NOTES FROM THE
ROYAL BOTANIC GARDEN
EDINBURGH

VOLUME XXII · No. 5 · 1958

A MONOGRAPHIC REVISION OF OSMANTHUS IN ASIA AND AMERICA

P. S. GREEN

Many genera in the Oleaceae are in need of taxonomic revision. New species have gradually been described until what were at first relatively small and compact groups have now become medium or large genera; this, too, without the various species ever having been considered in relation to each other. *Osmanthus* is one such genus, as was revealed by an examination of herbarium material and of the literature, and this paper is the outcome of the resultant investigations.

The delimitation of genera within the *Oleineae* also calls for revision, but, by restricting this review of *Osmanthus* to the species from Asia and America, many of the difficulties at generic level can be avoided. For this reason the New Caledonian and Hawaiian species have been omitted. The African *Olea welwitschii*, the only other species which has at any time been treated as an *Osmanthus*, is also excluded; it has been placed at one time or another in no less than five different genera and its immediate affinities almost certainly do not lie here.

Although the generic limits in the *Oleineae* are in need of revision as a whole, certain decisions on generic delimitation have had to be taken. In 1929 Stapf separated the two species *Osmanthus suavis* and *O. delavayi* as the genus *Siphonosmanthus*. He considered that the cylindrical corolla tube of these species was sufficiently distinct to warrant generic recognition. However with the discovery of *O. urceolatus*, described below, such a separation, based upon corolla shape, becomes somewhat artificial and the genus *Siphonosmanthus* is therefore reincorporated as a section of *Osmanthus*. The N. American *O. americanus* has also been treated by some as a distinct genus; first by Rafinesque in 1838 as the genus *Cartrema* and then by Small, nearly a hundred years later and presumably in ignorance of Rafinesque's name, as the genus *Amarolea*. This North American species has thus been accorded generic rank on two separate occasions whilst the several closely related E. Asiatic species have always been treated as *Osmanthus*, albeit in a section of their own. It is in agreement with this broader view that Small's genus *Amarolea* is here treated as synonymous with part of *Osmanthus*.*

* Since the manuscript of this revision was completed L. A. S. Johnson's paper "A Review of the Family Oleaceae" (Contrib. New South Wales Nat. Herb. ii, 395: 1957) has come to hand. In it he transfers the New Caledonian and Hawaiian species of *Osmanthus* to the revived genus *Gymnelaea* (Endl.) Spach. It is believed that this procedure is correct in principle but the level at which generic separation is effected differs in Johnson's review from that in this revision. Both the genera *Amarolea* and *Siphonosmanthus* are maintained by Johnson but in this revision they are more cautiously retained within *Osmanthus* until other closely allied genera have been revised.

HISTORY

The genus *Osmanthus* was founded by Loureiro in his Flora Cochinchinensis of 1790, with one constituent species: *O. fragrans*. Apparently by coincidence, Loureiro's epithet repeated that already used by Thunberg, who had described the same species as *Olea fragrans* in 1784, using Japanese material. Willdenow, when editing the second edition of Loureiro's flora in 1793, pointed out that Thunberg's and Loureiro's plants were the same. *Osmanthus fragrans*, however, was not the first species in the genus as now understood to be described and given a name, for Linnaeus had described *Olea americana* in 1776, though its transfer to *Osmanthus* was not effected until 1878.

Even after Loureiro's establishment of *Osmanthus* it took a considerable time for its acceptance to become at all widespread. The type species continued to be known and referred to by some as *Olea fragrans* for about a hundred years, that is until about the last decade of the nineteenth century. *Osmanthus heterophyllus* was first formally named *Olea ilicifolius* in 1832, some forty years after Loureiro's description of the genus, and *Osmanthus marginatus* was first described as *Olea marginata* in 1852, twenty years later still.

Until the last two decades of the nineteenth century only five species were known: *Osmanthus fragrans*, *O. americanus*, *O. heterophyllus*, *O. marginatus* and *O. fortunei*. One of these was known at the time as an *Olea*, *Olea marginata*, and one was an interspecific hybrid, *O.* × *fortunei* (*O. fragrans* × *O. heterophyllus*) although its hybrid origin was unsuspected.

Between 1880 and 1900 seven species were added: *O. suavis* (1882), *O. delavayi* (1886), *O. fordii* (1889), *O. yunnanensis* (as *Pittosporum yunnanense*, 1889), *O. cooperi* (1896), *O. matsumuranus* (as *O. marginatus* var. *formosanus*, 1898) and *O. armatus* (1900). Between 1900 and 1918 six further species were described: *O. scortechinii* (1906), *O. lanceolatus* and *O. venosus* (1911), *O. insularis* (1914), *O. serrulatus* (1916) and *O. rigidus* (1918). Three species were added in 1939 (*O. mexicanus*, *O. enervius* and *O. acutus*) and eight more are named and described in this paper. Today, therefore, the genus consists of twenty-nine species (two of them unknown to the present author) with, in addition, five further species incompletely collected and as yet unnamed.

It is worth noting that of the twenty-nine described species, no less than eight are known only from single collections and two, *O. fordii* and *O. reticulatus*, from but two. Particularly noticeable is the fact that of these eight species, *O. cooperi* has not been collected since the type material was gathered in 1895. This, together with the five unnamed new species described in this revision, shows that much collecting work yet remains to be done.

HISTORY IN CULTIVATION

A few species of *Osmanthus* are noteworthy horticultural plants and in all ten species are, or have been, in cultivation. *O. fragrans* has the longest history, probably reaching back many centuries, for it has long been prized in China, Japan, India and Assam for its abundant sweet-scented

flowers. From China, and probably Japan as well, it was introduced into Europe in the eighteenth century and has been in cultivation there ever since. *O. heterophyllus* must also have been cultivated for centuries in Japan, and although it is not known when *O.* × *fortunei* first arose, it too has certainly been grown in Japan for over 100 years. *O. americanus* has been grown in European gardens, but only for its botanical interest, and usually as a greenhouse plant, although Loudon (Arb. et Fruct. Brit. ed. 2, 1208: 1884) records a specimen growing in the open against a wall in southern England. Its cultivation has never been particularly widespread, but Rehder records it as having been taken into gardens as early as 1758.

Several species from the Sino-Himalayan regions have been introduced into cultivation during the last fifty or so years, but apart from *O. delavayi* it is unlikely that they will prove of particularly outstanding horticultural value in Britain, except as evergreen shrubs. The other species are: *O. armatus*, *O. serrulatus*, *O. suavis* and *O. yunnanensis*. Finally, although no plants are known to be growing in European gardens, *O. insularis* (as *O. zentaroanus*) is in cultivation in Japan, but whether for botanical interest or horticultural value I do not know.

Mention may be made here of the hybrid between *Osmanthus delavayi* and *Phillyrea decora* raised by the firm of Burkwood & Shipwith at Kingston-on-Thames and given the name × *Osmarea burkwoodii* Hort. (Gard. Chron. Ser. 3, lxxix, 438 in obs.: 1931). It is a very hardy evergreen shrub, more or less intermediate between its parents and of taxonomic interest as showing the close genetic affinity between the two genera, *Osmanthus* and *Phillyrea*, especially as it produces what appears to be viable pollen.

Apart from its horticultural importance the genus *Osmanthus* has very little applied or economic value. Sonohara, Tawada & Amano in their "Flora of Okinawa" state that *O. enervius*, *O. insularis* (as *O. zentaroanus*) and *O. marginatus* (as *O. bracteatus*) are used for timber and some of the larger tree species, such as *O. matsumuranus*, may also prove to be a source of timber. Gamble in his "Manual of Indian Timbers" ed. 1, 257 (1881) gives a description of the timber of *O. suavis* but does not mention its value or uses. He also states that the flowers of *O. fragrans* are used in Kumaun to keep insects away from clothes, and mentions the fact, noted much earlier by Fortune, that in China the flowers of *O. fragrans* are used for flavouring tea.

O. heterophyllus is recommended as a fire-break. Nakamura (Journ. Jap. For. Soc. xxxiii, 367: 1951) carried out a special investigation into the combustibility of the leaves of trees with a view to their suitability as fire-breaks and one of the species he recommends is *O. heterophyllus*.

Finally, Ludlow, Sherriff & Hicks on one of their field notes remark that in Bhutan the evergreen shoots of *O. suavis* are fed to cattle during winter.

MORPHOLOGY

(for ease of reference to species see Table)

HABIT. The genus *Osmanthus* consists of shrubs and trees. The largest specimens of *O. matsumuranus*, to judge from collectors' field notes,

reach to about 20 m. (or even 35 m. in one case), whilst in contrast, *O. delavayi* is a shrub normally ranging in height from about 0·6 to 2 m. and *O. reticulatus* is noted as being 2 m. in height.

Generally speaking, Sects. *Osmanthus* and *Siphosmanthus* are shrubs or small trees whilst Sects. *Leiolea* and *Linocieroides* are trees.

TABLE

(Note: the records of some Asiatic species are based in some instances on material which is doubtfully native; for further discussion see notes under the species concerned).

	U.S.A.	Mexico	Japan	Formosa and the Ryukyu Islands	China	India	Indo-China and Thailand	Malay Peninsula	Sumatra
Sect. **Leiolea**									
1. O. americanus									
var. americanus	x	x							
var. megacarpus	x								
var. microphyllus		x							
2. O. mexicanus		x							
3. O. minor					x				
4. O. matsumuranus				x	x	x	x		
5. O. marginatus				x	x				
6. O. scortechinii								x	
7. O. sumatranus									x
8. species "A"					x				
Sect. **Osmanthus**									
9. O. fragrans			x	x	x	x	x		
10. O. yunnanensis					x				
11. O. serrulatus					x				
12. O. henryi					x				
13. O. insularis			x	x					
14. O. fordii					x				
15. O. hainanensis					x				
16. O. × fortunei									
17. O. heterophyllus									
var. heterophyllus			x	x					
var. bibracteatus				x					
18. O. reticulatus					x				
19. O. armatus					x				
20. O. venosus					x				
21. species "B"					x				
22. species "C"					x				
23. O. lanceolatus				x					
24. O. attenuatus					x				
25. O. cooperi					x				
26. species "D"					x				
27. species "E"				x					
28. O. enervius				x					
29. O. urceolatus					x				
Sect. **Siphosmanthus**									
30. O. suavis					x	x			
31. O. delavayi					x				
Sect. **Linocieroides**									
32. O. didymopetalus					x				

BRANCHLETS. Very few characters of importance have been noted. In most species they are glabrous, at least at maturity, but in many they are puberulent when young, although often minutely so. However, with the formation of a phellem all puberulence is lost. Certain species, such as *O. reticulatus*, exhibit rather prominent lenticels on the bark of their twigs, but without observations on a range of fresh material it is uncertain how valuable a character this might prove.

LEAVES. In a genus where vegetative characters play such an important part in diagnosis and identification, the characters of the leaf, its shape, texture, margin, venation, etc., are of particular value. Throughout the genus the leaves are characteristically glabrous but in some species, for example those with puberulous petioles, the midrib above is often puberulous when young, especially at the base. The surface of the leaf, as is characteristic of many genera in the *Oleaceae*, is generally punctate with a greater or less development of glandular peltate trichomes, usually sunk in depressions on the surface, but often appearing under the lens as small scattered dots. An illustration of these glands and a more detailed account of their occurrence in *O. heterophyllus* has been given by Metcalfe (Kew Bull. 1938, 255).

PETIOLES. The petioles vary from being relatively thick and short as in *O. armatus* (3–8 mm. long) and *O. delavayi* (1–5 mm. long) to somewhat slender and long in *O. cooperi* (10–30 mm.). They are usually grooved above and often thickened at the base, particularly in Sect. *Leiolea*. They may be glabrous or puberulous, sometimes minutely so, with the hairs visible only on those of young leaves and with good magnification. In all the plants with puberulous petioles, the puberulence was most obvious on the upper surface (with one exception); in *O. serrulatus* when present it is even confined to the petiolar groove. However, in the single exception, species "C", the groove itself is glabrous and the back of the petiole puberulous.

TEXTURE OF LAMINA. The species of *Osmanthus* are evergreen with characteristically thick and coriaceous leaves; they may range, however, from almost chartaceous in *O. minor* and *O. matsumuranus* to very thick and coriaceous in *O. heterophyllus*, *O. armatus*, *O. venosus*, etc. Rigidity and thickness normally is imparted to the leaf by a variable development of sclerenchymatous idioblasts within the mesophyll and palisade tissue. It is planned that an account of these idioblasts, together with that of the general leaf anatomy, should form the subject of a separate note, but a few comments about their occurrence in various species will not be out of place here. In some species, such as *O. didymopetalus*, the idioblasts are extremely abundant, whilst in others, for example *O. serrulatus*, there are very few, and in *O. fordii* they appear to be absent. In many cases it has been found that quite a good diagnostic character exists in the presence or absence of minute raised dots on the surface of the leaves of dried specimens, and this character has been used to a limited extent in the artificial key to the species in Sect. *Osmanthus*. In *O. henryi*, for example, the "dots" are quite noticeable under a lens and distinct from one another, whilst in *O. fragrans* the dots are so numerous as to give the surface a minutely bullate appearance under the lens. It is believed that these raised "dots" indicate the presence of idioblasts within the leaf, tending

to keep the epidermis raised whilst the surrounding tissue shrank during drying, for those species with more "dots" are found on anatomical investigation to possess more idioblasts. The raised "dots" are not to be confused with the minute punctations imparted by the presence of peltate glands scattered over the leaf surface, so characteristic of this and allied genera. In *O. fordii* for example, where no idioblasts have been observed, there are no raised dots, but the leaf surface is none the less noticeably punctate.

Size and Shape of Lamina. The leaf shapes most characteristic of *Osmanthus* are lanceolate, elliptic and oblanceolate, sometimes narrowly so, but occasionally the leaves possess broader proportions and in *O. delavayi* they are characteristically ovate.

Size is not a very useful diagnostic character but the smallest leaves of the genus are found in *O. delavayi* and this species, together with *O. suavis*, may be separated from the others on leaf dimensions alone.

Leaf Margin. Leaf margin on the other hand is a much more valuable character from the point of view of identification. In Sects. *Leiolea* and *Linocieroides* it is characteristically entire and, although it may appear thickened, as in *O. marginatus*, this appearance is imparted by the inrolling which so often takes place to a greater or lesser extent. In *O. matsumuranus* one frequently finds that the leaves, especially in the upper half, possess blunt serrations, occasionally more or less acute but often obscure. This is exceptional for the section. Furthermore the impression obtained from the study of herbarium specimens alone is of a fundamentally different type of serration from that in Sect. *Osmanthus* where the teeth are spinescent; nor do the teeth appear to be restricted to leaves on somewhat immature shoots.

The greatest variability in leaf margin occurs in Sect. *Osmanthus*. In many species the leaves often develop thickened spinescent serrations, varying in length and number according to the species. It would appear that these serrations occur more frequently on leaves of immature shoots. In fact the phenomenon may be very comparable to that in *Ilex aquifolium* and other species of holly (cf. Hu, Journ. Arn. Arb. xxx, 241: 1949) where on young trees and basal shoots the leaves are strongly spinescent whilst on old trees and upper branches they are often entire. In *Osmanthus* some species are known only from specimens in which the leaves are either all entire or all serrate but it is very likely that these species exhibit both types of leaf margin in the wild. The margin is normally thickened in Sect. *Osmanthus* and the spines which terminate the teeth may be regarded as extensions of this thickening. The size, shape and number are usually diagnostic for a particular species and the different types are portrayed in Fig. 1. They vary from 3–4 spines, (3–) 5–8 (–11) mm. long in *O. heterophyllus*, to about 30, 1 mm. or less in length in *O. reticulatus* or about 20, 0·5 mm. long in *O. henryi*.

In Section *Siphosmanthus* the leaf margin is not entire; *O. delavayi* is characteristically serrate with, generally, 7–10 spiny teeth about 1 mm. long but in *O. suavis* the margin is shallowly subcrenate; between the two however every intermediate condition occurs.

LEAF APEX. The characteristic leaf apex for *Osmanthus* is acuminate, with a range for the genus from long narrowly acuminate to shortly acute or even blunt. In *O. attenuatus* and *O. lanceolatus* the apex is so drawn out that it is best described as attenuately acuminate; on the other hand some specimens of *O. marginatus* have a leaf apex so abruptly and shortly acuminate as to verge on being bluntly apiculate. In *O. delavayi* the apex is characteristically acute or blunt and in *O. didymopetalus* a superficial

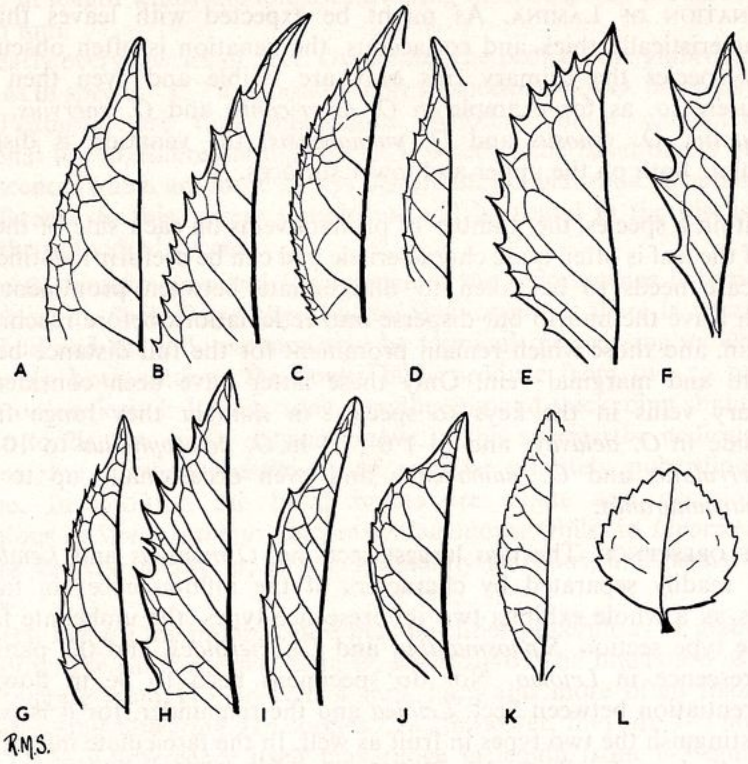

FIG. 1. Leaf margins of species of *Osmanthus*.

A, *O. fragrans*. B, *O. yunnanensis*. C, *O. serrulatus*. D, *O. henryi*. E, *O.* × *fortunei*. F, *O. heterophyllus*. G, *O. reticulatus*. H, *O. armatus*. I, *O. venosus*. J, *O. urceolatus*. K, *O. suavis* (All × ½). L, *O. delavayi* (× 1).

examination of the material available gives the impression that the apex is blunt or rounded. However, closer inspection shows that in nearly all cases in the latter species the apex has been damaged. A similar situation is thought to occur in the little known *O. fordii*, where the leaf apices of the type specimen are blunt or rounded, but one or two leaves are sub-acuminate with a small apiculus, the condition found in the only other specimen treated as this species.

The actual tip of the leaf is usually acute, although in some species, as for example in some specimens of *O. americanus* and *O. marginatus*, it may be quite blunt. In those species with a spinescent margin, however, it is sharply acute and in *O. armatus* and *O. heterophyllus*, where the serrations are strongly spinescent, the actual tip is likewise rigidly armed, whilst all degrees occur, between this condition and a normal acute tip, in those species which appear to possess an entire margin only.

BASE OF LAMINA. The leaf base is unimportant as a diagnostic feature in *Osmanthus*. In almost all cases it is narrowed or cuneate. However, in *O. armatus* and *O. delavayi* it is normally blunt or subcordate. Generally too the leaf base is slightly decurrent into the petiole and this may range from the condition where it is particularly noticeable, as for example in Sect. *Leiolea*, to the other extreme in *O. armatus*, where in many cases the leaf base is not decurrent at all.

VENATION OF LAMINA. As might be expected with leaves that are characteristically thick and coriaceous, the venation is often obscure. In many species the primary ribs only are visible and even then often obscurely so, as for example in *O. americanus* and *O. enervius*. In *O. reticulatus*, *O. venosus* and *O. yunnanensis*, the venation is distinctly reticulate both on the upper and lower surfaces.

Within a species, the number of primary veins on each side of the midrib of the leaf is often quite characteristic and can be useful in identification, but care needs to be taken to differentiate between prominent veins which leave the midrib but disperse into reticulations before reaching the margin, and those which remain prominent for the full distance between midrib and marginal vein. Only these latter have been considered as primary veins in the keys to species: in number they range from 4 per side in *O. delavayi* and (4–) 6 (–7) in *O. heterophyllus* to 10–12 in *O. serrulatus* and *O. yunnanensis* and even occasionally up to 15 in *O. matsumuranus*.

INFLORESCENCE. The two largest sections, *Osmanthus* and *Leiolea* are most readily separated by characters of the inflorescence; in fact the genus as a whole exhibits two inflorescence types, the umbellate fascicle in the type section, *Siphosmanthus* and *Linocieroides*, and the paniculate inflorescence in *Leiolea*. Nor do specimens need to be in flower for differentiation between Sect. *Leiolea* and the remainder, for it is possible to distinguish the two types in fruit as well. In the fasciculate inflorescence the pedicels are hardly thickened and are without nodes or bracts except at the very base, whilst in the paniculate ones, even in the extreme case where a single fruit only has been developed and most or all of the branches of the panicle have been shed, it is still possible to discern the evident nodal structure with bracts or bract scars at each node or dichotomy and, furthermore, the axis is thickened. Occasionally, however, freak inflorescences have been noted within Sect. *Osmanthus*, especially in cultivated specimens of *O. fragrans*, where, instead of a sessile umbel, the inflorescence has been raised to a greater or lesser degree on a common peduncle which branches towards the top. The branching is not strictly umbellate but it nevertheless contrasts with the regular dichotomy of the inflorescence in Sect. *Leiolea*. A freak inflorescence has also been observed on a specimen of *O. insularis* from the Bonin Is. but in this case the bracts are more or less foliaceous and atypical too.

In species "A" the inflorescence is corymbose, and is one of the anomalous features exhibited by this species. Furthermore the inflorescence bracts are larger than in any other species and the individual flowers are somewhat immersed and surrounded by the bracts.

In Sect. *Osmanthus* the flowers may arise from one, two or even three superposed axillary buds, each bud producing from about 3 to 9 flowers on pedicels ranging in length from 3–15 mm. Using dried herbarium specimens it is difficult to tell whether the pedicels are accrescent or not in fruit. In some species, it is doubtful whether much, if any, elongation and thickening takes place, but it is thought that it does occur in some, for example in *O. yunnanensis* where fruiting pedicels have been noted up to 25 mm. in length whilst the longest flowering ones observed are not more than 15 mm.

In nearly every species of Sect. *Osmanthus* the pedicels are glabrous and rarely, as in species "C" and occasionally in specimens of *O. heterophyllus* from Formosa, are they puberulous. Another minor character of occasional use in differentiating species is whether the basal bracts of the inflorescence, which are more or less persistent, are glabrous or pubescent and reference to this, where significant, will be found in the discussion under the individual species.

In Sects. *Linocieroides* and *Siphosmanthus* the inflorescence is basically the same as in Sect. *Osmanthus*, but in *Siphosmanthus* there is usually a single bud and the inflorescence may be terminal on occasion as well as axillary. In both sections the flower buds produce from two to twelve flowers on pedicels 1–10 mm. long, lengthening and thickening slightly in fruit up to 20 mm. in *O. didymopetalus*. In this species the pedicels are glabrous, but in *Siphosmanthus* they may be minutely puberulous or glabrate. In addition the basal bracts are ciliate and occasionally puberulous in *Siphosmanthus*, and early deciduous, whilst in *Linocieroides* they are densely pubescent, or less frequently glabrous, and persist even in fruit.

In Sect. *Leiolea* the inflorescence may be either puberulous or glabrous, even within the same species, as in *O. americanus*. The bracts are usually small ranging from 1–3 or even 4 mm. long and more often than not deciduous after flowering. (In species "A", however, they are 4–5 mm. in length.) The inflorescence itself may range in length from 1–3 cm. and may produce from 5–30 flowers according to the specimen and species. The individual pedicels are usually 1–2 mm. long, sometimes less and at the most 3 mm.

Flowers. Within each section there is surprisingly little variation in flower-structure, although each type is distinct. In all sections the colour is generally white, creamy-white, or yellowish white, but in some plants of *O. fragrans* it is golden yellow or orange, and, according to field notes, whitish or yellowish green in *O. marginatus*. In most species where noted in the field, the flowers are sweetly fragrant. *O. fragrans* is particularly famed for its sweet scent, and species in all sections are said to be fragrant. It is interesting to note, however, that, according to field notes, *O. fragrans* is on occasions inodorous, a condition also noted in one or two other species, but whether this observation is due to inodorous strains of the plants or to having been made at unsuitable times of the day, is not known.

The sexuality of flowers and the distribution of the different types are features of interest. Unisexual flowers are a common feature of all sections. In the specimens from Sects. *Osmanthus*, *Siphosmanthus* and *Linocieroides* where the sexuality of the flowers has been observed they have always

been found to be either hermaphrodite or functionally male. In many cases only a limited amount of material has been available but nevertheless it seems safe to describe these sections as being androdioecious. The stamens of the hermaphrodite flowers produce good pollen and the functional ovary conforms to the general structure for the genus but in male flowers the ovary takes the form of a narrow somewhat structureless cone. Sect. *Leiolea* differs from the rest of the genus in being dioecious and (except in *O. scortechinii* and *O. sumatranus*) on any one individual either the ovary or the stamens abort. The resultant staminodes are generally small with extremely short filaments whilst the functionless ovary is represented by a small rounded stump, a considerable contrast with that of other sections. In all species of Sect. *Leiolea*, except *O. scortechinii* and *O. sumatranus*, unisexual flowers only have been observed in this investigation but perfect flowers have also been reported in *O. americanus*. In the two former species, to judge from the two flowering specimens seen, the flowers are hermaphrodite. They are also unique in the possession of four stamens.

Calyx. Two main types of calyx are found in the genus. In Sect. *Osmanthus* it consists of four teeth which are glabrous, triangular, somewhat irregular, usually shallow and frequently erose. This type is also found in *O. didymopetalus*, where the teeth are usually very shallow, and in *O. scortechinii*, where such a calyx is exceptional for the section. In Sect. *Leiolea* on the whole, however, and in Sect. *Siphosmanthus*, the calyx is more or less campanulate and divided for about half of its length to give a definite tube as well as four lobes (5–8 in species "A"). The lobes are usually rounded and ciliate and may or may not be puberulous on the outside in *Leiolea*. In length the calyx is 2–4 mm. in *Siphosmanthus* and 1–1·5 mm. in *Leiolea* except in *O. sumatranus* where it is 2·5–3 mm. long with lobes of irregular length and shape.

Corolla. The corolla is almost completely uniform in shape throughout Sect. *Leiolea*. It is small and shortly campanulate with four rounded lobes approximately equal in length to the tube (1·5–3 mm. long), which is a little longer than the calyx. In *O. sumatranus*, however, the tube is 2·5 mm. long and the lobes only slightly more than 1 mm. In the Section as a whole the lobes are often ciliate on the margin and may be puberulous. In *O. americanus* hairs are found both inside and out, especially in the upper part.

In Sect. *Osmanthus* the pattern differs from that in *Leiolea*, but with the exception of *O. urceolatus*, is also basically the same throughout the section. There is a tube 1·5–2·5 mm. long with four rounded oblong lobes (1–) 1·3–4 (–5) mm. long, whilst the texture is usually thick and somewhat waxy in contrast to Sect. *Leiolea* where it is much thinner. There is considerable variation in the proportions of tube to lobes, which provides about the only character of the corolla which can be used for differentiation between species. In *O. urceolatus*, the corolla has an urceolate tube 5–7 mm. long with four small, broadly triangular teeth, 1 mm. long. This species acts as a link with Sect. *Siphosmanthus* where the corolla tube is long and subcylindric, (6–)7–11(–13) mm. long but only 1–2 mm. in diameter. The lobes moreover are rounded and longer than in *O. urceolatus* being more or less strap-shaped and (2–)3–4·5(–6) mm. long.

In Sect. *Linocieroides* the corolla tube is lacking altogether. The four petals are united in pairs at the very base for about 0·5–0·75 mm., with the free portion, which opens wide at anthesis, strap-shaped, oblanceolate and 3 mm. long. This general type is very reminiscent of that in the genus *Linociera* but careful inspection shows that in the bud the petals are quite definitely imbricate.

STAMENS. Throughout the genus the characteristic number of stamens is two, but in *O. scortechinii* and *O. sumatranus* there are four, and in species "A" three (although four stamens were found in one of the flowers examined). The attachment lies within the corolla tube, about the middle or in the upper half, occasionally near the top. In *O. didymopetalus*, where there is no corolla tube, the attachment is at the point of union of the paired petals. In one important feature the anthers fall into two types; in Sects. *Osmanthus* and *Siphosmanthus* a terminal appendage, usually quite well developed but occasionally only small and rounded, is present as an extension of the connective, whilst in Sects. *Leiolea* and *Linocieroides* there is no appendage and the anthers are rounded and hardly broader than long. In species "A", however, there is a possibility that there is a very small appendage but so far only a functionally female flower has been seen. Sect. *Leiolea* possesses anthers that are relatively small and only 1 mm. or less in length, whilst in Sect. *Linocieroides* they are twice as long and more comparable with the size found in Sects. *Osmanthus* and *Siphosmanthus*, that is 1–3 mm. long. The anthers may be subsessile or on filaments up to 3 mm. long, the filaments often lengthening with the opening of the bud. They are usually fairly slender but in *O. urceolatus* are stout and about 0·8 mm. broad. In the species of Sect. *Leiolea* where the flowers are diclinous, the stamens in female flowers are generally very small, on extremely short filaments, and appear quite abortive.

No real study has been made of the pollen grains and on superficial examination they all appear very similar and like those of related genera. They are ellipsoidal, and tricolpate, with what appears to be a fine granular surface. However, out of interest, as the revision progressed, measurements were made of the length of the grains in each species. For speed and simplicity the grains were mounted in a drop of lactophenol and covered with a thin cover slip. The grains expanded rapidly, and using the experience gained in a previous investigation into variation in the length of grains of individual specimens (Green in Trans. Bot. Soc. Edin. xxxv, 289: 1955), a sample of ten grains was measured in each case and the range and average measurements recorded. The same microscopic and optical arrangements were used as in the paper just mentioned. In no case was pollen grain length found to be diagnostic of a particular species for there is an unbroken range from one species to another, from 14μ (the minimum in *O. fragrans*) to 31μ (the maximum measured in *O. americanus*). It is perhaps significant that *O. americanus*, which has been reported as a hexaploid, should have the largest grains seen and, generally speaking, Sect. *Leiolea* has larger grains than those of other sections; the range of averages for the four sections being: *Leiolea* 21·1–29·9μ, *Siphosmanthus* 20·2–25·6μ, *Linocieroides* 19–20μ and *Osmanthus* 15·1–25·6μ, although in the case of one specimen of *O. yunnanensis* the mean size of the pollen grains was found to be 28·7μ.

OVARY. Throughout the genus the characters of the gynoecium are relatively stable: the bilocular ovary is rounded and surmounted by a fairly long style bearing a capitate, slightly bilobed stigma (Fig. 4*a* and *b*). The ovary itself and the style are approximately equal in length and together range, according to species, from about 1·5 to 4 mm. In species "A" the stigmatic lobes are more prominent, being 0·75 mm. long. They are somewhat larger than average in *O. fragrans* as well, where in addition the style is relatively short, giving a stumpy appearance as in Fig. 4*c*. Except in *O. sumatranus*, the gynoecium is characterised by the possession of peltate scales in Sect. *Leiolea*, especially on the ovary itself, and in this respect the section differs from all the others.

Despite the close similarity in the functional ovary, the abortive ovary of male flowers is of two very different types according to section. One, characteristic of Sects. *Leiolea* and *Linocieroides* consists of a small rounded stump up to 1 mm. high (Plate 13, *b*), whilst in Sects. *Osmanthus* and *Siphosmanthus* it takes the form of a narrow conical structure, varying from 1 to 3 mm. in height and often with lateral slits down the sides, the margins of which overlap; for a more detailed account reference should be made to a paper by Joshi (Journ. Ind. Bot. Soc. xv, 331: 1942). In many species no material with fertile ovaries has been seen, all the specimens being functionally male.

FRUIT. The fruit, a drupe, is similar throughout the genus and when ripe is dark bluish or purplish black with a glaucous bloom. Characteristically it is regularly or obliquely ellipsoid in shape, although in some species it may be slightly obovoid. In size it varies from 10–25 mm. in length and 6–15 mm. in breadth, although in Sect. *Siphosmanthus* it is smaller, 8–10 mm. × 5–6 mm., and in *O. scortechinii* it is small and almost spherical, 8–10 mm. × 6–7 mm. The mesocarp is quite well developed when the specimen is fresh and surrounds an endocarp which is characteristically hard and bony and up to about 1 mm. thick. However, in some species it is thinner, although still hard, as in *O. delavayi* and *O. suavis*, and in others, *O. didymopetalus*, *O. scortechinii* and occasionally in *O. americanus* and *O. marginatus*, it is quite thin and crustaceous. The endocarp is very often ribbed but the ribs may be absent as in *O. americanus*, very slight as in *O. didymopetalus*, or very noticeable and distinct as in *O. matsumuranus* and some specimens of *O. marginatus*.

CHROMOSOMES

Only five species of *Osmanthus* have been cytologically examined (Taylor in Brittonia, v, 337: 1945): *O. americanus*, *O. armatus*, *O.* × *fortunei*, *O. fragrans*, and *O. heterophyllus* (as *O. ilicifolius*). All the plants examined by Taylor were found to be diploids with 2n=46, except for that of *O. americanus*, which was hexaploid, 2n=138, whilst the hybrid *O.* × *fortunei* had previously been reported by Sugiura (Proc. Imp. Acad. Tokyo, xii, 144: 1936, and Bot. Mag. Tokyo, xlv, 354: 1931) to have 2n=44. All the species of *Chionanthus*, *Forestiera*, *Ligustrum*, *Olea*, *Osmanthus*, × *Osmarea* and *Phillyrea* counted by Taylor were found to have n=23 except for *O. americanus*. Most species and varieties of *Syringa* also had n=23 except some which had n=22 or 24, but this variation, it was suggested, is perhaps due to the great amount of hybridization

that has occurred in cultivated forms of the genus. Taylor further states that morphologically the chromosomes of *Osmanthus* cannot be distinguished from those of *Olea* and *Phillyrea*, an observation which fits in with the opinion that these genera are very closely related. It is unfortunate that no species of *Linociera* and *Notelaea* was available for examination.

Taylor notes that the percentage of polyploidy occurring within genera and species in the whole family *Oleaceae* is small, but one suspects that this may be due to the fact that so far relatively few species have been counted. In *O. yunnanensis* variation in pollen grain size of a magnitude usually associated with polyploidy has been noted (see p. 498).

AFFINITIES

The genus *Osmanthus* lies in a generic complex within the *Oleineae*, very close to *Linociera*, *Notelaea*, *Olea*, *Phillyrea* and *Steganthus*.

On the one hand there is a close relationship with *Olea*, reflected by the fact that it was from this genus that *Osmanthus* was originally split. In *Olea* the corolla is induplicate-valvate, the endocarp hard and the inflorescence characteristically paniculate. *Osmanthus* resembles it in part in these characters in that the endocarp generally is hard and in Sect. *Leiolea* the inflorescence is paniculate but throughout the corolla is consistently imbricate.

The small and debatable genus *Steganthus* proposed by Knoblauch in 1934 to contain what had previously been called *Olea welwitschii*, *O. urophylla* and *O. lancea* lies even closer to *Osmanthus*, for here the corolla is imbricate as well. However, it is worth noting that Turrill in his revision of the family for the Flora of Tropical East Africa (Oleaceae, 12: 1952) retains the genus *Olea* for the first named species, on the grounds that the aestivation of its corolla is not consistent and that in general character it is very similar to *O. hochstetteri* which has been consistently retained in *Olea*. More recently still, Verdoorn, in her revision of the Oleaceae of Southern Africa, suggests that *Olea urophylla* and *O. welwitschii* may prove to be no more than subspecies of the better known *Olea capensis* (Bothalia, vi, 581: 1956). Thus, with two of the constituent species retained in *Olea* by recent workers, the genus *Steganthus*, diagnosed primarily by its imbricate corolla and therefore close to *Osmanthus*, becomes even more dubious, a fact which further supports the affinity between *Osmanthus* and *Olea*.

The affinity with *Phillyrea* is likewise very close indeed, the only technical character separating the two genera depending upon the thickness of the endocarp: hard in *Osmanthus* and thin in *Phillyrea*. However true this may have been for the first known species in the genus, with many more now described, it appears that this distinction is no longer constant, for a thin crustaceous endocarp is found in *O. scortechinii*, and *O. didymopetalus* and occasionally in *O. americanus* and *O. marginatus*.

Osmanthus differs from *Notelaea* mainly in the same character as from *Olea*, that is in the possession of an imbricate rather than induplicate-valvate corolla. However, from an uncritical examination of the New Caledonian species it would seem that aestivation of the corolla is as unreliable a generic character here as in *Olea*.

Finally, the affinity with *Linociera* has become particularly evident with the discovery of the unique species *O. didymopetalus*, described in this revision and constituting a new section, *Linocieroides*. In this species the corolla is split to the base and the four petals are united in pairs at the very base where the stamens are attached; a very comparable condition to that in *Linociera*. However careful examination shows the corolla to be imbricate in the bud (it is induplicate-valvate in *Linociera*) and the inflorescence and general appearance is that of a typical *Osmanthus* and so it is treated as such in this revision.

The affinities of the sections to each other and of the species one with another are discussed under the respective sections and species.

ACKNOWLEDGEMENTS

It is a pleasure to express my sincere thanks to the Directors and Curators of several herbaria from whom material has been borrowed, namely: the Arnold Arboretum, Cambridge, U.S.A. (A); the Indian Botanic Gardens, Calcutta (CAL); the University of Florence, Italy (FI); the Botanical Institute, Kyushu University, Japan (FU); the Rijksherbarium, Leiden, Holland (L); the New York Botanic Garden, U.S.A. (NY); the Botanisk Museum, Oslo, Norway (O); the Muséum National d'Histoire Naturelle, Paris, France (P); the Botanic Gardens, Singapore, Malaya (SING); the National Taiwan University, Taipei (TAI); the Botanical Institute, University of Tokyo, Japan (TI); the Botanical Museum and Herbarium, Utrecht, Holland (U); the Institute of Systematic Botany, University of Uppsala, Sweden (UPS); the National Museum, Smithsonian Institution, Washington, U.S.A. (US); the Naturhistorisches Museum, Vienna, Austria (W).

Particular thanks are also due to the Keeper of Botany, the British Museum (Natural History), (BM), the Professor of Botany, University of Glasgow (GL), and the Director and the Keeper of the Herbarium, Royal Botanic Gardens, Kew (K), for facilities for study at their respective institutes. Also to Dr. H. Hara of the University of Tokyo who generously sent photographs of the types of several of the Japanese species.

Special gratitude is expressed for the translation of Japanese descriptions contained in Nakai and Koidzumi's "Trees and Shrubs Indigenous to Japan Proper", ed. 2, which was so willingly undertaken by Mr. R. H. Richens of the Commonwealth Bureau of Plant Breeding and Genetics.

My thanks are also due to Miss Rosemary Smith for the drawings and Mr. Ross Eudall for the photographs, to Miss Heather Prentice for assistance with various anatomical preparations and to numerous colleagues who have helped with discussion and encouragement, in particular to Mr. B. L. Burtt to whom I am also indebted throughout for invaluable advice.

OSMANTHUS Loureiro

Fl. Cochinch. i, 28 (1790) et Willdenow in ed. 2, i, 35 (1793); Endlicher, Gen. Pl. 572 (1838); Spach, Hist. Nat. Vég. Phan. viii, 268 (1839); De Candolle, Prodr. viii, 291 (1844); Bentham & Hooker f., Gen. Pl. ii, 677 (1876); C. B. Clarke in Hook. f., Fl. Br. India, iii, 606 (1882); Baillon,

Hist. Pl. xi, 249 (1891); Sargent, Silva of N. America, vi, 63 (1894); Knoblauch in Engler & Prantl, Das Pflanzenfam. iv, 2 Abt. 9 (1895); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Lemée, Dict. Descr. iv, 925 (1932); Gagnepain in Lecomte & Humbert, Fl. Gén. Indo-Chine, iii, 1061 (1933); Mori in Journ. Jap. Bot. xv, 542 (1939); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940).

Evergreen *shrubs* or *trees* to 20 m. in height, young stems glabrous or puberulous. *Leaves* opposite, glabrous, at least at maturity, but with the upper midrib and petiole sometimes puberulous; lamina generally thickish but ranging from very thick coriaceous to thin, from lanceolate or ovate to oblanceolate or obovate; margin entire or armed with sharp teeth, rarely subcrenate; apex ranging from blunt to long attenuately acuminate; base blunt to cuneate, usually slightly decurrent into the petiole; venation obscure or distinctly reticulate. *Inflorescence* axillary, fasciculate or paniculate, glabrous or puberulous. *Flowers* small, androdioecious, dioecious or hermaphrodite, usually white or cream, more rarely yellow, usually fragrant. *Calyx* with 4 lobes either irregularly triangular or rounded ciliolate. *Corolla* more or less campanulate, subcylindric or, in single species, urceolate or without tube, with 4, rounded triangular, oblong or occasionally strap-shaped lobes, imbricate in the bud. *Stamens* 2, filaments subsessile to 3 mm. long, anthers dorsifixed, with or without terminal appendage. *Ovary*, including style, 1·5–4 mm. long with generally a slightly bifid capitate stigma; bilocular with 2 anatropous ovules per loculus, placentation axile; in the male flowers abortive, either a more or less narrow cone 1–3 mm. long, or a rounded stump up to about 1 mm. *Fruit* a drupe, ellipsoid or obovoid, often somewhat obliquely so, endocarp usually hard, bony or crustaceous, often slightly ribbed.

Type species: *Osmanthus fragrans* Lour.

Key to Sections

1. Inflorescence paniculate, fruit stalk jointed; flowers dioecious (hermaphrodite in *O. scortechinii* and *O. sumatranus* which possess 4 stamens), abortive ovary in male flowers a rounded stump up to 1 mm. in height; corolla 1·3–3 mm. long, texture thin; anthers 1 mm. or less in length, rounded, without terminal appendage; leaves usually entire but occasionally bluntly serrate. Subtropical Eastern Asia, Malaysia and North and Central America . *Leiolea* (p. 454)

   Inflorescence fasciculate, fruit stalk not jointed; flowers androdioecious, abortive ovary in male flowers more or less conical, 1–3 mm. in length; corolla 3 mm. or more long, texture usually thickish, sometimes waxy; anthers 1 mm. or more in length, usually more, with a small or large terminal appendage (except in Sect. *Linocieroides*); leaves entire or, serrate often sharply so. Temperate or subtropical Eastern Asia 2

2. Corolla without tube, the 4 petals joined in pairs at the base; inflorescence axillary; anthers rounded without terminal appendage; endocarp thin crustaceous; leaves entire . *Linocieroides* (p. 535)

   Corolla with tube 1·5 mm. or more long; inflorescence axillary or terminal; anthers with small or large terminal appendage; endocarp thick or thin; leaves entire, sharply serrate or subcrenate . 3

3. Corolla with tube up to 2·5 mm. long (in *O. urceolatus* up to 7 mm. but urceolate); inflorescence axillary; anthers with small or large terminal appendage; endocarp usually thick and hard but occasionally thin; leaves up to 20 cm., and usually more than 4 cm. long, entire or sharply serrate . . . . . *Osmanthus* (p. 478)

Corolla with narrow tube 6–11 mm. long; inflorescence axillary or terminal; anthers with well developed terminal appendage; endocarp thin but hard or somewhat crustaceous; leaves up to 9·5 cm., but usually 1–5 cm. long, sharply serrate or subcrenate *Siphosmanthus* (p. 528)

Osmanthus Sect. **Leiolea** (Spach) P. S. Green, **comb. nov.**

Syn.: *Pausia* Rafin., Sylva Tellur. 9 (1838), non Rafin., Fl. Tellur. pt. iv, 105 (1838).

Cartrema Rafin., Sylva Tellur. 184 (1838); Merrill, Index Rafinesq. 189 (1949).

Olea L. Sect. *Leiolea* Spach, Hist. Nat. Vég. Phan. viii, 266 (1839).

Amarolea Small, Man. Southeast. Fl. 1043 et 1507 (1933).

Osmanthus Lour. Sect. *Microsmanthus* Nakai in Bot. Mag. Tokyo, xliv, 14 (1930).

Evergreen *shrubs* or *trees* up to 20 m. in height, stems glabrous or minutely puberulous when young. *Leaves* glabrous, at least at maturity, sometimes more or less pubescent when young on the upper midrib; lamina very thick and coriaceous to thin, most characteristically oblanceolate but ranging to obovate and elliptic; margin entire (except in *O. matsumuranus* where occasionally on fully developed leaves it is somewhat serrate especially in the upper half), usually slightly thickened and often revolute giving the impression of being thickened; apex ranging from acuminate to acute; venation often more or less obscure, never clearly reticulate. *Inflorescence* axillary, branched, paniculate (corymbose in species "A"), glabrous or puberulous, thickened in fruit, bracts usually deciduous after flowering (except in *O. americanus* and possibly *O. mexicanus*). *Flowers* dioecious or hermaphrodite, on short pedicels. *Calyx* campanulate 1–1·5(–3) mm. long, divided approximately halfway into 4 lobes (5–8 in species "A") ciliate, minutely fimbriate, glabrous or puberulous. *Corolla* tube 1·5–3 mm. long, lobes 4, rounded ovate or oblong (1–)1·5–2(–2·5) mm. long, often ciliate on the margin (puberulous in the upper half inside and out in *O. americanus* and *O. mexicanus*). *Stamens* characteristically 2 (3–4 in species "A" and 4 in *O. scortechinii* and *O. sumatranus*) attached in the upper half of the corolla tube, anthers small, 1 mm. or less in length, oblong rounded, without terminal appendage (except a very small indication of one in species "A"), in the female flower very small and incompletely developed. *Ovary*, with style, about 2–3 mm. long with capitate or slightly bilobed stigma, in the male flower reduced to a rounded stump up to 1 mm. in size. *Drupe* ellipsoid or obovoid, endocarp bony or crustaceous, smooth or ribbed.

Type species: *Osmanthus americanus* (L.) A. Gray

The eight species of this section* are more or less confined to the tropical and subtropical parts of Eastern Asia and North and Central America and contrast with the more strictly temperate Sects. *Osmanthus* and *Siphosmanthus*. The most wide-ranging American species is *O. americanus*, with a distribution from southernmost Virginia to South Mexico (Fig. 2B) where it approaches the other American species *O. mexicanus*, known only from one collection. In Eastern Asia (Fig. 2A) the most wide-ranging species is *O. matsumuranus*, distributed from Formosa (Taiwan) to Khasia in E. India; but approaching it in extent, and overlapping over a considerable area, is the variable *O. marginatus* with a range from the northernmost Ryukyus to Kwangsi and Hainan. Of more limited distribution in China is *O. minor* from a relatively small area in E. Kwangtung

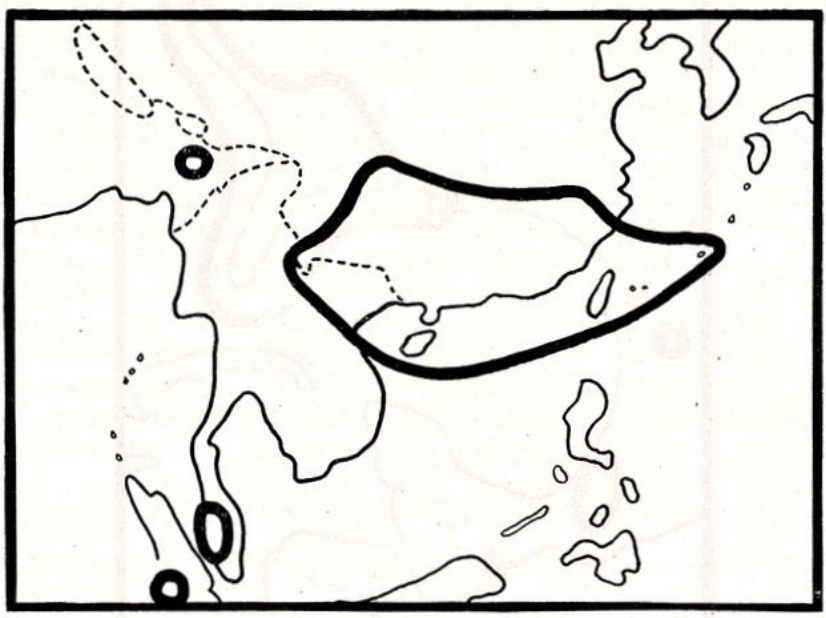

FIG. 2A. Map of the distribution of Sect. *Leiolea* in Asia.

and southern Kiangsi and species "A" known with certainty only from one collection from Yunnan. The remaining species are found in Malaysia; *O. scortechinii*, is confined to the mountains of the Malay Peninsula, in Perak and Selangor, and *O. sumatranus* is known only from Mt. Sago in Central Sumatra and of all the species in the genus most nearly approaches the equator.

