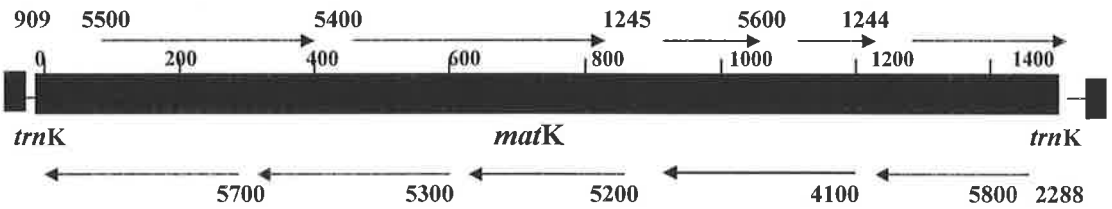
PCR reactions were made up to 50 μl, and included 28.5 μl of ddH_2O, 1 μl of 10 mM dNTPs, 2.5 μl of 50mM $MgCl_2$, 5μl of 10X reaction buffer, 0.5 μl of 0.4% BSA (Bovine Serum Albumin), 2.5 μl of the 10 μM two primers, 5 μl of template and 2.5 μl of enzyme mix. The enzyme mix was made up of 2.22 μl of ddH_2O, 0.25 μl of 10X reaction buffer and 0.19 μl of Taq polymerase (5 unit / μl).

The PCR temperature profile employed consisted of 35 cycles at 95^0C for 1 minutes, 52^0C for 1 minute 30 seconds, and 72^0C for 2 minutes. Prior to the cycling reaction, a BSA incubation of 60^0C for 30 minutes was performed.

Table 5-2. Primers used for amplification and sequencing *mat*K in the *Litsea* complex.

Primer	DNA sequence	Source
Forward		
909 (*trn*K3914F)	GGGGTTGCTAACTCAACGG	Johnson & Soltis, 1995
1244 (*mat*K7)	GTATTAGGGCATCCCATT	K.P. Steele & R. Vilgalys, 1994
1245 (KPS5)	GGATCCTTTCATGCATTATG	K.P. Steele & R. Vilgalys, 1994
5400	CTCAAATGATATCGAAGGG	Jones 1998, *Lauraceae* (personal communication)
5500	GATGGATTTCGGCAACAATA	Jones 1998, *Lauraceae* "
5600	GTGTACGACTAAACTCTTCG	Jones 1998, *Lauraceae* "
5200F	CCTTTCTTGAGCGAACAC	Jones 1998, *Lauraceae* "
Reverse		
2288 (*trn*K-2R)	AACTAGTCGGATGGAGTAG	
4100	TAGAACTAGATAGATCTCAGC	Edwards 1997, *Lauraceae* (personal communication)
2520	GATCCTTCCTGGTTGAAACCAC	Jones 1998, *Lauraceae* "
5200	GTGTTCGCTCAAGAAAGG	Jones 1998, *Lauraceae* "
5300	GCATCTTGTATCCAAGAGTG	Jones 1998, *Lauraceae* "
5800	GGTTCTCTATGTGACCTATG	Jones 1998, *Lauraceae* "

Figure 5-1. Approximate position of primers used for amplification and internal primers for overlapping sequences:



To prevent PCR contamination, a negative control was used for every primer combination in every reaction. The negative control consisted of all components of the reaction tubes excluding the DNA template that was replaced by ddH_2O. The PCR products were visualised after agarose gel electrophoresis with reference to a DNA size marker to estimate the length of the fragment. Once the required fragment was successfully amplified, the DNA was purified using PCR SPINCLEAN^{TM} DNA PURIFICATION KIT (Progen), following protocols provided by the manufacturers. Once the fragments had been purified, they were run out on a 0.8-1.2% agarose gel with reference to a mass marker. The bands were again visualised under a UV light and the concentration of the DNA fragments could be estimated.

To sequence the fragment of DNA, a series of reactions were set up, each with one different internal primer, thus producing single stranded DNA. The primers used were both in the 5' to 3' and 3' to 5' direction to get overlapping of the sequences. The internal primers used were chosen from those listed in Table 5-2. Sequencing reactions were performed in a 0.2 ml PCR tube, using 2 *u*l of primer, ~90ng of DNA template, 4 *u*l of Big Dye and 4 *u*l of Big Dye Buffer, using ddH_2O to make up a final reaction volume of 20 *u*l. This mixture was then temperature cycled at 1) 96^0C for 30 seconds, 2) 50^0C for 15 seconds, 3) 60^0C for 4 minutes with 25 cycles.

The sequencing products were transferred to 1.5 ml tubes containing 2 *u*l of 3M sodium acetate and 50 ul of 100% EtOH, vortexed and left on ice for 10 minutes. The samples were then centrifuged at 14,000 rpm for 15 minutes, the supernatant removed, and the pellet washed with 85% EtOH for 30 minutes and again centrifuged, the supernatant was poured off and the reactions were allowed to dry in a vacuum centrifuge. The dried reaction products were directly sequenced on an ABI-Prism automatic sequencer (Perkin Elmer, Norwalk, Connecticut) at the Adelaide Institute for Medical and Veterinary Science (IMVS). Sequences were assembled and checked using ABI Prism software (Factura and Autoassembler).

5.2.4 Sequence alignment

The sequences of the 23 taxa were aligned using DAPSA (DNA and Protein Sequencing Analysis), version 3.8 (Dr. E.H. Harley, University of Cape Town, copyright 1995). This allowed ambiguities to be checked manually and if a base was unclear on the electronic copy, it could be deciphered on hard copy and vice versa; otherwise it was recorded as an ambiguity. Once the partial sequences had been checked, they were aligned to an existing *mat*K sequence from database for *Lauraceae* (database in Dr. Paul Gadek's Lab of James Cook University). In this case, it was *Endiandra cowleyana* Bailey. The sequences were again examined against the hard copies to verify and any observed base changes. When all the overlapping sequences had been checked, a consensus sequence for that species was generated. This final consensus sequence was then aligned to the database sequence and the differences reverified. Consensus sequences were aligned and a data matrix produced.

5.2.5 Data analysis

The molecular data matrix for the phylogenetic analysis consisted of 23 taxa each of 1406 base pairs (bp) without alignment gaps in the coding region. Only phylogenetically informative characters were analysed. All autoapomorphies were excluded from all tree length calculations in this study. The trees were rooted using *Sassafras* as an outgroup.

Cladistic analysis was performed using the parsimony algorithm of the software package PAUP (version 4.0, Sinauer Associates) to analyse the aligned sequence matrix. A heuristic search was performed with 100 replicates with random addition sequence, tree-bisection-reconnection (TBR) branch-swapping and all characters and character states weighted equally (Fitch parsimony). Internal support was evaluated using Bootstrap analysis (Felsenstein, 1985), with 1000 replicates performed on the weighted data matrix, using the following PAUP setting: retain groups compatible with 50% majority-rule consensus, sample characters with equal probability but apply

weights, 10 replicate random sequence addition, MULPARS not in effect, and TBR branch-swapping.

5.3 Results and discussion

MatK sequences data --- DNA was successfully extracted from all the chosen 23 samples, including eight from herbarium samples more than 20 years old. Using a different primer pair, the amplified regions of *mat*K sequenced in this study were 1406 basepairs (bp) length without indel (insertion / deletion), except for those of *Lindera tienchuanensis* and *Lindera thomsonii*. The sequences of these two species missed 108 bp and 31 bp respectively (possibly due to primer mismatch). However, as *mat*K was very conservative in the *Litsea* complex, the number of nucleotide substitution was limited, agreeing with the results of Rohwer (2000), with potentially informative sites comprising only 1.14% of 1406 sites (16 bp). The details of aligned sequences can be seen in Appendix II.

Phylogenetic analysis --- Analysis of the *mat*K nucleotide change submatrix resulted in 45 equally parsimonious trees of 19 steps long, with CI (Consistency Index) = 0.8947, and RI (Retention Index) = 0.9048. The topology of the majority rule consensus tree is shown in figure 5-2.

All trees indicated that *Neolitsea* forms a strongly supported monophyletic group (97%), other large genera including *Litsea*, *Lindera* and *Actinodaphne* were polyphyletic. However, the *mat*K data supported four main groupings within those genera: *Laurus* and *Dodecadenia* clade (89% bootstrap), *Sinosassafras* and *Parasassafras* clade (100% bootstrap), *Actinodaphne* II (fascicled pseudo-umbel group) and *Lindera* Section *Cupuliformes* clade (67% bootstrap), *Litsea* Section *Tomingodaphne*, *Lindera* Section *Lindera* and *Lindera* Section *Sphaerocarpae* clade with 62% bootstrap.

A few nucleotide positions supported *Litsea* Section *Conodaphne* as the sister group of *Litsea* Section *Cylicodaphne*, their clade was then the sister group of *Laurus* and *Dodecadenia* clade; 75% of trees showed *Litsea* Section *Litsea* as the sister group to the clade made up of *Actinodaphne* II (fascicled pseudo-umbel) and *Lindera* Section *Cupuliformes*. They had a very close relationship with *Lindera* Section *Daphnidium*; *Actinodaphne* I (racemiform inflorescence group) was the sister group of *Neolitsea* in 60% of trees, showing they were sister groups; 60% of the trees indicate that *Iteadaphne* occur as sister to all other groups in the *Litsea* complex.

Comparison of sequence and morphological / leaf cuticle trees --- The sequence data support certain clades that are similar to those found in the morphological plus leaf cuticle analysis (Figure 4-3), but there is also significant disagreement between the two types of data. The two analyses consistently agree that the genera *Litsea, Lindera* and *Actinodaphne* are polyphyletic, the genera *Sinosassafras* and *Parasassafras* form a monophyletic group, the racemose inflorescence group in the genus *Actinodaphne* is very close to the genus *Neolitsea,* and that the deciduous sections in the bigger genera *Litsea* and *Lindera* have a close relationship. A notable difference between the two analyses is that the genus *Neolitsea* is supported as a monophyletic group by *mat*K sequneces but not by the morphological / leaf cuticle data. The section pairs between the bigger genera *Litsea* and *Lindera*, which are very similar to each other except for the number of anther cells, form monophyletic clades in morphological / leaf cuticle analysis, but they are widely spread in the molecular analysis. Additionally, *Laurus* and *Dodecadenia* form a monophyletic clade in the molecular analysis but not in the morphological / leaf cuticle analysis.

The main objective of this study has been to determine how many monophyletic groups within the *Litsea* complex could be recognized by using the plastid *mat*K sequences. The phylogeny obtained using *mat*K sequences shows that the phylogenetic relationships within the *Litsea* complex are poorly resolved due to the low degree of sequence divergence among the 23 taxa examined within the complex. It is not easy to establish the correct choice of a sequence where the rate of sequence

divergence is appropriate to the phylogenetic questions being addressed, because the rate of sequence variation for a specific gene may vary among, and even within groups. For example, in Rohwer's (2000) *Lauraceae* phylogenetic analysis using *mat*K sequences, *mat*K has been shown to be valuable for supporting a *Beilschmiedia-Cryptocarya* clade, but it has a limited resolution in other subdivisions of the family. In this study, a *Laurus-Dodecadenia* clade, a *Sinosassafras-Parasassafras* clade and monophyletic *Neolitsea* are well defined by *mat*K sequences, but phylogenetic relationships within *Litsea* and *Lindera* remain unclear. Soltis et al. (1998) stated that "a number of factors may potentially contributed to this rate variation, including generation time, extinction, episodic changes of rates of sequence divergence, and lineage-specific rate variation". "Genes are actually a mosaic of individual characters (nucleotides) that may vary considerably in evolution rate, all nucleotide positions in a gene sequence are not created equal"(Soltis et al., 1998). According to Hilu & Liang's (1997) research, the *mat*K gene includes a relatively conserved 3' region and a less conserved 5' region. For future research, just as Soltis et al. (1998) suggested, we should pay more attention to the individual nucleotide positions just as we closely scrutinize individual morphological characters.

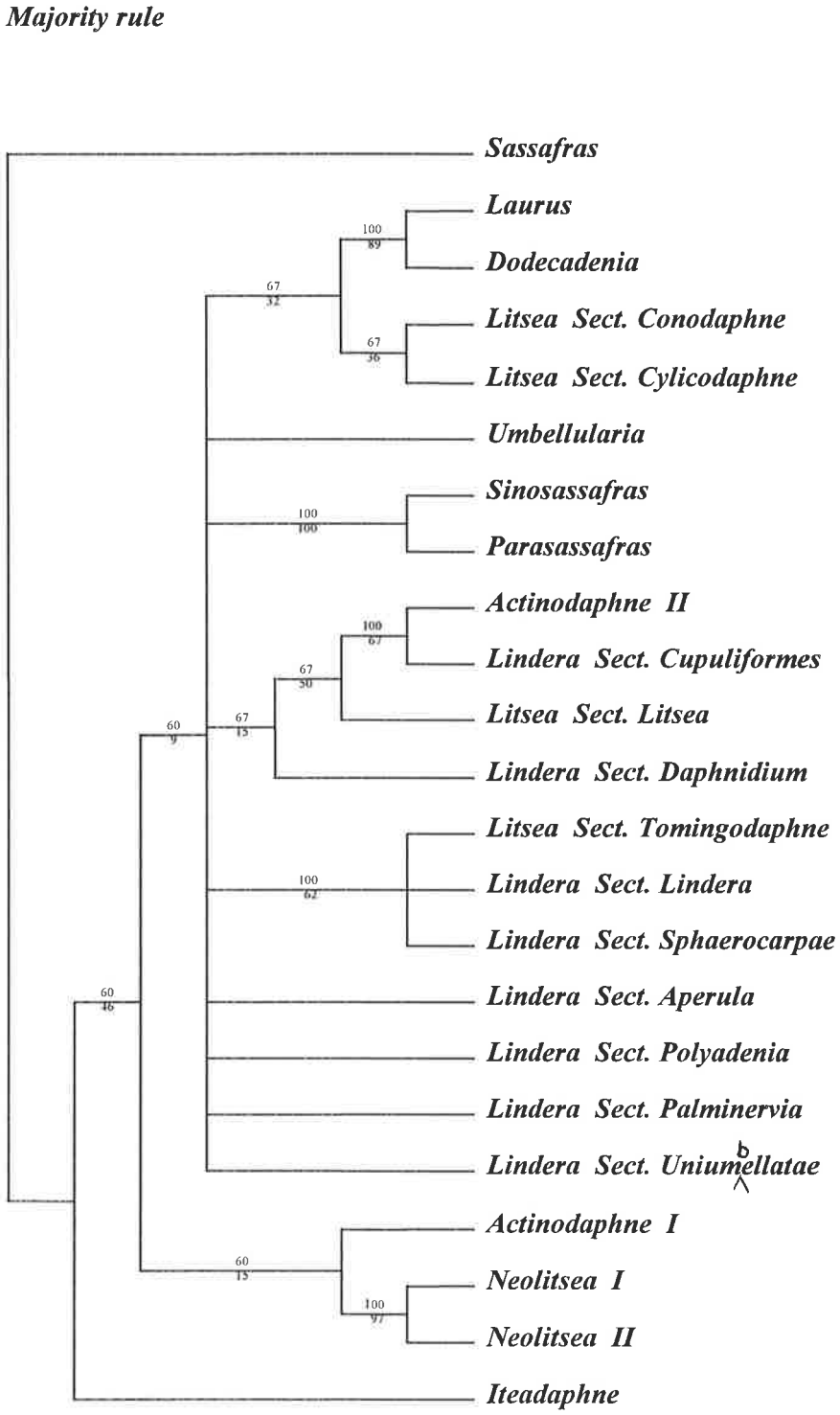


Figure 5-2. The majority-rule consensus tree of the 45 equally most parsimonious trees from the analysis of the *mat*K sequences submatrix. Bootstrap frequencies are indicated below branches.

Chapter Six
Systematic relationships within *Litsea* complex: based on the combined data

6.1 Introduction

With the appearance of molecular data sets, there has been a debate among systematists about the importance and reliability of molecular versus morphological data (Patterson, 1987; Hillis, 1987; Cracraft & Mindell 1989; Sytsma, 1990; Donoghue & Sanderson, 1992, Smith & Sytsma, 1994, Bremer, 1996). Frequently, morphological data are either ignored or explained in light of a cladogram derived from molecular characters (Rohwer, 2000; Kajita et al., 1998; Civeyrel et al., 1998). The large number of characters, relative unambiguity in scoring, and low levels of homoplasy have been promoted as reasons for preferring molecules over morphology. However, several arguments address the problems of molecular data and discuss the general utility of morphological data (Bremer et al., 1987; Donoghue & Sanderson, 1992; Hills, 1987; Patterson, 1987; Syvanen et al., 1989). Molecular data is generally obtained from only a small portion of the entire genome. The analysis of this data may result in cladograms that reflect the evolutionary history of the genes, but not the organisms (Doyle, 1992). Morphological data are assumed to be controlled from many loci distributed throughout the genome and therefore problems of gene trees are avoided. Morphology has been the traditionally most important source of information in plant taxonomy. A majority of taxonomic groups recognized today are defined by cardinal characters derived mainly from floral morphology, and hence, morphology should not simply be dismissed in favour of molecular data. The use of morphological data is a requisite bridge for the inclusion of crucial fossil data (e.g., Jordan & Hill, 1999).

There are obviously clear advantages to both molecular and morphological data. Both types of data have different strengths, and rather than argue for or against morphology, it seems sensible to use it in conjunction with molecular data. Miyamoto (1985) argued that phylogenetic relationships must be reconstructed with all available information in a combined analysis. In the combined analysis, morphological synapomorphies identified in such an analysis may also allow rapid prediction of the placement of further taxa. Steele and Vilgalys (1994) stressed that phylogenetic conclusions from *mat*K sequence data need to be corroborated with data from other sources including morphological characters because of *mat*K being a plastic gene. Today, most systematists agree that a combined analysis provides a strong basis for phylogenetic hypotheses and is the most appropriate method for phylogenetic reconstruction and classification (e.g. Kelly, 1998; Sennblad et al., 1998; Renner, 1999; Smith, 2000; Gadek et al., 2000). In this part of the study, I shall try to reconstruct the phylogenetic classification for the *Litsea* complex on the basis of the combined data from morphology, leaf cuticle and *mat*K sequences.

6.2 Materials and methods

6.2.1 Sampling

Eighteen taxa were sampled so as to include representatives for all the described genera in the *Litsea* complex and all the sections in the bigger genera like *Litsea* and *Lindera*. To investigate the monophyletic or paraphyletic status of the genera *Actinodaphne* and *Neolitsea,* two representatives each from them were included according to morphological and leaf cuticle investigation.(see Table 6-1).

Table 6-1. Species of the *Litsea* complex and outgroup taxa included in the combined analysis.

System	Taxa
Litsea	
Section *Tomingodaphne*	*Litsea cubeba (Lour.)* Pers
Section *Litsea*	*Litsea glutinosa (Lour.)* C.B. Rob.
Section *Conodaphne*	*Litsea umbellata* (Lour.) Merr.
Section *Cylicodaphne*	*Litsea dilleniifolia* P.Y. Pai et P.H. Huang
Lindera	
Section *Cupuliformes*	*Lindera megaphylla* Hemsl.
Section *Lindera*	*Lindera reflexa* Hemsl.
Section *Aperula*	*Lindera metcalfiana* Allen
Section *Polyadenia*	*Lindera communis* Hemsl.
Section *Sphaerocarpae*	*Lindera fruticosa* Hemsl.
Section *Palminervia*	*Lindera obtusiloba* Bl.
Section. *Uniumbellatae*	*Lindera tienchuanensis* W.P. Fang et H.S. Kung
Section *Daphnidium*	*Lindera thomsonii* Allen
Actinodaphne	
I (racemiform inflorescence group)	*Actinodaphne obovata* (Nees) Bl.
II (fascicled pseudo-umbel group)	*Actinodaphne forrestii* (Allen) Kosterm.
Neolitsea	
I penninerved group)	*Neolitsea confertifolia* (Hemsl.) Merr.
II (trinerved group)	*Neolitsea levinei Merr.*
Iteadaphne	*Iteadaphne caudata (Nees)* H.W. Li
Dodecadenia	*Dodecadenia grandiflora* Nees
Parasassafras	*Parasassafras confertiflora* (Meissn.) Long
Sinosassafras	*Sinosassafras flavinervia* (Allen) H.W. Li
Laurus	*Laurus nobilis* Linn.
Umbellularia	*Umbellularia californica* (Hooker et Arnott) Nuttall
Outgroup taxa: *Sassafras*	*Sassafras tzumu* (Hemsl.) Hemsl..

6.2.2 Analysis data

The data matrix for the phylogenetic analysis (see Appendix II) consistes of a molecular submatrix comprising 22 taxa, each of 1406 base pairs (bp) without alignment gaps in the coding region and a morphological / leaf cuticle submatrix comprising 53 characters as discussed in the proceeding two chapters. Only phylogenetically informative characters were analysed. All autoapomorphies were excluded from all tree length calculations in this study, and the trees were rooted using *Sassafras* as an outgroup.

6.2.3 Cladistic analysis

Cladistic analysis was performed using the parsimony algorithm of the software package PAUP (version 4.0, Sinauer Associates) to analyse the combined matrix. An initial heuristic search with 100 replicates with random addition sequence, tree-bisection-reconnection (TBR) branch-swapping and all characters and character states weighted equally (Fitch parsimony), was followed by a successive weighting analysis (Farris, 1969; 1989), using heuristic searches with 10 replicates with random sequence addition, TBR branch-swapping, and characters reweighed according to their rescaled consistency index, using the maximum value (best fit) criterion. All trees from these 10 replicates were then swapped to completion, after which another round of weighting was implemented. This process was repeated until the same tree length was obtained twice in succession. Internal support was evaluated using bootstrap analysis (Felsenstein, 1985), with 1000 replicates performed on the weighted data matrix, using the following PAUP setting: retain groups compatible with 50% majority-rule consensus, sample characters with equal probability but apply weights, 10 replicate random sequence additions, MULPARS not in effect, and TBR branch-swapping.

"Successive weighting is a method of determining whether some of the patterns are influenced by changes in unreliable characters and, if so, eliminating these characters and the topologies they produce" (Civeyrel et al., 1998). It is a means to improve the original matrix (Farris, 1969), not a means of choosing between equally parsimonious trees from the unit-weighted analysis (Carpenter, 1988, 1994). In this way, it is a powerful tool to detect conflict in data and to enhance the signal present in data (Goloboff, 1993; Sennblad & Bremer, 1996).

6.3 Results

Analysis of the combined data set resulted in 36 trees of 278 steps long, with CI = 0.3309, RI = 0.4312. The 50% majority consensus tree of the 36 equally parsimonious trees is presented in Figure 6-1. The single most parsimonious tree resulting from successive weighting analysis, was 39.3462 steps long, with CI = 0.5740 and RI = 0.7032 (Figure 6-2).

The combined molecular and morphological / leaf cuticle data gave a closely similar topology to the morphological + leaf cuticle matrix alone (Figure 4-3.), the well supported clades in molecular analysis reappeared in the combined analysis. These included *Laurus* + *Dodecadenia*, a monophyletic *Neolitsea*, *Sinosassafras* + *Parasassafras*, *Litsea* Section *Tomingodaphne* + *Lindera* Section *Sphaerocarpae* + *Lindera* Section *Lindera*, *Actinodaphne* I (*racemiform inflorescence group*) + *Neolitsea* clade. In contrast, the clade consisting of *Actinodaphne* II (*fascicled pseudo-umbel group*) and *Lindera* Section *Cupuliformes*, which appeared in the molecular analysis, was not supported in the combined data, and also *Litsea* sections *Conodaphne* and *Cylicodaphne* as sister groups based on *mat*K sequence data was not found in the combined matrix.

6.4 Towards an improved classification within *Litsea* complex

*Mat*K sequences and morphological + leaf cuticle data together provided a well-resolved phylogenetic tree for the *Litsea* complex. The degree of resolution supported by the combined analysis of the data was also much better than that for either data source independently. Furthermore, comparison of the results of the independent analyses with the simultaneous analysis indicated that *mat*K and the morphological + leaf cuticle data sets complement each other very well in the resolution they provided.

The present analysis, based on the combined data, showed that in the four bigger genera *Litsea*, *Lindera*, *Actinodaphne* and *Neolitsea*, the former three were polyphyletic whereas *Neolitsea* was monophyletic. From the perspective of traditional systematics, the current generic delimitations especially between taxa with 2-celled and 4-celled anthers such as *Lindera* and *Litsea*, were untenable. Both genera appear to contain groups of species that were independently derived from four-celled and two-celled ancestors respectively. Nevertheless, there were also indications in the cladogram that at least some genera could be distinguished by 2-celled and 4-celled anthers, such as *Iteadaphne* and *Dodecadenia*.

The next step was to identify monophyletic groups within the *Litsea* complex that could be recognized as genera. From the cladogram derived from the combined data, the components of *Litsea* and *Lindera* were spread among several clades. There were two clades involving sections from *Litsea* and *Lindera*. The first of these comprised of *Litsea* Sect. *Litsea* and *Lindera* Sect. *Aperula*. This clade was weakly supported in the analysis (bootstrap = 44%); and the morphological synapomorphy for this clade was the presence of long peduncles in the racemiform inflorescences. The close relationship between these taxa was recognized previously by Li (1985) and Tsui (1987).

The second clade consisted of *Litsea* Sect. *Cylicodaphne* and *Lindera* Sect. *Cupuliformes*. This clade was also weakly supported (bootstrap = 57%), the main morphological synapomorphy for this clade being a cup-shaped fruit cupule. The close relationships between these sections was also noticed both by Li (1985) and Tsui (1987).

The third main clade consisted of two sections in *Lindera*, Sect. *Uniumbellatae* and Sect. *Daphnidium*. This clade was supported by bootstrap value 72%, and was characterised by presence of trinerved leaves.

My study also showed that all the deciduous sections in *Litsea* and *Lindera* had very close relationships, forming a deciduous clade and separate from the evergreen clade.

Lindera Section *Polyadenia* appeared to be close to the trin-erved-leaf *Lindera* clade of Sect. *Uniumbellatae* and Sect. *Daphnidium*. *Litsea* Sect. *Conodaphne* was close to the clade consisting of *Iteadaphne* and the racemiform inflorescence *Litsea* Sections *Litsea* and *Aperula*.

The clade comprising *Parasassafras* and *Sinosassafras* constituted the Rohwer's (1993) *Parasassafras* and was strongly supported (bootstrap = 100%). The only unambiguous morphological apomorphy was the presence of a minute involucre, and this result supporting the conclusions of the treatment by Rohwer (1993).

The combined cladogram also showed that the genus *Actinodaphne* can be separated into two groups. One, characterised by racemiform inflorescences was shown to be close to *Neolitsea* (bootstrap = 82%); the other represented the fascicled pseudo-umbel *Actinodaphne* species and was sister to the combined *Neolitsea* and racemiform *Actinodaphne* clade.

The genera *Iteadaphne* and *Dodecadenia* were regarded previously to be a derived, advanced group because of their single flower in the involucre (Li, 1985), but this

viewpoint is not supported by the present analysis. *Dodecadenia* was the strongly supported sister to *Laurus* in the analysis (Bootstrap = 88%), with *Iteadaphne* weakly supported as the sister group to that clade, which is characterised by long peduncle in the inflorescence.

The genus *Umbellularia* was supported as an isolated group, characterised by its bisexual flowers. The dimerous-flowered genera *Laurus* and *Neolitsea* were placed as sister to *Dodecadenia* and as a monophyletic group nested in the paraphyletic *Actinodaphne* clade respectively.

6.4.1 Revised classification

When the results are compared to the older literature I found that they were virtually identical to those of Hooker (1890), who wrote in the "*Flora of British India*" vol.5 under the order *Laurineae* (present *Lauraceae*): "The species of this order were very difficult of discrimination without fruits, and the genera were in some cases far from natural; the characters of 2- and 4-celled anthers separating generically plants otherwise very nearly related." He wrote again under *Lindera*: "I follow Bentham (in *Gen. Plant.*) in bringing together under one genus all the Indian 1-celled Litseaceous plants, and have for the most part arranged them under the sections he has proposed. I expect, however, that when more complete specimens of this group are available, several of the genera now included under *Lindera* will be restored much upon the line I have indicated as sections." Although this agrees with what I found in my study of the *Litsea* complex, the weighting applied to the number of anther cells adopted by Kostermans overshadowed Hooker's ideas. The results of this study cast doubt on the significance of Kostermans' anther characters, and here proposed is an alternative classification which reflects better the patterns of variation seen within the complex based on morphology, leaf cuticle and molecular data.

Revised Classification:

1. ***Laurus*** Linn. Sp. Pl. 369. 1753.

   two species: *L. nobilis*; *L. canariensis*

2. ***Dodecadenia*** Nees in Wall. Pl. Asiat. Rar. 2: 63, 1831.

   Litsea Subg. *Dodecadenia* (Nees) Kosterm. In Comm. For. Res. Inst. Bogor 57: 48. 1957.

   Litsea Subg. *Uniflos* Yang et P.H. Huang in Acta phytotax. Sin. 16(4): 61. 1978.

   One species: *D. grandiflora.*

3. ***Iteadphne*** Bl. Mus. Bot. Lugd.-Bot. 1 (23): 365. 1857.

   two species: *I. confusa; I. caudata.*

4. ***Litsea*** Lam. Encycl. Meth.-Bot. 3: 574. 1753.

   Aperula Bl. Mus. Lugd.-Bot. 1: 365. 1851, **syn. nov.**;

   Lindera Sect. *Aperula* (Bl.) Benth. In Benth. et Hook.f. Gen. Pl. 3: 163. 1880.

5. ***Conodaphne*** (Bl.) J. Li, **stat. nov.**

   Tetranthera Jacq. Sect. *Conodaphne* Bl. Mus. Bot. Lugd.-Bat. 1: 376. 1851.

6. ***Actinodaphne*** Nees in Wall. Pl. Asiat. Rar. 2: 68. 1831.

   Actinodaphne group of racemiform inflorescence.

7. ***Neolitsea*** Merr. In Philip. Journ. Sci. Bot. Suppl. 1(1): 56. 1906.

   Tetradenia Nees in Wall. Pl. Asiat. Rar. 2: 64, t.178. 1831, non Benth.;

   Litsea Sect. *Neolitsea* Benth. in Benth. et Hook.f. Gen. Pl. 3: 161. 1880.

8. ***Actinodaphnopsis*** J. Li, **gen. nov.**

   Ab *Actinodaphni* Nees, differt inflorescentia ad fasciculum umbellatum axillarem reducta.

   Typus generis: *Actinodaphnopsis forrestii* (Allen) J. Li, comb. nov. (Base name: *Actinodpahne reticulata* Meissn. var. *forrestii* Allen in Ann. Miss. Bot. Gard. 25: 412. 1938)

   Actinodaphne group of fascicled pseudo-umbel.

9. ***Polyadenia*** Nees in Wall. Pl. Asiat. Rar. 2: 61. 1831.

   Lindera Sect. *Polyadenia* (Nees) Benth. in Benth. et Hook. f. Gen. Pl. 3: 163. 1880.

   Daphnidium Sect. *Cephalodaphne* Bl. Mus. Lugd. Bot. 1: 352. 1851.

10. ***Daphnidium*** Nees in Wall. Pl. Asiat. Rar. 2: 61 et 63. 1831.

Lindera Sect. *Daphnidium* (Nees) Benth. In Benth. et Hook.f. Gen. Pl. 3: 163. 1880.

Lindera Sect. *Uniumbellatae* H.P. Tsui in Acta Phytotax. Sin. 16(4): 60. 1978, **syn. nov.**

11. ***Umbellularia*** Nutt. N. Amer. Sylva 1: 103. 1842.

one species: *U. californica.*

12. ***Cylicodaphne*** Nees in Wall. Pl. Asiat.Rar. 2: 61 et 67. 1831.

Litsea Sect. *Cylicodaphne* (Nees) Hook.f. Fl. Brit. India 5: 164. 1886.

Lindera Sect. *Cupuliformes* H.P. Tsui in Acta Phytotax. Sin. 16(4): 63. 1978, **syn. nov.**

13. ***Parasassafras*** Long in Notes Roy. Bot. Gard, Edinburgh 4(3): 513. 1984.

Sinosassafras H.W. Li in Acta Bot. Yunnan. 7(2): 134. 1985.

One species: *P. confertiflora* (*Sinosassafras flavinervia, Lindera flavinervia*).

14. ***Lindera*** Thunb. Dissert. Nov. Gen. Pl. 3: 64, t. 3. 1783, non Adanson. Fam. Pl. 2: 499. 571, 1763 (Umbelliferae).

Tetranthera Jacq. Sect. *Tomingodaphne* Bl. Mus. Bot. Lugd.-Bot. 1: 375. 1851, **syn. nov**;

Lindera Sect. *Palminervia* Meissn. in DC. Prodr. 15(1): 246. 1864, **syn. nov.**;

Lindera Thunb. Sect. *Sphaerocarpae* H.P. Tsui in Acta Phytotax. Sin. 16(4): 65. 1987, **syn. nov.**

Lindera Sect. *Sassafrimorpha* Benth. in Benth. et Hook. f. Gen. Pl. 3: 163. 1880.

6.4.2 Key to genera

With the redefined genera, the objective of this study is not only to produce a phylogenetic classification, but also a practical key to the genera within the *Litsea* complex. Here I present such a key below, which includes all the genera within the complex.

1. Leaves deciduous or semi-evergreen (*i.e.* leaves wilted but not fallen in winter) .....***Lindera*** Thunb.

1. Leaves evergreen.
   2. Inflorescence with a minute involucre.....***Parasassafras*** Long
   2. Inflorescence with a large involucre.
      3. Fruiting perianth cup enlarged; fruit borne in a cup-shaped cupule.....
      .....***Cylicodaphne*** Nees
      3. Fruiting perianth non-enlarged; fruit borne in a flat or disc-shaped cupule.
         4. Flowers bisexual.....***Umbellularia*** Nutt.
         4. Flowers unisexual, dioecious
            5. Flower dimerous.
               6.Male flowers with 12 stamens, arranged into 3 whorls, all stamens with attached glands or those of whorls I and whorls II with attached glands; female flowers with four staminodes.....***Laurus*** Linn.
               6. Male flowers with 6 stamens, arranged into 3-whorls only stamens of whorl III with attached with glands; female flowers with six staminodes.....***Neolitsea*** Merr.
            5. Flower trimerous.
               7. Involucral bracts imbricate or alternate, early caducous.
                  8. Pseudo-umbels racemiform.....***Actinodaphne*** Nees
                  8. Pseudo-umbels fasciculated .....***Actinodaphnopsis*** J. Li
               7. Involucral bract decussate, persistent.
                  9. Pseudo-umbels containing one flower.
                     10. Anthers 4-celled.....***Dodecadenia*** Nees
                     10. Anthers 2-celled.....***Iteadphne*** Bl.
                  9. Pseudo-umbels containing more than one flowers.
                     11. Pseudo-umbels with long peduncles, inserted on the developed brachyblasts, so that the inflorescences racemiform.....***Litsea*** Lam.
                     11. Pseudo-umbels sessile or with short peduncles, inserted on the undeveloped or very abbreviated brachyblasts, so that the inflorescences umbellate.
                        12. Leaves trinerved.....***Daphnidium*** Nees
                        12. Leaves penninerved
                           13. Anthers 4-celled.....***Conodaphne*** (Bl.) J. Li
                           13. Anthers 2-celled.....***Polyadenia*** Nees

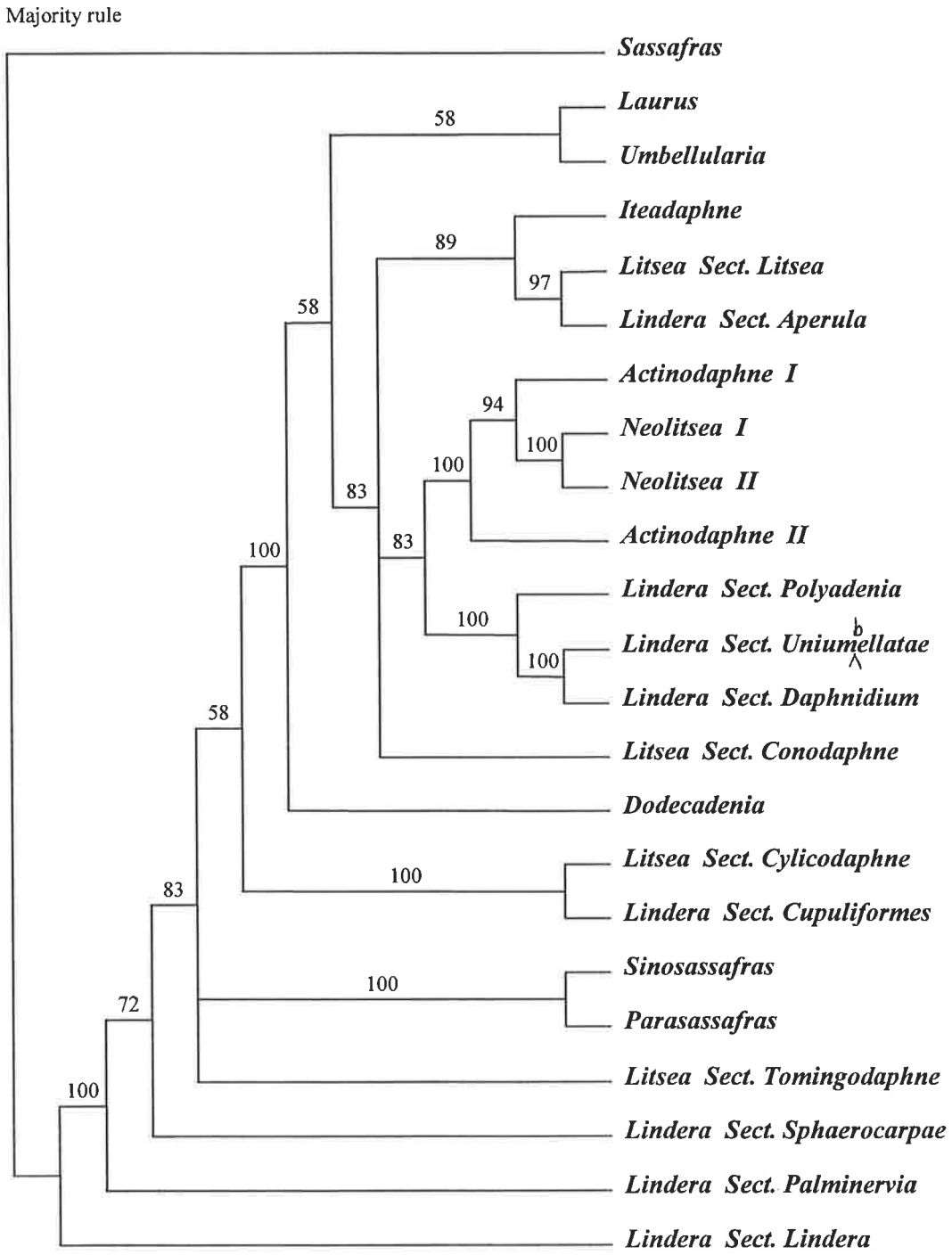


Figure 6-1. 50% majority consensus tree of the 36 equally parsimonious trees derived from the combined data matrix.

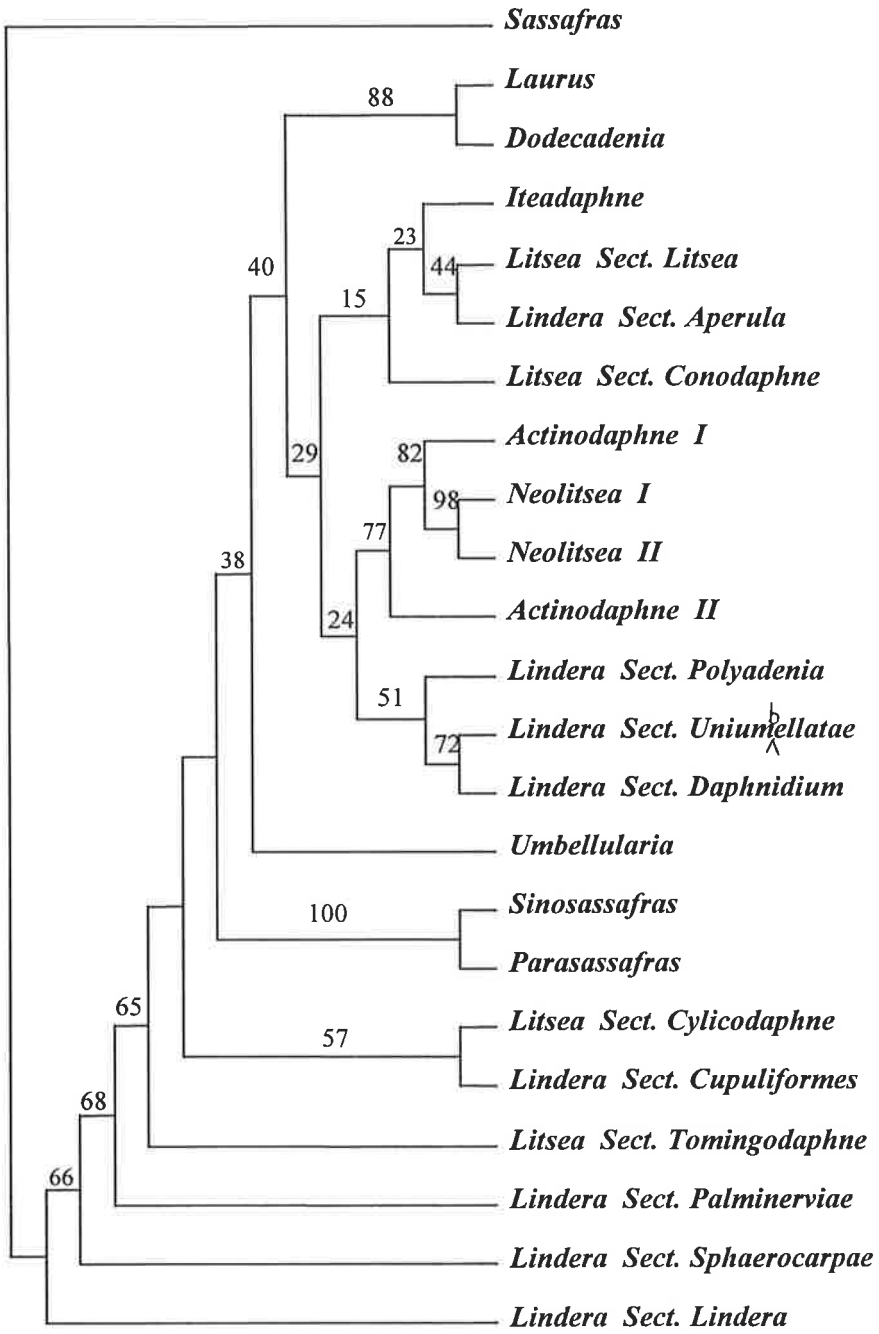


Figure 6-2. Single most parsimonious tree from the successive weighting analysis of the combined data matrix. Bootstrap frequencies are indicated above branches.

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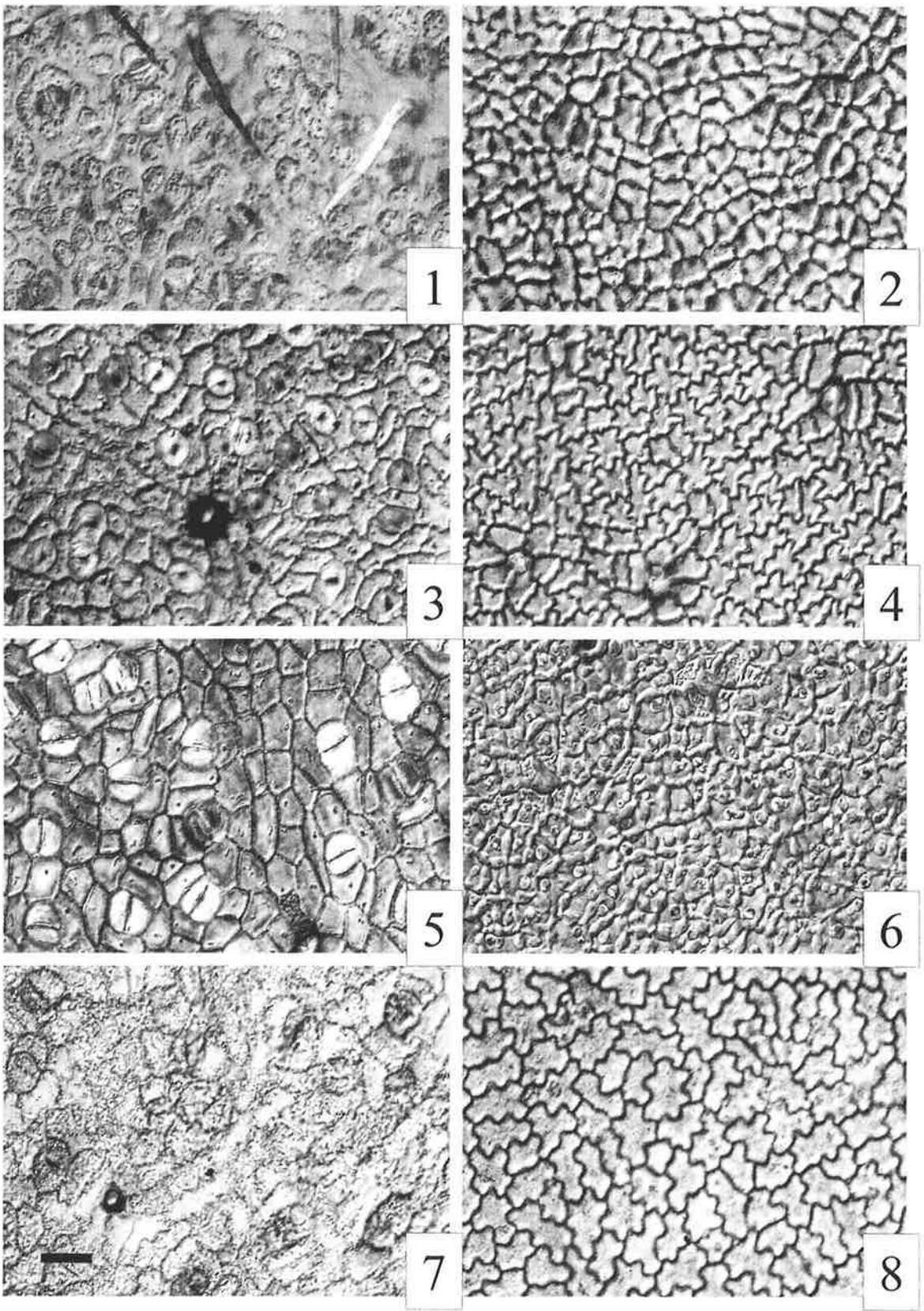
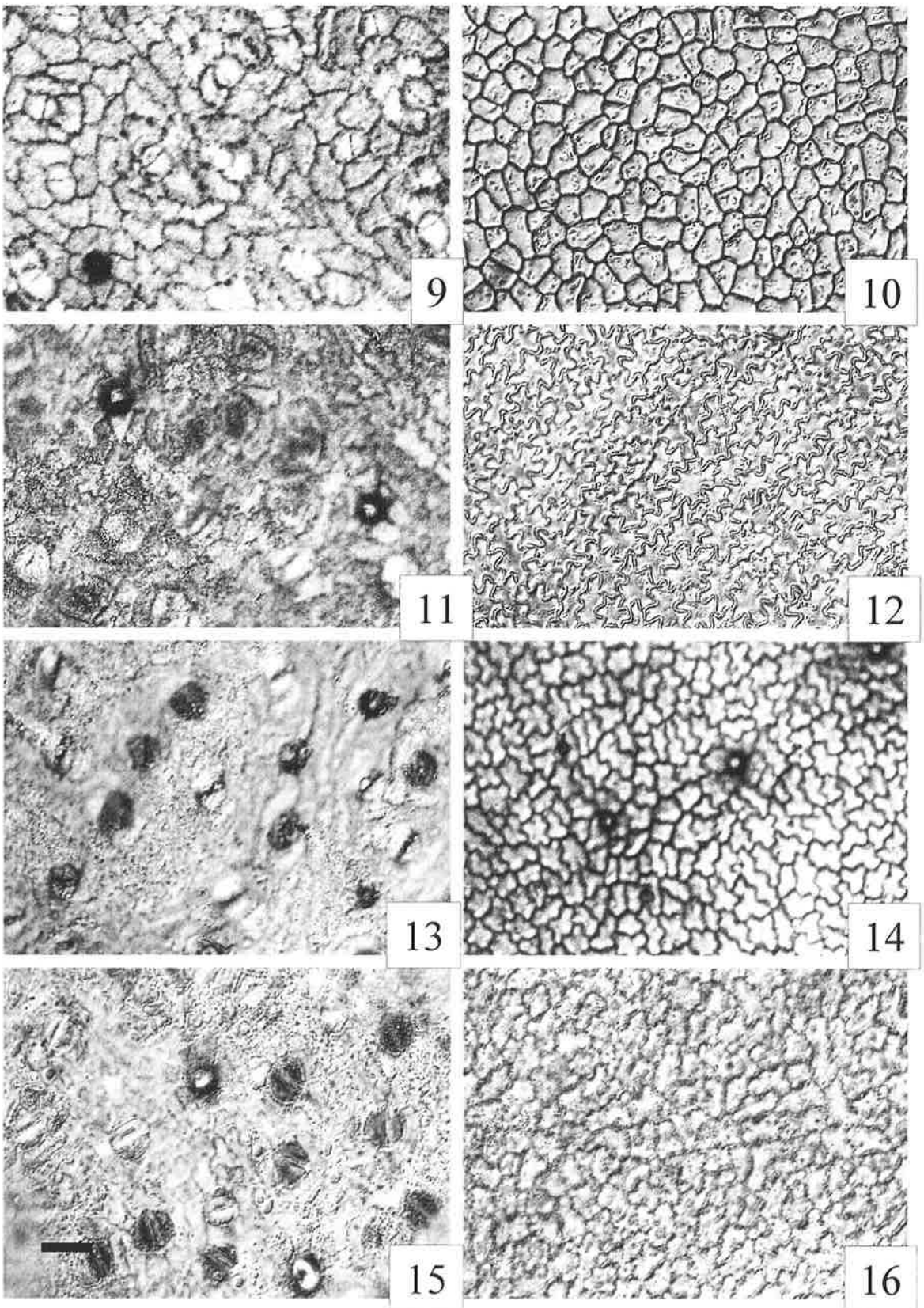
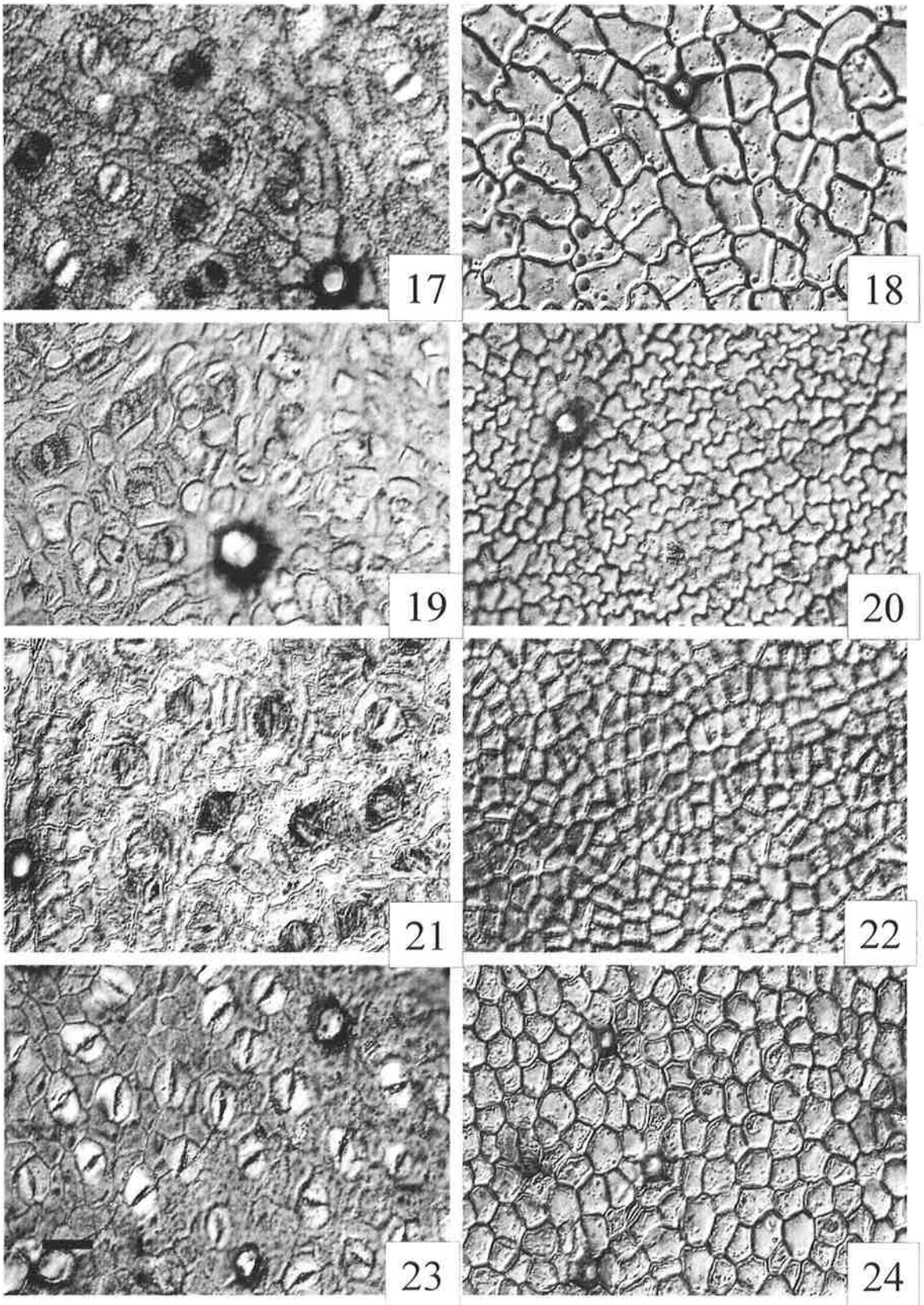
Leaf cuticle plates in *Actinodaphne*



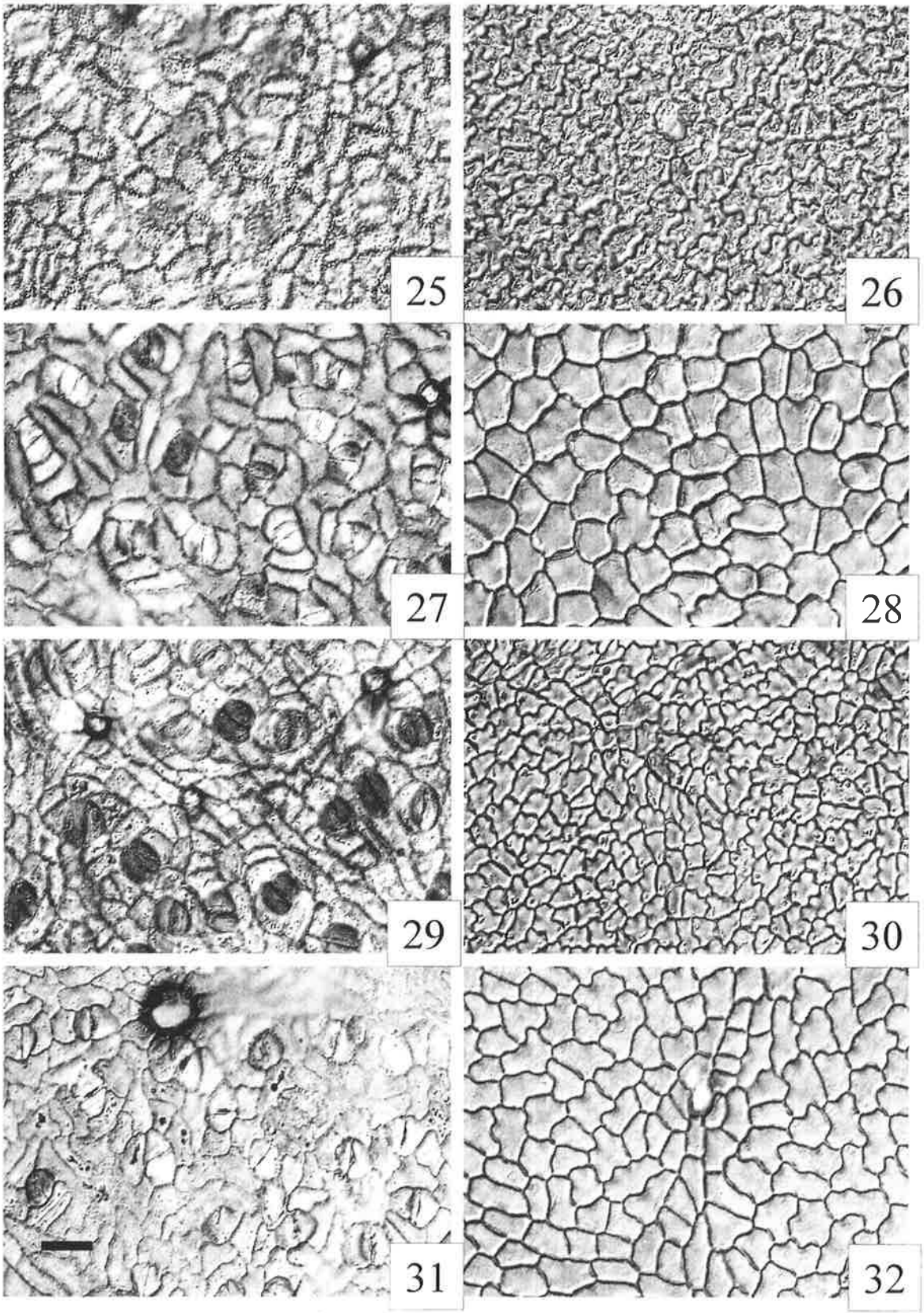
Plates 1-2: *A. acuminata*; plates 3-4: *A. albifrons*; plates 5-6: *A. angustifolia*; plates 7-8: *A. areolata*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



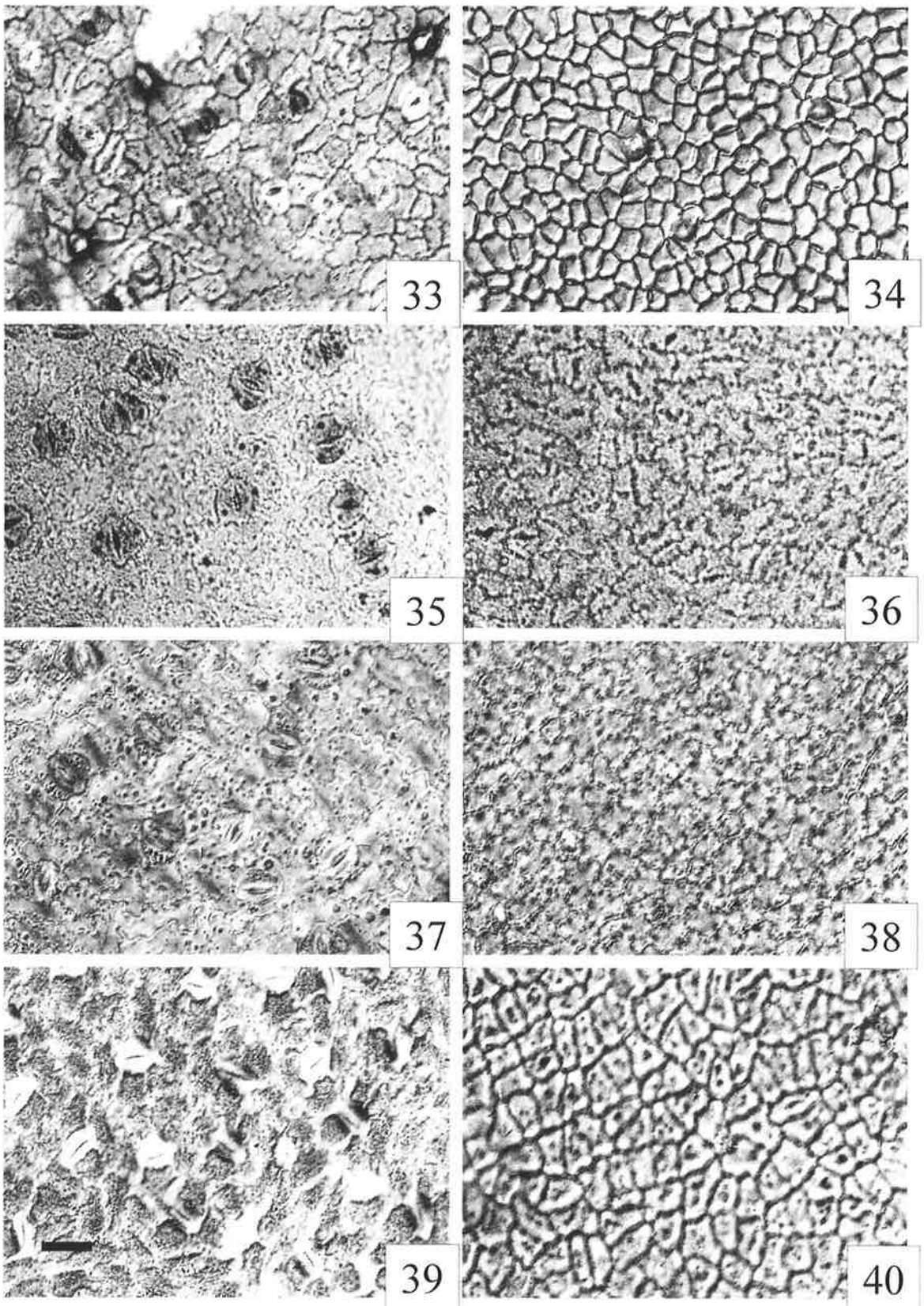
Plates 9-10: *A. boreneensis*; plates 11-12: *A. brassi*; plates13-14: *A. conferta*; plates 15-16: *A. cupularis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



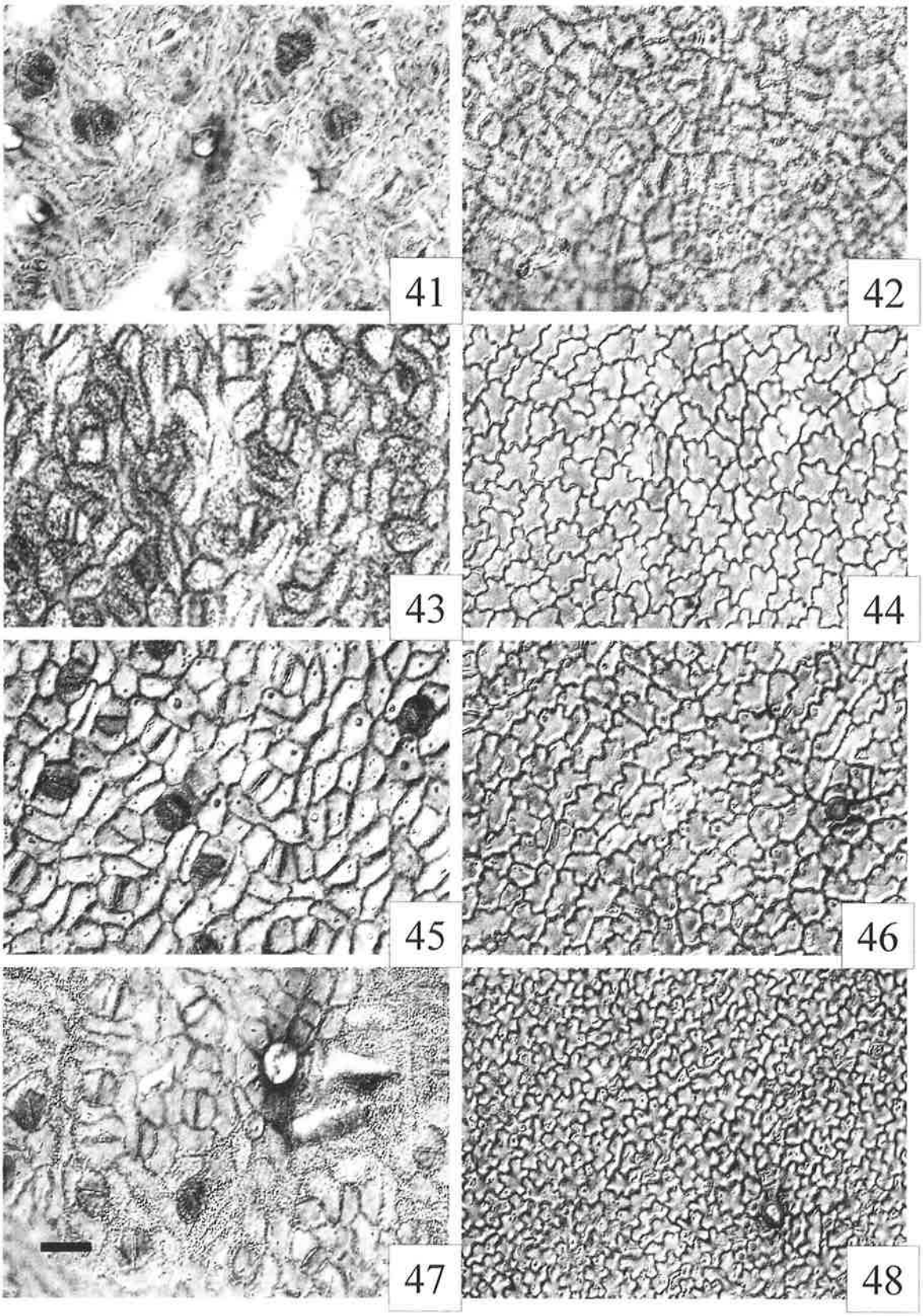
Plates 17-18: *A. diversifolia*; plates 19-20: *A. dolichophylla*; plates 21-22: *A. forrestii*; plates 23-24: *A. foxworthyana.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 33 um.



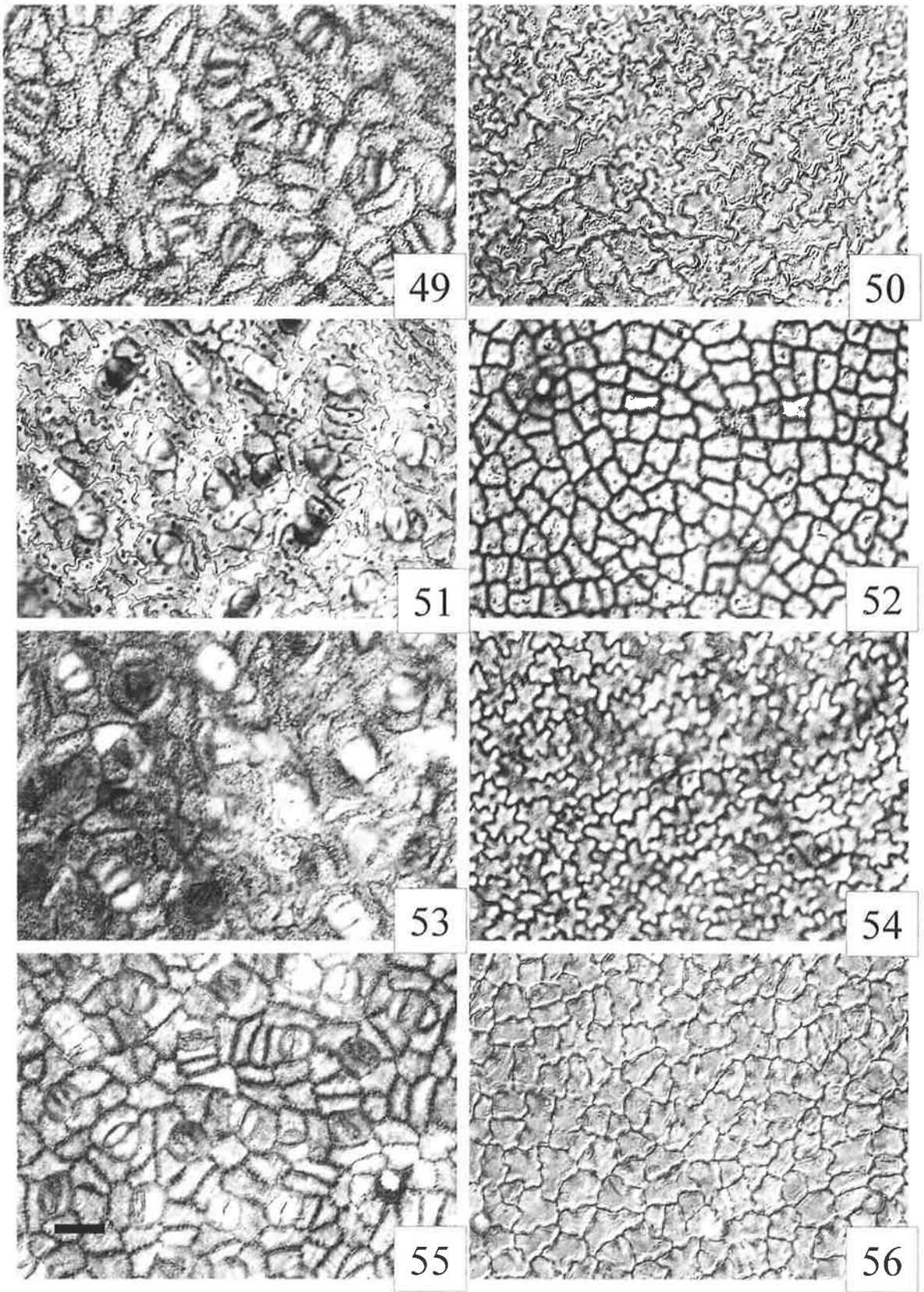
Plates 25-26: *A. glabra*; plates 27-28: *A. glaucina*; plates 29-30: *A. glomerata*; plates 31-32: *A. henryi.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um



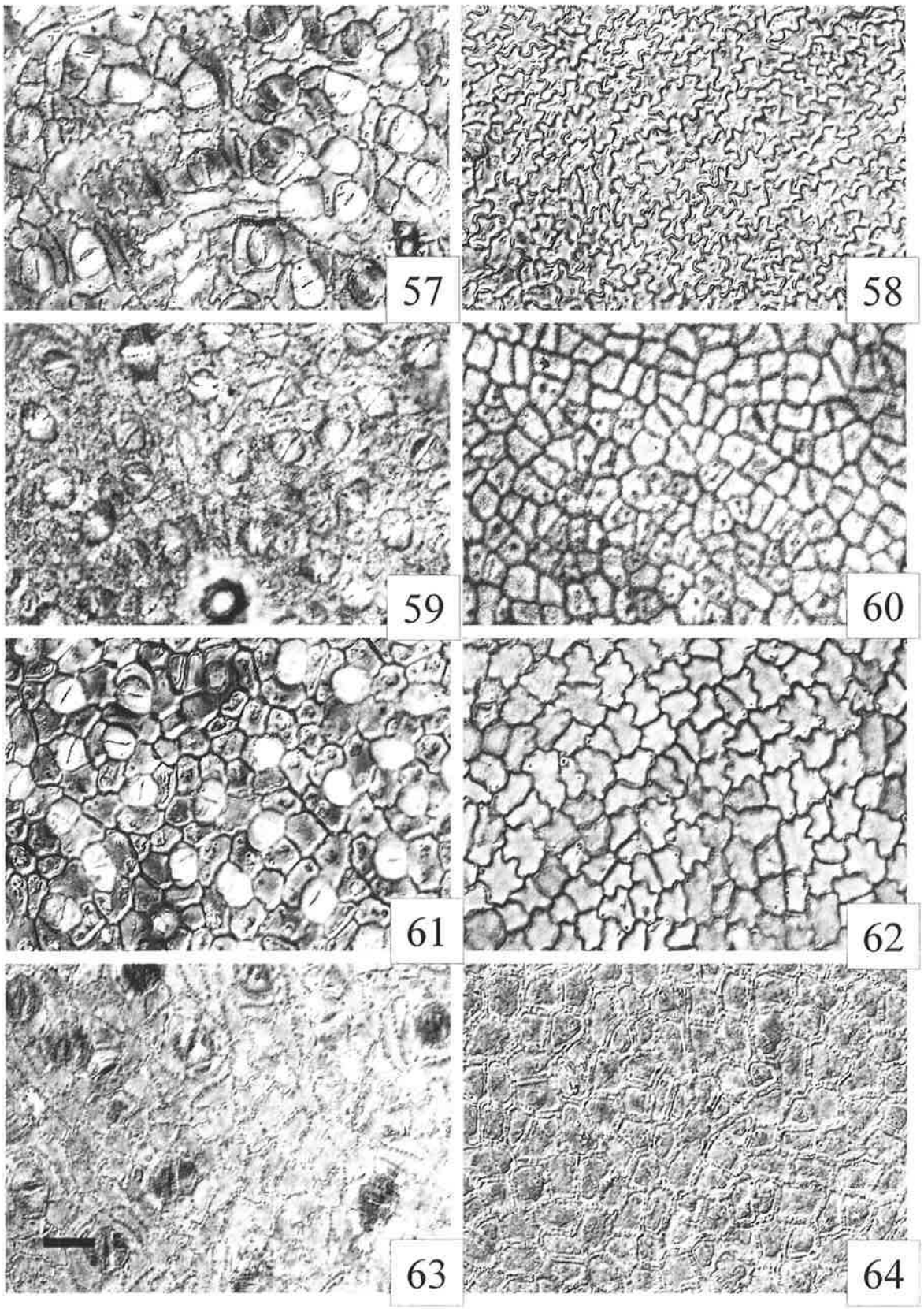
Plates 33-34: *A. hullettii*; plates 35-36: *A. koshepangii*; plates 37-38: *A. kweichowensis*; plates 39-40: *A. lancifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 35 um.



