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PLANTAE PAPUANAE ARCHBOLDIANAE, XV*

E. D. MERRILL AND L. M. PERRY

With one plate

IN CONTINUATION of our work on the Rubiaceae of this series, we again present a number of genera chosen not particularly as representing any special section or relationship in the family, but rather as a matter of convenience for study at the moment. We have studied *Hydnophytum* and *Myrmecodia* in conjunction with each other, since both have in common the peculiar tuber-like base. *Borreria* has the general habit of *Hedyotis* and is easily mistaken for it; the same is true of *Mitracarpus*. The genera considered in this paper are: *Dentella, Hedyotis, Ophiorrhiza, Argostemma, Airosperma, Hydnophytum, Myrmecodia, Nertera, Borreria,* and *Mitracarpus*.

RUBIACEAE (in part)

Dentella J. R. & G. Forster

Dentella Browniana Domin, Bibl. Bot. 22(Heft 89vii): 1170 (616). 1929; H. K. Airy-Shaw, Kew Bull. 1934: 294. 1934.

BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5825*, January 1934, alt. 10 m., a clearing on a savanna (very small prostrate herb with minute white flowers). Queensland and Northern Territory.

Hedyotis Linnaeus

Hedyotis Schlechteri (Val.) comb. nov.
Oldenlandia Schlechteri Val. Bot. Jahrb. 60: 11. 1925.

Hedyotis Schlechteri var. acuminata (Val.) comb. nov.
Oldenlandia Schlechteri var. *acuminata* Val. Bot. Jahrb. 60: 12. 1925, Nova Guin. 14: 236. 1925.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12775*, Feb. 1939, alt. 1200 m., in dense undergrowth of rain-forest gully (ascending herb 50 cm. high).

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. 25: 183–205. 1944.

It has been a question whether to align this collection with the species or with the variety. The plant is slightly more pubescent than one of the collections cited in the original description of the species, and also the inflorescence is paniculately cymose.

Hedyotis Klossii Wernh. Trans. Linn. Soc. II. Bot. 9: 69. 1916.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13212,* March 1939, alt. 850 m., rain-forest, occasional on shady stream banks (fruticose herb 30–50 cm. high; flowers white). Previously known only from the type collection.

Hedyotis decipiens (Val.) comb. nov.

Oldenlandia decipiens Val. Bot. Jahrb. 60: 12. 1925.

A very distinct species, known only from the type collection from Northeast New Guinea.

Hedyotis idenburgensis sp. nov.

Herba parva, ± 10 cm. alta, ramosa subglabra; caulibus basi lignescentibus, diffusis, interdum procumbentibus, acute tetragonis, internodiis 3–5 mm. longis, glabris; foliis oblongo-lanceolatis, 7–10 mm. longis, 2–3 mm. latis, utrinque angustatis, apice acutis, margine in sicco planis vel revolutis, nervis lateralibus utrinsecus 2 vel 3 utrinque inconspicuis vel subobscuris; petiolo brevi vix 2 mm. longo; stipulis parvis lineari-lanceolatis puberulis; pedunculis axillaribus, singulis vel oppositis, unifloris vel interdum cymosis, circiter 2 cm. longis, bracteis oppositis linearibus circiter 3 mm. longis prope apicem instructis; floribus breviter pedicellatis; ovario urceolato; calycis lobis remotis, lineari-lanceolatis, 1.5 mm. longis, erectis demum leviter divergentibus; corolla 3 mm. longa, infundibulari, fauce pubescente, lobis lanceolatis vix 1.5 mm. longis, intus pubescentibus; staminibus in medio tubo insertis, filamentis 0.6 mm. longis, antheris 1 mm. longis; stigmate exserto verisimiliter capitato; capsulis depresso-globosis calyce persistente coronatis, (incl. calyce) 3.5 mm. longis, 2.5 mm. diametro, glabris; seminibus pluribus, obtuse angulatis, sub lente leviter reticulatis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13477* (TYPE), March 1939, alt. 850 m., on mossy flood-swept banks of a stream in rain-forest (flowers white).

This species has the general habit of *Hedyotis biflora* L. The flower, however, is distinctive; the anthers are long and narrow, and the lobes of the corolla are pubescent on the upper surface; as in *H. biflora,* the throat is pubescent within. The fruit also is distinctive; the valves of the capsule do not project as in *H. biflora,* so that the calyx-lobes are much more obvious in the fruit of this species. Sometimes there are minute linear appendages or glands between the calyx-lobes.

Hedyotis Valetoniana sp. nov.

Oldenlandia coprosmoidea Valeton in Lam, Natuurk. Tijdschr. Nederl.-Ind. 89: 72, 101, 133, 134. 1929, nomen; non *Hedyotis coprosmoides* Trimen (1894).

Planta prostrata glabra; caulibus tetragonis basi lignescentibus, internodiis brevibus 2–5 mm. longis; foliis confertis, lanceolatis vel oblongo-lanceolatis, 5–15 mm. longis, 3–4.5 mm. latis, apice acutis vel acuminatis, basi anguste obtusis, crassiusculis, nervis lateralibus utrinque obscuris;

petiolis brevissimis, 1–1.5 mm. longis; stipulis in vaginam brevem connatis margine pectinatis, setulis brevibus centrali longiore linearibus acutis; pedunculis axillaribus, 1.5–4 mm. longis, apice bibracteatis, bracteis circiter 4 mm. longis, foliiformibus; floribus supra bracteas subsessilibus; ovario subcampanulato, 1.5 mm. longo; calycis lobis 2.5 mm. longis, lineari-oblongis, acutis, tubo 1 mm. longo; corolla infundibulari, 6.5 mm. longa, tubo intus glabro, fauce tantum pilosulo, lobis 3 mm. longis intus pubescentibus; staminibus in apice tubi insertis, antheris 1.5 mm. longis, ellipticis, apiculatis; stylo glabro, 4 mm. longo; stigmate bilobato, lobis circiter 0.5 mm. longis; capsulis urceolatis calyce persistente coronatis, 3 mm. longis (incl. calyce 5 mm.), 2.5 mm. diametro; seminibus obtuse angulatis sub lente reticulatis.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9326* (TYPE), Aug. 1938, alt. 3225 m., prostrate on sterile rocky knolls of grasslands (flowers lavender); near the foot of Doorman-top, *Lam 1610*, Oct. 1920, alt. 3250 m.

This species seems to be most closely related to *Oldenlandia nutans* Valeton; it differs in its prostrate very compact habit, fleshier leaves, and shorter corollas. Possibly a wider range of specimens would show gradations, but until such time as these are available it seems best to consider this a distinct species.

Hedyotis tenelliflora Bl. var. **papuana** (Val.) comb. nov.

Oldenlandia tenelliflora var. *papuana* Val. Nova Guin. **8**: 453. 1911, ibid. **14**: 234, *pl. 22, fig. A, 1–5.* 1925.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11628*, Dec. 1938, alt. 1600 m., deforested slopes, common grass associate on sandy soil (flowers white). BRITISH NEW GUINEA: Mafulu, *Brass 5152*, Oct. 1933, alt. 1250 m., small roadside weed on grassy spurs; Wuroi, Oriomo River, *Brass 5830*, rare on savanna clearing. Not previously reported from Papua.

Hedyotis vestita R. Br. in G. Don, Gen. Syst. **3**: 526. 1834.

Spermacoce costata Roxb. Fl. Ind. **1**: 376. 1820.

Hedyotis costata (Roxb.) Kurz, Jour. As. Soc. Bengal 45(2): 135. 1876; Merr. Enum. Philip. Fl. Plants **3**: 497. 1923; non *H. costata* R. Br. (1834).

Oldenlandia costata (Roxb.) Koorders, Exkurs.-Fl. Java **3**: 240. 1912.

NETHERLANDS NEW GUINEA: Nasau region, *Docters van Leeuwen 10752*, Oct. 1926, alt. 700 m.

As far as we know, this is the first record of the species from New Guinea.

Hedyotis pubescens (Val.) comb. nov.

Oldenlandia pubescens Val. Nova Guin. **8**: 439. 1911, ibid. **14**: 233. 1925, Bot. Jahrb. **60**: 10. 1925.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3934*, May 1933, alt. 500 m., in shelter of roadside undergrowth; Lake Daviumbu, Middle Fly River, *Brass 7621*, in a bamboo grove. Herb 30–40 cm. tall; flowers white.

The only difference we find between Valeton's description and the specimens cited is a ring of hairs or a hairiness on the inside of the corolla just at the base of the filaments; possibly in full-blown flowers this would be just below the throat or in it. The species seems to be common, having been reported from both Netherlands New Guinea and Northeast New Guinea.

Hedyotis congesta R. Br. in G. Don, Gen. Syst. **3**: 526. 1834.

Metabolos rigidus Bl. Bijdr. 992. 1826.

Hedyotis rigida (Bl.) Miq. Fl. Ind. Bat. 2: 181. 1857, non Walp. (1852).
Oldenlandia rigida (Bl.) Val. Nova Guin. 8: 438. 1911.

Hedyotis congesta R. Br. var. **longifolia** (Val.) comb. nov.
Oldenlandia rigida var. *longifolia* Val. Nova Guin. 8: 438. 1911, ibid. 14: 234. 1925.

NETHERLANDS NEW GUINEA: East slopes of Cyclops Mountains, *Brass 8926*, June 1938, alt. 450 m., occasional in forest undergrowth; 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13626*, March 1939, alt. 850 m., occasional in rain-forest (shrub 1 m. high; branches weak, spreading, fruit white). BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5691*, plentiful about borders of rain-forest and in small forest clumps on savannas (shrub about 1.5 m. tall with slender spreading branches; leaves glaucous above, pale and scaberulous beneath; flowers lavender-colored; soft, white, uneven fruit 5–7 mm. diameter); Tarara, Wassi Kussa River, *Brass 8426*, abundant in rain-forest and savanna-forest contact areas (herbaceous shrub 1–1.5 m. high; leaves glaucous above; flowers bluish white).

Valeton mentions the very characteristic white fruit; and Ridley believes the fleshy white fruit is unique in the genus.

Hedyotis Lapeyrousii DC. Prodr. 4: 420. 1830; Rich. Voy. Astrol. Bot. 2: 64. *pl. 23.* 1834.
Hedyotis auricularia var. *melanesica* Fosb. Bull. Torr. Bot. Cl. 67: 419. 1940.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13762*, April, alt. 60 m., in gravelly bed of foothill stream, rare. BRITISH NEW GUINEA: Daru Island, *Brass 6435*, common in rain-forest, gregarious in patches; Palmer River, 1 mile above junction Black River, *Brass 6941*, plentiful on a riverbank landslip; Lake Daviumbu, Middle Fly River, *Brass 7772*, massed in old clearings. SOLOMON ISLANDS: San Cristoval: Waimamura, *Brass 2621*, pathways and small clearings in lowland rain-forests, common.

This material appears to be identical with that from the New Hebrides as illustrated in the above-cited plate, and also with that described by Fosberg as a variety of *H. auricularia* L. Unfortunately we have no authentic material of the latter species for comparison; the collections which have been assigned to it have definitely smaller flowers than the Papuasian material. This also seems to be very close to, if not identical with, the material passing in New Guinea as the Linnaean species. The original was collected in Ceylon.

Hedyotis radicans (DC.) Miq. Fl. Ind. Bat. 2: 181. 1857; Merr. Enum. Philip. Fl. Pl. 3: 499. 1923.
Metabolos radicans DC. Prodr. 4: 435. 1830.
Oldenlandia radicans O. Kuntze, Rev. Gen. 1: 292. 1891.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3974*, May 1933, alt. 500 m., plentiful in a bamboo plantation (ascending herb with white flowers); Tarara, Wassi Kussa River, *Brass 8503*, rain-forest ground cover, associated with *Scleria lithosperma* Sw. in broken shade.

These collections seem to agree reasonably well with the Philippine material of this species at hand.

Hedyotis novoguineensis sp. nov.

Herba adscendens vel erecta vel decumbens, 30–50 cm. alta, basi perennis; caulibus argute quadrangulatis, minute pilosulis vel glabratis, 1–2 mm. crassis, foliosis, sparsim ramosis vel simplicibus, internodiis 1–6 cm. longis; foliis lanceolatis vel ellipticis, utrinque aequaliter angustatis, apice acutis, basi acutis vel cuneatis, margine in sicco interdum revolutis, 1.5–3.5(–4) cm. longis, 0.5–1(–2) cm. latis, supra glabris vel sparsim pilosulis, subtus hirtellis, nervis lateralibus utrinsecus 3, supra obscuris, subtus inconspicuis; petiolo 2–5 mm. longo, pubescente; stipulis ovatis, hirtellis, apice subulatis, superioribus margine subpectinatis vel glandulosis; floribus glomerulatis, axillaribus, densis, subsessilibus vel glomerulo pedunculato, bracteatis, bracteis ovario brevioribus; ovario obconico, vix 1.5 mm. longo, piloso; calycis lobis 1.5 mm. longis, lanceolatis, acutis, recurvis, pilosis et ciliatis; corollae tubo 2.5 mm. longo, extus glabro, fauce dilatato, intus pilosulo, lobis circiter 1 mm. longis, ovatis, extus sparsim intus densiuscule pilosulis; staminibus in fauce tubi insertis, antheris paulo exsertis; stylo glabro, 3 mm. longo; stigmate exserto; capsulis globosis, vix 2 mm. diametro, calycis lobis persistentibus recurvis coronatis, septicidaliter dehiscentibus; seminibus angulatis reticulatis, nigris.

British New Guinea: Wuroi, Oriomo River, *Brass 5831* (type), Jan. 1934, alt. 10 m., small savanna clearing (plant with pale purple flowers); Gaima, Lower Fly River (east bank), *Brass 8339*, Nov. 1936, scrambling amongst grass in dense savanna-forest (flowers white).

This species has the general habit of *Hedyotis stipulata* R. Br., but the calyx-lobes are narrower, pilose, and ciliate, and in fruit much less conspicuous than in *H. stipulata* R. Br.

Hedyotis glomerulata sp. nov.

Herba erecta, circiter 50 cm. alta glabra, basi probabiliter perennis; caulibus argute quadrangulatis, circiter 2 mm. crassis, foliosis, internodiis 2.5–4.5 cm. longis; foliis ellipticis, 2–3.5 cm. longis, 0.8–1.5 cm. latis, obtuse acutis, basi paulo angustatis, margine praecipue versus basim revolutis, nervis lateralibus utrinsecus 3, supra manifestis, subtus subprominulis, supra olivaceis, subtus pallidioribus; stipulis late ovatis breviter vaginantibus, apice breviter subulatis, superioribus margine pectinatis vel glandulosis; petiolo brevissimo vel foliis subsessilibus; floribus glomerulatis, axillaribus, densis, sessilibus, basi bracteatis; ovario obconico, 1.5 mm. longo glabro; calycis lobis oblongo-lanceolatis, ciliatis, 2 mm. longis; corollae tubo 2.5 mm. longo, fauce pubescente, lobis ovatis obtusiusculis ± 1 mm. longis, intus pubescentibus; antheris in apice tubi insertis, inclusis; stylo glabro, 2.5 mm. longo; stigmate subexserto; capsulis elongato-globosis, circiter 2 mm. diametro, calycis lobis recurvis coronatis, tarde septicidaliter dehiscentibus; seminibus pluribus angulatis reticulatis nigris.

British New Guinea: Mafulu, *Brass 5315* (type), Oct. 1933, alt. 1250 m., common amongst tall grass of deforested spurs (flowers white).

This species is very closely related to *Hedyotis novoguineensis*. It may be distinguished by its generally glabrous character; the calyx-lobes are ovate and ciliate, rather than lanceolate, and are slightly larger than in *H. novoguineensis*, and the capsules are a little more elongate and glabrous.

Hedyotis trichoclada sp. nov.

Herba parva perennis repens pubescens; caulibus dense pubescentibus vel breviter pilosis, internodiis 2–5 mm. longis; foliis 2.5–6 mm. longis, 1–3 mm. latis, ovatis, apice acutis vel obtusiusculis, basi obtusis, margine in sicco interdum revolutis, supra glabris vel prope marginem sparsim pilosis, subtus consperse pilosis vel glabris, margine ciliatis vel glabris, nervis lateralibus utrinsecus plerumque 2, supra inconspicuis, subtus manifestis; petiolo 1 mm. longo pubescente; stipulis connatis minutis obtuse ovatis, margine glandulosis; floribus solitariis axillaribus, pedunculis 0.5 mm. longis; ovario 1 mm. longo, campanulato, dense patenti-piloso; calycis lobis lineari-lanceolatis, vix 1.5 mm. longis, sinu lato, glandulis interjectis; corollae tubo 2.5–3 mm. longo utrinque glabro, lobis ovatis, 1 mm. longis, intus puberulis; staminibus in apice tubi insertis, antheris exsertis; stylo vix 1.5 mm. longo glabro; stigmate bilobo, lobis linearibus, 1 mm. longis; fructibus globosis, circiter 2 mm. diametro, calycis lobis coronatis; seminibus numerosis, angulatis, reticulatis, brunnescentibus.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9197* (TYPE), Aug. 1938, alt. 3225 m., matted on sandy banks of grassland stream (flowers white); 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9752*, Sept. 1938, alt. 3400 m., in wet grassy valley (flowers white, sometimes faintly violet, anthers dark violet).

Although the habit of this plant suggests *Anotis* DC., it has all the characters of *Hedyotis* L. There are about 25 to 30 seeds in the fruit.

Hedyotis nana sp. nov.

Herba parva perennis repens pubescens; caulibus implicatis dense patenti-pubescentibus, 1 mm. diametro, internodiis 2–5 mm. longis; foliis usque 4 mm. longis, 2.5 mm. latis, elliptico-ovatis vel subrotundatis, apice obtusiusculis, basi rotundato-cuneatis, crassiusculis, supra convexis, sub lente minutissime et profuse papillosis, glabris vel consperse pilosis, subtus concavis patenti-pilosis et cystolithis praeditis, nervis lateralibus utrinsecus 2, utrinque obscuris; petiolo 1 mm. longo, patenti-pubescente; stipulis inconspicuis, connatis, margine glandulosis; floribus solitariis, axillaribus, subsessilibus; ovario vix 1.5 mm. longo, dense patenti-piloso; calycis lobis ellipticis utrinque angustatis, acutiusculis, extus patenti-pilosis, intus minutissime papillosis, sinu lato, glandulis interjectis parvis; corolla in alabastro versus apicem sparsim pilosa; corollae tubo circiter 2 mm. longo, lobis 1 mm. longis, obtuse triangularibus; staminibus in apice tubi insertis; antheris subexsertis; stylo glabro brevi; stigmate bilobato; fructibus subglobosis, calycis lobis coronatis; seminibus numerosis, angulatis, reticulatis, nigris.

BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4691* (TYPE), Aug. 1933, alt. 2840 m., very plentiful in small flat masses on burnt grasslands (plant has strong odor of turnips; flowers white); Mount Albert Edward, southwestern slopes, *Brass 4394*, July 1933, alt. 3680 m., prostrate on wet bank of a small grassland stream (flowers pink).

Hedyotis nana and *H. trichoclada* are closely allied, the flowers differing chiefly in the pubescence and texture of the calyx-lobes; in the former there is a sparse pilosity on the upper part of the corolla. The species are readily distinguished by the leaves; although in both species these are very small, in *H. nana* they appear to be thicker in texture, are strongly concavo-convex, and on the upper surface under a good lens are very minutely but densely papillate; in *H. trichoclada* they are thinner in texture and lack the papillate surface of the other species. They are readily distinguished from the other species of *Hedyotis* in this region by their prostrate habit and minute leaves.

Ophiorrhiza Linnaeus

Ophiorrhiza sylvatica sp. nov.

Herba ± 30 cm. alta; caulibus decumbentibus nodis inferioribus radicantibus, novellis crispe pubescentibus, inconspicue angulatis vel compressis; foliis plerumque subaequalibus, lanceolatis, pergamaceis, in sicco supra olivaceis, subtus pallidioribus, apice sensim acutis, basi rotundato-cuneatis vel acutis, 2.5–6 cm. longis, 0.7–1.6 cm. latis, nervis lateralibus utrinsecus 8–10 supra inconspicuis, subtus prominulis, reticulo laxo; petiolo 5–10 mm. longo; stipulis filiformibus caducis, circiter 3 mm. longis; inflorescentiis terminalibus vel in axillis superioribus, pedunculatis, pedunculo 5–10 mm. longo, glabro; ramis subdivaricatis basi bracteatis, bracteis parvis filiformibus; floribus glabris breviter pedicellatis, subsecundis, minute bracteatis, ad anthesin 6 mm. longis; pedicellis 0.5–1 mm. longis; calyce cum ovario 1.5 mm. longo, dentibus vix 0.5 mm. longis; corollae tubo 3 mm. longo, intus circiter medio adpresse piloso (pilis erectis), sursum puberulo vel subglabro, lobis ovatis circiter 1 mm. longis prope apicem dorso calcaribus falciformibus 1 mm. longis praeditis; flore longistylo: antheris subtus medio tubo, filamentis brevissimis, vix 0.5 mm. longis, stylo glabro, subexserto; stigmate bilobato; flore brevistylo: antheris subexsertis, 1.5 mm. longis, linearibus, filamentis 2 mm. longis subtus medio insertis; stylo 2 mm. longo, glabro; capsulis anguste transverse oblongis, circiter 5 mm. latis, vix 1.5 mm. altis secus ramos subsecundis, breviter pedicellatis.

British New Guinea: Fly River, 528 mile Camp, *Brass 6765* (type), May 1936, alt. 80 m., plentiful amongst rotting wood and leaves in openings made by fallen trees.

This species is most closely related to *Ophiorrhiza palustris* Val.; it differs in having smaller subequal leaves, glabrous inflorescence, and smaller fruits. It also grows in a different habitat. The plant has both long- and short-styled flowers; in the long-styled flowers the stamens are on very short filaments very close to the base of the tube, the tips of the anthers just reaching the pilose ring approximately in the middle of the corolla-tube on the inside; in the short-styled flowers, the anthers are partly exserted, the filaments being attached at the pilose ring. A rather unusual combination of the characters is the glabrous peduncle and inflorescence developing at the apex of a branchlet covered by crisp short brown hairs; the corolla is conspicuously corniculate.

Ophiorrhiza longisepala sp. nov.

Herba ± 30 cm. alta; caulibus adscendentibus vel suberectis, versus apicem crispe pubescentibus, subrotundatis, internodiis 3–5 cm. longis vel versus apicem brevioribus; foliis ad nodos inaequalibus, majoribus 8–12 cm. longis, 2.7–4 cm. latis, minoribus 2–6.5 cm. longis, 0.7–2.3 cm. latis, ellipticis (interdum leviter ovatis), utrinque angustatis, apice acuminatis, basi acutis, tenuiter pergamaceis, in sicco olivaceis glabris, subtus pallidioribus, costa et nervis et venis minute pubescentibus; nervis lateralibus utrinsecus 7–12, supra manifestis, subtus prominulis, venis interspersis inconspicuis; petiolo 1–2.5 cm. longo, minute pubescente; stipulis filiformibus usque 9 mm. longis; inflorescentiis terminalibus subcorymbosis, circiter 2 cm. latis in fructu, pedunculatis, pedunculo 4(–10 in fructu) mm.

longo, crispe pubescente, ramosis, ramis 3 vel 4, brevibus, paucifloris; bracteis filiformibus; floribus pedicellatis, pedicello 1–2(–4 in fructu) mm. longo; ovario minute pubescente, obconico-urceolato, 1.5 mm. alto; calycis lobis lineari-filiformibus 2–2.5 mm. longis, in sicco apice recurvis; corolla in alabastro oblonga, parte inferiore puberula, tubo intus glabro, fauce barbato, lobis cristatis, intus papilloso-puberulis; staminibus circiter medio tubo insertis, antheris inclusis; stylo glabro, stigmaticis lobis linearibus acutis; capsulis 7 mm. latis, 3 mm. altis, calycis lobis persistentibus coronatis, puberulis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12251* (TYPE), January 1939, alt. 1750 m., plentiful in rain-forest gullies.

This collection at once suggested *Ophiorrhiza rivularis* Val. on account of the very long almost filiform calyx-lobes; however, it is less pubescent; the leaves are larger with about twice as many lateral veins; the inflorescences are pedunculate rather than sessile; the throat of the corolla is barbate rather than glabrous, and the anthers are included. It is very readily distinguished by the calyx-lobes, which are persistent in fruit.

Ophiorrhiza nerteriformis sp. nov.

Herba prostrata nodis radicans; caulibus subtetragonis vel compressis, novellis pubescentibus, internodiis 5–10 mm. longis; foliis parvis, 5–7 mm. longis, 3–6.5 mm. latis, leviter inaequalibus vel aequalibus, ovatis, acutis vel acutiusculis, basi rotundatis deinde brevissime cuneatis, margine interdum crispulis, supra glabris olivaceis, subtus pallidioribus, costa nervisque pubescentibus, nervis lateralibus oblique patentibus arcuatis, utrinsecus 4 vel 5 supra manifestis, subtus prominulis; reticulo subtus manifesto; petiolo circiter longitudinem folii aequante, pubescente; stipulis filiformibus 1–1.5 mm. longis; inflorescentiis saepissime terminalibus, pedunculo saepe trifloro, usque 1 cm. longo, pubescente, apice lineari-bracteato; floribus pedicellatis, pedicellis vix 2 mm. longis; flore extus paulo puberulo; ovario obconico, vix 1 mm. longo; calycis lobis vix 1 mm. longis, lineari-lanceolatis; corolla in alabastro 5-costata, costa cristata, corollae tubo 3 mm. longo, intus in dimidio superiore piloso, lobis 1.5 mm. longis, cristatis, crista apice latiore; staminibus in parte inferiore insertis, filamentis longis, antheris exsertis; stylo brevi; capsulis 3.5 mm. latis, 1.5 mm. altis, minute pubescentibus.

BRITISH NEW GUINEA: Kurandi, Eastern Division, *Brass 1445* (TYPE), May 1925, prostrate herb in dense masses on forest floor.

This species seems to approach the description of *Ophiorrhiza tenelliflora* Val., but the latter is a larger plant in all its parts, the petals are corniculate, and the stamens are inserted at the base of the corolla and included. In *O. nerteriformis* the flower-bud is five-crested, the crests narrowing down along the five ribs of the bud, the stamens are exserted, and although the filaments may extend to the base of the corolla, they are apparently free only about two-thirds of the length of the corolla-tube. This specimen was previously reported as *Nertera depressa* var. *papuana* Val., in a genus to which it could not possibly belong.

Ophiorrhiza tafaensis sp. nov.

Planta 20–40 cm. alta; caulibus ascendentibus, novellis crispe pubescentibus, pauciramosis, subteretibus vel leviter angulatis, internodiis 2–7 cm. longis, inferioribus superioribus longioribus; foliis leviter inaequalibus, 2.5–11 cm. longis, 1.3–3 cm. latis, ellipticis interdum lanceolatis, basi rotundatis et abrupte cuneatis, apice acutis, in sicco supra atro-fuscis glabris, subtus pallidioribus fere cinereis, costa et nervis minute pubescentibus, nervis lateralibus utrinsecus 7–12 supra manifestis, subtus perspicuis, venis interspersis; petiolo crispe puberulo, 4–10 mm. longo; stipulis filiformibus, caducis; inflorescentiis terminalibus et axillaribus, pedunculatis, pedunculo 5–10 mm. longo in fructu usque 2 cm., ramosis, ramis 2 vel 3, paucifloris; floribus breviter pedicellatis; ovario 1.5 mm. longo obconico-urceolato, puberulo; calycis lobis lanceolatis, acutis, vix 1 mm. longis; corolla in alabastro 5-costata, costa anguste alato-cristata, tubo 3.5 mm. longo, extus consperse puberulo, intus prope medio inter antheras piloso, lobis circiter 2 mm. longis intus papilloso-puberulis, extus anguste cristatis; antheris linearibus, 1.5 mm. longis, circiter medio tubo insertis; stylo brevi; stigmate bilobato, lobis linearibus stylum subaequantibus; capsulis 9 mm. latis, 3 mm. altis, puberulis.

British New Guinea: East Mount Tafa, *Brass 4133a,* May 1933, alt. 2100 m., small roadside herb, fairly common (plant purple-tinged; flowers white); Mavi, Mount Tafa Range, *Brass 4985* (type), Sept. 1933, alt. 2225 m., plentiful on shaded road-banks (fleshy small herb with wrinkled leaves, very pale beneath; stems, petioles, and peduncles red; flowers very pale pink).

In the compact inflorescence, the size of the leaves, and probably the general habit of the plant, this species suggests *Ophiorrhiza montisschraderi* Val.; it may be readily distinguished from the latter by floral characters. The corolla-lobes of the latter species are corniculate and the throat is densely barbate; in *O. tafaensis* the corolla-lobes are crested, the crests extending down along the middle of the lobes like very narrow wings, and the corolla has a band of hairs below the throat immediately back of the anthers.

Ophiorrhiza callianiha sp. nov.

Planta usque 1 m. alta; ramulis glabris, internodiis 1.5–6 cm. longis; foliis ad nodos subaequalibus vel leviter inaequalibus, 7.5–17 cm. longis, 2.5–6.5 cm. latis, chartaceis, ellipticis vel lanceolatis, apice acuminatis, acumine 1–1.5 cm. longo, basi cuneatis vel rotundato-decurrentibus, supra atrofuscis, glabris, subtus pallidioribus, nervis puberulis, nervis lateralibus utrinsecus 10–13 patenti-adscendentibus arcuatis utrinque prominulis; petiolo 1–2.5 cm. longo; stipulis brevibus filiformibus caducis; inflorescentiis terminalibus longe pedunculatis, pedunculo 4.5(–8 in fructu) cm. longo, glabro, 6 cm. latis, 3 cm. altis, ramosis, ramis 3 vel 4 plerumque dichotomis paucifloris; floribus primum laxe fasciculatis deinde subsecundis; ovario fere 2 mm. longo, puberulo; calycis lobis ovatis, acutiusculis, 1 mm. longis; corolla in alabastro tubulata vel sub anthesin apice (lobis) ovali, extus glabra, apice 5-costato, costa crassa, anguste cristata; corollae tubo 1.2–1.4 cm. longo, fauce villoso, lobis 4 mm. longis, oblongo-ovatis, intus glabris, extus cristatis; staminibus 3–4 mm. supra basim tubi insertis, filamentis liberis 1 mm., antheris 3 mm. longis, linearibus; stylo glabro, 1.4–1.6 cm. longo; stigmaticis lobis ovatis; capsulis glabris, 8–9 mm. latis, 4 mm. altis.

Solomon Islands: Bougainville: Kugumaru, Buin, *Kajewski 1957* (type), July 1930, alt. 150 m., rain-forest (small roadside plant up to 1 m. tall; flowers white, very showy).

The distinctive feature of this species is the rather large flower with long corolla-tube, slightly crested lobes, villous throat, and glabrous style; nevertheless, it does not compare in size with the flower of some of the Polynesian and Melanesian species.

Ophiorrhiza solomonensis sp. nov.

Planta usque 1.5 m. alta; ramulis ultimis glabris, compressis; foliis ad nodos leviter inaequalibus, 11–17 cm. longis, 5–6.5 cm. latis, tenuiter chartaceis, ellipticis, apice subabrupte acuminatis, basi obtusis vel rotundato-cuneatis, in sicco utrinque olivaceo-viridescentibus, glabris, nervis lateralibus utrinsecus circiter 12 utrinque perspicuis; petiolo 1–3.5 cm. longo, glabro; stipulis cito caducis; inflorescentiis terminalibus pedunculatis, pedunculo 2–6 cm. longo, puberulo, ramosis, ramis 3–5 vulgo dichotomis, paucifloris; floribus breviter pedicellatis, pedicello 1–2 mm. longo; ovario vix 1 mm. longo, puberulo; calycis lobis 0.5 mm. longis, lanceolatis; corolla in alabastro clavata, 1 cm. longa, apice leviter carinata; corollae tubo glabro, 6 mm. longo, fauce ± villoso, lobis 5 mm. longis, lanceolato-ellipticis; staminibus circiter tubo medio insertis, filamentis 4 mm. longis, antheris 2 mm. longis, exsertis; stylo brevi, 2 mm. longo, glabro; stigmate bifido, lobis linearibus 2 mm. longis, inclusis; capsulis non visis.

SOLOMON ISLANDS: Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2656* (TYPE), June 1931, alt. 1200 m., rain-forest (a shrub up to 1.5 m. high, with white flowers).

In this species the texture of the corolla is thinner and more delicate than in any of the others of the genus which we have examined, and the lobes are about as long as the tube. In the dried specimen the leaves also are very thin and brittle; they tend to be larger and are glabrous, although under high magnification there are minute granules or cystoliths(?) scattered over the lower surface.

Ophiorrhiza decipiens sp. nov.

Planta usque 50 cm. alta, ± erecta; caulibus suberectis, novellis dense puberulis, compressis, internodiis 2–4.5 cm. longis; foliis ad nodos inaequalibus, majoribus 7–11 cm. longis, 3–4.5 cm. latis, minoribus 3–6 cm. longis, 1–2.5 cm. latis, anguste ellipticis vel lanceolatis, apice acutis, basi cuneatis, tenuiter pergamaceis, in sicco supra olivaceis glabris, subtus pallide brunnescentibus, costa nervisque puberulis; nervis lateralibus utrinsecus 6–10, supra manifestis, subtus perspicuis, venis et reticulo laxo manifestis; petiolo 5–20 mm. longo, puberulo; stipulis singulis vel bifidis, filiformibus, 7 mm. longis; inflorescentiis saepissime terminalibus totis dense puberulis, 3 cm. latis, cum pedunculo 4 cm. longis, ramosis, ramis ultimis 2- vel 3-floris; floribus breviter pedicellatis, subsecundis; ovario circiter 1 mm. longo; calycis lobis ovatis, 0.5 mm. longis; corollae lobis 1.5–2 mm. longis, breviter corniculatis, cornu 1.5 mm. longo, trigono; flore longistylo: corollae tubo circiter 4 mm. longo, fauce dense barbato; staminibus circiter medio tubo insertis, antheris inclusis, 1.5 mm. longis; stylo 4 mm. longo, parce piloso; flore brevistylo: corollae tubo 4 mm. longo, intus 1 mm. supra basim sursum piloso, fauce non barbato; staminibus circiter medio tubo insertis, antheris exsertis; stylo 2 mm. longo, sparsim piloso; capsulis 5 mm. latis, 2 mm. altis, puberulis.

British New Guinea: Dieni, Ononge Road, *Brass 3877* (type in Herb. New York Bot. Gard.), April 1933, alt. 500 m., rain-forest floor, common (fleshy undershrub or herb up to 50 cm. high; stem and petioles purplish; flowers white).

Among the species of this genus already described, this one most closely approaches *Ophiorrhiza Lauterbachii* Val.; in *O. decipiens,* however, the stipules are not subpersistent, the plant is for the most part covered with a very short close pubescence, and the relative length of the corolla-tube and its lobes is different, in our species the lobes being about one half the length of the tube, while in Valeton's species they are longer than the corolla-tube. The two plants we have at hand show heterostyly, although the difference in the pubescence within the corolla-tube in the two types of flowers was not anticipated; the long-styled flower has a densely villous throat, the other has a diffuse pilosity extending down the tube.

Ophiorrhiza straminea sp. nov.

Planta usque 1.5 m. alta; ramulis glabris, compressis vel obtuse angulatis, internodiis 1.5–7 cm. longis; foliis ad nodos leviter inaequalibus, majoribus 11–17 cm. longis, 3.5–5.5 cm. latis, minoribus 5.5–10 cm. longis, 3–4 cm. latis, tenuiter chartaceis, utrinque glabris, in sicco supra olivaceis, subtus leviter pallidioribus, nervis lateralibus utrinsecus 11–17 utrinque prominulis, reticulo laxo subtus manifesto; petiolo 1–3 cm. longo; stipulis filiformibus, caducis; inflorescentiis terminalibus et axillaribus, pedunculatis, pedunculo 1.5–2 cm. longo, glabro vel puberulo, ramosis, ramis 3 vel 4 plerumque dichotomis, puberulis, circiter 6- vel 7-floris; floribus subsecundis; alabastro truncato, apice 5-plicato, medio sursum leviter dilatato; ovario dense puberulo, campanulato, 1.5 mm. longo; corolla glabra, tubo 4 mm. longo, ostio dense villoso, lobis 2.5 mm. longis, basi 1.5 mm. latis, acutiusculis, intus papilloso-puberulis, extus sub apice trigono-corniculatis; staminibus 1 mm. supra basim tubi insertis, antheris circiter 2 mm. longis; stylo 6 mm. longo, sparsim pilosulo; capsulis glabris, 6 mm. latis, 2 mm. altis.

Solomon Islands: Bougainville: Kupei Gold Field, *Kajewski 1729* (type), April 1930, alt. 1000 m., rain-forest (plant up to 1.5 m. tall; flowers cream).

This species perhaps is closest to *Ophiorrhiza Mungos* Linn. as described by Valeton in Ic. Bogor. 4: *t. 385.* 1914; it differs in being a more nearly glabrous plant, with shorter peduncles, and with corolla-lobes having a small trigonous crest or appendage.

Ophiorrhiza leptophylla sp. nov.

Planta usque 1.5 m. alta, herbacea, ramosa; ramulis crispe pubescentibus, compressis vel subangulatis; foliis 5–16 cm. longis, 2.5–7 cm. latis, tenuiter pergamaceis, ovatis vel ellipticis, apice subabrupte vel sensim acuminatis, basi rotundatis deinde breviter cuneatis, subaequalibus, supra consperse scabridulis vel crispe pubescentibus, subtus costa nervisque crispe pubescentibus, novellis lamina etiam crispe pubescente, margine interdum ciliatis, nervis lateralibus utrinsecus 9–16 utrinque prominulis, reticulo subconferto, distincte manifesto; petiolo 5 mm.(sub inflorescentia) — 5.5 cm. longo, crispe pubescente; stipulis anguste triangularibus, apice filiformibus, crispe pubescentibus; inflorescentiis 1 cm. altis, 1.5–2 cm. latis, saepissime terminalibus, interdum axillaribus, breviter pedunculatis, pedunculo 5–8 mm. longo, ramosis, ramis 3–5 subfastigiatis, non divaricatis, floribus confertis, pedicellis brevissimis; ovario subgloboso, 1 mm. longo, dense pubescente; calycis lobis anguste lanceolatis acutis, vix 1.5 mm. longis; corolla in alabastro tantum 6 mm. longa, probabiliter infundibuliformi, oblanceolata, extus dense et crispe pilosula, intus 1.5 mm. supra basim (sursum 2 mm.) villosa (probabiliter faucem includente), apice 5-corniculata, calcare 0.8 mm. longo; staminibus in fauce insertis, antheris 1.5 mm. longis; stylo circiter 2 mm. longo, stigmate bilobato, lobis linearibus, 1.5 mm. longis; capsulis 5 mm. latis, 2 mm. longis, crispe pubescentibus.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2035* (TYPE), Aug. 1930, alt. 850 m., common, growing close to the water (plant very fleshy, up to 1.5 m. tall; petals crystal white, young buds covered with green hair; fruit green).

Ophiorrhiza leptophylla has the same general habit as *O. trichoclada,* but it is readily distinguished by the thinner somewhat scabrid leaves, as well as by the short-peduncled and compact inflorescences and infructescences; the fruits are much more pubescent, and the stipules are not bifid.

Ophiorrhiza Valetonii nom. nov.

Ophiorrhiza nervosa Valeton, Bot. Jahrb. 60: 33. 1925, non Ridley (1912).

Known only from the Kani Mountains, Northeast New Guinea.

Ophiorrhiza trichoclada sp. nov.

Planta usque 1.5 m. alta, ramosa; ramulis crispe pubescentibus, internodiis superioribus 3–10 cm. longis, subtetragonis vel compressis; foliis 7–12 cm. longis, 3.5–7 cm. latis, pergamaceis, ellipticis vel late ellipticis, apice subabrupte acuminatis, basi rotundatis deinde brevissime cuneatis, subaequalibus, supra atro-fuscis, glabris vel consperse minute pubescentibus, subtus brunnescentibus, costa nervisque pubescentibus, nervis lateralibus utrinsecus 13–15 utrinque subprominulis, reticulo laxo, manifesto; petiolo 0.8 mm. (sub inflorescentia) — 3 cm longo, pubescente; stipulis 5 mm. longis, profunde bifidis, apice filiformibus, ± pubescentibus; inflorescentiis 4.5–5.5 cm. latis, 2–3 cm. altis, terminalibus, longe pedunculatis, pedunculo 5(ad anthesin) — 9 cm.(in fructu) longo, crispe et dense pubescente, ramosis, ramis ± divaricatis, subverticillatis, iterum ramosis, in ultimis ramulis floribus subsecundis, breviter pedicellatis, pedicello 1 mm. longo, minute bracteatis; tota flore extus minute et crispe pubescente; ovario obconico 1 mm. longo; calycis lobis 1 mm. longis, lineari-lanceolatis; corolla in alabastro late clavata, carinata, carinis irregulariter dentatis; corollae tubo 4.5 mm. longo, fauce dense villoso, pilis exsertis, ceterum glabro, lobis oblongo-ovatis, 2 mm. longis, apice incurvis, intus minute puberulis, dorso carinatis, carina prominente; staminibus 1 mm. supra basim tubi insertis, antheris 1.5 mm. longis, linearibus; stylo longo, consperse pilosulo; stigmate capitato, lobis inconspicuis; capsulis 6 mm. latis, 3 mm. altis, minute et consperse pubescentibus.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1778* (TYPE), April 1930, alt. 1000 m., rain-forest, common (plant up to 1.5 m. tall, growing in the shade, particularly on old roads; stem covered with light hair; flowers white; fruit brown-purple).

This species is suggestive of *Ophiorrhiza amoena* Val. from the Bismarck Archipelago. In the latter species the leaves are oblong-lanceolate and glabrous; the inflorescence is more compact, and the flowers are secund along the ultimate branchlets rather than crowded as if fasciculate.

Ophiorrhiza crispa sensu Valeton, Nova Guin. Bot. 14: 237. *t. 24, fig. B, 1, 2.* 1925; an *O. crispa* Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee, Nachtr. 392. 1905?

British New Guinea: Dieni, Ononge Road, *Brass 3985,* May 1933, alt. 500 m., rain-forest floor.

The collection cited above appears to belong without question with the material pictured and described by Valeton. All these collections are from relatively low altitudes. Whether they are conspecific with the original specimen, collected at 1800 m. in the Bismarck Mountains, is not clear to us from the original description.

Ophiorrhiza glabrifolia Valeton, Bot. Jahrb. 60: 27. 1925.

Netherlands New Guinea: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13359,* March 1938, alt. 850 m., rain-forest, on sandy flood-banks of river; Bernhard Camp, Idenburg River, *Brass 13738A,* April 1939, alt. 570 m., common ground herb in rain-forests of mountain slopes. Described from Northeast New Guinea.

Ophiorrhiza rupestris Hemsley, Kew Bull. 1894: 212. 1894.

Ophiorrhiza insularis Valeton in Gibbs, Phytog. and Fl. Arfak Mountains 220. 1917, Nova Guin. Bot. 14: 238. *t. 15, fig. A, 1–3.* 1925.

Solomon Islands: Ulawa: Coast, *Brass 2943,* October 1932, amongst blocks of coral limestone, common (leaves very pale beneath; flowers white); Kulambangra: Seashore, *Herre 154,* April 1929 (suffrutescent plant about 30 cm. tall; flower white).

These collections seemed to suit this species from the Solomon Islands. Later, in checking through the species of the genus, we were impressed by the likeness of the sketch of *Ophiorrhiza insularis* Val. Further checking with the description has led us to believe that the two are identical.

Argostemma Wallich

Argostemma perplexum sp. nov.

Planta 6–15 cm. alta, erecta, interdum ramosa; caule novello vel ramis pubescentibus, internodiis 3–9 mm. longis; foliis in paribus conformibus inaequalibus, majoribus 2.5–5 cm. longis, 0.5–1.7 cm. latis, minoribus 0.7–2.5 cm. longis, 1.5–9 mm. latis, lineari-lanceolatis vel lanceolatis, utrinque angustatis, apice acutis, basi cuneatis vel acutis, supra nigrescentibus, glabris vel consperse adpresse pilosulis, subtus pallidioribus, glabris vel costa pilosula, nervis lateralibus utrinsecus 5–7 supra inconspicuis, subtus manifestis; petiolis 5–15 mm. et 2–3 mm. longis; stipulis circiter 3 mm. longis, ovatis, apice plerumque bifidis, acutis vel breviter acuminatis, recurvis; pedunculo glabro, 5–7 mm. longo, bracteato; pedicello circiter 1 cm. longo, villoso; calyce rotato, cum ovario extus villoso, lobis glabratis, ovatis, acutis, 3 mm. longis, basi 2 mm. latis; corollae lobis ovatis, acuminatis, 1 cm. longis, 4 mm. latis, margine et apice sparsim pilosis; corolla circiter 20–23 mm. diametro; staminibus cohaerentibus; antheris dorso papillosis, thecis 4 mm. longis, appendiculis membranaceis 2 mm. longis, apice emarginatis.

Netherlands New Guinea: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13422* (type), March 1939, alt. 850 m., on shaded banks of a rain-forest stream (flowers white); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12343,* Jan. 1939, alt. 1500 m., on mossy rocks in a rain-forest stream (flowers white).

It has been difficult to determine to which species this material might be related. It is probably nearer *Argostemma griseum* Val. than to the others enumerated in Valeton's last work on the genus. In the type collection most of the plants are small, around 6 cm. tall, but one plant is 15 cm. high and branched; most of the inflorescences are single-flowered, but one plant in no. *12343* has a cyme with three flowers; sometimes the peduncle has two sets of bracts which would suggest that this inflorescence might represent a reduced cyme. Here the leaves do not seem to be at all ciliate as in *A. griseum* Val., and the stipules are definitely not rounded.

Argostemma callitrichum Valeton, Bot. Jahrb. **60**: 42. 1925, Nova Guin. Bot. **14**: 253. *t. 26, fig. D, 1–4.* 1925.

British New Guinea: Mavi, Mount Tafa Range, *Brass 4987*, Sept. 1933, alt. 2225 m., on wet road-bank, common (fleshy small herb under cover of larger plants; leaves pale green; flowers white).

This collection agrees reasonably well with the description and plate cited above. Known from Northeast and Netherlands New Guinea.

Argostemma distichum Valeton, Nova Guin. Bot. **8**: 447. 1911, ibid. **14**: 251. 1925.

British New Guinea: Palmer River, 2 miles below junction Black River, *Brass 7205*, July 1936, alt. 100 m., associated with mosses on decaying wood and on surface-roots exposed on floor of ridge forests (whole plant fleshy; flowers white).

A perfect match for the description of the plant from Netherlands New Guinea.

Airosperma Lauterbach & K. Schumann

Airosperma psychotrioides Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 565. 1900; Val. Bot. Jahrb. **61**: 32. 1927.

British New Guinea: Dieni, Ononge Road, *Brass 3879*, April 1933, alt. 500 m., rain-forest, common (shrub 1.5–2 m. high; flowers greenish white; blue fleshy fruit ± 1 cm. long, 8–9 mm. diameter). Known from Northeast New Guinea.

Airosperma ramuense Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 566. 1900; Val. Bot. Jahrb. **61**: 32. 1927.

British New Guinea: Dieni, Ononge Road, *Brass 3884*, April 1933, alt. 500 m., common in a rain-forest stream bed (large shrub with dark thin flat leaves pale underneath; inflorescence in leaf-axils, on branches, or low on the stem; corolla cream-colored, base of lobes purple). Described from specimens collected in the Bismarck Mountains; previously reported only from the type-locality.

Hydnophytum Jack

When we began the study of *Hydnophytum*, we found the genus already represented in Papuasia by more than 50 species; two keys are available, one by Beccari covering the species which he described, the other by Valeton including only the species of Northeast New Guinea. In a genus as large as this one, it would greatly facilitate determinative work to have a single key based on comparable and definite characters; however, we do not think it feasible to attempt this task without access to the already numerous types. The genus appears to offer good floral characters as well as those found in the fruits. The tuberous base also would sometimes seem to have definite characters, if we may judge by the material at hand. We have not found any species with pubescent leaves or branchlets. In only one instance were the branchlets furfuraceous, while in another a tendency appeared in that direction, but only on the youngest tips.

Hydnophytum agatifolium Val. Nova Guin. Bot. 8: 774. 1912.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 8805, 8903,* June 1938, alt. 20–100 m., plentiful on low trees of open fern slopes, also in rain-forest on banks of stream.

These two collections, from the type-locality of this species, agree reasonably well with the original description. The section from the tuberous base is more or less spiny, the spines being about 4 mm. long and at base about 2 mm. broad. In this character as well as in the flower and the pyrene, the species shows some resemblance to *Hydnophytum Forbesii* Hook. f.

Hydnophytum magnifolium sp. nov.

Tuber subleve, subglobosum, circiter 22 cm. diametro; ramis pluribus simplicibus usque 90 cm. longis, cylindricis vel versus apicem compressis, cinerascentibus vel brunnescentibus, internodiis superioribus 4.5–6 cm. longis; foliis magnis, 12–15.5 cm. longis, 5–8 cm. latis, ellipticis, utrinque angustatis, basi apiceque acutiusculis vel obtusiusculis, costa utrinque prominente, nervis lateralibus utrinsecus 9 vel 10 oblique adscendentibus, supra prominulis, subtus manifestis, venulis supra manifestis, subtus subobscuris; petiolo 1–2 cm. longo, supra plano; stipulis inconspicuis vel caducis; floribus in utraque parte folii insertionis conglomeratis, ima basi subimmersis; calyce libero, truncato, cum ovario 2.5 mm. longo; corolla 7 mm. longa, lobis obtuse ovatis, 2 mm. longis; flore longistylo: corollae tubo supra antheras dense piloso-barbato, infra staminum insertionem inconspicue annulato-barbato; antheris inclusis; flore brevistylo: fauce et parte superiore tubi dense pilosis; antheris exsertis, filamentis brevissimis, in fauce insertis; drupis 6 mm. longis; pyrenis 2 oblongis, 5 mm. longis, 2 mm. latis, basi acutiusculis, apice bilobis, inter lobos rostratis, dorso bisulcatis.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13768, 14130* (TYPE), April 1939, alt. 50 m., high and large epiphyte in rain-forest (tuberous base subglobose, 22 cm. diameter; several stout simple branches to 90 cm. long; flowers pale green [in the first collection cited] or white [in the second]).

This species is very close to *Hydnophytum macrophyllum* Warb. in having several stems, leaves about the same size, and flowers glomerulate. It differs in having about twice as many lateral nerves, and these are distinctly visible to the naked eye. Warburg does not say whether the flower is only in bud or near anthesis, except to note that at flowering time the calyx is longer than the disk. If his flowers were near anthesis, then his species is marked by very small flowers. In both the collections cited the flowers are more than twice as large as in Warburg's collection. The pyrene in our species is most like that of *H. Forbesii* Hook. f., the lobes being 0.5 mm. long and somewhat pointed, as well as the beak in the middle, this being 1 mm. long.

Hydnophytum heterophyllum sp. nov.

Tuber parvum consperse spinosum, spinis gracilibus, $\pm$ 1 cm. longis; caule solitario, pendulo, $\pm$ 1 m. longo, versus apicem ramoso, cylindrico; ramulis brunnescentibus leviter compressis, internodiis 1–4 cm. longis; foliis ovatis, apice obtusiusculis vel acutiusculis, basi leviter cordatis, costa utrinque manifesta, versus basim crassiuscula, nervis lateralibus utrinsecus 5 vel 6, supra inconspicuis, subtus obscuris; foliis ramulorum ultimorum ellipticis, parvis, 2.5–3 cm. longis, 1.3–1.9 cm. latis, basi et apice acutiusculis vel obtusiusculis, costa tantum manifesta; petiolo (5–)7–10 mm. longo; floribus in axillis foliorum basi bracteis minutis praeditis; alabastro tantum viso; calyce membranaceo, truncato, disco longiore; fauce corollae tubi et basi loborum pilis rectis exsertis dense obsitis; antheris linearibus, exsertis; drupis 6 mm. longis, lageniformibus; pyrenis 4 mm. longis, basi rotundatis, apice apiculato, apiculo 0.5 mm. longo, parte superiore dorsi leviter bisulcata.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12857* (TYPE), Feb. 1939, alt. 1200 m., high epiphyte in rain-forest (stock small with one pendent stem ± 1 cm. long; flowers unopened; fruits orange-colored).

It has been difficult to determine the alliance of this species; the apiculum of the pyrene, the hairiness of the inside of the corolla, and the ovate leaves suggest *Hydnophytum Moseleyanum* var. *Teysmannii* Becc., but the latter has obovate pyrenes, and in the specimen cited they are elliptic or slightly ovate in outline; the larger leaves here show a definite venation although they are not at all prominent. There is also a possibility that the species may be allied to *H. macrophyllum* Warb., but in the latter the leaves are described as slightly obovate to elliptic. Here the difference between the outline (elliptic and ovate) and size (2.5 — 3 × 1.3 — 1.9 cm. in contrast with 6.5 — 12 × 3.5 — 7 cm.) of the leaves on the younger and older parts of the specimen is particularly striking, more so than in any of the other material of this genus which we have at hand.

Hydnophytum nigrescens sp. nov.

Tuber globosum; caule ramoso; ramulis nigrescentibus longitudinaliter rugulosis circiter 3 mm. diametro, internodiis 1.5–2.5 cm. longis; foliis ellipticis, 3.5–8.5 cm. longis, 2–4.5 cm. latis, saepissime 4.5–5 × 2–2.5 cm., apice abrupte acutis, basi cuneatis, costa utrinque prominula, nervis lateralibus utrinsecus 8 vel 9 utrinque subobscuris; petiolo 4–7 mm. longo; floribus in nodis valde tumidis, bracteatis, bracteis longe pilosis, in alveolis inclusis; calyce glabro, margine leviter lobato vel undulato, (incl. ovario) 2 mm. longo; corollae tubo 5 mm. longo, infra antheras inconspicue barbato, ostio dense barbato, pilis 1 mm. exsertis, lobis 2 mm. longis, ovatis, sub apice uncinulatis; antheris inclusis, in fauce insertis; stylo 6 mm. longo; stigmate bilobo, lobis exsertis; drupis non visis.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7171* (TYPE), July 1936, alt. 100 m., common canopy epiphyte of ridge forests (a large plant with well developed tuberous stock, galleried, but containing no ants; branches black).

Among the New Guinean species, this one seems to approach *Hydnophytum Ledermannii* Val., but the branchlets are not furfuraceous, the nerves of the leaves are obliquely spreading, and the corolla is only very sparsely hairy at the base of the anthers and between them; however, the mouth of the corolla is filled with flat hairs.

Hydnophytum Archboldianum sp. nov.

Tuber magnum subleve; ramulis angulatis, novellis compressis, subfurfuraceis (cortice rimoso), interdum longitudinaliter rugulosis, atrofuscis, internodiis 1.5–3 cm. longis; foliis late ellipticis, 3–5 cm. longis, 1.5–3.3 cm. latis, apice obtusis vel rotundatis, basi rotundatis, margine in sicco revolutis, atro-rufescentibus, costa utrinque prominente, versus basim crassiuscula, nervis lateralibus subpatentibus, utrinsecus 4–6 supra prominulis, subtus manifestis, vel utrinque subobscuris; petiolo circiter 2 mm. longo, crassiusculo; floribus in nodis tumidis, in alabastro bracteis intus longe pilosis inclusis; floribus sub anthesin partim exsertis; calyce cupulari, truncato, interdum minute denticulato, glabro; corolla infundibulari, corollae tubo 9–10 mm. longo, fauce minute papilloso-pubescente, lobis oblongis, 3–3.5 mm. longis; antheris partim exsertis, 2.5 mm. longis, linearibus, basi sagittatis, medio dorso affixis; stylo 12 mm. longo; stigmate bilobato, lobis linearibus; drupis obovatis, 8 mm. longis; pyrenis 2 vel 3, obovoideis, 3 mm. longis, apice rotundatis, basi anguste obtusis.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9506* (TYPE), Aug. 1938, alt. 3225 m., epiphytic in forests of moist hollows, common (shrub with large tuberous stock and long straggling branches; stock purple inside; leaf-nerves slightly impressed below, prominent above; flowers purple-red, solitary in axils); same locality, *Brass 9240, 9492,* August 1938, alt. 3225 m., occasional in edge of forest and in forest undergrowth (erect somewhat fleshy shrub ± 1 m. high; flowers pale purple and purple-red; fruit red, fleshy).

Hydnophytum Archboldianum is perhaps most nearly related to *H. Ledermannii* Val. It may readily be distinguished from the latter species by its different leaves and flowers. Superficially it seems to be easily recognized by its dark reddish practically sessile elliptic leaves which appear to have buds in their axils. On closer examination, one finds that these are really bracts (5–7 mm. long) protruding from shallow alveoli, which cover the flower buds. Only a very few species of *Hydnophytum* have bracts as large as these. At anthesis the corolla projects above the bract about half its length; usually there is only one flower to a bud, but occasionally there are more. The fruit of the type is immature, the description being taken from a ripe drupe of no. *9492*. In both the type and in no. *9240* we have found three locules. Whether this indicates a four-seeded fruit with one aborted or whether the normal number of locules in the fruit is two, we are not prepared to say. It should be noted that the type is described as having a tuberous stock, whereas the other two collections cited are described as shrubs. These in Mr. Brass' opinion were mature shrubs, not young plants in which the tuber might not yet have developed. In a discussion of *H. radicans* Becc., Valeton points out that the tuberous base is sometimes lacking in that species, and of course *H. normale* Becc. has no tuberous base, but is epiphytic.

Hydnophytum contortum sp. nov.

Tuber rotundatum, subleve, irregulare, ± 28 cm. diametro; caulibus pluribus brevibus (in specimine typico ± 30 cm. longis), ramosis, cinerascentibus; ramis argute tetragonis, in parte superiore compressis, atro-fuscis vel brunnescentibus, cortice longitudinaliter ruguloso, internodiis 1–4 cm. longis; foliis ellipticis vel leviter obovatis, 3–6 cm. longis, 1.5–3.8 cm. latis, apice rotundatis, basi rotundatis vel obtusis vel cuneatis, coriaceis, costa supra impressa, subtus prominula, nervis lateralibus utrinsecus 4 vel 5 utrinque inconspicuis vel subobscuris; petiolo plerumque 2–4 mm. longo;

floribus in nodis valde tumidis, bracteis dense rufo-pilosis praeditis; calyce margine ciliato, ciliis 1 mm. longis, dense confertis; corollae tubo 5 mm. longo, fauce annulato-barbato, lobis ovatis sub apice uncinulatis; staminibus in ostio tubi insertis, filamentis 0.5 mm. longis, antheris 1 mm. longis, oblongis, exsertis; drupis lageniformibus, 5 mm. longis; pyrenis 2 obovatis, 4 mm. longis, apice rotundatis, basi acutis.

BRITISH NEW GUINEA: Wuroi, Oriomo River, *Brass 5849* (TYPE), common on savanna trees (several short contorted stems produced from a large rounded tuberous stock; a typical tuberous base measured 28 cm. in diameter with surface smooth, brown, and very irregular; leaves shining, thick, fleshy; flowers white; fruit soft, reddish orange).

Possibly this species should have been placed in *Hydnophytum tortuosum* Becc., with which it agrees in foliar and stem characters; in Beccari's species the calyx is described as being densely pilose-paleaceous with a short truncate or very obscurely denticulate limb. In *H. contortum,* the limb of the calyx is very short, being about even with the margin of the disk, and the margin of the calyx is clothed with a very dense row of brown cilia about 1 mm. long. The flowers on the plant were scarce, but this character persists in fruit. The only other place we find mention of a comparable character is in the description of *H. Kochii* Val. Here Valeton says the berry is crowned by the disk surrounded by a ring of castaneous hairs. Apart from the ciliate margin, in our species the calyx and ovary are glabrous. This is just another instance where it is necessary to re-examine a type in order to be sure of the characters of a species.

Hydnophytum longistylum Becc. Malesia 2: 152. *t. 38, figs. 1–10.* 1885; Guppy, The Solomon Islands and their Natives, 297. 1887; Valeton, Bot. Jahrb. **61**: 136. 1927.

SOLOMON ISLANDS: San Cristoval: Waimamura, *Brass 2855,* September 1932, epiphytic on beach trees, common (stems numerous on a large tuberous base, irregular in form and varying greatly in size, with an uneven muricate surface pierced by numerous entrance-holes of the small brown ants which inhabit it; stems 1 m. or more long, often galled, the nodes swollen; leaves very thick and fleshy, the veins obscure [visible when dry]; flowers white; fruit yellow, about 9 mm. long, 4 mm. diameter, with two large white seeds enclosed in mucilaginous pulp).

From Guadalcanal Island, there are two collections which in all details agree with *Hydnophytum Stewartii* Fosberg, Lloydia 3: 123. *fig. 5.* 1940. These are *Brass 2548* and *Kajewski 2389,* one collected at Berande, the other on the Berande River; the field notes indicate a plant with branches pendulous from a tumid stock inhabited by great numbers of small brown ants; the branches are more than a meter long. Kajewski describes the fruit as cream-colored, thickest at the base, tapering to a blunt point, 8 mm. long, 3 mm. in diameter. Unfortunately our specimen does not have ripe fruit. In every other respect, as far as we can see, except in the size of the flowers, these collections agree with the collection from San Cristoval, the latter having flowers with the dimensions given for *H. longistylum* Becc. Beccari and Valeton both indicate glomerulate flowers without a tubercle; this is true of the upper nodes, but on the lower nodes of our specimen the inflorescence consists of flowers and fruit at the end of a tubercle about 4 mm. long, just as in *H. Stewartii* Fosb. Owing to the difference in the size of the flowers and the lack of sufficient material to estimate the range of variation, we are keeping both species in the *status quo* for the present. Beccari had only very fragmentary material on which to describe his species, and it seems very possible that he had one of the upper nodes at hand when he says that neither tubercle nor peduncle was present.

Hydnophytum ellipticum sp. nov.

Tuber parvum, ± 10 cm. diametro; ramulis cinerascentibus vel brunnescentibus, longitudinaliter rugulosis, cylindricis, novellis compressis, internodiis 1.5–3 cm. longis; foliis ellipticis, 4–8 cm. longis, 2–4.3 cm. latis, utrinque angustatis, basi et apice acutiusculis vel obtusiusculis, costa utrinque prominente, nervis lateralibus utrinsecus circiter 4, supra inconspicuis, subtus subobscuris; petiolo 3–8 mm. longo, crassiusculo; floribus in alveolis, axillaribus, bracteis suffultis; calyce parte superiore libero, glabro, (incl. ovario) 2 mm. longo, margine truncato; corollae tubo 4 mm. longo, fauce et lobis basi dense barbato, pilis in fauce patentibus, in lobis erectis, lobis 2 mm. longis, oblongis; filamentis brevibus, in fauce insertis, antheris 1.5 mm. longis, linearibus, parte superiore exsertis; stylo 5 mm. longo; drupis 4 mm. longis; pyrenis 3 mm. longis, obovatis, apice rotundatis, basi acutiusculis, dorso convexis.

Netherlands New Guinea: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12111* (type), Jan. 1939, alt. 1800 m., frequent epiphyte in mossy forest (tuberous base small, about 10 cm. diameter; flowers white).

This species is possibly related to *Hydnophytum nigrescens,* but it is readily distinguished by the light-colored branches and the more shallow alveoli; in addition, the throat of the corolla is densely hairy, and the bracts in the alveoli are not so conspicuously hairy as in the species from the Palmer River.

Hydnophytum myrtifolium sp. nov.

Tuber irregulare; caulibus ramosis; ramis compressis vel leviter angulatis, brunnescentibus vel cinerascentibus, gracilibus; ramulis ultimis circiter 2 mm. diametro, internodiis 1–4 cm. longis; foliis ellipticis vel ovato-ellipticis, 1.5–4 cm. longis, 0.5–2.2 cm. latis, apice acutiusculis vel obtusis, basi obtusis vel cuneatis, in sicco margine recurvis, supra rugulosis, subtus plerumque planis, costa utrinque distincta, nervis lateralibus utrinque obscuris; petiolo 2–5 mm. longo; floribus in axillis foliorum confertis; bracteis minutis; calyce (incl. ovario) 2 mm. longo, glabro, truncato, membranaceo; corollae tubo 6 mm. longo, ostio barbato, lobis 2 mm. longis, ovatis; antheris in apice tubi sessilibus, medio dorso affixis, linearibus vix 2 mm. longis; stylo 7 mm. longo; pyrenis 2 ellipsoideis, 3 mm. longis, apice et basi rotundatis, dorso convexis.

British New Guinea: East Mount Tafa, *Brass 4093* (type), May 1933, alt. 2100–2300 m., common epiphyte in both mossy and foothill forests (closely attached by several roots or pendent on a single tough flexible root up to 1 m. long; the swollen irregularly shaped stock of a typical plant measured 20 cm. diameter, and was hollowed in wide galleries containing a quantity of water but no ants; some plants were found to contain a species of small red tree frogs; no ants were found in any of the specimens examined; leaves fleshy and shining, darker above; flowers white; fruit fleshy, red, ± 3 mm. diameter); Murray Pass, Wharton Range, *Brass 4589,* July 1933, alt. 2840 m., epiphytic on trunks of forest trees, not plentiful (branches produced from a rounded tuberous base 20 cm. or more in diameter; branches ridged and finely rugose; leaves dark; corolla white, the tube ± 1 cm. long; fruit bright red, soft, 6–7 mm. diameter).

In leaf-size this species probably falls somewhere near *Hydnophytum cordifolium* Val. and *H. parvifolium* Val. Both the latter species have flowers on very short tubercles. However, having observed the variation in tubercles and lack of them, it seems best to note that other species have been observed where the flowers are sometimes apparently sessile in upper axils, while those flowers farther down may be at the tip of a short tubercle in the axil. Neverthless, there are distinct and definite floral characters which set this species apart from the other small-leaved species. The corolla is rather large, with a long tube barbate at the mouth only. In most species with the mouth of the tube barbate, the throat or the space immediately below the anthers is also hairy. The anthers are sessile and attached by the middle of the back, being only half exserted from the mouth of the flower; the pyrenes too seem to be reasonably distinctive in the rounded base.

Hydnophytum confertifolium sp. nov.

Tuber parvum spinis conspersis praeditum; spinis ± 1 cm. longis interdum ramosis; caulibus pluribus ramosis; ramis angulatis; internodiis ultimi ramuli ± 1.5 mm. longis; foliis glabris subrotundatis, circiter 5 mm. longis et 4 mm. latis, in sicco rugulosis, margine recurvis, costa tantum basi manifesta; petiolo 1–2 mm. longo; stipulis parvis, late triangularibus, caducis; floribus in axillis foliorum insertis, ima basi immersis; calyce libero, glabro, margine undulato vel leviter lobato, cum ovario 2 mm. longo; corolla in alabastro clavata, apice 4-angulata, acutiuscula; corollae tubo 7–8 mm. longo, fauce parce piloso, lobis circiter 3 mm. longis, sub apice uncinulatis; antheris lineari-oblongis in fauce insertis, fere sessilibus; stylo longo, stigmate exserto; drupis maturis cum calyce 6 mm. longis; pyrenis 3 mm. longis, 2 mm. latis, obovatis, apice rotundatis, basi acutiusculis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12680* (TYPE), Feb. 1939, alt. 2150 m., mossy forest (high epiphyte; tuberous base small and bearing branched thorns; leaves concave; flowers greenish white with green apex; fruit red).

Although the corolla in bud strongly suggests that of *Hydnophytum alboviride*, the species is probably closer to *H. Vitis-Idaea*. Both species have flowers few in number (i. e. in an inflorescence), the base immersed in a small alveolus, the calyx free and either shallowly lobed or minutely denticulate, and small leaves. They are readily distinguishable by various characters: in *H. confertifolium* the tuberous base is thorny with scattered spines, and the flower-bud is clavate, tapering at the apex; in *H. Vitis-Idaea* the corolla-tube is slender and the lobes form an elliptic outline at the end, as if the flower might be hypocrateriform when open; the pyrenes are different in outline, the one being oblong, the other obovate, although they belong to the same general type.

Hydnophytum decipiens sp. nov.

Tuber subleve; caule versus basim circiter 5 mm. diametro, ramoso; ramis acute tetragonis, cinereis; internodiis 1–3.5 cm. longis; foliis ovatis vel rotundato-ovatis vel ellipticis, (1.1–)1.5–2 cm. longis, 0.7–1 cm. latis, apice acutiusculis vel obtusis, basi rotundatis interdum cuneatis, in sicco supra minute rugosis, subtus planis, glabris, costa utrinque manifesta, nervis lateralibus obscuris; petiolo 1–2 mm. longo; stipulis non visis; floribus in axillis foliorum insertis, ima basi immersis; calyce in parte superiore libero, truncato, corollae tubo 4 mm. longo, intus glabro, fauce glabro, lobis 2 mm. longis, obtusiusculis sub apice uncinulatis; antheris 1.5 mm. longis, linearibus, in fauce insertis; stylo 5.5 mm. longo; stigmate exserto; drupis 4 mm. longis, pyrenis 2.5 mm. longis, 2 mm. latis, apice rotundatis, basi acutiusculis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12684* (TYPE), Feb. 1939, alt. 2150 m., mossy forest, on branches of large trees (branches weak, ± 60 cm. long; flowers white).

This species seems to be closest to *Hydnophytum parvifolium* Val., at least as regards leaf-variation. It has been a little difficult to be sure where the line of distinction lies between an incipient tubercle and a shallow alveolus, both of which sometimes have bracts. Here the basal part of the flower appears to be covered by small bracts, but there is no elongation of the process indicating a tubercle, nor is there any great enlargement of the node indicating a deep alveolus.

The species is very close to our *Hydnophytum Vitis-Idaea,* but in the latter the throat has an erect pilosity which is lacking here.

Hydnophytum Vitis-Idaea sp. nov.

Tuber usque 15 cm. diametro, subleve; ramis ± 45 cm. longis, ramosis, basi 4 mm. diametro, glabris; ramulis angulatis vel novellis compressis, cortice apice transverse rimoso; internodiis ultimi ramuli 3–8 mm. longis; foliis glabris, subcoriaceis, late ellipticis interdum obovatis, minoribus fere rotundatis, 0.3–1 cm. longis, 0.2–0.5 cm. latis, apice rotundatis, basi cuneatis vel obtusis, in sicco supra rugosis, subtus levibus, costa utrinque leviter manifesta, nervis lateralibus obscuris; petiolo 0.5–1.5 mm. longo; stipulis inconspicuis vel mancis; floribus in utraque parte folii insertionis 1 vel 2 confertis, ima basi immersis; calyce libero glabro, minute denticulato, cum ovario 2 mm. longo; corollae tubo circiter 6 mm. longo, fauce erecto-piloso, pilis apice exsertis, lobis 5 mm. longis, oblongis, uncinulatis, intus minute puberulis; antheris linearibus in fauce insertis; stylo 9 mm. longo; stigmaticis lobis 1 mm. longis; drupis oblongis, cum calyce 4 mm. longis, 2 mm. latis; pyrenis oblongis, 3 mm. longis, apice rotundatis, vix 1.5 mm. latis, basi leviter angustatis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12046* (TYPE), Jan. 1939, alt. 1800 m., mossy forest (a common epiphyte on the branches of tall trees; tuberous base up to ± 15 cm. diameter; flowers white; fruit red).

The species is perhaps related to *Hydnophytum parvifolium* Val., but the leaves are smaller and of different outline, and the flower is much larger. Without the tuber, the plant suggests a loose form of *Vaccinium Vitis-Idaea* var. *minus* Lodd., although the leaves are smaller than in that plant.

Hydnophytum alboviride sp. nov.

Tuber subleve cinereum; ramis usque 1 m. longis, ramosis, obtuse angulatis, fusco-cinereis; ramulis compressis, sulcatis, atrofuscis; internodiis ultimi ramuli 0.5–1 cm. longis; foliis 0.9–1.5 cm. longis, 0.7–1.3 cm. latis, late ovatis vel subrotundatis, apice acutiusculis vel rotundatis, basi rotundatis, in sicco subcoriaceis, brunneis, utrinque minute rugosis, costa tantum versus basim manifesta, nervis lateralibus obscuris; petiolo 1.5–2 mm. longo, crassiusculo; stipulis truncatis; floribus sessilibus in alveolis ad articulationes nidulantibus paucis (1 vel 2), basi in bracteis pilosis involutis, in alabastro clavatis; calyce truncato glabro, margine ciliato, pilis 0.5 mm. longis, calyce cum ovario 2 mm. longo; corolla infundibulari, tubo 7 mm. longo intus glabro, lobis 2 mm. longis, obtuse triangularibus, sub apice uncinulatis; antheris 1.5 mm. longis, medio dorso in fauce tubi affixis, apice tantum exsertis; stylo 1 cm. longo; stigmate exserto; drupis non visis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12682, 12683* (TYPE), Feb. 1939, alt. 2150 m., mossy forest, epiphytic on branches of large trees (a large plant with branches up to 1 m. long, erect; leaves flat; flowers greenish white).

Of the species of *Hydnophytum* already described from New Guinea, this one superficially suggests *H. Hellwigii* Warb., but it differs considerably in specific details. Apart from the small leaves, the summary of the distinctive characters of this species might be indicated as: flowers in alveoli surrounded by bracts and long brown hairs; calyx with cilia 0.5 mm. long, also brown; corolla glabrous within; anthers closely affixed by the middle of the back, only the apices exserted. On the long leafless branches (the leaves often being only toward the tip), flowers or buds with the corolla half protruding may be observed at the nodes.

Hydnophytum buxifolium sp. nov.

Tuber subleve; ramis tetragonis, cinerascentibus; ramulis ultimis anguste alatis; internodiis 5–10 mm. longis; foliis lanceolatis, utrinque aequaliter angustatis, basi et apice anguste obtusis, utrinque minute rugulosis, 0.7–1.3 cm. longis, 0.3–0.6 cm. latis, costa tantum manifesta; petiolo circiter 1 mm. longo, crassiusculo; stipulis caducis; floribus in axillis foliorum bracteis suffultis; bracteis minutis; calyce (incl. ovario) 1.5 mm. longo, margine leviter lobato, glabro; corollae tubo 3 mm. longo, fauce dense barbato, pilis subexsertis, lobis oblongis obtusiusculis, sub apice uncinulatis, 2 mm. longis; antheris exsertis, oblongis, 1 mm. longis, filamentis 0.5 mm. in fauce insertis; stylo brevi, vix 3 mm. longo; drupa immatura, 2.5 mm. longa.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12681* (TYPE), Feb. 1939, alt. 2150 m., high epiphyte in mossy forest (flowers white).

Hydnophytum buxifolium most closely approaches *H. punamense* Lauterb., from the Bismarck Archipelago; however, in the New Guinean material the leaves are about twice as broad in proportion to their length, and the flowers are very much larger. Valeton has reported Lauterbach's species from southwestern Netherlands New Guinea, but he has added nothing to the original description except that, in his key to species of Northeast New Guinea, he gives larger dimensions for the leaves than those given in the original description.

Hydnophytum ramispinum sp. nov.

Tuber parvum ovoideum spinis praeditum; spinis 1.5–2 cm. longis, ramosis, interdum ramis ramosis, gracilibus; caulibus pluribus, 70–80 cm. longis, ramosis; ramulis ultimis compressis, angulatis, cortice furfuraceis; internodiis 1.5–4 cm. longis; foliis glabris subcoriaceis, lineari-oblongis, 3–6 cm. longis, 0.6–0.9 cm. latis, apice obtusis, basi rotundatis vel obtusis, in sicco leviter rugulosis, costa supra impressa, subtus prominula, nervis lateralibus obscuris; petiolo circiter 1 mm. longo; stipulis caducis; floribus 3–5 in axillis foliorum confertis, ima basi immersis; alabastro 2.5 mm. longo; calyce membranaceo truncato (incl. ovario) 1 mm. longo; corollae tubo 1 mm. longo, fauce sparsim pilosulo, lobis obtusis, 1 mm. longis; antheris in fauce insertis, 1 mm. longis; stylo brevi; drupis non visis.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12858* (TYPE), Feb. 1939, alt. 1200 m., rain-forest; common epiphyte of middle spaces (stock small, ovoid; stems several, pendent, 70–80 cm. long; flowers yellow).

In leaf-size and flower, this species is near *Hydnophytum stenophyllum* Val. and *H. punamense* Lauterb. In both the latter species the leaves are either attenuate-acute or acute, and in neither is there any mention of the furfuraceous character of the young bark. Unfortunately many of the species have no indication of the characters of the tuberous base. In this the slender branching spines are most distinctive.

Hydnophytum punamense Lauterb. Fl. Deutsch. Schutzgeb. Südsee, Nachtr. 401. 1905; Valeton, Nova Guin. Bot. 8: 508. 1911, Bot. Jahrb. 61: 140. 1927.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 13008*, Feb. 1939, alt. 1450 m., epiphytic on tall rain-forest tree (tuberous base small, ovoid, 14 × 10 cm.; branches ± 50 cm. long; flowers white; fruit yellow); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13403, 13413*, March 1939, alt. 850 m., common high epiphyte in rain-forest (branches upright; flowers white, very small; fruit orange-colored).

Valeton reported this species from southwestern Netherlands New Guinea, but we have thought it worth while to record it here and to call attention to the variation in the size and the form of the leaves. In the original they are described as lanceolate or sublinear, acute, the base subrounded or acute. Some of the smaller might be considered as linear-oblong, obtuse, with cuneate base, and in most of them, although the apex is narrow, it is not sharply pointed; the leaves vary in size from 2 to 5 cm. in length and from 0.5 to 1.3 cm. in breadth. We note this particularly, as Valeton, in his key to the species of Northeast New Guinea, says that the leaves are at most 35 × 7–8 mm. We have been unable to find any differences in the flowers and fruits of the collections at hand, although the flowers are 2 mm. long rather than 1 mm., as stated in the original description.

Hydnophytum longipes sp. nov.

Tuber? . . .; ramulis subangulatis vel novellis tetragonis, atrofuscis vel brunnescentibus, internodiis 1.5–9 cm. longis, foliis in sicco membranaceis, lanceolato-ellipticis, 5–15 cm. longis, 2.5–5.5 cm. latis, basi et apice aequaliter angustatis, apice acutis, basi cuneatis vel acutis, costa utrinque prominula, nervis lateralibus utrinsecus 8–10 utrinque distinctis, non prominulis, oblique adscendentibus deinde arcuatis; petiolo 3–7 mm. longo; stipulis 2 mm. longis, acutiusculis interdum apice breviter acuminatis, caducis; inflorescentiis pedunculatis, bifurcatis, pedunculo 3–5 cm. longo, ramis 1–1.5 cm. longis, ramulis ultimis 1–2.5 cm. longis, cicatricosis, floribus et fructibus apice et versus apicem ramulorum ultimorum sessilibus; calyce ima basi immerso (incl. ovario) 1 mm. longo, truncato, disco breviore; corolla in alabastro tantum visa, fauce annulato-barbato, lobis 2 mm. longis, basi pilis erectis praeditis, oblongis; staminibus in fauce tubi insertis, filamentis brevibus, antheris 1 mm. longis, lineari-oblongis, sub anthesin exsertis; stylo longo, stigmate probabiliter exserto, bilobato; drupis 5 mm. longis, ovoideis; pyrenis ellipsoideis, 4 mm. longis, basi et apice subrotundatis, dorso convexis.

SOLOMON ISLANDS: Bougainville: Kieta, *Kajewski 1571* (TYPE), March 1930, at sea-level, rain-forest (plant found growing on large tree, up to 1 m. long; flowers minute, green, with a prominent style; fruit yellow, semi-transparent, 7 mm. long, 4 mm. in diameter, oval-shaped).

Hydnophytum longipes belongs in the same group with *H. normale* Becc. and *H. radicans* Becc. It has, however, lanceolate-elliptic leaves with short petioles, narrower anthers, and the pyrenes are rounded at the apex, not at all emarginate as in the latter species.

Hydnophytum radicans Becc. Malesia 2: 132. *t. 30.* 1885; Valeton, Nova Guin. Bot. 8: 503. 1911, op. cit. 771. 1912; Lam, Nat. Tijds. Nederl.-Ind. 88: 204. 1928.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7172,* July 1936, alt. 100 m., common ridge-forest canopy epiphyte (tuberous stock small; branches long, weak and semi-herbaceous; leaves fleshy; flowers green; fruit soft, red, ± 5 mm. long, 3 mm. diameter).

This collection agrees with Valeton's description which he has given for material placed in this species with a query, but it also agrees fairly well with the original. The inflorescence shows great variation in size, the peduncle being from 2.5 to 6 cm. long, and the rest of the inflorescence 2–8 cm. long and 4–14 cm. broad.

Hydnophytum albense Valeton, Bot. Jahrb. 61: 128. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13980,* April 1939, alt. 50 m., flood-plain rain-forest (low epiphyte; flowers white).

The petioles are only about two-thirds as long as those described in the original; the differences between this species and *Hydnophytum subnormale* K. Schum. are not quite clear to us from Valeton's key, and the types would appear from the descriptions to be more or less fragmentary.

Hydnophytum Albertisii Becc. Malesia 2: 136. *t. 45, figs. 8–14.* 1885; Val. Nova Guin. Bot. 8: 772. 1912.

BRITISH NEW GUINEA: Fly River, 528 mile Camp, *Brass 6599, 7011,* May 1936, alt. 80 m., commonly associated with ferns, mosses, and orchids on branches of canopy trees (tuberous base often reduced to a series of small swellings on stem, or entirely absent in young plants already flowering; stems quadrangular; leaves bluish green).

There can scarcely be any doubt that these two collections belong to Beccari's species. Some of the leaves are even more sharply acuminate than that in Beccari's plate. The plants have flowers with both long and shorter styles. Those with the long style correspond to Beccari's figures. In the other the stamens, instead of being inserted in the tube and included, are inserted in the mouth of the corolla-tube, and thus are exserted with the very thick tuft of hairs which protrudes from the mouth of the corolla;

below the stamens the tube is densely hairy in the upper half or nearly two thirds; the style reaches only to the base of the anthers; the stigma is not distinctly lobed in the buds examined; the fruit is 4 mm. long, and one contained 4 pyrenes, another contained 3, while the other probably did not develop; the pyrenes are 3.5 mm. long, linear-oblong in outline or slightly wider at base (1 mm.), obtuse at the apex and base. Both plants appear to be developing fruits.

Hydnophytum Hahlii Rechinger, Rep. Spec. Nov. **9**: 186. 1912, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien **89**: 612. *t. 2, fig. 3a.* 1913?

SOLOMON ISLANDS: San Cristoval: Hinuahaoro, *Brass 2912*, Sept. 1932, alt. 900 m., mountain forests (small trees; branches swollen at the nodes; leaves pale, flat, fleshy, the nerves more prominent above; flower white; fruit smooth, 6 × 4 mm., marked longitudinally with white lines).

We have placed this specimen here with some hesitation. Rechinger's species grew on the branches of strand trees. However, the flowers on the specimen at hand are only in young bud, and when mature the stamens would be exserted, and for this reason the hairiness within the corolla is correspondingly different. The buds indicate a very dense growth of hairs protruding from the mouth of the corolla. The pyrene is more rounded than attenuate at the base. Neverthless the plate of Rechinger's species is so much like the plant at hand that we hesitate to place it elsewhere without further material for comparison.

Hydnophytum Guppyanum Becc. Malesia, **2**: 133. *t. 40.* 1885; Guppy, The Solomon Islands and their Natives, 297. 1887; Rechinger, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien **89**: 612. 1913.

SOLOMON ISLANDS: Ysabel: Tataba, *Brass 3421*, Jan. 1933, alt. 50 m., epiphytic on rain-forest trees, plentiful (stems under 1 m. long, ascending or pendent from a large swollen base much tunnelled by small brown ants; leaves fleshy, the upper side dull, the lower paler and shining; fruit reddish).

Rechinger was not sure of the determination of his specimen, but there can be no doubt that this is the same species as was described from the Shortland Islands.

Hydnophytum Kajewskii sp. nov.