The most outstanding character of the section and one which is most easily noted on the majority of herbarium specimens is the paniculate inflorescence. Even in fruiting specimens, the panicle is apparent either by the branching of the thickened fruit stalk or by its obviously nodal structure. Throughout the section the structure of the corolla is remarkedly constant both in shape and size and quite different from the remainder of the genus in its small size and thin texture, although it is perhaps

* Since this revision went to press it has become apparent that there exists another species in this section based upon *Olea capitellata* Ridl. of the Malay Peninsula. A full account and description will appear in the next number of the Notes R.B.G., Edinburgh.

somewhat thicker in *O. sumatranus*. The stamens also are characteristic of the section, being small, oblong, rounded and without the terminal appendage which so characterizes the remainder of the genus and allied genera such as *Olea*, *Notelaea* etc. In this respect (as in others) species "A" is exceptional, for whilst the stamens appear to be of the same general type they show a very small indication of an appendage; however, only the abortive stamens of female flowers have been seen and functional ones might show either a well developed appendage or the structure more normal for the section. In Sects. *Osmanthus* and *Siphosmanthus* where the

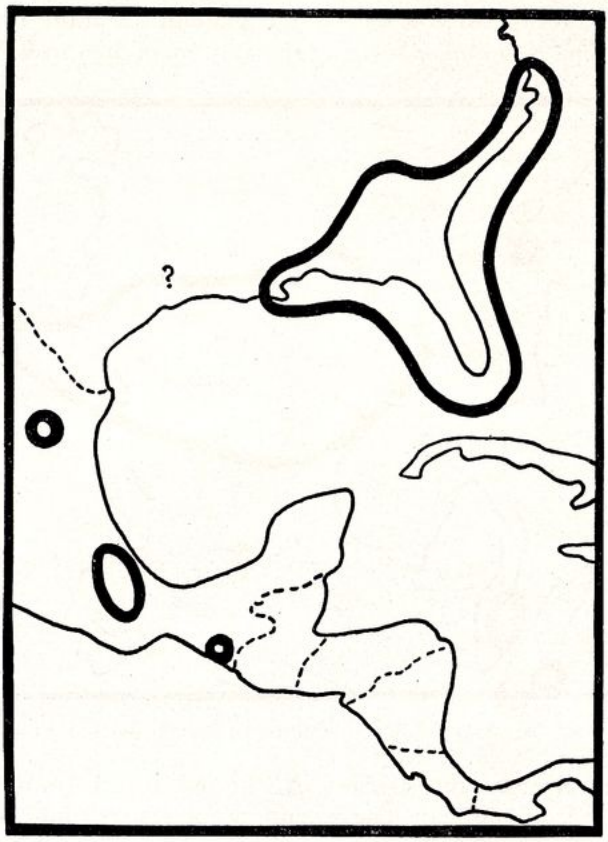

FIG. 2B. Map of the distribution of Sect. *Leiolea* in America.

flowers are androdioecious, the abortive ovary in the male flowers takes the form of a conical structure 1 mm. or more in length whereas in Sect. *Leiolea*, where all the flowers examined have been strictly dioecious (except in *O. scortechinii* and *O. sumatranus*) the "ovary" in the male flower is represented by a small rounded stump of tissue usually less, and never more, than 1 mm. in height.

Vegetatively the section has no unique features but certain of the species have the thinnest leaves of the genus and apart from *O. matsumuranus* all the species possess entire leaves without the serrations so characteristic of many of the species in Sect. *Osmanthus*. In *O. matsumaranus*, however, the leaves are often dentate, although the teeth are usually blunt, often

obscure and rarely acute. This bluntness and obscurity may possibly be due to the fact that the margin of the leaf in this species is scarcely thickened, whereas in those species which possess the more characteristic type of serration, the margin is considerably thicker and forms the actual point of the tooth.

All the species of Sect. *Leiolea* are remarkably near to one another in affinity, with the exception of species "A", and it has been difficult to express the specific differences in the form of a key designed for use with both sterile and fertile material. The two American species have many features in common and are closely allied one to the other. The same applies to the Chinese species, with the exception of species "A", which although it differs in several features and is in fact unique for the genus as a whole in some characters, is most satisfactorily placed in this section. *O. marginatus*, which is the most variable of all the species, shows close affinity with both *O. matsumuranus* and *O. minor* and, as the ranges overlap, the possibility of hybridization has to be entertained. However in the herbarium material examined no certainty of this is apparent and without carefully selected material with extensive field notes, the present arrangement of the Chinese species is considered to be the most practicable. *O. scortechinii* and *O. sumatranus* the southernmost of the Old World species, are unique in being hermaphrodite and in the possession of 4 stamens, but in all other characters they resemble the remainder of the Section except for the small thin-walled fruits in *O. scortechinii* which are rather interestingly parallelled in some southern specimens of *O. americanus* and to some extent in *O. mexicanus*, the southernmost of the American species. Further remarks on the affinities of each individual species will be found in the enumeration which follows.

Key to the Species of Section Leiolea

1. Primary veins on leaf 8 or more (rarely 7) per side, lamina usually more than 8 cm. long 2
   Primary veins on leaf 7 or less (rarely 8) per side, lamina often less than 8 cm. long (except in *O. americanus* and *O. marginatus*) . 3
2. Petioles generally 2 or more cm. long, leaf margin often serrate especially in the upper half, lamina usually 8–21 cm. long; inflorescence paniculate, 1·5–2 cm. long, upper bracts linear-lanceolate to narrowly ovate; stamens 2; stigma capitate . . 4. *O. matsumuranus*
   Petioles 1–2 cm. long, leaf margin entire, lamina usually more than 10 cm. long, inflorescence corymbose, less than 1·5 cm. long, upper bracts broadly ovate enclosing the base of the flowers; stamens usually 3 (occasionally 4); stigma lobes 0·75 mm. long 8. *Species* "A"
3. Petioles generally 1·5–3 cm. long, rarely less and then the leaf 8 cm. or less in length. E. Asia . . . . 5. *O. marginatus*
   Petioles generally up to 1·5 cm. long. rarely more and then the leaf 8 or more cm. in length; Asian and American species . . 4
4. Apex of leaf acute or subacuminate (rarely acuminate) and then average lamina length more than 8 cm. 5
   Apex of leaf acuminate, usually distinctly so (rarely subacuminate in *O. scortechinii*) 7

5. Petiole usually more than 1 cm. long (usually 1–1·5 cm. and if less then only on the smallest leaves of a branch), lamina usually more than 8 cm. long with 6–8 primary veins per side 1. *O. americanus*
   Petiole always less than 1 cm. long, lamina usually less than 7·5 cm. long with 4–6 primary veins per side 6
6. Lamina usually 4–5 cm. long, rarely, and only on the longest leaves, up to 6 cm.; inflorescence minutely puberulous, 1–1·5 cm. long. Mexico . . . 1c. *O. americanus* var. *microphyllus*
   Lamina usually 5–7·5 cm. long, rarely, and only on the smallest leaves, less than 5 cm.; inflorescence glabrous, 1 cm. long; stamens 4. Sumatra . . . . . 7. *O. sumatranus*
7. Primary veins on leaf usually 4 or 5 (rarely 6) per side; upper inflorescence bracts triangular; anthers attached about the middle of the corolla tube . . . . . 2. *O. mexicanus*
   Primary veins on leaf usually 6 or 7 (rarely 5 or 8) per side; upper inflorescence bracts ovate or lanceolate; anthers attached at the mouth of the corolla tube 8
8. Stamens 2; margin of leaf scarcely thickened; fruit with ribbed bony endocarp 15–30 mm. long by 8–12 mm. broad. China 3. *O. minor*
   Stamens 4; margin of leaves usually thickened and leaf often thick coriaceous; fruit with smooth crustaceous endocarp 8–10 mm. long by 6–7 mm. broad. Malaya . . . 6. *O. scortechinii*

1. **Osmanthus americanus** (L.) A. Gray, Syn. Fl. N. Amer. ii, pt. 1, 78 (1878).

Key to Varieties

1. Leaves (4–)8–12(–15) cm. long with 6 to 8 primary veins per side; fruit more than 10 mm. in diameter. U.S.A. and Mexico . . 2
   Leaves (3–)4–5(–6) cm. long with 4 or 5 primary veins per side; fruit 7–10 mm. in diameter. Mexico . . . var. *microphyllus*
2. Fruit about 1·2–1·8 cm. long . . . var. *americanus*
   Fruit about 1·8–2·5 cm. long . . . var. *megacarpus*

1a. var. **americanus.**

Sargent in 10th Census U.S. ix, "Forest Trees of N. America", 113 (1880) et Cat. of Forest Trees of N. America, 34 (1880); Nicholson, Ill. Dict. Gard. ii, 529 (1884–88); Sargent, Silva N. Amer. vi, 65, t. 279 et 280 (1894); Chapman, Fl. South U.S. ed. 3, 352 (1897); Bailey, Cycl. Amer. Hort. iii, 1177 (1901); Small, Fl. S.E. United States, 920 (1903) et ed. 2, l.c. (1913); Sargent, Man. Trees N. Amer. ed. 1, 779 et fig. (1905) et ed. 2, 857 et fig. (1922); Britton, N. Amer. Trees, 814 (1908); Schneider, Ill. Handb. Laubh. ii, 788 et figs. (1911); Hickel in Bull. Soc. Dendr. France, xxviii, 108 (1913); Bailey, Stand. Cycl. Hort. iv, 2412 (1916); Trelease, Winter Bot. ed. 1, 315 (1918) et ed. 2, 317 (1925); Standley in Contrib. U.S. Nat. Herb. 23 ("Trees and Shrubs of Mexico"), 1141 (1924); Uphof in Mitt. Deutsch. Dendr. Gesell. 209 et 214 (1924); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927) et ed. 2, 790 (1940); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Bailey & Bailey, Hortus Second, 523 (1941); Brown, Louisiana

Trees and Shrubs, 221 et fig. (1945); Fernald in Gray, Manual Bot. ed. 8, 1151 (1950); Little, U.S. Dept. Agr., Forest Service, Agric. Handbook 41 ("Check List of Native and Naturalized Trees U.S."), 248 (1953); Schmid in Schröter, Fl. des Südens, ed. 2, 136 et t. 91 figs. 4 et 3a, b et c (1956).

Syn.: *Olea americana* L., Mant. i, 24 (1767); Catesby, Hortus Europ. Amer. 16 et t. 29 (1767), et Nat. Hist. Carol., Flor. and Baham. Is. i, 61 (1771); Buc'hoz, Hist. Univ. Règne Vég. xi, 8, t. 9 (1776) et Herb. Col. Amér. [t. 76] (1783); Marshall, Arbust. Amer. 98 (1788); Walter, Fl. Carol. 240 (1788); Aiton, Hort. Kew. ed. 1, i, 14 (1789) et ed. 2, 22 (1810); Lamarck, Tab. Encycl. i, 28 (1791) et Encycl. Méth. iv, 543 (1797); Willdenow, Sp. Pl. i, 45 (1797); Michaux, Fl. Bor. Amer. ed. 1, ii, 222 (1803) et ed. 2, l.c. (1820); Vahl, Enum. i, 41 (1805); Persoon, Syn. Pl. i, 9 (1805); F. G. Dietrich, Lex. Gärt. 429 (1806); Willdenow, Enum. Pl. 13 (1809); Desfontaines, Hist. Arb. i, 112 (1809); Dumont de Courset, Bot. Cult. ed. 1, 717 (1802) et ed. 2, ii, 592 (1811); Duhamel, Traité Arbres Arbustes, ed. 2, v, 67 (1812); Michaux f., Hist. Arb. For. Amer. Sept. iii, 50, t. 6 (1813); Pursh, Fl. Amer. Sept. i, 7 (1814); Roemer & Schultes, Syst. Veg. i, 70 (1817); Rafinesque, Fl. Ludovic. 38 (1817); Nuttall, Gen. N. Amer. Pl. i, 5 (1818); Elliott, Sketch. Bot. S. Carol. and Georgia, i, 5 (1821); Sprengel, Syst. Veg. 1, 34 (1824); Eaton, Man. Bot. N. Amer. ed. 5, 306 (1829) et ed. 6, 239 (1833); Dietrich, Sp. Pl. ed. 6, i, 237 (1831); Croom in Amer. Journ. Sci., Ser. 1, xxvi, 318 (1834); G. Don, Gen. Syst. iv, 48 (1837); Loudon, Arb. Frutic. Brit. ed. 1, ii, 1208 et fig. (1838) et ed. 2, l.c. (1844); Spach, Hist. Nat. Vég. Phan. viii, 267 (1839); Dietrich, Syn. Pl. i, 37 (1839); Eaton & Wright, N. Amer. Bot. 333 (1840); Darby, Man. Bot. South. States, 226 (1841); De Candolle, Prod. viii, 286 (1844); Browne, Trees of Amer. 381 (1846); Darby, Bot. South. States, 429 (1855) et (1860); Gray, Man. Bot. Northern U.S. ed. 2, 356 (1856), ed. 3, 356 (1859), ed. 4, 356 (1866) et ed. 5, 401 (1867); Cooper in Smithsonian Rept. 1858, 253; Chapman, Fl. South. U.S. ed. 1, 369 (1860) et ed. 2, 369 (1883); Lasquereux in Owen, 2nd. Rept. Geol. Reconn. Arkansas, 382 (1860); Wood, Class Book Bot. 599 (1861); Porcher, Resources S. Fields and Forests, ed. 2, 570 (1869); Michaux f., trans. Smith, N. Amer. Sylva, ii, 128, t. 86 (1865); Wood, Amer. Bot. and Fl. pt. 4, 276 (1871); Young, Familiar Lessons Bot. with Fl. Texas, 451 (1873); Vasey, Cat. Forest Trees U.S. 20 (1876).

Olea laeta Salisb., Prodr. 13 (1796).

Pausia americana (L.) Rafin, Sylv. Tellur. 9 (1838).

P. odorata Rafin., l.c. nom. altern.

Cartrema odorata (Rafin.) Rafin., Aut. Bot. 16 (1840); Merrill, Index Rafinesq. 189 (1949).

C. americana (L.) Rafin. ex Jackson in Index Kewensis, i, 445 (1893); Merrill, l.c.

Osmanthus floridanus Chapman, Fl. Southern U.S. ed. 2, suppl. 2, 693 (1892) (non vid.) et ed. 3, 352 (1897); Small, Fl. South-eastern U.S. 921 (1903) et ed. 2, 921 (1913); Britton, N. Amer. Trees, 815 (1908); Small, Man. Southeastern Fl. 1043 (1933); Merrill in Castanea, xiii, 68 (1948).

Amarolea americana (L.) Small, Man. Southeastern Fl. 1043 (1933).

A. floridana (Chapm.) L. E. Arnold in Journ. E. Mitchell Sci. Soc. lii, 86 (1936).

Evergreen *tree* or *shrub* to 14 m. in height and diameter to 30 cm., bark grey or grey tinged with red; branches when young very minutely puberulous. *Leaves* glabrous, sometimes puberulous on the midrib above when young; *petiole (0·5–)1–1·5(–2) cm. long*, base slightly thickened, often puberulous when young; *lamina thick and coriaceous, occasionally thickish*, usually oblanceolate but occasionally ranging from narrow elliptic to narrow obovate, *(4–)8–12(–15) cm. long* by (1·5–)2–4(–5) cm. broad; margin entire and more or less revolute, slightly thickened; *apex acutate, acute or subacute, rarely acuminate*, tip blunt; base cuneate or narrow angustate, decurrent into the petiole; venation obscure and only the *primary veins* faintly visible above, impressed, below slightly raised, often very obscure, *6–8 per side*. *Inflorescence* axillary, paniculate, 1·5–3 cm. long, about 12 to 20-flowered, minutely puberulous or glabrate, thickened in fruit; bracts triangular, slightly keeled, minutely puberulous, ciliate, 1–1·5 mm. long, persistent in fruit. *Flowers* diclinous or rarely perfect, creamy or yellowish white, fragrant; pedicels 1 mm. long or less. *Calyx* 1–1·5 mm. long, lobes 4, triangular, 0·75–1 mm. long, puberulous and ciliate. *Corolla* tube 2–3 mm. long; lobes 4, ovate rounded, 1·5–2·5 mm. long, puberulous on both the outside, especially in the upper part, and the inside of the top of the lobes. *Stamens* 2; filaments 1 mm. long, attachment varying from the middle of the corolla tube to about 1 mm. from the top; anthers rounded without terminal appendage, 0·75–1 mm. long, range of average dimensions of pollen measured, 25·4–29·9 μ, with a range of extremes of 24–31 μ; in the female flowers the stamens small and abortive, about 0·25 mm. long, on very short filaments. *Ovary* 3 mm. long, dotted with peltate glands, including slender style about 2 mm. long and capitate, slightly bilobed stigma, in the male flower represented by a rounded stump less than 1 mm. in length. *Drupe* dark blue when ripe, obovoid or ellipsoidal 1·2–1·6 cm. long by 1–1·4 cm. broad; endocarp hard up to 1 mm. thick or sometimes much thinner and almost crustaceous, without ribs. Chromosome number (fide Taylor): 2n=138, hexaploid.

UNITED STATES OF AMERICA

VIRGINIA. Princess Ann Co.: Cape Henry, Seashore State Park, rich sand soil, locally common in pine-oak-hickory forests, 17 Aug. 1940, *F. E. Egler* 40–289 (NY).

NORTH CAROLINA. Brunswick Co.: Smith Island, 29 June 1939, *E. J. Alexander* s.n. (NY), and "moist rich soil", 14 July 1897, *Biltmore Herb.* 682b (BM, L, NY, W). Carteret Co.: Morehead City, vacant lot near beach, 1937, 16 Oct. 1938, *F. J. Leclaire* s.n. (NY); near Beaufort, sand banks, 1906, *I. F. Lewis* 216 (NY); Beaufort, woods, 10 Aug. 1902, *A. Ruth* 30 (E). New Hanover Co.: Wilmington, April, without collector (NY). Unlocated as to Co.: Bear Inlet, 23 July 1919, *J. A. Harris* C19562 (US).

SOUTH CAROLINA. Beaufort Co.: Bluffton, March 1880, *J. H. Millichamp* s.n. (NY). Dorchester Co.: Summerville, without date, *J. Brownfield* s.n. (US). Georgetown Co.: 17 miles N.W. of Georgetown, shrub bog, 25 Aug. 1939, *R. K. Godfrey & R. M. Tyron Jnr.* 1691 (NY).

GEORGIA. Ben Hill Co.: 15 miles east of Fitzgerald, wooded flood plain, 12 March 1939, *F. J. Herman* 10092 (NY). Charlton Co.: Chesser's Island, Okefinokee Swamp, very common in cleared hammock, 24 July 1931, *J. S. Harper* 361 (NY). Chatham Co.: near Savannah, moist border swamps and clay, 7 July 1897, *G. B. Sudworth* s.n. (US).

Glynn Co.: Jekyl Island, woods, 16 March 1914, *F. E. Lee* s.n. (NY). Jefferson Co.: Northside of Ogeechee Riv. just south of Louisville, deep woods, well drained sandy soil in bottomland, 27 July 1941, *W. H. & M. B. Duncan* 3778 (US). Meriwether Co.: near Nebula, wet ravine in Pine Mountains, 8 June 1910, *R. M. Harper* 2259 (NY). Stewart Co.: South of Omaha, dry shady woods, 19 July 1901, *R. M. Harper* 1099 (BM, E, NY, US). Sumter Co.: along Muchalee Creek just below Americus, low rich woods and hammock lands, 23 Jan. 1904, *R. M. Harper* 2039 (E, NY). Thomas Co.: Ochlockonee Riv. near Thomasville, 28 May–6 June 1895, *J. K. Small* s.n. (NY).

FLORIDA. Alachua Co.: Gainsville, March 1876, *A. P. Garber* s.n. (NY). Bay Co.: Lynn Haven, St. Andrew's Bay, on sand woods, 20 March 1926, *H. J. Banker* 3487 (NY). Brevard Co.: near Malabar, shore of Sound, 18 Dec. 1919, *J. K. Small, N. L. Britton & J. B. De Winkeler* 9369 (NY). Duval Co.: near Jacksonville, rich woodlands, March and November, without year, *A. H. Curtiss* 2314 (BM, FI, K, P, US) and 12 March 1894, *A. H. Curtiss* 4561 (E, K, NY, P, US, W); in the vicinity of Mayport and Jacksonville, 1870–1876, *H. D. Keeler* s.n. (NY); South Jacksonville, 1 April 1896, *L. H. Lighthipe* s.n. (NY); St. Nicholas, 9 April 1896, *L. H. Lighthipe* 125 (NY); Fort George Island, mouth of St. John's River, shell hammock, 1 April 1886, *J. D. Smith* s.n. (US). Escambia Co.: Pensacola, sandy woodlands, 13 April 1901, *Biltmore Herb.* 682e (NY). Flagler Co.: 3 miles E. of Bunnell, in high hammock, 8 Aug. 1929, *H. O'Neill* s.n. (US). Franklin Co.: Apalachicola, low ground along the river, 27 March 1900, *Biltmore Herb.* 682d (NY); East Point, in sandy woods, 5 May 1930, *H. N. Moldenke* 5972 (NY). Gadsden Co.: low woods along the Chatahoochee river, 10 April 1929, *E. J. Palmer* 35258 (NY); Ty Ty Bay, west of Quincey, 6 April 1925, *J. K. Small & E. T. Wherry* 11711 (NY). Hernando Co.: vicinity of Brooksville, dry sandy soil, 26 Oct. 1919, *R. N. Jones* 102 (US), and wet woodland in the high hummock near stream, Brooksville, 11–12 Feb. 1916, *J. B. Norton* 419 (US). Indian River Co.: Eau Gallie, Indian river, dry, fertile soil, 17 Sept. 1896, *A. H. Curtiss* 5778 (E, NY, P, K). St. John's Co.: without locality, 11 April 1879, *J. D. Smith* s.n. (US), and dry thickets, 25 Feb. 1882, *J. D. Smith* 432 (US). Lake Co.: vicinity of Eustis, 1–15 June 1894, *J. Nash* 986 (E, K, NY, P). Levy Co.: Gulf Hummock (and Rosewood), June 1876, *A. P. Garber* s.n. (US). Manatee Co.: Manatee, March 1878, *A. P. Garber* s.n. (US), March 1898, *J. H. Simpson* s.n. (NY), and in woods, Dec. 1897, *J. H. Simpson* s.n. (NY); south bank of Little Manatee Riv. U.S. Route 41, sandy scrub-land, 7 April 1950, *W. T. Dress & J. Hansen* s.n. (BM); Braidentown (Bradenton), 6 March 1898, and Palma Sola, 12 Dec. 1898, *J. H. Simpson* 9 (US); Palma Sola, 14 May 1900, *S. M. Tracy* 6668 (BM, E, NY, W), and 5 Jan. 1900, *S. M. Tracy* 6669 (NY). Nassau Co.: Fernandina, without date, *T. Hogg* s.n. (NY). Volusia Co.: New Smyrna, 29–31 March 1904, *A. B. Burgess* 604 (NY); Daytona, on shore, 7 Oct. 1903, *J. K. Small & J. J. Carter* s.n. (NY); near Daytona Beach, 25 March 1906, *Stella Dean* 1775 (US); Sanford, Calmetto-scrub, 1 April 1915, *S. Rapp.* s.n. (NY), and 23 March 1927, *S. Rapp.* s.n. (NY). Walton Co.: without locality, swamps, summer 1885, *A. H. Curtiss* s.n. (NY). Unlocated as to county: Hibernia, March 1869, *W. M. Canby* s.n. (NY, US); "In paludosis maritimis ad lac. Jamony" April 1843, *Rugel* s.n. (BM, K, NY, W).

ALABAMA. Lee Co.: Auburn, 4 April 1896, *F. S. Earle & L. M. Underwood* s.n. (NY), 27 March 1897, *F. S. Earle & C. F. Baker* s.n. (NY), and occasionally, usually along streams, often on rocky banks, 11 April 1900, *F. S. & Esther S. Earle* 56 (NY). Mobile Co.: Mobile, Nov. 1833, *Lewett* 202 (E), 1840, *A. Gray* s.n. (K), and swampy forests, 8 April 1895, *C. Mohr* s.n. (US). Pike Co.: between Brundidge and Troy, open sandy woods, the "Pecosin", 15 April 1931, *E. J. Palmer* 38673 (US).

MISSISSIPI. Jackson Co.: Ocean Springs, 1 April 1895, *J. Skehan* s.n. (US). Harrison Co.: Biloxi, 1 April 1895, *S. M. Tracy* s.n. (US), and 27 March 1900, *S. M. Tracy* s.n. ("=4972") (BM, E, W); Beauvoir, 20 March 1898, *S. M. Tracy* 4971 (NY, US) and 4972 (NY).

LOUISIANA. Orleans Co.: New Orleans, 1832, *Drummond* 285 (K). St. Tammany Co.: vicinity of Covington, 20 Sept. 1919, *G. Arsène* 11601 (US), and 5 April 1920, 11998 (NY).

MEXICO

OAXACA. Mont Pelado, 2400 m., Feb. 184–, *H. Galeotti* 529 (P, US).

VERACRUZ. Cumbre del Obispo, 29 Sept. 1829, *Schiede* s.n. (K, NY, US). Without locality and date, *Jurgensen* 382 (K).

The leaf shape in this species, with its wide geographic range from Virginia to Southern Mexico, shows a fair degree of variation and the apex, which is typically acute, is occasionally subacuminate or rarely even acuminate. It was suspected, at first, that the degree of acumination increased the further south the source of the material, but a careful examination of the large amount of material seen disproves this as an invariable rule. *O. mexicanus*, the only other American species, has distinctly acuminate leaves and in this respect, as well as in their thin texture, they are resembled by those of the specimens collected by Schiede from Cumbre del Obispo in Veracruz. However, leaves with a similar acuminate apex are occasionally found in the United States.

O. floridanus was distinguished from *O. americanus* by a finely pubescent inflorescence and a yellowish green fruit, 16–20 mm. in length. All degrees of pubescence of the inflorescence have, however, been seen and as no other character has been found which can be used for distinguishing the two species it is suspected that the colour given for the fruit shows it to have been immature. In this connection too it is interesting to note that the type specimen of *O. americanus* in the Linnean Herbarium has a pubescent inflorescence.

Fruit size appears variable and it is difficult to judge on which specimens the fruit is fully developed and on which immature. No other fruits were seen as large as those on the specimen which had been named *O. megacarpus* and until careful observations have been made on a range of living material it is felt to be wiser to retain the large fruited plant as a variety; under which further discussion on fruit size will be found.

In connection with the geographical range, mention should be made of the fact that Cooper in the Smithsonian Report for 1858, p. 253, records *O. americanus* as extending into Texas but no material from this State has been seen in this revision. Young in his "Familiar Lessons in Botany, with Flora of Texas" (1813) also includes *Olea americana* (p. 451) but states on the title page that it is "adapted to general use in the southern states" and his record for Texas is therefore not so definite. Attention should also be drawn to the fact that it is listed as occurring in Arkansas which is a considerable distance from the maritime areas from which the species is characteristically recorded (Lesquereux in Owen, 2nd Rept. Geol. Reconn. Arkansas 382: 1860).

1b. var. **megacarpus** (Small) P. S. Green, **stat. nov.**

Syn.: *Amarolea megacarpa* Small, Man. Southeast. Fl. 1043 et 1507 (1933).

Osmanthus megacarpus (Small) Small ex Little in Journ. Wash. Acad. Sci. xxxiii, 10 (1943); Little, U.S. Dept. of Agric., Forest Service, Agric. Handb. 41 ("Check List of Native and Naturalized Trees of U.S.") 249 (1953).

Fruit very fleshy, globose, 1·8–2·3 cm. long by 1·5–1·8 cm. broad, stone 1·2–1·4 cm. long by 1–1·1 cm. broad, pointed at the base.

FLORIDA. Sand hills, Lake Annie, 8 Jan. 1925, *J. K. Small & P. Matthaus* 11612 (holo. NY, iso. US). Flowering and fruiting specimens raised in the propagating house of New York Botanic Garden (no. 57383) from seed from Lake Annie, Dec. 1926, *J. K. Small* s.n. (NY).

Amongst the numerous specimens of *O. americanus* examined, only the two specimens cited above possess so large a fruit, and as in all other characters they conform to the type variety, specific status is hardly warranted on this fruit character alone. Especially is this so in the light of the fact that whilst Small in his original description gives the fruit size as 2–2·5 cm., and of *O. americanus* as 1–1·5 cm., apparently distinct and with no overlap, others give sizes which lie between these figures. For example Sargent in his careful description in "Sylva of N. America" (vol. vi, p. 65) gives the fruit size of *O. americanus* as 1 inch long, *i.e.* 2·5 cm. and illustrates fruit, labelled as natural size, 2·0 cm. long, and Brown in "Louisiana Trees and Shrubs" (p. 221) gives the size as $\frac{1}{2}$–$\frac{3}{4}$ inch, *i.e.* 1·3–1·9 cm. Other authors who have had the opportunity of describing fresh material also give lengths for the fruit which fall between 1·5 cm. and 2 cm., the maximum and minimum sizes as given by Small for *O. americanus* and *O. megacarpus* respectively. This lack of disjunction in the fruit size is further borne out by the size of the stone for Small says his *O. megacarpus* has stones more, and *O. americanus* less, than 1 cm. in diameter.

Small also says that the stone of *O. americanus* is acute at both ends and of *O. megacarpus* acute only at the base, but amongst the material examined with fruit that appears mature, some undoubted *var. americanus* had stones pointed at both ends, others were generally less pointed at the apex and some pointed only at the base (e.g. *Jones* 102 and *Small et al.* 9369).

The examination of a range of fully mature fresh fruits is desirable but until this has been done the retention of the large fruited form as *var. megacarpus* seems the most desirable course.

In the herbarium of the New York Botanic Garden there are two specimens collected by J. K. Small, without a number, and labelled *O. megacarpus* even though they are in flower. They are: "Southern end, Lake Region at Indian Prairie, Peninsular Florida, sandhills, 8 Dec. 1925" and "Near Lake Annie, Dec. 1925".

1c. var. **microphyllus** P. S. Green, **var. nov.**

A typo omnibus partibus minoribus differt.

Folia crassa coriacea, angusto-elliptica vel oblanceolata, (3–)4–5(–6) cm. longa, (1–)1·5–2(–2·5) cm. lata, venis plus minusve obscuris, venis principalibus utrinsecus 4–5. *Inflorescentiae* 1–1·5 cm. longae. *Fructus* fortasse paulo immaturus, 7–10 mm. longus, 6–7 mm. latus.

Shrub, the young stem minutely puberulous. *Leaves* glabrous, minutely puberulous on the midrib above when young; petiole 5–10 mm. long, minutely puberulous when young; lamina thick coriaceous, narrow elliptic or oblanceolate, *(3–)4–5(–6) cm. long* by (1–)1·5–2(–2·5) cm. broad; margin entire, slightly thickened and slightly revolute; apex weakly acuminate, tip blunt; base angustate-cuneate, decurrent into the petiole; venation usually more or less obscure with only primary ribs to be seen above and below, 4–5 per side. *Inflorescence* axillary, paniculate, 1–1·5 cm. long, minutely pubescent. Flowers not seen. *Fruit* probably slightly immature, slightly obovoid, 7–10 mm. long by 6–7 mm. broad, thin crustaceous endocarp.

MEXICO. Prov. Nuevo Leon: Sierra Madre Oriental, San Francisco Cañon, about 15 miles S.W. of Pueblo Galeana, alt. 2300–2400 m., scattered shrub on the tops of hills near mouth of cañon, 14 May 1934, *C. H. & M. T. Mueller* 371 (holo. NY, iso. P), and, last hill on west side of San Francisco Cañon, common in the top shrub zone on limestone, 15 July 1934, *C. H. & M. T. Mueller* 1033 (NY, US).

A variety which is chiefly distinguished from the type by the smaller leaves and more stunted appearance. The inflorescence is apparently shorter and more compact and it is suspected that the fruit will be somewhat smaller in size as well. It is known only from the two collections cited above and it is interesting that other Mexican material of *O. americanus* from a good deal further south has a much more typical appearance and the usual dimensions for the species.

2. **Osmanthus mexicanus** Lundell in Phytologia, i, 308 (1939).

Tree 6–7 m. high, diameter 25 cm. *Leaves* glabrous, blackened when dry; *petiole slender*, *1(–1·5) cm. long*; *lamina thickish*, densely black gland dotted below, narrow elliptic to oblanceolate, *(4–)5–7(–8) cm. long* by (1–)1·5–2(–2·5) cm. broad; margin entire scarcely thickened; apex *attenuate-acuminate*, the tip blunt; base angustate-cuneate, decurrent into the petiole; venation more or less obscure and *primary veins* only visible, slightly raised both above and below, *4–5(–6) per side*. *Inflorescence* axillary, narrow, paniculate, 1·5–2 cm. long, about 9–flowered, minutely puberulous, thickened in fruit; bracts triangular ciliate and minutely puberulous, apparently more or less deciduous in fruit. *Flowers* diclinous, subsessile. *Calyx* 1 mm. long, lobes 4 (occasionally 5), 0·5 mm. long ciliate. *Corolla* pubescent, especially in the upper part, tube 2 mm. long, lobes 4, broadly ovate rounded, 2 mm. long. *Stamens* 2, male flower not seen, in the female flower abortive and hardly developed, about 0·25 mm. long on filaments of about the same length, attachment just above the middle of the corolla tube. *Ovary* 3 mm. long dotted with peltate scales, including style 1·5 mm. long with short bifid stigma about 0·5 mm. across. *Drupe* ellipsoidal, 1·2–1·4 cm. long by 0·7–0·8 cm. broad, endocarp hard, about 0·5 mm. thick, not ribbed.

MEXICO. Chiapas Prov.: Cero Laguna, Mapastepec, Jan. 1938, *Eizi Matuda* 2023 (holo. MICH not seen, iso. K, NY).

Osmanthus mexicanus and *O. americanus* are closely allied and, although Chiapas is the southernmost of the Mexican provinces, the latter species extends at the southern end of its range to approximately the same latitude (e.g. *Galeotti* 529 from the province of Oaxaca). The two species can be distinguished one from the other by leaf size and texture and by the degree of acumination. Some material of *O. americanus*, however, shows a well developed acumen, especially the specimen collected by Schiede in 1829 from Cumbre del Obispo in Mexico. In fact the leaf and endocarp of this specimen are rather atypical for *O. americanus* and when the small leaf size of *O. americanus* var. *microphyllus* is considered as well, it becomes apparent that the two species are not outstandingly distinct. When further material is available from Mexico therefore, it might prove best to treat *O. mexicanus* as a subspecies of the better known and more widely ranging *O. americanus*.

3. **Osmanthus minor** P. S. Green, **sp. nov.** (Plate 13).

Frutex vel arbor, 2–14 m. alta. *Folia* primum puberula, petiolis gracilibus (5–)8–15(–20) mm. longis; laminis angusto-ellipticis vel angusto-oblanceolatis, (4–)5–8·5(–10) cm. longis, (1–)1·5–2·5(–3·5) cm. latis; marginibus integris non crassis; apicibus distincte acuminatis; basibus anguste angustatis vel anguste cuneatis; venis supra plerumque obscuris et subtus venis principalibus tantum plerumque conspicuis, utrinsecus (5–)6–7(–8). *Inflorescentiae* axillares, paniculatae, 1 cm. longae, bracteis superioribus late ovatis vel lanceolatis tenuibus carinatis. *Flores* unisexuales, pedicellis c. 2 mm. longis, *calyce* 1–1·5 mm. longo, lobis 4, 0·5–1 mm. longis ciliatis; *corollae* tubo 1·5–2 mm. longo, lobis 1·5 mm. longis, minute ciliatis; *stamina* 2, filamentis 2 mm. et antheris 0·75 mm. longis; *ovarium* floris feminei non visum, floris masculi abortivum. *Fructus* drupaceus, ellipsoidalis vel obovoideus, 1·5–2 cm. longus, 0·8–1·2 cm. latus, endocarpio osseo c. 1 mm. crasso costato.

Evergreen *shrub* or tree, 2–14 m. high, diameter at breast height 6–28 cm. *Leaves* when young puberulous otherwise glabrous throughout; *petiole slender* (*0·5–)0·8–1·5(–2) cm. long*; lamina thickish, narrow elliptic to narrow oblanceolate occasionally oblanceolate, (*4–)5–8·5(–10) cm. long* by (1–)1·5–2·5(–3·5) cm. broad; margins entire, not thickened; *apex clearly acuminate*, tip blunt; base narrow cuneate to narrow angustate occasionally angustate, decurrent into petiole; venation above with primary veins obscure, slightly impressed, rarely (*Taam* 319) clear, below primary veins raised and clearly visible, secondary veins usually not visible or obscure, (5–)6–7(–8) primary veins per side. *Inflorescence* axillary, shortly paniculate, *1 cm. long*, about 8–12-flowered, puberulous, slightly thickened in fruit, basal bracts triangular, thick, puberulous on the back, *upper bracts broad ovate to lanceolate*, thin, cuspidate, carinate, ciliate and puberulous on the keel. *Flowers* diclinous, cream coloured, pedicels 2 mm. long. *Calyx* 1–1·5 mm. long, lobes 4, bluntly triangular or ovate, 0·5–1 mm. long, ciliate. *Corolla* tube about 1·5–2 mm. long, lobes 4, 1·5 mm. long, minutely ciliate. *Stamens* 2, filaments 2 mm. long, shorter in the bud, attached near the top of the corolla tube, average diameter of pollen measured 21·4μ, with a range of extremes of 20–23μ. *Ovary*, female flower not seen, in the male represented by a rounded stump nearly 0·5 mm. high. *Drupe* black when ripe, ellipsoid or slightly obovoid, 1·5–2 cm. long by 0·8–1·2 cm. broad, endocarp hard bony up to 1 mm. thick, with 6 or 8 main ribs and occasionally a few smaller additional ones between.

KWANGTUNG. Thai-Yong, a mountain valley 600 m. elevation, 60 miles west from Swatow, surrounded by hills reaching 30 m. and intersected by glens, richly wooded, 12 Sept. 1899, *J. M. Dalziel* s.n. (holo. E). Wung-Yuen district: Tsing Wan Shan, Wong Chuk I and vicinity, fairly common, dry steep slope, clay, forest, 16–31 Aug. 1933, *S. K. Lau* 2024 (A). Sin-Fung district: Sha Lo Shan, Wa Mei T'ong village, abundant, thicket, 1–31 Dec. 1937, *Y. W. Taam* 165 (A) and 245 (A); Lo Lo-ha village, abundant, thicket, 6–25 July 1938, *Y. W. Taam* 915 (A); Ngong T'in Lo Shan, Lo T'am village, abundant, thicket, 8–26 Jan. 1938, *Y. W. Taam* 319 (A). Tapu district: Tai Mo Shan, fairly common, dry, silt, sandy soil, thicket, roadside, 18 July 1932, *W. T. Tsang* 21217 (A, K, NY); Tung Koo Shan, Tsui P'ei Muk, fairly common, dry clay, thicket, 8–29 Dec. 1932, *W. T. Tsang* 21731 (BM, K, NY).

KIANGSI. Kiennan district: Sai Hang Cheung near Tung Lei village, rare, dry steep slope, clay, 1–11 Sept. 1934, *S. K. Lau* 4346 (A, BM). Lugnan district: Oo Chi Shan, near Lam Uk village, fairly common, dry steep slope, loam, rocky, forest, 1–25 Oct. 1934, *S. K. Lau* 4860 (A, BM).

HONG KONG. New Territories, Tai Wai Mountain, on banks of a stream, 27 May 1914, *W. J. Tutcher* (*Hong Kong Herb.* No. 10949—K).

This species, the specimens of which have previously remained unnamed or been marked *O. fragrans*, *O. cooperi* or *O. matsumuranus*, is nearest to the last named. It is distinguished by the smaller size of the vegetative parts and by the shorter more compact inflorescence. In this last character it resembles some of the material of *O. marginatus* but the leaves are quite distinct both in shape and texture.

The only material to have been mentioned in the literature is that collected by Tutcher in the New Territories, Hong Kong in 1914. It was named *O. matsumuranus* by Tutcher (Rep. Bot. & For. Dept. Hong Kong 1914, 24 and 34: 1916) and reference is made to it by Chun (Sunyatsenia, i, 163–176: 1933); however, at that time *O. matsumuranus* was very imperfectly known.

With the exception of this Hong Kong material all other records are confined to N.E. Kwantung and S. Kiangsi and it would be interesting to know whether it occurs in the intermediate area.

4. **Osmanthus matsumuranus** Hayata in Journ. Coll. Sci. Tokyo, xxx, Art. 1 ("Materials for a Flora of Formosa"), 192 (1911); Matsumura, Index Pl. Jap. ii, 496 (1912); Kanehira, Formosan Trees, ed. 1, 367 et fig. (1917) et ed. 2, 622 et fig. (1936); Sasaki, List of Plants of Formosa, 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Makino & Nemoto Fl. Jap. ed. 2, 940 (1931); Merrill & Metcalfe in Lignan Science Journ. xvi, 397 (1937); Merrill in Journ. Arn. Arb. xix, 63 (1938); Tanaka & Odashima in Journ. Soc. Trop. Agric. x, 378 (1938); Mori in Journ. Jap. Bot. xv, 558 et figs. (1939).

Syn.: *Osmanthus marginatus* var. *formosanus* Matsumura in Bot. Mag. Tokyo, xii, 29 (1898).

O. obovatifolius Kanehira, Formosan Trees, ed. 1, 368 et 370 et fig. (1917); Sasaki, List of Plants of Formosa, 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 940 (1931); Mori in Journ. Jap. Bot. xv, 560 et fig. (1939).

O. wilsoni Nakai in Bot. Mag. Tokyo, xliv, 13 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 940 (1931); Mori in Journ. Jap. Bot. xv, 560 (1939).

O. pedunculatus Gagnep. in Lecomte & Humbert, Fl. Gén. Indo-Chine, iii, 1063 et figs. (1933) et in Bull. Soc. Bot. France, lxxx, 78 (1933).

Olea longipetiolata Merr. ex Tanaka & Odashima, nom. nud., in Journ. Soc. Trop. Agric. x, 378 (1938); Chia in Acta Phytotax. Sin. iii, 348 et 353 (1955).

Evergreen *shrub* or *tree*, 2·5 m. to 20 m. in height (33 m., *Lau* 1982), diameter at breast height, 3–24 cm.; bark grey or brownish grey, rough. *Leaves* glabrous throughout but bud leaves sometimes ciliate at first, *petioles* (*1·5–*)*2·0–2·5*(*–4·0*) *cm. long*, base thickened; *lamina chartaceous*

or slightly thicker, shining above, oblanceolate to occasionally obovate or subelliptic, *(5–)8–12(–21) cm. long* by (1·5–)2·5–4·5(–7) cm. broad; *margins slightly thickened entire or serrate, especially in the upper half, serrations obscure or evident, usually blunt but occasionally acute*, often more or less undulate in dried specimens; apex acuminate to shortly or weakly acuminate; base angustate to narrowly cuneate, decurrent into the petiole; venation above, impressed, primary veins usually clearly visible, secondary veins usually very faint, below primary and secondary veins raised but with relatively few secondary veins, *(7–)8–10(–15) primary veins per side. Inflorescence* axillary, paniculate, *1·5–2 cm. long*, about 10–30-flowered, glabrous or puberulous, thickened in fruit; bracts glabrous or rarely puberulous, ciliate at apex at least when young, usually deciduous after flowering, basal ones triangular ovate, 1 mm. long, *upper bracts linear-lanceolate*, slightly carinate, 2–4 mm. long. *Flowers* diclinous, whitish green or yellowish green, fragrant; pedicel 1·5–3 mm. long. *Calyx* 1–1·5 mm. long, lobes 4, 0·5–1 mm. long, ciliate. *Corolla* tube 1·5–2(–3) mm. long, lobes 4, oblong, 1·5–2 mm. long with ciliate margins. *Stamens* 2, filaments 1·5–2 mm. long, shorter in the bud, attached near the top of the corolla tube; anther rounded without terminal appendage, 0·5–0·75 mm. long, range of average dimensions of pollen measured, 20·8–23·8μ with a range of extremes of 20–25μ; in the female flowers the stamens smaller, abortive, on shorter filaments. *Ovary* 4 mm. long covered with peltate scales, including slender style about 3 mm. long with capitate slightly bilobed stigma; in the male flower the ovary represented by a rounded stump, 0·5 mm. long. *Drupe*, green ripening through purple or blue to black, ellipsoidal, 1·5–2·2 cm. long by 0·7–1 cm. broad, style more or less persistent; endocarp hard, about 1 mm. thick or slightly less with usually 6 ribs but occasionally 8 or more.

FORMOSA. Bankinsing mountains, *A. Henry* 543 (A), 824 (K), 824a (K), 1533 (A, K), 1535 (K) and 1686 (K); Rengachi, 11 Nov. 1924, *T. Hayashi* 705 (FU); Suisha, 6 Nov. 1924, *T. Hayashi* 707 (FU); "In littore occidentale laci Gettan, Tainan-syn," 19 Sept. 1929, *Y. Kudo & S. Sasaki* 15347 (TAI, US); "In silvis pedum montis Baram ad Nichigetsutan," 17 Sept. 1929, *Y. Kudo & S. Sasaki* 15170 (TAI); "Inter Sekiin et Bokkitsu ad Nichigetsutan," 18 Sept. 1929, *Y. Kudo & S. Sasaki* 15291 (TAI); "Nitigetutan, Taityu-syn", 9 July 1936, *K. Mori* s.n. (TAI); Lake Candidius, hill, 750 m., 31 May 1934, *J. Lindley Gressitt* 208 (A, BM, K, L, NY), and 1 June 1934, 228 (NY); also 15 Oct. 1927, *R. Kanehira* 21316 (A), and 21317 (A); near Lake Candidius, prov. Nanto, 10 March 1918, *E. H. Wilson* 9962 (A, BM), 9967 (holo. *O. wilsoni* A, iso. K), and 7 Dec. 1918, 11177 (A, BM, K); Musya-Santinozyo, 1 Aug. 1939, *G. Masamune, K. Mori & T. Nakamuda* 2209 (TAI): Pai wan-sya, Prov. Takao, 4 June 1917, *E. Matuda* s.n. (TAI), and Piumasya, Takao-syu, 29 May 1919, s.n. (TAI); Taikoku-syu, Tikusiko to Tikusitogge, Hokuto-syo, 20 April 1940, *T. Nakamuda* s.n. (TAI); Tutiba to Sikikun, Mt. Taiheizan, Rato-gun, 13 July 1929, *S. Suzuki* s.n. (TAI); Bunzangan, Rimogan, Ruggyahu, Masisakku, 730 m., Takasagozii Gunsô, 5 Oct. 1937, *T. Suzuki* 16966 (TAI); Kiirun, 12 May 1935, *T. Tanaka & Y. Shimida* 17854 (A, BM, E, L, NY, O, P, SING, W); "In silvis inter Suisuiha et Daibu, Taitô-tyô", 8 Jan. 1933, *T. Suzuki* 8070 (TAI); Kappanzan-Urai, Siutiku-syû, 14 July 1931, *T. Suzuki* 4544 (TAI); Kwarenkô-tyô, Tyûôsenzan, Bê Murudôn to Rôdohu no aidano Laurisilvae, 1600 m., Fukuyama, 27 July 1936, *T. Suzuki* 16132 (TAI); Arisan, prov. Kagi, 2000 m., 30 Jan. 1918, *E. H. Wilson* 9676 (A, K); without locality, 1915, *U. Faurie* 8221 (A, TAI), and 14 June, *A. Henry* 806 (NY).

HONG KONG. In wood, 28 Dec. 1929, *N. K. Chun* 40089 (K, NY).