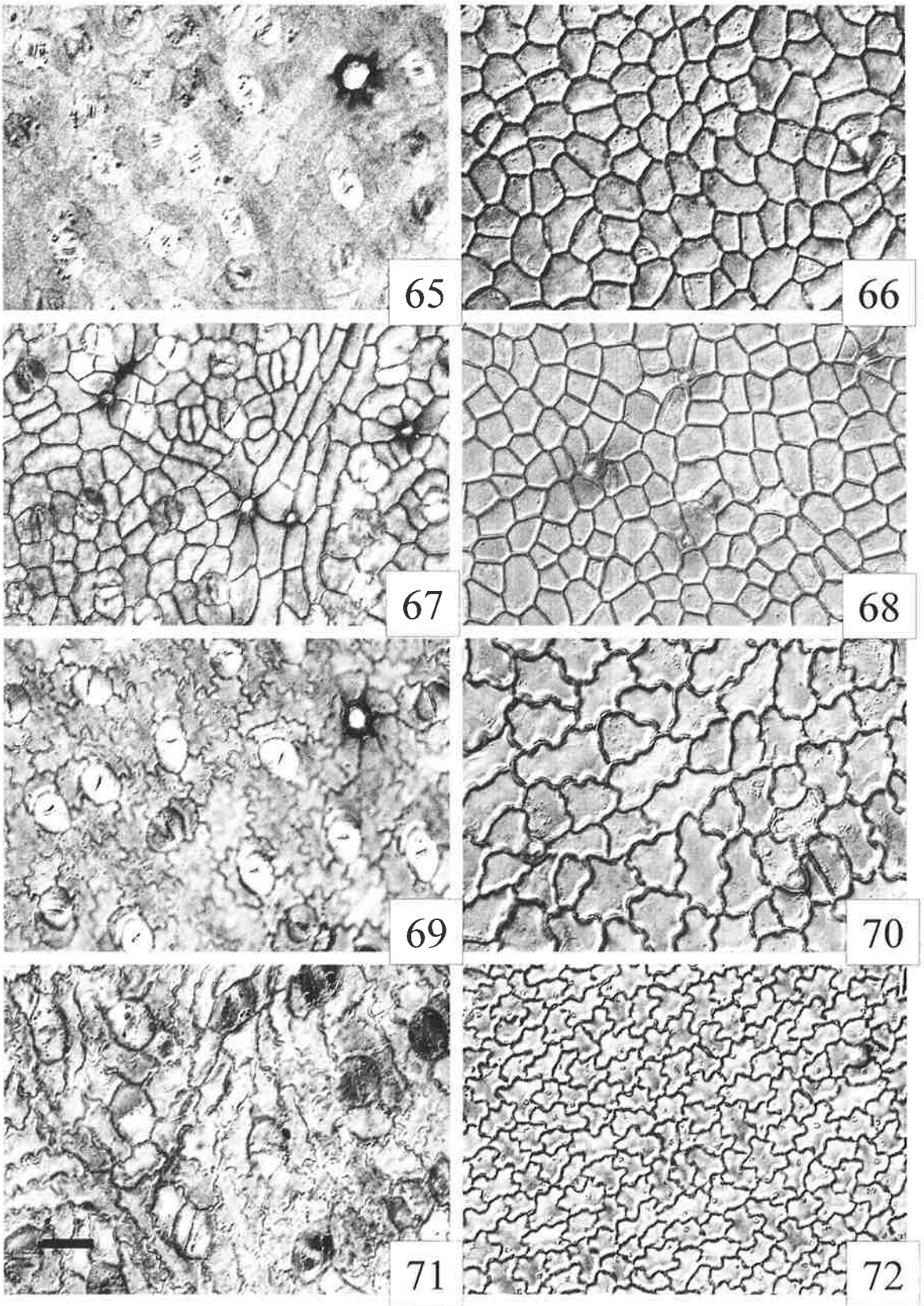
Plates 41-42: *A. lecomtei*; plates 43-44: *A. macrophylla*; plates 45-46: *A. macroptera*; plates 47-48: *A. maingayi.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



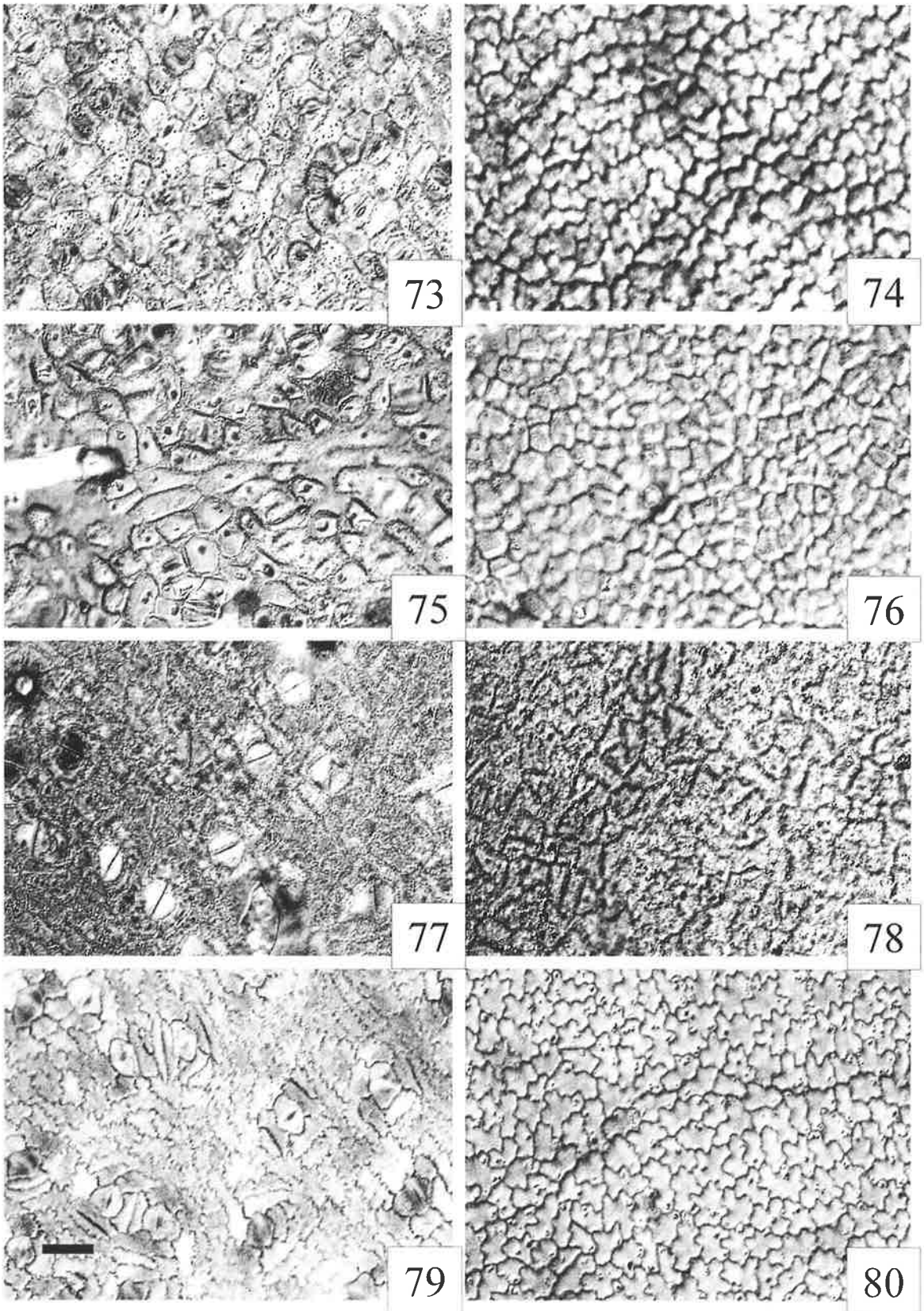
Plates 49-50: *A. malaccensis*; plates 51-52: *A. montana*; plates 53-54: *A. multiflora*; plates 55-56: *A. myriantha.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 35 um.



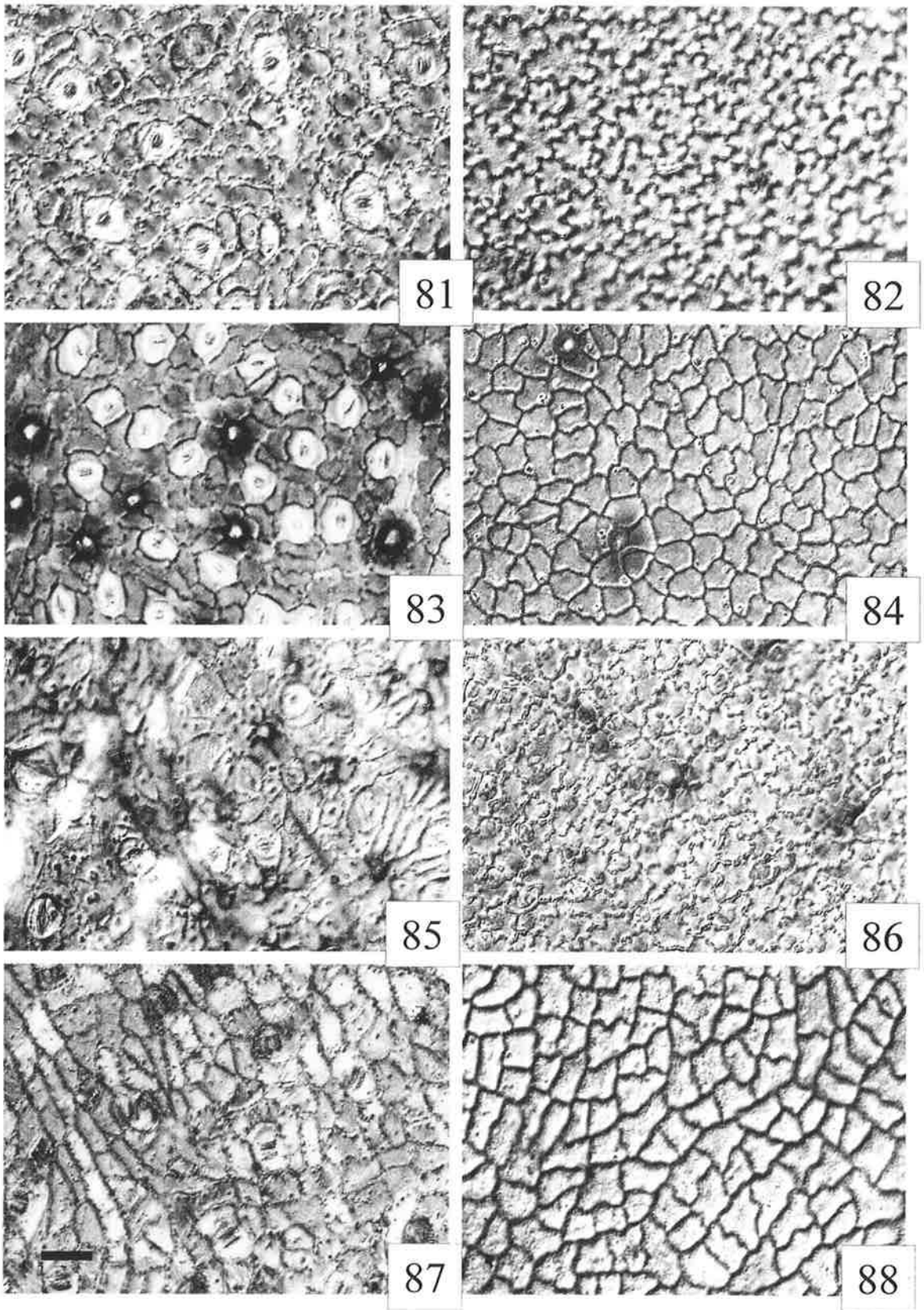
Plates 57-58: *A. nitida*; plates 59-60: *A. obovata*; plates 61-62: *A. oleifolia*; plates 63-64: *A. omeiensis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 33 um.



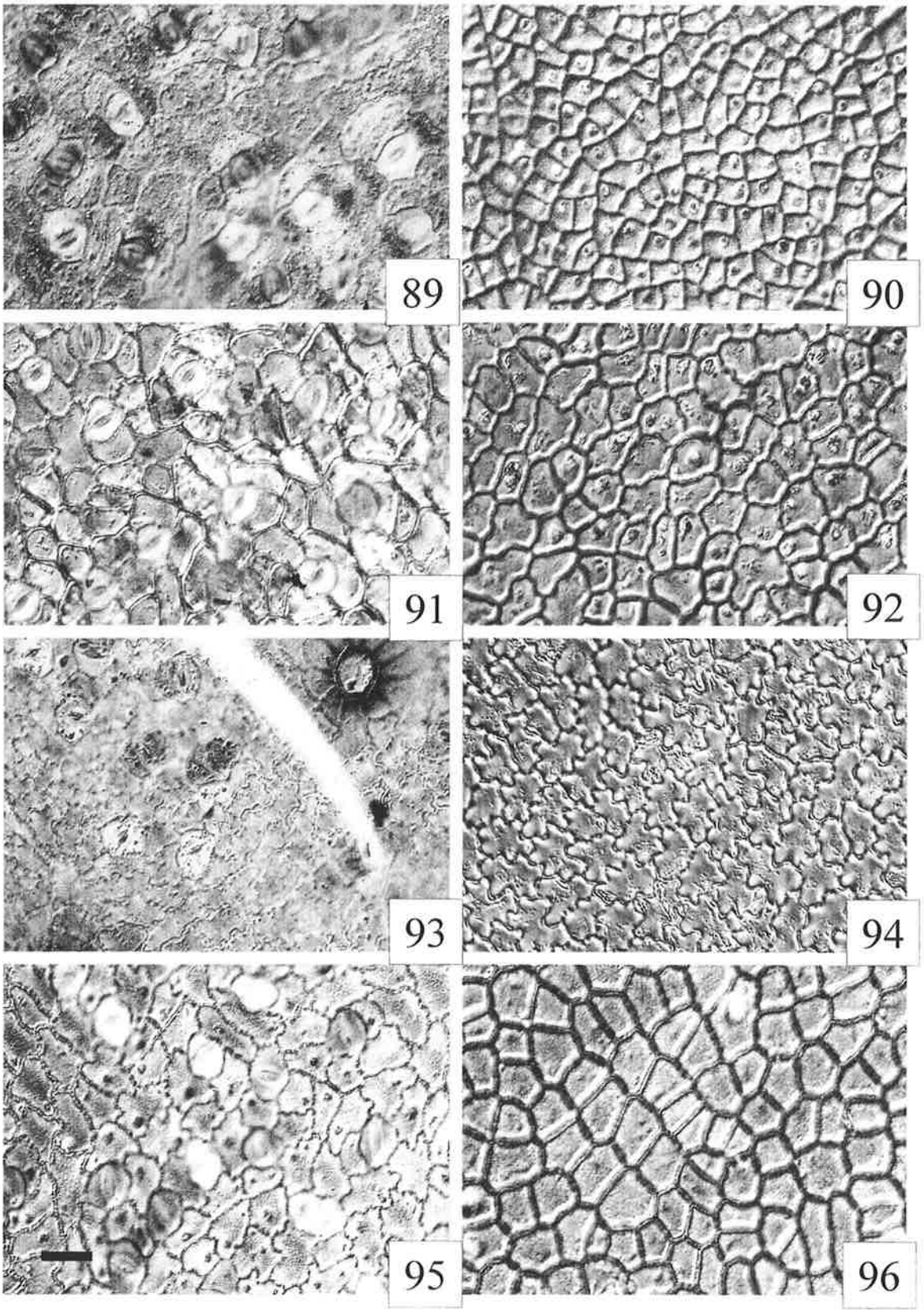
Plates 65-66: *A. pilosa*; plates 67-68: *A. pruinosa*; plates 69-70: *A. ridleyi*; plates 71-72: *A.sesquipedalis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



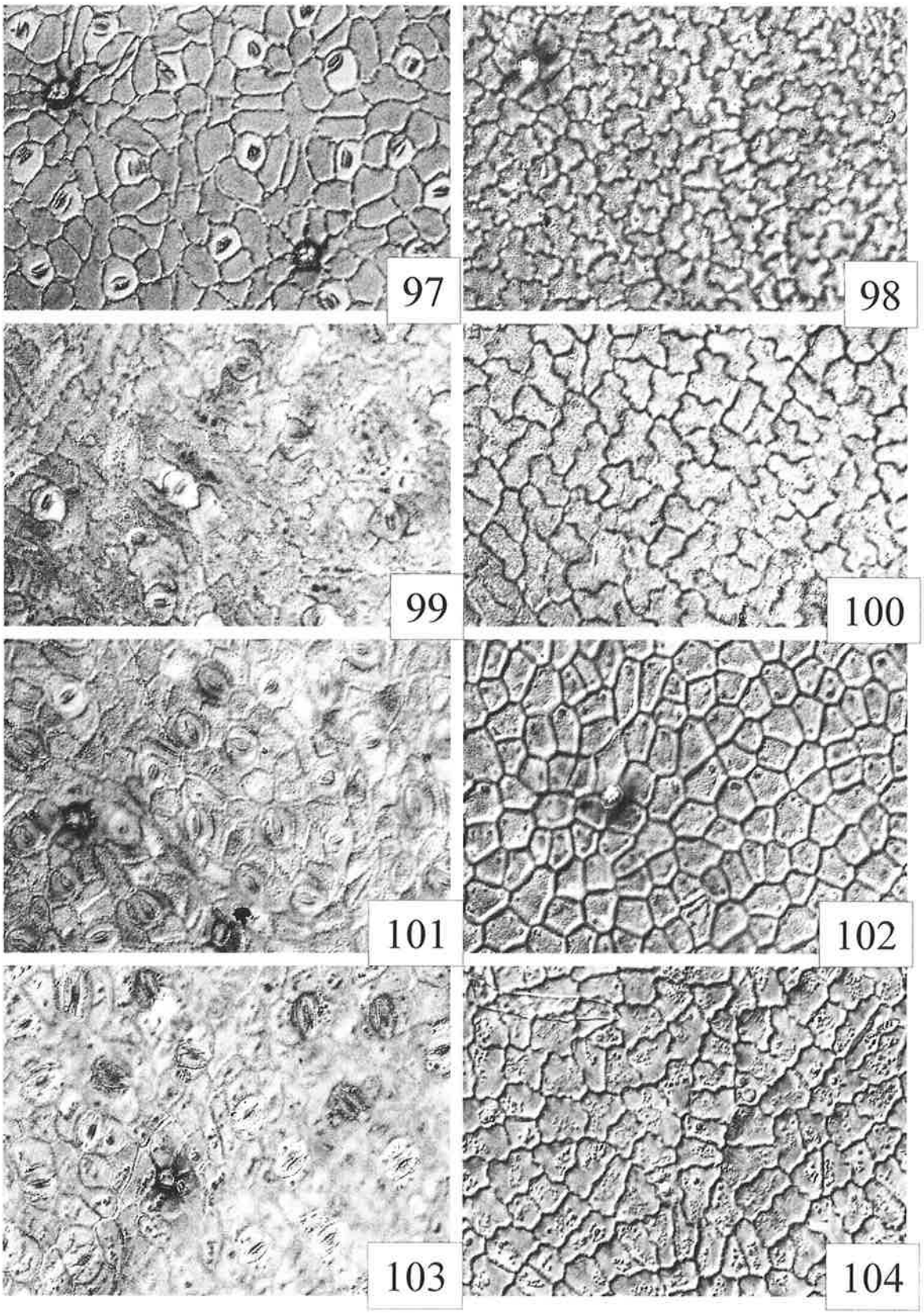
Plates 73-74: *A. sphaerocarpa*; plates 75-76: *A. tayabensis*; plates 77-78: *A. trichocarpa*; plates 79-80: *A. tsaii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



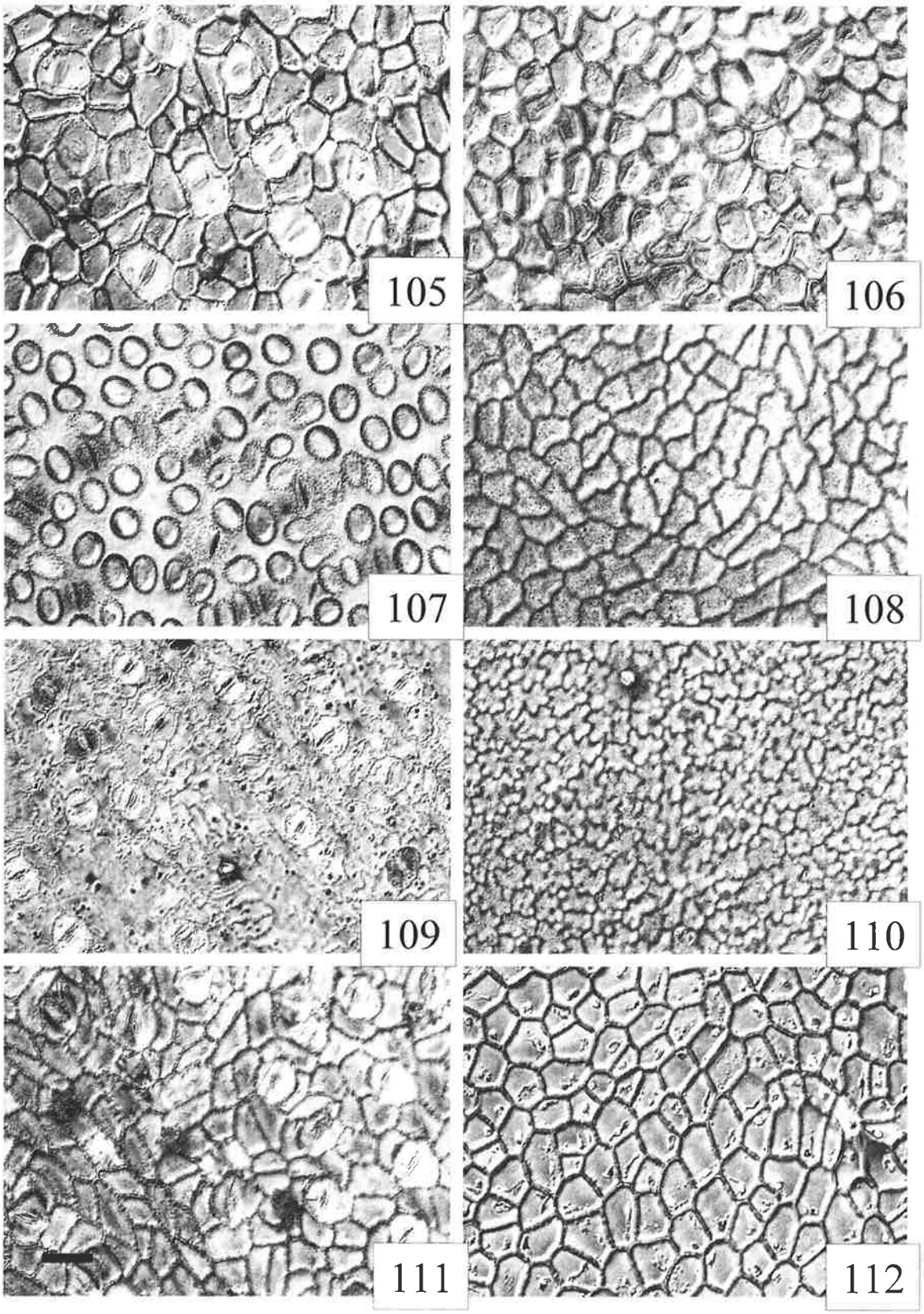
Plates 81-82: *Neolitsea aciculata*; plates 83-84: *N. acuminatissima*; plates 85-86: *N. acutotrinervia*; plates 87-88: *N. australiensis*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



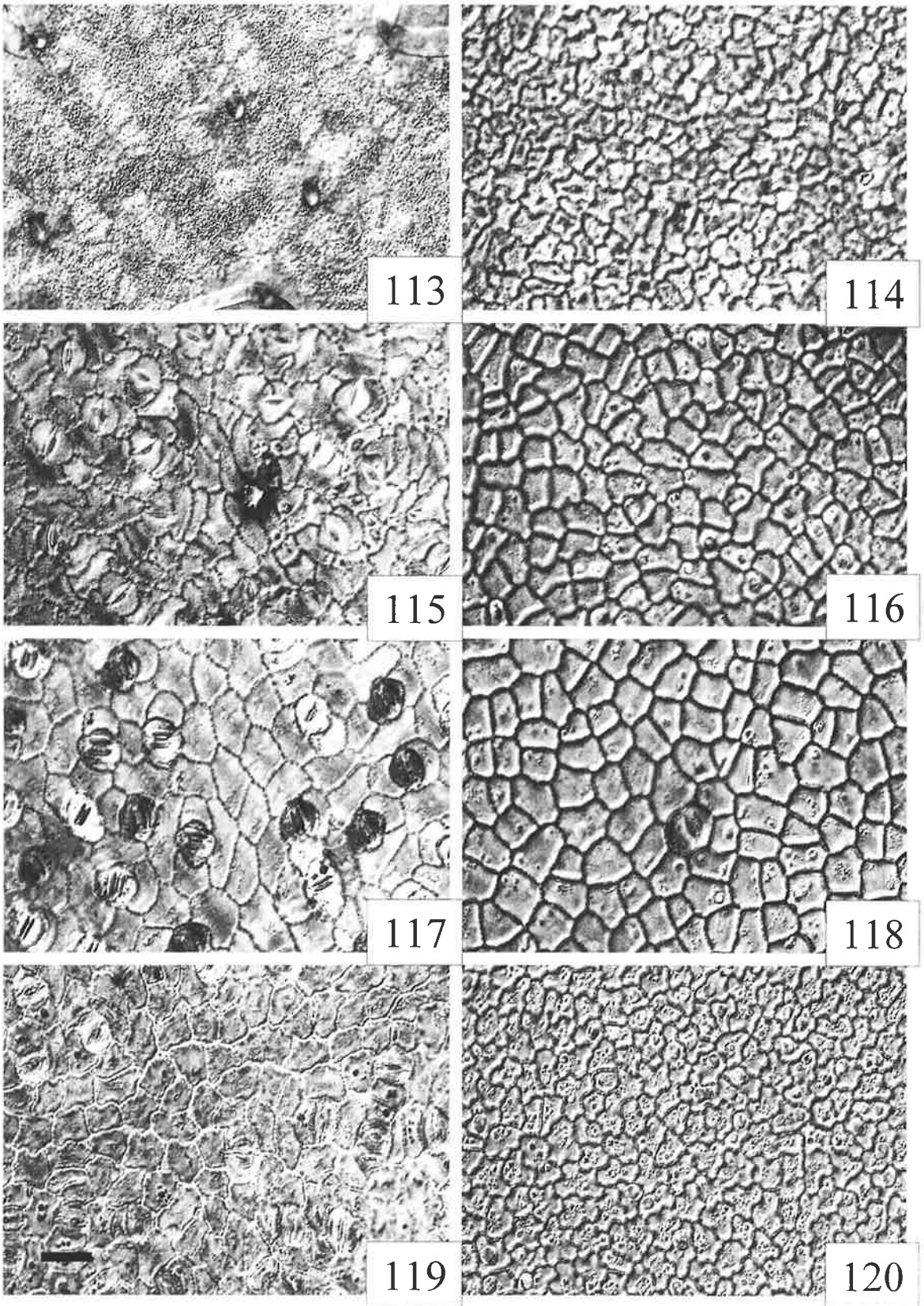
Plates 89-90: *N. brassii*; plates 91-92: *N. buisanensis*; plates 93-94: *N. cambodiana*; plates 95-96: *N. cambodiana var. glabra.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



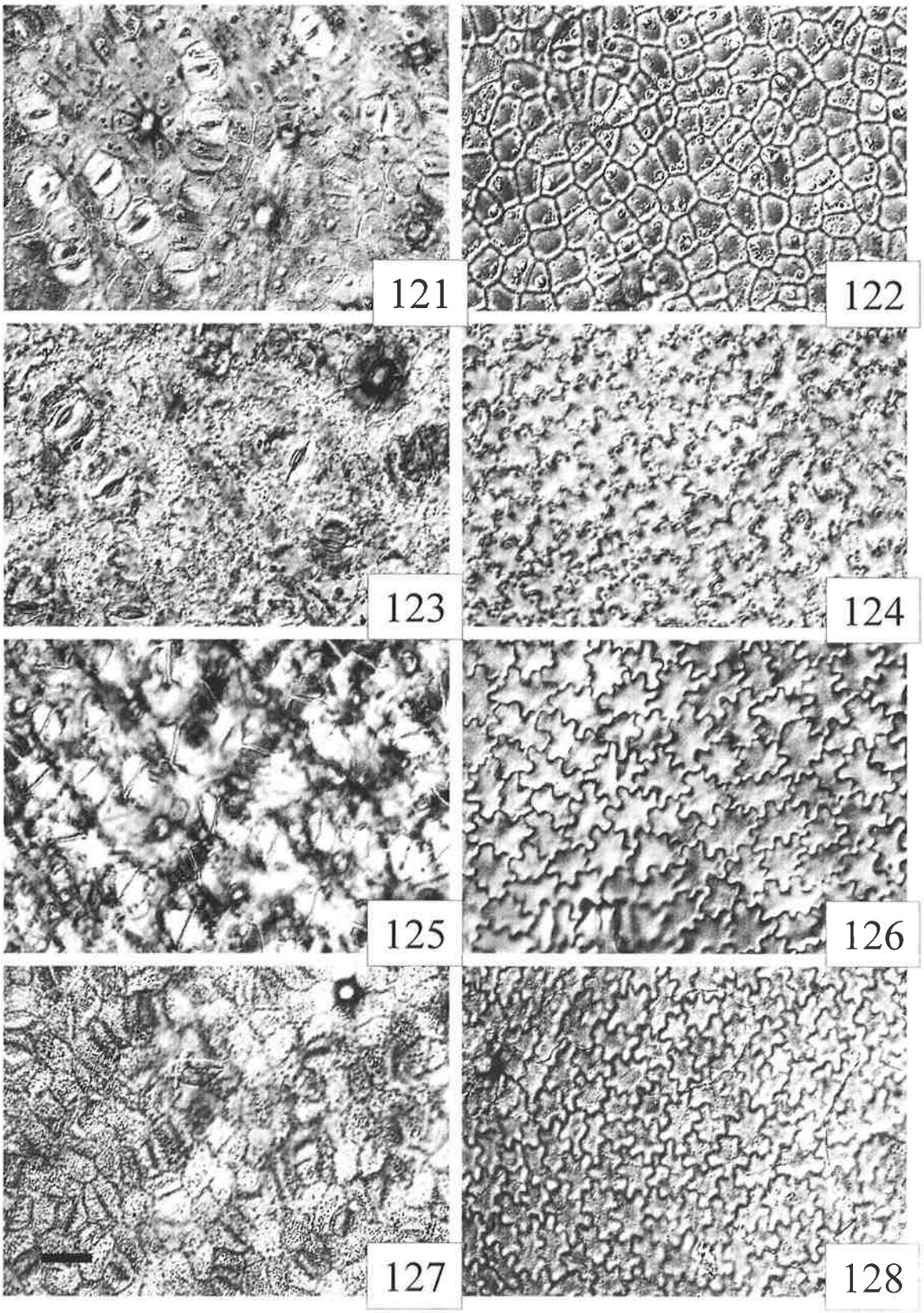
Plates 97-98: *N. cassia*; plates 99-100: *N. cassiaefolia*; plates 101-102: *N. chrysotricha*; plates 103-104: *N. chuii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



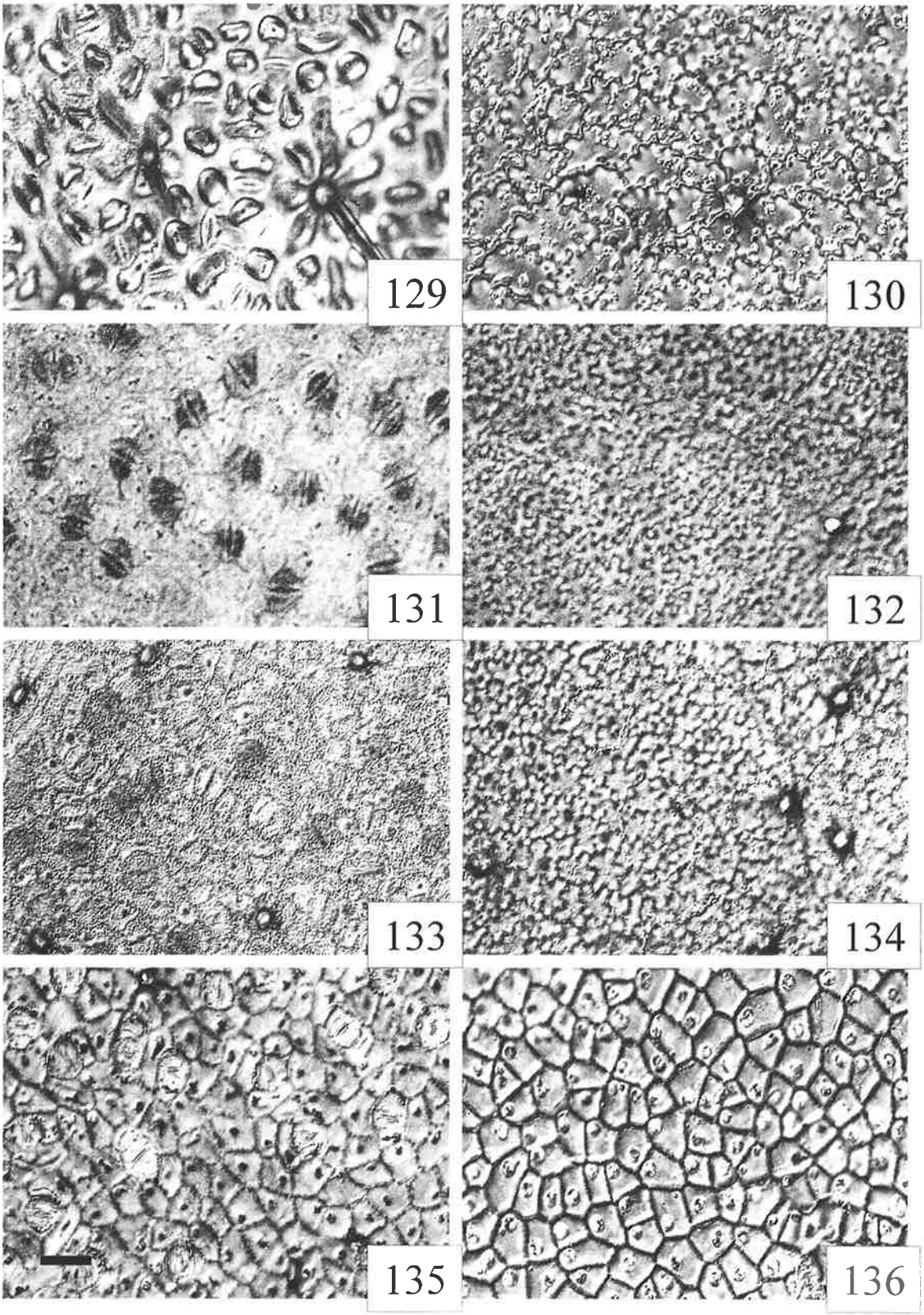
Plates 105-106: *N. coccinea*; plates 107-108: *N. confertifolia*; plates 109-110: *N. daibuensis*; plates 111-112: *N. ellipsoidea.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36um.



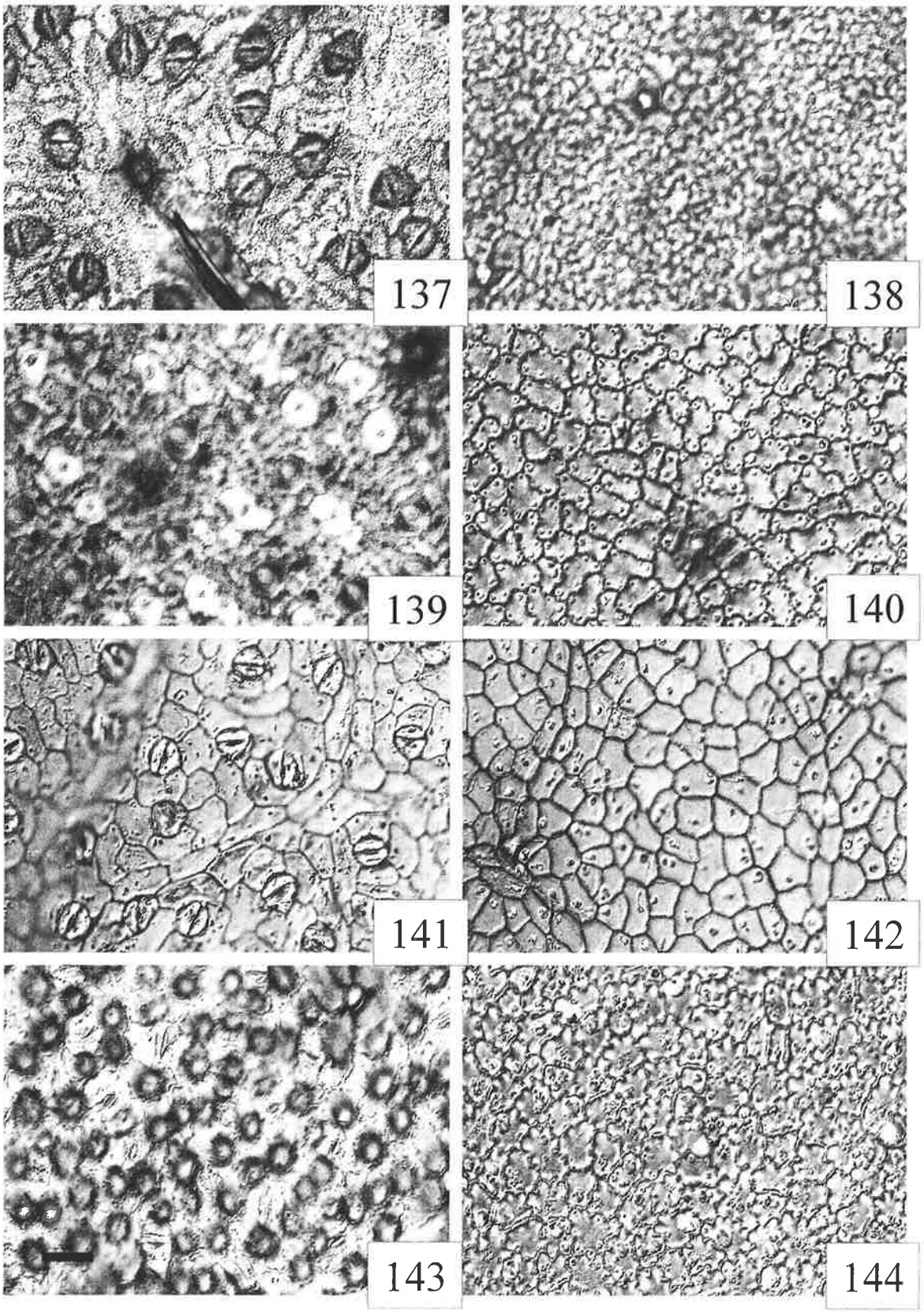
Plates 113-114: *N. fuscata*; plates 115-116: *N. gilva*; plates 117-118: *N. hainanensis*; plates 119-120: *N. hiiranensis*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



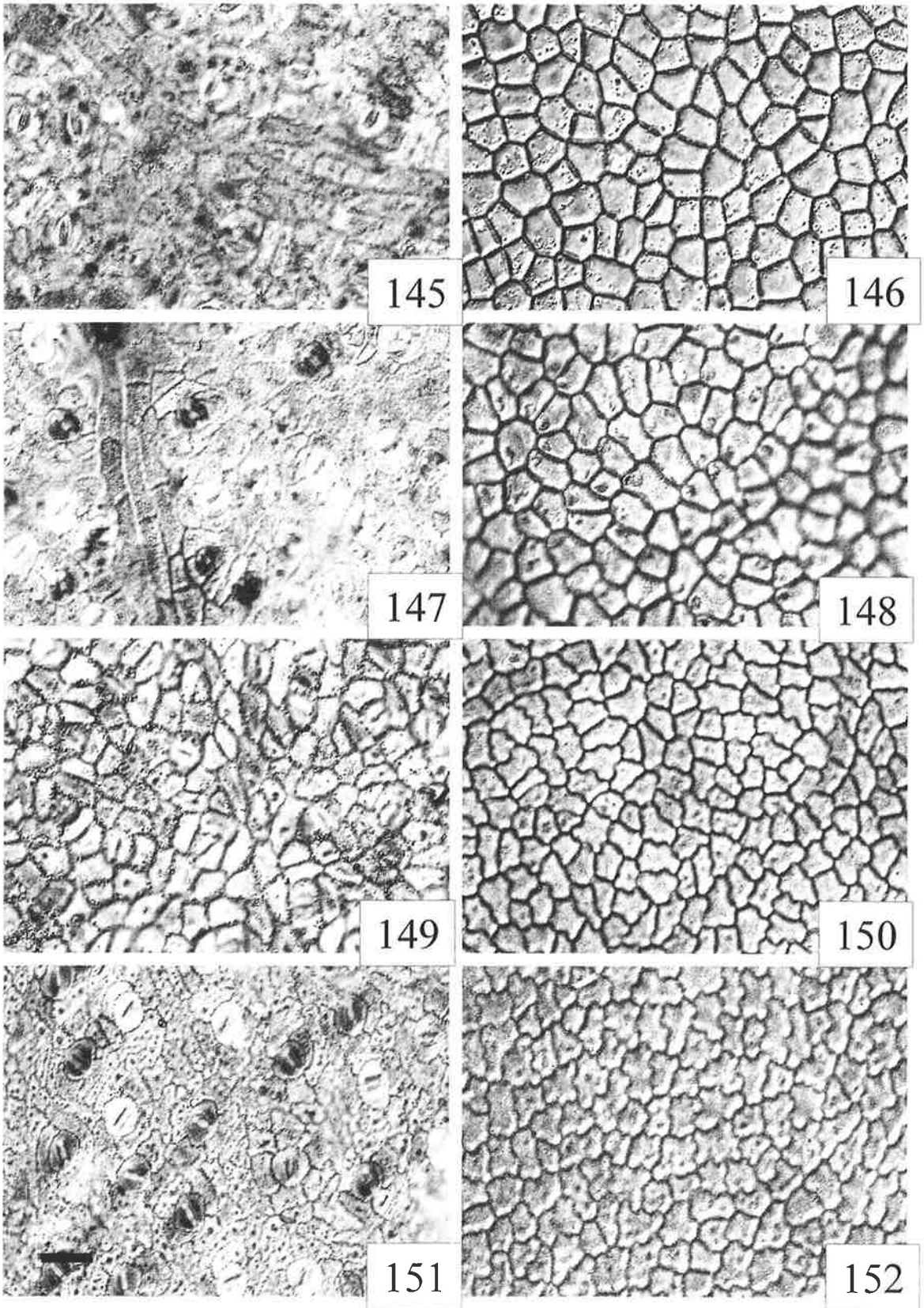
Plates 121-122: *N. homilantha*; plates 123-124: *N. hsiangkweiensis*; plates 125-126: *N. incana*; plates 127-128: *N. intermedia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



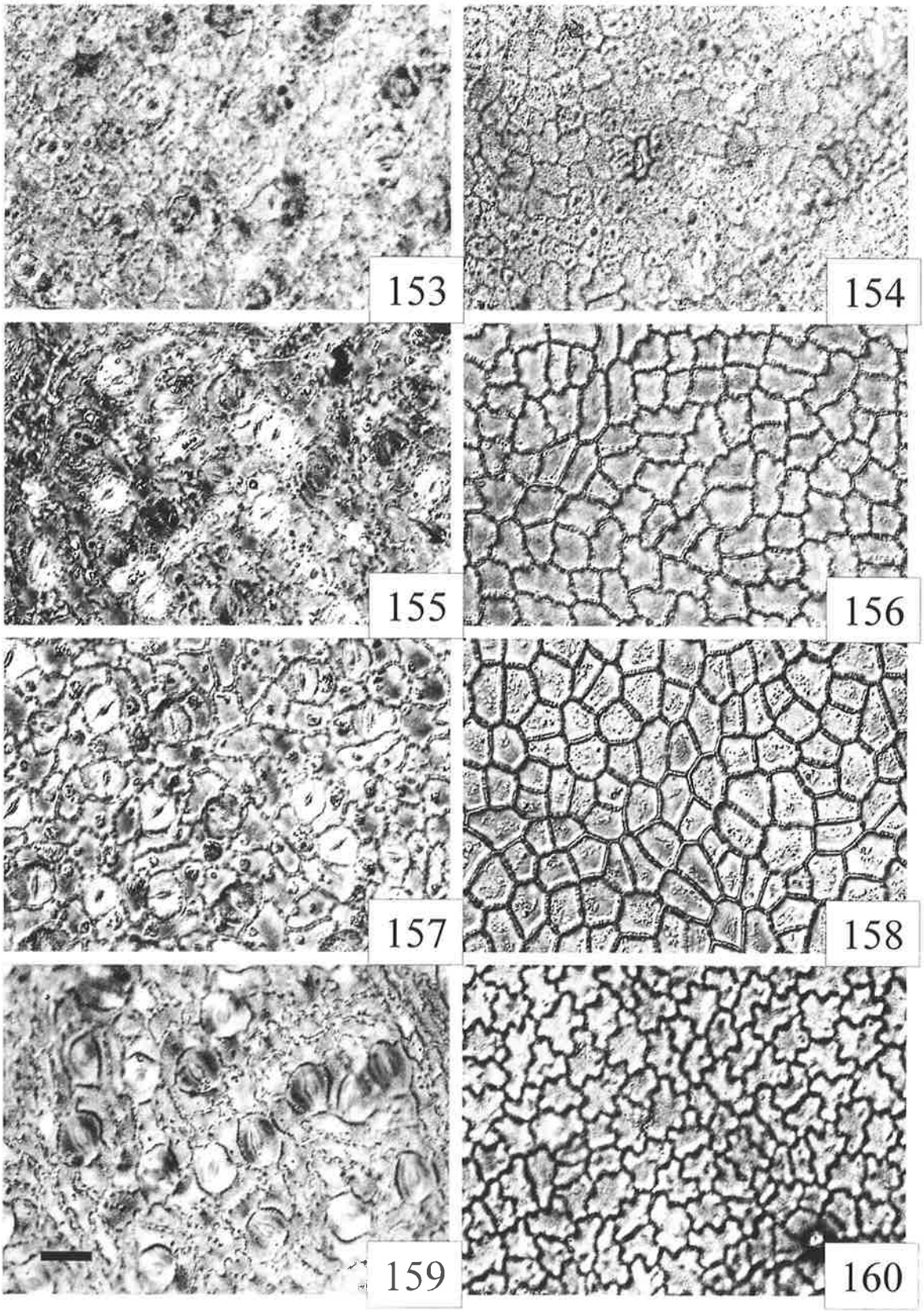
Plates 129-130: *N. kedohensis*; plates 131-132: *N. konishii*; plates 133-134: *N. lancifolia*; plates 135-136: *N. latifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



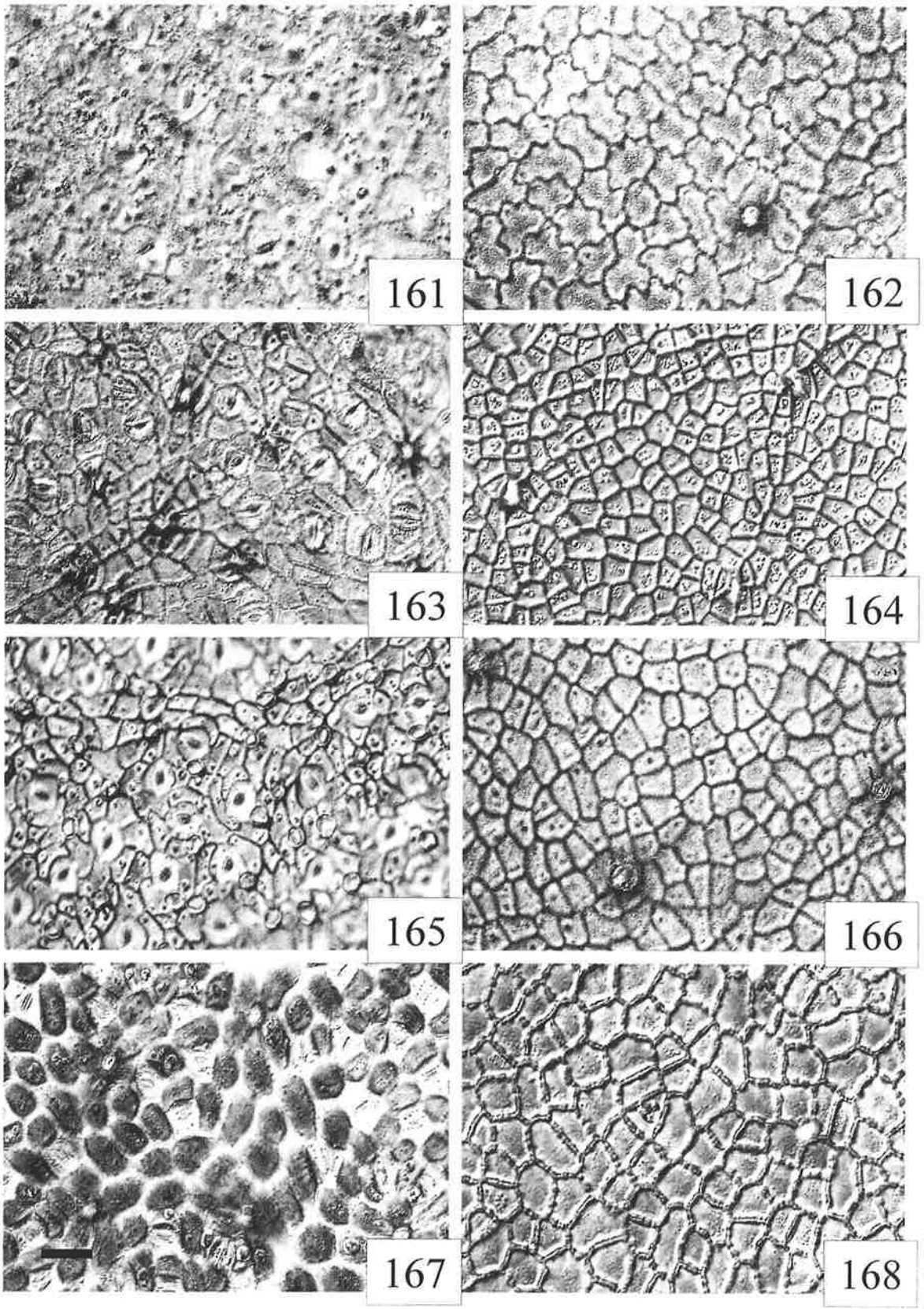
Plates 137-138: *N. levinei*; plates 139-140: *N. lunglingensis*; plates 141-142: *N. novo-guinensis*; plates 143-144: *N. oblongifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



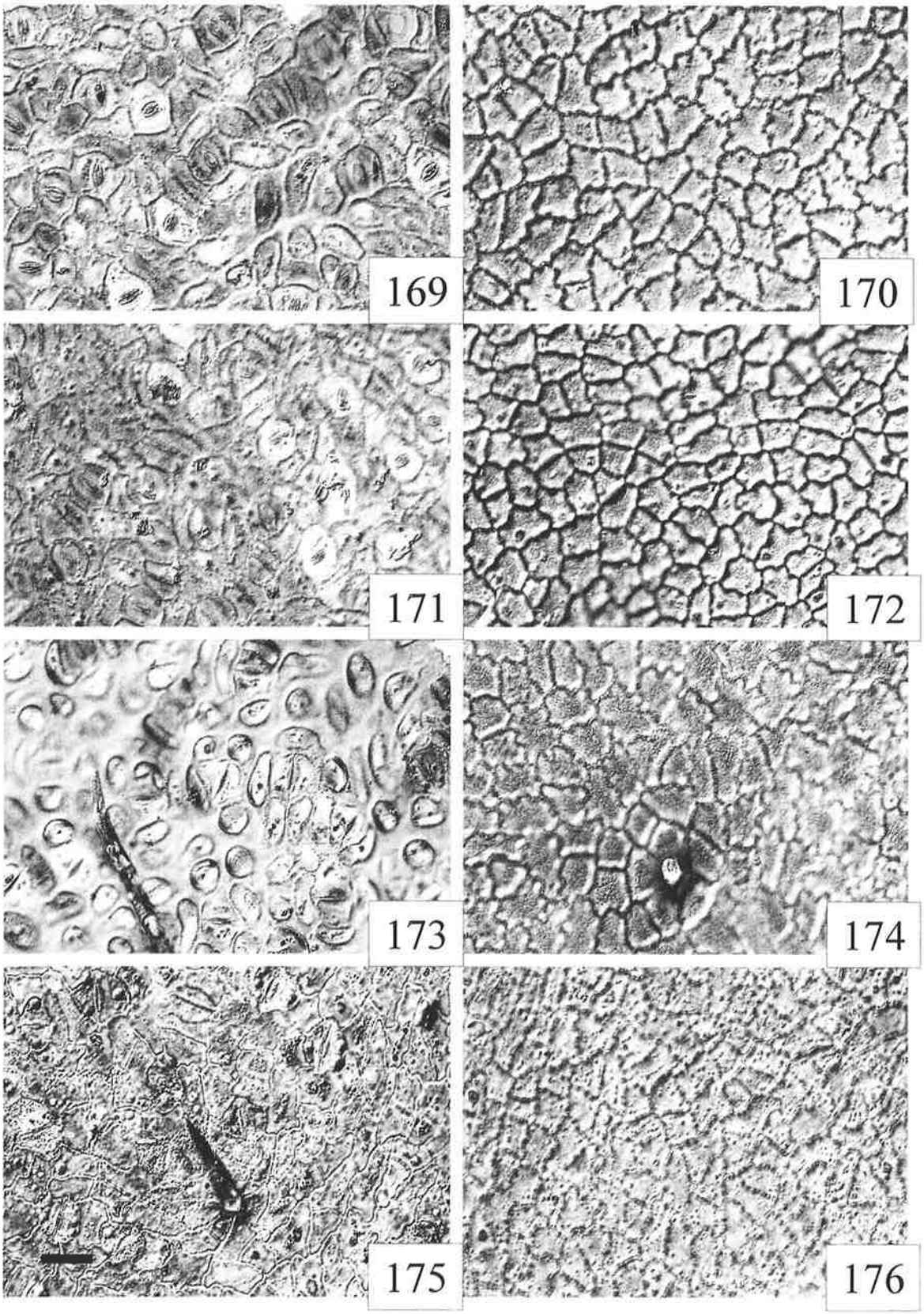
Plates 145-146: *N. obtusifolia*; plates 147-148: *N. ovatifolia var. puberula*; plates 149-150: *N. pallens*; plates 151-152: *N. parvigemma.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



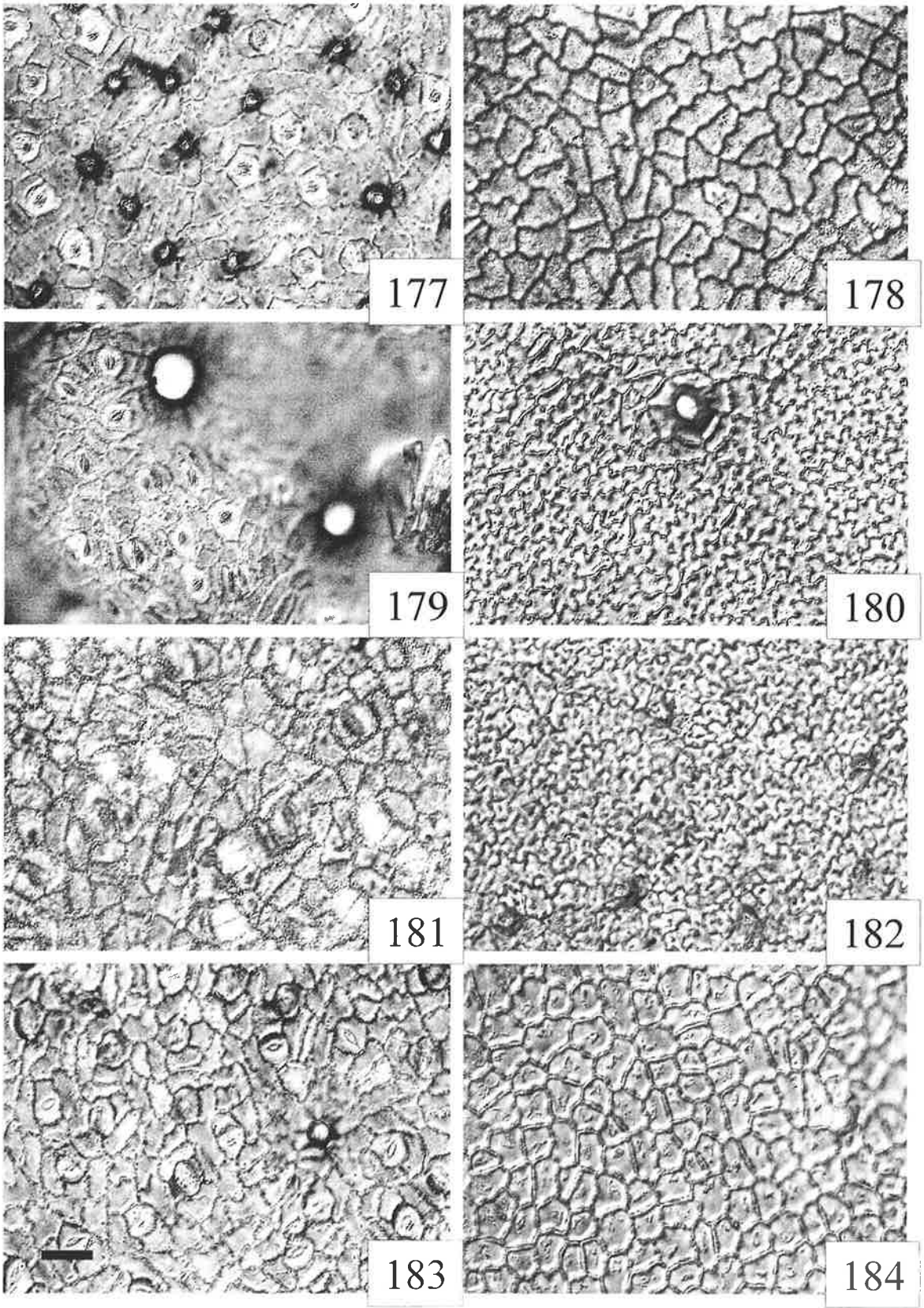
Plates 153-154: *N. phanerophlebia*; plates 155-156: *N. pingbiensis*; plates 157-158: *N. pinninervis*; plates 159-160: *N. polycarpa.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



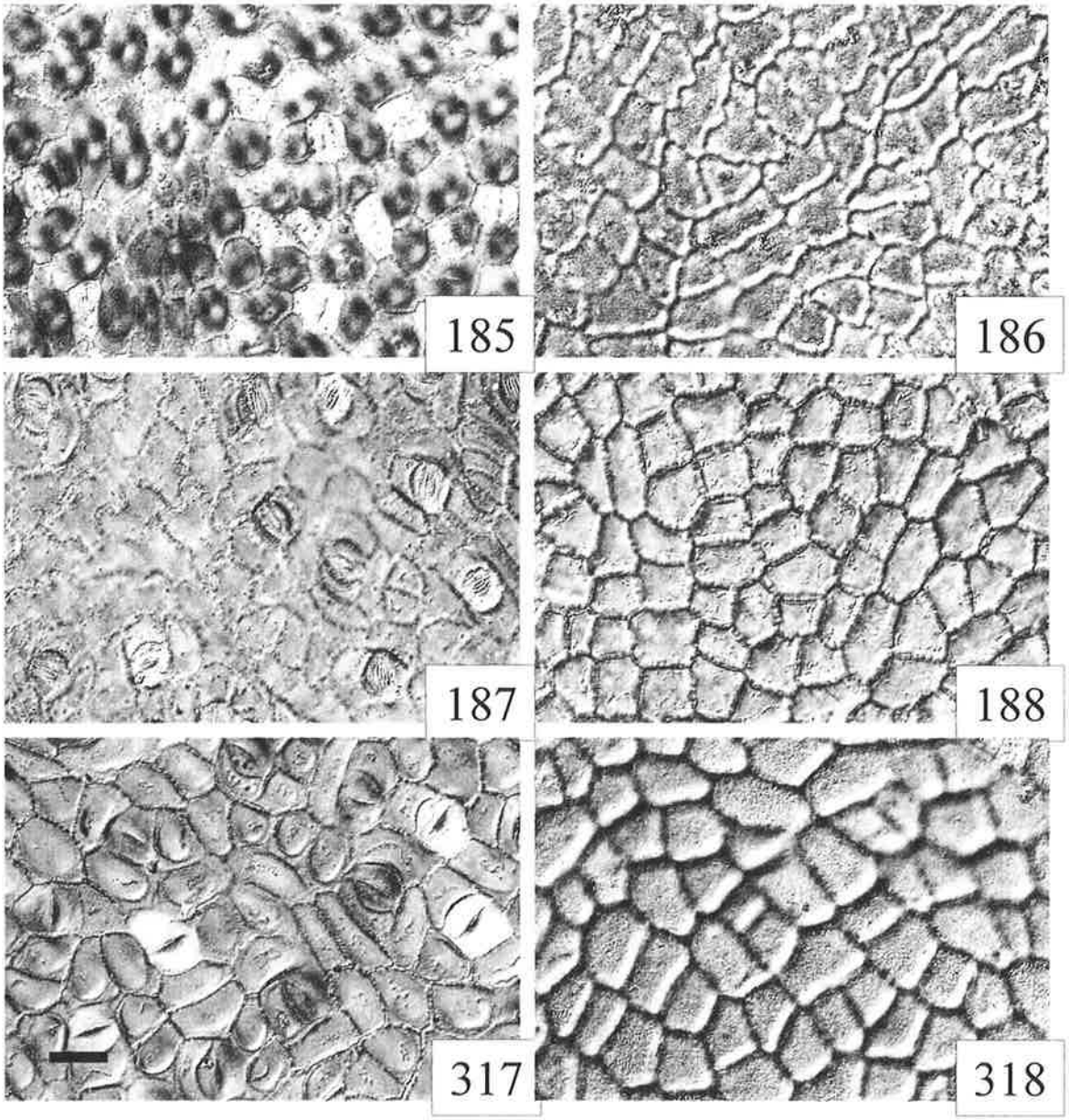
Plates 161-162: *N. pulchella*; plates 163-164: *N. sericea*; plates 165-166: *N. sericea* var. *aurata*; plates 167-168: *N. shiangningensis*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



Plates 169-170: *N. sutchuanensis*; plates 171-172: *N. sutchuanensis* var. *gongshanensis*; plates 173-174: *N. tomentosa*; plates 175-176: *N. undulatifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.

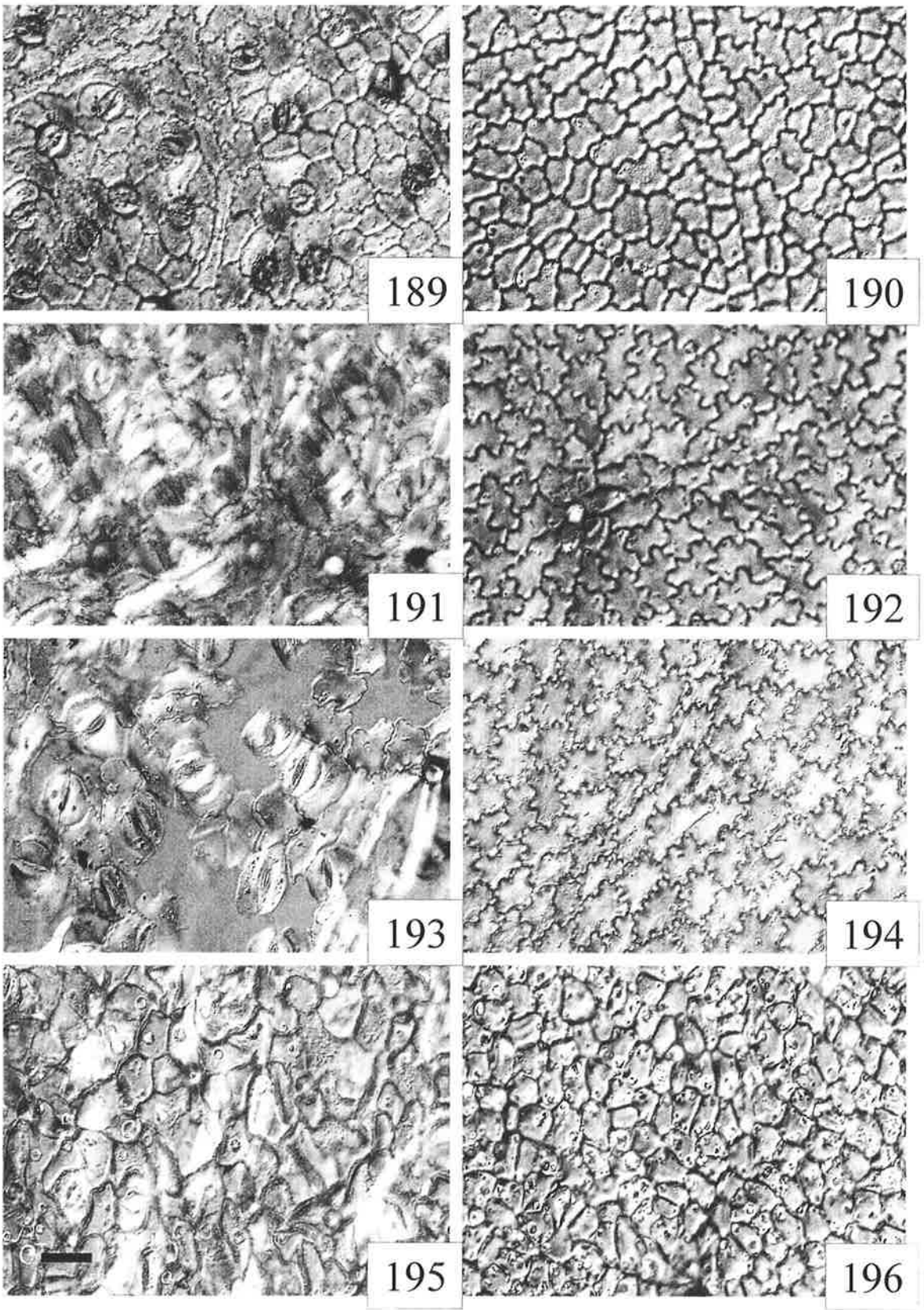


Plates 177-178: *N. variabillima*; plates 179-180: *N. velutina*; plates 181-182: *N. vidalii*; plates 183-184: *N. villosa.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.

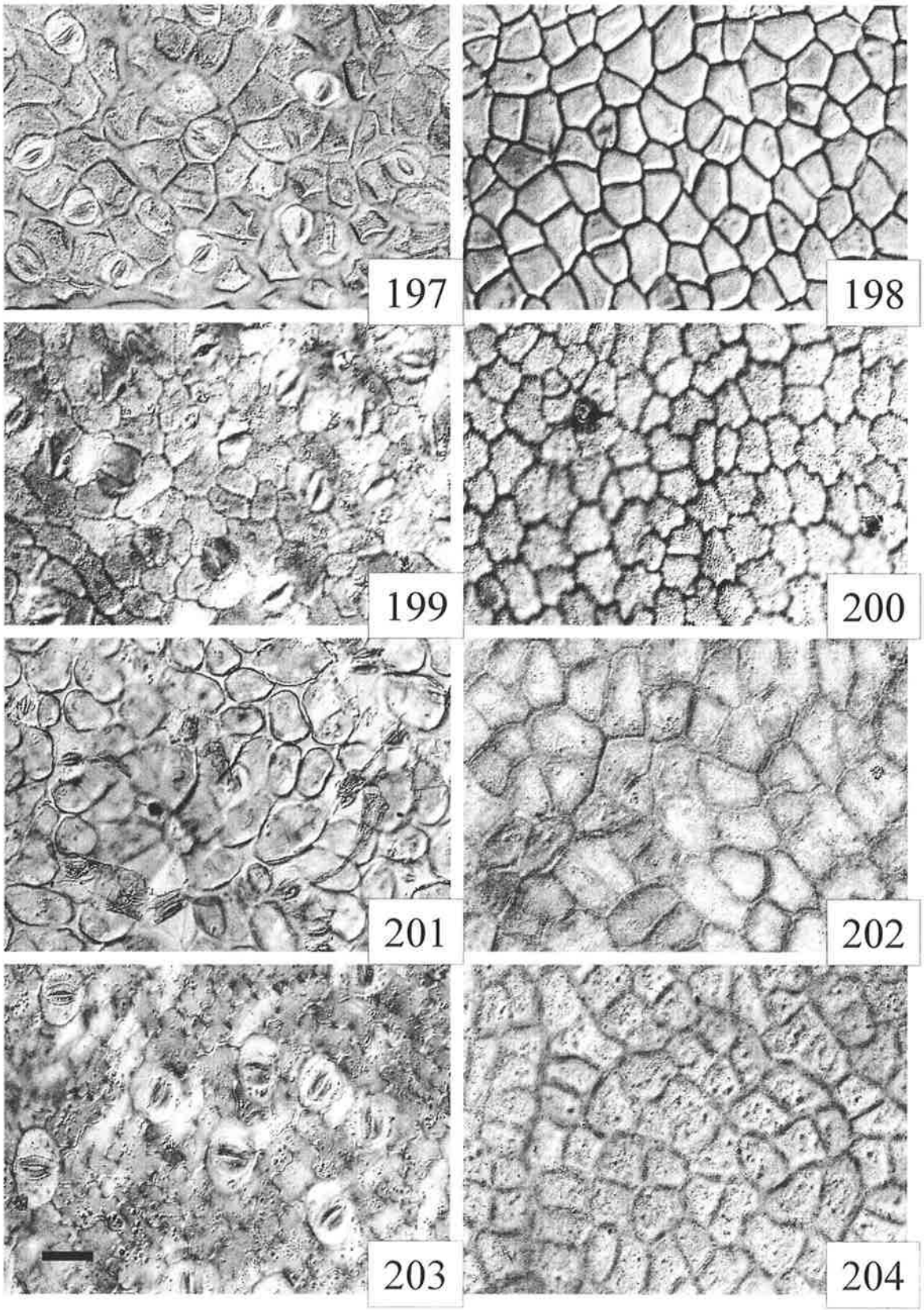


Plates 185-186: *N. wushanica*; plates 187-188: *N. zeyanica*; plates 317-318: *Lindera villipes*; Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale 1 cm = 40 um.