Tuber? . . .; caulibus ramosis; ramis acute tetragonis, internodiis 1.5–2 cm. longis; foliis subrotundis, 1–2.7 cm. longis, 0.9–2.4 cm. latis, apice rotundatis vel obtusis, basi cordatis, sessilibus, in sicco margine leviter recurvis, costa utrinque manifesta versus basim leviter incrassata, nervis lateralibus utrinsecus 4–6 supra prominulis, subtus manifestis vel inconspicuis, oblique patentibus; inflorescentiis in axillis graciliter pedunculatis, furcatis; pedunculo 1–1.5 cm. longo tetragono vel compresso; ramis plerumque 1 cm. longis dense cicatricosis; floribus paucis apice rami insertis, alabastris tantum visis; calyce truncato glabro, cum ovario 2 mm. longo; corollae tubo 3 mm. longo, fauce annulato-barbato, lobis 2 mm. longis, oblongis, glabris; filamentis in fauce tubi insertis, antheris 1.5 mm. longis, oblongis; stylo fere 4 mm. longo; drupis non visis.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1716* (TYPE), April 1939, alt. 1000 m., growing from a huge bulb on rain-forest trees (flowers white; fruit 6 mm. long, 4 mm. diameter, irregularly ovoid, green when ripe, with white longitudinal lines).

The leaves of this species at once call to mind the plate of *Hydnophytum ovatum* Becc. But in the latter species the flowers are inclosed in alveoli. As far as we know, this is the only species with small rounded leaves and pedunculate inflorescences.

Myrmecodia Jack

With so little material available for examination, it has not been easy to estimate the variability of specific characters in *Myrmecodia*. In the work here presented, we have relied chiefly on floral characters, those of the alveoli, and of the spines of the stem and tuberous base. The fruits do not have as distinctive features as those of *Hydnophytum* Jack. Occasionally the stipules offer unusual characters. In both *Hydnophytum* and *Myrmecodia* the pubescence within the corolla may vary according to whether the stamens are included or exserted. In Vegetationsbilder 15 (Heft 7), Professor H. J. Lam has a richly illustrated article on the species of *Myrmecodia* and *Hydnophytum* which he collected on the van Overeem Expedition to New Guinea, 1920–21. This contains much general information. Unfortunately, so far as we have been able to learn, the descriptions of Lam's specimens have not yet been published. In conjunction with this paper we are publishing a plate of five photographs taken by Mr. L. J. Brass during his collecting trips; these give a limited idea of the variation of habitat and habit. In examining the specimens of *M. Lamii* and *M. Brassii,* we found two types of spines on different pieces of the tuberous base, and supposed we had mixed the material in sorting, but on appealing for help to Mr. Brass, we found that the two belonged to the same base; he sent us a photograph illustrating this, and it (in part) is reproduced in the plate.

Myrmecodia Antoinii Becc. Malesia 2: 116. *t. 19, figs. 2–4.* 1884; Hook. f. Bot. Mag. 123: *t. 7517.* 1897; F. M. Bail. Queensl. Fl. 3: 775. 1900, Queensl. Agric. Jour. 27: 66. *t. 18.* 1911.

Myrmecodia echinata sensu Antoine Oest. Bot. Zeitschr. 32: 347. *tab.* 1882, non Gaud.

British New Guinea: Daru Island, Western Division, *Brass 6447,* April 1936, common epiphyte on savanna-forest trees; Tarara, Wassi Kussa River, *Brass 8670,* January 1937, common epiphyte in low savanna-forests.

This species was originally described from specimens collected on Thursday Island in Torres Straits. It has also been reported from Moa Island. Southern Papua is a logical extension of its range.

Myrmecodia tuberosa Jack, Trans. Linn. Soc. 14: 123. 1823; Becc. Malesia 2: 99. *t. 13, 14.* 1884?

British New Guinea: Kanosia, *Carr 11517,* mangrove swamps, Feb. 1935 (epiphyte, ant-infested; flowers mostly white).

Although somewhat skeptical of the range of this species, this is more like the Malayan species than any other illustrated by Beccari. The specimen does not appear to have any flowers, and hence we are making only a provisional determination. Beccari gives the range of the species as Malay Peninsula, Sumatra, Borneo, and Java.

Myrmecodia Lamii sp. nov. PL. I, FIG. E.

Tuber usque ± 70 cm. longum et 40 cm. diametro, irregulariter costatum, spinosum, in parte inferiore ecostatum spinis crassiusculis in manipulis sparsis ± 6 mm. longis ornatum, in parte superiore spinis gracilibus simplicibus vel aggregatis vel a basi ramosis 7–22 mm. longis praeditum; caulibus 3–4.5 cm. diametro (cum spinis), versus apicem foliosis, clypeolatis; clypeolis 1.5 cm. longis, 1 cm. latis, ultra insertionem petioli spinas paucas gerentibus; stipulis magnis profunde bifidis, lobis elongatis 1.5–2 cm. longis divergentibus ad basin cum clypeolo ad latera connatis; foliis 8–22 cm. longis, 2–3.5(–6) cm. latis, oblanceolatis, apice abrupte acutis vel obtusiusculis, basi sensim in petiolum 1–3 cm. longum attenuatis, coriaceis, nervis lateralibus utrinsecus 8–10, supra manifestis, subtus prominulis, margine crispis vel recurvatis; alveolis interclypeolaribus marginibus radiculosis, radiculis brevibus ramosis; floribus in alveolis profunde nidulantibus; bracteis membranaceis involucratis, intus dense fuscis pilosis (filamentosis), pilis 4 mm. longis; calyce cupulari, 3 mm. longo, membranaceo, margine undulato vel leviter lobato; corollae tubo 7–8 mm. longo, intus glabro, lobis oblongis, 4 mm. longis, apice acutis, 1 mm. infra apicem uncinulatis; antheris 2.5 mm. longis, dorso infra medium affixis, in apice tubi insertis; disco profunde concavo; stylo 9 mm. longo; stigmate 4-lobato, lobis parvis; ovario 4-loculari; pyrenis subtrigono-compressis, 6 mm. longis, 1.5–2 mm. diametro, punctulatis.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9445* (TYPE), Aug. 1938, alt. 3225 m., abundant, characteristic, and very conspicuous large gouty epiphyte in open peaty communities, on *Libocedrus,* and on various trees in low mossy thickets, also terrestrial in shrubberies and grassy glades (tuberous base covered with erect bristles to over 2 cm. long, elongated, about 50–70 cm. long, 30–40 cm. in diameter, usually protruding at right angles with the host tree, upright and thicker in proportion to length when terrestrial; branches several from a common apex, up to about 1 m. long and 5 cm. in diameter; leaf-margins recurved, the midrib sharply keeled below; flowers white, the anthers blue); 9 km. northeast of Lake Habbema, *Brass 10689,* Oct. 1938, alt. 2800 m., common epiphyte, usually high on the branches of tall trees but coming down close to the ground on dead trees in clearings (leaves concave, the margins crinkled and recurved; flowers pale blue); Bele River, 18 km. northeast of Lake Habbema, *Brass 11554,* Nov. 1938, alt. 2200 m., a common epiphyte on trees along the river (leaves concave; flowers bluish white).

This species is readily distinguished from the others which superficially resemble it in habit by the very conspicuous stipules which have divergent tips and which, at the base, extend along the sides of the clypeoli, forming a somewhat wing-like margin; the spines on the clypeoli are variable in number, on younger ones sometimes two or three or a small cluster, or perhaps none. The flowers have a rather thick corolla which is glabrous within, whereas in most other species the corolla is thick in the upper part, becoming membranous in the lower part. The only species-description which we find even suggesting a relationship is that of *Myrmecodia longissima* Val., Bot. Jahrb. 61: 148. 1927; the latter, however, has leaves three times as large and different in outline, as well as different floral characters, the corolla-lobes being linear and the tube within provided with a ring of hairs near the base.

We have named this species for Professor H. J. Lam, who, we believe, discovered it first. In Vegetationsbilder 15(Heft 7): *t. 37, 38, 40.* 1924, Professor Lam has given some excellent illustrations, but it seems rather unfortunate that some formal descriptions were not published in anticipation of the article or accompanying it; possibly these have been published, but, if so, we have not yet discovered the record.

Myrmecodia Brassii sp. nov. PL. I, FIG. A-C.

Tuber irregulare, versus apicem costatum, spinosum, in parte inferiore ecostatum spinis crassiusculis in manipulis sparsis ± 6 mm. longis ornatum, in parte superiore spinis numerosis gracilibus simplicibus saepe subaggregatis 6–13 mm. longis praeditum; caulibus (cum spinis) 3–4 cm. diametro, subobscure clypeolatis, clypeolis ± 10 mm. diametro, sursum consperse et margine dense spinosis, spinis simplicibus gracilibus, 7–15 mm. longis; stipulis intrapetiolaribus oblongis ad medium usque bifidis, novellis fere 1.5 cm. longis, maturitate apice caduco, parte relicta ± 5–7 mm. longa, obtusa, demum subreflexa; foliis 9–15 cm. longis, 1.5–3 cm. latis, oblanceolatis, apice acutis, basi sensim in petiolum 1–2 cm. longum attenuatis, coriaceis, nervis lateralibus utrinsecus 7–9, utrinque manifestis, obliquis; alveolis interclypeolaribus spinis clypeolorum plane obtectis; floribus in fundo alveolorum, bracteis intus pilosis involucratis; calyce cupulari truncato membranaceo, 3 mm. longo; corollae tubo (maturo 12 mm., in alabastro 8 mm. longo) intus circa medium et sub antheras annulato-piloso, inter antheras sparsim piloso, lobis 4 mm. longis, oblongis acutis, 1 mm. infra apicem membranaceo-uncinulatis; staminibus versus tubi apicem insertis, antheris in alabastro 2.5 mm. longis; disco concavo; stylo 6 mm. longo; stigmate 4–6-partito, lobis crasse linearibus vix 2 mm. longis; ovario 4–6-loculari.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9445* (TYPE), Aug. 1938, alt. 3225 m., associated with no. *9445*, often on the same tree, and very similar in general appearance, less common than no. *9445* and very seldom terrestrial (only two plants seen) (tuberous stem and branches gray-black, the branches very bristly; leaves concave, the margins not recurved, the midrib rounded below [before drying]; flowers white, the anthers blue).

Although the fineness of the spines, the similar leaf-outline, and the same general habit suggest *Myrmecodia Lamii*, the very fine slender spines or coarse bristles developed so abundantly on the stems or branches at once suggest a difference. The clypeoli are not nearly so obvious as in the other species, and the stipules are of the regular type, intrapetiolar, and at the base they do not appear to extend beyond the point of insertion of the petiole. The floral characters too are distinctive; the rather broad band of hairs at about the middle of the corolla-tube within and just below the stamens shows a tendency to extend upward between the anthers, while the stigmatic lobes are linear.

Myrmecodia sterrophylla sp. nov.

Tuber costatum, spinosum, spinis 5–15 mm. longis saepissime simplicibus; caulibus cum spinis circiter 4 cm. diametro, versus apicem foliosis, clypeolatis; clypeolis 10–13 mm. longis, 10 mm. latis, prope marginem dense spinosis, spinis 10(–15) mm. longis; stipulis lanceolatis, 1 cm. longis, profunde bifidis apice paulo divergentibus; foliis oblongo-lanceolatis, 14–27 cm. longis, 4–6 cm. latis, utrinque fere aequaliter angustatis, apice sensim acuminatis, basi in petiolum 2–5 cm. longum attenuatis, valde coriaceis, margine crispis planis, nervis lateralibus utrinsecus 8 vel 9 utrinque subprominulis; alveolis elongatis interclypeolaribus spinis clypeolorum obtectis; floribus seriatim in fundo alveolorum, bracteis intus pilosis involucratis; calyce (alabastro) 2 mm. longo, cupulari, truncato; corollae tubo infra stamina annulum tomentosum ferente; antheris 3 mm. longis; stigmate 6-lobato, lobis lineari-oblongis; fructibus oblongis; pyrenis 6, circiter 4 mm. longis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12138* (TYPE), Jan. 1939, alt. 1800 m., common as a high epiphyte in mossy forest (leaves somewhat concave, the margins crinkled; flowers white; fruit red).

Superficially this specimen very closely resembles *Brass 12047*, but the flowers definitely indicate a different species. In some ways it suggests *Myrmecodia longifolia* Val., but the leaves are clearly lanceolate and not somewhat long-acuminate.

Myrmecodia Archboldiana sp. nov.

Tuber costatum, dense spinosum, circiter 30 cm. longum, 16 cm. diametro; spinis 5–15 mm. longis e cortice stellatim fasciculatis vel interdum a basi ramosis vel simplicibus, gracilibus; caulibus (cum spinis) 2.5–4 cm. diametro, versus apicem foliosis, clypeolatis; clypeolis ± 10 mm. longis, 8–9 mm. latis, margine dense spinosis, spinis 1–2 cm. longis; stipulis ± 5 mm. longis cito caducis; foliis 20–29 cm. longis, 2.5–4 cm. latis, lineari-lanceolatis, apice acutis vel subacuminatis, basi sensim in petiolum 4–9 cm. longum attenuatis, tenuiter coriaceis, nervis lateralibus utrinsecus 12–15 supra manifestis interdum prominulis, subtus manifestis, margine planis; alveolis interclypeolaribus elongatis spinis clypeolorum plane obtectis; floribus in fundo alveolorum, bracteis involucratis verisimiliter intus glabris; calyce cupulari brevi truncato membranaceo 1–1.5 mm. longo; corollae tubo 16 mm. longo, intus glabro, versus basim 5 mm. membranaceo sursum crassiusculo; lobis 5 mm. longis, acutis, vix uncinulatis; staminibus in apice tubi insertis, antheris 3 mm. longis; disco plano; stylo 9 mm. longo; stigmate 2–4-lobato, lobis crassiusculis; ovario 2–4-loculari; pyrenis brevibus, circiter 3 mm. longis.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11216* (TYPE), Nov. 1938, alt. 2200 m., common on oaks in primary forest and also occurring on various trees in secondary forest (stock bottle-shaped, irregularly ridged and very spiny: typical example 30 × 16 cm.; petiole and midrib orange-colored; flowers white); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12047*, Jan. 1939, alt. 1800 m., common epiphyte in mossy forest (petioles bright orange-red; flowers white).

This species may resemble *Myrmecodia longifolia* Val. somewhat in habit, but the spines on the tuberous stem are longer and tend to be fascicled or stellate from the base rather than short and simple; the leaves are different in outline; there do not appear to be any hairs or filaments in the bracts of the alveoli, and the flower is glabrous, the corolla lacking the common annular pilosity within.

Myrmecodia erinacea Becc. Malesia 2: 105. *t. 12, fig. 7–11.* 1884; Valeton, Nova Guin. 8: 514. 1911, Bot. Jahrb. 61: 145. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13934,* alt. 50 m., April 1939, common low epiphyte in flooded rain-forests of river-plain (leaves convex and much crinkled; flowers greenish blue).

The species has been reported twice for Netherlands New Guinea, once from the island of Japen, the other from southwestern New Guinea, both times growing on *Rhizophora;* this collection indicates that the species extends inland as well as occurring on the coast.

Myrmecodia prolifera sp. nov.

Tuber ecostatum, ± oblongum, usque 13 cm. longum et 5 cm. latum, spinosum; spinis prope basim ramosis, basi 1–1.5 mm. ramis 5 mm. longis, pungentibus; caulibus 1.2 cm. (cum spinis 3.5 cm.) diametro, spinis usque 2 cm. longis saepissime simplicibus interdum pauciramosis; clypeolis indistinctis vel confluentibus, spinis interdum sub basi petioli instructis; stipulis cito caducis; foliis 10–17 cm. longis, 1.5–4 cm. latis, oblanceolatis vel oblongo-spathulatis, apice subabrupte acutis vel breviter acuminatis, basi sensim in petiolum 2–4 cm. longum leviter alatum elongato-attenuatis, pergamaceis, nervis lateralibus utrinsecus 6–9 patenti-arcuatis, supra manifestis subtus prominulis, margine planis vel in sicco versus basim leviter revolutis; alveolis oblongis spinis densissime obtectis; bracteis intus glabris vel sparsim pilosis, involucratis; calyce brevi cupulari truncato circiter 1.5 cm. longo; corollae tubo in parte inferiore annulato-barbato; staminibus in apice tubi insertis; stylo circiter 7 mm. longo; stigmate 4-partito, lobis linearibus; fructibus ut videtur in alveolis germinantibus.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13935* (TYPE), April 1939, alt. 50 m., common in open swamp-forests of river-plains (leaves convex, petioles white; flowers greenish blue).

This species, in the outline of the leaves, the four linear stigmatic lobes, and the ring of hairs inside the corolla-tube, suggests *Myrmecodia alata* Becc. It lacks the costate character of the tuberous stem and has definitely branched spines on the tuber and occasionally forked or twice-branched spines on the stem; the clypeoli appear to be continuous or obliterated except for the leaf-scars; the stem-spines are mostly clustered according to the position of the alveoli.

Myrmecodia paucispina Val. Bot. Jahrb. 61: 150. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13829,* April 1939, alt. 50 m., epiphytic in open swamp forest, rare (tuberous stem irregularly ovoid). BRITISH NEW GUINEA: Auga River, Mafulu, *Brass 5496,* Nov. 1933, alt. 580 m., epiphytic on river-bank trees, common (large unevenly swollen tuberous base frequently lobed or branched, the surface swellings only armed with prickles around and amongst which are entrance holes into interior galleries inhabited by small black ants; leaf-bearing branches quadrangular; flowers and fruit in deep pits; flowers white; fruit elongated, pale yellow).

On account of the fragmentary material which Valeton had at his disposal, his description of this species is somewhat difficult to place, yet there are sufficient characters given so that we have hesitated to place this material elsewhere at present. The collections agree with the original in the following features: thick four-sided stem with short internodes, the midrib of the leaf decurrent to form a small wing down the stem (not obvious in all specimens but clearly distinct in some), the general outline of the leaf, the practically naked branch, the fairly large uncinule of the corolla-lobes in bud, and the ring of hairs below the anthers. The specimens differ in having 4 pyrenes, and there are no small fascicled rootlets on the lower angles of the stem, nor are there any spines (Valeton does not say whether the spines are simple or branched) on the margins of the lower alveoli. There are occasional branched spines on the lower parts of the stem; the tuberous base has both single and branched spines but mostly branched, and in the latter the branches are often again branched, as in *Myrmecodia Albertisii* Becc., but the spines are somewhat coarser and more rigid. The leaves in these collections are about 12–28 cm. long, 4–8(–10) cm. broad, and strongly resemble that pictured by Beccari for *Myrmecodia alata*.

Myrmecodia Albertisii Becc. Malesia 2: 112. *t. 11.* 1884.

British New Guinea: Wuroi, Oriomo River, *Brass 5848,* Feb. 1934, alt. 10–30 m., hanging from branches of savanna trees, abundant (a thick, often branched stem growing from an elongated large swollen and very spiny base [typical base 50 × 23 cm.]; flowers bluish white, fleshy; fruit pale yellow, 10 × 6 mm., soft); Lake Daviumbu, Middle Fly River, *Brass 7599,* Aug. 1936, plentiful on low trees of lake-shore (flowers bluish white); Tarara, Wassi Kussa River, *Brass 8580,* Dec. 1936, very common savanna-forest epiphyte (stems and tuberous base very thorny; flowers bluish white).

The last collection has the long-styled flower pictured by Beccari; the others have short-styled flowers, the band of hairs being about one-third the length of the tube above its base, and the stamens attached to the apex of the tube; there does not seem to be any other essential difference. We take this to be an example of heterostyly in this species.

Myrmecodia salomonensis Becc. Malesia 2: 175. *t. 53, fig. 1.* 1884; Guppy, The Solomon Islands and their Natives, 297. 1887; Valeton, Bot. Jahrb. 61: 150. 1927. Pl. I, fig. D.

Solomon Islands: San Cristoval: Waimamura, *Brass 2585,* Aug. 1932, common, epiphytic on trees fringing rivers and the sea beach (pendulous under the branches of the host tree; lower tuberous part of stem elongated, marked with numerous small pits and tubercles; typical large specimen 45 cm. long, 16 cm. diameter at middle; leaf-bearing part of stem 60 cm. long, 4 cm. diameter, curved upward with a crown of thick glabrous leaves arranged in spirals [on account of the twisting of the stem]; corolla white, 4-angled, fleshy; a few young seedlings often rooting and growing in the bristly depressions between the leaf-rows; cavities in tuberous stem inhabited by colonies of small brown ants).

Beccari's original description is based on a leaf without a petiole, a fragment of a tuberous stem, and Guppy's notes. Guppy says the species is "noticed commonly on tall mangrove trees bordering the sides of streams in the lower part of their courses." Although the leaves of the specimen cited above are somewhat shorter (26 × 10–11 cm.) than that of the original, there can be little doubt that the two belong to the same species.

Clypeoli irregularly oblong, with spines mostly on the margins, the spines ± 10(–20) mm. long. Petioles ± 18 cm. long. Flowers in the alveoli between the clypeoli; calyx membranous, annular, 2 mm. long; corolla before anthesis 14 mm. long, 3.5 mm. diameter, within about 2 mm. above the base annular-villous, the lobes about 3 mm. long; anthers 2.5 mm. long; style 12 mm. long, the stigma indistinctly lobed; fruit 6-seeded.

Myrmecodia pendens sp. nov.

Tuber costatum spinosum, spinis 7–15 mm. longis, gracilibus, simplicibus vel interdum ramosis; caulibus (cum spinis) circiter 3.5 cm. diametro, versus apicem foliosis, indistincte clypeolatis; clypeolis sub insertionem petioli spinas 10–12 mm. longas gerentibus; stipulis ± 1 cm. longis, bifidis, intrapetiolaribus, lobis paulo divergentibus; foliis usque 20 cm. longis et 5 cm. latis, oblongo-oblanceolatis, versus apicem sensim acuminatis, basi sensim in petiolum usque 2 cm. longum attenuatis, pergamaceis vel tenuiter coriaceis, nervis lateralibus utrinsecus ± 11 utrinque subprominulis, venis interspersis; alveolis interclypeolaribus spinis clypeoli obtectis; bracteis intus pilosis involucratis; floribus in fundo alveolorum; calyce cupulari, 1 mm. longo, truncato; corollae tubo 1.3 cm. longo, 4 mm. supra basim dense annulato-piloso, lobis oblongis, ± 5 mm. longis, infra apicem 1 mm. uncinulatis; antheris in apicem tubi insertis, 3 mm. longis; disco plano; stylo circiter 9 mm. longo, stigmate indistincte lobato; ovario 4-loculari; fructibus elongatis; pyrenis 3–4 mm. longis.

BRITISH NEW GUINEA: Mafulu, *Brass 5401* in part (TYPE in Arnold Arb.), Nov. 1933, alt. 1250 m., lower primary forest junction with oak forest, i. e. upper edge of mixed rain-forest (upward of 50 plants pendent from branches of a tall tree; flowering plants 20 to 60 cm. long; tuberous base of largest plant 23 cm. long, 10 cm. greatest diameter, flanged and armed with prickles; leaves dark, smooth, with whitish midrib; flowers white; fruit orange-yellow, shining; smallest plant contained in upper cells a lining of soft white tissue — no ants; other plants inhabited by numerous small brown ants).

The two collections of this number which we have at hand show so much variation that it has seemed best at present to describe both as new species; unfortunately the other duplicates are unavailable for examination. The above type sheet consists of a leaf-bearing stem and a cross-section of a tuberous base; the latter is approximately 8 cm. in diameter, closely costate, and armed with slender, simple, and only very occasionally branched spines. The stem is about 15 cm. long, thickly beset with stouter simple spines and here and there spines with 1–3 branches. In the flower the stamens are at the apex of the tube, but the style is long enough so that the stigma is located in the midst of the opening anthers; the flowers examined have four locules. The other specimen (New York Bot. Gard.) has a tuberous base covered with branching spines; the stem also has branching spines around the alveoli forming a sort of protective cover, and the clypeoli are more or less confluent around the alveoli with occasional branching spines, but the stem does not give the impression of being densely spiny as in the other specimen; in the flower the anthers are low in the corolla-tube, and the style is just long enough to hold the stigma in the region of the anthers; the ovary is six-loculed and there are only very small tufts of hairs in the corolla below the stamens.

Myrmecodia pendula sp. nov.

Tuber costatum spinosum, oblongum, 15 cm. longum, 5 cm. diametro; spinis ramosis, basi 1–2 mm. longa, ramis 5–7 mm. longis; caulibus (cum spinis) 3 cm. diametro, versus apicem foliosis, clypeolis confluentibus consperse spinosis, spinis ramosis, ± 7 mm. longis; stipulis circiter 1 cm. longis cito caducis; foliis usque 11 cm. longis et 2.5 cm. latis, anguste oblanceolatis, apice acuminatis, basi sensim in petiolum 1.5 cm. longum attenuatis, tenuiter coriaceis, nervis lateralibus utrinsecus ± 8 supra manifestis, subtus inconspicuis, venis interspersis; alveolis breviter oblongis margine dense spinosis, spinis ramosis; floribus in fundo alveolorum; bracteis involucratis intus dense pilosis, pilis fuscis; calyce cupulari 3 mm. longo; corollae tubo 7 mm. longo, intus paulo infra stamina sparsim barbato; lobis fere 2 mm. infra apicem uncinulatis; staminibus in medio tubo insertis; stylo brevi; ovario 6-loculari; fructibus ovoideis; pyrenis ± 3 mm. longis.

British New Guinea: Mafulu, *Brass 5401* in part (type in New York Bot. Gard.), Nov. 1933, alt. 1250 m., lower primary forest junction with oak forest, i. e. upper edge of mixed rain-forest (upward of 50 plants pendent from branches of a tall tree; flowering plants 20–60 cm. long; tuberous base of largest plant 23 cm. long, 10 cm. greatest diameter, flanged and armed with branching prickles; leaves dark, smooth, with whitish midrib; flowers white; fruit orange-yellow, shining; smallest plant contained in upper cells a lining of soft white tissue — no ants; other plants inhabited by numerous small brown ants).

The distinctive characters of this species are the branching spines of both the tuberous base and the stem, the somewhat confluent clypeoli, the rather obviously uncinulate corolla-lobes, the bud tapering toward the apex, the anthers low in the tube, beneath them the very scanty tufts of hairs, the short style, and the 6-loculed ovary. Both *Myrmecodia pendens* and *M. pendula* were collected from the same branch and were intended to show variation; the photograph shows "detached plants hanging by the long roots by which they dangled in their treetop home."

Nertera Banks and Solander

Nertera granadensis (Mutis) Druce, Rep. Bot. Exch. Cl. Brit. Isles **1916**: 637. 1917.
Gomozia granadensis Mutis ex Linn. f. Suppl. 129. 1781.
Nertera depressa Banks & Solander ex Gaertn. Fruct. **1**: 124. *pl. 26.* 1788.
Nerteria depressa Smith, Ic. Ined. **2**: 28. *t. 28.* 1790.
Nertera depressa var. *papuana* Valeton, Bot. Jahrb. **61**: 156. 1927.

Netherlands New Guinea: 5 miles northeast of Wilhelmina-top, *Brass 9398*, alt. 3440 m., mossy banks of grassland stream; Lake Habbema, *Brass 9476*, alt. 3225 m., on mossy tree in edge of forest; 9 km. northeast of Lake Habbema, *Brass 10548, 10623*, alt. 2800 m., prostrate and creeping in stony bed of stream in forest, also creeping on log in native rest clearing; 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12392*, alt. 1500 m., creeping in moss on wet rocks of waterfall; Angi, Arfak Mountains, *Kanehira & Hatusima*, without field number, alt. 1900 m., April 1940, in mossy forest along the track from Momi to Lake Gita. British New Guinea: Mount Tafa, *Brass 5020*, alt. 2400 m., common in open places on roadside banks. Fruit fleshy, red.

There is a good deal of variation in the leaf-outline of the collections included under this species. In view of the variations already admitted in the specific concept, it is questionable whether var. *papuana* is sufficiently distinct to maintain or not. The genus needs a monographer's careful study. This record is made to call attention to the earlier but less commonly used specific name. Sir James Smith's description was based on the specimen and manuscript of Mutis.

Nertera nigricarpa Hayata, Jour. Coll. Sci. Tokyo 25(Art. 19): 115. 1908, Icon. Plant. Formos. **7**: 32. *pl. 6.* 1918.

Netherlands New Guinea: 5 miles northeast of Wilhelmina-top, *Brass 9397*, Aug.

1938, alt. 3440 m., mossy banks of grassland stream (fruit black, laterally compressed); 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10382,* Sept. 1938, alt. 3700 m., under shrub in wet rocky place (fruit black, glossy).

The New Guinean material is slightly smaller than that described from Formosa and the leaves are a little shorter-petiolate, but we believe that the collections belong in this species. All previous records have been from Mount Morrison, Formosa. This is the second genus which we have found common to these two regions, the other being *Stellaria* (*S. saxatilis* Buch.-Ham.), cf. Jour. Arnold Arb. **23**: 386. 1942.

Borreria G. F. W. Meyer

Borreria Baileyana (Domin) comb. nov.

Spermacoce Baileyana Domin, Bibl. Bot. 22(Heft 89^{vii}): 1182(628). 1929.

Spermacoce pogostoma Benth. var. *hispida* F. M. Bail. Bot. Bull. **4**: 11. 1891 (Dept. Agric. Bull. no. 13).

BRITISH NEW GUINEA: Dagwa, Oriomo River, *Brass 5934,* Feb. 16, 1934, alt. 40 m., common on open grassy ridges (slender erect herb with pale purple flowers); Daru Island, *Brass 6388,* abundant grass associate in savanna forests (flowers white).

Although we have no material for comparison, these collections seem to agree reasonably well with the description of the collections from the Cape York Peninsula, Queensland, and such a range could very well be expected.

Borreria papuana (F. v. Muell.) comb. nov.

Spermacoce papuana F. v. Muell. Descr. Notes Papuan Pl. **1**: 27. 1876.

BRITISH NEW GUINEA: Lake Daviumbu, Middle Fly River, *Brass 7540, 7817,* Aug. 1936, plentiful on savannas (flowers white); Tarara, Wassi Kussa River, *Brass 8572,* Dec. 1936, savanna forest, rare (flowers blue).

Valeton, Nova Guin. **8**: 516. 1911, mentioned that this species belonged to *Borreria* but did not actually make the combination. The type of the species was collected on the Mai Kussa or Baxter River, so that the last cited collection might almost be considered a topotype. It is a rather distinct species with very long seta-like calyx-lobes and long corolla.

Borreria laevis (Lam.) Griseb. Fl. Brit. West Ind. 349. 1861; Merr. Philip. Jour. Sci. **60**: 34. 1936.

Spermacoce laevis Lam. Tabl. Encycl. **1**: 273. 1791.

NORTHEAST NEW GUINEA: Marienberg, Sepik River, *Herre 238,* May 1929, river-bank. NEW BRITAIN: Kokopo, *Herre 173,* April 1929, cultivated land near seashore.

A cosmopolitan weed apparently spreading rapidly. In addition to the range cited by Merrill, records have been listed from Fanning Island and Niue Island.

Borreria linearis sp. nov.

Planta prostrata; caulibus repentibus, basi suffrutescentibus, ramosis, tetragonis, internodiis 1–2 cm. longis; ramis erectis, internodiis 4–15 mm. longis, sub nodis interdum scabridulis; foliis sessilibus coriaceis lineari-lanceolatis, 5–10 mm. longis, 2 mm. latis, acutis, basi angustatis, margine revolutis, versus apicem consperse scabridulis, nervo medio supra impresso, subtus prominente; stipulis membranaceis puberulis, vaginantibus, margine interfoliaceo sursum arcuato, laciniis setosis 2–4 mm. longis, circiter 4–6 et interdum brevioribus interjectis instructo; floribus glomerulatis, axillaribus et terminalibus; floribus et setoso-bracteis intermixtis; ovario obconico, 1 mm. longo, calycis lobis 4 linearibus, basi puberulis; corolla infundibuliformi, 2 mm. longa, tubo glabro, lobis obtusis, brevibus, 0.5 mm. longis, staminibus in apice tubi insertis; stylo glabro; stigmate bidentato; fructibus 1.5 mm. longis, leviter latioribus; calycis lobis persistentibus coronatis; seminibus 1 mm. longis, oblongis, brunnescentibus, minute punctulatis.

British New Guinea: East Mount Tafa, *Brass 4067* (type), May 1933, alt. 2350 m., common on a small burnt-over clearing in mossy forest (small prostrate plant with white flowers). Northeast New Guinea: On the ridges of Finisterre Mountain, *Schlechter 18224,* Sept. 1908, alt. 1200 m.

This species has been taken for *Borreria brachystema* (R. Br.) Val., but the latter has the stamens "on very short filaments at the base of the tube," whereas in *B. linearis* the stamens are inserted at the orifice of the corolla-tube and alternate with its lobes. There is very little pubescence on the plant, the stipular sheath being usually covered with minute hairs and often the region just below the node, but if this is glabrous usually the elevated lines which run down the angles of the stem are pubescent in the vicinity of the nodes. The upper part of the fruit is often sparsely pubescent as well as the lower part of the calyx. Although cystoliths are not visible in the dried plant, when a small part has been thoroughly soaked in water the lower surface of the leaves and sometimes the flowers show the presence of cystoliths; they are also present on the inner face of the seed.

Borreria lanceolata sp. nov.

Planta erecta, basi suffrutescens; caulibus ramosis, tetragonis, internodiis 1–2.5 cm. longis glabris; foliis subsessilibus subcoriaceis, lanceolatis 7–15 mm. longis, 2–3 mm. latis, apice acutis, basi rotundatis, margine revolutis, utrinque glabris, nervo medio supra impresso, subtus prominente fere carinato; nervis lateralibus utrinsecus 3 vel 4, supra obscuris, subtus inconspicuis; stipulis membranaceis puberulis, vaginantibus, margine interfoliaceo sursum arcuato, laciniis setosis 2–3 mm. longis, circiter 6 instructo; floribus glomerulatis, axillaribus et terminalibus, floribus et setoso-bracteis intermixtis; ovario obconico pubescente, 1 mm. longo; calycis lobis 4 lineari-lanceolatis ciliolatis, versus basim pubescentibus; corolla infundibuliformi, tubo extus puberulo, intus glabro, lobis obtusis circiter 0.8 mm. longis intus puberulis; staminibus in apice tubi insertis; stylo glabro; stigmate bidentato; fructibus 1.5 mm. longis, calycis lobis persistentibus coronatis (incl. calyce 3 mm. longis); seminibus 1 mm. longis, oblongis, brunnescentibus, minute punctulatis.

Netherlands New Guinea: Balim River, *Brass 11644, 11737* (type), Dec. 1938, alt. 1600 m., deforested slopes, stony grassland (flowers white).

Borreria lanceolata is closely related to *B. linearis;* it differs in its erect habit, lanceolate leaves, and slightly larger flowers with corolla-lobes definitely pubescent on the upper surface. The laciniae of the stipules do not appear to be quite so long as in the related species, and there is no sign of pubescence on the leaves; whether these differences are brought about by differences in altitude would be difficult to determine without further collections.

Mitracarpus Zuccarini[1]

Mitracarpus hirtus DC. Prodr. 4: 572. 1830?

Mitracarpus villosus (Sw.) DC. Prodr. 4: 572. 1830 (as *Mitracarpum villosum*); Fawcett & Rendle, Fl. Jamaica 5: 127. *fig. 39.* 1936.

BRITISH NEW GUINEA: Laloki River, Rona, *Brass 3559,* March 1933, alt. 450 m., common grassland herb; Kanosia, *Carr 11043,* open places, sea-level.

This is the plant currently passing as *Mitracarpus hirtus* (L.) DC. in the herbarium and in literature, although de Candolle does not make any reference to Linnaeus' species. Both *M. hirtus* and *M. villosus* (as *Mitracarpum hirtum* and *M. villosum*) were based on Swartz's species, and both were from Jamaica, in the West Indies. It is a little puzzling to try to understand why Fawcett and Rendle entirely ignored the disposition of *M. hirtus* in accepting *M. villosus,* in view of the fact that both were described from Jamaica and the former occupies fully as much space in literature as the latter, if not more.

EXPLANATION OF PLATE I

FIG. A. *Myrmecodia Brassii* Merr. & Perry (*Brass 9446*), epiphytic on *Podocarpus compacta* Wasscher; showing the two types of spines on the tuberous base. FIGS. B, C. *M. Brassii,* epiphytic on *Libocedrus.* FIG. D. *M. salomonensis* Becc. (*Brass 2585*), detached from host tree, but showing pendent habit. FIG. E. *M. Lamii* Merr. & Perry (*Brass 9445*), growing terrestrially on bare sandstone.

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[1] For the benefit of other workers who may be as curious as ourselves to learn why the generic name first appears in botanical publications as *Mitracarpum* Zucc., and later as *Mitracarpus* Zucc., we append the following reference: A Gray, Synopt. Fl. North America 1(2): 32. 1884.

Plantae Papuanae Archboldianae, XV

THE COMPARATIVE MORPHOLOGY OF THE WINTERACEAE VII. SUMMARY AND CONCLUSIONS

I. W. Bailey and Charlotte G. Nast

INTRODUCTION

In preceding numbers of this series (1–5, 10), we have described the floral and vegetative morphology of the Winteraceae. The data presented in these papers, together with Smith's (12, 13, 14) taxonomic treatments, provide the basis for a critical evaluation of available evidence regarding the composition, relationships, and phylogenetic significance of the family.

As now constituted, the family is composed of six genera: (1) *Drimys* J. R. & G. Forst., with 40 species in America (Mexico to Cape Horn and Juan Fernandez), Tasmania, Australia, New Guinea, Amboina, Celebes, Borneo, and the Philippines, (2) *Bubbia* v. Tiegh., with 30 species in New Guinea, Queensland, New Caledonia, and Lord Howe Island, (3) *Belliolum* v. Tiegh., with 8 species in New Caledonia and the Solomon Islands, (4) *Pseudowintera* Dandy, with 2 species in New Zealand, (5) *Exospermum* v. Tiegh., with 2 New Caledonian species, and (6) *Zygogynum* Baill., with 6 species in New Caledonia. The number of species in each genus, as outlined above, will doubtless be subject to future revision, since it is probable that the family will gain new members, especially in the genera *Drimys* and *Bubbia*, as the exploration of New Guinea progresses. The family now contains about 88 species, and one may anticipate that this number will eventually be increased to well over 100. The Winteraceae, therefore, instead of being the small group which only recently was dismissed as an inconsequential appendage of the Magnoliaceae, are seen to be a family of considerable consequence both in size and in geographic extent.

MORPHOLOGICAL CHARACTERISTICS

The Winteraceae are characterized as a family by their distinctive pollen, vesselless xylem, and curiously occluded stomata, and by combinations of cauline, floral, and foliar characters that are not duplicated in other dicotyledonous families.

Xylem. The xylem of the Winteraceae is of a structurally unique type among extant representatives of the angiosperms, the woods even of the similarly vesselless *Trochodendron* and *Tetracentron* having significant differences in their rays, wood parenchyma, and other structural features. Although the xylem of the Winteraceae is distinctive, it exhibits certain trends of structural specialization within the family, leading for example toward reduction or elimination of wood parenchyma in Sect. *Wintera* of *Drimys*, toward excessively widened multiseriate rays in *Pseudowintera*, and toward reduction of cell size, particularly in dwarfed or microphyllous species, in Sect. *Tasmannia* of *Drimys*.

LEAF. The lower epidermis of winteraceous leaves is characterized by having a more or less extensive alveolar modification of the cuticle which differs from the waxy layers of other angiospermic leaves, in its higher melting point and insolubility in boiling alcohol, hot ether, and other non-polar solvents. The alveolar material forms more or less massive deposits in the oval or circular depressions in which the stomata are situated, covering the guard cells and occluding the orifice. Although "plugged" stomata have been reported, Wulff (17), in various monocotyledons and dicotyledons, the particular morphological and chemical expressions of the phenomenon in the Winteraceae appear to be distinctive of the family.

The mode of insertion of the foliar vascular tissue in the eustele is stereotyped and stable throughout the Winteraceae, being prevailingly of the so-called trilacunar type. On the contrary, the patterns of vascularization within the petiole and lamina are diverse and variable within certain specific limits. Two trends of specialization are discernible in *Drimys,* leading (1) toward division of three foliar strands to form more or less numerous derivative bundles, and (2) toward fusion of foliar strands to form a single arc-shaped vascular bundle. The former trend of specialization is intensified in *Belliolum* and *Bubbia* and attains its climax in *Exospermum* and *Zygogynum.*

INFLORESCENCE. The inflorescences of the Winteraceae exhibit a wide range of morphological variability. In *Drimys* they are clearly axillary or intercalary on monopodially elongating axes, whereas in *Bubbia, Belliolum, Exospermum,* and *Zygogynum* they are terminal or "pseudoterminal" on sympodially elongating shoots. In *Pseudowintera* the inflorescences are apparently terminal or "pseudoterminal" on sympodial axillary short shoots of a monopodially elongating vegetative axis. The individual inflorescences of different representatives of the family exhibit numerous transitions between complexly branched, many-flowered, cyme-like types and single-flowered ones that may be either axillary (*Drimys*) or terminal (*Zygogynum*). These numerous transitional types of inflorescences are suggestive of phylogenetic series either of reduction or amplification.

According to Parkin (11), the pseudoterminal inflorescences of such genera as *Bubbia* and *Belliolum* developed from an intercalary type by the abortion of the terminal bud. In other words, a group of axillary inflorescences is congested at the apex of the stem, and the structure as a whole appears to be terminal because the apical bud is suppressed or absent. It should be emphasized in this connection, however, that if the pseudoterminal inflorescences of *Bubbia, Belliolum, Exospermum,* and *Zygogynum* are derived from intercalary ones as of *Drimys,* the terminal single flowers of certain species of *Zygogynum* must represent the end of a reduction series. There is much in the comparative morphology of the Winteraceae as a whole to justify such a conclusion.

PERIANTH. The flowers of the Winteraceae are characterized by having a combination of gamosepaly and polypetaly, together with a strong tendency toward reduction in the number of constituent parts both of the calyx and corolla. Variations in the number, size, form, and texture of the petals are of specific rather than generic significance. On the contrary, the calyptrate calyx of *Drimys* serves to differentiate this genus from the other genera of the family, which have rotate or variously lobed calyces that do not enclose the buds.

STAMENS. The microsporophylls of the Winteraceae are of three distinct morphological types. Four of the genera, *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum,* have short, comparatively broad, more or less truncated or apically flaring microsporophylls. The more or less protuberant sporangia are attached to the broad apex of these sporophylls and are oriented either transversely or in various diagonal positions. *Belliolum* is characterized generically by having apically tapered microsporophylls and particularly by having laterally attached sporangia oriented parallel to the long axis of the sporophyll. In these five genera, the sporophylls are not differentiated into filament, anther, and connective, and the sporangia are not excessively protuberant. The microsporophylls of *Drimys* fluctuate considerably in length and breadth, not only in different species, but also within the same flower. They are characterized, however, by having markedly protuberant thecae that are attached to the much constricted upper part of the sporophyll. The microsporophylls of Sect. *Wintera* are relatively broad, but those of Sect. *Tasmannia* are at times much elongated and narrow. The latter are more typically stamineal, exhibiting differentiation into filament, connective, and anther. Our comparative investigations of microsporophylls in other ranalian families suggest that there are two trends of morphological specialization in the Winteraceae, leading in *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum* to the formation of broadly truncated sporophylls bearing transversely oriented apical sporangia, and in *Drimys* to apically constricted sporophylls bearing markedly protuberant, laterally attached, subapical sporangia.

POLLEN. Throughout the family the pollen is associated at anthesis in permanent tetrahedral tetrads, each pollen grain having a distally oriented germ pore and a characteristically reticulate exine, the reticulations being composed of more or less extensively coalesced rods. The tetrads are unlike those of the Lactoridaceae and of certain representatives of the Annonaceae, Monimiaceae, and Nymphaeaceae, and are morphologically unique among families of ranalian affinities. Two obvious trends of specialization in pollen morphology are discernible, however, within the Winteraceae, leading to the formation of (1) a minutely, rather than a coarsely, reticulate exine in *Exospermum* and *Zygogynum,* and (2) in Sect. *Wintera* of *Drimys,* tetrads having four conspicuously protuberant papillae when dried pollen is re-expanded in water or lactic acid.

CARPELS. The salient trends of carpellary specialization within the Winteraceae are distinct and obvious. The carpels of Sect. *Tasmannia* of *Drimys* are conduplicate megasporophylls having a stipe and an adaxially folded lamina, with a deep slit-like opening that extends inward to the longitudinally oriented locule. The free margins and adjacent surfaces of the open conduplicate megasporophyll are provided with glandular hairs. In other words, the carpels have conspicuous stigmatic crests (actually double) which extend from the region of the stipe along the conduplicate adaxial parts of the sporophyll and slightly overtop its apex. When spread open, the lamina exhibits a palmately 3-veined vascularization, and the more or less numerous anatropous ovules are attached in longitudinally oriented series between the dorsal and ventral veins. The ovules are vascularized in part by short branches of the two ventral veins, in part by branches of the dorsal vein, and in part by strands originating near anastomoses of the ventral and dorsal vascular systems, the proportions of the three types of vascularization fluctuating from carpel to carpel. Thus, the ovules are attached not to the margins, but to the adaxial surface of the lamina of the megasporophyll.

The carpels throughout Sect. *Wintera* of *Drimys* have a fundamentally similar conduplicate form, vascularization, and placentation, but the external stigmatic crests are restricted to the adaxially projecting subapical part of the megasporophylls. The approximated ventral surfaces of the conduplicate carpels are firmly concrescent except at the level of the stigmatic crests, and therefore the megasporophylls cannot be unfolded as in the case of the less modified sporophylls of Sect. *Tasmannia*. In other words, with the closure of the cleft-like opening, the conduplicate carpels retract and eventually eliminate the stigmatic crests from the sealed parts of the megasporophyll. Thus, the subapical projection of the Sect. *Wintera* type carpel is not to be interpreted as a style-like outgrowth, but rather as a persistent remnant of the extensive adaxial stigmatic crests of open megasporophylls of the Sect. *Tasmannia* type.

Various transitional stages in the closure of conduplicate megasporophylls and in the restriction of their stigmatic crests occur in *Bubbia*, but in this genus, as in *Belliolum, Pseudowintera, Exospermum,* and *Zygogynum,* there is in addition a more or less pronounced abaxially directed deformation of the conduplicate megasporophylls. These trends of specialization commonly lead to the formation of carpels having conspicuously broadened and flattened apices with restricted, more or less transversely oriented, and therefore apparently terminal stigmatic crests. In such carpels there are concomitant modifications in the form and orientation of the locule, in the placental surfaces, and in the vascularization of the deformed conduplicate megasporophylls. Owing to these concomitant deformations from longitudinal to curved or transverse orientations, it is evident that the apparently terminal parts of the carpels actually are homologues of the ventral parts of primitive conduplicate megasporophylls of the Sect. *Tasmannia* type. The true apex of the carpel is curved around into a dorsal position. In the case of the syncarpous species of *Zygogynum*, the abbreviated stigmatic crests and the placentation appear to be dorsal. This is due, however, to the fact that a morphologically ventral part of the concrescent sporophylls has been deflected into an abaxial orientation and thus overtops the shortened morphologically dorsal part of the carpel.

Vascularization of bracts, bracteoles, and floral appendages. As previously stated, the vascularization of leaves in the Winteraceae is diversified and variable except in their trilacunar nodal attachments, which are stereotyped and stable throughout the family. In the case of fertile axes, even the vascular attachments of the appendages exhibit more or less extensive ranges of variability. Bracts and bracteoles may have three traces or the vascular strands may be reduced to one. Similarly sepals and petals may have three traces or the traces may be reduced to one or amplified to more than three. Each stamen has a single trace, but its mode of attachment to the toral vascular system is diversified and variable. The carpels may have a concentric or crescent-shaped trace, such as not infrequently occurs in petioles, or three traces, or the traces may be reduced to two or amplified to more than three. Accompanying this diversification of trace number and trace insertion is the occurrence in the flower of an irregular, variable, and complex eustele, which is due to an anastomosing and branching of bundles and the non-association of certain interfascicular regions with traces. The ranges of structural variability within species or genera may or may not overlap. Much additional material must be analyzed, however, before patterns of vascularization, either of the leaf or flower, can be utilized as a basis for sound taxonomic generalizations within the Winteraceae.

COMPOSITION OF THE WINTERACEAE

Various extraneous genera have in the past been assigned to the Winteraceae. All of these with the exception of *Illicium* have subsequently been transferred to more appropriate families. That *Illicium* should be segregated from *Drimys* and its allies and placed in an independent family has been suggested by van Tieghem (15), Diels (8), and McLaughlin (9). There is ample justification for such a procedure. The genus exhibits none of the distinctive characteristics of the Winteraceae and there are no significant similarities in any part of the plant that may be interpreted as indicative of close relationship to *Drimys* and its allies. The pollen is of a fundamentally different structural form, being typically tricolpate. Not only are there numerous vessels in the secondary xylem, but also the multiseriate rays are of a highly modified and much reduced type. The primary vascular cylinder of the stem is of a continuous pseudo-siphonostelic rather than a discontinuous eustelic type. The nodal anatomy and vascularization of the leaf are of a fundamentally different form, being unilacunar instead of characteristically trilacunar. The stomata are not occluded as in the Winteraceae and are of a distinctive morphological type, as are the structural patterns of the cuticle. The vascularization patterns of the torus and floral appendages are unlike those encountered in *Drimys* and its allies. Furthermore, the specializations of the conduplicate megasporophylls have progressed along fundamentally dissimilar lines, leading (1) to constriction of the apical part of the sporophyll and the formation of a style with "decurrent" stigmatic crests, and (2) to reduction of the ovules to one and its localization in the closed, more or less extensively adnate, basal part of the conduplicate carpel. The calyx is polysepalous, never rotate or calyptrate, and the stamens are of different morphological form. The chromosomes, as Whitaker (16) has shown, differ in size, form, and basic number from those of the Winteraceae. Although *Illicium* is not closely related to *Drimys* and its allies, it exhibits a number of significant similarities to the Schisandraceae. Whether the genus should be included in this family or segregated in an independent family, Illiciaceae, as suggested by van Tieghem (15) and Diels (8), is a problem which will be discussed in detail in a subsequent paper.

With the exclusion of *Illicium,* the Winteraceae become a homogeneous, natural aggregation of obviously closely related plants. The extant representatives of the family exhibit varying combinations of relatively primitive and highly specialized morphological characters, and the surviving genera in all probability represent end products derived from a common ancestry. There are two distinct categories of these genera: (1) *Drimys,* having intercalary inflorescences, calyptrate calyces, normally developed conduplicate carpels, and more stamineal appearing microsporophylls, and (2) *Bubbia, Belliolum, Pseudowintera, Exospermum,* and *Zygogynum,* having terminal or "pseudoterminal" inflorescences, rotate or lobed calyces which do not enclose the buds, carpels which exhibit more or less pronounced abaxial deformation, and microsporophylls that are not typically differentiated into filament, anther, and connective. Within the second category of Winteraceae, *Pseudowintera* is characterized by having terminal or "pseudoterminal" inflorescences on sympodial short shoots and by its much modified and excessively widened multiseriate rays, *Zygogynum* by its strongly developed syncarpy, and *Belliolum* by its apically tapered stamens, which bear laterally attached, longitudinally oriented sporangia, instead of transversely or diagonally oriented ones on a broad apex, as is the case in the other four genera of this category of the Winteraceae. The carpels of *Exospermum* are closely appressed and coherent at anthesis, as in certain species of *Bubbia,* but they are not actually concrescent or syncarpous as in *Zygogynum.* The diffused placentation, highly specialized foliar vascularization, and pollen, which is of the *Zygogynum* type, present serious obstacles to the inclusion of *Exospermum* in *Bubbia* as at present constituted. It should be noted, however, that available collections of *Bubbia, Belliolum, Exospermum,* and *Zygogynum* are so inadequate and the possibilities of additional representatives in unexplored regions so strong that these generic outlines may need future revision.

The Winteraceae are hermaphroditic with perfect flowers except in Sect. *Tasmannia* of *Drimys,* where the plants are dioecious or polygamo-dioecious, the staminate flowers usually bearing sterile carpels and the pistillate flowers being with or without functional stamens. The fertile carpels of Sect. *Tasmannia* (as of certain species of *Bubbia*) are, however, of a more primitive type than the obviously much modified conduplicate megasporophylls of Sect. *Wintera* of *Drimys.* The two sections of *Drimys* also exhibit more or less significant differences in their pollen, foliar sclerenchyma, and secondary xylem.

It is evident that Sect. *Wintera* of *Drimys* cannot have developed directly from Sect. *Tasmannia* or vice versa. In other words, both sections of *Drimys* must have been derived from much less specialized and now extinct ancestral groups. *Bubbia, Belliolum, Pseudowintera, Exospermum,* and *Zygogynum* are obviously more closely related one to another than any one of them is to *Drimys.* Although *Belliolum, Pseudowintera, Exospermum,* and *Zygogynum* may have developed from *Bubbia*-like ancestors, the five genera cannot be derived directly from *Drimys* or vice versa; they must have diverged from earlier and more primitive Winteraceae, from which the two sections of *Drimys* likewise were independently differentiated.

RELATIONSHIPS

In the past, *Drimys* and its presumed allies, including *Illicium,* have frequently been placed in the Magnoliaceae in a special tribe (Illicieae DC., Wintereae R. Br.) or subfamily (Drimyoideae Harms, Drimydoideae Skottsb.). However, to include such morphologically dissimilar elements as the Winteraceae, *Illicium,* the Schisandraceae, and *Tetracentron* in the Magnoliaceae broadens the concept of this family even beyond the limits of a natural sub-order. The evolutionary gap between the vesselless xylem of the Winteraceae and the relatively highly specialized vessel-bearing wood of *Magnolia, Liriodendron,* and allied genera is so great as to preclude any close degree of relationship between the two groups of plants. In addition, there are fundamentally significant morphological differences in the pollen, stamens, carpels, perianth, secondary phloem, nodal anatomy, vascularization of the leaf, stomata, patterns of vascularization of the torus and floral appendages, etc. Furthermore, the reported similarity (Whitaker, 16) in the basic chromosome number, i.e. 19,[1] is not indicative necessarily of close relationship, since the same basic number occurs in such diverse ranalian plants as *Trochodendron, Tetracentron,* and *Cercidiphyllum.*

As we have previously shown (6, 7), the Degeneriaceae, Himantandraceae, and Magnoliaceae (sensu stricto) form a compact natural group within the Ranales, the three families being more closely related to each other, on the basis of important morphological characters, than any one of them is to other families. The Winteraceae exhibit no significant evidence of close relationship to this group of families, even the salient trends of carpellary specialization being entirely different. The similarity between the carpels of *Degeneria* and of Sect. *Tasmannia* of *Drimys* is apparently due to the retention of primitive ranalian megasporophylls by plants which exhibit fundamentally different trends of morphological specialization in their flowers, stems, and leaves. Similarly, the vesselless xylems of the Winteraceae, *Trochodendron,* and *Tetracentron* should be interpreted as retentions of primitive vesselless types of ranalian wood by plants which show diverse trends of specialization in their other vegetative characters

[1] The chromosomes of only one of the 88 species of Winteraceae have been studied. In "*Drimys Winteri*" the 2n number is ± 76, but this hardly provides a basis for generalization concerning the family as a whole.

and in their reproductive organs. Too much emphasis has been placed in the past upon the mere fact that these plants are vesselless, without due regard to significant structural differences in their xylem. This will be discussed in greater detail in subsequent papers dealing with *Trochodendron* and *Tetracentron*.

Thus, although the Winteraceae obviously are of general ranalian affinities, as evidenced by their secretory cells and other characters, they do not appear to be closely related to any specific surviving family of the ranalian complex.

PHYLOGENETIC SIGNIFICANCE

In the recently described (7) monotypic ranalian family Degeneriaceae, both the stamens and the open carpel appear to be primitive, palmately 3-veined sporophylls of but slightly modified form. The lamina of the megasporophyll is adaxially folded or conduplicate and bears numerous ovules on its morphological upper surface, between its dorsal and ventral veins. In other words, the ovules are not attached to the margins of a classical involute, sealed sporophyll, but to the ventral surface of the megasporophyll as in certain of the Cycadofilicales. The microsporophylls, as in the related Himantandraceae (6), resemble the sterile sporophylls ("staminodia") and are not differentiated into filament, anther, and connective. The two pairs of slender, vertically elongated sporangia are immersed beneath the abaxial surface of the sporophylls and are situated between the median and lateral veins.

The Winteraceae are particularly significant in the study of the comparative morphology and phylogeny of the dicotyledons, not only owing to their retention of a primitive vesselless xylem, but also owing to their retention of extensive transitional series of carpellary structures illustrating successive stages in the closure and morphological modification of primitive, open, conduplicate megasporophylls of the *Degeneria* type. In addition, there are within the family successive steps in the development of more typical stamineal structures which arise apparently by the reduction of broad microsporophylls to slender filament and connective and by concomitant emergence or protuberance of the microsporangia, i. e. thecae. Furthermore, the family exhibits numerous transitions between complex intercalary or "pseudoterminal" inflorescences and simple, single-flowered ones. Since the single terminal flowers of *Zygogynum* appear to be the culmination of a reduction series, it is a question whether the single, large terminal flowers of *Magnolia* may not have originated through similar reductions of a complex ranalian inflorescence. In any case, it is unfortunate that so much attention has been focused upon the Magnoliaceae (sensu stricto) in discussions concerning the origin of the angiosperms, for the seedlings, stems, roots, leaves, stamens, and carpels of these plants all exhibit a relatively high degree of morphological specialization. More primitive and significant ranalian structures are retained by such families as the Winteraceae, Degeneriaceae, Himantandraceae, Trochodendraceae, etc. It should be emphasized in this connection, however, that each of these families exhibits a combination of primitive and more or less specialized characters, indicative of reticulate rather than linear relationships and of common origin from an ancestral ranalian stock. Until essential fossilized material is discovered, the composite structure of such ancestors can be synthesized only by combining the more primitive features of a number of diverse families.

There is no known species or genus of the Winteraceae, either extant or fossil, from which the rest of the family may have been evolved. Each known surviving member of the family exhibits one or more trends of morphological specialization which exclude any possibility of the plant being ancestral to all of the others. The Winteraceae are obviously an extremely ancient group of dicotyledons, the surviving representatives of which are end products derived from a common ancestry. Many structural features of this hypothetical ancestry can be synthesized from extant species and genera with a high degree of certainty, whereas others must remain for the present more or less speculative or problematical. The following is our concept of such an ancestral winteraceous stock and of its salient trends of morphological specialization:

Habit. Trees or large shrubs. Salient specialization: dwarfing of the entire plant or of its leaves, particularly in certain species of Sect. *Tasmannia* of *Drimys.*

Xylem. Vesselless, with diffuse parenchyma and primitive heterogeneous type I rays. Tracheids large, extremely elongated and provided with a relatively high ratio of scalariform and multiseriate-bordered pitting. Salient trends of specialization: (1) reduction or elimination of wood parenchyma in Sect. *Wintera* of *Drimys,* (2) excessive broadening of multiseriate rays in *Pseudowintera,* and (3) reduction in tracheary size and pitting, particularly in dwarfed and microphyllous species of Sect. *Tasmannia* of *Drimys.*

Leaf. Simple, entire, glabrous, exstipulate, pinnately veined, having numerous ethereal oil cells, characteristically occluded stomata, and three separate traces with trilacunar nodal attachments. Most significant trend of specialization: increasing complexity of vascularization patterns in *Bubbia* and *Belliolum,* culminating in *Exospermum* and *Zygogynum.*

Inflorescence. Plants hermaphroditic, with perfect flowers. Inflorescences probably complex and intercalary, as in Sect. *Wintera* of *Drimys.* Chief trends of specialization: (1) establishment of dioecious or polygamodioecious habit in Sect. *Tasmannia* of *Drimys,* (2) transitions from intercalary to "pseudoterminal" and terminal inflorescences, and (3) reduction of complex inflorescences to simple single-flowered ones.

Calyx. Gamosepalous, with a variable number of lobes. Salient trends of specialization: (1) reduction in the number of partly concrescent sepals to two, as common in *Drimys* and *Pseudowintera,* (2) elimination of the lobes to form entire or rotate calyces, and (3) complete concrescence of sepals to form a calyptrate calyx, as in both sections of *Drimys.*

COROLLA. Polypetalous, with an indefinite number of free petals. Chief trend of specialization: reduction in the number of petals, frequently to two (rarely to one or none) in Sect. *Tasmannia* of *Drimys*.

STAMENS. Numerous, sporophyll-like, and not differentiated into filament, anther, and connective, the sporangia partly embedded in the lamina of the microsporophyll. The exact form of the ancestral microsporophyll is uncertain. If the stamens of *Belliolum haplopus* (Burtt) A. C. Sm. and *B. Pancheri* (Baill.) v. Tiegh. are the least modified of surviving Winteraceae, as seems possible from comparative studies of other ranalian families, then there are two distinct trends of specialization in winteraceous microsporophylls, leading (1) in *Bubbia, Pseudowintera, Exospermum,* and *Zygogynum* to the formation of broadly truncated sporophylls bearing transversely oriented apical sporangia, and (2) in *Drimys* to more typically stamineal structures exhibiting various incipient stages of differentiation into filament, anther, and connective.

POLLEN. In tetrahedral tetrads, each grain having a distally oriented germ pore and a coarsely reticulate exine. Most significant trend of specialization: the development of a minutely reticulate exine in *Exospermum* and *Zygogynum*.

CARPELS. Sporophyll-like, stipitate, with conduplicate, palmately 3-veined lamina, having two closely approximated stigmatic crests which extend from the region of the stipe to the apex of the adaxially folded lamina, and bearing numerous anatropous ovules in two longitudinally oriented series between the dorsal and ventral veins, the ovules vascularized at least in part by branches of the dorsal vein. Chief trends of specialization: (1) reduction of the number of carpels, (2) closure of the megasporophyll with concomitant restriction of the stigmatic crests, (3) abaxial deformation of the megasporophylls with concomitant modification in the form and orientation of the stigmatic crests, locules, placentation, and vascularization, and (4) development of syncarpy in *Zygogynum*.

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GEOGRAPHICAL DISTRIBUTION OF THE WINTERACEAE

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IN THE preceding article in this Journal, Bailey and Nast (1) have summarized their conclusions concerning the comparative morphology of the Winteraceae and have commented upon the phylogenetic significance of the group. In view of the probable importance of this family in future considerations of primitive dicotyledons, a discussion of the implications of its geographical distribution seems to be desirable. The present paper is therefore complementary to the series of Bailey and Nast (see bibliography of the preceding article) and to the writer's taxonomic discussion of the family (28, 29, 30).

HISTORICAL SKETCH

The first known representative of the group of plants now known as the Winteraceae came to the attention of Europeans more than 350 years ago. In 1578 William Winter, who captained one of the ships on Drake's voyage, was forced by adverse weather to spend some weeks in the Straits of Magellan, and during this period his men learned of the antiscorbutic properties of the bark of a common Magellanic tree. This bark was brought to the attention of medical men and apparently was first described, under the name of "Winteranus cortex," by Dalechamps (7) in 1586. Subsequently the bark and the tree were described by such early students as Clusius (6), Bauhin (2), Parkinson (25), Jonston (20), Sloan (27), and Feuillée (17). At that time the "Winter's bark" was often confused with the bark of the West Indian *Canella alba* Murr., which apparently has somewhat similar properties.

A proper botanical description was given and a post-Linnaean binomial was first proposed for the plant in 1776. In this year J. R. & G. Forster (18) proposed the genus *Drimys,* with two species, the Magellanic *D. Winteri* and the New Zealand *D. axillaris,* both based upon the collections which they made during Cook's second voyage. In the same year Solander (19) published a description of the Magellanic species under the name *Winterana aromatica,* based upon collections by Captain Wallis and by Banks and Solander. The Forsters' name has been generally accepted for the generic and specific concepts as applied to the South American plant, and the binomial *Drimys Winteri* has appeared in innumerable botanical publications, often being accredited with an extensive geographical distribution which it does not possess. Typification of the genus *Drimys* and the use of the Forsters' binomial have already been adequately discussed (29: 10–17; 30: 154).

[1] In a recent bibliography (30: 164), I cited the title of a paper, "La distribution géographique et l'histoire des Winteraceae," which did not reach its destination in Switzerland in 1942, due to stoppage of mails. Some of the material in the unpublished paper is incorporated in the present treatment.

Long after its discovery in the far south, the genus was found at scattered points in South America and as far north as southern Mexico, while in Australia and New Zealand plants were found which were correctly referred to the general alliance of *Drimys Winteri.* For a long period *Drimys* and its relatives were placed in the family Magnoliaceae, but a separate family, the Winteraceae, was proposed by Lindley in 1836 (22). This name was accepted by such students of the group as Miers (24) and Eichler (15), but van Tieghem (31) rejected the name Winteraceae (founded upon *Wintera* Murr., a synonym of *Drimys*) and proposed to call the family the "Drimytacées" (apparently used in the Latin form only by Diels [11], as Drimytaceae). The essential synonymy of the family has already been recorded (30: 120), while Bailey and Nast (1) have discussed its composition and have given cogent reasons for the exclusion of the genus *Illicium*.

The first careful examination of generic lines in the Winteraceae was made by van Tieghem (31), and we are indebted to Dandy (9) for a proper disposition of the New Zealand species. The 88 species of the family now recognized (29, 30) are distributed in six genera, as follows: *Drimys* J. R. & G. Forst., with 40 species (Mexico to Cape Horn, Australia and Tasmania, New Guinea, Amboina, Celebes, Borneo, and the Philippines); *Bubbia* v. Tiegh., with 30 species (New Guinea, Queensland, Lord Howe Island, and New Caledonia); *Belliolum* v. Tiegh., with 8 species (New Caledonia and Solomon Islands); *Pseudowintera* Dandy, with 2 species (New Zealand); *Exospermum* v. Tiegh., with 2 species (New Caledonia); and *Zygogynum* Baill., with 6 species (New Caledonia).

In view of the inadequate exploration of some parts of the range of the family, conclusions as to its distribution must be partially tentative. It is not to be anticipated, however, that the broad outlines of distribution within the family will be greatly modified by future exploration or taxonomic readjustment. In the sense that all taxonomic work is preliminary and subject to future revision, the present discussion is tentative. To delay a presentation of geographical data and to refrain from drawing certain inferences from them, because they will inevitably be modified by future studies, seems undesirable to the writer.

PROBABLE CENTER OF ORIGIN

When the dicotyledons first appear in abundance in the fossil records of the Cretaceous Period, they are fully differentiated into surviving families and often even into surviving genera. The evolution of the principal families of woody dicotyledons long antedates the Middle Cretaceous, and therefore the place of origin and the early migrations of specific families cannot be determined solely upon the basis of present ranges, nor even upon ranges indicated by records from the Tertiary and Upper Cretaceous. The solution of such problems is dependent largely upon essential evidence from much earlier geological horizons.

Nevertheless, it is possible to reach certain preliminary conclusions regarding centers of origin from the evidence supplied by surviving members of a group, especially in cases where the phylogeny can be reconstructed with reasonable exactitude, as in the Winteraceae (Bailey and Nast, 1). That such conclusions are to be taken as established fact is not suggested; they merely provide us with a hypothesis subject to future checking when and if the fossil record becomes more complete. The possibility that a group of plants originated in an area far from its present range must be kept in mind; only the fossil record can indicate whether such an origin is likely for a given group. In the case of the Winteraceae the fossil record, as stated below, is so incomplete and undependable that it throws no light upon the center of origin or routes of migration of the family. Recourse to deductive reasoning, based upon a knowledge of modern members of the group, is necessary if one is to arrive at any conclusions, even tentative ones, regarding the past history of the family.

The chief center of diversification and morphological specialization of the Winteraceae appears to have been in Australasia. That this region was the probable center of origin of the family is indicated by the following facts: all of the six known genera occur there and only one in America; at least 84 species are known in the Old World as contrasted with only four in America; the total variability of the group is infinitely greater in the Old World than in the New; the New World species are comparatively highly evolved, as regards several characters (xylem, calyx, stamens, carpels), in comparison with various Old World groups; on the whole, the Old World species are more stable than those of America, where inter- and intraspecific variability are marked. Furthermore, many of the families of woody Ranales — possibly the majority of these families — among which the relationships of the Winteraceae are to be sought are predominantly Asiatic, some of them exclusively so.

On the strength of this evidence one seems to have ample reason to eliminate America as the probable place of origin of the family. In narrowing down the probabilities offered by the general Australasian region, however, one is upon less secure ground, and the conclusions drawn in the following paragraph are to be taken as highly speculative.

It seems probable that generic differentiation in the Winteraceae was taking place at a period when the Australian continent included or nearly included such regions as New Guinea, New Zealand, New Caledonia, and the Solomon Islands. The fact that four of the six known genera now occur in New Caledonia does not necessarily indicate this region as the center of origin of the family. Two of the genera which occur there, *Exospermum* and *Zygogynum,* exhibit trends of morphological specialization which indicate that they are derivative genera. *Belliolum,* known only from the eastern rim of the Australasian portion of the family, likewise appears comparatively specialized in most of its characters, although its stamens may conceivably be more primitive than those of *Bubbia*. *Pseudowintera* similarly appears to be comparatively highly evolved, with a type of inflorescence and wood ray which indicates long isolation from the *Bubbia*-like group which was probably its ancestor. The two remaining genera, *Bubbia* and *Drimys,* occur in considerable numbers in the high-lands of New Guinea. Both genera likewise occur in Queensland. *Bubbia,* however, is lacking in southeastern Australia and also in the Malayan islands extending toward the Philippines. Since the morphological evidence points to *Drimys* Sect. *Tasmannia* and *Bubbia* as more primitive, on the whole, than the remaining groups of the family, it might be inferred that the region where both these genera occur and where their speciation is most active is the probable place of origin of the family. This evidence points toward the New Guinea-Queensland area; but in suggesting this as the probable place of origin of the family one is indulging in speculation which can be verified only by future researches, especially those pertaining to palaeobotany.

ROUTES OF MIGRATION

The geographical distribution of the Winteraceae shows an interesting pattern (see map, 30: 121), which is by no means unique. A similar bicentric-palaeoantarctic distribution is found in the families Eucryphiaceae, Goodeniaceae, Stylidiaceae, Corsiaceae, and Centrolepidaceae. Some of these have a more extensive range than the Winteraceae and others a more restricted range; however, they are fundamentally similar in having representatives in southern America and also in Australasia (sometimes extending into Malaysia and Polynesia).

The only genus of Winteraceae which occurs in both hemispheres is *Drimys,* but examples of this type of generic distribution among angiosperms will occur to students of the regions under consideration. In order to illustrate, one need mention only the following genera, some of which are more restricted than *Drimys* and others more extended: *Nothofagus* (Fagaceae), *Phrygilanthus* (Loranthaceae), *Lomatia* (Proteaceae), *Colobanthus* (Caryophyllaceae), *Laurelia* (Monimiaceae), *Aristotelia* (Elaeocarpaceae), *Eucryphia* (Eucryphiaceae), *Drapetes* (Thymelaeaceae), *Fuchsia* (Onagraceae), *Pseudopanax* (Araliaceae), *Azorella* (Umbelliferae), *Griselinia* (Cornaceae), *Pernettya* (Ericaceae), *Jovellana* (Scrophulariaceae), *Hebe* (Scrophulariaceae), *Selliera* (Goodeniaceae), *Luzuriaga* (Philesiaceae), *Leptocarpus* (Restionaceae), and *Gaimardia* (Centrolepidaceae).

Contrasting with the illustrations given above, one may mention numerous families which occur in both hemispheres but which apparently have the two parts of their populations connected by a northern, rather than a southern, link. A few of these families are the Magnoliaceae, Schisandraceae, Calycanthaceae, and Nyssaceae, while illustrations of palaeoarctic genera are well known to every student of North American plants (e. g., Fernald, 16). Incidentally, the fact that *Illicium* shows this pattern of distribution rather than the Antarctic pattern may be cited as still another reason to question its presence in the Winteraceae.

In order to account for the type of distribution illustrated by *Drimys* and by numerous other plants and animals, various hypotheses have been formulated and a voluminous botanical and zoological literature has accumulated. In the case of the Winteraceae, a majority of which are montane plants, the seeds are of such a morphological type and so perishable as to rule out any possibility of dispersal by winds, birds, animals, or oceanic currents. Terrestrial continuity is essential for the migration of members of this family. Thus, three possibilities seem to merit serious consideration: (1) Matthew's thesis of northern origins and southward migrations, (2) Wegener's hypothesis of continental drift, and (3) Antarctic land connections.

Palaeobotanical advocates of Matthew's (23) hypothesis of the origin and migration of animals have argued that *Drimys* originated in the Holarctic and subsequently migrated into its present ranges in the Southern Hemisphere. Thus, Berry (3: 165) states regarding the Magnoliaceae: "No family is more obviously of northern origin, none is better represented in the forest floras of Upper Cretaceous times throughout the northern lands, or better exhibits the southward extension so characteristic of many other types as the pressure of plant populations behind them and the availability of suitable land routes to the southward permitted. Drimys, the most primitive in its anatomy, is today found farthest from its original home. Unfortunately, the geological history of this genus is practically unknown but the fact that the species are distinct in each region, i. e., in Australia, New Caledonia, New Zealand and America, indicates that they were very ancient immigrants into those regions before the present geography had come into existence." Later (4: 38), the same author remarks: "Comparison of the geologic record with the recent distribution shows that *Magnolia* and *Liriodendron* radiated from a northern center of dispersal, and it seems most logical to assume that the increasingly southern belts for *Schizandra-Illicium, Talauma,* and *Drimys* represent a further continuation of the same direction of dispersal as *Magnolia* and *Liriodendron.*"

The chief arguments in these quotations are evidently based upon the following premises: (1) *Drimys* is a structurally primitive genus of the Magnoliaceae, (2) it formerly had a Holarctic distribution, and (3) *Magnolia* and its close allies were derived from ancestors having a characteristically northern distribution. Each of these premises is unreliable.

In the first place, *Drimys* and its five allied genera belong in an independent family which at best is only very remotely related to the Magnoliaceae proper and which was not concerned in the evolution of *Magnolia, Liriodendron,* and related genera.

In the second place, there is no evidence to indicate that the Winteraceae ever were widely distributed in the Holarctic. Of the four recorded fossil species of *"Drimys,"* three are from the Southern Hemisphere (Patagonia, Seymour Island, and New South Wales) and one from West Central Oregon. The four species are based upon leaf impressions. The papillate lower epidermis of *D. patagonica* Berry (4) suggests that this plant was winteraceous and allied to the surviving *D. brasiliensis* Miers. The reference of the Australian *D. levifolia* Deane (10) to the genus is entirely provisional, the identification being based on "a fragment of a leaf of thin texture, resembling *Drimys, . . .*"; at any rate, the occurrence of the genus in the Tertiary of New South Wales, if corroborated, throws no light upon its distribution outside the modern range. Unfortunately, in the case of the geographically most significant fossil species, *D. antarctica* Dusén (13) and *D. americana* Chaney and Sanborn (5), no critical evidence is presented regarding their actual affinities. Until the stomata and cuticles or the vascular residues of such fossils are examined by modern palaeobotanical techniques, determinations of Winteraceae based solely upon superficial characters of leaf impressions must be considered unreliable. In other words, there is no conclusive evidence that *Drimys* ever occurred north of its present extensions into Mexico and the Philippines, nor conversely that it was formerly widely distributed in Antarctica. Furthermore, the occurrence of *Drimys* in the Goshen flora of Oregon, if authenticated, does not indicate that the Winteraceae are of northern rather than of southern origin, since it may be interpreted merely as extending the northern limits of the genus (during an admittedly warmer period) from Mexico to Oregon. The absence of Winteraceae in the numerous investigated Cretaceous and Tertiary floras of the Northern Hemisphere is to be anticipated, however, if the family is of extra-Holarctic origin and distribution with only subsidiary extensions north of the equator.

In the third place, although *Magnolia* and *Liriodendron* were abundantly represented in Upper Cretaceous and Tertiary floras of northern latitudes, there is no available evidence to indicate that the Magnoliaceae (sensu stricto) originated in the Holarctic or that such genera as *Talauma, Manglietia, Aromadendron, Elmerrillia,* etc., migrated southward into their present ranges in tropical and subtropical regions. The Magnoliaceae are morphologically relatively highly specialized both vegetatively and florally, and furthermore are a family with quite different morphological limits and generic diversity than supposed by Berry (3: 165) (e. g. Dandy, 8). They evidently are related to, but not directly derived from, the Degeneriaceae (Fiji) and Himantandraceae (Queensland and New Guinea). Nothing is known at present regarding the distribution of ancestral forms from which the three related families were derived.

Although the Wegener hypothesis of continental drift appears to be inacceptible at present to most geophysicists and geologists, at least in America, it continues to have an intriguing appeal to biologists. The ultimate acceptance or rejection of this hypothesis must rest upon geological grounds, but so many biological data have been cited to support it that it seems advisable to inquire into its application to problems of Antarctic distribution, and especially to the specific problem at hand. According to this hypothesis and its subsequent modifications, Pangaea was a single continent, eventually with two lines of rupture in the Mezozoic — between Euro-Africa and America, and between Africa and India. During the Jurassic, Australia broke away from India and Ceylon, and Antarctica from Africa, both retaining their connection with South America. Australia and Antarctica separated in the Tertiary, but Antarctica and South America did not separate until the Quaternary.

According to Du Toit's (14) modification of the Wegener hypothesis, there were two original continents, Gondwanaland and Laurasia, separated by the Tethys Sea. At the beginning of the Cretaceous, Australia was still connected, by way of Madagascar and India, with southern Asia. New Guinea and New Zealand broke away from Australia in the Tertiary; Antarctica separated from South America recently.

As far as the Antarctic distribution of plants is concerned, these two explanations have about the same bearing. Australia is supposed to have lost its connection with the Asiatic continent no later than the early Cretaceous, retaining its connection with America, via Antarctica, until the Tertiary. As a broad explanation of Antarctic distributions, this hypothesis is often quite credible. However, one is led to believe that the Australian flora should be more intimately related to that of America than to that of southeastern Asia. This should also be true of the New Guinean flora, which, according to all modifications of the Wegener hypothesis, should be more closely related to that of Australia than to that of Malaysia.

This, however, is not the case; the New Guinean flora is overwhelmingly Malaysian in its affinities, with fewer Australian elements. It would seem impossible to avoid the conclusion that Australia and southeastern Asia have been linked, via New Guinea and Malaysia, at some time since the differentiation of angiosperm genera. The connection between the floras of Australia and America is less pronounced, on the whole, than that between the floras of Australia and Malaysia.

Although the predominantly Asiatic elements in the New Guinean flora were acknowledged by such an authority on the region as Lam (21), the theory of the permanence of continents in this region was rejected by him in favor of Wegener's hypothesis. According to Lam, the Australian shelf, becoming disjoined from Antarctica and drifting northward, came into contact with the southeastern parts of Asia (the Malaysian arches) and was overrun with tropical species. This ingenious explanation might satisfy the facts if only the widespread lowland groups of plants were concerned. But the numerous groups of plants in common between the mountains of New Guinea and of Malaysia (*Drimys*, as an illustration, occurring in Borneo and the Philippines) cannot be explained as "recent adventives" which have passed from one region to the other in comparatively recent times, since the two areas have again drifted into proximity. On the contrary, many of them (including *Drimys*) are obviously relics, with limited means of dispersal and a high degree of local endemism.

In brief, the Wegener hypothesis, if it could be substantiated geologically, provides the terrestrial continuities necessary for the migration of *Drimys* from Australasia to South America via Antarctica, but it does not afford a valid explanation for the present distribution of *Drimys* and other montane plants of limited migrational ability in the Australasian-Malaysian regions.

The remaining hypothesis pertaining to bicentric-palaeoantarctic distributions assumes that the major land masses of the Southern Hemisphere have been in essentially their present positions for a long period, at least since the differentiation of modern families of flowering plants; to explain the existence of the same genus, or of closely related genera, in the austral parts of both hemispheres, one assumes past land connections through Antarctica. The present environment of Antarctica is obviously unfavorable to the survival of angiosperms and gymnosperms, but the continent does have a known flora of about 75 mosses, six hepatics, and no fewer than 250 lichens (Skottsberg, 26). That at least parts of Antarctica supported a well-developed flora of angiosperms and conifers during the Tertiary and Cretaceous Periods, as well as a diversified fauna, is demonstrated, however, by fossils obtained by the Swedish South Polar Expedition. One need not assume an Antarctic origin for these plants, but merely that they reached Antarctica from one hemisphere or the other by a more or less continuous land route.

The existence of this flora being reasonably certain, it remains to connect Antarctica with America on the one hand and Australasia on the other. Most proponents of the "land-bridge" hypothesis do not imply that continuous unbroken connections were essential for the migrations of plants and land animals. On the contrary, fluctuating and comparatively ephemeral connections, often insular in nature, would provide adequate "bridges" for most migrations. Furthermore, these connections, as far as the woody dicotyledons are concerned, could well be pre-Cretaceous. The ultimate acceptance or rejection of any "land-bridge" hypothesis in a given region and period must rest upon geological evidence, but even when the present geological evidence is negative in nature, the possibility of past land connections is not to be absolutely ruled out. Biological distributional data can provide only suggestions for the solution of this essentially geological problem.

In the case of austral connections, however, the American-Antarctic land connection by means of the Scoatia Arc seems to be beyond doubt, as indicated by geological observations in the South Orkneys and South Georgia, which agree with the folded ranges of the American continent; that this connection between the two continents was Cretaceous or early Tertiary has been substantiated by the discovery of fossil foraminifera. The mountains of Antarctica in many ways suggest the Andes of South America. (For a brief review of the geological evidence of this connection, the reader is referred to Du Rietz [12], where an extensive bibliography will be found.)

There was no such definite land connection between Antarctica and Australasia, but merely because geologists cannot point with certainty to this connection one is not justified in rejecting its probability. On the basis of plant distribution we may best hypothecate two independent and not necessarily simultaneous or complete connections between Antarctica and Australasia, one with New Zealand and one with Tasmania. The distribution of *Drimys,* for instance, points to the Tasmanian connection, for the New Zealand genus of Winteraceae, *Pseudowintera,* has no close relative in America. However, possibly the greater number of bicentric-palaeo-antarctic groups show the New Zealand rather than the Tasmanian affinity. Berry (4: 32–40) lays considerable stress upon the fact that many groups of plants cited in support of the theory of trans-Antarctic migration occur either in Australia or New Zealand, but not in both regions. This fact loses much of its significance if the two regions can be assumed to have had independent connections with Antarctica—an assumption, to be sure, which still awaits geological proof.

It is outside the scope of the present paper to discuss the numerous groups which have been cited as illustrations of trans-Antarctic migrations. Each of these groups needs detailed taxonomic and morphological investigation before even tentative conclusions as to its migratory routes can be reached. It is obvious that much of the discussion pertaining to this problem has been based upon inadequate data. Furthermore, there is no single solution to the problem, and conclusions which appear valid in one group may be entirely inapplicable to the next, even though their present distributions are superficially similar. It is also obvious that geological evidence must supply the ultimate answer to the problem. Nevertheless, the vast amount of accumulating biological evidence that distribution in certain groups took place by trans-Antarctic migrations is rapidly becoming incontrovertible.

SPECIATION

A consideration of the possible modes of speciation within a group is often a desirable complement to a discussion of geographical distribution, since migrations and speciation are frequently concomitant phenomena. It is obvious that in the Winteraceae, as pointed out by Bailey and Nast (1), there is no surviving genus which is "primitive" in all of its characters; on the contrary each genus is characterized by a combination of characters — some primitive and others advanced — in such a way as to indicate that the ancestral form possessed characters no longer found in combination.

The genus *Drimys,* since it occurs in both hemispheres, is of especial interest as illustrating intra-generic differentiation in the family. The American and the Old World representatives fall into two sharply marked sections, which could logically be re-established as independent genera, *Drimys* in America and *Tasmannia* in the Old World. Whether one thus recognizes two genera or two sections of a single genus, as we have done, seems immaterial to the present discussion. It is impossible to say that either of these sections is more primitive than the other. The Section *Tasmannia* appears closer to the hypothetical primitive condition in characters pertaining to its xylem, pollen, and carpels, while the Section *Wintera* seems to be the more primitive in its inflorescence and its hermaphrodite flowers.