KWANGTUNG. Wang Tung Chuen, Tseng Uen, on mountain side, March 1918, *To Kang Peng* (*Canton Christian College* 2327) (BM, K, NY); Poon Yue Distr., 31 Oct. 1918, *Canton Christian College* 3163 (A), and Canton vicinity, 29 Dec. 1918, 3260 (A, E, K);

Lung Yen Tung vicinity, Canton, 15 Feb. 1930, *N. K. Chun* 40346 (NY); "In monte Dingwu-schan ad occid. urbis Kanton", 2 Jan. 1916, *R. Mell* 203 (A); Canton brought in by native collector, without date, *S. Sampson* 920 (BM); White Cloud Mt., 13 Dec. 1918, *Canton Christian College* 3471 (A); Lofou shan, roadside, 26 Feb. 1930, *H. T. Ho* 60144 (NY); Lofou shan, East River Region, Way to Hwa-shin-tan, 232 m., in open light woods, 20 Dec. 1928, *Y. Tsiang* 1649 (A), and way to Choug-shu-Kwan, 232 m., in partial shade, light wood, 20 Dec. 1928, 1661 (A) and 1662 (A); Fang Ch'eng district, Kung P'ing Shan, T'aan Faan, growing in thicket on moist clayey soil, 1–9 Sept. 1936, *W. T. Tsang* 26783 (A); Nanhoi district, Sai Chiu shan, roadside, 7 Nov. 1929, *N. K. Chun* 7806 (A, E); Wung Yuen district, Wong Chuk I and vicinity, fairly common, dry gentle slope, loam, thicket, 16–31 Aug. 1933, *S. K. Lau* 1982 (A); Yunfou district, roadside, in light wood, 11 Feb. 1929, *Y. K. Wang* 1826 (A); Kon Liang Ling, Kochow, 19 Aug. 1928, *Y. Tsiang* 1009 (E) and 1109 (A); Foo Lung, Sup-Man-Ta Shan, in shaded woods, 18 July 1937, *H. Y. Liang* 69766 (A); Chung Shaan, beside the stream, 26 April 1931, *W. T. Tsang* 30 (NY); Ying-tak, 1 Jan. 1929, *Y. Tsiang* 532 (A); Yingtak district, in woods, 14 March 1930, *Y. F. Chun* 30419 (NY); without locality and date, probably near Canton, between 1820 and 1830, *C. Millett* s.n. (GL).

HAINAN. Ching Mai district: Mei Maan and vicinity, rare, dry steep slope, sandy soil, roadside hedge, village common, 9 Oct. 1932, *C. I. Lei* 109 (A, K, L, NY, P, SING, W); Pak Shik Ling and vicinity, Ku Tung village, rare, dry, level land, clay, thicket, 9 May 1933, *C. I. Lei* 638 (K, NY, US, W), and same locality, rare, moist steep slope, sandy soil, forest, 20 Aug. 1933, *C. I. Lei* 941 (A, K, L, NY, SING, W). Lam Ko-Chung district: Paak Shek Shan, dry place, 10 June 1928, *W. T. Tsang* 629 (A, K, NY); Na Chong Yuen village, rare, dry, level land, sandy soil, thicket, roadside, 16 Dec. 1932, *C. I. Lei* 299 (A, K, NY, W). Kan-en district: Chiun Fung Ling, near Sam Mo Watt village, rare, dry steep slope, clay, forest, 23 April 1934, *S. K. Lau* 3838 (A). Ngai district: Sai Tham Thing (Lai), Yeung Ling Shan, abundant, dry, gentle slope, sandy soil, 19 June 1932, *S. K. Lau* 123 (A, E, K, NY). Taam-chan district: Nga Ping Shan, growing in big ravine, 22 Sept. 1927, *W. T. Tsang* 918 (A, K, NY). Yae-hsien district: Yaichow, partial shade, light forest, 11 Aug. 1933, *H. Y. Liang* 62505 (A, NY); Yeung Lam Shan, near Yeung Lam village fairly common, dry, steep slope, forest, 4–24 May 1935, *S. L. Lau* 6223 (A). Without district: Po-ting, in forest, April 1935, *F. C. How* 72122 (SING), and 8 April 1935, *F. C. How* 71739 (A), in forested ravine, 350 m., 25 April 1935, *F. C. How* 72133 (A), in ravine, 350 m., 17 May 1935, *F. C. How* 72382 (A), and 400 m., by stream, Sept. 1935, *F. C. How* 73717 (P); Tai Pin, jungle, 290–300 m., 24 July 1935, *J. Lindley Gressitt* 1101 (A, BM, E), and edge of jungle, 320 m., 25 July 1935, 1113 (A, BM, E). Without locality: in shaded forest along stream, 21 Feb. 1934, *H. Y. Liang* 65051 (A, NY), and dense forest, 17 Aug. 1933, *C. Wang* 33748 (A, NY).

CHEKIANG. Region of King Yuan, 1300 m., in wood as undergrowth, 31 Aug. 1924, *R. C. Ching* 2540 (NY, US); and without locality, in open thickets, 1370 m., rare, 7 Aug. 1924, *R. C. Ching* 2341 (A).

KWANGSI. Sin Shu, 140 li S. Hin Yeu, 900 m., in open wood, rare, 3 Sept. 1928, *R. C. Ching* 7308 (A, NY); Seh-Feng Dar Shan, S. Nanning, 360 m., in wood, common, 15 Oct. 1928, *R. C. Ching* 7881 (A) and 7893 (A, NY).

YUNNAN. Fo-Hai, 1540 m., thickets, May 1936, *C. W. Wang* 74241 (A), 74321 (A), and 1530 m., mixed forest, June 1936, *C. W. Wang* 74324 (A, US), and 74385 (A); Sheau-meng-yeang, Che-hi Hsien, thickets, Aug. 1936, *C. W. Wang* 75681 (A); Meng-la, Jenn-yeh Hsien, 850 m., mixed woods, Nov. 1936, *C. W. Wang* 80844 (A); without locality, 10 Feb. 1910, *A. Henry* 1011 (A).

INDO-CHINA, TONKIN. "Environs de Tu-Phap", 24 May 1888, *B. Balansa* 3405 (holo. *O. pedunculatus* P, iso. L); "Bois près de la rive gauche de la rivière Noire près qu'en pace de Tu-Phap", Dec. 1888, *B. Balansa* 3620 (K); Du Chong, Prov. de Soutry; 27 Oct. 1938, *A. Petelot* 2137 (A, NY); "Province de Thai Nguyen, savanes arbustoires Long Hit", 17 Dec. 1939, *A. Petelot* 2674 (A) and 2676 (A); "environs de Pho Vi, Prov. de Bac Giang, forêt claire", June 1933, *A. Petelot* 4754 (NY, P), and June 1936, 5951 (NY) and 5954 (A, P).

ANNAM. La Hán, prov. de Thanh Hoa, 9 Aug. 1920, *Poilane* 1719 (A).

INDIA. Khasia, Amwee, 900 m., 26 Sept. 1850, *J. D. Hooker & T. Thomson* 2386 (BM, K, NY).

The existing literature gives the impression that this species possesses a relatively limited distribution; there are only two brief references to its existence outside Formosa, one by Merrill & Metcalfe in 1937 and the other by Merrill in 1936 (for full references see above). The plant referred to by Tutcher (Rept. Bot. & For. Dept. Hong Kong 1914, 24 and 34: 1915, quoted by Chun in Sunyatsenia, i, 163 and 176: 1933) is not this species as was thought at the time but *O. minor* the closely related species enumerated above. After examination of abundant material it is clear that the distribution extends from Formosa throughout the most southerly provinces of China to Indo-China and even as far as Khasia in India. One reason for the apparent restricted range in the past is that many of the specimens had been misidentified and, in consequence no doubt, became hidden amongst material of the genera and families to which they had been wrongly referred. For instance many Chinese specimens bore the determination *Sarcosperma laurina* Hook. f. (see Hu, Wang, & Hsie, in Bull. Fan. Inst. Biol. viii, 353: 1938), whilst the interesting specimen from Khasia, collected by Hooker & Thomson was named *Gomphandra axillaris* Wall. Furthermore it is worth noting that the early Henry material from Formosa was named *Linociera sp.* (Henry in Trans. Asiatic Soc. Jap. xxiv, suppl. 59: 1898).

The earliest specimen examined (named *Olea sp.*) was one sent to Sir William Hooker by Charles Millett who lived near Macao and Canton in the 1820's and 1830's. This specimen is now in the Herbarium, University of Glasgow.

Under the name *O. marginatus*, Matsumura and Hayata (Journ. Coll. Sci. Tokyo, xxii ("Enum. Pl. Formos."), p. 247: 1906) list the type of *O. matsumuranus* together with another specimen not seen. Doubtless *O. marginatus* var. *formosana* was intended but it is possible that this reference led to the listing of *O. marginatus* as a Formosan plant by Kawakami (A List of Plants of Formosa, 69: 1910).

The actual holotype, *Honda* s.n., Linkipo, Formosa (TI) has not been examined but by the courtesy of Dr. H. Hara of Tokyo a photograph has been received and placed in the Edinburgh herbarium.

The holotype of *O. wilsoni* Nakai, at the Arnold Arboretum, has been examined and whilst it is possible that that of *O. obovatifolius* Kanehira has not, a specimen which was examined when on loan from the Herbarium of Taiwan University might have been type material. The specimen was collected by E. Matuda at Pai-wan on 6 June 1917 and was labelled "*Osmanthus obetifolius* Kane." (sic) and also bore the word "Type". A photograph of this specimen is given by Mori (in Journ. Jap. Bot. xv, 560: 1939). Furthermore on the Kew sheet of *Wilson* 9967 (the type number of *O. wilsoni*), which had previously only borne the name *O. obovatifolius*, there is a note in Wilson's hand, "from the type tree". Both from the photograph given by Mori and this specimen it is clear that both names are synonymous with *O. matsumuranus* and in fact Kanehira himself placed *O. obovatifolius*, which he had described in the first edition of "Formosan Trees", in synonymy in his second edition.

Unlike *O. marginatus*, *O. matsumuranus* is relatively constant in morphological characters throughout its range and may be distinguished by the constantly thin texture of the leaf, the margin of which is often serrate in

the upper half and never thick, as occasionally in *O. marginatus*. In addition the venation of the lamina is generally more or less obscure in *O. marginatus* with 6 or 8 or even less primary veins per side as compared with the distinct primary venation of *O. matsumuranus*, with 8–10, even up to 15 but rarely as few as 7, per side. In characters of the flower and fruit the two species are very similar.

The other species most closely related, with which it might be confused, is *O. minor* from N.W. Kwangtung and S. Kiangsi, but in that species the leaves are smaller and more acuminate, the inflorescence bracts more ovate and thinner, and the inflorescence itself shorter and more compact. In addition there are fewer primary veins in the leaf of *O. minor*, (5–)6–7(–8) per side, and the petioles are shorter and more slender.

The name *Olea longipetiolata* Merrill, presumably based on a preliminary misidentification, is attached to specimens of *S.K. Lau* 123 in many herbaria. It was never published and the error was apparently discovered, for Merrill & Metcalfe cited the number under its correct name, *Osmanthus matsumuranus*, in Lignan Sci. Journ. xvi, 397 (1937). However, Tanaka and Odashima in their "Census of Hainan Plants" (Journ. Soc. Trop. Agric., x, 378: 1938) quote the name, although without description, and Chia (Act. Phytotax. Sin. iii, 348 and 353: 1955) points out the mistake. It is mentioned here for the sake of completeness.

5. **Osmanthus marginatus** (Champ. ex Benth.) Hemsl. in Journ. Linn. Soc. xxvi, 88 (1889); Knoblauch in Bot. Centralbl. lxi, 83 (1895); Dunn & Tutcher in Kew Bull. Add. Ser. x, 166 (1912); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Tanaka & Odashima in Journ. Soc. Trop. Agric. x, 378 (1938).

Syn.: *Olea marginata* Champ. ex Benth. in Hook. Kew Journ. Bot. iv, 330 (1852); Walp. Ann. v, 483 (1858); Bentham, Fl. Hong Kong, 215 (1861).

Osmanthus bracteatus Matsumura in Bot. Mag. Tokyo, xii, 14 (1898); Matsumura, Index Pl. Jap. ii, (2), 496 (1912); Wilson in Journ. Arn. Arb. i, 183 et 186 (1919); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931); Hara, Enum. Sperm. Jap. i, 124 (1948); Sonohara, Tawada & Amano, ed. Walker, Fl. Okinawa, 124 (1952); Walker, Important Trees of the Ryukyu Is. 273 (1954).

O. matsudai Hayata, Ic. Pl. Formos. ix, 75, fig. 30 (1920); Sasaki, List of Plants of Formosa, 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Kanehira, Formosan Trees, ed. 2, 622 (1936); Mori in Journ. Jap. Bot. xv, 557 (1939).

Gonocaryum sinense Hand.-Mzt. in Sinensia, iii, 189 (1933).

O. sinensis (Hand.-Mzt.) Hand.-Mzt., Symb. Sin. vii, 1006 (1936).

Evergreen *shrub* or *tree* usually small but reaching 15 m. in height and a diameter, at breast height, of 30 cm.; bark grey or brownish grey; branches brownish or grey, glabrous. *Leaves* glabrous; *petiole* *(1–)1·5–3 cm.* long, base thickened; lamina thick to very thick and coriaceous, rarely only thickish, shining above, obovate or oblanceolate to elliptic or narrowly elliptic, *(4–)5–12(–15) cm. long* by (1·5)2–4(–6) cm. broad; *margin entire, incurved, giving the impression of being thickened, rarely quite flat*; apex occasionally acuminate or acute to typically abruptly and

shortly acuminate or even bluntly apiculate; base angustate to cuneate-angustate, decurrent into the petiole; venation above and below more or less obscure with the primary veins only visible, either as a raised or sunk line, or occasionally by a slightly lighter colouration, reticulation typically not visible but occasionally seen below as lighter coloured lines, *(5–)6–7(–8) primary veins per side*. *Inflorescence* axillary, more or less compact, paniculate, 1–2 cm. long, about 10–20-flowered, glabrous or minutely puberulous, thickened in fruit; bracts ciliate, glabrous, or puberulous on the back, more or less deciduous after flowering, basal ones 1 mm. long broadly ovate, acute, upper ones 2 mm. long narrow ovate to linear, acute, slightly carinate. *Flowers* diclinous, whitish yellow, whitish green or yellowish green, pedicels 1–2 mm. long. *Calyx* 1·5 mm. long, lobes 4 approximately 0·75 mm. long, ciliate. *Corolla* tube 2–2·5 mm. long; lobes 4, oblong 1·5 mm. long, ciliate round the apex. *Stamens* 2; filaments 1–1·5 mm. long, shorter in the bud, attached near the top of the corolla tube; anthers rounded without terminal appendage 0·75–1 mm. long, range of average dimensions of pollen measured 21·1–25·5μ with a range of extremes of 20–27μ; in the female flower the stamens small, abortive, on short filaments. *Ovary* 4·5 mm. long including slender style 3 mm. long, slightly bifid stigma, the ovary covered with peltate scales, in the male flower the ovary represented by a rounded stump 0·3–0·5 mm. in length. *Drupe*, green, ripening through bluish to black, ellipsoidal or on some specimens asymmetrically obovoid, 2–2·5 cm. long, 1–1·5 cm. broad, style more or less persistent; endocarp hard about 1 mm. thick with about 10 ribs, or on some specimens thin-walled and more or less smooth.

HONG KONG. Happy Valley, near the top of the waterfall, *J. G. Champion* 436 (holo. K); Happy Valley, Jan. 1869, *C. A. Feilberg* s.n. (A); without locality 1869, *W. Lobscheid* s.n. (BM).

KWANGTUNG. Sin-fung district: Sha Lo Shan, Wa Mei T'on village, thickets, abundant, Dec. 1937, *Y. W. Taam* 193 (A); Ah P'o Kai Shan, Ch'a-P'ing village, roadside thickets, abundant, May 1938, *Y. W. Taam* 674 (A); Hau T'ong Shan, Fuk Lung Monastery, thickets, fairly common, June 1938, *Y. W. Taam* 843 (A). Hunan-Kiangsi-Kwangtung border: Man Chi Shan, Shek Pik Ha village, Jen-Hwa district, growing in thickets near a ravine, fairly common, April 1936, *W. T. Tsang* 26261 (A).

HAINAN. Yaichow, in woods, 15 July 1933, *F. C. How* 71028, (A, E, K, NY, US), also, in shaded forested ravine along stream, 18 Aug. 1933, *H. Y. Liang* 62669 (A); Po-ting in forest 650 m., 17 July 1935, *F. C. How* 73210 (A, BM), also, in forest 1150 m., 23 Sept. 1935, *F. C. How* 73696 (A, BM); Bo-ting, in dense woods, 16 Oct. 1936, *S. K. Lau* 28010 (A), in forest, 15 Nov. 1936, *S. K. Lau* 28211 (A), and, in forest 16 Nov. 1936, *S. K. Lau* 28219 (A); Bak-Sa, in dense woods, 1 May 1936, *S. K. Lau* 26590 (A) and 26593 (A), and 5 May 1936, *S. K. Lau* 26656 (A); Chim Fung Ling, Sam Mo Watt village, Kan-en district, forest, steep dry clay slope, fairly common, 13 April 1934, *S. K. Lau* 3754 (A); without locality, in mixed forest, 4 Oct. 1933, *C. Wang* 34465 (A, E, NY) and 34482 (A, K, NY).

KWANGSI. Seh-feng Dar Shan, S. Nanning, shrub under forest in ravine, rare, 600 m.. 22 Oct. 1928, *R. C. Ching* 8119 (holo. of *O. sinensis* W, iso. NY), and in wood 900 m., rare, 29 Oct. 1928, *R. C. Ching* 8323 (A); Shap Man Taai Shan, near Hok Lung village, S.E. of Shang sze, Kwangtung border, thicket, dry, clay, silt rocky, fairly common, 4 June 1933, *W. T. Tsang* 22420 (A, BM), 30 Aug. 1934, *W. T. Tsang* 24146 (A, NY), 14 Sept. 1934, *W. T. Tsang* 24260 (A, NY), and 5 Nov. 1934, *W. Y. Tsang* 24621 (A, NY); Yao Shan, Tseungyuen, mixed forest on rocky hill, 19 June 1936, *C. Wang* 39446 (A), 13 Oct. 1936, *C. Wang* 40095 (A), 1700 m., 16 Oct. 1936, *C. Wang* 40224 (A), and 1200 m., 4 Dec. 1936, *C. Wang* 40534 (A).

SZECHUAN. Mt. Omei, Oct. 1940, *T. C. Lee* 4548 (E).

HUNAN. Yun Shan near Wukang, tall, leafy shady forest, 900–1200 m., 6 June and 1 Aug. 1918, *Handel-Mazzetti* 746 (A, E, W) and May 1919, Wang-Te Hui (*H.-M.* 12049) (A, BM, E, W, US).

N.W. KIANGSI. Hwang-kan-shan, I-feng, in woods and shady forest in valley, rare, 15 Oct. 1947, *Y. K. Hsuing* 6369 (A).

S. ANHWEI. Ma Chi, Siunin, shady stream bank, 300 m., rare, 14 Aug. 1925, *R. C. Ching* 3213 (A, E, K).

CHEKIANG. Suan Ke, south of Ping Yung, 125–185 m., tree in dense wood of evergreens, 11 July 1924, *R. C. Ching* 2064 (US).

FORMOSA (TAIWAN). S. Cape, *A. Henry* 941 (A, K) and 1252 (A, K); Buizan, 3 Jan. 1919, *E. Matuda* s.n. (holo. of *O. matsudai* TI, iso. TAI); Taihokusyu, Suogun, Dainan'ô Gôn Rukiyohu, 600 m., Hosobasirakasi Gunsô, 6 June 1937, *T. Suzuki* 17762 (TAI); Taitôtyô, Sinkôgun, Kusuhara, Suibotei, 600 m., Hudibaside Gunsô, 7 Dec. 1939, *T. Suzuki* 19730 (TAI).

RYUKYU Is. Okinawa: April 1887, *Tashiro* s.n. (syntype of *O. bracteatus* TI); Syuri, Aug. 1930, *S. Aoki* s.n. (TAI); Kanagusu, 0–250 m., woods, 11 March 1917, *E. H. Wilson* 8060 (A, BM, K); Kunigamigun, 5–6 Jan. 1934, *R. Kanehira* 3313 (FU, NY); Kitadaitoto, *M. Yanagihada* 403 (TAI), 470 (TAI), and 496B (TAI). Iriomote: 60 m., low jungle, 21 Aug. 1934, *J. Lindley Gressitt*, 564 (NY).

O. marginatus as treated here, exhibits considerable variation over its full geographical range. Its floral morphology is remarkably constant, as is the case throughout the whole section (except species "A"), but in leaf shape, texture etc. all degrees of variation between several extremes are found. These extremes taken alone appear distinct, and it is upon some of them that the various synonyms have been based. However, after having examined a large amount of material it has become apparent that no certain line can be drawn to separate any particular taxon, either on morphological or geographical grounds. Any further study of the species, to be profitable, will entail extensive field studies coupled perhaps with experimental techniques. However, given such studies, and using them as a basis, it might then prove possible to recognize infra-specific groups.

The material from the Ryukyu Islands, possesses in most cases a leaf which is thinner and more elliptic than the type from Hong Kong, and it might have been possible to recognize a separate entity, based on the type material of *O. bracteatus*, had it not been for the fact that not only is the same elliptic leaf found on Hainan material but some Ryukyu material (*Kanehira* 3313) possesses a smaller thicker leaf showing a transition to the type of *O. marginatus*.

A number of specimens from Hainan possess small thickish leaves and match very closely the type of *O. matsudai* (*E. Matuda* s.n.) from Formosa, but any grouping based on leaf size proves artificial, for not only do some specimens (*How* 73201) show a few larger leaves as well, indicating that the leaf size is probably affected by growth conditions, but the type material from Hong Kong is itself very variable in this respect: leaves which are 5 or 6 cm. and 10 or 11 cm. long being found on two separate shoots. The *Matuda* material also exhibits a compact inflorescence, but this can also be matched by other specimens, for example *Lau* 26590 and 26593.

The material from Kwangsi is at first sight homogenous and several specimens can be matched exactly with the type of *O. sinensis*. The leaves, whilst very thick, are less marginate and the venation instead of being raised on the surface, is sunk. However, when comparison is made with material from other areas no constant separation can be made.

The northernmost specimens studied also represent another extreme in texture and venation (*Handel-Mazzetti* 746 and 12049, *Lee* 4548, *Ching* 3213 and *Hsuing* 6369) and in fact it appears that Handel-Mazzetti at one time considered basing a new species on his no. 12049 although the name and description were never published.

The fruit shows considerable variation. It is very difficult to be certain whether the fruit on individual specimens is fully mature or not, and it would seem that on most of the fruiting specimens it is immature, as for instance on the type material. However, two extremes of apparently ripe fruit have been seen, one ellipsoidal, with a thick slightly ribbed endocarp (e.g. *Ching* 8119) and the other (e.g. *Wang* 40224) asymmetrically obovoid with a much thinner and smooth wall.

Because of the variability of the species it is not always easy to distinguish it from specimens of *O. matsumuranus* and *O. minor*, the most nearly related species. However, the latter two species are less variable and can be distinguished on a combination of characters. Characteristically *O. marginatus* has thick coriaceous leaves but, as has been noted, occasional specimens, especially from the southern areas of its range, show leaves which are thinner. Usually, however, the leaves are then too small and with too few primary veins for *O. matsumuranus* and they generally possess too long and stout a petiole for *O. minor*, in which, in addition, the leaves also possess a more prominent venation with a distinctly acuminate apex and the inflorescence is constantly compact and short.

Most of the geographical range of the species is indicated by the citation of the material examined but it should be added that the species is recorded in the Ryukyus as far as the northernmost island, Kawanabe, between the Ryukyus proper and Yakusima (Ushiwo in Wilson in Journ. Arn. Arb. i, 186: 1919). On Okinawa, according to Sonohara, Tawada and Amano in their Flora of Okinawa ed. Walker, the species is "common on mountains".

Finally, various published misidentifications should be mentioned. One or two specimens have been recorded as *O. cooperi* Hemsl. (Sect. *Osmanthus*): Rehder in Journ. Arn. Arb. viii, 191 (1927) and Merrill & Metcalfe in Lignan Sci. Journ. xvi, 396 (1937), the latter being quoted by Tanaka & Odashima in their "Census of Hainan Plants" (Journ. Soc. Trop. Agric. x, 379: 1938). At a much earlier date Henry named his Formosan material as *Linociera* sp. (Trans. Asiatic Soc. Jap. xxiv, suppl. 59: 1898) and in addition, although the misidentifications have never been published, a high proportion of the material examined had previously been named *O. fragrans* Lour.

6. **Osmanthus scortechinii** King & Gamble in Journ. As. Soc. Beng. lxxiv, pt. ii, 265 (1906): Ridley, Fl. Malay Penins. ii, 315 (1923); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930).

Syn.: *O. scortechinii* var. *oblonga* King & Gamble, l.c.; Ridley, l.c.

Tree 12–18 m. high, stem diameter 25–28 cm. (King's Collector) young branches minutely puberulous or glabrous. *Leaves* mid-green in colour (King's Collector); *petioles 1–1·5(–2) cm. long*, minutely puberulent above

when young, base slightly thickened; lamina thick and more or less coriaceous, minutely puberulous when young along the upper midrib, especially towards the base, elliptic to oblanceolate, 6–10 cm. long by 2·0–3·5(–4) cm. broad; *margin entire more or less thickened*; apex acuminate or occasionally subacuminate tip more or less blunt; base angustate, decurrent into the petiole; venation with primary veins only visible, impressed above, raised and often obscure below, (5–)6–7 per side. *Inflorescence* axillary, paniculate, 1–1·5(–2) cm. long in fruit and thickened, about 6-flowered, minutely puberulous, sometimes sparsely so, basal bracts connate, thick, triangular, ciliate, upper bracts not seen, deciduous. *Flowers* ? hermaphrodite (*Scortechini* 414) pedicels 1–2 mm. long. *Calyx* minutely puberulous to glabrate, 1·5 mm. long; lobes 4, about 0·75 mm. long irregularly erose. *Corolla* tube 1·5 mm. long (in bud), lobes 4, about 1 mm. long (in bud). *Stamens 4*, filaments 0·5 mm. long (in bud), attached near the top of the corolla tube; anthers rounded without terminal appendage, 0·5 mm. long, pollen examined slightly unformed but about 21–24μ in diameter. *Ovary* 2 mm. long, covered in peltate scales, style 1 mm. long or perhaps more, stigma not seen. *Fruit* "light green" (King's Collector) possibly immature, ellipsoidal, often almost spherical, (7–)8–10(–13) mm. long by 6–7 mm. broad (? immature), style base more or less persistent; *endocarp thin crustaceous.*

MALAY PENINSULA. Perak: Taipeng, *Scortechini* 414 (lecto. K, isolecto. SING); Larut, 1200–1300 m., dense jungle, top of mountains, Dec. 1882, *King's Collector* (*Kunstler*) 3663 (holo. var. *oblonga* CAL, iso. P); Top of Gunong Ejou, 1350 to 1400 m., Dec. 1884, *King's Collector* (*Kunstler*) 6978 (BM, E, FI, K). Selangor: Gunong Mengkuang, 1500 m., 20 Jan. 1913, *H. C. Robinson* s.n. (K).

This species, whilst reminiscent of some of the forms within *O. marginatus*, exhibits two characters unusual in *Osmanthus*, the possession of four stamens and a thin crustaceous endocarp in the fruit. In addition it would appear that the flowers are not diclinous and in this respect resemble the next species, *O. sumatranus*. However, only one flowering specimen was examined, and that in the bud, yet it possessed both a well-developed ovary and what appeared to be developing stamens. Pollen was obtained by teasing an anther in lactophenol and although it did not expand in the lactophenol it is probable that this was because the flower was immature.

The possession of four stamens, each alternating with the petals, is an unusual character shared by this species and *O. sumatranus*, but it is not unique in the family. In *O. sandwicensis* also there are four stamens and the same condition is found in occasional species of *Linociera*, *Notelaea* and *Forestiera*. In addition it will be recalled that species "A", which generally exhibits the even more unusual number of three stamens also possesses four on occasion.

The thin endocarp is almost exceptional in *Osmanthus*, although in some forms of *O. marginatus* and *O. americanus* it appears fairly thin; there is always the possibility, however, that the material examined was not fully mature.

King & Gamble in describing *O. scortechinii* did not specify a type but cited four specimens: *Scortechini* 414, *Wray* 682, and *King's Collector* 5029 and 6978. A specimen of all these, excepting 5029, has been examined,

and the obvious choice for a lectotype would appear to be *Scortechini* 414 not only because it is the only cited specimen in flower, amongst those examined (the other two being in fruit), but also because it is the only one collected by Father Scortechini, after whom the species was named. At the time of the description King & Gamble were apparently working at the Royal Botanic Gardens, Kew and so the actual specimen most fitted for selection as lectotype is the one in the Kew Herbarium.

The leaves of most of the material examined are thick and coriaceous but Wray's specimen (no. 682) from Thaipeng, has leaves of a thinner texture. Ridley, whose field experience in Malaya was very considerable, says of this specimen: "Wray's plant has much broader leaves with nerves prominent beneath, probably a lowland form. In the high mountain forms the leaves are narrower and smooth beneath, the nerves often quite invisible." There are no flowers on Wray's specimen and it is possibly a separate undescribed taxon, but the material is too inadequate for certainty in this matter.

A var. *oblonga* King & Gamble was described along with the species and distinguished by the following characters "a bright red drupe reaching ·5 inches in length, slightly ribbed and with a spathulate embryo having the radicle nearly as long as the cotyledon, each ·1 inch". However, in the description of the species itself, no characters of the embryo which contrast with these are given, and the only clear distinctions would seem to depend on the colour and size of the drupe. In the genus as a whole the colour of ripe fruit is black or dark purple and it is suspected that the bright red colour given for the fruit of var. *oblonga* and the dark greenish blue given for the species itself both indicate that the fruit was immature. As to the size and shape of the drupe, admittedly the three fruits still remaining on the holotype at Calcutta are distinctly ellipsoidal, 11–13 mm. long by 6–7 mm. broad (the isotype at Paris has lost all its fruits), but the difference from the other material of the species, where the fruit dimensions are (7–)8–10 mm. long by 6–7 mm. broad, is small. In shape they are more nearly globose but with the only quantitative characters such small differences in size and shape, the separation of a distinct variety hardly seems justified.

Finally, it might be noted that after the original description King & Gamble add a note that "the structure of the wood, so far as the examination of a very small branch goes, confirms the placing of this plant in the genus *Osmanthus*."

7. **Osmanthus sumatranus** P. S. Green, **sp. nov.** (Plate 14).

Frutex. *Folia* glabra, petiolis 5–8 mm. longis; laminae ellipticae (3–)5–7·5 cm. longae, (1·5–)2–3 cm. latae, apicibus acutis vel subacuminatis, basibus angustatis, venis plus minusve obscuris, venis primariis tantum manifestis utrinsecus 4–6. *Inflorescentiae* axillares, panticulatae, glabrae, 1 cm. longae, bracteis inferioribus 2–2·5 mm. longis. *Flores* hermaphroditi, pedicellis 1·5-2 mm. longis. *Calyx* 2·5–3 mm. longus, lobis 4, longitudine et ambitu variis 1–2·2 mm. longis minute fimbriatis. *Corolla* tubo 2·5 mm. longo, lobis 4 late rotundatis c. 1 mm. longis. *Stamina* 4, filamentis c. 0·5 mm. longis, antheris 0·8 mm. longis, appendice terminali absente. *Ovarium* 2 mm. longum vel paulo majus, stylo 1 mm. longo. *Fructus* ignotus.

Evergreen *shrub*, branches glabrous. *Leaves* glabrous or very minutely puberulous on the midrib above when young; *petiole 5–8* mm. *long*, base slightly thickened, glabrous; *lamina* thickish, elliptic, *(3–)5–7·5 cm. long* by (1·5–)2–3 cm. broad; margin slightly thickened, entire; *apex acute or subacuminate*; base angustate, decurrent into the petiole; venation more or less obscure, especially above, *primary veins only visible*, 4–6 *per side*. *Inflorescence* axillary, paniculate, 1 *cm. long*, about 5–6 flowered, glabrous; bracts ciliolate, glabrous, *basal bracts 2–2·5 mm. long*, slightly keeled, broadly ovate, acute. *Flowers hermaphrodite*, greenish white; pedicels 1·5–2 mm. long. *Calyx 2·5–3 mm. long*, *lobes 4*, *1–2·2 mm. long*, oblong to ovate, *irregular in shape and length*, minutely fimbriate, sometimes slightly keeled. *Corolla* glabrous, *tube* 2·5 *mm. long*, *lobes* 4, *broadly rounded*, *slightly more than 1 mm. long*. *Stamens 4*, *filaments c. 0·5 mm. long*, attached near the top of the corolla tube; anthers rounded, without terminal appendage, 0·8 mm. long; average dimension of pollen measured 23μ with extremes of 22–24μ. *Ovary* not covered with scales, 2 mm. long or slightly more, including style about 1 mm. long, with a small capitate stigma. *Fruit* unknown.

SUMATRA. Northern slope of Mt. Sago, Pajakumbuh, alt. 2000 m., summit region, mossy forest, 29 June 1955, *W. Meijer* 3621 (holo. SING).

This interesting species, only recently collected, at first glance appears vegetatively very like some forms of *O. marginatus* sens. lat., but a close inspection shows numerous fundamental differences.

In a section where flower type is particularly constant, it is remarkable that the noteworthy characteristics of this species lie in the flower and show a close and distinct relationship with the other Malaysian species, *O. scortechinii*. The flowers are hermaphrodite and possess four stamens. *O. sumatranus* and *O. scortechinii* are the only species in Sect. *Leiolea* possessing these characters although hermaphrodite flowers have been reported in *O. americanus* and as has been pointed out above, under the last species, plants with four stamens are known in several related genera.

Despite the possession of these two unique features *O. sumatranus* and *O. scortechinii* are distinguishable one from the other in several characters of the flowers as well as in overall appearance. The proportions of corolla tube to lobes and the shape of the calyx are different. In *O. scortechinii* the calyx is typical of the section but in *O. sumatranus* it is very variable, at least in the one specimen seen, with the lobes broad or narrow on the same flower and variable as to the depth of division.

The discovery of this species, which, to judge from the label was thought at first to be a *Symplocos*, has considerably extended the range of the genus. The main concentration of species still remains in southern China, and, whilst there is no direct affinity between the flora of the Sumatran mountains and that of China, it is interesting to note that Ridley when writing up the botanical results of an expedition to Korinchi Peak in Sumatra (Journ. Fed. Malay States Mus. viii, 10: 1917) has drawn attention to the "curious distribution of *Goodyera schlechtendaliana* and *Potamogeton oxyphyllus* var. *Fauriei*, plants otherwise known only from Japan and China".

8. *Species* "A"

Trees? *Leaves* glabrous; *petioles 1–2 cm. long*, lamina thickish, oblanceolate (6–)8–14(–16) cm. long by (2·5–)3–4(–4·8) cm. broad; margin entire slightly thickened; apex acuminate, tip acute; base angustate-cuneate, decurrent into the petiole; venation just visible above, impressed, primary veins clearly visible below, raised, (7–)8–10 per side. *Inflorescence* axillary, *corymbose*, *1 cm. long*, about 7-flowered, puberulous, *bracts large*, *basal 2 mm. long*, *upper ovate*, *4–5 mm. long*, enclosing the base of the flowers, acute, carinate, pubescent on the outside especially on the keel. *Flowers* diclinous, pedicels 1 mm. long. *Calyx* campanulate, 1·5 mm, long, *5–8 teeth* about 0·5 mm. long, ciliate. *Corolla* tube 2–2·5 mm. long lobes 4, 2 mm. long. *Stamens 3* (rarely 4, in one flower out of five examined) male flowers not seen, anthers empty in the female flowers, two opposite each other between corolla lobes and one odd one opposite but not quite in the centre of a lobe; filament 0·75 mm. long, broader on the odd stamen, attached near the top of the corolla tube, anthers almost 0.5 mm. long, broad with a subtriangular connective and a very small rounded terminal appendage. *Ovary* bilocular 3 mm. long, style 1·5 mm. long with a bifid *stigma with lobes 0·75 mm. long* (in one flower examined, trilocular with a trifid stigma). *Fruit* unknown.

YUNNAN. Without locality on the specimen seen, 1933, *H. T. Tsai* 55978.

With the very limited material available it has been deemed prudent not to name this species, but its characters are so distinct and it shows so many unusual features for the genus that a description is called for.

The leaves bear a close resemblance to those of *O. matsumuranus* but the flower and inflorescence exhibit several aberrant features. The inflorescence is branched and therefore somewhat similar to the remainder of Sect. *Leiolea* but in this species it is corymbose rather than paniculate. The calyx too is unusual in that it possesses from 5–8 teeth instead of being regularly 4-lobed or toothed as in the remainder of the genus, and especially Sect. *Leiolea*, where the other species (except *O. sumatranus*) exhibit great regularity in this feature.

However, the greatest anomalies are found in the androecium, which almost invariably exhibits the odd number of three stamens. Two of them are arranged normally, symmetrically opposite each other and alternate with corolla lobes, but the third is asymmetrically placed just off centre on one of the lobes. This odd stamen also possesses a broader filament than the other two and a broader connective in consequence, although in the specimen examined the pollen sacs, which are sterile, appear to be the same size as on the other two stamens. It is a pity that there are no male flowers for examination when the androecium shows such unusual features. Within the genus three species possess four stamens, *O. scortechinii*, *O. sumatranus* and *O. sandwicensis*, and this number, atypical for the *Oleaceae* as a whole, is found occasionally in *Linociera*, *Notelaea* and *Forestiera* as well. No other species known exhibits the odd number of 3 stamens although Handel-Mazzetti found three stamens in a flower of *Olea yuennanensis* (Symb. Sin. vii, 2, 1009: 1936). Of the five flowers examined one was found to possess four stamens and it is possible

that additional material of this species will show four to be the normal number and this specimen exceptional; but in this connection it is interesting to note that one of the flowers with three stamens also possessed a trilocular ovary with a trilobed stigma, thus adding to this unusual trimerous condition. In addition, the relatively long stigmatic lobes are themselves unusual for the genus and its near allies.

The stamens themselves are not typical of the section, for although the only ones seen are from a female flower and are sterile and incompletely developed, they possess a very small rounded appendage at the top of the anther, where none is apparent even in the abortive stamens of female flowers of the other species. An appendage, often well developed, is characteristic of Sects. *Osmanthus* and *Siphosmanthus* and of related genera, but is absent in all the other species of this section so far known. However, in general shape and size the sterile stamens resemble those of the female flower in the other species of Sect. *Leiolea*, whereas the flowers in Sect. *Osmanthus* with a functional ovary possess fertile anthers; in fact Sect. *Osmanthus* is androdioecious.

The diclinous flowers with their general shape and size together with the possession of a branched inflorescence show distinct affinities with *O. matsumuranus*, despite the other aberrant features. It resembles this species very closely in the leaf, and at least for the present, it is best placed in the same section, although standing somewhat isolated from the other species.

In the herbarium of the Arnold Arboretum there is a sterile specimen (*H. T. Tsai* 62686, Yunnan, Ping-pien Hsien, 1500 m., in ravine, 16 July 1934) which resembles this species very closely indeed and may be a second specimen, but it might just possibly be *O. matsumuranus* for two of the leaves possess 2 or 3 obscure teeth in the upper half. However, the specimen recalls species "A" so closely that mention should be made of it here. It is particularly unfortunate that the type specimen should be completely lacking in field notes, especially locality, for it may possibly prove that the two specimens come from the same area.

Osmanthus Sect. **Osmanthus.**

Syn.: *Osmanthus* Sect. *Euosmanthus* Nakai in Bot. Mag. Tokyo, xliv, 14 (1930).

Evergreen *shrubs* or *small trees* up to 12(–18) m. high, young stems glabrous or puberulous. *Leaves* glabrous, midrib and petiole sometimes more or less puberulous; lamina thickish to very thick coriaceous, margin entire or with sharp spinescent teeth, 3–18(–35) per side and 0·5–10 mm. long, thickened or slightly thickened; apex ranging from blunt to long attentuately acuminate, the tip sometimes spinescent; venation obscure or distinctly reticulate. *Inflorescence* axillary, fasciculate, from 1–2(–3) buds, pedicels usually glabrous rarely puberulous. *Flowers* androdioecious. *Calyx* 0·5–1·5 mm. long with 4 ovate-triangular teeth, often erose or irregular in size, glabrous. *Corolla* tube 1·5-2·5 mm. long (in *O. urceolatus* 7 mm. long and urceolate), lobes 4, rounded oblong, (1–)1·3–4(–5) mm. long. *Stamens* 2, attached at the top or within the corolla tube, subsessile or filaments up to 3 mm. long; anthers 1–3 mm. long, usually with a

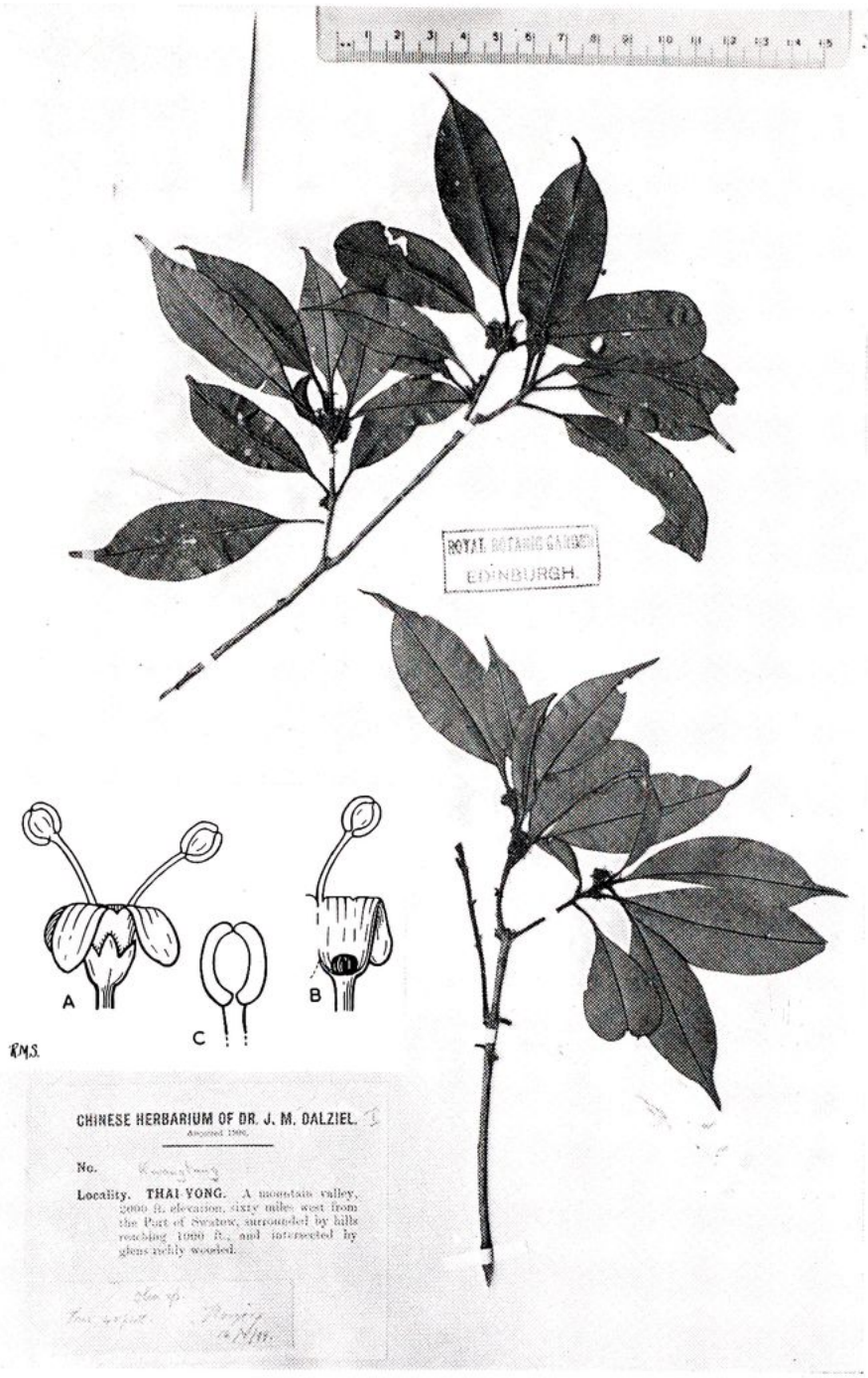

PLATE 13. *Osmanthus minor* P. S. Green.

Insert: A, flower (×5); B, flower halved and opened to show insertion of filament and abortive ovary (×5); C, anther (×10).

PLATE 14. *Osmanthus sumatranus* P. S. Green.

Insert: A, flower (×3); B, corolla opened and laid flat (×3); C, calyx and ovary (×5); D, anthers, dorsal and ventral aspects (×7·5).

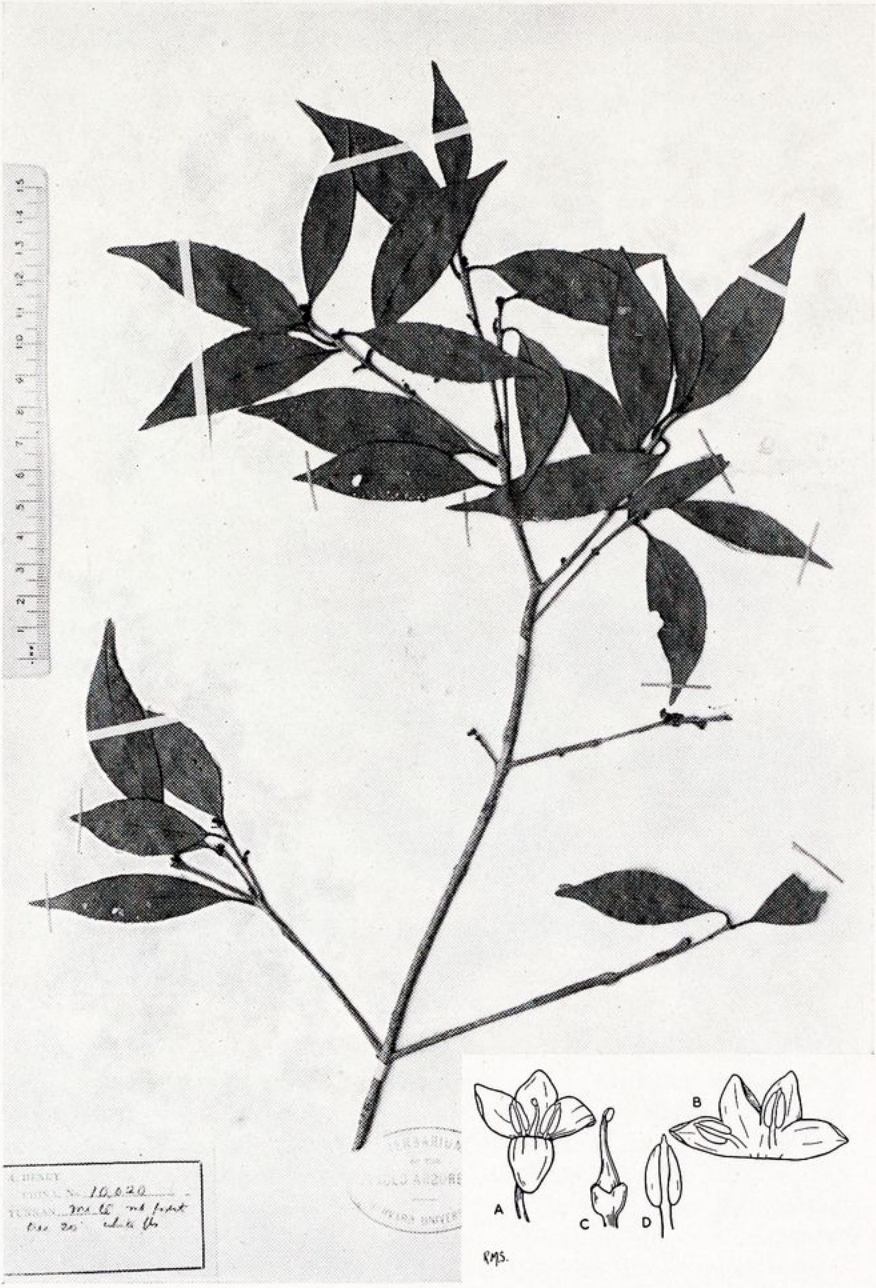

PLATE 15. *Osmanthus henryi* P. S. Green

Insert: A, flower (×3); B, corolla opened and laid flat (×3); C, calyx and ovary (×5); D, anther (×5).