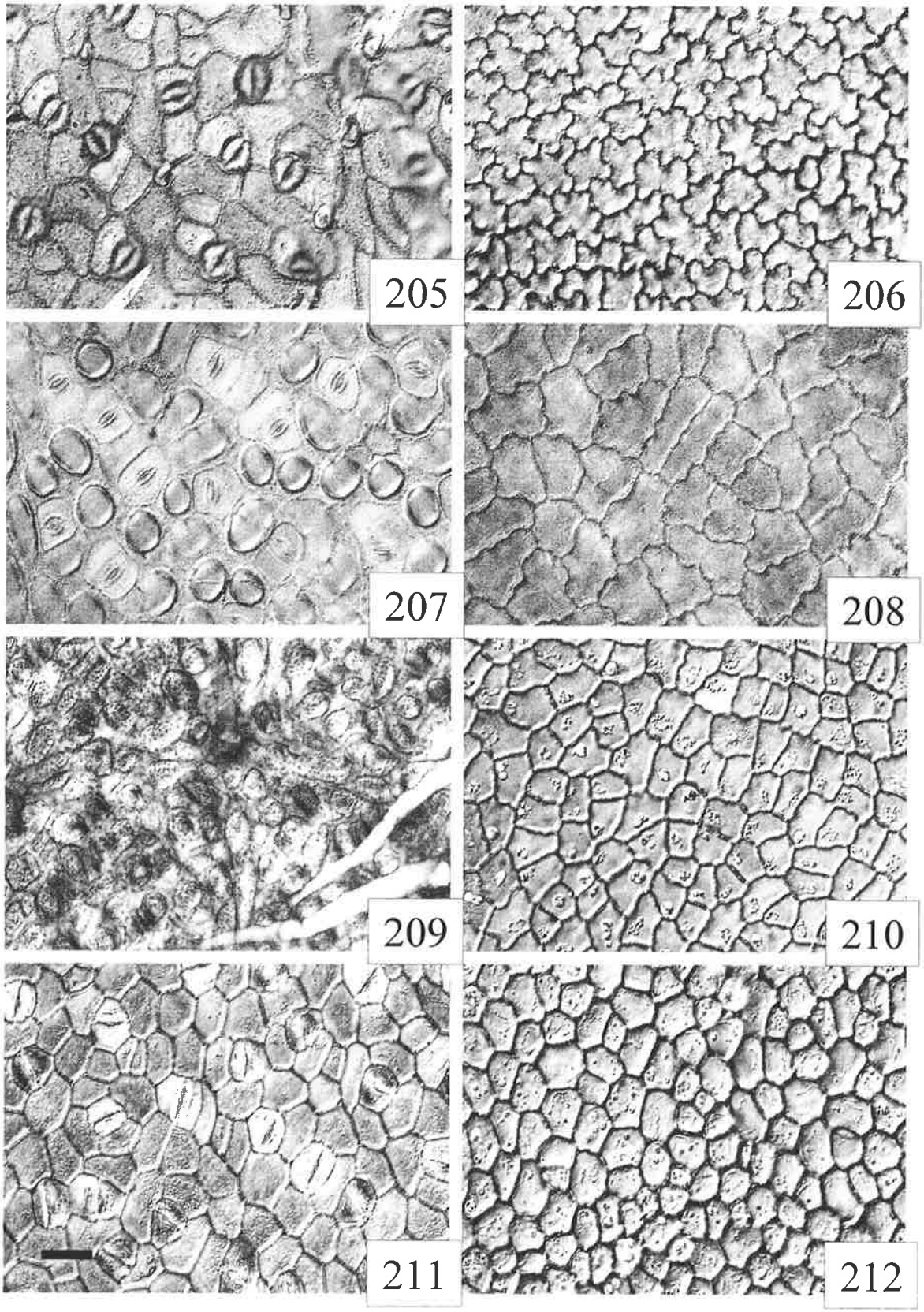
Leaf cuticle plates in *Lindera*



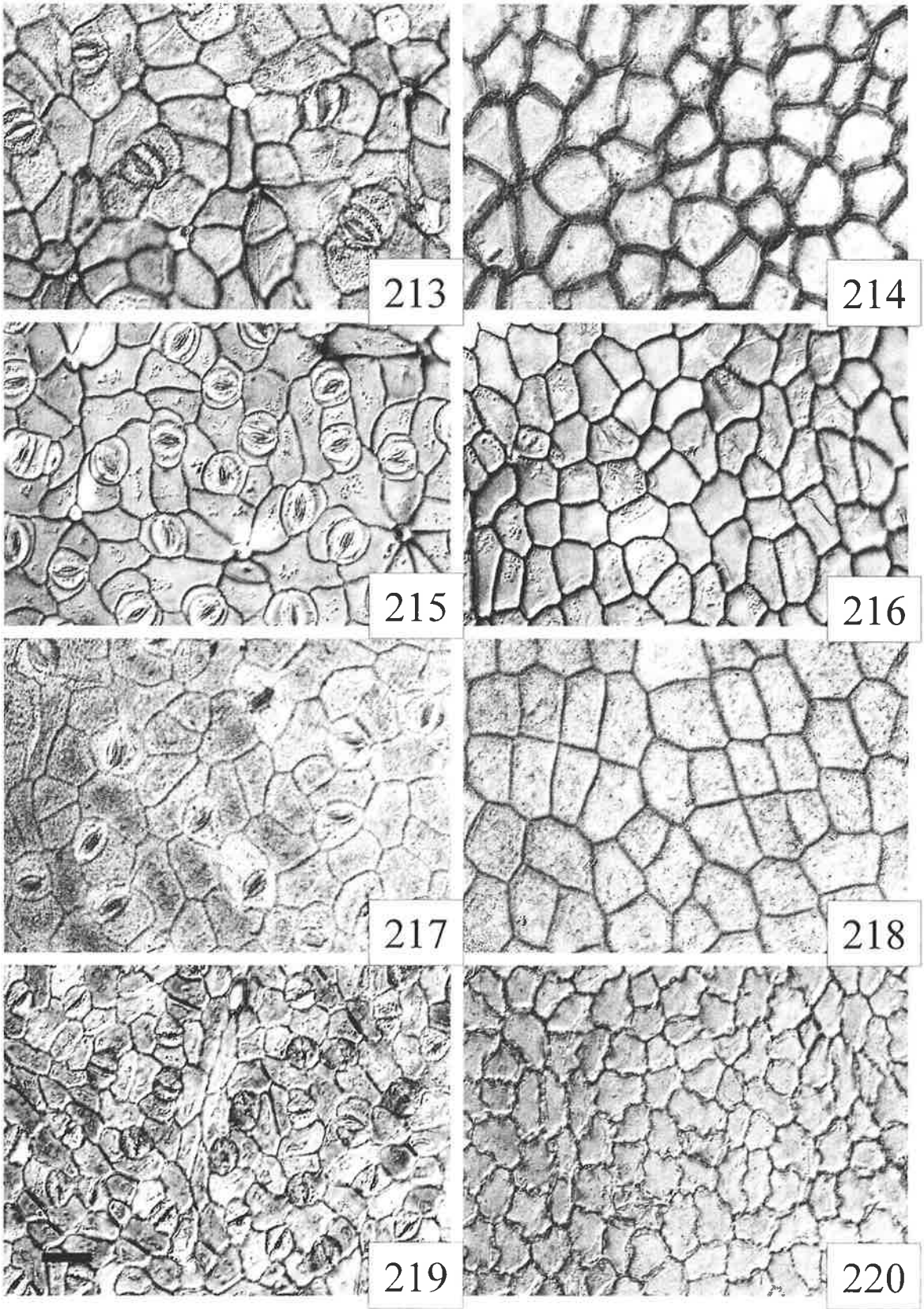
Plates 189-190: *Lindera aggregata*; plates 191-192: *L. akoensis*; plates 193-194: *L. angustifolia*; plates 195-196: *L. apoensis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 35 um.



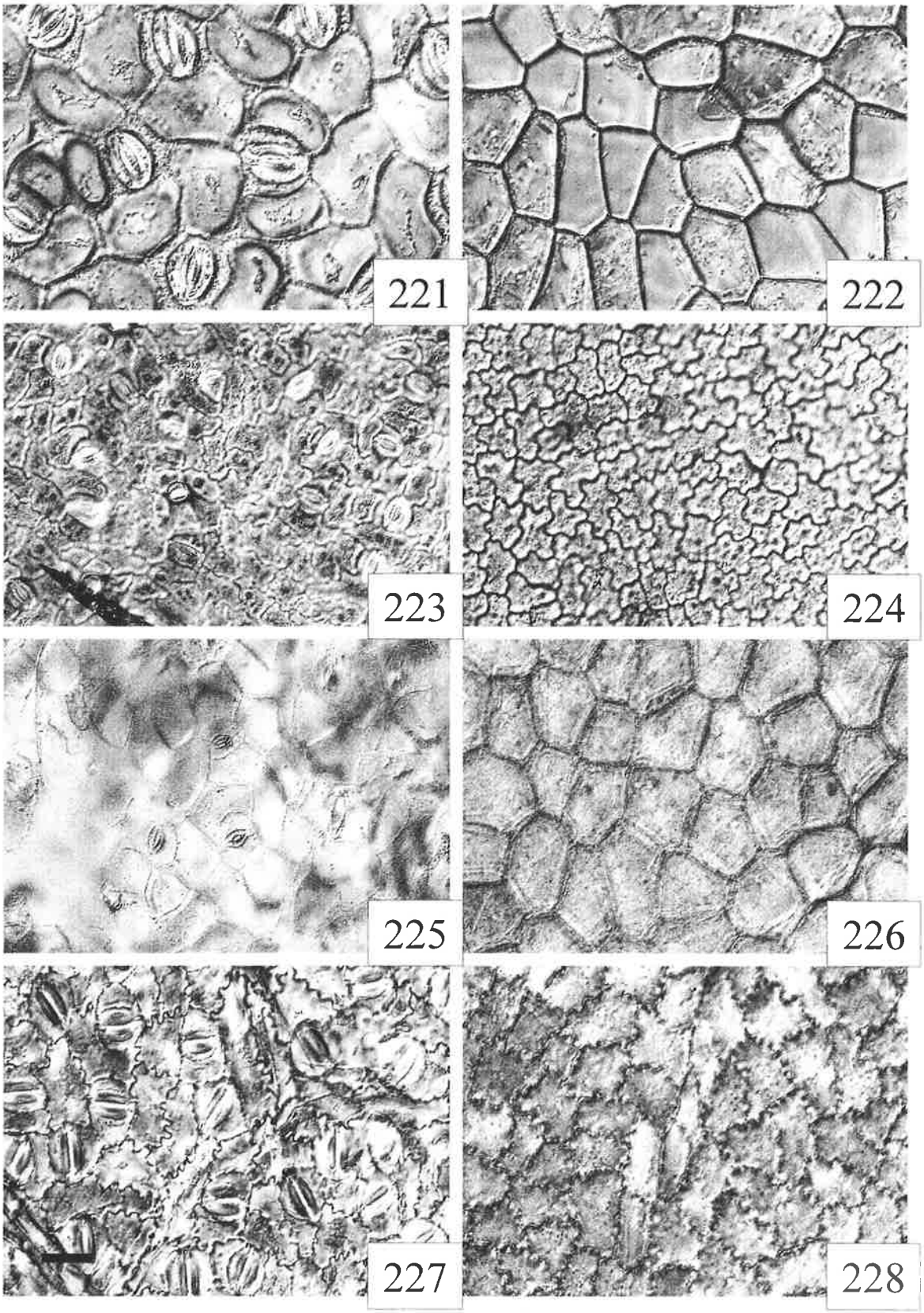
Plates 197-198: *L. assamica*; plates 199-200: *L. bibracteata*; plates 201-202: *L. ceridifolia*; plates 203-204: *L. chienii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



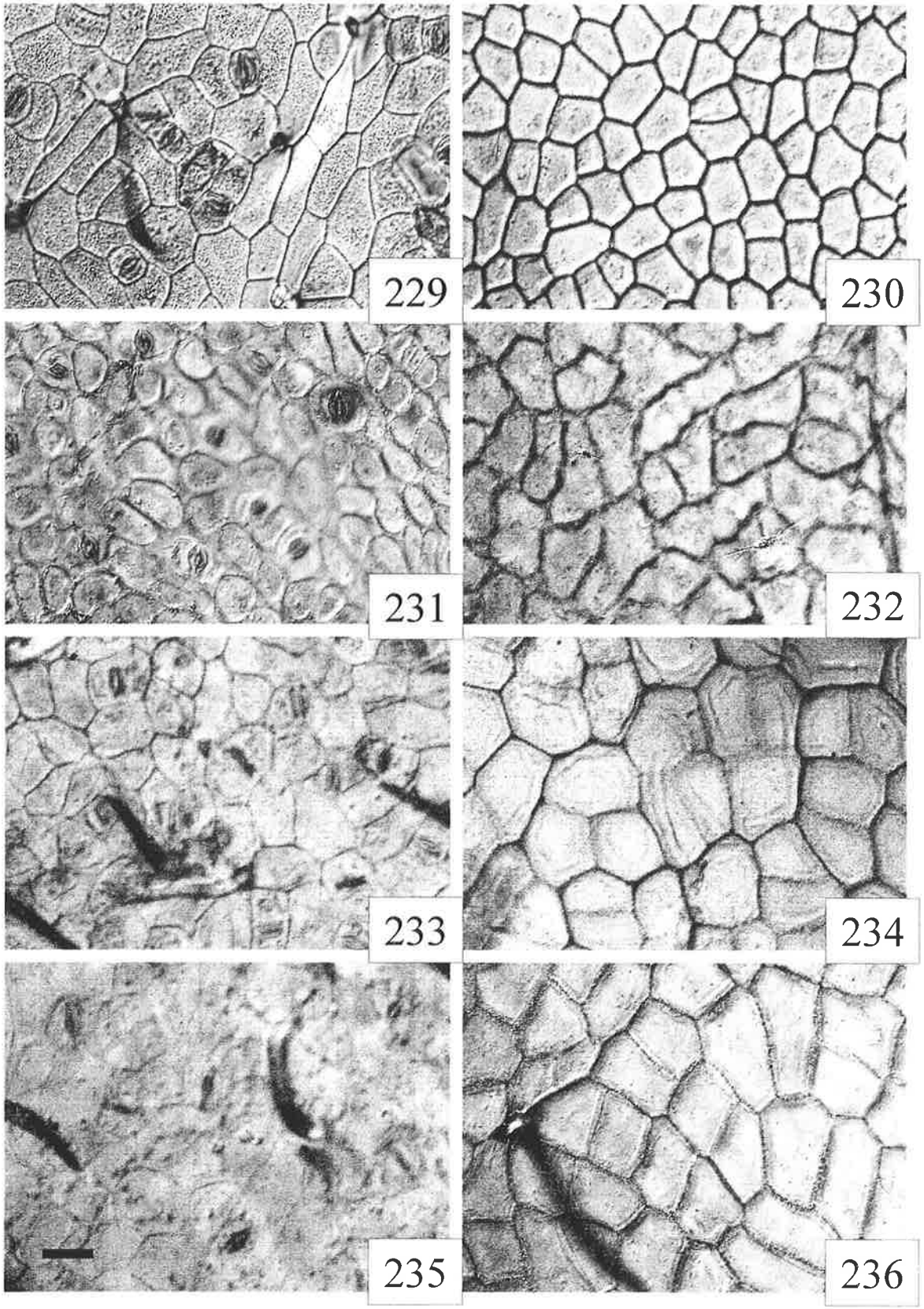
Plates 205-206: *L. chunii*; plates 207-208: *L. citriodora*; plates 209-210: *L. communis*; plates 211-212: *L. concinna.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um .



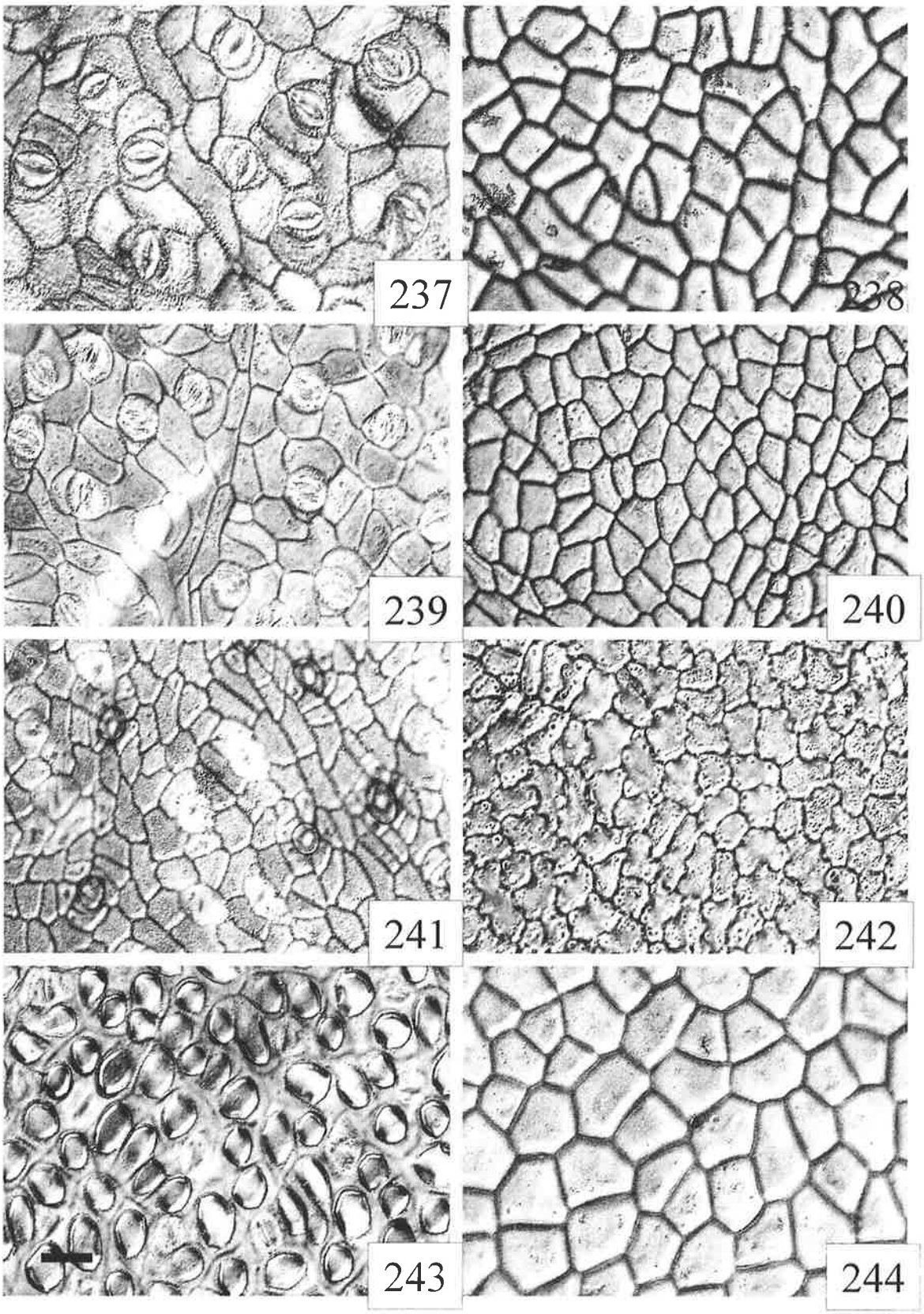
Plates 213-214: *L. cuspidata*; plates 215-216: *L. dictyophylla*; plates 217-218: *L. erythrocarpa*; plates 219-220: *L. floribunda.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 42 um.



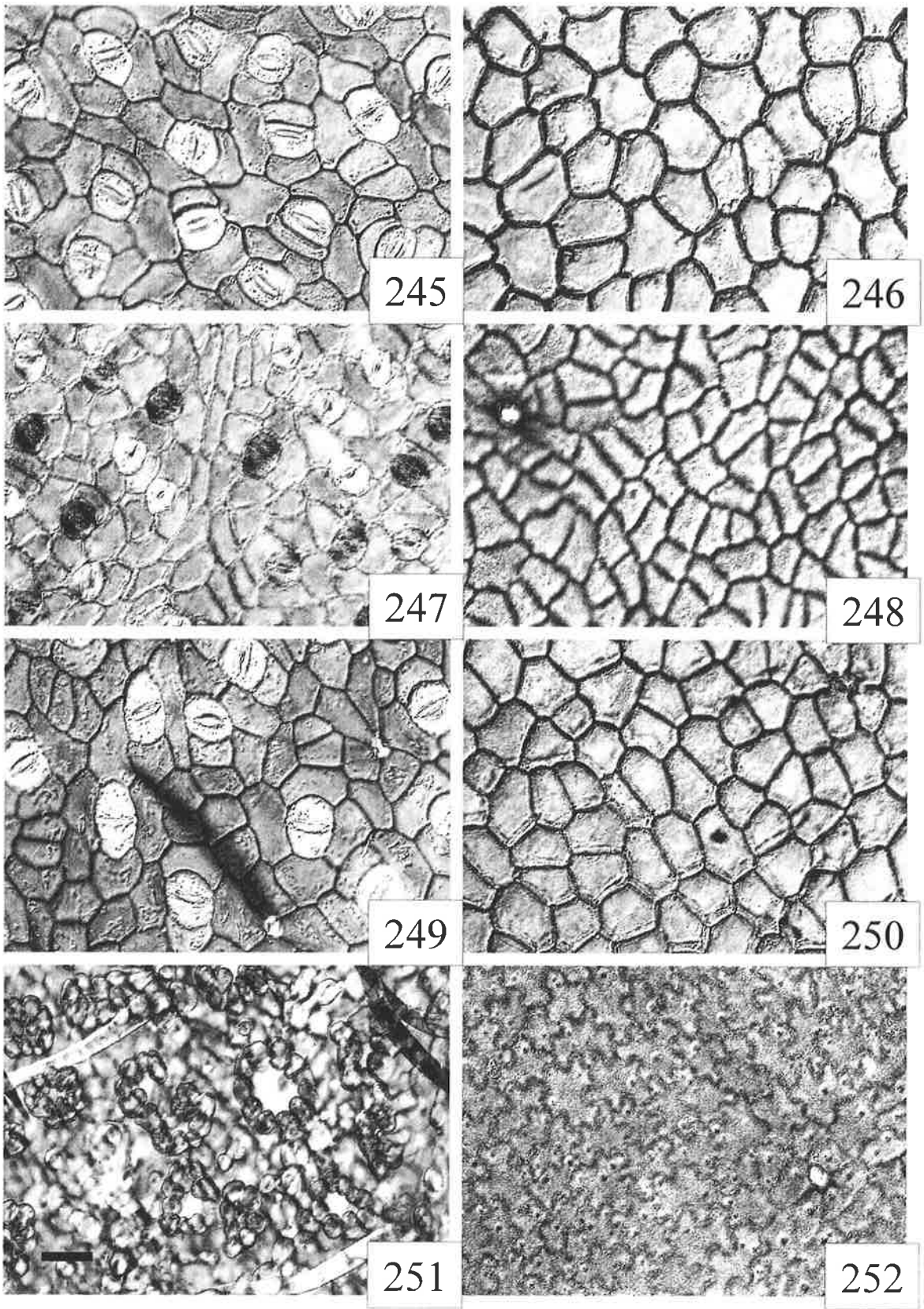
Plates 221-222: *L. foveolata*; plates 223-224: *L. fragrans*; plates 225-226: *L. fruticosa*; plates 227-228: *L. glauca.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 42 um.



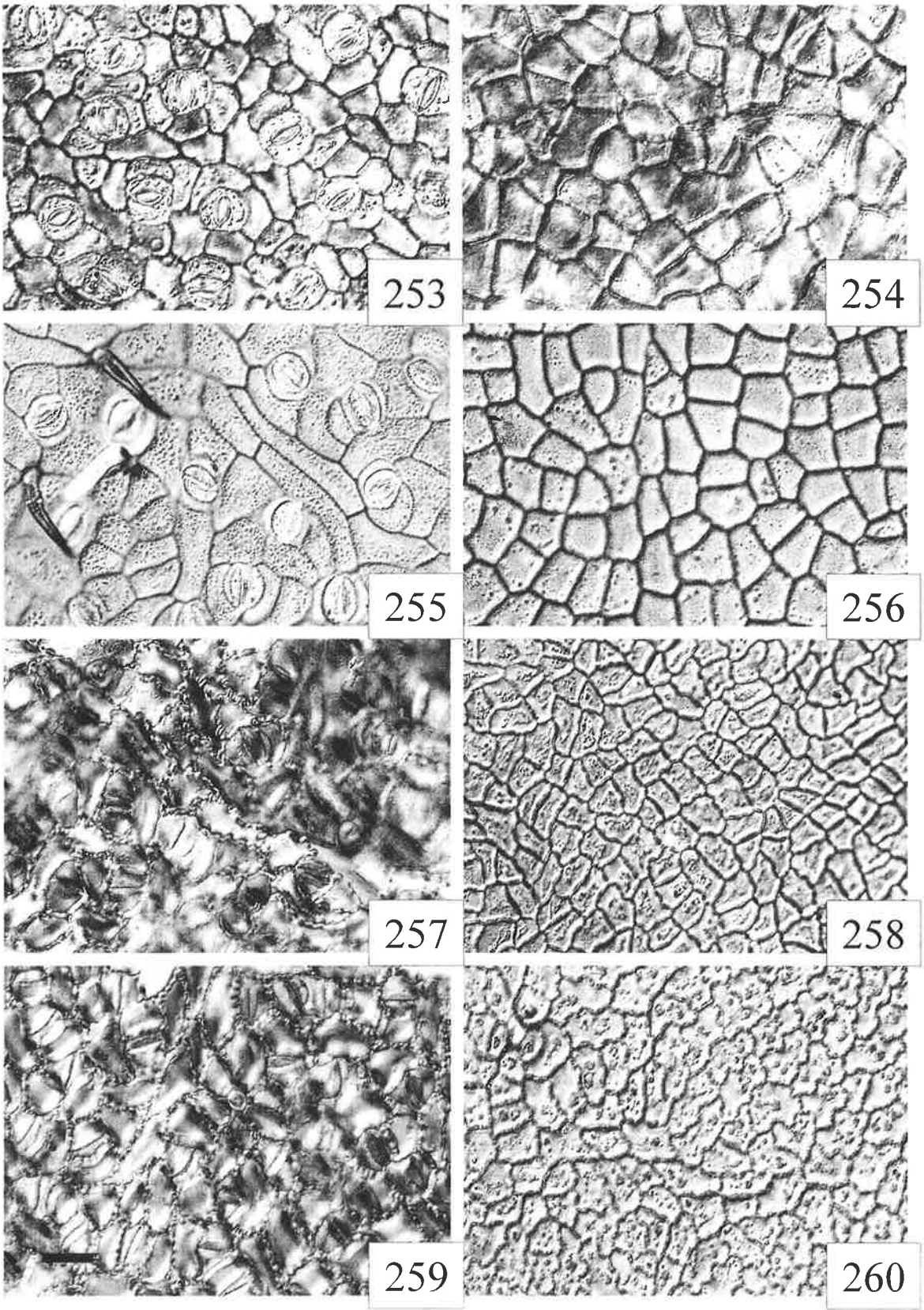
Plates 229-230: *L. gracilipes*; plates 231-232: *L. heterophylla*; plates 233-234: *L. kariensis*; plates 235-236: *L. kariensis* f. *glabrescens* . Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



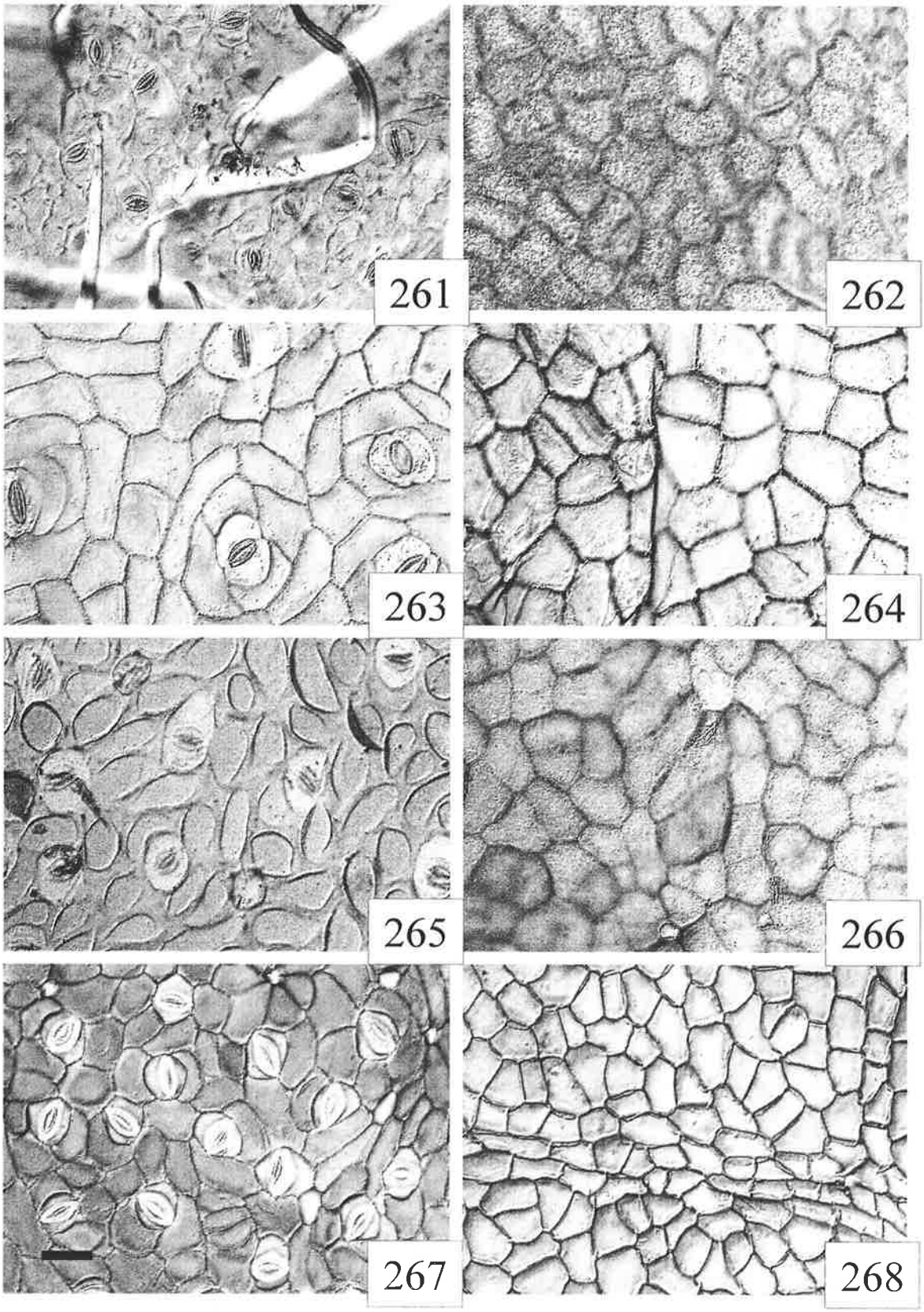
Plates 237-238: *L. kwangtungensis*; plates 239-240: *L. latifolia*; plates 241-242: *L. limprichtii*; plates 243-244: *L. longipedunculata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



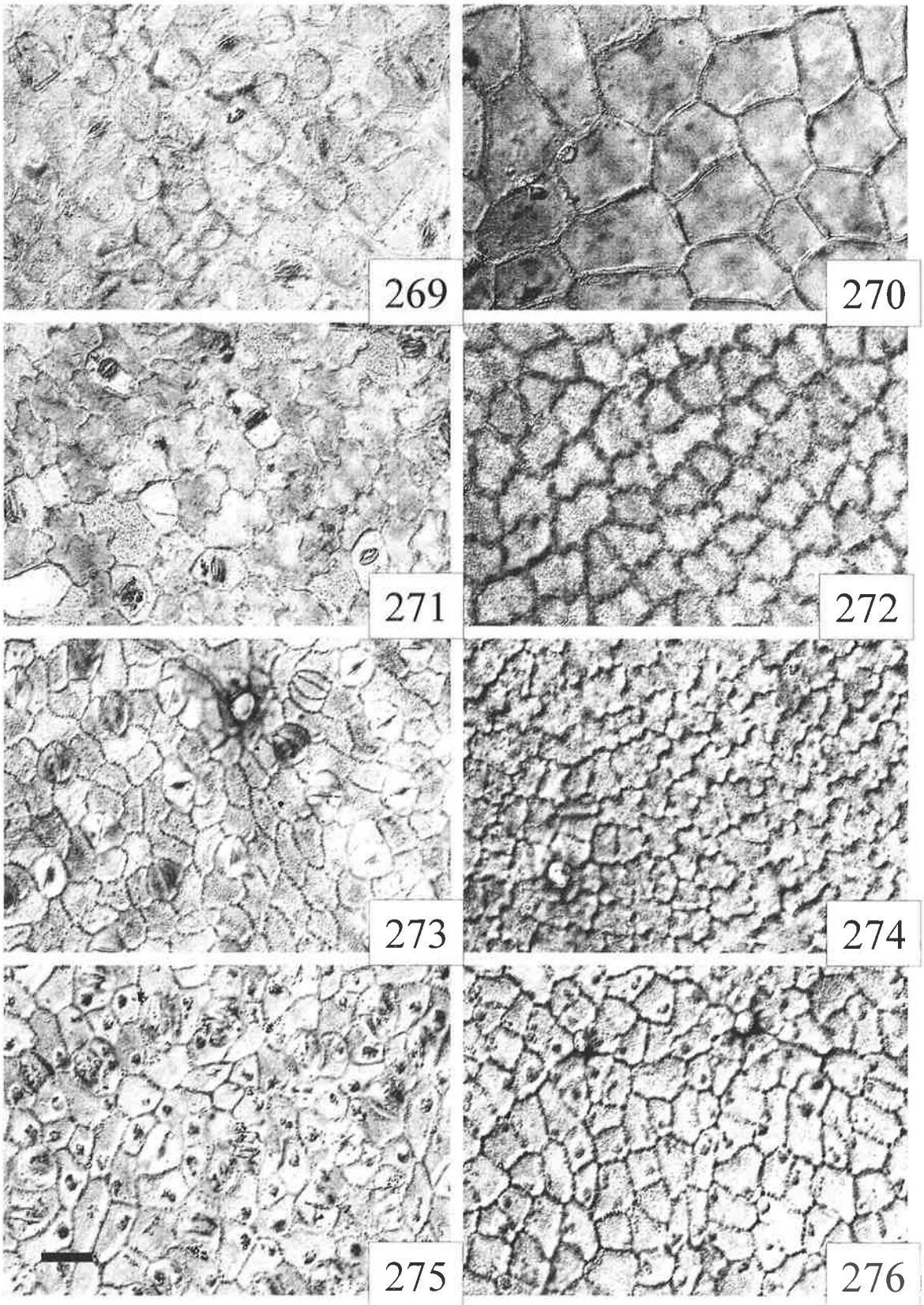
Plates 245-246: *L. lucida*; plates 247-248: *L. lungshengensis*; plates 249-250: *L. malaccensis*; plates 251-252: *L. megaphylla.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 42 um.



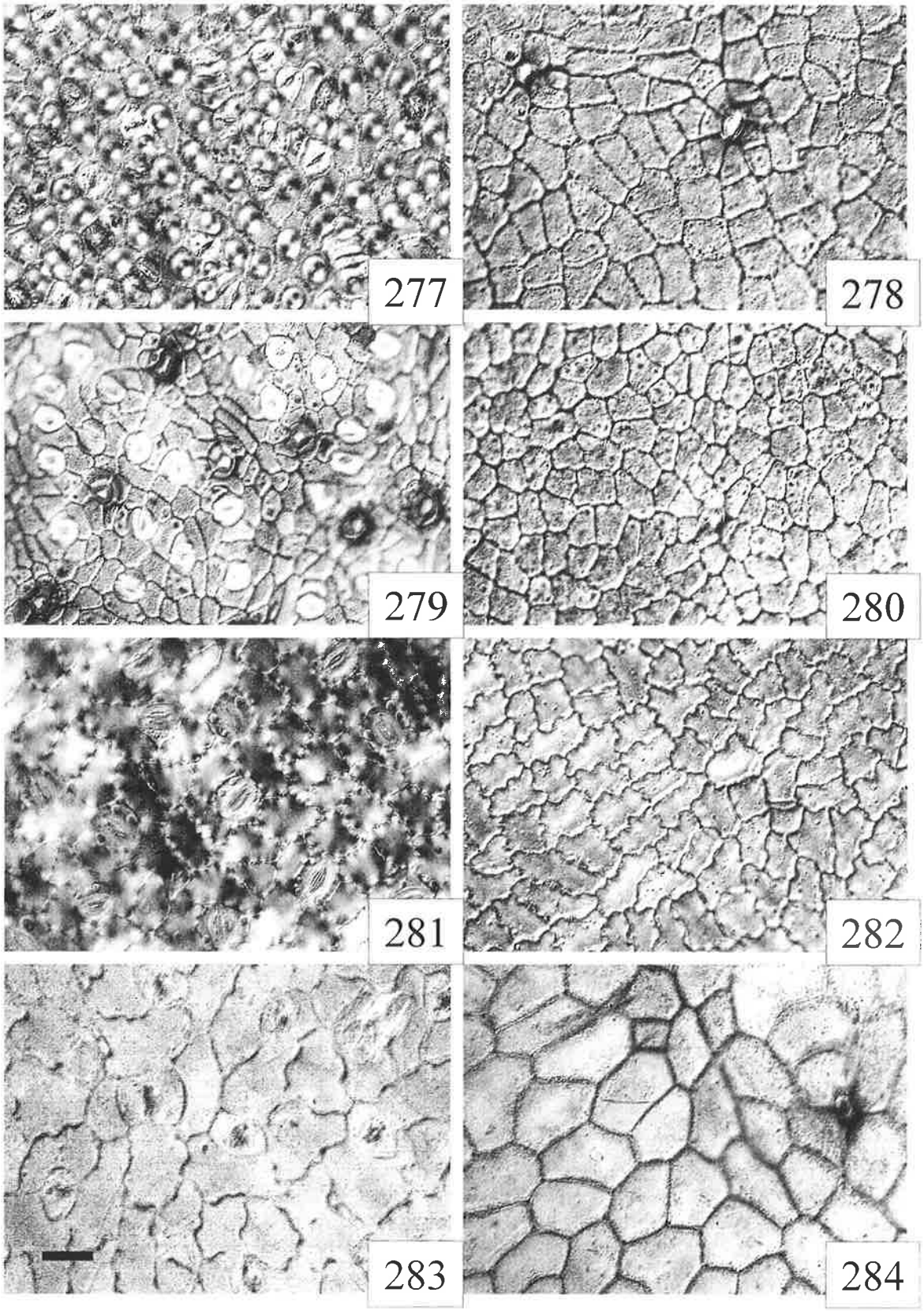
Plates 253-254: *L. melastomacea*; plates 255-256: *L. metcalfiana*; plates 257-258: *L. nacusua*; plates 259-260: *L. nacusua* var. *menglungensis* . Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



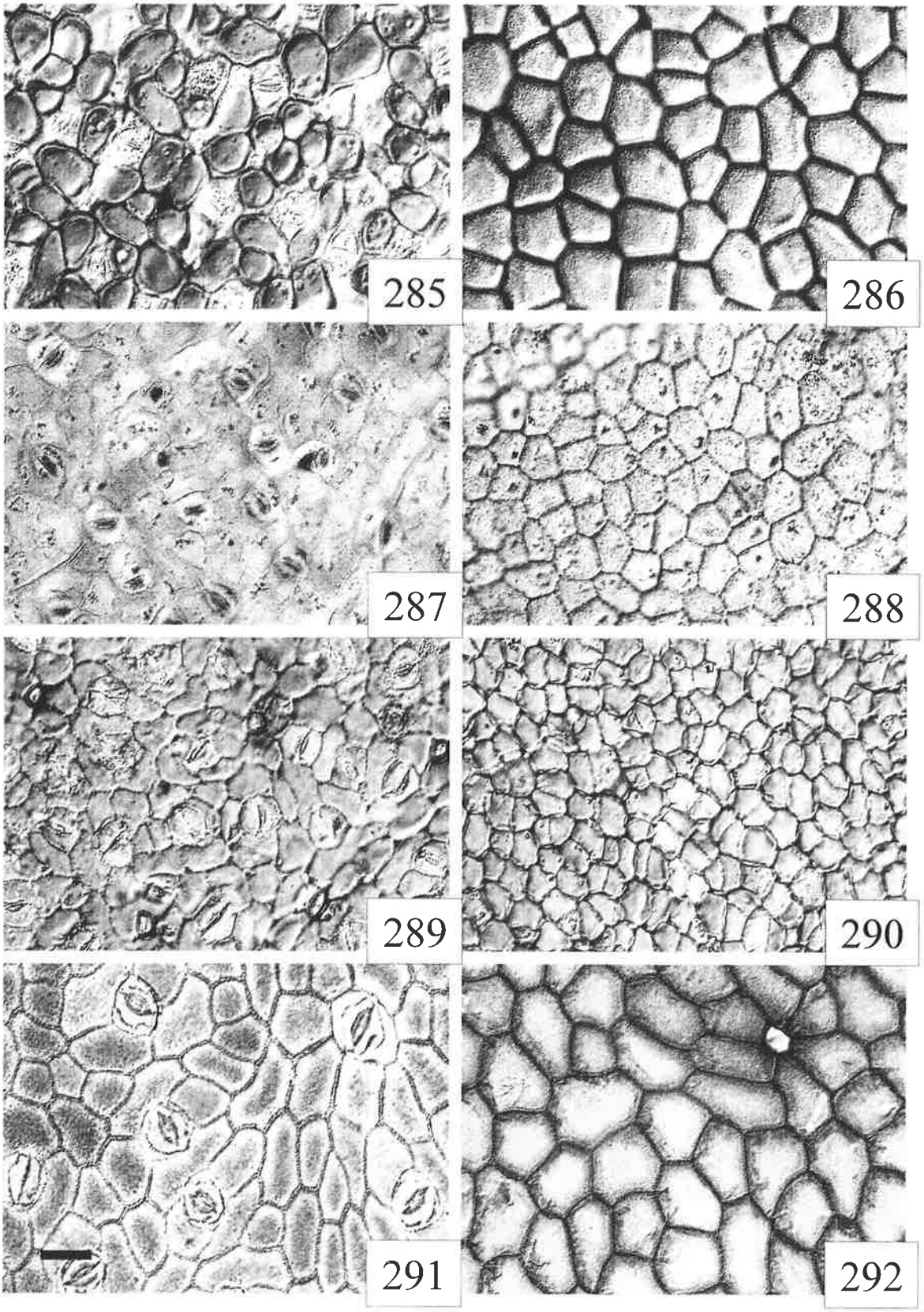
Plates 261-262: *L. obtusiloba*; plates 263-264: *L. pedicellata*; plates 265-266: *L. pipericarpa*; plates 267-268: *L. polyantha.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 41 um.



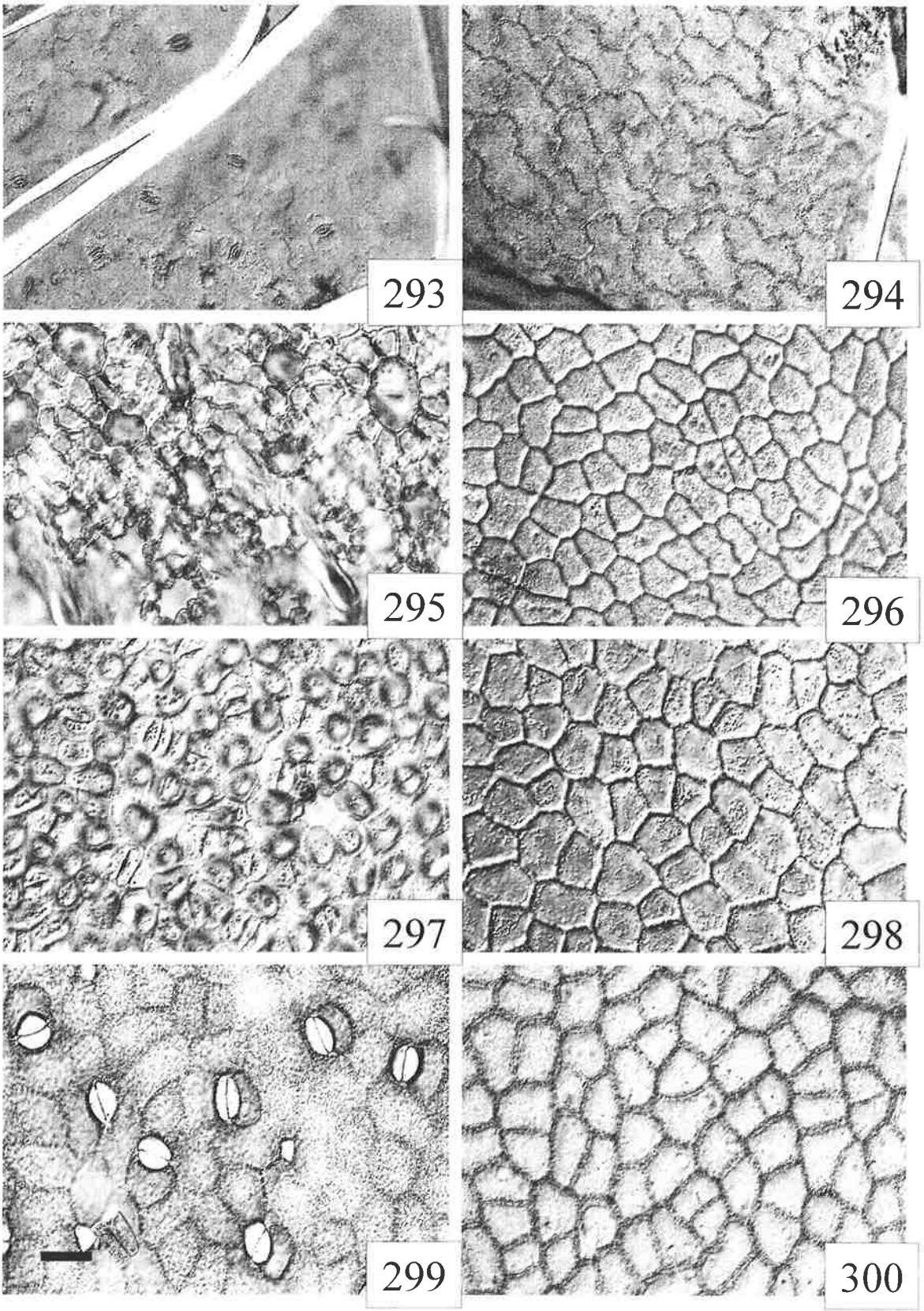
Plates 269-270: *L. pomiensis*; plates 271-272: *L. praecox*; plates 273-274: *L. prattii*; plates 275-276: *L. pulcherrima.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



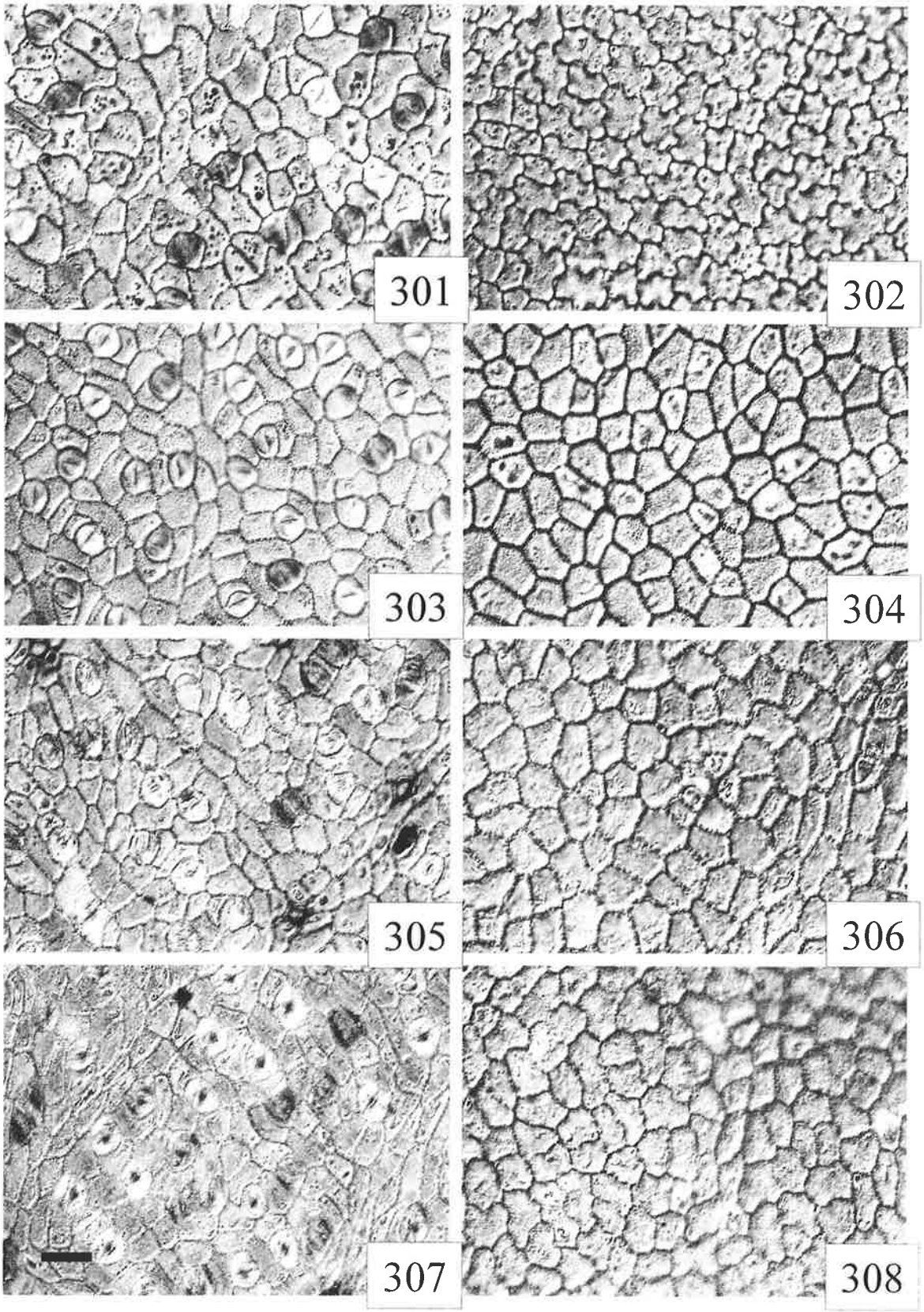
Plates 277-278: *L. pulcherrima* var. *attenuata*; plates 279-280: *L. pulcherrima* var. *hemsleyana*; plates 281-282: *L. queenslandica*; plates 283-284: *L. reflexa.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



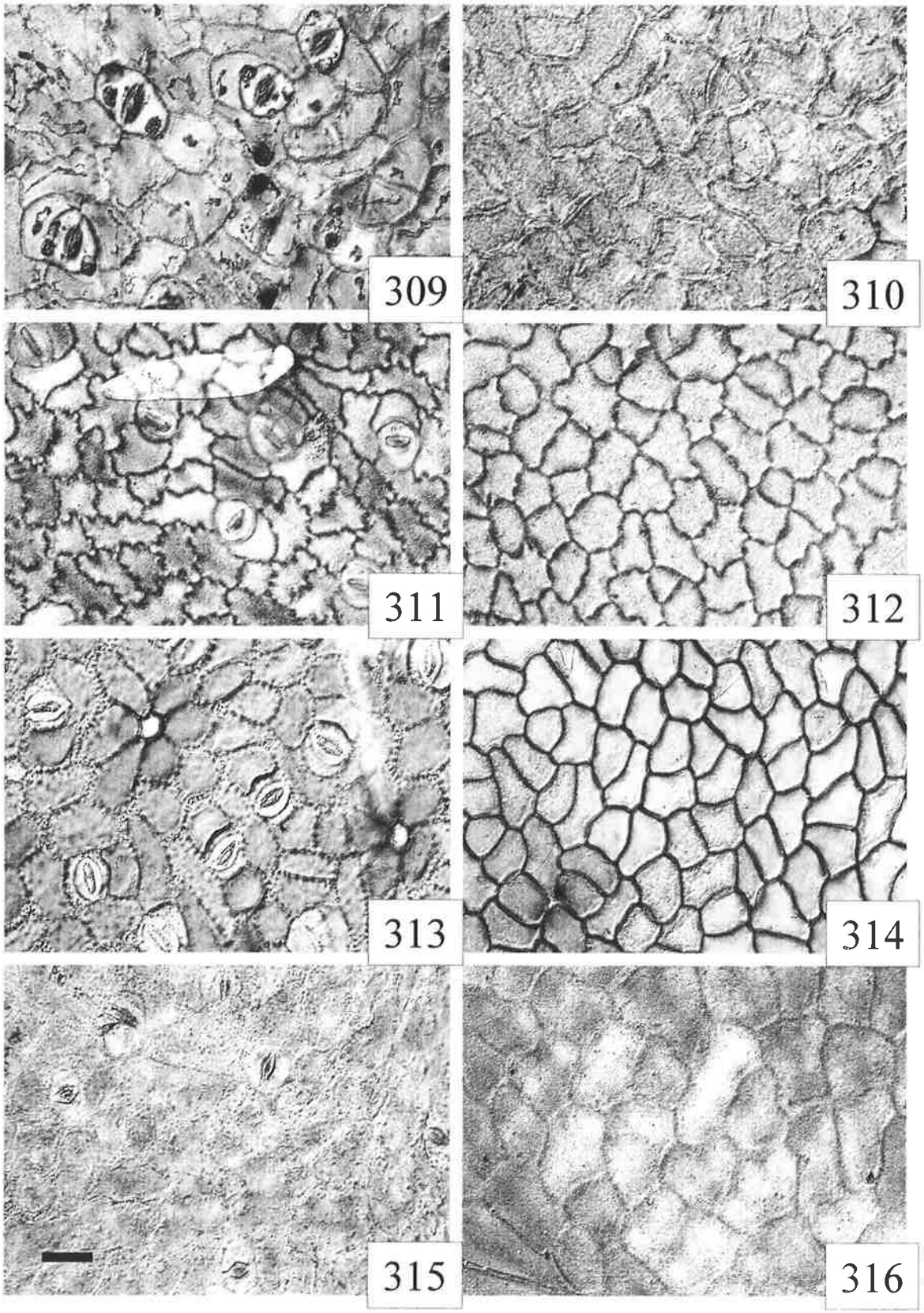
Plates 285-286: *L. robusta*; plates 287-288: *L. rubronervia*; plates 289-290: *L. rufa*; plates 291-292: *L. selangorensis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



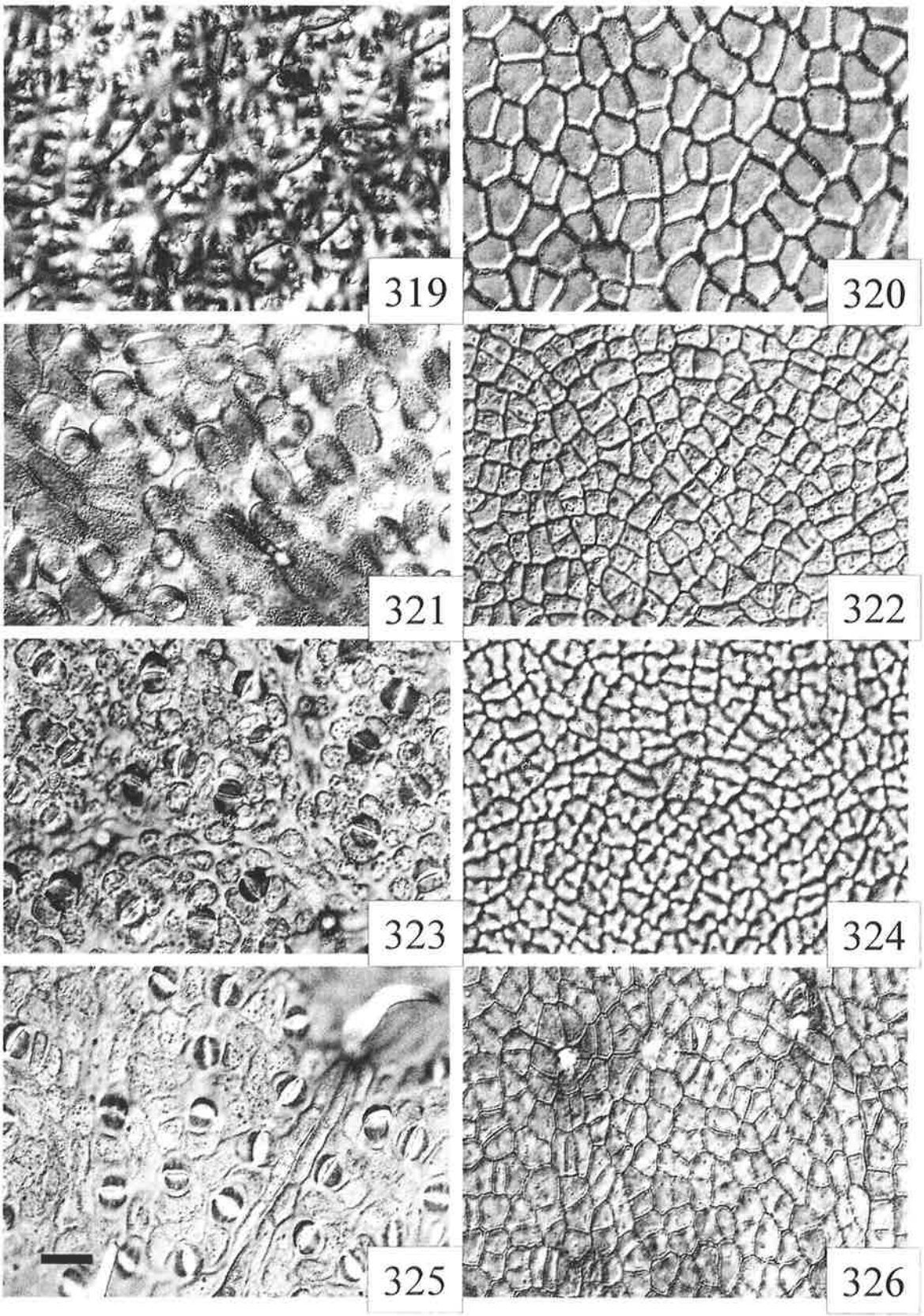
Plates 293-294: *L. sericea*; plates 295-296: *L. setchuenensis*; plates 297-298: *L. subcaudata*; plates 299-300: *L. subumbelliflora.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



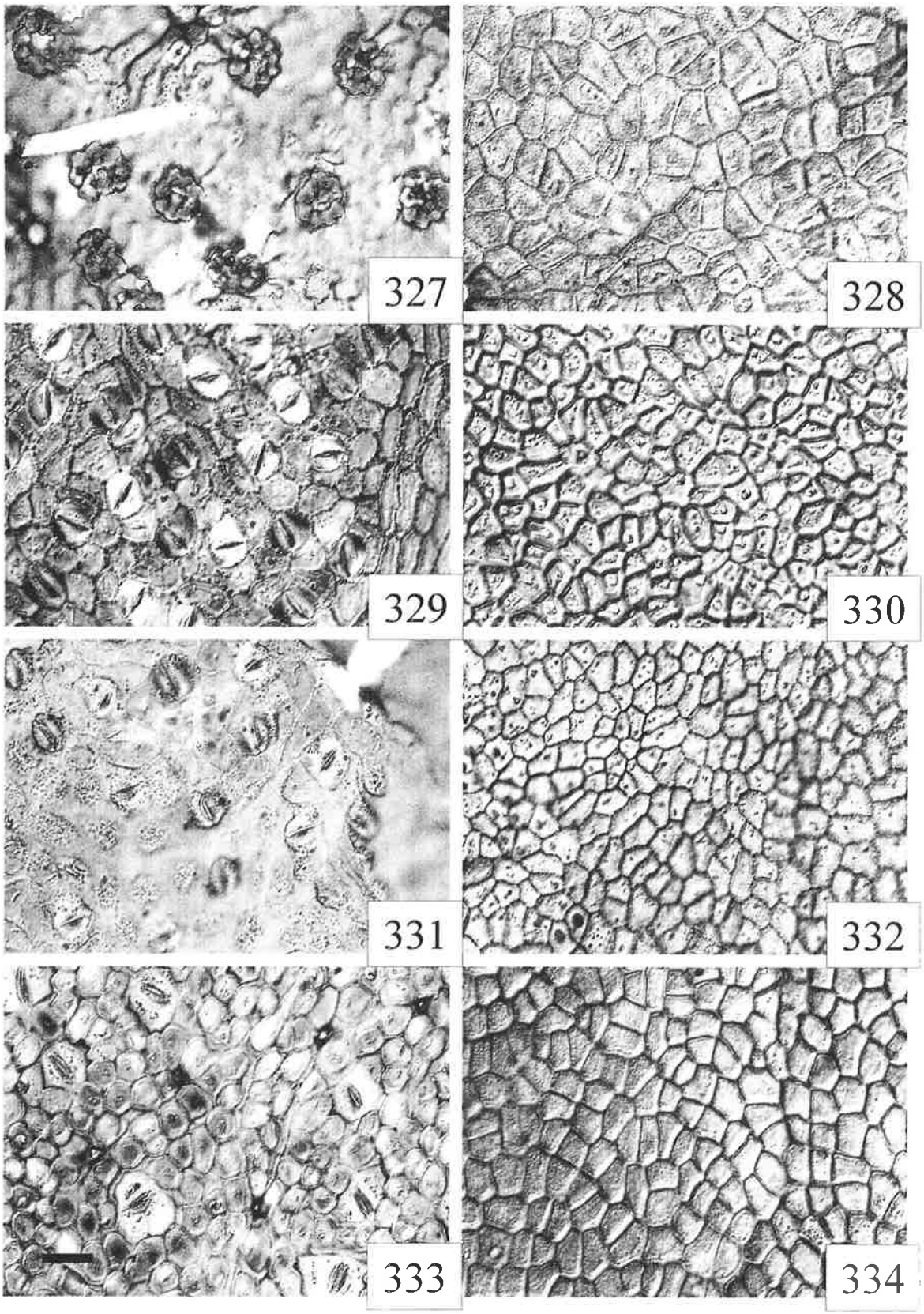
Plates 301-302: *L. supracostata*; plates 303-304: *L. thomsonii*; plates 305-306: *L. thomsonii* var. *vernayana*; plates 307-308: *L. tienchuanensis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



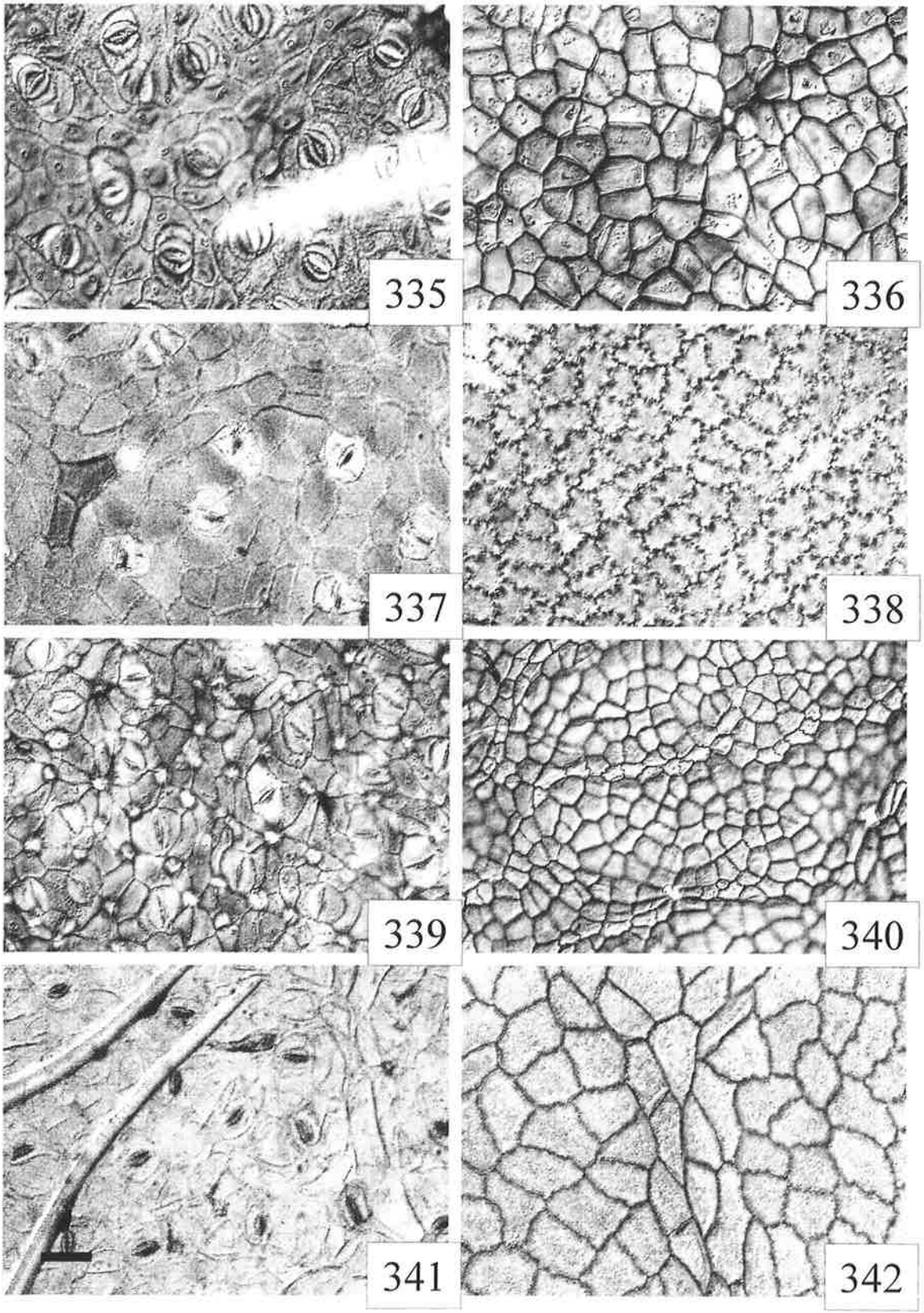
Plates 309-310: *L. tonkinensis*; plates 311-312: *L. tonkinensis* var. *subsessilis*; plates 313-314: *L. turfosa*; plates 315-316: *L. umbellata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



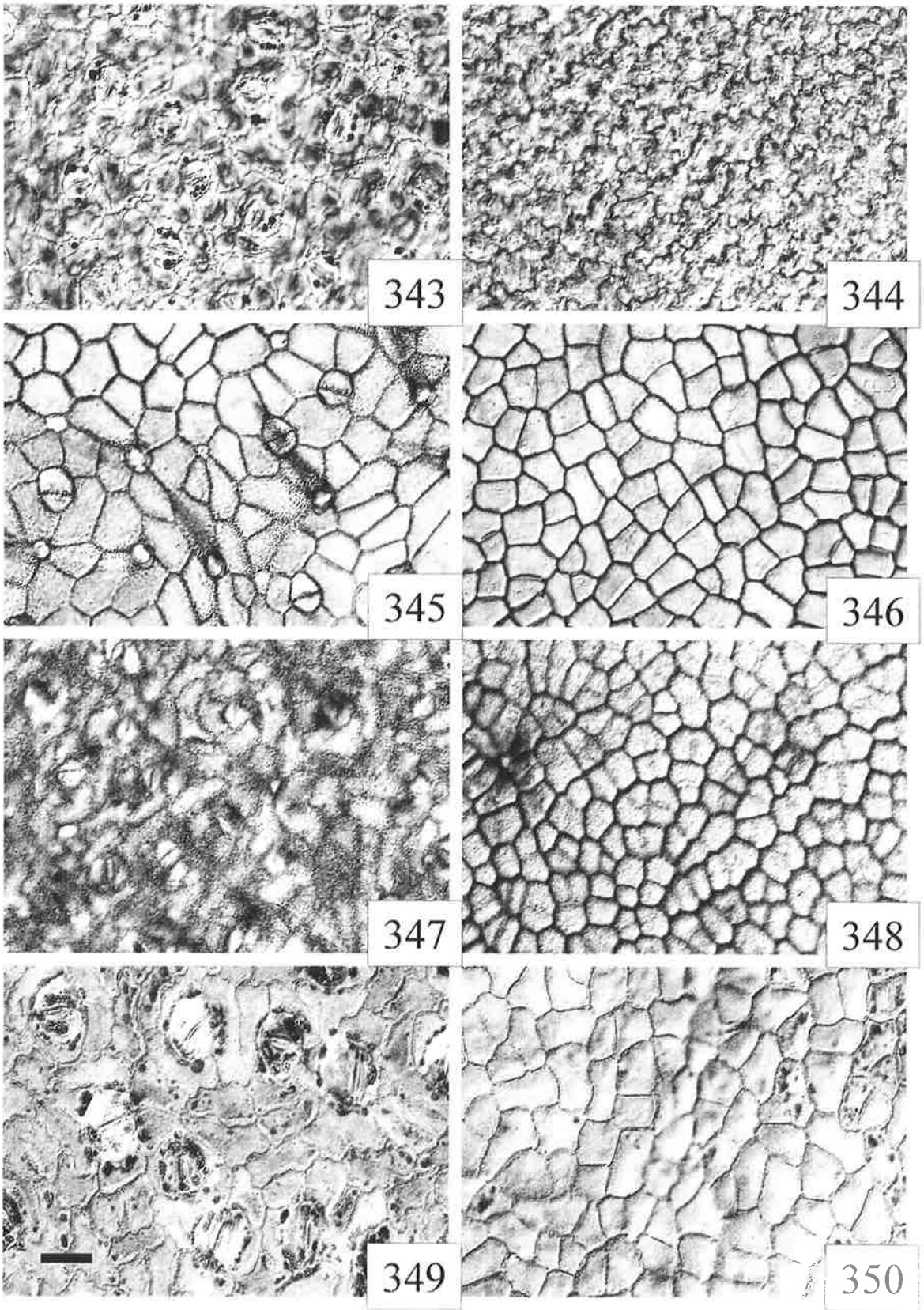
Plates 319-320: *Litsea. accedens*; plates 321-322: *L. accedentoides*; plates 323-324: *L. acuminata*; plates 325-326: *L. acutivena.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 35 um.