It is significant that, of the six Australasian genera, only one, *Drimys,* occurs in America. In a preceding section I have mentioned the extreme improbability of the family having originated in America. If the origin of the family was in Australasian regions, as seems likely, one should perhaps attempt to explain (1) why none of the genera except *Drimys* reached America, and (2) why the American representatives of *Drimys* are more primitive in some features than their Australasian congeners.

Whether the absence of all genera of the family except *Drimys* from America is due merely to chance dissemination of genetic factors in the migrating population or whether selective factors of the environment along the route of migration were operational must remain doubtful. At least the possibility of the operation of selective factors is suggested by the fact that *Drimys*, in its present range in New Guinea and Australia, survives a colder and less hospitable climate than any of the other existing genera. If the migrational route to America was through Antarctica, as hypothecated above, that portion of the family most resistant to the climate of high altitudes and high latitudes would have been most likely to make the successful migration; it cannot be assumed that the climate of Antarctica was ever tropical — more likely it was subtropical or temperate at best.

The fact that the Section *Wintera* combines certain primitive with other comparatively advanced characters is not necessarily a contradiction of an assumption that this is the migrating portion of the genus. It is merely necessary to assume that the separation of the genus into an eastern and a western population took place before such characters were fully stablized. Again, it is impossible to suggest whether the segregation of genetic factors was due entirely to chance or whether certain unsuspected selective factors were involved.

A distribution map of the species and varieties of the Section *Wintera* (29: 9) shows the scattered occurrence of isolated units which is often characteristic of ancient groups. Predominantly montane in habit, *Drimys* approaches sea-level only in the southernmost part of America, whereas toward the north it often occurs near the upper limit of arboreal vegetation. It is significant that the genus occurs in the two oldest mountain masses of South America — the Organ Mountains and the Pacaraima Range — as well as in the Andes. The genus was apparently widespread in South America at a period when the two older mountain ranges had some sort of a highland connection with the Andean region.

The criteria used for specific and varietal delimitation have been discussed in my taxonomic consideration of Sect. *Wintera* (29), where the unsatisfactory nature of some of these criteria was emphasized. The entire American population of *Drimys* is still highly polymorphic, and classification within the genus in this region must be based upon trends rather than upon concrete morphological characters. In the absence of any discernible morphological barriers, it may be suspected that all the members of Sect. *Wintera* will prove to be interfertile. However, this is not the case in nature, the disjunction of the various populations being maintained by poor dispersal capacity and presumably also by the intervention of inhospitable regions. Apparently a fairly high rate of precipitation is essential for the survival of the genus, and a glance at the above-mentioned map (29: 9) will indicate that extensive regions of comparatively dry country separate some of the areas of persistence.

The present-day groups in Sect. *Wintera* were presumably polytopic in origin. The existence of a linking ancestral syngameon cannot definitely be proved, in the absence of fossil evidence, but it may be hypothecated with considerable assurance, in view of the limited dispersal ability of the genus. The causes of the disappearance of the ancestral syngameon may possibly lie in climatic changes pertaining to a narrowing or a shifting of high precipitation areas; this, however, is speculative.

It may be assumed that in the original large polymorphic population the genetic constitution of the various parts was not identical. As a result of geographical isolation of the component parts, the potential variability of these parts was necessarily reduced, and therefore the surviving groups are not genetically identical. There is no obvious indication of the operation of selective factors in the present-day environments of the various local units, and hence it seems likely that chance dissemination of genetic material throughout the original population was primarily responsible for the different morphological trends.

The possibility, at least, that polyploidy is involved in the evolution of taxonomic units in Sect. *Wintera* is indicated by Whitaker's (32) record of the chromosomes of *"Drimys Winteri"* as about 76 in number. This record, however, is insufficient to be taken as a basis for discussion.

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NEW KWANGSI PLANTS[1]

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IN THIS paper, twelve new species and one new variety are described, all based on types from Kwangsi Province, China. In addition, three new combinations are made. Three of the new species were named by Dr. E. D. Merrill, in preliminary studies on the Chinese collections in the herbarium of the Arnold Arboretum. This paper is essentially a continuation of a previous article in this Journal (Jour. Arnold Arb. **24**: 444–459. 1943). All specimens herein cited are deposited in the herbarium of the Arnold Arboretum.

OLACACEAE

Olax laxiflora Merrill in herb. sp. nov.

Frutex scandens, 0.5–3.5 m. altus, ramis ramulisque brunneis glabris, lenticellis linearibus vel nullis; foliis chartaceis vel subcoriaceis, breviter petiolatis, oblongo-ovatis, 12–15 cm. longis, 5–6.5 cm. latis, acuminatis, basi late rotundatis, utrinque glabris subconcoloribus, supra nitidis, subtus paullo pallidioribus, nervis lateralibus utrinsecus 12–15, latissime patentibus, utrinque distinctis, sat procul a margine arcuato-anastomosantibus, rete venularum utrinque elevato; petiolis circiter 1 cm. longis; inflorescentiis axillaribus glabris paniculatis, 3.5–4.5 cm. longis, laxifloris, bracteis brevibus, distantibus, pedicellis 3–4 mm. longis; calycibus 1.5 mm. longis, plus minusve cuspidato-truncatis, glabris, margine submembranaceis integris; petalis 5, linearibus, circiter 10 mm. longis et 1 mm. latis; staminibus 5, filamentis complanatis, gracilibus, circiter 5 mm. longis et 0.8 mm. latis, antheris ellipticis, circiter 1.8 mm. longis; ovario ovoideo, stylo ad 8 mm. longo, stigmate obscure 3-lobato, lobis ovoideis; fructibus oblongo-obovoideis, circiter 2.8 cm. longis et 1.3 cm. latis, calyce accrescente totis circumdatis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22231* (TYPE), May 7, 1933, 0.5–3 m. high, fairly common in dry sandy places, flowers pale yellow; same locality, Na Wai Village, *W. T. Tsang 23863*, July 11–30, 1934, a climber 10.5 ft. high, fairly common in sandy soil, in thickets, fruit red, edible.

The new species is characterized by its large leaves, which are broadly rounded at base, its lax inflorescences, and its much elongated, slightly ovoid fruits.

ANNONACEAE

Fissistigma capitatum Merrill in herb. sp. nov.

Frutex scandens, ramulis teretibus brunneo-tomentosis; foliis subcoriaceis petiolatis, oblongo-ovatis, 9–15 cm. longis, 4.5–8 cm. latis, late rotundatis, leviter emarginatis, basi rotundatis, margine leviter revolutis, supra in sicco olivaceis, leviter tomentosis vel glabrescentibus, subnitidis,

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subtus in sicco brunneis, minute tomentosis, nervis lateralibus utrinsecus 15–18, supra distinctis, subtus elevatis, adscendentibus, venis tertiariis gracilibus, plus minusve parallelis, supra subconspicuis, subtus distinctis; petiolo 1–1.3 cm. longo, crasso, supra canaliculato, tomentoso; inflorescentiis oppositifoliis capitatis multifloris circiter 2 cm. diametro, pedunculis circiter 5 mm. longis, tomentosis, bracteis lanceolatis, acuminatis, circiter 7 mm. longis et 2 mm. latis, utrinque tomentellis; floribus subsessilibus (immaturis), calycibus 3-lobatis, lobis lanceolatis acuminatis, 6–7 mm. longis, tomentellis, basi cordatis; petalis 6.5 mm. longis, 3 exterioribus extus tomentellis; staminibus numerosis; carpellis dense tomentosis.

KWANGSI: Bako Shan, *R. C. Ching 7674,* Sept. 26, 1928; Chen-pien District, *S. P. Ko 56075* (TYPE), Nov. 19, 1935, a woody vine, in forests.

Although both specimens bear young flowers only, we do not hesitate to describe this as a new species on account of its very distinctly capitate more or less sessile flowers with long acuminate calyx-lobes.

SAXIFRAGACEAE

Cardiandra laxiflora sp. nov.

Subherbacea circiter 0.5 m. alta, caulibus brunneis sulcatis sparse pilosis 6 mm. diametro; foliis alternis petiolatis oblongo-ellipticis, 15–20 cm. longis, 7–9 cm. latis, acuminatis, basi longe attenuatis, margine grosse serratis, supra atro-viridibus sparse pilosis, subtus pallidioribus, costa nervisque supra glabris, subtus sparse pilosis, utrinque distinctis, nervis lateralibus utrinsecus 10–12 adscendentibus prope marginem arcuato-anastomosantibus, venulis utrinque subconspicuis; petiolo 2–4 cm. longo; inflorescentiis terminalibus longe pedunculatis laxe paniculato-corymbosis, circiter 13 cm. longis et 6 cm. latis, puberulis, pedunculis circiter 8 cm. longis, ramis circiter 1.5 cm. longis, basi bracteatis, bracteis linearibus; floribus paucis parvis exterioribus in corymbo sterilibus, longe pedicellatis, pedicellis circiter 1–1.5 cm. longis, calycis segmentis binis aequalibus, petaloideis albidis obovatis, 0.8–1.3 cm. longis, 0.6–1.2 cm. latis, venosis; floribus interioribus in corymbo fertilibus, pedicellis 3–6 mm. longis, calycis tubo ovario adnato hemisphaerico leviter puberulo vel glabro, 0.75–1 mm. longo, lobis 4 vel 5 triangulari-ovatis circiter 0.75 mm. longis; petalis 5 raro 4 albis imbricatis ovatis rotundatis circiter 2.5 mm. longis et 2 mm. latis; staminibus circiter 15 epigynis, filamentis filiformibus, 3 mm. longis, antheris obcordato-truncatis 0.5 mm. longis; ovario 3-loculari, stylis 3 liberis brevibus 0.5 mm. longis, subconicis, stigmate capitato.

KWANGSI: Tzu-yuen District, *Z. S. Chung 83587* (TYPE), Aug. 7, 1937, an herb in woods near stream, flowers white.

This is the second species of the genus to be found in China. The other species, **Cardiandra Moellendorffii** (Hance) comb. nov. (*Hydrangea Moellendorffii* Hance, Jour. Bot. 12: 177. 1874; *Cardiandra sinensis* Hemsley, Gard. Chron. III. 23: 82. 1903; *Cardiandra alternifolia* Sieb. & Zucc. var. *Moellendorffii* Engl. [as *Moellendorfii*] in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 18a: 201. 1928) is found in Hupeh, northern Kiangsi, and northern Chekiang. It differs from this new species mainly in the thicker, smaller leaves, larger and denser inflorescences, and the thicker, smaller bracts.

A photograph and fragments of the type of *Hydrangea Moellendorffii* Hance (*O. F. Moellendorff s. n.,* from Kiukiang, Kiangsi) are in the herbarium of the Arnold Arboretum. It is manifestly the same as *Cardiandra sinensis* Hemsley, as pointed out by Engler (l.c.). However, it differs from typical *Cardiandra alternifolia* Sieb. & Zucc. of Japan as much as do any other proposed species of the genus from Formosa and elsewhere, and to treat it as a variety of the Japanese species is not deemed advisable unless the genus is considered as monotypic and all species reduced to varieties of a single one, a treatment which is scarcely warranted in view of the wide geographical distribution of the group.

ROSACEAE

Photinia kwangsiensis sp. nov.

Arbor circiter 15 m. alta, ramulis hornotinis dense et adpresse brunneo-villosulis, annotinis villosulis vel subglabris; foliis persistentibus subcoriaceis, oblongo-ovatis vel oblongo-lanceolatis, 8–12 cm. longis, 3–4 cm. latis, acuminatis, basi late acutis vel subrotundatis, margine leviter revolutis, minute et conferte glanduloso-serrulatis, in sicco olivaceo-brunneis, utrinque subconcoloribus, supra haud nitidis glabris costa villosula exceptis, subtus dense villosulis, costa supra leviter impressa, subtus valde elevata, conspicua, venis lateralibus utrinsecus 12–15, valde obliquis, gracilibus, prope marginem anastomosantibus, supra inconspicuis, subtus distinctis, venulis subtiliter et dense reticulatis, supra elevatis; petiolo 1.5–2 cm. longo, dense villosulo; floribus ignotis; infructescentiis corymbosis terminalibus multifructigeris, 8–9 cm. longis, 12–13 cm. diametro, axibus secondariis teretibus villosulis, infimis saepe subverticillatis, pedicellis 3–5 mm. longis, villosulis, bracteis bracteolisque caducis; fructibus subglobosis, aurantiaco-rubris, 5 mm. longis, villosulis vel subglabris, calycis dentibus persistentibus incurvis.

KWANGSI: Liow Shaing, Tseung-yuen, *C. Wang 39616,* June 30, 1936; Yao Shan, *C. Wang 40293* (TYPE), Oct. 22, 1936, a tree 15 m. high, on river banks, fruits green.

In its pubescent leaves and other characters this species is near *Photinia Griffithii* Decaisne, differing in the more spreading nerves, the upper surfaces not shining but with distinct fine reticulations, and the more numerous minute glandular teeth along the margins.

Rubus septemlobus sp. nov. Subgenus *Idaeobatus,* § *Corchorifolii.*

Frutex scandens, ramulis dense brunneo-pubescentibus sparse aculeatis, aculeis 1 mm. longis, rectis; foliis simplicibus coriaceis petiolatis, palmatim ad ¼ 7-lobis, circiter 15 cm. diametro, in sicco supra atro-olivaceis, glabrescentibus venis pubescentibus exceptis, subtus dense brunneo-pubescentibus, lobis ovato-oblongis vel ovato-lanceolatis, terminalibus majoribus 8–9 cm. longis, 3–3.5 cm. latis, inferioribus minoribus 3–4 cm. longis, 1.5–2 cm. latis, ceteris intermediis, apice acuminatis, margine irregulariter serrulatis, venis venulisque supra leviter impressis, subtus elevatis; petiolis 5–6 cm. longis, dense brunneo-pubescentibus, sparse aculeatis, aculeis recurvis; stipulis foliaceis ovatis 1–1.2 cm. longis, 0.5–7.5 cm. latis, fimbriato-dissectis, extus pubescentibus, intus glabris; floribus (immaturis) axillaribus, 1 vel 2, subsessilibus, bracteis numerosis, foliaceis ovatis, 1–1.5 cm. longis, 0.5–1 cm. latis, margine fimbriatis vel subintegris, extus dense pubescentibus, intus glabris; calycis tubo 4 mm. longo, dense pubescente, lobis triangulari-ovatis, 2–3 mm. longis, 2–2.5 mm. latis; petalis albidis; staminibus numerosis.

KWANGSI: Yao Shan, Ping Nam, *C. Wang 39117* (TYPE), May 8, 1936, a scandent shrub, in ravines, flowers white.

A distinct species characterized by the deeply 7-lobed leaves. It is probably closest to *Rubus acuarius* Focke, of Yunnan.

Rubus kwangsiensis sp. nov. Subgenus *Idaeobatus*, § *Corchorifolii*.

Frutex scandens, ramulis glabris sparse aculeatis, aculeis 4–5 mm. longis, recurvis; foliis simplicibus membranaceis, longe petiolatis, oblongo-ovatis, 10–12 cm. longis, 5–7 cm. latis, longe acuminatis, basi subcordatis, margine irregulariter serrulatis, supra glabris nervis leviter pubescentibus exceptis, subtus glabris, nervis lateralibus utrinsecus circiter 8, arcuato-adscendentibus, venulis inconspicuis; petiolo 2.5–3.5 cm. longo, glabro, raro 1- vel 2-aculeato; stipulis lanceolatis adnatis, 6–8 mm. longis; floribus solitariis axillaribus, circiter 2 cm. diametro, pedicellis circiter 1 cm. longis, glabris; calycis tubo extus glabro, lobis longe ovato-triangularibus, 8 mm. longis, 3 mm. latis, longe acuminatis, intus dense puberulis; petalis rubris obovatis, circiter 8 mm. longis et 7 mm. latis; staminibus numerosis; carpellis numerosis; fructu ignoto.

KWANGSI: Tzu-yuen District, *Z. S. Chung 81673* (TYPE), May 21, 1936, a scandent shrub in forests, flowers red.

A species related to *Rubus corchorifolius* Linn. f., differing in the large membranaceous leaves, which are glabrous and not soft-pubescent beneath, and in the red flowers with relatively short petals.

Rosa kwangsiensis sp. nov. § *Synstylae*.

Frutex scandens, ramis ramulisque cinereo-brunneis, aculeis sparsis 4–6 mm. longis, basi valde dilatatis; foliis 3–7-foliolatis, petiolis inclusis 8–11 cm. longis, petiolis rhachibusque sparse aculeatis; foliolis membranaceis sessilibus vel subsessilibus ovatis vel obovatis, 3–6 cm. longis, 2–3 cm. latis, acutis, basi late acutis vel subrotundatis, simpliciter serratis, utrinque glabris, supra atro-viridibus, subtus pallide viridibus, nervis lateralibus utrinsecus 6–8, supra subconspicuis, subtus elevatis, rete venularum obscuro; petiolis 2–2.5 cm. longis, sparse tomentosis; stipulis adnatis, circiter 2 cm. longis, acuminatis, auriculis divergentibus 5–8 mm. longis triangularibus vel lanceolatis, margine distincte fimbriatis, stipitato-glandulosis; floribus rubris, 3–3.5 cm. diametro, in corymbis terminalibus multifloris 10 cm. longis latisque dispositis; bracteis foliaceis, oblongo-lanceolatis acuminatis, ad 8 mm. longis et 2 cm. latis, margine distincte fimbriatis; pedicellis gracilibus 1–1.5 cm. longis, glabris; receptaculis depresso-ovoideis, glabris, 4–5 mm. longis; sepalis ovato-lanceolatis, circiter 8 mm. longis et 3 mm. latis, apice longe acuminatis, extus glabris, margine et intus dense pubescentibus; petalis late obovatis, circiter 1.2 cm. longis et 8 mm. latis, emarginatis; filamentis ad 6 mm. longis; stylo unico glabro 5 mm. longo, stigmate capitato.

KWANGSI: Shuen-yuen, *Z. S. Chung 81540* (TYPE), May 12, 1936, a scandent shrub, flowers reddish.

A species allied to *Rosa Brunoniana* Lindl., differing notably in the glabrous pedicels and receptacles, the laciniate bracts and stipules, and the glabrous styles.

Rosa paucispinosa sp. nov. § *Synstylae.*

Frutex scandens, ramis atro-brunneis, aculeis paucis, 2–3 mm. longis, ramulis brunneis glabris inermis; foliis 5-foliolatis, petiolis inclusis 15–19 cm. longis, petiolis rhachibusque inermis, glabris; foliolis sessilibus chartaceis ovatis, 8–11 cm. longis, 3.5–5 cm. latis, longe acuminatis, basi acutis vel subrotundatis, margine simpliciter serratis, utrinque glabris, in sicco supra olivaceis, subtus pallidioribus, nervis lateralibus utrinsecus 8–10, supra subdistinctis, subtus elevatis, rete venularum supra inconspicuo subtus subconspicuo; petiolo 4.5–5 cm. longo; stipulis lanceolatis adnatis, 2–2.8 cm. longis, apice divergentibus, lanceolatis, acuminatis; floribus ignotis; infructescentiis terminalibus subumbellatis puberulis circiter 5-fructigeris; pedunculis circiter 1.7 cm. longis, pedicellis 2.5–3 cm. longis; fructibus globosis vel subglobosis, 1.5–2 cm. diametro, rubris, sparse puberulis vel glabrescentibus; stylo unico, 7 mm. longo; sepalis persistentibus vel deciduis, triangulari-ovatis, 6–7 mm. longis, 4–5 mm. latis, acutis, utrinque pubescentibus.

KWANGSI: Yao Shan, *C. Wang 40547* (TYPE), Dec. 4, 1936, climbing on trees, fruit red.

Although the flowers are unknown, this species appears to be strongly characterized by its very few prickles, large glabrous leaves, and large fruits, which are subumbellately arranged on a terminal peduncle.

Pygeum laxiflorum Merrill in herb. sp. nov. § *Cylopygeum.*

Arbor 7–12 m. alta inflorescentiis exceptis glabra, ramis teretibus purpureo-brunneis, consperse lenticellatis, ramulis circiter 1 mm. diametro, glabris; foliis chartaceis, ovato-lanceolatis, 8–10 cm. longis, 3–3.5 cm. latis, graciliter caudato-acuminatis, basi late acutis, margine integris, supra glabris olivaceo-brunneis, subtus pallidioribus glabris, glandulis nullis vel planis, nervis lateralibus utrinsecus 6–8, gracilibus, curvato-adscendentibus, prope marginem arcuato-anastomosantibus, supra leviter impressis, subtus elevatis, rete venularum utrinque leviter impresso, subconspicuo; petiolo 6–8 mm. longo, glabro; inflorescentiis spicatis axillaribus solitariis vel 2-vel 3-fasciculatis, gracilibus, primo minute pubescentibus, demum glabrescentibus, bracteolis minutis deciduis; floribus laxis, pedicellis gracilibus circiter 3 mm. longis; calycis tubo infundibuliformi, 1.5 mm. longo, 2 mm. diametro, extus minute puberulo, segmentis 10, 5 (sepalis) triangulari-ovatis, acuminatis, 0.5 mm. longis, puberulis, 5 (petalis) oblongis, obtusis vel rotundatis, 1 mm. longis, dense pubescentibus; staminibus circiter 15, filamentis glabris, usque 4 mm. longis; ovario glabro, stylo 3 mm. longo, glabro; fructibus oblongis, transverse dilatatis, circiter 7 mm. longis et 9 mm. latis, atro-purpureis, glabris, lignosis, semine solitario.

KWANGTUNG: Shih Wan Tai Shan, *H. Y. Liang 69816,* July 21, 1937, a tree 9 m. high, in light woods, flowers white. KWANGSI: Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24375* (TYPE), Sept. 28, 1934, a tree 20 ft. high, flowers white, fragrant. INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26891,* Sept. 27–30, 1936, a small tree 20 ft. high, fairly common in thickets, in dry clayey soil, fruits black; Ha-coi, Chuk-phai, Taai Wong Mo Shan and vicinity, *W. T. Tsang 27088,* Oct. 23–31, 1936, *27221,* Nov. 10–17, 1936, a tree, 20–35 ft. high, fairly common in thickets, fruits black.

THEACEAE

Tutcheria hirta (Hand.-Maz.) comb. nov.

Gordonia ? hirta Hand.-Maz. Anz. Akad. Wiss. Wien 58: 180. 1921.

Tutcheria villosa Wu, Bot. Jahrb. 71: 192, 1940, syn. nov.

HUPEH: Enshih District, *H. C. Chow 1812,* Oct. 29, 1934. KWEICHOW: Between Kuchow and Liping, *H. Handel-Mazzetti 10930* (ISOTYPE). KWANGSI: San-chiang District, *Steward & Cheo 1045,* Sept. 12, 1933; Pai-shou District, Pai-shou Shan, *Y. W. Taam 61,* Aug. 23, 1935; Shing-an District, *Z. S. Chung 81812,* June 19, 1936; Shan Chuen, *Z. S. Chung 83383,* July 2, 1937.

Handel-Mazzetti was uncertain as to the genus of this species, as he had no fruiting material. Wu was correct in his generic determination but he also had no fruiting material. Fruits are found in the *Steward & Cheo, Taam,* and *Chow* numbers cited above. The fruits are ovoid, 3-ridged, about 1.5 cm. long and 0.7 cm. across, pointed, and pubescent. This is the only known species of the genus that has its leaves pubescent beneath.

Tutcheria hirta var. **grandiflora** (Wu) comb. nov.

Tutcheria villosa var. *grandiflora* Wu, Bot. Jahrb. 71: 193. 1940.

KWANGSI.

Tutcheria hirta var. **cordatula** var. nov.

A typo speciei differt foliis basi cordatulis.

KWANGSI: Shih Wan Tai Shan, Tai Mien Shan, *H. Y. Liang 69639* (TYPE), July 14, 1937, a tree 7–12 m. high, in mixed dense forests along streams.

Hartia cordifolia sp. nov.

Arbor 12–18 m. alta, ramis glabris, ramulis novellis teretibus, leviter villosis; foliis glabris chartaceis ovatis, 5–8 cm. longis, 3–4.5 cm. latis, acutis vel acuminatis, basi cordatis, margine remote serrulatis, in sicco olivaceis, utrinque subconcoloribus, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 6–8 cum venulis supra leviter impressis, subtus subelevatis; petiolis valde alatis, 1.5–2.5 cm. longis, 3–4 mm. latis, leviter villosis vel subglabris; floribus axillaribus solitariis, pedicellis 2–5 mm. longis, sericeo-pilosis, pilis albidis; sepalis ovatis, 10 mm. longis, 8 mm. latis, obtusis vel rotundatis, extus leviter pubescentibus, intus glabris; petalis oblongo-obovatis, 1.2–1.4 cm. longis, 8–10 mm. latis, extus dense pallide sericeo-pubescentibus, intus glabris; staminibus numerosis, 6–8 mm. longis, filamentis alte connatis; ovario conico, dense pubescente; fructibus capsularibus ligneis, apice acutis, ad 1 cm. longis, 1.4 cm. diametro, valvis 5 crassis, sepalis persistentibus, pedicellis 2–5 mm. longis.

KWANGSI: Yao Shan, Tseung-yuen, *C. Wang 39433* (TYPE), June 19, 1936, a tree 12 m. high, in woods; Yao Shan, *C. Wang 40104,* Oct. 14, 1936, a tree 18 m. tall, in mixed woods, fruits green.

This species is near *Hartia micrantha* Chun, but it may be distinguished by the broader, shorter, and distinctly cordate leaves. The petioles are broadly winged.

Adinandra bracteata sp. nov.

Arbor 12 m. alta, omnino glabra, ramulis teretibus purpureo-brunneis striatis haud lenticellatis; foliis subcoriaceis ellipticis, 8–10 cm. longis, 3.5–6 cm. latis, obtusis vel acutis, basi acutis, margine integris vel parce minute serrulatis, supra atro-viridibus, subtus pallidioribus, in sicco utrinque brunneo-olivaceis, costa supra impressa, subtus elevata, nervis lateralibus 6–10, utrinque subconspicuis, venis tertiariis inconspicuis; petiolo 1–1.5 cm. longo, utrinque canaliculato; floribus solitariis axillaribus, basi 2-bracteatis, bracteis coriaceis ovatis, 6 mm. longis, 4–5 mm. latis, obtusis, pedicellis 2–3 mm. longis; sepalis coriaceis, suborbicularibus, rotundatis, 12 mm. longis, 10 mm. latis, margine integris, interdum parce ciliatis; petalis (immaturis) ovatis, 1.5 cm. longis, 1.2 cm. latis, rotundatis; staminibus (immaturis) 1.1–1.3 cm. longis; ovario glabro.

KWANGSI: Yao Shan, Kam Shau, *C. Wang 39626* (TYPE), July 12, 1936, a tree 12 m. high, in mixed woods, flowers white.

This species is characterized by its relatively large flowers, which are subtended by two coriaceous bracts. It suggests no close relationship to other known species.

Adinandra serrulata sp. nov.

Frutex 3–8 m. altus, ramis striatis, ramulis novellis teretibus brunneis pubescentibus; foliis chartaceis, oblongo-lanceolatis, 14–17 cm. longis, 4–5 cm. latis, acutis vel acuminatis, basi late acutis vel subrotundatis, margine distincte serrulatis, supra viridibus glabris, subtus pallidioribus sparse pubescentibus, in sicco supra atro-olivaceis, subtus brunneo-olivaceis, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 15–22, gracilibus, utrinque conspicuis, venis tertiariis subconspicuis; petiolo circiter 1 cm. longo, pubescente; floribus solitariis axillaribus, pedicellis circiter 2 cm. longis, pubescentibus; sepalis coriaceis, ovatis, acutis, 10 mm. longis, 8 mm. latis, extus pubescentibus, intus glabris; petalis ovato-oblongis, late acutis, 12 mm. longis, 8 mm. latis, extus superne medium versus dense pubescentibus, prope marginem et inferne glabris; staminibus 7–9 mm. longis, filamentis glabris, connectivo leviter pubescente; ovario globoso, 4 mm. longo, dense pubescente, stylo crasso, 7 mm. longo, leviter pubescente, stigmate inconspicuo; fructu globoso, 2 cm. diametro, leviter pubescente, calyce persistente.

KWANGSI: Ling-wun District, *S. K. Lau 28705* (TYPE), July 19, 1937, a shrub 3 m. high, in woods, flowers white; Chen-pien District, *S. P. Ko 55926*, Oct. 17, 1935, a shrub 8 m. high, in woods, fruits deep red.

This species is characterized by its chartaceous oblong-lanceolate leaves, distinctly serrulate along the margins and sparsely pubescent beneath, its flowers with pubescent sepals and ovaries, and with petals densely pubescent outside on the median part above. It is probably nearest *Adinandra Bockiana* E. Pritz., from which it may be readily distinguished by the larger leaves, flowers, and fruits.

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NOTES ON SOME CULTIVATED TREES AND SHRUBS

ALFRED REHDER

THE FOLLOWING new combinations became necessary when, in compiling a Bibliography of cultivated trees and shrubs, it was found that, in a number of cases, older names overlooked or neglected by previous authors existed which called for a change in the nomenclature of certain groups. The numerous new cases of change of category without change of the combination itself, as changes from *varietas* to *forma* or, in general, changes from one subspecific category to another, e. g. *Rhododendron maximum β. album* Pursh to *R. maximum* f. *album* (Pursh) Fernald, will appear with full synonymy in the Bibliography referred to above, as "gradus novus."[1] As these changes of grade which mostly concern garden forms do not need any discussion or explanation and do not change the name itself, their publication prior to the publication in my Bibliography seems unnecessary; it would simply be a repetition of the numerous synonyms.

Taxus baccata L. f. **Dovastoniana** (Leighton), comb. nov.

Taxus baccata "Westfelton Yew" Loudon, Arb. Brit. **4**: 2083, *fig. 1990* (1838).

Taxus baccata var. *β. Dovastoniana* Leighton, Fl. Shropshire, 497 (1841).

Taxus baccata var. *β. Dovastoni* Knight & Perry, Syn. Conif. 52 (1850), nom. — Lindley & Gordon in Jour. Hort. Soc. Lond. 5: 227 (1850), nom. — Hort. ex Lawson, List Pl. Fir Tribe, 81 (1851) "var." — Hort. Angl. ex Carrière, Traité Conif. 518 (1855). — Voss, Vilmor. Blumengärt. 1: 1243 (1896) "subsp. *vulgaris* f. *dovastoni*." — Pilger in Engler, Pflanzenreich, IV. 5(Heft 18): 114 (1903); in Mitt. Deutsch. Dendr. Ges. **1916**(25): 11 [1917] "f. *Dovastonii*."

Taxus disticha Wenderoth, Pflanz. Bot. Gärt. 1(Conif.): 42 (1851). — Henkel & Hochstetter, Syn. Nadelh. 354 (1865), pro syn.

Taxus Dovastoni Hort., *T. imperialis* Hort., *T. pendula* Hort., *T. horizontalis* Hort., *T. umbraculifera* Hort., *T. baccata horizontalis* Hort. ex Henkel & Hochstetter, l. c. (1865), pro syn.

In almost all publications listing this form, the subspecific epithet has been spelled *"Dovastoni,"* because the first publication of the form has been generally overlooked.

Pinaceae subfam. **Taxodioideae**, comb. nov.

Coniferae ord. I. *Cupressineae* § 5. *Taxodineae* Endlicher, Syn. Conif. 6 (1847).

[1] For a note on the term "gradus novus," new grade, see this Journal **22**: 570, footnote (1941). The term "status novus" was proposed by Bailey (in Gent. Herb. 1: 8) as a new term for a change of rank, to distinguish it from a transfer without change of rank which he proposed to call "translatio nova," new transfer, to be applied to transfers of names without change of rank from one genus to another or, in the case of subspecific names, from one species to another; both kinds of change are usually called "combinatio nova," new combination. The term "gradus novus," new grade, refers to changes of one subspecific grade to another under the same binomial and without change of the subspecific epithet, and therefore without change of the ternary combination itself, as in the example given above.

Coniferae ord. II. *Cunninghamieae* § 3. *Cunninghamieae* Endlicher, op. cit. 80 (1847) exclud. *Dammara*.

Coniferae trib. *Abietineae* subtrib. *Taxodieae* Parlatore in De Candolle, Prodr. **16**, 2: 365 (1868).

Coniferae trib. *Taxodieae* Bentham & Hooker f., Gen. Pl. **3**: 422 (1880).

Coniferae I. *Pinoideae* 1. *Abietineae* 1c. *Taxodiinae* Eichler in Nat. Pflanzenfam. II. **1**: 65, 84 (1889).

Araucariaceae §. *Taxodieae* Engler, Syllab. Vorles. grosse Ausg. 62 (1892).

Taxodiaceae F. W. Neger, Nadelh. 24, 127 (Samml. Göschen, no. 355) (1907).— Pilger in Nat. Pflanzenfam. ed. 2, **13**: 342 (1926).

Taxocupressaceae subfam. *Taxodioideae* Vierhapper in Abh. Zool.-Bot. Ges. Wien, **5**, 4: 23 (1910).

Pinaceae subfam. *Abietoideae* trib. *Taxodieae* Ascherson & Graebner, Syn. Mitteleur. Fl. ed. 2, **1**: 280, 355 (1912).

Pinaceae §. *Taxodieae* Engler, Syllab. Vorles. ed. 9, 122 (1924).

As according to the Rules of Nomenclature (Art. 24) the ending of names of subfamilies is -oideae, Vierhapper's name under *Taxocupressaceae* will be the correct name when this subfamily is transferred to *Pinaceae*, since the citation of the parenthetical author is not necessary. According to the Rules, in a transfer of the name of a division of higher rank than genus, the citation of the parenthetical author is not required (see Art. 49).

Chamaecyparis obtusa f. **Barronii**, nom. nov.

Retinispora tetragona R. Smith, Pl. Fir Tribe, 40 [1874?].— Barron ex Gordon, Pinet. ed. 2, 429 (1875).

Chamaecyparis thujaeformis [Hort.?] ex R. Smith, l. c. [1874?], pro syn.

Chamaecyparis obtusa var. *tetragona* (Gord.) Hornibrook, Dwarf Conif. 42 (1923), non Rehder (1919).

In 1919 (in Jour. Arnold Arb. **1**: 52) I had proposed the ternary combination *C. obtusa* f. *tetragona* for the form with variegated foliage called by Nicholson *C. obtusa tetragona aurea*, adopting "*tetragona*" as the subspecific epithet to avoid coining an entirely new epithet, because *aurea* was preoccupied and no green form seemed to be known in cultivation at that time. In 1923, however, Hornibrook described the green form as *Ch. obtusa* var. *tetragona* (R. Smith), but that name, being invalidated by the earlier homonym of 1919, has to be changed; I propose the name *Ch. obtusa* f. *Barronii* in honor of William Barron of the Elvaston Nursery, who introduced this plant from Japan, as also did Mr. R. Smith of Worcester.

Juglans ailantifolia var. **cordiformis** (Maxim.), comb. nov.

Juglans cordiformis Maximowicz in Bull. Acad. Sci. St. Pétersb. **18**: 62 (in Mél. Biol. **8**: 63) (1873).

Juglans Sieboldiana var. *cordiformis* (Maxim.) Makino in Bot. Mag. Tokyo, **9**: (313) (1895); **15**: 94 (1901).

Juglans Allardiana Dode in Bull. Soc. Dendr. France, **1908**: 34, *fig.* (1908).

Juglans coarctata Dode in op. cit. **1909**: 36, *fig.* (1909).

Juglans Lavallei Dode in op. cit. **1909**: 37, *fig.* (1909).

Juglans subcordiformis Dode in op. cit. **1909**: 43, *fig.* (1909).

In an article dealing with homonyms (in Jour. Washington Acad. Sci. **23**: 132. 1943), Little drew attention to the fact that the name *Juglans Sieboldiana* Maxim. (1873) is antedated by *J. Sieboldiana* Göppert (1855), based on a fossil plant. Therefore, the next oldest name for the species described by Maximowicz had to be taken up; this is *J. ailantifolia* Carrière in Rev. Hort. 1878: 414, *fig. 85–86* (1878). Carrière, when coining the specific epithet, apparently followed De Candolle in the spelling of the generic name. De Candolle has it as *Ailantus* (in his Prodr. 2: 88. 1825), which probably is more correct than Desfontaines' spelling, because the name is derived from Ailanto, its native name in the Moluccas.

Hamamelis intermedia (*H. japonica* Sieb. & Zucc. × *mollis* Oliver), hybr. nov.

A *Hamamelide japonica* differt ramulis pubescentibus; foliis supra initio sparse stellato-pubescentibus maturis fere glabris, subtus initio satis dense stellato-pubescentibus, demum glabrescentibus; petiolis pubescentibus; petalorum parte inferiore plerumque rubris vel rubescentibus; capsula subglobosa vel late ovoidea ad 1.2 cm. diam., paulo longiora quam lata apice vix attenuata calyce plus quam tertiam partem fructus aequante.

A *H. molli* differt ramulis demum glabrescentibus vel glabris; foliis plerisque obovatis, basin versus plus minusve angustatis, ima basi inaequilateraliter truncatis vel late cuneatis, raro uno latere subcordatis, supra initio pubescentibus demum glabris vel fere glabris, subtus initio stellato-pubescentibus, demum plerumque glabrescentibus, petiolis gracilioribus glabris vel leviter pubescentibus; capsula apice minus distincte quadrangulari.

Cultivated specimens: Arnold Arboretum, no. *1173–28, A. Rehder,* April 6, 1935, *E. J. Palmer,* March & August, 1936; no. *1174–28, E. J. Palmer,* March & June, 1938 and Sept. 1940, *A. Rehder,* June, 1939 and Oct. 1944; no. *726–29* (seed as *H. mollis* from N. Kidder, Milton, Mass.), *E. J. Palmer,* June 10, 1938.

This hybrid was first raised at the Arnold Arboretum in 1929, from seed collected the previous year from a plant of *Hamamelis mollis* received from Veitch and raised from seed sent to Veitch by Maries in 1878, and from a plant of the same species raised from seed collected by Wilson in 1907 and sent to the Arnold Arboretum. None of the seedlings from the plants cultivated at the Arnold Arboretum turned out to be true *H. mollis;* all proved to be intermediate between *H. mollis* and *H. japonica,* of which several varieties were growing in the Arboretum. The hybrid also appeared in some other places, as in the author's garden where the two parent species were standing side by side, and spontaneous seedlings appeared almost every year and always proved to be hybrids. The plants raised showed considerable variation in the amount of pubescence, size and shape of the leaves and the color of the flowers, but they all agreed in being intermediate in various degrees between the two parent species. The most striking difference between these lies in their pubescence, *H. mollis* having the under surface of the leaves covered with a dense stellate tomentum which persists until autumn, while *H. japonica* has the leaves quite glabrous on both sides or pubescent beneath only when young, glabrous and somewhat lustrous light green beneath, or pubescent only at the veins at maturity, lustrous and darker green above and of firmer texture than *H. mollis,* which has leaves of softer texture, coloring a clear yellow, and dropping earlier than those of *H. japonica.* The leaves of *H. mollis* are broad at the oblique base and deeply cordate or sometimes subcordate, while in *H. japonica* they are usually more or less narrowed toward the oblique base and broadly cuneate to truncate on one side and truncate to subcordate on the other. The flowers are similar in both species, with the petals bright yellow and reddish toward the base in *H. mollis* and bright yellow in *H. japonica* except in var. *flavo-purpurascens* (Mak.) Rehd., which has red or reddish petals, at least below the middle. The capsule in *H. mollis* is densely tomentose, larger and about as broad as high, 10–13 mm. across, with a broad truncate four-cornered apex and with a calyx enclosing the fruit more than ⅓ to nearly ½. In *H. japonica* the capsule is closely and more thinly pubescent, nearly ovoid, about 8 mm. across and somewhat narrowed toward the less strongly four-cornered apex, and the calyx encloses the capsule about ⅓ or sometimes more.

Clematis dioscoreifolia Léveillé & Vaniot in Repert. Sp. Nov. Reg. Veg. 7: 339 (1909).
Clematis paniculata var. *dioscoreifolia* (Lévl. & Vant.) Rehder in Jour. Arnold Arb. 1: 195 (1920).

Clematis dioscoreifolia Lévl. & Vant. var. **robusta** (Carr.), comb. nov.
Clematis Vitalba "aus Japan" Christmann, Pflanzensyst. 7: 309, *t. 55, fig. 2* (1781).
Clematis crispa sensu Thunberg, Fl. Jap. 239 (1784), non Linnaeus (1753).
Clematis virginica sensu Thunberg, Fl. Jap. 240 (1784), non *C. virginiana* Linnaeus (1762).
Clematis paniculata Thunberg in Trans. Linn. Soc. Lond. 2: 337 (1794). — Rehder & Wilson in Sargent, Pl. Wilson. 1: 331 (1913). — Non J. F. Gmelin (1791) [= *C. indivisa* Willd.]
Clematis Flammula robusta Carrière in Rev. Hort. 1874: 465, *fig. 59* (1874); **1899**: 529, *fig. 227* (1899). — Rehder & Wilson, l. c. (1913), pro syn.
Clematis recta π. *paniculata* Kuntze in Verh. Bot. Ver. Brandenb. **26**(Abh.): 115 (Monog. Clemat.) (1885).
Clematis recta sensu Finet & Gagnepain in Bull. Soc. Bot. France, **50**: 535 (1903); Contrib. Fl. As. Or. 1: 20 (1905); non Linnaeus (1753).

This ornamental vine, much planted for its profuse white flowers appearing in autumn, and until now well known under the name *C. paniculata* Thunb., unfortunately must change its name, since that name is a later homonym of *C. paniculata* J. F. Gmelin in Linnaeus, Syst. Nat. ed. 13, 3,1: 873 (1791). Gmelin's name, based on *C. integrifolia* Forster, Fl. Ins. Austral. Prodr. 42 (1786), non Linnaeus (1753), however, was not taken up by Willdenow, who gave to *C. integrifolia* Forst. the name *C. indivisa* in his Sp. Pl. 2,2: 1291 [1800]. Willdenow probably overlooked Gmelin's name or intentionally omitted it, because he adopted in the same publication Thunberg's *C. paniculata* as a valid name, which will have to replace *C. indivisa* Willdenow of 1800; both names are based on the same species, namely *C. integrifolia* Forster, non Linnaeus, and Gmelin's name has nine years' priority. It seems strange that in none of the New Zealand floras does the name *C. paniculata* Gmel. appear, not even as a synonym, though *C. indivisa* is described as a valid species. When, in 1920, I referred *C. dioscoreifolia* Lévl. & Vant. as a variety to *C. paniculata*, Art. 61 of the Rules (containing the so-called homonym rule) was not yet in force, not having been adopted until 1930 (ed. 3, p. 19).

There seems to be no earlier name to replace *C. paniculata* Thunb., non Gmelin, except *C. dioscoreifolia* Léveillé & Vaniot, representing a plant somewhat different from *C. paniculata* Thunb., but undoubtedly conspecific. Therefore, it will have to be accepted as the correct name for this species and *C. paniculata* Thunb. treated as a variety, for which the varietal name will be *"robusta,"* described and figured by Carrière in 1874 as *C. Flammula robusta.* Eleven years later Kuntze named this plant *C. recta* *π. paniculata,* which would be preferable as a varietal name, since the plant has been well known for a long time as *C. paniculata* Thunb.; but the latter is, according to Carrière's description, clearly the same plant as *C. Flammula robusta,* overlooked by Kuntze and not mentioned at all in his monograph, but cited as a synonym of *C. paniculata* in Sargent, Pl. Wilson. 1: 331 (1913).

Crataegus ser. **Crus-gallianae,** nom. nov.

Crataegus §. IV. *Crus-galli* Loudon, Arb. Brit. 2: 820 (1838). — Sargent in Rhodora, 3: 19 (1901); Silva N. Am. 1: 32 (1902). — Schneider, Ill. Handb. Laubh. 1: 769, 796 (1906) "sect.". — Rehder, Man. Cult. Trees Shrubs, 368 (1927) "group"; ed. 2, 364 (1940) "ser."

Crataegus . . . Berberifoliae Beadle in Biltmore Bot. Stud. 1: 127 (1902); in Small, Fl. Southeast. U. S. 533 (1903); nom. subnud.

Crataegus "Gruppe" *Crura galli* Zabel in Beissner et al., Handb. Laubh.-Ben. 171 (1903).

The name *Crataegus* §. *Crus-galli* Loudon given to a subdivision of *Crataegus* is contrary to Art. 4 of the Rules of Botanical Nomenclature, since it is ambiguous and may cause error, because the combination does not differ from the binary combination of a species, in this case *C. crus-galli* L., the type of this series. Therefore, the name is herewith changed to an adjective in plural form, which is the recommended form for names of series (see Art. 26 of the Rules of Botanical Nomenclature), to make it conform to the names of the other series of this genus.[2]

Crataegus . . . Berberifoliae, a *nomen subnudum* published without indication of category, as a subdivision different from ser. *Crus-gallianae* does not seem to be sufficiently distinct and is here enumerated as a synonym.

Amelanchier canadensis (L.) Med. var. **micropetala** (Robins.), comb. nov.

Amelanchier oblongifolia var. *micropetala* Robinson in Rhodora, 10: 33 (1908).

Amelanchier Botryapium var. *micropetala* (Robins.) Farwell in Rep. Michigan Acad. Sci. 17: 176 (1915).

Fernald, in Rhodora 43: 566 (1941), has shown that the type of *Amelanchier canadensis* (L.) Med. is the plant generally called *Amelanchier oblongifolia* Roemer, while *A. canadensis* of Sargent and most American authors will have to bear the name *A. arborea* (Michx.) Fernald (in op. cit. 563). This makes necessary the transfer proposed above.

Zanthoxylum L. subgen. **Thylax** (Raf.), comb. nov.

Fagara Duhamel, Traité Arb. Arbust. 1: 229, *t. 97* (1755).

Zanthoxylum Linnaeus, Syst. Nat. ed. 10, 2: 1290 (1759), p. p. quoad *Fagara* Duhamel; non Linnaeus (1753).

Thylax Rafinesque, Med. Bot. 2: 114 (1830).

Zanthoxylum sect. *Zanthoxylum* G. Don, Gen. Hist. Dichlam. Pl. 1: 801 (1831), non *Zanthoxylum* L. (1753), p. p.

[2] See also my proposal (in Jour. Arnold Arb. 20: 269. 1939) concerning a change of Art. 26 for the 7th Botanical Congress in Stockholm planned for 1940.

Mioptrila Rafinesque, Am. Man. Mulberry, 37 (1839).
Zanthoxylum a. *Euzanthoxylum* Endlicher, Gen. Pl. 1146 (1840). — Schneider, Ill. Handb. Laubh. 2: 118 (1907). — Non *Zanthoxylum* L. (1753).
Xanthoxylum Engler in Nat. Pflanzenfam. III. 4: 115 (1896). — Graebner in Ascherson & Graebner, Syn. Mitteleur. Fl. 7: 237 (1914). — Non *Zanthoxylum* L. (1753).

The oldest name, *Fagara* Duhamel (not listed in Index Kewensis), cannot be taken up as a subgeneric name for this subgenus, since it has been already used for another subdivision of the genus, namely *Z.* sect. *Fagara* G. Don, Gen. Hist. Dichlam. Pl. 1: 802 (1831), based on *Fagara* Linnaeus, Syst. Nat. ed. 10, 2: 897 (1759). The next oldest generic name available for this group is *Thylax* Rafinesque, with the species *T. fraxineum* Raf. (= *Z. americanum* Mill.), which is here proposed as the name for the subgenus typified by *Z. americanum* Mill. The subgeneric names sect. *Zanthoxylum* G. Don (1831) and *Z.* a. *Euzanthoxylum* Endlicher (1840) cannot be used for this subgenus, since they would imply that these groups are based on the type of the genus, which is not the case, since the type species is undoubtedly *Z. Clava-herculis* L. *Zanthoxylum* Linnaeus, Sp. Pl. 270 (1753) contains only two species: 1. Z. *Clava-herculis* and 2. *Z. trifoliatum* (= *Acanthopanax trifoliatus* (L.) Merr.) Therefore *Z. Clava-herculis* must be considered the type of the genus, though in 1759, Linnaeus (Syst. Nat. ed. 10, **2**: 1290) cites, besides Hortus Cliffortianus 487 and Catesby Car. 1, p. *26*, *t.26,* also *Fagara* Duhamel of 1754, which represents *Z. americanum* Mill. In his Genera Plantarum ed. 5, 130 (1754), Linnaeus describes *Zanthoxylum* as having no corolla, although in Hortus Cliffortianus he states that it has a small 5-parted perianth and a pentapetalous corolla with 5 ovate-oblong petals; also the figure of Catesby shows distinctly a double perianth and *Z. trifoliatum* has a double perianth.

In 1759 (Syst. Nat. ed. 10, 2: 897, 1290) Linnaeus recognizes two genera, *Fagara* and *Zanthoxylum,* chiefly distinguished by the number of stamens, four in the former, five in the latter genus, by bisexual or polygamous flowers and double perianth in *Fagara* and by dioecious flowers and simple perianth in *Zanthoxylum,* but the character of the perianth does not hold, since all the species enumerated have a double perianth and the number of stamens varies from three to eight. The species taken by all later authors as typical of *Zanthoxylum,* namely *Z. americanum* Mill. (*Z. fraxineum* Willd.), was only imperfectly known to Linnaeus and not recognized as a species, but only cited in synonymy as *Fagara* Duham., which according to Duhamel's figure represents without doubt the species later described as *Z. americanum* Mill. For the subgenus to which *Z. Clava-herculis* L. belongs, the correct name will be *Z.* subgen. *Fagara* (L.) Schneider (*Z.* sect. *Fagara* G. Don), based on *Fagara* Linnaeus (1759). If, however, the two subgenera are considered different genera, *Zanthoxylum* will be the generic name for *Z.* subgen. *Fagara* (L.) Schneid., and for *Z.* subgen. *Thylax* the generic name will be *Fagara* Duham. (1754). This just reverses Engler's arrangement and would create confusion which could only be avoided by conserving *Fagara,* which is by far the larger group in the sense of Linnaeus (1759) as amplified by Engler [1896], and accepting *Thylax* Raf. as the name for the genus typified by *Z. americanum* Mill., or by conserving both names in the sense of Engler. The two genera are close and none of the characters are strong enough for generic separation, so it seems preferable to consider them subgenera or sections of one genus, as done by most authors.

Rhododendron glaucophyllum, nom. nov.

Rhododendron glaucum Hooker f., Rhodod. Sikkim-Himal. 18, *t. 17* (1851). — Hutchinson in Rhodod. Soc., Rhodod. Sp. 300, *fig.* (1930). — Non Sweet (1830).

Rhododendron glaucum Hooker, being invalidated by the earlier homonym of *R. glaucum* (Lam.) Sweet, Hort. Brit. ed. 2, 344 (1830), has to receive a new name, since no other is available.

Rhododendron flavum [Hoffmanns.] G. Don, Gen. Hist. Dichlam. Pl. 3: 847 (1834). — Kuznetzov, Fl. Cauc. Crit. 4, 1: 31, 488 [1901, 1906]. — Non Pallas (1776), nom.

Azalea pontica Linnaeus, Sp. Pl. 150 (1753), non *R. ponticum* L. (1753).

Azalea arborea Linnaeus ex Linnaeus, Sp. Pl. ed. 2, 2: 1669 (1764), pro syn.

Azalea flava Hoffmannsegg, Verz. Pflanzenkult. Nachtr. 2: 62 (1826).

Anthodendron ponticum Reichenbach in Mössler, Handb. Gewächsk. ed. 2, 1: 308 (1827).

Rhododendron luteum Sweet, Hort. Brit. ed. 2, 343 (1830). — Wilson in Wilson & Rehder, Monog. Azalea, 103 (1921), non *Azalea lutea* Linnaeus (1753).

Rhododendron flavum var. *coronarium* Sweet, Brit. Flow. Gard. ser. 2, 4: *t. 331* (1836).

Rhododendron ponticum Schreber ex De Candolle, Prodr. 7, 2: 718 (1839), pro syn.; non Linnaeus (1762).

Azalea pontica α. *flava* De Candolle, l. c. (1839).

Anthodendron flavum Reichenbach ex K. Koch, Dendr. 2, 2: 184 (1872), pro syn.

Although this is not a new combination, it is enumerated here with complete synonymy to show that *R. flavum* is the correct name for the species usually called *R. luteum*. By Schneider (Ill. Handb. Laubh. 2: 500. 1911) the name *R. luteum* was applied to *R. calendulaceum* (Michx.) Torr., but that combination is invalidated by the older homonym of Sweet.

Rhododendron flammeum (Michx.) Sargent in Rhodod. Soc. Notes, 1, 3 (1917): 120 [1918].

?*Azalea flammea* Bartram, Travels N. & S. Carol. 323, 327 (1791), nom. subnud.

Azalea nudiflora α. *coccinea* Aiton, Hort. Kew. 1: 202 (1789). — Curtis in Bot. Mag. 5: *t. 180* (1792).

Azalea coccinea Curtis, l. c. (1792), pro syn. — Michaux, Jour. ed. C. S. Sargent in Proc. Am. Philos. Soc. 26: 9 (1889), nom.

Azalea fulva Michaux in Jour. Hist. Nat. 1: 410 (1792), nom. — Rehder in Jour. Arnold Arb. 4: 6 (1923), pro syn.

Azalea calendulacea α. *flammea* Michaux, Fl. Bor.-Am. 1: 151 (1803). — Pursh, Fl. Am. Sept. 1: 152 (1814).

Azalea speciosa Willdenow, Berlin. Baumz. ed. 2, 49 (1811). — Guimpel, Otto & Hayne, Abb. Fremd. Holzart. 1: 37, *t. 31* (1825).

Azalea periclymenoides α. *coccinea* Pursh, Fl. Am. Sept. 1: 152 (1814).

Azalea nudiflora sensu Loiseleur, Herb. Gén. Amat. 4: 213, *t.* (1820), non Linnaeus (1762).

Azalea calendulacea var. a. Elliot, Sketch Bot. S. Carol. 1: 239 (1821), p. p.
Azalea coccinea major Loddiges, Bot. Cab. 7: *t. 624* (1822).
Azalea speciosa α. *major* Sweet, Hort. Brit. 265 (1826).
?*Azalea nudiflora* var. *thyrsiflora* Gowen ex Lindley in Bot. Reg. 16: *t. 1367* (1830).
Rhododendron speciosum Sweet, Hort. Brit. ed. 2, 343 (1830), p. p., quoad "α. *major*." — G. Don, Gen. Hist. Dichlam. Pl. 3: 848 (1834). — Rehder in Wilson & Rehder, Monog. Azal. 131 (1921). — Non Salisbury (1796).
Rhododendron nudiflorum ζ. *coccineum* Sweet, l. c. (1830). — G. Don, op. cit. 847 (1834).
Azalea speciosa α. *coccinea* De Candolle, Prodr. 7, 2: 717 (1839).
Azalea calendulacea sensu Darby, Bot. S. Stat. 422 (1855), p. p. ; non Michaux (1803).
Rhododendron calendulaceum sensu Chapman, Fl. S. U. S. 265 (1860), p. p. ; non Torrey (1824).
Rhododendron calendulaceum f. *speciosum* Voss, Vilmor. Blumengärt. 1: 588 (1894).

Like the preceding species, this does not represent a new combination. It is enumerated here with complete synonymy to show that *R. flammeum* is its correct name; it is not listed in Index Kewensis. The species has been known for a long time as *R. speciosum* (Willd.) Sweet, but has been confused particularly with the red-flowered form of *R. calendulaceum* (Michx.) Torrey, from which it differs chiefly in the shape and pubescence of the corolla-tube; also the geographical distribution of the two species is different, *R. calendulaceum* being a plant of the Appalachian Mountains region from Pennsylvania to northern Georgia, while *R. flammeum* is found in the coastal plain region from central Georgia to South Carolina. Unfortunately, the name *R. speciosum* (Willd.) Sweet (*Azalea speciosa* Willd.), under which this species has been known for some time, is a later homonym of *R. speciosum* Salisb., which, although it is only a renaming of *R. ponticum* L. and therefore illegitimate, invalidates the later *R. speciosum* Sweet according to Art. 61 of ed. 3 of the Rules of Botanical Nomenclature adopted in 1930. For further details concerning this species, see my remarks in Wilson & Rehder, Monograph of Azaleas, 131–134 (1921).

Syringa laciniata Miller, Gard. Dict. ed. 8, *S.* no. 3 (1768). — Duroi, Harbk. Baumzucht, 2: 447 (1772). — K. C. Gmelin, Fl. Badens. 1: 14 (1805).
Syringa persica β. Linnaeus, Sp. Pl. 9 (1753).
Syringa persica 4. *laciniata* Weston, Bot. Univ. 1: 289 (1770). — Aiton, Hort. Kew. 1: 15 (1789) "γ". — Voss, Vilmor. Blumengärt. 1: 653 [1895], as forma. — McKelvey, Lilac, 450, *t. 140–147* (1928), var. — Rehder, Man. Cult. Trees Shrubs, ed. 2, 782 (1940), var.
Syringa capitata S. G. Gmelin, Reise Russl. 3: 304, *t. 32, fig. 1* (1774).
Lilac persica β. Lamarck, Encycl. Méth. Bot. 3: 513 [1791].
Lilac Persica laciniata Dumont de Courset, Bot. Cult. 1: 709 (1802), as synon. — Mirbel in Duhamel, Traité Arb. Arbust. éd. augm. [Nouv. Duhamel], 2: 208 [1804].
Liliacum laciniata Rénault, Fl. Dépt. Orne, 100 (1804).
Siringa persica laciniata Thiriart, Cat. Pl. Arb. Jard. Bot. Cologne, sér. 3: 1 (1806), *Syringa* in indice.
Syringa persica γ. *pteridifolia* Bosse, Handb. Blumengärt. ed. 2, 3: 461 (1842). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 91 (1920) "α. *typica* f. *pt.*", nom.
Syringa persica var. *pinnata* Jacques in Ann. Fl. Pomone, sér. 2, 1: 274, *t.* (1843). — Lingelsheim, l. c. (1920) "var. *typica* f. *p.*", nom.

For numerous citations of additional literature and pre-Linnaean as well as additional horticultural synonyms not cited here, see McKelvey, Lilac, 450–452 (1928).

Syringa persica [*S. afghanica* × *laciniata*] Linnaeus, Sp. Pl. 9 (1753), exclud. *β*. — Miller, Gard. Dict., ed. 8, *S.* no. 2 (1768). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 90 (1920). — McKelvey, Lilac, 433 (1928).

Syringa persica α. Linnaeus, Sp. Pl. 9 (1753).

Syringa persica 3. *coerulea* Weston, Bot. Univ. 1: 289 (1770).

Lilac persica et *L. persica* α. Lamarck, Encycl. Méth. Bot. 3: 513 [1791].

Lilac minor Moench, Meth. Pl. 431 (1794).

Syringa angustifolia Salisbury, Prodr. Stirp. Chap. Allert. 14 (1796).

Lilac persica ligustrina Mirbel in Duhamel, Traité Arb. Arbust. éd. augm. 2: 207 [1804].

Syringa persica α. *integrifolia* Vahl, Enum. Pl. 1: 38 (1805).

Syringa persica var. *typica* Schneider, Ill. Handb. Laubh. 2: 775, *fig. 485k-n, 486n-q* (1911). — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 90 (1920), p. p.

For numerous citations of additional literature and pre-Linnaean as well as additional horticultural literature not cited here, see McKelvey, Lilac, 433–436 (1928).

When Dr. Sax showed me the manuscript of his paper on "Lilac species hybrids," published in this number of the Journal, my attention was again drawn to the fact that *S. persica* is highly or completely sterile and that it never had been found wild in any country. Already Schneider in 1903 (in Wien. Ill. Gartenzeit. 28: 90), discussing the origin of *S. persica,* voices the opinion that it might be a hybrid of his *S. afghanica,* first described in the paper cited, and suggests that the other parent might be a cross of *S. vulgaris.* The spontaneous occurrence of *S. persica* var. *laciniata* in northwestern China was not known at that time, and Schneider (in his Ill. Handb. Laubh. 2: 775. 1911) states that the latter is possibly a variety of *S. afghanica* originated in cultivation. In regard to the origin and the greatly varying opinion about the valuation of *S. persica* and related forms, Mrs. McKelvey gives ample and detailed accounts in her monumental work "The Lilac" on pages 428–431, 436–445 and 452–459. As there can hardly be any doubt that the group generally called *S. persica* is a heterogeneous concept consisting of two different elements, a spontaneous species and a hybrid originated in cultivation, it cannot be maintained as a taxonomic unit, but should be separated as done above into the spontaneous species *S. laciniata* Mill. and the hybrid *S. persica* L. The hybrid apparently originated in Persia, whence *S. laciniata* had been introduced from northwestern China and *S. afghanica* from Afghanistan, although there is no actual proof, as far as I know, that *S. afghanica* had been in cultivation in Persia. *Syringa laciniata* seems to have a much wider distribution in cultivation; besides a specimen from Persian gardens there are in this herbarium specimens from gardens in Honan and Chile and a fragment from a specimen collected in Kashmir (*Srinuggur 5200*), grown as a hedge plant. In Honan it has apparently hybridized with *S. oblata* Lindl., for a specimen from a garden in Chengchow (*Hers 196,* April 24, 1921) is unmistakably intermediate between *S. oblata* and *S. laciniata*. This specimen has the large inflorescence and flowers with the stamens inserted much below the mouth as in *S. oblata* and leaves predominantly similar to those of *S. oblata*, only smaller and narrower and on one branch partly trifoliolate with acute oblong to elliptic leaflets, suggestive of those of *S. laciniata*. This specimen is also mentioned by Mrs. McKelvey under *S. chinensis* (Lilac, p. 404), but the insertion of the anthers shows clearly that it has nothing to do with *S. chinensis* or *S. vulgaris*. There is no evidence that *S. vulgaris* was cultivated in China or in Persia. It was introduced from southeastern Europe to western European gardens by way of Constantinople and was probably not known in Asiatic gardens before the twentieth century.

Since the account of the subdivision of *Syringa* in 1928 in McKelvey, The Lilac, p. 11, I have made some slight changes in the evaluation of the groups and added a new series. The incompatability, as shown by Sax (see p. 80 of this issue), of the species of subser. *Euvulgares* and those of subser. *Pubescentes* has led me to elevate the latter to the rank of series. The new series, *Pinnatifoliae*, proposed in 1922, is closely related to the ser. *Vulgares* and hybridizes with species of that series, but on account of such obvious morphological characters as pinnate leaves and the presence on the flowering branches of a terminal bud developing into a leafy shoot, it seems preferable to maintain it as a series.

With these changes the subdivisions of *Syringa* will be as follows:

Subgen. I. EUSYRINGA K. Koch, Dendr. 2, 1:.265 (1872).—Knoblauch in Nat. Pflanzenfam. IV. 2: 8 [1892] "sect."—Rehder in McKelvey, Lilac, 11 (1928) "sect."

Ser. 1. VILLOSAE Rehder in McKelvey, l. c. (1928).—Rehder, Man. Cult. Trees Shrubs, 777 (1940).

Syringa subgen. *Eusyringa* sect. *Villosae* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 80 (1910) "sect.", nom. subnud.; Ill. Handb. Laubh. 2: 778 (1911) "sect."—Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 75 (1920) "subsect."

Ser. 2. PUBESCENTES Lingelsheim in op. cit. 87 (1920) "subsect. *Vulgares* ser. *P.*"

Syringa subgen. *Eusyringa* sect. *Vulgares* subsect. *Pubescentes* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 80 (1910), nom. subnud.; Ill. Handb. Laubh. 2: 772 (1911).—Rehder in McKelvey, Lilac, 11 (1928) "sect. *Eusyringa* ser. *Vulgares* subser. *Pubescentes*."

Ser. 3. VULGARES Rehder in McKelvey, Lilac, 11 (1928) "sect *E.* ser. *V.*", exclud. subser. *Pubescentes*.

Syringa subgen. *Eusyringa* sect. *Vulgares* subsect. *Euvulgares* Schneider in Repert. Sp. Nov. Reg. Veg. 9: 79 (1910), nom. subnud.; Ill. Handb. Laubh. 2: 772 (1911). —Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 87 (1920) "sect. *Eusyringa* subsect. *Vulgares* ser. *Euvulgares*."

Ser. 4. PINNATIFOLIAE Rehder in Jour. Arnold Arb. 20: 427 (1939).

Subgen. II. LIGUSTRINA (Rupr.) K. Koch, Dendr. 2, 1: 271 (1872).

Syringa sect. *Ligustrina* Ruprecht in Bull. Phys. Math. Acad. Sci. St. Pétersb. 15: 371 (in Mél. Biol. 2: 551) (1857).—Maximowicz in Mém. Div. Sav. Acad. Sci. St. Pétersb. 9: 193 (Prim. Fl. Amur.) (1859).—Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 92 (1920).—Rehder in McKelvey, Lilac, 12 (1928).

Ligustrina (Rupr.) Ruprecht in Beitr. Pflanzenk. Russ. Reich. 11: 55 (1859).—Maximowicz in Bull. Acad. Sci. St. Pétersb. 20: 432 (in Mél. Biol. 9: 395; Diagn. Pl. Nov. Jap. Mandsh. dec. XIX) (1875).

Syringa oblata Lindl. var. **dilatata** (Nakai) Rehd. f. **pendula,** f. nova.

A *S. oblata* var. *dilatata* differt ramis ramulisque pendulis saepe leviter flexuosis.

Cultivated specimens in Herb. Arnold Arb.: Hort. Mrs. Daniel C. Hunt, Haverhill, Mass., *D. Wyman,* Oct. 12, 1938 (with photograph showing the habit) and May 23, 1940 (flowering branch); Arnold Arb. no. *291–40* (cutting from the original plant), *A. Rehder,* Oct. 2, 1944.

The photograph of the plant in the garden of Mrs. Hunt shows a shrub of globose outline with spreading pendulous branches often more or less wavy and about 1.5 m. tall at the time; the plant in the Arnold Arboretum is of similar shape but smaller. The original plant was obtained by Mrs. Hunt about 1926 from the Kelsey Nurseries in Boxford, Mass., where it must have been raised from seed sent by E. H. Wilson from Korea in 1917 to the Arnold Arboretum as *Syringa* spec., the first introduction of *S. oblata* var. *dilatata* into cultivation. The plant obtained by Mrs. Hunt was apparently the only one showing a pendulous habit; none of the plants raised at the Arboretum from Wilson's seed showed any variation in habit.

Lavandula officinalis L. f. **alba** (Gingins-Lass.), comb. nov.

Lavandula vera β. alba De Gingins-Lassaraz, Hist. Nat. Lavandes, 147 (1826).

Lavandula Spica β. alba Sweet, Hort. Brit. 316 (1827), nom. subnud.; non Weston (1770).

Lavandula officinalis f. *albiflora* Rehder in Jour. Arnold Arb. 20: 428 (1939).

When in 1939 (l.c.) I published the new name *Lavandula officinalis* f. *albiflora,* because *L. Spica β. alba* Sweet is invalidated by the earlier homonym of Weston, which represents a form of a different species, namely *L. latifolia* DC., I did not know of the publication by Gingins-Lassaraz in 1826 of *L. vera β. alba* containing the subspecific epithet *alba* in a validly published combination, one year earlier than the invalid *L. Spica β. alba.*

Viburnum plicatum Thunb. f. **tomentosum** (Thunb.), grad. nov.

Viburnum tomentosum Thunberg, Fl. Jap. 123 (1784). — Rehder in Sargent, Trees Shrubs, 2: 108 (1908); Man. Cult. Trees Shrubs, ed. 2, 835 (1940). — Non Lamarck (1778), nec Rafinesque (1808), nec Hance (1870).

Viburnum plicatum sensu Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 266 (Prol. Fl. Jap. 154) (1866), non Thunberg (1794).

Viburnum plicatum γ. tomentosum Miquel, l. c. (1866).

Viburnum tomentosum f. *typicum* Zabel in Beissner et al., Handb. Laubh.-Ben. 441 (1903).

As *Viburnum tomentosum* Thunb. is invalidated by the earlier homonym *V. tomentosum* Lam. (1778), the next oldest valid binomial has to be taken up, in this case *V. plicatum* Thunberg in Trans. Linn. Soc. Lond. 2: 332 (1794), which represents the double-flowered form of the species named by Thunberg ten years earlier *V. tomentosum.* Thus a teratological garden form becomes the nomenclatural type of *V. plicatum,* to which all the names of the double-flowered form are referable as synonyms except *V. plicatum* f. *rotundifolium,* which is best considered a distinct form, while the phylogenetic type represented by *V. tomentosum* becomes a form of *V. plicatum.*

Similar cases occur in the genus *Rosa,* where in several instances the double-flowered form was known and named earlier than the wild single-flowered phylogenetic or biological type.

Viburnum plicatum f. rotundifolium (Rehd.), comb. nov.

Viburnum tomentosum var. *rotundifolium* Hort. ex Rehder in Bailey, Cycl. Am. Hort. [4]: 1925 (1902); in Sargent, Trees & Shrubs, 2: 108 (1908) "f."

This form differs from the type of *V. plicatum* only in the broader leaves and in the flowers appearing about two weeks earlier.

Viburnum plicatum f. Mariesii (Veitch), comb. nov.

Viburnum tomentosum Mariesii Veitch in Jour. Hort. Soc. Lond. 27: 860, *fig. 195* (1902) "var." *sub fig.*

This form differs from *V. plicatum* f. *tomentosum* only in the larger cymes and larger flowers.

Viburnum plicatum var. lanceatum (Rehd.), comb. nov.

Viburnum tomentosum var. *lanceatum* Rehder in Sargent, Trees & Shrubs, 2: 109 (1908).

This variety is similar to *V. plicatum* var. *parvifolium* Miquel, but differs chiefly in the narrower, more gradually acuminate leaves, lanceolate on the shoots and more densely stellate-pubescent beneath.

Gramineae subfam. **Bambusoideae**, comb. nov.

Gramina . . . Bambusacea Kunth in Mém. Mus. Hist. Nat. Paris, 2: 75 (1815).

Gramineae IX. *Bambusinae* Agardh. Aphor. Bot. 153 (1817).

Gramineae sect. *Bracteaeflorae* Link, Handb. Erkenn. Gew. 1: 95 (1829).

Gramineae 10. *Bambuseae* Kunth ex Lindley, Introd. Nat. Syst. Bot. 304 (1830). — Hackel in Nat. Pflanzenfam. II. 2: 89 (1887) "*Gramineae* trib. *B.*"

Bambusaceae Link, Hort. Berol. 2: 308 (1833). — Nakai, Fl. Sylv. Kor. 20: 11 (1933).

Gramineae subtrib. *Bambusaceae* Endlicher, Gen. Pl. 102 [1836]. — Steudel, Syn. Pl. Glum. 1: 329 (1855) "trib."

Gramineae trib. *Festucaceae* subtrib. *Bambuseae* Meissner, Pl. Vasc. Gen. 1: 425; 2: 325 (1843).

Graminaceae D. *Festucinae* d. *Bambuseae* Horaninov, Char. Ess. Fam. Reg. Veg. 35 (1847).

Gramina subfam. *Bambusoideae* Ascherson & Graebner, Syn. Mitteleur. Fl. 2, 1: 769 (1902).

As *Gramineae* is a *nomen conservandum* with an alternative name ending in "aceae," the family name used by Ascherson & Graebner in combination with the subfam. *Bambusoideae* cannot be accepted and the new combination proposed above becomes necessary, if this subdivision of the family is considered a subfamily. In regard to the citation of the parenthetical author, see note under Pinaceae subfam. Taxodioideae (p. 68).

ARNOLD ARBORETUM,
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LILAC SPECIES HYBRIDS

Karl Sax

With one plate

There is a remarkable correlation between the taxonomic classification of the species of *Syringa* and the genetic affinities of the species. In Mrs. McKelvey's monograph (1928) of the lilacs, the genus was separated by Rehder into two sections, two series, and two subseries. No hybrids have ever been obtained from crosses between species of different sections, series, or subseries, but within these units there is considerable genetic compatability.

More recently, Redher (1945) has indicated that the sections are worthy of subgeneric rank, as *Eusyringa* and *Ligustrina*. The subgenus *Eusyringa* is divided into four series, the *Villosae, Pubescentes, Vulgares,* and *Pinnatifoliae*. The *Pinnatifoliae* have been separated from the *Vulgares* on morphological grounds, although there is considerable genetic compatability between these two series. The *laciniata* variety of *S. persica* has been raised to specific rank, and the typical *S. persica* and its entire-leaved varieties are now classed as hybrids. The nomenclature used in this survey is based upon Rehder's classification of the genus (McKelvey, 1928; Rehder, 1945).

Crosses have been made between various species of *Syringa,* but most of them have been made between rather closely related species. Improved types of lilacs of the *Villosae* series have been obtained from crosses between *S. Josikaea* and *S. villosa* made by L. Henry, and from crosses between *S. reflexa* and *S. villosa* which have produced the various forms of the *S. Prestoniae* hybrids. Within the *Vulgares* series crosses between *S. oblata* and *S. vulgaris* have given rise to the hybrid *S. hyacinthiflora* and to the various Lemoine hybrids, but these hybrids differ from the common lilacs only in the time of flowering and a few other minor characters. The only new distinctive types of lilacs of ornamental value have been obtained from crosses between *S. laciniata* and *S. vulgaris.*

Within the subgenus *Eusyringa* there is more or less genetic compatability between species. In the *Villosae* series there are nine species. All are of Asiatic origin with the exception of *S. Josikaea,* which is a native of the Carpathian Mountains. Five of the nine species, including *S. Josikaea,* have been used in various combinations to obtain species hybrids, and it is possible that all of the *Villosae* species are inter-fertile to some degree. However, even the species crosses which produce some vigorous hybrids also produce some abnormal plants. According to Miss Preston (McKelvey, 1928), the cross between *S. reflexa* and *S. villosa* results in a large proportion of dwarf and variegated progeny as well as plants which are very vigorous.

The species of the *Pubescentes* series are all of Asiatic origin and many of them are rather similar in general morphological characters; yet species hybridization in this group of lilacs is limited. During the past fifteen years we have attempted to combine the fragrance of *S. pubescens* with the more attractive flowers of *S. velutina, S. Potanini, S. microphylla,* and other species. Many of the crosses produce viable seeds, but the seedlings are albinos and soon die. Occasionally a variegated seedling survives but grows slowly. Several hybrid plants from the cross of *S. velutina* × *S. pubescens* have survived for ten years, but they are small and poorly developed. A cross between *S. pubescens* and *S. Potanini* produced a number of seedlings which are now two years old, but they lack vigor and probably will not survive. The only vigorous hybrid obtained in this subseries was from a cross between *S. Potanini* and *S. microphylla,* but this cross also produced some dwarf seedlings. It is possible that certain other combinations would also produce some vigorous hybrids, but as a group there is considerable incompatibility among the species of the *Pubescentes.*

The species of the *Vulgares* series include *S. vulgaris, S. oblata,* and *S. laciniata. Syringa vulgaris* is a native of southeastern Europe, while the other species are indigenous in China. There is considerable genetic affinity among these species. Crosses between *S. vulgaris* and *S. oblata* have produced many vigorous hybrids in the past and we have grown a number of second generation segregates. Both spontaneous and artificial hybrids of *S. vulgaris* and *S. laciniata* have been grown. According to Rehder (1945), a hybrid between *S. oblata* and *S. laciniata* has been found in a garden in Chengchow, China. We have obtained viable seeds from a cross between *S. laciniata* and a variety of *S. oblata.*

The series *Pinnatifoliae* is represented by a single species, *S. pinnatifolia.* Although this is a distinct species, it is rather closely allied to species of the *Vulgares* series. It produces hybrids with *S. oblata* varieties which are vigorous but sterile (Rehder, 1935). It is probable that it will also cross with *S. vulgaris.* We have obtained hybrids between *S. laciniata* and *S. pinnatifolia;* these hybrids are uniform and vigorous.

The hybrids of greatest horticultural value have been obtained from crosses between *S. laciniata* and *S. vulgaris.* The first hybrids were obtained from a spontaneous cross in the Botanical Garden at Rouen. In 1777 Varin, the director of the garden, planted open pollinated seeds of *S. laciniata* and obtained the hybrid first known as the Varin lilac or *S. rothomagensis,* and now known as *S. chinensis.* Varin did not recognize the progeny of the cut-leaved lilac as a natural hybrid of *S. laciniata* × *S. vulgaris,* but considered it as the normal progeny of a degenerate or abnormal form of the Persian lilac (McKelvey, 1928).

At the end of the 19th century, hybrids between *S. laciniata* and *S. vulgaris* were produced through artificial pollination by L. Henry and by E. Lemoine. The hybrids were similar to those obtained by Varin, but varied according to the variety of the *S. vulgaris* parent used in the cross. Mrs. McKelvey recognizes about a dozen forms of *S. chinensis.* Several varieties have originated as bud sports. These hybrids are generally considered to be the most attractive of all lilacs. They tend to resemble the Persian lilac in habit of growth and inflorescence, but the leaves usually are entire, as in the *S. vulgaris* parent. The Chinese lilacs are sterile and there is no conclusive evidence that they have ever produced viable seeds either spontaneously or as the result of artificial pollination.

The subgenus *Ligustrina* of *Syringa* includes three species, all of Asiatic origin. Little is known of their genetic relationships, as they are not of great horticultural interest. We have tried to obtain hybrids between these tree lilacs and species of the *Villosae* and *Vulgares* groups, but with no success.

In view of the remarkable correlation between the taxonomic classification and the genetic compatibility of the species of *Syringa,* the former taxonomic status of the Persian lilac was an enigma. The typical form of *S. persica* is a plant with predominantly entire leaves and resembles × *S. chinensis,* a known hybrid between *S. laciniata* and *S. vulgaris.* It is highly or completely sterile, although L. Henry in 1897 tells of crossing *S. vulgaris* with an entire-leaved Persian lilac and obtaining several dozen seedlings. There is, however, no record of seed production on any of the entire-leaved forms of *S. persica.* The typical form is not a native of Persia, nor has it been found wild in any part of the world. Mrs. McKelvey has shown that it was first recorded in 1660, fifty years after *S. laciniata* was described by a French naturalist, who obtained the variety from Italy as *Ligustrum nigrum.*

In 1900 E. Lemoine suggested that *S. persica* was a hybrid between *S. persica laciniata* and *S. vulgaris.* There is, however, no record of *S. vulgaris* in Persia, either as an indigenous or as an introduced plant, at the time of the origin of *S. persica.* It is possible that the obscure species *S. afghanica* was the entire-leaved parent. There is no doubt that *S. laciniata* was the other parent, because it was the only available species which could have contributed the genes for the occasional cut and laciniate leaves of *S. persica.* Cytological studies by Tischler (1930) and by the author (Sax, 1930) have shown that the meiotic divisions in *S. persica* are very irregular. The evidence from distribution, genetic behavior, and cytological analysis confirms Lemoine's conclusion that the typical *S. persica* is a hybrid and is allied to × *S. chinensis.*

Syringa laciniata is the only Persian lilac known to exist as an indigenous species. It was collected by F. N. Meyer in 1915 in Kansu, China. Seeds sent to the Arnold Arboretum produced plants which, according to Mrs. McKelvey (1928), were identical with the cut-leaved variety long known in cultivation as *S. persica laciniata.* It is evident that the cut-leaved variety is the only true species of Persian lilac and that it is a native not of Persia, but of China. Presumably it was introduced into Persia over the old trade routes from China long before the 17th century.

The entire-leaved Persian lilacs and all varieties of *S. chinensis* grown in the Arnold Arboretum are sterile. Occasionally *S. chinensis* sets a few partially developed seeds, but none have been viable. We have had no success in crossing these species with either *S. vulgaris* or *S. laciniata*. Earlier cytological studies (Sax, 1930) showed great cytological irregularity at meiosis with about 12 bivalents and 12 univalents. Since all pure species of *Syringa* have 22–24 pairs of chromosomes, the apparent cytological behavior of the hybrids was difficult to explain. More recent studies show that the normal chromosome number is present at diakinesis, but the pairing is loose and irregular.

Our crosses between *S. laciniata* and *S. vulgaris* have set seeds and most of the seedlings have lived for one or two years, but we have obtained no mature plants. In 1939 and in 1940 open pollinated seeds were collected from the only remaining specimen of *S. laciniata* in our collections. A total of 243 plants was grown. Of these only six had the cut leaves characteristic of the seed parent. These seedlings during the first few years were entirely cut-leaved and the leaves were more pinnate than those of the mature seed parent. In fact, these plants appeared to be a new and distinct type of lilac. In the fifth year, however, these segregates lost their juvenile characters and began to resemble the mature maternal parent, and were very similar to four-year-old cuttings from the parent plant. The transition from the juvenile form to the mature plant is shown in *Figure 1*. These seedlings are fertile and are undoubtedly the result of self-pollination which reproduces the parental species.

The remaining 237 seedlings all were predominantly entire-leaved as they developed. Most of these plants survived for only one or two years and only five have survived to 1944. Two of the survivors have flowered but have set no seeds. In every respect they resemble *S. chinensis* and certain forms of *S. persica* except that they are less vigorous. The leaf types of the two parents and of a form of *S. chinensis* are shown in *Figure 2*. The entire-leaved seedlings must be spontaneous hybrids between *S. laciniata* and the surrounding specimens of *S. vulgaris*. The fact that most of the seedlings were weak and did not survive apparently is not unusual in this and other species hybrids of *Syringa*. Although Varin is reported to have planted open pollinated seeds of *S. persica laciniata* for many years and no doubt Lemoine made many artificial crosses, yet we have only about a dozen varieties of the hybrids. Since there are hundreds of varieties of *S. vulgaris*, an equal number of *S. chinensis* hybrids could be obtained if the cross were fully compatible. Apparently *S. laciniata* is highly, but not completely, self-sterile. It sets a few selfed seeds, but is usually cross-pollinated, and will cross spontaneously with adjacent specimens of *S. vulgaris*. Most of the resulting seeds are viable, but only a few develop into vigorous mature plants.

Syringa chinensis and *S. persica* have predominantly entire leaves, but all forms have some lobed or laciniate leaves. The prevalence of entire leaves varies in different varieties of the hybrids. The frequence of cut leaves appears to depend upon the vigor of the plant, and different branches of the same plant may vary greatly in leaf form. The leaf types of mature hybrids are shown in *Figure 3*. These specimens are from different plants, but similar variation often can be found on the same plant.

Further evidence of the genetic nature of *S. laciniata* is provided by the results of crossing with *S. pinnatifolia*. The F_1 seedlings are vigorous and uniform. The leaves of the parents and the hybrid are shown in *Figure 4*. The twigs of the parent species are from mature plants, while that of the F_1 is from a two-year-old seedling. As the hybrid matures the leaf characters may become more intermediate. The uniformity of the eight F_1 plants indicates that both parents are relatively homozygous. *Syringa pinnatifolia* is highly self-sterile and sets seed only when pollinated by adjacent *S. oblata* (Rehder, 1935) or perhaps *S. vulgaris* plants. The natural hybrids are relatively uniform and are sterile, but are of little horticultural value. The *S. laciniata* × *S. pinnatifolia* hybrids are attractive shrubs and should be of considerable horticultural value if the flowers prove to be at all attractive.

SUMMARY

There is a remarkable correlation between the taxonomic classification of the genus *Syringa* and the genetic compatibility of the 28 species. With one exception the species which belong to different subgenera and series have not been crossed spontaneously or by artificial pollination. Species within these taxonomic units show considerable genetic compatibility, although many of the hybrids often lack vigor and most of them are sterile. *Syringa pinnatifolia,* the sole species of the *Pinnatifoliae* series, can be crossed with *S. oblata* and *S. laciniata* of the *Vulgares* series, but is placed in a distinct series on morphological grounds.

The species hybrids of greatest horticultural value have been obtained from crosses between *S. laciniata* and *S. vulgaris* and are known as × *S. chinensis*. The entire-leaved Persian lilacs also are hybrids involving *S. laciniata* and an entire-leaved species — *S. afghanica* or *S. vulgaris*.