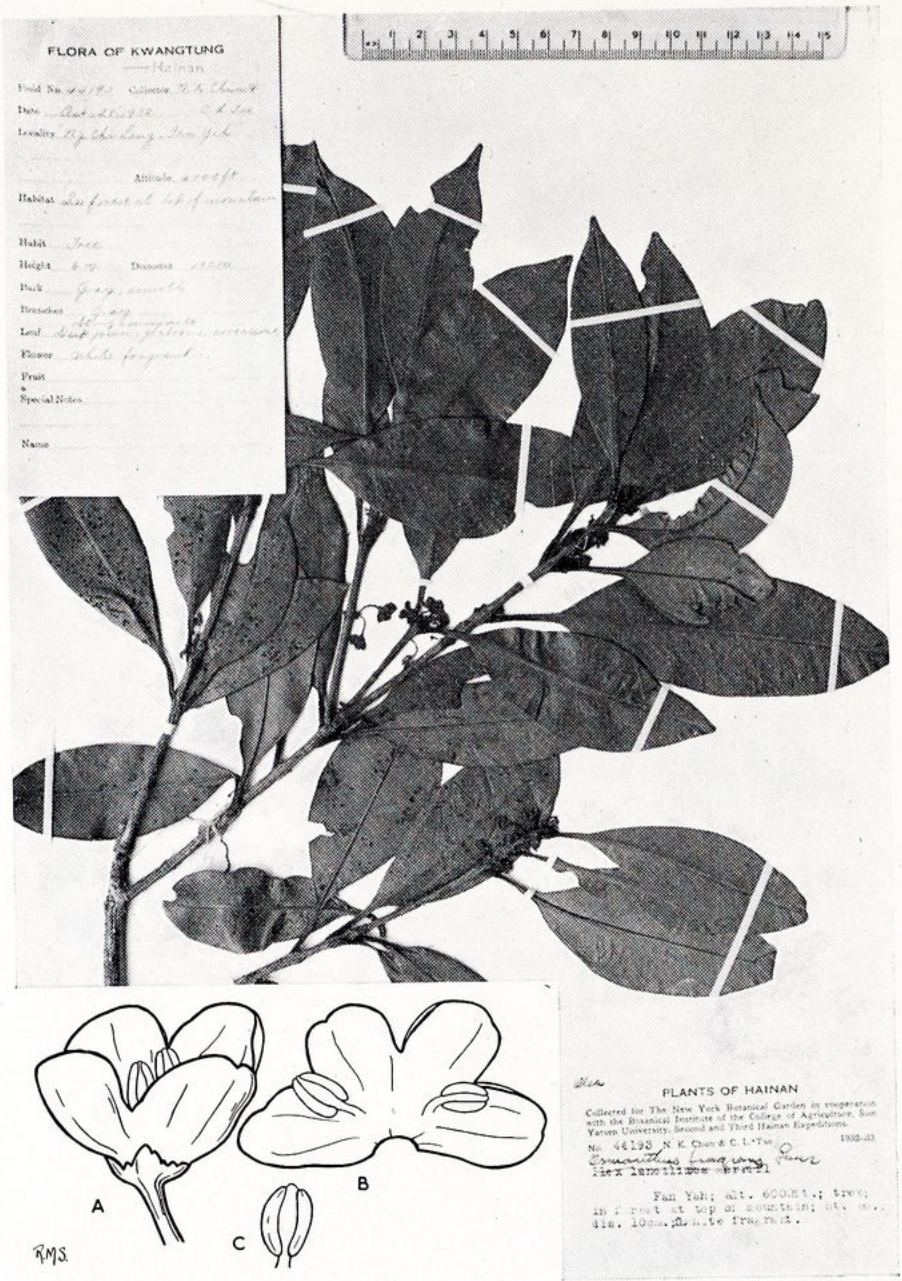

PLATE 16. *Osmanthus hainanensis* P. S. Green
Insert: A, flower (×4); B, corolla opened and laid flat (×4); C, anther (×5).

terminal appendage, sometimes distinctly so. *Ovary* including style, 1·5–3·5 mm. long, style 0·5–2 mm. long with a capitate or bilobed stigma, in the male flowers abortive and more or less conical 1–3 mm. long. *Drupe* regularly or obliquely ellipsoidal, 1–1·8 cm. long, 0·6–1 cm. broad; endocarp hard, thin or up to almost 1 mm. thick, often slightly ridged.

Type species: *Osmanthus fragrans* Lour.

In geographical distribution this section is confined to Eastern Asia (Fig. 3) and stretches from North India to the Bonin Islands although restricted to the more temperate areas, in contrast to Sect. *Leiolea* which also spreads into the hotter tropical and subtropical regions. *Osmanthus fragrans* is the most wide ranging of the species but because it has been grown for so long as a cultivated plant its present distribution is probably not its natural one. In contrast are those species at present known only from a single locality and gathering, e.g. *O. cooperi*, *O. urceolatus* etc.

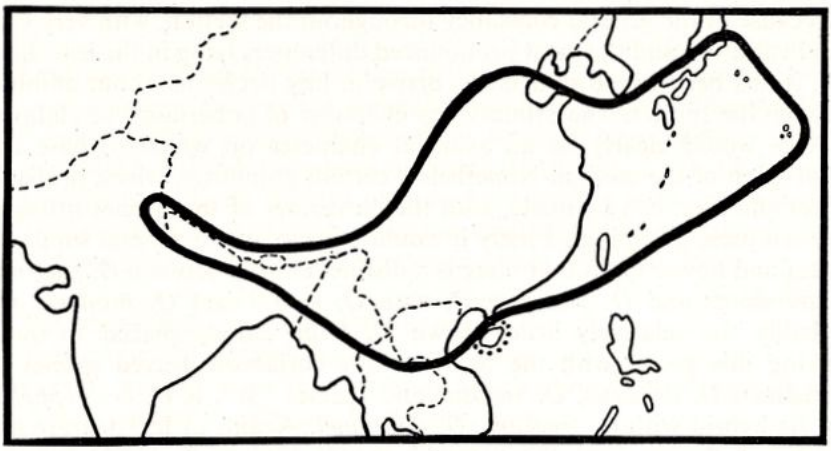

FIG. 3. Map of the distribution of Sect. *Osmanthus* (———) and Sect. *Linocieroides* (---------).

Throughout the section, with the exception of *O. urceolatus*, the floral structure remains fairly constant, although not as constant as in Sect. *Leiolea*. The main variations lie in the differing proportions of corolla lobes and in the size and insertion of the stamens. In *O. urceolatus* corolla-shape reaches its extreme expression and is urceolate; the tube is 5–7 times as long as the lobes, which take the form of relatively small triangular teeth, 1 mm. long. In fact were this species unique in any other features as well, it would almost certainly warrant a separate section of its own.

The style shape is fairly constant throughout the section and is generally more or less like that shown in Figs. 4A and B, although in *O. fragrans* it is characteristically short with slightly larger stigmatic lobes as in Fig. 4C. In the male flowers the whole ovary is abortive and, as in Sect. *Siphosmanthus*, takes the form of a conical structure generally about 1–2 mm. long. This abortive ovary contrasts considerably with that in Sect. *Leiolea* even though it appears to possess no particular structure except, in many cases, a slight development of two overlapping flap-like walls towards the apex.

Vegetatively the section is characterized by the possession of more or less thick or coriaceous leaves which are often sharply serrate. The leaves may be thickly coriaceous, as in *O. armatus*, *O. venosus* and *O. reticulatus* or considerably thinner, although still thicker than many in Sect. *Leiolea*. Similarly, in contrast to that section, the leaves on immature branches are characteristically sharply serrate with spiny teeth which may be quite small and numerous, as in *O. fragrans* where they are up to 1 mm. in length and up to 25 per side in number, or larger and fewer as in *O. heterophyllus* where they are usually 5–8 mm. long and 3 or 4 per side. Generally speaking these serrations seem most evident on young plants and tend to disappear on those which are more mature, but the distinction between serrate and entire leaves does not seem to be simply and entirely a matter of maturity for flowering specimens of many species have been seen with both types of leaves; a phenomenon which has several times caused confusion in the past as for example in the description of *O. rehderianus*, the serrate expression of *O. yunnanensis*.

Because of the general constancy throughout the section, with very little floral variation and the most pronounced differences lying in the leaf shape etc., it has been found difficult to arrive at any decisions about affinities between the species. The primary key character of puberulous or glabrous petioles would clearly be an artificial character on which to base any subdivision of the section. Nonetheless certain groupings, which probably reflect affinities, can be made, with the remainder of the species fitting in between these groupings. Firstly it would appear from a general similarity of leaf and flower types that there is a distinct affinity between *O. fragrans*, *O. serrulatus* and *O. yunnanensis*, with *O. henryi* and *O. insularis* and probably the relatively little known *O. fordii* closely placed to these. Linking this group with the thicker more coriaceous-leaved species *O. reticulatus*, *O. armatus*, *O. venosus* and species "B", is *O. heterophyllus* and its hybrid with *O. fragrans*, *O.* × *fortunei*. Again, in leaf texture and shape and flower type, there would appear to be an affinity between *O. attenuatus*, *O. lanceolatus* and *O. cooperi*, as well as between *O. cooperi* and species "D", whilst species "E" and *O. enervius* stand somewhat on their own, as does *O. urceolatus*.

Key to the species of Section Osmanthus
(mainly based on vegetative characters)

1. Petiole more or less puberulous, at least when young, perhaps minutely so 2
   Petiole glabrous, even when young 17
2. Axillary bud scales glabrous 3
   Axillary bud scales more or less puberulous . . . 7
3. Lamina twice as long as broad or less, usually serrate with serrations usually 2–3 mm. long and up to 10–12 per side, apex strongly spinescent. Only known in cultivation . . 16. *O.* × *fortunei*
   Lamina more than twice as long as broad, entire or serrate with serrations up to 2 mm. in length and up to 20–30 per side, apex acute, very acute or finely spinescent 4

4. Leaf blade usually between two and three and a half times as long as broad, if serrate then serrations 1 mm. or less in length and up to 20–30 per side; apex acute or finely spinescent 5
   Leaf blade four times as long as broad, usually more, rarely less and then juvenile with a serrate margin and serrations 1–2 mm. long and up to 20 per side; apex long attenuately acuminate, very acute or finely spinescent . . . . . 23. *O. lanceolatus*
5. Primary veins of leaves 10 or less per side (rarely in some specimens of *O. fragrans* up to 12 but then in only one or two of the leaves), raised or impressed; serrations when present up to 1 mm. long but usually less and generally less than 20 per side; outline of leaf broadly lanceolate, lanceolate, elliptic or even ovate, only rarely oblanceolate 6
   Primary veins of leaves usually 10–12 per side, raised above, never impressed; serrations when present usually 1 mm. or more long and generally more than 20 per side; outline of leaf oblanceolate or narrow ovate, occasionally narrow elliptic or elliptic 10. *O. serrulatus*
6. Leaf usually broadly lanceolate or lanceolate, less commonly ovate or oblanceolate, surface generally minutely bullate under the lens, primary veins usually impressed above, only rarely slightly raised; style when developed about 0·25 mm. long . 9. *O. fragrans*
   Leaf elliptic, rarely slightly oblanceolate, surface with small distinct raised dots under the lens but not minutely bullate, primary veins raised above; style when developed about 0·75 mm. long 12. *O. henryi*
7. Texture of leaf very thick coriaceous 8
   Texture of leaf thickish but not coriaceous 14
8. Lamina usually more than twice as long as broad, rarely not so, and then the leaf usually less than 6 cm. long 9
   Lamina usually twice as long as broad or less. Only known in cultivation . . . . . 16. *O.×fortunei*
9. Petioles usually 12 mm. or more long (if less, then only on the smallest leaves of the specimen) 10
   Petioles usually 11 mm. or less (if more, then only on the largest leaves of the specimen) 13
10. Reticulations on leaf clearly present and *raised* above and below, primary veins 8–12 per side . . . . 20. *O. venosus*
    Reticulations on leaf obscure or, rarely, clear in places and then *not raised* below, primary veins 5–7 per side 11
11. Lamina usually between 2 and 3 times as long as broad, only the narrowest leaves over 3 times, whole petiole and base or midrib of lamina puberulous; pedicels glabrous 12
    Lamina usually between 3 and 4 times as long as broad, only the broadest leaves under 3 times, back of petiole puberulous; pedicels puberulous, leaf surface glossy above . . 22. *Species "C"*
12. Breadth of lamina generally more than 2·5 cm., if less, then only the narrowest leaves, margin of leaves entire or with up to 16 small sharp serrations per side, 0·5–1 mm. long; corolla urceolate, tube 5–7 mm. long and lobes 1 mm. long. Hupeh 29. *O. urceolatus*

Breadth of lamina generally less than 2·5 cm. (not counting teeth), if more then only the broadest leaves, margin entire or with up to 5 large armed teeth per side, (3–)5–8(–10) mm. long; corolla not urceolate, tube 1–1·5 mm. long and lobes 2·5–3·5 mm. long. Japan and Formosa . . . . . 17. *O. heterophyllus*

13. Length of lamina more than 8 cm. (rarely less and then only the smallest leaves of the specimen), margin armed with 6–14 spinescent teeth, venation clear and reticulate below, 7–10 primary veins per side . . . . . 19. *O. armatus*

Length of lamina 7 cm. or less, margin when not entire armed with 3–5 spines, venation below clear or obscure, (4–6)6(–7) primary veins per side . . . 17. *O. heterophyllus* and variety

14. Lamina less than four times as long as broad, rarely almost so, breadth of leaves 2 cm. or more, if less then only the narrowest leaves 15

Lamina at least four times as long as broad, breadth usually 2 cm. or less, rarely slightly more and then only the broadest leaves 24. *O. attenuatus*

15. Petioles more than 9 mm. long (if less then only on the smallest leaves of the specimen), primary veins barely visible above . . 16

Petioles usually less than 8 mm. long (if more then only on the largest leaves of the specimen), primary veins more or less clear above 12. *O. henryi*

16. Primary veins on leaf less than 7, usually 5–6 per side, base of leaf angustate, occasionally subcuneate. Hupeh 29. *O. urceolatus*

Primary veins on leaf 7–9 per side, base of leaf cuneate. Formosa 27. *Species "E"*

17. Venation of leaves more or less reticulate, either above or below, and usually raised 18

Venation of leaves obscure, reticulations not, or only just, discernible 30

18. Lamina less than 6 cm. long 19

Lamina usually 7 cm. long or more 21

19. Apex of leaf blunt or acute, rarely slightly subacuminate, tip, when not damaged, acute but not conspicuously or sharply so, anthers about 1 mm. long, as long as broad, subsessile . 14. *O. fordii*

Apex of leaf acuminate or elongate acuminate, rarely subacuminate, tip conspicuously or sharply acute, anthers about 1·5 mm. long, 1.5–2 times as long as broad, filament 0·5–1 mm. long . 20

20. Base of midrib above minutely puberulous. Yunnan 12. *O. henryi*

Base of midrib above glabrous. Japan, Bonin and the Ryukyu Islands 13. *O. insularis*

21. Venation of leaves with 10–12 or more primary veins per side, margin when completely serrate with usually 25 or more sharp teeth, 1–3 mm. long, per side. China 22

Venation of leaves with 10 or less primary veins per side (rarely in *O. fragrans* and *O. reticulatus* up to 12 and then only in one or two leaves), margin when serrate with usually less (often far less) than 25 teeth up to 1 mm. long 23

22. Leaves usually lanceolate, occasionally narrow lanceolate to ovate or rarely elliptic, serrations when present 2–3 mm. long, usually light coloured on drying. Yunnan and Szechuan 10. *O. yunnanensis*
Leaves oblanceolate or narrow obovate, rarely narrowly elliptic or elliptic, serrations when present 1 mm. long, dull colouration on drying. Szechuan and Hupeh . . . 11. *O. serrulatus*

23. Lamina twice as long as broad or less, margin usually serrate with serrations usually 2–3 mm. long. Only known in cultivation 16. *O.* × *fortunei*
Lamina more than twice as long as broad, margin entire or serrate with small serrations about 1–2 mm. long . . . 24

24. Leaf blade generally between two and four times as long as broad, margin entire or serrate with small serrations about 1 mm. long 25
Leaf blade four times as long as broad, usually more and rarely slightly less, margin usually entire but if serrate then serrations about 1 mm., rarely up to 2 mm. long. Formosa 23. *O. lanceolatus*

25. Petioles 1 cm. long or less 26
Petioles 1 cm. long or more (if less then leaves only 6 cm. or less) 27

26. Venation of leaves above reticulate, clear, and raised 18. *O. reticulatus*
Venation of leaves above more or less obscure, with primary veins only visible and usually impressed . . . 9. *O. fragrans*

27. Apex of leaf with an acute or very acute tip, acuminate, if subacuminate then venation above obscure with only the primary veins visible and often impressed 28
Apex of leaf acute but blunt-tipped, subacuminate, venation above more or less reticulate and raised, veins on dried material with a yellowish tinge. Hainan . . . . 15. *O. hainanensis*

28. Texture of leaf thick or thickish but not coriaceous, rarely glossy, margin only slightly thickened, venation raised or impressed, reticulations clear or obscure 29
Texture of leaf very thick coriaceous and more or less glossy, margin distinctly thickened, venation raised and more or less reticulate above and below . . . . . 21. *Species "B"*

29. Surface of leaf usually covered with small raised, but distinct, dots, not minutely bullate under the lens, venation usually more or less reticulate above with primary veins raised, tip of leaf conspicuously pointed. Japan and Bonin and Ryukyu Is . 13. *O. insularis*
Surface of leaf with a minutely bullate appearance under the lens, venation usually more or less obscure above with usually only the primary veins visible and generally impressed not raised, tip of leaf acute but not conspicuously so . . . 9. *O. fragrans*

30. Petioles less than one-sixth the length of the lamina, usually 10 mm. long or less, if more then clearly less than one-sixth . . 31
Petioles more than one-sixth the length of the lamina, over 10 mm. long, usually more than 15 mm. . . . 25. *O. cooperi*

31. Lamina less than four times as long as broad, apex acute, acuminate or blunt 32
Lamina four or more times as long as broad, rarely slightly less, apex long attenuately acute. Formosa . . 23. *O. lanceolatus*

32. Primary veins of leaves 6 or less per side 33
Primary veins of leaves 6 or more per side, usually more . 35

33. Lamina at least three times as long as broad, apex long acute, venation very obscure, only primary veins just visible, either above or below. Formosa and Ryukyu Is. . . . . 28. *O. enervius*
Lamina up to three times as long as broad, usually less, apex blunt, shortly acute or acuminate, venation obscure or more or less reticulate. Mainland of China 34

34. Leaf blade usually less than twice as long as broad, apex blunt or shortly acute, occasionally subacuminate, with a small apiculum which is often lost, venation often more or less reticulate with primary veins fairly clear above and below. Kwangtung 14. *O. fordii*
Leaf blade between two and three times as long as broad, apex distinctly acuminate with a very acute point, venation obscure, especially above, with only primary veins barely visible. Kwangsi 26. *Species "D"*

35. Axillary bud scales glabrous . . . . . 9. *O. fragrans*
Axillary bud scales more or less puberulous . . . 36

36. Lamina more than 3 times as long as broad, reticulations very obscure above and below, surface with a minutely bullate appearance under a lens. Formosa . . . . . 27. *Species "E"*
Lamina less than 3 times as long as broad, reticulations usually more or less visible above, obscure below, surface covered with small but distinct raised dots under a lens. Yunnan . 12. *O. henryi*

9. **Osmanthus fragrans** Lour., Fl. Cochinch. i, 29 (1790) et Willdenow in ed. 2, i, 35 (1793); Spach, Hist. Nat. Vég. viii, 268 (1839); De Candolle, Prodr. viii, 291 (1844); Siebold in Ann. Soc. Roy. pour l'Encouragement Hort. Pays-Bas (Jaarb. Kon. Ned. Maatsch. Ann. Tuin.) 1844–45, 34; Hance in Bonplandia, ii, No. 9, 120 (1854); Debeaux in Act. Soc. Linn. Bordeaux, xxx (Fl. Shanghai) 94 (1875); Lavallée, Arb. Segrez. 169 (1877); "W.G." in Garden, xix, 261 et fig. (1881); Gamble, Man. Ind. Timbers, ed. 1, 257 (1881) et ed. 2, 472 (1902); Hance in Journ. Bot. xx, 37 (1882); Clarke in Hook. f., Fl. Brit. Ind. iii, 606 (1882); Hance in Journ. Bot. xxi, 323 (1883); Nicholson, Ill. Dict. Gard. ii, 529 et fig. (1884–88); Hemsley in Journ. Linn. Soc. Lond. xxvi, 88 (1889); Anon. in Bot. Mag. Tokyo, v, 99 (1891); Sargent, Silva N. Amer. vi, 63 (1894); Bean in Garden, l, 86 (1896): Mouillefert, Traité Arbres Arbrisseaux, ii, 982 (1896); Matsumura in Bot. Mag. Tokyo, xii, 29 (1898); Henry in Trans. As. Soc. Jap. xxiv, suppl., 59 (1898); Diels in Engler Bot. Jahrb. xxix, 532 (1900); Bailey, Cycl. Amer. Hort. iii, 1177 (1901); Koorders & Valeton in Meded. s'Lands Plant. lix (Bijdr. Blooms. Java viii) 226 (1902); Brandis, Indian Trees, 445 (1906); Matsumura & Hayata in Journ. Coll. Sci. Univ. Tokyo, xxii (Enum. Pl. Formos.) 247 (1906); Pavolini in Nuovo Giorn. Bot. Ital.

N.S. xv, 427 (1908); Makino in Bot. Mag. Tokyo, xxiii, 15 (1909); Apgar, Ornam. Shrubs U.S. 281 et fig. (1910); Kawakami, Inst. Pl. Formos. 69 (1910); Pampanini in Nuovo Giorn. Bot. Ital. N.S. xvii, 690 (1910) et Plante Vasculari Dell' Hupeh, 142 (1911); Stapf in Kew Bull. 1911, 177 et tab.; Wilson in Publ. Arn. Arb. ii (Veg. West. China) 323 (1912); Schneider, Ill. Handb. Laubh. ii, 789 et figs. (1911); Diels in Notes R.B.G. Edinb. vii, 193 et 265 (1912); Dunn & Tutcher in Kew Bull. Addn. Ser. X (Fl. Kwangtung and Hongkong) 166 (1912); Koorders-Schumacher, Syst. Verzeichn. i, (i), Fam. 243, 155 (1912); Koorders, Exkursionsfl. Java, iii, 50 (1912); Matsumura, Ind. Pl. Jap. ii, (2), 496 (1912); Bean, Trees and Shrubs, ed. 1, ii, 110 (1914) et ed. 7, ii, 377 (1951); Rehder in Sargent in Publ. Arn. Arb. iv ("Pl. Wilsonianae") ii, 609 (1916); Koorders & Valeton, Atlas Baum. Java, iv, t. 654 (1916); Léveillé, Cat. Pl. Yun-Nan, 181 (1916); Kanehira, Formosan Trees, ed. 1, 368 (1917); Bailey, Stand. Cycl. Hort. iv, 2412 (1916); Makino, Ill. Fl. Jap. 900 et fig. (1924); Trelease, Winter Bot. ed. 1, 315 (1918) et ed. 2, 317 (1925); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927); Unemura in Journ. Jap. Bot. v, 227 (1928); Merrill in Sunyatsenia, i, 28 et tab. (1930); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931); Gagnepain in Lecomte & Humbert, Fl. Gén. Indo-Chine, iii, 1062 (1933); Terasaki, Nippon Shokubatsu Zufu (Jap. Bot. Ill. Album), 1517 (1933); Merrill in Trans. Amer. Phil. Soc. N.S. xxiv, (2), 306 (1935); Handel-Mazzetti, Symb. Sin. vii, 1005 (1936); Tanaka & Odashima in Journ. Soc. Trop. Agric. x, 378 (1938); Kerr in Craib, Fl. Siam. Enum. ii, 410 (1939); Cocker in Gard. Chron. Ser. 3, cvii, 101 et fig. (1940); Bailey & Bailey, Hortus Second, 523 (1941); Hara, Enum. Sperm. Jap. i, 124 (1948); Cheo in Bot. Bull. Acad. Sin. iii, 158 (1950); Bean in Chittenden, Dict. Gard. iii, 1452 (1951); Cowan, The Journeys and Plant Introductions of George Forrest, 206 (1952); Ohwi, Fl. Jap. 939 (1953); Schmid in Schröter, Fl. des Südens, ed. 2, 136 et t. 91 fig. 3 et 3d (1956).

Syn.: *Olea fragrans* Thunb. in Nova Acta Soc. Sc. Upsal. iv, 34 et 39 (1784) et Fl. Jap. 18, t. 2 (1784); Aiton, Hort. Kew. ed. 1, i, 14 (1789) et ed. 2, 22 (1810); Lamarck, Tabl. Encycl. i, 28 (1791) et Encycl. Méth. iv, 544 (1797); Willd., Sp. Pl. i, 46 (1797); Lettsom, The Natural History of the Tea-Tree, ed. 2, 43 et tab. (1799); Dumont de Courset, Bot. Cult. ed. 1, 718 (1802) et ed. 2, ii, 592 (1811); Vahl, Enum. Pl., i, 43 (1805); Persoon, Synops. i, 9 (1805); F. G. Dietrich, Lex. Gärt, vi, 432 (1806); Willd., Enum., 13 (1809); Desfontaines, Hist. Arb. i, 112 (1809); Duhamel, Traité Arbres et Arbustes, ed. 2, v, 68 et t. 24 (1812); Sims in Bot. Mag. xxxvii, t. 1552 (1813); Roxburgh, Hort. Bengal. 3 (1814); Roemer & Schultes, Syst. Veg. i, 71 (1817); Roxburgh, Fl. Ind. ed. Carey & Wallich, i, 105 (1820) et ed. Carey, l.c. (1832); Sprengel, Syst. Veg. i, 34 (1824); Blume, Bijdr. 682 (1826); Nees von Esenbeck, Pl. Offic. i, t. 213 (1828); Wallich, Cat. no. 2810 (1831); Loddiges, Bot. Cab. xviii, t. 1786 (1831); S. Dietrich, Sp. Pl. ed. 6, i, 238 (1831); G. Don, Gen. Syst. iv, 48 et fig. (1837); Loudon, Arbor. et Fructic. Brit. ed. 1, ii, 1208 (1838) et ed. 2, l.c. (1844); D. Dietrich, Syn. Pl. i, 37 (1839); Ross in Journ. Agric. and Hort. Soc. India, ii, (i), 358 (1843); Houssaye, Monogr. du Thé, 49 (1843); Hasskarl, Cat. Hort. Bog. Alt. 118 (1844); Siebold & Zuccarini, Abhand. Akad. Munch. iv (iii), 167 (1846); Blume, Mus. Bot. Lugd.-

Bat. i, 316 (1850); Miquel, Fl. Ind. Bat. ii, 547 (1856); Ettingshausen, Blatt-Skel. Dikot. 69 et fig. (1861); Grisebach, Fl. Brit. W. Ind. Is. 405 (1864); Miquel, Ann. Mus. Bot. Lugd.-Bat. ii, 264 (1866) et Cat. Mus. Bot. Lugd.-Bat. 57 (1870); Woods, Amer. Bot. and Fl. pt. 4, 276 (1871); Smith, Contrib. Mat. Med. and Nat. Hist. China, 161 (1871); Soubieran & Thiersant, Mat. Med. Chinois, 175 (1874); Brandis, For. Fl. N.W. and Central India, 309 (1874); Franchet & Savatier, Enum. Pl. Jap. i, 312 (1875); Savatier, Livres Kwa-wi, 119 (1875); Regel in Gartenfl. xxviii, 276 (1879); Dippel, Handb. Laubh. i, 139 (1889); Entleutner, Immergr. Ziergeh. S. Tirol, 114 (1891); Bretschneider, Bot. Sin. ii, 384 (1892); Léveillé, Fl. Kouy-Tchéou, 295 (1914).

Olea fragrantissima Graumüller, Handb. Pharm. Med. Bot. iii, 265 (1815), nom. nud.

Notelaea posua D. Don, Prod. Fl. Nep. 107 (1825); Dietrich, Sp. Pl. ed. 6, i, 246 (1831); De Candolle, Prod. viii, 291 (1844); Clarke in Hook. f., Fl. Brit. Ind. iii, 611 (1882).

Olea posua Buch.-Ham. ex D. Don, l.c., pro syn.

O. buchanani Herb. Lamb. ex D. Don, l.c., pro syn.

O. acuminata Wall. ex G. Don, Gen. Syst. iv, 49 (1837); Wallich, Cat. no. 2809 (1831) nomen nud.; De Candolle, Prodr. viii, 285 (1844).

O. acuminata var. *longifolia* DC., Prodr. viii, 285 (1844).

O. fragrans var. *acuminata* (Wall.) Blume, Mus. Bot. Lugd.-Bat. i, 316 (1850).

O. fragrans var. *longifolia* (DC.) Blume, l.c.

O. ovalis Miquel in Journ. Bot. Neérl. i, 111 (1861); Hemsley in Journ. Linn. Soc. Lond. xxvi, 88 (1889); Merrill in Sunyatsenia, i, 28 et t. 9 (1930).

O. sinensis Hort. ex Lavallée, Arb. Segrez. 169 (1877) in synon; Dippel, Handb. Laubholzk. i, 139 (1889), in synon.

Osmanthus fragrans var. *reticulata* Hort. ex Lavallée, Arb. Segrez. 169 (1877) nom. nud.

Olea fragrans var. *alba* Anon., Useful Pl. Jap. ii, t. 393 (1895).

O. fragrans var. *lutea* Anon., l.c., t. 392.

Osmanthus fragrans var. *latifolius* Makino in Bot. Mag. Tokyo, xvi, 32 (1902) et xxiii, 15 (1909); Matsumura, Index Pl. Jap. ii, 2, 496 (1912); Schneider, Ill. Handb. Laubh. ii, 789 et fig. (1911); Makino, Ill. Fl. Jap. ed. 2, 218 et fig. (1948).

O. fragrans f. *latifolius* Makino ex Schneider, Ill. Handb. Laubholzk. ii, 789 et fig. (1911).

O. asiaticus Nakai, Trees and Shrubs Indig. Jap. Proper, ed. 1, i, 264 et fig. (1922) et cum Koidzumi ed. 2, i, 352 et fig. (1927) et in Bot. Mag. Tokyo, xxviii, 43 (1924); Sasaki, List Pl. Formosa, 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Mori in Journ. Jap. Bot. xv, 544, fig. (1939); Hara, Enum. Sperm. Jap. i, 123 (1948); Sonohara, Tawada & Amano ed. Walker, Fl. Okinawa, 124 (1952); Ohwi, Fl. Jap. 940 (1953).

O. latifolius (Mak.) Koidzumi in Bot. Mag. Tokyo, xl, 337 (1926); Makino in Journ. Jap. Bot. iv, 4 (1927); Ohwi, Fl. Jap. 940 (1953).

O. fragrans var. *thunbergii* Makino in Journ. Jap. Bot. iv, 4 et tab. (1927); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Makino, Ill. Fl. Jap. 1074 et fig. (1948); Hara, Enum. Sperm. Jap. i, 124 (1948).

O. acuminatus (Wall. ex G. Don) Nakai in Bot. Mag. Tokyo, xliv, 14 (1930).

O. aurantiacus var. *thunbergii* (Makino) Honda in Nom. Pl. Jap. 511 (1939) (non vid.).

O. intermedius Nakai in Bull. Nat. Sci. Mus. Tokyo, no. 27, 35 (1949).

O. aurantiacus var. *cremeus* Nakai, l.c. 34.

Evergreen *tree* or *shrub*, 2–12(–18) m. high, bark greyish, glabrous. *Leaves* glabrous, *surface generally very minutely and finely bullate in appearance under the lens* from very numerous small raised dots, occasionally obscurely so, *petioles glabrous* (or rarely puberulous), (5–)8–12(–20) mm. long; lamina thick, dark shining green above, lighter below, broadly lanceolate, less commonly ovate or oblanceolate, (4–)7–11(–15) cm. long by (1–)2–4(–5) cm. broad; *margins* slightly thickened, *entire, or occasionally serrate, especially in the upper half, with up to 18(–25) small teeth, 1 mm. or less in length* (Fig. 1A); apex abruptly acuminate to long acuminate, *tip acute*; base angustate or acute, very slightly decurrent into the petiole; venation usually more or less obscure above, impressed, and primary veins only visible, below raised usually clearly reticulate, *(6–)9(–10) primary ribs per side. Inflorescence* axillary, fasciculate (rarely and as a freak subpaniculate), 2(–3) buds per axil with up to 9 flowers per bud; pedicels glabrous, (2–)4–10(–16) mm. long, *basal connate bracts glabrous* (2–)3(–4) mm. long, slightly cuspidate. *Flowers* very fragrant, rarely (fide *Forrest* 25390 and *Chevalier* 29189) inodorous, white, pale yellow, golden yellow or orange. *Calyx* 1 mm. long with 4 erose teeth. *Corolla* texture waxy, tube 1–1·5 cm. long, *lobes* 4, *2–3 mm. long. Stamens* 2, filaments 0·5 mm. long attached near the top of the corolla tube; *anthers 1 mm. long, slightly longer than broad* with small terminal appendage, range of average dimensions of pollen measured 15·1–20·9μ with a range of extremes of 14–22μ. *Ovary about 1·5 mm. long with a short style about 0·5 mm. long and a bilobed stigma* (Fig. 4C). *Drupe* 1·8–2·4 cms. long by 0·7–1 cm. broad, dark purple, *stone obliquely ellipsoidal* somewhat acuminate at apex, endocarp hard, up to 0·5 mm. thick, slightly ribbed. Chromosome number (fide Taylor): 2n=46.

CHINA

CHEKIANG. Chusan, without date, *W. Brown* 25 (E), without date, *Dr. Cantor* s.n. (K); Hangchow Christian College, 11 Oct. 1928, *C. Y. Chiao* s.n. (*Nanking Univ. Herb.* no. 18836) (NY, US); without locality, 10 Sept. 1890, *H. J. Hinkin* s.n. (K).

CHILI. Pekin, without date, *Bretschneider* 496 (K); Prince Park, Peiping, 30 Sept. 1930, *T. N. Liou* 1736 (NY), and 9 Oct. 1931, *T. P. Wang* 370 (NY); Tientsin, 7 Oct. 1912, *Mary Strong Clemens* 1913 (E).

FUKIEN. Amoy Island, Cult. in garden of Univ. of Amoy, 25 April 1923, *H. H. Chung* 1619 (A, E, K); Amoy region, Kulangsu Island, cult. 26 Nov. 1922, *H. H. Chung* 770 (E); Huiglura district, cult. 17 Feb. 1923, *H. H. Chung* 965 (K); Kushan, in thickets, 11 May 1930, *H. H. Chung* 8489 (A); Foochow and vicinity, 5 April 1936, *Luetta Chen* 111 (A); Ling-yen, 1200 m., probably planted, 21 Sept. 1912, *W. R. Price* 1163 (K); Yung Chen, without date, *H. F. Rankin* s.n. (K).

HUNAN. Changning district, I-Chia-Ao, on slope in forest, 240 m., 1 July 1935, *C. S. Fan & Y. Y. Li* 119 (L, W); Sinning Hsien, Ma-Ling-Tung, 650 m., 29 Sept. 1935, *C. S. Fan & Y. Y. Li* 569 (L, W); Yi Chang district, P'ing T'ou Shan, Pai Mu Village, fairly common, dry roadside, 21–29 March 1934, *W. T. Tsang* 23401 (US), abundant, dry sandy soil, 1–11 April 1934, *W. T. Tsang* 23507 (US), and abundant, clay, thicket, 1–13 May 1934, *W. T. Tsang* 23689 (US); Supra vicum Lantien versus minas Hsikwangschan distr., Hsinhwa prope vicum Lintji, 450 m., 9 Oct. 1918, *Handel-Mazzetti* 795 (A) and 12727 (E, W).

HUPEH. Chienshih Hsien, 20 Sept. 1934, *Ho-Ch'ang Chow* 1646 (E, NY); Patung Hsien, 4 May 1934, *Ho-Ch'ang Chow* 54 (E, NY), and 31 Oct. 1934, 1069 (NY); Patung district, without date, *A. Henry* 2497 (K), and 2498 (K, US); Ichang and immediate neighbourhood, without date, *A. Henry* 2288 (K, FI, NY); Nan-To and mountains to northward, without date, *A. Henry* 2638 (K); Changlo, cult., without date, *A. Henry* 7722 (K, US); Vallata di Pan-huo, 800 m., 1–10 Sept. 1905, *Silvestri* 1804 (FI); without locality, *A. Henry* 7784 bis (E), April 1900, *E. H. Wilson* 38 (E, K, NY, W), Nov. 1900, *E. H. Wilson* 496 pro parte (K), and Sept. 1908 ,*E. H. Wilson* 2374 (E, K, US).

KANSU. Ping-lo, 7 Oct. 1914, *F. N. Meyer* 1788 (K).

KIANGSI. Lungnan district, Oo Chi Shan, near Lam Uk village, fairly common, dry, steep slope, clay, thicket, 1–25 Oct. 1934, *S. K. Lau* 4644 (A, US); without locality, cultivé dans les jardins, Autumn 1873, *A. David* s.n. (P).

KIANGSU. Nanking, cult., Oct. 1924, *A. N. Steward* 7277 (E, K, US), and 1844, *Lechancher* s.n. (P); Sou-Kiang, 1855, *Montigny* 114 (P).

KWANGSI. Lu Shan, cult., 10 Sept. 1932, *H. C. Cheo* 350 (E, K); Nanning, 100 m., in garden, 1 Dec. 1928, *R. C. Ching* 8501 (NY, US); On Tak, side of village, 22 Sept. 1935, *S. P. Ko* 55799 (A); Ta Tseh Tsuen, Yung Hsien, cult., 10 Oct. 1933, *A. N. Steward & H. C. Cheo* 1109 (NY, SING, W); Kwai Fa Shue, Hsi-chang village and vicinity, Ch'u-fen-Shan, Kwei-liu district, fairly common, thicket, 24–29 Sept. 1937, *W. T. Tsang* 28396 (US).

KWANGTUNG. Canton Christian College Campus, 9 March 1923, *To Kang Ping* (*Lignan Univ. Herb.* 10938) (NY); In Mt. Bagwanschan prope Cantonem, 300 m., 28 Nov. 1915, *Handel-Mazzetti* 196 (A); Hort. prope Macao, 1779–1780, *David Nelson* s.n. (BM); Macao, 1841, *J. Calléry* s.n. (P); Lung Mun district, Nam Tan village, Ts'z Tong, Ma Cha Market, cultivated, 12 Jan. 1929, *Fung Hom* 8 (*Lignan Univ. Herb.* 18433) (NY); Teng Woo Mt., 18 Nov. 1916, *Levine & Groff* (*Canton Christian College Herb.* 94) (A); Liu district, 11 Oct. 1918, *C. O. Levine* (*Canton Christian College Herb.* 3190) (A, E, K); Yang Shan district, Yang Shan and vicinity, south of Linchow, July-Sept. 1932, *T. M. Tsui* 708 (K, L, NY, SING, W); Wat Shui Shan, in valley, 7 Nov. 1928, *H. D. Wong* 7328 (K, NY); Canton and Macao, Jan. 1837, *Gaudichaud* 273 (P) and 274 (P); Pukak, *R. Krone* s.n. (holo. *Olea ovalis*, U).

KWEICHOW. Environs de Kouy-Yong, etc., Cult. partout dans les jardines, Aug. 1897, *E. Bodinier* 1891 (E, P); Miao Wang, Kianghou Hsien, 24 Sept. 1931, *A. N. Steward, C. Y. Chiao & H. C. Cheo* 452 (E, K, L, NY, P, W); Pingchow, 250 m., in open yard, cult., 17 Sept. 1930, *Y. Tsiang* 7183 (E, K, NY, US); Meitan, on open slopes, 6 Feb. 1931, *Y. Tsiang* 8036 (NY); Kiansi, along roadside, 30 Aug. 1930, *Y. Tsiang* 8781 (W); without locality, 1850–1857, *P. Perny* s.n. (P).

SHANGTUNG. Hua Ying Sze, Nao Shan, 18 July 1930, *C. Y. Chiao* 2798 (E, K, NY, US); Lung Yung, Tsinanfu, rocky slope, 300 m., cultivated, 7 Sept. 1930, *C. Y. Chiao* 3068 (E, K, NY, US); Taianfu, Temple of Tai Shan, 130 m., potted tree, 1 May 1929, *C. Y. Chiao* 2154 (NY).

SHENSI. Lun-san-huo, Oct. 1895, *G. Giraldi* 736 (FI); Falde del Thae-pei-san, Aug. 1896, *G. Giraldi* 1642 (FI); Monte Lean-san, Sept. 1893, *G. Giraldi* 4387 (FI).

SZECHUAN. Chentu, 7 March 1936, *S. S. Chien* 5008 (E, W), and in garden, 28 April, 5282 (E); Nanchuan Hsien, in woods, 23 Oct. 1928, *W. P. Fang* 5628 (E, K, NY); Tienchuan Hsien, Tienchuan chow, 900–1050 m., roadside, 6 Sept. 1928, *W. P. Fang* 3405 (E, K, NY, US), on the side of a bridge, 7 Sept., 3409 (E, K), and at the side of a house, 7 Sept., 3410 (E, K, NY); Omei Shan, 900 m., on slope in forest, 24 Aug. 1938, *C. Y. Chiao & C. S. Fan* 404 (A), in forests, rare, 29 July 1938, *W. P. Fang* 12699 (A, US), 24 Nov. 1946, *W. K. Hu* 8901 (E, US), 800–1100 m., Oct. 1937, *Y. S. Liu* 1652 (A), and Sept. 1904, *E. H. Wilson* 5040 (K); Pei-pah, cult., 15 March 1946, *Y. W. Law* 346 (K); Tachienlu to Sackon via Mouping, 2800–3700 m., Aug.-Sept. 1929, *H. Stevens* 6 (US); without locality, Sept. 1908, *E. H. Wilson* 2374 (E, K, US).

YUNNAN. Yunnan-fu, without date, *Ducloux* 252 (K); Environs de Yun-nan-sen, Pagode de Hi long tan, 6 Oct. 1897, *Ducloux* 464 (P); lat. 25° 40′ N., 2100 m., "grown as an ornamental shrub by the Chinese of the Tali Valley", June–Oct. 1906, *G. Forrest* 4743 (E); Tali, grown in Tali plain, 29 March 1933, *McLaren's Collectors* C.302 (E, K); Lichiang valley, lat. 27° N., 2500 m., "cultivated generally by the Chinese of Yunnan as an ornamental shrub", Oct. 1906, *G. Forrest* 3100 (E); S.W. end of Likiang valley, Wenfang-tze, cult., 25 Aug. 1939, *R. C. Ching* 21334 (A); W. end of Likiang valley, Puchitze, cult., 10 Oct. 1939, *R. C. Ching* 21758 (A); Tengyueh valley, lat. 25° N., 1650 m.–2150 m., "much cultivated by the Chinese and to be found in the vicinity of most temples", July 1912, *G. Forrest* 8581 (E, K); N'Maikha-Salwin divide, lat. 25° 30′ N., in thickets, Oct. 1919, *G. Forrest* 18558 (E, K); ad regionis calide temperatae ad orientem fluminis Dsolin-ho vicum Alaodjing, 2000 m., 6 Sept. 1914, *Handel-Mazzetti* 4896 (W); Yuanchang, 2150 m., without date, *A. Henry* 13213 (A, E, K, US); Mengze, cult., without date, *A. Henry* 11002 (K, US); Ping-pien Hsien, 1400 m., on open slope, 30 Aug. 1934, *H. T. Tsai* 61717 (A); Shunning, Hila, Wamulung, 2600 m., among forest, common, *T. T. Yü* 16670 (E); without locality, Nov. 1906, *E. E. Maire* 22 (E), and "grown in the courts of all the temples", Sept. 1904, *G. Forrest* 576 (E, K).

FORMOSA (TAIWAN). Taihoku, Feb. 1915, *E. Matuda* s.n. (TAI); Taihoku City, cult., 1 Feb. 1938, *K. Mori* s.n. (TAI); Mt. Sitisei, Taihoku, 4 Jan. 1930, *S. Suzuki* 3508 (TAI), vicinity of Taihoku, 20 Aug. 1929, *Tanaka* 5049 (BM); in hortis Kelung, 13 March 1903, *U. Faurie* 315 (P); Shinten, Jan. 1914, *U. Faurie* 371 (BM); Dorawan, Touen, 27 Dec. 1909, *T. Kawakami & Y. Shimada* s.n. (TAI); Bento, Keikogai, Inrin-gun, Taichu, 20 March 1945, *H. Morimoto* 756 (TAI); garden of police station, Herimbi, 900 m., 27 March 1912, *W. R. Price* 281 (K); Harisha, Prov. Nanto, commonly cultivated, 10 May 1918, *E. H. Wilson* 9956 (K); without locality, cult., 1864, *R. Oldham* 3111 (K).

INDIA

UNITED PROVINCES. Dehra Dun, 600 m., 1891, *J. S. Gamble* 23723 (K), 1928, *U. Singh* 209 (NY, W), and 700 m., Sept. 1930, *R. R. Stewart* 11477 (NY); Kumaun, Ramgamga valley, 1200 m.–1500 m., probably planted, 3 April 1884, *J. F. Duthie* 3145 (BM); West Almora, 11 Oct. 1933, *Bis Ram* s.n. (NY); Kapkot, 1050 m., without date, *R. Strachey & J. E. Winterbottom* 2 (BM, K); Kumaon, without locality and date, *Wallich* (*R. Blinkworth*) 2809c (Syntype of *Olea acuminata*, and holo. of *Olea acuminata* var. *longifolia*, BM, E, GL, K, L, NY); Gurhwal and Kumaun, 1200 m.–1800 m., scarcely wild, without date, *E. Madden* s.n. (K); Askot, April 1881, *J. R. Reid* s.n. (E); Landour, Mussoorie, 2000 m., cult., 10 Aug. 1935, *R. R. Stewart* 14901 (NY).

SIKKIM. Darjeeling, 2000 m., 1 Oct. 1902, *J. H. Lace* 2381 (E), 2100 m., Oct. 1876, *J. S. Gamble* 1699D (BM) and 8291 (K); Goompahar, Darjeeling, 2100 m., Oct. 1881, *J. S. Gamble* 10005 (K); Palangdong Forests, Goompahar Range 1890, *H. H. Haines* 1126 (E, K); Rishep, 900 m., 30 Oct. 1912, *G. H. Cave* s.n. (E); Sureil, 1400 m., 14 April 1919, *G. H. Cave* s.n. (E); Tonglo, 3050 m., May 1892, *H. H. Haines* 1127 (K); without locality, 2100–2450 m., *J. D. Hooker* s.n. (BM, E, L, NY, W), and 1914, *G. H. Cave* s.n. (A).

ASSAM. Khonoma, Naga Hills, 2100 m., 20 Aug. 1935, *N. L. Bor* 2697 (K); Paona, Naga Hills, 1800 m., 2 Sept. 1935, *N. L. Bor* 6274 (K); Khasiya, 1844, *W. Griffith* 154 (K, W) and 155 (K, W); Khasya, Ihobh, without date, *W. Griffith* s.n. (K); without locality 1891, *Dr. King's Collector* s.n. (A).

E. PAKISTAN

Silhet, *Wallich* 2809d (syntype of *Olea acuminata*, BM, K, W).

NEPAL

Narainhetty, nr. Kathmandu, 1802, *F.* (*Buchanan*) *Hamilton* s.n. (holo. of *Notelaea posua*, BM, iso. K); Kawa, Khater Dara, 2150 m., in heavy forest, 24 April 1952, *Polunin, Sykes & Williams* 827 (BM, E); Dhaulakot, 1800 m., 13 Oct. 1952, *Polunin, Sykes & Williams* 5631 (BM, E); Leware nr. Pokhara, 1200 m., 30 Oct. 1954, *Stainton, Sykes & Williams* 8312 (BM, E); without locality and date, *Wallich* 2809a (BM, E, GL, K, L, NY, P, SING, W).

BURMA

Hpimaw, 2450 m., one small tree in a cleared gully below the bungalow, 2 Oct. 1919, *R. Farrer* 1351 (E); West flank of the Chinsi-li N'Maikha-Salwin divide, lat. 26° 23′ N. long, 88° 48′ E., in open thickets, Nov. 1924, *G. Forrest* 25390 (E, K, NY, US, W).

THAILAND

Payap, Doi-Angka, 2400 m., 2 May 1921, *A. F. G. Kerr* 5314 (E, K).

INDO-CHINA

Cambodge, without date, *Collard* s.n. (P); Tonkin meridional, Ké So, cult., 4 March 1888, *R. P. Bon* 3742 (P); Tonkin, prov. de Ninh Binh, village de Yen D'oi Huyen de Y'en, Hoa, cult. dans un jardin annamite, 21 Nov. 1913, *A. Chevalier* 29189 (P); Tonkin, Prov. Yen Buy, Van Phu, Feb. 1931, *A. Petelot* 4215 (NY, US); without locality and date, *J. de Loureiro* s.n. (holo. of *Osmanthus fragrans*, BM).

JAPAN

Honshiu. Tokyo, 15 Oct. 1879, *J. Matsumura* s.n. (US); Hiroshima, cult., 12 Nov. 1893, *U. Faurie* 11586 (K); Uenohara, Yamanashi Pref., cult. in open garden at 500 m. alt., 21 Sept. 1946, *A. F. Hussey* 229 (US) and 230 (US); Yokohama, cult., 1862, *Maximowicz* s.n. (K); in sylvis montanis prope oppidum Okasakki, without date, *Pierot* s.n. (L); Kobe, cult., 22 Oct. 1944, *K. Uno* 32 (A); Kurashiki, Okayamaken, cult., 28 Oct. 1950, *K. Uno* s.n. (A); Yokosuka, 1866–76, *Savatier* 814 (P) and 815 (K).