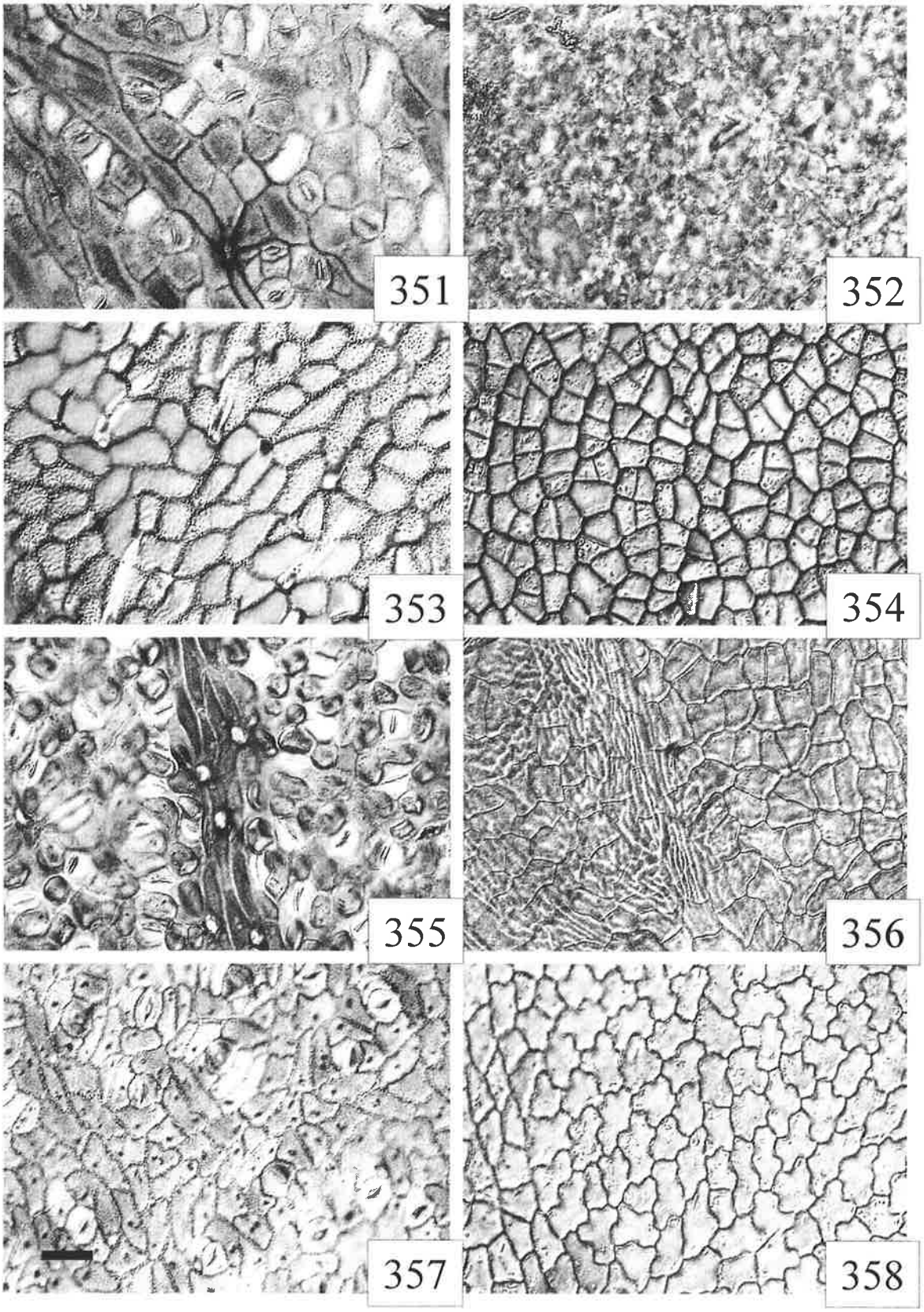
Plates 327-328: *L. akoensis*; plates 329-330: *L. alveolata*; plates 331-332: *L. ampla*; plates 333-334: *L. angulata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



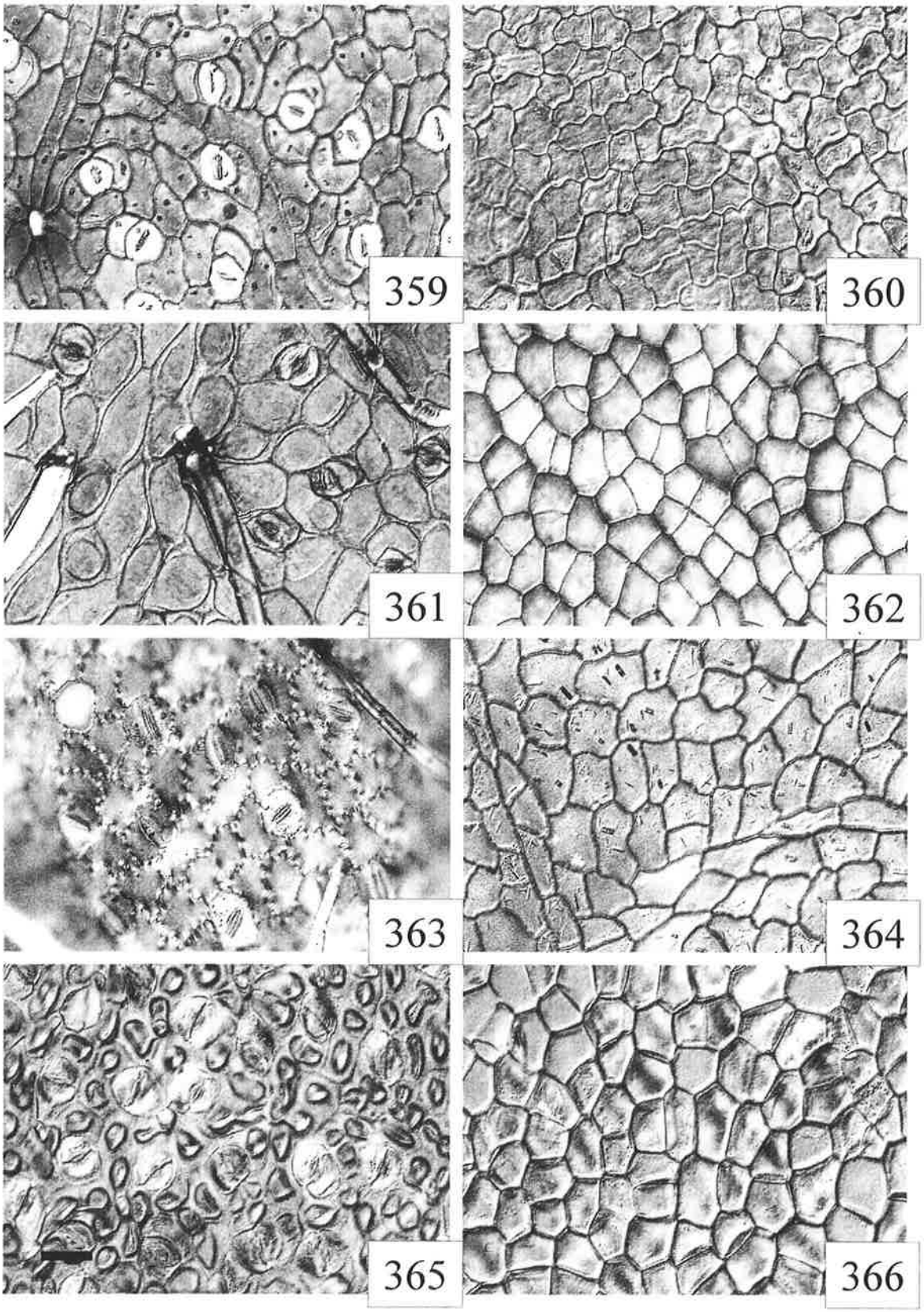
Plates 335-336: *L. artocarpifolia*; plates 337-338: *L. atrata*; plates 339-340: *L. aurea*; plates 341-342: *L. auriculata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



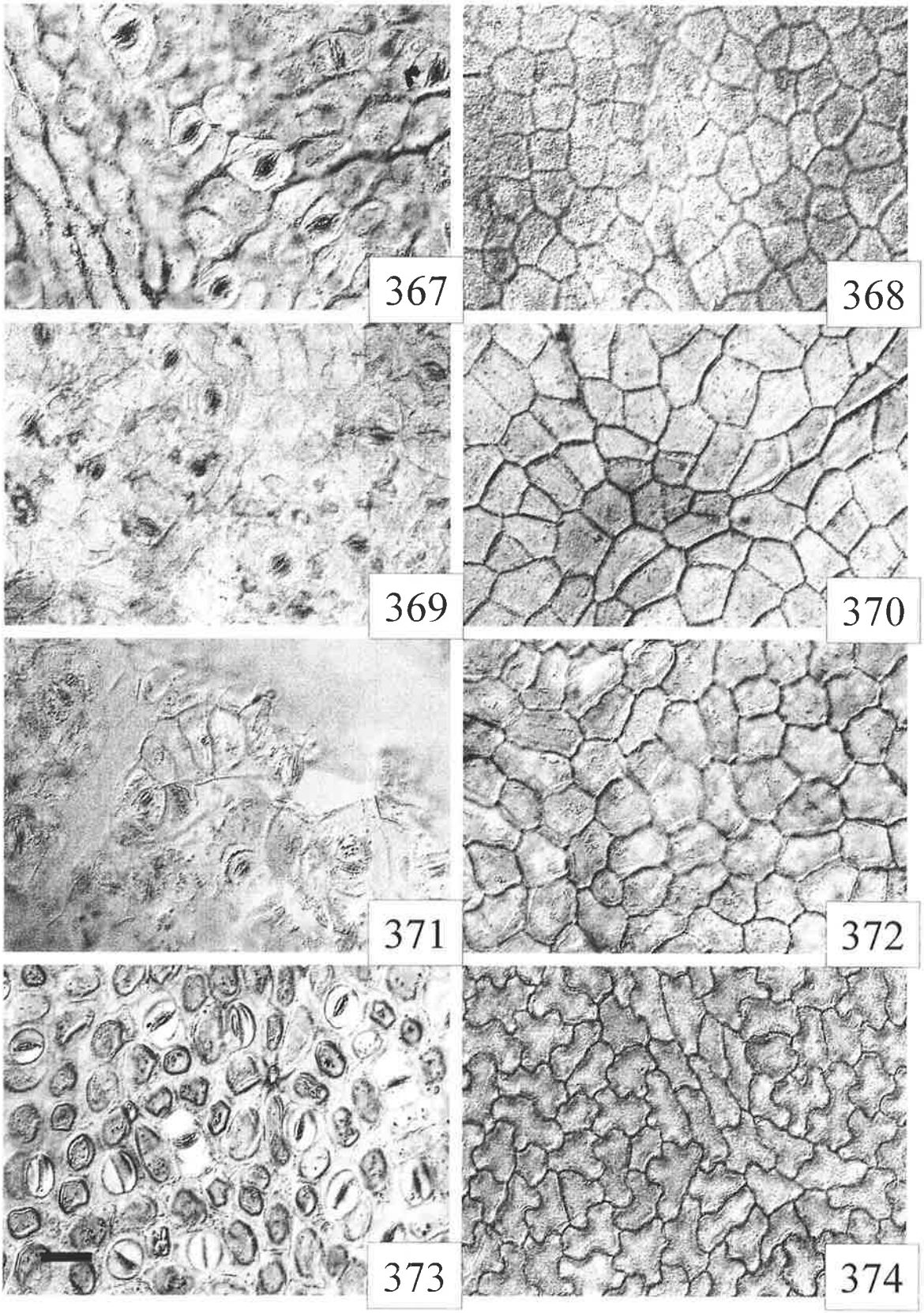
Plates 343-344: *L. balansae*; plates 345-346: *L. barringtonioides*; plates 347-348: *L. baviensis*; plates 349-350: *L. beilschmiediifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



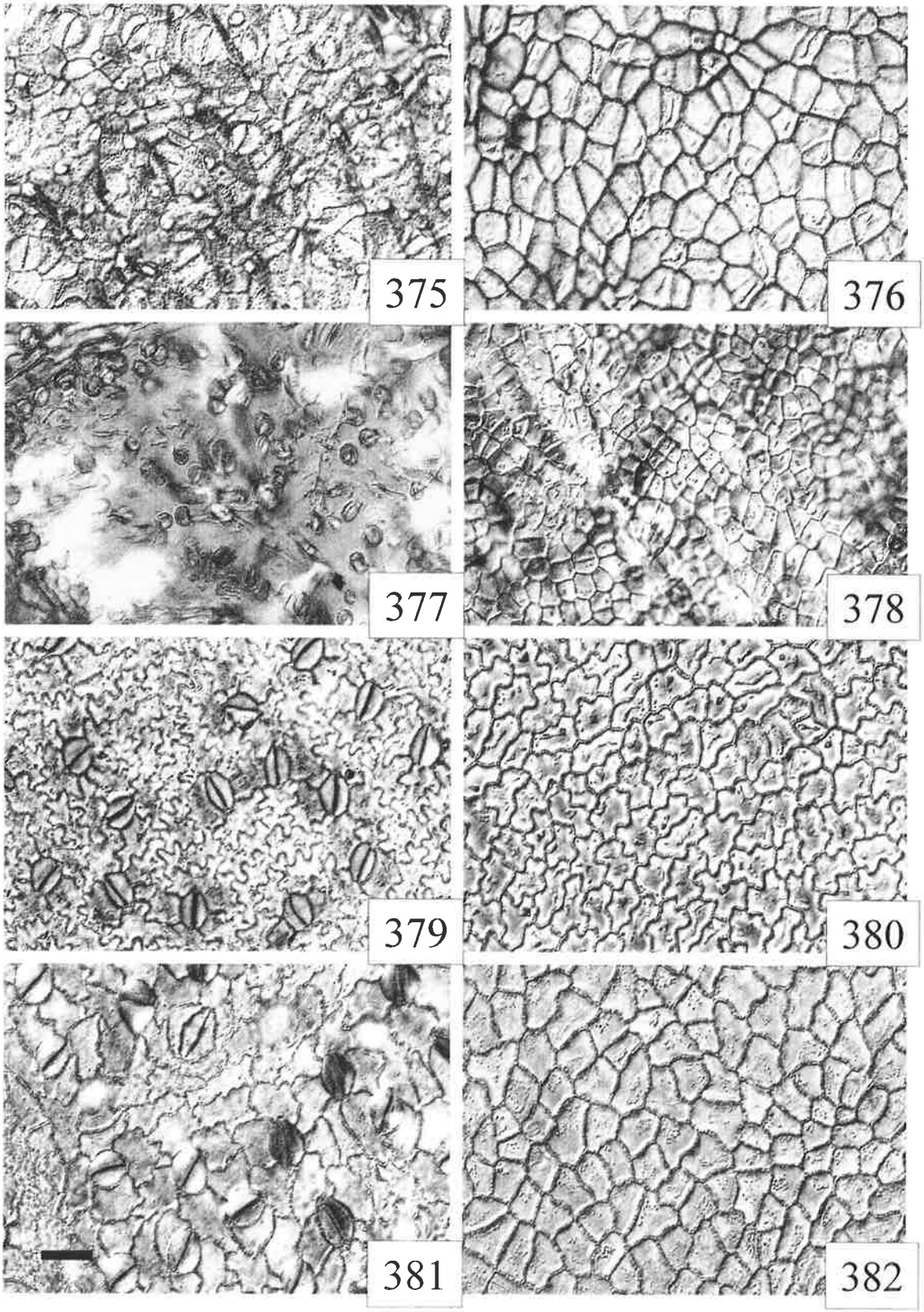
Plates 351-352: *L. brachystachya*; plates 353-354: *L. caesifolia*; plates 355-356: *L. calophyllantha*; plates 357-358: *L. cassiaefolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



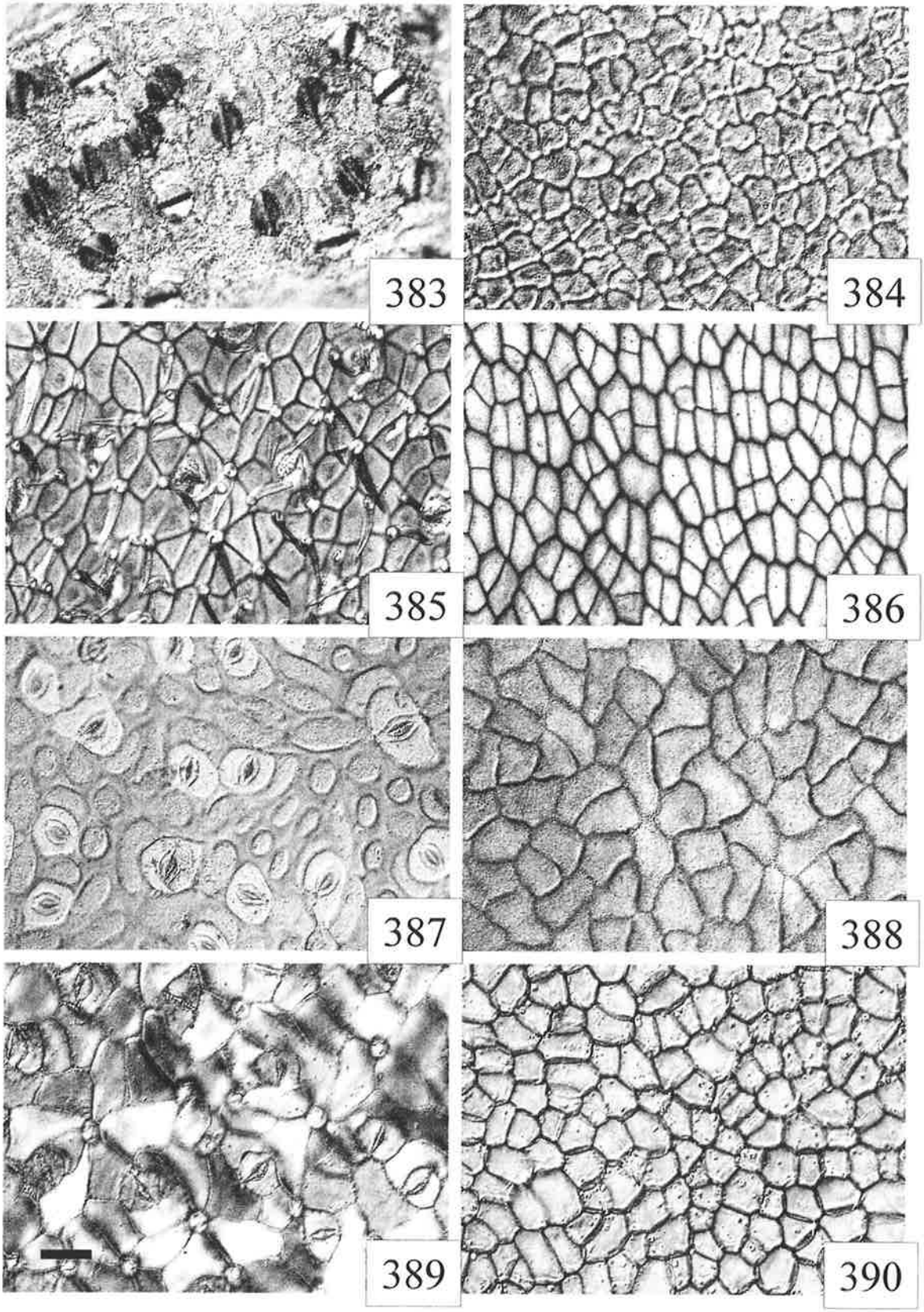
Plates 359-360: *L. castanea*; plates 361-362: *L. caulocarpa*; plates 363-364: *L. chinensis*; plates 365-366: *L. chingpingensis*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



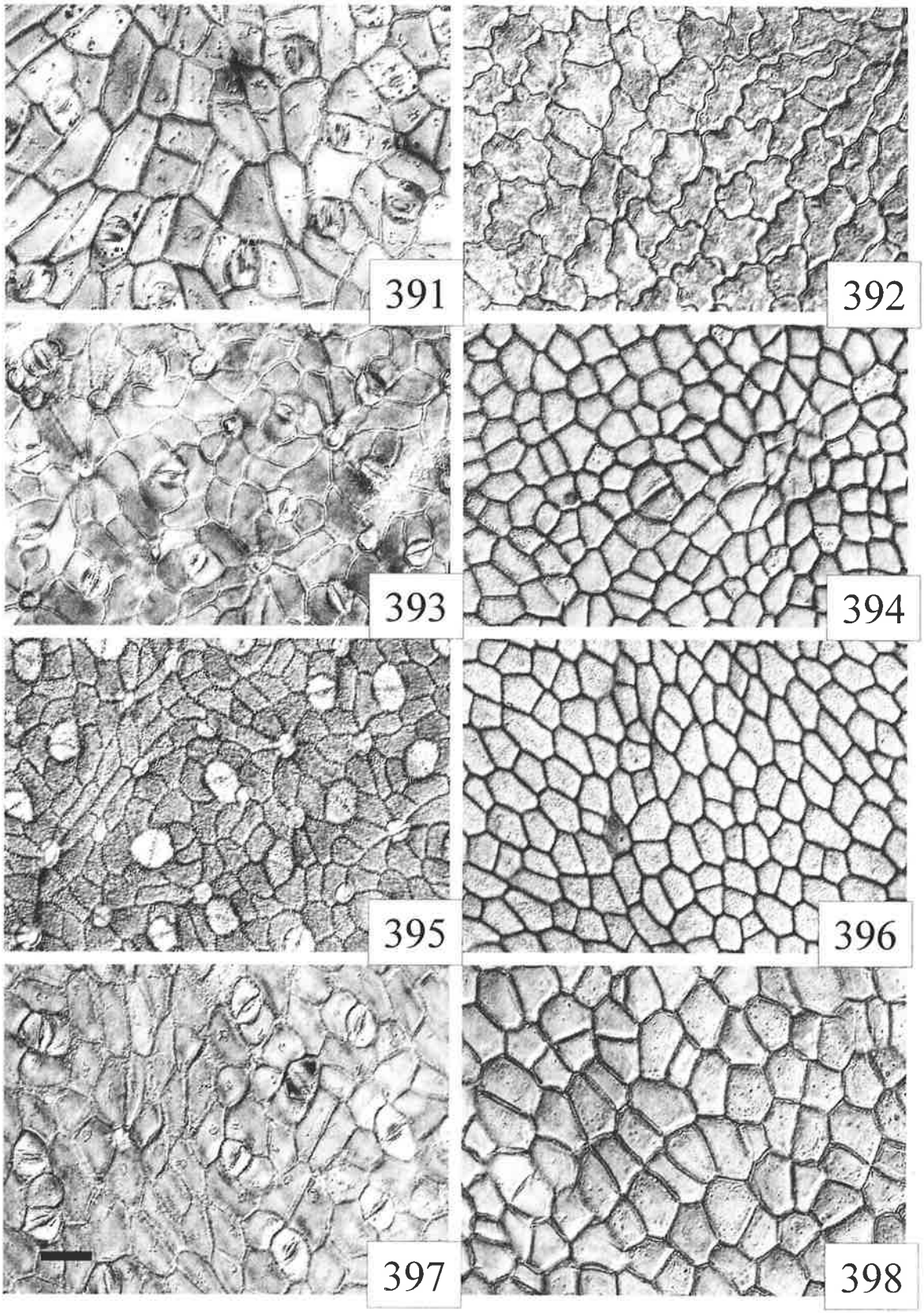
Plates 367-368: *L. chunii*; plates 369-370: *L. chunii* var. *latifolia*; plates 371-372: *L. chunii* var. *likiangensis*; plates 373-374: *L. collina.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



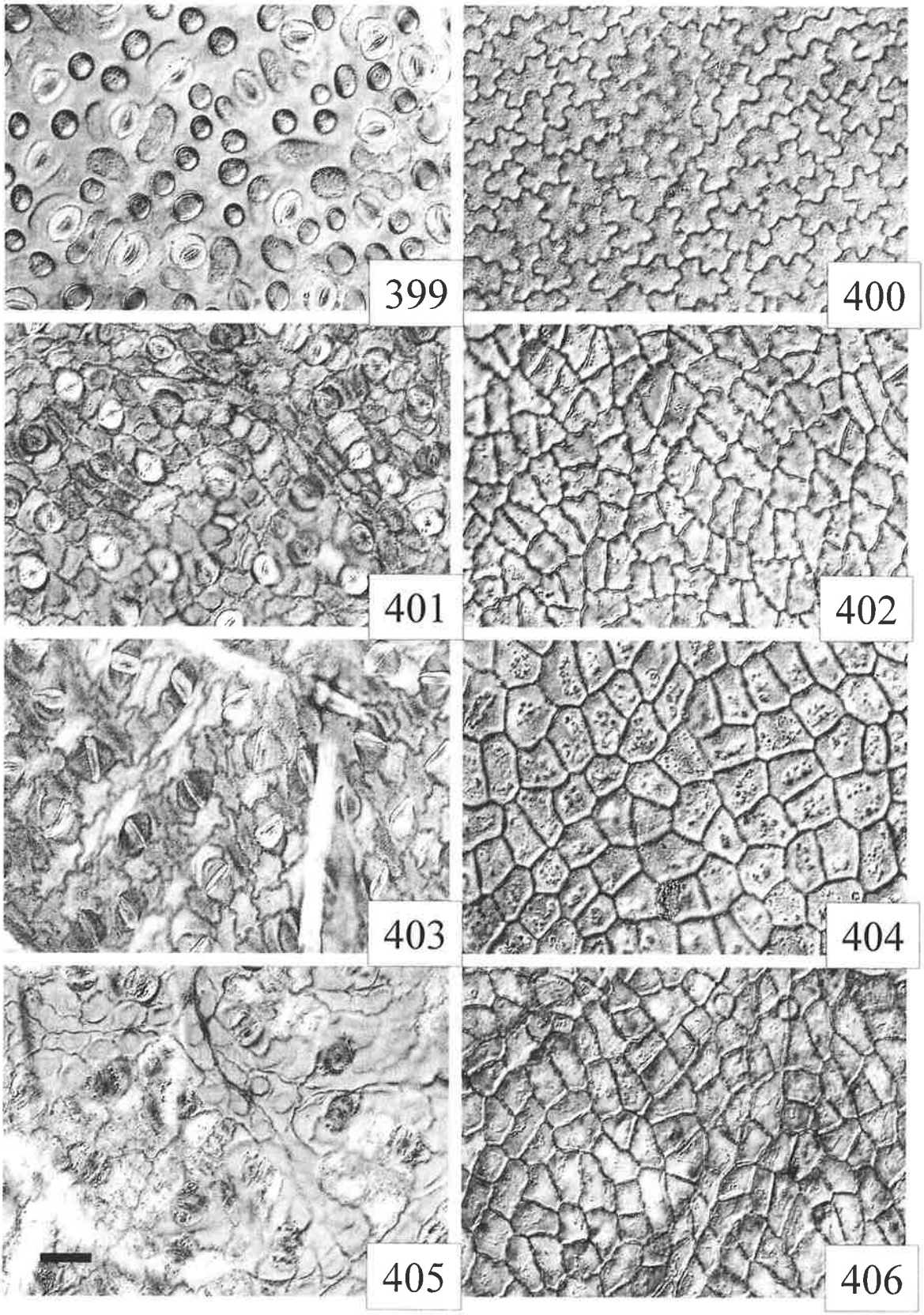
Plates 375-376: *L. confusa*; plates 377-378: *L. cordata*; plates 379-380: *L. coreana*; plates 381-382: *L.* ***coreana*** var. ***lanuginosa.*** Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



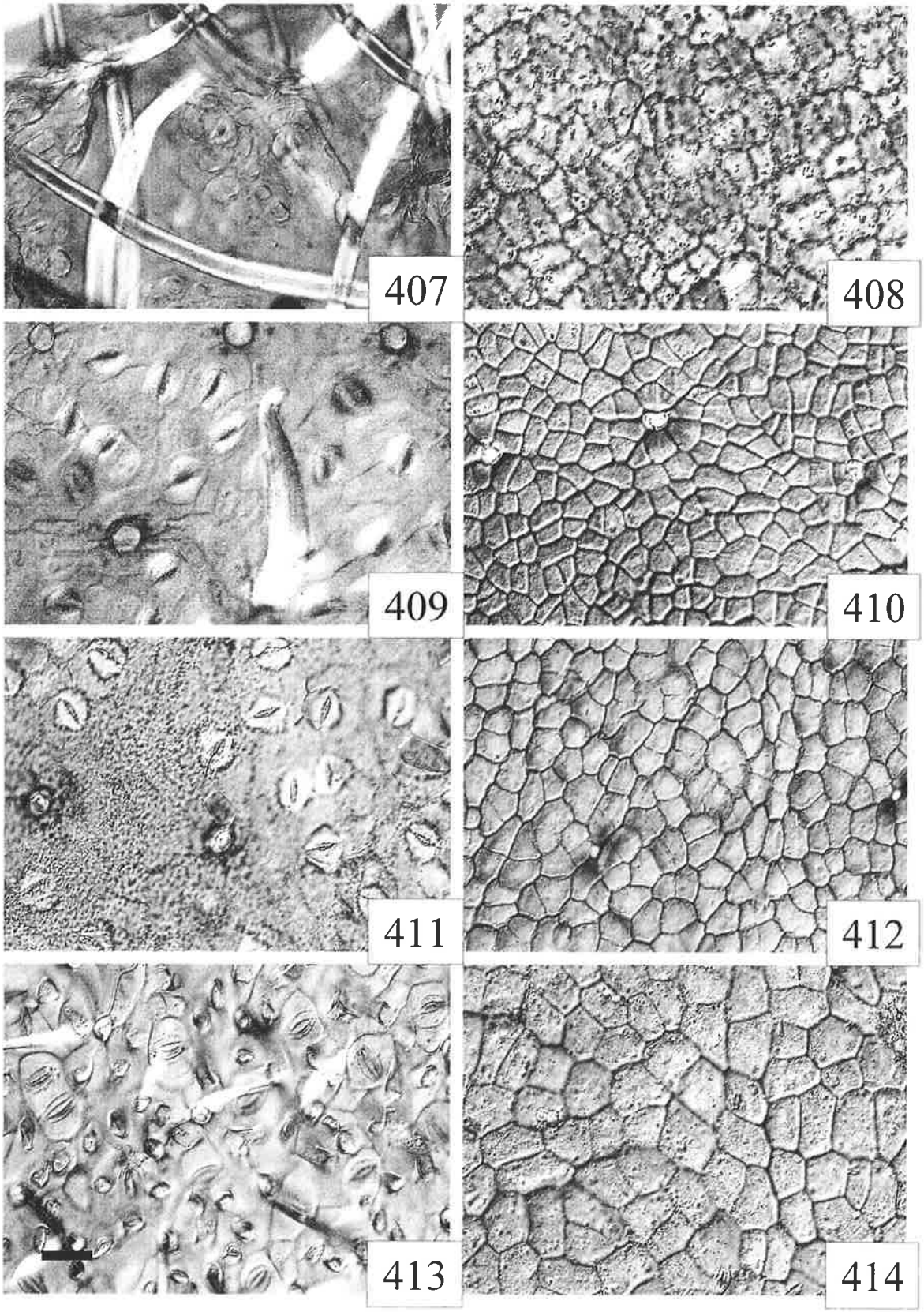
Plates 383-384: *L. coreana* var. *sinensis*; plates 385-386: *L. costalis*; plates 387-388: *L. cubeba*; plates 389-390: *L. cuprea.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



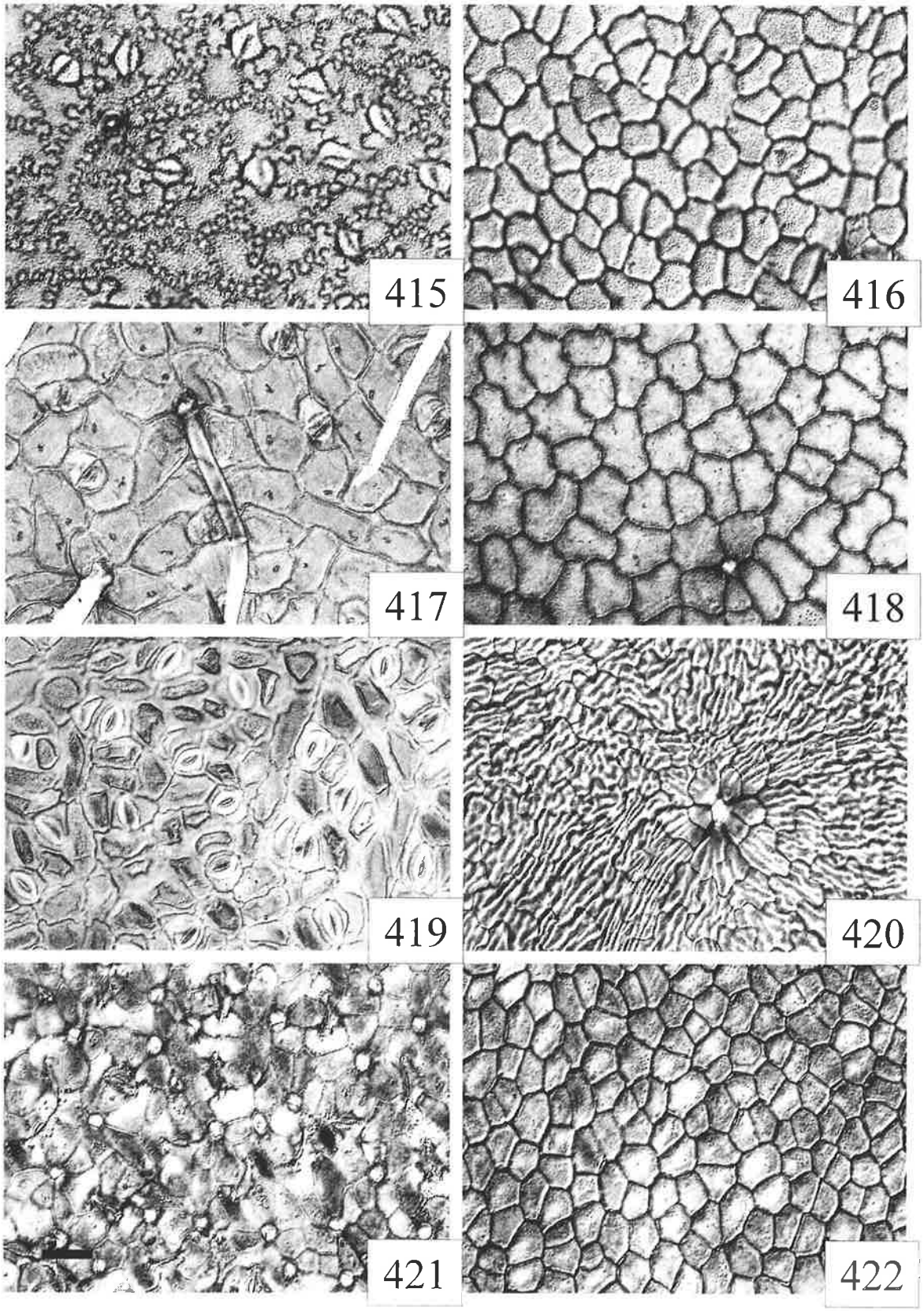
Plates 391-392: *L. clyindrocarpa*; plates 393-394: *L. densiflora*; plates 395-396: *L. dilleniifolia*; plates 397-398: *L. diversifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



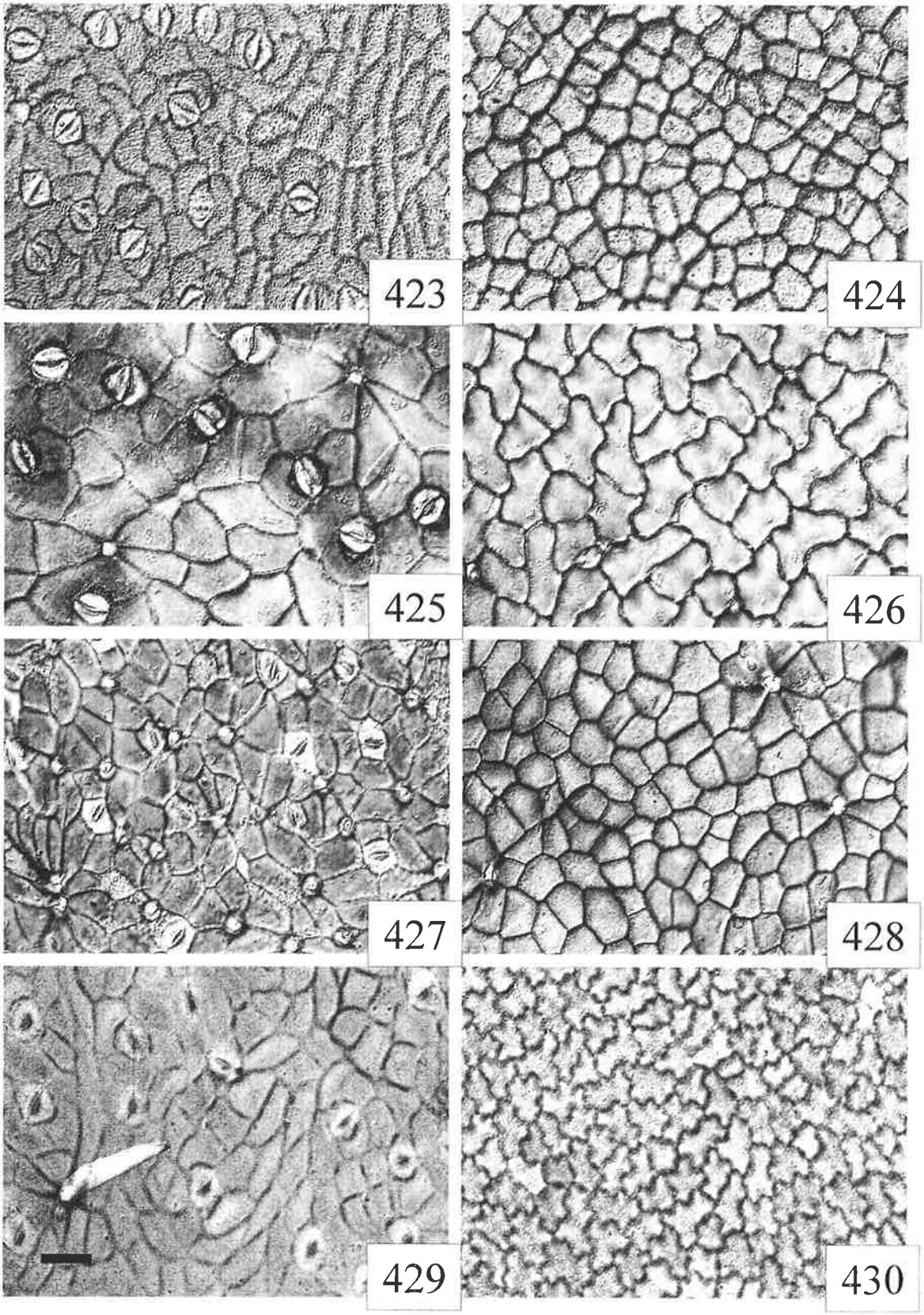
Plates 399-400: *L. elliptica*; plates 401-402: *L. elongata*; plates 403-404: *L. elongata* var. *faberi*; plates 405-406: *L. elongata* var. *mushaensis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



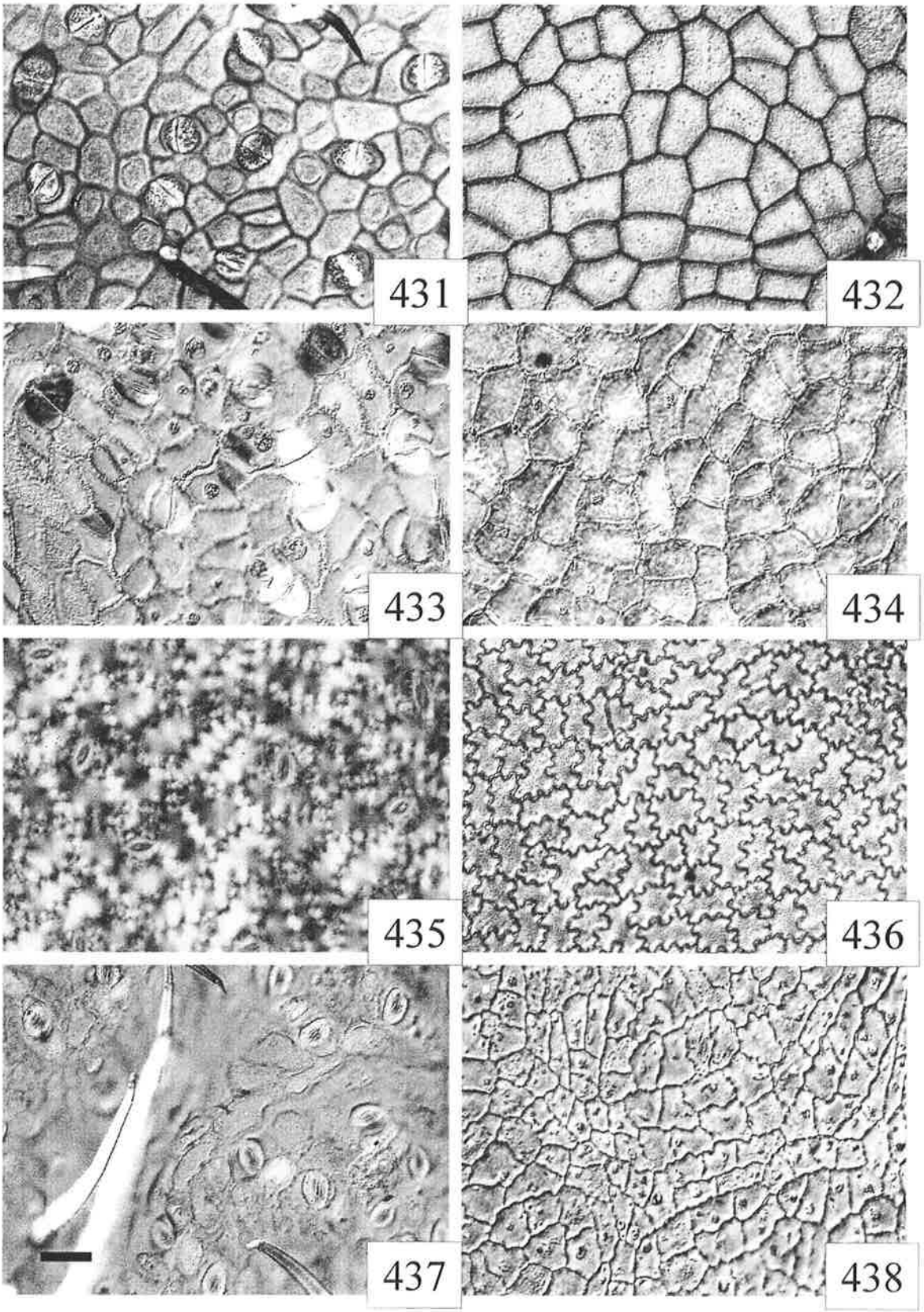
Plates 407-408: *L. elongata* var. *subverticillata*; plates 409-410: *L. engleriana*; plates 411-412: *L. erectinervia*; plates 413-414: *L. euosma.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



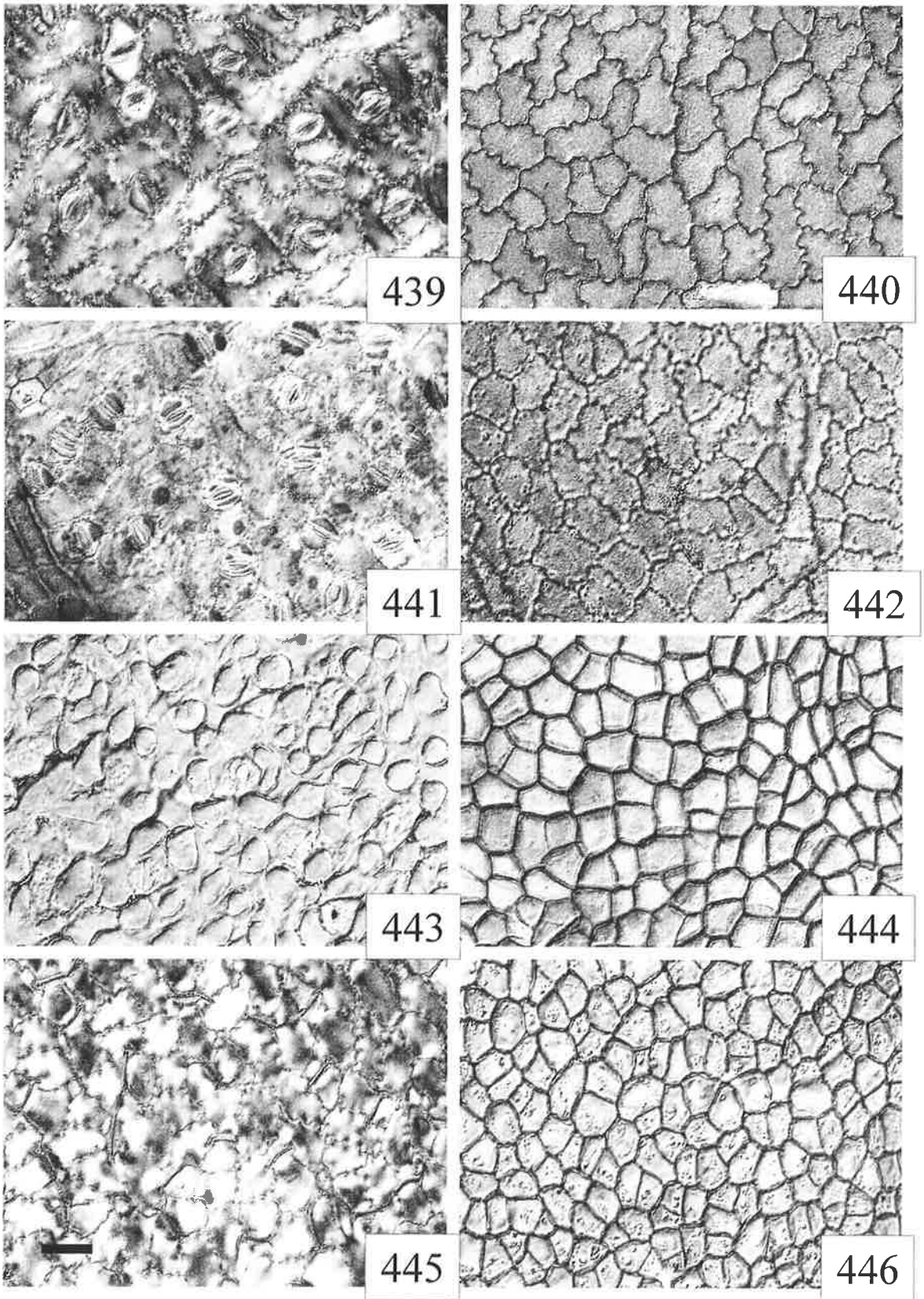
Plates 415-416: *L. fenestrata*; plates 417-418: *L. ferruginea*; plates 419-420: *L. firma*; plates 421-422: *L. formanii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



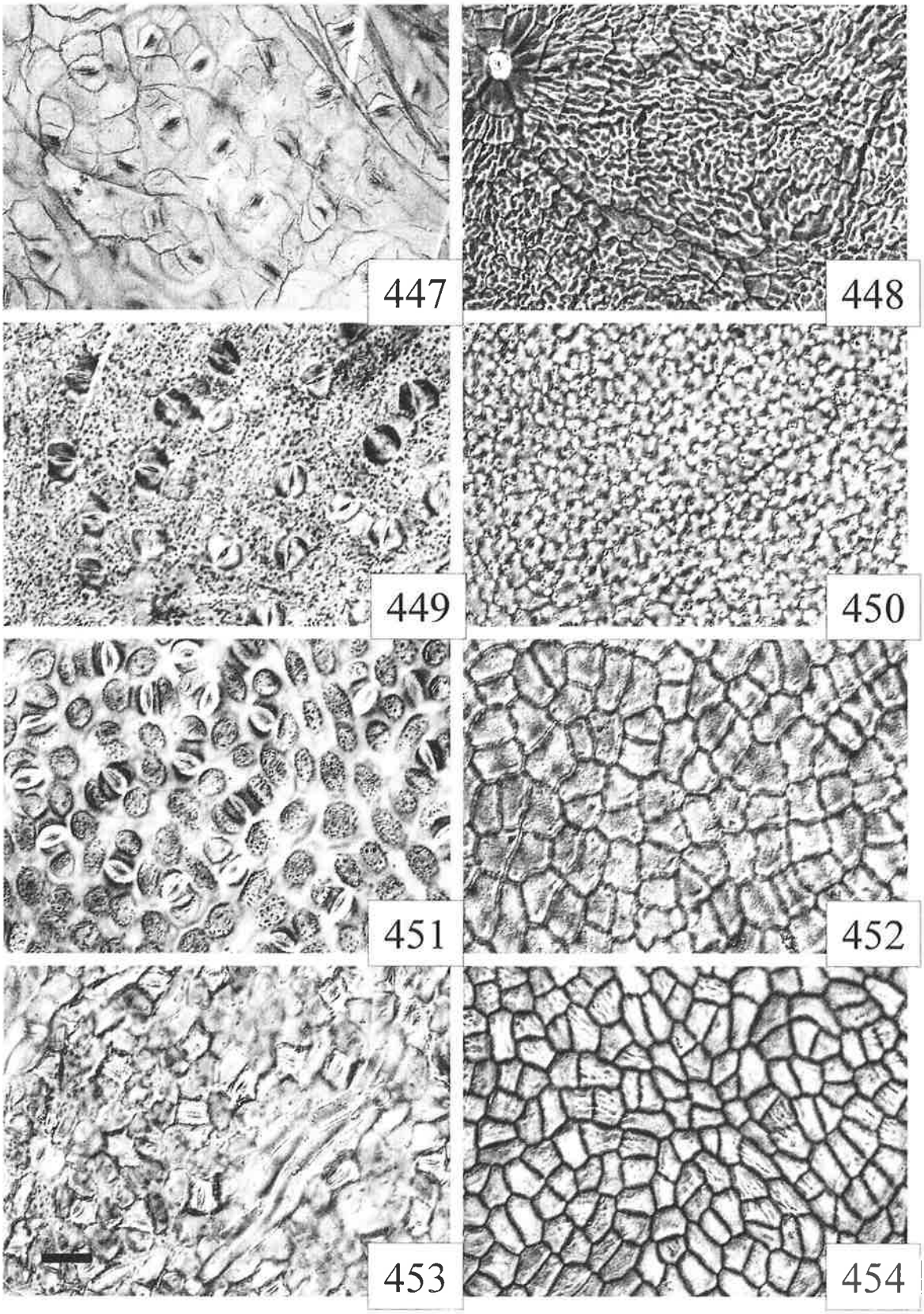
Plates 423-424: *L. forstenii*; plates 425-426: *L. fulva*; plates 427-428: *L. garciae*; plates 429-430: *L. garrettii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 41 um.



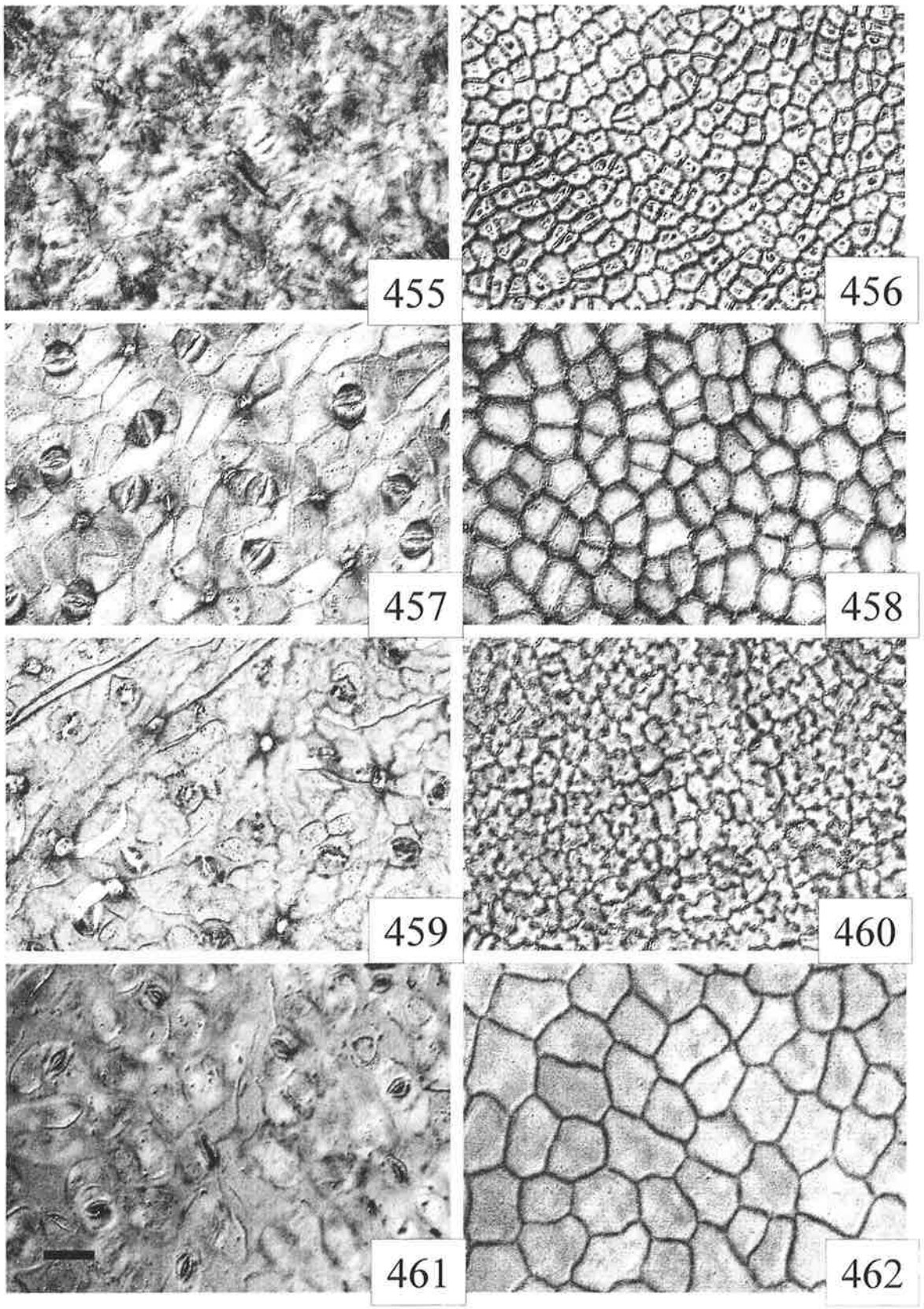
Plates 431-432: *L. glaberrima*; plates 433-434: *L. glaucescens*; plates 435-436: *L. globosa*; plates 437-438: *L. globosa.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



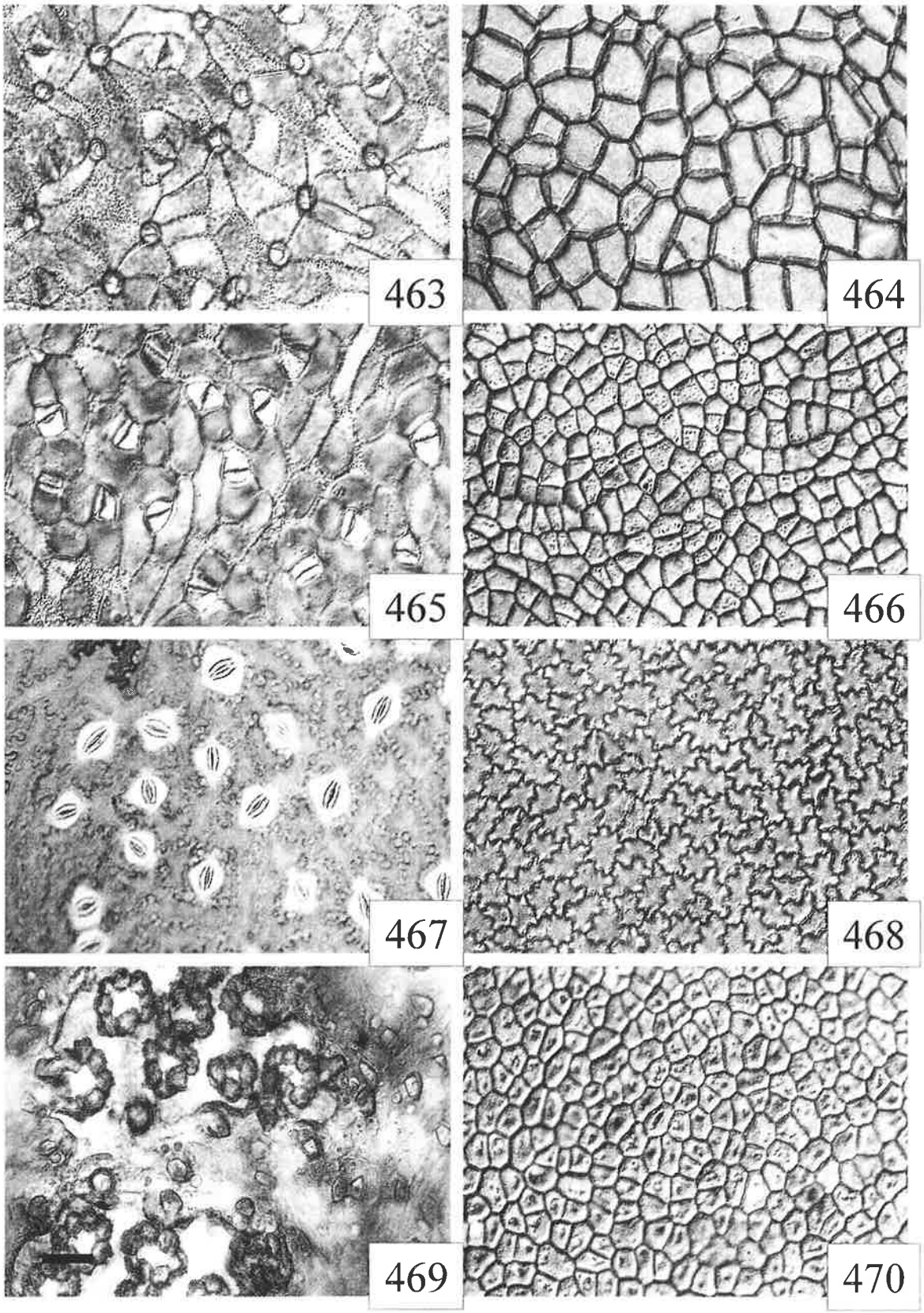
Plates 439-440: *L. glutinosa*; plates 441-442: *L. glutinosa* var. *brideliifolia*; plates 443-444: *L. gongshanensis*; plates 445-446: *L. gracilis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



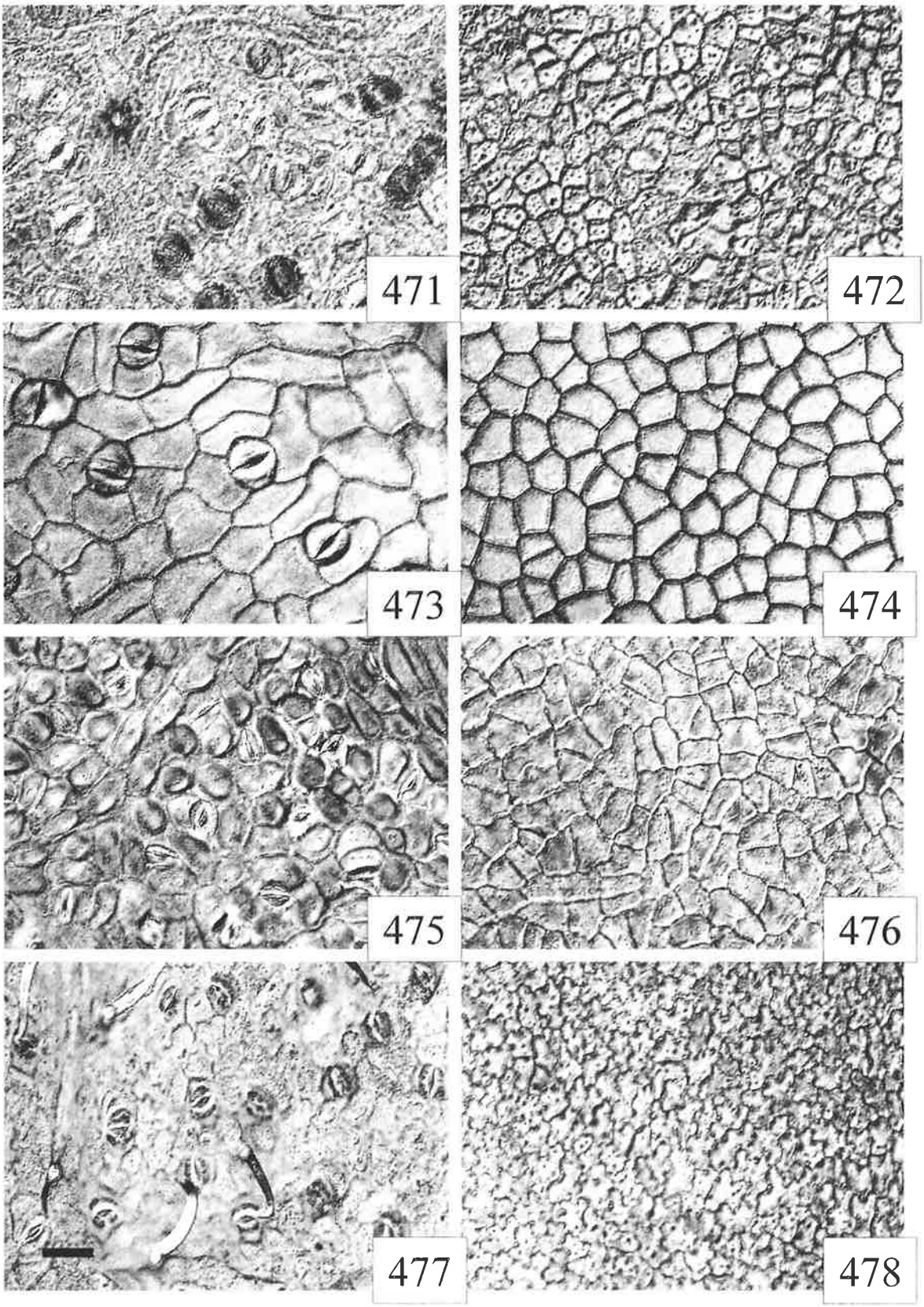
Plates 447-448: *L. grandis*; plates 449-450: *L. greenmaniana*; plates 451-452: *L. greenmaniana* var. *angustifolia*; plates 453-454: *L. guppyi.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



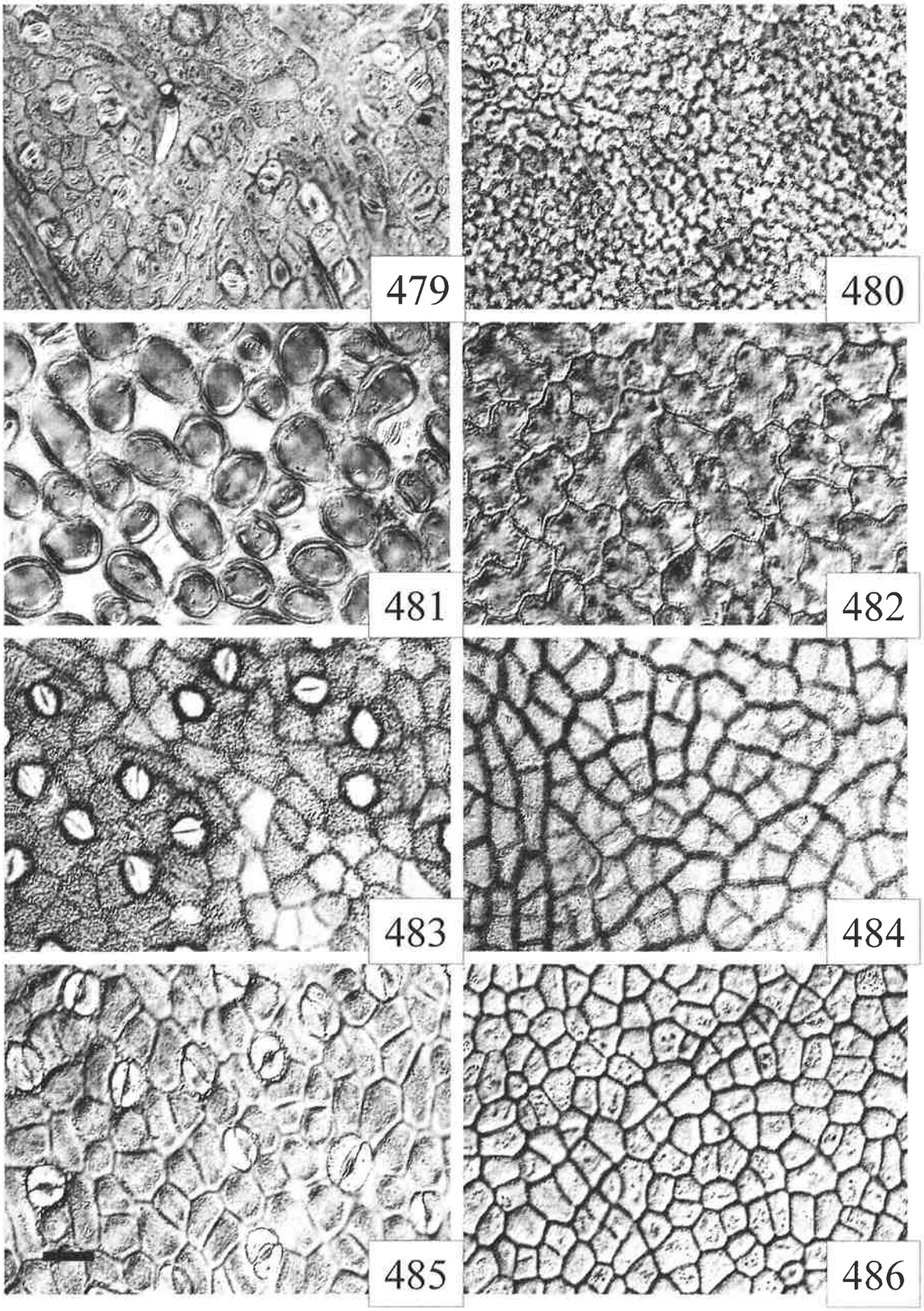
Plates 455-456: *L. honghoensis*; plates 457-458: *L. hutchinsonii*; plates 459-460: *L. hypophaea*; plates 461-462: *L. ichangensis*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



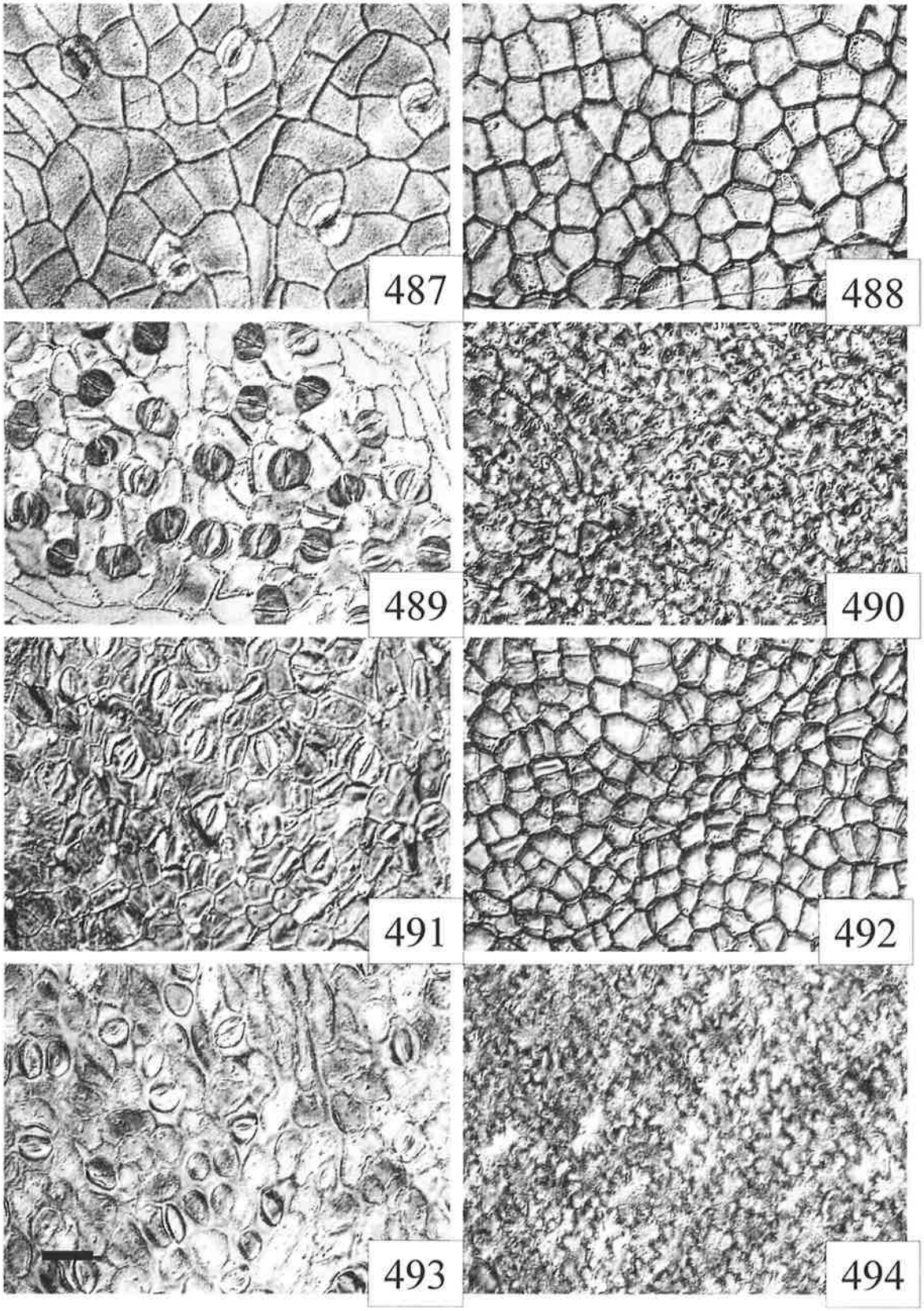
Plates 463-464: *L. impressa*; plates 465-466: *L. insignis*; plates 467-468: *L. irianensis*; plates 469-470: *L. japonica.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



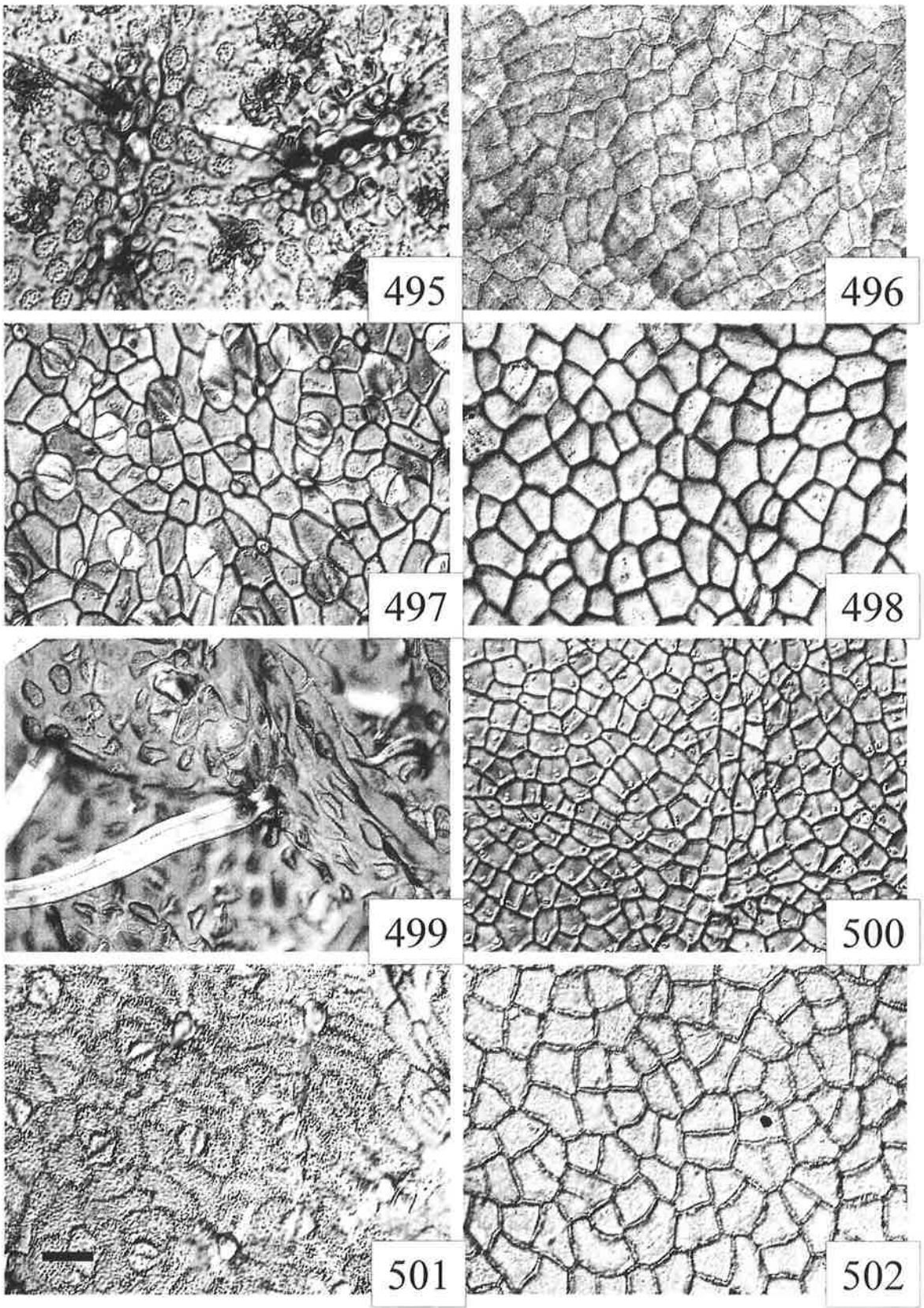
Plates 471-472: *L. javanica*; plates 473-474: *L. johorensis*; plates 475-476: *L. kobuskiana*; plates 477-478: *L. kostermansii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



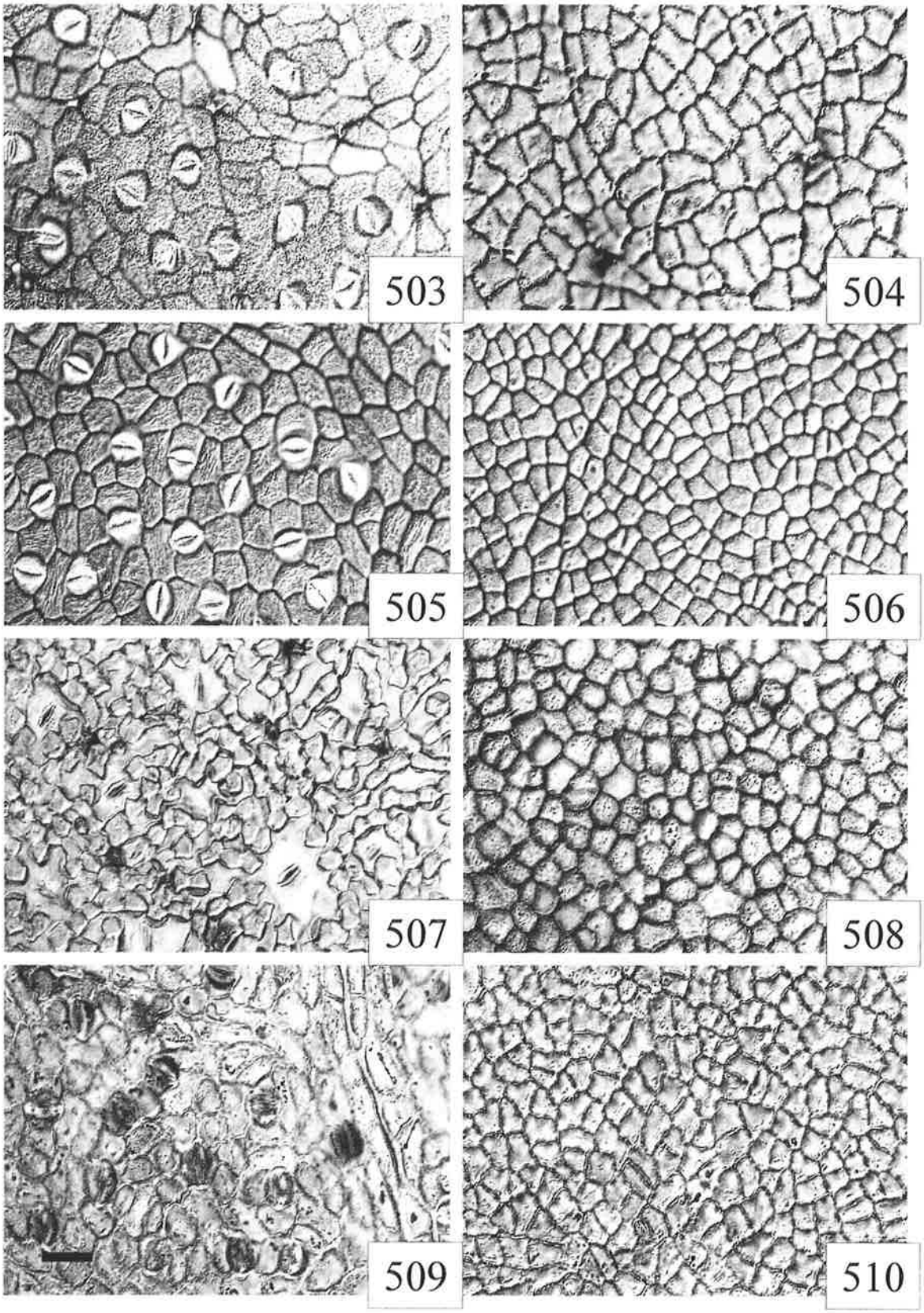
Plates 479-480: *L. krukovii*; plates 481-482: *L. kwangtungensis*; plates 483-484: *L. lanceolata*; plates 485-486: *L. lancifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



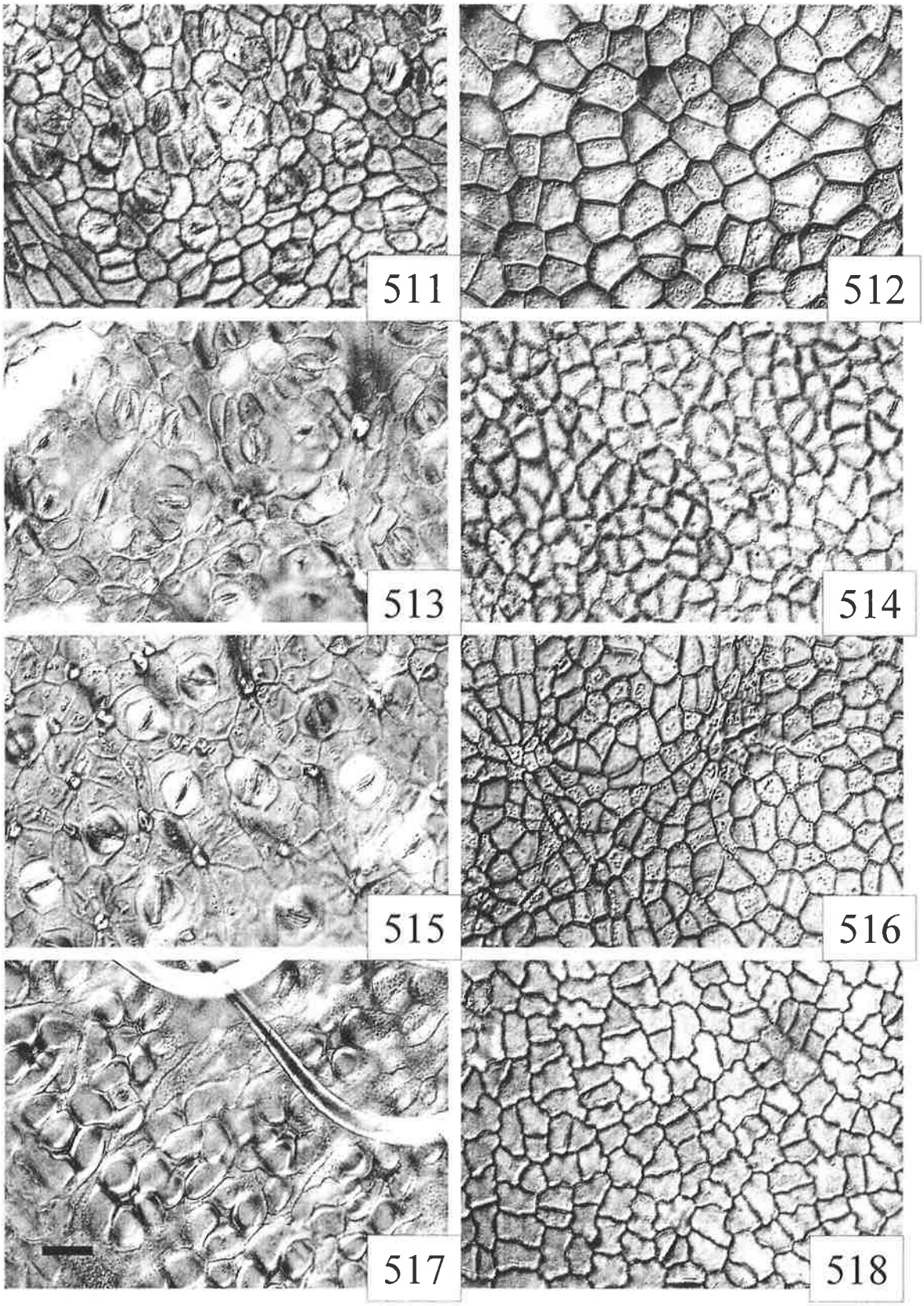
Plates 487-488: *L. lancifolia* var. *ellipsoidea*; plates 489-490: *L. lancilimba*; plates 491-492: *L. ledermannii*; plates 493-494: *L. lii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um .