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EXPLANATION OF PLATE I

FIG. 1. Variation in foliage of *S. laciniata*. Juvenile stage at left from a four-year-old seedling. Transitional stage in center from five-year-old seedling. At the right are three specimens from the same mature plant. FIG. 2. Foliage of *S. laciniata* and *S. vulgaris*, with the hybrid *S. chinensis* between. FIG. 3. Variation in foliage of *S. persica*. These specimens were from different varieties, but similar variation often can be found on a single plant. FIG. 4. Foliage of *S. laciniata* (left) and *S. pinnatifolia* (right), and of the F_1 hybrid seedling.

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Lilac Species Hybrids

ON THE UNDERGROUND PARTS OF TACCA PINNATIFIDA J. R. & G. FORST. (1776) = TACCA LEONTOPETALOIDES (LINN.) O. KUNTZE

E. D. MERRILL

With two plates

WHEN I undertook the preparation of the illustrations for Technical Manual 10–420[1] in the fall of 1942, naturally one of the species that I wished to include was the plant currently known as *Tacca pinnatifida* J. R. & G. Forst., the so-called Polynesian arrow-root. This is essentially a strand species in certain parts of the Old World tropics, and in former years it was an important source of food for the various native peoples inhabiting the vast area covered by its range. In earlier years it was actually cultivated by various peoples and in various localities all the way from India to Hawaii as well as in central Africa; as noted below, its present-day range in the Pacific region may be largely or perhaps wholly due to its ancient cultivation there. In modern times its actual cultivation has largely ceased. Its fairly large tubers are intensely bitter and are reported to be poisonous if eaten; yet the starch is easily extracted by maceration and washing, and, as finally prepared, it was utilized as food.

I turned to the published literature with confidence that I could locate a good illustration of its underground parts, for in excess of 25 pictures exist in botanical and horticultural literature. In this search I was disappointed. Being personally familiar with the plant, having seen it some thirty years ago as it occurs in nature, I knew what to expect, and yet when it came to preparing an illustration I did not dare to depend on my memory after the lapse of so many years. As a result, the drawing I had prepared for the Technical Manual depicts only those parts of the plant above the surface of the ground. Apparently in my years of tropical service I assumed, as others had done, that everything worthy of note regarding the underground parts of this striking species had been recorded in botanical literature, for many scores of descriptions have been published, to say nothing of the numerous illustrations. In all the literature examined I have found only two good descriptions of the underground parts, those of Rumphius in 1747 and Degener in 1932, but no really good illustrations.

It is indeed curious that good illustrations of the underground parts of this species apparently do not exist. In earlier years, in addition to its extensive cultivation here and there in the Old World tropics and the com-

[1] MERRILL, E. D. Emergency food plants and poisonous plants of the Islands of the Pacific. War Department, Technical Manual 10–420: 1–149. *f. 1–113.* 1943. Government Printing Office, Washington. Available from the Superintendent of Documents, price 15 cents.

mon utilization of its starch as food, it was commercially exploited in Polynesia, for the prepared starch, known as Tahiti arrow-root and as Polynesian arrow-root, was exported to Europe. In the middle of the last century large shipments are reported to have been made from Honolulu to San Francisco, particularly at the time of the gold rush to California in 1849–50.

In the special literature on economic plants there are numerous references to the actual cultivation of this *Tacca*, but today it apparently receives little attention. Dr. Harold St. John, of the University of Hawaii, informs me that it was formerly extensively cultivated in Hawaii, and that it was an important food plant. Some plantings were carefully attended, but in other places it was allowed to grow unattended in brush-lands adjacent to cultivated tracts. He notes that it is still cultivated by a few natives in the Kona District on the Island of Hawaii, but that its tubers are no longer shipped to Honolulu; further, that it also persists near the sites of former Hawaiian habitations on all the larger islands of the group. Being familiar with the plant as it occurs not only in Hawaii but also on Mehetia, Mangareva, Pitcairn, Rapa, Rurutu, Rotuma, and in Fiji, he is of the opinion that its occurrence and distribution in Polynesia are due to its tubers having been carried from one island to another by the early Polynesians, and he even suggests that it is a crop plant unknown in the wild.

This may be true for the Pacific islands, but it does not apply to those parts of Malaysia with which I am familiar. I believe that in the Malay Archipelago it is a native littoral species, and further, that its present-day distribution in Malaysia is probably due to its buoyant seeds having been floated here and there by ocean currents, assuming of course that they may retain their viability for some time while floating in salt-water. I base this belief on Guppy's observations as well as my own.

This belief is confirmed by the observations of Ridley,[2] who states, p. 318, that the plant grows in sand on the seashore and that its seeds have a spongy testa, by means of which they float for many months. He accounts for its wide distribution in central Africa (and this would apply to its occurrence in cultivation in parts of India) and perhaps to some extent for its abundance in the Polynesian islands by the utilization of its tubers as food, with the significant statement that: "In the intermediate area [i. e., Malaysia] it is rarely if ever used for food, and is not planted." Yet Rumphius notes the use of its starch for food in Amboina at the end of the sixteenth century, and Blanco, in 1837, states that the starch, known as *gaogao*, was sold in the Manila markets. Thus it may well have been cultivated here and there in the Malay Archipelago in earlier times.

In the Philippines one occasionally notes scattered plants in inland localities, but in such places the species is rare. However, on various small, isolated, and uninhabited islands — and such islands where I observed it are quite incapable of supporting human life, being unadapted to agricul-

[2] Ridley, H. N. Dispersal of plants throughout the world. i–xx. 1–744. *t. 1–22.* 1930.

tural pursuits — one frequently finds the species in abundance. On such islands it is found immediately back of the seashore, in deep sand heavily charged with comminuted vegetable debris, well above high-tide mark, in the partial shade of beach thickets and forests, but yet where the sand is at times disturbed by wave action. This observation as to its natural habitat being near the seashore conforms with those of others, notably Rumphius, who for this particular species selected the name *litorea* because of its characteristic habitat. On such islands as above noted I never observed it inland from the seashore. Guppy,[3] in contrasting *Tacca pinnatifida* with another species, states that the seeds of *Tacca pinnatifida* float for months, and that they owe their buoyancy to the spongy tissue developed in their seed-coverings. Unfortunately, he did not determine how long the seeds floating in salt-water retained their viability; this, as with the seeds of such species as *Hibiscus tiliaceus* Linn. and other widespread strand plants, would seem to be a desirability.

Here is apparently a species native of certain littoral parts of the Malay Archipelago and distributed through natural means throughout that region and perhaps to littoral regions of southern Asia, but which has further been distributed by man in various parts of India, especially inland, and to the wide stretches of the Pacific Ocean. However, the objective of this short paper is to discuss the underground parts of the plant, rather than its origin and how it was distributed. Whatever the method or methods of distribution, its present range extends from India and Ceylon to Indo-China and Formosa, southward through Malaysia to the northern parts of Australia and New Caledonia, and throughout the Pacific region as far east as Hawaii and the Marquesas Islands. It is suspected that the African material referred by Limpricht to another species actually represents the one here discussed.

In checking the numerous listed illustrations, I note that the first published one, that of Ammann in 1741, does show two tubers, but here possibly because the artist may have superimposed the basal parts of two plants, one in flower and one in fruit (*Plate 2, f. A*). This first published picture of the underground parts is the best one yet issued in that possibly it does depict the original tuber and the new primary tuber terminating a short rhizome.

In the horticultural literature, generally speaking, only those parts of the plant above ground are shown, the various authors who published colored plates prepared from living specimens apparently having been interested only in the ornamental aspects of the plant. A few botanical illustrations do show the beginning of the development of the specialized tuber-bearing rhizomes. Curiously, several of the modern illustrations go back to Rumphius (1747), sometimes as to the habit, more frequently as to the underground parts, which are not too well depicted, although excellently

[3] Guppy, H. B. Observations of a naturalist in the Pacific between 1896 and 1899, 2: 19. 1906. (Plant dispersal).

described by him. In the recent standard monographic treatment[4] of 1928, the only illustration of this very common and widely distributed species was taken wholly from Rumphius. This is *Tacca litorea* Rumph. Herb. Amb. 5: 328. *t. 114.* 1747. The illustration was prepared about 1690, although not published until 1747; this figure shows only a somewhat deformed and shrunken old tuber (*Plate 1, f. A*) from which the plant had developed, but neither the characteristic rhizomes nor the equally characteristic new tubers that are produced at the ends of the rhizomes and at some distance from the base of the plant. Lamarck's misleading illustration of 1793 was clearly drawn from an herbarium specimen (*Plate 1, f. B*) and is very unsatisfactory. Dubard, Agr. Prat. Pays Chauds 11: 106. *f. 38.* 1911 (*Plate 1, f. E*), illustrates the vegetative parts as springing from a depressed-globose tuber which bears a couple of incipient rhizomes but no secondary tubers. Sadebeck, Die Kulturgewächse der deutschen Kolonien und ihre Erzeugnisse, *f. 31.* 1899, depicts the initial tuber but without rhizomes or secondary tubers (*Plate 1, f. C*). Degener, Fl. Hawaiiensis 2: *t.* [*11*]. 1932, while giving one of the best descriptions of the underground parts that I have seen (*Tacca hawaiiensis* Limpr. = *T. pinnatifida* J. R. & G. Forst. = *T. Leontopetaloides* (Linn.) O. Kuntze), provides an excellent habit sketch of the plant but without even a vestige of the old tuber, although his illustration does depict a couple of incipient rhizomes (*Plate 1, f. D*). His description of the underground parts is so good that it is here reproduced:

"Glabrous herb with depressed-globose light yellowish brown about 5 cm. high and 8 cm. wide thin-skinned smooth tuber near surface of ground . . . which is replaced during the year by a new main tuber which arises from a downward-growing thick rhizome at a lower level and remains dormant after yearly death of aerial parts of plant; secondary smaller tubers also forming from buds above old tuber and spreading downward; tubers white within, starchy, somewhat juicy; roots arising from top of old tuber, spreading. . . ."

But this is not the only good published description, for that of Rumphius, written toward the close of the seventeenth century but not published until 1747, is actually as good. The Latin version of this old description is: "Radices ejus panem referunt, magnitudine binorum pugnorum, immo majores, nudae & gilva obductae pellicula, interne albae, & succosae, atque ex superiore ipsarum parte multae dependent fibrillae, undique autem ad latera modi excrescunt, ex quibus novi propullulant surculi. Primaria vero radix directe cauli obposita saepe haud major est minore pugno, bulbosa, ac sine gemmis, ad binorum vero digitorum spatium supra hanc e stipite crassus excrescit caulis, deorsum flexus, e quo similis dependet radix, seu bulbus, plerumque major primariâ radice." His original Dutch version is equally good and explicit: "De worteln zyn broodjes in de groote van twee vuisten of meer, buiten kaal, en met een vaal buideken omgeven, binnen wit, en zappig, van boven hangen 'er veele Vaselingen, rondom ter

[4] LIMPRICHT, W. Taccaceae. Pflanzenreich 92(IV. 42): 1–32. *f. 1–5.* 1928.

zyden komen knobbeln voort, waar uit nieuwe spruitjes worden. De principaale wortel regt over den stam staande is dikwils niet grooter dan een kleene vuist, bultig, en zonder afzetzel, maar twee vingers boven de zelve komt uit den stam een dikken steel neerwaarts, daar aan een diergelyke wortel of bol hangt, gemeenlyk grooter dan de principaale."

Clearly Rumphius excavated the underground parts carefully, noting the characteristic downward-growing rhizomes produced from the stem just above the old tuber, that a new tuber was formed at the end of each rhizome, and further that the new main tuber was larger than the original one. I have reproduced these two old descriptions in extenso, for they conform to Degener's modern one quoted above. That Rumphius did not depict the underground parts as he described them should not be charged against him, when it is understood that his original illustrations were destroyed by fire, and that the new ones that were used to illustrate his Herbarium Amboinense were prepared by others after he had become blind. Clearly what one observes regarding the underground parts of this very characteristic and striking species depends on how carefully the tubers are dug and at what stage in the development of the plant the excavating was done. One might find, shortly after the vegetative parts appear, only a normal tuber; later this tuber would be more or less deformed and shrunken; still later the new rhizomes would be evident; and finally, if the underground parts be examined after the vegetative parts have reached full maturity or have disappeared, the original tuber would be found to have been more or less absorbed, and the new main tuber even larger than the original one, with a varying number, never very numerous, of smaller tubers which at the next growing season would produce small plants; these new tubers, large and small, are solitary and each terminates a simple rhizome.

Tubers that I examined many years ago in the Philippines varied from about five to about seven or eight centimeters in greatest diameter, varying in shape from globose to broadly ellipsoid. The new ones occurred in the loose sandy soil some distance from the base of the old plant and sometimes as much as ten inches below the surface of the soil. Dubard, l. c., notes that, according to the soil conditions, the new tubers may be as much as a foot from the base of the plant. Wohltmann[5] reproduced a photograph of somewhat dessicated tubers originating in Samoa, the largest being about 10 cm. in diameter, stating: "Das unterirdische, bisweilen kriechende Rhizom entwickelt Achselsprosse, welche sich zu mit dichtem Stärkemehl angefüllten Knollen verdicken." Mr. W. Greenwood, of Lautoka, Fiji, who kindly sent me some dried material, states that the tubers in Fiji are about five by seven centimeters as he has observed them; two of these small tubers from a very young plant are shown (*Plate 1, f. I, K*). The plants, being juvenile, were not more than about a foot high, and the characteristic rhizomes and secondary tubers had not commenced to form except in one case, among the several examined. I am also indebted to Mr. E. Y.

[5] WOHLTMANN, F. Tacca pinnatifida, die stärkemehlreichste Knollenfrucht der Erde. Tropenpflanz. 9: 120–128. *f. 103.* 1905.

Hosaka, of Honolulu, for his courtesy in sending me fresh tubers for greenhouse culture. Unfortunately these did not produce new plants, and so it was impossible for me to have any tests made with the view of determining the poisonous principle involved. That they are poisonous when fresh is unquestionably true, for Dr. St. John informs me that on Mehetia Island he took a small bite of a tuber, then spat it out immediately. It burned his tongue worse than *Colocasia,* was disagreeable and nauseating, making him half-sick for the rest of the forenoon. He calls my attention to E. M. Loeb's quotation of a native saying on Niue Island, Bishop Mus. Bull. **32**: 103. 1926: "The pia [*Tacca*] is the most poisonous of all plants since all the animals who eat of this bush are sure to die." It is reported to be very bitter, and one author who examined the starch noted the presence of raphides.

Dr. St. John could not, because of restrictions on travel due to war conditions, examine living plants, but he did kindly send me several sketches of the underground parts, these prepared by Miss Marie Neal, of the Bishop Museum, one from herbarium specimens, the others from preserved material. These figures are here reproduced (*Plate 1, f. F, G, H, J*).

While in the title of this paper I have, for obvious reasons, given the almost universally used Latin binomial of this plant, I have also noted that the oldest valid name for the species is *Tacca Leontopetaloides* (Linn.) O. Kuntze, Rev. Gen. Pl. 704. 1891, its basis being *Leontice Leontopetaloides* Linn. Sp. Pl. 313. 1753, which in turn was based wholly on Amman[n]'s description and illustrations of *Leontopetaloides* Amman[n], Comment. Acad. Sci. Imp. Petropol. **8**: 211. *t. 13* [and *t. 13 bis*]. 1741. Both of Ammann's original illustrations are reproduced herewith (*Plate 2, f. A, B*). This has been done for two reasons, first because the Ammann paper is not very generally available in the libraries of botanical institutions, and second to point up the obvious fact that the Linnaean specific name is the one that Limpricht should have used in a modern monograph that otherwise follows the provisions of the International Code of Botanical Nomenclature; there is no conserved list of specific names. He cites in the synonymy of *Tacca pinnatifida* J. R. & G. Forst. (1776) not only *Leontice Leontopetaloides* Linn. and *Tacca Leontopetaloides* O. Kuntze, but also the original Ammann illustration on which both of these binomials were wholly based. Limpricht states that the tubers are "permagna (saepe mole capitis infantis)," this apparently having been taken from Roxburgh, Fl. Ind. ed. 2, **2**: 172. 1832, who says: "Root tuberous, perennial, often as large as a child's head, round, and pretty smooth." The latter author had living specimens in the Calcutta Botanic Garden, the species having been introduced from Malaya in 1800. Hooker f., Fl. Brit. Ind. **6**: 287. 1892, was somewhat cautious, as he says: "*Rootstock* globose, 1 ft. diam. under cultivation." Rumphius says that the tubers are as large as one's two fists or larger. Although I have never seen tubers of the wild form more than about 8 cm. in largest diameter, it is highly probable that they reach sizes considerably larger than this, at least in cultivation. Burkill, Dict. Econ.

Prod. Malay Peninsula 2: 2118. 1935, states that the tubers sometimes weigh about two pounds, while Heyne, Nuttige Pl. Nederl. Ind. ed. 2, 1: 453. 1927, sub *Tacca Leontopetaloides* (Linn.) O. Kuntze, mentions material from the Anambas Islands, where the tubers were reported to be as large as a coconut; if by this comparison an unhusked coconut was intended, one would suspect that the observer may have confused the large corms of *Amorphophallus campanulatus* Blume with the tubers of *Tacca*. No less acute an observer than Rumphius did this when he described and illustrated what is clearly an *Amorphophallus* as *Tacca sativa* Rumph., Herb. Amb. 5: *324. t. 112.* 1747, and following this *Tacca phallifera* Rumph. op. cit. *326. t. 113;* in the latter the vegetative parts and fruits are clearly those of *Tacca pinnatifida* J. R. & G. Forst. = *T. Leontopetaloides* (Linn.) O. Kuntze, but the detached inflorescence, *f. 2,* indicated in the explanation of the plate as "*Figura Secunda Phallum* ipsum, seu *Taccae fungum* denotat," is clearly a representation of the spathe and spadix of an *Amorphophallus,* of the Araceae.

To the generally accepted synonyms, *Tacca pinnatifida* Gaertn. (1788), *T. dubia* Spreng. (1829), *T. Gaogao* Blanco (1837), and *T. oceanica* Nutt. (1838), may be added *T. hawaiiensis* Limpr. f. (1928), for I agree with Dr. St. John's opinion, as expressed by him, *in lit.,* that the latter supposedly distinct species is but a small form of the ubiquitous *Tacca pinnatifida* J. R. & G. Forst. = *T. Leontopetaloides* (Linn.) O. Kuntze. On the basis of such material as has been available to me for study, I find Limpricht's recent monographic treatment unsatisfactory. While most authors refer the African material to *Tacca pinnatifida* J. R. & G. Forst., Limpricht does not admit its occurrence in Africa, but places such material under *Tacca madagascariensis* Boj. and *T. involucrata* Schum. & Thonn. One suspects that he placed too much confidence in variable characters, and that as with *T. hawaiiensis* Limpr. certain other reductions are indicated. To be noted in this connection is Exell's recent critical Catalogue of the Vascular Plants of S. Tomé (1944), where (p. 344) he accepts the binomial *Tacca Leontopetaloides* (Linn.) O. Kuntze and, on the authority of Durand & Schinz, credits the species to S. Tomé, an island in the Gulf of Guinea near the west coast of Africa.

Some might argue from Ammann's illustration, which apparently attempts to indicate a maculate stem (although this character is not mentioned in his description), that something other than this common *Tacca* might have been the basis of his *Leontopetaloides.* Certainly in 1741 he could have had nothing from the range of *Tacca maculata* Seem. (Fiji, Samoa, northern Australia); all he says as to locality is "India Orientalia," and this might mean from any part of the Indo-Malaysian region. His description of the stems is: "Caules . . . praealti, teretes, cineracei, striis nigricantibus creberrimis notati, digiti minoris crassitie"; and the striking longitudinally striate stem is very characteristic of the widespread species here discussed.

After all, this note is perhaps a pointed commentary on how little attention many collectors in the field give to the underground parts of plants that they collect. The situation a few centuries ago is in sharp contrast to this, for then, because of the medicinal or other economic uses of the underground parts of plants, those concerned with preparing illustrations of plants generally gave very special attention to roots, tubers, bulbs, rhizomes, and corms, that are normally not shown at all well by ordinary herbarium specimens.

EXPLANATION OF PLATES

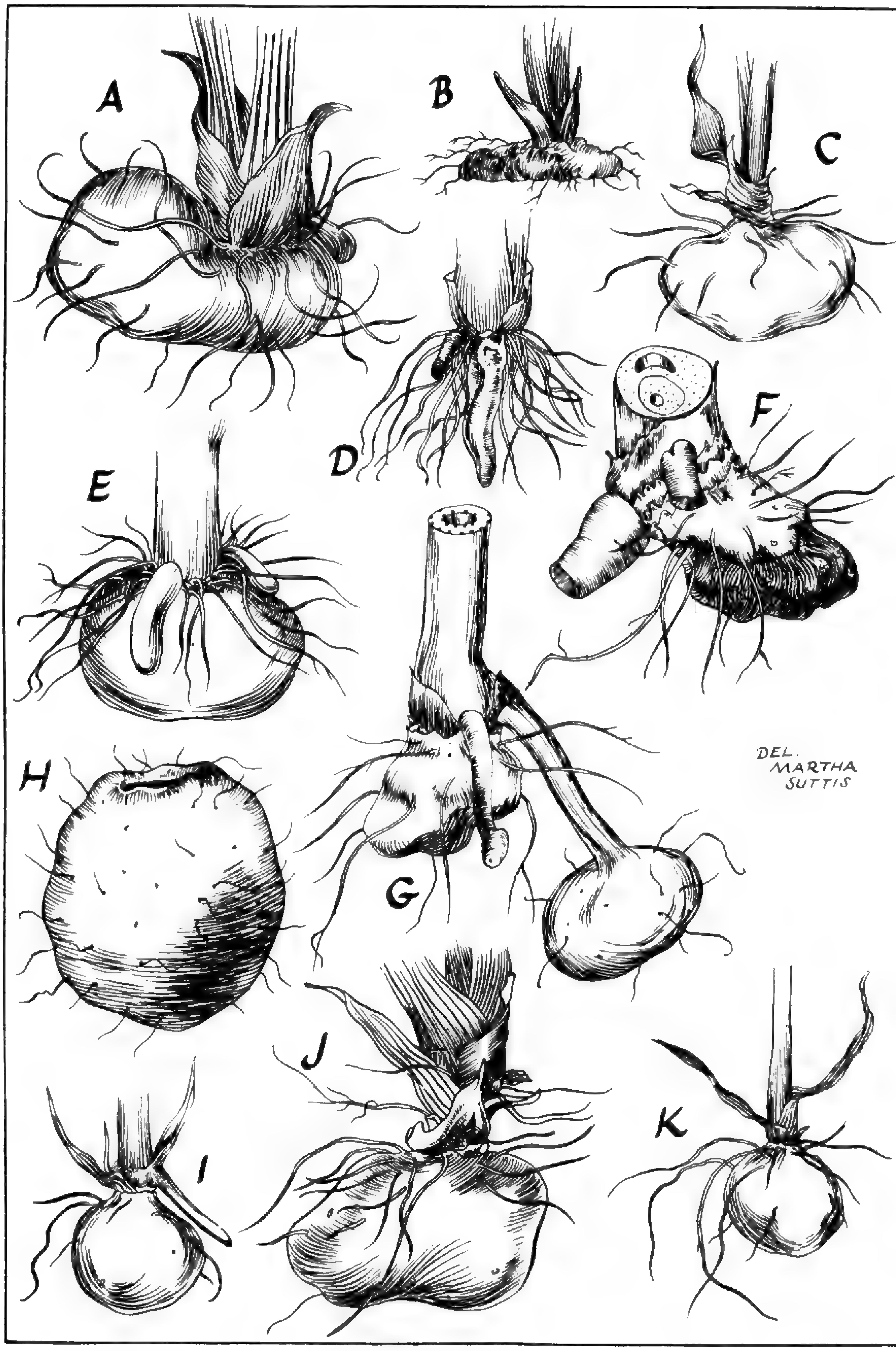
PLATE I

Underground parts of *Tacca Leontopetaloides* (Linn.) O. Kuntze (*T. pinnatifida* J. R. & G. Forst.). FIG. A. The tuber after Rumphius (1747). FIG. B. The tuber after Lamarck (1793). FIG. C. The tuber as depicted by Sadebeck (1899). FIG. D. No old tuber shown but incipient rhizomes are indicated, Degener (1932). FIG. E. The initial tuber and two incipient rhizomes as depicted by Dubard (1911). FIGS. F, G, H, J. Redrawn from sketches made by Miss Marie Neal, Bishop Museum, Honolulu, all from preserved material except F, which was taken from a herbarium specimen; of these G depicts the remnants of the initial tuber and two rhizomes, one of these bearing a partly grown secondary tuber, and H, a mature tuber as detached from the end of a rhizome. FIGS. I, K. Young tubers from juvenile Fijian plants, one showing the beginning of a rhizome, the last two natural size.

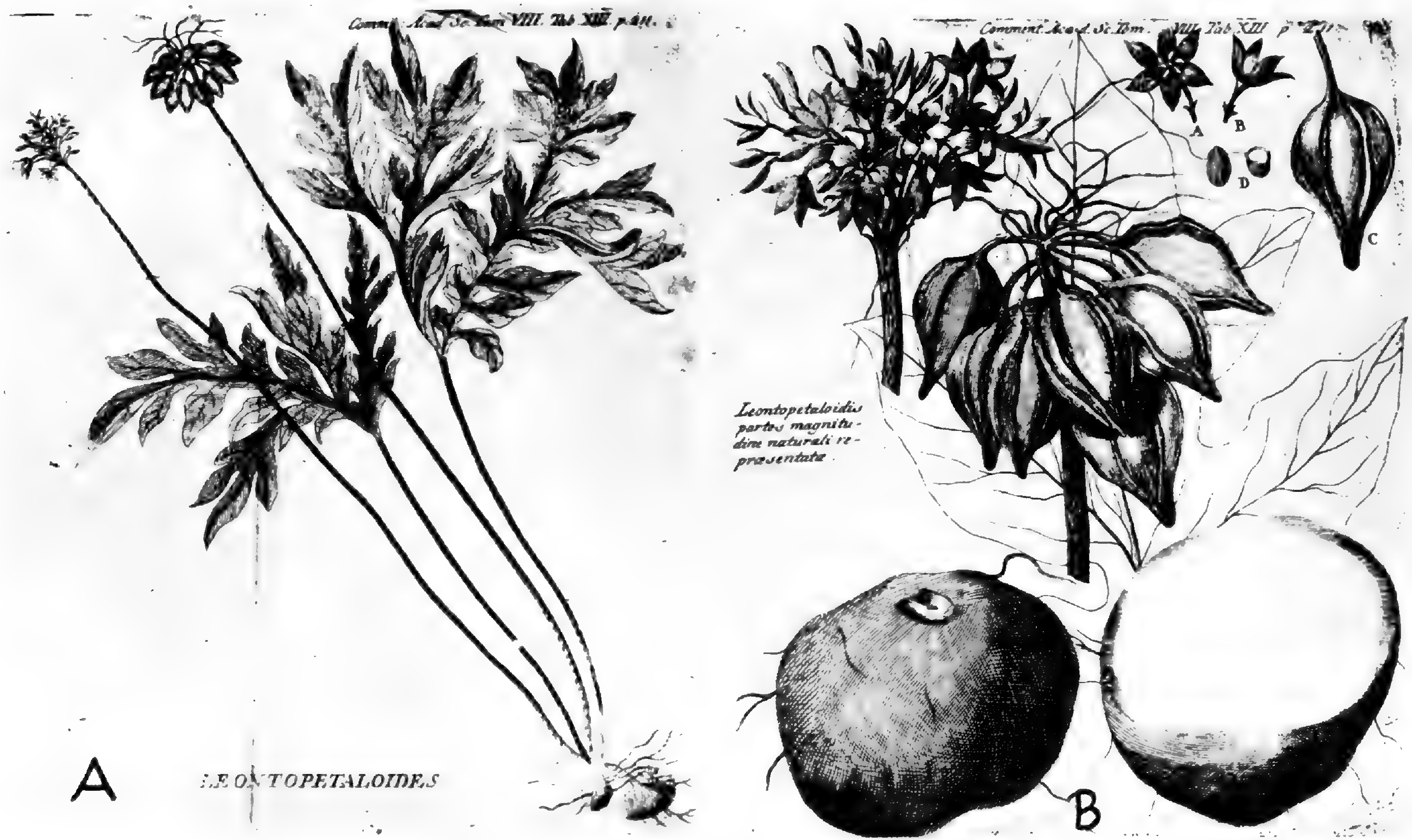
PLATE II

FIGS. A, B. The original illustrations of *Leontopetaloides*, Amman[n] Comment. Acad. Sci. Petrop. 8: *t. 13.* 1741. This is the entire basis of *Leontice Leontopetaloides* Linn. Sp. Pl. 313. 1753, and hence of *Tacca Leontopetaloides* (Linn.) O. Kuntze. Both Linnaeus and Limpricht cite the plate as *113.* There are two plates, both indicated as "Tab. XIII," the first showing the habit of the entire plant, including the underground parts, the second a part of a leaf, the inflorescence, fruits and flowers, and the tuber (detached), natural size. Incidentally the underground parts are depicted on the plate showing the habit of the entire plant more nearly as they actually are than in any hitherto published illustrations that I have seen. Reduced about ½.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.



Tacca leontopetaloides (Linn.) O. Kuntze



Tacca Leontopetaloides (Linn.) O. Kuntze

OCHROCARPOS ODORATUS (RAFINESQUE) MERRILL, A NEW NAME FOR A MUCH NAMED SPECIES, WITH A NEW SPECIES FROM SAMOA

E. D. MERRILL

With one text-figure

A CHANGE in the name of the widely distributed Old World strand tree currently known as *Ochrocarpus*[1] *excelsus* Vesque and as *O. ovalifolius* T. Anders. is inevitable under the provisions of the International Code of Botanical Nomenclature. The genus *Lolanara* Raf. (1837) was based wholly on "*Lolanwara*" [i.e., *Lolan waran, Lignum clavorum* Rumph. Herb. Amb. **3**: 97. *t. 64.* 1743], as was its sole species *Lolanara odorata* Raf. Rafinesque's original rather sketchy description is as follows: "*Lolanara* R (nom ind) Cal. bisquamosus, Petalis 6, duplice series, 3 int. major. Stam. plurima hypogyna. Drupo ovato, nucleo bivalvis intus pulposo polysp.?— *L. odorata* fol. ovatis sparsis scabris. Oceanic tree. Lolanwara of Rumphius. Family Hesperidia." — Raf. Fl. Tellur. **2**: 34. 1836 [1837]. This generic name first appears as a *nomen nudum,* Raf. op. cit. **1**: 16. 1836 [1837].

Lolanara Raf. and *L. odorata* Raf. were duly entered in Index Kewensis **2**: 108. 1894, the position of the genus being indicated as: "An SAPOTACEA? — Cf. Hassk. Neuer Schl. zu Rumph's Herb. Amboin. 55." The generic name is not listed by de Dalla Torre and Harms, Genera Siphonogamarum. When I was attempting to determine the status of the various forms described by Rumphius in his monumental Herbarium Amboinense[2] and the numerous binomials based by later authors on that work, naturally handicapped by the limited library facilities available in Manila, where the task was accomplished, I did not have access to Rafinesque's work and overlooked the entry in Index Kewensis. Heyne's[3] disposition of *Lignum clavorum* Rumph., the key to the proper reduction of *Lolanwara odorata* Raf., appeared in the same year that my work was published, he referring the plant that Rumphius described and illustrated to *Ochrocarpus ovalifolius* T. Anders., but it should be noted that Pierre had reduced *Lignum clavorum* Rumph. to *Calysaccion excelsum* Pierre as early as 1896, Bull. Soc. Linn. Paris **2**: 1225. 1896. As no botanical material from Amboina or its neighboring islands representing *Lignum clavorum* Rumph. was available to me, I could only accept Teysmann's suggestion, as listed by Hass-

[1] The original spelling of the generic name was *Ochrocarpos,* which I have retained. Most authors have used the form *Ochrocarpus.*

[2] MERRILL, E. D. An interpretation of Rumphius's Herbarium Amboinense. 1–595. 1917.

[3] HEYNE, K. De nuttige planten van Nederlandsch-Indië **3**: 257. 1917.

karl, that some genus of the Sapotaceae was represented; although here it should have been evident that some other family was represented from the Rumphian description if not from the illustration. Earlier, Henschel had referred the Rumphian entity, with doubt, to *Calophyllum spurium* Choisy, the family being correct, but the genus manifestly wrong. See also Lam, Bull. Jard. Buitenzorg III. 7: 247. 1925. Thus to the synonymy of *Ochrocarpos* Thouars (1808) (*Calysaccion* Wight, 1840), *Lolanara* Raf. (1837) is to be added. The synonymy of this much named species is as follows:

Ochrocarpos odoratus (Raf.) comb. nov.

Lolanara odorata Raf. Fl. Tellur. **2**: 34. 1836 [1837].

Calophyllum excelsum Zoll. & Mor. Nat. Geneesk. Arch. Ind. **2**: 582. 1845; Hassk. & Zoll. Flora **30**: 661. 1847.

Calysaccion ovalifolium Choisy, Mém. Soc. Phys. Hist. Nat. Genève **12**: 425. 1850 (Guttif. Ind. 45).

Mammea excelsa Planch. & Triana, Ann. Sci. Nat. IV. Bot. **15**: 244. 1861.

Calysaccion obovale Miq. Fl. Ind. Bat. Suppl. 500. 1862; A. Gray, Proc. Am. Acad. Arts Sci. **5**: 315. 1862.

Calysaccion tinctorium Seem. Fl. Vit. 13. *t. 9.* 1865.

?*Calysaccion Horstii* Teysm. & Binn. Cat. Hort. Bogor. 205. 1866, ***nom. nud.***

Ochrocarpus ovalifolius T. Anders. ex Hemsl. Bot. Challenger Exped. **1**(2): 122, 234. 1885; Guppy, Solomon Islands 294. 1887; K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 449. 1901; Koord. & Val. Bijdr. Boomsoort. Java **9**: 391. 1903; Baker f. Jour. Bot. **61**: Suppl. 9. 1923.

Ochrocarpus pachyphyllus K. Schum. in K. Schum. & Hollr. Fl. Kaiser Wilhelms Land 51. 1889; K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 449. 1901.

Ochrocarpus tinctorius Drake, Ill. Fl. Ins. Mar. Pacif. 116. 1890; Lauterb. Bot. Jahrb. **41**: 231. 1908.

Ochrocarpus excelsus Vesque in DC. Monog. Phan. **8**: 525. 1893; Merr. Philip. Jour. Sci. **9**: Bot. 115. 1914, **29**: 398. 1926; Lauterb. Bot. Jahrb. **58**: 6. *f. 1, A-H.* 1922, **59**: 19. 1924; Kanehira, Bot. Mag. Tokyo **45**: 330. 1931, Fl. Micrones. 240. *f. 111.* 1933, Jour. Dept. Agr. Kyushu Univ. **4**: 372. 1935; Hosokawa, Bull. Biogeogr. Soc. Japan **5**: 145. 1934, **7**: 196. 1937; Christoph. Bishop Mus. Bull. **128**: 147. 1935.

Calysaccion excelsum Pierre, Bull. Soc. Linn. Paris **2**: 1225. 1896.

Ochrocarpos obovalis Safford, Contr. U. S. Nat. Herb. **9**: 335. 1905.

Lignum clavorum Rumph. Herb. Amb. **3**: 97. *t. 64.* 1743.

The species is a very widely distributed one in Malaysia, Micronesia, and western Polynesia, having been recorded by various authors, under various names, from Java, Sangian (Sunda Strait), Christmas Island (south of Java), Borneo, Banguey, the Moluccas, Timor, Kei Archipelago, Admiralty Islands, New Guinea, Bismarck Archipelago, Solomon Islands, Marianas, Caroline and Palau Islands (Guam, Saipan, Tinian, Rota, Pagan, Truk, Palau, Kusai, Ponape), Fiji, and Samoa. All authors are in agreement that it is a littoral tree, and doubtless it is to be classed among those species whose fruits or seeds are adapted to dissemination by floating in salt water. I have examined the following specimens:

PHILIPPINES: Mangsi Island, between Balabac and Borneo, *Wilkes Expedition* (G), originally identified as representing *Garcinia mangostana* Linn. and later corrected to *Calysaccion obovale* Miq.; this is a record new to the Philippine flora. BORNEO: Banguey Island, *Castro & Melegrito 1412.* JAVA: Pandeglang, *Netherl. Ind. For. Serv. Ja. 2625.* MOLUCCAS: Wetar and Boeroe Islands, *Netherl. Ind. For. Serv. bb.*

27281, 22702. SOLOMON ISLANDS: Owa Raha Island, *L. J. Brass 2081.* MARIANAS ISLANDS: Guam, *Guerrero 755;* Tinian, *Kanehira 1066.* CAROLINE ISLANDS: Palau, Babeldaob, *Kanehira 5040.* FIJI: *Seemann 46* (G) (isotype of *Calysaccion tinctorium* Seem.), *A. C. Smith 1190* (G).

Various recorded VERNACULAR NAMES are *chopak* (Tinian), *chopag* (Guam), *fetau* (Samoa), *kapurantia* (Amboina), *kembang satoe* (Java), *loro waran, lolan waran, lolan wakan* (Amboina), *luas* (Truk), *lues* (Ponape), *ogoldveesak* (Palau), *oyag* (Fiji), *oyagu* (Truk), *manapau* (Samoa), *tatarat* (Bismarck Archipelago), *lalan bitauer, mattabue, mattabuen* (Buru), *vetao, uvitao* (Fiji).

Thus a rather formidable synonymy has been built up over the course of years, in part due to the fact that botanists working in different centers did not have access to material in other institutions, and were thus obliged to depend on not always too satisfactory descriptions, and in part, doubtless, due also to frank differences of opinion as to the limits of this or that pro-

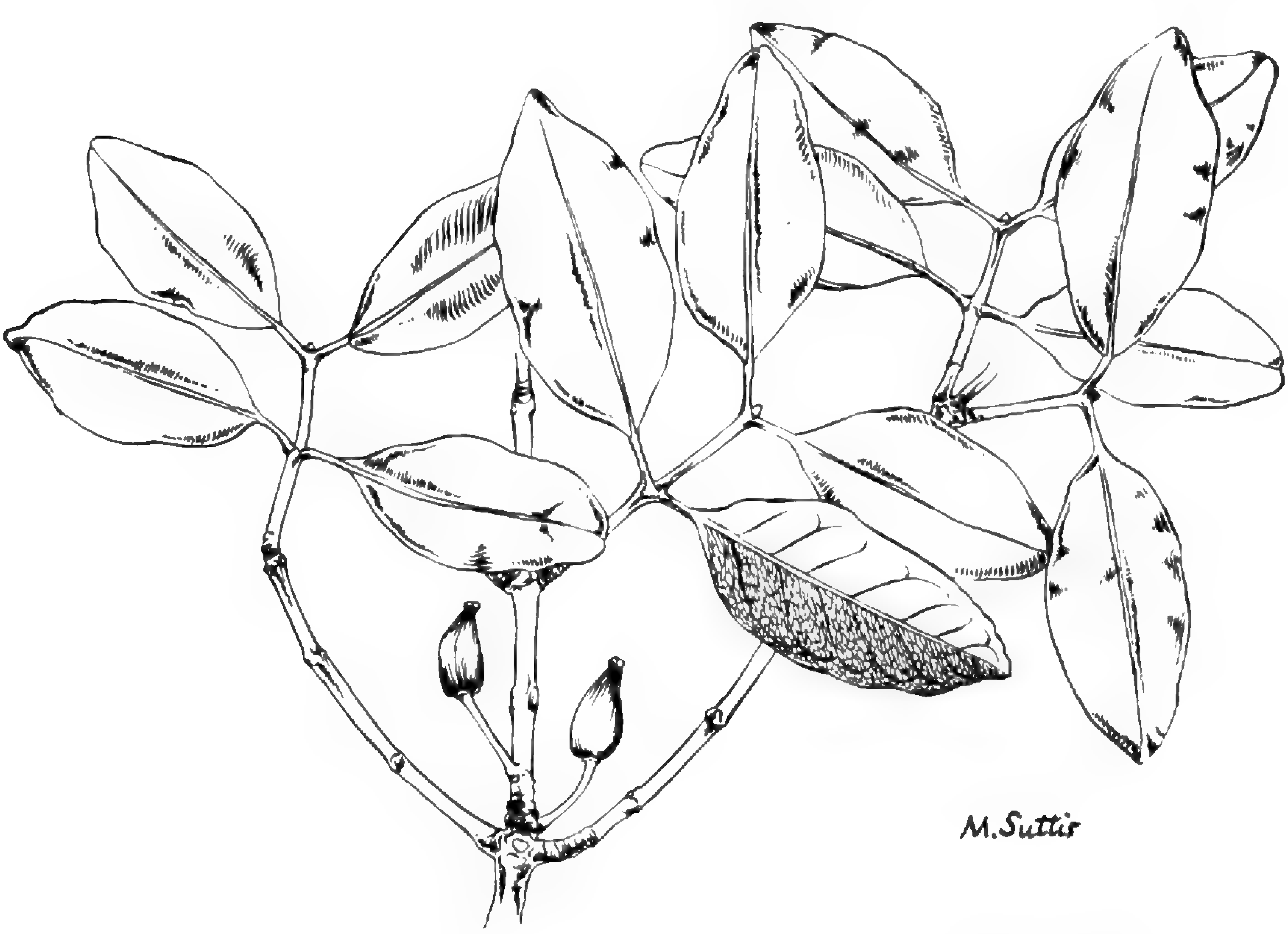


FIG. 1. *Ochrocarpos glaucus* Merr.: a fruiting branchlet drawn from the type, × about ⅓.

posed species. The species is remarkably uniform in its various characters throughout its wide range.

Ochrocarpos glaucus sp. nov. FIG. 1.

Arbor 15–18 m. alta, glaberrima (floribus ignotis), ramis ramulisque pallidis plus minusve longitudinaliter rugosis, ultimis 1.5 mm. diametro; foliis crasse coriaceis, oblongo-ellipticis, 6–10 cm. longis, 3–4 cm. latis, obtusis vel rotundatis, basi subrotundatis vel late acutis, supra pallide olivaceis, nitidis, subtus glaucis, nervis primariis utrinsecus 7–10, subtus paullo elevatis, haud perspicuis, arcuato-anastomosantibus, utrinque sub-dense reticulatis, costa subtus elevata, crassa; petiolo 1 cm. longo; floribus ignotis; fructibus solitariis, in axillis defoliatis, immaturis inaequilateraliter anguste ovoideis, sursum plus minusve angustatis, crasse subrostratis, in sicco castaneis, sublaevibus, 2 cm. longis et 1 cm. diametro; sepalis caducis.

SAMOA: Savaii, above Matavanu, *Christophersen & Hume 2029,* July 15, 1931, in medium wet forest, alt. about 900 m., a tree 15–18 m. high, fruits green. Type, herb. Arnold Arboretum.

Although the flowers of this species are unknown and the fruits are immature, it clearly represents an undescribed species of *Ochrocarpos,* characterized by its small leaves which are distinctly glaucous beneath. It, with *Christophersen & Hume 2053,* from the same locality, is mentioned by Christophersen in a note following *Ochrocarpus excelsus* Vesque, Bishop Mus. Bull. 128: 147. 1935, as possibly representing an undescribed species.

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STUDIES OF PACIFIC ISLAND PLANTS, IV
NOTES ON FIJIAN FLOWERING PLANTS

A. C. SMITH

IN THE present paper a discussion of several species in various families is presented and five species, based for the most part on recently collected material, are described as new. I am indebted to Dr. L. Croizat for the descriptions of two new species of Euphorbiaceae, here included. Herbaria in which cited specimens are deposited are indicated by parenthetical abbreviations: Arnold Arboretum (A), Bernice P. Bishop Museum (Bish), Gray Herbarium (GH), New York Botanical Garden (NY).

POTAMOGETONACEAE

Diplanthera uninervis (Forsk.) Aschers. in E. & P. Nat. Pfl. Nachtr. 1: 37. 1879; F. N. Will. in Bull. Herb. Boiss. II. 4: 221. 1904; Aschers. & Graebn. in Pflanzenr. 31 (IV. 11): 152. 1907; Greenwood in Jour. Arnold Arb. 25: 402. 1944.

VITI LEVU: Nandronga: Thuvu, *Greenwood 927* (GH) (in sand above and below low water mark on shores; broken pieces cast up in large quantities), *Greenwood 927B* (GH) (on beach); Serua: Naitonitoni Beach, near Navua River, *Greenwood 927A* (GH).

The recent Fijian collections of this widespread species are of interest because of the paucity of Pacific specimens in herbaria. The species has previously been reported from Fiji, usually as *Halodule australis* Miq., but a definite collection has been cited only by Greenwood (l. c.). The plant is not accounted for in Seemann's Flora Vitiensis.

HYDROCHARITACEAE

Hydrilla verticillata (L. f.) Royle, Ill. Bot. Himal. 376. 1839; Presl, Bot. Bemerk. 112. 1844 [adv. repr. from Böhm. Ges. Wiss. Abh. V. 3: 542. 1845]; Caspary in Bot. Zeit. 14: 901. 1856; Benth. Fl. Austral. 6: 259. 1873; Aschers. & Gürke in E. & P. Nat. Pfl. II. 1: 250. *f. 184, A, B*. 1889; Gagnep. in Lecomte, Fl. Gén. Indo-Chine 6: 4. *f. 2*. 1908; Koorders, Exkursionsfl. Java 1: 94. 1911, Atlas 1: *f. 21*. 1913; F. M. Bailey, Compr. Cat. Queensl. Pl. 518. 1913; Greenwood in Jour. Arnold Arb. 25: 403. 1944.

Serpicula verticillata L. f. Suppl. 416. 1781; Roxb. Pl. Coast Corom. 2: *pl. 164*. 1798.

VITI LEVU: Nandi: Tuna River, *G. Dennis 955* (GH) (forming extensive mats in tidal waters in the dry season, but washed out in large quantities during heavy rains in the wet season; in flower Nov. 10, 1942).

The cited specimen must be considered one of the most interesting recently obtained in Fiji, as it extends the range of *Hydrilla* into the Pacific area. From records which I can locate, the nearest stations are in the East Indies and Australia, the species apparently not having been noted from either New Guinea or New Zealand. Our specimens bear young staminate flowers, which are still in the membranaceous muricate spathes. Mr. Greenwood (in litt.) expresses the opinion that *Hydrilla* was probably introduced into Fiji.

EUPHORBIACEAE

By L. CROIZAT

Cleistanthus micranthus Croizat, sp. nov.

Arbuscula 5-metralis, innovationibus pilis perpaucis brevibus exceptis glabris subangulatis, ramis adultioribus dissite irregulariterque lenticellatis. Foliis distichis ellipticis plus minusve falcatis 7–9 cm. longis, 2–3 cm. latis, glaberrimis, subcoriaceis, pallide brunneo-olivaceis subconcoloribus, margine integerrimo subrevoluto, nervis late patentibus, margine anastomosatis, gracilibus, ca. 8-jugis, petiolo ruguloso vix 0.5 cm. longo, stipulis coriaceis late triangularibus integris ad 1 mm. longis et 1 mm. basi latis. Inflorescentiis more generis axillaribus pulviniformibus, vix 0.5 cm. latis et longis, plurifloris squamulosis glabris, secus ramulum dissitis. Flore ♂ anthesi vix ineunte viso: calyce glabro subgloboso ca. 1.2 mm. lato, laciniis triangularibus crassiusculis oblongo-deltoideis ca. 1.3 mm. longis, 0.7–0.8 mm. latis, petalis minutis albicantibus subdolabriformibus cuspidatis, ca. 0.5 mm. longis, 0.6–0.7 mm. latis, disco annulari-pulvinato integro ca. 0.25 mm. alto; staminibus pro ratione floris magnis, brevibus, oppositisepalis, antheris oblongis ca. 0.7 mm. longis et 0.6 mm. latis, apiculatis, basi divaricatim sagittatis, filamento crassiusculo ca. 0.5 mm. longo; pistillodio ovoideo ca. 0.8 mm. longo, apice 3-partito, laciniis aequalibus stylum cum stigmatibus simulantibus. Floris ♀ perianthio unico sub fructu viso, putrido, saltem annotino, ca. 3 mm. lato, breviter stipitato, columella ca. 3.5 mm. longa, basi florum ♂ hornotinorum glomerulis fulto.

VITI LEVU: Serua: In hills, alt. about 200 m., *Greenwood 1018* (A, TYPE), May, 1943 (tree 5 m. high).

This is the first record of *Cleistanthus* Hook. f. in the Fiji Islands. The genus has so far been known only from certain islands of Micronesia, such as the Pelew and Truk groups (*C. carolinensis* Jabl., *C. insularis* Kanehira, *C. angularis* Kanehira, *C. Morii* Kanehira), and New Caledonia (*C. stipitatus* Muell. Arg.), not to mention points farther west, from Australia to eastern Africa, which represents its probable center of dispersal. *Cleistanthus micranthus* is most nearly allied to *C. stipitatus* Muell. Arg., but differs in the spreading primaries, the less coriaceous and blunter leaf, and the smaller, glabrous inflorescence. In the classification of Jablonszky (in Pflanzenr. 65[IV. 147. VIII]: 35. 1915), *C. micranthus* apparently falls into Sect. *Australes* Jabl., together with *C. stipitatus* (Baill.) Muell. Arg. and *C. Dallachyanus* (Baill.) Benth. Thus composed, this section ranges from Australia to New Caledonia and the Fiji Islands.

Croton Parhamii Croizat, sp. nov.

Frutex innovationibus hispido-pubescentibus, serius glabrescentibus, trichomatibus saepius brunneis pilo centrali porrecto. Foliis elliptico-lanceolatis brunnescentibus, 3–9 cm. longis, 2–4 cm. latis, tenuiter chartaceis, apice sat obtuse acuminatis, basi rotundatis vel rotundato-cuneatis, margine sat obscure crenato-dentatis, supra glabris, subtus trichomatibus saepissime stellatis hispidis in lamina parcius in costa crebre indutis, venis penninerviis arcuato-adscendentibus anastomosantibus ca. 8–12-jugis, primo jugo haud triplinervio; petiolo gracili aeque ac innovationibus induto 0.5–2 cm. longo, glandulis posticis ad basim laminae 2, breviter stipitatis disciformibus.

Inflorescentia subspicata ad 10 cm. longa. Floribus ♂ : pedicello ca. 3–6 mm. longo, perianthio in alabastro subglobuloso, in anthesi latius cyathiformi (ut videtur), ca. 2 mm. longo et 3 mm. lato, petalis cum sepalis subaequilongis, staminibus ca. 10. Floribus ♀ : perianthio extus pubescente late campanulato ca. 3 mm. longo et 5 mm. lato, pedicello 8–10 mm. longo, perianthii lobis ad basim liberis ellipticis, ca. 1–2 mm. longis et 1.5 mm. latis, margine integris, uno alterove interdum subanisomero, petalis glandulisque ut videtur nullis, ovario late ovoideo indumenti copia brunneo-hispidulo, ca. 1.5 mm. magno in stylum evidenter abeunte; stylorum cruribus 3, pro ratione sat crassis, nigris, epapillosis dorso puberulis, ca. 2 mm. longis, fere ad basim 2-partitis, columella fructu delapso gracili ad 5 mm. longa.

VITI LEVU: Tholo West: Ridge between Naloka and Naraiyawa, in forest, alt. about 900 m., *B. E. Parham 2464* (A, TYPE), July 26, 1938.

The slightly accrescent ♀ perianth in fruit, with evolute lobes at anthesis, readily distinguishes this new species from *C. heterotrichus* Muell. Arg., which it suggests at first in the pubescence of the lower leaf-surface. *Croton Storckii* (Muell. Arg.) Seem. has a different foliage and ♀ perianth, with a much smaller ovary and scarcely accrescent lobes. *Croton Verreauxii* Baill. is an Australian species, with a ♀ perianth that has characters similar to those of *C. Storckii*. *Croton microtiglium* Burk. is known only from Tonga and suggests the characters of *C. leptopus* Muell. Arg., to judge from the description and an authentic specimen of the latter here available. *Croton Levatii* Guillaumin, of the New Hebrides, is very summarily described (in Bull. Soc. Bot. France 66: 275. 1919), but the remark "sepalis petalisque angustioribus" rules out *C. Parhamii*.

ELAEOCARPACEAE

Elaeocarpus cassinoides A. Gray, Bot. U. S. Expl. Exped. 1: 204. 1854; C. Muell. in Walp. Ann. 4: 331. 1857; Seem. Fl. Vit. 29. 1865; Hemsl. in Jour. Linn. Soc. Bot. 30: 171. 1894.

VANUA LEVU: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, TYPE COLL.); lower Wainunu River Valley, alt. 0–200 m., *Smith 1735* (GH) (tree 13 m. high, in open forest; native name: *wailoaloa*). KORO: Eastern slope of main ridge, alt. 200–300 m., *Smith 1007* (GH) (spreading tree 23 m. high, in dense forest; trunk 1 m. diam.); western slope, alt. 300 m., *Smith 1086* (GH) (tree 14 m. high, in thickets; petals pale pink).

Elaeocarpus cassinoides has previously been known only from the type collection, a fruiting specimen. Although it was originally reported by Gray from both Fiji and Tonga, its occurrence in the latter group is questionable; Gray remarks, "Those [specimens] from the two localities, as ticketed, are so exactly alike that they might have been taken from the same stem, and, since the habitats are not to be verified from Dr. Pickering's notes, one or the other may be considered doubtful." Mueller, Seemann, and Hemsley, in the publications cited above, repeat Gray's data without citing additional specimens, and it seems that the species has not been re-collected in Tonga. Since the Fijian specimens cited above are obviously conspecific with the type, I believe that the record of this species from Tonga is erroneous. In view of the inadequacy of the original description, I here redescribe the species. Of the cited specimens, *Smith 1007* and *1086* are in flower and the others in fruit.

Tree, up to 23 m. high, the branchlets subterete, slender, brownish, at first pale-puberulent, soon glabrescent; petioles puberulent and glabrescent like the branchlets, slender, canaliculate, 5–15 mm. long; leaf-blades papyraceous or chartaceous, oblong- or obovate-elliptic, 5–10 cm. long, 2–4.5 cm. broad, subacute to attenuate at base, obtuse or obtusely cuspidate at apex, inconspicuously serrulate especially distally (teeth 2 or 3 per centimeter), glabrous on both surfaces or obscurely puberulent on nerves beneath when young, the costa plane or slightly raised above, prominent beneath, the secondary nerves 4–7 per side, erecto-patent, anastomosing, usually prominulous above and slightly raised beneath, the veinlet-reticulation lax, prominulous on both sides or obscure above; racemes axillary, usually 3–4 cm. long at anthesis, 12–17-flowered, short-pedunculate, the rachis and pedicels pale-puberulent, the bracts submembranous, lanceolate, 2–3 mm. long, acute, sparsely puberulent, soon caducous, the pedicels 2–3.5 mm. long at anthesis; sepals 5, submembranaceous, deltoid-oblong, 1.5–2 mm. long, 0.7–1.2 mm. broad, subacute, puberulent on margins, otherwise glabrous, carinate within; petals 5, glabrous, submembranaceous, obovate-cuneate, 1.3–1.7 mm. long, 0.8–1.2 mm. broad, fimbriate with 6–8 lobes, these subequal, obtuse, about 0.3 mm. long; disk 5-lobed, the lobes about 0.4 mm. high and 0.7 mm. broad, each copiously hispidulous and deeply sulcate; stamens 15 or 16, uniseriate, about 3 mm. long, the filaments slender, glabrous, about 0.6 mm. long, the anthers oblong, hispidulous throughout, obtuse, about 0.7 mm. long; ovary and base of style pale-puberulent-hispidulous, the locules 2, each biovulate, the style 0.4–0.5 mm. long, bifid; fruiting inflorescence often shortened by loss of apical portion of rachis, the pedicels stout, 4-5 mm. long, glabrous; fruit glabrous, obovoid, 14–16 mm. long and 8–11 mm. broad at apparent maturity, the pericarp about 3 mm. thick including the rugulose epicarp and the nearly smooth hard endocarp, the locule usually solitary, the dissepiment rarely persistent.

For the time being I am unable to refer *E. cassinoides* to its appropriate section. It is probably related to such New Guinean sections as § *Dactylosphaera* Schlechter and § *Fissipetalum* Schlechter, but it does not entirely agree with either of these. Another Fijian species of this general relationship is *E. kasiensis* A. C. Sm., which was originally referred to § *Dicera*. However, since I have studied the New Guinean species of *Elaeocarpus* and looked into the typification of § *Dicera* (see Jour. Arnold Arb. **25**: 223. 1944), I realize that the two Fijian species here discussed should not be placed in § *Dicera*. A study of all the Pacific species is advisable before these can be properly placed. Two other Fijian species possibly of this relationship, both very inadequately known, are *E. laurifolius* A. Gray and *E. pyriformis* A. Gray.

Elaeocarpus (§ *Dicera*) **pittosporoides** sp. nov.

Arbor ad 6 m. alta partibus florum exceptis ubique glabra, ramulis gracilibus teretibus cinereis; foliis apicem ramulorum versus confertis, petiolis leviter canaliculatis gracilibus 1–2 cm. longis, laminis subcoriaceis vel chartaceis in sicco fuscis vel olivaceis, obovato-ellipticis, 6.5–10 cm. longis, 2.5–4.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice obtuse cuspidatis, margine leviter recurvatis et remote undulato-crenulatis, costa utrinque valde elevata, nervis lateralibus utrinsecus 6–8 erecto-patentibus anastomosantibus et rete venularum laxo utrinque plus minusve prominulis; racemis axillaribus subpendulis ad 6 cm. longis 2–4-floris, pedunculo interdum ad 3 cm. longo et rhachi gracilibus substriatis, bracteis mox caducis, pedicellis gracillimis sub anthesi 2–2.5 cm. longis; sepalis 5 papyraceis vel subcarnosis oblongis, 5.5–6 mm. longis, 1.5–2 mm. latis, subacutis, extus glabris, intus minute puberulis et conspicue carinatis, margine leviter incrassatis; petalis 5 submembranaceis, obovatis, longitudine sepalos aequantibus, 2.5–3 mm. latis, intus basim versus paullo tomentellis ceterum glabris, apice 3–5-lobulatis, lobis 1–2 mm. longis subacutis; disco annulari-pulvinato circiter 0.5 mm. alto obscure 5-lobato superne sparse hispidulo; staminibus 26 vel 27 circiter 3.5 mm. longis 1- vel 2-seriatis ubique minute papilloso-hispidulis, filamentis subteretibus 1–1.5 mm. longis, antheris 2–2.5 mm. longis, apice subacutis erostratis; gynaecio glabro, ovario ovoideo 2-loculari, loculis 4-ovulatis, stylo crasso subulato 2–2.5 mm. longo.

VITI LEVU: Namosi: Hills between Navua River and Suva, alt. 200–300 m., *Greenwood 1010* (A, TYPE), May, 1943 (upright tree 5–6 m. high; inflorescences in leaf-axils near apices of branchlets; flower-buds yellow, somewhat dependent on very thin pedicels).

Elaeocarpus pittosporoides appears to have no close relatives among the known Fijian species. I have recently (in Jour. Arnold Arb. **25**: 223. 1944) had occasion to discuss the typification of § *Dicera*, to which the new species definitely belongs. In floral characters it is very similar to *E. dentatus* (J. R. & G. Forst.) Vahl, the type of the section, but in foliage and in its slender lax inflorescences it is quite different.

TILIACEAE

Brownlowia sp.

VITI LEVU: Lautoka: Mountains near Lautoka, alt. about 550 m., *Greenwood 957* (A) (shrub or small tree); Namosi: Hills between Navua River and Suva, alt. about 250 m., *Greenwood 957A* (A); vicinity of Namuamua, alt. 400 m., *Gillespie 3000* (GH); Rewa: Slopes of Korombamba Mt., alt. 200 m., *Gillespie 2372* (GH).

The cited specimens indicate a substantial extension of the known range of *Brownlowia;* all are sterile, but their place in the genus seems certain, and it is nearly equally certain that they represent an undescribed species. The Fijian specimens are probably of the relationship of *B. argentata* Kurz, as this is represented by material from New Guinea and the Solomon Islands. The occurrence of the genus in the New Hebrides, not previously reported, is indicated by *Kajewski 616* (A) from Vanikoro, a specimen probably referable to *B. argentata.* From this species the Fijian specimens differ in obvious foliage characters, the leaf-blades being longer and with more numerous lateral nerves.

Yuncker (in Bishop Mus. Bull. **178**: 80. 1943) has recently reported *Brownlowia* from Niue, also in sterile condition; this record appears to be the easternmost for the genus.

ELATINACEAE

Elatine gratioloides A. Cunn. in Ann. Nat. Hist. **4**: 26. 1840; Nied. in E. & P. Nat. Pfl. ed. 2. **21**: 276. 1925; Greenwood in Jour. Arnold Arb. **25**: 398. 1944.

Elatine americana sensu Hook. f. Fl. Nov. Zel. **1**: 27. 1853.

Elatine americana var. *australiensis* Benth. Fl. Austral. **1**: 178. 1863; Cheesem. Man. N. Z. Fl. 73. 1906, ed. 2. 568. 1925; F. M. Bailey, Weeds & Pois. Pl. Queensl. 22. *f. 37.* [1907].

VITI LEVU: Lautoka: Mountains near Lautoka, alt. about 600 m., *Greenwood 952* (GH) (entire plant light green; creeping on mud under two inches of slowly running water, in taro plantation).

This species, until Greenwood (l. c.) mentioned it, had previously been reported only from Australia and New Zealand. The collection of a specimen of *Elatine* in Fiji is of especial interest, since, to the best of my knowledge, only one other collection of the genus has previously been cited in literature from the entire Pacific region (other than New Zealand). The earlier collection was *Seemann 183,* from the island of Taveuni, Fiji, which was referred by Seemann (Fl. Vit. 10. 1865) to *E. ambigua* Wight. According to Niedenzu (in E. & P. Nat. Pfl. ed. 2. **21**: 276. 1925), *E. ambigua* and *E. gratioloides* are distinct species, the flowers being pedicellate in the former and sessile in the latter. Niedenzu states the range of *E. ambigua* to include Fiji, and I assume that his record is based upon *Seemann 183.* From an examination of a duplicate of this number in the Gray Herbarium, I am inclined to believe that it also represents *E. gratioloides,* since the flowers are usually essentially sessile, only rarely being on short pedicels about 1–2 mm. long. The value of pedicel-length as a specific character may be questioned, since in all other features *Seemann 183* agrees with *Greenwood 952* and the several New Zealand and Australian specimens in the Gray Herbarium. It seems probable to me that the only Fijian species of the genus is *E. gratioloides,* but the difference between this species and *E. ambigua* should be carefully checked.

Bentham, following his original description of *E. americana* var. *australiensis,* states: "This plant, whether a distinct species or a variety of the N. American one, is found also in New Zealand and the Fiji islands, and is very variable." His record from Fiji was doubtless based upon *Seemann 183,* which had been tentatively referred to *E. americana* by A. Gray in Bonplandia **10**: 36. 1862.

In the most recent survey of the genus in its entire range, Niedenzu (l. c. 274–276) expresses the opinion that *E. gratioloides* is distinct from both *E. triandra* Schkuhr and *E. americana* (Pursh) Arn. The customary procedure by writers on the flora of Australia and New Zealand is to mention the austral plant as *E. americana* var. *australiensis* Benth. Fassett has recently reduced *E. americana* to varietal rank, as *E. triandra* var. *americana* (Pursh) Fassett (in Rhodora **33**: 72. 1931, **41**: 373. 1939), but the austral variety is not placed by him. It remains for a monographer to decide what status *E. gratioloides* merits; for the time being I follow Niedenzu in considering it a specific entity. The type was collected by R. Cunningham in 1833, in a bog at Tauraki, Hokianga River, North Island, New Zealand.

FLACOURTIACEAE

Flacourtia vitiensis (Seem.) comb. nov.

Thacombauia vitiensis Seem. Fl. Vit. 426. *pl. 100.* 1873.

Flacourtia ovata Gillespie in Bishop Mus. Bull. **83**: 27. *f. 34* (excl. *a, f, g*). 1931.

The monotypic genus *Thacombauia* was originally described by Seemann as a member of the Humiriaceae, but subsequently it was questionably referred to the Euphorbiaceae by Durand, Pax, and Dalla Torre and Harms. A glance at Seemann's plate demonstrates the identity of the plant with *Flacourtia ovata,* which was recently emended by me in Sargentia 1: 61. 1942. While it is regrettable that the name honoring the famous King Thacombau thus falls into synonymy, nevertheless it is a source of satisfaction to place the genus.

MYRTACEAE

Syzygium phaeophyllum Merrill & Perry, nom. nov.

Eugenia durifolia A. C. Sm. in Bishop Mus. Bull. 141: 105. *f. 56.* 1936.

Syzygium durifolium Merrill & Perry in Sargentia 1: 76. 1942, non in Mem. Am. Acad. Arts & Sci. 18: 176. 1939.

Dr. E. H. Walker has called our attention to an oversight in our use of the specific epithet *durifolium* for two different species, the earlier from Borneo and the later from Fiji. Consequently, the Fijian species is here renamed. — E. D. Merrill and L. M. Perry.

MYRSINACEAE

Tapeinosperma Greenwoodii sp. nov.

Arbor ad 5 m. alta ubique partibus juvenilibus et inflorescentiis puberulis exceptis glabra, ramulis subteretibus rugulosis cinereis apicem versus 3–6 mm. crassis; foliis apicem ramulorum versus aggregatis, petiolis angulatis supra complanatis crassis (1.5–2 mm. diametro) 5–8 mm. longis, laminis chartaceis juventute copiose pellucido-punctatis mox opacis in sicco fusco-olivaceis elliptico-oblongis vel obovatis, 12–16 cm. longis, 5–8 cm. latis, basi gradatim angustatis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine saepe undulatis et paullo recurvatis, costa supra leviter canaliculata subtus prominente, nervis lateralibus primariis utrinsecus 15–20 cum aliis debilioribus interspersis patentibus rectis marginem versus anastomosantibus utrinque valde prominulis, rete venularum intricato utrinque paullo prominulo; inflorescentiis axillaribus multifloris tri- vel quadripinnatim paniculatis, 12–20 cm. longis, 6–14 cm. latis, pedunculo 4–6 cm. longo et rhachi ramulisque gracilibus dense brunneo-glanduloso-puberulis; bracteis deltoideo-oblongis circiter 1.1 × 0.7 mm. subacutis utrinque puberulis et margine ciliatis; pedicellis teretibus gracilibus 0.8–1 mm. longis puberulis; calyce rotato-cupuliformi circiter 2.5 mm. diametro, basi rotundato, extus parce glanduloso-puberulo, intus glabro, lobis 5 fere ad basim liberis late ovatis, circiter 0.8 × 1.1 mm., margine minute glanduloso-ciliolatis, apice emarginatis vel interdum rotundatis; corolla (paullo ante anthesin) circiter 3 mm. longa, lobis fere ad basim liberis ovatis 2–2.5 mm. latis, apice acutis, superne leviter punctatis; staminibus prope basim corollae insertis subsessilibus, antheris elongato-deltoideis circiter 1 × 0.8 mm. saepe glandulas 2 vel 3 dorso gerentibus; gynaecio sub anthesi circiter 1.6 mm. longo, ovario ovoideo in stylum gracilem circiter 1 mm. longum attenuato, stigmate minuto subpeltato, placenta ovoidea 2-ovulata.

VITI LEVU: Lautoka: Mt. Evans, alt. about 900 m., *Greenwood 944* (A, TYPE), Oct. 25, 1942 (small tree 3–5 m. high, the inflorescences lax, dependent).

Tapeinosperma Greenwoodii is most closely allied to *T. clavatum* Mez, with which it has in common short petioles, elliptic leaf-blades of moderate size and with prominulous venation, and ciliate and usually emarginate calyx-lobes. However, the new species has a much more ample and more complex inflorescence, the pedicel is slender and not conspicuously swollen distally into a conical calyx like that of *T. clavatum,* and the flowers are smaller throughout. The calycine character seems dependable, as the several specimens of *T. clavatum* examined have the calyx as described by Gillespie (in Bishop Mus. Bull. 74: 9. *f. 8.* 1930). The new species may also be compared with *T. Hornei* Mez, a species with long-petiolate large leaves, a shorter, simpler, and lepidote inflorescence, and larger flowers with acute or acuminate calyx-lobes.

RUBIACEAE

Mussaenda L.

Although it has been customary to refer the Pacific representatives of *Mussaenda* to *M. frondosa* L., examination of specimens and literature indicates that this is erroneous. Students of the Pacific floras have apparently been aware of this fact, but no alternative identification has been seriously suggested for the common Pacific plant, which is, in some areas, one of the most abundant elements of second growth vegetation. However, a species supposedly endemic to Raiatea, *M. raiateensis* J. W. Moore, was described in 1933. A careful examination of abundant Pacific material of the genus, including an isotype of *M. raiateensis* (for the loan of which I am greatly indebted to Dr. Moore, of the University of Minnesota), inclines me to believe that a single species occurs from the New Hebrides to the Society Islands, to which Moore's binomial may be applied. A discussion of the relationships of this Pacific species and an emended description follow.

The Linnaean species, *M. frondosa* (Sp. Pl. 177. 1753), is based upon several earlier references, among them Linnaeus' Flora Zeylanica (p. 35. 1747) and Burman's Thesaurus Zeylanicus (p. 165, *tab. 76.* 1737). The actual type is a collection of Hermann from Ceylon. The Ceylon plant described in the above references, and further amplified by Trimen (Handbook Fl. Ceylon 2: 323. 1894), is a scrambling shrub, with the branchlets, leaves, and the enlarged calyx-lobe densely and closely velutinous-tomentose. A representative specimen from Ceylon is *J. M. de Silva 38* (A).

The actual geographical range of *M. frondosa* is in doubt, but its occurrence in the eastern Malaysian and the Pacific regions is highly questionable. In their recent work on the genus in Papuasia (in Jour. Arnold Arb. 25: 192–196. 1944), Merrill and Perry did not find the species represented in the available material. The true *M. frondosa,* as represented by specimens from Ceylon and India, differs from the Pacific entity not only in its habit and its generally more obvious pubescence, but also in its longer normal calyx-lobes (5–10 mm. long), in its anthers being more deeply inserted on the corolla-tube (tips of anthers 4–9 mm. below apex of tube), and in its fruit being elenticellate or essentially so.

A closer relative of the Pacific plant than *M. frondosa* is *M. philippica* A. Rich., of the Philippine and Solomon Islands. In common with the Pacific entity, Richard's species differs from *M. frondosa* in its more highly placed stamens and its lenticellate fruits. From *M. philippica,* the Pacific plant differs in its longer and more or less subulate, rather than deltoid-lanceolate, calyx-lobes, and in its comparatively thick pericarp, which, when mature, remains firm and does not readily break. Another species of the Solomon Islands, *M. Kajewskii* Merr. & Perry (in Jour. Arnold Arb. 25: 194. 1944), is very close to *M. philippica* and differs from the Pacific plant in the same characters pertaining to comparatively short calyx-lobes.

The common *Mussaenda* of Micronesia has been mentioned in the literature as *M. frondosa* L. (Volkens in Bot. Jahrb. 31: 475. 1901; Safford in Contr. U. S. Nat. Herb. 9: 330. 1905; Merr. in Philip. Jour. Sci. Bot. 9: 147. 1914; Fosberg in Occ. Pap. Bishop Mus. 15: 215. 1940) and *M. sericea* Bl. (Valeton in Bot. Jahrb. 63: 300. 1930; Kanehira in Bot. Mag. Tokyo 45: 351. 1931, Fl. Micrones. 369. 1933, in Jour. Dept. Agr. Kyushu Univ. 4: 421. 1935). This Micronesian *Mussaenda* is certainly not *M. frondosa* in the limited sense of Ceylon and Indian plants, and its identity with *M. sericea,* based on a Moluccan specimen, is open to doubt. However, I see no reason to exclude the Micronesian specimens now available to me (*Kanehira 90, 1157, 1177, 1993, Herre 12* [all NY]) from *M. philippica* A. Rich. At any rate, these Micronesian plants differ from those of the more southerly islands (New Hebrides to Societies) in the characters above discussed for *M. philippica.*

Another species of *Mussaenda* occurring in the Pacific region is *M. cylindrocarpa* Burck, found in the New Hebrides (Guillaumin in Jour. Arnold Arb. 13: 4. 1932) but apparently not extending farther east into the Pacific. This species is characterized by having its stamens deeply inserted on the corolla-tube and its fruit cylindric, and it is not concerned in a discussion of the identity of the species which is so abundant in Fiji, Samoa, and eastward.

To summarize, it seems obvious that the common *Mussaenda* which extends from the New Hebrides to Rarotonga is amply distinct from *M. frondosa* L. and that its closest allies are more probably *M. philippica* A. Rich. and *M. Kajewskii* Merr. & Perry. This entity does not appear separable from *M. raiateensis* J. W. Moore, although it is a fairly variable species, in which subspecific divisions may eventually seem desirable. For the time being I cannot tie up the slight morphological variations, such as those pertaining to the degree of pubescence, with geographical regions. The following description is based on all material of the species now available to me.

Mussaenda raiateensis J. W. Moore in Bishop Mus. Bull. 102: 44. 1933.

Mussaenda frondosa sensu Forst. f. Fl. Ins. Austr. Prodr. 17. 1786; A. Rich. Sert. Astrolab. 2: ix. 1834; Endl. in Ann. Wien. Mus. Naturgesch. 1: 175. 1836; Guillemin in Ann. Sci. Nat. Bot. II. 7: 251. 1837; Seem. in Jour. Bot. 2: 72. 1864, Fl. Vit. 123. 1866; Powell in Jour. Bot. 6: 370. 1868; Engl. in Bot. Jahrb. 7: 477, pro parte. 1886, Forschungsr. Gazelle Siphon. 46, pro parte. 1889; Drake, Ill. Fl.

Ins. Mar. Pac. 189. 1890; Hemsl. in Jour. Linn. Soc. Bot. **30**: 180. 1894; Reinecke in Bot. Jahrb. **25**: 690. 1898; Burkill in Jour. Linn. Soc. Bot. **35**: 40. 1901; Cheesem. in Trans. Linn. Soc. Bot. II. **6**: 282. 1903; Gibbs in Jour. Linn. Soc. Bot. **39**: 151. 1909; Wilder in Bishop Mus. Bull. **86**: 102. 1931; Guillaumin in Jour. Arnold Arb. **13**: 4. 1932; Fosberg in Bull. Torr. Bot. Club **67**: 420. 1940; non L.

?Mussaenda formosa sensu Seem. Fl. Vit. 123, as synonym. 1866 (forsan quoad Forst. Icon. ined. *t. 56, 57*), non Jacq.

Mussaenda frondosa var. *pilosissima* sensu Reinecke in Bot. Jahrb. **25**: 690. 1898; Rechinger in Denkschr. Akad. Wiss. Wien 85: 368. 1910 (repr. **3**: 194); Setchell in Carn. Inst. Publ. **341**: 43. 1924; non Engl.

Mussaenda sp. Christoph. in Bishop Mus. Bull. **128**: 199. 1935.

Shrub or slender tree 2–10 m. high, sometimes said to be epiphytic or subscandent, the branchlets slightly flattened when young, densely hispidulous with pale or brownish hairs 0.3–0.5 mm. long, at length terete, glabrescent, brownish, striate, gray-lenticellate; stipules interpetiolar, 7–17 mm. long, deeply bifid, sericeous toward base, sparsely hispidulous distally, soon caducous, each lobe subulate-lanceolate; petioles slender, subterete or shallowly canaliculate, 5–25 (–40) mm. long, densely hispidulous to glabrescent like the branchlets; leaf-blades papyraceous, olivaceous or brownish when dried, often slightly paler beneath, ovate or oblong-elliptic, 10–18(–20) cm. long and 5–10(–14) cm. broad (uppermost leaves sometimes smaller), acute to attenuate (rarely subrounded or obtuse) at base and decurrent on the petiole, gradually acuminate at apex (acumen 5–30 mm. long), entire or lightly undulate at margin, sparsely hispidulous (often densely so on veins) and often soon glabrescent above, more densely hispidulous beneath (especially on nerves and in axils, the hairs pale, spreading, 0.5–1 mm. long) but at length often essentially glabrescent, the costa nearly plane or raised above, prominent beneath, the secondary nerves 7–10(–12) per side, ascending, curved or nearly straight, prominulous above, strongly elevated beneath, the veinlet-reticulation copious, plane or faintly impressed on both sides; inflorescence terminal, several- to many-flowered, often wide-spreading at maturity and up to 12 cm. long and broad but usually much smaller, the branches and pedicels hispidulous like the petioles or puberulent, essentially glabrous in fruit, the pedicels slender, short, up to 5 mm. long or essentially none, the bracts (up to 6 mm. long) and the minute bracteoles linear-subulate and soon caducous; calyx-tube oblong-cylindric or turbinate, at anthesis 3–5 mm. long, hispidulous or sericeous with pale or brown hairs 0.1–0.5 mm. long, the lobes 5, erect, linear-subulate, 4–6.5 mm. long, hispidulous, glabrescent within and distally, one lobe often enlarged; enlarged calyx-lobe membranaceous, white or yellowish, ovate or ovate-lanceolate, 5–8(–10.5) cm. long, 2.5–6.5 cm. broad, attenuate to obtuse at base and contracted into a slender stipe 5–20 mm. long, short-acuminate or cuspidate at apex, sparsely hispidulous on both sides or glabrescent, several-nerved from base, the veinlet-reticulation often obvious; disk annular, glabrous; corolla slenderly infundibular, pale yellow proximally, yellow or orange distally, 23–40 mm. long including lobes, the tube hispidulous or sericeous (often inconspicuously so) without, glabrous or subglabrous within toward base and distally (above attachment of anthers) copiously and densely soft-strigose with pale ascending hairs about 1 mm. long, the lobes 5, spreading, oblong or ovate-deltoid, 3–6.5 mm. long and broad, cuspidate at apex, usually puberulent without and copiously glandular-puberulent within; stamens 5, glabrous, inserted in throat of corolla (tip of anthers 1–3 mm. below apex of corolla-tube), the filaments very short, the anthers linear, 3.5–5.5 mm. long, acute at apex, sagittate at base; style filiform, glabrous, equaling or slightly exceeding the corolla-tube, bifid for about 1.5 mm. at apex; fruit ellipsoid or turbinate, glabrous at maturity, green when fresh, brownish or blackish when dried, 10–15 mm. long, 7–11 mm. broad, truncate at apex, obtuse at base and contracted into a slender stipe 2–4 mm. long, the calyx-lobes caducous or the enlarged one sometimes subpersistent, the pericarp firm, copiously marked with large gray elliptic lenticels, the seeds minute, black, reticulate.

DISTRIBUTION: New Hebrides, Fiji, Samoa, Tonga, Rarotonga, and Society Islands; probably also in some of the adjacent groups. Reported from a variety of habitats, including clearings, thickets, open forest, and occasionally rain-forest; in Fiji it is one of the commonest plants in second growth thickets and is rarely absent from this habitat. Reported altitudes range from sea-level to 900 m. The type is *Moore 684* from Raiatea.

NEW HEBRIDES: ANEITYUM: *Milne* (NY); Anelgauhat Bay, *Kajewski 922* (A, NY). FIJI: VITI LEVU: Lautoka: Mountains near Lautoka, *Greenwood 164* (A); Tholo North: Nandarivatu, *Degener & Ordonez 13526* (A, NY), *Reay 9* (A); Sovutawambu, near Nandarivatu, *Degener 14602* (A, NY); Naitasiri: Vicinity of Nasinu, *Gillespie 3555* (NY); Waindina River basin, *MacDaniels 1053* (A). KANDAVU: Namalata Isthmus region, *Smith 25* (GH, NY). VANUA LEVU: Thakaundrove: Hills south of Nakula Valley, *Smith 330* (GH, NY); Valanga, Savu Savu Bay, *Degener & Ordonez 13987* (A, NY); summit of Uluinabathi Mt., Savu Savu Bay region, *Degener & Ordonez 13936* (A, NY); Maravu, near Salt Lake, *Degener & Ordonez 14185* (A). TAVEUNI: Vicinity of Wairiki, *Gillespie 4754* (NY). OVALAU: Vicinity of Levuka, *Gillespie 4471* (NY), *Degener & Ordonez 13795* (A, NY). MAKONDRONGA: *Degener & Ordonez 13814* (A, NY). KORO: Eastern slope of main ridge, *Smith 1030* (NY). ONEATA: *U. S. Expl. Exped.* (NY). FULANGA: *Smith 1173* (NY). Fiji, without other locality: *U. S. Expl. Exped.* (GH, NY), *Seemann 238* (GH), *Horne* (GH), *Prince* (GH). SAMOA: SAVAII: Vaipouli, *Vaupel 355* (NY); Salailua, *Christophersen 2999* (NY). UPOLU: Near Malololelei, *Christophersen 323* (NY). TAU: Fitiuta trail back of Luma, *Garber 610* (NY). Samoa, without other locality: *U. S. Expl. Exped.* (GH). TONGA: TONGATABU: Along the Hala Loto, *Setchell & Parks 15490* (GH). EUA: Western edge of the Plateau, *Parks 16200* (A, GH, NY). COOK ISLANDS: RAROTONGA: *Parks & Parks 22209* (GH). SOCIETY ISLANDS: RAIATEA: West side of highest mountain, March 24, 1927, *Moore 684* (TYPE COLL., herb. Univ. Minnesota).

COMMON NAMES (and sources): In Fiji: *Mbovu* or *Mbovo* (all collectors), *Vakatharendavui* (Smith), *Vombo* (Reay); in Samoa: *Uto'uto, Ma'osina* (Powell), *Fua i tausaga, Laupaepae* (Setchell), *Alo alo vao, Fue* (Christophersen); in Rarotonga: *Kotuku* (Cheeseman, Wilder).

NATIVE USES: In Fiji decoctions of the leaves and bark are commonly used as a cure for fever, chest complaints, and kidney diseases.

Airosperma

Airosperma Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 565. 1901.

Abramsia Gillespie in Bishop Mus. Bull. **91**: 27. 1932.

Dr. L. M. Perry has kindly pointed out to me the apparent similarity of *Airosperma* (with four species endemic to New Guinea) and *Abramsia* (monotypic and supposedly endemic to Fiji). Careful examination of the literature and the available specimens indicates that these two generic concepts are essentially identical. We thus have another illustration of a genus extending from New Guinea to Fiji, presumably to be anticipated in the intervening island groups, from which it has not yet been reported.

In their original discussion of *Airosperma*, Lauterbach and K. Schumann place the genus in the "Albertinae," pointing out its essential characters of pendulous solitary ovules and contorted corolla-lobes. In the classification of K. Schumann (in E. & P. Nat. Pfl. IV. 4: 16. 1891), this appears to be correct, and *Airosperma* may be placed in the Coffeoideae-Guettardinae-Alberteae (op. cit. 87–89). This is the position assigned to the genus by Krause (in E. & P. Nat. Pfl. Nachtr. 3: 328. 1908).

Gillespie, in placing his new genus *Abramsia*, expresses a belief that its relationships are in the Ixoreae; the pendulous ovules, however, would seem to exclude consideration of this or any other division of the Psychotriinae. Gillespie emphasizes precisely the same combination of characters which differentiates *Airosperma*, and indeed his illustration (op. cit. *fig. 31*) shows that the fundamental characters of *Abramsia* are similar to those of *Airosperma* (illustrated in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee *t. 21.* 1901).

Although the specific epithets originally associated with *Airosperma* were *psychotrioides* and *ramuensis*, and although subsequent discussions have treated the generic name as feminine, it must be considered neuter, according to Art. 72 (2) of the International Rules of Botanical Nomenclature (1935).

Airosperma trichotomum (Gillespie) comb. nov.

Abramsia trichotoma Gillespie in Bishop Mus. Bull. **91**: 29. *fig. 31.* 1932; Fosberg in Bull. Torrey Bot. Club **67**: 422. 1940, in Sargentia **1**: 125. 1942.