Kiushiu. Nagasaki, 1863, *Maximowicz* s.n. (K, FI, L, NY, US, W), and 1862, *R. Oldham* 538 (K, FI, L, W); in locis montuosis saxosis prope urbem Nagasaki, without date, *Pierot* s.n. (L); Prov. Satsuma, 23 Sept. 1923, *G. Masamune* s.n. (NY); Higo, 14 Oct. 1931, *Nisimuda* s.n. (TAI); Higo, Kumagun, Nisimura, 14 Oct. 1917, *Z. Tasiro* s.n. (TAI); Mt. Kirishima, cult., without date, *Z. Tasiro* s.n. (K); Bungo, 2 Nov. 1906. *H. Sakurai* s.n. (E). Without locality: Japan, without date, *O. G. J. Mohnike* s.n. (L), *Siebold* (L), *C. J. Textor* (L) and *Thunberg* s.n. (holo. of *Olea fragrans*, UPS, iso. Herb, Smith LINN.).

CULTIVATED

Java: without date, *Blume* s.n. (L), prope Batavia, Aug. 1938, *Kollmann* s.n. (BM, NY), and without date, *Zollinger* 3118 (BM, W). Calcutta: 20 Dec. 1814, *F. (Buchanan) Hamilton* 38 (E), and without date, *Wallich* 2810 (W). Malaya: Penang, *Wallich* (*G. Porter* 2809e (syntype of *Olea acuminata*, BM); Singapore, 1 Feb. 1841, *Walker* s.n. (BM). Britain: Hort. Pitcairn, Islington, 1775 (BM); Liverpool Bot. Garden, 1821, *ex Herb. Stead* s.n. (NY). Austria: Hort. Schoenbrun, without date, *ex Herb. Jacquin* s.n. (W), and 12 Sept. 1827, *ex Herb. Hayne* s.n. (W); Hort. Toggenhausanus, Nov. 1816, *A. Martini* s.n. (W). France: Chateau de Varennes, 4 Dec. 1926, *D. V. Pirie* s.n. (K); Jardin de Cels, 2 Oct. 1818 (K). Italy: Hort. Bot. Pisa, no. 1321, 29 Sept. 1876, *J. Caruel* s.n. (FI); Riva, 5 Oct. 1898, *M. F. Müllner* s.n. (W); La Mortola, Aug. 1903, *C. Schneider* s.n. (A). St. Vincent: without date, *A. Anderson* s.n. (K), and *L. Guilding* s.n. (K). U.S.A.: D.C., Washington Botanic Garden, 1898, *J. N. Rose* 4127 (US); South Carolina, Jasper Co., in woods, 4 March 1929, *A. W. Christensen* s.n. (NY). Hawaii, Nakawao, Maui, planted in garden of Anthony Apo Tam, 25 Jan. 1928, *O. Degener* 2444 (NY).

In eastern Asia *Osmanthus fragrans* has been cultivated for so long a period that it is now almost impossible to discern its exact area of distribution as a native plant. Especially is this so since it is impossible in many cases to tell from the field notes whether the plant was intentionally cultivated or not. It is almost certain, however, that it is a native plant in the Sino-Himalayan region, that is in southwest China, the Eastern Himalayas and probably in the mountains that extend into northern Thailand. Specimens have been examined from Nepal, Sikkim, Assam, Burma and Yunnan that appear to have been undoubtedly wild and this also applies to some extent to certain material from Szechuan, Kweichow

and Kwangsi. However, one can be less certain in the case of these last three provinces when it is borne in mind how widely the species is cultivated, and that, for example, Augustine Henry stated (*Henry* 7722) that he had never seen it wild. Even in Yunnan, George Forrest, who was so well acquainted with the native plants of S.W. China, adds the following comments to some of his specimens: "cultivated generally by the Chinese of Yunnan as an ornamental shrub" (*Forrest* 3100), "much cultivated by the Chinese and found in the vicinity of most temples" (*Forrest* 8581) and "grown in the courts of all the temples" (*Forrest* 576). With such an extensive cultivation, even in S.W. Yunnan, it is not impossible that the plant may have become naturalized. However, it is perhaps significant that whilst the possession of glabrous young stems and petioles is typical of the species, a number of specimens, all from Yunnan, have been discovered which are puberulous in these parts, and, to judge from the field notes, they appear to be of wild origin (e.g. *Forrest* 18558, *Henry* 13213, *Yü* 16670 and *Ducloux* 464, although this last might have been cultivated or merely protected). This local occurrence of a form with minutely hairy petioles is worthy of comment especially as it appears to resemble the type in other characters. Also worthy of note is the fact that the two specimens, which are in flower, have pollen grains which lie in the upper end of the range for the species, *i.e.* (18–)19·9–20(–21)μ. However, one or two other specimens with glabrous petioles also have grains the same size although all but one (and that from Japan) are from N.E. Burma and Yunnan. All the countries and provinces from which material of *O. fragrans* has been examined are listed above, but it has also been recorded from the island of Hainan (Tanaka & Odashima, Journ. Soc. Trop. Agric. x, 378: 1938), and from Okinawa in the Ryukyu Is. as *O. asiaticus*, "a cultivated ornamental" (Sonohara, Tawada & Amano, ed. Walker, Fl. Okinawa, 124: 1952).

In cultivation *Osmanthus fragrans* is to a certain extent variable and Japanese botanists have recognised several segregate species. Perhaps the most distinct, apart from the orange-flowered form which is dealt with below, is that which has been known under the name *O. asiaticus* Nakai, characterized by a relatively short broad leaf with the margin more or less completely serrate. As the type specimen of Loureiro at the British Museum is this form, by the strict application of the rules of nomenclature *O. asiaticus* is a synonym of *O. fragrans* Lour. even when this segregate is considered to warrant specific rank.

As recently as 1949 Nakai (Bull. Nat. Sci. Mus. Tokyo, no. 27, p. 34) described *O. intermedius* as a species growing spontaneously in Kiushiu, Japan. After a study of all the names proposed by Nakai, Makino and others it appears that Nakai recognized four separate species and one variety, which, together with a synonymy not actually quoted in full but deduced from his writings and incorporating his apparent opinions from various sources, are:

Osmanthus aurantiacus (Makino) Nakai (*Olea fragrans* Thunb.).

O. aurantiacus var. *cremeus* Nakai.

O. asiaticus Nakai (*O. fragrans* Lour. *O. fragrans* var. *latifolius* Makino and *O. latifolius* (Makino) Koidzumi).

O. acuminatus (Wall. ex G. Don) Nakai.

O. intermedius Nakai (*O. fragrans* var. *thunbergii* Makino and *O. aurantiacus* var. *thunbergii* (Makino) Honda).

This synonymy, however, is nomenclaturally inaccurate and is quoted here to show the grouping of the numerous names that have been used for the segregates as deduced from the writings of Nakai and others.

The plants from the Himalaya, Assam and Yunnan were separated by Nakai as a distinct species, *O. acuminatus*, with the diagnosis: "Folia longissime attenuata. Pedicelli usque 17 mm. longi". In view of this separation a careful examination and analysis has been made of most of the material of *O. fragrans* seen during this revision. The specimens were analysed for flower colour and time of flowering (where these are noted), general and apical shape of leaves, leaf length and breadth, degree of serration of the leaf margin and length of the pedicel. These factors were then considered both together and geographically by expressing each character in a composite symbol after the fashion of those used by Anderson in his studies of introgressive hybridization (Anderson, Introgressive Hybridization, 1949) and then plotting them on an outline map covering the area from Japan to the eastern Himalaya. The result of this analysis showed that there is no correlation between any of the characters and their distribution except that there is a tendency for the Sino-Himalayan plants to have longer leaves and a slightly more attentuate apex. This would support Nakai's separation of *O. acuminatus* were it not for the fact that it is only a *tendency*, with the consequent impossibility of drawing a clear distinction. Specimens have been seen from central and east China (e.g. *Chow* 54) with leaves similar to Himalayan plants and the separation of western plants even at subspecific rank seems hardly justifiable.

Pedicel length, the other character used by Nakai to differentiate *O. acuminatus*, bears no relation to geographic distribution. In fact the length of 17 mm. given by Nakai for his species is not even shown by iso-typic material in the Edinburgh Herbarium with pedicels only 5–10 mm. long, whilst on the specimen with the longest pedicels examined (*Farrer* 1351), they range from 9–16 mm. only and no more.

There appears to be no correlation between the degree of serration of the leaf margin and geographic distribution, except that no specimen with serrations has been observed from further west than China (one specimen cultivated in the Calcutta Botanic Garden, *F. Buchanan Hamilton* 38, introduced from China, has serrate leaves). There is a tendency for leaves with serrations to be shorter, more elliptic or ovate and less lanceolate, but this again is only a tendency and exceptions occur both ways. As has been said, the plant known as *O. asiaticus* is a more or less separable form with a relatively short broad leaf possessing a more or less serrate margin, and were it not for intermediate specimens and the fact that throughout the genus the degree of serration often varies with age except in some cultivated forms propagated clonally (cf. *O. heterophyllus* cultivars), there might be good grounds for considering it a distinct variety. It is significant in this connection that all the material seen from Formosa is of the *asiaticus* type and much of it is labelled as having been cultivated. In fact, no certainly wild specimens of this type have been seen, whatever their country of origin.

In the discussion after the original description of *O. intermedius*, Nakai states that Thunberg's plant has deep orange flowers. This, however, must be wrong for Thunberg in his diagnosis of *Olea fragrans* says that the flowers are "flavo-alba". Thus Thunberg's plant should be equated with *O. intermedius* or *O. aurantiacus* var. *cremeus* rather than with *O. aurantiacus*. *O. intermedius* is supposed to differ from *O. aurantiacus* var. *cremeus* by flowering in March instead of August and September, by having a solitary trunk rather than one branching from the base and by possessing leaves constantly bearing small serrations in the upper half. However, these characters by themselves hardly seem sufficient basis for the separation of a species. Especially is this so when the great variation in leaf shape is borne in mind together with the wide range in flowering times recorded with the herbarium specimens—every month from April to November with a concentration in September and October.

Finally, of the names considered by Nakai, *O. aurantiacus* (Makino) Nakai is treated below at the rank of a form.

The precise origins of the cultivated forms are lost in the obscurity of of the past but at least it would appear that they did not arise from the wild stock present in Yunnan today. Whether the species is truly native to Japan is doubtful, even though it has been found growing spontaneously in Kiushiu (Makino in Bot. Mag. Tokyo, xxiii, 15: 1909 and Nakai in Bull. Nat. Sci. Mus. no. 27, 35: 1949), for it is worth remembering that today it is found growing spontaneously in Jamaica, propagating itself naturally after having escaped from cultivation. It is likewise doubtful if it is native in Formosa where it is commonly cultivated. In the lists given above of specimens examined, although Japan, Indo-China, Fomosa and many Chinese provinces are not listed under the heading "Cultivated", they are left under separate headings only because the species is so familiar in these countries and because in many cases it is impossible to be certain which specimens are or are not of wild origin. That it has been in cultivation in these countries for a very long time is borne out by the record of Kaempfer (Amoen. 5, 844: 1712) for Japan where he states that the plant comes from China and by its inclusion in the classic Japanese work, Kwa-wi, of 1759. It is likewise recorded by Osbeck who saw it in Canton in 1751. Canton was probably the source from which it was introduced into Britain in 1771 and there is a specimen in the British Museum dated 1775 from William Pitcairn's garden in Upper St., Islington. During the next few decades it was introduced into most of the European countries and to India, St. Vincent and Java, either directly or via Britain. That it has been intentionally planted in India is borne out by the statement of Gamble in his Manual of Indian Timbers, ed. 1, 257 (1881) where he says that in Northern India *O. fragrans* is "sometimes gregarious but more often planted for the sake of its sweet-scented flowers".

forma **aurantiacus** (Makino) P. S. Green, **stat. nov.**

Syn.: *O. fragrans* var. *aurantiacus* Makino in Bot. Mag. Tokyo, xvi, 32 (1902); Schneider, Ill. Handb. Laubh. ii, 789 (1911); Matsumura, Index Pl. Jap. ii, 2, 496 (1912); Makino, Ill. Fl. Jap. 904 (1924) et ed. 2, 219 et fig. (1948); Stapf in Bot. Mag. cliv, t. 9211 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931); Hara, Enum. Sperm. Jap. i, 124 (1948);

Bean in Chittenden, Dict. of Gard. iii, 1452 (1952); Ohwi, Fl. Jap. 939 (1953); Schmid in Schröter, Fl. des Südens, ed. 2, 136 et t. 91 fig. 1 (1956).

O. aurantiacus (Makino) Nakai, Trees and Shrubs Indig. Jap. Proper, ed. 1, i, 265 et fig. (1922) et cum Koidzumi, ed. 2, i, 353 et fig. (1927); Nakai in Bot. Mag. Tokyo, xxxviii, 43 (1924) et l.c. xliv, 15 (1930); Terasaki, Nippon Shokubutsu Zufu (Jap. Bot. Ill. Album), 1516 (1933); Bailey & Bailey, Hortus Second, 523 (1941).

Distinguished from the type by its orange-coloured flowers. The leaves are characteristically lanceolate and usually entire or with a few somewhat irregularly placed serrations.

This form is mainly distinguished as a cultivated plant, where a difference in flower colour is often important. For this reason, together with the fact that flower colour is not always noted on herbarium material and without it the form is otherwise indistinguishable, no separate list of material of this form has been made, but it is worth noting that *Ching* 8501 from Kwangsi, *Fang* 3410 and *Chiao & Fan* 404 from Szechwan, *Forrest* 4743 from Yunnan, and *Polunin, Sykes & Williams* 5631 from Nepal are all stated to have orange-coloured flowers. However, *Stainton, Sykes & Williams* 8312 from Nepal is said in the field notes to have a corolla which is cream-coloured externally and orange within. The form *aurantiacus* has been known in cultivation for a considerable time and is referred to as *O. fragrans* var. *floribus rubris* by Lavallée (Arb. Segrez. 169: 1877). It is worth noting too that Bretschneider (Bot. Sin. ii, 384: 1892) says of the plants of *O. fragrans* in cultivation in Pekin that the flowers are white, yellow or red (or reddish brown) which further supports the view that they are only colour forms.

In addition to the material of *O. fragrans* that has been cited, two specimens discussed below and lacking flowers can only be identified as "near *O. fragrans*". They may eventually prove to be distinct.

Firstly there is *Handel-Mazzetti* 745=12048 ("Hunan austro-occ.: in monte Yün-schan prope urbem Wukang, in silva elata frondosa umbrosa", alt. 900–1190 m., 6 June 1918—A, E, W). This material has been named *O. fragrans* by Handel-Mazzetti but not only are the petioles, young shoots and young leaves puberulous (cf. some puberulous specimens from Yunnan already mentioned) but the bud scales are very pubescent as well. In addition the ovary (and style) has a different shape. In *O. fragrans* the style is characteristically short, and somewhat unique in this respect for the genus (Fig. 4C) but in *Handel-Mazzetti* 745 it is about 1 mm. long and comparable with that of most other species (Fig. 4A). Lastly the fruit, which may be immature, is different. It appears more symetrically ellipsoidal and possesses prominent lenticels, recalling the fruit of *O. yunnanensis*.

The other specimen is *H. Tsai* 54356 from Yunnan (Shang-pa Hsien, 2700 m., in woods, 10 Oct. 1933—A). Here also the style is clearly different from typical *O. fragrans*, being once again elongate and about 1 mm. long (Fig. 4B). The flowers on the specimen examined are over and, although the field notes on the label say that they are "minute, greenish", it is quite possible that the corolla had already been shed when the note was made, for the specimen evidently bore immature fruit as well; these

latter are noted as being "oblong-globose, green", but seemingly quite undeveloped, to judge from the only one seen. The leaves are somewhat different from *O. fragrans* in that they are clearly oblanceolate, but otherwise they bear a close resemblance to those of some specimens of that variable species.

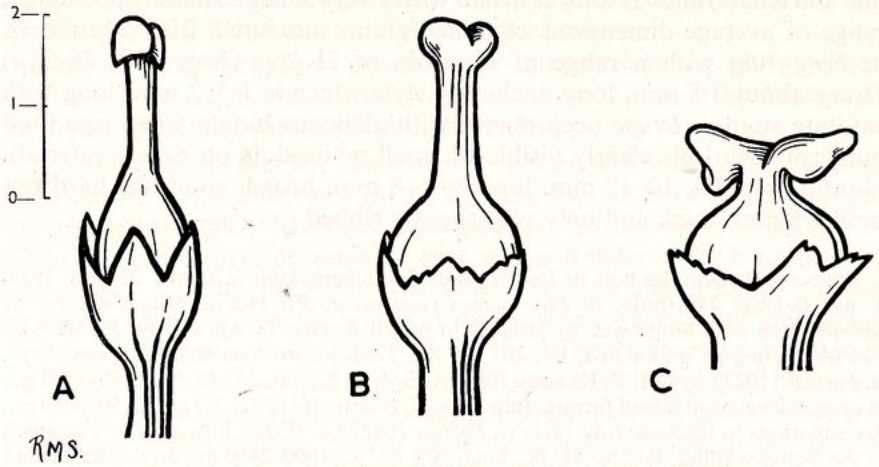

FIG. 4. Ovaries of: A, *Handel-Mazzetti* 745; B, *Tsai* 54356 and C, *Osmanthus fragrans* (*Forrest* 576).

10. **Osmanthus yunnanensis** (Franchet) P. S. Green, **comb. nov.**

Syn.: *Pittosporum yunnanense* Franch. in Bull. Soc. Bot. France, xxxiii, 415 (1886) et Pl. Delavay. 76 (1889).

Osmanthus forrestii Rehder in Notes R.B.G. Edinb. xiv, 20 (1923); Nakai in Bot. Mag. Tokyo, xliv, 25 (1930); Bean, Trees and Shrubs, ed. 1, iii, 262 (1933) et ed. 7, ii, 379 (1951); "G.W.T." in Gard. Chron. Ser. 3, ciii, 90 (1938); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Bean in Chittenden, Dict. of Gard. iii, 1452 (1951); Cowan, The Journeys and Plant Introductions of George Forrest, 206 (1952); Synge in Journ. Roy. Hort. Soc. Lond. lxxxi, 534 (1956).

O. forrestii var. *brevipedicellatus* Handel-Mazzetti, Symbol. Sin. vii, 1006 (1936).

O. rehderianus Handel-Mazzetti, l.c.

O. rehderianus var. *tenianus* Handel-Mazzetti, l.c.

Evergreen *shrub* or *tree* to 15 m. high, diameter of trunk to about 60 cm., branches glabrous, new growth minutely puberulous and quickly glabrous. *Leaves glabrous, usually covered with numerous closely placed small raised dots*; *petioles glabrous* (4–)6–10(–15) mm. long; lamina thickish to subcoriaceous, *usually lanceolate* but varying from narrow lanceolate to narrow ovate or elliptic, *(5–)9–12(–19) cm. long* by (2–)3–5(–6) cm. broad; *margin* slightly thickened, *entire or spinose dentate, teeth 2–3 mm. long* with, in a fully toothed leaf, *(23–)25–30(–38) teeth per side* (Fig. 1B); apex long acute or elongate acuminate, *tip spinescent*; base blunt to angustate, very slightly decurrent into the petiole; venation reticulate and raised above and below, especially below, *10–12 primary veins per side*. *Inflorescence* axillary, fasciculate, (1–)2(–3) buds with 5–7 flowers per bud; pedicels (5–)10(–15) mm. long (rarely to 25 mm. in fruit), glabrous; basal connate bracts 2–4 mm. long, ciliate, blunt or acute.

Flowers waxy, creamy white, yellow or white (green, *Forrest* 17056), sweetly fragrant. *Calyx* 1 mm. long with 4 deeply erose teeth. *Corolla tube 1–1·5 mm. long*, *lobes* 4, *3–5(–7) mm. long*, reflexed in fully opened flowers. *Stamens* 2, filaments about 1 mm. long in bud, later to 2 or 2·5 mm., attached near the top of the corolla tube; *anthers 2·5–3 mm.* long, one and a half times as long as broad with a very small terminal appendage; range of average dimensions of pollen grains measured, 21·8–24μ (28·7μ in *Feng* 708) with a range of extremes of 21–26μ (*Feng* 708, 26–31μ) *Ovary* about 3·5 mm. long, including style which is 1·5–2 mm. long with capitate stigma. *Drupe* deep purple with glaucous bloom when ripe (and numerous lenticels clearly visible as small white dots on dried material), blunt ellipsoidal, 10–15 mm. long by 5–8 mm. broad, endocarp hard but only 0·5 mm. thick and only very slightly ribbed.

YUNNAN. Ho Kin, les bois de les gorges de San-tchang-kiou, 2200 m., 22 May 1884, *J. M. Delavay* 780 (holo. of *Pittosporum yunnanense*, P); Hokin, Shiang-shu-ho by Ma-erh-shan near Sing-kwei, by streams in mixed forests, 18 April 1939, *K. M. Feng* 708 (A); Yung-pe mountains, lat. 26° 45′ N., 2750 m., in open thickets, Sept. 1913, *G. Forrest* 11027 (A, BM, E, K) and 11060 (A, BM, E, K), lat. 26° 42′ N., 2450–2750 m., in open thickets and mixed forests, July 1918, *G. Forrest* 16662 (E, K) and 2750–3050 m., dry situations in thickets, July 1918, *G. Forrest* 16827 (A, E, K); hills around Yung-peh in the Yangtze valley, lat. 26° 48′ N., long. 100° 42′ E., 1800–2450 m., on dry scrub-clad slopes, Sept. 1921, *G. Forrest* 20585 (E, K, P, W); mountains west of Yung-peh, lat. 26° 30′ N., long. 100° 50′ E., 2450–2750 m., amongst scrub in open rocky hillsides and in open mixed forests, Dec. 1921, *G. Forrest* 21050 (holo. of *O. forrestii*, E, iso. K, P, US, W); mountains north of Yung-peh, lat. 26° 55′ N., long. 100° 50′ E, 2450–2750 m., in open thickets on dry hillsides, Aug. 1922, *G. Forrest* 23178 (E, K); Ghi Shan, east of Tali lake, lat. 25° 48′ N., 2750 m., open situations amongst scrub, Aug. 1914, *G. Forrest* 13476 (E, K), and Aug. 1917, "duplicate of 1914", *G. Forrest* 15512 (A, E, K); western flank of the Tali Range, lat. 25° 40′ N., 2750 m., in open thickets, Sept. 1917, *G. Forrest* 15547 (A, E, K); Chienchuan-Mekong divide, lat. 26° 40′ N., long. 99° 40′ E., 2750–3050 m., in open thickets in side valleys, July 1922, *G. Forrest* 23079 (E, K), and lat. 26° 30′ N., long. 99° 20′ E, 2750 m., in mixed forests, Aug. 1923, *G. Forrest* 23488 (BM, E, K) and 23490 (E, K); Weng-feng-tze, S.W. end of Likiang valley, open thickets, 16 April 1939, *R. C. Ching* 20034 (A), and in mixed forests, 5 Jan. 1939, *K. M. Feng* 274 (A); hills S.W. of Lichiang, lạt. 26° 45′ N., long. 100° 10′ E., 3250 m., in thickets by streams and on the margins of mixed forests, June 1922, *G. Forrest* 21367 (E, K, P); mountains south of Likiang, near Hochin and Chiuho, 25–28 May 1922, *J. F. Rock* 4063 (A, US), and Sungkwe Hochin Range, 2450 m., 1923, *J. F. Rock* 8313 (A, NY); eastern slopes of Likiang Snow Range, Yangtze watershed, wild near Yungpei, Feb. 1923, *J. F. Rock* 8232 (A, E, NY, US); Likiang Hsien, 3000 m., woods, July 1935, *C. W. Wang* 71312 (A); S. Chungtien, Chiao-tou on Yangtze bank, 2200 m., by stream in wooded side valley, 30 Oct. 1939, *K. M. Feng* 3182 (A); bocages des collines arides à Siao-on-long, 2550 m., Feb., *E. E. Maire* 143 (A, K); "Brousse des monts à Tché-ki", 2600 m., March, *E. E. Maire* 195 (holo. of *O. rehderianus*, W, iso. A, K); "prope vicum Sanyingpan ad septentr. urbis Yunnanfu, 26° lat., in regione calide temperata in saltubus substr. arenaceo", c. 2400 m., 24 March 1914, *H. Handel-Mazzetti* 614 (holo. of *O. forrestii* var. *brevipedicellatus*, W, iso. E, P), 14 March 1914, *C. Schneider* 397 (A, K), 15 March 1914, *C. Schneider* 400 (A), and 16 March 1914, *C. Schneider* 412 (A); Beyendjing, in silvis Tieso, July 1917, *S. Ten* 272 (W); in silvis Pay kou la (Kuti) prope Beyendjing, 16 Feb. 1919, *S. Ten* 303 (holo. of *O. rehderianus* var. *tenianus*, W), and Pay kou, Kou ty, 16 Feb. 1918, *S. Ten* 481 (A, E, US); Ni Kou (Pe tsao liu), 28 June 1917, *S. Ten* 399 (A, E); Pin-chuan Hsien, 2800 m., in ravine, 20 July 1933, *H. T. Tsai* 53688 (A).

SZECHUAN. Mountains around Muli, lat. 28° 12′ N., 2750 m., in open thickets by stream, Sept. 1918, *G. Forrest* 17056 (A, E, K).

CULTIVATED. Trewithen, Cornwall, 20 March 1936, *G. H. Johnstone* s.n. (K); Arnold Arboretum, 23 Sept. 1927, *A. Rehder* s.n. (A).

The affinities of this species lie on the one hand with *O. fragrans* and on the other with *O. serrulatus*. From the former it may be distinguished by the larger dentation of the leaves which are also more clearly reticulate and possess 10–12 primary veins per side, and by the larger flowers. From the latter it differs in the completely glabrous petiole, even in young leaves, and in the generally larger dimensions of the leaf, which are usually broadest below the middle and not above.

Quite a good herbarium character of this species, not given in the description above, is the distinctive light colour assumed by the leaves on drying, generally with a yellowish venation.

It is unfortunate that the name of this species, which has become fairly well known in gardens, at least in Britain, should have to be changed but the plant which Franchet described as *Pittosporum yunnanense* in 1886 is undoubtedly the same as that which Rehder described some 37 years later. It is all the more surprising therefore that Rehder did not recognise his own species when in 1930, seven years after describing *O. forrestii*, he saw Franchet's type in the Paris Herbarium, realized it was not a *Pittosporum*, and named it *O. fragrans* (Journ. Arn. Arb. xii, 76: 1931). However, although George Forrest had collected numerous gatherings of this species, Rehder apparently saw only one at the time of his description of *O. forrestii* in 1923, the first flowering material collected (*Forrest* 15547, 16662, 16827 and 21367 are all fruiting specimens and were already collected at that time, but in his diagnosis he says "fructus non visus"). Furthermore it is possible that he had still not seen and become familiar with this range of material by the summer of 1930, and that the isotype specimen of *O. forrestii* had not yet reached Paris and been available there for comparison by Rehder.

In his Symbolae Sinicae (vii, 1006: 1936) Handel-Mazzetti described a new species, *O. rehderianus*, and stated that it differed from *O. forrestii* in the possession of entire leaves and especially in the longer filaments. Neither of these differences are of any value however. As with most, if not all, species in Sect. *Osmanthus*, immature shoots have dentate or serrate leaves, whilst on fully mature shoots they are entire, and whether a particular specimen has dentate or entire leaves depends entirely on the maturity of the branch from which it was taken. Some collections even show a range from one condition to the other on the same branch. The filament length, stressed by Handel-Mazzetti, is no more reliable, for although Rehder admittedly described *O. forrestii* as having "filamentis brevissimis" it is only in the bud or when the flower is just opening that they are very short. In the fully open flower they elongate to 2 mm. or more as may be seen in one or two of the flowers on the type specimen, whilst, conversely, a few undeveloped flowers on the type of *O. rehderianus* possess a very short filament.

Also in Symbolae Sinicae (l.c.) Handel-Mazzetti describes *O. forrestii* var. *brevipedicellatus*, characterized by its subsessile flowers. However, with the greater range of material now available for examination it is apparent that while many specimens generally have a long pedicel others have a short one, so short indeed that the flowers only just protrude beyond the enveloping basal bracts, and have the appearance of being subsessile. Intermediate conditions also occur (e.g. *Ten* 481) and in view

of this it is felt that the retention of the variety is unjustified. Furthermore it is not known what length these short pedicels attain when in fruit, and it is possible that some of the relatively short pedicelled fruiting specimens examined, possess flowers which are subsessile.

Handel-Mazzetti at the same time described var. *tenianus* of *O. rehderianus* and stated that it was a variety analogous with *O. forrestii* var. *brevipedicellatus*; and in the same way that this variety is an artificial segregate, so is var. *tenianus*. The only distinction of possible importance given by Handel-Mazzetti is the length of the corolla lobes (5–7 mm.) but occasional flowers of other typical specimens of *O. yunnanensis* exhibit lobes which are just as long.

Pollen grains from ten different collections have been measured and apart from one exception they all fall into a compact group possessing a pollen grain diameter of between 21·8 and 24·0μ. *Feng* 708, however, has an average diameter of 28·7μ although in general appearance it is no different from the other collections. It is significant that a size difference of this order is the kind that would be expected between two plants of a polyploid pair (Green in Trans. Bot. Soc. Edin. xxxvi, 289: 1955), and, as *Feng* 708 does not appear to differ from the other specimens examined, it is perhaps possible that it has been collected from an autotetraploid inhabiting the same geographical area as the diploid.

11. **Osmanthus serrulatus** Rehder in Sargent in Publ. Arn. Arb. iv ("Plantae Wilson."), ii, 610 (1916); Bean, Trees and Shrubs, ed. 1, iii, 262 (1933) et ed. 7, ii, 381 (1951); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930) (sphalm. *O. serratus*); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 790 (1940); Bailey & Bailey, Hortus Second, 523 (1941); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

Evergreen *shrub* or small *tree* to 12 m. high, young shoots glabrous or very minutely puberulous when young. *Leaves* glabrous, sometimes with midrib minutely puberulous above when young, *minutely punctate but the dots not usually raised*; *petiole glabrous or occasionally minutely puberulous in the grooved upper surface* *(5–)8–12(–17) mm. long* (5–8 mm. in the type); lamina thickish to coriaceous, *oblanceolate or narrow obovate* to narrowly elliptic or elliptic, *(6–)8–13(–15) cm. long* (6–9 cm. in the type) by (1·5)2·5–4(–5) cm. broad (1·5–3 cm. in the type); margin slightly thickened, *entire or with numerous small teeth 1 mm. with up to 29–35 per side* (Fig. 1c), if few teeth then confined to upper half; apex acuminate, *tip acute sharp*; base angustate to subcuneate, slightly decurrent into the petiole; venation reticulate on both surfaces, especially so above, *10–12 primary veins per side*. *Inflorescence* axillary, fasciculate, one (rarely two) buds per axil with 4–9 flowers per bud; pedicel (7–)10–12 mm. long glabrous; *basal connate bracts glabrous* ciliolate, 2–3 mm. long, blunt or slightly cuspidate. *Flowers* white, fragrant (fide Wilson). *Calyx* about 1 mm. long with 4 irregular erose teeth. *Corolla tube 1 mm. long* and slightly more, *lobes* 4, rounded, *4 mm. long*. *Stamens* 2, filaments 1·5–2 mm. long, attached at the top of the corolla tube; *anthers 2·5 mm. long*, twice as long as broad with a very small acute terminal appendage; range of average dimensions of pollen grains measured, 21–21·6μ with a range of extremes of 20–24μ. *Ovary* about 2·5 mm. long including style about

1 mm. long and a slightly bilobed capitate stigma. *Drupe* blue-black ellipsoidal 10–15 mm. long by 6–8 mm. broad, endocarp thin.

SZECHUAN. Omei-hsien, Mt. Omei, 8 Nov. 1946, *W. K. Hu* 8362 (E), and 800–1300 m., Oct. 1937, *Y. S. Liu* 1752 (A); Mupin, thickets, 1500–1800 m., Oct. 1910, *E. H. Wilson* 4216 (holo. A, iso. K); O-pien Hsien, among woods, 2500 m., 5 May 1932, *T. T. Yü* 644 (A), and among bushes, 2600 m., 6 May 1932, *T. T. Yü* 655 (A); without locality, woods, May 1904, *E. H. Wilson* 4079 (A, BM, K) and 4079a (A, BM, K).

KWANGSI. Shuen-yuen, under woods, 22 May 1936, *Z. S. Chung* (*T. S. Tsoong*) 81681 (A).

CULTIVATED. Arnold Arboretum, 25 Sept. 1915, from *Wilson* 7349 (=4216) (A).

O. serrulatus is probably most nearly related to *O. yunnanensis* but differs in possessing a leaf generally broadest above the middle, with finer forwardly directed teeth, less prominent reticulation, minute puberulence of young shoots, and in various floral details. Other differences given by Rehder when he described *O. forrestii* are, in the light of the more numerous gatherings now available for study, found to be less reliable.

Three specimens in the herbarium of the Arnold Arboretum from Kwangsi have been examined which do not exactly match any described species. Vegetatively, however, they most nearly agree with *O. serrulatus* and it is considered worth mentioning them here. They are: *C. Wang* 40020 (Yao Shan, in mixed woods, 12 Oct. 1936), *Z. S. Chung* (*T. S. Tsoong*) 83517 and 83530 (Tzu Yuen district, in woods, 4 Aug. 1937).

12. **Osmanthus henryi** P. S. Green, **sp. nov.** (Plate 15).

Arbuscula 6 m. alta, ramulis primum glabris vel parce et minute puberulis. *Folia* glabra, basi costae supra primum minute puberula; petioli (5–)8–10 mm. longi supra glabrati vel minute puberuli; laminae ellipticae vel raro leviter oblanceolatae, (4–)5–10(–12) cm. longae, (1·3–)2–3·5(–4) cm. latae, marginibus incrassatis integris vel dentibus 0·5 mm. longis utrinsecus c. 20 usque acute serratis, apicibus acute acuminatis, basibus cuneatis vel interdum angustatis, in petiolum leviter decurrentibus; venis plus minusve obscure reticulatis, venis primariis elevatis et utrinque manifestis, utrinsecus 6–8. *Inflorescentiae* axillares fasciculatae, pedicellis 3–5 mm. longis glabris. *Calyx* c. 1 mm. longus, dentibus quattuor late triangularibus. *Corollae* tubo 1 mm. longo, lobis quattuor ovatis 2·5 mm. longis. *Stamina* duo, filamentis 1 mm. longis in medio corollae tubi insertis, antheris 1·5 mm. longis appendice terminali acuta bene explicatis. *Ovarium* c. 2·5 mm. longum, stylo c. 1·5 mm. longo incluso. *Fructus* ignotus.

Small bushy evergreen *tree* to 6 m. in height, young shoots glabrous or sparsely and minutely puberulous. *Leaves* glabrous, base of midrib above minutely puberulous when young, *punctate with numerous small raised dots*; *petioles glabrate or minutely puberulous on the upper surface* (*5–)8–10 mm. long*; lamina thickish, elliptic, rarely slightly oblanceolate, (4–)5–10 (–12) cm. long by (1·3–)2–3·5(–4·5) mm. broad; margin thickened, *entire or sharply serrate*, *teeth 0·5 mm. long*, *up to about* 20 *per side* (Fig. 1D); apex acuminate, *tip sharply pointed*; base cuneate or occasionally angustate, slightly decurrent into the petiole; venation more or less

obscurely reticulate, *primary veins* raised and visible above and below, *6–8 per side*. *Inflorescence* axillary, fasciculate, one bud per axil with 4–5 flowers per bud; pedicels 3–5 mm. long, glabrous; *basal connate bracts sparsely puberulous or glabrate*, 1·5–2 mm. long, cuspidate. *Flowers* white or yellowish, fragrant. *Calyx* about 1 mm. long, with 4 broadly triangular lobes (erose in *Maire* 232). *Corolla* tube 1 mm. long, lobes 4, ovate, 2·5 mm. long. *Stamens* 2, filaments 1 mm. long, attached in the middle of the corolla tube; anthers 1·5 mm. long, one and a half times as long as broad, with a well-developed acute terminal appendage; range of average dimensions of pollen grains measured 19·4–20·1μ with a range of extremes of 18–21μ. *Ovary* about 2·5 mm. long including style about 1·5 mm. long with capitate stigma. *Fruit* unknown.

YUNNAN. Mi-lê, Mengtse, mountain forest, 1 Nov. without year, *A. Henry* 10020 (holo. K, iso. A, NY); "Brousse de Gui-mo-tong", 2400 m., June, without year, *E. E. Maire* 232 (A, K, W).

The affinities of this species appear to lie with *O. fragrans*, *O. serrulatus* and *O. insularis*. The puberulence of the base of the midrib on the upper surface of the leaf with the occasional puberulence of the young shoot and petiole serves to distinguish it from *O. fragrans* and *O. insularis*, whilst the slightly puberulous inflorescence bracts separate it from all three species. The serrate teeth on the margin of the leaves are smaller than those usually found in *O. fragrans* and those of *O. serrulatus*. These teeth also distinguish *O. henryi* from all the material of *O. insularis* that has been seen, although, according to Nakai (in Nakai & Koidzumi, Trees and Shrubs Indigenous to Japan Proper, ed. 2, i, 350: 1927) the leaves of young branches in this latter species are spinose with serrate teeth. Finally the leaves are almost constantly elliptic and details of proportions in the parts of the flower also help to separate *O. henryi* from its allies.

The largest leaves on the type specimen are much smaller than those on *Maire* 232, being only 8 cm. long, but there is no doubt that the two specimens are conspecific and the small leaves on Maire's gathering exactly match those of the type.

13. **Osmanthus insularis** Koidzumi in Bot. Mag. Tokyo, xxviii, 150 (1914); Matsumura, Ic. Pl. Koisk. ii, 63, t. 116 (1914); Wilson in Journ. Arn. Arb. i, 107 et 109 (1919); Nakai in Nakai & Koidzumi, Trees and Shrubs Indig. Jap. Proper, ed. 2, i, 350 (1927); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Hara, Enum. Sperm. Jap. i, 126 (1948).

Syn.: *Osmanthus zentaroanus* Makino in Journ. Jap. Bot. iii, 8 (1926); Nakai in Nakai & Koidzumi, Trees and Shrubs Indig. Jap. Proper, ed. 2, i, 348 et fig. (1927); Nakai in Bot. Mag. Tokyo, xliv, 17 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 940 (1931); Nakai in Bot. Mag. Tokyo, xlv, 130 (1931); Masamune in Mem. Fac. Sci. Agric. Taihoku, xi, Bot. 4 ("Fl. and Geo. Yakusima"), 368 (1934); Hara, Enum. Sperm. Jap. i, 126 (1948); Sonohara, Tawada & Amano, ed. Walker, Fl. Okinawa, 124 (1952); Ohwi, Fl. Jap. 940 (1953); Walker, Important Trees of Ryukyu Is. 274 (1954); Yamamoto in Journ. Jap. Bot. xxxi, 32 (1956).

O. hachijoensis Nakai in Nakai & Koidzumi, Trees and Shrubs Indig. Jap. Proper, ed. 2, i, 350 et fig. (1927); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Hara, Enum. Sperm. Jap. i, 124 (1948); Ohwi, Fl. Jap. 940 (1953).

Evergreen *shrub* or *tree* to 15 m. high and diameter of trunk up to 1 m. (fide Nakai), young branches glabrous. *Leaves* glabrous; petiole (5–)7–15 (–20) mm. long, glabrous; lamina thickish, *covered with small raised dots especially above*, usually elliptic but ranging from lanceolate to ovate-elliptic, (3·5–)5–8(–13) cm. long by (1·5–)2–3·5(–6·5) cm. broad; margin slightly thickened, *entire* (*spinous with serrate teeth on young trees*, fide Nakai); apex elongate acuminate or acute, rarely slightly so, *tip conspicuously acute*; base angustate, occasionally cuneate or cuneate-angustate, decurrent into the petiole; *venation* with primary veins discernible above and below, *usually more or less reticulate above*, only occasionally so below, *primary veins 7–9 per side*. *Inflorescence* axillary, fasciculate, 1(–2) buds per axil with about 4 flowers per bud; pedicels 5–10 mm. long, glabrous, basal connate bracts glabrous, about 2 mm. long, blunt. *Flowers* white, wanting in fragrance (fide Nakai). *Calyx* 1–1·5 mm. long with 4 entire teeth. *Corolla* tube 1·5–2 mm. long, lobes 4 more or less acute, 1·5–2·5 mm. long. *Stamens* 2, filaments 0·5 mm. long, attached in the upper half of the corolla tube; anthers about 1·5 mm. long, about twice as long as broad, with a fairly well developed terminal appendage; range of average dimensions of pollen grains measured, 19·6–21·6μ with a range of extremes of 18–23μ. Functional *ovary* not seen, in the male flower abortive, more or less conical about 2 mm. long. *Drupe* bluish-black and pruinose (fide Nakai), ellipsoidal or slightly obliquely so, 1·5–1·8 cm. long by 0·7–1 cm. broad (fide Nakai, 2 cm. or more in length), endocarp woody, just under 1 mm. thick.

JAPAN

BONIN ISLANDS (OGASAWARA JIMA). Chichijima, 4 May 1917, *H. Otomo* s.n. (A), 5 April 1934, *T. Tsuyama* s.n. (TI), and 15 Nov. 1935, *T. Tsuyama* s.n. (TI); Ani-jima, 0–200 m., abundant on all islands, 3 May 1917, *E. H. Wilson* 8367 (A, K).

HACHIJO ISLAND. Higashiyama, 15 June 1920, *T. Nakai* s.n. (TI, labelled as syntype of *O. hachijoensis* Nakai); Izu, 31 Oct. 1954, *J. Yokoyama, Tokyo Science Museum*, no. 1132 (E).

KIUSHU. Satsuma, 1926, *Z. Tashiro* s.n. (TI), and Sisiku, Eimura, 16 Nov. 1917, *Z. Tashiro* s.n. (TAI); Mt. Kirishima, 100–1000 m., 1917, *Z. Tashiro* s.n. (A); without locality, 22 April 1935, *Herb. Univ. Imp. Kyushuensis* 17685 (FU).

YAKUSIMA. 1 Aug. 1927, *G. Masamune* s.n. (NY).

According to Nakai in his description of *O. zentaroanus*, the leaves of young trees normally possess the serrate teeth typical of so many species of Sect. *Osmanthus*, but no specimen with such leaves has been seen in this revision. Nakai also gives the fruit size for *O. hachijoensis* as 2 cm. or more but in the material examined the longest fruits were 1·8 cm. However, it should be borne in mind that Nakai was probably describing fresh material with the drupes still covered in a thick soft mesocarp, as shown in his figure of *O. zentaroanus*, a covering which almost completely disappears on drying.

Judging from the material examined, *O. insularis* most nearly resembles *O. fragrans* but it would be advantageous to see the type of leaf serrations possessed by young plants before forming a firmer assessment of its affinities. From *O. fragrans* it can be most clearly distinguished by the very acute apex to the leaf with its relatively large and less numerous raised dots on both surfaces. The details of the flowers are different too but out of nine collections seen, only two are in flower. Most of the material is sterile and leaf characters are therefore of prime importance in identification.

The material from Chichijima in the Bonin Islands collected by H. Otomo consists of both flowering and fruiting material but the former appears somewhat abnormal. The inflorescence buds were opening at the time the gathering was made and in addition to the fact that the bracts appear remarkably foliaceous, the fascicles of flowers are raised on a common peduncle 3–10 mm. in length. Abnormal inflorescences are also exhibited by pedunculate material of *O. fragrans* on occasion, but in this case it is interesting to observe that in both the collections made by Tsuyama, also from Chichijima, there is also a small but distinct peduncle 1–2 mm. long, and in most of the fruiting material a small peduncle of about 1 mm. can be seen, although usually enclosed within the basal inflorescence bracts.

The flower colour according to Nakai is white but a golden-flowered form in the Botanic Garden of the Department of Agriculture, Kagoshima University, has been described as *O. zentaroanus* f. *aureus* Hatusima (Journ. Jap. Bot. xxix, 231: 1954) with the remark that it may possibly be indigenous to Kagoshima Prefecture. A specimen (*TSM* No. 863) collected by Hatusima on 7 Oct. 1952 from the plant cultivated at Kagoshima, has been examined in the Edinburgh Herbarium.

Actual type material of *O. insularis* and *O. zentaroanus* has not been examined but it is unlikely that more than one species occurs in the Bonin Islands and as the material from there labelled *O. insularis* fits the descriptions of Koidzumi and Matsumura, it is felt to be sufficiently authentic. In the case of *O. zentaroanus*, it is understood that the holotype is probably in Makino's private herbarium, but it is possible that one or other of the collections made by Zentaro Tashiro in 1917 and cited above may be isotypic; but in any case the material is almost certainly correctly identified.

Relatively little material of this species exists in herbaria, at least from other localities than Kyushu, and it is perhaps because of this that the plants from Hachijo-jima and the Bonins have been described and maintained as separate taxa. Examination of the sheets cited above, however, leaves no doubt that they all belong to the same species. The Bonin Islands are situated some 600 miles from Japan itself and about 450 miles from Hachijo-jima but, to quote from Wilson, who visited the islands in 1917 (Journ. Arn. Arb. i, 104: 1919), "the flora is in all its essential characters an outpost of the Chino-Malayan flora," and a number of Japanese species are found growing there, for example, *Ligustrum japonicum*, "which is very plentiful and differs in no way from specimens collected in Japan and Liukius" (Wilson l.c., 108).

In addition to the localities from which material has been seen, this species, as *O. zentaroanus*, is recorded from the Korean Archipelago at Port Hamilton, or Kyobuntô, on Nishijima (Nakai in Bot. Mag. Tokyo, xlv, 130: 1931 where he lists his herbarium No. 12033). It is also recorded from the Ryukyu Islands. Walker (Important Trees of the Ryukyu Islands, 275: 1954) gives the following localities where it is said to be a small evergreen tree in the forests; Amami Oshima in the northern group (Amami Gunto), and Kunigami, the northern part of Okinawa in the central group (Okinawa Gunto). Finally, it is also recorded, as *O. zentaroanus*, from Ehime Prefecture, Sikoku, Japan by S. Yamamoto (Journ. Jap. Bot. xxxi, 32: 1956).

14. **Osmanthus fordii** Hemsl. in Journ. Linn. Soc. Lond. xxvi, 89 (1889); Dunn & Tutcher in Kew Bull. Addn. Ser. x ("Fl. Kwangtung and Hongkong"), 166 (1912); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930).

Small *shrub*, shoots glabrous. *Leaves* glabrous, coriaceous, *distinctly punctate but dots not raised*; *petioles glabrous* 6–8(–10) mm. long; *lamina* thickish *broadly elliptic* (in the type) *to ovate or lanceolate*, *(3–)3·5–6 cm. long* by (1·5–)2–3(–3·5) cm. broad; margin slightly thickened, *entire*; apex blunt (in the type) or acute, occasionally subacuminate, with a small apiculum except where it has been lost; base cuneate to blunt, very slightly decurrent into the petiole; venation with the primary veins clear above and below and sometimes more or less reticulate, *(4–)5–6 primary veins per side*. *Inflorescence* axillary, fasciculate, dense, 1(–2) buds per axil with about 6 flowers per bud, pedicels 1·5–4 mm. long, basal connate bracts, 2 mm. long glabrous, cuspidate. *Flowers* cream-coloured (fide Dunn & Tutcher). *Calyx* 0·5 mm. long obscurely 4-toothed, erose, margin distinctly lighter in colour than the base. *Corolla* somewhat fleshy, tube 1·5 mm. long or slightly less, lobes 4, 1·5–2 mm. long or less, acute. *Stamens* 2, *subsessile*, attached about the middle of the corolla tube; anthers about 1 mm. long, as broad as long, with a very small blunt terminal appendage; average dimensions of pollen grains measured, 18μ, with a range of extremes of 17–19μ. Functional *ovary* not seen, in the male flower abortive, more or less conical, about 1 mm. long, *Fruit* unknown.

KWANGTUNG. Lienchow River, August 1887, *C. Ford* 116 (holo. K); North River region, on top of Hau T'ung Mountain, 16 July 1924, *K. P. To*, *W. T. Ts'ang & U. K. Ts'ang* (*Canton Christian College* 12910) (BM, E, P, US).

The type material of this species has very distinct broadly elliptic leaves with a blunt apex, and no other material has been seen which exactly matches it in leaf shape, but the other collection cited above, which had previously been determined as "*cf. O. fordii*", does possess an occasional leaf with these characters. The majority, however, are ovate or lanceolate and it is believed that Ford's specimen, although the nomenclatural type, is somewhat atypical of the species, perhaps due for some reason or another to stunted growth. Nevertheless there are only these two collections on which to base a judgment.