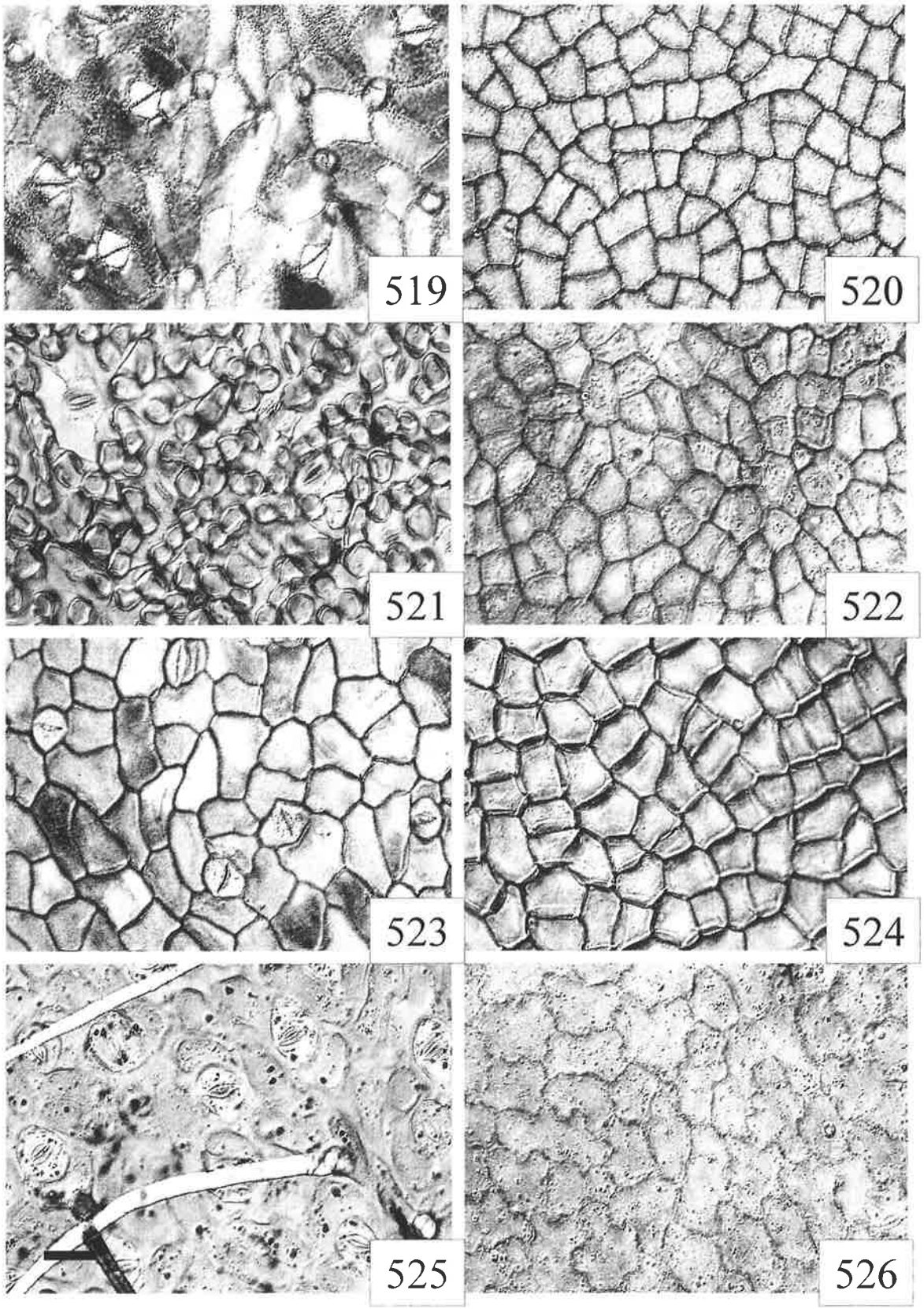
Plates 495-496: *L. liniii*; plates 497-498: *L. liyuyingi*; plates 499-500: *L. longistaminata*; plates 501-502: *L. lucida.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



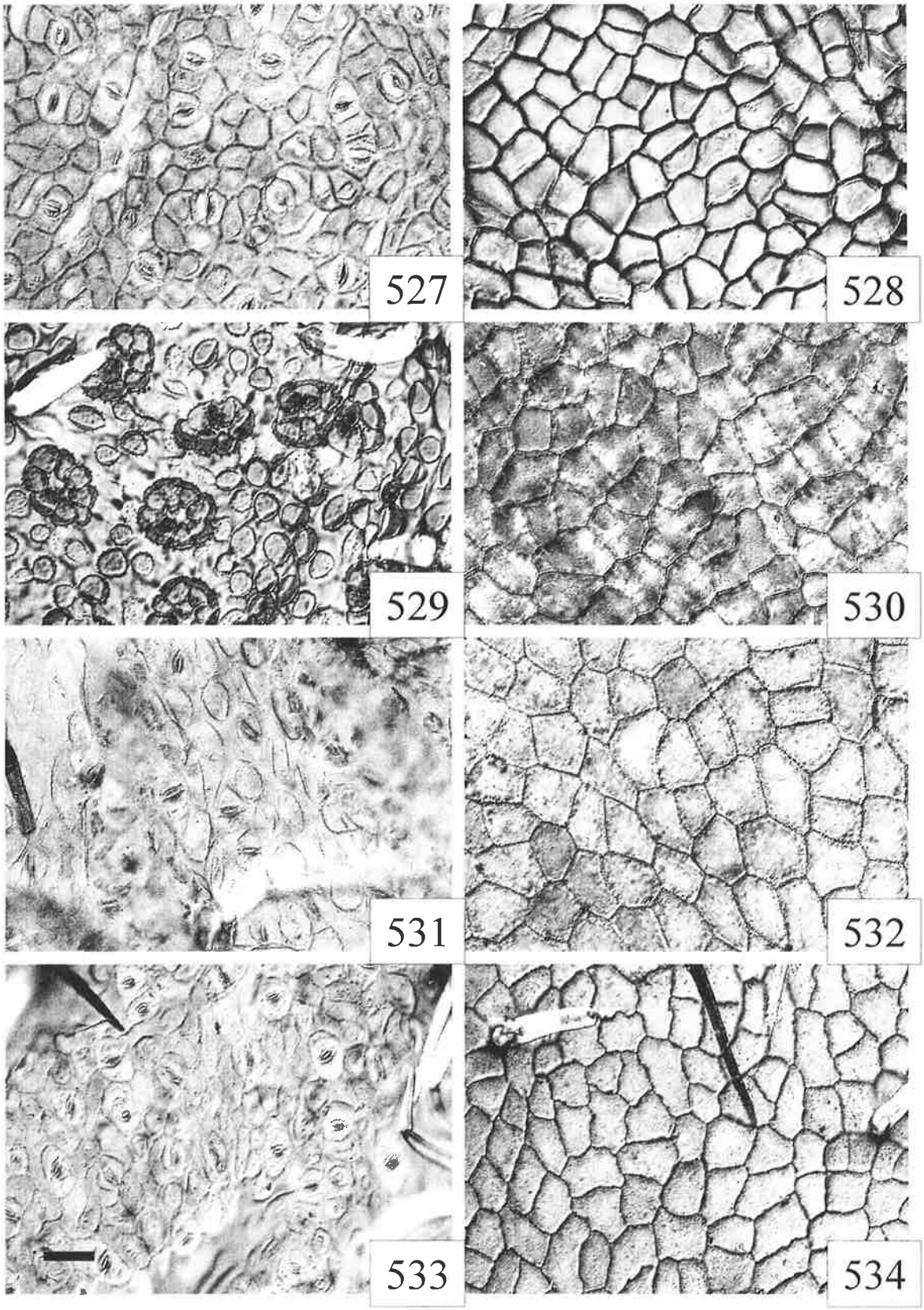
Plates 503-504: *L. luzonica*; plates 505-506: *L. machilifolia*; plates 507-508: *L. machilifolia**; plates 509-510: *L. machiloides*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 34 um.



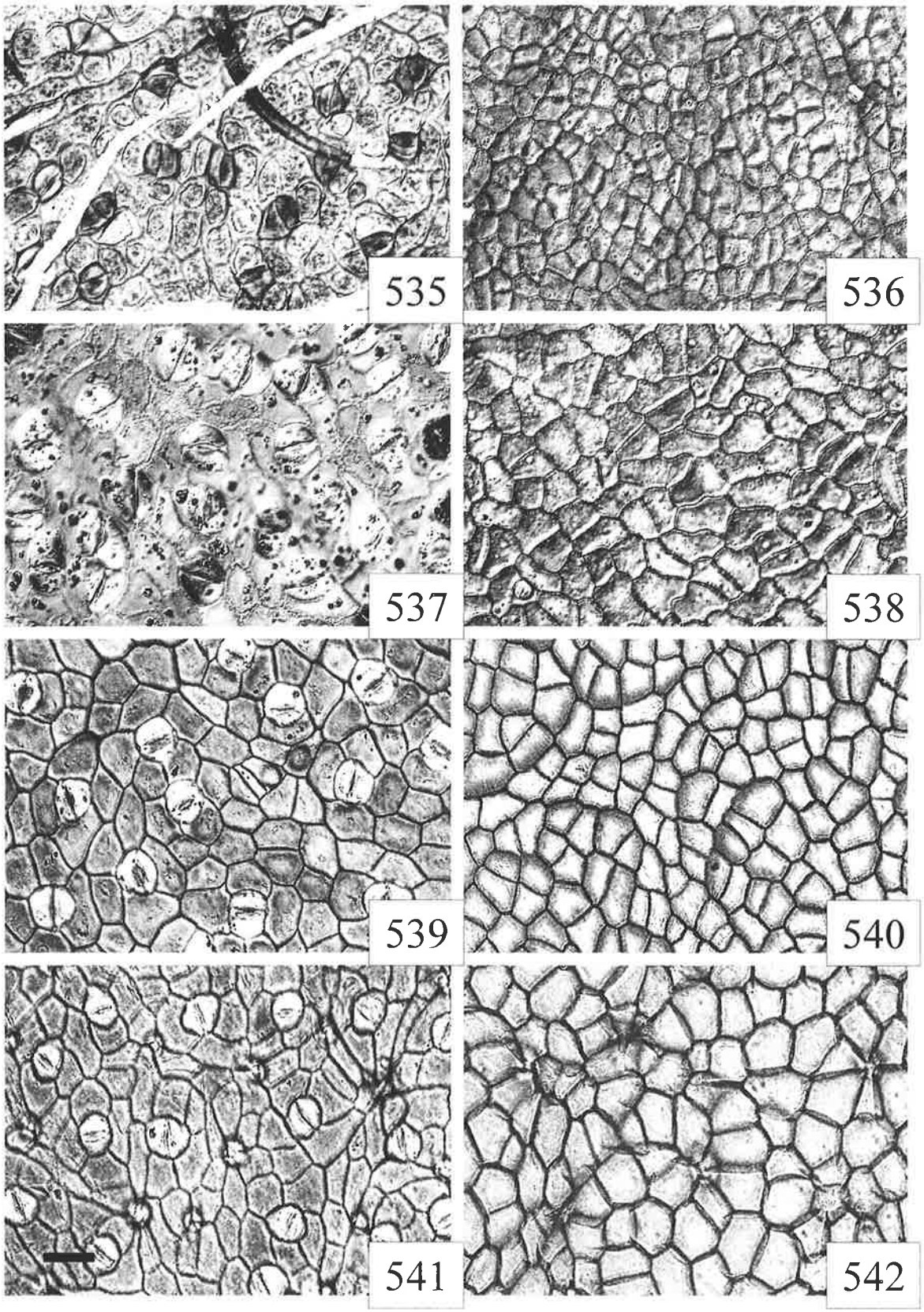
Plates 511-512: *L. magnoliifolia*; plates 513-514: *L. mappacea*; plates 515-516: *L. megacarpa*; plates 517-518: *L. membranacea.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 36 um.



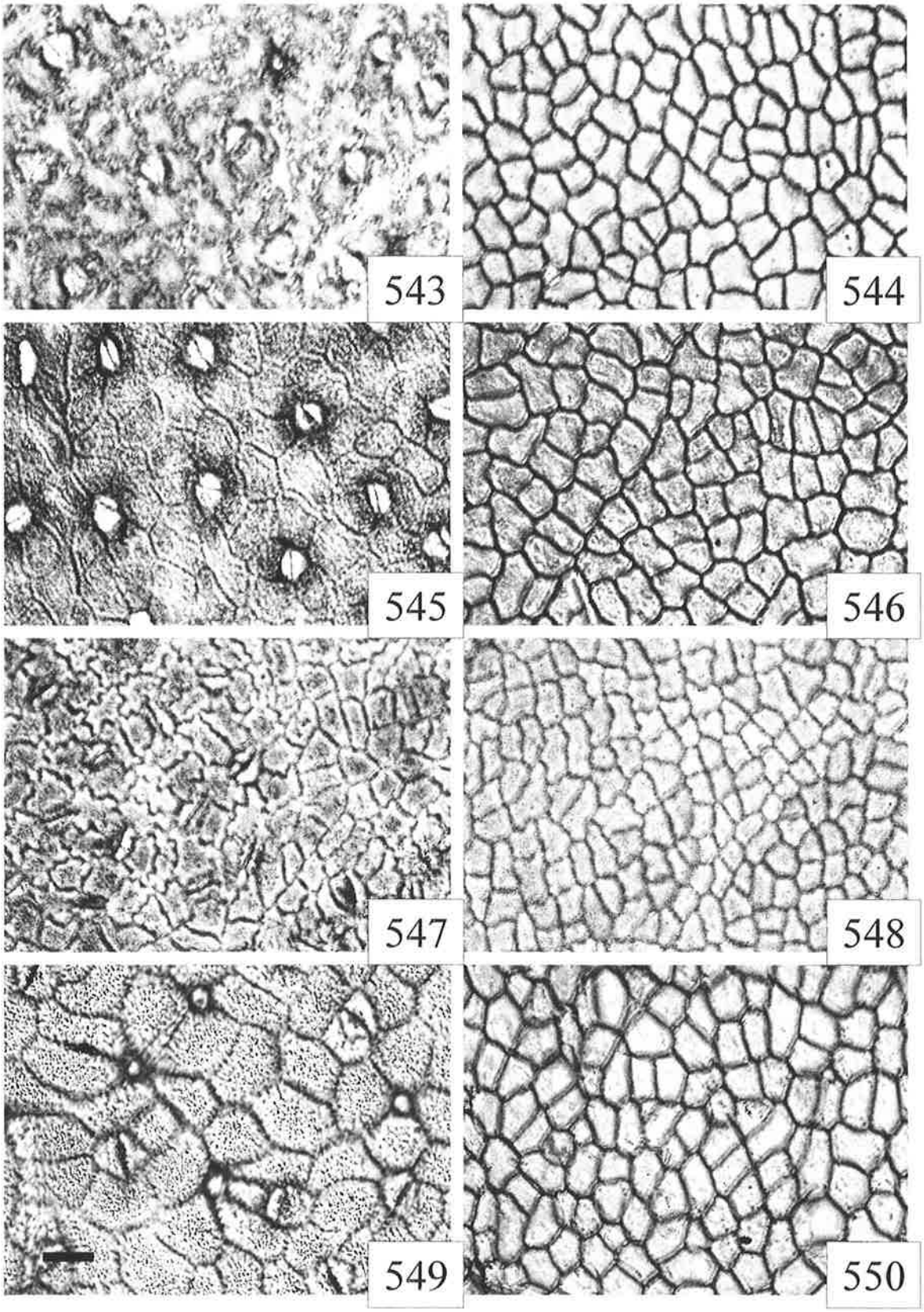
Plates 519-520: *L. meyeri*; plates 521-522: *L. micrantha*; plates 523-524: *L. micrantha**; plates 525-526: *L. mollis.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



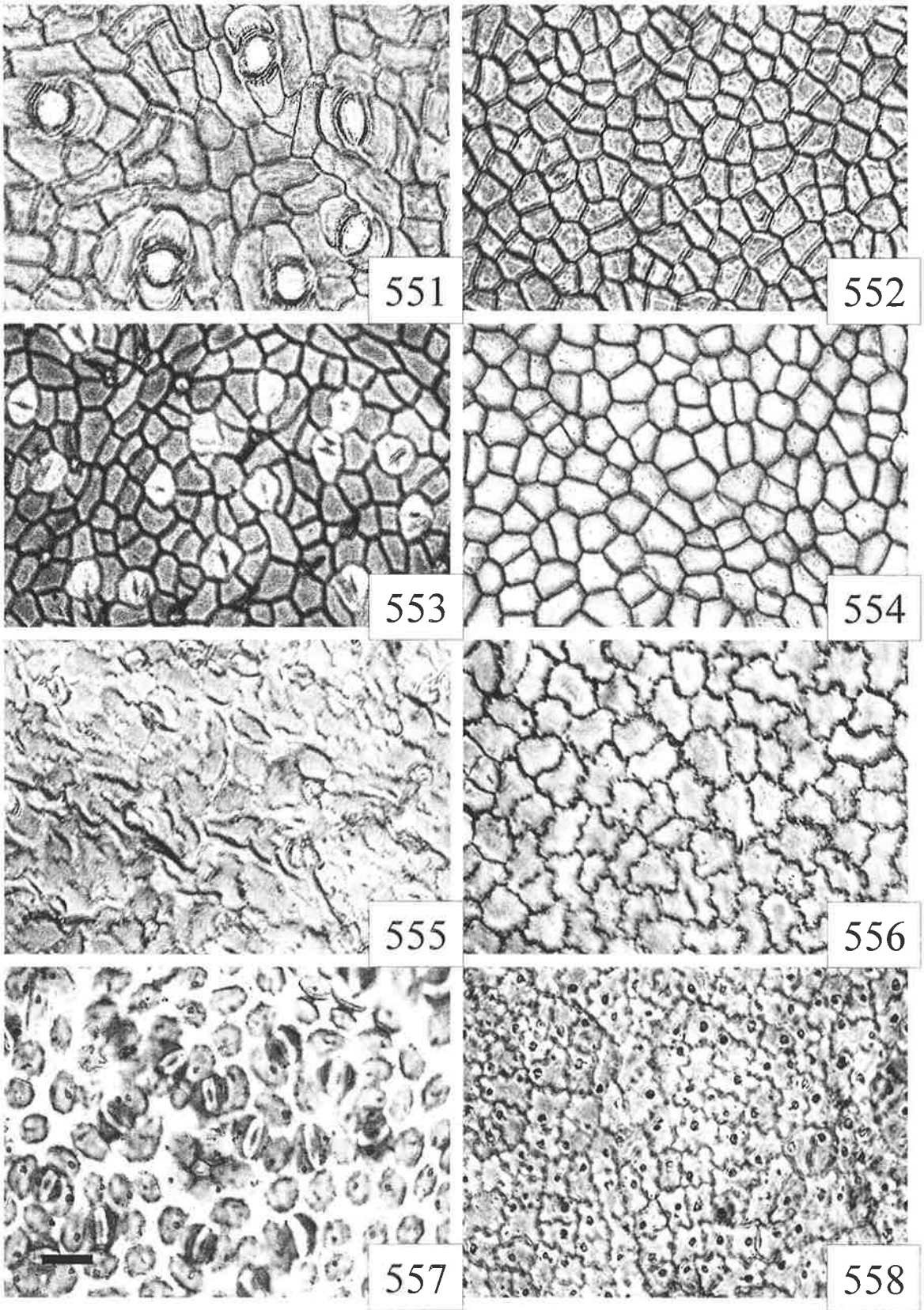
Plates 527-528: *L. monopetala*; plates 529-530: *L. morrisonensis*; plates 531-532: *L. moupinensis*; plates 533-534: *L. moupinensis* var. *szechuanica* . Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



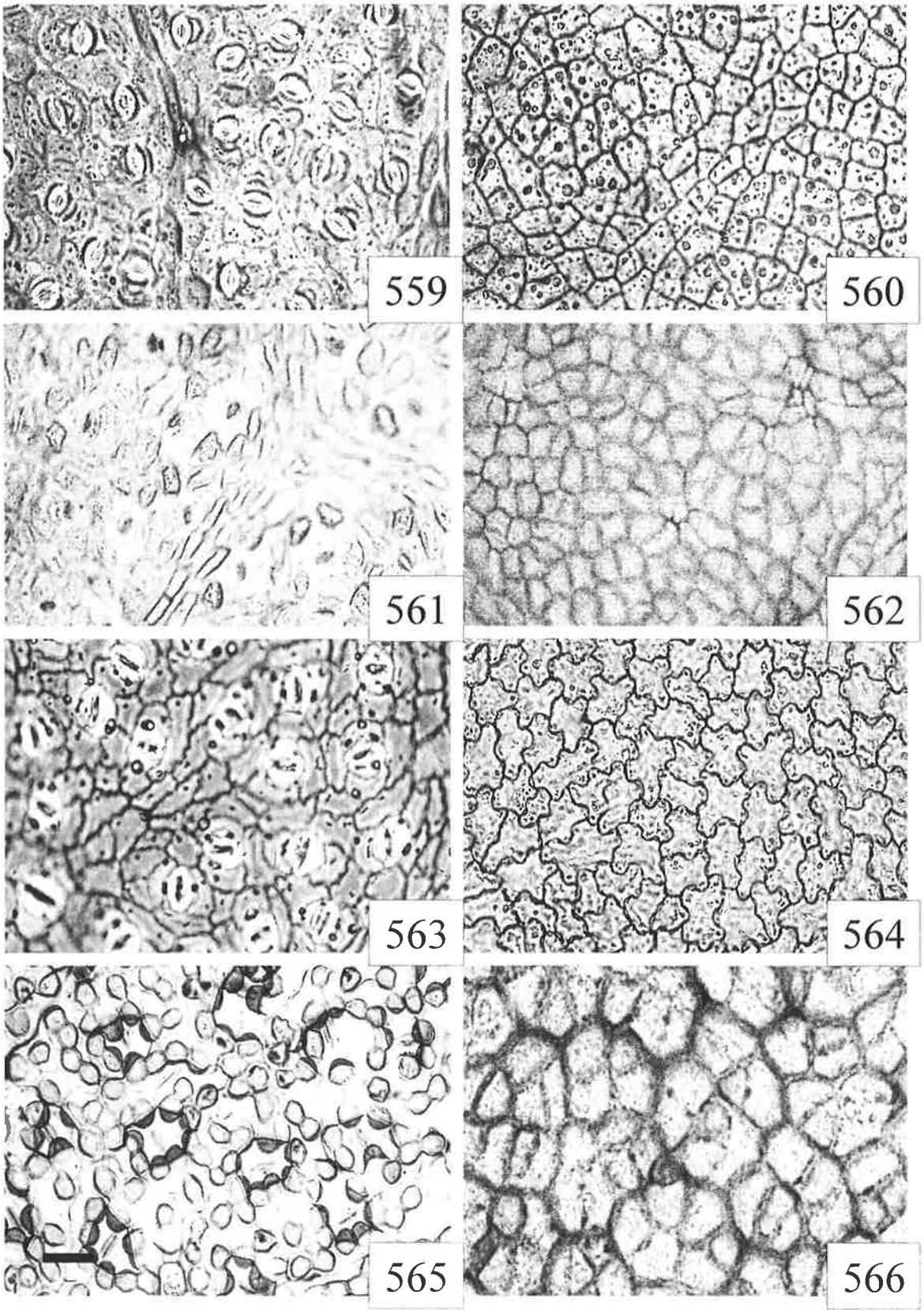
Plates 535-536: *L. nakii*; plates 537-538: *L. neesiana*; plates 539-540: *L. nidularis*; plates 541-542: *L. noronhae*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



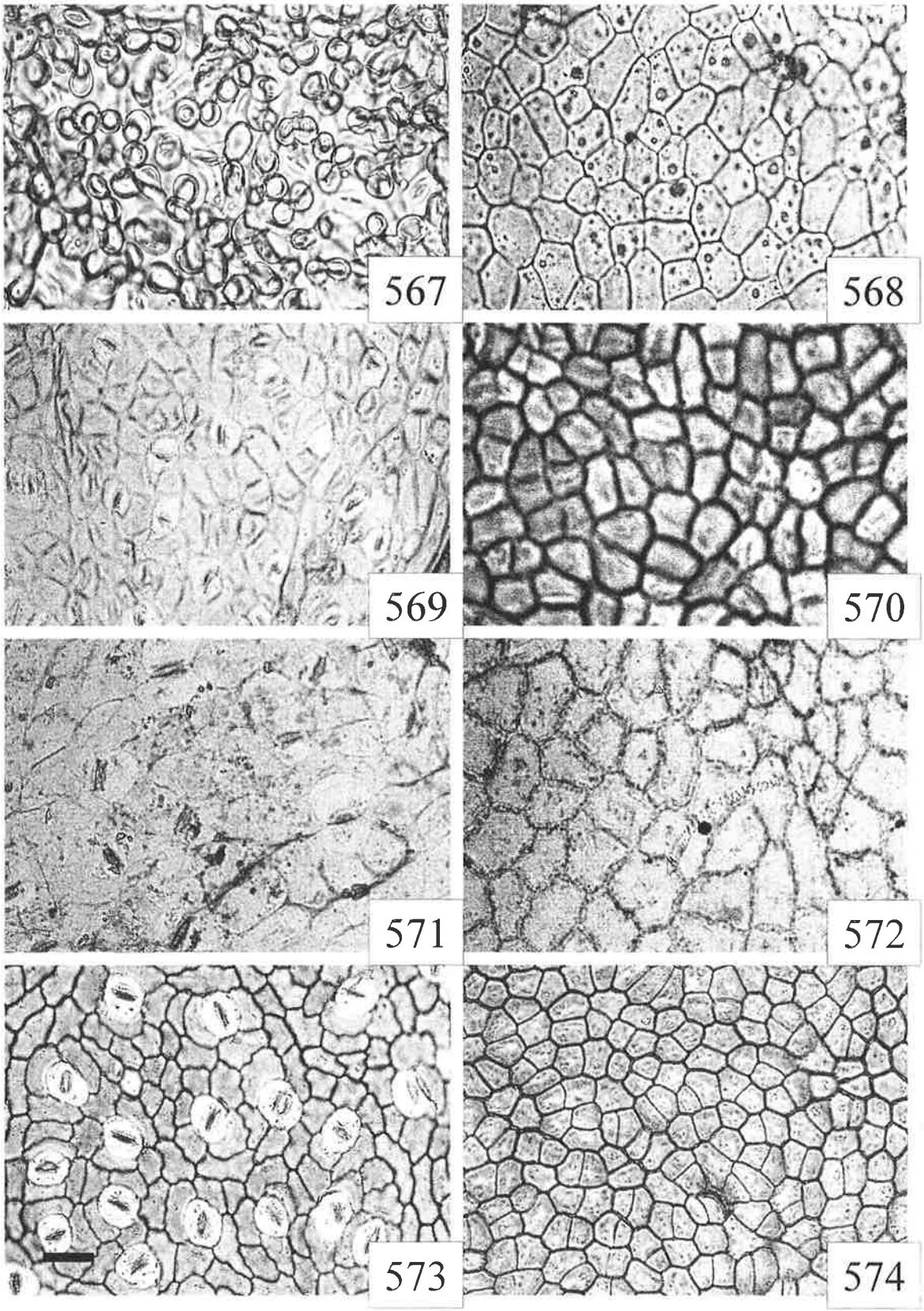
Plates 543-544: *L. ochracea*; plates 545-546: *L. oppositifolia*; plates 547-548: *L. orientalis*; plates 549-550: *L. pallidifolia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



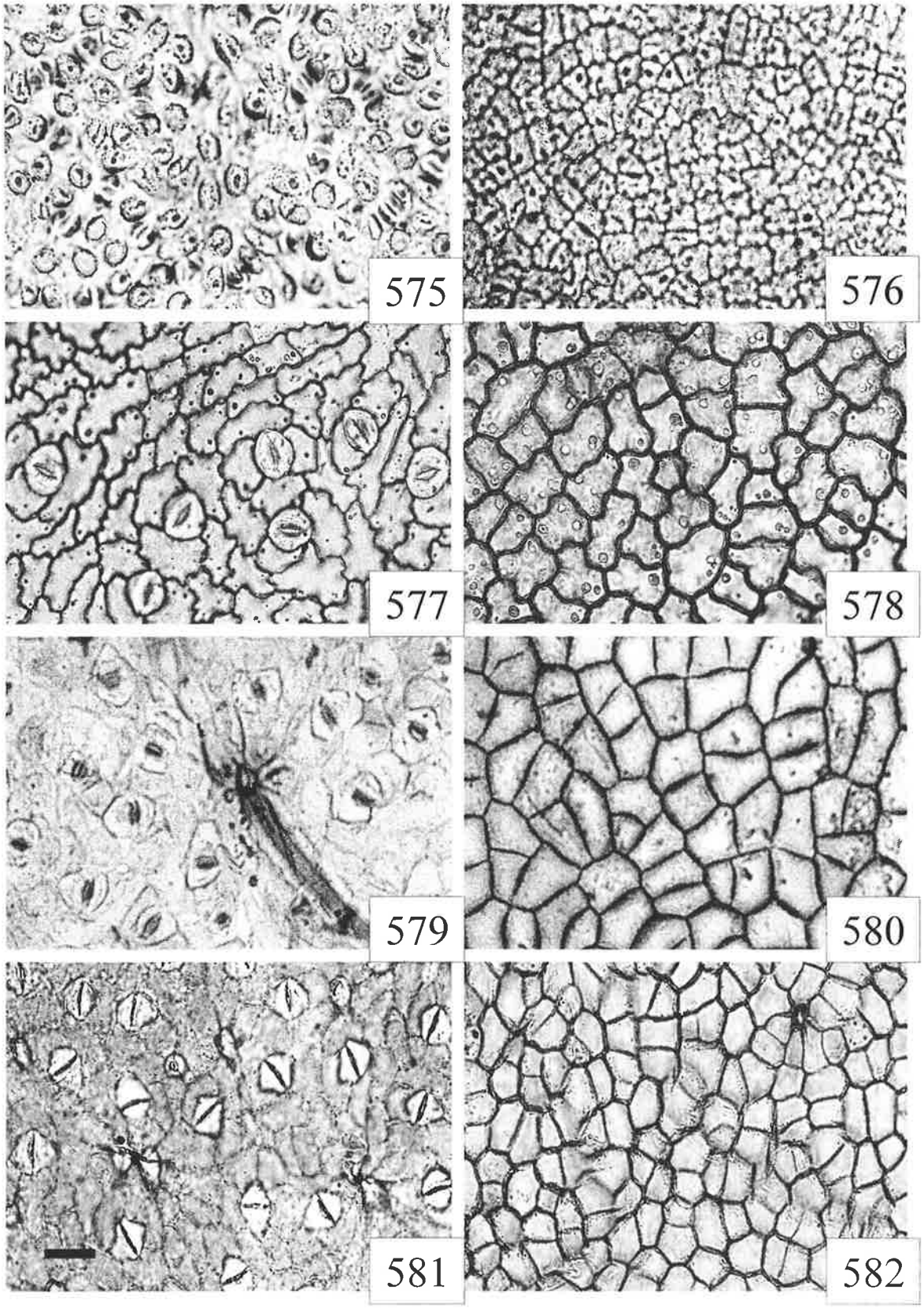
Plates 551-552: *L. palustris*; plates 553-554: *L. panamonja*; plates 555-556: *L. parvifolia*; plates 557-558: *L. pedunculata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 37 um.



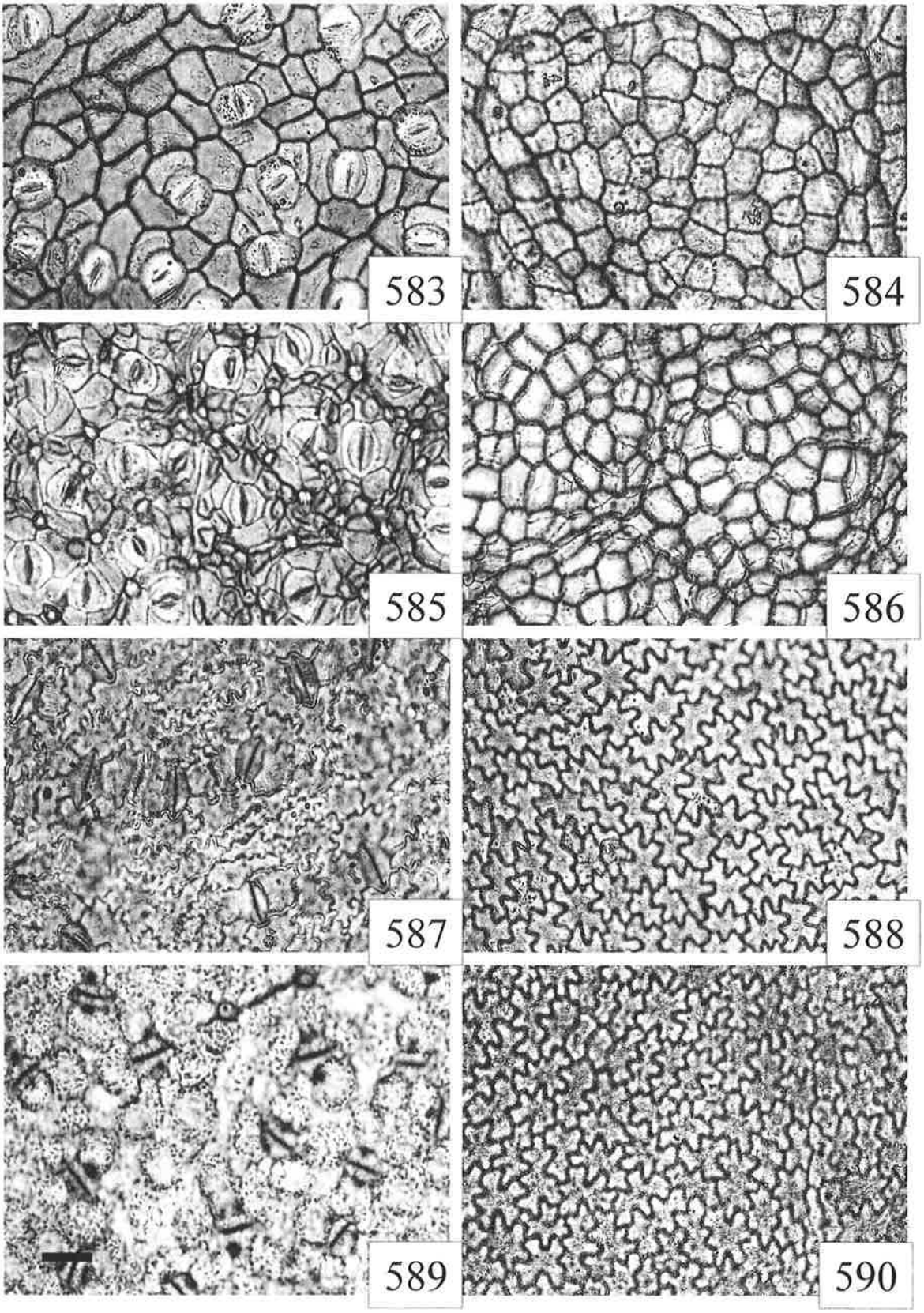
Plates 559-560: *L. pedunculata*; plates 561-562: *L. perrottetii*; plates 563-564: *L. philippinensis*; plates 565-566: *L. pierrei* var. *szemois.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



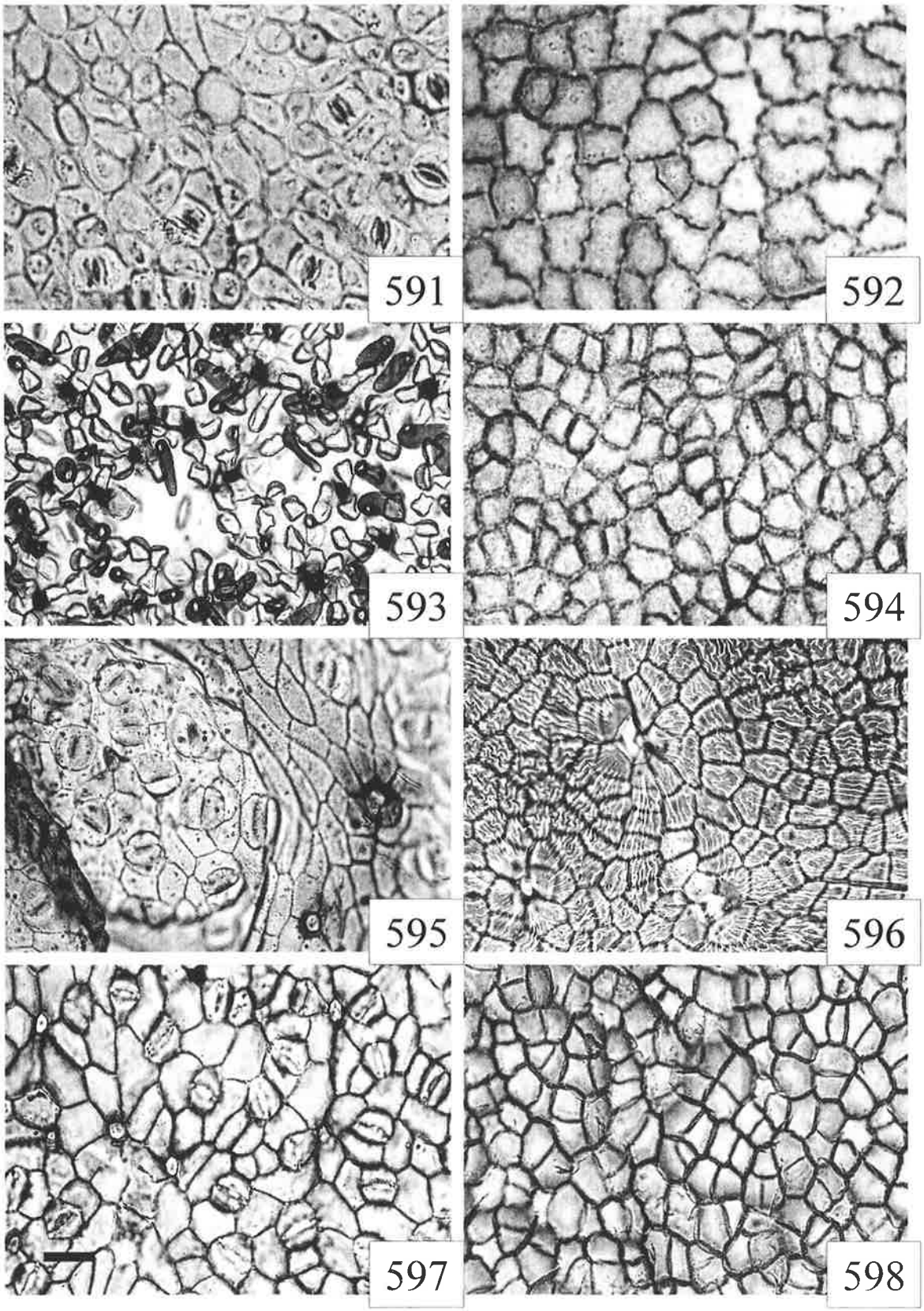
Plates 567-568: *L. pipericarpa*; plates 569-570: *L. polyantha*; plates 571-572: *L. populifolia*; plates 573-574: *L. pruriens.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 39 um.



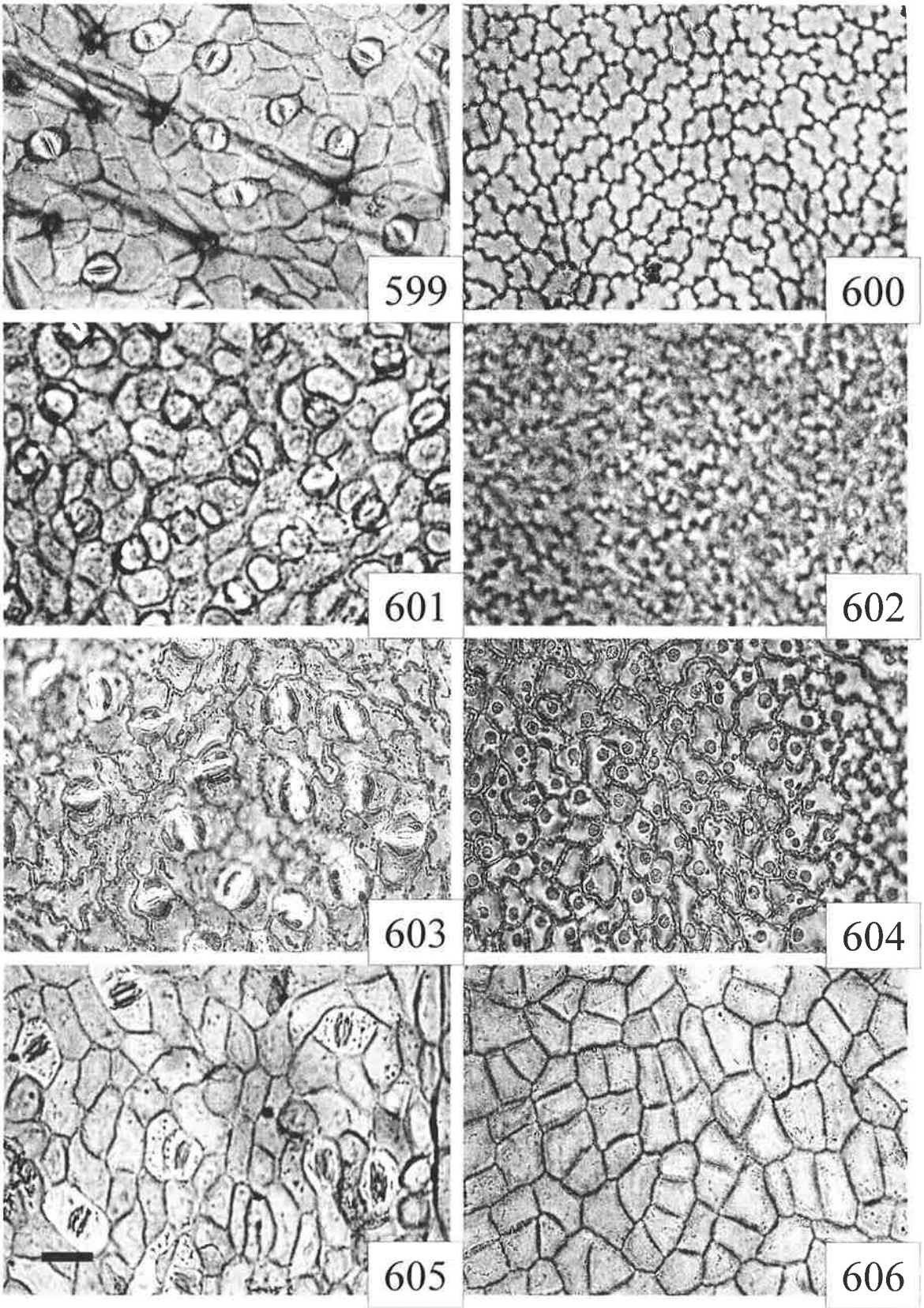
Plates 575-576: *L. pseudoelongata*; plates 577-578: *L. pumila*; plates 579-580: *L. pungens*; plates 581-582: *L. quercoides*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 41 um.



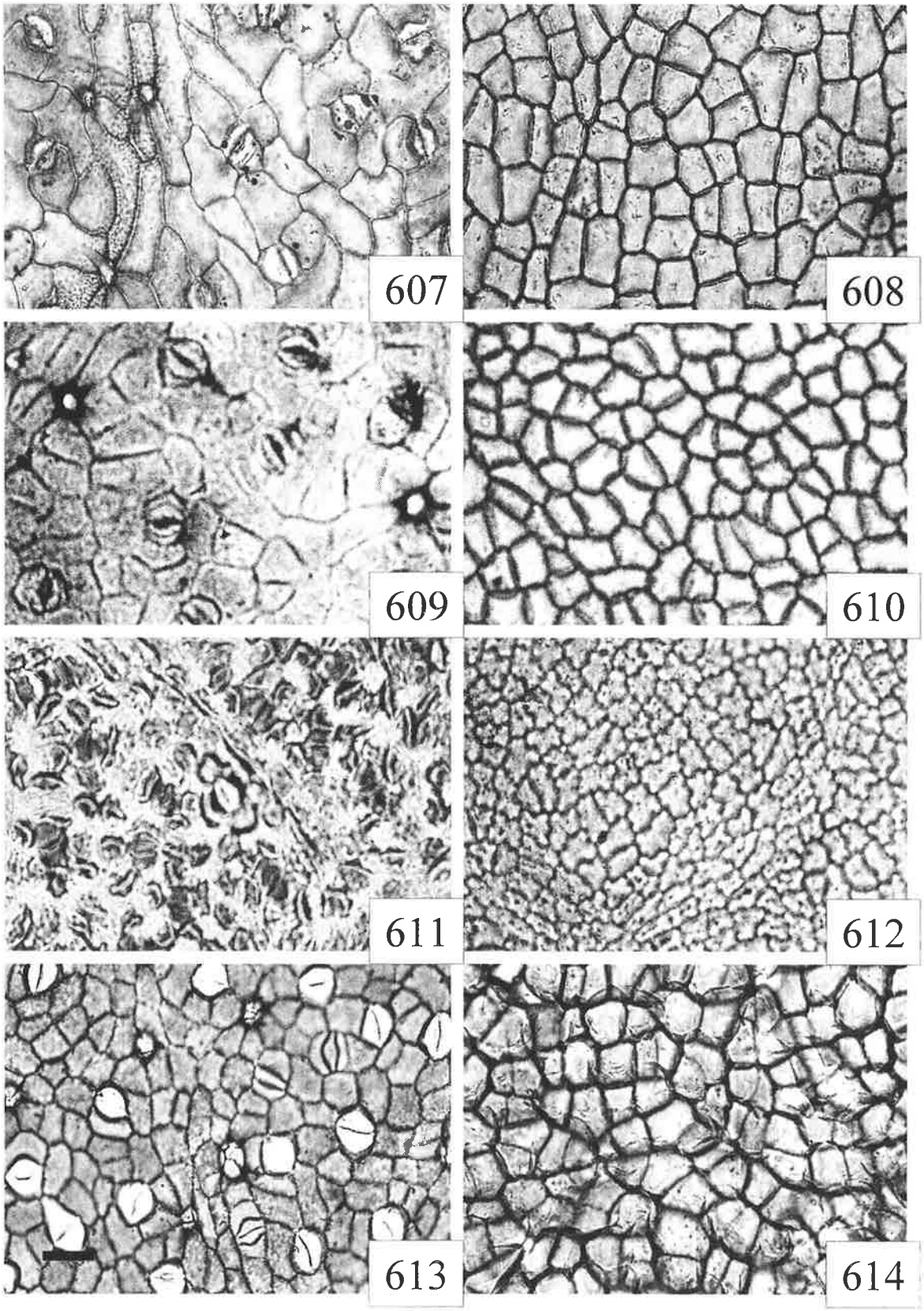
Plates 583-584: *L. resinosa*; plates 585-586: *L. robusta*; plates 587-588: *L. rotundifoli*; plates 589-590: *L. rotundifolia* var. *oblongifolia*. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 48 um.



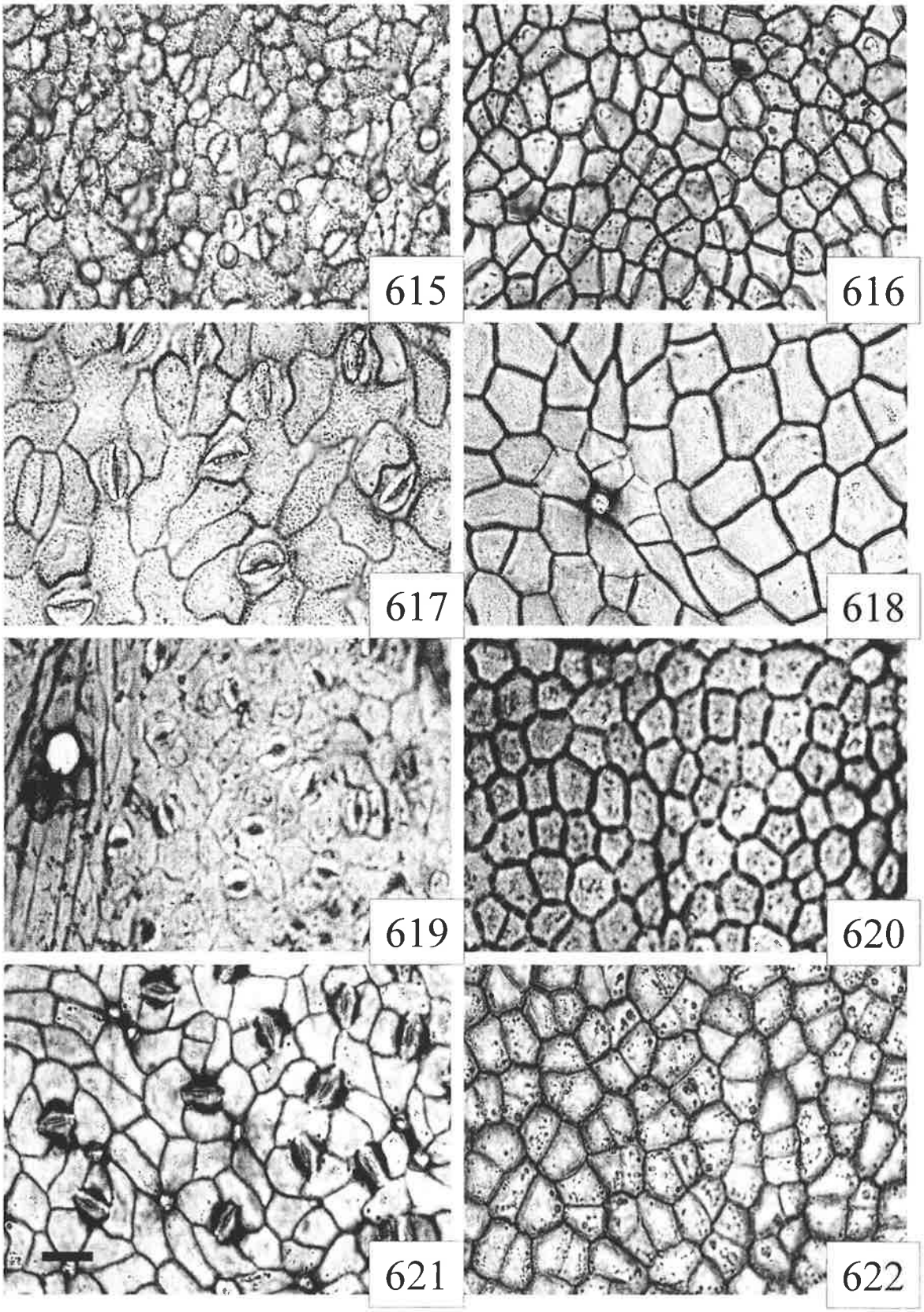
Plates 591-592: *L. rubescens*; plates 593-594: *L. rubicunda*; plates 595-596: *L. rufo-fusa*; plates 597-598: *L. rumphii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



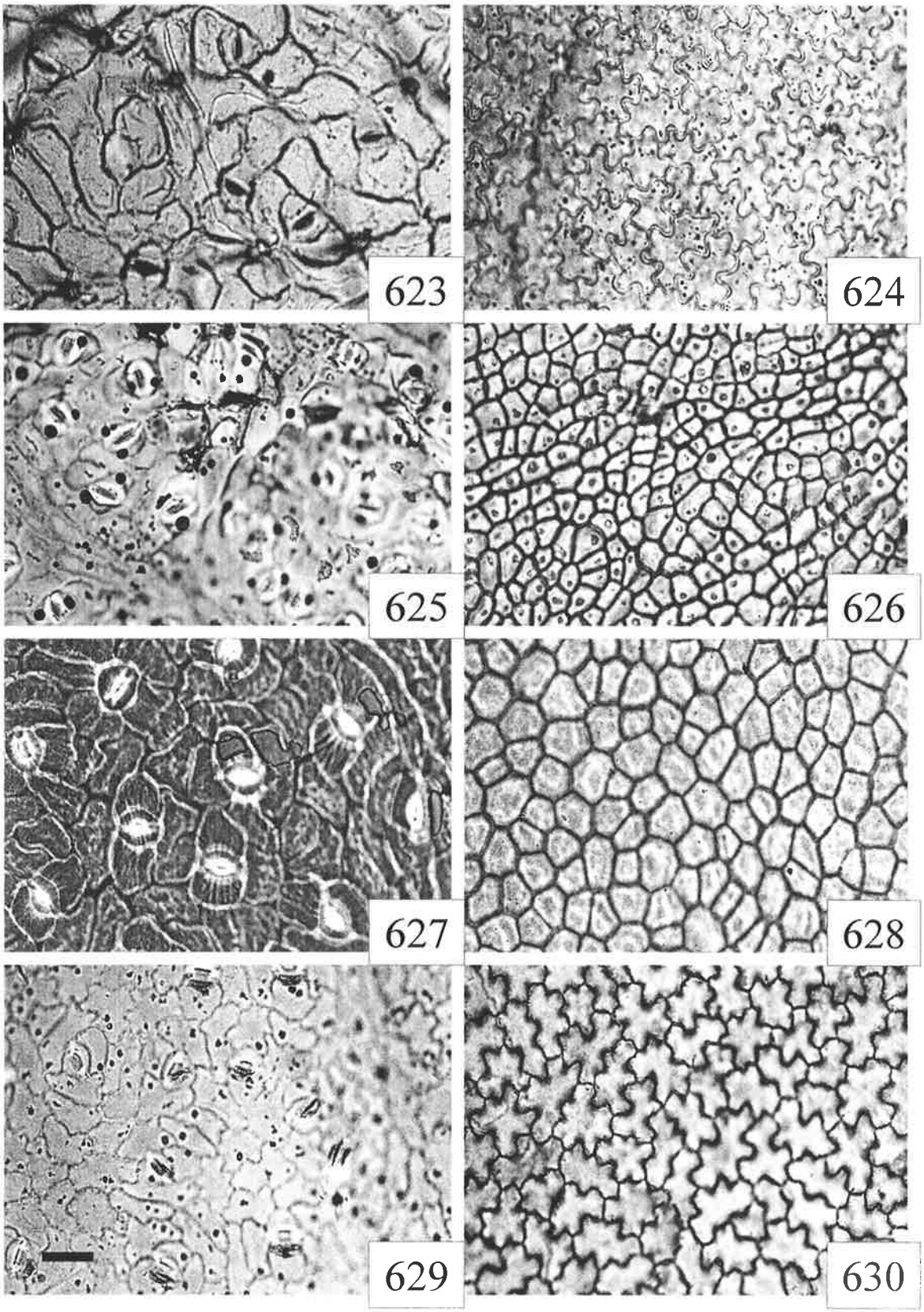
Plates 599-600: *L. salicifolia*; plates 601-602: *L. sasakii*; plates 603-604: *L. schaffneri*; plates 605-606: *L. sericea.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



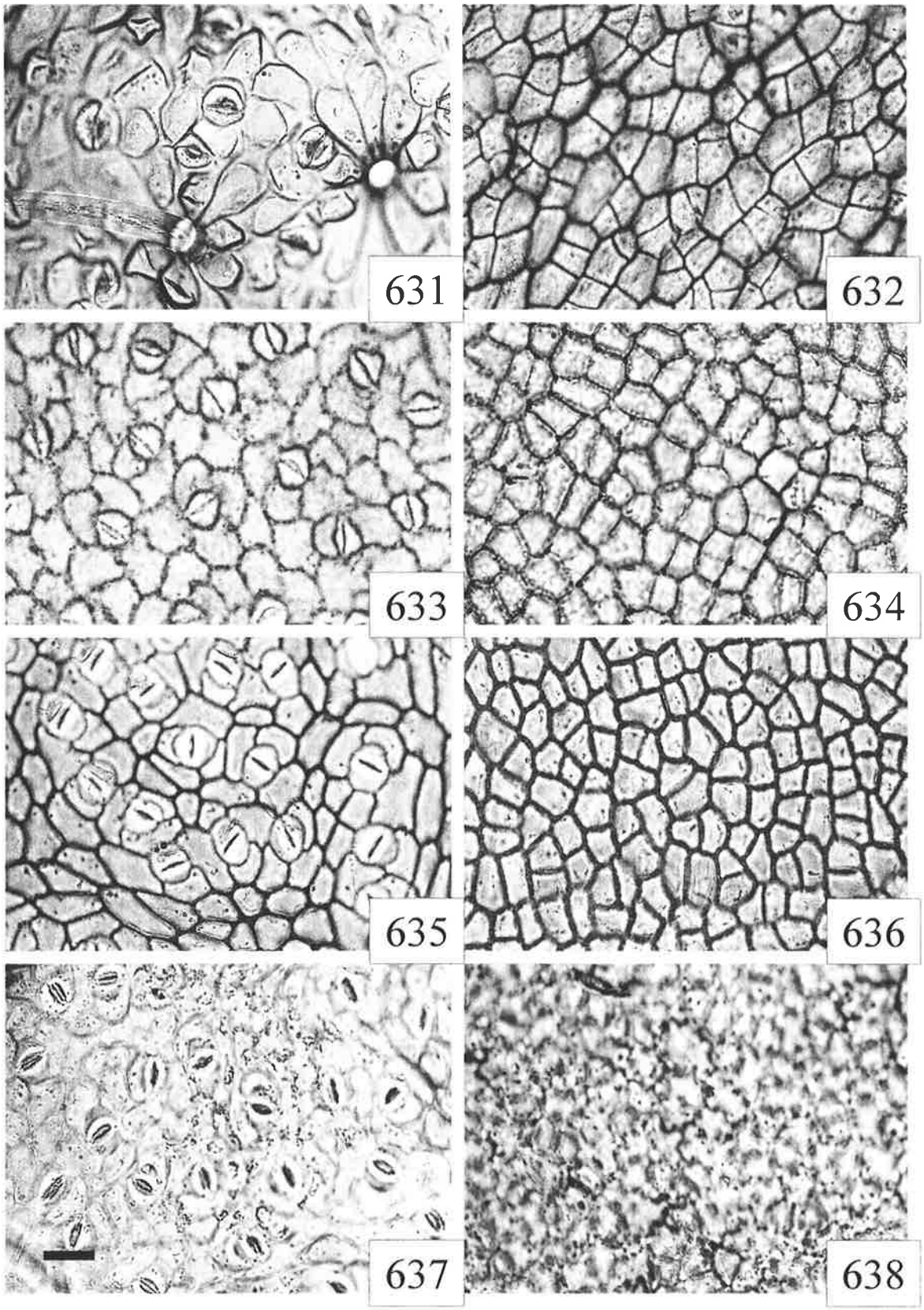
Plates 607-608: *L. singaporensis*; plates 609-610: *L. spathacea*; plates 611-612: *L. subcoriacea*; plates 613-614: *L. subovata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



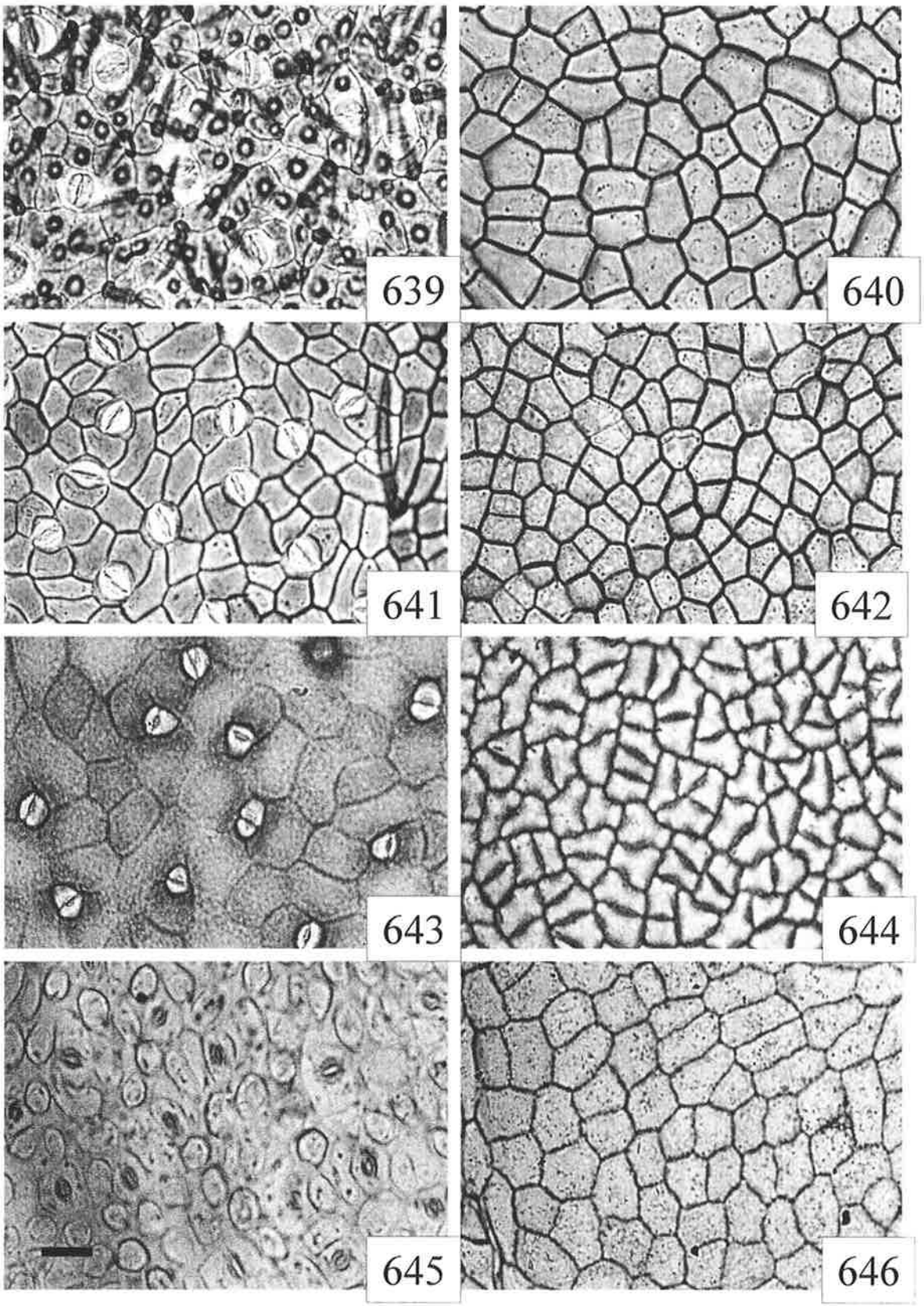
Plates 615-616: *L. sumatrana*; plates 617-618: *L. taronensis*; plates 619-620: *L. tibetana*; plates 621-622: *L. timoriana.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