Airosperma trichotomum is known from several collections from the Fijian islands of Viti Levu, Vanua Levu, and Taveuni, which are cited in the listed publications. The available material shows that the species is fairly variable as to leaf-size, but in important respects it is reasonably consistent.

Although linear calyx-lobes characterize *Airosperma psychotrioides* (the illustrated New Guinean species), other species of the genus, notably *A. grandifolium* Val., have the calyx-lobes more or less deltoid. In the Fijian species the calyx-lobes are still smaller, but this character is hardly of generic value. Gillespie's species is also marked by its large thin leaves and comparatively ample inflorescences.

Mastixiodendron

Mastixiodendron Melchior in Bot. Jahrb. **60**: 167. 1925.

Dorisia Gillespie in Hook. Ic. Pl. **32**: *pl. 3190.* 1933.

Mastixiodendron and *Dorisia* were both originally described as members of the Cornaceae allied to *Mastixia* Bl. Gillespie's genus was transferred to the Rubiaceae by the present writer in 1936 (in Bishop Mus. Bull. **141**: 140) and was referred to the tribe Chiococceae, but at that time *Mastixiodendron* was insufficiently known to me to be carefully considered. More recently Merrill and Perry (in Jour. Arnold Arb. **23**: 416. 1942) have also removed *Mastixiodendron* from the Cornaceae to the Rubiaceae,[1] commenting on its close relationship to *Dorisia*. Further examination of the two specific entities involved demonstrates that the differences between them are scarcely generic in nature. Those differences pointed out by Gillespie deal merely with the comparative length and position on the fruit of the calyx-tube and appear to be of specific value only.

In order to have the reduction of *Dorisia* to *Mastixiodendron* verified, ample material of the two species involved — *Dorisia flavida* (Seem.) A. C. Sm. from Fiji and *Mastixiodendron pachycladon* [*"pachyclados"*] (K. Schum.) Melchior from New Guinea — was submitted to Dr. Charlotte G. Nast for study. Her report states that: *"Dorisia* and *Mastixiodendron* could be taken as congeneric. Their nodal anatomy (trilacunar), stomata (the usual rubiaceous type), wood, and pollen are similar. The wood has oblique-porous vessels, septate fibers, no wood parenchyma, and fairly short heterogeneous rays. The tricolpate pollen grain has a fairly fine but distinctly reticulate exine. *Mastixia* Bl. is not related to *Mastixiodendron*. The wood of the two genera is entirely different, that of *Mastixia* having scalariform vessels with many bars, diffuse-aggregate parenchyma, and very long heterogeneous rays. The stomata of *Mastixia* are not of the rubiaceous type, and the tricolpate pollen grain is very finely reticulate, almost granular in appearance, the pores being smaller and the grooves larger than those of the pollen grain of *Mastixiodendron*."

In view of this evidence, and because of the lack of differentiating taxonomic characters, it appears that *Dorisia* may be incorporated in the older genus. *Mastixiodendron,* as thus amplified, has a range extending from Halmahera (see Merrill and Perry in Jour. Arnold Arb. **25**: 205. 1944) through New Guinea to Fiji. Its discovery in the Solomons and New Hebrides is to be anticipated and would complete a very natural geographical distribution.

Mastixiodendron flavidum (Seem.) comb. nov.

Canthium flavidum Seem. Fl. Vit. 132. 1866.
Plectronia flavida Benth. & Hook. f. ex Drake, Fl. Ins. Mar. Pac. 194. 1890.
Dorisia rarissima Gillespie in Hook. Ic. Pl. **32**: *pl. 3190*. 1933.
Dorisia flavida A. C. Sm. in Bishop Mus. Bull. **141**: 140. 1936; Fosberg in Sargentia 1: 120. 1942.

This species is known from the Fijian islands of Vanua Levu, Rambi, and Viti Levu, as mentioned in the above-cited publications. Gillespie mentions *Horne 1132*, and Fosberg *Parham III*, as pubescent-leaved individuals possibly worthy of nomenclatural recognition. These two specimens, both in fruit, appear to the present writer to represent an undescribed species.

Mastixiodendron pilosum sp. nov.

Arbor, ramulis leviter angulatis demum subteretibus cinereisque, apicem versus copiose puberulis; stipulis rigidis oblongo-lanceolatis 18–25 mm. longis inconspicue puberulis mox caducis; petiolis subteretibus vel leviter canaliculatis robustis (1–2 mm. diametro) 2–4 cm. longis dense puberulis;

[1] Apparently *Mastixiodendron* was first referred to the Rubiaceae by Danser (in Blumea **1**: 69. 1934), in his study of the Cornaceae of the Netherlands Indies.

laminis chartaceis in sicco fuscis subtus pallidioribus oblongo-ellipticis, 12–22 cm. longis, 6–9.5 cm. latis, basi acutis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine integris paullo recurvatis, supra glabris subnitidis, subtus pilis pallidis patulis 0.1–0.4 mm. longis conspicue et persistenter molliter pilosis, costa conspicua supra subplana vel leviter canaliculata subtus prominente, nervis secundariis utrinsecus 7–10 patentibus marginem versus curvatis et laxe anastomosantibus supra paullo subtus valde elevatis, rete venularum intricato utrinque prominulo; inflorescentiis thyrsoideis axillaribus ad 15 cm. longis pauciramosis, pedunculo longo ramulisque copiose pallido-puberulis, bracteis parvis mox caducis, pedicellis sub fructu gracilibus 2–4 mm. longis puberulis, bracteolis lanceolatis circiter 1 mm. longis inconspicuis subtentis; calyce post anthesim turbinato ut pedicello puberulo, limbo brevi persistente, lobis 4 vel 5 deltoideis acutis ad 1 mm. longis; corolla non visa; fructibus oblongo-ellipsoideis, ad 20 × 7 mm., basi et apice obtusis, praeter calycis lobos glabris, calycis limbo subnullo, lobis 4 vel 5 inconspicuis membranaceis late deltoideis minute hirtellis infra fructus apicem 2–3 mm. orientibus, pericarpio circiter 1 mm. crasso, exocarpio carnoso, mesocarpio tenui fibroso, endocarpio duro, loculis seminibusque 1 vel 2, seminibus oblongo-ellipsoideis ad 13 mm. longis et 2 mm. latis utrinque obtusis, testa conspicue reticulato-incrassata, albumine copioso albo.

VANUA LEVU: Mbua: Between Mbua and Ndevoka, *Mrs. H. B. R. Parham 111* (A) (tree near creek; fruits orange). Fiji, without definite locality: *Horne 1132* (GH, TYPE). The Horne collection, the better of the two listed, was probably also obtained on Vanua Levu, from which the bulk of his collection came.

The leaves of *M. flavidum* (Seem.) A. C. Sm. are entirely glabrous beneath or very minutely puberulent on the costa and principal nerves, whereas those of the new species are densely, conspicuously, and persistently soft-pilose beneath with pale spreading hairs. The young branchlets, stipules, inflorescence-branches, fruiting pedicels, mature calyces, and persistent calyx-lobes of *M. pilosum* are similarly pubescent, the corresponding parts in *M. flavidum* being glabrous. These differences appear to be of specific value, and I doubt if such a well-defined species as *M. flavidum* should be interpreted to include the pubescent form here described as new.

Both of the Fijian species differ from the New Guinean *M. pachycladon* in their less robust habit, longer and more slender petioles, narrower leaf-blades, and more nearly completely inferior fruits.

COMPOSITAE

Erigeron sumatrensis Retz. Obs. Bot. 5: 28. 1789.

VITI LEVU: *Parks s. n.* (Bish); Tholo North: Nandarivatu, on open slopes, *Parks 20623* (Bish).

This widespread weed, often recorded under the later binomial of *E. linifolius* Willd. (1804), has been reported from only Hawaii and Easter Island in the Pacific region.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NOTES ON SOME CHINESE AND KOREAN SPECIES OF THALICTRUM

BERNARD BOIVIN

With one plate

RECENT collections in China made under the auspices of the Arnold Arboretum have resulted in the assembling of about 200 specimens of *Thalictrum,* mostly from Yunnan; these are now deposited in the Gray Herbarium. The purpose of the present paper is to present descriptions of certain new species found among this material and to discuss other noteworthy species. When this work was first undertaken, in October, 1943, there was a nearly complete lack of material for comparison in the Harvard herbaria, and I was forced to depend upon the original descriptions in making identifications. Since then, however, at Dr. Merrill's request, Sir William Wright Smith, of the Royal Botanic Garden at Edinburgh, has very kindly sent us thirteen packets containing authentic fragments of as many of Léveillé's species. Each packet is fully annotated and contains fairly large fragments, so carefully selected that no trouble was experienced in identifying them, except, of course, when the plants had been badly preserved or collected too early.

I am deeply indebted to Sir William Wright Smith for his generosity in sending these fragments, and also to the authorities of the Arnold Arboretum and the Gray Herbarium for the specimens and facilities placed at my disposal. All cited specimens, unless otherwise stated, are deposited in the Gray Herbarium.

Subgenus **Thalictrum** (DC.) Reichenb.

§ **Homothalictrum** Boivin

Thalictrum Esquirolii H. Lév. & Vaniot in Bull. Acad. Int. Géogr. Bot. 17(210–211): ii. 1907.

Part of the type material, consisting of a complete plant and an inflorescence, is in the Gray Herbarium; this is very good material in full bloom. Most of the herbarium specimens which I have seen identified as this species have been correctly named.

Thalictrum minus L. var. **elatum** Lecoyer in Bull. Soc. Bot. Belg. 24: 202. 1885.

Thalictrum amplissimum H. Lév. & Vaniot in Bull. Acad. Int. Géogr. Bot. 11: 51. 1902.

Thalictrum minus var. *amplissimum* H. Lév. & Vaniot ex H. Lév. Fl. Kouy-Tchéou 339. 1915.

A fragment of a syntype of *T. amplissimum* is preserved in the Gray Herbarium. This is a side branch of the inflorescence of a plant 2 feet high, collected in flowering condition. Whether the actual type is at Edinburgh or at the Académie Internationale de Géographie Botanique is not known, nor whether the original material is made up of two different collections or a single collection.

§ **Leptostigma** Boivin

Thalictrum acteaefolium Sieb. & Zucc. var. **clematidifolium** (Franch.) Finet & Gagnep. in Bull. Soc. Bot. France 50: 611. 1903.

The variety, known from Szechuan and Yunnan, is pubescent throughout and its anthers are about 1 mm. long, while the typical form is entirely glabrous and has anthers about 1.5 mm. long. Specimens of the typical form are at hand from Japan, Korea, Kiangsi, and Chekiang.

Thalictrum Atriplex Finet & Gagnep. in Bull. Soc. Bot. France 50: 613. *pl. 19, B.* 1903.

This species is closely related to *T. baicalense* Turcz., and it is probable that the latter should be placed in § *Leptostigma* rather than in § *Physocarpum*. Indeed, *T. baicalense* is a more or less heterodox species.

Thalictrum cirrhosum H. Lév. in Rep. Nov. Sp. 7: 97. 1909.

A fragment of an isotype, preserved in the Gray Herbarium, proves to be altogether different from any other specimen at hand. The whole plant is pubescent except upon the upper surface of the leaves. All the hairs are simple and short except those on the lower surfaces of the leaves, these bearing numerous short branches and having stellate tips. This is a unique type of pubescence in *Thalictrum*. The specific epithet *cirrhosum* is undoubtedly wrong, for the type has no cirrhi, nor have any other specimens of the genus. But the Edinburgh isotype is labeled "*cirrosum*" in Léveillé's hand. This could be the adjectival form of "cirrus" and could well be used to describe a plant having the habit of *T. trichopus* Franch. or *T. cincinnatum* Boivin. However, as the fragment looks much more like *T. deciternatum* Boivin than like any other species, one is at a loss to understand Léveillé's choice of a specific epithet.

Thalictrum deciternatum sp. nov. PL. I, FIGS. 4–7.

Planta omnino glabra, sed foliolis inferne interdum pubescentibus, caule, ramis, petiolis petiolulisque pruinosis, 50–125 cm. alta, radicibus fibrosis, haud stolonifera. Folia basilaria aetate florendi desunt. Folia caulinaria 10–30 cm. longa, sessilia in apice dilatationis petiolaris vel breviter petiolata, 6–10-ternata. Stipellae desunt. Foliola 3–10 mm. longa, bi-trilobata, crassa, margine revoluto, superne dense viridia et nervis paullo impressis, inferne glauca et nervis rugosis valde reticulatis. Foliolum terminale basi cuneatum apice rotundo-truncatum, mucronatum. Inflorescentia paniculata ramosa copiosa paullulum foliosa. Pedicelli sub receptaculo recurvati. Sepala elliptica lutea ca. 4 mm. longa. Filamenta lutea filiformia ca. 5 mm. longa. Antherae oblongo-lineares 3–3.5 mm. longae, mucrone 0.1–0.3 mm. longo. Ovaria subsessilia 4–5. Stigma sessile 1–1.5 mm. longum anguste bialatum a sepalis recedit. Carpella immatura compressa subsessilia, ventre basi cuneato, summo rotundo, nervo ventrali quam dorsali paullulum convexiore. Floret junio julio et augusto.

YUNNAN: Ad lat. or. mont. niveor. prope Lichiang, in dumetis, ad 1.25 m., alt. ca. 3200 m., junio 16, 1914, *C. Schneider 1805* (TYPE); Lichiang Snow Range, common along mountain stream, August 27, 1937, *T. T. Yü 15480;* eastern slopes of Likiang

Snow Range, gulch leading to main peak, among rocks, fls. yellow, May 24, 1922, *J. F. Rock 3801;* Likiang Snow Range, open pasture, plant 3 ft. high, fls. green-yellow, June 25, 1939, *R. C. Ching 30272;* Li-kiang Hsien, grassy slope under forest, fls. greenish white, alt. 3000 m., July 1935, *C. W. Wang 70955;* Wei-si Hsien, Yeh-chih, mountain slope, fls. yellow, alt. 3600 m., Aug. 1935, *C. W. Wang 68341;* Chi-ling Shan, Cheng-kiang, fls. light purple, alt. 1960 m., Aug. 25, 1939, *H. Wang 41681;* without detailed data, *T. T. Yü 9891, 12008.*

Thalictrum Delavayi Franch. in Bull. Soc. Bot. France **33**: 367. 1886.
?*Thalictrum grandisepalum* H. Lév. in Bull. Acad. Int. Géogr. Bot. **11**: 297. 1902.
?*Thalictrum Duclouxii* H. Lév. in Rep. Nov. Sp. 7: 98. 1909.

Thalictrum grandisepalum recalls *T. Delavayi* in its flowers, but it might possibly be a different species. The type fragment at hand shows a plant collected too early in bloom and very poorly preserved. A fragment of a syntype of *T. Duclouxii* is also at hand, but this was collected when the flowers were still in bud. Consequently, it is impossible to identify with certainty either of Léveillé's species listed above.

Thalictrum Finetii sp. nov. Pl. I, figs. 1–3.

Planta 50–200 cm. alta, foliolis inferne et fructibus dense pubescentibus, caule et petiolis puberulis. Pubescentia caulinaris fructuum et petiolorum e pilis capitatis translucidis minutis, foliorum opacis minutis crassiusculis. Radices fibrosae, nec planta stolonifera. Caulis et rami flexuosi. Folium basilarium deest aetate florendi. Folia caulinaria regulariter 4-ternata et fere omnia sessilia in apice dilatationis petiolaris. Petioluli arcuantes. Stipellae desunt. Foliola membranacea ovata 5–15 mm. longa, trilobata lobis crenatis. Inflorescentiae variabiles, aliae reductae, aliae amplae. Pedicelli sub receptaculo recurvati et fere omnes ex axillis foliorum 1–3-ternatorum. Sepala 4–5, elliptica, 3.5–4.5 mm. longa. Filamenta filiformia pallide lutea ca. 6 mm. longa. Antherae oblongo-lanceolatae ca. 2.5 mm. longae, acumine ca. 1 mm. longo. Ovaria 7–10. Stigma 0.9–1.2 mm. longum haud alatum sed ventrale. Carpella matura laminaria, divaricata, stipite ca. 0.4 mm. longo, ventre semi-obovato ca. 4 mm. longo et 1.5 mm. lato, nervo dorsali recto, ventrali convexo et alis angustis undulatis munito. Floret julio et augusto.

Szechuan: Mt. Omei, hillside, fls. white, alt. 2200 m., Aug. 1, 1938, *K. N. Yin 117* (type); Mt. Omei, shrubby flat, 3 ft. high, fls. white, alt. 3300 m., July-Aug. 1931, *F. T. Wang 23458;* Lieng-ho-kou, grassland, fls. yellow, alt. 12000 ft., Aug. 1938, *T. S. Wen 563.* Yunnan: Mekong-Sąlween Divide, rocky places in mountains, casual, 15–20 inches high, fls. yellow, alt. 4000 m., Aug. 11, 1938, *T. T. Yü 22298;* Chengkang, Snow Range, common on grassy slope, 2–3 ft. high, fls. white, alt. 3460 m., July 24, 1938, *T. T. Yü 16930;* A-tun-tze, ravine, July-Aug. 1935, *C. W. Wang 64790;* Che-tse-lo, Pi-lo Shan, fls. yellow, alt. 4000 m., Aug. 18, 1934, *H. T. Tsai 58014;* Litiping, between Likiang and Weihsi, in mixed forests, 3–5 ft. high, Oct. 9, 1939, *R. C. Ching 22072;* Wei-si Hsien, Yeh-chih, common on mountain slope, alt. 3200 m., July 1935, *C. W. Wang 68033;* north flank of Haba Snow Range, open pasture, 3 ft. high, fls. white, Aug. 20, 1939, *K. M. Feng 2100;* Ta-li Hsien, on open slope, 3 ft. high, fls. white, alt. 3500 m., July 30, 1933, *H. T. Tsai 53943;* without detailed data, *T. T. Yü 6915.*

This species is dedicated to the botanist A. Finet, who published, in collaboration with A. Gagnepain, a very good treatise on the eastern Asiatic species of *Thalictrum.* The nearest relative of *T. Finetii* is *T. platycarpum* Hook. f. & Thoms., of which a syntype is at hand. However, the new species is much larger throughout, with longer anthers and with a narrower fruit, which has less prominent ribs, a shorter stipe, and a well defined style.

Thalictrum Smithii sp. nov. PL. I, FIGS. 20–22.

Planta 40–150 cm. alta, plus minusve pubescens vel fere glabra, radicibus fibrosis in locis tuberosis, tuberibus ovoideis. Folia caulinaria ca. 5-ternata. Stipellae desunt. Foliola membranacea ovata crenata, (0.5–)1(–1.5) cm. longa. Inflorescentia ampla paniculata ramosa ramis flexuosis et fere nudis. Pedicelli brevissimi (3–)5(–15) mm. longi recti. Sepala elliptica dorso puberula ca. 2.5 mm. longa. Filamenta filiformia ca. 4 mm. longa. Antherae oblongo-lineares, ca. 2.5 mm. longae, apice obtusae. Ovaria 4–5. Stigma ventrale subsessile haud alatum, 0.7–1 mm. longum. Carpella matura haud compressa costata sessilia, ventre obovoideo 1.2–1.6 mm. longo et 0.8–1.2 mm. lato, nervis gibbosulis. Floret septembri.

SIKANG: Muli, Wachin, Shawan, common on margin of thickets, 1–2 ft. high, achenes black, alt. 3000 m., Oct. 11, 1937, *T. T. Yü 14487* (TYPE). YUNNAN: Chetse-lo, in forest, fls. yellow, alt. 3200 m., Sept. 7, 1934, *H. T. Tsai 58383;* Shang-pa Hsien, on open slope, 5 ft. high, fls. yellowish, alt. 1500 m., Sept. 27, 1933, *H. T. Tsai 54683;* without detailed data, *H. T. Tsai 57289.*

This new species is dedicated to Sir William Wright Smith.

Thalictrum samariferum sp. nov. PL. I, FIGS. 31, 32.

Planta omnino glabra 10–45 cm. alta. Radices fibrosae, interdum in locis paullulum tuberosis. Stolones desunt. Folia ab internodiis superantur, 5–6-ternata et sessilia in apice dilatationis petiolaris. Foliola coriacea, margine revoluta, minora, ca. 3 mm. longa, basi cuneata, apice trifida vel saepius (1–)3(–5)-lobata. Stipulae adnatae integrae lanceolatae. Stipellae desunt. Inflorescentia interdum simplex, saepius plus minusve ramosa, semper foliosa. Pedunculi fere omnes ex axillis foliorum 2–5-ternatorum. Pedicelli recurvati, vel, si recti, sub receptaculo valde reflexi. Flores 5–25. Carpella matura ca. 10 in receptaculo. Stigma paullulum alatum 1–1.2 mm. longum et sessile. Stipes carpelli maturi 3–7 mm. longus haud alatus nisi prope ventre. Venter carpelli maturi 5–7 mm. longus et 4–5 mm. latus, obcordatus et laminaris bialatus, alis regularibus, alia ventrali convexa, altera dorsali convexiore, et ambae 0.5–2 mm. latae et membranaceae. Nervi carpelli maturi quatuor, quorum unus ventralis, unus dorsalis et duo laterales, omnes vero paullulum rugosi. Flores mihi ignotae sunt.

YUNNAN: A-tun-tze, mountain slope, fruit greenish white, alt. 2700 m., Sept. 1935, *C. W. Wang 70156* (TYPE); A-tun-tze, border of woods, fruit green, alt. 3000 m., July-Aug. 1935, *C. W. Wang 64885, 64772;* without detailed data, *T. T. Yü 12993.* Southeastern TIBET: Sacred mountain Kar-war-kar-boo, Tsa-wa-rung, on bare rocks at foot of mountain, fruit light brown, alt. 3500 m., Sept. 1935, *C. W. Wang 66468;* Djermai, Tsa-wa-rung, alt. 3200 m., Aug. 1935, *C. W. Wang 65720;* Gerda, Ree-su-la, Tsa-wa-rung, on grassy slope, fruit purple, alt. 3600 m., Aug. 1935, *C. W. Wang 65913.*

In habit this species closely resembles *T. elegans* Wall., but it has a much larger fruit, a usually simpler and more leafy inflorescence with longer pedicels, and is always glabrous. Another specimen from Yunnan, *T. T. Yü 6236,* collected early in bloom, may also belong here.

Thalictrum trichopus Franch. in Bull. Soc. Bot. France 33: 370. 1886.
Thalictrum Tenii H. Lév. in Rep. Nov. Sp. 7: 98. 1909.

A fragment of an isotype of *T. Tenii* is preserved in the Gray Herbarium.

Thalictrum virgatum Hook. f. & Thoms. Fl. Ind. 1: 14. 1855. PL. I, FIGS. 25–27.
Thalictrum virgatum var. *stipitatum* Franch. in Bull. Soc. Bot. France 33: 369. 1886.
Thalictrum verticillatum H. Lév. in Rep. Nov. Sp. 7: 97, 99. 1909.

Léveillé's reduction of his own *T. verticillatum* to *T. virgatum* is correct, judging from part of the type material of the former and an isotype of the latter preserved in the Gray Herbarium. Franchet's var. *stipitatum* is the typical form of this species. Lecoyer's drawing (in Bull. Soc. Bot. Belg. 24: *pl. 4, fig. 10.* 1885) does not represent *T. virgatum.*

Thalictrum Yui sp. nov. PL. I, FIGS. 23, 24.

Species *Thalictro deciternato* nostro aspectu multo consimilis. Differt pubescentia totius plantae e pilis capitatis translucidis composita, nisi in foliolis inferne pilis crassiusculis et opacis. Ovaria conspicue stipitata. Stigma ca. 1 mm. longum. Carpella matura compressa subcostata, stipite 1.3–2.3 mm. longo, ventre 2.2–2.8 mm. longo et 1.5–1.7 mm. lato, nervo dorsali paullulum convexo, ventrali multo convexiore quam dorsali.

SIKANG: Muli, Kulu, rocky places in thickets, casual, 2–3 ft. high, achenes pale brown, alt. 3300 m., Sept. 14, 1937, *T. T. Yü 14273* (TYPE).

§ Erythrandra Boivin

Thalictrum javanicum Bl. Bijdr. Fl. Ned. Ind. 2. 1825.
Thalictrum Argyi H. Lév. in Bull. Herb. Boiss. II. 6: 504. 1906.

A fragment of an isotype of *T. Argyi* is preserved in the Gray Herbarium.

Thalictrum ramosum sp. nov. PL. I, FIGS. 12–15.

Planta diffusa e basi ramosa viridula glabra debilis, 25–40 cm. alta. Folia basilaria adsunt, triternata, 20–30 cm. longa. Stipellae desunt. Foliola membranacea, (1–)1.5(–2) cm. longa, saepius obovata et apice crenata, nervis inferne rugosulis. Flores subcorymbosi. Sepala orbicularia 2–2.2 mm. longa. Filamenta alba clavata 1.5–2.2 mm. longa. Antherae ellipsoideae, ca. 0.7 mm. longae, apice rotundae. Ovaria staminibus parum longiora, 8–12. Stigma ventrale haud alatum ca. 0.3 mm. longum. Stylus cum stigmate ca. 0.5 mm. longus. Carpella matura brunnea sessilia fusiformia haud compressa nec costata, ventre lanceolato ca. 4.5 mm. longo et 1.2 mm. lato, nervo ventrali paullum convexiore quam dorsali. In eadem planta nonnunquam et flores et carpella matura inveniuntur quia flores ad anthesim veniunt in successione a mense aprili.

SZECHUAN: South of Kuan Hsien, along ditch, fls. reddish, alt. 850–950 m., Apr. 14, 1930, *F. T. Wang 20378* (TYPE); Mt. Omei, under shady rocks, fls. greenish white, alt. 900 m., Apr. 15, 1932, *T. T. Yü 274;* Chengtu, Mar. 15, 1937, *S. S. Chien 5880.*

Thalictrum Rockii sp. nov. PL. I, FIGS. 28–30.

Planta 1.5 m. alta, omnino pubescens nisi in caule inferiore e pilis uniseriatis translucidis aetate florendi, aetate maturandi glabra nisi in foliolis inferne pubescentia crassiuscula opaca praedita. Folia caulinaria 4–5-ternata estipellata, foliolis 0.8–1.5 cm. longis, trilobatis, lobis saepius crenatis. Inflorescentia copiosa ramosissima paniculata. Sepala ovata ca. 3 mm. longa. Filamenta clavata 5.5–7.5 mm. longa. Antherae oblongo-lanceolatae ca. 1 mm. longae. Ovaria ca. 4, ventre compresso breviore quam stipite, stigmate ca. 0.5 mm. longo breviore quam stylo libero. Carpella matura pendula haud costata laminaria, stipite tenui 3–3.5 mm. longo, ventre semi-obovato 5–5.5 mm. longo, 2.8–3.2 mm. lato, nervo ventrali multo convexiore quam dorsali. Floret junio julioque.

KANSU: Upper Tebbu (T'ieh-pu) country, below Shihmen, Tsaluku valley, in forests of spruces, willows, etc., fls. creamy white, alt. 11000 ft., July-Aug. 1925, *J. F. Rock 13054* (TYPE); T'ao River basin, valley of Tayüku, grassy slopes, fls. greenish, alt. 8500 ft., July 1925, *J. F. Rock 12835*. TSINGHAI (Ch'ing-hai): Ba valley, under willows, fls. greenish yellow, alt. 9900 ft., June 23, 1926, *J. F. Rock 14271*.

In the herbarium of the New York Botanical Garden there is a fruiting specimen of this species, collected by W. Y. Hsia (no. *2400*) at Ling-shan-kou in Cho-lu Hsien.

Thalictrum Wangii sp. nov. PL. I, FIGS. 8–11.

Planta 30–40 cm. alta, omnino dense pubescens pilis capitatis translucidis. Folia caulinaria 3-ternata, ea inflorescentiae 1–2-ternata. Stipulae semi-ovatae ca. 1 mm. longae. Stipellae desunt. Foliola membrancaea ca. 8 mm. longa, fere orbicularia, apice trilobata, lobis crenatis. Inflorescentia 4–8-flora. Pedicelli 1–2 cm. longi, sub receptaculo plus minusve recurvati, omnes ex axillis foliorum 1–2-ternatorum. Flores albi. Sepala elliptica ca. 5 mm. longa. Filamenta alba apice clavata ca. 4.5 mm. longa. Antherae oblongo-lineares, albae, ca. 1.5 mm. longae, apice rotundatae. Ovaria fusiformia 4–6. Stylus cum stigmate ca. 1.8 mm. longus. Stigma anguste bialatum ca. 0.6 mm. longum. Carpella matura ignota. Floret julio.

YUNNAN: Li-kiang Hsien, in woods, fls. yellowish white, alt. 2700 m., July 1935, *C. W. Wang 71546* (TYPE). Southeastern TIBET: Dzer-nar, Tsa-wa-rung, dry slope on border of woods, alt. 3000 m., Sept. 1935, *C. W. Wang 66523*.

The closest relative of this species seems to be *T. Fargesii* Franch.

§ Physocarpum DC.

Thalictrum coreanum H. Lév. in Bull. Acad. Int. Géogr. Bot. 11: 297. 1902.

In my recently published monographic study of *Thalictrum,* I expressed doubt (in Rhodora 46: 368. 1944) as to whether *T. coreanum* and *T. ichangense* Lecoyer (ex Oliv. in Hook. Ic. Pl. 18: *t. 1765.* 1888) were distinct species. At the time this original paper was prepared, we had very good and abundant material of the latter but only one poor specimen of the former. At present, the situation is reversed, and I have available very good fragments of *T. coreanum* but only one poor specimen of *T. ichangense.* From the material at hand, and from my recollection of that which I have previously examined, these two species are undoubtedly distinct. *Thalictrum coreanum* has a compact subcorymbose inflorescence and a fruit which is sessile or nearly so, with a body about three times longer than broad. Its leaflets are orbicular, 9 in number to each basal leaf, and very leathery at maturity. *Thalictrum ichangense* has a somewhat diffuse inflorescence with the flowers more or less racemose on the branches. Its fruit is conspicuously stipitate, with a body about five times longer than broad. The leaflets of its basal leaves are more or less triangular, with a rounded base, and usually are 3 or 5, or very rarely 9, per leaf. At maturity the leaflets are firm, strongly bicolored, and always dull beneath. *Thalictrum coreanum* has a much stouter appearance throughout.

Thalictrum tuberiferum Maxim. in Bull. Acad. Sci. St. Pétersb. 22: 227. 1876.

Thalictrum Fauriei H. Lév. in Rep. Nov. Sp. 7: 100. 1909; nec. H. Lév. & Vaniot in Bull. Soc. Bot. France 53: 388. 1906; nec Hayata in Jour. Coll. Sci. Tokyo 22: 7. 1906.

Thalictrum punctatum H. Lév. in Rep. Sp. Nov. 10: 376. 1912.

Fragments of the type of *T. Fauriei* H. Lév. and of the syntype of *T. punctatum* are available; both apparently belong to *T. tuberiferum* Maxim.

§ Tripetrium DC.

Thalictrum aquilegifolium L. Sp. Pl. 547. 1753.

Thalictrum Taqueti H. Lév. in Rep. Nov. Sp. 7: 339 (nec 100). 1909.

Thalictrum Dunnianum H. Lév. in Rep. Sp. Nov. 8: 549. 1910.

Fragments of type material of Léveillé's species are available in the Gray Herbarium. *Thalictrum Dunnianum* is merely a renaming of the *T. Taqueti* based on *Taquet 508,* this specific epithet having been used twice by Léveillé.

Subgenus Lecoyerium Boivin

§ Cincinneria Boivin

Thalictrum Mairei H. Lév. in Rep. Nov. Sp. 7: 339. 1909. PL. I, FIGS. 16–19.

Planta robusta omnino glabra 50–150 cm. alta. Folia basilaria petiolata, petiolo basi valde dilatato. Folia caulinaria 4–5-ternata petiolo brevi. Stipulae membranaceae semi-orbiculares. Stipellae membranaceae semi-orbiculares 1–3 cm. latae, ad ramificationes petioli fere omnes adsunt. Foliola ca. 1 cm. longa, membranacea. Inflorescentia paniculata valde ramosa et foliosa. Pedicelli robusti 1–3 cm. longi, sub receptaculo paullo incurvati, fere omnes ex axillis foliorum 2–3-ternatorum. Sepala fere orbicularia 4. Ovaria ca. 10. Stigma conspicue bialatum lanceolatum sepala excedens, ca. 3 mm. longum et 0.5–1 mm. latum. Carpella matura costata fere haud compressa, valde reflexa, stipite crasso ca. 1 mm. longo, ventre lanceolato 6–7.5 mm. longo et 1.8–2 mm. lato. Stigma persistens circinatum. Floret maio et julio.

SZECHUAN: Inter Oti et Ouentin, in dumetis, fl. roseo-lilacini, alt. ca. 2500 m., junio 3, 1914, *C. Schneider 1170;* inter Kuali et Molien, planta ad 1 m., alt. ca. 3200 m., majo 25, 1914, *C. Schneider 1382.* SIKANG: Muli, Kulu, Tungyehtze, under thickets, casual, 3–5 ft. high, achenes pale brown, alt. 3100 m., Sept. 22, 1937, *T. T. Yü 14335.* YUNNAN: N. W. Likiang, Ah-nar-koo, near Shikoo, in open pasture, fls. canary, June 1, 1939, *R. C. Ching 20652;* Likiang Snow Range, on open hillside, fls. yellow, June 14, 1939, *R. C. Ching 30228;* eastern slopes of Likiang Snow Range, Pai-shui Ho, fls. dull dark purple, May 17, 1922, *J. F. Rock 3572;* without detailed data, *T. T. Yü 5706, 11686.*

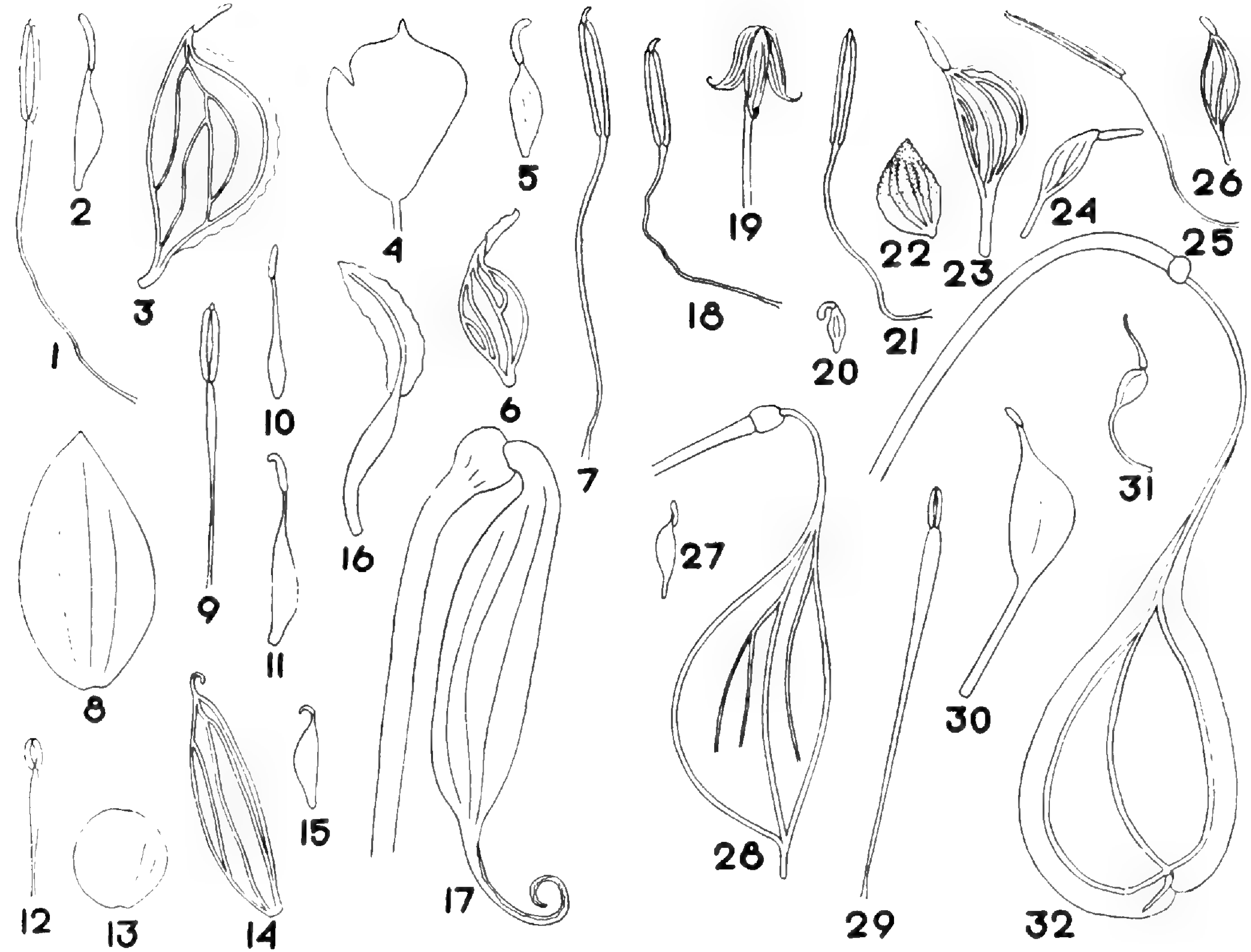
This species evidently belongs to the Section *Cincinneria,* along with *T. macrostigma* Finet & Gagnep. The closest relative of these two species is *T. macrocarpum* Gren., from the French Pyrénées. At first I took the species described above to be new, but, through a fragment received from Edinburgh, I was able to ascertain its identity with *T. Mairei.* However, the above description, based on the cited specimens, does not seem superfluous.

EXPLANATION OF THE PLATE

All drawings are × 6 except Fig. 4, which is × 2, and Fig. 19, which is × 1.

FIGS. 1–3. ***Thalictrum Finetii*** Boivin: stamen and ovary, *Yin 117;* fruit, *Ching 22072.* FIGS. 4–7. ***Thalictrum deciternatum*** Boivin: contour of a terminal leaflet, ovary, immature fruit, and stamen, *Schneider 1805.* FIGS. 8–11. ***Thalictrum Wangii*** Boivin: sepal, stamen, ovary, and young fruit, *Wang 71546.* FIGS. 12–15. ***Thalictrum ramosum*** Boivin: stamen, sepal, and ovary, *Wang 20378;* fruit, *Yü 274.* FIGS. 16–19. ***Thalictrum Mairei*** H. Lév.: ovary and stamen, *Ching 20652;* single fruit and head of fruits, *Yü 14335.* FIGS. 20–22. ***Thalictrum Smithii*** Boivin: ovary and stamen, *Tsai 54683;* fruit, *Yü 14487.* FIGS. 23, 24. ***Thalictrum Yui*** Boivin: ovary and fruit, *Yü 14273.* FIGS. 25–27. ***Thalictrum virgatum*** Hook. f. & Thoms.: stamen and ovary, *J. D. Hooker,* Sikkim; fruit, *Yü 14544.* FIGS. 28–30. ***Thalictrum Rockii*** Boivin: fruit, *Hsia 2400;* stamen and ovary, *Rock 13054.* FIGS. 31, 32. ***Thalictrum samariferum*** Boivin: ovary and fruit, *Wang 70156.*

GRAY HERBARIUM,
HARVARD UNIVERSITY.



Chinese and Korean Species of Thalictrum

FURTHER NOTES ON THE FLORA OF INDO-CHINA[1]

Hui-Lin Li

This brief article supplements a previous paper (Jour. Arnold Arb. **24**: 362–374. 1943), and in it three new species and two new varieties are described, one new name is proposed, and four previously described species are for the first time recorded from Indo-China. The genera *Bredia* and *Stapfiophyton* are new to that country. The types of the new forms herein described are deposited in the herbarium of the Arnold Arboretum.

ELAEOCARPACEAE

Elaeocarpus hainanensis Oliv. in Hook. Ic. Pl. **25**: *t. 2462*. 1896.

Elaeocarpus linearifolius Knuth, Repert. Sp. Nov. **49**: 66. 1940, syn. nov.

Indo-China: Annam, Tourane and vicinity, *J. & M. S. Clemens 3484* (isotype of *E. linearifolius*), May-June, 1927, shrub or small tree, river-margin, flowers dull yellow.

This Indo-Chinese plant, described by Knuth as *E. linearifolius*, is manifestly the same as the Hainan species. This is one of the many species common to both regions.

THEACEAE

Cleyera japonica Thunberg var. **tonkinensis** var. nov.

A typo speciei differt foliis obovatis, 4–6 cm. longis, 2.5–3.5 cm. latis, obtusis, fructibus longe pedicellatis, pedicellis ad 3 cm. longis.

Indo-China: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan and vicinity, *W. T. Tsang 26987* (type), Oct. 16–22, 1936, *29371*, July 14–31, 1939, a small tree 20 ft. high, fairly common in thickets, fruits yellow or black.

Among the different varieties of the species as treated by Kobuski (Jour. Arnold Arb. **18**: 118–129. 1937), this new variety is nearest var. *Morii* (Yamamoto) Masamune, but it may be readily distinguished by the smaller leaves with obtuse apices and by the much longer fruiting pedicels.

FLACOURTIACEAE

Hydnocarpus annamica sp. nov.

Arbor 8–10 m. alta, ramulis teretibus puberulis vel subglabris; foliis chartaceis oblongo-ellipticis, 10–14 cm. longis, 3.5–4.5 cm. latis, longe acuminatis (acumine 2–2.5 cm. longo), basi acutis, margine integris, supra in sicco atro-brunneis, glabris, subtus pallidioribus parce puberulis, venis lateralibus utrinsecus 6 vel 7, supra distinctis, subtus elevatis, valde arcuatim adscendentibus, rete venularum utrinque subconspicuo; petiolo 1–2 cm. longo, puberulo vel glabrescente; floribus ignotis; fructu axillari solitario oblongo-ovoideo, circiter 3 cm. longo et 2 cm. lato, dense fulvo-

[1] Prepared with partial support of a grant from the Penrose Fund, American Philosophical Society, to Dr. E. D. Merrill, to assist him in working up the accumulated collections of Chinese and Indo-Chinese botanical material in the herbarium of the Arnold Arboretum.

velutino, pericarpio 0.5 mm. crasso, semine solitario, ovoideo, circiter 1.5 cm. longo et 1.3 cm. lato; pedicello 7 mm. longo, crasso.

INDO-CHINA: Annam, 12 kilometers north of Dankia, Lang-Biang, *E. Poilane 18660* (TYPE), Jan. 13, 1931, a tree 8–10 m. high, on slightly rocky argillaceous soil, in forests, alt. 1200–1500 m.; the fruit has a strong odor.

In the absence of flowers, the species cannot be placed in the proper section of the genus. It is strongly characterized by the one-celled, one-seeded fruit. Prof. I. W. Bailey, who examined the structure of the wood, reports that in all respects it is that of a *Hydnocarpus*.

MELASTOMATACEAE

Bredia violacea sp. nov.

Frutex parvus, ramis teretibus hirsutis; foliis in paribus aequalibus, subchartaceis, oblongo-ovatis, circiter 9–10 cm. longis, 5.5–6 cm. latis, acuminatis, basi distincte cordatis, 7-nerviis, margine hirsutis, supra sparse setosis, subtus leviter puberulis, venis venulisque supra subconspicuis, subtus distinctis; petiolis circiter 5 cm. longis, sparse hirsutis; inflorescentiis terminalibus cymoso-paniculatis, circiter 15 cm. longis, leviter puberulis et sparse longe hirsutis, pilis saepissime glandulosis, pedunculis 8–9 cm. longis, pedicellis circiter 1 cm. longis, violaceis, bracteolis minutis, vix 1 mm. longis; calycis tubo 5 mm. longo, lobis 4, late triangulari-ovatis, 3 mm. longis, 3.5 mm. latis, acutis vel subrotundatis, leviter puberulis et sparse longe hirsutis, in sicco distincte violaceis; petalis 4, membranaceis, oblongo-ovatis, 7–8 cm. longis, 4–5 cm. latis, late acutis, in sicco superne albidis, inferne violaceis; staminibus 8 aequalibus, filamentis glabris, circiter 6 mm. longis, antheris linearibus, leviter curvatis, olivaceis, circiter 8 mm. longis, longe acuminatis, connectivo sub theça antice tuberculato, postice breviter calcarato, stylo circiter 1.1 cm. longo, olivaceo.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30751* (TYPE), Oct. 13-Nov. 22, 1940.

In general appearance, this species closely resembles *Bredia tuberculata* (Guillaumin) Diels, but it differs, among other characters, in its cymose-paniculate instead of umbellate inflorescences. In the inflorescence character, it belongs to the group of *Bredia hirsuta* Blume. The new species is characterized by its broad distinctly violet calyx-lobes and its large violet anthers. The genus is new to Indo-China.

Stapfiophyton peperomiaefolium (Oliv.) Li, Jour. Arnold Arb. 25: 29. 1944.
Sonerila peperomiaefolia Oliv. in Hook. Ic. Pl. 19: *t. 1814.* 1889.
Gymnagathis peperomiaefolia Stapf, Ann. Bot. 6: 315. 1892.

INDO-CHINA: Tonkin, Ha-Coi, Taai Wong Mo Shan, Chan Uk Village near Chuk-phai, *W. T. Tsang 29029,* May 1–10, 1939, an herb, fairly common in thickets, in dry sandy soil, fruit brown. The species has previously been known only from Kwangtung.

This is an acaulescent plant which closely matches the syntype (*C. Ford 336,* photo. in herb. New York Botanical Garden), except that the leaves are somewhat broader and less acute. The Indo-Chinese specimen is in fruit, while the type is from a flowering plant.

Blastus membranifolius sp. nov. § *Desmoblastus*

Frutex, ramis junioribus minute subalbide tomentellis; foliis inaequalibus vel aequalibus, tenuiter membranaceis, longe petiolatis, oblongis, 10–12 cm. longis, 3.5–6 cm. latis, longe acuminatis, basi subrotundatis vel rotundatis, utrinque et margine setulosis, nervis primariis 3 marginalibus duobus gracilioribus additis, venis transversalibus supra inconspicuis, subtus prominentibus; petiolo 1.5–7 cm. longo, subalbide tomentello; floribus axillaribus, solitariis vel 2- vel 3-fasciculatis, pedunculis circiter 7 mm. longis, tomentellis; calycibus obconico-quadrangularibus, extus tomentellis, 1.5 mm. longis, lobis brevibus; petalis rhomboideis, 2–3 mm. longis; staminibus 4, filamentis 2–3 mm. longis, antheris 1.5–2 mm. longis, apice rotundatis, connectivo sub theca calloso.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30112* (TYPE), May 18-July 5, 1940.

The new species is allied to *Blastus tenuifolius* Diels and *B. setulosus* Diels, differing from both in the leaves being setulose on both surfaces and in the longer pedicels.

Memecylon nigrescens Hook. & Arn. Bot. Beechey Voy. 186. 1833; Merr. Lingnan Sci. Jour. **13**: 65. 1934.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30643,* Oct. 13-Nov. 22, 1940. Kwangtung, Hainan; new to Indo-China.

Memecylon ligustrifolium Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Miscel. **4**: 117. 1852.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26950,* Oct. 1–8, 1936, a shrub 10 ft. high, fairly common in thickets, in dry sandy soil, fruits black; Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30361,* July 18-Sept. 9, 1940; Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30654,* Oct. 13-Nov. 22, 1940. Kwangtung, Kwangsi; new to Indo-China.

Memecylon coacerviflorum nom. nov.

Memecylon confertiflorum Merr. Jour. Arnold Arb. **19**: 58. 1938, non Cogn. 1891.

INDO-CHINA: Southern Annam.

VERBENACEAE

Tsoongia axillariflora Merr. var. **trifoliolata** var. nov.

A typo speciei differt foliis plerumque trifoliolatis.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30135* (TYPE), May 18-July 5, 1940. KWANGTUNG: Shih Wan Tai Shan, Foo Lung, *H. Y. Liang 69710,* July 16, 1937, shrubby, scandent, in open forests, flowers yellow.

Callicarpa formosana Rolfe, Jour. Bot. **20**: 358. 1882.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, Shuei Mei Village, *W. T. Tsang 29378,* July 14–31, 1939, a shrub 7 ft. high, fairly common, growing in clayey soil among scattered shrubs, flowers lavender; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29947,* May 18-July 5, 1940. Formosa, the Philippines, eastern and southern China; new to Indo-China.

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A TAXONOMIC REVIEW OF TROCHODENDRON AND TETRACENTRON

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With one text-figure

INTRODUCTION

IN CONTINUATION of the studies of certain woody families of Ranales undertaken by Prof. Bailey, Dr. Nast, and the writer, and published in recent volumes of this Journal, we propose next to consider a group of eastern Asiatic genera which have, from time to time, been associated with one another in the same family, subfamily, or tribe. These genera are *Trochodendron* Sieb. & Zucc. (1838), *Euptelea* Sieb. & Zucc. (1841), *Cercidiphyllum* Sieb. & Zucc. (1846), *Tetracentron* Oliv. (1889), and *Eucommia* Oliv. (1890). That these genera, all of which are small and some of which are monotypic, have aroused a high degree of interest among taxonomists, phylogenists, morphologists, anatomists, and horticulturists during the last century is demonstrated by the fact that we have examined, in connection with our studies, more than 250 separate papers discussing one or more of them. Many of these papers are floristic or horticultural notes, others are standard works of a taxonomic nature, but not a few are detailed morphological and anatomical studies. Our examination of past work has been as exhaustive as possible, in order that we might become familiar with the many and often conflicting opinions concerning the phylogeny and morphology of the genera concerned. These opinions have ranged from that of van Tieghem (26), who places each of the five genera in a separate family, to those of Finet and Gagnepain (5), who join all the genera in a single tribe of the Magnoliaceae, Oliver (23), who joins them all in the Trochodendraceae, and Hallier (8), who places them all in the Hamamelidaceae. Between these extreme views are to be found all shades of opinion, and the classification of these five genera remains an enigma to most students.

As a result of our study of ample material of the groups in question — material doubtless far exceeding in quantity and quality any available to past students, largely because of the extensive Asiatic herbarium of the Arnold Arboretum — we are inclined to support the view of van Tieghem and to erect separate families for the five genera. This course may appear radical to conservative taxonomists, who are perhaps inclined to overlook the fact that, in dealing with very ancient and primitive groups such as the Ranales, a sound classification cannot be attained by the use of traditional comprehensive family limits. Our criteria for family delimitation in the Ranales, we believe, are as sound and conservative as those in current usage by students of other orders; that the application of these criteria results in the establishment of numerous small, or even monotypic, families in the Ranales reflects upon the extraordinary diversity and great age of the group, and not upon an exceptionally radical viewpoint on our part. At any rate, in placing *Trochodendron, Euptelea, Cercidiphyllum, Tetracentron,* and *Eucommia* in separate families we are proposing nothing new. Such recent phylogenists as Hutchinson (19), Wettstein (30), and Diels (4) have arranged the genera in question in either three or four families. Our principal disagreement with these students is the separation of *Tetracentron* from the Magnoliaceae and of *Euptelea* from the Trochodendraceae (the latter course also proposed by Wettstein). As a matter of fact, *Cercidiphyllum* and *Eucommia,* according to many modern treatments, are to be removed from the Ranales altogether and placed as relatives of the Hamamelidaceae and Urticaceae respectively.

The present paper is planned to redescribe the monotypic genera *Trochodendron* and *Tetracentron,* to give reasonably full citations to the literature pertaining to these genera, to list the specimens available in the larger American herbaria, and briefly to discuss the inter-relationships of the two groups. In the following paper in this Journal, Prof. Bailey and Dr. Nast initiate a series designed to discuss the morphological and anatomical details of *Trochodendron* and *Tetracentron.* In the course of this study we have fortunately been able to examine material from the following herbaria, hereafter designated by the parenthetical letters: Arnold Arboretum (A), Chicago Natural History Museum (Ch), Gray Herbarium (GH), Missouri Botanical Garden (M), New York Botanical Garden (NY), University of California (UC), and U. S. National Herbarium (US). The privilege of borrowing this material is greatly appreciated.

Perhaps the best way to outline the principal studies on the five genera mentioned above is to give a brief chronological sketch of past work; those treatments which appear to be of especial importance in an understanding of the groups are discussed in the following paragraphs.

HISTORICAL SKETCH

Until the nineteenth century was well advanced, Japan remained an unknown land to European botanists. For that reason many of the conspicuous and widely cultivated trees of that country received no botanical names until the publication of the important Flora Japonica by Siebold and Zuccarini (1826–1870). In this publication, in 1838, *Trochodendron aralioides* was described and well illustrated, being placed in the "Winteraneae" of R. Brown. In 1840 Junghuhn (in Tijdschr. Nat. Gesch. Phys. 7: 308) independently described *Gymnanthus paradoxus* as a Japanese plant of the Magnoliaceae, related to *Illicium*. The identity of his plant with *Trochodendron aralioides,* apparently first pointed out by Endlicher (Gen. Pl. Suppl. **2**: 73. 1842), has been obvious to all subsequent students.

Euptelea was founded in 1841 by Siebold and Zuccarini (Fl. Jap. **1**: 133), with one species, *E. polyandra,* as a new genus of the Ulmaceae. *Cercidiphyllum,* proposed without a specific epithet by the same authors in 1846 (in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4**[3]: 238), was not related by them, their specimen having been in fruit only. The specific epithet *japonicum* was added to *Cercidiphyllum,* and accredited to Siebold and Zuccarini, by Hoffmann and Schultes in 1852 (in Jour. Asiatique IV. 20: 282).

The nomenclators of the period preceding 1860 — namely Endlicher, Steudel, Walpers, Meisner, Dietrich, and Lindley — agreed in referring *Trochodendron* to the Magnoliaceae as a relative of *Illicium,* in placing *Euptelea* in the Ulmaceae, and in ignoring *Cercidiphyllum.*

In 1858 Miers (*22*) published a study of the Winteraceae, pointing out that *Trochodendron* is not a relative of the group but more nearly approaches the Ternstroemiaceae — a suggestion which was not taken seriously by subsequent students. Bentham and Hooker, in their Genera Plantarum (**1**: 17. 1862), unwisely stated that *Trochodendron* is ". . . Araliacea anomala ovario subsupero," for which they were rebuked by Seemann in his revision of the Hederaceae (in Jour. Bot. **2**: 238. 1864). For *Trochodendron* and *Euptelea,* Seemann proposed the new "order" Trochodendreae, relating it to the Wintereae, Ranunculaceae, and Magnoliaceae. Seemann was thus the first to suggest the isolated nature of *Trochodendron,* although he is not usually recognized as the author of the family Trochodendraceae because of his spelling of the name.

Hooker and Thomson (*16*), in 1864, in a short but important study of *Euptelea,* agreed with Seemann in removing it from the Ulmaceae. They concluded to place the genus in the Magnoliaceae, "section" Wintereae, noting its highly anomalous nature and stating that it might possibly represent a distinct family. Hooker and Thomson first called attention to the existence of this group of plants outside of Japan, by proposing the new species *Euptelea pleiosperma* from northeastern India.

Also in 1864, Eichler (*2*) published a very important anatomical study of *Drimys* and *Trochodendron,* concluding that the latter genus belongs in the vicinity of the Winteraceae. The following year Eichler (*3*) emphasized his conclusions and his agreement with Seemann in a supplementary paper.

Bentham and Hooker profited from the work of Seemann and Eichler, and in a supplement to the first volume of Genera Plantarum (1867) they erected the tribe Trochodendreae in the Magnoliaceae, for *Trochodendron* and *Euptelea.* The same position was indicated for the two genera by Baillon (Hist. Pl. **1**: 191. 1868–69), under the name Magnoliaceae IV. [series?] "Eupteleeae."

The genus *Cercidiphyllum*, after a long period of neglect, was again brought into the discussion by Baillon (in Adansonia **10**: 132. 1871) in connection with his notes on the Hamamelidaceae; his noncommital account also suggested that the genus is related to the Saxifragaceae, series "Cunoniées." Maximowicz (in Mél. Biol. **8**: 142. 1872) was the first to associate *Cercidiphyllum* with *Trochodendron* and *Euptelea* in the Magnoliaceae. Maximowicz also proposed a second species of *Cercidiphyllum* and divided *Trochodendron aralioides* into two varieties, one based upon his own inadequately published *T. longifolium*. Franchet and Savatier, in 1873, in their enumeration of Japanese plants, followed Maximowicz in referring all three genera to the Magnoliaceae.

The family Trochodendraceae, in its modern spelling, was proposed by Prantl in 1888 (24) to include *Cercidiphyllum*, *Euptelea*, and *Trochodendron;* in a supplement to the same work in 1891 Prantl further extended the family to include *Tetracentron*. The last genus was described by Oliver in 1889 (in Hook. Ic. Pl. **19**: *pl. 1892*), on the basis of Henry's collections from Hupeh, and was placed in the Magnoliaceae, tribe Trochodendreae. In the following year, Oliver described the monotypic *Eucommia* (in Hook. Ic. Pl. **20**: *pl. 1950*. 1890), also based on Henry's plants from Hupeh, without referring it to a family.

Toward the end of the nineteenth century, some of the genera under discussion were introduced into Europe and North America for cultivation, especially *Cercidiphyllum*, a striking tree which is now to be seen in many parks and botanical gardens. *Eucommia* attracted attention for the gutta-percha content of its bark. During the following years the remaining genera were also brought into cultivation to a more limited extent, largely through the efforts of Sargent at the Arnold Arboretum.

By far the most important morphological discussion of these plants up to that time was Harms' study of the Trochodendraceae in 1897 (10). Harms pointed out that the wood of *Tetracentron* is vesselless, like that of *Trochodendron* and *Drimys*. He retained *Tetracentron* in the Magnoliaceae with the explanation that this family, which he interpreted to include such an anomalous genus as *Drimys*, is not unduly expanded by the inclusion of *Tetracentron*. The remaining four genera were placed by Harms in the Trochodendraceae — the Eupteleoideae for *Cercidiphyllum*, *Euptelea*, and *Eucommia*, and the Trochodendroideae for *Trochodendron*. While one cannot agree with Harms' disposal of these genera, it should be pointed out that his subsequent studies caused him to modify his opinions; his morphological and anatomical work on *Trochodendron* and its "allies" is of the highest quality and his several papers are indispensable for a knowledge of these plants.

A work of even greater import was van Tieghem's study of the "Homoxylées," published in 1900 (26). It is unfortunate that van Tieghem's presentation was so untraditional from a taxonomic point of view, for had his conclusions been presented in a more orthodox manner his treatment surely would have received the attention it merited from his contemporaries. Recognizing that the three groups typified by *Trochodendron, Tetracentron,* and *Drimys* stand apart from all other dicotyledons in their vesselless wood, van Tieghem proposed for them the subclass Homoxylées, as opposed to the Hétéroxylées, including all the other dicotyledons. His Homoxylées are divided into three families, the Trochodendracées, Tetracentracées, and Drimytacées (Winteraceae of other authors). With some emphasis, van Tieghem pointed out that these families could not be associated with the genera *Eucommia, Cercidiphyllum,* and *Euptelea,* for which he proposed the family names Eucommiacées, Cercidiphyllacées, and Euptéléacées respectively. While van Tieghem's work on these genera leaves much to be desired, his conclusions appear to be far sounder than those of his contemporaries. An amusing commentary of van Tieghem's perhaps deserves to be quoted in full (*26*: *261*): "Il [le petit groupe des Homoxylées] se compose, pour le moment, des trois genres Trochodendre, Drimyte et Tétracentre. Malgré leur caractére si remarquable, qu'on vient de rappeler, ces trois genres ont été, et sont encore aujourd'hui classés tous purement et simplement dans la famille des Magnoliacées, ou dans son voisinage immédiat. Quand on étudie cette famille, on se borne à dire à leur sujet: 'Chose curieuse, il y a tel et tel genre de Magnoliacées, où le bois secondaire est homogène, différent de celui de toutes les autres Dicotylédones et semblable à celui de la presque totalité des Gymnospermes.' Et puis, c'est tout. L'idée ne vient à l'esprit de personne, que précisément ces genres singuliers ne sont peut-être pas des Magnoliacées, et qu'en tout cas, il y a lieu d'y regarder de plus près. Et si l'idée n'en vient pas, c'est sans doute parce que l'on admet implicitement que d'avoir telle ou telle sorte de bois secondaire, c'est chose sans aucune importance pour la Classification des plantes."

With van Tieghem's publication, what may perhaps be termed the exploratory phase of the study of *Trochodendron* and its "allies" came to a close. In the years since 1900 many students have given attention to the group, and those interested in the larger aspects of family relationships have proposed their own solutions. The principal detailed studies are here mentioned briefly.

Solereder, in 1900 (25), published an important detailed morphological study of *Cercidiphyllum,* pointing out that its floral characters do not seem to be those of the Ranales; he referred the genus, and also *Eucommia,* to the Hamamelidaceae. Wagner (28) presented in 1903 a study of the morphology of the branchlets and inflorescence of *Trochodendron.* Also in 1903, Hallier (6) discussed the relationships of the five genera under consideration, suggesting that all demonstrate affinities with the Hamamelidaceae; he further emphasized this opinion in 1904 (7) and 1905 (8, 9) — it is an opinion which has found no supporters and which is scarcely substantiated by the facts. Harms' treatment in Engl. & Prantl, Nat. Pfl. Nachtr. 3: 110–112 (1906) is important because of its concise summary of then current opinions, including van Tieghem's, certain of whose family names were properly latinized. Some of these family names now came into general usage, the Cercidiphyllaceae and Eucommiaceae being accepted by Engler in the sixth edition of his Syllabus (1909).

From a taxonomic point of view, the most carefully documented work on the Chinese representatives of *Tetracentron, Cercidiphyllum, Euptelea,* and *Eucommia* has been that of Rehder and Wilson, in Sargent's Plantae Wilsonianae (vol. 1, 1913). In very detailed studies of the Cercidiphyllaceae in 1916 (11) and 1918 (12), Harms concluded that the family is correctly placed in the Ranales. An elaborate study of the leaf-anatomy of *Cercidiphyllum* was published in 1923 and 1924 by Weisse (29). The family Eucommiaceae was treated in excellent detail by Harms in 1930 (13) and was placed in the Rosales following the Roridulaceae. The Flora of Japan by Makino and Nemoto (Nippon-Shokubutsu-Sôran, ed. 2. 1931) is perhaps the first major floral effort to recognize the family Eupteleaceae as distinct. In 1933 McLaughlin (21), on the basis of his examination of their wood anatomy, suggested that *Euptelea* and *Tetracentron* be made the types of two separate families, although the use of such family names was avoided. In the same year, Harms (14) revised his conclusions on the Eucommiaceae to place the family in the Urticales. This position was given support by Tippo's careful study of the Eucommiaceae in 1940 (27).

In the two preceding paragraphs I have listed only the recent major studies pertaining to this group of plants. There remain to be considered the opinions of various recent phylogenists. The opinion of Hallier has already been mentioned, and to a certain extent this doubtless influenced that of Lotsy, who in 1911 (20) placed *Tetracentron* in the Magnoliaceae, *Trochodendron* and *Euptelea* in the Trochodendraceae, and *Eucommia* and *Cercidiphyllum* in the Hamamelidaceae, suggesting the derivation of the latter family from a ranalian ancestor through this series. Bessey, in 1915 (1), placed the Trochodendraceae and Cercidiphyllaceae in the Ranales and the Eucommiaceae in the Rosales, but unfortunately he offered no opinion as to the position of *Euptelea* and *Tetracentron*. Hayata (15) agreed with Bessey in the position of the three above-mentioned families. Hutchinson, in his several discussions pertaining to the ranalian complex (17, 18, 19), placed the Trochodendraceae (including *Trochodendron* and *Euptelea*) and Cercidiphyllaceae in the Magnoliales and the Eucommiaceae in the Hamamelidales; he did not account for *Tetracentron*. Wettstein's treatment in 1935 (30) has the Eucommiaceae in the Urticales, the Cercidiphyllaceae and Eupteleaceae in the Hamamelidales, and the Trochodendraceae (*Trochodendron* only) in the Polycarpicae following Magnoliaceae, which includes *Tetracentron*. In the most recent edition of Engler's Syllabus, Diels (4) has placed the Trochodendraceae (including *Trochodendron* and *Euptelea*) and Cercidiphyllaceae in the Ranales and the Eucommiaceae in the Rosales, while *Tetracentron* is not mentioned.

From these more or less current opinions, the reader may observe that agreement as to the delimitation and phylogenetic position of these groups has not been reached; yet it is evident that progress has been made and that these small genera have appeared highly important to numerous students. We propose to discuss the genera and to indicate the characters that have led us to the opinion that each represents a unigeneric family. *Eucommia* may be left out of consideration, for Tippo (27) has ably summarized the evidence for placing this genus in the Urticales. *Cercidiphyllum* remains highly puzzling and must still be examined in great detail; we feel that it may be included in the Ranales, but its exact relationships appear very questionable. The remaining genera — *Trochodendron*, *Tetracentron*, and *Euptelea* — will be discussed from a taxonomic viewpoint in this paper and a subsequent one.

TROCHODENDRACEAE

Trochodendraceae Prantl in E. & P. Nat. Pfl. 3(2): 21, p. p. (quoad *Trochodendron*). 1888; Sargent in Garden and Forest 7: 105, p. p. 1894, For. Fl. Jap. 13, p. p. 1894; Oliv. in Hook. Ic. Pl. **24**: *pl. 2361*, p. p. (quoad *Trochodendron*). 1895; Harms in Ber. Deutsch. Bot. Ges. **15**: 359, p. p. (quoad *Trochodendron*). 1897, in E. & P. Nat. Pfl. Nachtr. **1**: 158, p. p. 1897; Engl. Syllabus ed. 2. 116, excl. *Cercidiphyllum*. 1898; v. Tiegh. in Jour. de Bot. **14**: 262 seq. (Trochodendracées). 1900; Engl. Syllabus ed. 3. 123, p. p. 1903, ed. 4. 124, p. p. 1904; Schneid. Ill. Handb. Laubholzk. **1**: 269, excl. *Euptelea*. 1904; Harms in E. & P. Nat. Pfl. Nachtr. **3**: 110. 1906; Boodle & Fritsch, Solereder's Syst. Anat. Dicot. 31, 809, p. p. 1908; Engl. Syllabus ed. 6. 132, excl. *Euptelea*. 1909; Lotsy, Vortr. Bot. Stammesg. **3**: 456, excl. *Euptelea*. 1911; Bessey in Ann. Mo. Bot. Gard. **2**: 128. 1915; Engl. & Gilg, Syllabus ed. 8. 190, excl. *Euptelea*. 1919; Hayata, Ic. Pl. Formos. **10**: 189. 1921; Hutchinson in Kew Bull. **1921**: 186. 1921; Chun, Chin. Econ. Trees 128, p. p. 1922; Engl. & Gilg, Syllabus ed. 9, 10. 203, excl. *Euptelea*. 1924; Hutchinson in Kew Bull. **1924**: 120. 1924, Fam. Fl. Pl. Dicot. 85, excl. *Euptelea*. 1926; Rehder, Man. Cult. Trees & Shrubs 212, excl. *Euptelea*. 1927, ed. 2. 244, excl. *Euptelea*. 1940; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 307. 1931; Wettst. Handb. Syst. Bot. ed. 4. **2**: 690. 1935; Diels, Engl. Syllabus ed. 11. 205, excl. *Euptelea*. 1936; Masamune, Short Fl. Formos. 63. 1936; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 208. 1936.

Magnoliaceae subord. *Illicieae* Endl. Enchir. Bot. 428, p. p. (quoad *Trochodendron*). 1841.

Magnoliaceae trib. *Illicieae* sensu Walp. Rep. **1**: 72, p. p. (quoad *Trochodendron*). 1842, **2**: 747, p. p. (quoad *Trochodendron*). 1843; non DC.

Magnoliaceae II. *Wintereae* Lindl. Veg. Kingd. ed. 2. 419, p. p. (quoad *Trochodendron*). 1847, ed. 3. 419, p. p. 1853.

Trochodendreae Seem. in Jour. Bot. **2**: 238 (order), excl. *Euptelea*. 1864; Eichl. in Flora **48**: 12 (familie), excl. *Euptelea*. 1865, in Jour. Bot. **3**: 150 (order), excl. *Euptelea*. 1865.

Magnoliaceae trib. *Trochodendreae* Benth. & Hook. f. Gen. Pl. **1**: 954, excl. *Euptelea*. 1867; Baill. Hist. Pl. **1**: 164, p. p. 1868–69; Durand, Ind. Gen. Phan. 4, p. p. (quoad *Trochodendron*). 1888; Finet & Gagnep. in Bull. Soc. Bot. Fr. 52: Mém. 4: 23 (Trochodendrées), p. p. (quoad *Trochodendron*). 1905 (repr. Contr. Fl. As. Or. **2**: 23. 1907).

Magnoliaceae III. *Trochodendreae* Eichl. Blüthendiagr. **2**: 150, excl. *Euptelea*. 1878.

Trochodendraceae II. *Trochodendroideae* Harms in Ber. Deutsch. Bot. Ges. **15**: 359. 1897, in E. & P. Nat. Pfl. Nachtr. **1**: 159. 1897.

The Trochodendraceae is in this paper interpreted as a unigeneric family, whereas most of the above references are to a more inclusive concept. For the most part, *Euptelea* has been included in the family, while many writers have extended it to include *Cercidiphyllum* and even *Eucommia*; except by a few writers *Tetracentron* has been excluded, but this genus is by far the closest relative of *Trochodendron*. Of the references listed above, the following interpret the Trochodendraceae in the limited unigeneric sense: van Tieghem (1900), Makino & Nemoto (1931), and Wettstein (1935). Harms' subfamily Trochodendroideae (1897) is also limited to the single genus *Trochodendron*.

Trochodendron Sieb. & Zucc. Fl. Jap. **1**: 83. 1838; Endl. Gen. Pl. 839. 1839, Enchir. Bot. 428. 1841; Steudel, Nom. ed. 2. **2**: 720. 1841; Endl. Gen. Pl. Suppl. **2**: 73. 1842; Walp. Rep. **1**: 72. 1842; Meisn. Pl. Vasc. Gen. Pars Alt. 339. 1843; Walp. Rep. **2**: 747. 1843; Dietr. Syn. Pl. **3**: 216. 1843; Lindl. Veg. Kingd. ed. 2. 419. 1847, ed. 3. 419. 1853; Miers in Ann. Mag. Nat. Hist. III. **2**: 115. 1858, Contrib. Bot. **1**: 144. 1861; Benth. & Hook. f. Gen. Pl. **1**: 17. 1862, 954. 1867; Seem. in Jour. Bot. **2**: 237. 1864; Eichl. in Flora **48**: 12. 1865, in Jour. Bot. **3**: 150. 1865; Baill. Hist. Pl. **1**: 163, 191. 1868–69; Pfeiff. Nomencl. Bot. **2**: 1496. 1874; Eichl. Blüthendiagr. **2**: 150. 1878; Durand, Gen. Ind. Phan. 4. 1888; Prantl in E. & P. Nat. Pfl. **3**(2): 23. 1888; Harms in Ber. Deutsch. Bot. Ges. **15**: 350. 1897, in E. & P. Nat. Pfl. Nachtr. **1**: 159. 1897; Solereder in Ber. Deutsch. Bot. Ges. **17**: 397. 1900; v. Tiegh. in Jour. de Bot. **14**: 262. 1900; Hall. f. in Ber. Deutsch. Bot. Ges. **23**: 89 (*Trochodendrum*). 1905, in New Phyt. **4**: 157 (*Trochodendrum*). 1905; Harms in E. & P. Nat. Pfl. Nachtr. **3**: 111. 1906; Lotsy, Vortr. Bot. Stammesg. **3**: 456. 1911; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3386. 1917; Hutchinson, Fam. Fl. Pl. Dicot. 85. 1926; Rehder, Man. Cult. Trees & Shrubs 213. 1927, ed. 2. 245. 1940; Wettst. Handb. Syst. Bot. ed. 4. **2**: 689. 1935.

Gymnanthus Jungh. in Tijdschr. Nat. Gesch. Phys. **7**: 308. 1840.

A monotypic genus of trees; branchlets terete, marked at the nodes with conspicuous pseudoverticillate leaf-scars and, above these, by the narrow scars of bud-scales, terminated by a conspicuous ovoid bud, the bud-scales numerous, imbricate, the innermost the largest; stipules none; leaves pseudoverticillate in clusters of (4–) 6–12 at apex of branchlets, those of the lower verticils often subpersistent, some of the leaves never fully developing; leaves with usually canaliculate petioles and simple coriaceous serrulate pinnate-nerved blades; inflorescence a raceme-like modified pleiochasial cyme,[1] terminal at inception, soon appearing axillary, essentially epedunculate, the hermaphrodite flowers more closely arranged distally than proximally, each subtended by a soon caducous bract; pedicels slender (the proximal ones the longest), usually bearing 2–5 inconspicuous bracteoles on the torus or just below it and sometimes another 1–3 farther down (these linear, bract-like); perianth none (unless the above-described toral bracteoles are perianth-remnants); pedicel swollen into the subcoriaceous obconical torus, this bearing the numerous stamens on its rugulose outer surface in 3 or 4 superimposed series (uppermost stamens the longest persistent, the lowermost soon caducous and leaving scars) and the several carpels in a single whorl at its apex; stamens with filiform filaments and basifixed oblong 4-sporangiate mucronulate anthers, the thecae dehiscing by lateral clefts for their entire length; carpels fused to the torus at base, spreading, at anthesis laterally coalescent, the ovary unilocular, with 2 rows of anatropous ovules borne near the ventral suture, abruptly narrowed distally into a style, this (like the ovary) distinctly conduplicate and deeply canaliculate ventrally; fruit a follicetum composed of laterally

[1]A detailed discussion of the development of the inflorescence is given by Wagner (28), who considers it an interrupted "Primanpleiochasium." A further description will be given by Bailey and Nast in a subsequent paper.

coalescent follicles, dehiscing loculicidally on its upper (morphologically ventral) surface with a stellate rupture which often extends outward through the stylar portions of the follicles, the lateral walls of the follicles fused, thin-coriaceous or papyraceous, the outer (dorsal) and upper (ventral) follicle walls coriaceous and brittle; seeds dependent in two rows, mixed with sterile ovules of somewhat similar size, the outer integument modified into a mass of spongy tissue (sometimes wing-like) at the micropylar end, the funicle forming a ridge on one side of the embryoniferous portion and continued into a chalazal projection, the inner integument thin, membranaceous, the endosperm oleaginous, the embryo minute, ellipsoid, cleft at apex.

Trochodendron aralioides Sieb. & Zucc. Fl. Jap. **1**: 84. *pl. 39, 40.* 1838; Endl. Enchir. Bot. 430. 1841; Walp. Rep. **1**: 72. 1842, op. cit. **2**: 747. 1843; Dietr. Syn. Pl. **3**: 310. 1843; Sieb. & Zucc. in Abh. Bayer. Akad. Wiss. Math. Phys. Cl. **4**(2): 185 [Fl. Jap. Fam. Nat. **1**: 77]. 1846; Hoffm. & Schultes in Jour. Asiat. **20**: 336. 1852 [repr. Noms Indig. Pl. Jap. Chin. 80. 1853]; Eichl. in Flora **47**: 452 seq. 1864; Miq. in Ann. Mus. Bot. Lugd.-Bat. **2**: 258 [Prol. Fl. Jap. 146]. 1866, in Adansonia **8**: 211. 1868; Baill. Hist. Pl. **1**: 163. 1868–69; Franch. & Sav. Enum. Pl. Jap. **1**: 19. 1873; Pfeiff. Nomencl. Bot. **2**: 1496. 1874; Prantl in E. & P. Nat. Pfl. **3**(2): 23. *f. 19.* 1888; Tanaka, Illustr. Useful Pl. **1**: *pl. 304.* 1891; Sargent in Garden and Forest **6**: 75. 1893, For. Fl. Jap. 15. 1894; Groppler in Bibl. Bot. **6**[Heft 31]: 15. *pl. 1 & 2, f. 5.* 1894; Hook. f. in Curtis's Bot. Mag. **120**: *pl. 7375.* 1894; Masters in Gard. Chron. III. **15**: 716. *f. 91.* 1894; Tanaka, Useful Pl. Jap. 81. 1895; Henry in Trans. As. Soc. Jap. **24**: Suppl. 16 [List Pl. Formos.]. 1896; Parment. in Bull. Sci. Fr. & Belg. **27**: 319. *pl. 11, f. 48.* 1896; Harms in Ber. Deutsch. Bot. Ges. **15**: 350 seq. 1897; Bretschn. Hist. Eur. Bot. Disc. China 602. 1898; Matsum. in Bot. Mag. Tokyo **12**: 54. 1898; Ito & Matsum. in Jour. Coll. Sci. Tokyo **12**: 285 [Tent. Fl. Lutch.]. 1899; Shirasawa, Ic. Ess. For. Jap. **1**: 75. 1899, *pl. 42.* 1900; v. Tiegh. in Jour. de Bot. **14**: 262. 1900; Wagner in Ann. Naturhist. Hofmus. Wien **18**: 409 seq. *f. 1, 2.* 1903; Veitch in Jour. Roy. Hort. Soc. **27**: 865. *f. 197.* 1903; Schneider, Ill. Handb. Laubholzk. **1**: 269. *f. 178, a-f.* 1904; Pynaert in Rev. Hort. Belge **30**: 86. *pl.* 1904; Vilmorin & Bois, Frut. Vilmorin. 10. 1904; Finet & Gagnep. in Bull. Soc. Bot. Fr. **52**: Mém. 4: 25. 1905 [repr. Contr. Fl. As. Or. **2**: 25. 1907]; H. Mayr, Fremdl. Wald- und Parkbäume 522. 1906; Matsum. & Hayata in Jour. Coll. Sci. Tokyo **22**: 11 [Enum. Pl. Formos.]. 1906; Purpus in Mitteil. Deutsch. Dendr. Ges. **1906**: 41. 1906; Hayata, Fl. Mont. Formos. 44. 1908, Ic. Pl. Formos. **1**: 30. 1911; Lotsy, Vortr. Bot. Stammesg. 456. *f. 277.* 1911; Matsum. Ind. Pl. Jap. **2**(2): 98. 1912; Silva Tarouca, Unsere Freil.-Laubgehölze 365. 1913; Bean, Trees and Shrubs **2**: 603. *fig.* 1914; Thompson & Bailey in Mem. N. Y. Bot. Gard. **6**: 29. 1916; Rehder in Bailey, Stand. Cycl. Hort. **6**: 3386. 1917; Kanehira, Formosan Trees 25. *fig.* 1917; Bailey & Thompson in Ann. Bot. **32**: 507. 1918; Harms in Mitteil. Deutsch. Dendr. Ges. 1917 [**26**]: 86. 1918; Engl. & Gilg, Syllabus ed. 8. 191. 1919, ed. 9, 10. 203. 1924; Wilson in Jour. Arnold Arb. **1**: 178. 1920; Hayata in Bot. Mag. Tokyo **39**: (230). 1925; Mottet, Arbres et arbustes d'ornement 46. 1925; Hutchinson, Fam. Fl. Pl. Dicot. 85. *f. 6.* 1926; Nakai in Jour. Jap. Bot. **3**: 86. *fig.* 1926; Rehder, Man. Cult. Trees & Shrubs 213. 1927, ed. 2. 245. 1940; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 307. 1931; Terasaki, Nippon Shokubutsu Zuhu (Ic. Fl. Jap.) *pl. 1599.* 1933; Nemoto, Nippon-Shokubutsu-Sôran-Hoi (Fl. Jap. Suppl.) 208. 1936; Diels, Engl. Syllabus ed. 11. 205. 1936; Masamune, Short Fl. Formos. 63. 1936; Kanehira, Form. Trees Indig. Isl. 178. *pl. 35, f. 130.* 1936.

Gymnanthus paradoxus Jungh. in Tijdschr. Nat. Gesch. Phys. **7**: 308. 1840.

Trochodendron longifolium Maxim. in Ind. Sem. Hort. Petrop. **1865**: 34, nomen. 1865; Miq. in Adansonia **8**: 211, nomen. 1868; Baill. Hist. Pl. **1**: 163, nomen. 1868–69; Hook. f. in Curtis's Bot. Mag. **120**: sub *pl. 7375.* 1894; Nakai in Jour. Jap. Bot. **3**: 86. *fig.* 1926.

Trochodendron aralioides var. *longifolium* Maxim. in Mél. Biol. 8: 371. 1871, in Bull. Acad. Sci. St. Pétersb. 17: 145. 1872; Franch. & Sav. Enum. Pl. Jap. 1: 19. 1873; Finet & Gagnep. in Bull. Soc. Bot. Fr. 52: Mém. 4: 25. 1905 [repr. Contr. Fl. As. Or. 2: 26. 1907]; Matsum. Ind. Pl. Jap. 2(2): 98. 1912; Makino & Nemoto, Nippon-Shokubutsu-Sôran (Fl. Jap.) ed. 2. 307. 1931.

Trochodendron aralioides var. *genuinum* Maxim. in Mél. Biol. 8: 372. 1871, in Bull. Acad. Sci. St. Pétersb. 17: 145. 1872.

Trochostigma aralioides Sieb. & Zucc. ex Wagner in Ann. Naturhist. Hofmus. Wien 18: 418, sphalm. 1903.

Tree, usually 5–20 m. high, occasionally said to be up to 25 m. high and with a trunk up to 5 m. in diameter (presumably in very old trees), glabrous throughout; branchlets brownish to cinereous, stout (2.5–7 mm. in diameter distally), the internodes striate when dry, usually 5–20 mm. (sometimes to 11 cm.) long; terminal bud up to 21 mm. long and 8 mm. broad, the bud-scales papyraceous, scarious-margined, the outer ones deltoid to broadly reniform, 1–3 mm. long, 2–5 mm. broad, carinate, subulate or cuspidate at apex, the inner ones progressively larger, the innermost ones oblong-elliptic, striate, up to 20 × 8 mm., obtuse or mucronulate at apex; petioles of mature leaves rugulose and usually deeply canaliculate above when dried, slightly enlarged at base, 2–9 cm. long, stout (usually 1–1.5 mm. in diameter, sometimes 0.7–3 mm.); leaf-blades often glossy above and rugulose on both surfaces when dried, olivaceous or brownish when dried, variable in shape[2] from broadly ovate to lanceolate-elliptic (or rhombic-ovate, rhombic-obovate, or elliptic), 5–12 (–14) cm. long, (2.5–) 3–7 (–8) cm. broad, rounded or broadly obtuse at base and shortly decurrent on the petiole, cuspidate or acuminate at apex (acumen obtuse, 3–12 mm. long), slightly thickened and narrowly recurved at margin, entire toward base, distally crenulate-serrulate (teeth 2–4 per centimeter, callose-mucronulate distally), the costa plane or slightly impressed or canaliculate above, raised or prominent beneath, the secondary nerves 5–7 (–8) per side, erecto-patent, lightly curved or straight, slightly raised on both sides or impressed above, the lower 2 or 3 pairs arising from the costa just above base, the veinlets immersed on both sides or forming a prominulous or impressed reticulum beneath; inflorescence 5–13 cm. long, 10–20 (–30-)-flowered, the rachis rugulose-striate, stout (1–2 mm. in diameter at anthesis, up to 3 mm. in fruit), the bracts thin-papyraceous, linear, 10–25 mm. long, 1–3 mm. broad; pedicels inconspicuously striate, at anthesis usually 15–35 (rarely to 50) mm. long, in fruit occasionally to 60 mm. long; toral bracteoles submembranaceous or papyraceous, deltoid-oblong or linear, obtuse, 0.5–1.7 mm. long, 0.3–0.6 mm. broad; stamens 40–70, spreading or often reflexed at anthesis, at length all caducous, 3.3–7 mm. long, the filaments narrowest at base, gradually swollen upward, 2.3–5 mm. long, the anthers 1–2 mm. long, 0.7–1 mm. broad and nearly as thick (dorsiventrally), obtuse at base, the connective projecting into a blunt short apical mucro; carpels (4–) 6–11, the ovary obovoid or angled by lateral pressure, at anthesis 2–2.5 mm. long and 1.5–2 mm. broad, the ovules usually 16–24, sometimes up to 30, the style 0.5–2 mm. long, 0.4–0.5 mm. in diameter at base, obtuse, often recurved distally, ventrally stigmatic in the apical one-half to two-thirds; mature folliceta 7–10 mm. in diameter; seeds often about 7–12 per follicle, mixed with an equal or larger number of sterile ovules (ovules showing about 65% sterility).