In the herbarium of the Arnold Arboretum is a sterile specimen from Hainan (Bo-ting, shrub in thicket, 24 Oct. 1936, *S. K. Lau* 28090) similar in some respects to *O. fordii*. The leaves are small and elliptic with generally 5 or 6 primary veins and although the apex of some of them is acute or subacuminate one or two are distinctly acuminate. Moreover the texture is much thicker and the reticulation recalls that of *O. heterophyllus* var. *bibracteatus*, whilst the petiole is up to 15 mm. and thus much longer. However, with so little material of *O. fordii* available and with no other collections exactly matching it, it is impossible to name this Hainan specimen.

15. **Osmanthus hainanensis** P. S. Green, **sp. nov.** (Plate 16).

Frutex vel arbor 6 m. alta. Folia glabra, petiolis 1·5–2 cm. longis glabris; laminae crassae coriaceae ellipticae vel leviter oblanceolatae, 7–11 cm. longae, 2·5–4·5 cm. latae, marginibus integris paulo incrassatis, apicibus subacuminatis acumine obtuso, basibus angustato-cuneatis vel acutis in petiolum decurrentibus; venis elevatis utrinque plus minusve manifestis, venis principalibus utrinsecus 7–8(–9). *Inflorescentiae* axillares fasciculatae, floribus cuique gemmae 4–5, pedicellis 5–10 mm. longis glabris. *Calyx* c. 1 mm. longus dentibus quattor brevibus plus minusve erosis. *Corolla* tubo 2·5 cm. longo, lobis quattuor 3 mm. longis. *Stamina* duo, filamentis paulo plus quam 1 mm. longis in parte inferiore corollae tubi annectis, antheris fere 2 mm. longis appendice minima et obtusa. *Ovarium* et *fructus* ignotus.

Evergreen *tree* 6 m. high, diameter 10 cm. bark grey, young shoots glabrous. *Leaves* glabrous, *surface covered with small raised dots especially above*; *petiole glabrous* 1·5–2 cm. long; lamina deep green, thick coriaceous, elliptic to slightly oblanceolate, 7–11 cm. long by 2·5–4·5 cm. broad; margin slightly thickened, entire; apex subacuminate, tip blunt; base angustate-cuneate to acute, decurrent into the petiole; *venation raised, more or less clear above and below, 7–8(–9) primary ribs per side. Inflorescence* axillary, fasciculate, 1 bud per axil with 4–5 flowers per bud, pedicel 5–10 mm. long, glabrous, basal connate bracts glabrous, 2–3 mm. long, slightly cuspidate. *Flowers* white, fragrant. *Calyx* about 1 mm. long with 4 shallow slightly erose teeth. *Corolla* open campanulate, *tube 2·5 mm. long*, *lobes* 4, rounded ovate, 3 *mm. long*. *Stamens* 2, filament just over 1 mm. long, attached in the lower half of the corolla tube; *anthers just under 2 mm. long*, two-thirds as broad as long, with a very small blunt terminal appendage, average diameter of pollen measured 25·6μ with a range of extremes of 24–27μ. *Ovary* in the male flower abortive, conical, about 3 mm. long, functional ovary and fruit not seen.

HAINAN. Ng Chi Ling, Fan Yah, 1800 m., in forest at top of mountain, 28 Oct. 1932, *N. K. Chun & C. L. Tso* 44193 (holo. NY, iso. A, K, US).

The description of this species is based on a specimen which, although previously determined as *Osmanthus fragrans* and as *Ilex lancilimba* Merrill, is clearly neither. However, it does bear some resemblance to *O. yunnanensis* and to *O. serrulatus* from Yunnan, Szechuan and Kwangsi. In *O. yunnanensis* the leaf is characteristically lanceolate, much more reticulate both above and below, and possesses 10–12 primary ribs per

side, whilst in *O. serrulatus*, the leaf below is much smoother and the venation more obscure. The flowers too, whilst approximately the same size and relatively large for the genus, are different in detail; in *O. hainanensis* the corolla tube and lobes are approximately equal and in the other species the lobes are twice as long as the tube or more. In these species the stamens are also larger and attached at the top of the tube, not in the lower half. Finally the areas of distribution are quite distinct.

16. **Osmanthus × fortunei** Carrière in Rev. Hort. xiii, 67 et fig. (1864) et Production et Fixation des Var. Vég. 51 (1865); Stapf in Kew Bull. 1911, 177 et fig.; Schneider, Ill. Handb. Laubh. ii, 791 (1911); Silva Tarouca, Unsere Freiland-Laubgehölze, ed. 1, 275 (1913) et cum Schneider, ed. 3, 244 (1930); Bean, Trees and Shrubs, ed. 1, ii, 112 (1914) et ed. 7, ii, 380 (1951); Bailey, Stand. Cycl. Hort. iv, 2412 (1916); Nakai, Trees and Shrubs Indig. Jap. Proper, ed. 1, i, 266 et fig. (1922) et cum Koidzumi ed. 2, i, 355 et fig. (1927); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927) et ed. 2, 789 (1940); Koidzumi in Bot. Mag. Tokyo, xl, 336 (1926); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931); Terasaki, Nippon Shokubutsu Zufu (Jap. Bot. Ill. Album), 1518 (1933); Cocker in Gard. Chron. Ser. 3, cvii, 101 et fig. (1940); Bailey & Bailey, Hortus Second, 523 (1941); Makino, Ill. Fl. Jap. 1074 et fig. (1948); Hara, Enum. Sperm. Jap. i, 124 (1948); Bean in Chittenden, Dict. Gard. iii, 1452 (1951); Ohwi, Fl. Jap. 940 (1953); Schmid in Schröter, Fl. des Südens, ed. 2, 136 et t. 91 fig. 2 (1956).

Syn.: *Olea japonica* Siebold, nom. nud. in Verh. Batav. Gen. xii ("Synop. Pl. Oecon. Jap."), 36 (1830), in Jaarb. Kon. Ned. Maatschap. 1844–45, 34, et in Siebold et Zuccarini in Abh. Akad. Münch. iv, iii, ("Fl. Jap. Fam. Nat.") 187 (1846); Hasskarl, Cat. Hort. Bog. Alt. 118 (1844).

Osmanthus fortunei var. *cordifolius* Carr. in Rev. Hort. xiii, 71 (1864).

O. fortunei var. *ovatus* Hort. ex Carr., Production et Fixation des Var. Vég. 51 (1865).

O. ilicifolius var. *latifolius* Hort. ex Mouillefert, Traité Arbres et Arbrisseaux, ii, 982 (1896).

O. latifolius Hort. ex Mouillef., l.c. pro synon.

O. aquifolium var. *ilicifolius latifolius* Hort. ex Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896), nom. nud.

O. japonicus Sieb. ex Makino in Bot. Mag. Tokyo, xvi, 31 (1902).

O. aquifolium var. *japonicus* (Sieb. ex Makino) Makino in Bot. Mag. Tokyo, xxiii, 14 (1909); Matsumura, Index Pl. Jap. ii, 495 (1912).

Evergreen *shrub*, young shoots minutely puberulous. *Leaves* glabrous but with base of midrib minutely puberulous above, *surface generally covered with minute raised dots, sometimes closely so*; *petiole minutely puberulous at least when young* (5–)7–10(–12) mm. long; lamina thick coriaceous, broadly elliptic, *(4·5–)5–7(–9) cm. long by (2–)3–4(–4·5) cm. broad* (Fig. 1E); *margin* thickened, *subentire to regularly sharp serrate toothed with up to 10–12 teeth per side up to 4 mm. long*; apex acuminate

or subacuminate with spinescent tip; base subacute or blunt, very slightly decurrent into the petiole; venation slightly raised and more or less reticulate above and below, especially clear above, *6–8 primary veins per side*. *Inflorescence* axillary, fasciculate, 1(–2) buds per axil with about 6 flowers per bud; pedicels 5–10 mm. long, glabrous; basal connate bracts 2–3 mm. long, very minutely puberulous or glabrous, more or less cuspidate. *Flowers* white, fragrant. *Calyx* about 1 mm. long with 4 slightly erose teeth. *Corolla* tube 1·5–2 mm. long, *lobes* four, *4–5 mm. long*. *Stamens* 2, filaments 1·5 mm. long in the open flower, attached almost at the top of the corolla tube; anthers 1–1·25 mm. long, about as long as broad, with a small terminal appendage, range of average dimensions of pollen grains measured, 18·3–18·8μ with a range of extremes of 18–20μ. Only known in the male state with a more or less conical abortive ovary about 1 mm. long. Chromosome number (fide Sugiura): 2n=44.

JAPAN. Tokyo, 1882, *ex Herb. K. Miyabe* s.n. (A), Oct. 1908, *ex Herb. Yokohama Nursery* s.n. (E), and 20 June 1946, *Terakawa* 173 (US); without locality and date, *H. Bürger* s.n. (L) and *Siebold* s.n. (L).

FORMOSA. Suigenti, Taihoku City, 28 May 1929, *S. S. Suzuki* s.n. (TAI).

BRITAIN. Hort. Veitch, *ex Herb. Hookeriana* 1867 (K); Hort. Kew, 24 March 1880, *G. Nicholson* 262 (A).

FRANCE. La Mauleirie, Angers, 13 Nov. 1876, ex Herb. *E. Gadeceau* 4544 *pro parte* (BM).

SWITZERLAND. Locarno, Park des Grand Hôtels, 27 April 1905, *C. Baenitz* s.n. (A, E, L).

ITALY. Hort. Bot. Pisa, no. 2346, 7 April 1876, *J. Caruel* s.n. (FI); La Mortola, without date and collector (K).

U.S.A. South Carolina: Court Inn garden, Camden, 30 Dec. 1927, *Susan D. McKelvey* s.n. (A).

This plant, known only in cultivation, has been grown in Japan for a very considerable time. It is almost certainly the hybrid between *O. fragrans* and *O. heterophyllus*, for in all characters it appears to be intermediate between these two species, although as far as is known no attempt has been made at resynthesis by recrossing the two species. The probability of its hybrid origin is further borne out by the Japanese name of *Hiragi-mokusei*, a combination of *Hiragi*, the name for *O. heterophyllus*, and *Mokusei* that for *O. fragrans*. The fact that it is only known in the male state with an abortive ovary might also be thought to support the idea of hybridity but this condition is more likely to be due to the fact that all the plants are ramets of the one original clone, which happens to possess male and not hermaphrodite flowers, both conditions being common in this androdioecious section of the genus. The pollen grains on examination appear normal and fully developed and it seems possible that the plant is fully male fertile. The chromosome numbers of *O. heterophyllus* and *O. fragrans* are the same: 2n=46 (Taylor in Brittonia, v, 347: 1945) and although the chromosome number of *O.* × *fortunei* is said to be 2n=44 by Sugiura (Bot. Mag. Tokyo, xlv, 354: 1931) it is possible that this may be an error, for all the other recorded somatic numbers in the *Oleineae* are 2n=46, except for a single hexaploid (Taylor, l.c.) and some varieties of the much cultivated genus *Syringa*.

From the time of its introduction until early in the present century, considerable confusion existed over its differentiation from *O. heterophyllus* (*O. ilicifolius*), despite the fact that Carrière distinguished the two soon after their introduction and bestowed the name *O. fortunei* on this plant. However, the name and the distinctions were overlooked until 1911 when Stapf (Kew Bull. 1911, 177) published a comprehensive account of the plants and names concerned. For a long time *O.×fortunei* had been known as *O. aquifolium*, as witness the following references to it under this name: Anon. in Gard. Chron. Ser. 2, vi, 689 and fig. (1876) and, vii, 239 and fig. (1877); Regel in Gartenflora, xxviii, 276 and fig. (1879); Nicholson, Ill. Dict. Gard. ii, 529 (1884–1888); Hemsley in Journ. Linn. Soc. Lond. xxvi, 87 (1889); Entleutner, Immergr. Ziergehölze, S. Tirol, 114 (1891); Dippel, Handb. Laubh. i, 140 and fig. (1891); Bean in Garden, l, 86 (1896) and Bailey, Cycl. Amer. Hort. iii, 1177 (1901). It is interesting to note that although Stapf finally elucidated the matter and Carrière had already made the botanical distinction, to judge from the quotation by Siebold of the name *Hiraki-mok'sen* in his *Synopsis plantarum oeconomicarum universi regni Japonici* (p. 36) in 1830, the two plants had always been distinguished in Japan. Makino (Bot. Mag. Tokyo, xvi, 31: 1902) applied the epithet of Siebold's *nomen nudum*, *Olea japonica*, to *Osmanthus×fortunei* with a full description of the plant as an *Osmanthus*, and when seven years later he reduced it to the rank of variety (Bot. Mag. Tokyo, xxiii, 14: 1909) he cited Dippel's figure (Handb. Laubh. i, 140: 1891) showing without doubt that the same plant was intended.

In addition to the confusion over the use of *O. aquifolium* for both *O.×fortunei* and *O. heterophyllus*, the name *Olea japonica* appears to have been used for both plants as well, for, on the strength of a determination on an herbarium sheet, Miquel gives *O. japonica* as a synonym of *O. aquifolium* f. *cuneata* (Ann. Mus. Bot. Lugd.-Bat. ii, 264: 1866). Similarly, to judge from the names on the specimens in the Leiden Herbarium, the *nomen nudum*, *Ilex odora* Siebold, has also been applied to both plants and one comes to the conclusion that Siebold himself was uncertain of their differentiation.

According to Siebold (Annuaire de la Société royale pour l'encouragement de l'horticulture dans les Pays-bas (Jaarb. Kon. Ned. Maatschap.), 1844 and 1845, 34), *O.×fortunei* was introduced into Holland by J. E. Teijsman in 1843. At this time Teijsman was Curator of the Buitenzorg Botanic Gardens so it would appear that the plant was introduced via Java. It is known that *O. heterophyllus* was grown there, having probably been sent from Japan by Siebold, but there is no direct record of *O.×fortunei* in Java. However, when one considers the confusion that has existed over the two plants this is perhaps not surprising.

In Britain according to Bean (Trees and Shrubs, ed. 7, ii, 381: 1951) *O.×fortunei* was introduced both by Thomas Lobb in 1856 and Robert Fortune in 1862. However, it is doubtful if Lobb did in fact introduce the plant, for, according to the Hortus Veitchii (404: 1906), Lobb only brought in *O. aquifolium* var. *ilicifolius*, which at that time was the recognized name for *O. heterophyllus*, *O.×fortunei* being known as

O. aquifolium. That Fortune introduced the plant is certain, for it was on a plant from Fortune that Carrière based his name and description.

It would seem that a form with a white border to the leaves has been in cultivation, but whether it is still to be found in gardens I do not know. It is referred to under the phrase names *Osmanthus latifolius* var. *foliis marginatis* by Lavallée (Arb. Segrez. 170: 1877) and *Osmanthus ilicifolius* var. *latifolius* subvar. *foliis marginatis* by Mouillefert (Traité des Arbres et Abrisseaux, 1892–98, pt. 2, 982). It is possibly this form which is called *Osmanthus ilicifolius* var. *latifolius marginatus* by Bean (Garden, l, 87: 1896) and *O. aquifolium* var. *ilicifolius latifolius variegatus* by Nicholson (Kew Handlist Trees and Shrubs, ii, 89: 1896).

17. **Osmanthus heterophyllus** (G. Don) P. S. Green, **comb. nov.**

var. **heterophyllus.**

Syn.: "*Ilex aquifolium*" sec. Thunb., Fl. Jap. 79 (1784) non Linn.

I. heterophylla G. Don, Gen. Syst. ii, 17 (1832).

Olea ilicifolia Hassk., Cat. Hort. Bog. Alt. 118 (1844); Entleutner, Immergr. Ziergehölze S. Tirol, 114 (1891).

Olea aquifolium Siebold & Zuccarini in Abh. Akad. Muench. iv, iii (Fl. Jap. Fam. Nat.) 166 (1846); Miquel in Ann. Mus. Bot. Lugd.-Bat. ii, 264 (1866), et in Cat. Mus. Bot. Lugd.-Bat. 57 (1870); Koch, Dendrologie, ii, I, 277 (1872); Franchet & Savatier, Enum. Pl. Jap. i, 312 (1875); Anon., Useful Pl. Jap. ii, t. 551 (1895).

Osmanthus aquifolium Sieb. in Sieb. & Zucc., Abh. Akad. Muench. iv, iii (Fl. Jap. Fam. Nat.) 166 (1846) pro syn.; Lavallée, Arb. Segrez. 169 (1877); Anon. in Gard. Chron. Ser. 3, ii, 379 et fig. (1887); Sargent, Forest Flora of Japan, 52 (1894) et Silva of N. America, vi, 63 (1894); Matsumura in Bot. Mag. Tokyo, xii, 15 (1898); Shirasawa, Ic. Ess. Forest. Jap. i, t. 82 (1900); Bailey, Cycl. Amer. Hort. iii, 1177 (1901); Apgar, Ornam. Shrubs U.S. 281 et fig. (1910); Stapf in Kew Bull. 1911, 177: Hayata in Journ. Coll. Sci. Tokyo, xxx, art. i ("Materials Fl. Formosa") 191 (1911); Schneider, Ill. Handb. Laubh. ii, 789 et figs. (1911); Matsumura, Ind. Pl. Jap. ii, 2, 495 (1912); Hickel in Bull. Soc. Dendr. France, xxviii, 108 et fig. (1913); Silva Tarouca, Unsere Freiland-Laubgehölze, ed. 1, 275 (1913) et cum Schneider, ed. 3, 244 (1931); Bean, Trees and Shrubs, ed. 1, ii, 110 (1914) et ed. 7, ii, 378 (1951); Bailey, Stand. Cycl. Hort. iv, 2412 (1916); Kanehira, Formosan Trees, 367 (1917); Trelease, Winter Bot. ed. 1, 315 (1918) et ed. 2, 317 (1925); Makino, Ill. Fl. Jap. 899 et fig. (1924); Koidzumi in Acta Phytotax. et Geobot, viii, 53 (1939).

Osmanthus aquifolium Hort. ex Koch in Belg. Hort. xii, 112 (1862) nom nud., et Dendrologie, ii, I, 278 (1872) pro syn.

Ilex odora Sieb. ex Miquel in Ann. Mus. Bot. Lugd.–Bat. ii, 264 (1866) pro syn.

Olea aquifolium f. *subintegra* Miq. in l.c.

O. aquifolium var. *subintegra* (Miq.) Miq., Cat. Mus. Lugd.-Bat. 57 (1870).

Osmanthus heterophyllus Hort. ex Koch, Dendrologie, ii, I, 278 (1872) pro syn.

Olea aquifolium var. *ilicifolia* Hort. ex Dippel, Handb. Laubh. i, 141 et fig. (1889); Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896); Bailey, Cycl. Amer. Hort. iii, 1177 (1901); Silva Tarouca, Unsere Freiland-Laubgehölze, ed. 1, 272 et fig. (1913) et cum Schneider, ed. 3, 244 et fig. (1931); Schneider, Ill. Handb. Laubh. ii, 789 et fig. (1911).

Osmanthus ilicifolius (Hassk.) Hort. ex Carrière in Rev. Hort. lvii, 546 (1885), Anon. in Gard. Chron. ser. 2, vii, 239 et fig. (1877); Nicholson, Dict. Gard. ii, 529 (1884–88); Mouillefert, Traité Arbres et Arbrisseaux, ii, 982 (1896); Bean in Garden, l, 86 (1896); Nakai, Trees and Shrubs Indig. Jap. Proper, ed. 1, i, 268 et fig. (1922), et cum Koidzumi, ed. 2, i, 356 (1927); Rehder in Journ. Arn. Arb. v, 240 (1924) et Man. Cult. Trees and Shrubs, ed. 1, 758 (1927) et ed. 2, 789 (1940); Sasaki, List of Plants of Formosa, 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Terasaki, Nippon Shokubutsu Zufu (Jap. Bot. Ill. Album), 1519 (1933); Masamune in Mem. Fac. Sci. Agric. Taihoku, xi, Bot. 4 ("Fl. and Geo. Yakusima") 368 (1934); Schneider in Gartenschönheit, xx, 52 et fig. (1939); Mori in Journ. Jap. Bot. xv, 550 et fig. (1939); Bailey & Bailey, Hortus Second, 523 (1941); Makino, Ill. Fl. Jap., ed. 2, 219 et fig. (1948); Hara, Enum. Sperm. Jap. i, 125 (1948); Bean in Chittenden, Dict. Gard. iii, 1452 (1951); Ohwi, Fl. Jap. 940 (1953).

Osmanthus diversifolius Hort. ex Mouillefert, Traité Arb. et Arbriss. ii, 982 (1896), pro syn.

O. aquifolium f. *subangulatus* Makino in Bot. Mag. Tokyo, xxiii, 14 (1909); Matsumura, Index Pl. Jap. ii, 2, 495 (1912).

O. sp. Hayata in Journ. Coll. Sci. Tokyo, xxv, art. 19 (Fl. Mont. Formos.): 161 (1908).

O. integrifolius Hayata in Journ. Coll. Sci. Tokyo, xxx, art. 1 ("Mater. Fl. Formos."), 191 (1911); Kawakami, List Pl. Formos. 69 (1910); Matsumura, Ind. Pl. Jap. ii, 2, 496 (1912); Hayata, Ic. Pl. Formos. v, 125 et fig. (1915); Kanehira, Formos. Trees, ed. 1, 368 et fig. (1917), et ed. 2, 620 et fig. (1936); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931).

O. ilicifolius var. *subangulatus* (Makino) Makino in Journ. Jap. Bot. vii, (5), 14 (1931); Hara, Enum. Sperm. Jap. i, 126 (1948).

O. ilicifolius var. *undulatifolius* Makino in l.c.; Hara, l.c.

O. ilicifolius f. *subangulatus* (Makino) Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931).

Evergreen *shrub* or small *tree*, 1–8 m. high, bark smooth, pale, branches when young puberulous. *Leaves* glabrous with midrib puberulous above especially at the base, *surface generally punctate with the dots often raised above*; *petiole puberulous at least when young*, (4–)6–8(–14) mm. long; lamina thick coriaceous, glabrous, ovate to elliptic or rarely obovate, *(3–)4–6(–7) cm. long by (1–)1·5–2·5(–3) cm. broad* (not including spines), margin thickened, *entire or armed with up to 3–4(–5) large strong spiny teeth per side*, *(3–)5–8(–11) mm. long* (Fig. 1F); apex acute usually with an armed point; base cuneate slightly decurrent into the petiole: venation reticulate more or less visible above and below (sometimes obscure or wanting below), *(4–)6(–7) primary ribs per side*. *Inflorescence* axillary,

fasciculate, 1 or 2 buds per axil with 6–8 flowers per bud, pedicels (3–)5–6(–8) mm. long, glabrous or rarely slightly puberulous (*Kanehira & Sasaki* 21786 and *Simada* 826), basal connate bracts 2–3 mm. long with a slight puberulence towards the apex, or rarely puberulous. *Flowers* pure white, fragrant. *Calyx* 1–1·5 mm. long with 4 somewhat irregular teeth which are often slightly erose. *Corolla* tube 1–1·5 mm. long, lobes 4, *2·5–3·5 mm. long*. *Stamens* 2, *filaments 1·5–3 mm. long* attached at the centre or lower half of the corolla tube, *anthers 1·5–2·5 mm. long*, about twice as long as broad, with apical appendage, range of average dimensions of pollen measured, 19·4–23·8μ with a range of extremes of 18–25μ. *Ovary* 3 mm. long including style 2 mm. long with a slightly bilobed capitate stigma. *Drupe* about 1·5 cm. long by 1 cm. broad, dark purple, stone slightly obliquely ellipsoid, only very slightly ribbed. Chromosome number (fide Taylor): 2n=46

JAPAN

Honshu. Hiroshima-ken: West of Kobe, Onomichi, 10–11 Nov. 1893, *P. Faure* 11494 (K). Idsu-san: Atami, 12 Oct. 1907, *H. Sakurai* s.n. (E), and Sogami, 20 Oct. 1906, *K. Sakurai* s.n. (A). Kanagawa-ken: woods between Kamakura and Zushi, 12 Feb. 1929, *R. Kent Beattie & Y. Kurihara* 10443, 10445, and 10446 (A); Ooyama, 800 m., 27 Oct. 1951, *S. Suzuki* 39 (A). Yokohama: 2 July 1876, *J. Bisset* 71 (E, K), and 18 April 1880, *J. Bisset* 1510 (BM); 1862, *Maximowicz* s.n. (BM, FI, L); Sagami, Kamakura, near Yokohama, 2 Nov. 1896, *K. Wanatabe* s.n. (K). Musashi province: cultivated around base of Mitsumine-san, 3 Jan. 1914, *E. H. Wilson* 6967 (A); Gardens near Yeddo [Tokyo], Nov. 1860, *R. Fortune* s.n. (BM, K). Mino Province: Sakamoto, cultivated, 30 Oct. 1914, *E. H. Wilson* 7731 (A); without locality, 5 Nov. 1925, *K. Shiota* 3450 (A). Suruga Province: Mt. Kuno, 15 Nov. 1952, *S. Kitamura* s.n. (A). Without Province: Yokoska, 26 Nov. 1876, *J. Bisset* 1504 (BM), and 1866–74 *L. Savatier* 812 and 813 (K); Fujiyama, 21 Oct. 1890, *P. Faure* 6651 (K); "in sylva ad ripam fluvii Matsia Gawa prope pagum Saijo ins. Nippon", *J. Pierot* s.n. (L); Owar, 23 Oct. 1930, *K. Shiota* 4314 (A); Totigi-Ken, Takakudayama, Tomiyamura, Kawauti-gun, 4 May 1930, *T. Susuki* s.n. (TAI); Tiba-ken, Mt. Robusinzan, Anbogun, 16 April 1940, *T. Susuki* 21218 (TAI).

Kyu Sui. Nagasaki: 1863, *Maximowicz* s.n. (BM, K, NY), and 1862, *Oldham* 544 (holo. of *Olea aquifolium* f. *subintegra* Miq., L, iso. K) and 965 (K); "in sylvis et fruticetis clivosis circum urbem Nagasaki", *J. Pierot* s.n. (L); Nagasaki, near Kamatsugawa, cultivated, 1892, *C. S. Sargent* s.n. (A); "In vallibus montis Kawara Jama, ins Kiu Siu", *J. Pierot* s.n. (L).

Shikoku. Tosa Province, Shiraga-gama, ravines and woods, common, 600–1500 m., 19 Nov. 1914, *E. H. Wilson* 7825 (A).

Without locality and date: *ex Herb. Mohnike* (K, L); *Siebold* (L); *C. J. Textor* (L); *Thunberg* (UPS).

FORMOSA (Taiwan)

Taihoku Province: Mt. Tikusizan, Sept. 1922, *K. Kanehira & S. Sasaki* s.n. (TAI); Mt. Taiton, 27 April 1932, *S. Suzuki* s.n. (TAI), and Nov. 1936, *T. Kitamura* s.n. (TAI); Mt. Syokwannon, Tikusiko, Houkutosyo, Sitiseigun, 17 Oct. 1939, *T. Nakamura* 4011 (TAI); Mt. Koteirenzan, Sekitei, Bunzangun, 14 April 1940, *T. Nakamura* s.n. (TAI); above Sagan, hedgerows, 13 Dec. 1918, *E. H. Wilson* 11227 (A, BM, K); Mt. Nankotaizan Ratogun, 2100 m., *Y. Yamamoto* s.n. (TAI). Nanto Province: Musha to Noko, 2333–3000 m., forests, common, 6 March 1918, *E. H. Wilson* 10036 (A, BM, K). Kagi Province: Arisan to Mt. Morrison, forests, common, 25 Oct. 1918, *E. H. Wilson* 10913 (A, BM, K); Niitakayama (Mt. Morrison), 2750 m., 13 Oct. 1927, *R. Kanehira & S. Sasaki* 699 (A, FU), 17 Oct. 1906, *T. Kawakami & U. Mori* 2003 (holo. of *O. integrifolius*, TI). Tainansyu, Niitakasita to Taataka, Kagigun, 30 Oct. 1935, *H. Simada* 826 (TAI). Taityusyu, Onoue, Nokogun, 25 Aug. 1929, *S. Suzuki* 2591 (TAI). Taito, Izumo tiuzaisyo, 11 Aug. 1936, *Y. Yamamoto* 478 (TAI). Mt. Taiheizan, 5 Aug. 1928, *S. Suzuki* 260 (A).

CULTIVATED

ASIA. Java, Hort. Bogor., without date (holo. of *Ilex heterophylla* G. Don, L). China, The Lawn, Shanghai, 16 Nov. 1879, *Herb. F. B. Forbes* 2397 (BM).

EUROPE. Belgium, Ghent, cult. Van Houtte, 5 Aug. 1873, coll. *H. Zabel* s.n. (A). France, Nantes, 20 Oct. 1890, *J. Bruneau* s.n. (BM). Italy, Hort. Bot. Pisa, no. 1535, 7 April 1876, *J. Caruel* s.n. (FI). Germany, Hort. Bot. Darmstadt, Sept. 1927, *J. A. Purpus* s.n. (A). Great Britain: The Camp, Windlesham, Surrey, June 1902, *J. D. Hooker* 28443 (K); Hort. Bot. Kew, Jan. 1883, *G. Nicholson* 261 (E); Sunningdale Nurseries, Bagshot, Surrey, 15 July 1899, *H. White* s.n. (K). Holland, Hort. Acad. Lugd.-Bat., without date (L).

AMERICA. Flushing, New York, cult., 17 Nov. 1889, *Hort. Parsons* (A); Botanic Garden, Washington, D.C., 1898, *J. N. Rose* 4127 (US); Univ. of California Campus, Berkeley, Nov. 1932, *H. F. Copeland* s.n. (A, BM, K), and Adelante, The Garden of Anson and Anita Blake, Berkeley, California, 16 Nov. 1941, *N. Floy Bracelin* 1756 (E, K, L).

It is difficult, if not impossible, in the case of material from Japan to distinguish between cultivated and wild specimens. The species undoubtedly appears to be native in Japan, at least in the southern parts of the main islands, and has been recorded from Yakusima as well (G. Masamume, Mem. Fac. Sci. Agric. Taihoku Univ. xi, Bot. 4, 368: 1934). But it is equally certain that it was in cultivation before the beginning of botanical exploration. Similarly, whilst most of the Formosan material is of wild origin, some specimens have been taken from cultivated plants, perhaps introduced from Japan, and it is difficult to judge whether the native Formosan plants differ from the Japanese in any small but consistent way. Hayata, who must have known the species in Japan, described *O. integrifolius* based on Formosan material, and some of the Formosan specimens examined in this investigation, whilst not specifically distinct from the Japanese, are nevertheless somewhat different, with a tendency to larger, more entire leaves and larger flowers (e.g. *Wilson* 10913). The actual type specimen of *O. integrifolius* (*T. Kawakami & U. Mori* 2003, Mt. Morrison, 2450 m., 17 Oct. 1906) has not been examined, but by the courtesy of Dr. H. Hara of Tokyo, a photograph has been seen (now deposited in the Herbarium, Royal Botanic Garden, Edinburgh) together with a leaf from the specimen. From the photograph it appears that at least one of the leaves bears a single tooth, characteristic of *O. heterophyllus*, and judging by this and other features, specific differentiation does not appear to be warranted. Whether some of the Formosan material merits varietal or subspecific separation cannot be decided until a wider and better annotated range of wild material is available for study. However, it is worth noting in this connection that another of Hayata's Formosan species, *O. bibracteatus*, was reduced to varietal rank under the name *O. ilicifolius* by Mori (Journ. Jap. Bot. xv, 552: 1939), a reduction maintained in this revision and under which further discussion will be found. The wild Formosan material examined is certainly more variable than most of the material from Japan and the reason for this is possibly that much of the latter is from cultivated plants raised by means of vegetative propagation and therefore clonal.

O. heterophyllus was first recorded for Japan by Kaempfer (Amoen. Exot. 781: 1712) as "Kookotz, vulgo Firaggi, Aquifolium seu Agrifolium vulgo dictum" and it was no doubt on the basis of this record, using Lobel's name for holly (Stirpium Historia, 582: 1576), that Linnaeus in

his Species Plantarum (p. 125: 1753) listed Japan, when citing the distribution of *Ilex aquifolium*. In a similar way, Thunberg (Fl. Jap. 78: 1784) lists *Ilex aquifolium* L. for Japan and cites Kaempfer; two specimens from Japan exist under this name in Herb. Thunberg, in both of which the flowering stage has just passed. This confusion with *Ilex* is one of the explanations for the mixture of names that has been applied to this species. Blume, when naming material of this species in the Botanic Garden at Bogor, applied the name *I. aquifolium* var. *heterophylla*? Ait. (Bijdr. 1150: 1826), for the diagnostic possession of opposite leaves, whilst observed, was nevertheless not fully appreciated. George Don, intending to draw up a "complete enumeration and description of all plants hitherto known" (Gen. Syst. 1831–1838) distinguished the Japanese plant from the European and raised the variety considered by Blume to the rank of species and thus, from the nomenclatural point of view, established the first available epithet. It is upon this that the new combination is based, resting, for typification, upon Blume's specimen in the Leiden Herbarium.

Whilst this type was not at first recognized in the Herbarium at Leiden, where Blume's material is deposited, it is the only specimen labelled "ex horto Bogoriense" in Blume's hand with, in another unidentified hand, the name "*Ilex heterophylla*".

Because the name of this species has recently become stabilized after having been so unstable in the past, it is with great regret that yet another name has to be coined and applied in this revision, especially as the species has been known in cultivation for so long, but under the International Code of Nomenclature there is no alternative. Both the epithets *aquifolium* and *ilicifolius* have been applied, and at one time the species was confused with *O.* × *fortunei*, the hybrid between it and *O. fragrans*. In this connection it is interesting to note that whilst the identity and nomenclature of *O.* × *fortunei* was elucidated by Stapf (Kew Bull. 1911, 177), Hemsley (Journ. Linn. Soc. Lond. xxvi, 87: 1889) distinguished two morphological entities in 1889 and cited a specimen of this species in Herb. Forbes (now in the British Museum (Natural History)).

These various epithets have also been attributed to different authorities. The most recent name to be regarded as correct is *O. ilicifolius* (Hassk.) Hort. ex Mouillefert. *Ilicifolius* had been thought to be the earliest available epithet, having been used by Hasskarl in the combination *Olea ilicifolius*, based upon Blume's type. However, Mouillefert was not the first either to give a description of this species under this name or to validate it by reference to Hasskarl. The first that has come to my notice is Carrière (Rev. Hort. lvii, 546: 1885), although it is possible that other authorities may be hidden in the literature, the plant having been well known by this name in horticultural circles long before this date. This is evident from its use in the Proceedings of the Royal Horticultural Society of London, ii, 370 (1862) where a plant submitted on May 6 of that year by Mr. Standish is mentioned under the name *Osmanthus ilicifolius fol. variegatus* [sic] and, a fortnight later (o.c. 378 and 379), plants were submitted under the names *Osmanthus ilicifolius*, *O. ilicifolius* var. *variegatus*, *O. ilicifolius* var. *variegatus nanus* and *O. ilicifolius diversifolius*.

As has been stated, this species has been in cultivation in Japan for a long time. From there it was introduced into Java early in the last century, probably by Siebold, who sent living plant material to Blume at that time (Flora, xi, 2, 756: 1828). It was introduced into Britain through Thomas Lobb, the collector for Messrs. Veitch, in 1856 (Veitch, Hortus Veitchii, 404: 1906) and plants were advertised at one guinea two years later (Gard. Chron. 1858, 419). Very shortly afterwards, in 1861, it was also introduced by Robert Fortune (Gard. Chron. 1862, 240), and quite independently to Holland by Siebold between 1859 and 1861 and offered for sale by the firm of von Siebold & Co. in 1861 (Catalogue Prodrome des Plantes du Japon introduites en Hollande dans les années 1859, 1860 et 1861, von Siebold & Co. 1861, 5). It is interesting to note that a plant introduced by Fortune called *O. aquifolium variegatus nanus* was awarded a First Class Certificate by the Royal Horticultural Society of London on June 11th 1861 (Proc. R. Hort. Soc. Lond. i, 615: 1861) and another, under the name *O. ilicifolius fol. variegatus*, a Second Class Certificate on May 6th 1862. (Proc. R. Hort, Soc. Lond. ii, 370: 1862).

As with many decorative plants cultivated over a long period, variations from the typical form have arisen and been preserved by vegetative propagation. Several such forms of *O. heterophyllus* are cultivated and propagated vegetatively and have been known for a long time, some at least having originated, to judge by Fortune's introductions, in Japan. Judged from the botanical point of view, however, they do not warrant recognition in any of the categories included in the International Code of Botanical Nomenclature, and they are best treated as cultivars under the International Code of Nomenclature for Cultivated Plants. It is proposed, therefore, to treat them in this category but for completeness from the nomenclatural point of view the full synonomy is given for each cultivar.

cultivar 'Aureus'

Syn.: *Osmanthus aquifolium* var. *foliis-aureo-variegatus* Lavallée, Arb. Segrez. 169 (1877), nom. nud.

O. ilicifolius var. *aureo-variegatus* Mouillefert, Traité Arbr. et Arbrisseaux, ii, 982 (1896); Bean in Chittenden, Dict. Gard. iii, 1452 (1952).

O. ilicifolius var. *aureo-marginatus* Hort. ex Bean in Gard. l, 86 (1896); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Bailey & Bailey, Hortus Second, 523 (1941).

O. aquifolium var. *aureus* Hort. ex Bailey, Cycl. Amer. Hort. iii, 1177 (1901) nom. nud.; Schneider, Ill. Handb. Laubh. ii, 790 (1911); Rehder in Journ. Arn. Arb. v, 240 (1924).

O. aquifolium var. *aureo-marginatus* Hort. ex Bailey, Stand. Cycl. Hort. ed. 2, iv, 2412 (1917).

O. ilicifolius f. *aureus* (Hort. ex Bailey) Rehder in Journ. Arn. Arb. v, 240 (1924); Hara, Enum. Sperm. Jap. i, 125 (1948).

O. ilicifolius var. *aureus* (Hort. ex Bailey) Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927).

O. ilicifolius f. *aureo-marginatus* (Hort. ex Bean) Rehder, Bibl. Cult. Trees and Shrubs, 575 (1949).

A variant with variegated leaves margined with yellow.

cultivar 'Rotundifolius'

Syn.: *Olea aquifolium* f. *cuneata* Miquel in Ann. Mus. Bot. Lugd.-Bat. ii, 264 (1866).

Olea aquifolium var. *cuneata* (Miq.) Miq., Cat. Mus. Lugd.-Bat. 57 (1870).

Olea aquifolium var. *rotundifolia* Jaeger in Jaeger & Beissner, Ziegeh. ed. 2, 229 (1884) non vid.; Dippel, Handb. Laubh. i, 141 (1889).

O. rotundifolia Hort. ex Entleutner, Immergr. Ziergehölze S. Tirol, 115 et fig. (1891).

Osmanthus rotundifolius Hort. ex Dippel, Handb. Laubh. i, 141 (1889) in syn.; Bean in Garden, l, 87 (1896).

O. aquifolium var. *rotundifolius* Hort. ex Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896); Schneider, Ill. Handb. Laubh. ii, 790 (1912); Bean, Trees and Shrubs, ed. 1, ii, 111 (1914) et ed. 7, ii, 378 (1951); Bailey, Stand. Cycl. Hort. ed. 2, iv, 2412 (1917).

O. ilicifolius f. *rotundifolius* (Jaeger) Rehder in Journ. Arn. Arb. v, 240 (1924) et Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Hara, Enum. Sperm. Jap. i, 125 (1948).

O. ilicifolius var. *rotundifolius* (Jaeger) Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927); Bailey & Bailey, Hortus Second, 523 (1941); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

A variant with rounded more or less obovate leaves 2·5–4 cm. long, usually entire and with a wavy margin and cuneate base. A dwarf slow-growing type.

This cultivated variety was in cultivation in Japan more than a century ago and there is a specimen in the Leiden Herbarium from there (ex. Herb. Bürger, without locality and date).

cultivar 'Myrtifolius'

Syn.: *Osmanthus myrtifolius* Hort. ex Nicholson, Ill. Dict. Gard. ii, 529 (1884–1888); Bean in Garden, l, 87 et fig. (1896).

Olea aquifolium var. *myrtifolia* Hort. ex Dippel, Handb. Laubh. i, 141 (1889).

Osmanthus ilicifolius var. *myrtifolius* Hort. ex Mouillefert, Traité des Arbr. et Arbrisseaux, ii, 982 (1896); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927) et ed. 2, 789 (1940); Bailey & Bailey, Hortus Second, 523 (1941); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

O. aquifolium var. *myrtifolius* Hort. ex Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896); Bailey, Cycl. Amer. Hort. iii, 1177 (1901) et Stand. Cycl. Hort. ed. 2, iv, 2412 (1917); Schneider, Ill. Handb. Laubh. ii, 790, et fig. (1911); Bean, Trees and Shrubs, ed. 1, ii, 110 (1914) et ed. 7, ii, 378 (1951); Silva Tarouca & Schneider, Unsere Freiland-Laubgehölze, ed. 3, 244 (1931).

O. ilicifolius f. *myrtifolius* (Hort. ex Nicholson) Rehder, Bibl. Cult. Trees and Shrubs, 576 (1949).

A variant with entire elliptic to elliptic-oblong leaves 2·5–4.5 cm. long, unarmed except for a spine-tipped acute or acuminate apex.

A dwarf-growing type of a more spreading habit than the others. According to Bean (Trees and Shrubs, ed. 7, ii, 378: 1951 and earlier editions) there is a form of this cultivar with leaves margined with yellow but no material which fits this description has been seen in this revision.

cultivar 'Purpureus'

Syn.: *Osmanthus aquifolium* var. *ilicifolius-purpureus* Hort. ex Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896), nomen nud.

O. ilicifolius var. *purpurascens* Hort. ex Bean in Gard. l, 87 (1896); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Bailey & Bailey, Hortus Second, 523 (1941).

O. aquifolium var. *atropurpureus* Schneider, Ill. Handb. Laubh. ii, 790 (1911); Bailey, Stand. Cycl. Hort. ed. 2, 2412 (1917).

O. aquifolium var. *purpureus* Hort. ex Bean, Trees and Shrubs, ed. 1, ii, 111 (1914) et ed. 7, ii, 378 (1951); Silva Tarouca & Schneider, Unsere Freiland-Laubgehölze, ed. 3, 244 (1931); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

O. ilicifolius f. *purpureus* (Hort. ex Bean) Rehder in Journ. Arn. Arb. v, 240 (1924); Schneider in Gartenschönheit, xx, 52 et fig. (1939); Hara, Enum. Sperm. Jap. i, 125 (1948).

O. purpureus Hort. ex Cat. Pl. Jard. Aclim. Orotava, 32 (1923) nom. nud.

O. ilicifolius var. *purpureus* (Hort. ex Bean) Rehder, Man. Cult. Trees and shrubs, ed. 1, 758 (1927).

O. ilicifolius f. *purpurascens* (Hort. ex Bean) Rehder, Bibl. Cult. Trees and Shrubs, 575 (1949).

A variant in which the young leaves are purplish black and, when mature, green with a purple tinge.

Said to have been raised at Kew in 1880 and to be the hardiest form of the species.

cultivar 'Variegatus'

Syn.: *Osmanthus aquifolium* var. *variegatus* Hort. in Proc. R. Hort. Soc. Lond. i, 615 (1861); Carrière, Production et Fixation des Var. Vég. 52 (1865).

O. aquifolium var. *variegatus-nanus* Hort., l.c.

O. aquifolium var. *foliis argenteo-variegatus* Lavallée, Arb. Segrez. 169 (1877) nom. nud.

O. ilicifolius var. *foliis variegatus* Hort. ex Lavallée, l.c. 170.

O. ilicifolius var. *argenteo-marginatus* Hort. ex Bean in Garden, l, 87 (1896); Bailey & Bailey, Hortus Second, 523 (1941).

O. ilicifolius var. *argenteo-variegatus* Mouillefert, Traité Arb. et Arbrisseaux, ii, 982 (1896).

O. aquifolium var. *ilicifolius variegatus* Hort. ex Nicholson in Kew Handlist Trees and Shrubs, ii, 89 (1896).

O. aquifolium var. *argenteus* Hort. ex Bailey, Cycl. Amer. Hort. iii, 1177 (1901) nom. nud.; Schneider, Ill. Handb. Laubh. ii, 790 (1911).

O. aquifolium var. *argenteo-marginatus* Hort. ex Bailey, Stand. Cycl. Hort. ed. 2, iv, 2412 (1917).

O. ilicifolius var. *albo-marginatus* Schneider in Gartenschönheit, xx, 52 et fig. (1939).

O. ilicifolius var. *variegatus* (Hort.) Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927); Bailey & Bailey, Hortus Second, 523 (1941); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

O. ilicifolius f. *variegatus* (Hort.) Rehder in Journ. Arn. Arb. v, 240 (1924) et Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Hara, Enum. Sperm. Jap. i, 126 (1948).

A variant with variegated leaves margined in creamy white.

Levallée (Arb. Segrez. 169: 1877) and Mouillefert (Traité Arbr. et Arbrisseaux, ii, 982: 1896) also list a variety with the phrase names *O. aquifolium* var. *foliis pictis* and *O. ilicifolius foliis pictis* with leaves spotted with whitish yellow, but no material has been seen which fits this description. It is also uncertain in what characters *O. ilicifolius* var. *variegatus nanus* and *O. ilicifolius diversifolius*, mentioned above as having been shown to the Royal Horticultural Society of London in 1862, differed from the five cultivars enumerated above. Finally, it seems possible that *O. ilicifolius* var. *undulatifolius* Makino, described from a cultivated plant from Enoshima, Honshu, Japan in 1931, and of which no material has been seen in the course of this revision, is a further cultivar not yet introduced to European gardens.

var. **bibracteatus** (Hay.) P. S. Green, **comb. nov.**

Syn.: *Osmanthus bibracteatus* Hayata, Ic. Pl. Formos. ix, 71 et fig. (1920); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931).

O. ilicifolius var. *bibracteatus* (Hay.) Mori in Journ. Jap. Bot. xv, 552 et fig. (1939).

A variety which mainly differs from the type in the slightly larger entire leaves and larger flowers subtended by larger more puberulous bracts.

An evergreen *shrub* (or small tree?), branches puberulous when young. *Leaves* glabrous; petiole 1 cm. long, puberulous when young; lamina thick coriaceous, puberulous on the midrib when young, especially towards the base, elliptic-lanceolate, 4·5–6·5 cm. long by 1·5–2·8 cm. broad; margin entire, slightly thickened; apex slightly acuminate with a long acute and sharp point but a high proportion of the leaves examined with tip eaten off or malformed; base angustate to acute, decurrent into the petiole; venation raised, primary and marginal veins visible above, less so below, 6–7 primary veins per side. *Inflorescence* axillary, fasciculate, about 6 flowers per bud, usually one bud per axil; pedicel glabrous, 5–15 mm. long; basal connate bracts puberulous 3–4(–5) mm. long, weakly cuspidate. *Calyx* irregularly 4-toothed, c. 1 mm. long. *Corolla* more or less campanulate, *tube 1·5–2 mm. long*, *lobes* 4, *c. 5 mm. long*. *Stamens* 2; *filaments about 1·3 mm. long* attached at the centre of the corolla tube; *anthers just over 3 mm. long* with appendage. *Ovary* about 3·5 mm. long including slender style 2 mm. long and a capitate stigma. *Fruit* unknown.

FORMOSA. Daibuzan, 20 Nov. 1918, *Eizi Matuda* s.n. (iso. TAI).

The description given above has been drawn up from a duplicate of the type received on loan from the National Taiwan University. The holotype, a photograph of which has been examined, is in the Herbarium of the Botanical Institute, University of Tokyo. With only a single specimen available it has been difficult to assess the taxonomic status of this plant. The flowers are quite clearly larger than those of typical *O. heterophyllus*, having both a larger more campanulate corolla (lobes apparently not reflexed) and larger anthers on shorter filaments. But not only does some of the Formosan material placed under var. *heterophyllus* (especially *Wilson* 10913) show a tendency towards these characters, but Mori, who reduced Hayata's species to the rank of variety, had, to judge from his cited material, two other specimens, not seen in this investigation, to assist him in his assessment of the plant. Because of this and the apparent intermediate form mentioned, the reduction to varietal rank is maintained.

Another difference from var. *heterophyllus* lies in the bracts, which are more puberulous in this plant; however, very pubescent bracts are also found on Kanehira & Sasaki's specimen from Mt. Niitaka in Formosa, a specimen which is otherwise typical *O. heterophyllus*. The same is true of *Simada* 826 from the same region, which to judge from its label, was at one time determined as var. *bibracteatus*, although a determination label of Mori's names it *O. ilicifolius*. These plants are also noteworthy in possessing puberulous pedicels.

The original description of *O. bibracteatus* states that the branches are glabrous, but a very careful examination shows the remains of hairs and it seems that when young and fresh they were almost certainly puberlous.