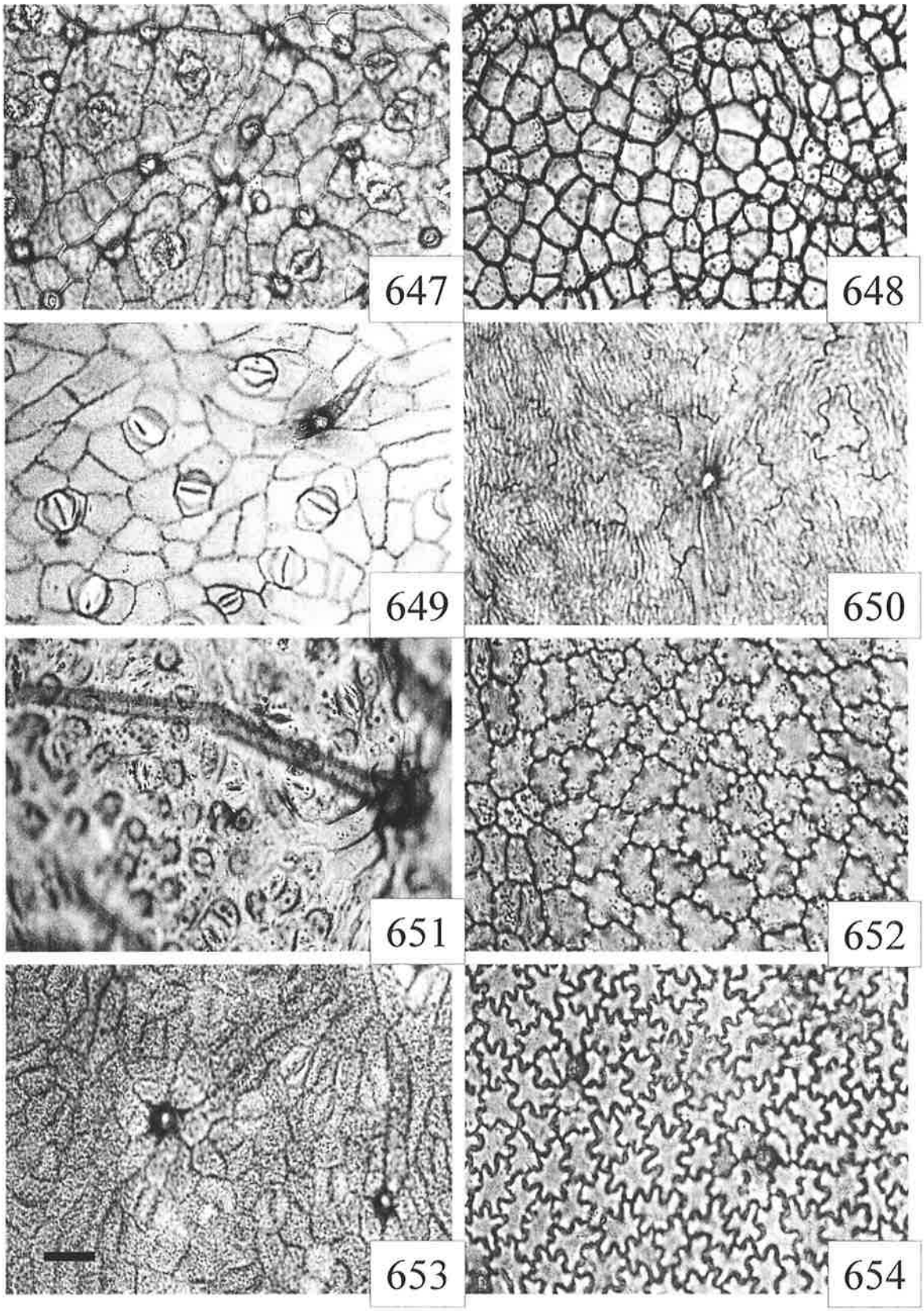
Plates 623-624: *L. tomentosa*; plates 625-626: *L. trichophylla*; plates 627-628: *L. triflora*; plates 629-630: *L. triplinervia.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



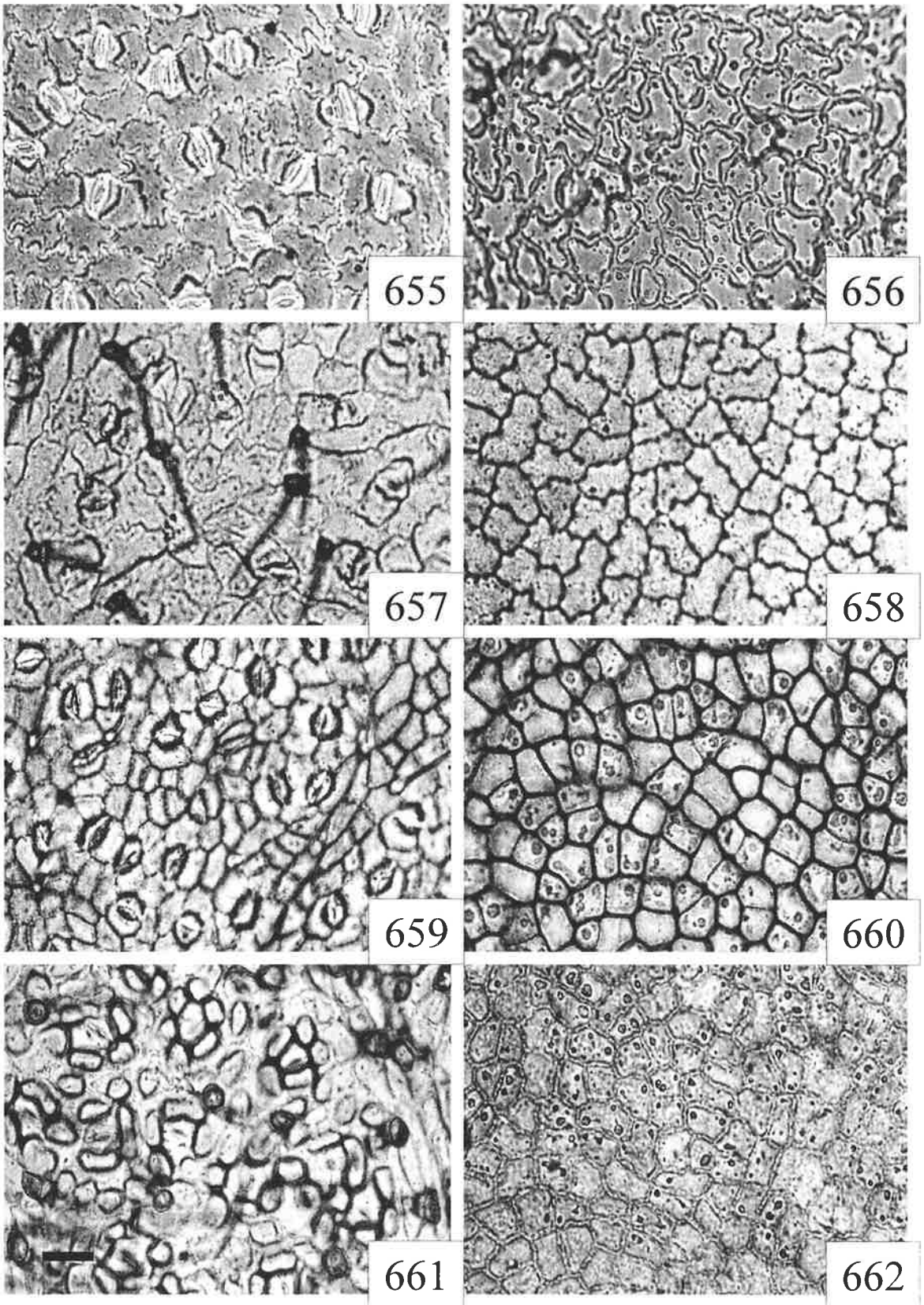
Plates 631-632: *L. trunciflora*; plates 633-634: *L. tuberculata*; plates 635-636: *L. turfasa*; plates 637-638: *L. umbellata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



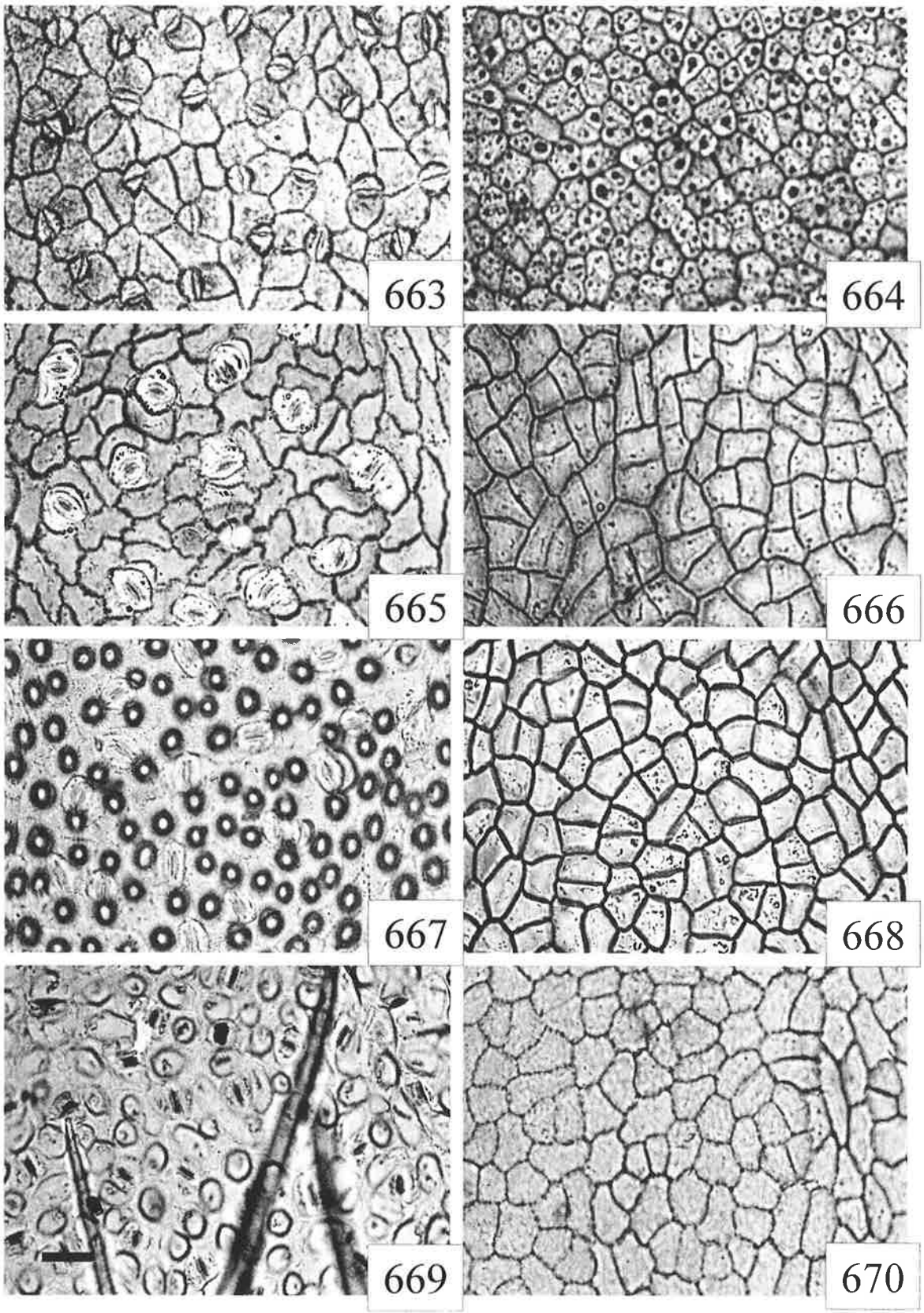
Plates 639-640: *L. vang* var. *lobata* ; plates 641-642: *L. variabilis*; plates 643-644: *L. varians*; plates 645-646: *L. veitchiana.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



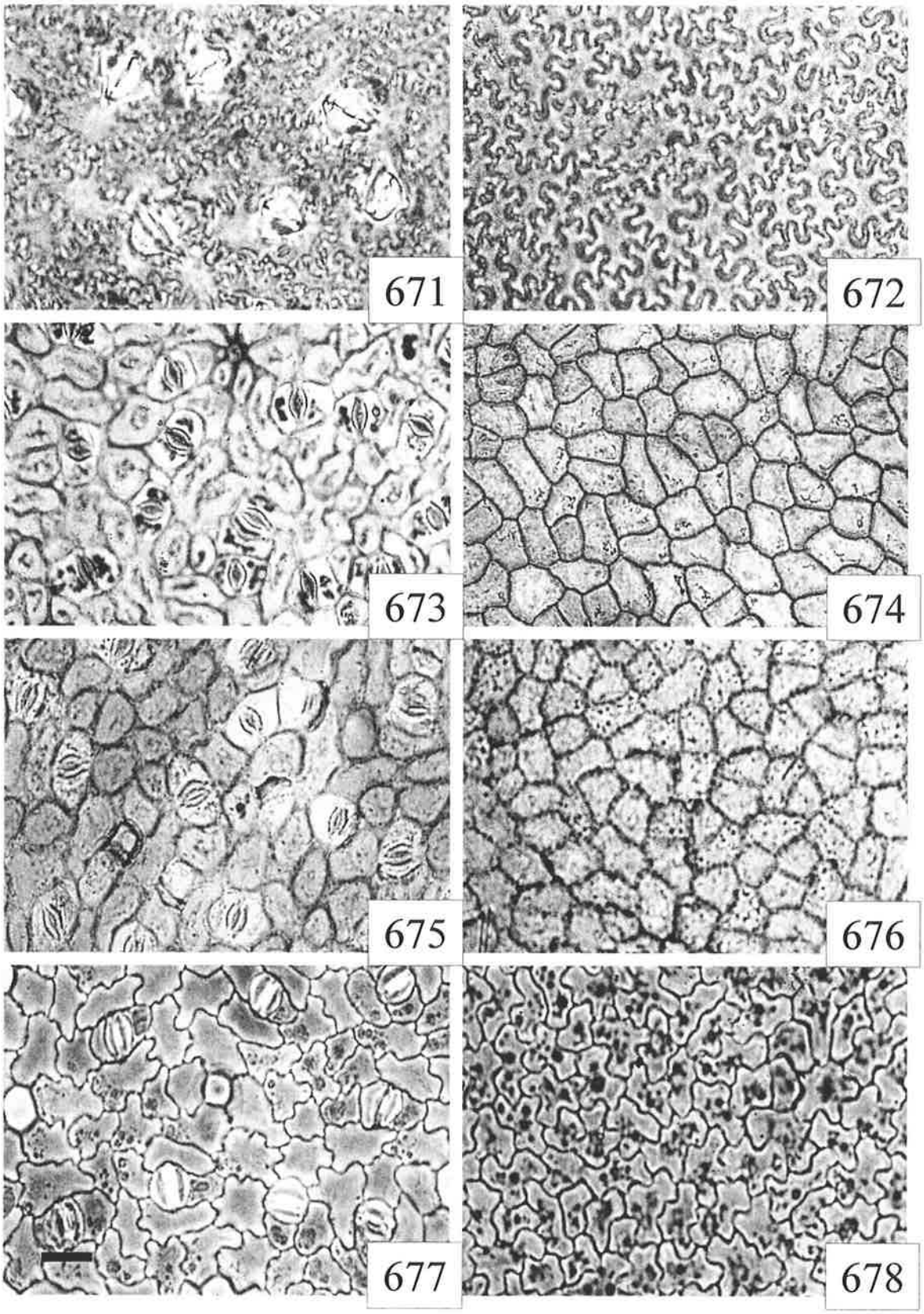
Plates 647-648: *L. velutina*; plates 649-650: *L. verruculata*; plates 651-652: *L. verticillata*; plates 653-654: *L. verticillata**. Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



Plates 655-656: *L. verticillifolia*; plates 657-658: *L. viridis*; plates 659-660: *L. walkeri*; plates 661-662: *L. wilsonii.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 38 um.



Plates 663-664: *Litsea yunnanensis*; plates 665-666: *Dodecadenia grandiflora*; plates 667-668: *D. grandiflora* var. *griffithi*; plates 669-670: *Iteadaphne caudata.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.



Plates 671-672:*Laurus nobilis*; plates 673-674:*Parasassafras convertiflora*; plates 675-676: *Sinosassafras flavinervia*; plates 677-678: *Umbellularia californica.* Left plates are abaxial surfaces; right plates are adaxial surfaces. Scale: 1 cm = 40 um.

Appendix I: Checked Specimens

1. Checked specimens in *Litsea*

Litsea accedens (Boerl.) Boerl.

Indonesia: Ranou, Poring / Nalamad (North Borneo), 3400 ft. alt., Oct. 19, 1961, M.A. Mujin (SAN 26719) (BO-0119383).

Litsea accedentoides Koord. & Valet.

Indonesia: Insular Java, Kds 32437 (BO-0119382).

Litsea acuminata (Bl.) S. Kurata

Japan: Pref. Okinawa, Isl. Ishigaki, Isl. Yaeyama: Mt. Omoto, Ishigoki-city, 1000-1500 m alt., in evergreen forest; Aug. 7, 1981, N. Fukuoka and M. Ito No. 251 (KUN-0103130). **Taiwan:** Nantou county, 1850 m alt., Mar. 22, 1984, Lu S.Y. 14336 (TAIF-068331); Taipei, Jan. 19, 1975, Lu S.Y. 3342 (TAIF-068329); Pingtung county, 1470 m alt., Jan. 9, 1984, Lu S.Y.s.n. (TAIF-068328); Ilang county, 600 m alt., Jul. 30, 1996, Liu C.K. 255 (TAIF-081006); Keelong City, 600-757 m alt., Apr. 28, 1997, Liu C.K. 611 (TAIF-084458); Botel Tobago (Formosa), Apr. 25, 1962, Chang C.E. 2952 (BO-0119378).

Litsea acutivena Hayata

China: Guangdong Prov., Xingping County, 800 m alt., Oct. 27, 1958, Deng L. 8202 (KUN-0103131); Guangdong Prov., Yingde County; Feb. 6, 1956, Deng L. 916 (KUN-0103132). **Taiwan:** Pingtung county, 300 m alt., Oct. 8, 1985, Lu S.Y. 17251 (TAIF-076294); Pingtung county, 420 m alt., Jun 24, 1993, Chen K.C. 190 (TAIF-077037); Taitung county, 100 m alt., Oct. 18, 1985, Lu S.Y. 17464 (TAIF-068338); Pingtung county, 1000 m alt., Jan. 8, 1984, Lu S.Y. 13927 (TAIF-065517); Pingtung county, Feb. 26, 1980, Lu S.Y. s.n. (TAIF-084120)

Litsea akoensis Hayata

Taiwan: Taipei County, Shihting, 100-300 m alt., Jul. 29, 1969, Y. Ando et al 39 (KUN-0103135); Nantou county, 1000 m alt., Lu S.Y. 16776 (TAIF-076328); Chiayi county, 300-500 m alt., Nov. 21 1995, Liao C.C. 1653 (TAIF-074039); Chiayi county, 1600 m alt., Lu

S.Y. 15086 (TAIF-085087); Chiayi county, 1000 m alt., Aug. 9, 1985, Lu S.Y. 16812 (TAIF-068252); Pingtung county, Dec. 6, 1995, Liu S.M. 163 (TAIF-075892).

Litsea akoensis var. *chitouchiaoensis* Liao

Taiwan: Kaohsiung county, 250 m alt., Chen K.C. 187 (TAIF-076695, 071873).

Litsea albescens (Hook. f.) D.G. Long

China: SE Tibet, Medog, Buqiong Lake, 1400 m alt., Nov. 14, 1992, ETM-1301 (KUN-0103180); Medog, Buqiong Lake, 1500 m alt., Nov. 11, 1992, ETM-1184 (KUN-0103179).

Litsea alveolata Allen

New Guinea: Bele River, 18 km NE of Lake Hambbema, 2200 m camp, 2450 m alt., Nov. 1938, L.J. Brass 11466 (BO-0104328).

Litsea ampla Merr.

Indonesia: Near Mansforbo Isle of Biok, Div. Geelvinkbay, 35 m alt., Nov. 16, 1959, V.W. Moll (BW 9576) (BO-0104329).

Litsea angulata Bl.

Indonesia: Kata F.R. near Sg. Telau, Ulu Lawas, 5th division, 145 ft. alt., Oct. 19, 1971, Ilias Paie (S. 27924) (BO-0104327).

Litsea angulata Villa

Indonesia: Borneo, PT. ITCI area, Balikapan, 700 m alt., Aug. 14, 1974, D. Darnaedi D. 457 (BO-0104326).

Litsea artocarpifolia Gamble

Indonesia: S. Borneo, Sampit R. Region, 30 m alt., Aug. 1, 1953, A. Kostermans 82057 (BO-0113274).

Litsea atrata S. Lee

China: Yunnan Prov., Jinghong to Xiaojie, Apr. 28, 1957, Sino-Russ. Exped. 9803 (KUN-0103110, KUN-0103111); Yunnan Prov., Pingbian County, 850 m alt. Jun. 22, 1956, Sino-Russ. Exped. 3678 (KUN-0103103); Yunnan Prov., Xishuangbanna Trop. Gard., Mar. 26, 1964, Li Y.H. 5233 (KUN-0103127).

Litsea aurea Kostermans

Indonesia: Ulu Mayeng, Kakus, 200 m alt., Aug. 17, 1964, Sibat ak Luang S. 21863 (BO-0104325).

Litsea auriculata Chien & Cheng

China: Zhejiang Prov., West Tianmushan, Jul. 27, 1936, H. Migo s.n. (KUN-0103159); Zhejiang Prov., West Tianmushan, Apr. 23, 1936, H. Migo s.n. (KUN-0103160).

Litsea balansae Lecomte

Vietnam: Samdao to Yongan, 400 alt., Feb. 9, 1965, Sino-Viet. Exped. 2147 (KUN-0103209). **China:** Yunnan Prov., Hekou County, Yunnan Uni. Exped. 2535 (KUN-0103165); Yunnan Prov., Hekou county, 200 m alt., Jul. 11, 1953, Liu W.X. 250 (KUN0103203).

Litsea barringtonioides Kostermans

Indonesia: $0^0$30'N, $117^0$20'E. East Kalimantan, East Kutai Reserve, <300 m alt., M. Leighton 57 (BO-0104385).

Litsea baviensis Lecomte

Vietnam: N Vietnam, 600m alt., Feb. 10, 1965, Sino-Viet. Exped. 2270 (KUN-0102167); N. Vietnam, Jan. 27, 1965, Sino-Viet. Exped. 1842 (KUN-0102162). **China:** Hainan Prov., Tingan county, Jan. 7, 1934, Liang X.R. 64323 (KUN-0102157).

Litsea beilschmiediifolia H.W. Li

China: Yunnan Prov., Pingbian County, 1700 m alt., Sep. 22, 1954, Feng K.M.4625 (KUN-0102002); Yunnan Prov., Jingping County, 1900 m alt., Mar. 21, 1962, Wu S.G. 3883 (KUN-0102005, Isotype); Yunnan Prov., Pingbian county, 1720 m alt., May 21, 1954, Mao P.Y. 04368 (KUN-0102003).

Litsea brachystachya Bl.

Indonesia: Insular Java, Kds. 40252 (BO-0119428).

Litsea caesifolia Elmer

Indonesia: N. Borneo, Penataran Basin, 3500 ft. alt., Jul. 27, 1933, J. & M.S. Clemens34148 (BO-0104330).

Litsea calophyllantha K. Schum.

Indonesia: Kouiser Wilhehmslands, (BO-0119427).

Litsea cassiaefolia Bl.

Indonesia: Insular Java, Kds 3639 (BO-0119426).

Litsea castanea Hook. f.

Indonesia: S. Sumatra, Lampung, Way Kambas, 10 m alt., Feb. 7, 1972, Muchtar 87A (BO-0118974).

Litsea caulocarpa Merrill

Malaysia: Bintulu (Sarawak), Labang F.R. Dec. 5, 1961, Ilias Paie, S 15867 (BO-0118975).

Litsea chinese Lam.

Indonesia: Kds 38739 (BO-0118973)

Litsea chinpingensis Yang et P.H. Huang

China: Yunnan Prov., Gongshan county, 1500-1700 m alt., Oct. 1, 1940, Feng 8112 (KUN-0102015, KUN-0102016, KUN-0102017); Yunnan Prov., Gongshan county, 1600 m alt., Sep. 22, 1956, Mao P.Y. 501 (KUN-0102022).

Litsea chunii Cheng

China: Yunnan Prov., Weixi county, 3000 m alt., May 10, 1940, Feng 3775 (KUN-0102148); Yunnan Prov., Zhongdian county, May 24, 1939, Feng 1021 (KUN-0102149); Yunnan Prov., Heqing county, 2800-3100 m alt., Sep. 30, 1958, Wang W.T. 312 (KUN-0102048, KUN-0102047).

Litsea chunii var. *latifolia* (Yang) H.S. Kung

China: Sichuan Prov., Aug. 14, 1938, Wang Tso-pin 8736 (KUN-0102223); Sichuan Econom. Plant Exped. 1322 (KUN-0102228).

Litsea chunii var. *likiangensis* Yang et P.H. Huang

China: Yunnan Prov., Likiang county, 3000 m alt., Aug. 7, 1959, Feng K.M. 22632 (KUN-0102250); Yunnan Prov., Liking county, 3140 m alt., Jun. 27, 1959, Feng 22269 (KUN-0102244); Yunnan Prov., Liking county, 3100 m alt., Jul. 28, 1959, Feng 22453 (KUN-0102247, KUN-0102248, KUN-0102249).

Litsea collina S. Moore

Indonesia: BO-0119425.

Litsea confusa Koord. & Valet.

Indonesia: Java 3061 (BO-0119424); Java, 540 m alt., M. Moga (BO-0119422); Java Res. Besoeki Panjoer-Idjerr (BO-0119423).

Litsea cordata Hook. f.

Indonesia: Borneo, Bukit Raya, Batu Bodinging, KCT 47 km, Feb. 7, 1983, Veldkamp 8576 (BO-24047).

Litsea coreana Lev.

Taiwan: Taichung county, 200 m alt., Chen K.C. 181 (TAIF-0077036); Taichung, 750 m alt., May 21, 1986, Lu S.Y. 19360 (TAIF-065347); Taichung county, Chen K.C. 147 (TAIF-071807); Taipei city, 700 m alt., Chen K.C. 162 (TAIF-071806); Taitung county, 920 m alt., May 20 ,1986, Lu S.Y. 19421 (TAIF-065348).

Litsea coreana var. *lanuginosa* (Migo) Yang et P.H. Huang

China: Jiangxi Prov., Jinggangshan, 800 m alt., Sep. 12, 1965, Lai S.K. 5017 (KUN-0106757); Jiangxi Prov., Nanping county, Apr. 25, 1958, Nie M.Q. & Lai S.K. 2343 (KUN-

0102194); Yunnan Prov., Shongming county, 2000 m alt., Nov. 15, 1957, Qiu B.Y. 55509 (KUN-0102172, KUN-0102173).

Litsea coreana var. *sinensis* (Allen) Yang et P.H. Huang

China: Zhejiang Prov. Tianmushan, Aug. 21, 1953, Hong T. & Geng 305 (KUN-0102276); Zhejiang Prov., Hanzhou, Putuoshan Exped. 1437 (KUN-0102287); Jiangxi Prov., Qiangshan county, 770 m alt., Aug. 17, 1958, Nie M.Q. & Lai S.K. 4172 (KUN-0102286)

*Litsea cubeba (*Lour.) Pers.

China: Yunnan Prov., Mong-ka, 1750 m alt., Feb. 6, 1934, Tsai 56811 (KUN-0102262); Yunnan Prov. Ershan county, 2350 m alt., Apr. 30, 1988, Ershan Exped. 88-171 (KUN-0102270); Yunnan Prov., Luoping county, 800 m alt., Nov. 23, 1984, Sun H. 0481 (KUN-0102087); Yunnan Prov., Menghai county, 1100 m alt., Jan. 17, 1982, Wu C.Y. Li X.W. & Bao S.Q. 82090 (KUN-0103376, 0103377). **Taiwan:** Nantou, 600 m alt., Apr. 24, 1985, Lu S.Y. 15878 (TAIF-068245); Miaoli county, 670 m alt., Feb. 11 1995, Wang C.M. & Li C.Y. 01444 (TAIF-077909); Nantou county, 770 m alt., Apr. 24, 1985, Lu S.Y. 15875 (TAIF-078143); Nantou county, 600-800 m alt., Jun. 10,1995, Liu S.M. 7 (TAIF-075922); Taipei county, 300 m alt., Feb. 18, 1995, Lu S.Y.24563 (TAIF-065409). **Indonesia:** Java, Houtsoorten van der Gadeh 499 (BO-0119420).

Litsea cubeba var. *obtusifolia* Yang et P.H. Huang

China: Hainan Prov., Baoting county, 3200 m alt., Sep. 13, 1935, Hou K.Z. 73662 (KUN-0101512).

Litsea cuprea Merrill

Indonesia: N. Borneo, Bochil Loengei-Foehil, Sep. 1912, Amdjah 669 (BO-0118972).

Litsea cylindrocarpa Gamble

Indonesia: W. Java, Sjiandjm. Kosheram 23003 (BO-0118971).

Litsea densiflora (Teschn.) Kosterm.

Indonesia: Celebes, central part, area of Mt. Nakilalaki, SE of Lake Lindu to Sidaunta, 800-1000 m alt., May 5, 1975, W. Meijer 10027 (BO-0118970).

Litsea dilleniifolia P.Y. Pai et P.H. Huang

China: Yunnan Prov., Changyuang county, 1050 m alt., Jul. 6, 1974, Li Y.H. 012623 (KUN-0101516); Yunnan Prov., Xishuangbanna, Menlun, 500 m alt., Apr. 17, 1960, Li Y.H. 001768 (KUN-0101513, typus); Yunnan Prov., Kenma county, Mar. 16, 1950, Li Y.H. 2274 (KUN-0101514).

Litsea diversifolia Bl.

Indonesia: W. Java, Mt. Salak, 1600 m alt., Sep. 1968, Kostermans s.n. (BO-0118969).

Litsea elliptica Bl.

Indonesia: Ensibau, Semirau, Kec. Jangkang, Kab. Sanggau, Jun. 18, 1994, S. Sudin & J. Mayer 055 (BO-0032403).

Litsea elongata (Wall. ex Nees) Benth. et Hook. f.

China: Yunnan Prov., Funing county, Oct. 12, 1964, Lin Z.W. 573 (KUN-0101562); Yunnan Prov., Chu-Hsiung, 1300 m alt., Sep. 24, 1939, Li M.K. 0191 (KUN-0101531); Yunnan Prov., Wenshan county, 2100 m alt., Aug. 29, 1961, Wu S.G. 61-3834 (KUN-0101517).

Litsea elongata var. *faberi* (Hemsl.) Yang et P.H. Huang

China: Sichuan Prov., Omei county, 2000 m alt., Sep. 16, 1957, Yang G.H. 57316 (KUN-0102468); Sichuan Prov., Nanchuan county, 650 m alt., Apr. 29, 1957, Li G.F. 60870 (KUN-0102471); Sichuan Prov., Omei county, Jul, 16, 1939, Sun S.L. 0699 (KUN-0102504); Yunnan Prov., Chaotong county, Oct. 6, 1958, Li X.W. 222 (KUN-0102399, KUN-0102400).

Litsea elongata var. *mushanensis* (Hay.) Liao

Taiwan: Taichung county, 2270 m alt., Mar. 21, 1984, Lu S.Y. 14323 (TAIF-065562); Taichung county, 1700-1800 m alt., Aug. 10, 1995, Chen C.H. et al 1285 (TAIF-080128); Miaoli county, 1300 m alt., Jan. 12, 1975, Lu S.Y. 3295 (TAIF-068248); Chiayi county, Oct. 10, 1979, Lu S.Y. s.n. (TAIF-065030); Nantou county, Feb. 18, 1993, Chen K.C. 83 (TAIF-077035).

Litsea elongata var. *subverticillata* (Yang) Yang et P.H. Huang

China: Sichuan Prov., Chongqing, Aug. 18, 1963, Wu C.Y. 63-33 (KUN-0102499); Sichuan Prov., Nanchuan county, 650 m alt., Mar. 29, 1957, Li G.F. 60270 (KUN-0104857).

Litsea engleriana Teschn.

New Guinea: Lake Trist, Morobe, 520o m alt., Feb. 10, 1967, J.S. Womersley NGF 24901 (BO-0119380).

Litsea erectinervia Kosterm.

Indonesia: BO-0119379.

Litsea euosma W.W. Sm.

China: Yunnan Prov., Jingping county, 480 m alt., Apr. 16, 1956, Sino-Russ. Exped. 672 (KUN-0102503); Yunnan Prov., Guannan county, 1500 m alt., Nov. 4, 1965, Wenshan Exped. 218 (KUN-0102516); Yunnan Prov. Tenchong county, Xiong 680950 (KUN-00102519); Yunnan Prov., Mengla county, 500 m alt., Aug. 22, 1959, Pei S.J. 59-9481 (KUN-0102530, KUN-0102531).

Litsea fenestrata Gamble

Indonesia: Borneo, San 40857 (BO-0104535)

Litsea ferruginea Bl.

Indonesia: Sg. Lebau, near Ramah Rapek, Upper Pelagae, Ulu Kapit, 7th division, Sep. 17, 1973, Paul Chai et al, S.33214 (BO-0118965).

Litsea firma Hook. f.

Indonesia: Bangha, 20 m alt., Sep. 12, 1949, Kostermans 587 (BO-119381).

Litsea formanii Kosterm.

Indonesia: Celebes, N. slope of G. Klabat, 600 m alt., Jun 28, 1956, L.L. Forman 271 (BO-0104534).

Litsea forestenii Boerl.

Indonesia: BO-0104539.

Litsea fulva (Bl.) Villar

Indonesia: Kata F.R. near Sg. Telau, Ulu. Lawas, 5th division, 1200 ft. alt., P.Chai & Ilias Paie S. 27932 (BO-0104533).

Litsea garciae Vidal

Taiwan: Taitung county, Lu S.Y. 17512 (TAIF-077322, 068335, 068334, 077323). **Indonesia:** E. O. Borneo. P. Laoer, N.O. v. Shagen, Nov. 6, 1920, van Sloten 2273 (BO-0119453).

Litsea garretti Gamble

China: Yunnan Prov., Jingdong county, 1100 m alt., Sep. 17, 1959, Xu S.G. 4956 (KUN-01000340, KUN-0100341); Yunnan Prov., Jingdong county, 1350 m alt., Mar. 26, 1959, Xu S.G. 3407 (KUN-01000342).

Litsea glauscencens H.B.& K.

Mexico: Canada de Mamacla. Dpto. Tepeji de Rodriguez, Apr. 5, 1982, F. Gonzalez Medrano 12357 (?); Between Oxaea and Valle National 40 km N of Ixtlan de Jurarez, 2740 m alt., Oct. 22, 1985, B. Bartholomew 3305 (KUN-0100416).

Litsea globosa Yang et P.H. Huang

China: Guangdong Prov. Nov. 22, 1930, Gao X.P. 50982 (KUN-0100557); Guangdong Prov., Liannan county, 150 m alt., Aug. 1, 1958, Tan P.Q. 58843 (KUN-0100556).

Litsea glutinosa (Lour.) C.B. Robinson

China: Yunnan Prov. Yun county, 1150 m alt., Sep. 25, 1958, Chen J 9 (KUN-0100438, KUN-0100437); Yunnan Prov., Mengla county, May 1959, Li Y.H. 01253 (KUN-0100470).

Taiwan: Chinmen County, Jan. 12, 1990, Chen K.C. 195 (TAIF-071840, 071838, 071839); Kinmen county, 100-253 m alt., Jun 14, 1995, Tai K.H. s.n. (TAIF-070594). **Indonesia:** Cult. In Hort. Bogor, Feb. 27, 1960, (BO-0118964).

Litsea glutinosa var. *brideliifolia* (Hay.) Merr.

China: Guangdong Prov., Xuwen county, Apr. 3, 1954, Xuwen Exped. 234 (KUN-0100563).

Litsea gonshanensis H.W. Li

China: Yunnan Prov., Gongshan county, 1340 m alt., Jan. 10, 1991, Dulongjiang Exped. 1679 (KUN-01000580); Yunnan Prov., Gongshan county, 1300 m alt., Feb. 7, 1991, Dulongjiang Exped. 3974 (KUN-0100587); Yunnan Prov., Gongshan county, 1320 m alt., May 4, 1994, Dulongjiang Exped. 6730 (KUN-0100725); Yunnan Prov., Gongshan county, 1300 m alt., Nov. 25, 1959, Feng 24398 (KUN-0100558 (typus), KUN-0100559).

Litsea gracilis Gamble

Indonesia: E. Borneo, E. Kutei, Sg. Nenubar region, 5 m alt., Jun. 6, 1951, S. Kostermans 5068 (BO-0118963).

Litsea grandis (Wall. ex Nees) Hook.f.

Indonesia: BO-24058.

Litsea greenmaniana Allen

China: Yunnan Prov., Wang C.W. 73799 (KUN-0100751); Yunnan Prov., Xishuangbanna, Menghai county, Feb. 23, 1957, Sino-Russ. Exped. 5078 (KUN-0100749); Guangdong Prov., Nanxiong county, 300-400 m alt., May 27, 1958, Deng L. 6198 (KUN-0100766).

Litsea greenmaniana var. *angustifolia* Yang et P.H. Huang

China: Guangxi Prov., Damiaoshan county, 900-1200 alt., Aug. 17, 1958, Cheng S.Q. 16271 (KUN-0100786); Guangxi Prov., Damiaoshan county, Aug. 3, 1958, Chen S.Q. 16020 (KUN-0100777, KUN-0100776); Guangxi Prov., Luochen county, 880 m alt., Jul. 17, 1958, Cheng S.Q. 14977 (KUN-0100781).

Litsea guppyi (F. Muell.) F. Muell. ex Forman

Indonesia: East of Sag, Sag near base of Mt. Talawe, Talasea, New Britain, 500 ft. alt., May 23, 1966, D. Frodin NGF 26774 (BO-0104536).

Litsea honghoensis Liou

China: Yunnan Prov., Wenshan county, 2000-2200 m alt., Aug. 20 1947, Feng K.M. 11355 (KUN-0100788); Yunnan Prov., Wenshan county, 2200 m alt., Sep. 24, 1958, Tsai H.T. 8072 (KUN-0100803, KUN-0100804); Yunnan Prov., Guannan county, Mar. 15, 1940, Wang C.W. 87841 (KUN-0100783).

Litsea honghoensis var. *megaphylla* H.W. Li var. nov. ined.

China: Yunnan Prov., Chanyuang county, 1250 m alt., Oct. 28, 1989, Tao G.D. & Li H.W. 882 (KUN-0100798); Yunnan Prov., Mengla county, 820 m alt., Dec. 18, 1988, Zhu H. 2169 (KUN-0100823).

Litsea hutchinsonii Merr.

Philippines: Mt. Halcon, Mindoro, Jan.-Feb. 1948, G.E. Edang 3328 (BO-0118962)

Litsea hypophaea Hay.

Taiwan: Pingtung county, 1000 m alt., Jan. 9, 1984, Lu S.Y. 14045 (TAIF-068253); Pingtung county, Apr. 8-10, 1989, Chiou W.L. s.n. (TAIF-065426); Taitung county, 900 m alt., Jan. 4, 1984, Lu S.Y. 14110 (TAIF-065425).

Litsea ichangensis Gamble

China: Hubei Prov., Xingshan county, May 27, 1957, Liu Y. 478 (KUN-0106978); Liu Y. 470 (KUN-0106979); Hubei Prov., Shennongjia Forest District, 1300 m alt., Sep. 1, 1980, Sino-Amer. Exped. 510 (KUN-0100821); Hubei Prov., Shennongjia Forest District, 2100 m alt., Sep. 3, 1980, Sino-Amer. Exped. 631 (KUN-?).

Litsea impressa Boerl.

Indonesia: Inl. Naam, Sund Thuru madam, Feb. 3, 1915, Houtsoorten van der Gadeh 34 (BO-0118961).

Litsea insignis Bl.

Indonesia: Ulu Lawas, 5th division, Paul Chai & Ilias Paie S. 30678 (BO-0118959).

Litsea irianensis Kosterm.

Indonesia: New Britain, Keravat, 150 m alt., Dec. 29, 1954, A. Floyd 6683 (BO-0118960).

Litsea japonica Juss.

Japan: Flora of Yakushima Is., Kagoshima Pref., Oct. 22, 1983, J. Murata, T. Yahara, F. Shimozono and H.T. Im 16041 (KUN-0100830).

Litsea javanica Bl.

Indonesia: Inl. Naam, Soend Ki-lemo, Houtsoorten van den Gadeh 274 (BO-0104527); Kds 3289 (BO-0119387).

Litsea johorensis Gamble

Indonesia: Comp 11A, Bakit Bauk Forest Reserve, Jul. 11, 1953, J. Sinclair 39896 (BO-0119386).

Litsea kobuskiana Allen

China: Guizhou Prov., Tsoong P.C. 1555 (KUN-0105000).

Litsea kostermansii C.E. Chang

Taiwan: Taoyuan county, 520 m alt, Sep. 24, 1991, W.L. Wagner 6646 (KUN-0100828).

Litsea krukovii Kosterm.

Taiwan: Pingtung county, 900 m alt., Chen K.C. 186 (TAIF-- 076693); Taipei county, 450-500 m alt., Aug. 21, 1996, Chiang H.L. 145 (TAIF-080953).

Litsea kwangtongensis H.T. Chang

China: Guangdong Prov., Longmen county, 880 m alt., Oct. 24, 1958, Wei Z.F. 121980 (KUN-0100827); Guangxi Prov., Ningming county, 1000 m alt., Oct. 9, 1958, Zhang Z.B. 12871 (KUN-0100826).

Litsea lanceolata (Bl.) Kosterm.

Indonesia: Bukit Raya, Kapit district, 3rd Division, 150 ft. alt., Apr. 2, 1969, Soepadmo, Smith & Chai S. 27624 (BO-0119385).

Litsea lancifolia (Roxb. ex Nees) Benth. et Hook. f. ex F.-Villar

China: Yunnan Prov., Fuhai, 1540 m alt., May, 1936, Wang C.W. 74028 (KUN-0100837), Wang C.W. 74175 (KUN-0100834); Yunnan Prov., Pingbian county, 800 m alt., Oct. 27, 1954, Feng K.M. 5207 (KUN-0100747); Yunnan Prov., Menghai county, 1700 m alt., Apr. 25, 1957, Sino-Russ. Exped. 9683 (KUN-0100910, KUN-0100911).

Litsea lancifolia var. *ellipsoidea* Yang et P.H. Huang

China: Yunnan Prov., Jingping county, May 19, 1953, Xu Y.C. 452 (KUN-0103721); Yunnan, Prov., Yuangyan county, 1100 m alt., Jun. 13, 1974, Luchun Exped. 1942 (KUN-0103712, KUN-0103713).

Litsea lancilimba Merr.

China: Yunnan Prov., Pingbian county, 1820 m alt., Oct. 7, 1954, Feng 4767 (KUN-0103740, KUN-0103739).

Litsea ledermanii Teschn

Indonesia: b.b.14297 (BO-0119384).

Litsea lii Chang

Taiwan: Pingtung county, 1600 m alt., Jan. 23, 1984, Lu S.Y. 14144 (TAIF-076234); Pingtung county, 1680 m alt., Jan. 23, 1984, Lu S.Y. 14163 (TAIF-076230); Pingtung, 1400 m alt., Apr. 23, 1995, Lu S.Y. 24714 (TAIF-067243); Taitung county, 620 m alt., Oct. 7, 1985, Lu S.Y. 17400 (TAIF-065509).

Litsea lii var. *munkao-tahangensis* (Liao) Liao

Taiwan: Pingtung, 1470 m alt., Jan. 9, 1984, Lu S.Y. 14017 (TAIF-068299); Pingtung county, Apr. 11, 1995, Lu S.Y. 4017 (TAIF-068293); Pingtung county, Jan. 9, 1984, Lu S.Y. 14015 (TAIF-068298); Pingtung county, 900 m alt., Jan. 21, 1984, Lu S.Y. 14109 (TAIF-068291, 068291); Kaohsiung county, Chen K.C. 64 (TAIF-071917).

Litsea longistaminata (Liou) Kosterm.

China: Yunnan Prov., Gengma county, 1600 m alt., Dec. 3, 1958, Zhu D.P. 453 (KUN-01-03793, KUN-0103794); Yunnan Prov., Longlin county, 1600 m alt., Dec. 21, 1933, Tsai 56682 (KUN-0103749); Yunnan Prov., Xishuangbanna, Mar. 20, 1963, Sino-Russ. 0041 (KUN-0103799); Yunnan Prov., Luxi county, Nov. 23, 1960, Yin W.Q. 1534 (KUN-0103766).

Litsea lucida Bl.

Indonesia: Borneo, Kayeli, K. 44 (BO-0104543).

Litsea luzonica (Bl.) F.-Vill.

Indonesia: N. Borneo, Kalawat, Apr. 8, 1950, M.R. Henderson S.F. No. 38967 (BO-0104537).

Litsea machilifolia Gamble

Indonesia: Borneo, Loa, Nen 791 (BO-0118968); Achmod 1042 (BO-0118958).

Litsea machiloides Yang et P.H. Huang

China: Guangdong Prov., Gaoyao county, Dec., 23, 1956, Huang C. 162639 (KUN-0103815).

Litsea magnoliifolia Yang et P.H. Huang

China: Yunnan Prov., Cheli county, 950 m alt., Sept. 1936, Wang C.W. 78654 (KUN-0103822); Yunnan Prov., Changyuang county, 850 m alt., Dec. 31, 1989, Tao G.D. et Li H.W. 40010 (KUN-0154279); Yunnan Prov., Gengma county, 740 m alt., Feb. 23, 1960, Li Y.H. 2133 (KUN-0103818, KUN-0103819).

Litsea mappacea Boerl

Indonesia: W. Java, 1500 m alt., Kostermans 3 (BO-0104542).

Litsea megacarpa Gamble

Indonesia: N. Borneo, Tawau, St. Lucia F.D., Kodir A 2072 (BO-0119389).

Litsea megalophylla Merrill

Indonesia: Tenompok, 5000 ft. alt., J. & M.S. Clemens 02854 (BO-0104538).

Litsea membranacea Elmer

Philippines: Luzon, Baguio, Benguet, Mar. 1907, A.D.E. Elmer 8961 (BO-0119388).

Litsea meyeri Kosterm.

Indonesia: BO-0119390.

Litsea micrantha Merrill

Indonesia: Mt. Mayo, Davao Province, M. Ramas, Mindanao, Apr.-May, 1927, R. Edano 49370 (BO-0119391)

Litsea microphylla Merrill

Indonesia: Inland San Teodoro at & above Subaan R., 800 m alt., Apr. 29, 1986, C.E. Ridsdale 1290 (BO-0119392).

Litsea mollis Hemsl.

China: Yunnan Prov., Shuijiang county, 900 m alt., May 31, 1973, Sun B.X. et al 0543 (KUN-0103835); Yunnan Prov., Guannan county, 1500 m alt., Nov. 4, 1964, Wu C.A 9714 (KUN-0103845); Hubei Prov., Lichuan county, Oct. 4, 1957, Fu G.X. and Zhang Z.S. 1805 (KUN-0106982).

Litsea monopetala (Roxb.) Pers.

China: Yunnan Prov., Hekou county, Apr. 6, 1953, Fang 3 (KUN-0105007); Yunnan Prov., Hekou county, May 24, 1953, Xiao 67 (KUN-0101714); Yunnan Prov., Hekou county, 150-250 m alt., Jun. 1953, Jiang X. 167 (KUN-0101701). **Indonesia:** BO-0118967; N. Sumatra, Medan, 20 m alt., Nov. 14, 1938, J.A. Lorzing 17364 (BO-0119393)

Litsea morrisonensis Hayata

Taiwan: Hualien county, 1000-1300 m alt., Lu S.Y. 18067 (TAIF-084449); Nantou county, 2900 m alt., Jan. 16, 1996, Chiu S.T. et al 03379 (TAIF-083578); Hualien county, 2100 m alt., Lu S.Y. 15016 (TAIF-?); Pingtung county, 2300 m alt., Jan. 24, 1984, Lu S.Y. 14267 (TAIF-076274); Kauhsiung county, Dec. 12, 1996, Liou C.K. 406 (TAIF-084415).

Litsea moupinensis Lec.

China: Sichuan Prov., Omei Mt., 1000-1800 m alt., Mar. 27, 1959, Beijing Instit. Exped. 00823 (KUN-0101761); Sichuan Prov., Maowen county, 1900 m alt., May 1, 1961, Water Exped. 7014 (KUN-0104834); Sichuan Prov., Baoxing county, Song S.P. 38738 (KUN-0101756, KUN-0101766

Litsea moupinensis var. *szechuanica* (Allen) Yang et P.H. Huang

China: Sichuan Prov., Omei Mt., Mar. 30, 1940, Cheng W. C. 10046 (KUN-0101771); Sichuan Prov., Kuan county, May 1930, Wang F.T. 2069 (KUN-0101819); Sichuan Prov., Pingshan county, 800 m alt., Jun. 1, 1959, Sichuan Exped. 0729 (KUN-0101800).

Litsea neesiana (Schouer) Hemsl.

Mexico: Chiapas, 1675 m alt., Sep. 27, 1981, D.E. Breedlove 53056 (KUN-0101825).

Litsea nidularis Gamble

Indonesia: N. Borneo, Sandoken, 100 m alt., Apr. 5, 1935, Castro 4484 (BO-0119431).

Litsea noronhae Bl.

Indonesia: Java, Fjipahoe by Builengarg, Aug. 14, 1896 (BO-0119429).

Litsea oppostifolia L.S. Gibbs

Indonesia: Indonesian border, Western Slopes of Bukit Tibang, 3500 ft. alt., Jul. 11, 1969, J.A.R. Aderson & Ilias bin Paie S. 28644 (BO-0104387).

Litsea paludosa Kosterm.

Indonesia: E. Borneo, Central Kutei, Apr. 2, 1955, A. Kostermans 10355 (BO-0104381).

Litsea palustris Kosterm.

Indonesia: Betong, Meludam Penis., Aug. 23, 1960, Haji Bajang 13032 (BO-0119421).

Litsea pedunculate (Diels) Yang et P.H. Huang

China: Guizhou Prov., Aug. 4, 1959, S Guizhou Exped. 3234 (KUN-0101871); Guizhou Prov., Kaili county, 1200 m alt., May 1, 1959, S Guizhou Exped. 1802 (KUN-0101864); Yunnan Prov., Pingbian county, 1160 m alt., Aug. 8, 1953, Mao P.Y. 2820 (KUN-0101880, KUN-0101881).

Litsea pedunculata var. *pubescens* Yang et P.H. Huang

China: Yunnan Prov., Pingbian county, 1700 m alt., Oct. 18, 1939, Wang C.W. 82591 (KUN-0101891).

Litsea perrottetii (Bl.) F.-Vill

Taiwan: Kaohsiung county, 100 m alt., Aug. 2, 1993, Chen K.C. 222 (TAIF-076523); Tsoong P.C. s.n. (TAIF-30492); Kaohsiung county, Jul. 15, 1993, Chen G.C. 200 (TAIF-071868). **Philippine:** Luzon, Province of Nueva Vizcaya, Mar.-Apr., 1912, R.C.McGregar 2-326 (TAIF-?); Luzon, Province of Cagayan, Jan-May, 1915, V. Velasco 2-26 (TAIF-?). **Indonesia:** E. Borneo, Talaud, Karake lang, 40 m alt., Apr. 25, 1926, H.J. Lam 2586 (BO-0104384)

Litsea philippinensis Merr.

Philippines: Catanduanes, Nov. 14-Dec. 11, 1917, M. Ramos 30514 (BO-0104376).

Litsea pierrei Lec. var. *szemois* Liou

China: Yunnan Prov., Fuhai, 1540 m alt., Jun. 1936, Wang C.W. 74326 (KUN-0101897); Yunnan Prov., Cheli county, 800 m alt., Oct. 1936, Wang C.W. 79516(KUN-?); Yunnan Prov., Mengla county, Apr. 6, 1959, Li Y.H. 1068 (KUN-0101905, KUN-0101900).

Litsea pipericarpa (Miq.) Kosterm.

Indonesia: N. Sumatra, c. 25 km SW of Blang Kedjeren, 2000-3000 m alt., Mar. 31, 1975, W.J.J.O.de Wilde & B.E.E. de Wilde-Duyfies 15939 (BO-0119433).

Litsea pollidifolia Merrill

Indonesia: N. Borneo, Krettam Besar, Elapura For. District, Sandakan, 70 m alt., Mar. 16, 1948, Anthony A 754 (BO-0104375).

Litsea populifolia (Hemls.) Gamble

China: Yunnan Prov., Daguang county, 1750 m alt., Sep.13, 1987, Frag. Exped. 870647 (KUN-0156234); Yunnan Prov., Yiliang county, 1973, Wu C.Y. 142 (KUN-0101915); Yunnan Prov., Zhengxiong county, Sep. 21, 1958, Li X.W. 193 (KUN-0101907).

Litsea pruriens Kosterm.

Indonesia: E. Borneo, Balikpapan Distr., Mentawir R. Region near G. Mentawir, 100 m alt., Mar. 1, 1955, A. Kostermans 10147 (BO-0119435).

Litsea pseudoelongata Liou

China: Hainan Prov., Wenchan county, May 24, 1954, E Hainan Exped. 362 (KUN-0101974).

Litsea pumila Kosterm.

New Guinea: Vagelkop Peninsula Nettoti Range, S slope of Mt. Nettoti, 1650 m alt., Nov. 30, 1961, P. Van Royen & H. Sleumer 7905 (BO-0119434).

Litsea pungens Hemsl.

China: Sichuan Prov., Hu S.Y. s.n. (KUN-0104829); Hu S.Y. (KUN-0104830); Sichuan Prov., Nanchuan county, 2050 m alt., Li G.F. 62590 (KUN-0164166).

Litsea quercoides Elmer

Philippines: Province of Sorsogon, Irosin (Mt. Balusan), May, 1916, A.D.E. Elmer 14067 (BO-0119430).

Litsea resinosa Bl.

Malaysia: Binatang, Palau Bruit, Sarawak, Jan. 1957, F.G. Rambli 4977 (BO-0119419); Bangha, Hobok, Besar, Oct. 5, 1949, A. Kostermans 1069 (BO-0119418).

Litsea robusta Bl.

Indonesia: BO-0118128.

Litsea rotundifolia Hemsl.

China: Guangxi Prov., Yining county, Jul. 19, 1958, Zhong S.Q. A61966 (KUN-0164305).

Litsea rotundifolia var. *oblongifolia* (Nees) Allen

China: Guangdong Prov., Huihan county, Sep. 4, 1958, Wei Z.F. 121571 (KUN-0102781). **Taiwan:** Nantou county, 780 m alt., Chen K.C. 226 (TAIF-071923, 076521); Nantou county, 670 m alt., Chen K.C. 213 (TAIF-076696); Taichung, 700-900 m alt., Oct. 26, 1983, Lu S.Y. 13268 (TAIF-068268, 077085).

Litsea rubescea Lec.

China: Yunnan Prov., Weixi county, 2500-2700 m alt., Apr. 27, 1940, Feng 3488 (KUN-0102926); Yunnan Prov., Weixi county, 1850-1900 m alt., May 4, 1940, Feng 3634 (KUN-0102927); Yunnan Prov., Weishan county, 2500 m alt., Jul. 8, 1984, Frag. Exped. 194 (KUN-0156223); Yunnan Prov., Wenshan county, 1700 m alt., Sep. 24, 1958, Tsai H.T. 58-8021 (KUN-0102823, KUN-0102824).

Litsea rubescea var. *yunnanensis* Lec.

China: Yunnan Prov., Zhenkan county, 2500 m alt., Jul. 22, 1938, Yu T.T. 16872 (KUN-0106078).

Litsea rubicunda Kosterm.

Indonesia: E. Borneo, Berau Tdg. Redeh, 0 m alt., Nov. 7, 1963, A. Kostermans 21639 (BO-0118127).

Litsea rufo-fusca Kosterm.

Malaysia: Sarawak, Tj. Keranji, Saribas, Dec. 15, 1967, J.A.R. Anderson S. 26695 (BO-0118126).

Litsea rumphii Boerl.

Indonesia: Jaheri 78 (BO-0118125).

Litsea salicifolia Hook.f.

Indonesia: BO-0118965.

Litsea schaffneri Bartlett

Mexico: Saan Luis Potasi, Municipio Guadalcazar, 169 km E of Charco Blanco, 1670 m alt., Oct. 28, 1985, Batholomew B. et al, 3580 (KUN-0106186).

Litsea sericea (Nees) Hook.f.

China: Yunnan Prov., Yangbi county, May 2, 1929, Qing R.C. 22490 (KUN-0106151); Yunnan Prov., Mekang-Salwin divide Sewalongha, 3400 m alt., Aug. 25, 1938, Yu T.T. 22481 (KUN-0106100); Yunnan Prov., Weixi county, 3050 m alt., Jul. 3, 1956, Mao P.Y. 25 (KUN-0106139, KUN-0106140).

Litsea singaporensis Gamble

Malay Peninsula: Sungai Kayu, E. Johore, Feb. 18, 1937, E.J.H. Corner SFN. 32286 (BO-0118955)

Litsea subcoriacea Yang et P.H. Huang

China: Guangxi Prov., Longshen county, 1100 m alt., 1955, Fulin Collect. 00949 (KUN-0164317); Guangxi Prov., Longshen county, Nov. 29, 1957, Li Z.T. et Chen Y.C. 600514 (KUN-0164301); Yunnan Prov., Jingdong county, 2200 m alt., Sep. 9, 1959, Xu S.G. 5395 (KUN-1006193, KUN-0106185).

Litsea subovata (Miq.) Kosterm.

Indonesia: Java 155 (BO-0118954).

Litsea sumatrana Boerl

Indonesia: Sumatra, Ayer Angat, foot of Koba Volcano, Palembang, 2500 ft. alt., H.O. Forbes 2864 (BO-0118953).

Litsea taronensis H.W. Li

China: Yunnan Prov., Gongshan county, 1350 m alt., Dec. 22, 1990, Dulongjiang Exped. 1272 (KUN-0106216).; Yunnan Prov., Gongshan county, 2200 m alt., Nov. 17, 1959, Feng 24309 (KUN-0106210, isotype); Yunnan Prov., Gongshan county, Dulongjiang, 1900 m alt., Jan. 10, 1991, Dulongjiang Exped. 1884 (KUN-0106214, KUN-0106213).

Litsea tibetana Yang et P.H. Huang

China: Tibet Prov., Medog county, 1260 m alt., Aug. 10, 1974, Qingzhang Exped. 1738 (KUN-0106250, KUN-0106238).

Litsea timoriana Span.

Indonesia: W. Flores, Manau near Ruteng, 1100 m alt., Apr. 24, 1965, Kostermans & Wirawan 491 (BO-0114541).

Litsea tomentosa Bl.

Indonesia: E. Borneo, Kutei nature-reserve, Bontang, 5 m alt., Mar. 23, 1970, A. Dilmy 1249 (BO-0118951).

Litsea triplinervia Bl.

Indonesia: E. Borneo, Sangasanga Region, 20 m alt., Aug. 2, 1952, Kostermans 7759 (BO-0104529).

Litsea trichophylla Kosterm.

Indonesia: W. Irian, near Inggembit, May 29, 1967, W. Soegeng Reksodihardjo 297 (BO-0118950).

Litsea trunciflora Gamble

Indonesia: Borneo, F.H. Endert 4199 (BO-0118949).

Litsea tsinglingensis Yang et P.H. Huang

China: Gangsu Prov., 1956, Yellow River Invest. 284 (KUN-0162001).

Litsea tuberculata Boerl

New Guinea: Lae, Morobe District, N.G.F. 4302 (BO-0118948).

Litsea turfosa Kostermans

Indonesia: Borneo, Goeroeng Klam, H. Hallier 2478 (BO-24067).

Litsea umbellata Merr.

China: Yunnan Prov., Xishuangbanna Trop. Gard., 560 m alt., Apr. 22, 1960, Li Y.H. 001847 (KUN-0106281); Yunnan Prov., Xishuangbanna Trop. Gard., Mar. 7, 1959, Li Y.H. 000797 (KUN 0106277); Yunnan Prov., Mengyang, 850 m alt., Mar. 25, 1957, Sino-Russ. Exped. 7542 (KUN-0106288, KUN-0106287). **Indonesia:** Java by Depok (BO-0118957); BO-0104540.

Litsea vang Lec. var. *lobata* Lec.

China: Yunnan Prov., Changyuang county, 790 m alt., May 26, 1974, Li Y.H. 011667 (KUN-0106266); Tibet Prov., Xiran, 1200 m alt., ETM-1813 (KUN-0106246, KUN-0106247).

Litsea variablis Hemsl.

China: Hainan Prov., Tongjia to Maoshanlin, Aug. 18, 1932, Cheng N.J. 43556 (KUN-0106251); Hainan Prov., Qongzhong county, 500 m alt., Nov. 27, 1956, Deng L. 3343 (KUN-0106258); Hainan Prov., Linshui county, 700 m alt., Nov. 19, 1956, Deng L. 3225 (KUN-0106259); Guangdong Prov., Xingyi county, Jun. 27, 1929, Jiang Y. 2645 (KUN-01008912); Guangxi Prov., Heng county, 250 m alt., Apr. 26, 1957, Chen Z.Z. 50330 (KUN-0100897).

Litsea variablis var. *ablonga* Lec.

China: Yunnan Prov., Funing county, 900 m alt., May 15, 1940, Wang C.W. 89254 (KUN-0100925); Yunnan Prov., Funing county, 600 m alt., May 15, 1940, Wang C.W. 89268 (KUN-0100923).

Litsea varians (Bl.) Boerl.

Indonesia: Beaufort, Sabah, Jul. 28, 1977, Talib Bidin SAN 84685 (BO-0104324).

Litsea veitchina Gamble

China: Sichuan Prov., Yangyuan county, 2800 m alt., Apr. 29, 1940, Water Exped. 5528 (KUN-0164135); Sichuan Prov., Luoning county, 2600 m alt., May 17, 1960, Water Exped.

5749 (KUN-0164134); Sichuan Prov., Maowen county, 2500-3000 m alt., Jul. 11, 1959, Sichuan Exped. 5134 (KUN-0106372).

Litsea velutina Boerl

Indonesia: Java, Kds 36763 (BO-0104323).

Litsea verruculata Koord. et Valet.

Indonesia: W. Java, Tjibeba, 1000 m alt., Jan. 11, 1969, Kostermans s.n. (BO-0104322).

Litsea verticillata Vidal

Philippines: Prov. Of Bataan, Lamao River, Apr. 1904, Thomas E. Borden 634 (BO-0104321).

Litsea verticillata Hance

China: Yunnan Prov., Sichou county, 1200-1300 m alt., Oct. 27, 1947, Feng 12199 (KUN-0106291); Yunnan Prov., Pingbian county, 1600 m alt., Mar. 29, 1958, Feng 21784 (KUN-0106302); Guangxi Prov., Ningming county, Oct. 9, 1958, Zhang Z.B. 12055 (KUN-0106335).

Litsea verticillatifolia Yang et P.H. Huang

China: Hainan Prov., Ledong county, Jul. 1, 1936, Liu X.C. 27383 (KUN-0106396).

Litsea viridis Liou

China: Yunnan Prov., Pingbian county, 410 m alt., Apr. 29, 1959, Mao P.Y. 03096 (KUN-0106390); Yunnan Prov., Pingbian county, 400 m alt., Nov. 23, 1953, Mao P.Y. 03135 (KUN-0106394); Yunnan Prov., Pingbian county, 400 m alt., Sep. 29, 1954, Feng K.M. 4726 (KUN-0106381).

Litsea wilsonii Gamble

China: Sichuan Prov., Omei Mt. 475 m alt., Jul. 25, 1940, Lee T.C 3018 (KUN-0104024); Sichuan Prov., Omei Mt., 1200 m alt., Feb. 27, 1940, Fang W.P. 13836 (KUN-0104008); Sichuan Prov., Omei Mt. May 6, 1939, Sun S.L. 97 (KUN-0104049).

Litsea yunnanensis Yang et P.H. Huang

China: Yunnan Prov., Pingbian county, 1600 malt., Nov. 28, 1953, Mao P.Y. 03230 (KUN-0104041, KUN-0104042, KUN-0104043); Yunnan Prov., Menghai county, Apr. 25, 1957, Sino-Russ. Exped. 674 (KUN-0104038).

2. Checked specimens in *Lindera*

Lindera aggregata (Sims) Kostermans

China: Guangdong Prov., Pingyuan county, 500 m alt., Apr. 4, 1957, Deng L. 3999 (KUN-0049242); Guangdong Prov. Nanxiong county, 600-700 m alt., May 25, 1958, Deng L. 6086 (KUN-0049243); Anhui Prov., Huangshan, Aug. 22, 1935, Liou T.N. & Tsoong P.C. 2951 (KUN-0049231, KUN-0049232, KUN-0049233).

Lindera angustifolia Cheng

China: Zhejiang Prov., Hanzhou, Mar. 29, 1959, Hanzhou Exped. 2008 (KUN-0106718); Zhejiang Prov., Hanzhou, Jun. 7, 1959, Hanzhou Exped. 2334 (KUN 0106716); Jiangsu Prov., Sep. 10, 1956, Liu F.X. et al. 2575 (KUN-0049316)

Lindera apoensis Elmer

Indonesia: BO-0104505.

Lindera assamica (Meisn.) Kurz.

Nepal: Shewaden-Papung, Aug. 22, 1977, H. Ohashi, H. Kanai, H. Ohba & Y. Tateishi 771048 (KUN-0049329). **Indonesia:** BO-0104506.

Lindera bensoin (L.) Blume

America: West Virginia, Brooke county, Apr. 20, 1980, D.E. Burfford & T. Shinizu 21896 (KUN-0049326); Pennsylvania, Armstrong county, Jun. 17, 1979, E.W. Wood, D.E. Bouford 4213 (KUN-0049335); Georgia, Murray county, 580 m alt., May 17, 1982, Chen X.Q., He S. A., Ying J.S. & Zhang A.L. 779 (KUN-0049334).

Lindera bibracteata Boerl.

Indonesia: W. Java, Gegerbintang ridge, 1500-1700 m alt., Mar. 15, 1954, W. Meijer 2727 (BO-0104549); N. Borneo, Mt. Nankok, 5500 ft. alt., Apr. 17, 1933, J.K.M.S. Clemens 32686 (BO-0104507).

Lindera cercidifolia Hemsl.

China: Sichuan Prov., Nanchuan county, 2100 m alt., May 25, 1953, Li G.F. 61585 (KUN 0151454); Sichuan Prov., Nanchuan county, 1750 m alt., Jun. 3, 1957, Li G.F. 61704 (KUN 0151453); Sichuan Prov., Nanchuan county, 1700 m alt., Jun. 27, 1957, Li G.F. 62412 (KUN-0151460).

Lindera chienii Cheng

China: Jiangsu Prov., 200 m alt., Oct. 20, 1956, Deng Y.B. 3663 (KUN-0049601); Anhui Prov., Chu county, Jul. 25, 1959, 448 (KUN-?)

Lindera chunii Merr.

China: Guangdong Prov., Luofushan, 2100 m. alt., Feb. 28, 1930, Gao X.P. 50136 (KUN-0049608); Guangdong Prov., Chonghua county, 480 m alt., Nov. 9, 1958, Deng L. 8359

(KUN-0049607); Guangdong Prov., Fengchuan county, 350-400 m alt., May 24, 1958, Huang C. 164019 (KUN-0049611).

Lindera communis Hemsl.

China: Yunnan Prov., Jingdong county, 1800 m alt., Aug. 17, 1959, Xu S.G. 5131 (KUN-0049629); Yunnan Prov., Jingdong county, 1300 m alt., Mar. 26, 1959, Xu S.G. 3411 (KUN 0049630); Yunnan Prov., Kunming, 1900 malt., Chu P.Y. 22 (KUN-0049651).

Lindera concima Rialey

Malay Peninsula: Pahang, Tahan, Jun. 16, 1922, SFN Mat Haniff & Noor 7996 (KUN-0104508).

Lindera cuspidata Boerl.

Indonesia: N.E. Celes, 500-600 m alt., Jun. 10, 1956, L.L. Farman 339 (BO-0104547).

Lindera dictyophylla Allen

China: Yunnan Prov., Menghai county, Feb. 22, 1957, Sino-Russ. Exped. 5055 (KUN-0150218); Yunnan Prov., 1500 m alt., Apr. 25, 1957, Sino-Russ. Exped. 9691 (KUN-0150214); S. Yunnan Prov., KUN-0150207.

Lindera erythrocarpa Makino

China: Zhejiang Prov., Taishun county, Jun. 7, 1959, Zhang S.R. 5594 (KUN-0106776); Hunan Prov., Wugan county, Oct. 16, 1963, Liu L.H. & He G.Z. 016255 (KUN-0150340); Jiangsu Prov., Yixing county, Jun. 23, 1962, Mao S.H. 49 (KUN-0150336); Guangxi Prov., Quan county, 840 m alt., Oct. 21, 1958, Chen Z.Z. 52524 (KUN-0164486).

Lindera floribunda (Allen) H.P. Tsui

China: Hunan Prov., Lanshan county, Tsoong P.C. 844 (KUN-0106778); Hunan Prov., Xingning county, 370 m alt., Nov. 14, 1962, Liu L.H. 15540 (KUN-0106777); Hunan Prov., Baojin county, 380 m alt., Sep. 30, 1958, Liu L.H. 1000 (KUN-0100679); Guizhou Prov., Anlong county, 1100 m alt., Jun. 9, 1960, Guizhou Exped. 3184 (KUN-0104793).

Lindera foveolata H.W. Li

China: Yunnan Prov., Xichou county, 1600 m alt., Dec. 13, 1964, Liu F.Y. 10010 (KUN-0150420); Yunnan Prov., Xichou county, 1730 m alt., May 20, 1964, Wang S.Z. 382 (KUN-0150424); Yunnan Prov., Xichou county, Dec. 13, 1964, Lin Z.W. 681 (KUN-0150419).

Lindera fragrans D. Oliver

China: Sichuan Prov., 1939, Liu & Wang. 386 (KUN-0104948); Sichuan Prov., Pa-Chwo Fu, 700 m alt., Oct. 1930, Wang F.T. 22675 (KUN-0150430); Sichuan Prov., 1280 m alt., Jun. 3,

1958, Zhang Z.R. 25081 (KUN-0150429); Hubei Prov., Badong county, Jun. 3, 1939, Wang T.P. 10793 (KUN-0150436).

Lindera fruticosa Hemsl.