[2]See Plate V of the following paper in this Journal, by Bailey and Nast.

linear-ellipsoid, about 3–3.5 mm. long including projections at base and apex, the embryoniferous portion ellipsoid-oblong, 1.3–1.7 mm. long, 0.3–0.5 mm. broad; sterile ovules associated with seeds castaneous, irregularly linear in shape, somewhat papyraceous, 2.5–3.5 mm. long.

DISTRIBUTION: Japan (central Honshu southward), Ryu Kyu Islands, and Formosa, at elevations between 300 and 2000 m. toward the north and up to 2700 m. in central Formosa (Arisan and Niitaka-yama). Although some of the earlier references cited above (e. g. Hoffman & Schultes in 1852, Miquel in 1866, Maximowicz in 1871, Franchet & Savatier in 1873, Hooker in 1894) mention the species as occurring in Hokkaido (Yezo), this appears to be erroneous. According to Sargent (For. Fl. Jap. 16. 1894), "Trochodendron . . . is certainly not an inhabitant of the alpine forests or of Hokkaido, as stated in some works on the Japanese flora, although, perhaps, it occurs in northern Hondo at the sea-level, as it is hardy in the gardens of Nikko at an elevation of 2,000 feet above the ocean . . . fine specimens of this tree are found scattered through public and private gardens in Tokyo and Yokohama." No herbarium specimens or authentic published records indicate the native occurrence of the species north of lat. 37° N.

In the following citations, the spelling of Japanese place names is made uniform, as far as possible, with that proposed in S. Gerr's A Gazetteer of Japanese Place Names (Cambridge, Mass., 1942). The islands and prefectures are arranged in general from northeast to southwest. A good map of Formosa, showing collectors' routes, has been published by Matsumura and Hayata (in Jour. Coll. Sci. Tokyo 22. 1906).

JAPAN: (Without other locality): *Buerger* (NY), *ex Herb. Lugd.-Bat.* (GH, M). HONSHU: Tochigi Pref.: Hills east of Lake Chuzenji, *J. G. Jack*, Aug. 12, 1905 (A, GH); above Lake Chuzenji, *J. G. Jack*, Oct. 25, 1905 (A, GH); Gumma Pref.: Mitsumine-san, *Collector?*, July 16, 1908 (US); [Musashi Prov.], *S. Naito 21* (NY); Nagano Pref.: ["Prov. Senano", i. e. Shinano], *Tschonoski* (type coll. of *T. aralioides* var. *longifolium*, GH, M, US); Niegawa, at temple, *J. G. Jack*, Sept. 2, 1905 (A, GH); Ogawa, *J. G. Jack*, Sept. 5, 1905 (A, GH); Tsubakura-dake, *E. H. Wilson 7487* (A); Kanagawa Pref.: Mt. Tanjawa, *K. Sakurai*, Aug. 27, 1910 (A); Mt. Hakone, *L. Savatier 36* (NY); Shizuoka Pref.: Gotemba, *E. H. Wilson 6629* (A); Amagi-san, Izu, *Collector?*, May 25, 1897 (US); Gifu Pref.: [Mino Prov.], *K. Shiota 1951, 5086, 5556, 6678, 6992* (all A), *H. Mayr*, May 13, 1886 (A); Hiroshima Pref.: [Aki Prov.], *H. Mayr*, May 15, 1886 (A); Miyajima, *K. Sakurai*, July 17, 1910 (A). SHIKOKU: Kochi Pref.: Kiragawa, *S. Watanabe*, May 22, 1886 (UC); Nanokawa, Tosa, *K. Watanabe*, May 1888 (GH); Shiraga-yama, *E. H. Wilson*, Nov. 22, 1914 (A). KYUSHU: Fukuoka Pref.: Hikosan, *Maximowicz*, 1863 (GH, M), *M. Takenouchi 1017* (US); Oita Pref.: Sobosan, *U. Faurie 3643* (A, UC); Nagasaki Pref.: Vicinity of Nagasaki, *Siebold* (TYPE COLL., GH); Kagoshima Pref.: Kirishima-yama [Nishi-Kirishima], *E. H. Wilson 6238* (A, M). YAKUSHIMA: (Without other locality): *E. H. Wilson 6041* (A, Ch, GH, US), *T. Komeda 22284* (A), *G. Masamune*, Aug. 7, 1924 (NY). RYU KYU ISLANDS: Amami Oshima: Yuwan-dake, *R. Kanehira 3410* (NY). FORMOSA: Mt. Daiton, *S. Suzuki*, Oct. 1923 (A); Daiton Range, near Sozan, *E. H. Wilson 11231* (A, US), *T. Tanaka & Y. Shimada 10992* (A, Ch, M, NY, US), *T. Tanaka 5412* (A, NY); Tamsui, *A. Henry* (coll. *Morse*) *1398* (NY); Taihei-zan, *S. Suzuki*, Aug. 10, 1928 (A); eastern approach to Taihei-zan, *H. H. Bartlett 6103* (US); mountains west of Karenko, *E. H. Wilson 11161* (A); Niitaka-yama (Mt. Morrison), *R. Kanehira & S. Sasaki 21814* (US); Arisan, *U. Faurie*, Mar. 1915 (A), *439* (A), *E. H. Wilson 9716* (A, US), *J. L. Gressitt 197* (A, NY), *B. Hayata & S. Sasaki 877* (UC), *S. Sasaki 351* (A), *R. Kanehira 2874* (NY); South Cape, *A. Henry 1981* (NY); Mt. Tikusi, *Y. Simada 350* (A), *876* (UC); without detailed locality, *U. S. Expl. Exped.* (US). CULTIVATED: *C. S. Sargent*, Nov. 8, 1892 (A) (Nikko, Tochigi Pref., Honshu, Japan); Hort. Vilmorin, Verrières, France (A); *W. J. Bean*, June 1, 1909 (A) (Coombe Wood, England); *E. Walther*, June 1936 (A) (Golden Gate Park, San Francisco); *T. A. Havemeyer*, Nov. 16, 1926 (A) (Glen Head, Long Island, Hort. Havemeyer).

NATIVE NAMES: *Yama-kuruma; Yama-guruma; Nagaba-no-yamaguruma; O-mochi-no-ki; Torimochi-noki;* and variants. The most widely used native name, *Yama-kuruma* or a variant of it, apparently means mountain-wheel, referring to the habitat of the plant and the rotate arrangement of its leaves and floral parts. Siebold and Zuccarini based their generic name upon the Greek words for wheel and tree, ". . . ob foliorum in ramis staminumque in floribus dispositionem."

It has never been seriously proposed to recognize more than one species in *Trochodendron,* the binomial *T. longifolium* having been mentioned only casually or in synonymy, unless Nakai (in 1926, Japanese text) intended to accept it. However, several writers have accepted the narrow-leaved form as representing a distinct variety, var. *longifolium.* In order to weigh the value of varietal divisions within *T. aralioides,* I have carefully examined the cited specimens, coming to the conclusion that the species is reasonably coherent and that variations in leaf-shape are only individual.

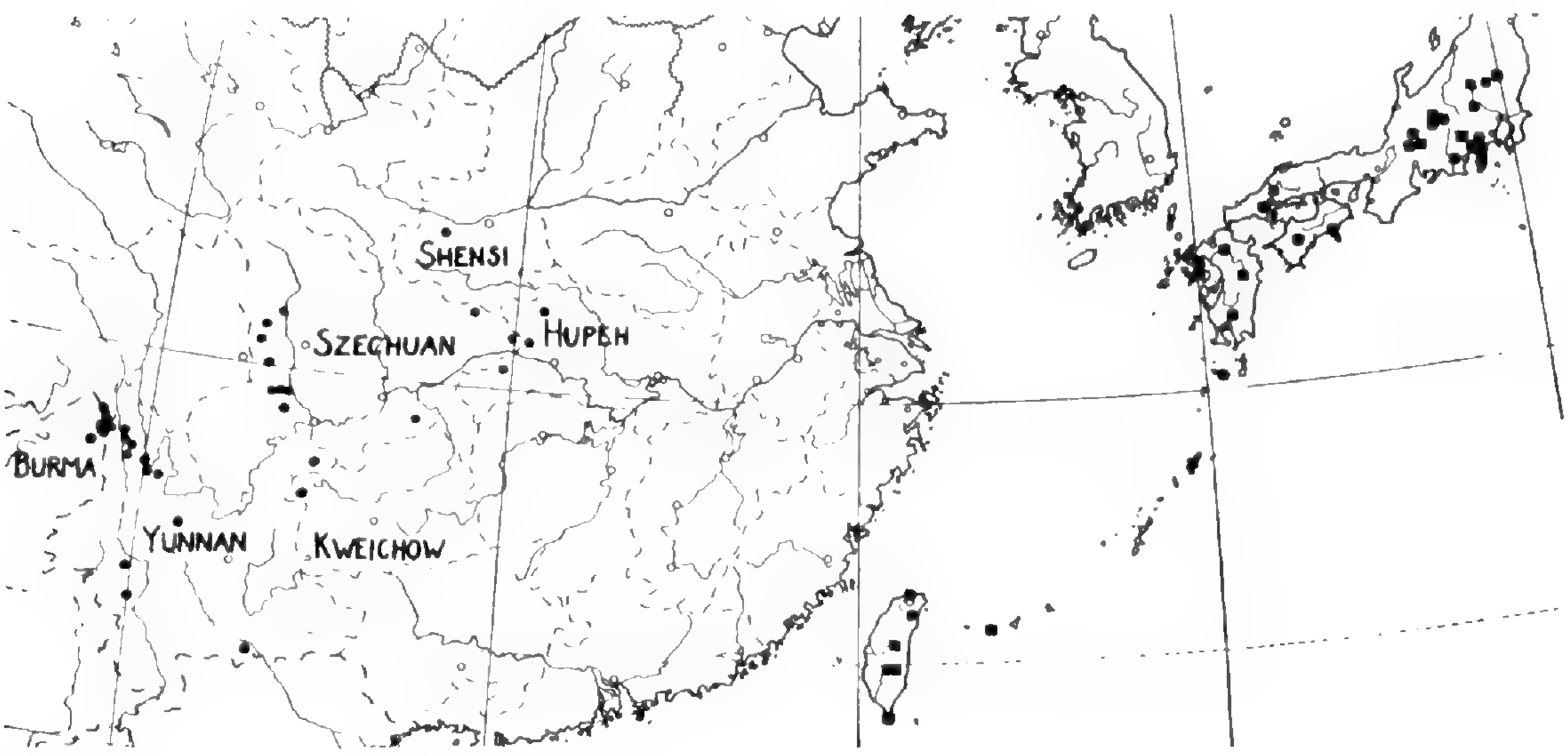

FIG. 1. Distribution of *Trochodendron aralioides* and *Tetracentron sinense.* Each solid square (*Trochodendron*) or solid dot (*Tetracentron*) represents an approximate locality from which herbarium specimens are available or have been cited in a reliable published record. Many of these localities are represented by several collections. From Goode's series of base maps, no. 226.

The material from Formosa, the Ryu Kyu Islands, and all the Japanese islands except Honshu has consistently broad leaves, except for some juvenile shoots accompanying *Wilson 6041* from Yakushima. The mature leaves of this collection, apparently from the same tree, are normally broad, suggesting that the narrow-leaved aspect, at least in some cases, may be merely a juvenile manifestation. The collections from Honshu, for the most part, have similarly broad leaves, but the type collection of var. *longifolium* and a few other specimens have the blades comparatively narnow, although there are many intergrades between this form and the more common broad-leaved form. No other characters separate var. *longifolium* from the typical aspect of the species, and this narrow-leaved form appears to be of little consequence. Geographically it may be said to occur here and there toward the northern limits of the species, but it is also likely to occur as a juvenile form of normally broad-leaved individuals.

Although it is an evergreen tree, with leaves which persist for two to four years, *Trochodendron aralioides* shows a definite annual cycle of development. The terminal buds apparently open in April or early May, after which the inflorescence and the pseudoverticil of new leaves expand very rapidly. The new bud can already be observed at the growing point among the developing leaves. Fully mature flowers are found during May, and toward the end of this month or during June the stamens are lost, leaving the maturing carpels. The fruits develop during the summer, and dehiscence of the carpels may take place as early as August, although this commonly does not occur until October or November. By December the fruits have fully dehisced and most of the seeds have escaped. The new bud is well formed by late autumn. The old inflorescences, with opened and often shattered folliceta, frequently persist until spring or even until the new bud has opened and the cycle begun again in April.

TETRACENTRACEAE

Tetracentraceae v. Tiegh. in Jour. de Bot. 14: 355 seq. (*Tetracentracées*). 1900. [*Tetracentraceae* Harms in Ber. Deutsch. Bot. Ges. 15: 357, nomen provis. 1897.]

Magnoliaceae V. *Tetracentroideae* Harms in Ber. Deutsch. Bot. Ges. 15: 359. 1897.

Magnoliaceae IV. *Tetracentreae* Harms in E. & P. Nat. Pfl. Nachtr. 1: 158. 1897.

Magnoliaceae Sect. *Tetracentreae* Lotsy, Vortr. Bot. Stammesg. 3: 453. 1911.

The first occurrence of the name Tetracentraceae is found in Harms' work of 1897, cited above, where he remarks: "Man könnte eine eigene Familie der *Tetracentraceae* auf sie gründen, die aber doch wohl an keiner anderen Stelle des Systems besser untergebracht würde als in der Nachbarschaft der *Magnoliaceae* und *Trochodendraceae*, . . . " I interpret this to be a provisional use of the family name and hence not acceptable publication under the International Rules. The propriety of van Tieghem's publication of this and other family names in French only is also open to question, but nevertheless I prefer to accept his publication as adequate, since his intention to propose new families in these cases is indisputable. If one wishes to apply Art. 23 of the International Rules of Botanical Nomenclature (ed. 3. 1935) stringently, the present treatment may be considered the first valid use of the family name Tetracentraceae.

Tetracentron Oliv. in Hook. Ic. Pl. 19: *pl. 1892.* 1889; Prantl in E. & P. Nat. Pfl. 3(2): 273. 1891; Harms in Ber. Deutsch. Bot. Ges. 15: 350. 1897, in E. & P. Nat. Pfl. Nachtr. 1: 158. 1897; v. Tiegh. in Jour. de Bot. 14: 355. 1900; Hall. f. in Ber. Deutsch. Bot. Ges. 23: 89 (*Tetracentrum*). 1905, in New Phyt. 4: 157 (*Tetracentrum*). 1905; Lotsy, Vortr. Bot. Stammesg. 3: 453. 1911; Rehder in Bailey, Stand. Cycl. Hort. 6: 3322. 1917; Chun, Chin. Econ. Trees 132. 1922; Rehder, Man. Cult. Trees & Shrubs 261. 1927, ed. 2. 253. 1940; Hu in Contr. Biol. Lab. Sci. Soc. China 5(5): 9. 1929; Wettst. Handb. Syst. Bot. ed. 4. 2: 689. 1935; Lee, For. Bot. China 493. 1935; Chen, Ill. Man. Chin. Trees & Shrubs 302 (*Tetracendron*). 1937.

A monotypic genus of trees; branchlets bearing alternately directed short shoots at the nodes, sometimes forking by means of occasional lateral long shoots (short shoots very rarely interrupted and giving rise to long shoots);

short shoots conspicuously marked throughout by the crowded concentric scars of fallen leaves and bud-scales, at anthesis and in early fruit terminated by a bud (which is at first enclosed by the stipular sheathing base of the petiole and is at length free), a single subterminal leaf, and a single inflorescence arising below the petiole and dorsal or lateral to it;[3] short shoot bud composed of two imbricate bracts, a terminal (at inception) incipient inflorescence, and a secondary collaterally terminal (actually axillary at base of inflorescence) bud which consists of a single bract, a developing leaf with its dorsal or lateral surface toward the incipient inflorescence, and the primordium of the short shoot (enclosed in the stipular base of the young petiole); bracts of the terminal short shoot bud coriaceous, strongly concave; leaves simple, deciduous; petioles of mature leaves alate proximally with stipular flanges which form a sheathing base enclosing the terminal bud; leaf-blades thin, serrate-margined, palmate-veined; inflorescence a slender spike, short-pedunculate; flowers hermaphrodite, numerous, aggregated in clusters of 4, the adjacent clusters alternately placed (this arrangement often scarcely apparent at anthesis due to abortion of some flowers or irregular development, the flowers thus sometimes appearing irregularly spaced on the rachis), each flower sessile in the axil of a minute bract; sepals 4, obscurely imbricate at base (lateral sepals outside the upper and lower sepals at both margins); petals none; torus inconspicuous, flattened; stamens 4, borne on torus at base of sepals and opposite them, the filaments slender, the anthers basifixed, erect, the connective stout, subclavate, truncate-rounded at apex, not or scarcely exceeding the thecae, the sporangia 4, lateral, the thecae dehiscing by 2 longitudinal clefts, the resultant valves at length fully reflexed, oblong, rounded at each end; carpels 4, alternate with stamens and sepals, laterally coalescent proximally at anthesis, carnose, the ovary triquetrous, unilocular, bearing the stylar portion from its inner angle, the style subulate, conduplicate, at first erect, soon recurved, stigmatic along the ventral suture for most of its length; placentae 2, parallel along the ventral suture of the ovary, the ovules attached to the placenta near middle of locule, horizontal at anthesis; style becoming more sharply recurved soon after anthesis, the ovary becoming strongly arched by rapid elongation of its ventral surface; fruit a follicetum composed of 4 laterally coalescent follicles, the sepals persistent, the mature carpels firmly concrescent along the lower part of the ventral suture, greatly developed ventrally, the dorsal margin and style not increasing in size after anthesis, the carpels loculicidally dehiscent along the entire exposed portion of the ventral suture to base of the persistent style, the adjacent carpel-halves at length falling together, the pericarp and dissepiments (formed by fusion of adjacent walls) firmly papyraceous; seeds pendulous from apex of locule (i. e. from midde of ventral suture, now apical in position), the outer integument modified into a spongy tissue which projects in two or three lateral wing-like ridges, sometimes more massive at the micropylar end, the funicle forming a ridge on one side of the embryoniferous portion and continued into a chalazal projection which may be wing-like, the inner integument thin, membranaceous, the endosperm oleaginous, the embryo minute, subglobose or ellipsoid, becoming obscurely cleft at apex.

[3]The details of the complex pattern of foliation and inflorescence structure will be discussed in a subsequent paper by Bailey and Nast.

Tetracentron sinense Oliv. in Hook. Ic. Pl. 19: *pl. 1892.* 1889; Prantl in E. & P. Nat. Pfl. 3(2): 273. 1891; Henry in Kew Bull. 1897: 407. 1897; Bretschn. Hist. Eur. Bot. Disc. China 779. 1898; v. Tiegh. in Jour. de Bot. 14: 356. 1900; Diels in Bot. Jahrb. 29: 323. 1900; Vilmorin & Bois, Frut. Vilmorin. 10. 1904; Finet & Gagnep. in Bull. Soc. Bot. Fr. 52: Mém. 4: 26. 1905 (repr. Contr. Fl. As. Or. 2: 26. 1907); Bean in Kew Bull. 1909: 356. *fig.* 1909; Lotsy, Vortr. Bot. Stammesg. 3: *f. 274* (generic name only). 1911; Wilson, Veg. W. China 19. 1912; Schneider, Ill. Handb. Laubholzk. 2: 927. *f. 579.* 1912; Rehder & Wilson in Sargent, Pl. Wils. 1: 417. 1913; Silva Tarouca, Unsere Freil.-Laubgehölze 362. 1913; Wilson, Nat. in W. China 1: 37, 52, 177. 1913; Bean, Trees and Shrubs 2: 584. 1914; Thompson & Bailey in Mem. N. Y. Bot. Gard. 6: 29. 1916; H. Lév. Cat. Pl. Yun-Nan 175. 1916; Rehder in Bailey, Stand. Cycl. Hort. 6: 3322. 1917; Harms in Mitteil. Deutsch. Dendr. Ges. 1917 [26]: 85. 1918; Bailey & Thompson in Ann. Bot. 32: 507. 1918; Chun, Chin. Econ. Trees 132. *pl. 50.* 1922; Mottet, Arbres et arbustes d'ornement 46. 1925; Wilson in Jour. Arnold Arb. 7: 239. 1926; Rehder, Man. Cult. Trees & Shrubs 261. 1927, ed. 2. 253. 1940; Hu & Chun, Ic. Pl. Sin. 1: 23. *pl. 23.* 1927; Hu in Contr. Biol. Lab. Sci. Soc. China 5(5): 9. 1929; Cox in New Flora & Silva 6: 11. *f. 5.* 1933; Lee, For. Bot. China 493. *pl. 138.* 1935; Chen, Ill. Man. Chin. Trees & Shrubs 302. *fig.* 1937; Merr. in Brittonia 4: 53. 1941; Fang in Ic. Pl. Omeiens. 1 (2): *pl. 58.* 1944.

Tree up to 30 m. high, glabrous throughout, the trunk often exceeding 1 m. in diameter (sometimes up to 20 ft. in girth, according to E. H. Wilson), the crown much-branched, often somewhat flat; young branchlets (long shoots) purpurascent and slightly angled, soon terete, cinereous, and inconspicuously lenticellate, distally 1.5–4 mm. in diameter, faintly flexuose or essentially straight, the internodes (on long shoots) usually 2–5 cm. long; short shoots up to 4 cm. long, 2–4 (–5) mm. in diameter; outer bract (of the terminal short shoot bud) oblong-elliptic, up to 15 mm. long and 9 mm. broad when expanded, obtuse at apex, entire and scarious at margin, the inner bract similar but slightly smaller and callose-mucronulate at apex; petioles of mature leaves slender (0.7–1.5 or rarely 2 mm. in diameter), rugulose and often striate when dried, semi-terete, canaliculate toward base and sometimes distally, 2–4 cm. long, the stipular flanges papyraceous or scarious, linear, 7–15 mm. long, 0.5–1.5 mm. broad, rounded or subacute at apex and abruptly decurrent on the petiole; mature leaf-blades papyraceous or chartaceous when dry, green, becoming olivaceous or fuscescent when dry, slightly paler beneath, ovate or ovate-elliptic,[4] 7–16 cm. long, 4–11.5 cm. broad, deeply or shallowly cordate at base with rounded sinus or rarely truncate-rounded, acuminate at apex (tip elongate-deltoid, 6–15 or rarely 20 mm. long, callose-tipped), regularly and finely serrate at margin except within the basal sinus (teeth 3–7 per centimeter, callose-tipped, subacute or obtuse, rarely subspinulose and with narrowly recurved margins), the principal nerves 5 or 7, spreading from base, fairly straight, inconspicuously anastomosing, slightly impressed or nearly plane above, strongly elevated beneath, the lateral nerves with several outwardly directed ramifications, the veinlets freely anastomosing, forming a lax reticulum which is immersed to faintly prominulous above and prominulous or sharply raised beneath (or with the ultimate veinlets impressed or immersed); inflorescence slender (rachis and peduncle 0.6–1 mm. in diameter, striate when dried), 7–20 cm. long, the peduncle 5–22 mm. long; flowers about 80-125 (in bud, often fewer at anthesis), the

[4]See Plate VI of the following paper in this Journal, by Bailey and Nast.

flower-subtending bracts papyraceous, broadly deltoid, 0.3–0.5 mm. long, 0.4–0.7 mm. broad at base, rounded or obtuse at apex; sepals papyraceous, oblong or deltoid-suborbicular, at anthesis 1–1.5 mm. long and slightly narrower, rounded at apex, entire at margin; filaments subterete or slightly flattened, (0.5–) 1.5–3 mm. long at anthesis, the anthers oblong, at anthesis 0.4–0.8 mm. long and 0.5–0.7 mm. broad (unopened); carpels 1.3–1.7 mm. long at anthesis, the style 0.6–1 mm. long, the ovules usually 6, sometimes 5, oblong-obovoid, subacute at base, rounded at apex, slightly dorsiventrally flattened; mature folliceta oblong, 2.5–4.5 mm. long, 2–3.5 mm. broad, depressed at apex; seeds usually 6 per follicle (sometimes 4 or 5, rarely fewer and very rarely only 1, the ovules showing about 10% sterility on the average), linear, 2–3.5 mm. long including projections at base and apex, 0.5–0.7 mm. broad including lateral ridges, the embryoniferous portion 0.8–1.5 mm. long.

DISTRIBUTION: South-central China, in the Provinces of Shensi, Hupeh, Szechuan (doubtless also in eastern Sikang), Kweichow, and Yünnan, and in northern Burma, at altitudes from 1600 to 3600 m. The species is not known north of lat. 34° N. nor east of long. 111° E. The most southern collections of it thus far known are Henry's from south of the Red River in Yünnan, near the Indo-Chinese frontier, at a latitude probably somewhat lower than 23° N. Henry (in Kew Bull. 1897: 100, 407. 1897) reports the species as very common in this region, and therefore it may be expected in adjacent Indo-China. Wilson (Nat. in W. China 1: 37, 52. 1913) describes *Tetracentron sinense* as one of the commonest trees in the region of the Hupeh-Szechuan frontier north of the Yangtze. It is also common in western Szechuan and northwestern Yünnan, where it is often reported as the most abundant species of tree.

In the following citations, localities are arranged in general from northeast to southwest. Dr. J. F. Rock has very kindly checked the spelling of the localities listed below.

CHINA: SHENSI: Tai-pai Shan, *W. Purdom 669* (A), *670* (A, GH, US). HUPEH: Western Hupeh (no other data), *E. H. Wilson 2156* (A, NY, US); Huan-tsao, western Hupeh, *W. Y. Chun 4139* (A); Fang Hsien, *E. H. Wilson 659* in pt. (A); Fang Hsien and Chien-shih Hsien (without other indication), *A. Henry 6243* (GH), *6690* (A, GH, US), *7417* (GH, US) (all COTYPE COLLS.). SZECHUAN: "Tchen-kéou-tin" (Chengkou?), *P. Farges* (NY); summit of Fei-yüeh, Chien-chi Hsien, *E. H. Wilson 4328* in pt. (A); western Szechuan (no other data), *E. H. Wilson 659* in pt. (GH, US), *659a* in pt. (A); Fei-yüeh Ling, *W. C. Cheng 1992* (A, NY, US); west of Wen-chuan Hsien, *W. C. Cheng 3419* (A, NY, US); Pan-lan Shan, west of Kuan Hsien, *E. H. Wilson 4328* in pt. (A, US); Mupin, *E. H. Wilson 659a* in pt. (A); Mt. Tien-chuan, *Y. S. Liu 1347* (A); O-mei Hsien, *S. S. Chien 6105* (A); O-mei Shan, *E. H. Wilson 4721* (A), *W. P. Fang 2653* (A, NY), *2725* (A, NY), *6705* (A, NY), *12781* (A, US), *C. Y. Chiao & C. S. Fan 514* (A); Wa Shan, *E. H. Wilson 659a* in pt. (A); Ma-pien Hsien, *F. T. Wang 22990* (A). KWEICHOW: Huei-hsiang-ping, Fan-ching Shan, *A. N. Steward, C. Y. Chiao, & H. C. Cheo 663* (A, Ch, NY, US). YÜNNAN: *G. Forrest 14164* (A), *18488* (A); Chen-hsiung Hsien, *H. T. Tsai 52708* (A); northwestern Li-chiang, I-chi, *R. C. Ching 20854* (A); northwestern Li-chiang, A-hsi, *R. C. Ching 22034* (A); western Li-chiang, Kai-tzu on Yangtze, *K. M. Feng 2624* (A); Wei-hsi Hsien, *C. W. Wang 63646* (A), *64005* (A), *67836* (A), *H. T. Tsai 57831* (A), *59953* (A), *63072* (A); Wei-hsi Hsien, Yeh-chih, *C. W. Wang 68662* (A), *71750* (A); Mekong Valley, mountains of K'ang-p'u, Yeh-chih, and An-wa, *J. F. Rock 8932* (A, UC, US); Shang-pa Hsien, *H. T. Tsai 56579* (A); Mekong-Yangtze Divide, *G. Forrest 19641* (A); Doyon Lungpa Valley, Lu Chiang (Salwin River), *H. F. Handel-Mazzetti 8295* (A); Der-la, Ch'ang-p'u-t'ung, *C. W. Wang 66899* (A); Si-gi-tung, Ch'ang-p'u-t'ung, *C. W. Wang 67416* (A); Salwin Valley, Si-gi-tung, *T. T. Yü 19217* (A); Salwin-Chiu Chiang Divide, "Hevaty," *T. T. Yü 21073* (A); Taron-Taru Divide, Tang-teh-wang, *T. T. Yü 20013* (A); "Tchoan ouanho, tie so," near Pai-yen-ching, *S. Ten 185* (A, US); Mien-ning, Po-shang, *T. T. Yü 18061* (A); Shun-ning, Hi-la, Wu-mu-lung, *T. T. Yü 16699*

(A); south of Red River from Man-mei, *A. Henry 9744* (A, M, US); Feng-chen Ling, *A. Henry 9744A* (A). BURMA: Upper Burma, Kang-fang, *F. K. Ward 199* (A, NY). CULTIVATED: *Herb. Arnold Arb. 6722* (A) (in Arboretum, 1916, 1917); *Herb. Arnold Arb. 17408* (A) (in Arboretum, Oct. 13, 1912; grown from *Wilson 659*).

NATIVE NAMES: Apparently the only native name recorded for *Tetracentron,* except possibly in Chinese characters, is *Shui ch'ing shu,* mentioned by Diels in Bot. Jahrb. 29: 323. 1900.

Tetracentron sinense is a very stable species, within which no subspecific categories have been proposed. The available specimens are remarkable for their lack of variation, even the dimensions of foliar and floral parts being unusually consistent.

The collection of specimens at practically all seasons makes possible the following record of the annual cycle. During May, or possibly late in April, the buds open and each short shoot gives rise to an inflorescence and a single leaf. At this season the stipular petiole-base completely encloses the next short shoot bud. During June and July the flowers mature and the stipular flanges relax, permitting the new bud to enlarge slightly. In August the stamens fall and the carpels begin to mature. Between the end of August and early November each short shoot bears a single mature leaf and, if it is a fertile shoot, a mature fruiting inflorescence, from which the seeds gradually fall. The new bud now becomes fully developed and entirely free of the stipular flanges. The leaves fall between late October and December, but the fruiting spikes often persist until January. Between January and late spring the tree is in its winter condition, with fully developed buds terminating the short shoots.

CONCLUSIONS

Trochodendron and *Tetracentron* are both so distinct from the Magnoliaceae, in numerous anatomical and morphological features, as to make any comparison of them with that family superfluous for the time being. *Trochodendron* is now universally recognized as belonging in a distinct family, but in many treatments *Tetracentron* is still treated as a member of the Magnoliaceae. Of all existing genera which might with some justification be placed in the same family as *Trochodendron, Tetracentron* is the only one deserving consideration. It is curious, therefore, that so many students have overlooked this affinity, at the same time linking *Euptelea* and even *Cercidiphyllum* with *Trochodendron.* This oversight can be accounted for if one realizes that *Trochodendron* and *Tetracentron* are superficially very unlike, their leaf-texture and venation and their inflorescence being strikingly dissimilar at first glance; furthermore, the presence of a perianth in *Tetracentron* and its putative absence in *Trochodendron* (the toral bracteoles having been ignored by most students) have been unduly stressed. Detailed study of the two genera, however, reveals important similarities — characters which they have in common and which are not shared by any other plants. *Euptelea* is very remotely related to *Trochodendron* and *Tetracentron,* as will be discussed in future papers, and yet this is the genus most closely associated with *Trochodendron* in most treatments. *Cercidiphyllum,* although suggesting *Tetracentron* in certain superficial respects, is actually only a remote relative and is now universally placed in a unigeneric family. The family Winteraceae, which shares the character of vesselless wood with *Trochodendron* and *Tetracentron,* is so different in innumerable other respects (and also in details of wood anatomy) that comparison is superfluous. Van Tieghem's suggestion (26) that these three groups compose a distinct subclass of dicotyledons is not tenable, as their retention of the primitive vesselless wood appears to have been independent.

The following paragraph summarizes the important external morphological similarities and differences between *Trochodendron* and *Tetracentron.* Detailed consideration of some of these and of the internal characters will be the subject of a series of papers by Prof. Bailey and Dr. Nast, initiated in this Journal.

The branching of the genera is different, *Tetracentron* having short shoots alternately directed from the long shoots, while *Trochodendron* has only long shoots.. Actually, however, the method of foliation and inflorescing is somewhat similar in the two genera. The principal differences in these respects are as follows: leaves numerous in pseudoverticils in *Trochodendron,* solitary in *Tetracentron;* stipular flanges none in *Trochodendron,* present in *Tetracentron;* leaf-blades coriaceous and pinnate-nerved in *Trochodendron,* thin (papyraceous or chartaceous) and palmate-nerved in *Tetracentron.* The internodes (on short shoots) in *Tetracentron* are of course much more reduced than in *Trochodendron.* The inflorescence in *Trochodendron* is raceme-like and in *Tetracentron* spike-like or perhaps a true spike. The basal bracts (bud-scales) are numerous in *Trochodendron* and uniformly 2 in *Tetracentron.* The flower-subtending bracts are elongate and soon caducous in *Trochodendron,* minute and subpersistent in *Tetracentron.* In *Trochodendron* the flowers are comparatively few and laxly alternate on the rachis, while in *Tetracentron* the flowers are more numerous and are arranged in definite clusters of 4, the adjacent clusters being alternately placed. The pedicel in *Trochodendron* is long and the torus is bracteolate, while in *Tetracentron* the pedicel is entirely lacking. The perianth is lacking in *Trochodendron* (unless the toral bracteoles are interpreted as modified segments), while *Tetracentron* has 4 persistent sepals with a definite pattern of imbrication. The torus in *Trochodendron* is large, subcoriaceous, and obconical, while in *Tetracentron* it is flattened and inconspicuous. The stamens in *Trochodendron* are numerous and are whorled on the outer surface of the torus; in *Tetracentron* they are always 4 and are opposite the sepals. The stamens of the two genera are remarkably similar, the anthers of *Trochodendron* being faintly mucronulate and those of *Tetracentron* truncate-rounded at apex. The carpels of the two genera are fundamentally alike in structure, but different in details. Those of *Trochodendron* are several, larger, and with only a slight ventral overgrowth; those of *Tetracentron* are reduced to 4, small, and have a very pronounced ventral overgrowth which results in a follicle of quite different shape. The ovules are numerous in *Trochodendron* and are attached to elongate placentae, while in *Tetracentron* they are 6 or fewer and are borne on the placentae only at the middle of the locule. The folliceta of the two genera are fundamentally similar but have a different aspect due to the strong ventral development of the carpel in *Tetracentron.* The seeds are numerous in *Trochodendron* and are associated with numerous sterile ovules, while in *Tetracentron* the seeds are 6 or fewer and there are proportionately fewer enlarged sterile ovules. The seeds in the two genera are remarkably similar, except that the outer integument in *Tetracentron* is more spongy and wing-like. The endosperm is abundant in both genera, perhaps somewhat more oily in *Tetracentron,* while the embryo is similarly placed and minute in both cases.

Whether the two genera are placed in the same or in different families depends upon the importance of the characters mentioned above. The similarities are striking, but the fundamental differences are also striking. In view of these differences, we believe that the erection of two families is justified.

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MORPHOLOGY AND RELATIONSHIPS OF TROCHODENDRON AND TETRACENTRON, I. STEM, ROOT, AND LEAF

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With six plates

INTRODUCTION

Owing to their retention of a primitive cambium and a vesselless type of xylem, *Trochodendron* and *Tetracentron* are fully as significant as the Winteraceae, Degeneriaceae, and Himantandraceae in discussions regarding the origin and phylogeny of the angiosperms. Furthermore, as indicated by Dr. Smith in the preceding article in this Journal, the opinions of taxonomists and morphologists concerning the relationships and classification of the two monotypic genera are exceedingly diversified and contradictory. It seemed advisable, accordingly, to utilize the extensive collections assembled by Dr. Smith as a broad basis for morphological as well as taxonomic re-investigations of these unusually significant genera. In presenting the results of our observations, we shall deal largely with morphological features that are incompletely or inadequately covered in the extensive literature.

XYLEM

The most obvious structural characteristics of the wood of *Trochodendron* and *Tetracentron* were first described by Eichler (9) and Harms (12) and have subsequently been re-described by a succession of investigators, e.g. van Tieghem (22), Solereder (20), Kanehira (13), Sahni (17), Mathiesen (14), and McLaughlin (15). That the xylem of both the primary and secondary bodies of stems, roots, leaves, and inflorescences is entirely devoid of vessels or of vestiges of vessels has been clearly demonstrated by Thompson and Bailey (21) and Bailey and Thompson (3). Although the xylem of *Trochodendron* and *Tetracentron* is of a structurally unique type and not to be confused with that of any other known representative of the angiosperms or of the lower vascular plants, the woods of the two genera are so similar as to render difficult and uncertain the task of determining to which genus certain fossil woods from significant geological horizons of India, Greenland, and the northwestern United States actually are related.

As should be anticipated, see Bailey and Faull (1), the woods of *Trochodendron aralioides* Sieb. & Zucc. and *Tetracentron sinense* Oliv. exhibit certain ranges of anatomical variability not only within different parts of the same tree but also in homologous parts of trees grown under different environmental conditions. The most conspicuous and significant differences in the size and form of cambial initials and *pari passu* in the size, form, and structural details of tracheary elements, rays, and parenchyma occur in passing from young shoots (e.g. of herbarium specimens) to the outer parts of large mature stems. Numerous specimens of the mature wood of *Trochodendron* are available for comparison with herbarium material, but the largest stem of *Tetracentron* that we have succeeded in obtaining has twelve growth layers and a woody cylinder approximately three centimeters in diameter. This specimen affords valuable clues regarding the succession of structural changes — particularly of the rays — that occur during the normal enlargement of a stem. The final form and distribution of the rays in old wood can be accurately reconstructed from the cambium and inner phloem of bark from an old tree collected by E. H. Wilson (no. *659*).

The available evidence indicates that certain anatomical features of the xylem of *Tetracentron* do not fall within the range of structural variability of *Trochodendron*. The most significant of these are the following. As shown by Thompson and Bailey (21), the first formed secondary xylem of stems and roots of *Tetracentron* is characterized by having numerous broad and abnormally short tracheids that subtend the vascular strands of leaves, buds, branches, and rootlets. These tracheids are profusely pitted on both their tangential and radial walls and appear to facilitate the movement of water from a stem into its appendages, or from rootlets into roots. More or less isolated and sporadically distributed radial seriations of these short tracheids extend outward into the subsequently formed secondary xylem. Whether they ever persist in the outer growth layers of old stems and roots unfortunately cannot be determined at present, but it seems likely that they may be found in tissue which subtends the bases of persistent branches. Such tracheids do not occur, however, in either the first-formed or the later-formed secondary xylem of *Trochodendron*.

The wood parenchyma of *Tetracentron* is of a structurally unique type and unlike that of any other vascular plant with which we are familiar. During the maturation of wood parenchyma in normal, uninjured stems of gymnosperms and dicotyledons, derivatives of the fusiform initials of the cambium divide approximately transversely, *Fig. 10,* forming vertically oriented, uniseriate strands of parenchymatous cells. In *Trochodendron,* the wood-parenchyma strands are uniseriate, *Fig. 11,* but the anticlinal partitions are more or less extensively and obliquely oriented. In *Tetracentron,* a large proportion of the derivatives of the long fusiform initials tend to divide first in more or less extensive, longitudinal anticlinal planes, *Fig. 12,* and subsequently the products of these divisions divide transversely or in various diagonal anticlinal planes. The fully matured parenchymatous strands, therefore, are largely biseriate, except in strands or parts of strands where divisions of the *Trochodendron*-type may have occurred. In transverse sections of normally developed, uninjured wood of Winteraceae, as of various gymnosperms — where the radial seriation of successively formed derivatives of the fusiform cambial initials is not disturbed by the enlargement of vessel members or by excessive apical elongation of non-perforate tracheary elements — the parenchymatous strands appear as single cells of approximately the same tangential diameter as the tracheids. On the contrary, in transverse sections of the wood of *Tetracentron, Fig. 8,* a majority of the parenchymatous strands appear as paired cells and only relatively infrequently as single cells, i.e. where they are sectioned at the level of their tapered ends, *Fig. 12,* or other uniseriate parts. Occasional paired cells are encountered in transverse sections of *Trochodendron* where the uniseriate parenchymatous strands are sectioned at the level of their diagonal partitions, *Fig. 11,* just as three, or even four, such cells may be encountered in transverse sections of *Tetracentron* where the strands are sectioned at appropriate levels, *Fig. 12.*

The wood parenchyma of both *Trochodendron* and *Tetracentron* fluctuates from scanty to abundant, not only in different stems, but also in different growth layers of the same stem. In *Trochodendron,* the parenchymatous strands when abundantly developed tend to be diffusely distributed among the thicker-walled tracheids of the latewood, whereas in *Tetracentron* they may at times be loosely associated in zonal arrangements and may occur in the transitional as well as in the later-formed parts of the growth layers.

The eustele or vascular part of the primary body of stems is composed of more numerous discrete bundles in *Trochodendron* than in *Tetracentron.* This is correlated with significant differences in the number of strands in the leaves of the two genera. Since the first-formed multiseriate rays of the secondary body extend outward from the parenchymatous interfascicular parts of the eustele, the number of such rays in the first-formed growth layer of the secondary body of *Trochodendron* tends to be higher than in the homologous part of *Tetracentron.* During subsequent enlargment of the stems, the relationship becomes reversed,[1] the old wood of *Trochodendron* having conspicuously larger and fewer multiseriate rays per unit area, *Fig. 7,* than does comparable wood of *Tetracentron, Fig. 9.* Furthermore, the rays of the latter genus ultimately attain a more "homogeneous" form, i.e. the cells of the uniseriate rays are less vertically extensive than in *Trochodendron,* compare *Figs. 7* and *9.*

In growth layers of comparable widths and ages, the wood of *Tetracentron* is softer and lighter than that of *Trochodendron,* due largely to the fact that the tracheids of the latewood have thinner walls in relation to their cross-sectional area. In addition, the latewood tracheids of *Tetracentron* are of more uniformly rectangular outline as seen in transverse sections of the wood, and their radial seriation is less disturbed by excessive apical elongation of the tracheary elements during their maturation.

Mathiesen (14) has attempted to differentiate the woods of the two genera by the presence or absence of pits in the tangential walls of the latewood tracheids. Such pits fluctuate, however, from numerous to infrequent in *Trochodendron,* and, in young wood of *Tetracentron,* from very

[1]For detailed discussions of ray changes that occur during the enlargement of dicotyledons see Barghoorn (4, 5) and Bailey and Howard (2).

abundant (short tracheids) to scanty or absent (normal long tracheids). Not until numerous specimens of the older wood of *Tetracentron* are available for detailed investigation will it be possible to determine whether tracheary pitting provides under all conditions reliable criteria for differentiating the woods of the two genera.

NODAL ANATOMY AND VASCULARIZATION OF THE LEAF

The petioles of the palmately veined leaves of *Tetracentron* have extensive stipular flanges that enclose the much elongated slender buds, *Fig. 35,* except during the final emergent phases of their development. At this level of the petiole, *Fig. 2,* there are three conspicuous vascular strands which tend to broaden and to coalesce at higher levels of the petiole and thus to form a cylindrical stele and a more or less continuous secondary body, *Fig. 1.* The coalescence of the expanded strands and the levels at which specific changes occur fluctuate from petiole to petiole. Not infrequently the vascular cylinder retains an opening or gap in its adaxial side, *Fig. 1,* or this opening may be partly occluded by a detached strand of vascular tissue. At the base of the lamina, the vascular cylinder or cylindrical complex of strands becomes abruptly dissociated into 5–7 bundles which form the principal veins of the leaf. At the nodal level of the stem, three vascular bundles depart from three widely separated parts of the circumference of the eustele, *Fig. 3,* leaving three conspicuous parenchymatous gaps in the secondary body. In other words the nodal anatomy of *Tetracentron* is stereotyped and stable and is characteristically of the so-called trilacunar type.

The highly polymorphic, pinnately veined leaves of *Trochodendron, Figs. 23–33,* are exstipulate and only infrequently have buds in their axils. The larger leaves of a pseudoverticil commonly have from 5–7 vascular strands in the base of their petioles, *Fig. 5.* These strands depart from a relatively restricted part of the circumference of the eustele of the stem, *Fig. 6,* and there is much less extensive "girdling" of the lateral bundles than in multilacunar Magnoliaceae. The vascular strands rapidly coalesce, forming an arc, *Fig. 4,* which extends upward through the petiole and midrib of the lamina. This arc-shaped strand may or may not be accompanied in the petiole by two small adaxially detached bundles. The smaller leaves of a pseudoverticil, as also the leaves of juvenile plants, commonly have three vascular bundles, but the strands may at times be reduced to two or even to a single vascular bundle with concomitant modifications in the nodal anatomy of the stem. Thus, the nodal anatomy of *Trochodendron* fluctuates from multilacunar to unilacunar and, in contrast to the stabilized trilacunar condition of *Tetracentron,* is plastic and variable.

SCLERENCHYMA AND SECRETORY IDIOBLASTS

The secondary phloem of *Trochodendron* and *Tetracentron* does not exhibit the precocious flaring of the multiseriate rays and early stratification into narrow alternating arcs of soft bast and fibers that occur so characteristically in Magnoliaceae (*sensu stricto*), Degeneriaceae, and Annonaceae. Nor is there a sclerification of the multiseriate rays close to the cambium as in *Euptelea* and many Winteraceae. In bark from old stems of *Trochodendron,* the phloem is characterized by forming large irregular masses of dense non-fibrous, crystal-bearing sclerenchyma. The structurally closely similar sclerenchymatous tissue of *Tetracentron* occurs in less massive, more tangentially oriented clusters, as seen in transverse sections. Nests and diaphrams of sclerenchyma such as are formed so commonly in the pith of various woody ranalian families do not occur in *Trochodendron* and *Tetracentron.*

The leaves of *Trochodendron* are typified by the presence of profusely branching, sclerenchymatous idioblasts which are discussed by Dr. Foster in the following article in this Journal. These bizarre elements project into the large, intercellular spaces of the mesophyll. Similar intercellular spaces and sclerenchymatous idioblasts occur in the cortex of young stems and may be encountered in the pith, particularly in those parts of the stems where the leaves are congested in pseudoverticils. On the contrary, *Tetracentron* is characterized by the occurrence, in the leaf and the outer cortex of both stems and roots, of large more or less extensively elongated or branching secretory idioblasts. These elements have "resinous" contents which stain intensely with sudan IV, but differ markedly in form from the nearly spherical secretory cells of the Winteraceae, Magnoliaceae, and other woody ranalian families.

STOMATA

Solereder (20) described the stomata of *Trochodendron, Tetracentron, Euptelea,* and *Cercidiphyllum* as being surrounded by several neighboring cells which are not of special form and orientation, in contrast to those of the Magnoliaceae (including *Drimys, Illicium, Schisandra,* and *Kadsura*) investigated by Vesque (23), where the guard cells are accompanied by subsidiary cells which are oriented parallel to the pore — the so-called rubiaceous type of stomata. On the contrary, Rao (16) maintains that the stomata of *Euptelea* and *Cercidiphyllum* are of Florin's (10) haplocheilic type, whereas those of *Trochodendron* and *Tetracentron* resemble the stomata of other investigated genera of the Magnoliales in being of his syndetocheilic type.[2] It should be emphasized in this connection, however, that Florin's classical investigations of stomata have dealt thus far with gymnosperms and that the terms haplocheilic and syndetocheilic were formulated specifically for use in dealing with gymnosperms. The terms clearly convey implications regarding the morphological form as well as the ontogenetic development of gymnospermous stomata and it is not certain as yet whether they should be adopted in dealing with angiosperms. The available evidence concerning angiospermic stomatal structures, summarized by De Bary (8), Solereder (20), and others, indicates that the morphological form and the ontogenetic development of these structures is exceedingly diversified and variable. Stomata with subsidiary cells oriented

[2]In the haplocheilic or simple-lipped type the guard cells are formed by a single division of an epidermal initial, whereas in the syndetocheilic or complex-lipped type both guard cells and subsidiary cells are derived from a single epidermal initial.

parallel to the pore may arise as products of the divisions of a single epidermal initial (rubiaceous type) or by divisions of more than one epidermal cell (false rubiaceous type). To classify the stomata of dicotyledonous genera as haplocheilic or syndetocheilic, particularly in discussions of putative relationships between angiosperms and gymnosperms, is at present premature and likely to be misleading.

In all of the numerous gymnosperms figured by Florin (11), with the exception of *Gnetum gnemonoides* Brongn., the guard cells are depressed below the general level of the outer surface of the epidermis and are more or less extensively *overtopped* by adjacent epidermal cells. On the contrary, the guard cells of *Tetracentron* and *Trochodendron* rest in a setting formed by the *subtending* parts of contiguous epidermal cells, *Figs. 13* and *14.* Furthermore, the outer vestibules of the stomata are formed by the cuticular covering of the guard cells rather than by that of neighboring cells, as in those gymnosperms which form such structures. The number, size, and form of the contiguous epidermal cells that are concerned in the formation of the setting for the guard cells fluctuates widely in both genera.

In *Tetracentron,* most of the subtending contiguous cells are of comparatively small size and appear to have been formed by appropriate anticlinal divisions of the larger surrounding epidermal cells, *Figs. 17–19.* Such an inference is strengthened by the not infrequent occurrence of large undivided epidermal cells having extensions which subtend the guard cells, (A) in *Figs. 17–19.* In this genus, the subtending cells usually are not concrescent at the center of the setting, leaving an irregularly shaped opening into the intercellular spaces of the mesophyll, *Figs. 13, 17–19.* At the focal level of the outer surface of the leaf, the narrow, curved, exposed parts of the smaller subtending cells resemble subsidiary cells oriented parallel to the outline of the guard cells. This deceptive similarity to "rubiaceous types" of stomata disappears, however, when adequately prepared material[3] is examined at successive focal levels, *Figs. 17–19.*

[3]Maceration and other techniques developed in connection with the study of cuticles and cuticularized residues of gymnosperms are unreliable in studying various types of angiospermic stomata. We have tested a wide variety of techniques in investigating the stomata of dried dicotyledonous leaves such as may be obtained from herbarium specimens. In dealing with *Tetracentron* and *Trochodendron* two types of preparations are essential. (1) Transverse sections of leaves prepared by soaking pieces of leaves in hot water, dehydrating, embedding in paraffin, serial sectioning, staining in Haidenhain's haematoxylin and sudan IV, and finally mounting the sections in glycerine. (2) Isolated sheets of the epidermis with more or less attached mesophyll for examining the stomata in surface view. Such sheets may be obtained in various ways, one of the most successful of which is the following. Small pieces of re-expanded leaves are attached by their lower surfaces to cover glasses, using Haupt's fixative hardened by formalin vapor. In the case of *Tetracentron,* most of the foliar tissue can then be peeled away, leaving the epidermis attached to the cover glass. In the case of *Trochodendron,* the overlying foliar tissues must be cut away under a dissecting microscope. The adhering epidermal strips are then stained with Delafield's haematoxylin and mounted in clarite. Microtome sections cut parallel to the lower surface of the leaf, obtained and treated as in (1), are also of value in interpreting surface views of the stomata.

The stomata of *Trochodendron* are of a fundamentally similar type, but differ in their more conspicuously developed cuticular vestibules, *Figs. 14–16,* their more extensively submerged contiguous cells, *Figs. 20–22,* and their much higher proportion of centrally concrescent subtending cells. *Figs. 15* and *16.* As indicated in *Figs. 20–22,* many of the subtending cells which form the setting for the guard cells become completely submerged by displacements during the ontogenetic development of the stomata. Thus, at the focal level of the outer surface of the leaf, the guard cells appear to be surrounded, at least in part, by ordinary epidermal cells "which are not of special form and orientation." Only where parts of the subtending cells are externally exposed does one encounter the appearance of narrow subsidiary cells oriented parallel to the outline of the guard cells, right side of *Fig. 21,* left side of *Fig. 22.* In *Figs. 14, 21,* and *22,* there is a narrow slit-like opening in the setting of the guard cells which communicates with the intercellular spaces of the mesophyll. In *Figs. 15* and *20,* the subtending cells are concrescent at the center of the setting and the passageway is closed. In *Fig. 16,* there is a broad cuticularized layer between the guard cells and their subtending, contiguous epidermal cells.

It seems likely that from a solely ontogenetic viewpoint of cell lineages, the stomata of *Tetracentron* and *Trochodendron* may be likened to Florin's haplocheilic gymnospermous type, but actually they are of a fundamentally different morphological form. Not until the stomata of a wide range of the Ranales and other orders have been carefully re-investigated will it be possible to assess the phylogenetic significance of different stomatal structures in discussions regarding the origin and the relationships of the dicotyledons.

It should be emphasized, in these connections, that the stomata and the vascular tissues of *Tetracentron, Trochodendron,* and the Winteraceae are of unusual interest from physiological as well as morphological points of view. They provide three distinctly different anatomical-physiological systems in vesselless plants with broad leaves that deserve intensive experimental investigation. The more or less conspicuously coriaceous leaves of the Winteraceae have stomata that are "plugged" by an alveolar modification of the cuticle. In these plants, there is an evident tendency to eliminate scalariform tracheary pitting. On the contrary, *Tetracentron* and *Trochodendron* have scalariformly pitted tracheids in the earlier-formed part of their growth layers. The coriaceous leaves of *Trochodendron* exhibit stomatal and other adaptations for retarding transpiration. The leaves of *Tetracentron* do not have such obvious morphological modifications for reducing water-loss, but there are conspicuous tracheary adaptations which appear to facilitate a more rapid flow of water from stems into leaves and from rootlets into roots.

PALAEOBOTANICAL CONSIDERATIONS

Among the abundant, palmately veined, dicotyledonous leaves of Cretaceous and early Tertiary strata are many which were referred by the earlier palaeobotanists to such heterogeneous form genera as *Populus,* *Populophyllum, Celastrophyllum,* etc. More recently Berry (7), and subsequently Seward and Conway (19), Sanborn (18), and others have recognized that the form and the venation of certain of these leaves so closely simulate those of *Cercidiphyllum* and *Tetracentron* as to indicate that they probably belong either to these genera or to closely related plants. The hypothesis that *Trochodendron* and *Tetracentron* or their allies were widely distributed in Holarctica during pre-glacial times is strongly supported by the occurrence of characteristic vesselless fossil wood in India, the northwestern United States, and East Greenland and of a fruit and seeds of *Trochodendron*-like type in the London Clays.

The re-examination of fossilized dicotyledonous floras to insure more accurate and reliable identifications of individual components of such floras is clearly a task for palaeobotanists, but the palaeobotanist must rely upon taxonomists and morphologists for basic data regarding extant dicotyledons and for clues concerning critical diagnostic criteria that may be preserved in fossilized material. It is advisable, accordingly, to summarize certain of our morphological observations for possible future palaeobotanical use, particularly as they are based upon the most extensive collections of *Trochodendron* and *Tetracentron* that have ever been assembled for investigation.

The leaves of *Trochodendron aralioides* Sieb. & Zucc., the only surviving species of the genus, are highly polymorphic, as illustrated in *Figs. 23–33.* Although certain of the diverse foliar forms may ultimately be shown to be correlated with specific geographical races or genetically significant varieties, the available evidence indicates that many, if not most of them, are due to ontogenetic and environmental influences and may occur on a single tree, either simultaneously or during successive stages of its growth to maturity. In any case, the polymorphism is so extensive that it should be reckoned with in any search for *Trochodendron* in fossil floras, as in the revision of heterogeneous form genera.

To insure a higher degree of diagnostic reliability, the student of dicotyledonous fossils must ultimately resort in many cases to techniques comparable to those which are being used so profitably in studying the foliar organic residues of gymnosperms and ferns. The chemically and mechanically most resistent, and therefore the structurally most persistent, parts of leaves commonly are the cuticularized and heavily lignified parts, i.e. the cuticle and epidermis, sclerenchyma, and xylem. The foliar cuticle of *Trochodendron* is very thick and forms distinctive stomatal vestibules, the sclerenchymatous elements are characteristically bizarre, and the vesselless xylem occurs in specific structural patterns within the petiole.

The palmately veined leaves of *Tetracentron sinense* Oliv. exhibit a much less extensive variability in external form than do the pinnately veined ones of *Trochodendron.* As indicated in *Figs. 34–39,* the leaves fluctuate somewhat in size, in breadth as related to length, in the degree of fineness of their serrations, in the contour of their bases and in their symmetry, but their range of variability does not overlap that of the conspicuously dimorphic foliage of *Cercidiphyllum japonicum* Sieb. & Zucc., which we shall discuss in a subsequent paper. Difficulties in differentiating the leaves of *Tetracentron* and *Cercidiphyllum* in fossil floras may be anticipated only upon the assumption that the ranges of morphological variability in hypothetical extinct species of the two genera tended to overlap. To clarify such putative uncertainties by resorting to microscopic analyses of foliar organic residues is likely to prove more difficult than in the case of the tough coriaceous foliage of *Trochodendron*. The leaves of *Tetracentron* and *Cercidiphyllum* are soft and delicate, having tenuous cuticles and no strikingly distinctive sclerenchymatous features. The highly characteristic secretory cells of the lamina of *Tetracentron* are unlikely to be preserved in recognizable form. A more profitable preliminary line of palaeobotanical endeavor in dealing with *Tetracentron* would appear to be a search for leaves with intact petioles or associated fragments of vesselless stems. As indicated earlier, the petioles of this genus are characterized by having extensive, bud-enclosing, stipular flanges, whereas the petioles of *Cercidiphyllum* are not. It is of interest in this connection that, according to Berry (7), many of the earliest known dicotyledonous leaves of late Lower Cretaceous horizons had petioles which enclosed the buds.

There is obviously no difficulty in differentiating the pinnately veined leaves of *Trochodendron* from the palmately veined ones of *Tetracentron*. Existing palaeobotanical uncertainties are due to superficial similarities in form and venation of the leaves of these genera and of other remotely related dicotyledons. On the contrary, the vesselless woods of *Trochodendron* and *Tetracentron* are remarkably similar, but are unlike the xylem of any other known representatives of the angiosperms. Thus, although the fossilized vesselless woods described by Sahni (17), Mathiesen (14), and Beck (6) should be compared to *Trochodendron* and *Tetracentron*, there is at present considerable uncertainty as to which genus they are more closely related. The most significant of these fossils is Sahni's *Homoxylon rajmahalense*, from the Rajmahal Hills of India, since it may prove to be of Jurassic age and would thus become the earliest known representative of the angiosperms. The specimen is a fragment of wood from a stem of relatively large size. There is no attached bark and the pith and earlier growth layers are not included. Sahni's description of the specimen is based largely upon comparison with *Trochodendron*, no wood of *Tetracentron* having been available for comparative purposes. The size, form, and description of the rays in *Homoxylon rajmahalense* are, however, of the type illustrated in *Fig. 9*, and are indicative of closer relationship to *Tetracentron* than to *Trochodendron*. It is essential that the specimen be reexamined to determine whether the wood parenchyma is likewise of the type which occurs in the former genus.

Beck's (6) specimen of vesselless wood from a Tertiary horizon of the northeastern United States resembles *Homoxylon rajmahalense* in its grosser features and in having rays that are suggestive of *Tetracentron* rather than of *Trochodendron*. The wood parenchyma of this specimen also deserves detailed re-investigation. In the case of Mathiesen's (14) *Tetracentronites Hartzi,* from an Eocene horizon of East Greenland, both the rays and the wood parenchyma need to be re-examined for evidence of affinities to *Tetracentron* or *Trochodendron.*

It is unfortunate that none of these specimens of vesselless dicotyledonous wood include the pith, since the primary body, nodes, and first-formed secondary xylem of stems afford distinctive and reliable criteria for differentiating *Tetracentron* from *Trochodendron.* In dealing with fossilized dicotyledonous wood, it is essential for collectors to search for and to preserve both the earlier and the later-formed parts of stems. Similarly, in collecting such botanically significant leaves as those of *Trochodendroides,* a careful search should be made for fragments of small shoots which may occur within the same matrix. For, if they prove to be vesselless, they provide strong corroborative evidence for excluding *Populus, Cercidiphyllum, Grewia,* and other vessel-bearing genera whose leaves have at times been confused with those of *Tetracentron* or of *Trochodendron.*

It should be emphasized, in conclusion, that available palaeobotanical evidence, although fragmentary and uncertain in specific instances, indicates as a whole that *Tetracentron* and *Trochodendron* or closely allied plants have a very extensive geological record, extending backward to the late Lower Cretaceous, and possibly to the Jurassic in the Rajmahal horizon of India. These plants appear to have been widely distributed through Holarctica during pre-glacial times and only subsequently to have been confined to "relic" Asiatic areas.

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EXPLANATION OF PLATES

PLATE I

FIG. 1. *Tetracentron, H.U. 18052.* Transverse section of upper part of petiole, × 21. FIG. 2. *Tetracentron, H.U. 18050.* Transverse section of lower part of petiole, showing enclosed bud, × 25. FIG. 3. *Tetracentron, H.U. 18053.* Transverse section of stem at level of trilacunar node, × 25. FIG. 4. *Trochodendron, H.U. 18093.* Transverse section of upper part of petiole, × 27. FIG. 5. *Trochodendron, H.U. 18082.* Transverse section of basal part of petiole, × 21. FIG. 6. *Trochodendron, H.U. 18072.* Transverse section of stem at level of multilacunar node, × 11.

PLATE II

FIG. 7. *Trochodendron, H.U. 8383.* Tangential longitudinal section of wood from a large stem, showing form and distribution of the rays, × 50. FIG. 8. *Tetracentron, H.U. 9695.* Transverse section of the wood, showing paired parenchymatous cells; the radially seriated derivatives of the cambium are oriented crosswise of the page, × 500. FIG. 9. *Tetracentron, Wilson 659.* Tangential longitudinal section of the cambium and inner phloem of bark from an old tree, showing form and distribution of rays, × 50.

PLATE III

FIG. 10. Typical transverse planes of anticlinal division in the formation of the uniseriate wood-parenchyma strands of most gymnosperms and dicotyledons. FIG. 11. *Trochodendron.* Diagonal anticlinal divisions in the formation of the uniseriate wood-parenchyma strands. FIG. 12. *Tetracentron.* Longitudinal and diagonal planes of anticlinal division in the formation of biseriate wood-parenchyma strands. FIG. 13. *Tetracentron, Wilson 659.* Transverse section of a stoma, showing cuticular vestibule, guard cells, and subtending contiguous epidermal cells, approx. × 270. FIGS. 14–16. *Trochodendron. Jack,* in 1905. Transverse sections of stomata showing cuticular vestibule and three types of settings for the guard cells, approx. × 270.

PLATE IV

Borders of the cuticular vestibule densely stippled. Guard cells less densely stippled. Exposed parts of contiguous epidermal cells lightly stippled. Submerged parts of contiguous cells indicated by broken lines.

FIG. 17. *Tetracentron, Wilson 659.* Surface view of stoma, showing guard cells with their partly subtending contiguous epidermal cells; (A) large subtending cells, approx. × 675. FIGS. 18, 19. *The same.* Less highly magnified surface views of stomata, showing various patterns of contiguous epidermals cells; (A) large subtending cells, approx. × 320. FIGS. 20–22. *Trochodendron, Jack,* in 1905. Surface views of stomata, showing varying degrees of submergence of the contiguous epidermal cells, approx. × 675.

PLATE V

Leaves of *Trochodendron aralioides* Sieb. & Zucc., one-half natural size.

FIG. 23. *Takenouchi 1017.* FIG. 24. *Faurie 3643.* FIG. 25. *Wilson 9716.* FIG. 26. *Simada 876.* FIG. 27. *Sasaki 351.* FIG. 28. *Wilson 11231.* FIG. 29. *Mayr,* in 1886. FIG. 30. *Takenouchi 1017.* FIG. 31. *Gressitt 197.* FIG. 32. *Wilson 9716.* FIG. 33. *Jack,* in 1905.

PLATE VI

Leaves of *Tetracentron sinense* Oliv., one-half natural size.

FIG. 34. *Henry 6243.* FIG. 35. *Tsai 57831.* FIG. 36. *Wilson 659a.* FIG. 37. *Cheng 3419.* FIG. 38. *Cheng 3419.* FIG. 39. *Wang 67836.*

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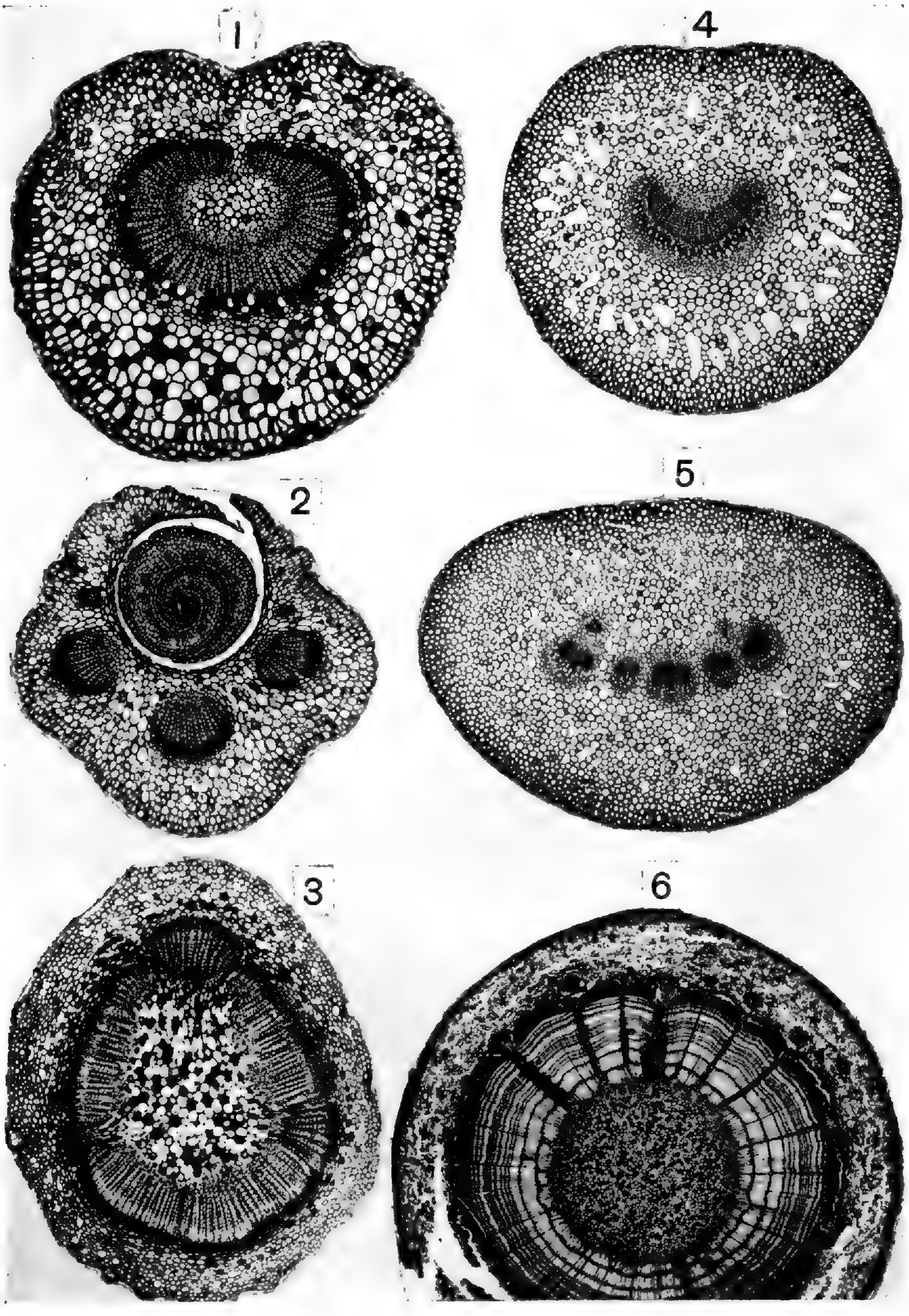
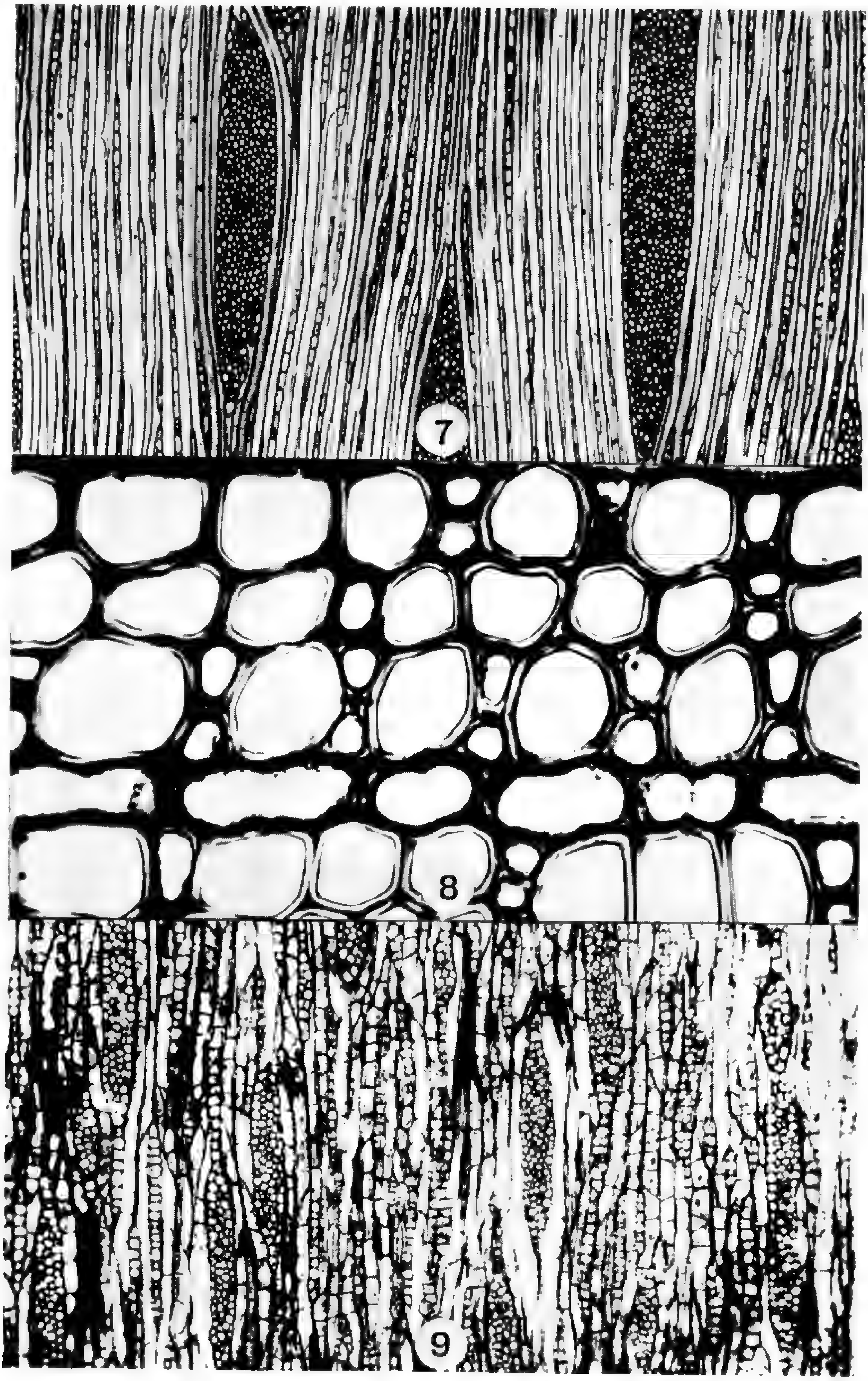


MORPHOLOGY OF TROCHODENDRON AND TETRACENTRON



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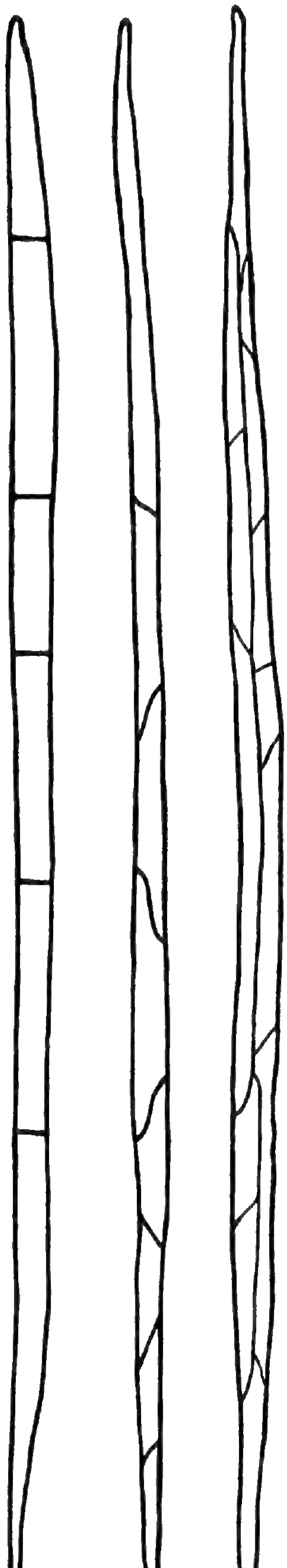

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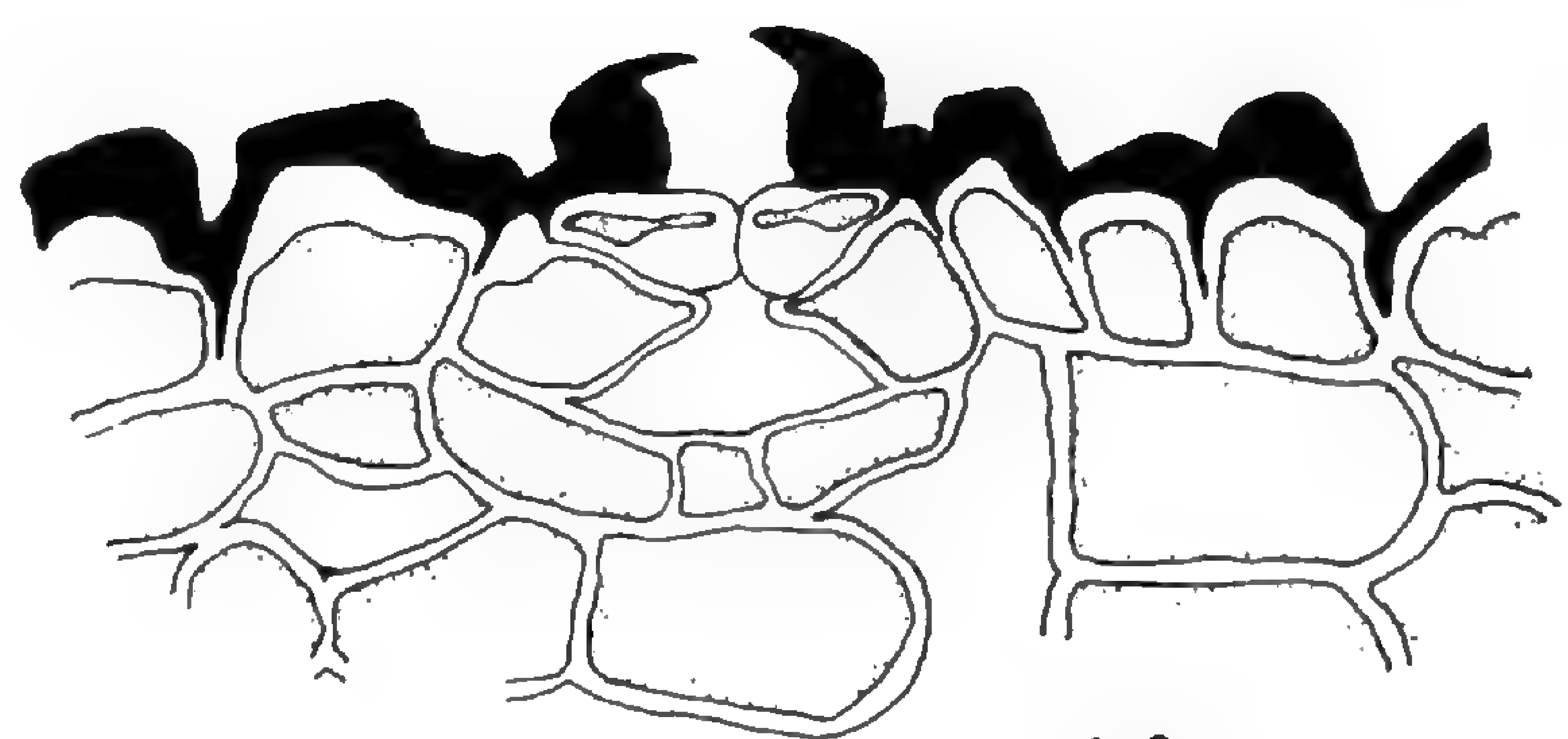

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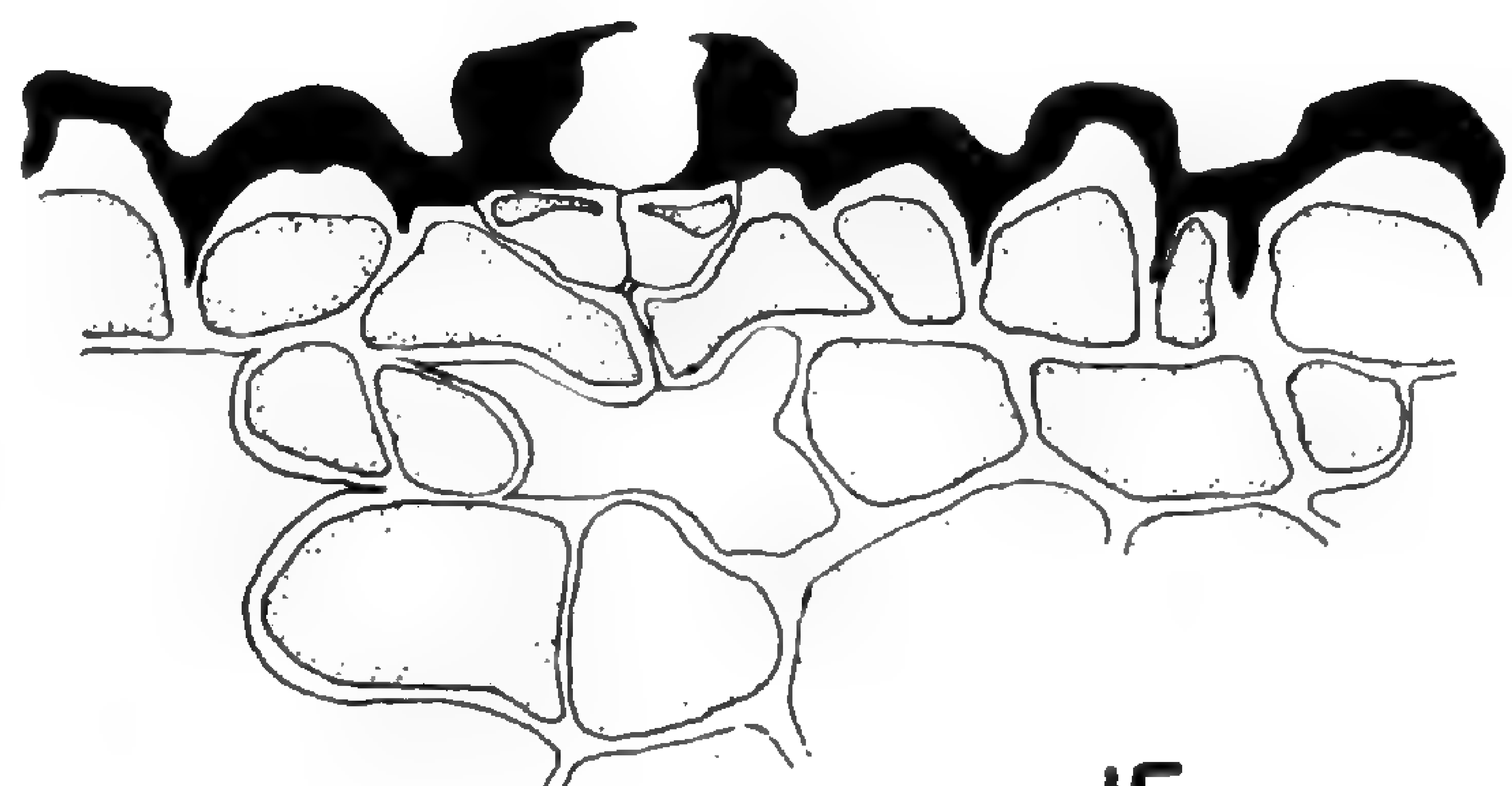

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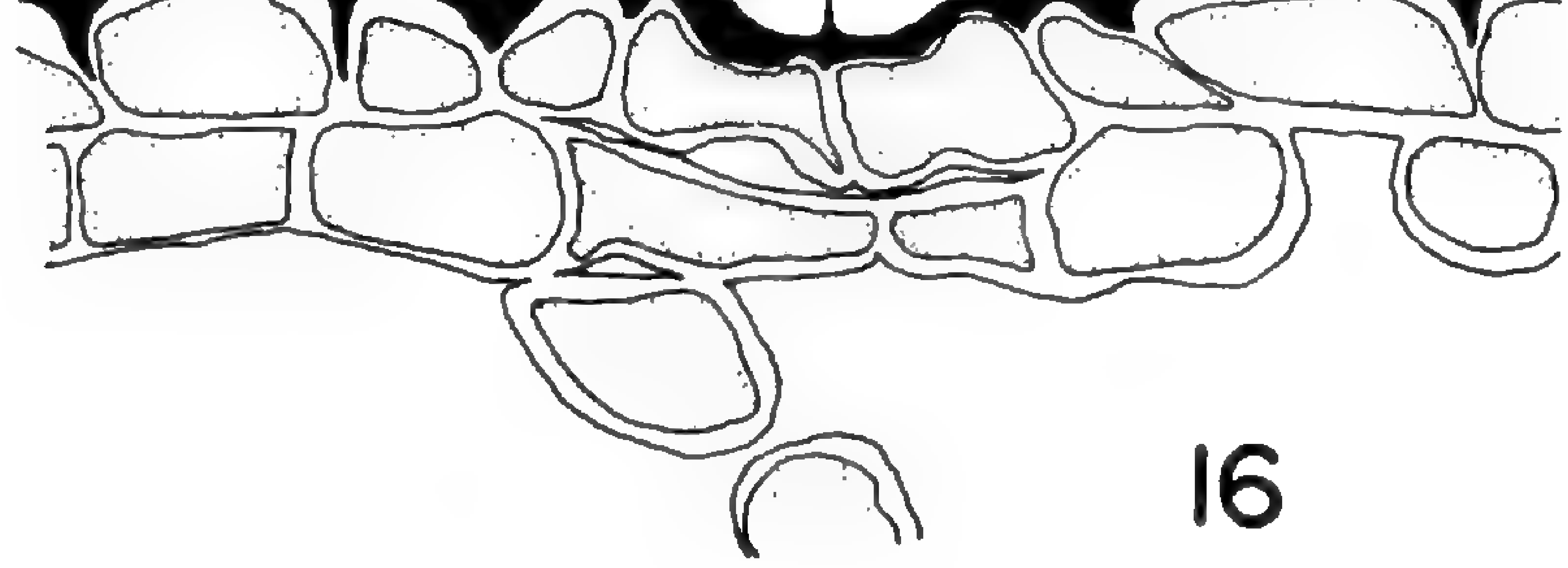