A sterile specimen from Hainan (*Lau* 28090) which, although possessing smaller leaves generally only slightly acuminate, bears some resemblance to this variety, also recalls *O. fordii* and a further reference to it will be found under that species.

Finally, it should be mentioned that Kanehira (Formosan Trees, ed. 2, 621: 1936) sunk *O. bibracteatus* under *O. lanceolatus*. However, the type material shows there is no justification for such a treatment.

18. **Osmanthus reticulatus** P. S. Green, **sp. nov.** (Plate 17).

Frutex 2 m. altus ramulis juvenilibus glabris. *Folia* glabra, supra costa primum minute puberula, petiolis 5–10 mm. longis glabris; laminae crassae coriaceae ellipticae vel angusto-ovatae vel etiam lanceolatae, (4–)5–8(–10) cm. longae, (1·5–)2–3 cm. latae; marginibus crassis integris vel serrato-dentatis cum dentibus acutis ad 1 mm. longis vel minoribus utrinsecus 15 (–30) usque, apicibus acuminatis vel interdum acutis, acumine acuto, basibus angustatis vel fere breviter angustatis, in petiolum leviter decurrentibus; venis utrinque elevatis et manifeste reticulatis, venis primariis utrinsecus (7–)8–10(–12). *Inflorescentiae* axillares fasciculatae, pedicellis 3–5 mm. longis glabris, bracteis infimis glabris. *Calyx* c. 1 mm. longus, dentibus quattuor brevibus plus minusve irregularibus et leviter erosis. *Corolla* tubo 2 mm. longo, lobis quattuor, 1·5 mm. longis vel paulum ultra. *Stamina* duo, filamentis c. 0·5 mm. longis in medio corollae tubi insertis, antheris paulo plus quam 1 mm. longis. *Ovarium* fertile et *fructus* non visa.

Evergreen *shrub* 2 m. high, young shoots glabrous with pale coloured bark, finely lenticulate. *Leaves* glabrous, midrib of very young leaves minutely puberulous above, *surface punctate but the dots not raised, more clearly so below*; *petiole glabrous 5–10 mm. long*; *lamina thick coriaceous*, elliptic to narrow ovate or even lanceolate; (4–)5–8(–10) cm. long by (1·5–)2–3 cm. broad; margin thickened, *entire or more generally, on the specimen seen, serrate toothed with the teeth sharp, 1 mm. or less in length and up to 15(–30) per side* (Fig. 1G); *apex sharp pointed*; base angustate to almost shortly so, slightly decurrent into the petiole; *venation raised and distinctly reticulate above and below, (7–)8–10(–12) primary veins per side. Inflorescence* axillary, fasciculate, usually 1 bud per axil with 4–6 flowers per bud; pedicels 3–5 mm. long, glabrous; basal connate bracts glabrous, 1·5–2·5 mm. long, shortly cuspidate. *Flowers* white. *Calyx* about 1 mm. long with 4 shallow somewhat irregular and slightly erose teeth. *Corolla* tube 2 mm. long, lobes 4, 1·5 mm. long or slightly more. *Stamens* 2, filaments about 0·5 mm. long attached in the middle of the corolla tube; anthers just over 1 mm. long, nearly twice as long as broad with a small rounded terminal appendage; average dimension of pollen grains measured, 19·6μ with a range of 18–21μ. Functional *ovary* not seen, in the male flower abortive, more or less conical about 1 mm. long. *Fruit* unknown.

KWEICHOW. Ta Ho Yen, Fan Ching Shan, 1600 m., along streambank, 14 Nov. 1931, *A. N. Steward, C. Y. Chiao & H. C. Cheo* 931 (holo. A, iso. BM, NY, P, US, W); Pin fa, liane arborescent, Oct. 1908, *J. Cavalerie* 5586 (E).

Vegetatively this species recalls *O. serrulatus* and in fact the type specimen had previously been determined as that species. However, it differs in the heavier reticulation of the leaf which in addition is generally smaller and more elliptic, and in details of the flower. *O. reticulatus* also bears some resemblance to *O. armatus* and *O. venosus* but differs in its smaller serrations and glabrous petioles, bud scales and young shoots.

19. **Osmanthus armatus** Diels in Engler Bot. Jahrb. xxix, 532 (1900); Wilson in Gard. Chron. ser. 3, l, 113 et fig. (1911); Bean in Kew Bull. 1913, 166, et Trees and Shrubs ed. 1, ii, 111 (1914) et ed. 7, ii, 379 (1951); Rehder in Sargent in Publ. Arn. Arb. no. 4 ("Pl. Wilson."), ii, 611 (1916); Bailey, Stand. Cycl. Hort. iv, 2412 (1916); Bean in Gard. Chron. ser. 3, lxviii, 117 et fig. (1920); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927) et ed. 2, 789 (1940); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Silva Tarouca & Schneider, Unsere Freiland-Laubgehölze, ed. 3, 244 (1930); Stapf in Bot. Mag. cliv, t. 9232 (1931); Schneider in Gartenschönheit, xx, 52 et fig. (1939); Bailey & Bailey, Hortus Second, 523 (1941); Bean in Chittenden, Dict. Gard. iii, 1452 et fig. (1951).

Evergreen *shrub* or *tree* 1–10 m. high, young shoots puberulous. *Leaves* glabrous with midrib puberulous above, generally punctate above but the dots not usually raised; *petiole puberulous 3–5(–8) mm. long*; *lamina thick, very coriaceous*, narrow lanceolate to lanceolate-elliptic, (6–)8–10(–12) cm. long by (1·5–)2–3(–3·5) cm. broad (not counting teeth); *margin thickened and armed with sharp spiny teeth, rarely entire, 6–14 teeth per side 2–5(–10)*

mm. long (Fig. 1H); *apex* narrow acute *with spinescent tip*; base blunt to subcordate not decurrent into the petiole; venation reticulate, distinct and raised above and below, *7–10 primary ribs per side. Inflorescence* axillary, fasciculate, 1–2 buds per axil with 4–6 flowers per bud; pedicels 3–8 mm. long, glabrous; *basal connate bracts pubescent* 3–4 mm. long, cuspidate. *Flowers* white, fragrant. *Calyx* 1–1·5 mm. long with 4 slightly erose teeth. *Corolla* tube 2·5 mm. long, lobes 4, more or less truncate, 2 mm. long. *Stamens* 2, filaments 0·8 mm. long, attached at the top of the corolla tube; anthers 1–3 mm. long, about twice as long as broad, with a fairly well developed terminal appendage; range of average dimensions of pollen grains measured, 20·4–21·6μ with a range of extremes of 19–23μ. Functional *ovary* not seen, in the male flower abortive, more or less conical, about 2 mm. long. *Drupe* violet-black, ellipsoidal, 1·5 cm. long by 1 cm. broad, stone 1·3 by 0·7 cm., fruiting pedicels 6–10 mm. long. Chromosome number (fide Taylor): 2n=46.

HUPEH. Five Finger Mountain, 10 June 1926, *Y. Chen* 3018 (A); Nan-T'o and mountains to the northward, without date, *A. Henry* 4597 (K, NY); Patung district, without date, *A. Henry* 5182 (K); Changyang, without date, *A. Henry* 7587 (BM, K); Fang, without date, *A. Henry* 6730 (K); North and South of Jehang, on rocks in woods, Sept. 1901, *E. H. Wilson* 2645 (A, E, K, NY, US, W).

SZECHUAN. Nan ch'uan, without date, *C. Bock & A. Rosthorn* 2040 (holo. O); District de Tchen-Kéou-Tin, without date, *R. P. Farges* s.n. (A).

This species possesses affinities with *O. serrulatus*, *O. yunnanensis*, *O. reticulatus* and *O. venosus*, yet it is one of the most distinctive by virtue of its very thick coriaceous leaves with their large strong marginal spines. From *O. yunnanensis* and *O. reticulatus* it differs in the puberulous petioles and bud scales and the large leaf spines, and from *O. serrulatus* and *O. venosus* by its short petioles, and by its leaves having fewer primary ribs and larger marginal spines.

O. armatus was introduced into cultivation in Britain in 1902 by E. H. Wilson working for Messrs. Veitch. He brought a single plant from China and it is probable that all the plants at present growing in gardens have been propagated clonally from this one introduction.

20. **Osmanthus venosus** Pampanini in Nuov. Giorn. Bot. Ital. N. S. xviii, 174 ("Piante Vascolari dell' Hu-peh", 265) (1911) et Bull. Soc. Tosc. Ortic. xxxvi, 217 (1911); Rehder in Sargent in Publ. Arn. Arb. iv ("Pl. Wilson.") ii, 611 (1916); Nakai in Bot. Mag. Tokyo, xliv, 17 (1930).

Syn.: *Siphonosmanthus venosus* (Pampan.) Knoblauch in Notizbl. Bot. Gart. Berlin, xi, 1031 (1934).

Evergreen *shrub* or small *tree* to 10 m. high, young stems puberulous. *Leaves* glabrous with the midrib puberulous above, minutely but distinctly punctate above and below but the dots not raised; *petioles puberulous (7–)10–15(–20) cm. long*; *lamina thick coriaceous*, narrow elliptic to slightly lanceolate or oblanceolate, (4·5–)7–11(–14) cm. long by (1·5–)2–2·5(–4) cm. broad; margin thickened, entire or toothed, especially in the upper half, teeth sharp, 1–2 mm. long, on the material seen with up to 3 teeth per side in the upper half or sometimes with a pair of teeth towards the base but probably, if fully toothed, up to about 10 per side

(Fig. 11); apex acuminate or acute, tip acute; base angustate to blunt, very slightly decurrent into the petiole; *venation clearly reticulate and raised* above and below, *(8–)9–11(–12) primary veins per side. Inflorescence* axillary, fasciculate, 1–2 buds per axil with 4–5 flowers per bud; pedicels 3–8 mm. long, glabrous; *basal connate bracts* 2–5 mm. long *densely puberulous*, cuspidate. *Flowers* white, fragrant (fide Wilson). *Calyx* 1–1·5 mm. long with 4 irregular teeth. *Corolla* tube 2·5 mm. long narrowed at the base, lobes 4, ovate, 2 mm. long. *Stamens* 2, filaments about 0·75 mm. long, attached about the middle of the corolla tube; anthers about 2 mm. long, nearly twice as long as broad with a large rounded terminal appendage, dimensions of pollen grains measured, (21–)22·6(–24)μ. *Ovary* about 3 mm. long, including style about 1·5 mm. long with capitate stigma. *Fruit* unknown.

HUPEH. "Monti di Nan-tcian, l.d., Ta-p'in", Nov. 1907, *Silvestri* 3367 and 3367a (syntypes FI, photograph and fragments, A); Ichang, 300–900 m., cultivated, Sept. 1909, *E. H. Wilson* 2374a (A, BM, E, K, US).

Pampanini in his original description ascribes this species to Sect. *Siphosmanthus* Franch. whilst some years later Knoblauch transferred it to the then relatively new genus *Siphonosmanthus* Stapf. Careful examination of the type, however, shows that the corolla tube is only a little (*i.e.* a quarter) longer than the lobes and not, as defined by Franchet for the section, "longe tubulosa" or by Stapf, for the genus, "subcylindrico". The latter also describes the corolla in *Siphonosmanthus* as hypocraterimorph and measurements of the species he transferred to the genus show a corolla tube which is at least twice the length of the lobes. Admittedly the figure given by Pampanini shows a corolla in which the tube is almost twice the length of the lobes but the figure is misleading. In his description he gives the tube as 2·5 mm. and the lobes as 2 mm. long and this also accords with the dimensions of the flowers on *Wilson* 2374a, in which also the corolla is certainly not hypocraterimorph but has a tube which is almost urceolate and not subcylindric. In view of this, *O. venosus* is here placed in Sect. *Osmanthus*. Rehder in Plantae Wilsonianae (p. 611) also notes that Pampanini's figure exaggerates the length of corolla tube and describes it as campanulate rather than tubular.

Furthermore Pampanini states that the stamens are inserted at the base of the corolla tube and possess a filament 1 mm. long, but an examination of the specimens cited shows that the insertion should more accurately be given as the middle of the tube and the filament as much less than 1 mm.

In addition to the two collections cited above there is, in the Edinburgh Herbarium, a specimen gathered by *Father Siméon Ten* in Yunnan. ("Tao hoa chan, in orientalis Pe yen tsin", 15 Sept. 1916, *S. Ten* 313) which seems most nearly to resemble *O. venosus*. The flowers, however, such as remain, are smaller (corolla 3 mm. long) and carried on longer pedicels (8–12 mm. long). The leaves too, although larger (8–12 cm. long by 2·5–3·5 cm. broad) and slightly more lanceolate than is general in the other specimens, are similar in their venation (slightly less prominently reticulate perhaps) and have the same puberulous upper surface to the midrib and petiole. The inflorescence bracts are similarly puberulous, as

are the young branches, but because Yunnan is some distance from Hupeh it is felt that it is best only to make a comparison between Ten's specimen and *O. venosus* and leave it at that until further material is forthcoming from both the provinces and the area in between.

21. *Species "B"*

Evergreen *shrub*, young branches glabrous. *Leaves* glabrous, *slightly glossy above*, punctate below with black dots; petioles 10–15 mm. long glabrous; *lamina thick coriaceous*, elliptic to narrow ovate or lanceolate, (5–)6–8 cm. long by 2–3 cm. broad; *margin thickened*, entire or bluntly serrate, the serrations occasionally developed into small sharp teeth but in most cases observed little more than small crenations, serrations not more than 1 mm. long and up to about 7 per side; apex acuminate, tip acute but not spinescent; base angustate, decurrent into the petiole; venation obscurely reticulate above and below but with *primary veins clear and raised*, *(7–)8(–9) per side*. *Inflorescence* axillary, fasciculate, 1 bud per axil with up to about 5 flowers per bud; pedicels 3–7 mm. long, glabrous; basal connate bracts thick, 2·5–3 mm. long, rounded or blunt. *Calyx* 1 mm. long with 4 more or less triangular somewhat irregular teeth often erose. *Corolla* and *stamens* not seen. *Ovary* about 3 mm. long including a style about 2 mm. long with capitate stigma. *Fruit* unknown.

KWANGTUNG. Loh Fau Shan, 27–30 Oct. 1916, *Canton Christian College Herbarium (C. O. Levine)* 578 (A, US).

Despite the fact that Loh Fau Shan is probably one of the botanically better known areas in Kwangtung, no other material has been seen which matches this gathering. It has previously been determined as *O. fragrans* and as *O. fordii*; however, the thickness of the leaf, the leaf margin and the ovary length exclude the former species, whilst leaf shape, texture, margin, venation and petiole distinguish the latter. No other material has been seen in which the margin, which appears as though it ought to be characteristically serrate, has such poorly developed blunt serrations; in fact it is suspected that the material might be somewhat abnormal.

22. *Species "C"*

Evergreen *shrub* 3 m. high, *young shoots and vegetative buds puberulous*. *Leaves* glabrous, *smooth and slightly glossy above*, *petioles puberulous*, *1–1·5 cm. long*; lamina thick coriaceous, elliptic (5–)6·5–9(–10) cm. long by 1·5–3 cm. broad; margin entire, slightly thickened; apex acuminate, tip acute; base angustate, slightly decurrent into the petiole; venation obscurely reticulate, primary veins impressed above, 6–7 per side. *Inflorescence* axillary, fasciculate, 1–2 buds per axil with about 5 flowers per bud; *pedicels* 2–6 mm. long, *puberulous*; basal connate bracts thick, 1–2 cm. long cuspidate, puberulous. *Flowers* white, fragrant. *Calyx* 0·5 to about 1 mm. long with 4 narrowly triangular erose lobes. *Corolla* tube about 1·5 mm. long with 4 lobes about 2 mm. long. *Stamens* 2, filaments less than 0·3 mm. long (? in bud), attached in the lower half of the corolla tube; anthers just over 1 mm. long with a well developed pointed terminal

appendage, together with the appendage about twice as long as broad. Functional *ovary* not known, in the male flower abortive, narrowly conical, about 1 mm. long. *Fruit* not known.

KWANGTUNG. "Tung Koo Shan, Tapu district, fairly common, silt, sandy soil, thicket", 8–29 Sept. 1932, *W. T. Tsang* 21629 (K, NY).

Two specimens of this collection have been examined in detail, both of them in the Herbarium of the New York Botanic Garden, but the material is barely in flower and it is possible that some of the dimensions given above for the parts of the flower would be different were the flowers fully open. It is because the material is thus inadequate that it has not been used as the basis of a new species.

Superficially there is a close resemblance to *O. fragrans* and it had previously been named as such, but not only do the flowers appear different, but the distribution of hairs on the vegetative shoots and the pedicels is quite unlike anything found in *O. fragrans* or other species. The hairs on the petioles are usually most dense on the upper surface, in the groove and margins, but here it is glabrous in those parts, with the puberulence confined to the under surface. In the dried state the leaves have a distinct yellow colouration, especially below, and that, together with the glossy upper surface of the leaves, gives the material an unusual facies. A similar but less marked appearance is exhibited by a specimen of *O. fragrans* from Fukien (*H. H. Chung* 8489), which, however, is quite glabrous and typical of its species.

23. **Osmanthus lanceolatus** Hayata in Journ. Coll. Sci. Tokyo, xxx, Art. 1 ("Materials for a Fl. Formosa"), 192 (1911), et Ic. Pl. Formos. ii, 122, t. 24 (1912) et v, 125 et fig. (1915); Matsumura, Index Pl. Jap. ii, 2, 496 (1912); Kanehira, Formos. Trees, ed. 1, 369 et fig. (1917) et ed. 2, 621 et fig. (1936); Sasaki, List Pl. Formos. 336 (1928); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Mori in Journ. Jap. Bot. xv, 554 et fig. (1939).

Syn.: *Osmanthus sp.* Hayata in Journ. Coll. Sci. Tokyo, xxv, Art. 19 ("Fl. Mont. Formos.") 161 (1908).

O. diabuensis Hayata, Ic. Pl. Formos. ix, 72 et fig. (1920); Sasaki, List Pl. Formos. 336 (1928); Makino & Nemoto, Fl. Jap. ed. 2, 938 (1931).

O. gamostromus Hayata, Ic. Pl. Formos. ix, 74 et fig. (1920); Nakai in Bot. Mag. Tokyo, xliv, 15 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 939 (1931); Mori in Journ. Jap. Bot. xv, 554 et fig. (1939).

Evergreen *shrub* or small *tree* to 12 m. high by 1 m. diameter (fide Wilson), shoots characteristically glabrous but puberulous on young juvenile shoots (*e.g.* from young plants, sucker shoots, etc.). *Leaves* glabrous but on juvenile shoots minutely puberulous on the midrib above, *surface covered with distinct and generally raised dots*; *petiole glabrous or minutely puberulous on juvenile shoots* (5–)8–10 mm. long; *lamina* thickish, sometimes coriaceous, *narrow lanceolate to lanceolate*, *(4–)8–11 (–14) cm. long by 1–3 cm. broad*; margin thickened, sometimes slightly so, entire or on juvenile shoots serrate with small spinescent teeth 1(–2) mm. long and up to 20 per side except on the acumen; *apex long acuminate to*

very long and attenuately so, tip very acute; base angustate, sometimes almost cuneate, slightly decurrent into the petiole; venation, *primary veins generally discernable* and slightly raised above and below, sometimes obscurely reticulate, 6–8(–9) primary veins per side. *Inflorescence* axillary, fasciculate, 1–2 buds per axil with about 6 flowers per bud; pedicels 2–10 mm. long, glabrous; *basal connate bracts glabrous* 1·5–3 mm. long, blunt to cuspidate. *Flowers* white, fragrant (fide Wilson). *Calyx* 1 mm. long with 4 somewhat irregular teeth. *Corolla* tube 1·5 mm. long, lobes 4, 2 mm. long. *Stamens* 2, filaments about 0·5 mm. long, attached almost at the top of the corolla tube; anthers 1·5 mm. long, only slightly longer than broad with a small rounded terminal appendage; range of average dimensions of pollen grains measured, 18·9–21·1μ with a range of extremes of 17–22μ. *Ovary* about 2 mm. long, style just over 1 mm. long with slightly bilobed capitate stigma. *Fruit* unknown.

FORMOSA. Tôzan, Mount Morrison, Oct. 1906, *G. Nakahara* s.n. (holo. of *O. lanceolatus* TI, photo. E); W. of Mt. Morrison, Sui Sun, 2100 m., 26 Oct. 1912, *W. R. Price* 1013 (E, K); Tainan-syu, Kagi prov., Mt. Arisan, Jan. 1912, *B. Hayata* s.n. (holo. of *O. gamostromus*, TI), 1 Feb. 1918, *R. Kanehira & S. Sasaki* s.n. (TAI), 2250 m., 6 Oct. 1927, *R. Kanehira & S. Sasaki* (*Herb. Govt. Formosa* No. 21682) (A, FU, K), 2 Feb. 1918, *E. H. Wilson* 9735 (A, BM, K), 2000–3000 m., abundant, 18 Oct. 1918, *E. H. Wilson* 10807 (A, BM, K), and 5 Nov. 1932, *Yamamoto & Mori* s.n. (US); Mt. Daibu, 20 Nov. 1918, *Y. Matsuda* (*E. Matuda*) s.n. (holo. of *O. daibuensis* TI, iso. TAI); Hwaling, Mt. Daroko, 2000 m., in bushes, 25 Aug. 1951, *H. Keng & K. Kao* (*Herb. Nat. Taiwan Univ.* No. 2679) (A); Taityu-syu, Onoue to Tonbara, 26 Aug. 1929, *S. Suzuki* 2666 (TAI), and Mt. Hassenzan 2100–2400 m., 2 July 1932, *N. Iida, M. Tajima & M. Okayama* s.n. (TAI).

O. lanceolatus is very close to *O. enervius*, also from Formosa, and to *O. attenuatus* from Kwangsi, and reference should be made to these two species for a list of the main differences.

O. daibuensis was said by Hayata to differ from *O. lanceolatus* by "the more acuminate leaves with lateral veins arranged in a much acuter angle". However, these differences are very small and can be accounted for by the fact that Hayata was describing a narrow-leaved form, and the photographs of the two holotypes in Tokyo, sent by the courtesy of Dr. H. Hara, show at least one or two leaves on *O. lanceolatus* as long as and as acuminate as those of *O. daibuensis*.

O. gamostromus was said by Hayata to differ "in having much broader leaves, much acuter sepals and especially in the bracteoles which are connate by pairs at the base". However, just as *O. daibuensis* was based on a narrow-leaved form, so *O. gamostromus* was based on one from the opposite extreme of variation within the species. With the more abundant material now available these differences are seen to possess no significance. Examination of the calyx teeth on the different specimens shows them to be somewhat irregular in the shape and size of their apices. Similarly the connate pairs of bracts, emphasized and illustrated by Hayata, are to be found on other specimens more typically *O. lanceolatus* in leaf shape, for example the 1918 *Kanehira & Sasaki* gathering and *Wilson* 9735, cited above. These bracts are deciduous sooner or later and they happened to persist on the material used by Hayata as his type. In addition to the material cited above one specimen with unusually long narrow juvenile foliage has been seen from: "Kwarenkôtyô, Kenkaigun, Tausai, Nanko-

taizan, Bunaraha, 1200 m., Kusahara", 9 July 1937, *T. Suzuki, N. Hukuyama & H. Simada* (ST. 17569, TAI). The leaves are 12–16 cm. long and 1·5 cm. broad and have 20–30 teeth, but otherwise they resemble other juvenile shoots. It seems probable that the specimen was taken from a sucker shoot or some such exceptional growth.

24. **Osmanthus attenuatus** P. S. Green, **sp. nov.** (Plate 18).

Frutex 4 m. altus; surculi primum puberuli. *Folia* glabra costis supra puberulis, petiolis 7–10 mm. longis puberulis; laminae angusto-lanceolatae vel lanceolatae, (6–)7–9(–10) cm. longae 1·5–2(–2·5) cm. latae, marginibus integris, apicibus longe attenuatis pungenter acuminatis, basibus angustatis in petiolum leviter decurrentibus, venis supra obscuris subtus obscurissimis, venis primariis tantum vix conspicuis, utrinsecus 6–7. *Inflorescentiae* axillares fasciculatae, pedicellis 2–5 mm. longis, bracteis basalibus puberulis. *Calyx* fere 1 mm. longus dentibus quattuor erosis. *Corolla* tubo 2 mm. longo, lobis quattuor 2 mm. longis. *Stamina* duo, filamentis 1 mm. longis in medio corollae tubo insertis, antheris c. 2 mm. longis. *Ovarium* fertile non visum. *Fructus* ignotus.

Shrub 4 m. high, shoots puberulous when young. *Leaves* glabrous with the midrib puberulous above, *surface closely covered with very numerous small dots giving it a minutely bullate appearance*; *petiole puberulous* 7–10 mm. long; *lamina thickish, narrow lanceolate to lanceolate, (6–)7–8(–10) cm. long by 1·5–2(–2·5) cm. broad*; margin entire slightly thickened; apex long attenuate, tip sharply acute; base angustate, slightly decurrent into the petiole; *venation obscure above and particularly so below*, only the primary veins barely visible, 6–7 per side. *Inflorescence* axillary, fasciculate, 1(–2) buds per axil with (3–)4–5 flowers per bud; pedicels glabrous 2–5 mm. long; basal connate bracts puberulous, 2–3 mm. long, cuspidate. *Flowers* white, fragrant. *Calyx* a little less than 1 mm. long, with 4 erose teeth. *Corolla* tube 2 mm. long, lobes 4, 2 mm. long. *Stamens* 2, filaments 1 mm. long, attached in the middle of the corolla tube; anthers about 2 mm. long, twice as long as broad, with a fairly well developed terminal appendage; average dimension of pollen grains measured 19·7μ with a range of extremes of 19–21μ. Functional *ovary* not seen, in the male flower abortive, more or less conical, about 1 mm. long. *Fruit* unknown.

KWANGSI. Ling Wang Shan, San Chiang Hsien, 2100 m., in forest, 19 Sept. 1933, *A. N. Steward & H. C. Cheo* 1025 (holo. A, iso. BM, SING, W).

The lanceolate leaves recall those of *O. lanceolatus* from Formosa, a species which appears to possess a close affinity. However, *O. lanceolatus* may most easily be distinguished by the possession of glabrous bud scales and petioles (except that young shoots from juvenile plants have a slight puberulence), by the generally more prominent venation and more distantly placed dots on the leaf surfaces, and by details of lengths and proportions in the flower. There is also a close affinity with another Formosan species, *O. enervius*, but here the glabrous petioles and shoots, the leaf size and details of the flower, are different.

According to the field notes on the label the plant is known by the Chinese name "Kue I Hura".

PLATE 17. *Osmanthus reticulatus* P. S. Green
Insert: A, flower (×3); B, corolla opened and laid flat (×3); C, anther (×5).

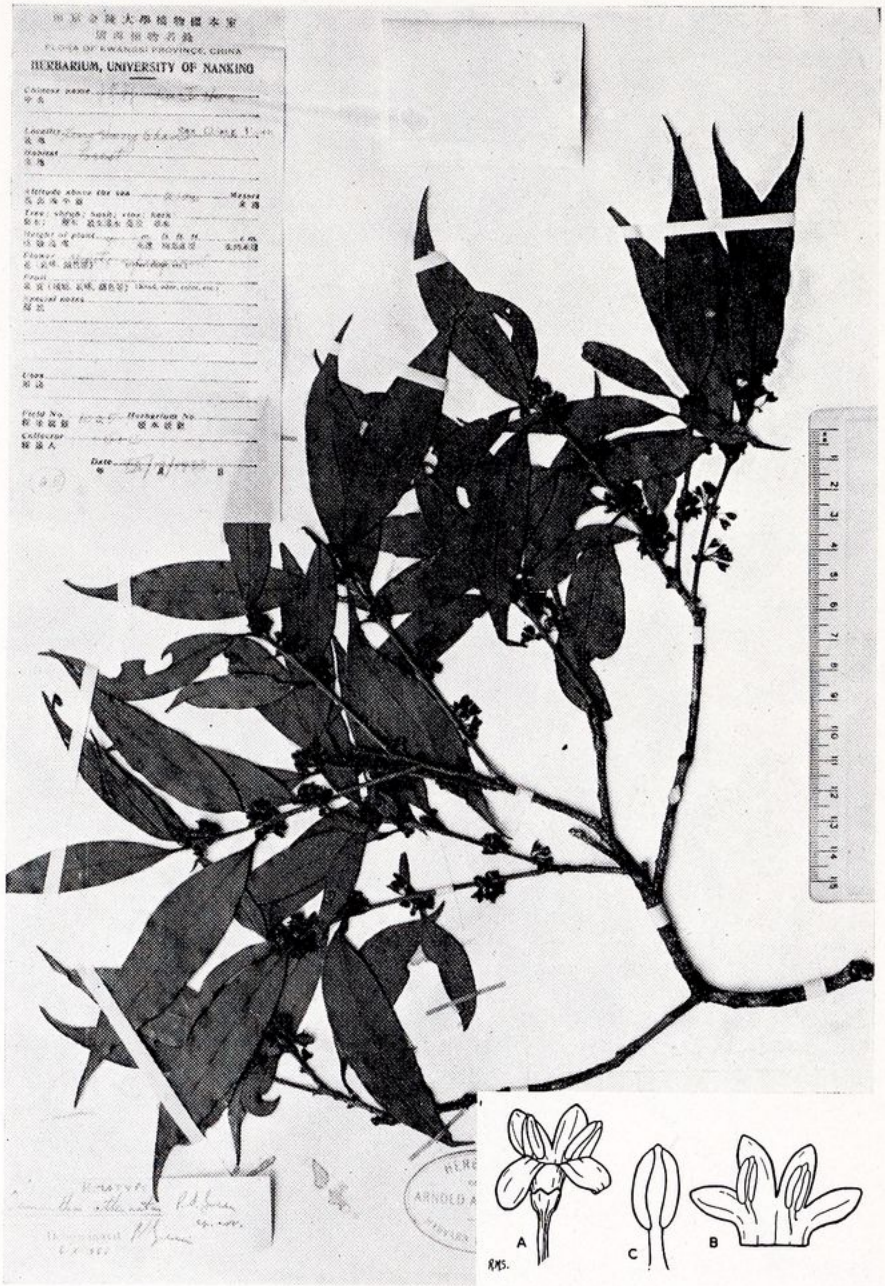

PLATE 18. *Osmanthus attenuatus* P. S. Green.
Insert: A, flower (×3); B, corolla opened and laid flat (×3); C, anther (×5).

PLATE 19. *Osmanthus urceolatus* P. S. Green.

Insert: A, flower (×2); B, flower with half the corolla removed to show the ovary and insertion of stamens (×2); C, stamen (×3); D, ovary (×5).

PLATE 20. *Osmanthus didymopetalus* P. S. Green.

Insert: A, young flower (×4); B, fully opened flower (×4); C, young bud showing the imbricate corolla lobes (×8).

25. **Osmanthus cooperi** Hemsl. in Kew Bull. 1896, 18; Nakai in Bot. Mag. Tokyo, xliv, 15 (1930).

Evergreen *tree*, 3·5 m. high, young shoots glabrous or for a short time minutely puberulous. *Leaves* glabrous, surface covered with very numerous but distinct raised dots; *petioles (10–)15–20(–30) mm. long*, glabrous; lamina coriaceous, elliptic to oblanceolate or narrow obovate, (5–)6–8 (–10) cm. long by (2–)2·5–3(–4) cm. broad; margin thickened, entire, apex acuminate, tip sharply acute; base cuneate-angustate, slightly decurrent into the petiole; venation obscure, *primary veins* only visible above and below, very slightly raised, *(5–)6–7 per side. Inflorescence* axillary, fasciculate, (1–)2(–3) buds per axil with up to about 6 flowers per bud; pedicels (6–)8–10 mm. long, glabrous; *basal connate bracts minutely puberulous*, 1·5–3 mm. long, more or less cuspidate. *Calyx* about 0·75 mm. long with 4 irregularly erose teeth. *Corolla* tube 1·5–2 mm. long, lobes 4, 1·5–2 mm. long. *Stamens* 2, *subsessile* just above the middle of the corolla tube; anthers just over 1 mm. long, twice as long as broad with a small terminal appendage; range of average dimensions of pollen grains measured 16·4–17μ with a range of extremes of 15–19μ. Functional *ovary* unknown, in the male flower abortive, more or less conical, about 1 mm. long. *Fruit* unknown.

CHEKIANG. Ningpo, cultivated in the garden of the British Consulate, believed to be a native of the neighbouring hills, 1895, *G. M. H. Playfair* s.n. (holo. K, iso. E); Ningpo, "cult. by Mr. Playfair", *A. Henry* 11048 (A, NY, probably isotypic).

In affinity this species is possibly near *O. fragrans*, but the two may be most easily distinguished by the fewer and more obscure primary veins on the leaves, the minutely puberulous inflorescence bracts, and the subsessile anthers, of *O. cooperi*. The leaves resemble those of some of the thinner-leaved forms of *O. marginatus* (Sect. *Leiolea*) and it is probable that this vegetative resemblance was the cause of a few misidentifications of *O. marginatus* being published as *O. cooperi* (Rehder in Journ. Arn. Arb. viii, 191: 1927 and Merrill & Metcalf in Lignan Sci. Journ. xvi, 396: 1937).

After the original description of *O. cooperi*, Hemsley quotes Playfair as saying, "Mr. W. M. Cooper, formerly Consul here, informed me a short time since that he believed a certain *Olea* in the garden of the Consulate to be an undescribed species. The tree was, I presume, transplanted by him from the neighbouring hills, like many others in the compound." Since that date no further material of the species has been collected, yet it would be unlikely that it does not still exist in the wild state somewhere in Chekiang.

26. *Species "D"*

Small evergreen *tree*, young shoots glabrous. *Leaves* glabrous, closely covered with very small raised dots giving a minutely bullate appearance on both surfaces; petiole 8–10 mm. long, glabrous; lamina thick subcoriaceous, narrowly ovate, 5–9 cm. long by 2–3·5 cm. broad; margin entire, slightly thickened; *apex acuminate, tip sharp pointed*; base acute to almost blunt, very slightly decurrent into the petiole; *venation obscure*,

especially above, primary veins slightly raised and just visible below, 5–6 per side. *Inflorescence* axillary, fasciculate, 1 bud per axil with up to about 5 flowers per bud; pedicels 3–4 mm. long, glabrous; basal connate bracts 1 mm. long, cuspidate, glabrous. *Flowers* white. *Calyx* about 1 mm. long with four triangular teeth. *Corolla* tube about 2 mm. long with four rounded lobes just over 2 mm. long. *Stamens* 2, filaments less than 0·5 mm. long attached in the middle of the corolla tube; anthers c. 1 mm. long, one and a half times as long as broad with a small acute terminal appendage. Functional *ovary* not known, in the male flower abortive, more or less conical, about 1 mm. long. *Fruit* unknown.

KWANGSI. Yao Shan, mixed woods, 29 Oct. 1936, *C. Wang* 40347 (A).

This species appears quite distinct but only a single specimen with no more than one or two withered flowers has been seen. From one of these flowers the description above has been drawn up and although the description is fairly complete it is felt that it is better not to give the plant a name until further and better material is known.

The leaves bear a close resemblance to those of *O. urceolatus*, particularly to those which are entire, but the corolla has quite a different shape and the young shoots and petioles are glabrous. The leaves also resemble *O. cooperi* except in the shape and there is no doubt that further material of all three species is needed.

27. *Species* "E"

Evergreen, young shoots minutely but densely puberulous. *Leaves* glabrous except for puberulous midrib above; *petioles minutely but densely puberulous when young* 8–12 mm. long; lamina thickish, oblanceolate (5–)8–10·5 cm. long by (1–)2–3 cm. broad; margin slightly thickened, *entire or* (*on 2 leaves*) *with 1 or 2 small sharp teeth in upper half not more than 1 mm. long*; apex acuminate and long acute, *tip spinescent*; base cuneate, slightly decurrent into the petiole; *venation obscure above and below*, *primary veins* just visible, slightly impressed above, sometimes just raised below, *7–9 per side*. *Inflorescence* bud scales puberulous about 1 mm. long.

FORMOSA. Mt. Goryosenzan, Sankyo, Taihoku, 26 Sept. 1943, *G. Masamune* 4035 (TAI).

This specimen does not match any other species of *Osmanthus*, although it lies near to *O. enervius* also from Formosa, and being sterile is too incomplete for description. However, it has the characteristic appearance of the species of this genus, and, with the indication of sharp marginal serrations given on two of the leaves, its place would seem to be in Sect. *Osmanthus*. I have seen no material of *O. acutus*, also from Formosa, but the description and figure given by Mori (Journ. Jap. Bot. xv, 546: 1939) show that this specimen cannot belong to that species.

28. **Osmanthus enervius** Masamune & Mori in Journ. Jap. Bot. xv, 549 et figs. (1939); Sonohara, Tawada & Amano, ed. Walker, Fl. Okinawa, 124 (1952).

Small *tree*, shoots glabrous. *Leaves* glabrous, *closely covered with very numerous small dots giving it a minutely bullate appearance*, petiole 5–8 mm. long, glabrous; lamina coriaceous, lanceolate or elliptic-lanceolate, (3·5–)5–7 cm. long by 1·3–2 cm. broad, margin slightly thickened, entire, *apex attenuate acute*, occasionally slightly acuminate, tip sharply acute; base cuneate-angustate, slightly decurrent into the petiole; *venation very obscure*, *primary veins* only to be seen, just visible above, only occasionally so below, *5–6 per side*. *Inflorescence* axillary, fasciculate, 1–2 buds per axil with about 6 flowers per bud, pedicels glabrous 1–5 mm. long, *basal connate bracts 1–2 mm. long puberulous*, cuspidate. *Calyx* about 0·75 mm. long with 4 irregular erose teeth. *Corolla* campanulate, tube 1·5 mm. long; lobes 4, 1·3 mm. long. *Stamens* 2, filaments thickish, 0·5 mm. long attached in the middle of the corolla tube; anthers just over 1 mm. long, twice as long as broad, with a small rounded terminal appendage, average dimension of pollen grains measured, 18·5μ with a range of extremes of 18–19μ. Functional *ovary* not seen, in the male flowers abortive, more or less conical, about 1 mm. long. *Fruit* unknown.

FORMOSA. Takimi to Mt. Hidaiwayama, Tousei-gun, Taichyu (Tatumi-Meijiousen, Taityu-syu), 29 Oct. 1936, *K. Mori* s.n. (holo. TAI).

O. enervius shows very close resemblances to *O. lanceolatus*, another Formosan species, of which it suggests a diminutive form. However, the two species can be distinguished by the smaller and less markedly acuminate leaves in *O. enervius*, together with their even more obscure venation, very dense surface punctation and puberulous inflorescence bracts.

I have only seen the type material from Formosa, but *O. enervius* is recorded from the southernmost group of the Ryukyu Islands by Sonohara, Tawada & Amano, who say, "a tree on the mountains of Ishigaki and Irimote, used for timber."

29. **Osmanthus urceolatus** P. S. Green, **sp. nov.** (Plate 19).

Frutex ad 3 m. altus, ramulis juvenilibus puberulis. *Folia* glabra, costa supra puberula excepta; petioli 1–2 cm. longi, dense puberuli; laminae crassae subcoriaceae ellipticae vel anguste-ellipticae ad angusto-ovatae (4–)5–8(–9) cm. longae (1·5–)2·5–3(–3·5) cm. latae; marginibus serratis cum dentibus parvis 0·5–1 mm. longis utrinsecus 16 usque raro integris, apicibus acuminatis vel elongato-acuminatis, acumine acuto, basibus angustatis vel cuneatis in petiolum leviter decurrentibus; venis utrinque obscuris, venis primariis utrinsecus (5–)6–7. *Inflorescentiae* axillares fasciculatae, pedicellis 5–10 mm. longis, bracteis infimis dense puberulis. *Calyx* 1 mm. longus, dentibus quattuor brevibus rotundatis obtusis erosis. *Corolla* urceolata, tubo 5–7 mm. longo, lobis quattuor latis triangularibus 1 mm. longis. *Stamina* duo, filamentis robustis 1·5 mm. longis c. triente ab basi corollae insertis, antheris 3 mm. longis. *Ovarium* c. 3·5 mm. longum stylo c. 2 mm. longo incluso. *Fructus* ignotus.

Evergreen *shrub* to 3 m. high, branches puberulous when young. *Leaves* glabrous except on the midrib above, which is puberulous, especially towards the base, covered with numerous minute raised dots above and below; petiole 1–2 cm. long, puberulous; lamina thick subcoriaceous,

elliptic or narrow elliptic to narrow ovate (4–)5–8(–9) cm. long by (1·5–)2·5–3(–3·5) cm. broad, *margin* slightly thickened, *serrate with small sharp teeth 0·5–1 mm. long* especially *in the upper half, up to 16 serrations per side, rarely entire on the material seen* (Fig. 1J); apex acuminate to elongate acuminate, tip sharply acute; base angustate to cuneate, slightly decurrent into the petiole; *venation obscure* above and below and slightly raised, *(5–)6–7 primary veins per side. Inflorescence* axillary, fasciculate, 1 bud per axil with 3–4 flowers per bud; pedicels 5–10 mm. long, glabrous; *basal connate bracts* 1–2 mm. long; blunt to slightly cuspidate, *densely puberulous. Flowers* white. *Calyx* 1 mm. long with four shallow rounded obtuse erose teeth. *Corolla urceolate, tube 5–7 mm. long with 4 broad triangular lobes 1 mm. long. Stamens* 2, included, *filament stout 1·5 mm. long and 0·8 mm. broad,* attached about one-third from the base of the corolla tube; *anthers 3 mm. long,* more than twice as long as broad, with a quite well developed rounded terminal appendage; diameters of pollen grains measured (19–)20·7(–21)μ. *Ovary* about 3·5 mm. long including a style about 2 mm. long with a capitate stigma. *Fruit* unknown.

HUPEH. Enshih Hsien, 26 Oct. 1934, *H. C. Chow* 1793 (holo. E, iso. A, NY).

Due to the shape of its corolla, *O. urceolatus* is distinct from every other species. Quite apart from the large size of the corolla, the proportions of tube to lobes are unique, and it might be thought that the species should more correctly be placed in Sect. *Siphosmanthus.* However, in that section the corolla tube is narrow and of uniform breadth as well as being long, whereas here it is widest at about the middle and hardly cylindrical. In addition the leaves are typical of Sect. *Osmanthus* and, although characteristic of the species, in detail they bear some resemblance to a small-leaved *O. fragrans* or to *O. serrulatus.*

The limited field notes do not say whether or not the flowers are fragrant. Generally in this genus they are scented, but in any case this plant could prove a valuable introduction and asset to gardens with its autumnal flowering and evergreen habit.

Osmanthus Sect. **Siphosmanthus** Franchet in Bull. Soc. Linn. Paris, i, 613 (1886); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930).

Syn.: *Siphonosmanthus* Stapf in Bot. Mag. cliii, t. 9176 (1929); Lemée, Dict. Descr. vi, 136 (1935); Rehder, Man. Cult. Trees & Shrubs, ed. 2, 788 (1940).

Evergreen *shrubs* or *small trees* up to 7·5 m. high, young stems puberulous. *Leaves* glabrous, midribs puberulous above, at least when young; lamina thick, coriaceous or subcoriaceous, lanceolate, elliptic or ovate, (0·5–)1–5(–9·5) cm. long; margin shallowly subcrenate, or serrate with sharp points to the teeth; apex blunt or acute to rarely acuminate; venation generally obscure, occasionally more or less reticulate. *Inflorescence* axillary and terminal, fasciculate, basal bracts usually early deciduous. *Flowers* androdioecious. *Calyx* 2–4 mm. long with 4 more or less rounded ciliate teeth 1–2 mm. long, green often tinged with purple. *Corolla* tube subcylindrical (6–)7–11(–13) mm. long, 1–2 mm. diameter, lobes 4 more or less strap-shaped (2–)3–4·5(–6) mm. long, rounded.

Stamens 2, filaments 0·5–1 mm. long attached to the corolla 2–4 mm. from the top of the tube; anthers 2 mm. long with a well developed terminal appendage. *Ovary*, including style, 2·5–4 mm. long with a slightly bifid capitate stigma; in the male flower abortive, more or less conical. *Drupe* ellipsoidal or ovoid; endocarp hard but thin, 0·3 mm. thick.

Type species: *Osmanthus delavayi* Franch.

The main distinction of this section is based upon the possession of a long narrow corolla tube, 6–11 mm. long, whereas in Sect. *Osmanthus*, the section with the nearest affinity, the tube is usually only 2·5 mm. long at the most. However, with the description of *O. urceolatus*, where the corolla tube is 7 mm. long, this distinction of size vanishes and differentiation comes to depend upon the shape of the tube, narrow subcylindric in Sect. *Siphosmanthus*, and urceolate or shortly campanulate in Sect. *Osmanthus*.

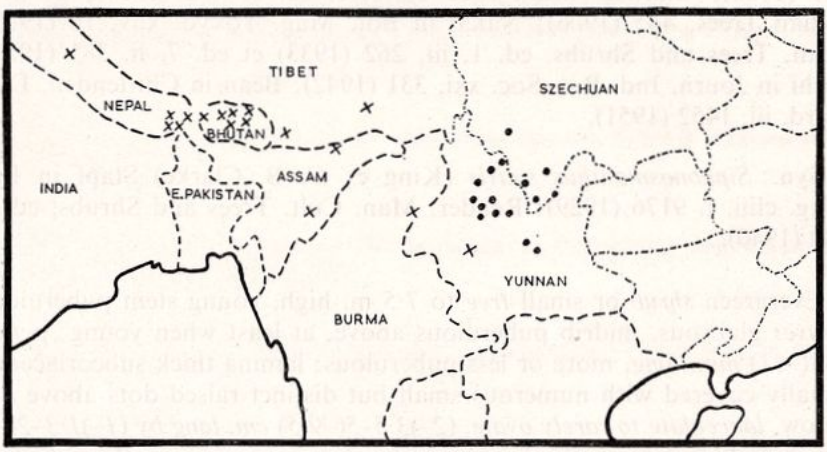

FIG. 5. Map of distribution of Sect. *Siphosmanthus*.
× *Osmanthus suavis*. ● *O. delavayi*.

Although the main sectional distinction rests upon the shape of the corolla tube there are one or two other characters of note. Alone in the genus the two species in this section possess terminal inflorescences on occasion, in addition to the typical axillary ones. The leaves too have the smallest dimensions of the genus, being generally no more than 5 cm. although occasionally up to 9·5 cm. long. The endocarp too is thin although hard for its thickness, whilst in Sect. *Osmanthus* it is characteristically and generally fairly thick, hard and bony.

The geographic distribution of the section is interesting in that *O. suavis* is the only species of the genus to be centred in India, and in fact, apart from *O. fragrans* and *O. matsumuranus*, no other species is found west of the Chinese border. The complete distribution of *Siphosmanthus* is shown in Fig. 5.

O. venosus, placed in this section when described by Pampanini, is now referred to Sect. *Osmanthus* (see p. 519).

Key to the species of Sect. Siphosmanthus

Leaves usually more than 3·5 cm. long and 1·3 cm. broad, rarely as small as 2 cm. long and 1 cm. broad; lanceolate, rarely ovate and then the leaves large; petioles 5 mm. or more in length; margin subcrenate, rarely with sharp teeth; venation obscure, but usually with primary veins visible below, 5–9 per side . . . . 30. *O. suavis*

Leaves usually less than 2·5 cm. long and 1·5 cm. broad, rarely as large as 4 cm. long and 2 cm. broad; broadly elliptic or ovate, less commonly lanceolate or narrow elliptic; petioles up to 5 mm. long, usually less than 3 mm.; margin sharply serrate, rarely with blunt teeth; venation obscure but with primary veins sometimes visible, 4 per side 31. *O. delavayi*

30. **Osmanthus suavis** King ex C. B. Clarke in Hook. f., Fl. Brit. Ind. iii, 607 (1882); Gamble, Man. Ind. Timbers, ed. 2, 472 (1902); Brandis, Indian Trees, 445 (1906); Nakai in Bot. Mag. Tokyo, xliv, 16 (1930); Bean, Trees and Shrubs, ed. 1, iii, 262 (1933) et ed. 7, ii, 381 (1951); Joshi in Journ. Ind. Bot. Soc. xxi, 331 (1942); Bean in Chittenden, Dict. Gard. iii, 1452 (1951).

Syn.: *Siphonosmanthus suavis* (King ex C. B. Clarke) Stapf in Bot. Mag. cliii, t. 9176 (1929); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940).