China: Yunnan Prov., Gongshan county, 1400 m alt., Mar. 8, 1991, Dulongjiang Exped. 4620 (KUN-0150483); Yunnan Prov., Gongshan county, 1830 m alt., Mar. 6, 1991, Dulongjiang Exped. 4211 (KUN-01504520); Yunnan Prov., Gongshan county, 1400 m alt., Nov. 23, 1990, Dulongjiang Exped. 683 (KUN-0150465, KUN-0150456); Yunnan Prov., Gongshan county, 1400 m alt., Dec. 6, 1990, Dulongjiang Exped. 891 (KUN-0150462); Yunnan Prov., Shunning, 2780 m alt., Jul. 12, 1938, Yu T.T. 16716 (KUN-0151397); Sichuan Prov., Nanchuan county, 1380 m alt., Sep. 2, 1957, Li G.F. 63966 (KUN-0104915).

Lindera glauca (Sieb. et Zucc.) Bl.

China: Shangxi Prov., Jiangyan county, 1250 m alt., June 15, 1959, Li P.Y. 1770 (KUN-0150510); Shangxi Prov., Mienhsien, Apr. 26, 1943, Fu K.T. 4064 (KUN-0150514); Hubei Prov., Fan county, 1280 m alt., Aug. 28, 1959, Xie J.Q. 17857 (KUN-0106793).

Lindera glaucophylloides H.W. Li

Vietnam: Laojie, 20 m alt., Sino-Viet. Exped. 801 (KUN-0150759).

Lindera gracilipes H.W. Li

China: Yunnan Prov., Pingbian county, 800 m alt., Oct. 21, 1954, Feng 5110 (KUN-?); Yunnan Prov., Pingbian county, 900 m alt., Apr. 15, 1954, Mao P.Y. 03835 (KUN-?, isotype); Yunnan Pingbian county, 900 m alt., Sep. 19, 1954, Mao P.Y. 03923 (KUN-?).

Lindera heterophylla Meissn.

China: Yunnan Prov., Deqing county, Yang J.S. s.n. (KUN-0100013); Yunnan Prov., Gongshan county, 3100 m alt., May 12, 1960, Water Exped. 8391 (KUN-0100021); Yunnan Prov., Zhongdian county, 3100 m alt., Aug. 24, 1962, Zhongdian Exped. 1125 (KUN-0100026); Yunnan Prov., Lijiang county, 2900 m alt., Sep. 11, 1958, Wang W.C. 239 (KUN-0100006, KUN-0100008).

Lindera kariensis W.W. Smith

China: Yunnan Prov., Weixi county, Jun. 14, 1940, Feng 4546(KUN-0150767); Yunnan Prov., Zhongdian county, 3500 m alt., Jul. 23, 1939, Feng 1771 (KUN-0150764); Yunnan Prov., Aug. 30, 1938, Wu C.Y. 11593 (KUN-0150790). Tibet Prov. Salwin and Irrawady divid, Mt. Kenichunpo, May-Jul. 1932, J.F. Rock 22022 (KUN-0150778).

Lindera kariensis W.W. Smith f. *glabrescens* H.W. Li

China: Yunnan Prov., Weixi county, 2400 m alt., Jun. 2 1940, Feng 4351 (KUN-0150814); Yunnan Prov., Gongshan county, 2800-3000 m alt., Sep. 8, 1940, Feng 7650 (KUN-0150808); Yunnan Prov., 3600 m alt., May 24, 1964, Wu S.G. 6884 (KUN-0150810).

Lindera kwantungensis (Liou) Allen

China: Guangdong Prov., Xingyi county, Mar. 22, 1931, Huang Z. 31772 (KUN-0150833); Hainan Prov., Dingnan county, Jan. 17, 1934, Liang S.R. 64753 (KUN-0150832); Guangxi Prov., Damiaoshan county, 3000 m alt., Jul. 11, 1958, Chen S.Q. 14891 (KUN-0150825); Hainan Prov., Qiongzhong county, 200 m alt., Nov. 25, 1956, Deng L. 3243 (KUN-0150831).

Lindera latifolia Hook.f.

China: Yunnan Prov., Jingdong county, 1900 m alt., Mar. 28, 1940, Li M.K. 1955 (KUN-0150873); Yunnan Prov., Jingdong county, 1900 m alt., Nov. 6, 1963, Yang Z.H. 101439 (KUN-0150843); W. Yunnan, Qing R.C. 50501 (KUN-0150851); Yunnan Prov., Jingdong county, 2200 malt., Jan. 21, 1982, Wu C.Y., Li X.W. & Bao S.Q. 82135 (KUN-0150921).

Lindera limprichtii H.W. Winkler

China: Shangxi Prov., Luoyan county, 650 m alt., Oct. 31, 1958, Tang C.L. 873 (KUN-0151000); Shangxi Prov., Luoyan county, 1100 m alt., Mar. 30, 1963, Wang Z.B. 8678 (KUN-0150998); Gangsu Prov., Wenchan county, 1800 m alt., May 3, 1966, Wang Z.B. 19169 (KUN-0150991); Gangsu Prov., Wenchan county, 1800 m alt., Sep. 19, 1958, Zhang Z.Y. 965 (KUN-0150992); Sichuan Prov., Mao county, 2100 m alt., Jul. 30, 1930, Wang F.T. 21967 (KUN-0151002).

Lindera longipedunculata Allen

China: Yunnan Prov., Tason-Taru Divid, 2300 m alt., Nov.5, 1938, Yu T.T. 20986 (KUN-0151029); Yunnan Prov., Gongshan county, 2200 m alt., Nov. 17, 1959, Feng 24304 (KUN-0151028); Yunnan Prov., Lanyashan, Jun. 7, 1964, Wu S.G. 7082 (KUN-0151026).

Lindera lucida Boerl

Indonesia: J.A. Larzing 6904 (BO-0104510); N. Borneo, Myburgh Prov., Sandakan, A.D.E. Elmer 20352 (BO-0104509); Gunung Sabampolulu, Kabaena, Jul. 27, 1993, McDonald & Ismail 4000 (BO-0104511).

Lindera lungshengensis S. Lee

China: Guangxi Prov., Longshen county, 1660 m alt., Jul. 19, 1955, Guang-Fu Forrest Exped. 00915 (KUN-0151052); Guangxi Prov., Longshen county, Jun. 27, 1958, Cheng Z.Z. 51083 (KUN-0164506).

Lindera megaphylla Hemsl.

China: Hunan, 650 m alt., Oct. 12, 1958, Liu L. H. 10038 (KUN-0151128); Hunan, 750 m alt., Oct. 13, 1958, Liu L.H. 10052 (KUN-0151127); Hubei Prov., Shenlongjia Forest district, 750 malt., Sep. 29, 1980, Sino-Amer. Exped. 1900 (KUN-0151131).

Lindera megaphylla f. *trichoclada* (Rehd.) Cheng

China: Yunnan Prov., Xichou county, 1360 m alt., Dec. 6, 1961, Wu Q. A. 097 (KUN-0151160); Yunnan Prov., Shiping county, 2400 m alt., Dec. 2, 1958, Wu S.G. 957 (KUN-0151151); Guizhou Prov., Zunyi, Mar. 27, 1928, Tsoong P.C. 331 (KUN-0104795).

Lindera melastomacea (Nees) Villar

Indonesia: Khasia Hills, BO-0104512.

Lindera menghaiensis H.W. Li

China: Yunnan Prov., Xishuangbanna, 1360 m alt., Mar. 4, 1957, Sino-Russ. Exped. 5655 (KUN-0151187, type).

Lindera metcalfiana Allen

China: Yunnan Prov., Malipo county, 1300-1500 m alt., Dec. 20, 1947, Feng 13915 (KUN-0151212); Yunnan Prov., Pingbian county, 1600 m alt., Mar. 29, 1958, Feng 21782 (KUN-0151219); Yunnan Prov., Wenshan county, 2200 m alt., Aug. 13, 1947, Feng 11219 (KUN-0151210); Hainan Prov., Linshui county, 700 m alt., Nov. 18, 1956, Deng L. 3195 (KUN-0151305).

Lindera nacusua (D. Don) Merr.

China: Yunnan Prov., Gongshan county, 2000 m alt., Apr. 20, 1991, Dulongjiang Exped. 6226 (KUN-0151315); Yunnan Prov., Gongshan county, 1900 m alt., Oct. 7, 1956, Mao P.Y. 00546 (KUN-0151359); Yunnan Prov., Shang-pa county, 2000 m alt., Sep. 22, 1933, Tsai H.T. 56582 (KUN-0151350, KUN-0151349, KUN-0151348).

Lindera nacusua var. *menglunensis* H.P. Tsui

China: Yunnan Prov., Mengla county, 580 m alt., Li Y.H. 386 (KUN-0151389); Yunnan Prov., Menghai county, 1959, Zhou X. 508 (KUN-0151390); Yunnan Prov., Mongla county, May 27, 1961, Li Y.H. 03093 (KUN-0151395); Yunnan Prov., Mengla county, Jun. 21, 1959, Li Y.H. 1425 (KUN-0151387).

Lindera obtusiloba Blume

China: Shangdong Prov., Yuantai, Apr. 29, 1959, Shangdong Wild Life Exped. 50021 (KUN-0151430); Shangdong Prov., Kunlun Mt., May 8, 1959, Shangdong Wild life Exped. 0433 (KUN-0151421); Henan Prov. Lushi county, 1430 m alt., Oct. 6, 1958, Fu J.Q. 1881 (KUN-0151427); Hubei Prov., Shenlongjia Forest District, 2150 m alt., Sep. 14, 1980, Sino-

Amer. Exped. 1308 (KUN-0151469, KUN-0151466); Liaoning Prov., Changhai county, Jun. 21, 1957, Zhu Y.C. 741 (KUN-0151422); Japan: Shiga Pref., Ika-gun, Yogo-cho, 250-300 m alt., Jun. 26, 1988, Im, H.T. 10512 (KUN-0151471).

Lindera pedicellata Kosterm.

Indonesia: N. Borneo, Tenompok, Oct. 27, 1931, J. & M.S. Clemens 26849 (BO-0104513).

Lindera pipericarpa Boerl

Malaysia: Sarawak, Kampong Bidi, Bau, 1st Div. 310 m alt., May 20, 1975, Othman et al. S. 37545 (BO-0104548).

Lindera polyantha Boerl

Indonesia: W. Java, Sochaboesni, Ja 2202 (BO-0104514).

Lindera pomiensis (H.P. Tsui) H.P. Tsui

China: Tibet Prov., Pomi county, 2400 m alt., Sep. 8, 1973, Qing-Tibet Exped. 1404 (KUN-0100116); Tibet Prov., Pomi county, Sept. 10, 1976, Wu C.Y. 5722 (KUN-0100115).

Lindera praecox (Sieb. Et Zucc.) Blume

China: Zhejiang Prov., Hanzhou, Jun. 27, 1959, Hanzhou Exped. 2503 (KUN-0106867); Zhejiang Prov., West Tianmushan, Jul. 27, 1936, H. Migo s.n. (KUN-0100101); **Japan:** Honshu, Nagano Pref., 1250 m alt., Jul. 6, 1980, Taekokubo 190 (KUN-0100106);

Lindera prattii Gamble

China: Sichuan Prov., Baoxing county, 1550 m alt., Apr. 20, 1959, Sichuan Econom. Plant Exped. 00114 (KUN-0100089); Sichuan Prov., Pingshan county, 1460 m alt., Jun 20, 1959, Sichuan Econom. Plant Exped. 1109 (KUN-0100095); Sichuan Prov., Ganlou county, 2000 m alt., Aug. 12, 1959, Sichuan Exped. 4463 (KUN-0100093).

Lindera pulcherrima (Nees) Benth. ex Hook.f.

China: Tibet Prov., 2350 m alt., Feb. 22, 1993, ETM 3689 (KUN-0100149); Hunan Prov., Yizhang county, Tsoong P.C. 759 (KUN-0106881); Palmaja 2200 m - Batasi 2100 m. Aug. 8, 1972, H. Kanai et 721558 (KUN-0100153); Hubei Prov., Oct. 2, 1958, Li H.J. 6907 (KUN-0106874); Hubei Prov., Xunen county, 1000 m alt., Jul. 18, 1958, Li H.J. 5018 (KUN-0106864). **Nepal:** Dhaulagri Zone, Parbat Distr., Ghandruk (1950 m alt.)---Ghandruk Deorali (2530 m alt.), Jul. 10, 1983, H. Ohba, H. Kanai, M. Wakabayashi, M. Suzuki & S. Aiyama 8310196 (KUN-0100154).

Lindera pulcherrima var. *attenuata* Allen

China: Guangxi Prov., Longshen county, Sep. 4, 1957, Xie F.H. 3804 (KUN-0164469).

Lindera pulcherrima var. *hemsleyana* (Diels) H.P. Tsui

China: Tibet Prov., Dexing county, 1700 m alt., Apr. 29, 1993, ETM 6031 (KUN-0100141); Tibet Prov., Chayi county, 2700 m alt., Jul. 18, 1973, Qing-Tibet Exped. 73-785 (KUN-0100140); Sichuan Prov., Hu S.Y. s.n. (KUN-0164179).

Lindera racemosa Lecomte

Vietnam: Sapa to Aguy Ho, 1630 m alt., Dec. 3, 1964, Sino-Viet. Exped. 176 (KUN-0100164).

Lindera reflexa Hemsl.

China: Guangdong Prov., Nanxiong county, 500-600 m alt., May 25, 1958, Deng L. 6118 (KUN-0100144); Fujian Prov., Taining county, 1600 m alt., Jun. 16, 1978, Cai G.L. 399 (KUN-0106883); Jiangsu Prov., Nanjing, Mar. 18, 1962, Mao S.H. 014 (KUN-0100184); Jiangxi Prov., Guixi county, 600 m alt., Jul. 24, 1958, Nie M.Q. & Lai S.K. 3768 (KUN-0100201); Anhui Prov., Hsihsien, Jun. 3, 1935, H. Migo s.n. (KUN-0100167); Guizhou Prov., Tongren county, 700 m alt., Jul. 8, 1988, Wulinshan Exped. 1564 (KUN-?).

Lindera robusta (Allen) H.P. Tsui

China: Hainan Prov., Qiongzhong county, Oct. 24, 1956, Chen S.Q. 10912 (KUN-0100244); Hainan Prov., Qiongzhong county, 700 m alt., Dec. 7, 1956, Deng L. 3556 (KUN-0100240); Hainan Prov., Dongfang county, 1000-1150 m alt., Nov. 30, 1956, Chen S.Q. 11527 (KUN-0100243); Hainan Prov., Wuzhishan, 1500 m alt., Oct. 21, 1932, Chen N.J. 4410 (KUN-0100241).

Lindera rubronervia Gamble

China: Jiangxi Prov., Xunwu county, 750 m alt., Aug. 12, 1962, Yue J.S. s.n. (KUN-0100256); Jiangxi Prov., Qianshan county, 1270 m alt., Aug. 23, 1958, Nie M.Q. 4434 (KUN-0100253); Jiangxi Prov., Lushan, Jul. 4, 1941, H. Migo s.n. (KUN-0100273).

Lindera rufa Gamble

Indonesia: Mt. Murat, Lawas, 7938 ft. alt., Oct. 10, 1967, Anderson & Ilias S. 26475 (BO-0104515).

Lindera selangorensis Rialey

Indonesia: BO-0104516.

Lindera sericea (Sieb. et Zucc.) Blume

Japan: Shikoku Isl., Tokushima Pref., 900 m alt., Jul. 13, 1982, M. Takahashi 1081 (KUN-0100620).

Lindera sericea var. *glabra* Blume

Japan: Shikoku, Tokushima Pref., 1500-1700 m alt., May 20, 1983, M. Takahashi 1557 (KUN-0100619).

Lindera setchuensis Gamble

China: Sichuan Prov., Omei Mt., 900 m alt., Sep. 3, 1957, Yang G.H. 57058 (KUN-0100662); Sichuan Prov., Omei Mt., 700 m alt., Oct. 17, 1976, Tao D.D. 11502 (KUN-0100663); Sichuan Prov., Yaan county, 700 m alt., Oct. 28, 1938, Wang T.P. 9965 (KUN-0100646, KUN-0100647, KUN-0100648).

Lindera subcaudata (Merr.) Merr.

China: Guangdong Prov., May 18, 1931, Chen N.J. 41044 (KUN-0100611); Guangdong Prov., Luyuan county, 1900 m alt., Nov. 27, 1957, Deng L. 5872 (KUN-0100616).

Lindera subumbelliflora Kosterm.

Indonesia: Ponto Kuning, S. Salawesi, 1000 m alt., Tantra 1786 (BO-0104517); Nanukan, N of Tarakan, East Borneo, Nov. 1953, W. Meijer 1898 (BO-0104519).

Lindera suprocostata Lecomte

China: Yunnan Prov., Lichiang county, Wen-pe-shan, 2500 m alt., Apr. 13, 1937, Yu T.T. 8151 (KUN-0101131); Yunnan Prov., Jingdong county, 2600 m alt., May 14, 1963, Wu Q.A. 9143 (KUN-0101114); Yunnan Prov., Heqing county, 2500 m alt., Oct. 14, 1958, Wang W.C. 352 (KUN-0101138); Yunnan Prov., Dongchuan county, 2500 m alt., Oct. 12, 1964, SE Yunnan Exped. 688 (KUN-0101144, KUN-0101145).

Lindera thomsonii Allen

China: Yunnan Prov., Mong-ka, 1750 m alt., Mar. 2, 1934, Tsai H.T. 56362 (KUN-0101202); Yunnan Prov., Kengma county, 2300 m alt., Aug. 7, 1938, Yu T.T. 17267 (KUN-0101177); Yunnan Prov., Linchan county, 1950 m alt., Sep. 3, 1957, Xing J.S. 682 (KUN-0101212, KUN-0101213).

Lindera thomsonii var. *vernayana* (Allen) H.P. Tsui

China: Yunnan Prov., Jingdong county, Huangtsaolin, 1900 m alt., Mar. 30, 1940, Li M.K. 3019 (KUN-0101360); Yunnan Prov., Longling county, 2500 m alt., Aug. 10, 1941, Wang C.W. 90050 (KUN-0101375).

Lindera tienchuanensis Fang et H.S. Kung

China: Sichuan Prov., Maowen county, May 22, 1959, Sichuan Econom. Plant Exped. 2258 (KUN-0101388); Sichuan Prov., Baoxing county, 1700 m alt., Sichuan Econom. Plant Exped. 00053 (KUN-0101387).

Lindera tonkinensis Lec.

China: Yunnan Prov., Hekou county, 130 m alt., Dec. 13, 1953, Liu W.X. 00729 (KUN-0103001, KUN-0103002); Yunnan Prov., Pingbian county, 800 m alt., Apr. 21, 1954, Mao P.Y. 03929 (KUN-0103004); Yunnan Prov., Hekou county, 390 m alt., May 28, 1953, 85 (KUN-0103007).

Lindera tonkinensis var. *subsessilis* H.W. Li

China: Yunnan Prov., Shuanbai county, 1800 m alt., Apr. 20, 1957, Ying W.Q. 831 (KUN-0103075); Yunnan Prov., Kengma county, 1400 m alt., Apr. 1936, Wang C.W. 72833 (KUN-0103065); Yunnan Prov., Shuanjiang county, 1100 m alt., Sep. 7, 1957, Xing J.S. 727 (KUN-0103067); Yunnan Prov., Oshan county, 1500 m alt., Oct. 6, 1958, Wu S.G. 273 (KUN-0103020, KUN-0103021).

Lindera triloba (Sieb. et Zucc.) Blume

Japan: Shikoku, Ehime Pref., 700-1000 m alt., Jul. 31, 1984, M. Takahashi 1811 (KUN-0103149).

Lindera turfosa Kosterm.

Indonesia: Borneo, Poertianak, BO-24044.

Lindera umbellata Thunb.

Japan: Honshu, Kanagawa Pref.., 300-600 m alt., Apr. 26, 1987, H. Ohba et al. 16 (KUN-0103152); Shiga Pref., Jul. 26, 1988, Im H.T. 10521 (KUN-0103150); Yugashima, Prov. Izu, Jun. 24, 1932, H. Migo s.n. (KUN-0103157).

Lindera umbellata var. *membranacea* (Maxim) Momiyama

Japan: Honshu, Iwate Pref., Jul. 9, 1986, H. Ohashi et al. 22169 (KUN-0103158).

Lindera villipes H.P. Tsui

China: Yunnan Prov., Lanyashan, 310 m alt., Jun. 8, 1964, Wu S.G. 7090 (KUN-0103136); Yunnan Prov., Tenchong county, 2800 m alt., May 21, 1964, Wu S.G. 6773 (KUN-0103139); Yunnan Prov., Gongshan county, 3000 m alt., Oct. 1935, Wang C.W. 67069 (KUN-0103140).

3. Checked specimens in *Neolitsea*

Neolitsea acuminatissima (Hay.) Kanehira. et Sasaki

Taiwan: I-Lan county, 1600-1700 m alt., Jan. 18, 1995, Lu S.Y. 24555 (TAIF-065449); Taichung county, 2320 m alt., Oct. 15, 1994, Wang C.M. W01271 (TAIF-077922); Taichung county, 2550-2795 m alt., Jun. 26, 1994, Wang C.M. W001020 (TAIF-077926); Taichung

county, 1900-2000 m alt., Aug. 13, 1993, Huang C.L. 33 (TAIF-080500); Miaoli county, 2150 m alt., Apr. 1, 1992, Ching I.P. 14926 (TAIF-080451).

Neolitsea acutotrinervia (Hayata) Kanehira & Sasaki

Taiwan: Ilan county, 1800 m alt., Chen K.C. s.n. (TAIF-077416); Taichung county, 2100 m alt., Chen K.C. s.n. (TAIF-077297); Taipei county, 1640 m alt., Jul. 6, 1985, Shie B.L. 1011 (TAIF-058199); Taichung county, 2000 m alt., Chen K.C. s.n. (TAIF-077286); Taichung county, 2050 m alt., Chen K.C. 329 (TAIF-077257).

Neolitsea alongensis Lect.

China: Yunnan Prov., Xishuangbanna, 1800 m alt., Sep. 1936, Wang C.W. 7845 (KUN-0104551); Yunnan Prov., Xishuangbanna, 1200 m alt., Oct. 1936, Wang C.W. 79412 (KUN-0104554); Yunnan Prov., Xishuangbanna, 1400 m alt., Sep. 1936, Wang C.W. 79123 (KUN-0104553).

Neolitsea australiensis Kosterm.

Australia: 28^{0}03'S, 152^{0}24'E, Cunningham's Gap, May 18, 1986, D.L. Jones s.n. (GRS-082304); 28^{0}17'S, 153^{0}28'E, Thumbulgum, NSW, Sep. 1897, NSW 151982 (QRS-079061); 25^{0}12'S, 151^{0}41'E, Mount Perry 9247-668129, S of Mt. Perry, 480 m alt., Aug. 24, 1985, P.I. Forester PIF2132 (QRS-?); 26^{0}29'S, 152^{0}55'E, Mount Eerwah, Moreton District (QLD), 250 m alt., Jan. 04, 1985, P.R. Sharpe 3663 (QRS-?).

Neolitsea brassii Allen

Australia: N.P. Reserve 202, 17^{0}17'S, 145^{0}37'E, 760 m alt., B. Gray 1289 (QRS-?); Tolga, 17^{0}13'S, 145^{0}29'E, 860 m alt., Jan. 17, 1978, B. Gray 869 (QRS-?); State Forest Reserve 143 Windmill L.A., 16^{0}33'S, 145^{0}15'E, 800 m alt., Mar. 1, 1979, B. Gray 1294 (QRS-?); State Forest Reserve 607, Porish of Dinden, Bridle Logging Area, 16^{0}58', 145^{0}36', 480 m alt., May 29, 1985, B. Gray 4030 (QRS-?); SFR 607 Porish of dinden, Bridle L.A., 16^{0}58', 145^{0}56', 480 m alt., Oct. 1, 1985, B. Gray 4175 (QRS-?).

Neolitsea buisanensis Yamamoto & Kamikoti

Taiwan: Pingtung county, 700 m alt., Liou C.K. 50 (TAIF-076282); Pingtung county, 300 m alt., Sept. 26, 1994, Wan C.M. W01231 (TAIF-077981); Pingtung, Jan. 1, 1995, S.Y. Lu 24456 (TAIF-065583); Pingtung county, 150 m alt., Mar. 4, 1995, Chen K.C. 354 (TAIF-077298); Pintung county, 300-350 m alt., Wu S.C. 1235 (TAIF-083597).

Neolitsea buisanensis form. *sutsuoensis* Liao

Taiwan: Pingtung county, Hengchun Peninsula, Dec. 19, 1980, Chiou W.L. 015 (TAIF-077333, TAIF-077276, TAIF-077275).

Neolitsea cambodiana Lect.

China: Guangdong Prov., Qujiang, Oct. 11, 1930, Gao X.B. 50824 (KUN-0106419); Guangdong Prov., Qujiang, Aug. 29, 1930, Gao X.B. 50790 (KUN-0106420); Guangdong Prov., Lian county, 780 m alt., Oct. 30, 1958, Tan P.Q. 60071 (KUN-0106410).

Neolitsea cambodiana var. *glabra* Allen

China: Guangxi Prov., Damiaoshan county, Aug. 3, 1958, Chen S.Q. 16025 (KUN-0106436); Guangxi Prov., Damingshan county, Aug. 3, 1958, Chen S.Q. 16035 (KUN-0106434); Guangxi Prov., Damiaoshan county, 850 m alt., Jul. 12, 1958, Chen S.Q. 15672 (KUN-0106437).

Neolitsea cassioefolia Merrill

Indonesia: Cult. In Hort. Bogor, Jun. 8, 1956, A. Kostermans 11138 (BO-0104522).

Neolitsea chrysotricha H.W. Li

China: Yunnan Prov., Lanyashan, 3100 m alt., Jun. 8, 1964, Wu S.G. 7095 (KUN-0106438 (Typus), KUN-0106450 (Isotype)); Yunnan Prov., Pianma, 2500 m alt., 1964, Wu S.G. 8104 (KUN-0106449)

Neolitsea chunii Merr.

China: Guangdong Prov., Ongyuan county, Nov. 1, 1935, Liu X.Q. 25087 (KUN-0106474); Guangdong Prov., Lechan county, Nov. 25, 1931, Huang Z. 31494 (KUN-0106471); Guangdong Prov., Lianshan county, 550 m alt., Jul. 10, 1958, Tan P.Q. 58740 (KUN-0106484).

Neolitsea coccinea B.C. Stone

Malaysia: State of Selangor, GunongMengKuang, 5000 ft. alt., Feb. 4, 1913, H.C. Roberison s.n. (SING-059817); Fraser Hill, upon the Selangor border, 4000-4370 ft. alt., Apr. 16-30, 1922, I.H. Barkill & R.E. Holttum s.n. (SING-079840).

Neolitsea confertifolia (Hemsl.) Merr.

China: Hubei Prov., Shenlongjia Forest District, 800-1050 m alt., Sep. 21, 1980, Sino-Amer. Exped. 1608 (KUN-0106525); Hubei Prov., Shennongjia Forest District, Sep. 11, 1980, Sino-Amer. Exped. 1027 (KUN-0106522); Hubei Prov., Shenlongjia Forest District, 1440-1650 m alt., Sep. 1980, Sino-Amer. Exped. 603 (KUN-0106523); Guangdong Prov., Luyuang county, Mar. 27, 1934, Gao X.P. 53971 (KUN-0106507).

Neolitsea daibuensis Kamikoti

Taiwan: Pingtung county, 750 m alt., Chen K.C. 358 (TAIF-077254); Pingtung county, 1150 m alt., Chen K.C. 350 (TAIF-077251); Kaohsiung county, 1350 m alt., Chen K.C. 328 (TAIF

077204); Pingtung county, 1400 m alt., Apr. 23, 1995, Lu S.Y. 24707 (TAIF-067237); Pingtung county, 1200 m alt., Mar. 12, 1995, Lu S.Y. 24618 (TAIF-066031).

Neolitsea dealbata (R.Br.) Merr.

Australia: State Forest Reserve 310, Porish of Dadgarra, Tree logging area, 17^{0}18', 145^{0}42', 680 m alt., May 7, 1985, B. Gray 4008 (QRS-?); R843, Porish of Belleden Ker Frenchmans Creek, 17^{0}18', 145^{0}55', 40 m alt., Jun. 27, 1985, B. Gray 4091 (QRS-?); R843, Frenchmans Creek, 17^{0}18'S, 145^{0}55'E, 40 m alt., May 15, 1997, Gray B. 7199 (QRS-?); Tolga Scrab, Porish of Barron, 17^{0}14', 145^{0}28', 720 m alt., Mar. 28, 1985, B. Gray 3979 (QRS-?). **Indonesia:** Cult. In Hort. Bogor, BO-01014523.

Neolitsea ellipsoidea Allen

China: Hainan Prov., Weien county, Oct. 18, 1933, Liang X.R. 63482 (KUN-0106561); Hainan Prov., Wuzhishan, Oct. 23, 1932, Chen N.J. 44131 (KUN-0106562).

Neolitsea fuscata (Thwait.) Merrill

Ceylon: Sita Ratmalia Estate above Haputale, 1700 m alt., May 8, 1969, Kostermans 23395 (BO-0104524).

Neolitsea hainanensis Yang et P.H. Huang

China: Hainan Prov., Ledong county, Jun. 15, 1936, Liu X.C. 27249 (KUN-0106559).

Neolitsea hiiranensis Liu & Liao

Taiwan: Pingtung county, 250 m alt., Chen K.C. 282 (TAIF-077207); Taitung county, Jan. 1, 1995, Lu S.Y. 24455 (TAIF-065578); Pingtung county, 340 m alt., Dec. 8, 1995, Liu S.M. 246 (TAIF-075902); Pingtung county, 300 m alt., Chen K.C. 346 (TAIF-077234); Pingtung county, 300 m alt., Chen K.C. 295 (TAIF-077209).

Neolitsea homilantha Allen

China: Yunnan Prov., Xichou county, 1100-1150 m alt., Oct. 23, 1947, Feng 12566 (KUN-0106583); Yunnan Prov., Yanshan county, 1200 m alt., Oct. 3, 1939, Wang C.W. 84194 (KUN-0106579); Yunnan Prov., Xichou county, 1500 m alt., Oct. 17, 1958, Tsai H.T. 58-8514 (KUN-0106573, KUN-0106574, KUN-0106575).

Neolitsea hsingkweiensis Yang et P.H. Huang

China: W Hunan Prov., Baojin, 500 m alt., Sep.11, 1958, Liu L.H. 9756 (KUN-0106604).

Neolitsea incana Elmer

Philippines: Puerto Princesa (Mt. Pulgar), Province of Palawan, Island of Palawan, May, 1911, A.D.E. Elmer 13184 (BO-0104525).

Neolitsea intermedia Elmer

Philippines: Luzon Island, Sassagon Prov., Irasin, A.D.E. Elmer 17231 (BO-0104526).

Neolitsea kedahensis Gamble

Malaysia: State of Kedah, Kedah Peak, 3000 ft. alt., Jul. 1925, T. Thppenice s.n. (SING-063370); Kadah Peak, 3000 ft. alt., Jun. 1893, Hbr 3590 (SING-063372); Gunong Jeroi, Kedah (Kedah Peak), 2500-3000 ft. alt., Jun. 1921, Evans & Garden 30 (SING-063371); Cameron Highlands, Sungai Boh Volley, 3500 ft. alt., Oct. 9, 1963, Chow Wee-lek 886 (SING-063373).

Neolitsea konishii (Hay.) Kanehira & Sasaki

Taiwan: Kaohsiung county, 850 m alt., Chen K.C. 327 (TAIF-077230); Nantou county, 1350 m alt., Oct. 8, 1985, Mi. Minaki et al., 2057 (TAIF-069990); Taipei county, Lu S.Y. s.n. (TAIF-084542); Taipei county, 550 m alt., Lu S.Y. s.n. (TAIF-084961); Nantou county, 800 m alt., Aug. 7, 1985, Lu S.Y. 16783 (TAIF-065096).

Neolitsea kwangsiensis Liou

China: Guangdong Prov., Gaoyao county, Dec. 23, 1956, Huang C. 162630 (KUN-0106601).

Neolitsea lancifolia (Thw.) Kosterm.

Ceylon: Kitulgelle, 200 ft. alt., Apr. 1969, Kostermans & Wirawan 830 (BO-0104528).

Neolitsea latifolia S. Moore

Indonesia: Java, Bogor, Cult. in Hort. Bogor, Nov. 16, 1947, BO-0104530.

Neolitsea levinei Merr.

China: Hainan Prov., Lechan county, Nov. 28, 1930, Chen N.J. 42316 (KUN-0108319); Guangdong Prov., Liangshan county, 900 m alt., Jun. 19, 1958, Tan P.Q. 58386 (KUN-0108279); Yunnan Prov., Malipo county, 1300-1600 m alt., Nov. 7, 1947, Feng K.M. 12981 (KUN-0106608).

Neolitsea lunglingensis H.W. Li

China: Yunnan Prov., Tenchong county, 1740-1850 m alt., Jul. 21, 1960, Ying W.Q. 60-1234 (KUN-0108291).

Neolitsea novo-guinensis (Teschn.) Merrill

Indonesia: N. Moluccas, Obi Isl., Anggai, Gunung Batu Putih, 600 m alt., Nov. 19, 1974, E.F. de Vogel 4157 (BO-0104531); Bele River, 18 km NE of Lake Habbrms, 2200 m alt., Nov. 1938, L.J. Brass & C. Versteegh 11155 (BO-0104532); **Malaysia:** Sarawak, Bt. Mersing. Anap. 1000 m alt., Sep. 5, 1964, Sibat et Luang S. 21970 (BO-0104545).

Neolitsea oblongifolia Merr. et Chun

China: Hainan Prov., Baoting county, 2100 m alt., Jul. 17, 1935, Hou K.Z. 73215 (KUN-0108297); Hainan Prov., Lingshui county, 400 m alt., Nov. 15, 1956, Deng L. 3136 (KUN-0108299); Hainan Prov., Linshui county, Nov. 7, 1956, Deng L. 3070 (KUN-0108298).

Neolitsea obtusifolia Merr.

China: Hainan Prov., Chanjian county, Dec. 19, 1933, Liang X.R. 66489 (KUN-0108305); Hainan Prov., Qiongzhong county, Oct. 10, 1956, Chen S.Q. 10437 (KUN-0108306).

Neolitsea ovatifolia Yang et P.H. Huang var. *puberula* Yang et P.H. Huang

China: Yunnan Prov., Pingbian county, 1250 m alt., Apr. 18, 1954, Mao P.Y. 03875 (KUN-0108307, KUN-0108308, isotypus).

Neolitsea pallens (D. Don) Momiyama et Hara

China: Tibet Prov., Niela county, 2400 m alt., Jun. 28, 1975, Qing-Tibet Exped. 6053 (KUN-0108359, KUN-0108360).

Neolitsea parvigemma (Hay.) Kanehira & Sasaki

Taiwan: Taitung county, 1050 m alt., Chen K.C. 335 (TAIF-077713); Pingtung county, 300 m alt., Chen K.C. 359 (TAIF-078221); Pingtung county, Chen K.C. 345 (TAIF-078220); Kaohsiung county, 10-356 m alt., Yang C.S. 236 (TAIF-071636); Kaohsiung county, Chen K.C. 507 (TAIF-076712).

Neolitsea phanerophlebia Merr.

China: Guangdong Prov., Yugan county, Oct. 4, 1930, Chen N.J. 41847 (KUN-0108355); Guangdong Prov., Longmen county, 860 m alt., Oct. 24, 1958, Wei Z.F. 121975 (KUN-0108341); Guangdong Prov., Liangshan county, 540 m alt., Jul. 5, 1958, Tan P.Q. 58529 (KUN-0108342); Guangdong Prov., Lianpin county, 350 m alt., May 23, 1958, Wei Z.F. 120137 (KUN-0108339, KUN-0108340).

Neolitsea pingbienensis Yang et P.H. Huang

China: Yunnan Prov., Pingbian county, 1800 m alt., May 5, 1954, Mao P.Y. 04139 (KUN-0108222; KUN-0108221, KUN-0108220); Yunnan Prov., Pingbian county, 1880 m alt., Apr. 3, 1954, Mao P.Y. 03682 (KUN-0108218, isotypus).

Neolitsea pinninervis Yang et P.H. Huang

China: Guangxi Prov., Damiaoshan county, Aug. 3, 1958, Chen S.Q. 16035 (KUN-0108231); Guangxi Prov., Damiaoshan county, 750-1000 m alt., Aug. 7, 1958, Chen S.Q. 16098 (KUN-0108232).

Neolitsea polycarpa Liou

China: Yunnan Prov., Jingping county, 2300 m alt., Qiu B.Y. 56985 (KUN-0108260); Yunnan Prov., Shiping county, 2400 m alt., Nov. 30, 1958, Wu S.G. 910 (KUN-0108261); Yunnan Prov., Wenshan county, 2000 m alt., Jan. 15, 1933, Tsai H.T. 51551 (KUN-0108237, KUN-0108238).

Neolitsea pulchella (Meissn.) Merr.

China: Hainan Prov., Dongfan county, 420-800 m alt., Nov. 29, 1956, Chen S.Q. 11479 (KUN-0108206); Guangdong Prov., Liangshan county, 570 m alt., Jul. 9, 1956, Tan P.Q. 58699 (KUN-0108204).

Neolitsea sericea (Bl.) Koidz.

China: Zhejiang Prov., Putuo, Jun. 5, 1936, H. Migo s.n. (KUN-0108209); Zhejiang Prov., Putuo, 280 m alt., Nov. 6, 1983, Tao G.F. 426 (KUN-0108208). **Taiwan:** Hsinchu county, 1400 m alt., Chen K.C. 534 (TAIF-078442); Kaohsiung county, 1750 m alt., Chen K.C. s.n. (TAIF-077411); Taoyuan county, 1300 m alt., Chen K.C. 466 (TAIF-076745);Taichung county, 2100 m alt., Chen K.C. 250 (TAIF-077492); Taichung county, 2150 m alt., Chen K.C. 353 (TAIF-077423); Taitung county, 220 m alt., Chen K.C. 364 (TAIF-077404); Taitung county, 200 m alt., Chen K.C. 361 (TAIF-077405); Taitung county, 180 m alt., Chen K.C. 366 (TAIF-077402); Taitung county, 150 malt., Chen K.C. 311 (TAIF-077282); Taitung county, 200 m alt., Lu Y.C. & Liao C.C.1582 (TAIF-082291); Taitung county, Jun. 10, 1983, Lu S.Y. 10136 (TAIF-067550).

Neolitsea shiangningensis Yang et P.H. Huang

China: Guangxi Prov., Damiaoshan county, Nov. 8, 1958, Chen S.Q. 17124 (KUN-0108174); Guangxi Prov., Damiaoshan county, 800-1200 m alt., Aug. 9, 1958, Chen S.Q. 16195 (KUN-0108169); Guangxi Prov., Damiaoshan county, Nov.8, 1958, Chen S.Q. 17137 (KUN-0108175).

Neolitsea sutchuanensis Yang

China: Yunnan Prov., Gongshan Prov., 1900 m alt., Nov. 18, 1959, Feng K.M. 24342 (KUN-0108130, KUN-0108131, KUN-0108132).

Neolitsea sutchuanensis var. *gonshanensis* H.W. Li

China: Yunnan Prov., Gongshan county, 2000-2300 m alt., Sep. 5, 1940, Feng K.M. 7459 (KUN-0108145, KUN-0108146); Yunnan Prov., Gongshan county, 2700 m alt., Aug. 26, 1940, Feng K.M. 6987 (KUN-0108144).

Neolitsea tomentosa H.W. Li

China: Yunnan Prov., Pingbian county, 1700 m alt., Sep. 22, 1954, Feng K.M. 4616 (KUN-0108152); Yunnan Prov., Pingbian county, 1400 m alt., Sep. 14, 1934, Tsai H.T. 61952 (KUN-0108149 (Typus), KUN-0108150).

Neolitsea undulatifolia (Levl.) Allen

China: Yunnan Prov., Pingbian county, 1400 m alt., Jul. 9, 1934, Tsai H.T. 62499 (KUN-0108161); Yunnan Prov., Malipo county, 1900-2000 m alt., Nov. 2, 1947, Feng K.M. 12754 (KUN-0108164, KUN-0108165); Yunnan Prov., Guangnan county, 1550 m alt., Mar. 7, 1940, Wang C.W. 87582 (KUN-?).

Neolitsea variabillima (Hayata) Kanehira & Sasaki

Taiwan: Kaohsiung county Oct. 6, 1995, Chen K.C. 451 (TAIF-077369, TAIF-076728); Taipei county, 550 m alt., Liu C.K. 183 (TAIF-076567); Hsinchu county, 1500 m alt., Chen K.C. 536 (TAIF-078951); Taoyuan county, 200 m alt., Chen K.C. 425 (TAIF-076654).

Neolitsea velutina W.T. Wang

China: Yunnan Prov., Xichou county, 1200 m alt., Dec. 21, 1939, Wang C.W. 85866 (KUN-0108186 (Isotypus); KUN-0108187, KUN-0108188).

Neolitsea vidalii Merr.

Philippines: Laguna Prov., Dahican River, Sep. 1912, M. Ramos 1352 (SING-079841); Rigal Prov., Aherrio 2674 (SING-079842).

Neolitsea villosa Merrill

Philippines: Medang, Fraser's hill, Pahang, 4000 m alt., Feb. 11, 1966, K.M. Kochummen 97781 (SING-033116); Bagaio, Benguei SubProv., Jan. 1916, H. Sandkuhl 355 (SING-079843); SING-079844; Lake Balinsasayao, Tanjay, Negros Oriental, Sep. 1948, G.E. Edano 6759 (SING-079847, 079845); Mt. Balatongan, Cagayan Prov., Nov. 1929, G. Edano 78516 (SING-079846); Batangas Prov., Aug. 1914, M. Ramos 1907 (SING-079848). **Taiwan:** Taitung county, 150m alt., Chen K.C. 367 (TAIF-076981); Taipei county, 10 m alt., Ciang H.L. 288 (TAIF-082101); Taitung county, 200 m alt., Sep. 17, 1994, Lu Y.C. & Liao C.C. 1583 (TAIF-082293); Taitung county, 200 m alt., 200 m alt., Chen K.C. 312 (TAIF-076975); Nantou county, 700 m alt., Chen K.C. 369 (TAIF-076995); Nantou county, 700 m alt., Chen K.C. 368 (TAIF-076982).

Neolitsea wushanica (Chun) Merr.

China: Sichuan Prov., Omei Mt. 1200 m alt., Oct. 7, 1940, Fang W.P. 14260 (KUN-0108196); Sichuan Prov., Omei Mt., May 18, 1940, Fang W.P. 14657 (KUN-0108197); Guangdong Prov., Yanshan county, 800 m alt., Jun. 18, 1956, Deng L. 1528 (KUN-0108210).

Neolitsea zeylanica Merrill

Malaysia: State of Jahore, P. Setindan, Jan. 3, 1937, E.J.H. Corner s.n. (SING-079855); State of Johore, Palau Setindan, Mersing, Aug. 15, 1935, E.J.H. Corner 29778 (SING-079851); State of Jahang, Tonjong Ruit, P. Tioman, Aug. 17, 1935, E.J. Corner 29797 (SING-079876, SING-079875); State of Pahang, Ka Pekan, Jan. 20, 1889, SING-079871; State of Pahang, Pulau Chibeh, P.Tioman, Aug. 19, 1935, E.J.H. Corner s.n. (SING-079854); State of Pahang, Pckau, Nov. 29, 1924, 17224 (SING-079860); State of Pahang, Kuantau, Aug. 4, 1924, 16145 (SING-079856); State of Selanger, Weir Hill, Nov. 18, 1916, C.F. 871 (SING-079853); State of Peak, Pangkor, Jul. 29, 1936, E.J.H. Corner s.n. (SING-079874); State of Peak, Palau Lalang, Nov. 28, 1925, E. Seimum s.n. (SING-079873); Brisa, May 24, 1891, ?759 (SING-079852); Rocky ground, Palau Yu: S. China Sea, 100-135 ft. alt. Jul. 30, 1955, B.E.G. Allen s.n. (SING-079850); Kwala Pahaug, Jun. 17, 1913, 321 (SING-079849); Telok, bara, Kuaulau, Apr. 3, 1919, C.F. 3156 (SING-079861, SING-079854); Gicuoua Takon, Jul. 1911, 16124 (SING-079858); Pu Ubiu-east end, Jan. 7, 1897, Jorseph Lai LJ 158 (SNG-079856); Bedok (Singore), Apr. 1897, SING-079870; Setul, Aug. 1910, 14962 (SING-079869); Jelak, aling, Oct. 31, 1951, J. Smiclair S.F.39307 (SING-079868); Penang, SING-079867; Siuggora (Siam); Jan. 26, 1916, A. Annouiale (SING-079866); Langong Bunga, Sep., 1880, B.B. 446 (SING-079865); Chongi, SING-081638; Singapore, SING-081640; Singapore, SING-081639; Bakil Timah (Singapore), May 31, 1938, Ngadiman 34984 (SING-081636, SING-081635); mesilou River, 5000 ft. alt., Feb. 9, 1964, W.L. Chow & E.J.H. Corner 4309 (SING-515482).

4. Checked specimens in *Actinodaphne*

Actinodaphne acuminata Meissn.

Japan: Aokagonoki, Sep. 4, 1927, Col. No. 14 (QRS-030516).

Actinodaphne albifrons Kostermans

Ceylon: Mandagala-Oya Forest, Ratnapure District, Sabaragamuwa Prov., 700 m alt., Jun. 22, 1976, S. Waas 1686 (QRS-?).

Actinodaphne angustifolia Nees

Indonesia: Java, Jul. 16, 1918, W.F. Winckel 234B (SING-0104377).

Actinodaphne apoensis (Elm.) Kostermans.

Indonesia: BO-0104379.

Actinodaphne areolata Bl.

Malaysia: State of Johore, S. Seoili, Mawai, Apr. 14, 1935, E.J.H. Comer 29270 (SING-079726).

Actinodaphne borneensis Meissn.

Indonesia: Tawau, Balung, 60 ft. Alt., Jan. 10, 1963, Abon Gibot 37056 (BO-0104369)

Actinodaphne brassii Allen

Solomon Islands: Kwara'ae name Duungwo, Santa Ysabel, 200 m alt., Mar. 20, 1964, T.C. Whitemore BSIP2592 (SING-510052); Forest adjacent to Tina River, Guadalcanal, about 12 miles inland from the coast, 600 m alt., Nov. 14, 1962, Womersley & Whitemore BSIP1139 (SING-509150); Sata Yabel, Bogotu, Nov. 6, 1963, T.C. Whitemore BSIP2765 (SING-510184); Kwara'ae name Guula, New Georgia Group, Baga Island, Jan. 26, 1964, Whitemore's BSIP3071 (SING-510482); South West. Koong Kapi River, Shortland, 290 m alt., Feb. 25, 1969, P. Runikera BSIP 13087 (SING-079728); Ologhata Harbour, N.E. Choiseul, 400 m alt., Oct. 31, 1969, I. Gafai BSIP 17423 (SING-079727); South West Guadalcanal, Lambi Bay Area, 170 m alt., Nov. 1, 1968, H. Fa'arods BSIP12372 (SING-079729); E. Sekoloe River, N.W. Choiseul, 300 m alt., Dec. 8, 1969, I. Gafai BSIP18599 (SING-079730); East Mbirambira, West Choiseul, 200 m alt., Jan. 20, 1970, I. Gafai BSIP18880 (SING-079731); Makina Area, East Guadalcanal, 120 m alt., Sep. 26, 1968, R. Mouriasi BSIP 11824 (SING-079732); Tetere Makira Bay, S. San Cristobal, 320 m alt., Oct. 24, 1968, I. Gafai BSIP 12549 (SING-079733); Kokove Area, N.E. Kolombangora, 220 m alt., Jan. 12, 1968, R. Mauriasi BSIP 8619 (SING-079734).

Actinodaphne caccoriea **?**

Malaysia: Tungganu, Camp II, Gunong Lawit, 2000-3000 ft., Mar. 13, 1975, Mohd Shah, Samsuri & Ahmad Shukor MS 3502 (SING-079775).

Actinodaphne conferta Merill

Malaysia: Medang, Blopura Forest District, Kabili-Seilok, 50 m alt., Apr. 23, 1939, Enggoh 10512 (SING-079736); Belandoh & Sungei, Blopura Forest District, Saudulcau, Dec. 10, 1947, Austin Cuadra A1147 (SING-079737); Medang Pasit, Beaufart Forest District, Lumart, Mar. 27, 1948, Austin Cuadra A1309 (SING-079738); Medang, Kabili-Sepilok, 25 m alt., Apr. 22, 1937, Keith 7088 (SIMG-079739); Medang, Banka, Lobok-Besar, 20 m alt., Oct. 20, 1949, Kostermans & Anta 1231 (SING-079741); **Philippine:** Mindanao, Surigao, Jun. 1914, M. Ramos & J. Pasgasio 34692 (BO-0104370).

Actinodaphne corneri Lunrab sp. nov.

Malaysia: State of Johore, Mawai-Jenaluang Rd. Feb. 9, 1935, L.J.H. Coner s.n. (SING-067396); State of Johore, S. Berassau, Mawai-Jenuluang Rd. Apr. 28, 1935, L.J/H. Corner s.n. (SING-067397).

Actinodaphne cupularis (Hemsl.) Gamble

China: Sichuan Prov., Nanchuan county, Mar. 20, 1957, Li G.F. 60116 (KUN-0047062); Sichuan Prov., Nanchuan county, May 14, 1957, Li G.F. 61151 (KUN-0047075); Sichuan Prov., Kuan county, 1300 m alt., May 1, 1930, Wang F.T. 20663 (KUN-0047082).

Actinodaphne diversifolia Merr.

Indonesia: N. Borneo, Mt. Kinabalu, Sungei Mamut, 4000 ft. alt., Aug. 7, 1961, W.L. Chew, E.J.H. Corner & A. Stainton 1251 (SING-514717); Sandakan and Vicinity, M. Ramos 1838 (BO-0104367).

Actinodaphne dolichophylla Merr.

Philippines: Surigao, May 3, 1927, C.A. Wenzel 7598 (BO-0104371).

Actinodaphne forrestii (Allen) Kosterm.

China: Yunnan Prov., Zhaotong county, 1870 m alt., Dec. 9, 1974, KUN-0164074; Shunning county, 2400 m alt., Jun. 26, 1938, Yu T.T. 16476 (KUN-0047107); Yunnan Prov., Pingbian county, 1600 m alt., Nov. 9, 1939, Wang C.W. 82744 (KUN-0047114); Yunnan Prov., Tengchong county, 1930-2120 m alt., Sep. 12, 1960, Ying W.Q. 60-1023 (KUN-0047131, 0047137).

Actinodaphne foxworthyana L.S. Gibbs

Malaysia: Upper Kinobalu, 6000-13500 ft. Alt., Mar. 29, 1932, J.& M.S. Clemens 29247 (BO-0104372).

Actinodaphne glabra Blume

Indonesia: E. Borneo, E. Kutei, Sangkulirang island, 30 m alt., May 24, 1951, A. Kostermans 4888 (BO-0104380).

Actinodaphne glaucina Allen

China: Hainan Prov., Wuzhishan, Oct. 8, 1932, Chen N.J. 44045 (KUN-0047141, isotypus).

Actinodaphne glomerata (Bl.) Nees

Malaysia: Mt. Kinabalu, Sabah, Bembangan Camp, 5000 ft. alt., Feb. 27, 1964, W.L. Chew & E.J.H. Corner 4567 (SING-515647); Mt. Kinabalu, Oct. 1, 1931, J. & M. S. Clemens 26668 (SING-079743); Ulu Trenggana, Sep. 22, 1955, J. Sinclair & Kiah 40926 (SING-063392); Ulu Temalad, Mujong, Horse Mountains, Mar. 22, 1964, P.S. Ashton S 17624 (SING-079746); Sahagaya, J.R. Blopura, Samdaham, May 13, 1949, A. Cuadra A 2264 (SING-

079745); Johore, Kuala Sedili, Jun 26, 1959, Kadin & M. Noor 190 (SING-501309); Sungei Mupoh, Kota Tinggi-Mersing Rd, Johore, Nov. 14, 1965, J. Sinclair 10846 (SING-079742); Salleh, Ulu Trengganu, Sep. 22, 1955, J. Sinclair & Kiah 40926 (SING-063392); **Singapore:** Bukit, Jun. 1894, H.N. Ridley 6296 (SING-063394); Bukit Panjang, Oct. 1900, H.N. Ridley s.n. (SING-081707). **Indonesia:** E. Borneo, E. Kutei, G. Tepian Labang, 30 m alt., Jun. 17, 1951, A. Kostermans 5285 (BO-0104373)

Actinodaphne henryi Gamble

China: Yunnan Prov., Menghai county, Dec. 28, 1958, Zhao S.W. 0240 (KUN-0047156); Yunnan Prov., Jinghong county, 1200 m alt., Apr. 5, 1957, Sino-Russ. Exped. 5883 (KUN-0047144); Yunnan Prov., Mengla county, 650 m alt., Oct. 13, 1959, Tsai H.T. 59-10940 (KUN-0047148).

Actinodaphne hullettii Gamble

Malaysia: Malacca, SING-063414; Malacca, Hullett 647 (SING-063415).

Actinodaphne koshepangii Chun ex H.T. Chang

China: Hunan Prov., Xingning county, Nov. 4, 1962, Liu L.H. 15428 (KUN-0106632).

Actinodaphne kweichouwensis Yang et P.H. Huang

China: Guangxi Prov., Longjin county, Nov. 6, 1958, Li H.C. 40210 (KUN-0106644); Guangxi Prov., Debao county, Nov. 30, 1958, Li Z.T. 602065 (KUN-0047169); Guizhou Prov., Anlong county, 1000 m alt., May 13, 1960, Guizhou Exped. 2421 (KUN-0104787).

Actinodaphne lancifolia Meissn.

Japan: Isl. Tsushima, Shimoagata, Jun 24, 1968, H. Ohashi and K. Sahma 10586 (KUN-0047168).

Actinodaphne lecomtei Allen

China: Sichuan Prov., Omei Mt., 1750 m alt., Oct. 8, 1957, Yang G.H. 57479 (KUN-0047165); Sichuan Prov., Omei Mt., 1800 m alt., Oct. 5, 1957, Yang G.H. 57471 (KUN-0047175).

Actinodaphne macrophylla Nees

Indonesia: Java, Bogor Botanical Garden, Cultivated, Sep. 9, 1991, Hyland, B. 14202 (QRS-?); de Voog 1616 (BO-0104382); **Singapore:** Mandai Rd. Sep. 29, 1940, Kiah s.n. (SING-081755).

Actinodaphne macroptera Miq.

Indonesia: SW Java, Vdjung Kulan Reserve, Mt. Pajung, 5 m alt., Nov. 11, 1950, Kostermans 101 (BO-0104374).

Actinodaphne maingayi Hook.f.

Malaysia: N. Borneo, Medang, Kabili F.D., Sandakn, 20 ft. alt., Sep. 16, 1938, Agama 9939 (SING-079756); W. Kattai, CE. Borneo, 450 m alt., Sep. 15, 1925, F.H. Endert 3330 (SING-079757); Borneo, Loa Haur, W. Samarinda, 40 m alt., May 15, 1952, Kostermans 6954 (SING-079758); State of Pahang, Fraser Hill, 4000 ft. Alt., Aug. 11, 1937, E.J.H. Corner s.n. (SING-079749, SING-079750); Knaw Pih Hill Khsoom, Dec. 2, 1918, Hacciff 3915 (SING-079751, SING-079752); State of Pahang, Fraser's Hill, 4000 ft. Alt., Aug. 11, 1937, E.J.H. Corner s.n.(SING-0079754); Fraser Hill, upon the Selangor border, 4000 ft. Alt., Sept. 10, 1923, 11314 (SING-079755); Fraser Hill, Upon the Selanger border, 4000 ft. Alt., 11314 (BO-0104383); State of Johore, Sunyai Sevili, Feb. 19, 1939, Ngoviman s.n. (SING-079753).

Actinodaphne malaccensis Hook.f.

Malaysia: State of Johore, Sungai Kaya, Mar. 13, 1937, Kiah 32386 (SING-063403); Ulu Sama, Sarawak, Aug. 14, 1938, Daud & Tachun 36060 (SING-079747, SING-079748).

Actinodaphne montana Gamble

Malaysia: State of Pahang, Bok Plaurarium, Camerm Highlaws, 4000 ft. alt., Apr. 3, 1937, Admar 32840 (SING-063396); State of Kedah, Gunong Lang, Mar. 26, 1938, Kiah 35069 (SING-063397; SING-079759).

Actinodaphne multiflora Benth.

Indonesia: Misool, Fakal, Sorong, Sep. 15, 1948, D.R. Pleyte 855 (BO-0034461).

Actinodaphne nitida Teschn.

New Guinea: Mt. Riu, Tangula Island, Subprovince Misima, Province Milne Bay., 50 m alt., LAE 73268 (QRS-?); Sepik-Gebiet, n-7728 (SING-079761); Heath Island, Talasea Substrict, West new Britain District, 120 m alt., Jun. 23, 1972, D.B. Foreman LAE 52149 (BO-0104366).

Actinodaphne obovata Bl.

China: Yunnan Prov., Pingbian county, 1100 m alt., Apr. 8, 1954, Mao P.Y. 03722 (KUN-0047203); Yunnan Prov., Pingbian county, 1000 m alt., Oct. 22, 1954, Feng K.M. 5138 (KUN-0047197; KUN-0047196); Yunnan Prov., Malipo county, 1100 m alt., Nov. 13, 1951, Mao P.Y. 653 (KUN-0047210).

Actinodaphne oleifolia Gamble

Malaysia: State of Pahang, Gunong Tahan, 5500 ft. alt., Mar. 1929, E. Seimuno 341 (SING-063418); State of Pahang, Gunong Tahan, 6000 ft alt., Sep. 18, 1928, R.E. Horhum 20725 (SING-063419); Pahang, Gunong Tapis, Kuantan, 4600 ft. alt., Jun. 14, 1934, SFN. 28831

(SING-079762); Pahang, Gunong, Nov. 19, 1900, 13720 (SING-079763); Gunong Tahan, 16109, (SING-079764); Lianggagang, H. Hallier 2899 (BO-23938).

Actinodaphne omeiensis (Liou) Allen

China: Sichuan Prov., Omei Mt., Zhang 183 (KUN-0047238); Sichuan Prov., Omei county, 950 m alt., Yang G.H. 55580 (KUN-0047253); Sichuan Prov., Omei Mt., 1100-1200 m alt., Jul. 3, 1931, Wang F.T. 23212 (KUN-0047234).

Actinodaphne pilosa (Lour.) Merr.

China: Guangdong Prov., Xuwen county, Mar. 27, 1954, Xuwen Exped. 82 (KUN-0047267); Guangxi Prov., Ningming county, 350 m alt., Oct. 19, 1958, Zhang Z.B. 13000 (KUN-0047270); Guangxi Prov., Longjin county, 150-200 m alt., Sep. 4, 1958, Zhang Z.B. 11615 (KUN-0047262).

Actinodaphne procera Nees

Indonesia: BO-0104368.

Actinodaphne pruinosa Nees

Malaysia: Fraser Hill, Pahang, 4000 ft. alt., Aug. 26, 1923, Henderson 11284 (SING-079765); Medang, Camp 23, Ulu Gombak F.D. 1800 m alt., Sep. 15, 1960, K.M. Kochummen 94469 (SING-079766); Moniits Rd. Oct. 1886, (SING-079767); Bt. Kawa Rd. Five miles S. of Kuching, Jan. 8, 1966, J.A.R. Anderson S. 25437 (BO-0104546).

Actinodaphne ridleyi Gamble

Malaysia: State of Johore, Giuciccy Pulai, 12165 (SING-079768).

Actinodaphne sesquipedalis Hook.f.

Malaysia: State of Johore, Pengkalan Raja, Pontiana, Jul. 4, 1939, Ngadiman 36765 (SING-067399); Farms Rd. Frasers Hill, 4000 ft. Alt., Mar. 27, 1959, Md. Shah & Noor 714 (SING-501526); Medang Sisit. Kuehing, NO S. 0097 (SING-079780); Malacca, Morotai, totodokoe, 30 m alt., May 9, 1949, A. Kostermans 695 (SING-079781); State of Kelantan, Bukit Batu pupan, s. Lebir, 750 ft. alt., Jul. 4, 1935, M.R. Henderson 29513 (SING-079775); Ulu brang, 1000 ft. alt., Jul, 1937, L. Moysoy-Kich 33877 (SING-079776); Bukit kajang, 500 ft., alt., Nov. 7, 1935, E.J.H. Corner 30296 (SING-079777); Ulu Kajang, Nov. 24, 1935, E.J.H. Corner 30557 (SING-079778); State of Selangor, Wew Kupercrue, Jun. 7, 1916, C.F. 607 (SING-079769); Manior-Rovo, Nov. 16, 1951, J. Smichair S.F. 39330 (SING-079770); Polo Boetong, Jul. 1890, B. Biutis 2473 (SING-079771, SING-079772); Watulaee, Apr. 1890, B.Biutis 2304 (SING-079773); Bukit Lagong F.R. Nov. 1, 1953, J. Sinclair 40098 (SING-079774); New Guinea: Vogelkop, Namtoo Mts., 300 m alt., Aug. 1948, A. Kostermans 2868

(SING-079779); Bakit Lagong Forest reserve, Kepong, Selangor, Nov. 7, 1953, J. Sinclair 40098 (BO-0104504).*Actinodaphne sphaerocarpa* Nees

Indonesia: Java, Kds 38941 (BO-0034535).

Actinodaphne tayabensis Merill

Philippines: Mt. Bulusan, Sorogan Prov., Jul.-Aug. 1947, M.D. Sulit s.n. (SING-079782).

Actinodaphne trichocarpa Allen

China: Sichuan Prov., Omei Mt., 1950 m alt., Apr. 18, 1940, Sun S.L. 1571 (KUN-0047298); Sichuan Prov., Guan county, Jun. 6, 1959, Water Exped. 00557 (KUN-0164247); Yunnan Prov., Shunning, 2600 m alt., Jul. 11, 1938, Yu T.T. 16691 (KUN-0047283).

Actinodaphne tsai Hu

China: Yunnan Prov., Malipo county, 1300-1500 m alt., Dec. 16, 1947, Feng K.M. 13881 (KUN-0047312); Yunnan Prov., Malipo county, 1700 m alt., May 19, 1962, Feng K.M. 22638 (KUN-0047317).

5. Checked specimens in *Dodecadenia*

Dodecadenia grandiflora Nees

China: Tibet Prov., Chuona county, 2700-2800 m alt., Jul 19, 1975, Wu C.Y., Chen S.K. & Lu S.L. 75-1048 (KUN-0049206); Tibet Prov., Niela county, 2500 m alt., Jun. 8, 1975, Qing-Tibet Exped. 6033 (KUN-0049199); Yunnan Prov., Dayao county, 2800 m alt., Jun. 7, 1989, Chen Y.& Bai B. 352 (KUN-0687207, KUN0687208).

Dodecadenia grandiflora var. *griffithii* (Hook.f.) Long

China: Yunnan Prov., Lijiang county, 2500 m alt., Sep. 13, 1938, Yu T.T. 20204 (KUN-0049210).

6. Checked specimens in *Iteadaphne*

Iteadaphne caudata (Nees) H.W. Li

China: Yunnan Prov., Tengchong county, 2020 m alt., Oct. 28, 1965, Zhao J.Z. 51 (KUN-0049453); Yunnan Prov., Jingdong county, 1800 m alt., Jun. 15, 1993, Peng H. 291 (KUN-0049230); Yunnan Prov., Maguan county, 1400 m alt., Oct. 4, 1958, Tsai H.T. 58-8330,

(KUN-0049415); **Vietnam:** Sapa-Yiyho, 1630 m alt., Dec. 8, 1964, Sino-Viet. Exped. 130 (KUN-0049603).

7. Checked specimens in *Parasassafras*

Parasassafras confertiflora (Meissn.) Long

China: Yunnan Prov., Luxi county, Dec. 2, 1958, Chen J. 458 (KUN-0104559); Yunnan Prov., Ximeng county, 2000 alt., Nov. 4, 1984, Qian Y.Y. 682 (KUN-0104558).

8. Checked specimens in *Sinosassafras*

Sinosassafras flavinervia (Allen) H.W. Li

China: Yunnan Prov., Jingdong county, 2200 m alt., Jun. 5, 1963, Wu Q.A. 9468 (KUN-0150387); Yunnan Prov., Jingdong county, 1900 m alt., Nov. 6, 1963, Yang Z.H. 101437 (KUN-0150376); Yunnan Prov., Jingdong county, 2480 m alt., May 5, 1981, Bao S.Y. 427 (KUN-?); Yunnan Prov., Lanchang to Ximeng, Oct. 21, 1989, Tao G.D. & Li X.W. 39701 (KUN-0162099, 0162100).

9. Checked specimens in *Umbellularia*

Umbellularia californica (Hooker et Arnott) Nuttall

America: California State, Los Angeles county, 3500 ft. Alt., Feb. 22, 1985, B. Bartholomew 2092 (KUN-0162110); California State, Sonoma county, 300 m alt., Jun 3, 1985, B. Bortholomew, B. Anderson, H.W. Li & T.S. Ying 2251 (KUN-0162111).