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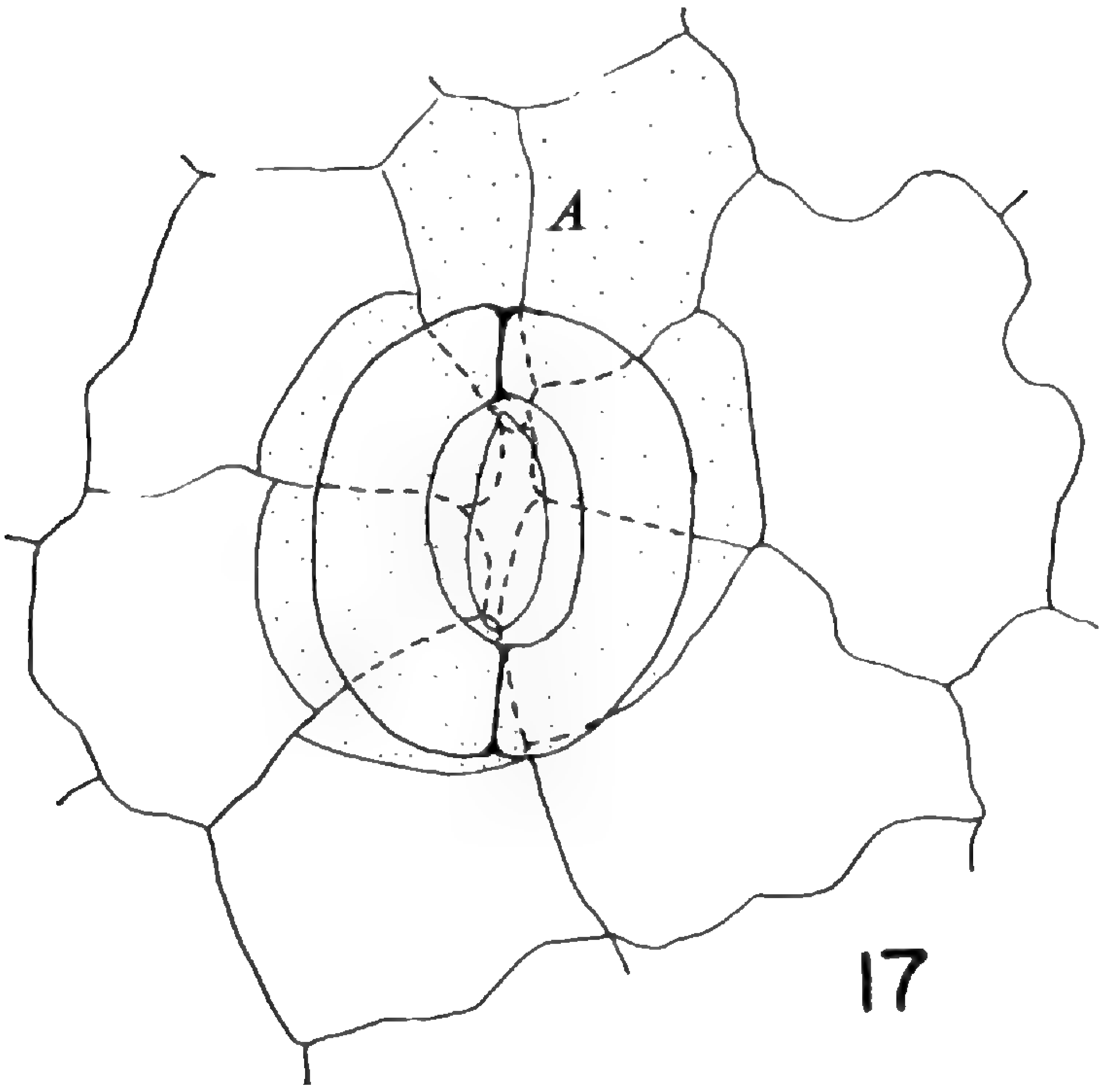
Morphology of Trochodendron and Tetracentron



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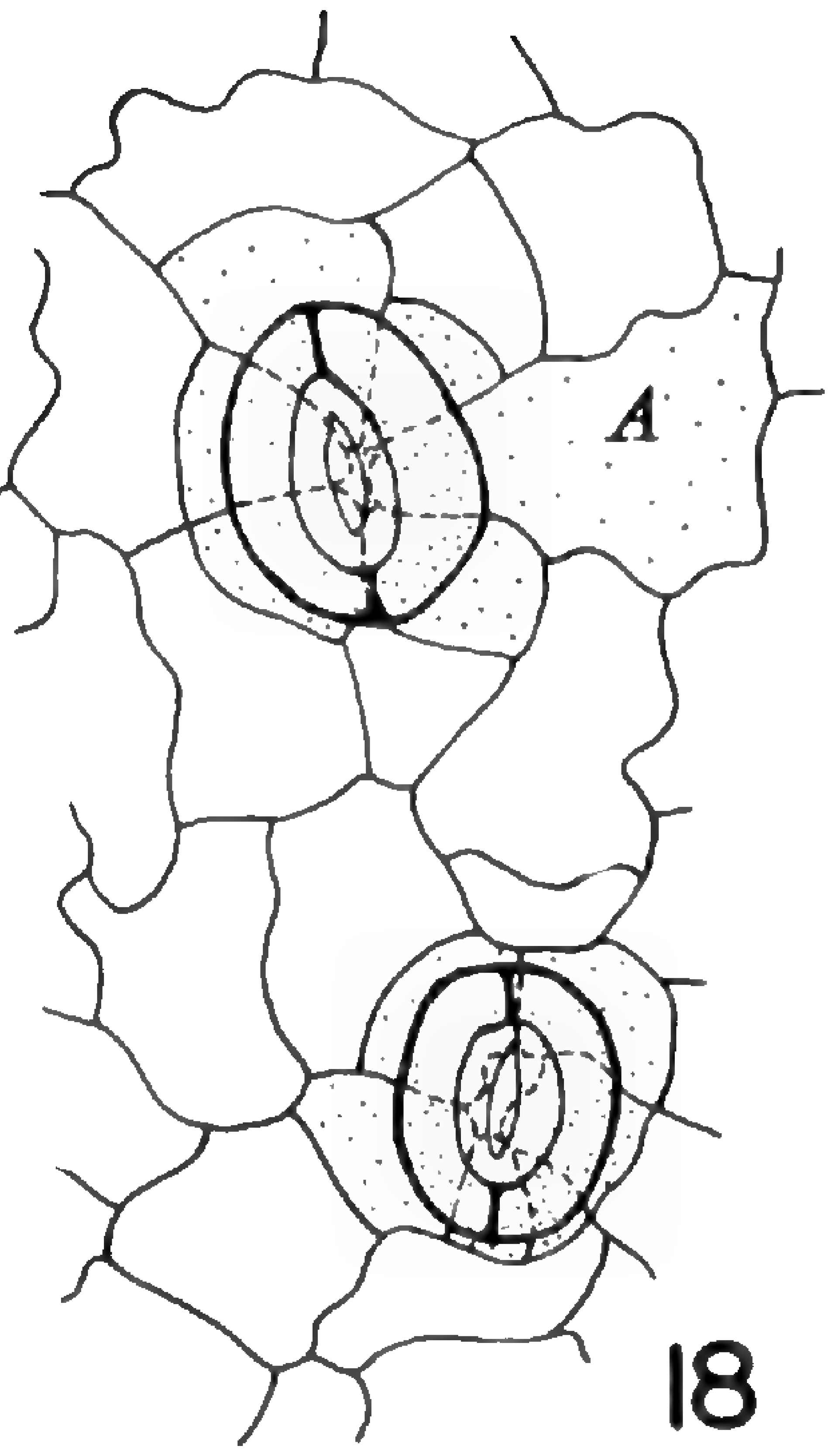

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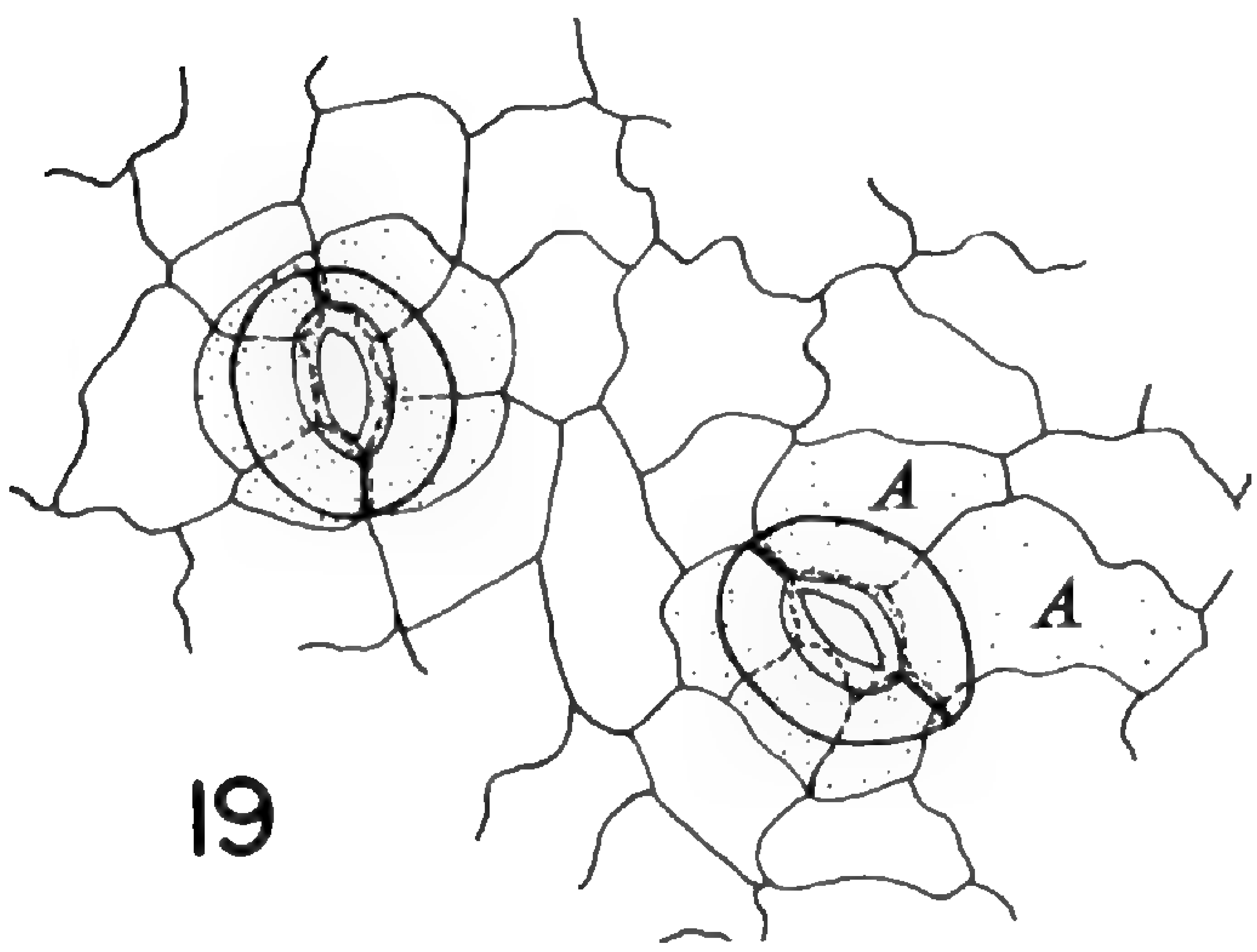

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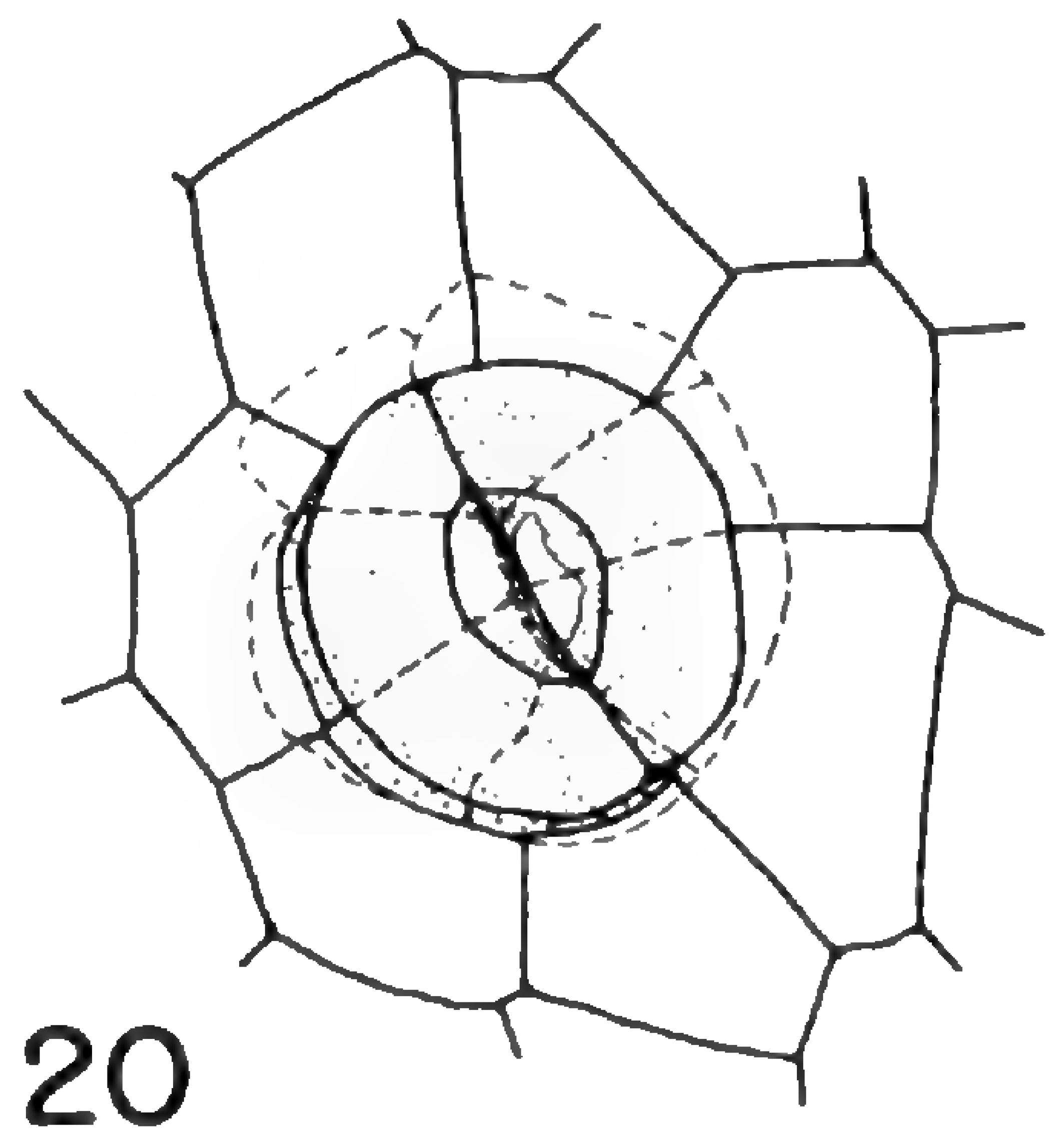

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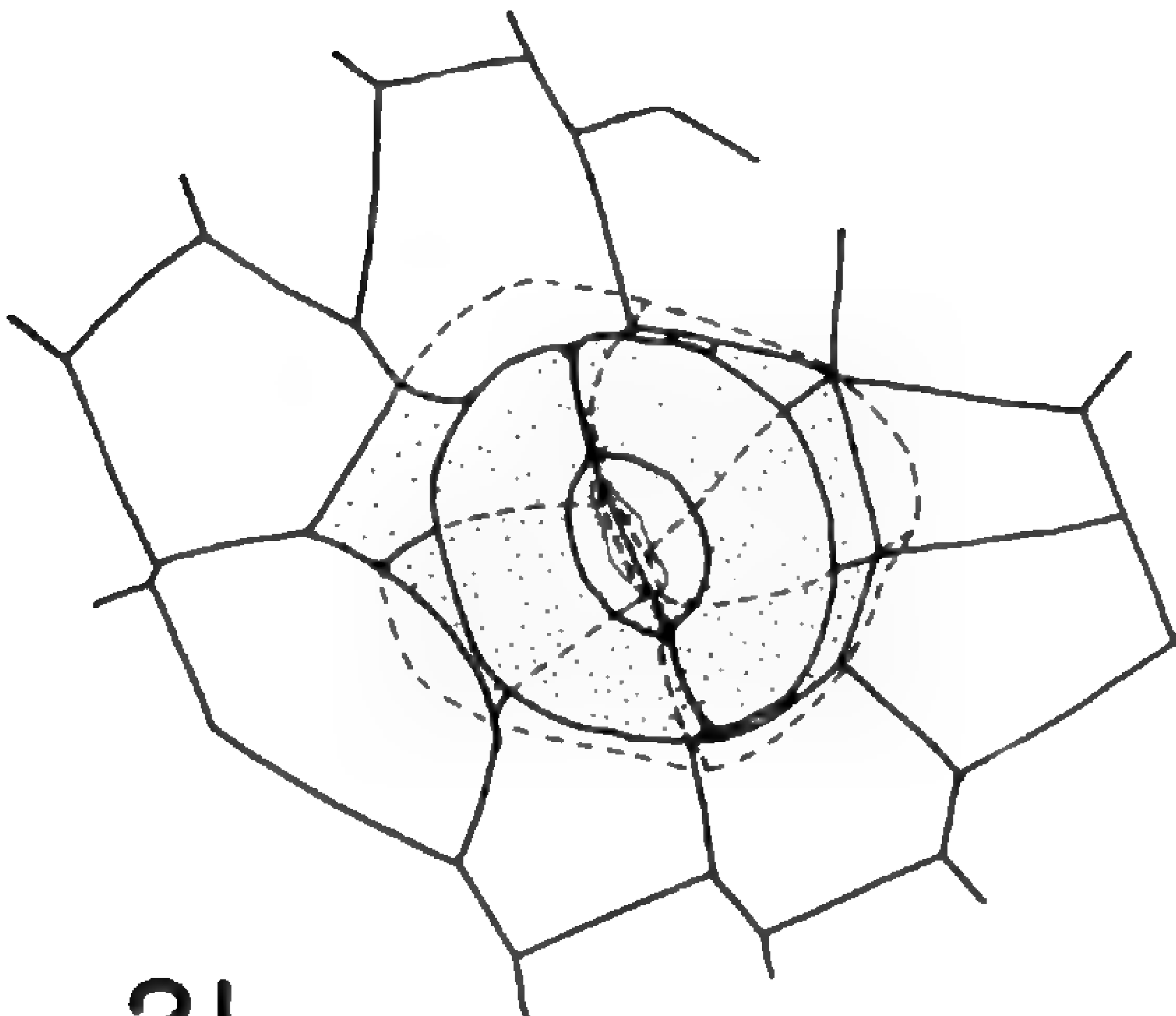

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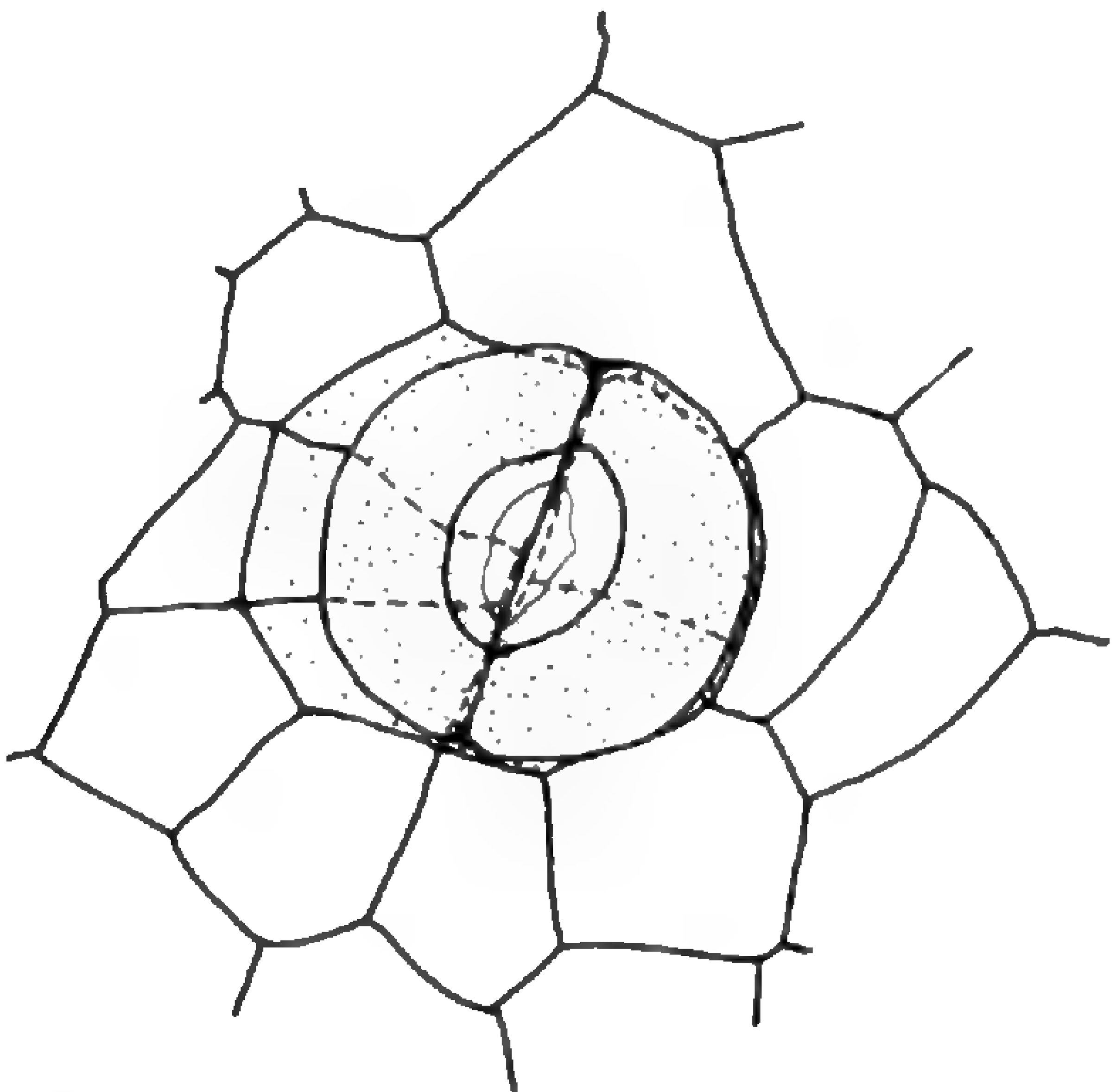

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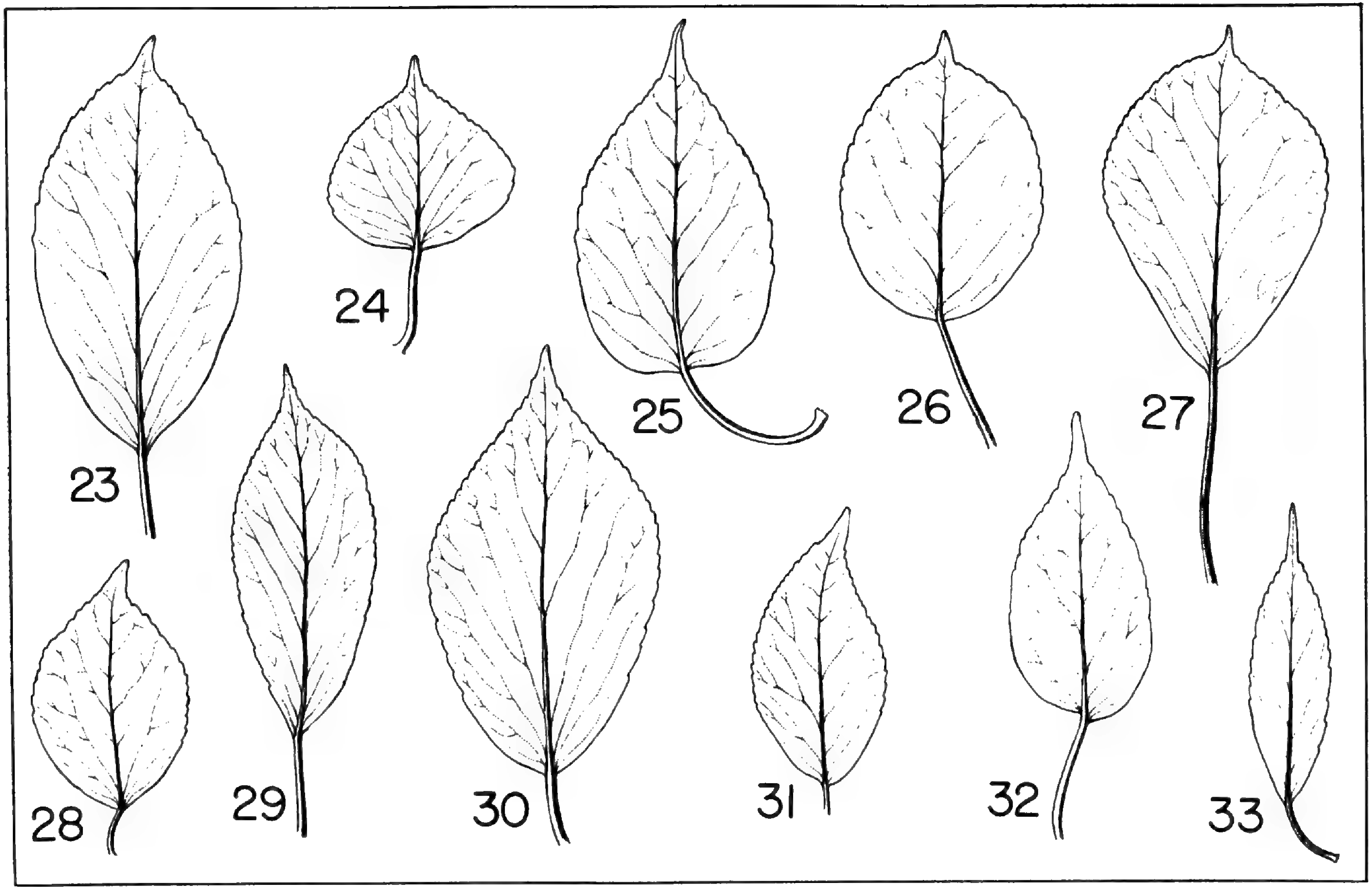
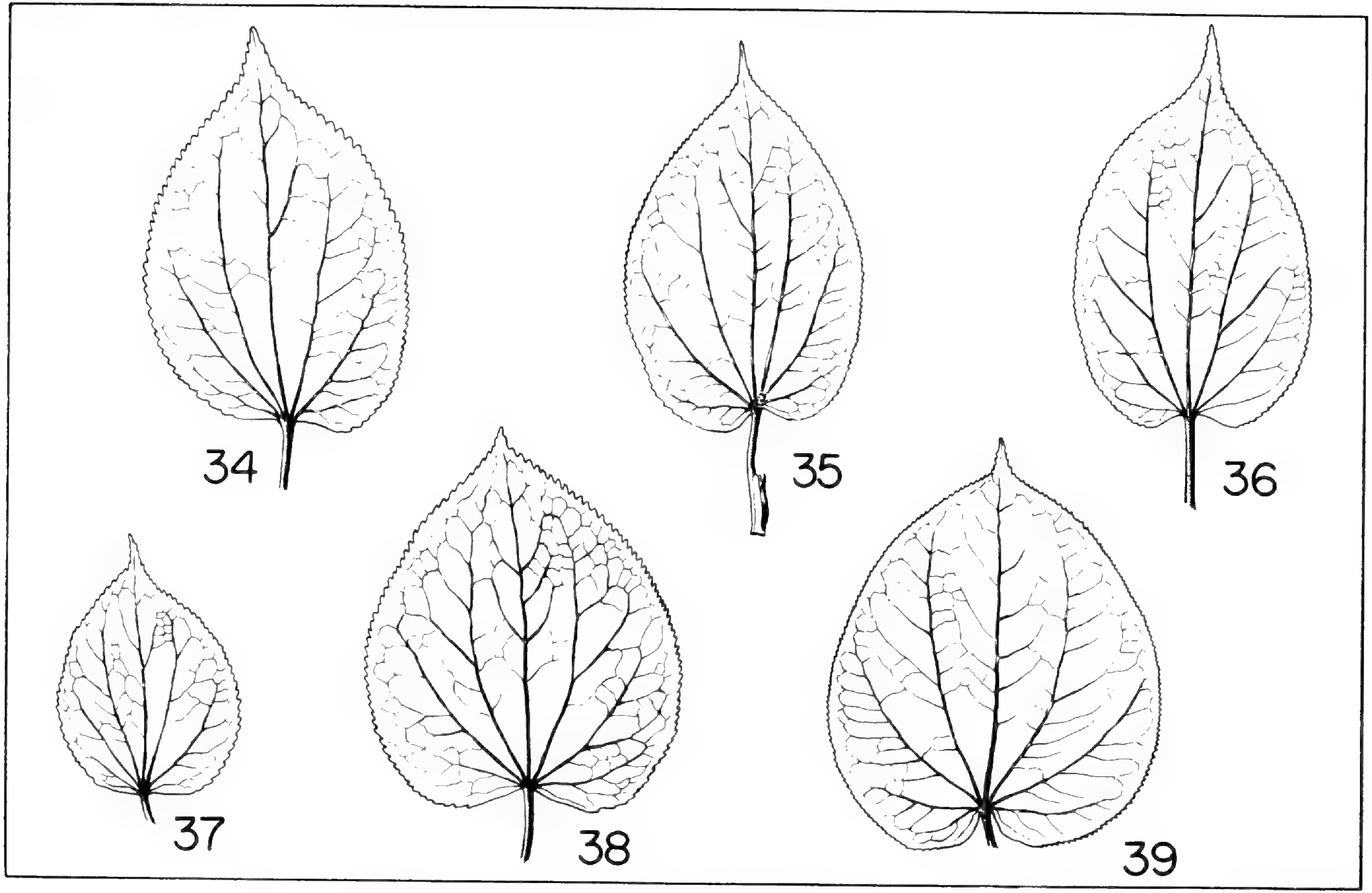
Morphology of Trochodendron and Tetracentron



Morphology of Trochodendron and Tetracentron



Morphology of Trochodendron and Tetracentron

THE FOLIAR SCLEREIDS OF TROCHODENDRON ARALIOIDES SIEB. & ZUCC.

ADRIANCE S. FOSTER

With four plates

INTRODUCTION

THE PRESENCE of branched sclereids in the parenchyma of the foliage leaf of *Trochodendron* has been regarded by Blenk (5), Matsuda (8), Parmentier (9, 10), Harms (7), van Tieghem (13), and Solereder (12) as one of the important diagnostic characters of this remarkable dicotyledon. As far as I have been able to determine, however, no study has been made either of the structure and development of the sclereids or of the possible fluctuations in their relative abundance, form, and distribution within the leaves of different individuals. Data on these points are essential in any effort to judge the systematic value of the sclereids in differentiating *Trochodendron* from other woody ranalian genera. In the present article, the results of a study of the form, structure, and distribution of sclereids in the mature foliage leaf of *Trochodendron* are presented. Living material, as well as leaves from 25 separate herbarium collections, has been investigated. A study of the ontogeny of the sclereids is now in progress and the results will be described separately in a future paper.

MATERIAL AND METHODS

Abundant fresh material was secured, through the coöperation of Mr. Eric Walther, from a vigorous specimen of *Trochodendron* growing in the Strybing Arboretum of Golden Gate Park, San Francisco. Professor I. W. Bailey kindly furnished leaves from 20 herbarium collections representing, in equal number, specimens collected at various localities in Japan and Formosa. Acknowledgement is also due to Miss Alice Eastwood of the California Academy of Sciences, Dr. J. M. Greenman of the Missouri Botanical Garden, and Dr. H. L. Mason of the University of California for providing additional herbarium material from Japan. Specific reference to the various herbarium sheets is made in the text as well as in the explanatory legends accompanying the plates.

In order to study the form and distribution of the sclereids in the lamina of herbarium specimens, the general technique recently outlined by Bailey and Nast (1: 472–473) was employed. Sectors of the lamina, extending from the margin to the midrib, were first heated in water, then cleared in an electric oven in 5% NaOH, dehydrated in alcohol, and mounted from xylene without staining into balsam. Fresh material was similarly processed except that it was found desirable to extract first the chlorophyll in hot alcohol. For a more detailed examination of the form of the sclereids, portions of the lamina and petiole of fresh leaves were macerated by the method already described in a recent article (Foster 6: 303–304). Serial sections of both the petiole and sectors of the lamina of fresh leaves were also studied and were prepared by the usual technique (Foster 6: 303).

Grateful acknowledgement is made to my wife, Helen Vincent Foster, for her skillful drawings of the sclereids illustrated in *Plates II-IV*, and to Professor I. W. Bailey for his helpful comments throughout the investigation.

DISTRIBUTION OF THE SCLEREIDS

Before describing the remarkable polymorphism of the foliar sclereids, it is necessary to comment briefly on the general distribution of these cells in the adult foliage leaf. Serial sections as well as cleared leaf-sectors show that the sclereids typically occur as idioblasts dispersed through certain of the parenchymatous tissues of both petiole and lamina. In the petiole, the sclereids are most abundant in the inner extremely lacunate region of the cortex. Longisections indicate that, while the sclereids may occasionally appear in superposed groups of three or more connected cells, they are usually isolated from one another by parenchymatous elements. In the lamina, sclereids are found as idioblasts in the parenchyma tissue of the midrib and throughout the spongy mesophyll to within a few cells of the marginal epidermis. A careful study of cleared laminar sectors reveals considerable fluctuation in the relative abundance of sclereids. In many of the Japanese and Formosan collections, the profusely branched sclereids are so crowded as to suggest a loose "tissue" (*fig. 2*), while in other specimens, as for example G. G. P.[1], the sclereids tend to be more widely and evenly spaced within the vein-islets (*fig. 1*). Several of the Formosan collections appear unique because of the presence of small nests or clusters of irregular thick-walled sclereids above the juncture of the veins supplying each marginal tooth. This structural peculiarity is entirely wanting in the G. G. P. and the Japanese collections which have been studied and cannot be properly interpreted until a wider range of material is available for examination.

FORM AND STRUCTURE OF THE LAMINAR SCLEREIDS

Previous descriptions of the sclereids of *Trochodendron* are both vague and inadequate and, as in the case of the sclereids of *Camellia japonica* (Foster, 6), a variety of terms has been applied to these cells, viz.: (1) "branched sclerenchyma cells" (Blenk, 5; Prantl, 11; Harms, 7; Solereder, 12); (2) "sclérites"[2] (van Tieghem, 13); (3) "internal hairs"[2] (Parmentier, 9, 10), and (4) "trichoblasts"[2] (Matsuda, 8). In none of these

[1]For brevity, the abbreviation "G.G.P." will be used throughout this paper to refer to the leaves of the specimen in Golden Gate Park, San Francisco.

[2]This term and others which have been applied to idioblastic sclereids in the seed plants have been discussed historically in a recent paper (Foster, 6). In that article (Table 1, p. 320) Seward is incorrectly cited as the originator of the term "sclérite." Further research shows that this term can be traced back through the French literature as far as the work of Bertrand (4). It has not been possible, however, to determine whether this author was the first to introduce the term into botanical literature.

papers, however, is any indication made of the remarkable polymorphism of the sclereids which is only fully revealed by the study of cleared sectors taken from comparable regions of the lamina of different individuals. By means of this relatively simple technique it becomes obvious that the laminar sclereids vary from radiately branched elements with dichotomous arms (*figs. 7–11*) to bizarre asymmetrical (*figs. 12, 13*), cruciform (*fig. 14*), and fiber-like forms (*figs. 15–22*). Intergradations of the most varied character occur between these form-types and preclude rigid demarcations. Nevertheless, when the *extremes* in sclereid-form are studied from the standpoint of their frequency and location within the lamina, certain interesting trends can be detected. The profusely ramified type of cell (*figs. 7–13*) appears to dominate throughout the submarginal portion of the laminae of all collections. In contrast, the strictly fusiform type of sclereid (*figs. 16–22*) attains the peak of development in the marginal portion[3] of the lamina and, moreover, is most consistently present in the leaves of the Formosan collections. Indeed, during the early phases of the investigation it seemed possible that the presence of large fiber-like marginal sclereids might represent a unique feature restricted to the leaves of Formosan plants. The examination of additional herbarium material from both Japan and Formosa, however, failed to reveal a sharp contrast with respect to this feature. For convenience, the fusiform and ramified types of sclereids will be described separately with special reference to (1) their occurrence within the various collections and (2) their form and structure.

1. *Fusiform types.* On the basis of the herbarium specimens available for study, it is clear that the fusiform or fiber-like type of sclereid is most abundant and reaches its greatest size[4] in the marginal region of the lamina of the Formosan collections (*figs. 2, 16–19*). Out of ten separate collections, only two failed to exhibit this character plainly. In contrast, the marginal sclereids in the collections from Japan tend to be profusely ramified and in many specimens differ from the submarginal sclereids merely in their larger size and more massive walls. Several of the Japanese collections were particularly notable for the complete absence of contrast, either in size or form, between the marginal and submarginal sclereids (e.g. *Wilson 6041*). Five out of the fifteen Japanese collections, however, were exceptional. One of the most striking of these was represented by the leaves of seedlings collected on Yakushima. In this material, long, slender, fusiform elements with abundant spicules are common in the marginal region of the lamina (*fig. 20*). Several other Japanese collections were likewise distinguished by the presence of fusiform marginal sclereids (*figs. 21, 22*). But in these specimens the sclereids are much shorter and less fiber-like than in the extreme examples provided by the Formosan material.

[3]By "marginal" is meant the narrow border of tissue between the small peripheral veins and the marginal epidermis. "Submarginal" designates the remaining portion of the lamina exclusive of the midrib (cf. *fig. 1* and *2*).

[4]The length of the fiber-like sclereids represented in *figures 16–19* are, respectively: 763, 795, 588, and 602 microns.

Structurally regarded, the fusiform type of marginal sclereid is very thick-walled with the lumen reduced to a narrow channel except in the median region of the cell. In certain of the Formosan collections (*Henry 1398, Simada 350, Tanaka 5412*) many of the fiber-like sclereids are relatively smooth-walled except near the mid-region (*figs. 16–18*). More commonly, however, the sclereid is provided with very numerous sharp-pointed spicules or blunt, knob-like processes (*figs. 2, 19, 21, 22*). This condition closely resembles the situation in the large fusiform petiolar sclereids of *Camellia japonica* (Foster 6, *pl. 2* and *3*). In contrast, however, to the extremely numerous and often ramiform pit-canals typical of the sclereids of *Camellia,* pits are relatively few and apparently are restricted to the central portion of the fusiform sclereids in *Trochodendron.* A full discussion of their structure and development will be presented in a future paper.

2. *Ramified types.* As stated earlier in this paper, the ramified type of sclereid predominates throughout the submarginal region of the lamina of all collections (*figs. 1, 2*). Branched sclereids, which fluctuate greatly in size, also occur interspersed among the huge fiber-shaped marginal sclereids of the Formosan collections (*fig. 2*). In this material, transitions between fusiform and branched types are abundant and often are extremely irregular and grotesque in character (*fig. 18*).

As is clearly shown in *Plate III,* the branched sclereids vary widely in their form. In certain of the collections from Japan as well as Formosa a series of repeatedly dichotomizing branches radiates in a more or less symmetrical fashion from the central body of the sclereid (*figs. 7, 9*). More commonly, however, the branched sclereids are asymmetrical because of the unequal development of one or more of the arms (*figs. 1, 2, 8, 10–13*). There is, of course, no sharp boundary between the symmetrical and asymmetrical types of branching and both conditions may intergrade within the same leaf. The forms depicted in *Plate III* were deliberately selected to show some of the extremes. In one collection from Japan an amazing degree of polymorphism was discovered, the sclereids ranging in form from profusely branched elements to cruciform and short, irregular, fiber-like types (*figs. 14, 15*). In no other specimen investigated were submarginal sclereids, comparable to the cell shown in *figure 15,* encountered.

As to structure, the ramified sclereids typically are thick-walled cells with correspondingly narrow lumina (*figs. 8–13*). Exceptions to this condition, however, occur in two collections, one from Japan (*Siebold*) and one from Formosa (*Tanaka 5412*). In these specimens, *all* of the submarginal sclereids are relatively thin-walled and possess very slender arms (*fig. 7*). Some of the Japanese collections exhibit an extreme condition with respect to the thickness of the sclereid-wall. In these cases, a "stratum" of very thin-walled sclereids occurs just beneath the abaxial epidermis. Many of these cells are trilobate in surface view and differ from the neighboring parenchyma elements principally by the presence of very short, spicule-like arms. The latter may occur in pairs at each corner or may be unequal in number and vestigial in appearance. Such sclereids, in a certain sense, seem to represent transitions between parenchyma cells and the more elaborately branched, thicker-walled sclereids which occur at deeper levels in the mesophyll. The relative abundance of spicules on the ramified types of sclereids fluctuates widely. For example, spicules appear consistently on all the sclereids of the G. G. P. specimen, their abundance varying with the size and form of the cell (*figs. 1, 5, 6, 8*). Spicules are likewise prominent in one of the collections from Yakushima, Japan (*fig. 13*). Beginning with these extremes, various conditions of decreasing prominence of spicules were noted in the collections culminating in such smooth-walled types as is illustrated in *figure 7*. As in the case of the fiber-like marginal sclereids, pits are few in number and are confined to the median region of the cell.

FORM AND STRUCTURE OF THE PETIOLAR SCLEREIDS

As stated previously, sclereids are largely confined to the inner highly lacunate cortical parenchyma of the petiole. The examination of partially macerated tissue, supplemented by serial longisections, of the G. G. P. specimen reveals extensive fluctuations in the form of the petiolar sclereids. In no instance, however, have symmetrical radiately branched elements comparable to those found in the submarginal portion of the lamina been observed. Very commonly, the petiolar sclereids are roughly H-shaped, with paired, acuminate vertical arms (*fig. 3*). The latter lie freely within the longitudinally extended air-spaces in the parenchyma. In elements of this type, one or more uncinate lateral branches are often present. Further complexity results in many cases from the development of additional vertical arms (*fig. 4*). Sclereids of this kind likewise are scattered within the parenchyma tissue of the midrib. Many of the petiolar sclereids, however, are more irregular in form, with their various branches unequal in length and radiating in the most varied directions from the central body. As shown in *figures 3* and *4* spicules, varying in size and distribution, occur in the petiolar sclereids.

Because of the great difficulties involved in the study of cleared portions of the petiole, it has not been possible to determine fully the distribution of the various form-types in the herbarium collections. However, in several of the Formosan collections (*Simada 350* and *Wilson 11231*) magnificent examples of fiber-like sclereids occur in addition to H-shaped and irregularly branched types. Two of the longest of the fusiform types measured respectively 1002 and 1465 microns in length. Such extremely long sclereids are of particular interest because of the presence of similar but shorter cells in the marginal region of the lamina of the same specimens (cf. *figs. 17* and *19*). Whether typical fiber-like sclereids ever occur in the petiole of the Japanese material remains to be determined. As far as the present study goes, there is no evidence of them.

DISCUSSION AND CONCLUSIONS

The present study of the foliar sclereids in *Trochodendron* provides an excellent illustration of the range in form, size, and structure possible within the limits of one morphological "cell-type." Because of the abundance of intergradations it is obvious that no sharp boundaries exist between the various form-types. Thus, in the lamina, the profusely branched and fiber-like forms are clearly the extremes in cell specialization at the two ends of a continuous morphological series (*Plates III* and *IV*). Similarly, in the petiole, the H-shaped and fusiform types cannot be rigidly demarcated from the more irregularly branched forms.

From these facts it is clear that the entire gamut of form-types must be fully recognized if the sclereids are to be used as one of the diagnostic criteria of *Trochodendron*. This is particularly evident when the fluctuations in the occurrence of the fiber-like type of sclereid are taken into consideration. In the majority of the Japanese collections, strictly fusiform, unbranched sclereids are absent from both the marginal and submarginal portions of the lamina. Conversely, the majority of the Formosan specimens are distinguished by the high proportion of elongated, relatively unbranched, marginal sclereids (*figs. 2, 16, 17, 19*).

Admittedly, however, the present investigation has merely uncovered what appears to be a *general trend* in the distribution of the fiber-like type of foliar sclereid. Obviously a wide range of leaf-types, collected from different regions of the same plant as well as from individuals growing under various ecological conditions in both Japan and Formosa, should be compared. Nevertheless, in the material examined, there appears to be no correlation between the size or form of the lamina and the presence or absence of fiber-like marginal sclereids. This is most convincingly shown in the case of the living specimen in Golden Gate Park. Here it was possible to examine a wide series of leaf-types, including the minute laminae of the transition forms between bud-scales and foliage leaves. In all instances, the marginal region of the lamina is devoid of the very elongate, fiber-like sclereids typical of most of the Formosan collections (compare *figs. 1* and *2*). The herbarium material was necessarily very limited and consisted of one or two leaves from each collection. Nevertheless the size and form of the leaf varied and, in the specimens furnished by Professor Bailey, included laminae which were lanceolate, ovate, and rhomboid in contour (cf. Bailey and Nast, 3: *Pl. V*). In all of this material, the occurrence of fiber-like marginal sclereids varied independently of either the size or form of the leaf-blade.

In their recent survey of the leaves of the Winteraceae, Bailey and Nast (2) have shown that the trends of sclerification include armed sclereids as well as nests of sclereids, lignified thickenings of the mesophyll, and sclerenchymatous vein-jackets. In *Trochodendron*, whose systematic relationships with other ranalian groups remains to be clarified, the foliar sclereids appear to exhibit two major trends in specialization, viz.: (1) the slender, radiately branched types (*figs. 7–11*) and (2) the massive fiber-like forms (*figs. 16–22*). The phylogenetic and systematic implications of this polymorphism will not become apparent, however, until the foliar sclerenchyma of other ranalian genera has been fully studied.

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EXPLANATION OF PLATES

PLATE I

Laminar sectors cleared in NaOH and photographed unstained in balsam. In each figure, the margin is toward the upper edge of the plate. Magnification × 93.

FIG. 1. Golden Gate Park material, showing irregularly branched sclereids. Note the large size and muricate surface of certain of the marginal sclereids. FIG. 2. *Simada 876*, Formosa, showing the closely packed fiber-like marginal sclereids. Note variations in size and type of branching of the submarginal sclereids.

PLATE II

Camera-lucida drawings of sclereids isolated by maceration from leaves of the Golden Gate Park specimen. In order to show the distribution of the spicules, the narrow branched lumen of these cells has been omitted in the drawings. Magnification × 240.

FIG. 3. Slender H-shaped sclereid from the petiole. Note the short uncinate branches of this cell. FIG. 4. Sclereid from the petiole with three systems of vertical branches. Note intergradations between spicules and short lateral branches. FIG. 5. Radiately branched sclereid from the submarginal region of the lamina. FIG. 6. Large, irregularly branched, muricate sclereid from the marginal region of the lamina. Elements of this type are also shown *in situ* in *Plate I, fig. 1*.

PLATE III

Camera-lucida drawings of sclereids from the submarginal region of cleared sectors of the lamina. Each cell is shown as it appears in median optical view; the central portion of the lumen is indicated by the broken outline. *Figs. 7–11,* radiately branched types; *figs. 12, 13,* irregularly branched types; *fig. 14,* cruciform type; *fig. 15,* irregular fiber-like type. Magnification × 180.

FIG. 7. *Siebold* (type coll.), Japan. FIG. 8. *Golden Gate Park* specimen. FIG. 9. *Wilson 11231,* Formosa. FIG. 10. *Wilson 11231,* Formosa. FIG. 11. *Sasaki 351,* Formosa. FIG. 12. *Henry 1398,* Formosa. FIG. 13. *Wilson 6041,* Yakushima, Japan. FIG. 14. *U.S.N.H. 350937,* Japan (*Collector?,* May 25, 1897, Amagi-san). FIG. 15. *U.S.N.H. 350937,* Japan (*Collector?,* May 25, 1897, Amagi-san).

PLATE IV

Camera-lucida drawings of fiber-like sclereids from the marginal region of cleared sectors of the lamina. Each cell drawn in median optical view; dotted outline indicates central portion of lumen. Magnification × 180.

FIG. 16. *Henry 1398,* Formosa. Long, slender, fiber-shaped sclereid. Note relatively smooth wall. FIG. 17. *Simada 350,* Formosa. Note short, irregular branches near central region of cell. FIG. 18. *Tanaka 5412,* Formosa. Irregular, fiber-like sclereid. This cell illustrates the common intergradation in form between strictly fusiform and branched sclereid-types. FIG. 19. *Wilson 11231,* Formosa. Very broad, fusiform type, prominently muricate. Consistently present in this collection. FIG. 20. *Wilson 6041,* Yakushima, Japan. Fiber-like type, with abundant spicules. FIG. 21. *Jack,* Oct. 25, 1905, Japan. Short, fusiform type. Abundant in this collection. FIG. 22. *U.S.N.H. 350937* (*Collector?,* May 25, 1897, Amagi-san). Short, irregularly branched type, closely resembling *fig. 21.*

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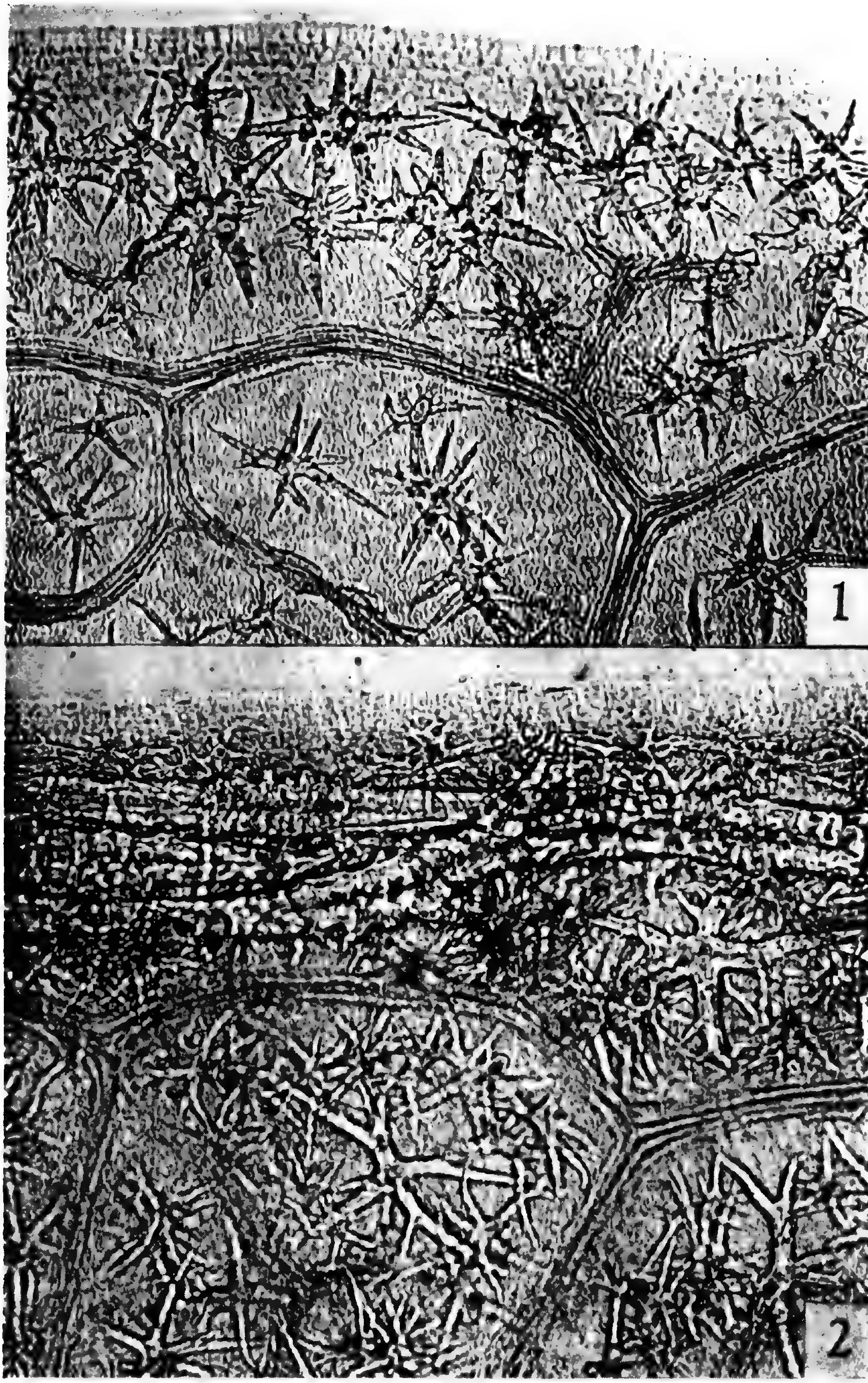
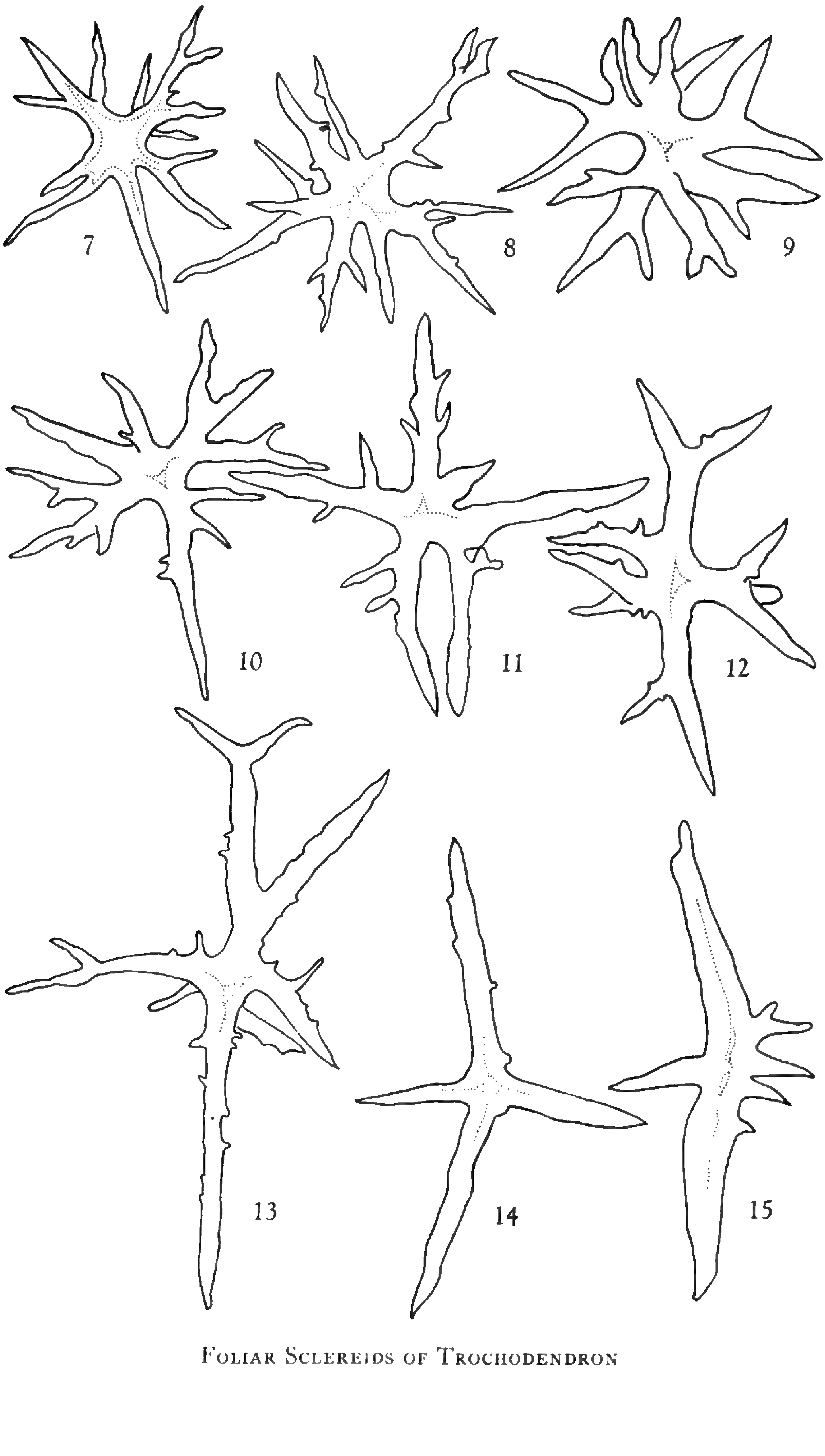
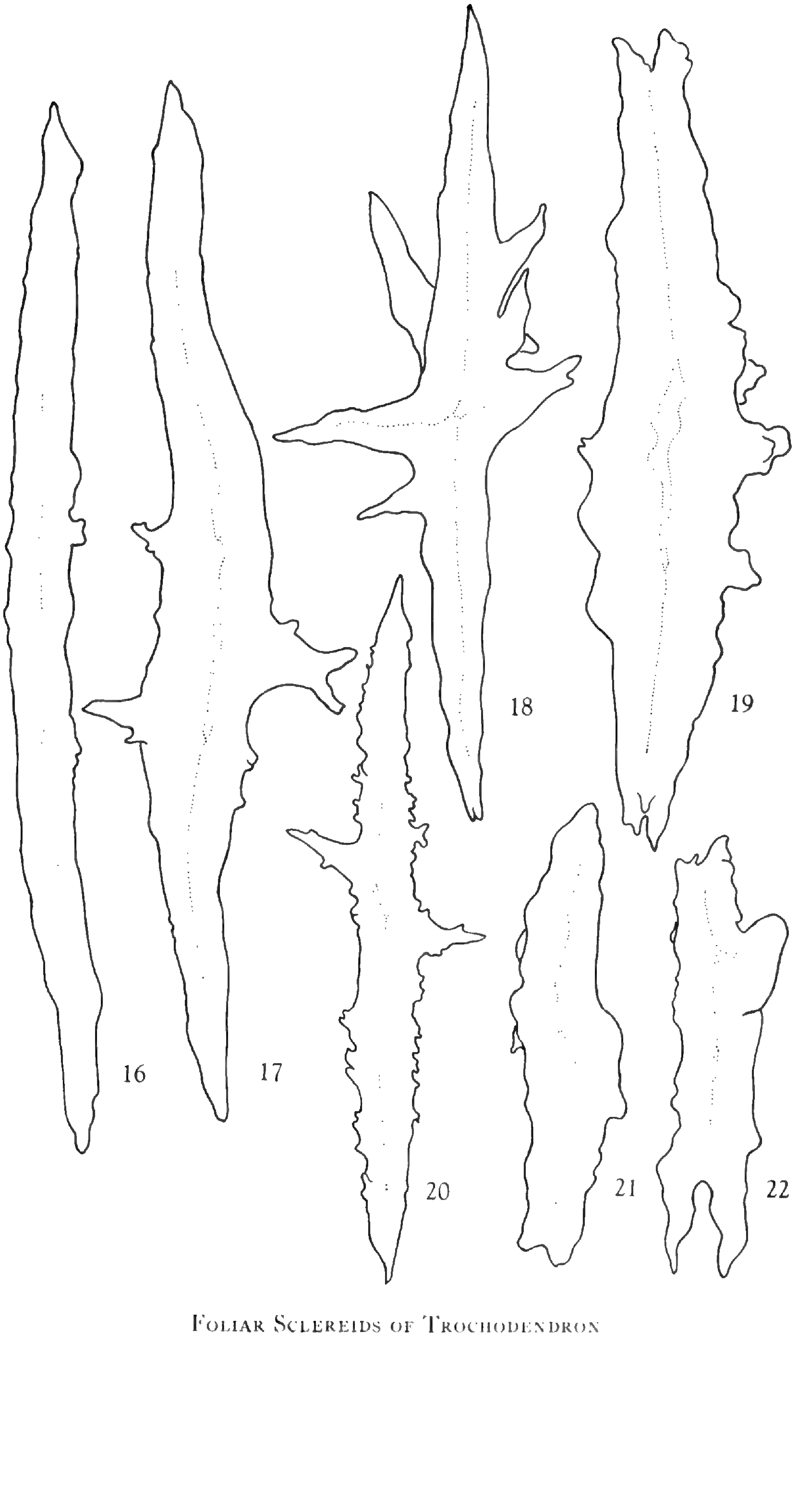


Foliar Sclereids of Trochodendron

Foliar Sclereids of Trochodendron



FOLIAR SCLEREIDS OF TROCHODENDRON



Foliar Sclereids of Trochodendron

TWO NEW SPECIES FROM THE VICINITY OF HONGKONG

E. D. Merrill

With three text-figures

In the course of identifying a collection of plants made by Mr. Y. W. Taam at Hongkong, Lantao Island, and Hongkong, New Territory, I was rather surprised to note several apparently undescribed species from a limited area that has been intensively explored from a botanical standpoint for more than a century. The material studied represents approximately 575 numbers, and it was submitted to me by Prof. H. H. Bartlett of the University of Michigan, who financed the field work. The material was well selected and well prepared.

Two novelties are described in this paper. In addition to these, one species previously described from outside of China is recorded for the first time from that country. A third species illustrated is what I take to be the little known *Maackia australis* (Dunn) Takeda. Incidentally, the collection contains a number of species previously described from various parts of Kwangtung Province but which hitherto have not been recorded from Hongkong and Lantao Islands or from Hongkong, New Territory. Naturally, the collection made in what is a most important classical region contains a great many topotypes — that is, specimens collected from approximately the same localities as were those on which many scores of descriptions of new species were based. Fortunately it was possible for Mr. Taam to ship his material to the United States before the Japanese occupation of Hongkong took place. In addition to the few records included in this paper, his material showed clearly that the Kwangtung-Hongkong form long passing as *Hippocratea obtusifolia* Roxb., the type of which was from India, is actually rather remote from that species, and elsewhere in this Journal (p. 170) Dr. A. C. Smith has described this as a new species of *Loeseneriella*.

ORCHIDACEAE

Eulophia R. Brown

Eulophia macrorhiza Blume, Fl. Jav. Orch. 155 (Orch. Archipel. Ind. 183). *t. 63, f. 2, t. 66B*. 1858.

Hongkong: Lantao Island, near Tungchung, rare in thickets, *Y. W. Taam 2092*, June 3, 1941, det. C. Schweinfurth. A variable species extending from Java to Celebes, New Guinea, and the Philippines (Luzon, Leyte); new to the area and to China.

LEGUMINOSAE

Maackia Ruprecht & Maximowicz

Maackia ellipticocarpa sp. nov. Fig. 1.

Frutex circiter 2 m. altus, inflorescentiis exceptis glaber vel subglaber (floribus ignotis); ramis teretibus levibus, atro-purpureis vel olivaceo-purpureis, conspersissime lenticellatis, ramulis ultimis glabris, 2 mm.

diametro; foliis 9–15 cm. longis, foliolis 7–9, ovatis vel elliptico-ovatis, plerumque acutis vel leviter acuminatis basi plerumque rotundatis, interdum obtusis, subcoriaceis, 2–4.5 cm. longis, 1.2–2.5 cm. latis, olivaceis, subopacis, subtus paullo pallidioribus, utrinque glaberrimis, nervis primariis utrinsecus circiter 6, arcuato-anastomosantibus, subtus elevatis, distinctis, reticulis ultimis subconfertis; petiolulis leviter incrassatis, 1–1.5 mm. longis; inflorescentiis terminalibus, sub fructu ad 12 cm. longis, ramis primariis 2 vel 3, racemiformibus, partibus junioribus obscure breviter pubescentibus glabrescentibus; pedicellis 5 mm. longis, obscure breviter adpresse pubescentibus, vetustioribus glabrescentibus; fructibus ellipticis vel oblongo-ellipticis, compressis, 2–3.5 cm. longis, 1–1.5 cm. latis, valvis

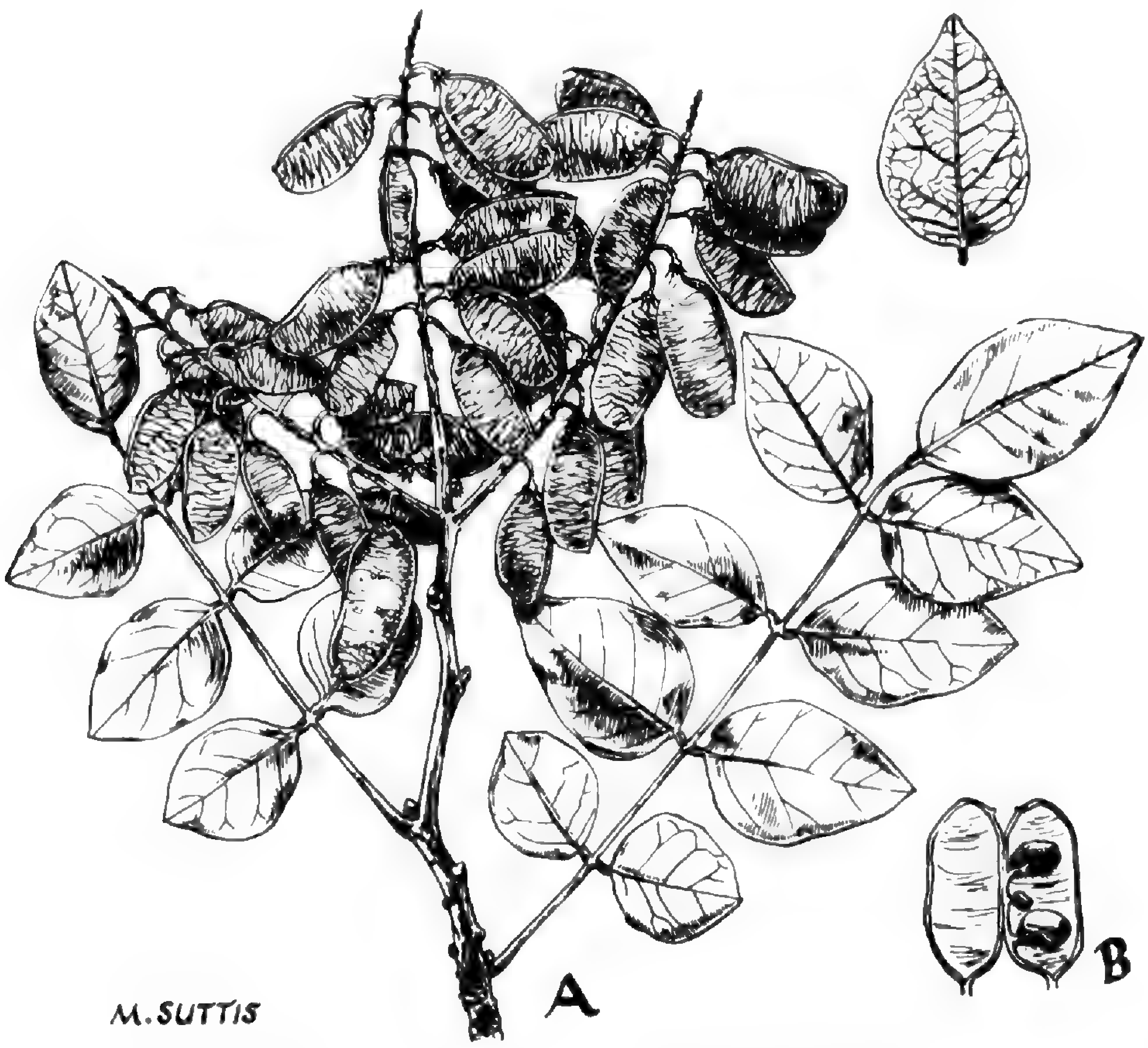


FIG. 1. *Maackia ellipticocarpa* Merrill: *a*. a fruiting branchlet, × ½; *b*. a pod with seeds, × ½.

glabris vel deorsum leviter adpresse pubescentibus, distincte consperseque glandulosis, utrinque rotundatis vel basi interdum late acutis vel obtusis, irregulariter subtransverse reticulato-venosis, suturis superioribus anguste carinatis, haud alatis; seminibus 1–3, ad 7 mm. longis.

HONGKONG: Lantao Island, near Tungchung, *Y. W. Taam 1693,* Sept. 12, 1940, abundant on dry clay slopes near the seashore, among scattered shrubs.

This species is clearly allied to *Maackia Tashiroi* (Yatabe) Makino, of southern Japan and the Liu Kiu Islands, differing in its fewer leaflets and its distinctly glandular fruit-valves. The original illustration of *Cladrastis Tashiroi* Yatabe, Bot. Mag. Tokyo 6: 345. *t. 10.* 1892, is excellent, and we fortunately have a fine series of specimens from Oshima representing the species, these with both flowers and fruits. The number of leaflets on this material varies from 9 to 15 on each leaf. Makino, Notes Bot. Gard. Edinb. 8: 102. 1913, has explained the confusion regarding *Derris chinensis* Benth., the fruiting specimen of which, from Oshima, actually represents *Maackia Tashiroi* (Yatabe) Makino, while the Hongkong flowering specimen represents *Millettia pulchra* Benth.

Maackia australis (Dunn) Takeda, Notes Bot. Gard. Edinb. **8**: 102. *t. 27, f. 57–62.* 1913. Fig. 2.

Cladrastis australis Dunn, Kew Bull. Add. Series **10**: 86. 1912.

Hongkong: Lantao Island, *Y. W. Taam 2134*, June 7, 1941, a shrub 2 m. high, abundant on damp slopes among scattered shrubs, flowers white, odorless.

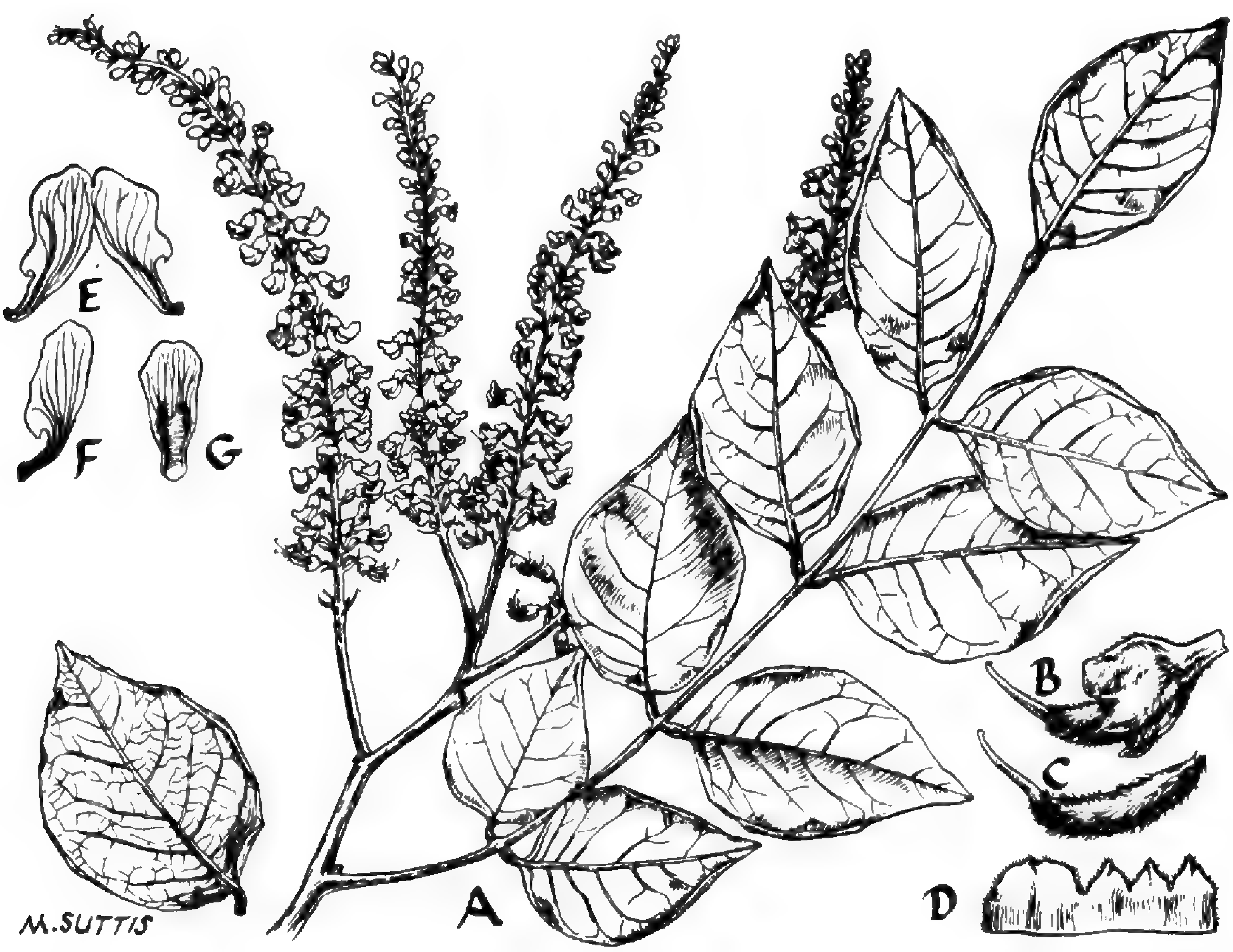


Fig. 2. *Maackia australis* (Dunn) Takeda: *a*. a flowering branch, × ½; *b*. calyx, ovary, and style; *c*. ovary and style; *d*. calyx, spread, showing the three small lobes and the fourth larger one; *e*. keel petals; *f*. a wing petal; *g*. standard; *b-g* all enlarged.

When this specimen was first studied it was thought to represent a distinct species, because of certain discrepancies between its characters and those of *Cladrastis australis* Dunn as indicated in the original description of the latter, and in Takeda's consideration of it. In this Taam specimen the standard is oblong or narrowly oblong-obovate, not ovate as in Dunn's description, and the leaflets have 7 or 8 pairs of lateral nerves rather than 5. Dunn described the leaflets of his species as "in apicem obtusum angustata," but Takeda, on the basis of the same material that Dunn had, says that they are mucronulate, and his figure, *t. 27, f. 61*, shows them to be very slenderly and sharply acuminate. His figure of the standard, *t. 27, f. 60,* shows it to be very narrowly oblong-obovate (not ovate as Dunn says), the slender nerves extending to the base, the basal parts not thickened and nerveless or nearly so as in the Taam collection. A re-examination of the type specimen and a comparison of the Taam material with it is desirable, as it may reasonably be expected that there are certain errors in the original description, or possibly representatives of more than a single species were included.

Dunn's description was based on a collection made on the North West River in Kwangtung Province, and a Millet collection, "*Sophora* from China, Hort. Soc. Hort. Lond. 1838," indicating that the species was cultivated in England at that date. It is by no means impossible that this Millet specimen was grown from seeds collected by him on Lantao Island. Takeda says that the Millet specimen in the Kew Herbarium bears the date 1835. Certainly at the date indicated there was no possibility of the Millet collection having been made on the North West River in Kwangtung Province.

EBENACEAE

Diospyros Linnaeus

Diospyros Taamii sp. nov. FIG. 3.

Arbor parva, circiter 7 m. alta, partibus junioribus fructibusque exceptis glabra; ramis teretibus, glabris, in sicco longitudinaliter subrugosis, ramulis

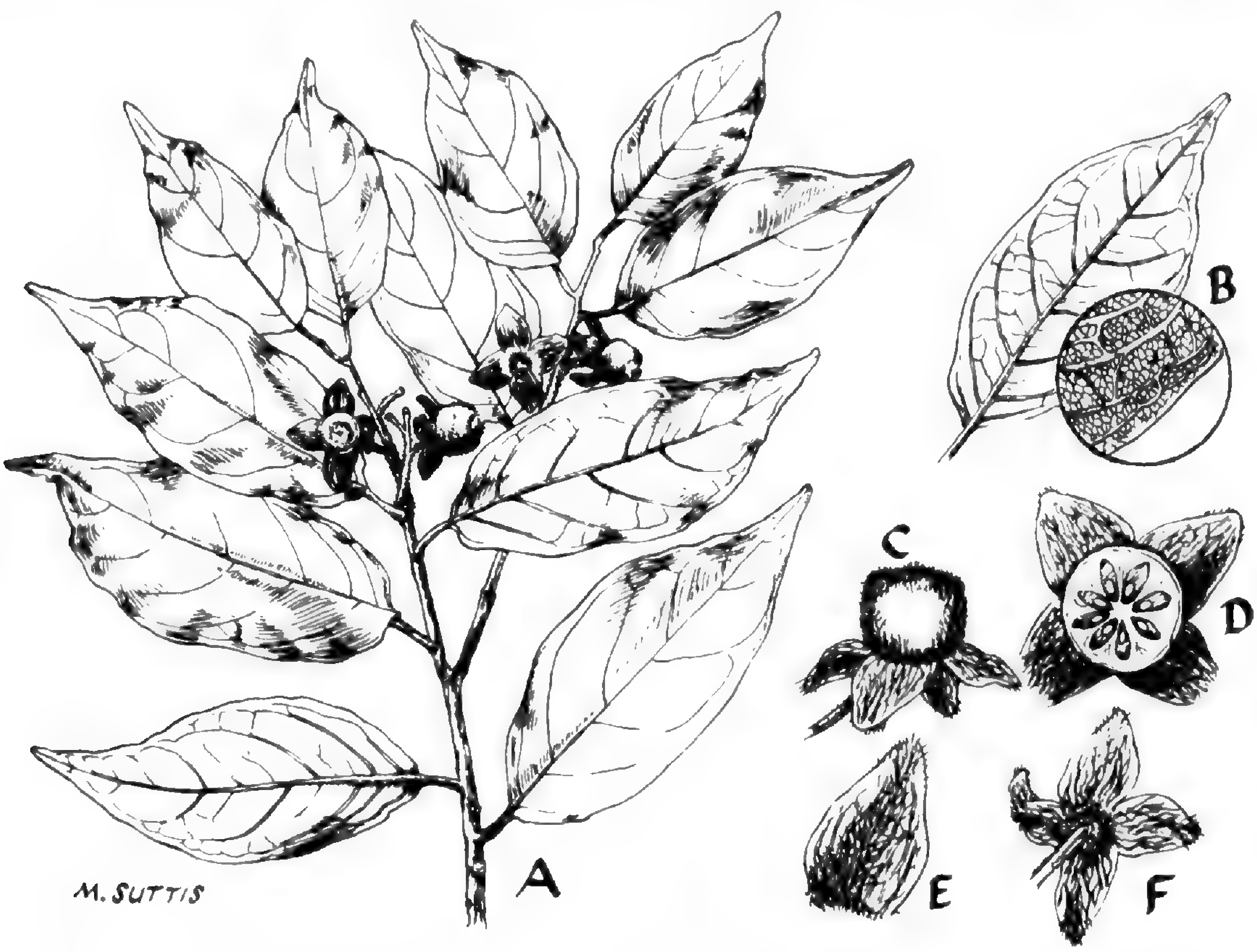


FIG. 3. *Diospyros Taamii* Merrill: *a.* a fruiting branch, × ½; *b.* a leaf, with a portion enlarged to show the ultimate reticulations; *c.* an immature fruit, × 1½; *d.* cross-section of an immature fruit, showing the persistent sepals; *e.* an individual sepal, dorsal view; *f.* dorsal view of a fruiting calyx; all somewhat enlarged.

ultimis gracilibus, glabris, 1 mm. diametro; foliis firmiter chartaceis vel subcoriaceis, utrinque glabris, in sicco pallidis, oblongis vel oblongo-ellipticis, 6–10 cm. longis, 2–4 cm. latis, sursum angustatis, distincte sed obtuse acuminatis, basi subrotundatis vel late acutis, nervis primariis utrinsecus 5 vel 6, supra obscuris, subtus distinctis, elevatis, curvato-adscendentibus, arcuato-anastomosantibus, utrinque sat dense reticulatis sed vix foveolatis; petiolo 6–8 mm. longo, glabro; floribus ignotis; fructibus in ramulis ultimis solitariis vel 2 vel 3 in ramulis specialibus racemosim dispositis, his plus minusve subadpresse hirsutis et aliquando foliiferis, fructibus globosis, immaturis circiter 1 cm. diametro, 8-locellatis, densissime adpresse breviter pallide pubescentibus; sepalis persistentibus coriaceis, ovatis, circiter 1 cm. longis et 8 mm. latis, sursum leviter angustatis, rotundatis, utrinque dense subreticulato-venosis, venis venulisque subelevatis, extus consperse hirsutis, pilis longis, adpressis, pallidis.

HONGKONG: Lantao Island, Tai Shan, *Y. W. Taam 2169,* June 12, 1941, abundant on moist slopes in thickets.

With fruiting material alone available it is difficult to place this rather strongly marked species in its proper group. It seems to be allied to *Diospyros Tutcheri* Dunn, but in that species the fruits are described as glabrous.

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DAVID DON'S "PRODROMUS FLORAE NEPALENSIS"

WILLIAM T. STEARN

THE "Prodromus Florae Nepalensis, sive Enumeratio Vegetabilium quas in Itinere per Nepaliam proprie dictam et Regiones conterminas, ann. 1802–1803, detexit atque legit D. D. Franciscus Hamilton, (olim Buchanan)" by David Don (1799–1841) is an unpretentious little book of considerable importance to students of the Himalayan flora,[1] for many species were first described in its 256 pages. It evidently took a long time to prepare. A letter to Wallich from Buchanan-Hamilton dated 16 October 1821 states that "A Mr. Don, however, who lives with Mr. Lambert, to whom I gave duplicates of the collection presented to Sir J. E. Smith, is engaged in publishing an account of them together with those which you have sent, and I believe he has both abilities and industry to produce a very valuable work." (Ann. Roy. Bot. Gard. Calcutta **10**[2]: xxxi. 1905). Don's preface is dated "Kalendis Octobris, Ann. 1824" and in Trans. Linn. Soc. London **18**: 518 (1841) he states that it was "completed and some copies of the work distributed before the close of 1824." As the title-page is dated "MDCCCXXV," it was evidently not intended or expected to be available to the public until 1825, and the Monthly Literary Advertiser, no. 240, p. 28, 32 (9 April 1825) lists it among the new books published in March 1825. A copy once belonging to John Lindley (1799–1865), who published, in the Botanical Register **11**: sub *t. 872* (1 March 1825), a scathing review of Don's work, is in the Lindley Library of the Royal Horticultural Society. On the title-page Lindley has written "Published 1 Feb. 1825," and there seems no reason to question this statement. Hence *February 1825 may be taken as the date of publication of D. Don's "Prodromus Florae Nepalensis."* The names published in it thus have priority over names published in A. P. DeCandolle's "Prodromus Systematis Regni Vegetabilis" vol. 2 (Nov. 1825; cf. Stearn in Candollea **8**: 1–4. 1939).

LINDLEY LIBRARY,
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LONDON, ENGLAND.

[1]For dates of publication of another important work on Himalayan plants, Royle's "Illustrations of the Botany . . . of the Himalayan Mountains" (1833–1840), see Sprague in Kew Bull. **1933**: 378–390 (1933), Stearn in Jour. Arnold Arb. **24**: 484–487 (1943).

NOTES ON HIPPOCRATEACEAE IN SOUTHEASTERN ASIA

A. C. Smith

With three text-figures

In attempting to identify a specimen of Hippocrateaceae recently collected in Hongkong, it became necessary to look into the typification of *Hippocratea obtusifolia* Roxb., a name which has in the past accommodated many of the capsular-fruited large-disked specimens of the family from southeastern Asia. In the course of this study the available material from India, Burma, Indo-China, and China was examined, and it became apparent that two undescribed Chinese species had been passing as *H. obtusifolia*. Descriptions of these and notes on several other species follow, new combinations in the genera *Loeseneriella* and *Pristimera* being proposed for some of them. Specimens are cited from the following herbaria: Arnold Arboretum (A), Gray Herbarium (GH), New York Botanical Garden (NY).

Loeseneriella A. C. Sm.

Loeseneriella obtusifolia (Roxb.) A. C. Sm. in Am. Jour. Bot. 28: 440. 1941.
Hippocratea obtusifolia Roxb. Fl. Ind. 1: 170. 1820.
Hippocratea tortuosa Wall. Cat. no. 4216, nomen. 1830.

Hippocratea obtusifolia is based upon a plant collected on the Coromandel coast of India. The species has been accredited with a very wide distribution and has become, in herbarium usage, a collective concept. Careful examination of the pertinent early literature and the available historical specimens is essential for a proper understanding of Roxburgh's species. In this connection, several available specimens fortunately permit a clear understanding of it.

A specimen labeled "*Hippocratea obtusifolia* Roxb. Hort. bot. Calcutt." (GH), in flower, agrees very well with the original description. It is apparent that Roxburgh had this species in cultivation at Calcutta, from his comment: "Flowering time in the Botanic Garden, March and April; the seeds take one year to ripen." There appears to be little doubt that the specimen at hand was collected from the original plant and that it may be taken essentially as an isotype.