Evergreen *shrub* or small *tree* to 7·5 m. high, young stem puberulous. *Leaves* glabrous, midrib puberulous above, at least when young; *petiole 5–8(–11) mm. long*, more or less puberulous; lamina thick subcoriaceous, usually covered with numerous small but distinct raised dots above and below, *lanceolate to rarely ovate, (2–)3·5–5(–9·5) cm. long by (1–)1·3–2(–4) cm. broad*; *margin shallowly subcrenate or serrate occasionally with sharp points*, up to about 24 teeth per side (Fig. 1K); apex acute to rarely acuminate or even long acuminate, tip blunt; base angustate, sometimes slightly decurrent into the petiole; venation very occasionally more or less reticulate, usually with the *primary veins* visible at least below, *5–8(–9) per side. Inflorescence* axillary and terminal, fasciculate, usually 1 bud per axil with 3–5(–9) flowers; pedicels 4–10 mm. long, minutely puberulous or glabrate; basal bracts acute, slightly ciliolate 2–3 mm. long usually early deciduous. *Flowers* white or cream-coloured, fragrant. *Calyx* 3–4 mm. long with 4 more or less rounded ciliate teeth about 1 mm. long, green, often tinged with purple. *Corolla* tube 7–9 mm. long, 1–2 mm. diameter, lobes 4, more or less strap-shaped, 3–4·5 mm. long, rounded. *Stamens* 2, filament 0·5 mm. long attached in the corolla tube about 2 mm. from its top; anthers 2 mm. long, about twice as long as broad with a well developed terminal appendage; range of average dimensions of pollen grains measured 20·2–25·6μ with a range of extremes of 19–27μ. *Ovary* about 2·5 mm. long, including a style about 1·25 mm. long, with a slightly bifid capitate stigma. *Drupe* bluish-black, ellipsoid or ovoid, 8 mm. long by 5 mm. broad, endocarp hard but thin about 0·3 mm. thick.

INDIA

SIKKIM. Tonglo, 2750 m., 29 April 1919, *G. H. Cave* s.n. (E), 24 April 1920, *G. H. Cave* s.n. (E), 18 May 1876 and 13 Nov. 1876, *G. King* s.n. (BM, FI), Dec. 1881, *G. King* s.n. (L), N.E. spur, 8 May 1877, *J. L. Lister* s.n. (L), and "spur towards the Pulbazer road", c. 2750 m., 8 May 1913, *Lacaita* 28/8.5 (BM); Kalipokri to Tonglu, 2750 m., 4 June 1902, *J. H. Lace* 2276 (E); Kalapokry, 3050 m., 22 Sept. 1877, *G. King* 5002 (BM); Gangtok to Karponang, 2400 m., 8 April 1938, *Ludlow, Sherriff & Taylor* 4024 (BM, E); Chiabhanjan, 3050 m., 29 May 1919, *G. H. Cave* s.n. (E); Sandakphu, 3050–3350 m., 15 Oct. 1935, *K. Biswas* 3531 (A).

BHUTAN. Chendebi, 2600 m., in *Rhododendron arboreum* forest, 13 May 1937, *Ludlow & Sherriff* 3040 (BM, E); Ha Dzong, 3050 m., in conifer forest, 30 April 1949, *Ludlow, Sherriff & Hicks* 16092 (BM, E); Rudo La (E. side), 2400 m., on banks in dense rain forest, 16 April 1949, *Ludlow, Sherriff & Hicks* 18714 (BM, E); Pangkar, near Lhuntse Dzong, Kurn Chu, 2750 m., common in dense rain forest, *Ludlow, Sherriff & Hicks* 18733 (BM, E); Donga La (W. side), 3050 m., in dense rain forest, 23 April 1949, *Ludlow, Sherriff & Hicks* 20518 (BM, E); Descent to Rydang, 2600 m., 1838, *W. Griffith* s.n. (holo. K).

ASSAM. Pankim La, south side, Bahpara frontier tract, 2400 m., upper temperate rain forest, 2 May 1935, *F. Kingdon Ward* 11377 (BM); Ranges north of Shergaon, 2150–2750 m., in forest, 5 May 1938, *F. Kingdon Ward* 13614 (BM).

MANIPUR. Ching Sow, 2600 m., growing along with Rhododendrons, 17 April 1882, *G. Watt* 6546 (E, P).

NEPAL

Siklis, north of Pokhara, 2750 m., 21 April 1954, *Stainton, Sykes & Williams* 4942 (BM, E).

BURMA

Between Sadon and the Yunnan Chinese border at Changtifang and Kambaiti, Nov. 1922, *J. F. Rock* 7394 (NY, US).

CHINA

Yunnan. Shunning, Hila, Wumulung, 2900 m., among forest, 11 July 1938, *T. T. Yü* 16697 (E).

S.E. TIBET

Pachakshiri district, Nyng La, lat. 28° 45′ N., long. 94° 15′ E., 2150–2400 m., common in dense mixed forest, 26 April 1938, *Ludlow, Sherriff & Taylor* 3679 (BM, E).

Osmanthus suavis was first collected by William Griffith in his journeyings in Bhutan in 1837–38. Considerable time elapsed before it was described and named, for Griffith went no further than calling it *Olea sp.* (Itin. Not. 156, no. 785: 1848) and much later Gamble, in the first edition of his Manual of Indian Timbers, refers to it as *Osmanthus sp.* (p. 257: 1881) although he gave a short description, particularly of the structure of its timber. When writing up the Oleaceae for the Flora of British India, C. B. Clarke found that Sir George King had given the species the unpublished name of *Osmanthus suavis* which he took up and to which he gave valid publication.

The relationship between this species and *O. delavayi*, a very close one indeed, is discussed under the latter species. Sufficient here to say that whilst the leaf shape and size of the earlier collections of *O. suavis*, and of the plant in cultivation in Britain, was very consistent, some of the later gatherings have shown a much wider variation. For example, *Ludlow & Sherriff* 3679 from South East Tibet has leaves which are very short, small and ovate, the largest on the specimen in the Edinburgh Herbarium

being only 3 cm. long by 2 cm. broad; contrasting with this are *Kingdon Ward* 11377 and 13613 from Assam where the leaves are the largest seen, being 5·5–9·5 cm. long, in the former lanceolate and in the latter, ovate.

According to the field notes attached to *Ludlow, Sherriff & Hicks* 16092, in Bhutan the evergreen shoots are fed to cattle during winter.

31. **Osmanthus delavayi** Franchet in Bull. Soc. Linn. Paris, i, 613 (1886); Hemsley in Journ. Linn. Soc. Lond. xxvi, 87 (1889); Vilmorin & Bois, Fruct. Vilmor. (Vilmor. Cat. Prim.), 185 et fig., 1904 (1905); Bean in Kew Bull. 1910, 393; Osborn in Garden, lxxv, 178 et fig. (1911); Schneider, Ill. Handb. Laubhölz. ii, 791 (1911); Mottet in Rev. Hort. N. S. xii, 173 et fig. (1912); Stapf in Bot. Mag. cxxxviii, t. 8459 (1912); Silva Tarouca, Unsere Freiland-Laubgehöltze, ed. 1, 275 (1913) et cum Schneider, ed. 3, 244 et fig. (1931); Bean, Trees and Shrubs, ed. 1, ii, 112 et fig. (1914) et ed. 7, ii, 379 et fig. (1951); Anon. in Gard. Chron. ser. iii, lv, 269 et fig. (1914); Anon. in Journ. Roy. Hort. Soc. Lond. xl, Proc., p. lxii et fig. (1915); Rose in Garden, lxxix, 232 et fig. (1915); Bailey, Stand. Cycl. Hort. 2412 (1916); Léveillé, Cat. Pl. Yun-Nan, 181 (1916); "W" in Gard. Ill. xxxix, 451 et fig. (1917); Anon. in Garden, lxxxiii, 185 et fig. (1919); Jacob in Garden, lxxxiv, 154 (1920); Grove in Country Life, lv, 1056 et fig. (1924) et o.c. lxi, p. lxiv et fig. (1927); Anon in Garden, lxxxviii, 757 et fig. (1924); Johnson in Garden, xci, 149 et fig. (1927); Rehder, Man. Cult. Trees and Shrubs, ed. 1, 758 (1927); Kirk, Brit. Garden Flora, 380 et fig. (1927); Fraser in Gard. Chron. ser. iii, lxxxiii, 355 (1928); Nakai in Bot. Mag. Tokyo, xliv, 14 (1930); Anon. in Gard. Chron. ser. iii, xcii, 368 et suppl. tab. (1932); Rehder in Journ. Arn. Arb. xv, 303 (1934); Hallett in Gard. Chron. ser. iii, ci, 348 et fig. (1937); Proctor in Gard. Chron. ser. iii, cxv, 200 et fig. (1944); Bean in Chittenden, Dict. Gard. iii, 1452 et fig. (1951); Cowan, The Journeys and Plant Introductions of George Forrest, 206 (1952).

Syn.: *Ligustrum phillyrea* Lévl. in Bull. Géog. Bot. xxv, 41 (1915) et in Cat. Pl. Yun-Nan, 181 (1916); Rehder in Journ. Arn. Arb. xv, 303 (1934).

Siphonosmanthus delavayi (Franch.) Stapf in Bot. Mag. clii, sub. t. 9176 (1929); Handel-Mazzetti, Symb. Sin. vii, 1007 (1936); Rehder, Man. Cult. Trees and Shrubs, ed. 2, 789 (1940); Bailey & Bailey, Hortus Second, 686 (1941).

Evergreen *shrub* 0·6–2 or occasionally 5 m. high, young stems densely puberulous. *Leaves* glabrous, midrib puberulous above, at least when young; *petiole (1–)2–3(–5) mm. long*, puberulous, at least when young; lamina thick coriaceous, stiff, usually punctate with very small black dots and occasionally covered with small raised but distinct dots, especially below, *broadly elliptic or ovate to lanceolate, rarely narrowly elliptic or slightly obovate, (0·5–)1–2·5(–3·8) cm. long by (0·4–)0·6–1·5(–2) cm. broad; margin serrate, teeth spinescent or occasionally shallow and non-spiny*, (4–)7–10(–15) teeth per side, up to 1 mm. long (Fig. 1L); apex acute to blunt with an acute sharp tip; base angustate to blunt, slightly decurrent into the petiole; venation obscure, sometimes *primary veins* visible, *4 per side. Inflorescence* axillary and terminal, fasciculate, usually 1 bud per axil with 2–5 flowers; pedicels 1–5 mm. long glabrous or occasionally with

a few hairs; basal bracts acute, ciliolate, sometimes slightly puberulous, usually early deciduous, 1–2 mm. long. *Flowers* white, very fragrant. *Calyx* 2–4 mm. long. with 4 more or less rounded ciliate teeth 1–2 mm. long, green, often tinged with purple. *Corolla* tube (6–)8–11(–13) mm. long, 1–2 mm. diameter, lobes 4, (2–)3–4(–6) mm. long, rounded. *Stamens* 2; filaments 1 mm. long attached in the corolla tube about 3–4 mm. from the top of the tube; anthers 2 mm. long about twice as long as broad, with a well developed terminal appendage; range of average dimensions of pollen grains measured 20·2–23·4μ with a range of extremes of 19–25μ. *Ovary* 3–4 mm. long including a style about 2·5 mm. long with a slightly bifid capitate stigma. *Drupe* bluish black, ellipsoidal-ovoid, 10 mm. long by 6 mm. broad, endocarp acute at the apex, hard but thin, about 0·3 mm. thick.

YUNNAN. Lan-Kong, 5 March 1883, *J. M. Delavay* 185 (P), sur le Hee-chan-men (Lan-Kong), 2800 m., 13 March 1883, *J. M. Delavay* s.n. (holo. of *O. delavayi*, P) and 3000 m., 4 Sept. 1888, *J. M. Delavay* s.n. (P); Environs de Kiu Tsien, 5 Feb. 1909, *F. Ducloux* 1169 (E); Chouy-tang-tse, region de Kiao-Kia, March 1909, *F. Ducloux* 1170 (E); between Kwang-tung-hsien and Shan Chiao, 2150–2450 m., on dry chalky hills, Feb. 1903, *G. Forrest* 574 (E); Lang-Kung Hsien valley, on the ascent of the Sung-Kwei Pass, lat. 26° 20′ N., 2750–3050 m., amongst mixed scrub, April 1906, *G. Forrest* 2011 (E) and 2019 (E); Sung-Kwei Pass, lat. 26° 12′ N., 3050 m., in mixed and pine forest, May 1917, *G. Forrest* 13771 (E); Mountains of the Chungtien Plateau, lat. 27° 30′ N., 3050 m., in open scrub, April 1914, *G. Forrest* 12394 (BM, E); Chungtien, Haba, 3500 m., margin of woods, 12 Sept. 1937, *T. T. Yü* 13529 (E); Wa-di-i Shan, lat. 27° 40′ N., 3650 m., rocky scrub, Aug. 1917, *G. Forrest* 15373 (E); ab urbe Yünnanfu septentr. versus ad viam parvam directam Huili ducentem, inter vic. Dwangai et Munayi, lat. 25° 50′ N., c. 1950 m., 12 March 1914, *H. Handel-Mazzetti* 576 (W); Tali, top of Piê Yün Mountain, June, received 29 March 1933, *McLaren's Collectors* C. 93 (BM, E); Pai-Ching, Sept., received 13 April 1936, *McLaren's Collectors* F. 241 (E); Hua-Ping, middle part of mountain, March, received 9 May 1935, *McLaren's Collectors* L. 12 (BM, E); Yung-Ling, summit of mountain, May, received 27 March 1934, *McLaren's Collectors* P. 35 (BM, E); Eastern slopes of Likiang Snow Range, Yangste watershed, 1923–24, *J. F. Rock* 8198 (NY) and 9814 (NY); and western slopes, 3350 m., April 1923, *J. F. Rock* 8213 (US); between Likiang and Young Ning, 3400 m., in spruce forests, May 1928, *J. F. Rock* 17204 (NY, US), and on dry slopes, 3080 m., 1929, *J. F. Rock* 17385 (BM, NY); Lichiang-fu, 2750 m., on wooded mountain slopes, 6 April 1922, *F. Kingdon Ward* 5024 (E); Lichiang Snow Range, 2500 m., grassy mountain slope amongst thickets, 6 April 1938, *T. T. Yü* 11016 (BM, E); Mt. Wuaha, Yung-ning lake shore, 2925 m., Aug. 1932, *J. F. Rock* 24248 (BM, E, NY); Kouty, 1918, *S. Ten* 473 (E).

SZECHUAN. In montis Lungdschu-schan prope urbem Huili ad vicum Djifangkou, c. 2850 m., 26 March 1914, *H. Handel-Mazzetti* 902 (W); in montium Daliangschan (Territorii Lolo) ad orientem urbis Ningyüen, c. 2600–2800 m., 25 April 1914, *H. Handel-Mazzetti* 1677 (W); Inter oppidum Yenyüen et flumen Yalung, jugi Sandao-schan, lat. 27° 31′ N., c. 3150–3350 m., 12 May 1914, *H. Handel-Mazzetti* 2208 (E); Mountains of Muli and Kulu, outskirts of forest at Djago, 3400 m., April 1929, *J. F. Rock* 17395 (E, NY, US, W); Muli, 2750 m., in the forest below the cliff, 9 Sep. 1921, *F. Kingdon Ward* 4944 (E); Muli, near Lamasery, 2700 m., margin of forest, *T. T. Yü* 14140 (BM, E); near Kuapie, 3200 m., May 1921, *C. Schneider* 1333 (E); Mont de Pe-long-tsien, 3200 m., 1914, *E. E. Maire* 868 (BM, E); plateau de Ta-hai-tse, 3200 m., *E. E. Maire* 167/1913 (E); Io-chan, rochers mousseux, 3200 m., *E. E. Maire* 748/1914 (E) and, together on the same sheet, Ta-hai-tse and Io-chan, May, *E. E. Maire* s.n. (holo. of *Ligustrum phillyrea*, E).

The relationship between this species and *O. suavis*, as has already been mentioned under that species, is a very close one; in fact it is somewhat doubtful whether complete specific status should be accorded to the two

plants. *O. delavayi* from northern Yunnan and southwest Szechuan is on the whole less variable in its morphology and more compact in its geographical distribution (Fig. 5). Until about thirty years ago, *O. suavis* also appeared less variable and its known distribution was confined to Sikkim and Bhutan with one outlier in Manipur. However, many of the latest collections especially those of Kingdon Ward from Assam, Rock from Burma, Ludlow & Sherriff from S.E. Tibet and Yü from W. Yunnan, have shown a much greater variability, as well as indicating a far wider distribution. It is now obvious not only that the two species approach each other geographically but in their morphology as well. On one hand *Ludlow & Sherriff* 3679 from S.E. Tibet (at least the specimen in the Edinburgh Herbarium) has the smallest leaves of any specimen of *O. suavis* examined, some leaves being less than 2·5 cm. long, whilst the Maire specimens from Szechuan (on which Léveillé based his *Ligustrum phillyrea*) have the largest leaves for *O. delavayi*, being occasionally over 3·5 cm. long and when compared with the Yü and Rock material from Yunnan and Burma respectively, are hardly distinguishable.

Despite this, however, the two species are most clearly separated by leaf size, especially if size is combined with the number of primary veins and perhaps the character of the leaf margin. The length of the petiole is also useful but this is probably correlated with lamina length which in these species has been shown to overlap slightly. Apart from leaf characters there appears to be no way of distinguishing the two species for there are no real floral differences. *O. suavis* tends to have more flowers per bud perhaps, and to be more uniform in the length of the corolla tube and lobes, but these are only tendencies with many exceptions. However, when petiole length, leaf margin and primary venation are considered together, a distinction can be made. Moreover, *O. delavayi* is generally a much smaller plant. Field notes show it to be a shrub usually up to 2 m. but occasionally up to 5 m. in height, whereas *O. suavis* is described as a shrub or small tree reaching 7·5 m. It is possible, however, that this tendency may be a reflexion of the climatic differences between Szechuan and Yunnan on the one hand and Sikkim and Bhutan on the other where the annual rainfall tends to be greater. The altitudinal ranges of the two are very much the same. It is worth noting too that one of the specimens of *O. delavayi* which most closely resembles *O. suavis*, the Maire material from Szechuan, is described on the field note as being a "petit arbre".

Additional proof that the two species are very close is perhaps provided by the fact that they appear to be interfertile. Pollen of *O. suavis* growing in the Royal Botanic Garden, Edinburgh, was taken in the spring of 1954 and dusted on to two or three emasculated flowers of *O. delavayi*. Two ripe drupes were obtained which have since germinated, and the seedlings, while still rather small, appear somewhat intermediate with perhaps a greater tendency towards *O. suavis*.

When consideration is given to the close similarities and distribution of *O. delavayi* and *O. suavis*, one approaches the conclusion that they should be ascribed subspecific rather than specific rank. However, in view of the fact that relatively little material is as yet known from the vast areas between China and Bhutan and not all of that which is known is of an intermediate character (*e.g.* the Kingdon Ward specimens from

Assam exhibit the largest leaves yet seen) and that the stocks of the two plants in cultivation, at least in Britain, are quite different from one another, it is felt that it is better to leave the taxonomic status of the two plants untouched. This course also has the advantage from the horticultural point of view in that the better known plant, *O. delavayi*, will continue to bear this name.

O. delavayi is probably the best known species in British gardens today, and because of the masses of very fragrant white blossom produced in early spring is likely to increase in popularity. It was given an Award of Merit by the Royal Horticultural Society in April 1914, an Award of Garden Merit in March 1923 and a First Class Certificate in April of 1931.

Osmanthus Sect. **Linocieroides** P. S. Green, **sect. nov.**

Ab aliis sectionibus lobis petalorum per paria coalitis et inter paria fere liberis differt.

Folia integra. Inflorescentiae axillares fasciculatae. Flores androdioecii. Corolla sine tubo; petala quattuor, plus minusve libera, per paria ad basin per c. 0·5–0·75 mm. coalita; antherae c. 1·5 mm. longae appendice terminali absente.

Evergreen *tree* up to 15 m. in height, branches glabrous or minutely puberulous when young. *Leaves* glabrous or slightly puberulous at the base of the midrib above when young; lamina thick coriaceous; margin entire, slightly thickened; apex acute or subacuminate; venation more or less obscure. *Inflorescence* axillary, fasciculate, pedicels slender, lengthening and thickening slightly in fruit. *Flowers* androdioecious. *Calyx* 0·5 mm. long with 4 more or less shallow teeth, somewhat irregular. *Corolla* without tube, petals 4, imbricate in the bud, united in pairs at the base for about 0·5–0·75 mm., strap-shaped, slightly oblanceolate, 3 mm. long. *Stamens* 2; filaments 1–1·5 mm. long, fully developed in the mature flower, attached at or just below the junction of the paired petals; anthers about 1·5 mm. long without terminal appendage. *Ovary*, including style, about 2·5 mm. long with a slightly bifid capitate stigma; in the male flower, abortive, more or less conical, about 1 mm. long. *Drupe* slightly asymmetrically ellipsoidal, endocarp thin crustaceous, slightly ribbed.

The recognition of the unique *Osmanthus didymopetalus*, known only from Hainan, (Fig. 3, p. 479), has necessitated the description of this new section. It is quite unlike any other in the genus, in the possession of a deeply divided corolla with the four almost free petals united in pairs at their very base. In this respect it closely resembles the genus *Linociera* but there the petals are induplicate-valvate and not imbricate as in this case. Furthermore, in this section the two petal pairs are widely separated, even in the bud, and in the mature flower they hang out on opposite sides of the ovary. When the first specimen was examined it was thought that it must be a freak, but no fewer than six different collections have been seen in flower and all with the same unique corolla. Stapf considered that the corolla of Sect. *Siphosmanthus* was distinct enough to warrant a new genus, *Siphonosmanthus* and both Rafinesque and Small have proposed generic status for *O. americanus*, and thus indirectly for Sect. *Leiolea*, and, should they be treated as such, it would be very necessary

to raise this section *Linocieroides* to generic rank as well. However, the inflorescence and fruit characters agree with other species of *Osmanthus* and, at least until the whole of the tribe *Oleineae* has been reviewed from the point of view of generic limits, it is felt that the soundest course is to propose a new section of *Osmanthus*.

The section *Linocieroides* resembles Sect. *Osmanthus* in the possession of a fasciculate inflorescence, and when the corolla has withered and been shed there is no certain way of separating the two sections. In most species of Sect. *Osmanthus* the endocarp is hard and thick, but some species, e.g. *O. serrulatus*, possess a thin one like that in *O. didymopetalus*. Similarly the flowers are androdioecious, rather than dioecious as in the non-tropical species of Sect. *Leiolea*, but resemblances with this latter section exist in the rounded ellipsoid anther, larger in *O. didymopetalus*, without a terminal appendage. Furthermore the leaves show no sign of serration, the general condition in *Leiolea*, but no great stress can be laid on this character for in Sect. *Osmanthus* the characteristic serrate leaves are only found on immature, or slightly immature, shoots.

Finally, this section represents the furthest condition in floral reduction in the genus. Occasional apetalous species occur in *Olea*, *Notelaea* and other related genera but none has been recorded in *Osmanthus* and so far the condition in *O. didymopetalus* is the nearest approach. It represents the opposite type of development to that found in Sect. *Siphosmanthus*, where the corolla is elaborated, rather than reduced, with the formation of a long tube.

32. **Osmanthus didymopetalus** P. S. Green, **sp. nov.** (Plate 20).

Arbuscula 15 m. alta, ramulis primum glabris vel minute puberulis. *Folia* glabra, costis supra primum saepe basim versus leviter puberulis exceptis; petioli 1–2(–2·5) cm. longi glabri vel praesertim supra puberuli; laminae crassae coriaceae angusto-ellipticae vel interdum ellipticae vel lanceolatae, (4·5–)6·5–10(–17) cm. longae, (1·3–)2–2·5(–6) cm. latae, marginibus integris paulo incrassatis, apicibus acutis vel interdum subacuminatis, acumine acuto sed plerumque defecto, basibus angustatis vel cuneatis, in petiolum decurrentibus; venis plus minusve obscuris, venis primariis tantum utrinque manifestis raro supra paene reticulatis utrinsecus 5–6(–8). *Inflorescentiae* axillares, fasciculatae, pedicello floris 3–10 mm. longo, fructus 8–15(–20) mm. longo; bracteae basales crassae plerumque puberulae interdum glabrae. *Calyx* 0·5 mm. longus dentibus quattuor plus minusve brevibus. *Corolla* e petalis quattuor per paria basi per 0·5 mm. coalitis paribus inter se plus minusve liberis, lobis 3 mm. longis loratis leviter oblanceolatis. *Stamina* duo, filamentis 1–1·5 mm. longis, petalorum sinubus (vel vix infra) insertis, antheris 1·5 mm. longis sine appendice terminali. *Ovarium* c. 2·5 mm. longum, stylo c. 1 mm. longo incluso, stigmate capitato et leviter bifido. *Fructus* drupaceus, purpureus vel purpureo-ruber, leviter oblique ellipsoidalis, 16–25 mm. longus, 8–10 mm. latus, endocarpio tenui crustaceo.

Small evergreen *tree* up to 15 m. in height, young branches glabrous or minutely puberulous. *Leaves* glabrous, midrib above often slightly puberulous towards the base at first; petiole 1–2(–2·5) cm. long, puberulous,

especially above, or glabrous; lamina thick coriaceous, narrow elliptic to occasionally elliptic or lanceolate (4·5–)6·5–10(–17) cm. long by (1·3–)2–2·5(–6) cm. broad; margin entire slightly thickened; apex acute or occasionally subacuminate, tip acute but generally damaged giving the leaf a rounded or blunt appearance; base angustate or cuneate, decurrent into the petiole; venation more or less obscure, primary veins only visible above and below, rarely just reticulate above, *5–6(–8) primary veins per side*. *Inflorescence* axillary, fasciculate, 1 or 2 buds per axil with 6–12 flowers per bud; pedicels 3–10 mm. long in flower, 8–15(–20) mm. long in fruit, glabrous; *basal bracts 2–3 mm. long, thick, generally puberulous*, sometimes glabrous. *Flowers* white, creamy white or yellow, fragrant. *Calyx* 0·5 mm. long with 4 triangular teeth occasionally shallow and somewhat irregular. *Corolla* of *4 more or less free petals arranged in two pairs, each pair joined at the base for about 0·5–0·75 mm., lobes 3 mm. long* strap-shaped, slightly obanceolate. *Stamens* 2, filaments 1–1·5 mm. long at full length only when the flower is mature and the pollen shed, attachment at or just below the point of fusion of the paired petals; *anthers* 1·5 mm. long *rounded ellipsoidal* one and a half times as long as broad, *without terminal appendage*; range of average dimensions of pollen grains measured 19–20·8μ with a range of extremes of 18–21μ. *Ovary* about 2·5 mm. long, including style about 1 mm. long, with a slightly bifid capitate stigma. *Drupe* purple, or purplish red, slightly asymmetrically ellipsoidal with a blunt apex, slightly beaked and with a small flat base, 16–25 mm. long by 8–10 mm. broad, when immature and dried distinctly narrowed at both ends, endocarp thin crustaceous, slightly ribbed.

HAINAN. Bo-ting, 900 m., in forest, 24 Sept. 1935, *F. C. How* 73705 (A, SING), in dense woods, 16 Oct. 1936, *S. K. Lau* 28013 (A) and in forest, 17 Nov. 1936, *S. K. Lau* 28221 (A); Yaichow, in woods, 5 March 1933, *F. C. How* 70301 (K, NY, US) and c. 2100 m., Feb. 1933, *F. C. How & N. K. Chun* 70143 (E, K, NY, US); Ng Chi Leng, Ah Ping, 900 m., in forest, 24 Oct. 1932, *N. K. Chun & C. L. Tso* 44144 (L, NY, W); Chim Fung Mt., near Sha Mo Kwat village, Kan-en district, rare, steep slope, clay, rocky, forest, 13–31 Dec. 1934, *S. K. Lau* 5099 (A). Without locality, in mixed and shaded forest, top of the mountain, 18 Oct. 1933, *H. Y. Liang* 63485 (holo. E, iso. A, K, NY); 3 Nov. 1933, *H. Y. Liang* 63630 (NY, US), in light woods, partial shade, 23 Oct. 1933, *H. Y. Liang* 63771 (E, NY, US); 11 Jan. 1934, *H. Y. Liang* 64428 (E, NY) and 64429 (K, NY), 17 Jan. 1934, *H. Y. Liang* 64751 (E, NY); 25 Feb. 1934, *H. Y. Liang* 65263 (NY, US) and 65265 (NY); mixed forest, 18 Oct. 1933, *C. Wang* 34716 (A, NY) and 34719 (NY); 1 Jan. 1934, *C. Wang* 36060 (NY, US) and 36076 (K, NY).

Superficially perhaps this species most nearly resembles a narrow-leaved form of *O. fragrans*, to which many of the specimens had been assigned. However, the almost constantly elliptic leaves with their more or less obscure venation below and generally fewer primary veins serve to distinguish it even without the flowers. It also bears some resemblance to the small narrow-leaved forms of *O. marginatus*, but the fasciculate inflorescence, recognisable either in flower or fruit separates it without difficulty.

Although quite a large number of gatherings have been seen, they have all been made in Hainan and the species appears to be endemic to the island.

In all the material examined it is strange how few leaf apices have remained intact in the living plant. On *Lau* 28221 they are nearly all

undamaged and the acute tip of the leaf may be observed, but there are very few leaves on all the other collections examined (including the type), apart from one or two on *How* 73705, where the leaf tip remains intact. At first the generality of this damage was not apparent and it was thought that the leaf was characteristically rounded or blunt, but this appears not to be the case despite the fact that it is not known why this species should exhibit so many damaged leaves on so many different gatherings from so many different localities.

Insufficiently Known Species

Osmanthus acutus Masamune & Mori in Journ. Jap. Bot. xv, 546 et figs. (1939).

Type (not seen): *R. Kanehira & S. Sasaki* 20039, Formosa, Prov. Tainan, Tâtaka, 9000 ft., 27th Oct. 1918.

Osmanthus rigidus Nakai in Bot. Mag. Tokyo, xxxii, 37 (1918), Trees and Shrubs Indig. Jap. Proper, ed. 1, 263 et fig. (1922) et, cum Koidzumi, ed. 2, i, 347 et fig. (1927), et in Bot. Mag. Tokyo, xliv, 16 (1930); Makino & Nemoto, Fl. Jap. ed. 2, 940 (1931); Hara, Enum. Sperm. Jap. i, 126 (1948); Ohwi, Fl. Jap. 941 (1953).

Type (not seen): "In Hortis Botanicis Imperialis Universitatis Tokyo, culta. Patria ignota".

Excluded Species

Osmanthus buxifolius Hort. ex Bailey, Cycl. Amer. Hort. iii, 1177 (1901) et Stand. Cycl. Hort. iv, 2412 (1917), nom. nud.

"Probably *Olea capensis* L".

Osmanthus latifolius Hort. ex Bailey, ll, cc., nom. nud.

"Probably a *Phillyrea*".

Osmanthus ligustrifolius Hort. ex Bailey, ll, cc., nom. nud.

"Probably a *Phillyrea*".

INDEX TO EXSICCATAE

1069 (*9*), 1646 (*9*), 1793 (*29*); Christensen, A. W., s.n. (*9*); Chun, N. K., 7806 (*4*) 40089 (*4*), 40346 (*4*); Chun, N. K. & C. L. Tso, 44144 (*32*), 44193 (*15*); Chun, Y. F., 30419 (*4*); Chung, N. H., 770 (*9*), 965 (*9*), 1619 (*9*), 8489 (*9*); Chung, Z. S., 81681 (*11*), 83517 (*sub 11*), 83530 (*sub 11*); Clemens, M. S., 1913 (*9*); Copeland, N. F., s.n. (*17*); Collard, s.n. (*9*); Curtiss, A. H., 2314 (*1*), 4561 (*1*), 5778 (*1*), s.n. (*1*).

Dalziel, J. M., s.n. (*3*); David, A., s.n. (*9*); Deam, Stella, 1775 (*1*); Degener, O., 2444 (*9*); Delavay, J. M., 185 (*31*), 780 (*10*), s.n. (*31*); Dress, W. J. & J. Hansen, s.n. (*1*); Drummond, 285 (*1*); Ducloux, F., 252 (*9*), 464 (*9*), 1169 (*31*), 1170 (*31*); Duncan, W. H. & M. B., 3778 (*1*); Duthie, J. F., 3145 (*9*).

Earle, F. S. & C. F. Baker, s.n. (*1*); Earle, F. S. & E. S., 56 (*1*); Earle, F. S. & L. H. Underwood, s.n. (*1*); Egler, F. E., 40–289 (*1*).

Fan, C. S. & Y. Y. Li, 119 (*9*), 569 (*9*); Fang, W. P., 3405 (*9*), 3409 (*9*), 3410 (*9*), 5628 (*9*), 12699 (*9*); Farges, R. P., s.n. (*19*); Farrer, R., 1351 (*9*); Faure, P., 6651 (*17*), 11494 (*17*); Faurie, U., 315 (*9*), 371 (*9*) 8221 (*4*), 11586 (*9*); Feilberg, C. A., s.n. (*5*); Feng, K. M., 274 (*10*), 708 (*10*), 3182 (*10*); Forbes, F. B., 2397 (*17*); Ford, C., 116 (*14*); Forrest, G., 574 (*31*), 576 (*9*), 2011 (*31*), 2019 (*31*), 3100 (*9*), 4743 (*9*), 8581 (*9*), 11027 (*10*), 11060 (*10*), 12394 (*31*), 13476 (*10*), 13771 (*31*), 15373 (*31*), 15512 (*10*), 15547 (*10*), 16662 (*10*), 16827 (*10*), 17056 (*10*), 18558 (*9*), 20585 (*10*), 21050 (*10*), 21367 (*10*), 23079 (*10*), 23178 (*10*), 23488 (*10*), 23490 (*10*), 25390 (*9*); Fortune, R., s.n., (*17*); Fung, Hom, 8 (*9*).

Galeotti, H., 529 (*1*); Gaudichaud, 273 (*9*), 274 (*9*); Gadeceau, E., 4544 (*16*); Gamble, J. S., 1699D (*9*), 8291 (*9*), 10005 (*9*), 23723 (*9*); Garber, A. P., s.n. (*1*); Giraldi, G., 736 (*9*), 1642 (*9*), 4387 (*9*); Godfrey, R. K. & R. M. Tryon Jnr., 1691 (*1*); Gray, A., s.n. (*1*); Gressitt, J. L., 208 (*4*), 228 (*4*), 564 (*5*), 1101 (*4*), 1113 (*4*); Griffith, W., 154 and 155 (*9*), s.n. (*30*); Guilding, L., s.n. (*9*).

Haines, H. H., 1126 (*9*), 1127 (*9*); Hamilton, F. B., 38 (*9*), s.n. (*9*); Handel-Mazzetti, 196, (*9*), 576 (*31*), 614 (*10*), 745 (*sub 9*), 746 (*5*), 795 (*9*), 902 (*31*), 1677 (*31*), 2208 (*31*), 4896 (*9*), 12048 (*sub 9*), 12049 (*5*), 12727 (*9*); Harper, J. S., 361 (*1*); Harper, R. M. 1099 (*1*), 2039 (*1*), 2259 (*1*); Harris, J. A., C19562 (*1*); Hatusima, 863 (*sub 13*); Hayashi, T., 705 (*4*), 707 (*4*); Hayata, B., s.n. (*23*); Herb. Hayne, s.n. (*9*); Henry, A., 543 (*4*), 806 (*4*), 824 (*4*), 824a (*4*), 941 (*5*), 1011 (*4*), 1252 (*5*), 1533 (*4*), 1535 (*4*), 1686 (*4*), 2288 (*9*), 2497 (*9*), 2498 (*9*), 2638 (*9*), 4597 (*19*), 5182 (*19*), 6730 (*19*), 7587 (*19*), 7722 (*9*), 7784 bis (*9*), 10020 (*12*), 11002 (*9*), 11048 (*25*), 13213 (*9*); Herb. Mohnike, s.n. (*17*); Herb. Univ. Imp. Kyushu, 17685 (*13*); Herb. Stead, s.n. (*9*); Herman, F. J., 10092 (*1*); Hinkin, H. J., s.n. (*9*); Ho, H. T., 60144 (*4*); Hogg, T., s.n. (*1*); Hong Kong Herb., 10949 (*3*); Hooker, J. D., 28443 (*17*), s.n. (*9*); Hooker, J. D. & T. Thomson, 2386 (*4*); How, F. C., 70301 (*32*), 71028 (*5*), 71739 (*4*), 72122 (*4*), 72133 (*4*), 72382 (*4*), 73210 (*5*), 73696 (*5*), 73705 (*32*), 73717 (*4*); How, F. C. & N. K. Chun, 70143 (*32*); Hsuing, T. K., 6369 (*5*); Hu, W. K., 8362 (*11*), 8901 (*9*); Hussey, A. F., 229 (*9*), 230 (*9*).

Iida, N., M. Tajima & M. Okayama, s.n. (*23*).

Jacquin, s.n. (*9*); Johnstone, G. J., s.n. (*10*); Jones, R. N., 102 (*1*); Jurgensen, 382 (*1*).

Kanehira, R., 3313 (*5*), 21316 (*4*), 21317 (*4*); Kanehira, R. & S. Sasaki, 699 (*17*), s.n. (*17*), s.n. (*23*); Kawakami, T. & Y. Shimada, s.n. (*9*); Kawakami, T. & U. Mori, 2003 (*17*); Keeler, H. D., s.n. (*1*); Keng, H. & K. Kao, 2679 (*23*); Kerr, A. F. G., 5314 (*9*); King, G., 5002 (*30*), s.n. (*30*); King's Collector, 3663 (*6*), 6978 (*6*), s.n. (*9*); Kitamura, S., s.n. (*17*), Ko, S. P., 55799 (*9*); Kollmann, s.n. (*9*); Krone, R., s.n. (*9*); Kudo, Y. & S. Sasaki, 15170 (*4*), 15291 (*4*), 15347 (*4*).

Lacaita, 28/8.5 (*30*); Lace, J. H., 2276 (*30*), 2381 (*9*); Lau, S. K., 123 (*4*), 1982 (*4*), 2024 (*3*), 3754 (*5*), 3838 (*4*), 4346 (*3*), 4644 (*9*), 4860 (*3*), 5099 (*32*), 6223 (*4*), 26590 (*5*), 26593 (*5*), 26656 (*5*), 28010 (*5*), 28013 (*32*), 28090 (*sub 14*), 28211 (*5*), 28219 (*5*), 28221 (*32*); Leclaire, F. J., s.n. (*1*); Leclancher, s.n. (*9*); Lee, F. S., s.n. (*1*); Lee, T. C., 4548 (*5*); Lei, C. I., 109 (*4*), 299 (*4*), 638 (*4*), 941 (*4*); Law, Y. W., 346 (*9*); Lewis, I. F., 216 (*1*); Lewett, 202 (*1*); Liang, H. Y., 62505 (*4*), 62669 (*5*), 63485 (*32*), 63630 (*32*), 63771 (*32*), 64428 (*32*), 64429 (*32*), 64751 (*32*), 65051 (*4*), 65263 (*32*), 65265 (*32*), 69766 (*4*); Lighthipe L. H., 125 (*1*), s.n. (*1*); Liou, T. N., 1736 (*9*); Lister, J. L., s.n. (*30*); Liu, Y. S., 1652 (*9*), 1752 (*11*); Lobscheid, W., s.n. (*5*); Loureiro, J. de, s.n. (*9*); Ludlow & Sherriff, 3040 (*30*); Ludlow, Sherriff & Hicks, 16092 (*30*), 18714 (*30*), 18733 (*30*), 20518 (*30*); Ludlow, Sherriff & Taylor, 3679 (*30*), 4024 (*30*).

McKelvey, S. D., s.n. (*16*); McLaren's Collectors, C93 (*31*), C302 (*9*), F241 (*31*), L12 (*31*), P35 (*31*); Madden, E., s.n. (*9*); Maire, E. E., 22 (*9*), 143 (*10*), 167 (*31*), 195 (*10*), 232 (*12*), 748 (*31*), 868 (*31*), s.n. (*31*); Martini, A., s.n. (*9*); Masamune, G., 4035

(*27*), s.n. (*9*), s.n. (*13*); Masamune, G., K. Mori & T. Nakamuda, 2209 (*4*); Matuda, E., 2023 (*2*), s.n. (*4*), s.n. (*5*), s.n. (*9*), s.n. (*17 var.*), s.n. (*23*); Matsumura, J., s.n. (*9*); Maximowicz, s.n. (*9*), s.n. (*17*); Meijer, W., 3621 (*7*); Mell, R., 203 (*4*); Meyer, F. N., 1788 (*9*); Millet, s.n. (*4*); Millichamp, J. H., s.n. (*1*); Miyabe, K., s.n. (*16*); Mohnike, O. G. J., s.n. (*9*); Mohr, C., s.n. (*1*); Moldenke, H. N., 5972 (*1*); Montigny, 114 (*9*); Mori, K, s.n. (*4*), s.n. (*9*), s.n. (*28*); Morinoto, H., 756 (*9*); Mueller, C. H. & M. T., 371 (*1 var.*), 1033 (*1 var.*); Müllner, M. F., s.n. (*9*).

Nakai, T., s.n. (*13*); Nakama, T., 4011 (*17*), s.n. (*4*), s.n. (*17*); Nash, G., 986 (*1*); Nakahara, G., s.n. (*23*); Nelson; D., s.n. (*9*); Nicholson, G., 261 (*17*), 262 (*16*); Nisimuda s.n. (*9*); Norton, J. B., 419 (*1*).

Oldham, R., 538 (*9*), 544 (*17*), 3111 (*9*); O'Neill, H., s.n. (*1*); Otomo, H., s.n. (*13*).

Palmer, E. J., 35258 (*1*), 38673 (*1*); Perny, P., s.n. (*9*); Petelot, A., 2137 (*4*), 2674 (*4*), 2676 (*4*), 4215 (*9*), 4754 (*4*), 5951 (*4*), 5954 (*4*); Pierot, J., s.n. (*9*), s.n. (*17*); Pirie, D. V., s.n. (*9*); Pitcairn, Hort., s.n. (*9*); Playfair, G. M. H., s.n. (*25*); Poilane, 1719 (*4*); Polunin, Sykes & Williams, 827 (*9*), 5631 (*9*); Price, W. R., 281 (*9*), 1013 (*23*), 1163 (*9*); Purpus, J. A., s.n. (*17*).

Ram, Bis., s.n. (*9*); Rankin, H. F., s.n. (*9*); Rapp, S., s.n. (*1*); Rehder, A., s.n. (*10*); Reid, J. R., s.n. (*9*); Robinson, H. C., s.n. (*7*); Rock, J. F., 4063 (*10*), 7394 (*30*), 8198 (*31*), 8213 (*31*), 8232 (*10*), 8313 (*10*), 9814 (*31*), 17204 (*31*), 17385 (*31*), 17395 (*31*), 24248 (*31*); Rose, J. N., 4127 (*9*); Rugel, s.n. (*1*); Ruth, A., 30 (*1*).

Sakurai, H., s.n. (*9*), s.n. (*17*); Sampson, T., 920 (*4*); Sargent, C. S., s.n. (*17*); Savatier, L., 812 & 813 (*17*), 814 (*9*), 815 (*9*); Schiede, s.n. (*1*); Schneider, G. 397 (*10*), 400 (*10*), 412 (*10*), 1333 (*31*), s.n. (*9*); Skehan, J., s.n. (*1*); Scortechini, 414 (*6*); Shiota, K., 3450 (*17*), 4314 (*17*); Siebold, s.n. (*9*), s.n. (*16*), s.n. (*17*); Silvestri, 1804 (*9*), 3367 and 3367a (*20*); Simada, H., 826 (*17*); Simpson, J. H., 9 (*1*), s.n. (*1*); Singh, U., 209 (*9*); Small, J. K., s.n. (*1*), s.n. (*1 var.*); Small, J. K., N. L. Britton, & J. B. De Winkeler, 9369 (*1*); Small, J. K. & J. J. Carter, s.n. (*1*); Small, J. K. & P. Matthaus, 11612 (*1 var.*); Small, J. K. & E. T. Wherry, 11711 (*1*); Smith, J. D., 432 (*1*), s.n. (*1*); Stainton, Sykes & Williams, 4942 (*30*), 8312 (*9*); Stevens, H., 6 (*9*); Steward, A. N., 7277 (*9*); Steward, A. N. & H. C. Cheo, 1025 (*24*), 1109 (*9*); Steward, A. N., C. Y. Chiao & H. C. Cheo, 452 (*9*), 931 (*18*); Stewart, R. R., 11477 (*9*), 14901 (*9*); Strachey, R. & J. E. Winterbottom, 2 (*9*); Sudworth, G. B., s.n. (*1*); Suzuki, S., 39 (*17*), 260 (*17*), 2591 (*17*), 2666 (*23*), 3508 (*9*), 4544 (*4*), 8070 (*4*), 16132 (*4*), 16966 (*4*), 17762 (*5*), 19730 (*5*), 21218 (*17*), s.n. (*4*), s.n. (*16*), s.n. (*17*).

Taam, Y. W., 165 (*3*), 193 (*5*), 245 (*3*), 319 (*3*), 674 (*5*), 843 (*5*), 915 (*3*); Tanaka, 5049 (*9*); Tanaka, T. & Y. Shimada, 17854 (*4*); Tashiro, Z., s.n. (*5*), s.n. (*9*), s.n. (*13*); Ten, S., 272 (*10*), 303 (*10*), 313 (*sub 20*), 399 (*10*), 473 (*31*), 481 (*10*); Terakawa, 173 (*16*); Textor, C. J., s.n. (*9*), s.n. (*17*); Thunberg, s.n. (*9*), s.n. (*17*); To Kang Peng, 2327 (*4*), 10938 (*9*); Tokyo Science Museum, 863 (*sub 13*), 1132 (*13*); Tracy, S. M., 4971 (*1*), 4972 (*1*), 6668 (*1*), 6669 (*1*), s.n. (*1*); Tsai, H. T., 53688 (*10*), 54356 (*sub 9*), 55978 (*8*), 61717 (*9*), 62686 (*sub 8*); Tsang, W. T., 30 (*4*), 629 (*4*), 918 (*4*), 21217 (*3*), 21629 (*22*), 21731 (*3*), 22420 (*5*), 23401 (*9*), 23507 (*9*), 23689 (*9*), 24146 (*5*), 24260 (*5*), 24621 (*5*), 26261 (*5*), 26783 (*4*), 28396 (*9*); Tsiang, Y., 532 (*4*), 1009 (*4*), 1109 (*4*), 1649 (*4*), 1661 (*4*), 1662 (*4*), 7183 (*9*), 8036 (*9*), 8781 (*9*); Tsoong, T. S., 81681 (*11*), 83517 and 83530 (*sub 11*); Tsui, T. M., 708 (*9*); Tsuyama, T., s.n. (*13*); Tutcher, W. J., 10949 (*3*).

Uno, H., 32 (*9*), Uno, K., s.n. (*9*).

Wallich, 2809 (*9*), 2809a (*9*), 2809c (*9*), 2809d (*9*), 2809e (*9*), 2810 (*9*); Walker, s.n. (*9*); Wanatabe, K., s.n. (*17*); Wang, C., 33748 (*4*), 34465 (*5*), 34482 (*5*), 34716 (*32*), 34719 (*32*), 36060 (*32*), 36076 (*32*), 39446 (*5*), 40020 (*sub 11*), 40095 (*5*), 40224 (*5*), 40347 (*26*), 40534 (*5*), 71312 (*10*), 74241 (*4*), 74321 (*4*), 74324 (*4*), 74385 (*4*), 75681 (*4*), 80844 (*4*); Wang-Te-Hui, 12049 (*5*); Wang, T. P., 370 (*9*); Wang, Y. K., 1826 (*4*); Ward, F. Kingdon, 4944 (*31*), 5024 (*31*), 11377 (*30*), 13614 (*30*); Watt, G., 6546 (*30*); White, H., s.n. (*17*); Wilson, E. H., 38 (*9*), 496 (*9*), 2374 (*9*), 2374a (*20*), 2645 (*19*), 4079 (*11*), 4079a (*11*), 4216 (*11*), 5040 (*9*), 6967 (*17*), 7731 (*17*), 7825 (*17*), 8060 (*5*), 8367 (*13*), 9676 (*4*), 9735 (*23*), 9956 (*9*), 9962 (*4*), 9967 (*4*), 10036 (*17*), 10807 (*23*), 10913 (*17*), 11177 (*4*), 11227 (*17*); Wong, H. D., 7328 (*9*); Wray, L., 682 (*6*).

Yamamoto, Y., 478 (*17*), s.n. (*17*); Yamamoto & Mori, s.n. (*23*); Yanagihada, M., 403 (*5*), 470 (*5*), 496b (*5*); Yokoyama, J., 1132 (*13*); Yokohama Nursery, s.n. (*16*); Yü, T. T., 644 (*11*), 665 (*11*), 11016 (*31*), 13529 (*31*), 14140 (*31*), 16670 (*9*), 16697 (*30*).

Zabel, H., s.n. (*17*); Zollinger, 3118 (*9*).

INDEX TO NAMES

(*Note : synonyms are printed in italics*)