Appendix II: Complete data matrix for phylogentic analysis including morphology plus leaf cuticle features (character 1-53) and *mat*K sequences (character 54-1459)

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                                    5         15         25         35         45         55         65
                                    ----+---------+---------+---------+---------+---------+---------+-----
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Laurus                              01000000010100000111010101101110100000003000320101000CTATTTCAGGAATATAT
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Litsea__Sect.Conodaphne             01000000111101000122110101000110111??0000102220012100CTATTTCAGGAATATAT
Litsea__Sect.Cylicodaphne           00100000001110111112110101000120010000120100111023200CTATTTCAGGAATATAT
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Lindera__Sect.Aperula               01000001110121000110110101001110010020000100110022210?TATTTCAGGAATATAT
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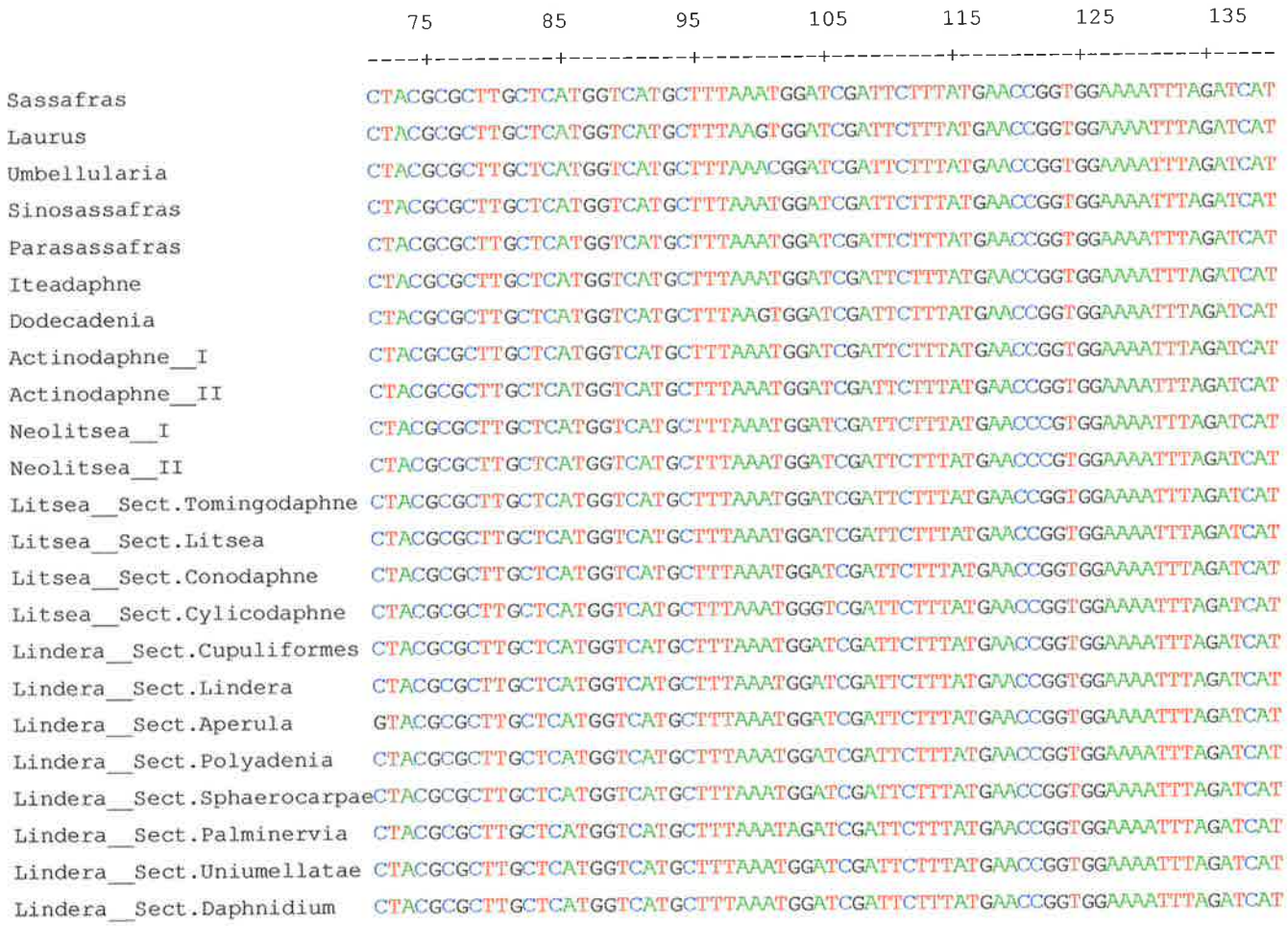
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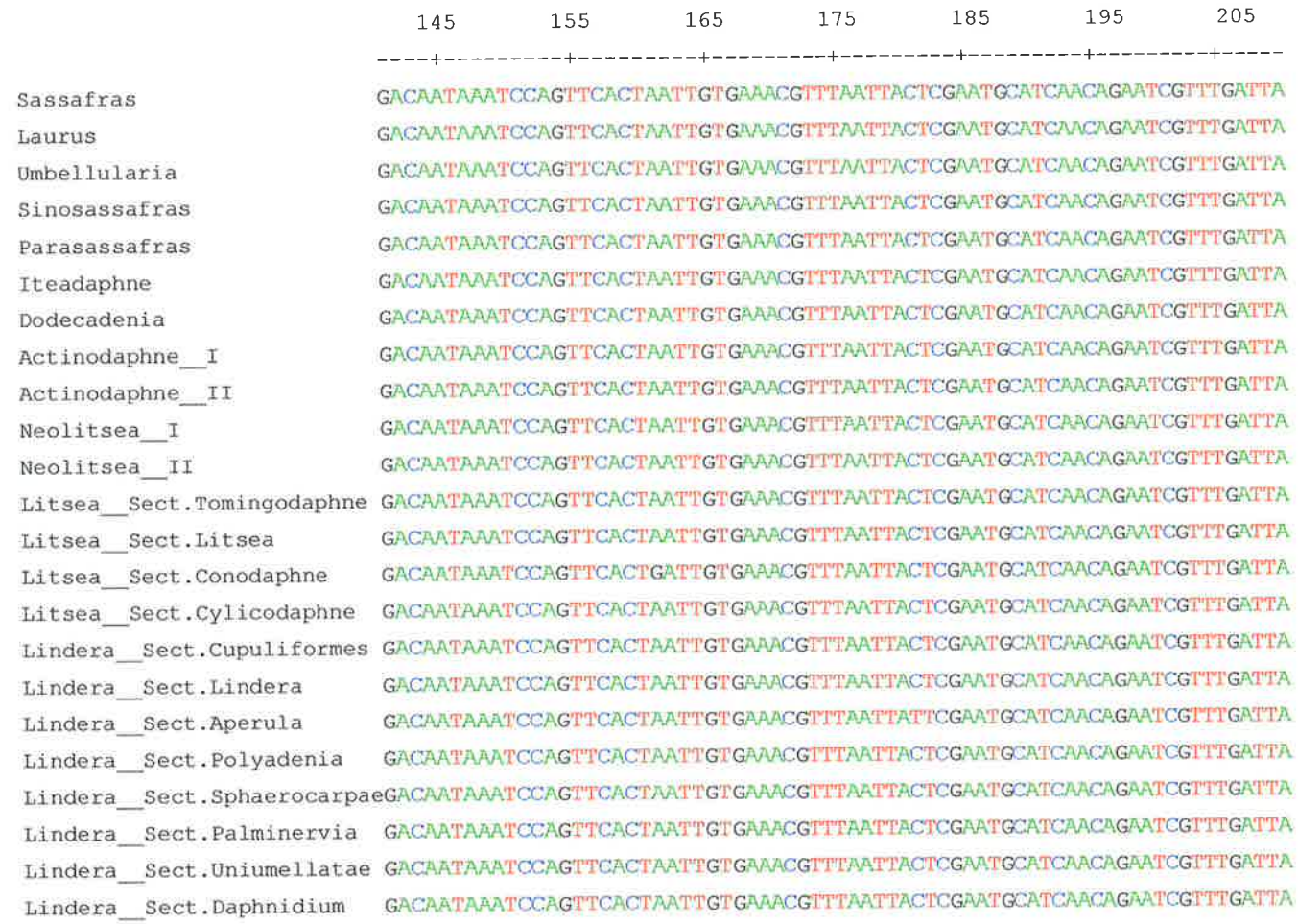
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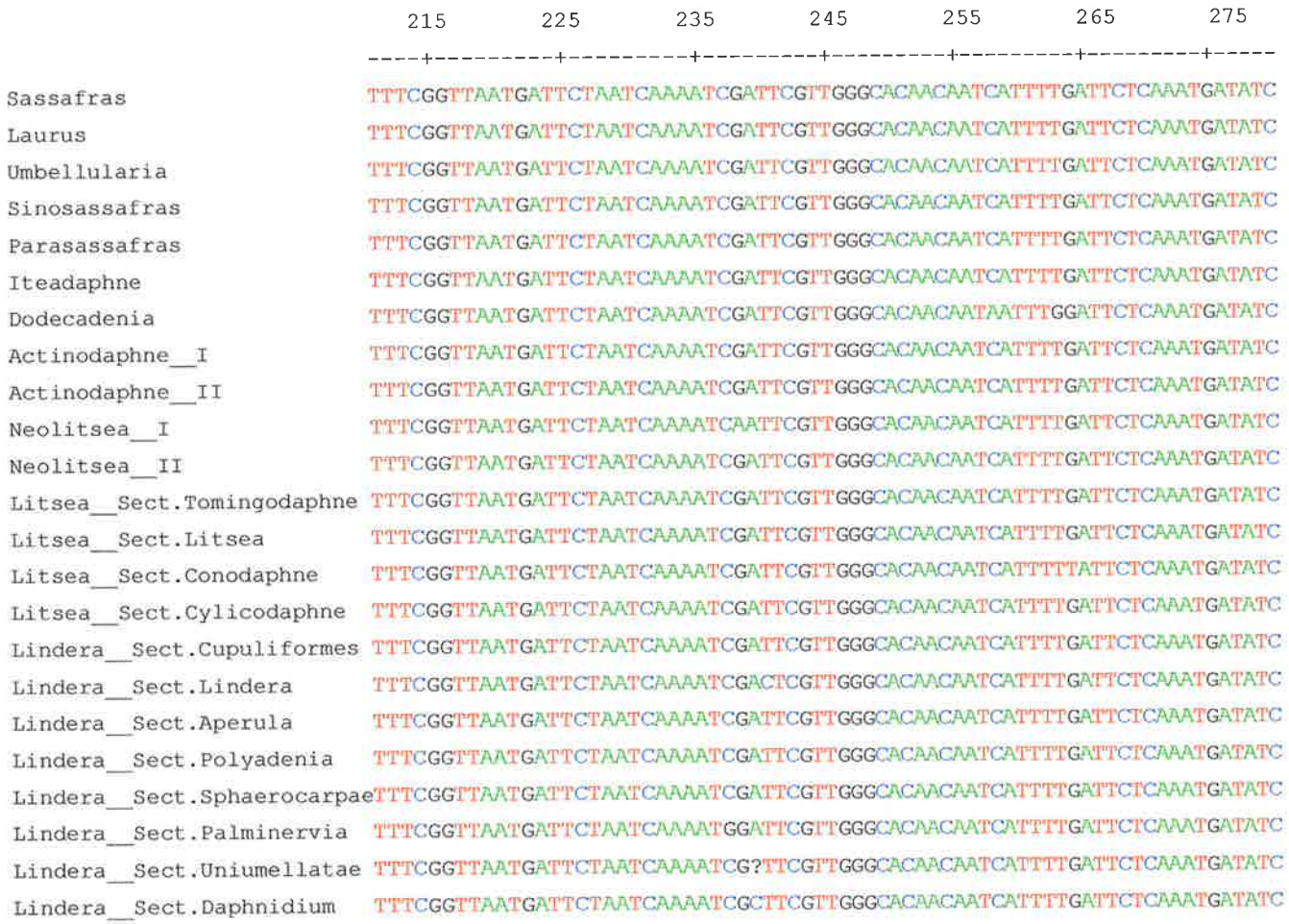
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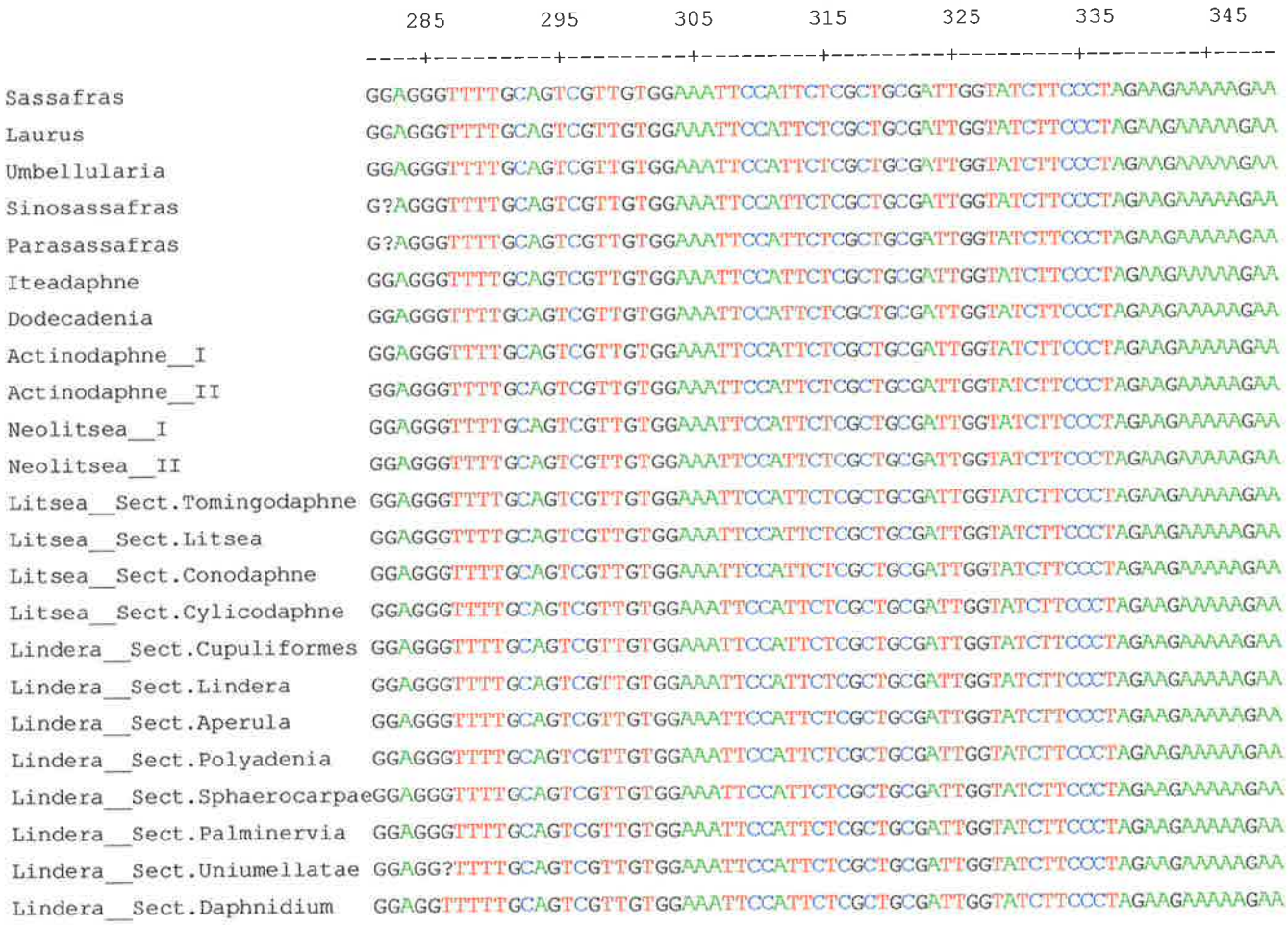
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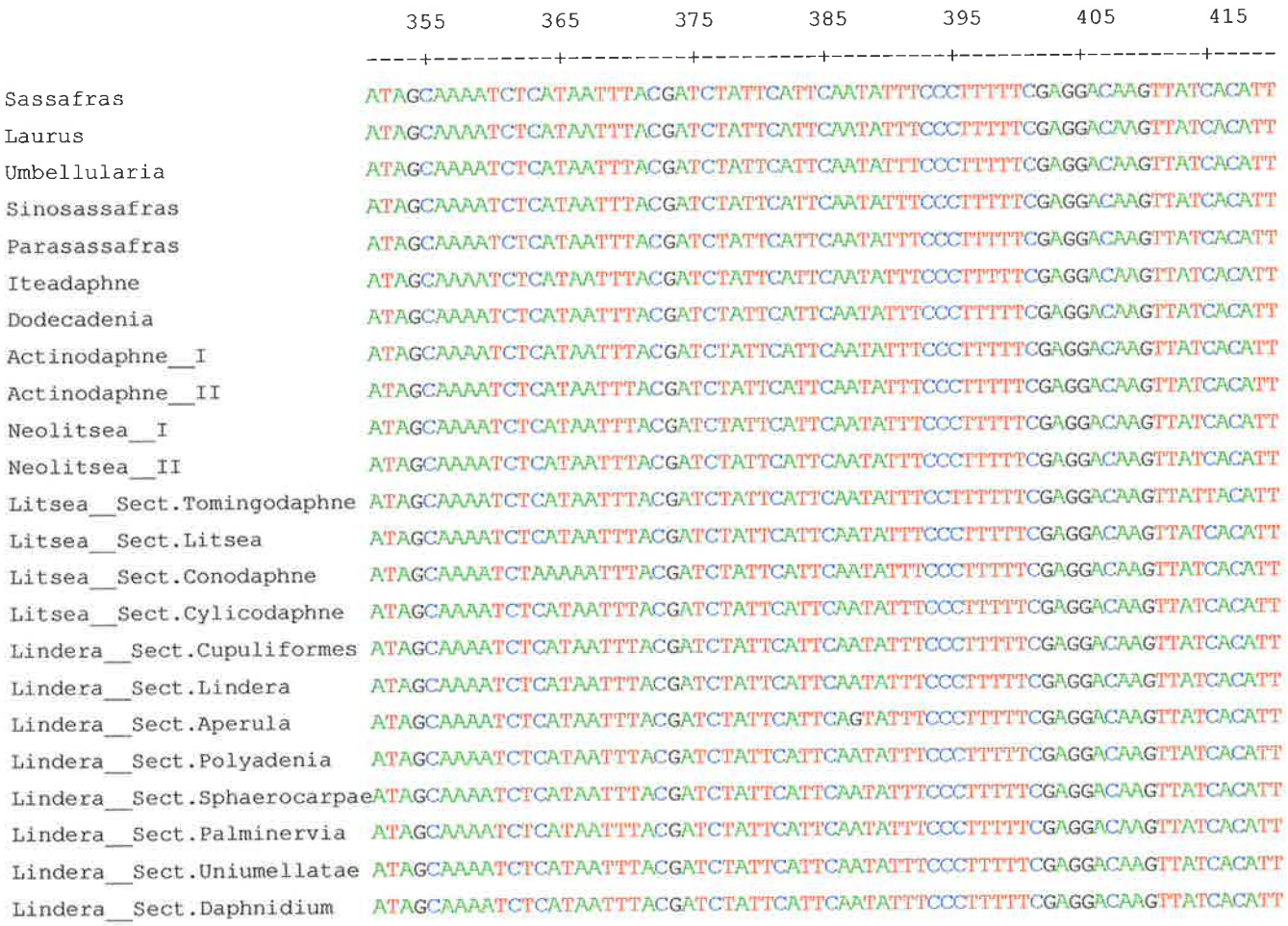
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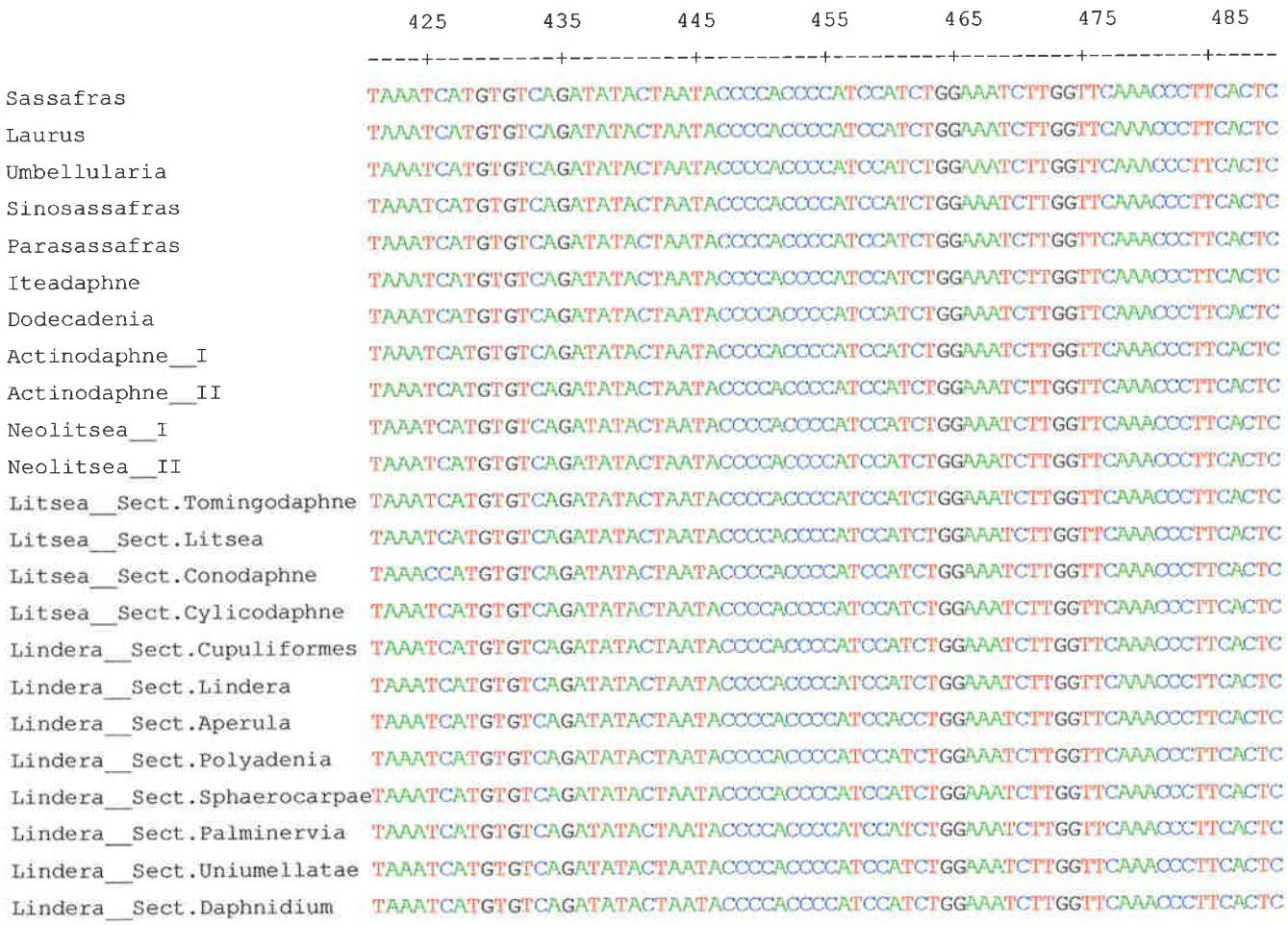
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Neolitsea__I
Neolitsea__II
Litsea__Sect.Tomingodaphne
Litsea__Sect.Litsea
Litsea__Sect.Conodaphne
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Lindera__Sect.Cupuliformes
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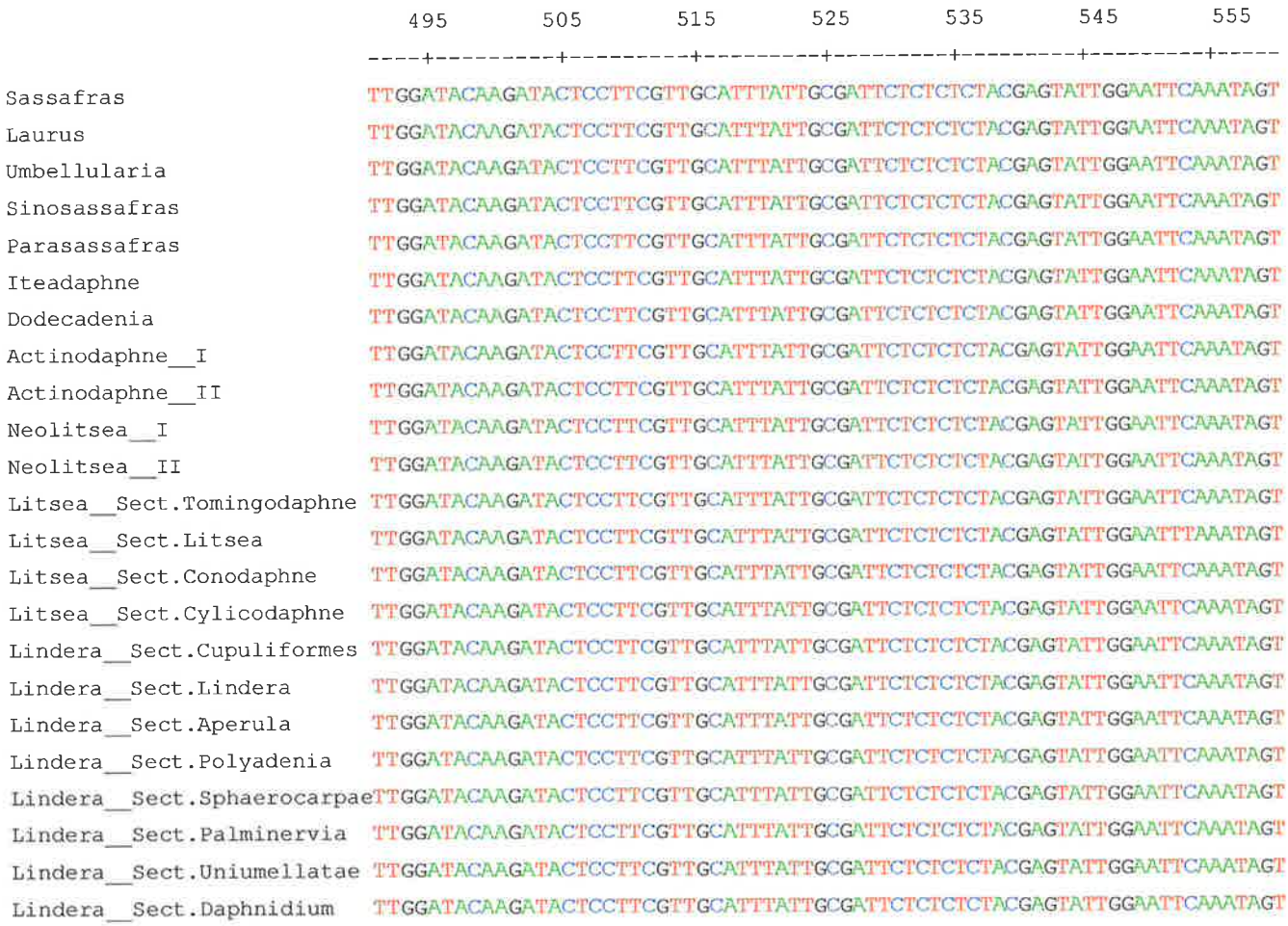
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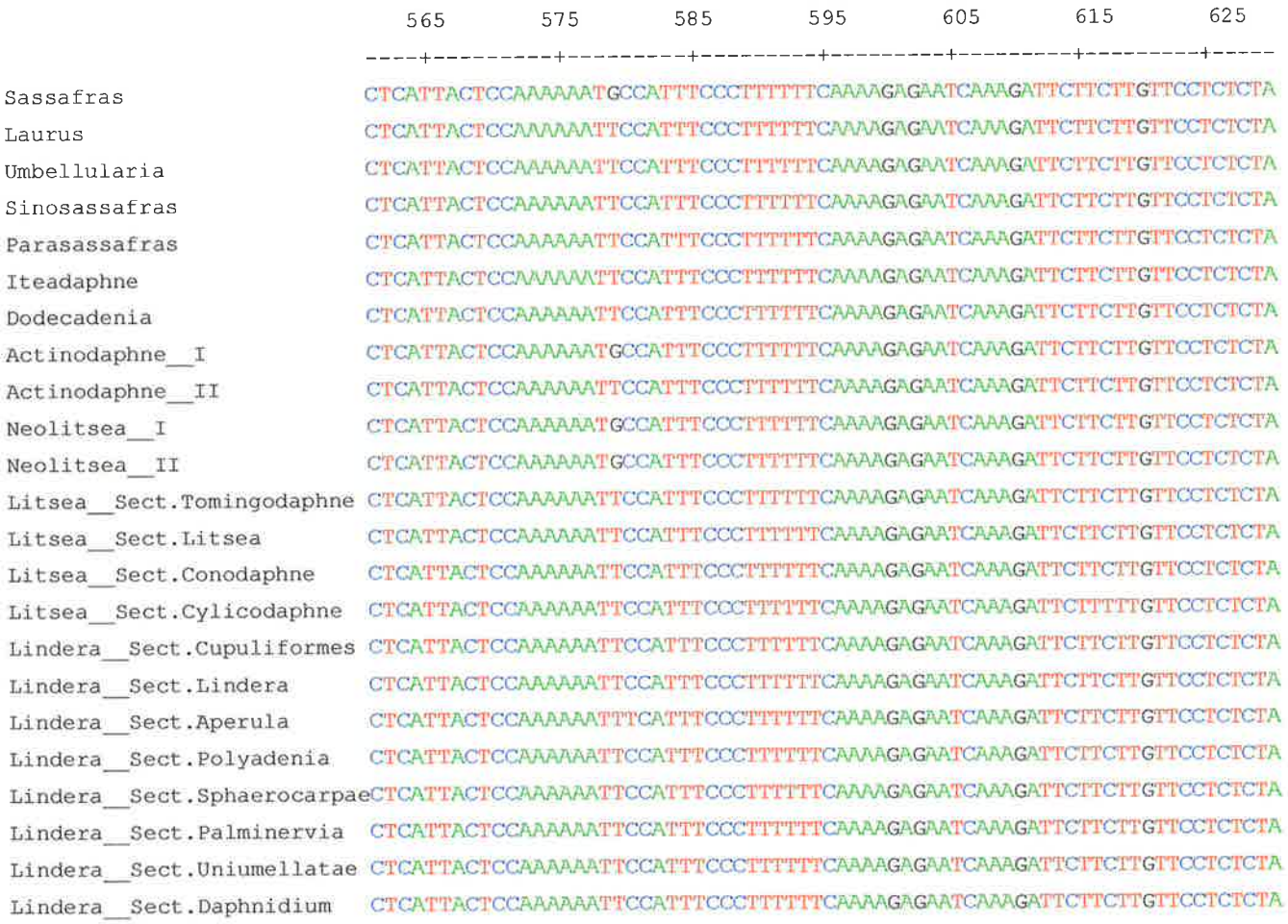
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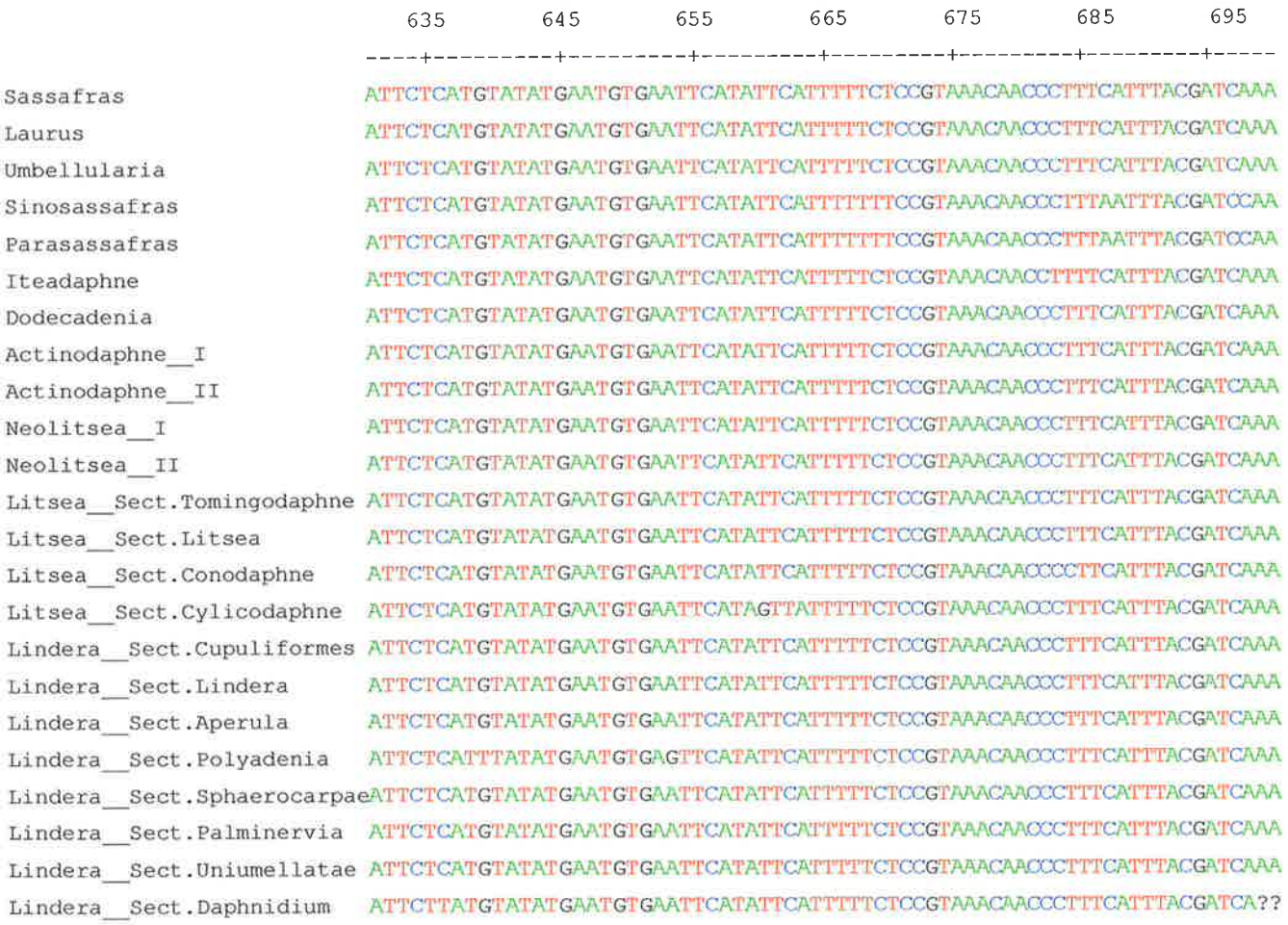
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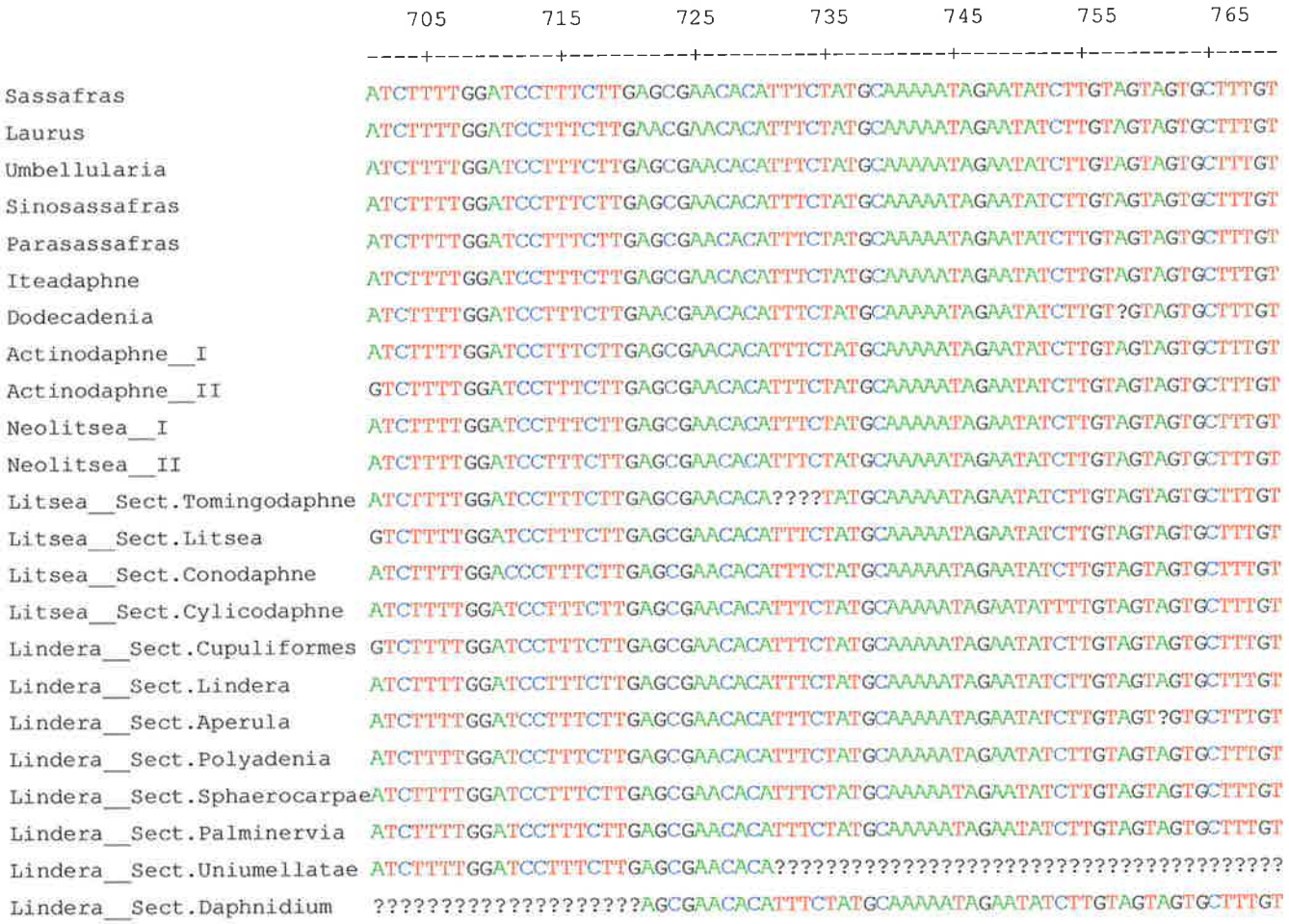
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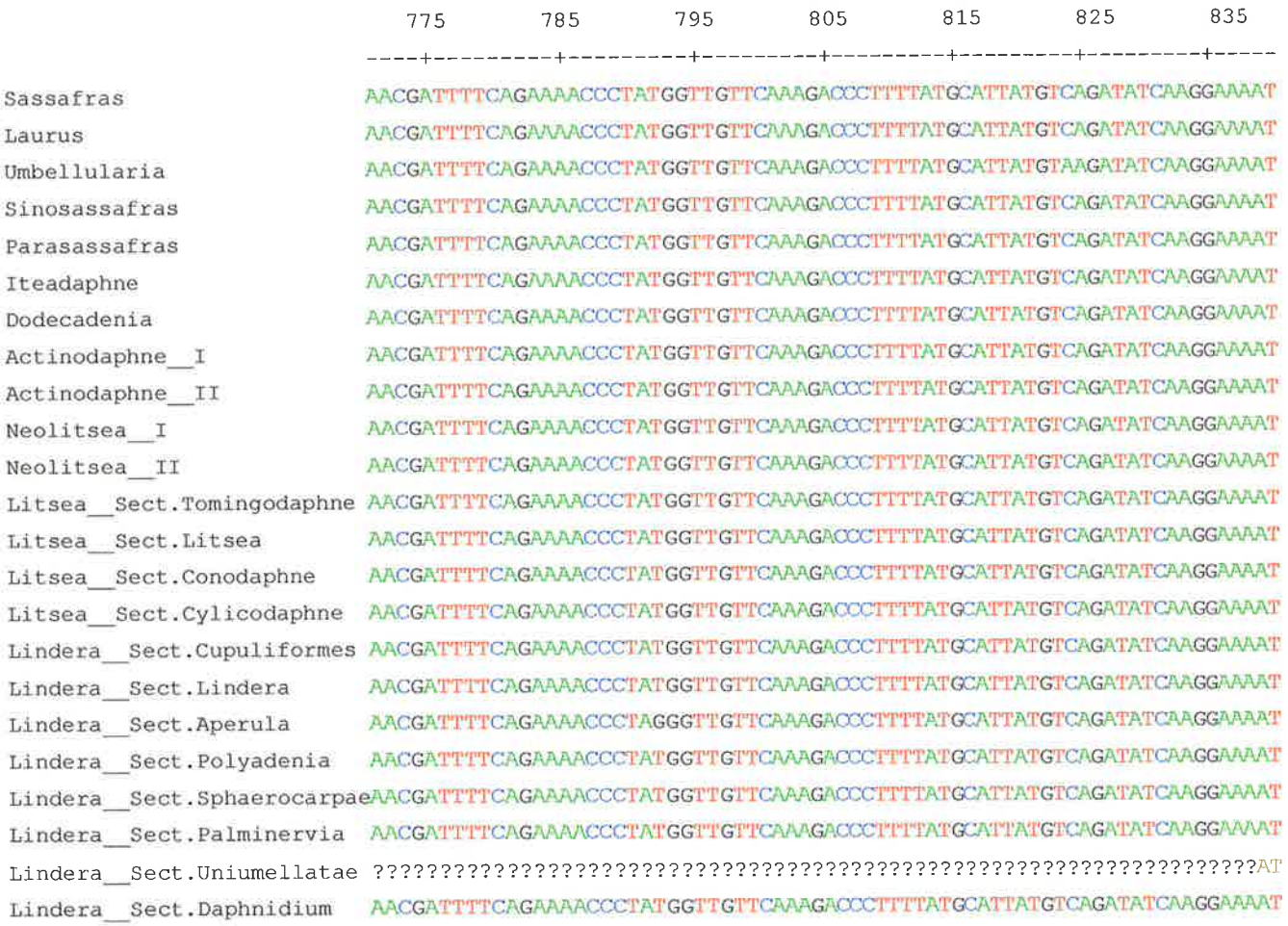
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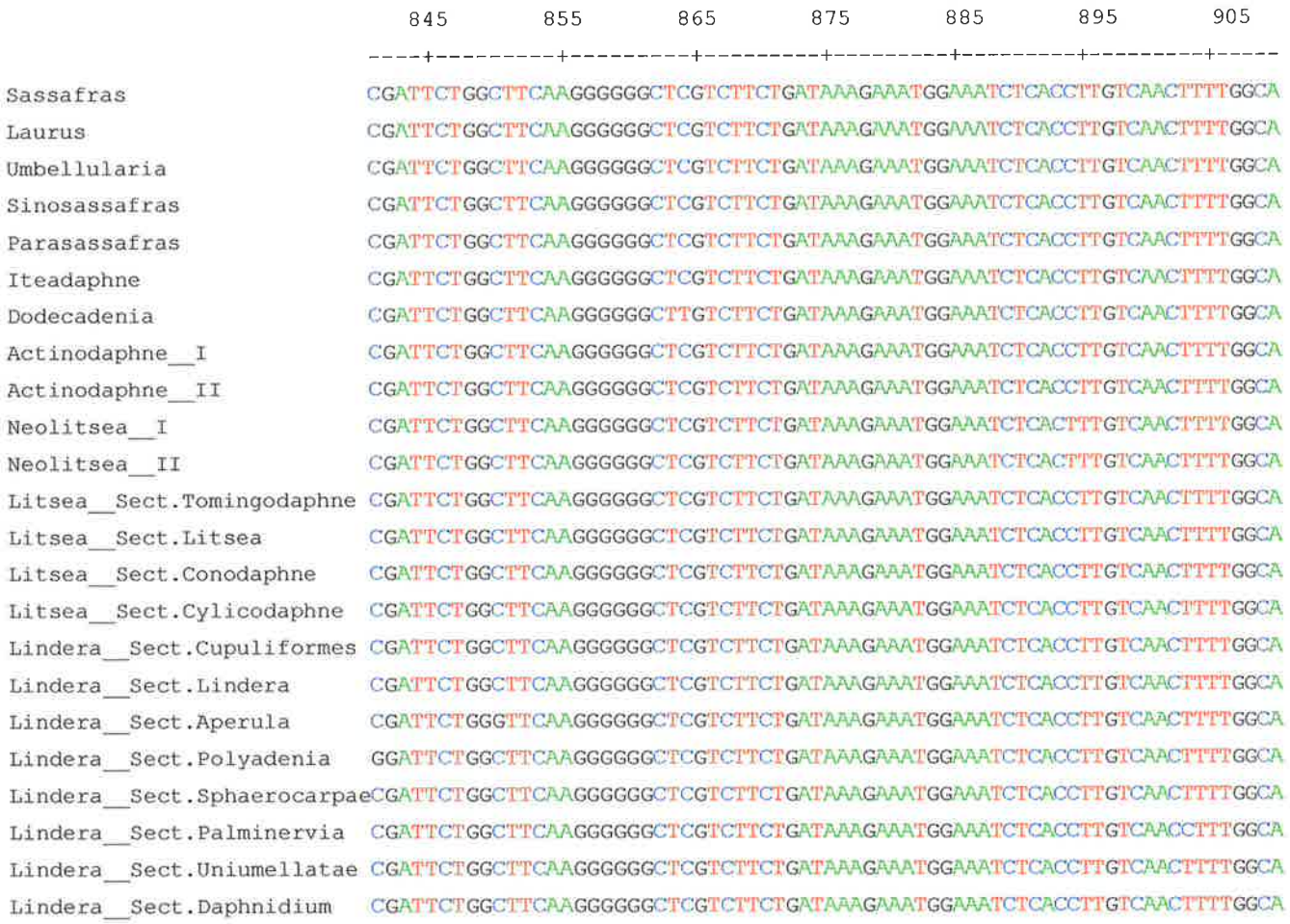
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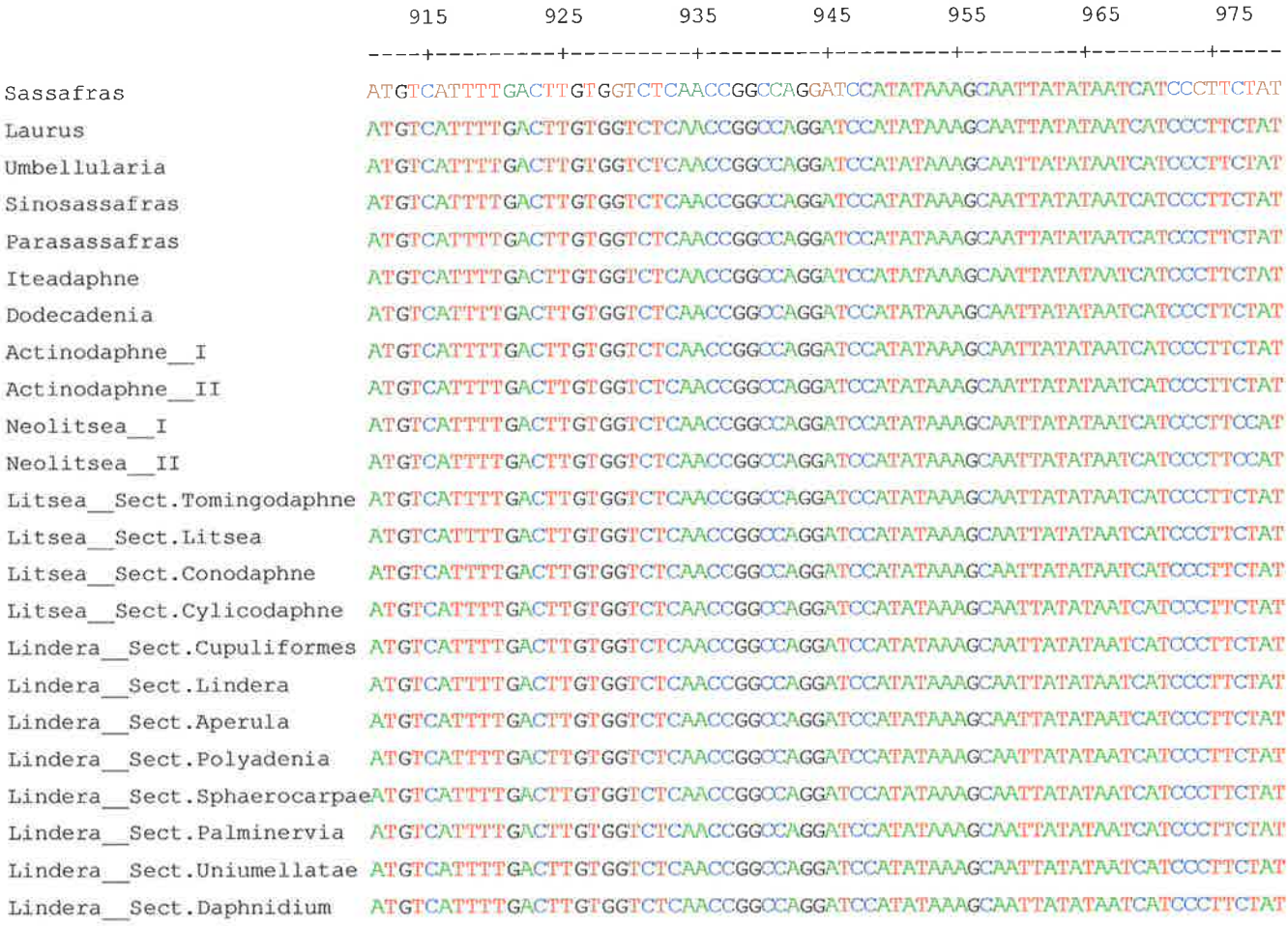
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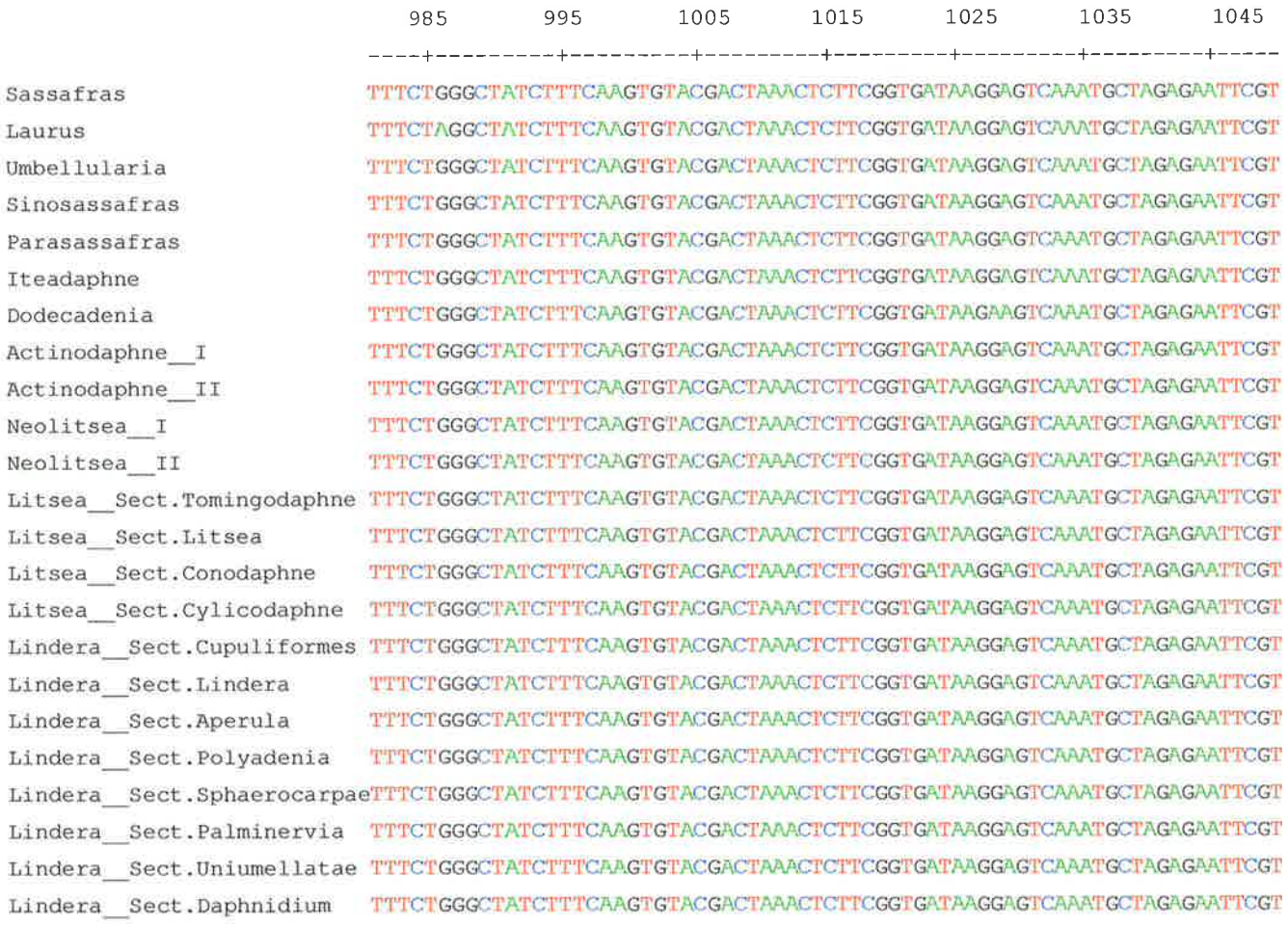
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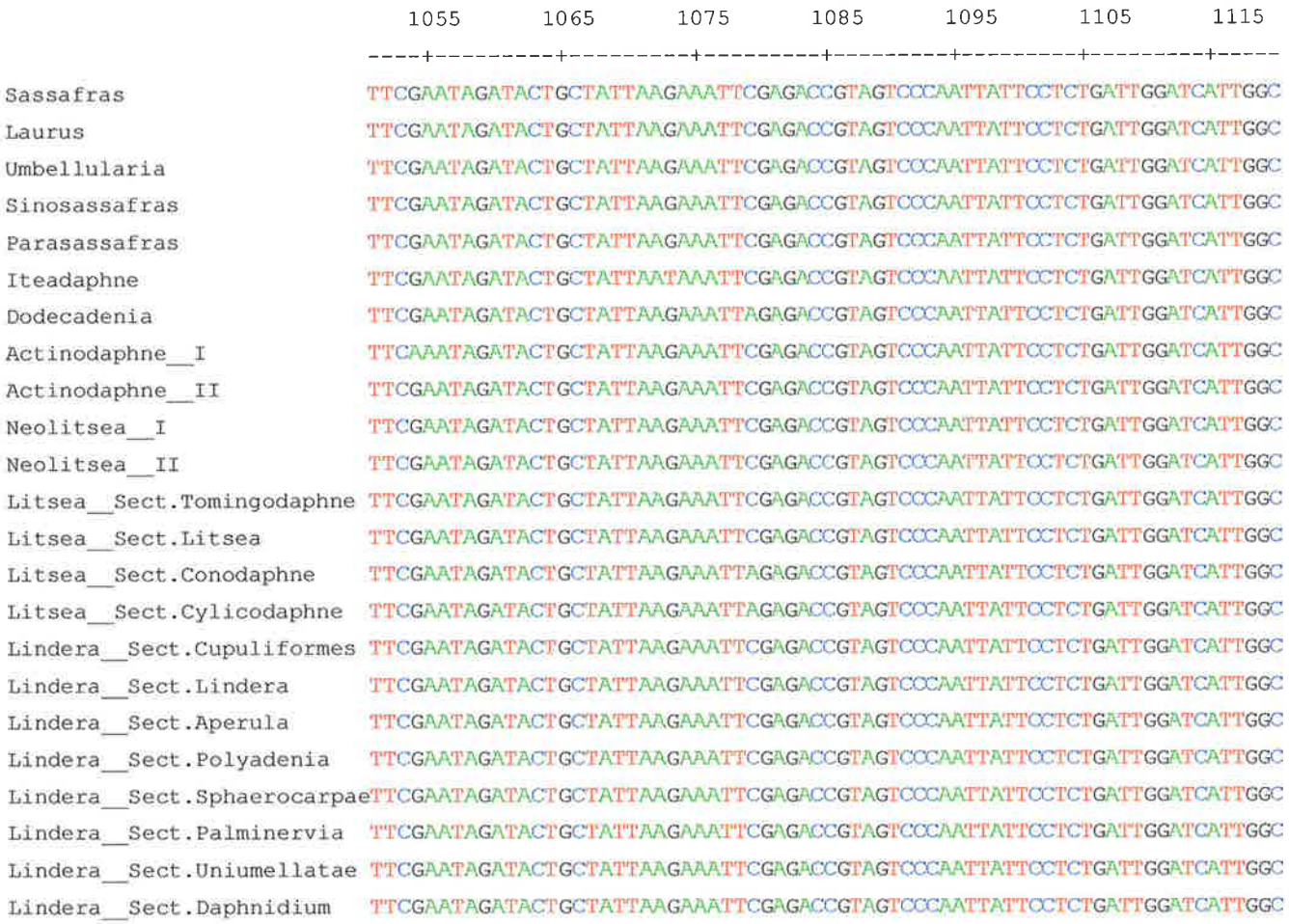
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Lindera__Sect.Uniumellatae TTCGAATAGATACTGCTATTAAGAAATTCGAGACCGTAGTCCCAATTATTCCTCTGATTGGATCATTGGC
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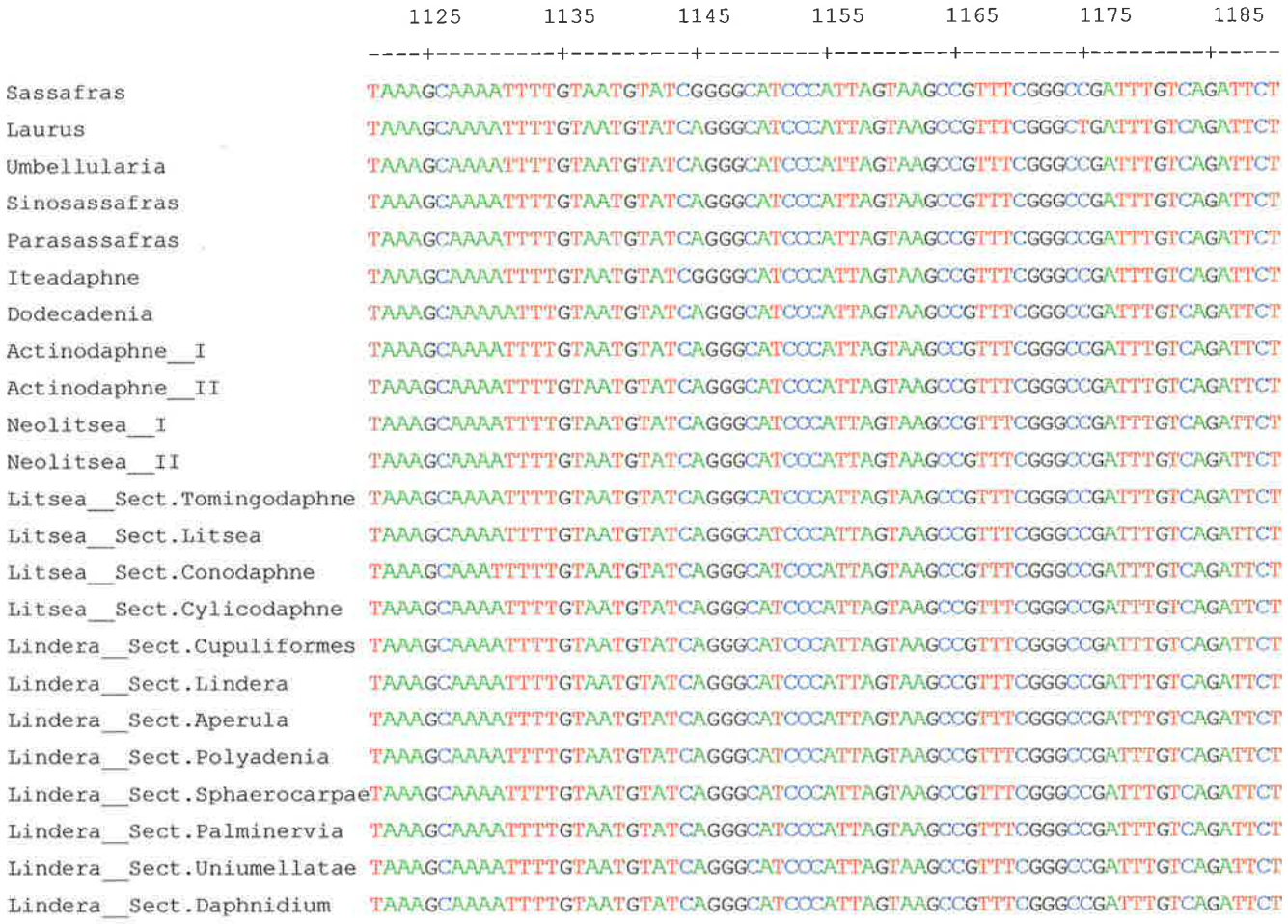
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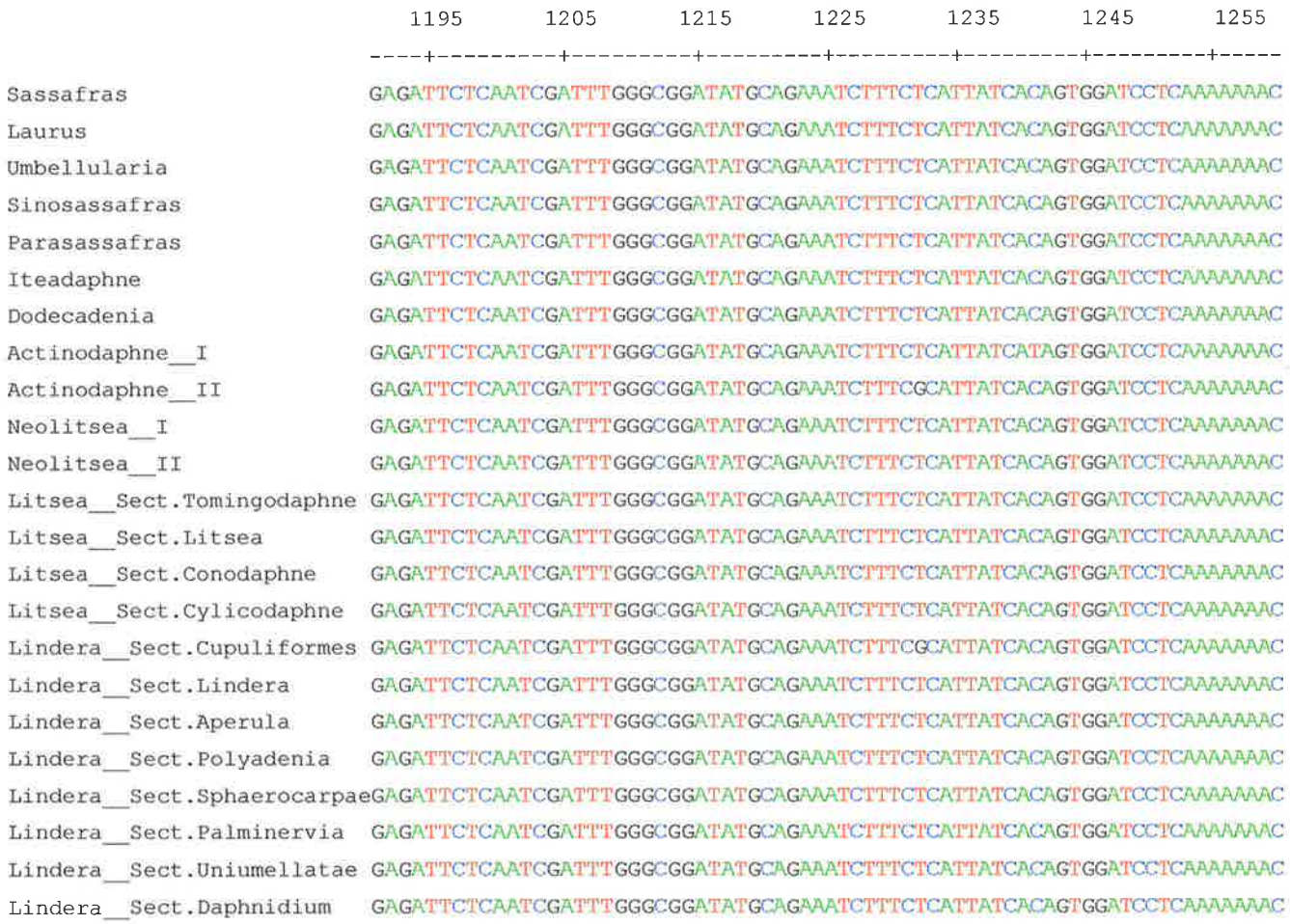
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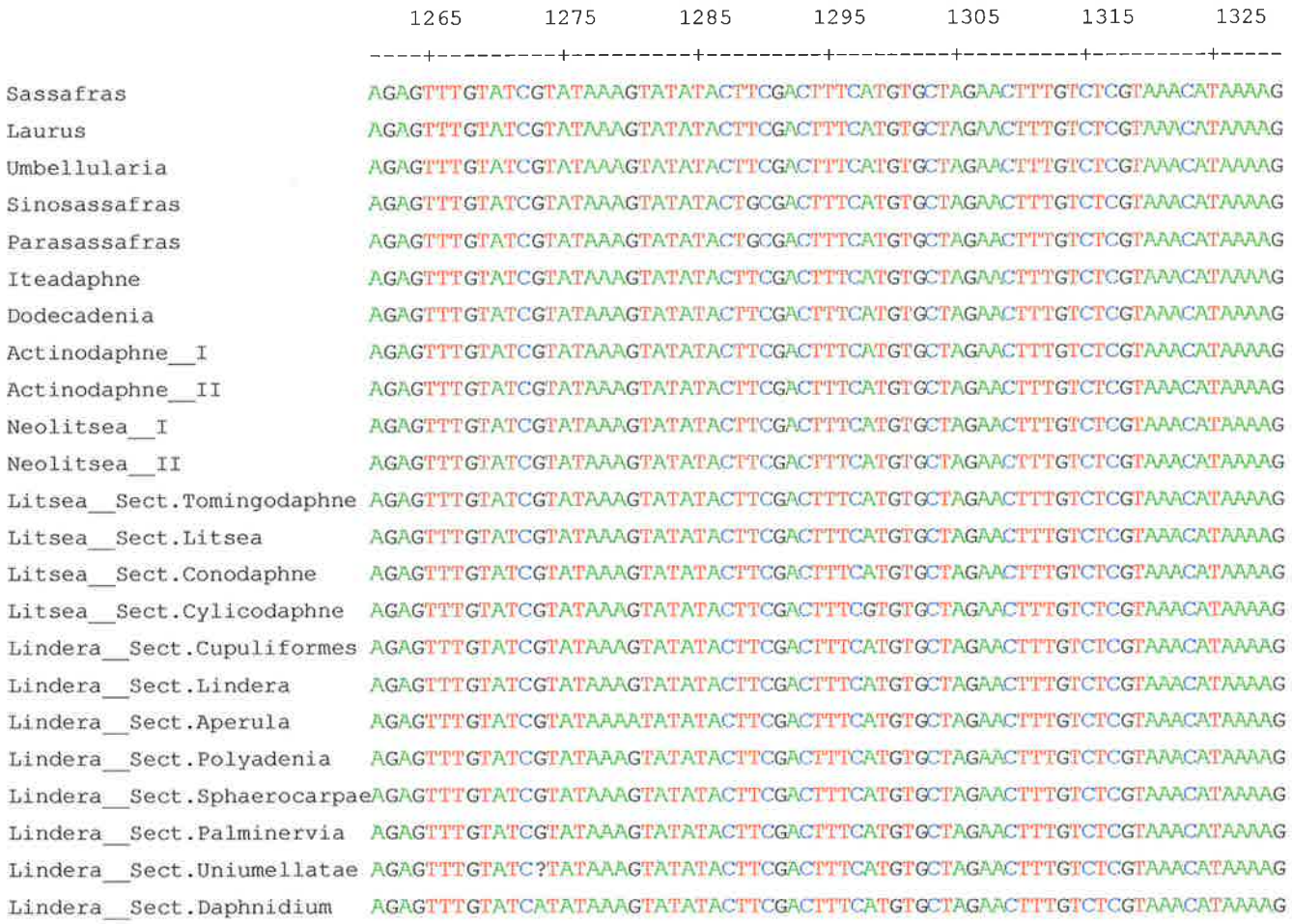
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Laurus AGAGTTTGTATCGTATAAAGTATATACTTCGACTTTCATGTGCTAGAACTTTGTCTCGTAAACATAAAAG
Umbellularia AGAGTTTGTATCGTATAAAGTATATACTTCGACTTTCATGTGCTAGAACTTTGTCTCGTAAACATAAAAG
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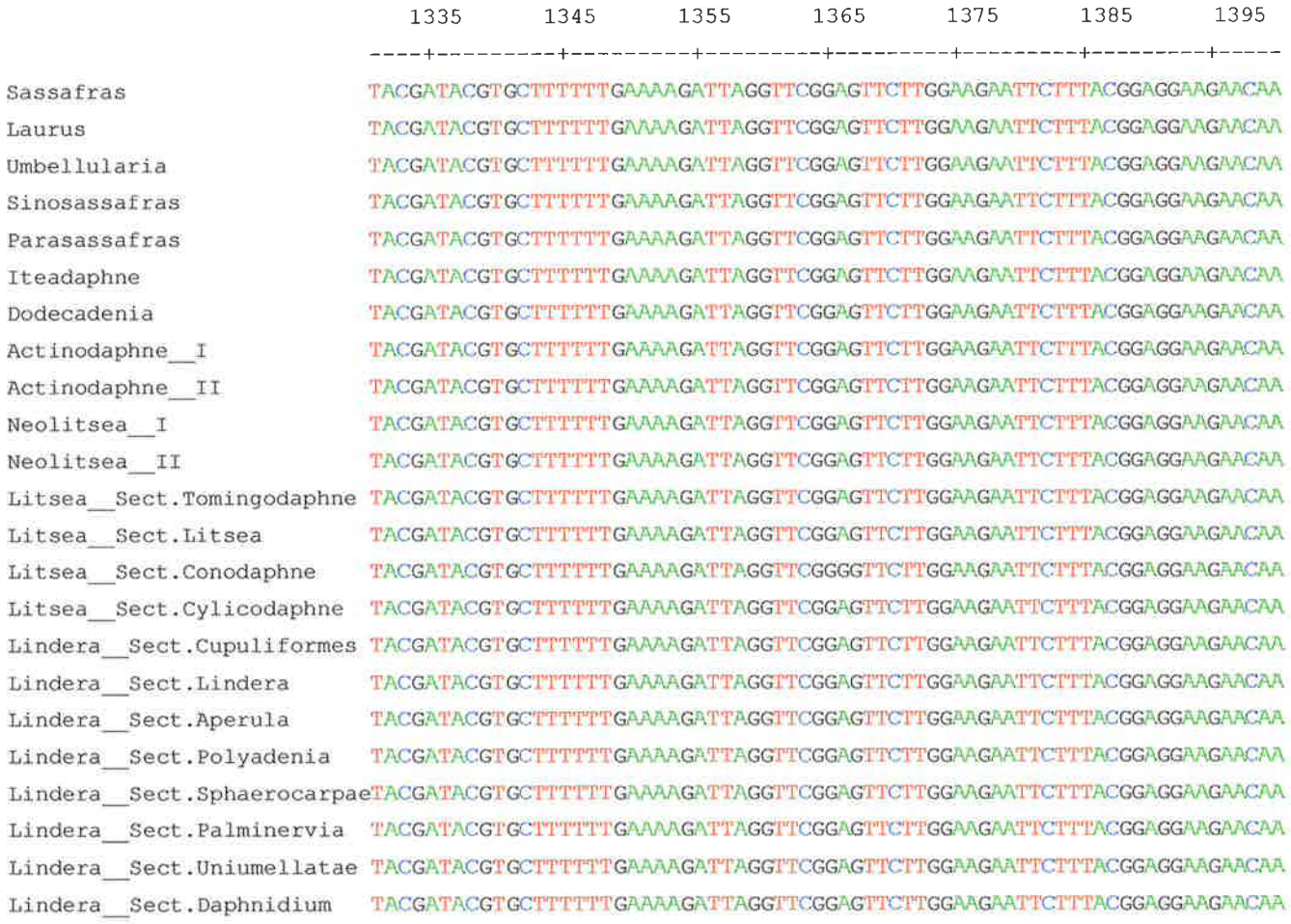
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Dodecadenia
Actinodaphne__I
Actinodaphne__II
Neolitsea__I
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Lindera__Sect.Cupuliformes
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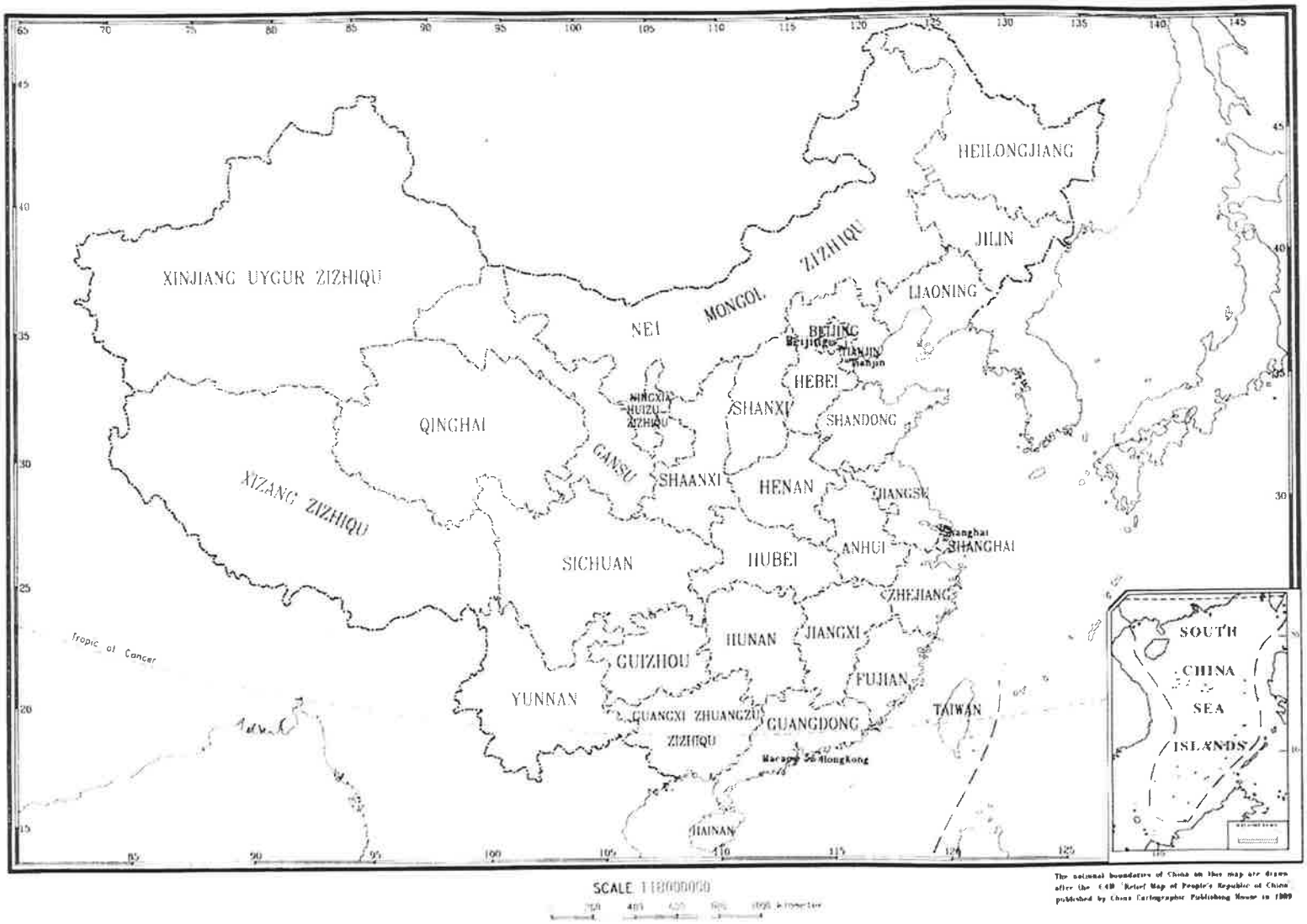
Appendix III:

Map of China



The national boundaries of China on this map are drawn after the 1:4M "Relief Map of People's Republic of China" published by China Cartographic Publishing House in 1989

CHINA'S ADMINISTRATIVE DIVISIONS

ANHUI – Southeast
BEIJING – Northeast
FUJIAN – Southeast
GANSU – North Central
GUANGDONG – Southeast
GUANGXI – South Central
GUIZHOU – South Central
HAINAN – South Central
HEBEI – Northeast
HEILONGJIANG – Northeast
HENAN – Southeast
HONG KONG – Southeast
HUBEI – Southeast
HUNAN – Southeast
JIANGSU – Southeast
JIANGXI – Southeast
JILIN – Northeast
LIAONING – Northeast
MACAO – Southeast
NEI MONGOL – North Central
NINGXIA – North Central
QINGHAI – North Central
SHAANXI – North Central
SHANDONG – Northeast
SHANGHAI – Southeast
SHANXI – Northeast
SICHUAN – North Central
SOUTH CHINA SEA ISLANDS – Southeast
TAIWAN – Southeast
TIANJIN – Northeast
XINJIANG – Northwest
XIZANG – West Central
YUNNAN – South Central
ZHEJIANG – Southeast

Appendix IV:

Systematic relationships within the *Litsea* complex (*Lauraceae*): a cladistic analysis on the basis of morphological and leaf cuticle data

Li, J. and Christophel, D.C. (2000). Systematic relationships within the Litsea complex (Lauraceae): a cladistic analysis on the basis of morphological and leaf cuticle data. *Australian Systematic Botany*, 13(1) 1 - 13.

Appendix V:

Key to the revised genera in the *Litsea* complex

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Key to the *Litsea* complex leaf cuticles

(Using taxonomical computer program LucID)