A second specimen, labeled "*Hippocratea obtusifolia* R. in fruit. BGC. 6 Augt. 1889" (GH), is also apparently taken from the same plant in the Calcutta Botanic Garden.

A third important collection is *Wight 465* (GH, NY), in flower, almost certainly a duplicate of the specimen which served as the basis of Wight's much-cited plate of *Hippocratea obtusifolia* (Ic. Pl. Ind. Or. 3: *pl. 963.* 1845). According to Wight's text (op. cit. 3(3): 5), the specimens from which the drawing was made came from "the eastern slopes of the Neilgherries by the roadside from Kottergherry to Matypolium . . ." The Wight specimen permits one to state with considerable assurance that he and Roxburgh had the same concept in mind for *Hippocratea obtusifolia*.

A fragmentary specimen of *Wallich 4216* (GH), which number is the source of the name *Hippocratea tortuosa*, is essentially identical with the other specimens mentioned above, and thus one is able to place this binomial of Wallich's with confidence.

The collections mentioned above, with two others, are the only specimens which at present I can confidently refer to *Loeseneriella obtusifolia*. Whether or not this species has a distribution outside of peninsular India needs reconsideration, in spite of the numerous floras and lists which have implied for it a very extensive range. Following are citations upon which my concept of the species is based:

INDIA: Bombay: Konkan ("Concan") District, *Stocks* (GH); Madras: Nilgiris, *Wight 465* (GH, NY); Aiyur, Salem District, *E. K. Kristman 41* (GH); cultivated: *Hort. Calcutta Botanic Garden*, without date, in flower (GH), Aug. 6, 1889, in fruit (GH) (specimens probably from type plant of *Hippocratea obtusifolia*); without data: *Wallich 4216* (GH) (source of the name *Hippocratea tortuosa*).

The advisability of separating the Old World species of this alliance from *Hippocratea* L. has recently been discussed by the writer (in Am. Jour. Bot. **28**: 439. 1941).

Loeseneriella concinna sp. nov. FIG. 1.

Hippocratea obtusifolia sensu Benth. Fl. Hongk. 62. 1861; Dunn & Tutcher in Kew Bull. Add. Ser. **10**: 62. 1912; non Roxb.

Frutex volubilis, ramulis gracilibus glabris primo fusco-purpureis demum saepe cinereis interdum copiose scabrido-lenticellatis; foliis oppositis glabris, petiolis inconspicuis supra canaliculatis 2–4 mm. longis, laminis chartaceis viridibus vel fusco-viridibus saepe nitentibus oblongo-ellipticis, (3–) 4–7 cm. longis, (1.2–) 1.5–3.5 cm. latis, basi obtusis vel subrotundatis et in petiolum decurrentibus, apice obtusis vel obtuse cuspidatis, margine crenato-serrulatis (dentibus 2 vel 3 per centimetrum saepe obscure calloso-apiculatis), costa utrinque valde elevata, nervis secundariis utrinsecus 4–6 patentibus brevibus anastomosantibus et rete venularum copioso intricato utrinque prominulis; inflorescentiis cymoso-paniculatis apicem ramulorum versus axillaribus 2–3.5 cm. longis et latis paucifloris, ramulis pedicellisque gracilibus leviter puberulis demum glabrescentibus, pedunculo communi 1–1.5 cm. longo, bracteis bracteolisque deltoideis acutis 0.6–1 mm. longis margine glanduloso-serrulatis; floribus glabris ultimis binis vel ternatis, pedicellis sub anthesi in dichotomiis 10–15 mm. longis alteris 5–10 mm. longis; sepalis papyraceis deltoideis subacutis, circiter 0.7 mm. longis, 1–1.5 mm. latis, margine basim versus obscure ciliolatis; petalis tenuiter carnosis oblongo-lanceolatis, 4–5 mm. longis, 1.7–2.5 mm. latis, apice calloso-mucronulatis, margine apicem versus obscure ciliolatis; disco carnoso annulari-pulvinato, basi 2–2.5 mm. diametro et obscure pentagono, 1–1.5 mm. alto, medium versus obscure constricto, apice angustiore et leviter crenulato; filamentis sub anthesi circiter 1.3 mm. longis et basi 0.6–0.8 mm. latis, superne angustatis, antheris 0.4–0.5 × 0.6–0.7 mm.; ovario in disco immerso trigono, ovulis in quoque loculo 4 oblique adscendentibus, stylo conico-subulato 0.8–1 mm. longo truncato; capsulis divergentibus obovato-ellipticis, maturitate 3.5–6 cm. longis et 1.5–3.5 cm. latis, basi obtusis, apice emarginatis, pericarpio venis longitudinalibus anastomosantibus prominulis copiose striato; seminibus plerumque 4, ala basali submembranacea vel papyracea elliptica maturitate ad 3 × 2 cm. basi obtusa, parte embryonifera falcato-ellipsoidea ad 15 mm. longa.

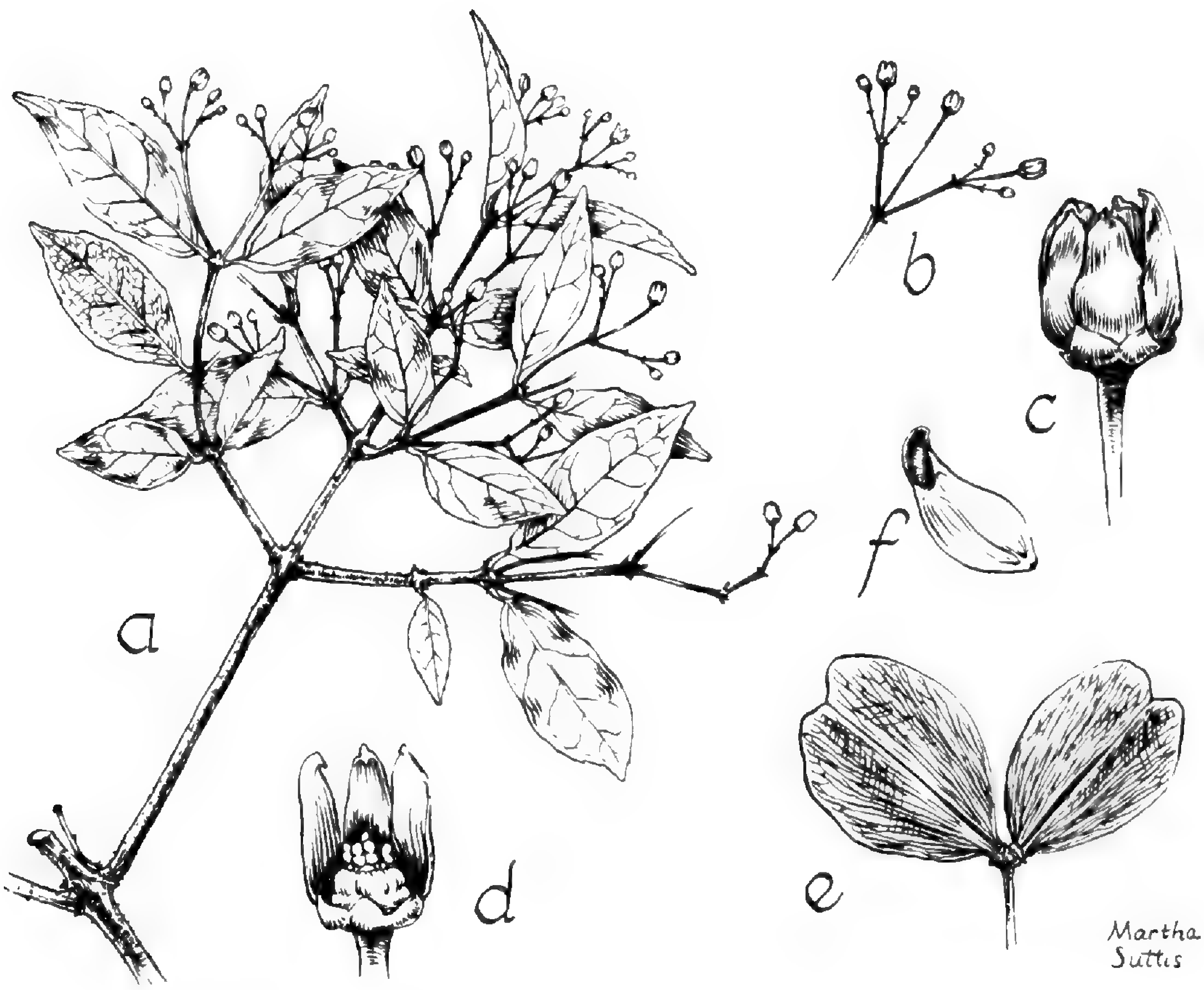

FIG. 1. *Loeseneriella concinna; a.* flowering branchlet, × ½; *b.* detail of inflorescence, × ½; *c.* flower slightly before full anthesis, × 3; *d.* flower with two petals removed, × 3; *e.* fruit with one capsule aborted, × ½; *f.* seed, × ½. *Figs. a-d* drawn from the type, *e* from *Tsang 21743, f* from *Tsang 16674.*

CHINA: Hongkong: *Ford* (A); Lantao Island, Shantao, Tungchung and vicinity, *Y. W. Taam 2105* (A, TYPE), June 4, 1941 (fairly common on sandy stony slope among scattered shrubs; flowers yellow); Lantao Island, Taai Ue Shan, *Lingnan Univ. 16674 (Tsang)* (A, NY) (in a ravine; fruit yellow; native name: *Ch'ing Heung Tsai Shue*); Kwangtung: Tung Koo Shan, Tapu District, *W. T. Tsang 21743* (A, NY) (fairly common on dry steep slope, in silty sandy rocky soil, among scattered shrubs [fruit]); Kwangsi: Shap Man Taai Shan, near Iu Shan village, Shang-sze District, Kwangtung border, *W. T. Tsang 22444* (A) (fairly common in thickets in silty clayey rocky soil; flowers yellow).

This species of southern China, which has been passing in herbaria as *Hippocratea obtusifolia* Roxb., may be readily distinguished from that Indian species, discussed above, as follows:

Petioles 4–10 mm. long; leaf-blades elliptic, often broadly so, 4–11 × 2.5–7 cm.; inflorescence ample, often as long as the leaves, many-flowered; pedicels 1.5–3 mm. long at anthesis, with the sepals brown-puberulent; style 1.2–1.6 mm. long; ovules 6 per locule...*L. obtusifolia.*

Petioles 2–4 mm. long; leaf-blades oblong-elliptic, usually 4–7 × 1.5–3.5 cm.; inflorescence compact, shorter than the leaves, few-flowered; pedicels 5–15 mm. long at anthesis, with the sepals essentially glabrous; style 0.8–1 mm. long; ovules 4 per locule. . . . . *L. concinna.*

Loeseneriella Merrilliana sp. nov. FIG. 2.

Hippocratea obtusifolia sensu Merr. in Lingnan Sci. Jour. 6: 328. 1928 [1930]; non Roxb.

Frutex volubilis, ramulis divaricatis glabris fusco-cinereis saepe copiose scabrido-lenticellatis; foliis oppositis glabris, petiolis robustis canaliculatis 5–8 mm. longis, laminis chartaceo-coriaceis in sicco fusco-viridibus subnitentibus oblongo-ellipticis, (5–) 6–10.5 cm. longis, (2–) 2.5–5.5 cm. latis, basi obtusis vel anguste rotundatis et in petiolum decurrentibus, apice

FIG. 2. *Loeseneriella Merrilliana; a.* flowering branchlet, × ½; *b.* flower with two petals removed, × 3; *c.* flower, × 3; *d.* fruit with one persistent capsule, × ½; *e.* seed, × ½. *Figs. a-c* drawn from the type, *d* and *e* from *How 73743.*

in acuminem obtusum 5–10 mm. longum abrupte cuspidatis, margine inconspicue crenato-serrulatis (dentibus circiter 2 per centimetrum obscure nigro-callosis), costa utrinque subprominente, nervis secundariis utrinsecus 4–6 adscendentibus utrinque paullo elevatis, rete venularum intricato utrinque priminulo vel supra subimmerso; inflorescentiis cymoso-paniculatis apicem ramulorum versus axillaribus 2.5–6 cm. longis saepe multifloris, ramulis pedicellisque dense sed minute farinoso-puberulis, pedunculo communi plerumque 1–1.5 cm. longo, bracteis bracteolisque deltoideis acutis 1–1.5 mm. longis subintegris; floribus ultimis binis vel ternatis, pedicellis gracilibus sub anthesi in dichotomiis 3–8 mm. longis alteris circiter 2 mm.

longis; sepalis ovato-deltoideis, 1–1.2 mm. longis, 1.5–1.8 mm. latis, apice obtusis, margine ciliolatis; petalis tenuiter carnosis oblongo-lanceolatis, 4–5 mm. longis, 1.7–2.5 mm. latis, apice dorso mucronulato-calcaratis, utrinque obscure farinoso-puberulis; disco carnoso annulari-pulvinato, basi 2–3 mm. diametro et obscure pentagono, 1–1.5 mm. alto, glabro, medium versus obscure constricto; filamentis ligulato-deltoideis 1–1.7 mm. longis, basi 0.8–1.5 mm. latis, superne angustatis, antheris 0.4–0.5 × 0.6–0.8 mm.; ovario in disco semi-immerso trigono, ovulis in quoque loculo 8, stylo conico-subulato 1–1.5 mm. longo truncato; capsulis immaturis obovato-ellipticis vel anguste ellipticis, ad 6 cm. longis et 3.2 cm. latis, basi obtusis et minute stipitatis, apice rotundatis vel emarginatis, pericarpio venis inconspicue striato, seminibus abortu paucis, ala basali membranacea late elliptica.

CHINA: Hainan: Sin Woh, Taam Chau District, *W. T. Tsang 381* [Lingnan Univ. *17130*] (A, TYPE; NY), May 19, 1928 (growing on the plain of a stream; flowers white, fragrant); Po-ting, alt. 350–550 m., *F. C. How 72209* (A), *73743* (A) (twining plants in forested ravines; flowers [*72209*] pale green; fruits [*73743*] lustrous green); Yeung Lam Shan, near Yeung Lam village, Yai Hsien, *S. K. Lau 6337* (A) (rare woody climber on dry steep slope on sandy soil in forest; flowers white); Yaichow, *H. Y. Liang 62274* (NY) (scandent, in forested ravine: immature fruits green).

This new species from Hainan differs from the plant of Hongkong, Kwangtung, and Kwangsi above described as *L. concinna* in several obvious characters, namely the longer petioles, the more coriaceous and larger leaf-blades with a more obvious acumen, the usually more ample inflorescence with shorter pedicels and larger sepals, the farinose-puberulent character of its inflorescence-branches and petals, and in having 8 rather than 4 ovules per locule. From the Indian *L. obtusifolia* (Roxb.) A. C. Sm. the new species differs in the proportionately narrower leaf-blades, which are more coriaceous in texture and have a more obvious acumen, in the longer pedicels and slightly larger petals, and in having 8 rather than 6 ovules per locule.

A closer relative of the new species is apparently the Indo-Chinese **Loeseneriella dinhensis** (Pierre) comb. nov. (*Hippocratea dinhensis* Pierre, Fl. For. Cochinch. 4: *pl. 301A*. 1893). The Hainan plant differs from this, however, in its fewer secondary nerves, its more ample inflorescence, and its less highly elevated disk. It should be noted that the Indo-Chinese specimen *Pételot 2119* (or *2219*) cited by Merrill (in Jour. Arnold Arb. **21**: 374. 1940) as *Hippocratea obtusifolia* Roxb. is very close to the new species and possibly identical with it. However, *Pételot 2119* has the leaf-blades proportionately a little broader than our species, the pedicels shorter, and the ovules only 6 per locule. The Pételot plant is somewhat more suggestive of the true *L. obtusifolia* than the other specimens here discussed, but I doubt if it can be referred to the Indian species.

Hippocratea obtusifolia and *H. dinhensis* are placed by Loesener (in Nat. Pfl. ed. 2. **20b**: 213. 1942) in *Hippocratea* subgen. *Euhippocratea* sect. *Barbatae*, the type-including section of *Hippocratea*, which in the writer's opinion (see Brittonia 3: 356–367. 1940) is a monotypic American genus.

Loeseneriella yunnanensis (Hu) comb. nov.

Hippocratea yunnanensis Hu in Bull. Fan Mem. Inst. Biol. **10**: 152. 1940.

CHINA: Yünnan: Pu-Erh Hsien, Po-Pien-Kiang, alt. 1100 m., *C. W. Wang 81219* (A, TYPE COLL.) (on open dry slope along river-bank; flowers greenish); Chu-yüan, *A. Henry 10865* (A,NY) (large climber; flowers green); Shih-Ling, alt. 1200 m., *A. Henry 13274* (A,NY) (climbing shrub).

This is another species of the general alliance of *L. obtusifolia* (Roxb.) A. C. Sm., to which it is very similar in foliage, differing perhaps in having slightly shorter petioles and thicker leaf-blades. The flowers of *L. yunnanensis* are noticeably larger (sepals about 1.5 × 2 mm.; petals 5–8 × 2.5–4 mm.) than those of *L. obtusifolia* (sepals 0.7–0.8 × 0.6–1.2 mm.; petals 3.5–4.5 × 1.5–2 mm.). The disk is less highly elevated, being only 1–1.5 mm. high but widening to a base 3.5–4 mm. across; the disk of the Indian species is 1.7–2.3 mm. in diameter but proportionately higher. The filaments of the Yünnan plant are longer (2–2.5 mm. rather than 1–1.5 mm.), and the ovules are 8–10 per locule rather than 6. The available fruits of the two species show no consequential differences. Hu compared his new species with *Hippocratea puberula* Craib, but that species has much larger and longer-petioled leaves and smaller flowers.

Loeseneriella Arnottiana (Wight) comb. nov.

Hippocratea Arnottiana Wight, Ill. Ind. Bot. **1**: 133. *pl. 46, 47A.* [1839]; Lawson in Hook. f. Fl. Brit. Ind. **1**: 624. 1875.

INDIA: Madras: *Wight 463* (GH, NY), *2445* (NY) (probably parts of TYPE COLL.); Kodaikanal Region, Palni Hills, Madura District, *Anglade* (A).

The Wight specimens cited above agree well with the original description and illustrations and are very probably a part of the type collection, cited without number; nos. *463* and *2445* are so similar that it seems likely that they are parts of a single original collection, subsequently re-numbered. The original locality is mentioned as "Malabar" by Wight, and as Quilon [Travancore State, Madras] by Lawson. The Anglade collection, from the same part of India, agrees precisely with *Wight 463* and *2445*. The species is very distinct in its large flowers (about 8 mm. in diameter at anthesis), spreading spatulate clawed petals, and papillose disk; the ovules are 8 or 10 per locule.

Loesener (in Nat. Pfl. ed. 2. **20b**: 214. 1942) places *Hippocratea Arnottiana* in *Hippocratea* subgen. *Euhippocratea* sect. *Scutellatae,* a synonym of *Prionostemma* Miers, a very different American genus in the writer's understanding (see Brittonia **3**: 391–396. 1940).

Loeseneriella serrata (Griffith) comb. nov.

Hippocratea serrata Griffith, Not. Pl. As. **4**: 473. 1854, Ic. Pl. As. **4**: *pl. 582.* 1854.

Griffith's species is difficult to interpret, due to the inadequacy of the original description and plate, but the latter is sufficiently clear to suggest with reasonable certainty that a species of *Loeseneriella* is represented, characterized by narrowly oblong-elliptic serrate leaf-blades and fairly short inflorescences. The original locality is given as: "Journey from Assam to Ava. Tsakan Delvi," probably in central Burma.

A specimen which agrees well with Griffith's plate is *Helfer 905* (GH), from "Tenasserim and Andamans." The leaves of this specimen are essentially identical with those of the plate and agree with the description as to "costa venisque lutescentibus, subtus pallidioribus, . . ." The flowers of the Helfer specimen have the pedicels and sepals glandular-puberulent, the petals lanceolate-oblong, 3.5–4 mm. long, the disk obvious, the filaments and style about 1 mm. long, and the ovules 6 or 8 per locule.

Pristimera Miers

Pristimera indica (Willd.) A. C. Sm. in Am. Jour. Bot. 28: 440. 1941.
Hippocratea indica Willd. Sp. Pl. 1: 193. 1797.

China: Hainan: Ka Chik Shan and vicinity, Ch'ang-kiang District, *S. K. Lau 1675* (NY); Ue Lung Shan, Ch'ang-kiang District, *S. K. Lau 3131* (A); Pak Shik Ling and vicinity, Ching Mai District, *C. I. Lei 847* (NY); Yaichow, *H. Y. Liang 62979* (A, NY).

The above specimens are listed because the species appears not to have been otherwise recorded from China. Although, as indicated by herbarium records, *Pristimera indica* is a very widespread species, it is fairly variable as currently interpreted and its range cannot be stated without detailed study of the genus. The Hainan material, however, appears quite identical with that from India and Ceylon. Willdenow gives the original locality as "in India orientali."

Pristimera setulosa sp. nov. Fig. 3.

Frutex scandens, ramulis hornotinis acute quadrangularibus copiose setulosis (pilis 0.1–0.15 mm. longis, glandulosis [?]), annotinis glabrescentibus, vetustioribus teretibus cinereis; foliis oppositis glabris, petiolis gracilibus leviter canaliculatis 3–5 mm. longis, laminis chartaceis in sicco fusco-viridibus ellipticis, 4–6.5 cm. longis, 2–3.5 cm. latis, basi obtusis vel subacutis et in petiolum decurrentibus, apice obtusis vel breviter et obtuse cuspidatis, margine crenulato-serrulatis (dentibus 5 vel 6 per centimetrum inconspicuis), costa utrinque valde elevata, nervis secundariis utrinsecus 4 vel 5 arcuato-adscendentibus supra subplanis subtus prominulis, rete venularum supra immerso subtus laxe prominulo; inflorescentiis solitariis vel binis in axillis foliorum saepe delapsorum subdichotome cymosis multifloris 1.5–3 cm. longis et latis, pedunculo ad 17 mm. longo ramulisque quadrangularibus et copiose setulosis, bracteis papyraceis glabris deltoideo-oblongis 0.5–0.8 mm. longis acutis, bracteolis similibus minoribus; floribus in ramulis ultimis binis pedicello gracili 0.6–0.8 mm. longo obscure setuloso excepto glabris; sepalis papyraceis deltoideo-oblongis, 0.4–0.5 mm. longis, circiter 0.3 mm. latis, obtusis, margine erosulis; petalis tenuiter carnosis elliptico-oblongis, circiter 1 mm. longis et 0.5 mm. latis, apice obtusis, integris, utrinque obscure papillosis, glabris; disco obscuro minutissime annulari; staminibus 3 minutis, filamentis ligulatis circiter 0.15 mm. longis, antheris circiter 0.1×0.15 mm.; ovario depresso-subgloboso sub anthesi circiter 0.4 mm. diametro 3-lobato, ovulis in quoque loculo 2 collateralibus, stylo inconspicuo circiter 0.15 mm. longo truncato.

China: Yünnan: Man-hao [on Yang Chiang (Red River) near Indo-Chinese boundary], *A. Henry 9612* (NY, type) (large climber with yellow flowers, coll. June 19 [year?]).

The new species differs from the common *P. indica* (Willd.) A. C. Sm., which apparently does not occur in interior China, in its densely setulose young branchlets and inflorescence-branches. The hairs are very abundant, stand out stiffly, and are glossy when expanded, as though glandular in nature. The young branchlets and inflorescence-branches are sharply quadrangular, whereas these parts in *P. indica* are usually subterete.

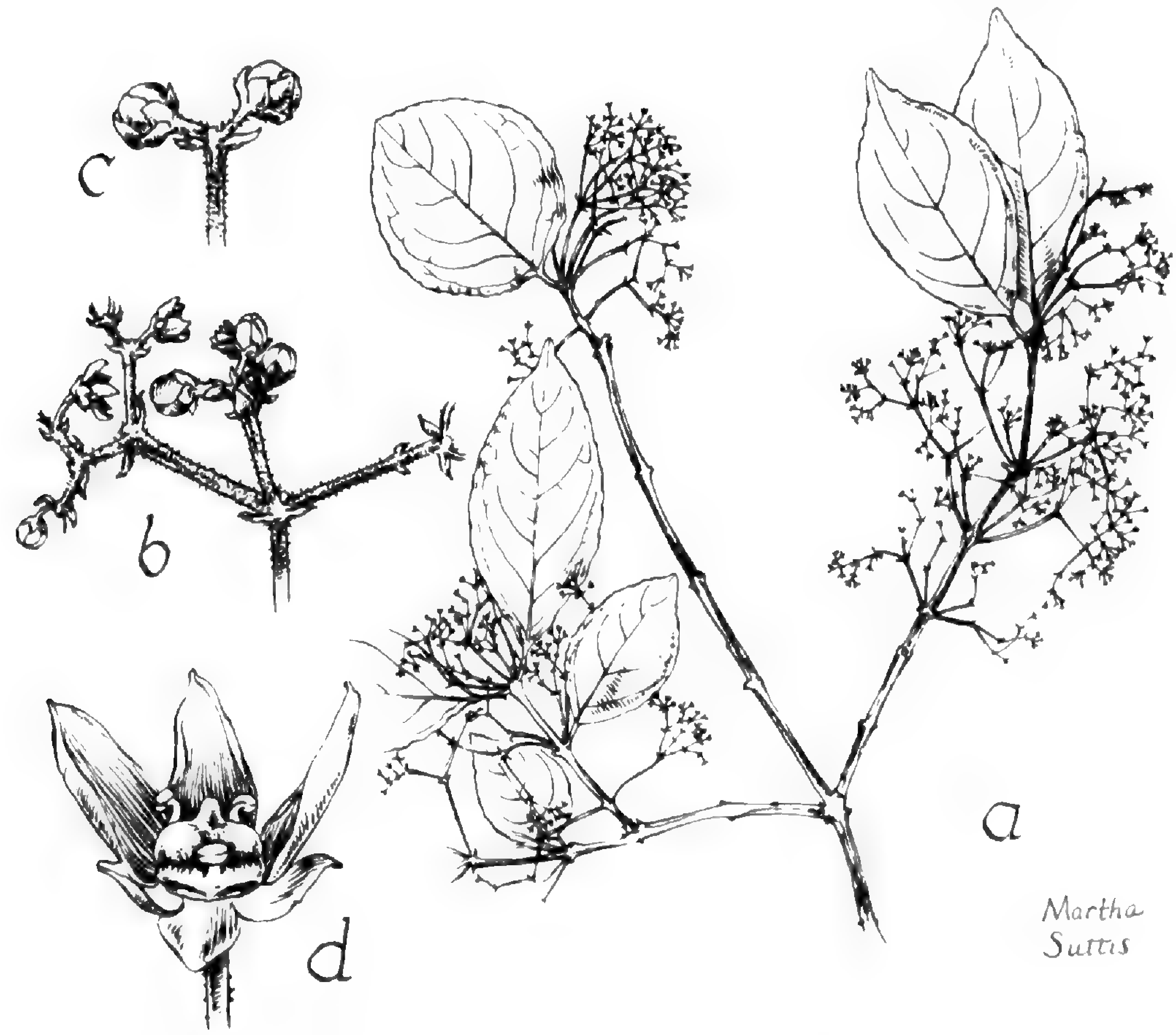

FIG. 3. *Pristimera setulosa; a.* flowering branchlet, × ½; *b.* detail of inflorescence, × 3; *c.* young flowers, × 5; *d.* flower with two petals removed, × 20. Drawn from the type.

Pristimera arborea (Roxb.) comb. nov.

Hippocratea arborea Roxb. Hort. Beng. 5, nomen. 1814, Pl. Coast Corom. 3: 3. *pl. 205.* 1819, Fl. Ind. 1: 171. 1820.

INDIA: Cult. Calcutta Botanic Garden, *Wallich 4212C* (NY), *Collector?,* Feb. 22, 1901 (A); "East Himalaya," *Griffith 910* (GH); "W. Himalaya," *J. F. Duthie* (A). BURMA: (Without data), *J. C. Prazer 23* (NY). CHINA: Yünnan: Puerh cliffs, alt. 1800 m., *A. Henry 13203* (A) (large climber); Sheau-meng-yeang, Che-li Hsien, alt. 960–1000 m., *C. W. Wang 75610* (A), *79608* (A) (vines, in woods on mountain-slopes; capsules green).

The Wallich specimen cited above is listed under *Hippocratea arborea* Roxb. by Wallich (Cat. no. 4212C. [1830]) as "HBC.," thus indicating that it was taken from a plant cultivated in the Calcutta Botanic Garden. In habit this Wallich specimen agrees precisely with Roxburgh's descriptions and illustration; in floral details these descriptions and the illustration are highly inaccurate, which is not surprising in view of the fact that at anthesis the flower is little more than 1 mm. in diameter. However, there seems no doubt that Roxburgh had at hand a species of *Pristimera* closely allied to *P. indica* (Willd.) A. C. Sm. The original collection is said to have come from the "interior parts of India," and Roxburgh (Pl. Coast Corom. 3: 4. 1819) states that the species was in cultivation at Calcutta. It seems very likely, therefore, that the Wallich specimen was taken from the type plant or a descendant of it.

It is also possible that the fruiting specimen cited above (*Collector?*, Feb. 22, 1901) came from a descendant of Roxburgh's original plant, although its leaves are slightly thicker and less obviously serrate than those of *Wallich 4212C*. In its fruit, the collection of 1901 seems to agree well with Roxburgh's concept.

Of the other Indian specimens cited above, *Griffith 910* has inflorescences identical with those of *Wallich 4212C*, although its leaves are somewhat more coarsely serrate; I believe that the Griffith specimen can be referred here with reasonable certainty. It is probably part of the same collection which was questionably referred to *Hippocratea arborea* by Lawson (in Hook. f. Fl. Brit. Ind. 1: 625. 1875), as from "Bhotan and the Khasia Mts." The Duthie specimen consists of young leaves and inflorescences and is accompanied by mature fruits; it is referred to the species with confidence. Lawson (l. c.) states that this species differs from *Hippocratea indica* "apparently in nothing but size." The two species are indeed very similar in inflorescence characters, but the much larger leaves and fruits of *Pristimera arborea* make it readily recognizable.

The cited Burmese specimen is remarkably similar to *Wallich 4212C* in both foliage and inflorescences, while the cited Chinese specimens, all in fruit, seem undoubtedly to belong here. The range of the species is thus from northeastern India across [northern?] Burma to southern Yünnan. Apparently it has not previously been recorded outside of India.

Pristimera cambodiana (Pierre) comb. nov.

Hippocratea cambodiana Pierre, Fl. For. Cochinch. 4: *pl. 302B*. 1893; Pitard in Lecomte, Fl. Gén. Indo-Chine 1: 896. 1912.

INDO-CHINA: Cambodge: Samrong-tông, *L. Pierre 869* (COTYPE COLL., A, NY). CHINA: Yünnan: Lan-Tsang Hsien, alt. 890–1100 m., *C. W. Wang 73135* (A), *76712* (A) (woody vines, on mountain slope or on outcrop on river-bank). Upper BURMA: *J. C. Prazer* in 1894 (A, 2 sheets), *39* (NY).

A single flower associated with *Wang 73135* agrees precisely with the flowers described and well figured by Pierre. The species is marked by its small flowers, involute petals, inconspicuous disk, and 6-ovulate locules. In foliage, the cited Chinese specimens agree very well with the available cotype collection. *Wang 76712* bears juvenile fruits, the capsules of which are much shorter than those of *Pierre 869* but similar in texture. The cited Prazer specimens from Burma agree precisely with *Pierre 869* in foliage, and the available capsules are identical in shape with those of the Pierre specimen but are shorter, perhaps due to immaturity.

These collections extend the range of the species to southern Yünnan and northern Burma; otherwise it has been recorded only from the southern part of Indo-China (Cochinchine and Cambodge).

Pristimera cambodiana differs from the widespread *P. indica* (Willd.) A. C. Sm. in its much larger leaves, flowers, and fruits, its 6- rather than 2-ovulate locules, and in other obvious characters. Nevertheless the floral characters of the two species are fundamentally similar, and I believe that Pierre's species is safely referable to *Pristimera,* as emended by the writer in Brittonia 3: 367–383. 1940, and in Am. Jour. Bot. **28**: 440. 1941.

A closer relative of *P. cambodiana* is **Pristimera Grahamii** (Wight) comb. nov. (*Hippocratea Grahamii* Wight, Ill. Ind. Bot. **1**: 134. [1839], Ic. Pl. Ind. Or. **2**: *pl. 380.* 1840). From this Indian species, *P. cambodiana* differs in its somewhat larger leaves, shorter pedicels, glabrous rather than faintly puberulent disk, and longer filaments and style. *Pristimera Grahamii* is represented by two specimens collected by Law (GH) in the Kanara District, Bombay; the type (coll. Graham) is said to have come from Bombay.

It should be noted that *Wang 73135* was cited by Hu as the type of *Mangifera austro-yunnanensis* (in Bull. Fan Mem. Inst. Biol. **10**: 160. 1940). This circumstance is doubtless due to a mixture of numbers, as the data on the field label of our specimen are different, while Hu's description of the *Mangifera* obviously does not pertain to our plant.

Both *Hippocratea cambodiana* and *H. Grahamii* are placed by Loesener (in Nat. Pfl. ed. 2. **20b**: 216. 1942) in *Hippocratea* subgen. *Euhippocratea* sect. *Thyrsiflorae,* whereas *Hippocratea indica* and *H. arborea* are placed by him in *Hippocratea* subgen. *Euhippocratea* sect. *Micranthae* (op. cit. 212).

SUMMARY

Three new Chinese species of Hippocrateaceae are above described and seven new combinations are proposed in *Loeseneriella* and *Pristimera* for species of southeastern Asia. The seven species of capsular-fruited Hippocrateaceae now known from China may be keyed as follows:

Flowers comparatively large, the petals at least 4 mm. long, often spreading at anthesis, the disk conspicuous, annular-pulvinate, 1–1.5 mm. high, slightly constricted near the middle; capsules usually obovate-elliptic (*Loeseneriella*).

Inflorescence-branches and pedicels essentially glabrous, the pedicels 5–15 mm. long at anthesis; ovules 4 per locule; petioles 2–4 mm. long; leaf-blades usually 4–7 × 1.5–3.5 cm. (Hongkong, Kwangtung, Kwangsi).. *Loeseneriella concinna.*

Inflorescence-branches and pedicels puberulent at anthesis, the pedicels 2–8 mm. long at anthesis; ovules 8–10 per locule; leaf-blades 5–10.5 × 2–6 cm.

Leaf-blades oblong-elliptic, the acumen 5–10 mm. long; petioles 5–8 mm. long; petals 4–5 × 1.7–2.5 mm.; filaments 1–1.7 mm. long (Hainan)............ .... *Loeseneriella Merrilliana.*

Leaf-blades elliptic, obtuse or short-cuspidate; petioles 2–5 mm. long; petals larger, 5–8 × 2.5–4 mm.; filaments 2–2.5 mm. long (southern Yünnan)..... .... *Loeseneriella yunnanensis.*

Flowers small, the petals less than 3 mm. long, suberect at anthesis, the disk obscure, scarcely apparent as a pulvinate thickening at base of stamens; capsules narrowly oblong (*Pristimera*).

Petals about 1 mm. long at anthesis; ovules 2 per locule; capsules 2-seeded.

Leaf-blades chartaceous, usually 3.5–10 × 2–5 cm.; capsules at maturity (not known for *P. setulosa*) 3–4.5 × 1–1.5 cm.

Young branchlets and inflorescence-branches glabrous, usually subterete (Hainan; also India, Indo-China, Malaysia, etc.)...... *Pristimera indica.*

Young branchlets and inflorescence-branches densely setulose with apparently glandular hairs, sharply quadrangular (Yünnan)..... *Pristimera setulosa.*

Leaf-blades chartaceous to subcoriaceous, usually 10–17 × 5–9 cm.; capsules at maturity 6.5–9.5 × 2.5–3.5 cm. (southern Yünnan; also northeastern India and Burma).. *Pristimera arborea.*

Petals 2.5–3 mm. long at anthesis; ovules 6 per locule; capsules 7–10.5 × 2–3 cm., usually 6-seeded; leaf-blades coriaceous, usually 12–15 × 5–9 cm. (southern Yünnan; also Indo-China and Burma)............... *Pristimera cambodiana.*

In addition to these seven species, another apparently undescribed species of *Loeseneriella* from China is represented by *R. C. Ching 6573* (NY), from Chang Tung, E. Tan Shan, Kwangsi. This is a distinct species with copiously pubescent petals, but the collection seems inadequate to be the sole basis of a new species.

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A NEW SPECIES OF ISOETES FROM NEW GUINEA*

A. H. G. ALSTON

Isoëtes habbemensis sp. nov.

Rhizoma bilobatum(?), circa 3.5 × 1.5 cm., 1 cm. altum, appresse semi-globosum, sursum foliorum fasciculum gerens, subtus radicibus nigro-brunneis circa 2 mm. in diametro dense indutum. Folia leviter curvata, usque ad 14 cm. longa, medio circa 3 cm. in diametro, in sectione semi-circularia, dorso rotundata, supra subplanata, nervo subprominente et marginibus leviter alatis; foliorum parte superiore viride, lacunis circa 4 mm. longis, apicibus fallentibus; parte inferiore foliorum circa 3 cm. longa, pallide rufo-fuscescente, basin versus late alata usque ad 1 cm. lata. Stomata nulla. Ligula deltoidea. Velum nullum. Sporangia obovato-oblonga, circa 1 cm. longa, 4 mm. lata, multilocularia. Megasporae circa 575 μ in diametro, sublaeves, valde tricarinatae, siccitate pallide griseo-albidae. Microsporae dense echinulatae, circa 43 μ in diametro, siccitate fuscescentes.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9440* (TYPE in herb. Brit. Mus.), *9441* (form with short recurved leaves), very abundant in marginal shallows; 4 km. N. E. of Wilhelmina-top, alt. 3660 m., *Brass & Myer-Drees 9974* (form with shorter leaves), common in stony shallows of a lake. The cited specimens are deposited in the herbarium of the British Museum, and duplicates are in the Gray Herbarium.

This species is separated from *I. neoguineensis* Bak., the only other species recorded from New Guinea, by its nearly smooth megaspores, which are very slightly rugose on the back. These megaspores are greyish white when dry and light brown when wet. *Isoëtes neoguineensis* was first collected by A. Giulianetti on Mount Scratchley at 10000–13000 ft., and recently by Brass (no. *4366*) in the shallows of an alpine lake at 3680 m. on Mount Albert Edward. The megaspores were incorrectly described as "laeves" by Baker; they are strongly tuberculate. *Isoëtes philippinensis* Merrill & Perry, from a stream at 400–500 m. near Momungan, in Lanao Province of Mindanao, is separated by the reticulate sculpturing of its megaspores. The megaspores of I. *sinensis* Palmer, which was found in a pond near the Ming tomb in Spirit Valley (Nanking), are conspicuously crested. The other Chinese species, *I. hypsophila* Hand.-Maz., from moorland pools at 3600 m. in Yunnan, has smooth mega- and microspores, while the Indian *I. coromandeliana* L. f. has tuberculate megaspores.

BRITISH MUSEUM (NATURAL HISTORY),
LONDON.

*Botanical Results of the Richard Archbold Expeditions.

NEW OR CRITICAL EUPHORBIACEAE FROM THE AMERICAS

L. Croizat

With one plate

This paper consists of the descriptions of various new species and varieties, a new genus *Moacroton* from Cuba, and critical notes and records, reductions, and transfers. Unless otherwise stated, the types of the forms herein described are preserved in the herbarium of the Arnold Arboretum.

Phyllanthus Linnaeus

Phyllanthus vichadensis sp. nov.

Fruticulus caules strictos plures erectos e rhizomate perenni edens, ramis glaberrimis exalatis subexalatisve. Foliis ellipticis carnosulis enerviis 5–7 mm. longis, 2 mm. latis, utrinque aequo iure acuminatis petiolulo ca. 1 mm. longo, stipulis subsetaceis integris ca. 2 mm. longis. Floribus secus apicem ramulorum dispositis, ♂ ad 3 capitulatim aggregatis subsessilibus, ♀ longius pedicellatis saepissime singulis. Perianthio ♂ ca. 2 mm. longo 2.5 mm. lato 5-lobo, antheris 3 in columna ca. 1.5 mm. alta coalitis longitudinaliter dehiscentibus, columna basi incrassata revera haud glandulosa. Perianthio ♀ magnitudine fere ♂ 5-lobo, lobis costatis rotundato-ellipticis, disco nullo subnullove, ovario globuloso depresso ca. 1 mm. in anthesi magno, stylis 3 ca. 1 mm. longis e basi liberis subliberisve apice bilobato partitis, pedicello sub fructu nonnihil apice incrassato ad 4 mm. longo.

Colombia: Comisaria El Vichada: About 70 km. southeast of Orocué, *Haught 2779.*

This new species is described as an inconspicuous perennial of the open *llanos.* Its habit is reminiscent of *P. diffusus* Kl., an annual weed with which it was originally confused in the herbarium. Fragments of *Leprieur 319* and *Schomburgk 529* in our herbarium show that it definitely differs from *P. hyssopifolioides* H. B. K. (well represented by *Williams 15945a;* Venezuela, Amazonas, Puerto Ayacucho) and *P. guianensis* Kl. in foliage as well as in floral characters. It may be remarked that the habit and gross morphology of the latter is reminiscent of the species in the vicinity of *P. caroliniensis* Walt.

Croton Linnaeus

Croton caboensis sp. nov.

Frutex lignosus innovationibus pallide ochraceis velutino-hispidis demum glabratis. Foliis pro more ovatis, interdum lanceolatis vel oblongo-ovatis, 5–8 cm. longis, 2–5 cm. latis, olivaceo-brunneis vel brunneis, submembranaceis, subtus laxius stellato-pubescentibus subgriseis, supra pilis subsimplicibus more proprio adpressis setoso-pubescentibus, apice breviter acuminatis, basi rotundatis vel leviter cuneatis, margine subintegris ciliatis, nervis adscendentibus ca. 7–9-jugis, primo jugo ramoso, glandulis stipulisque nullis subnullisve, petiolo tomentello gracili, 0.5–2.5 cm. longo. Inflorescentia spicata brevi ad 4 cm. longa. Floribus ♂ gracilius pedicellatis, pedicello ca. 3 mm. longo, perianthio totidem lato longoque, petalis sepalisque subaequalibus, staminibus ad 15. Floribus ♀: perianthio ca. 3 mm. longo, totidemque lato, apetalo, lobis 5 fere ad basem liberis, costulatis, caeterum glabratis tenuibusque margine integris, ovario subglobuloso pallide ochraceo hispido ad 3 mm. magno, stylis 3, cruribus fere ad basem partitis, 3.2 mm. totis longis, glandulis 5 discretis, pedicello crasso ca. 1 mm. longo, semine ca. 7 mm. longo, 3–3.5 mm. lato, pallido, valde nitido, testa facie anteriori praesertim obscurissime grosseque rugulosa, caruncula subquadrangula parva, columella fructu delapso ad 7 mm. longa, coccis tomento hispido indutis, epicarpio verruculoso.

MEXICO: Baja California: Todos Santos, Cape Region, *T. S. Brandegee s. n.*, Oct. 4, 1899 (TYPE, Herb. Univ. Calif.); San José del Cabo, *T. S. Brandegee s. n.*, Sept. 11, 1891; Corral Piedras, *Katharine Brandegee s. n.*, Sept. 16, 1893.

My first impulse on examining this peculiar plant was to treat it as a subspecies of *C. fragilis* H. B. K., for it clearly belongs in the affinity of that species. However, a careful study of the group of *C. fragilis* H. B. K. as a whole indicated that if this form be placed under that species it was necessary to merge under this binomial numerous other allied forms that have uncontroversially been named, characterized and accepted as distinct entities. In addition, the apparently substrigose indumentum of the upper surface of the leaf, the large and shiny seeds, and the very hispid indumentum of the young capsules are characters which separate *C. caboensis* Croiz. from all other allies of *C. fragilis* H. B. K. at a glance. Baja California, lastly, is well known as a region of much endemism. *Croton flavescens* Greenm. has a quite different indumentum, and sharp keels on its capsule valves.

Croton culiacanensis sp. nov.

Frutex 1–2 m. altus, innovationibus tenuiter puberulis griseis, citius glabratis. Foliis lanceolato-ovatis vel lanceolatis, 3–7 cm. longis, 1.5–4 cm. latis, subtus griseo-tomentulosis, supra pallide viridibus, apice breviter acuminatis, basi rotundatis vel cuneato-rotundatis, eglandulosis sed laminae ipsius basi more proprio subauriculato-callosa, margine subintegris, venis ca. 5–6-jugis primo jugo laminam dimidiam attingente, petiolo graciliore 1–2.5 cm. longo, stipulis subnullis. Inflorescentia 2-sexuali, spicata, gracili, ad 10 cm. longa. Floribus ♂: perianthio delicato ca. 2 mm. longo, 3 mm. lato, petalis sepalisque subaequilongis, staminibus ca. 15–20. Floribus ♀: perianthio vix 2 mm. magno albicante, lobis (fructu ineunte) ca. 3.5 mm. longis 2 mm. latis, margine subreduplicativis subintegris, costatis, petalis nullis, glandulis in disculum connatis latis at haud conspicuis, ovario ca. 2 mm. longo latoque albicante, hispidulo, obvie 3-cocco, stylis 3, quove iteratim partito, ca. 2.5 mm. longo.

MEXICO: Sinaloa: Culiacán, *E. Palmer 1507* (TYPE); Ymala, *E. Palmer 1446;* Culiacán, *Brandegee s. n.*, 1904; Mazatlán, *Eyerdam & Beetle 8660.*

Currently this has been identified as representing *C. Watsonii* Standl., or as *C. Ortegae* Standl. It is close to both in its affinities, but cannot easily be confused with either. *Croton Watsonii* Standl. is endemic to the eastern coast of Mexico, and has much larger ♀ flowers, with a definitely silvery indumentum; the undersurface of the leaf is silvery lepidote, not puberulous or tomentose. *Croton Ortegae* Standl. which is known from the western coast of Mexico, also has much larger ♀ perianths, styles cleft but once, smaller ovaries, and, above all, conspicuous tubular glands at the apex of the petiole. In *C. culiacanensis* Croiz. no glands appear, and the base of the blade is somewhat corrugated, and subauriculate in a peculiar manner.

Croton gynopetalus sp. nov.

Frutex, innovationibus griseo-tomentosis tardius glabratis. Foliis ovatis, 2.5–5 cm. longis, 0.5–2.5 cm. latis, utrinque sed subtus magis conferte tomentosis, supra olivaceis subtus cinereis vel cinereo-roseatis apice latius acuminatis basi rotundato-cuneatis vel rotundatis, margine subintegris vel plus minusve grosse dentato-serratis, penninerviis, nervis ca. 5–8-jugis adscendentibus, glandulis subsessilibus patelliformibus ceraceis obviis 2, petiolo 1–1.5 cm. longo, stipulis fere nullis. Inflorescentia spicata ca. 3–5 cm. longa. Floribus ♂ : perianthio in alabastro ca. 2 mm. magno, staminibus, ut videtur, 10–12, pedicello brevissimo. Floribus ♀ : perianthio ca. 3 mm. longo, 2 mm. lato, lobis 5 erectis, postico 1 minore, caeteris subaequalibus obovato-ligulatis, integerrimis, petalis setaceis, ovario ellipsoideo ca. 2 mm. longo tomentello griseo, stylis 3 ad basem partitis ca. 2 mm. longis, disco sat evoluto.

MEXICO: Oaxaca: San Geronimo, *Purpus 7159* (TYPE, Herb. Chicago Nat. Hist. Museum).

The position of this new species is doubtful. The material now available clearly shows that a complex of more or less closely related forms ranges between Guatemala and Vera Cruz, speciating as follows: (1) by more or less extensive reductions in the size of the lobes of the ♀ perianth which are nearest the axis of the inflorescence, and by an increase in the number of the lobes so reduced; (2) by a tendency in the foliage to become stabilized either as entire or as serrate, the difference between extremes being of specific order, all floral characters left aside; (3) by variations in the size of the ♀ perianth and capsule.

To the complex just mentioned belong: (a) *C. jutiapensis* Croiz., Guatemala; (b) *C. itzaeus* Lund., Yucatán; (c) *C. gynopetalus* Croiz., Oaxaca; (d) *C. ramillatus* Croiz. and its var. *insignilobus* Croiz., Chiapas and Vera Cruz. Of these five entities, two, *C. ramillatus* Croiz. and *C. jutiapensis* Croiz. have plainly anisomerous ♀ perianths, the remaining three showing also some irregularity in the size of the lobes of the ♀ flower, one or more of which tend to be smaller than the rest. This group, consequently, varies in the ♀ perianth in a manner strongly suggesting the modifications taking place in this organ in *C. capitatus* Michx., *C. Palmeri* S. Wats., *C. leucophyllus* Muell.-Arg. of northeastern Mexico and Texas, and in *C. mentiens* (S. Moore) Pax and its allies of Brazil.

Croton gynopetalus Croiz. has foliage intermediate between that of *C. ramillatus* Croiz. and *C. itzaeus* Lund., that is, more or less entire to dentate-serrate. It differs from both in the presence of petals in the ♀ perianth; from the former also in the much larger perianth-lobes, only one lobe being reduced; and from the latter in the much less pubescent and grayish, more definitely ellipsoid ovary. The position of *C. ramillatus* Croiz. var. *insignilobus* Croiz. is still doubtful as between *C. ramillatus* Croiz. and *C. gynopetalus* Croiz., and will remain so until the full significance of the petals in the ♀ flower of single known collection of the latter is ascertained.

Croton ramillatus sp. nov.

Fruticulus lignosus, videtur dioecius, plus minusve intricatim ramosus, innovationibus trichomatibus stellatis haud delicatis pallide luteis vel subcinereis vestitis, citius glabratis. Foliis ellipticis vel ovato-lanceolatis, utrinque fere aequo jure attenuatis tomentosisque, supra brunneis vel olivaceis subtus sordide cinereis, margine integerrimis, nervis adscendentibus ca. 5–7-jugis penninerviis, glandulis tubulosis minimis vel saepius subnullis, petiolo sat gracili 3–5 mm. longo. Inflorescentiis exacte spicatis, plerumque 7–10 cm. longis. Floribus ♂ : staminibus ca. 10 in perianthio ca. 2 mm. longo latoque, pedicello vix 1.5–2 mm. longo. Floribus ♀ : perianthio habitu erecto, more proprio anisolobo, scilicet lobis posticis ca. 4 valde diminutis subsetaceis ad 1 mm. longis, anticis ca. 3 ligulatis rotundatis margine integerrimis ca. 2 mm. longis, disco valde adpresso subnullove, ovario rotundato pallide hispidulo ca. 1.5 mm. longo latoque stylis 3, quove ad basem partito ca. 2 mm. longo, capsula sub fructu glabrata, coccis subtrigonis vel potius lineato-carinatis.

MEXICO: Vera Cruz: Barranca de Panoya, *Purpus 8450* (TYPE, Herb. Chicago Nat. Hist. Museum); Zacuapan, *Purpus 2114, 2415;* Mata Zarza, *Purpus 9324.* Three ♂ collections, all from Vera Cruz, *Purpus 14045, 14145, 16369,* may also belong here.

This new species has been confused with *C. rhamnifolius* H. B. K. and *C. sphaerocarpus* H. B. K. (*C. morifolius* Willd. sensu Muell.-Arg.), which it hardly resembles at all. In its vegetative characters it strongly suggests *C. Sutup* Lund., but the erect ♀ flower with uneven lobes up to 8 in number, and the simple cleft styles set it apart from that species in a decisive manner.

Croton ramillatus var. **insignilobus** var. nov.

A var. *typico* lobis perianthii ad 5, anticis majoribus, postici minus diminutis, capsula — ut videtur — paullo majore discedit.

MEXICO: Chiapas: East of Monserrate, *Purpus 10066* (Herb. Univ. Calif.).

This variety is discussed under *C. gynopetalus* Croizat.

Croton Shreveanus sp. nov.

Frutex ca. 2-metralis, innovationibus apice hispido-lanulosis citius glabratis. Foliis griseo-viridibus longe ovatis vel elliptico-ovatis, 5–12 cm. longis, 2.5–6.5 cm. latis, stipellis anticis 2–4 (neque glandulis more generis veris) ad costae originem positis, limbo apice sat breviter acuminato, basi rotundato vel subcordato, margine tenuissime glanduloso-serrato, primum tomenti copia griseo vel griseo-olivaceo, citius utrinque glabrato at margine setuloso, nervis adscendentibus ca. 6-jugis, petiolo ca. 1–2 cm. longo, stipulis subnullis, primo tomentoso dein glabrato sed hinc inde semper hispido. Inflorescentiis spicatis ad 13–15 cm. longis. Floribus ♂ : perianthio ca. 3 mm. lato, 2.5–3 mm. longo, petalis sepalisque subaequilongis, staminibus ca. 15, filamentis basi valde lanulosis. Floribus ♀ :

perianthio minuto, vix 1.5–2 mm. lato, 1–1.5 mm. longo, lobis valde acutis triangularibus integris vix accrescentibus, petalis minimis ligulatis, ovario globuloso ca. 1.5 mm. magno, albicante, hispidulo, stylis 3 ca. 5 mm. longis, cruribus ad tertium inferum partitis.

MEXICO: Sinaloa: Capadero, Sierra Tacuichamona, 3000 feet above sea-level, "slender spreading shrub 2 m. high," *Gentry 5580* (Herb. Univ. Calif.; duplicate in Herb. F. Shreve).

This shrubby species belongs in the affinity of *C. adspersus* Benth., which also occurs in western Mexico but ranges southward. It is a very distinct entity, easily recognized by the peculiar stipellae of the limb, reminiscent of the appendages of certain species of *Alchornea* Sw., but very seldom found in *Croton*. It is not *C. Roxanae* Croiz. from Nayarit, Sinaloa and, possibly, Guerrero, which is directly allied with *C. sphaerocarpus* H. B. K., and *C. fragilis* H. B. K.

Croton sancti-lazari sp. nov.

Fruticulus dioecius intricatus, innovationibus tomento stellato hispido pallide citrino vel aurantiaco parcius indutis, serius glabratis. Foliis ellipticis vel sublanceolato-ellipticis 1–2 cm. longis, 0.3–0.9 cm. latis, integerrimis, apice plus minusve late rotundatis, basi rotundato-cuneatis, subtus cinereis vel pallide luteis hispido-tomentosis, supra viridibus tomento stellato dissito glabratis, tenellis toto hispido aurantiacis vel fulvescentibus, haud lepidotis, nervis adscendentibus ca. 5–7-jugis, petiolo brevissimo 3 mm. longo vel minore, glandulis nullis, stipulis subcarnosis, triangularibus. Inflorescentiis spicato-capitatis aurantiacis vel lutescentibus, pro more oliganthis. Floribus ♂ : perianthio hispido-tomentoso ca. 2 mm. lato, 1.5 mm. longo, lobis triangularibus, petalis glabris subaequilongis, staminibus ca. 10. Floribus ♀ : perianthio vix 2 mm. longo latoque, lobis acutis triangularibus, petalis (videtur) nullis, ovario trigono subglobuloso dilute aurantiaco grossius tomentoso ca. 2 mm. longo, 1.5 mm. lato, stylis 3 carnosulis, ca. 2–2.5 mm. longis, quove fere ad basem partito, semine ovato apice sat acuminato ca. 3 mm. longo, 2 mm. lato.

MEXICO: Coahuila: South of Castaños, rocky slopes of El Puerto de San Lazaro, *Wynd & Mueller 155* (TYPE ♂, Herb. Arnold Arb.; ♀ Herb. F. Shreve); Coahuila-Chihuahua boundary: Sierra Almagre, "bushy 1–2 feet tall, on floor of open canyons," *Johnston & Mueller 1141* (Herb. Gray).

A very strong species, related, but not closely, to *C. hypoleucus* Schlecht. and its group. It suggests in certain of its vegetative parts dwarfed states of *C. fruticulosus* Torr. The absence of lepidote hairs throughout well separates *C. sancti-lazari* Croiz. from somewhat similar early spring growth forms of *C. neomexicanus* Muell.-Arg., as represented by *M. E. Jones 29177* collected near Laredo, Texas.

Croton lotorius sp. nov.

Frutex ca. 5-pedalis, ligneus perennis, innovationibus laxe cinereo-tomentellis. Foliis griseo-viridibus supra glabratis subtus tenuiter griseo-tomentosis, ovatis, 3–5-plinerviis, 2.5–5 cm. longis, 1.5–3 cm. latis, nervis ca. 6-jugis patentibus vix anastomosatis, margine obtuse dentatis vel duplicato-dentatis crenis glandulosis ad 4 per cm., apice plus minusve acuminatis, basi rotundatis, petiolo gracili 1–2 cm. longo apice glandulis 2 stipitatis ornato, basi stipulis acutis vel setaceis integris fulto. Infloescentiis gracilibus spicatis 2-sexualibus ca. 10 cm. longis. Floribus ♂ : perianthio ca. 1.5–2 mm. lato, staminibus paucis, pedicello ca. 1 mm. longo. Floribus ♀ : perianthio inter generis minimo vix 1.5–2 mm. longo subcampanulato, pedicello ca. 0.5 mm. longo; calyce hispidulo, fere ad basim partito, lobis integris apice virescentibus, ovario globuloso hispidulo albicante, stylis gracilibus ca. 2 mm. longis partitis. Caetera desunt.

GUATEMALA: Huehuetenango: Between Santa Ana Huista and Rancho Lucas, Sierra de los Cuchumatanes alt. 800–900 m., *Steyermark 51332*.

This plant is used in baths and is locally known as "sanalotodo," a name frequently given to herbs supposed to be panaceas. It suggests *C. trinitatis* Millsp., but that is a strictly herbaceous plant, while *C. lotorius* Croiz. is manifestly woody, and differs further in the characters of its indumentum.

Croton pyriticus sp. nov.

Arbor 20-metralis et ultra alta. Innovationibus lepidotis, lepidibus centro brunneis inde indumento velato. Foliis firme chartaceis late ovatis vel triangulari-ovatis 4–9 cm. latis, 4–11 cm. longis, apice abrupte breviterque acuminatis, basi truncatis vel coarctato-cuneatis, margine subintegris repandulisve, adultis supra dissite leproso-lepidotis, subtus copia lepidum brunneo-argenteis vel more proprio subaureis (inde nomen specificum, e pyritis nitore desumptum), nervis utrinque manifestis late adscendentibus ca. 6-jugis, primo jugo majore ramoso, glandulis nullis, petiolo 1.5–6 cm. longo, stipulis nullis. Inflorescentiis apicalibus lateralibusque spicatis ad 10 cm. longis, interdum 1-sexualibus paniculato-ramosis. Floribus ♂ ca. 4 mm. longis, 7 mm. latis, lobis late ovatis petalis subaequilongis, staminibus ca. 15. Floribus ♀ ca. 7 mm. longis, fere totidem latis, perianthio ad basem partito, lobis late ovatis abrupte acuminatis ca. 2.5 mm. latis margine indumento molli sulphureo tectis dorso leproso-lepidotis, petalis obovato-ligulatis ad 2 mm. longis, aeque ac lobis margine indutis, ovario globuloso ca. 2 mm. magno, subargenteo-lepidoto, evoluto sub lente gravi nonnihil verrucoso, stylis pluri-partitis carnosulis ad 4 mm. longis, semine (e *Davidson 865*, in capsula ad specimen tantum solutum) 15 mm. longo, 10 mm. lato, antice ad latera compresso lineolis 3–4 e caruncula ortis obliquis utrinque exarato, rubro-brunneo maculoso-striato, postice nonnihil carinato, cocco (delapso) ad 19 mm. longo, epicarpio dissite verrucoso.

COSTA RICA: Vicinity of El Alto R. R. Station on road to Cartago, alt. 1550 m., *Allen 661* (TYPE); slope of Cerro Carpintera above La Unión de Tres Ríos, alt. 1350–1500 m., *Dodge & Goerger s. n.;* Alajuela: San Juanillo, alt. 1525 m., *A. Smith 2756;* same locality, alt. 1400 m., "Pacific tropical," *A. Smith 10008.* PANAMÁ: Chiriquí: Boqueli, alt. ca. 1300 m., *Davidson 865.*

In a previous paper, in Field Mus. Publ. Bot. **22**: 448. 1942, I provisionally referred this to *C. eluterioides* Lotsy. A careful study of all the species of this group so far known from Alabama to Costa Rica, undertaken on the basis of capsules and seeds, has eventually shown that Lotsy's species is not represented.

The forms in this affinity belong to Sect. *Eluteria* Griseb., and are characterized by a more or less densely lepidote foliage, and petaliferous ♀ flowers. Mueller-Arg., Schlechtendal, Baker and other authors have treated this section in a very unsatisfactory manner, which is understandable, considering that with few exceptions the species under it cannot be identified from characters other than those of the capsule and seed.

Croton argyranthemus Michx., extending from Georgia to Texas, suggests Sect. *Eluteria* Griseb. in some respects, and might ultimately prove to be an extreme depauperate form of this group. The species of Sect. *Eluteria* Griseb. which are all woody shrubs or trees, more or less densely lepidote and silvery, their ♀ flower petaliferous, styles usually several times dichotomous, and are natives of the region extending from Alabama to Panamá may be separated as follows:

Seed 11 mm. long, 6 mm. broad, or larger.
- Epicarp at maturity densely muricate with subwoody processes; seed 11 mm. long, 7 mm. broad, caruncle apical, conspicuous, testa ungrooved: Eastern Guatemala, Yucatán, Chiapas.............................*C. eluterioides* Lotsy.
- Epicarp at maturity with scattered subgranular warts; seed 14 mm. long, 9–10 mm. broad, caruncle frontal, inconspicuous, testa with 3–4 shallow grooves radiating downward from the caruncle: Panamá to Costa Rica, possibly northward to southern Guatemala.................................*C. pyriticus* Croizat.

Seed not over 10 mm. long, 5 mm. broad.
- Pedicel of fruit slender, scarcely or not at all woody, (1.5)–2 to 3.5 cm. long.
  - Leaves definitely elliptic, penninerved, with 8–14 or more pairs of subparallel very broadly spreading veins; seed 9–10 mm. long, 4–5 mm. broad; epicarp at maturity with few scattered warts: Vera Cruz and Chiapas, Mexico, to Venezuela, Ecuador, and the West Indies generally...........*C. nitens* Sw.
  - Leaves definitely ovate to lanceolate-ovate, with no more than 6–7 pairs of ascending veins; seed about 7 mm. long, 4–5 mm. broad; epicarp at maturity as in *C. nitens* Sw.; Central and Eastern Guatemala. *C. guatemalensis* Lotsy.
- Pedicel of fruit woody to subwoody, almost always stiff, less than 1.5(–2) cm. long.
  - Leaves elliptic, obtuse to short-acuminate, veins conspicuous, blade underneath markedly silvery to ashen; seed ellipsoid about 6 mm. long, 4.5 mm. broad: Alabama.................................*C. alabamensis* A. E. Smith.
  - Leaves lanceolate to lanceolate-elliptic, seldom ovate-cordate, veins weak or inconspicuous, blade underneath olivish to copper-colored, often glabrescent in age; seed ellipsoid 5–5.5 mm. long, about 4 mm. broad: Tamaulipas to British Honduras and Guatemala........*C. pseudochina* Schlecht. & Cham.
  - Leaves ovate to lanceolate-ovate, rounded to subcuneate at base, veins inconspicuous, blade underneath as in *C. pseudochina* Schlecht. & Cham.; seed scaraboid to sublenticular about 6 mm. long, 5–5.5 mm. broad: Chiapas?, Guerrero to Sonora............................*C. reflexifolius* H. B. K.

The specific limits in this group are not all evident in the same degree. Careful field studies and experimental cultivation are needed to elucidate the status of puzzling forms which gravitate around *C. pseudochina* Schlecht. & Cham., and *C. reflexifolius* H. B. K.

Croton flavescens Greenm. var. **Brandegeanus** var. nov.

A typo seminibus 4.5–5 mm. longis, neque 7–8 mm. longis recedit.

MEXICO: Sonora: Between Mazatan and Matapé, 4 miles north of Macori, *Wiggins & Rollins 391.*

Croton flavescens Greenm. in Proc. Amer. Acad. **39**: 81. 1903, and its forms constitute a complex, ranging from Michoacán, possibly farther south, to central Sonora. All these forms are more or less closely related to *C. fragilis* H. B. K., and *C. limnocharis* Croiz., but can be distinguished from these two species by the keel of the ovary and mature capsule, which is narrowed and prominent in *C. flavescens* Greenm., rounded off and quite obscure in the other species. The entire group is most controversial, and should be subjected to experimental cultivation.

Here also belong: *Brandegee s. n.*, Culiacán, Sonora; *Rose, Painter & Rose 9413*, Guerreo, Iguala, and *Ferris & Mexia 5164*, Sinaloa, Labradas. The type-collection of *C. flavescens* Greenm. is *Pringle 8667*, Michoacán: Volcanic hills, Monte León Station, 5000 feet above sea-level.

Croton glandulosus L. var. **septentrionalis** Muell.-Arg. in DC. Prodr. 15(2): 686. 1866; Ferg. in Missouri Bot. Gard. Rept. 12: 51. *pl. 17.* 1901, *p.p. descr. emend.*
Croton glandulosus L. var. *angustifolius* Muell.-Arg. loc. cit.; Ferg. op. cit. 53. *pl. 16. f. 2. syn. nov.*

Semine ca. 3.25 mm. longo, 2.75–3 mm. lato (inde primo intuitu scaraboideo neque ellipsoideo), caruncula in speciminibus siccis subventrali (i. e., seminis a dorso spectata haud manifesta), arillo in semine maturo saepius brunneo badiove. Foliis saepius (saltem ad ramorum floriferorum radicem) acuminatis.

LECTOTYPUS: Arkansas, Little Rock, *Engelmann 6*, 1835 (in Herb. Missouri Bot. Gard.).

Engelmann 6 is the lone specimen out of the six cited by Mueller-Arg. at publication which perpetuates the epithet *septentrionalis* in connection with the form currently identified as such in the literature. I cannot find the slightest differences by which to separate *Engelmann 6* from *Lindheimer 172*, Ferguson's presumed lectotype of *C. glandulosus* L. var. *angustifolius* Muell.-Arg.

Croton glandulosus L. var. **parviseminus** var. nov.

Semine ca. 3.25 mm. longo, 2.25 mm. lato (inde primo intuitu ellipsoideo neque scaraboideo), caruncula in speciminibus siccis subapicali (i. e., seminis a dorso spectata manifesta), arillo pallido maculis obscurioribus parcius notato.

TEXAS: *Lindheimer 691b* (Herb. Gray).

This variety, which better specimens and experimental cultivation may yet suggest to be better treated as a form, appears to be delicate, sparingly branched and subumbellate in habit. It does not seem to be frequent, for of it I have seen only three specimens, *Reverchon s. n.*, Buzzard Springs, Texas; *Sister Mary Clare s. n.*, Applewhite Rd. 18 miles South of San Antonio, Texas; *Sister Mary Clare 291*, Somerset Rd. 13 miles southwest of San Antonio, Texas. The type-collection was originally included by Mueller-Arg., in DC. Prodr. 15(2): 686. 1866, among the specimens cited as representing *C. glandulosus* L. var. *septentrionalis* Muell.-Arg.

Croton glandulosus L. var. **pubentissimus** var. nov.

Perennans, e loco natali a basi conferte ramosus subdumosus ca. 30 cm. altus, 50–60 cm. latus, cultus laxior at ramorum dispositione idem. Indumento subhispido copioso, foliorum lamina utrinque bene induta, pilis interdum adpressis habitu subsimplicibus. Perianthii lobis sub fructu quam capsula longioribus, semine ovoideo ca. 4 mm. longo, totidemque lato.

TEXAS: Kleberg Country, Padre Island, *Cory s. n.*, 1940.

This is a strong variety, quite unlike *C. glandulosus* L. var. *hirtus* (L'Hér.) Muell.-Arg., which it somewhat suggests in the abundant pubescence. It certainly differs from *C. glandulosus* L. var. *Lindheimeri* Muell.-Arg., which is a more delicate plant, with short indumentum, well represented by the material of *Martindale* and *Parker,* collected at the Philadelphia Navy Yard, and erroneously identified by Ferguson (in Missouri Bot. Gard. Rept. 12: 52. 1901) as *C. glandulosus* L. var. *scordioides* (Lamck.) Muell.-Arg. *Croton glandulosus* L. var. *Simpsonii* Ferg. which may not differ from *C. arenicola* Small, has none of the characters of this new variety.

Croton yavitensis sp. nov.

Arbuscula ad 7 m. alta innovationibus grossius stellato-tomentosis pallide luteis ochraceisve. Foliis fere exacte ellipticis 6–15 cm. longis 2–6 cm. latis apice vix dilatatis sat abrupte acuminatis basi rotundatis subauriculatisque, supra costa puberula excepta glabris subnitidis, subtus pube laxa late stellata parcius pubescentibus, penninerviis ca. 8-jugis, margine remote obscureque dentato-serratis, petiolo ca. 5 cm. longo, stipulis subnullis. Floribus ♂ ignotis. Floribus ♀ sub fructu tantum visis sat mancis: perianthio 1 cm. minore lobis 5 integris triangularibus haud accrescentibus, petalis abortivis nigricantibus vix 1 mm. longis; capsula sub-3-dyma cylindrico-truncata ca. 1.5 mm. magna indumento pallide luteo fere eradiato scabrida, stylis taeniatis iterum partitis involutis, semine ellipsoideo ca. 1 cm. longo 0.8 cm. crasso, brunneo haud nitido, caruncula manifesta antica nempe crinito-fissa.

VENEZUELA: Amazonas: Yavita, *Williams 14029.*

This is a strongly marked species of uncertain affinities.

Moacroton Croizat

Moacroton gen. nov.

Frutices vel arbores humiles e Cuba orientali, foliis coriaceis supra nitidis, subtus lepidibus plus minusve confertis adpressis tectis. Flore ♂ : perianthio in serie duplici 3–(5)-mero, petalis sepalis subsimilibus, pro ratione affinitatis valde diminuto: antheris 3–6 subsessilibus, scilicet in apice filamenti brevissimi potius pro glandula salutandi impositis, in anthesi subhorizontalibus, staminodiis nullis. Flore ♀ : perianthio 4–(5)-mero laciniis integris erectis vel suberectis, glandulis petalisve nullis: capsula coccorum dorso acutata: stylorum cruribus more proprio abbreviatis, integris vel 3–4-lobulatis: semine fere *Crotonis* L. in affinitate *C. reflexifolii* Kunthiani.

Genus optime a *Crotone* L. discedit: (1) Habitu proprio; (2) Natura androecii a genere Linneano omnino aliena, flore ♂ caeterum minimo; (c) Stylorum fabrica in *Crotone* L. haud obvia. Genus sistit relictum in regione Cubana formis peculiaribus celebrata. In systemate ad *Julocrotonem* Mart. inserendum.

Species typica: *Moacroton Leonis* Croiz.

This new genus keys out as follows:

A) ♂ flower petaliferous.
- a) Filaments filiform, at least elongate and cylindric; anthers introrse in anthesis, parallel with the center-line of the flower; stamens always more than 6 . . . . *Croton* L.
- b) Filaments very short, subglandular club-shaped; anthers almost horizontal in anthesis, perpendicular with the center-line of the flower; stamens 3–6 . . . . *Moacroton* Croiz.

B) ♂ flower apetalous.
a′) Stamens free... *Lasiocroton* Griseb.
b′) Stamens in a column.................................. *Leucocroton* Griseb.

This assemblage is remarkable on account of its genera differing mainly, if indeed not wholly, in the characters of the ♂ flower. Its species, however, can be separated only from the characters of the ♀ perianths. Great caution is therefore to be used, lest the ♂ flowers be overlooked as having slight significance.

Moacroton Leonis sp. nov. PL. I, FIGS. 5, 6.

Frutex videtur, innovationibus brunneo-furfuraceis. Foliis primo intuitu supra nitidis, glaberrimis atro-olivaceis valde coriaceis, margine bene revolutis, costa medio supra impressa, subtus prominente, nervis lateralibus nullis. Lamina longe elliptica, interdum vix ad medium parum dilatata, ad 6 cm. longa, 0.7 cm. lata vel minore, indumento supra nullo subtus lepidibus minimis valde sparsis, petiolo sat crasso ca. 0.5 cm. longo, glandulis ad basem limbi ipsissimam 2 pro more lente caute inquirendis, stipulis valde obsoletis. Inflorescentiis mihi adhuc obviis 1-sexualibus spicatis, ad 4–5 cm. longis, more proprio simul cum innovationibus prorumpentibus, quapropter aegre pro apicalibus lateralibusve salutandis, revera exquisite intercalaribus (vide Croizat in Bull. Torrey Club 70: 496–509. 1943), rachide crasso, floribus ♂ distantibus paucis in axilla squamulae valde ciliatae. Flore ♂ minimo quam 2 mm. minore pedicello gracili ca. 3 mm. longo: sepalis 4, petalis 3 subsimilibus pellucido-puncticulatis: androecio 3-mero antheris in apice filamenti clavati incrassati brevissimi. Flore ♀ in situ haud viso (adest fructus juvenilis tantum solutus, qui diligenter cum *M. trigonocarpi* (Griseb.) Croiz. comparatus, huic valde similis evadit): capsula 8 mm. longa, laevi, ca. 6 mm. lata, coccorum dorso carinato, hinc inde lepidibus sparsis ornata: stylo more generis brevissimo, vix 1 mm. longo, cruribus apice 1–3-lobulatis.

CUBA: Oriente: Region of Moa, tableland 400 m. high between the Río Cabanas and the Río Moa, growing on limonite, *Marie-Victorin & Clément 21735* (TYPE); same region, "charrascal" on serpentine at Playa de la Vaca, *Marie-Victorin & Clément 21774*.

It proves impossible under the present conditions to study the types of the species of Urban. However, the descriptions suggest that my new species is neither *M. Ekmanii* (Urb.) Croiz. nor *M. cristalensis* (Urb.) Croiz., which do not have narrowly elliptic leaves rounded or truncate at the tip. Nothing like my new species, likewise is to be found in Carabia's monographic study (Carib. Forest. 3: 114–135. 1942). The specific name honors Hermano León (Dr. Joseph Sylvestre Sauget y Barbier) of the Colegio de la Salle, Vedado, Havana, Cuba.

The inflorescence here described, if constant (which might well be the case), would constitute one more character further to differentiate *Moacroton* Croiz. from *Croton* L.

Moacroton trigonocarpus (Griseb.) comb. nov. PL. I, FIGS. 3, 4.

Croton trigonocarpus Wright ex Griseb. in Nachr. Gesell. Wiss. Gött. 1865, No. 7: 173. March 15th. 1865; Muell.-Arg. in DC. Prodr. 15(2): 576. 1866; Carab. in Carib. Forest. 3: 125. 1942.

Moacroton Ekmanii (Urb.) comb. nov.

Croton Ekmanii Urb. Symb. Antil. 9: 194. 1924; Carab. in Carib. Forest. 3: 125. 1942, *non* Leonard 1927.

Moacroton cristalensis (Urb.) comb. nov.

Croton cristalensis Urb. Symb. Antil. 9: 197. 1924; Carab. in Carib. Forest. 3: 125. 1942.

Urban appears to have overlooked *Croton trigonocarpus* Griseb., and it is not impossible that *Croton Ekmanii* Urb. and *C. cristalensis* Urb. may prove to be other than forms or varieties of Grisebach's much earlier species. I have seen authentic material of the latter, which patently differs from *M. Leonis* Croiz., but none of Urban's specimens. The transfers to *Moacroton* of all these entities is effected, consequently, as a matter of course, pending a final revision of the entire group.

Argythamnia P. Browne

I see no reason to maintain *Ditaxis* Vahl ex Juss. as a genus distinct from *Argythamnia*. Accordingly, I treat the latter as **Argythamnia** P. Browne subg. **Ditaxis** (Vahl ex Juss.) comb. nov.

Argythamnia coatepensis (Brand.) comb. nov.

Croton coatepensis Brand. in Zoe 5: 249. 1908.

The holotype, *Purpus 2827* (in herb. Univ. Calif.) has a ♂ flower with the technical characters of *Argythamnia,* that is, the staminal column is single-whorled with no more than 5 stamens. In all other characters it is very difficult to separate this plant from the numerous polymorphic states of *Argythamnia guatemalensis* Muell.-Arg. (*A. tinctoria* Millsp. in Field Mus. Bot. 1: 303. 1896, syn. nov.) which ranges from Central America to eastern and western Mexico and Venezuela (*Potter 5145,* Guanta, roadside on the outskirts of the city, Herb. Gray).

Argythamnia micrandra sp. nov.

Fruticulus vix pedalis, radice videtur annua, pilis malphighiaceis sat longis ad caules indutus, parce ramosus. Foliis ellipticis vel obovato-ellipticis 2–3.5 cm. longis, 1–2 cm. latis apice breviter acuminatis basi longe cuneatis, ultra medium dentato-serratis subtrinerviis, aeque ac caulibus indutis, petiolo ca. 1 cm. longo, stipulis lanceolatis ad 3–4 mm. longis. Perianthio ♂ vix 2 mm. lato, sepalis 4, petalis setaceis minimis, columna staminali 9-andra vix 1 mm. alta. Perianthio ♀ ad 5–6 mm. sub fructu vix maturo lato, sepalis petalisque 5, petalis glandulosis minimis subnullisve, ovario in anthesi vix 0.75 mm. magno pilis erectis longe hispido, stylis minutis bipartitis.

MEXICO: Guerrero: Coyuca, Cutzamala, *Hinton 6307* (Herb. Gray).

A very distinct, apparently weedy species. The 2-whorled minute staminal column, with about 9 stamens, is the technical character that places this entity under *Argythamnia* subg. *Ditaxis* (Vahl ex Juss.) Croiz.

Alchornea Swartz

Alchornea orinocensis sp. nov.

Arbuscula ad 10 m. alta, innovationibus rachidibusque parcius puberulis glabratisve. Foliis penninerviis basi antice optime stipellatis, elliptico-ovatis

6–21 cm. longis 4–11 cm. latis apice breviter acuminatis basi rotundato-cuneatis, margine dentato-serratis serraturis apice incurvis glandulosisque ad 3 per cm., nervis ca. 7-jugis, trabeculis evidentibus, glandulis maculosis secus costam in axillis nervorum positis, petiolo sat gracili ca. 10 cm. longo, stipulis subnullis. Floribus ignotis. Fructu capsulari epicarpio tenui sublaevi vix granuloso, coccis delapsis ad 8 mm. longis, columella ca. 5 mm. longa, semine fere exacte ellipsoideo ad 6 mm. longo, 4.5 mm. crasso subcylindrico, ad chalazam fere truncato ad micropylem abrupte acuminato, arillo striato-rimoso brunneo subnitido.

VENEZUELA: Amazonas: Alto Orinoco, Tamatama, *Williams 15833* (TYPE); same locality, *Williams 15087*.

The strictly penninerved leaves, and the well-marked stipellae at the anterior face of the blade near the insertion of the petiole, as well as the cicatricose glands along the midrib are characteristic.

Gitara Pax & Hoffmann

Gitara panamensis sp. nov.

Frutex vel arbuscula videtur, innovationibus hispidulis, cortice juvenili albicante rimoso, habitu toto rigido. Foliis obovato-lanceolatis 7–15 cm. longis, 2.5–6 cm. latis tenuiter chartaceis, glabrescentibus, penninerviis, trabeatis, nervis latius adscendentibus ca. 8-jugis, basi cuneatis vix vel haud truncatis, margine ad tertium inferum mediumve bene dentato-serratis (dentibus ad 7–8), apice abrupte sat longe caudatis, petiolo hispidulo ca. 0.5 cm. longo, stipulis membranaceo-scariosis basi incrassatis, triangulari-acuminatis, margine integris, adpressis ad 5 mm. longis. Inflorescentiis (videtur) lateralibus spicatis 1–4 cm. longis, mono-dioecis, floribus ♀ apicalibus terminalibusve. Perianthio ♂ simplici delicato ca. 3 mm. lato 2 mm. longo, ca. 5-lobo, staminibus ca. 30, 1.5 mm. longis, connectivo penicillato, staminodiis glandulisve nullis. Perianthio ♀ 6-mero lobis lanceolatis acuminatis integris anthesi peracta ca. 4–5 mm. lato, ovario maturescente ca. 5–6 mm. lato hispido, stylis 3 basi in columnan coalitis ca. 5–10 mm. longis subplumosis, glandulis nullis.

PANAMÁ: Hills between Pinogaṇa and Yavisa, *Pittier 6543*, 1914.

Gitara Pax & Hoffm. is a segregate from *Tragia* L., which latter consists of a multitude of forms as yet scarcely understood. Its technical characters strongly suggest *Angostylis* Benth., to judge from the descriptions and illustrations I have so far seen, but it is otherwise easily mistaken for *Argythamnia* P. Browne, having been originally identified, distributed as representing the latter genus. I retain *Gitara* Pax & Hoffm. as a genus for the present.

Gitara venezolana Pax & Hoffm. has ecaudate leaves much narrowed at the tip, with truncate bases, the venation appearing as if markedly 3-nerved. In these characters, and, possibly, the smaller ♀ flower, Pax & Hoffmann's species does not agree with mine.

Cunuria Baillon

Cunuria (?) **casiquiarensis** sp. nov.

Arbor ad 6 m. alta. Foliis firme coriaceis ellipticis 11–18 cm. longis, 7–10 cm. latis apice obtuse rotundatis, basi rotundato-cuneatis, margine integris, in sicco atrobrunneis, supra glaberrimis haud nitidis, subtus sparse minuteque puberulis, ad basem in lamina obscure cicatricoso-glandulosis, nervis patentibus ca. 10-jugis, petiolo validiusculo canaliculato 2–3 cm. longo stipulis subnullis. Inflorescentia ♂ ignota. Inflorescentia ♀ axillari rigida at 7–8 cm. longa indumento adpresso rufido tomentella. Perianthio ♀ 4–5-lobo, lobis vix 0.75 mm. longis triangularibus, petalis glandulisque nullis, pedicello sub fructu indurato, ad 1.5 cm. longo, ovario ovoideo ca. 1.5 mm. longo latoque trigono-costato pubescènte, stylis sessilibus simplicibus 3 vix 0.5 mm. longis patentibus, columella coccis delapsis gracili ca. 5 mm. longa, apice abrupte incrassata.

VENEZUELA: Amazonas: Alto Casiquiare, Capihuara, *Williams 15690.*

The genera in this assemblage are ill defined, and it is difficult to make identifications unless one has complete material. *Cunuria* is suggested by the intangibles of habit, and the characters of the foliage, but the inflorescence is somewhat unconventional, when compared with that of *C. Spruceana* Baill., the standard-species. *Conceveiba* Kl. and *Conceveibastrum* (Muell.-Arg.) Pax & Hoffm. appear to ruled out of consideration by their foliage, and the manifest glands at the base of the ♀ perianth.

Sebastiania Sprengel

Sebastiania pusilla sp. nov.

Fruticulus glaberrimus parte epigea, ut videtur, vix ultra palmari, ramis emortuis persistentibus intricato-ramosus. Foliis statu juvenili tantum visis carnosulis penninerviis pro more obovatis ca. 1 cm. longis totidemque latis margine incrassatis sat obscure denticulato-serratis omnino exaristatis, nervis 3–4-jugis, limbo toto eglanduloso apice obtuse acuminato vel retuso-truncato basi longius cuneato petiolo glanduloso canaliculato apice saepius laeviter papilloso ca. 1 cm. longo, stipulis papillosis triangulari-lanceolatis ad 0.5 cm. longis. Inflorescentiis terminalibus, basi flores 1–2 ♀ gerentibus nec ultra 2–2.5 cm. longis simplicibus spicatisque. Flore ♂ vix 1.25 mm. longo latoque in axilla squamulae basi glandulis 2 baculiformibus ornatae singulo: perianthio subintegro cupulari, staminibus subsessilibus 3. Flore ♀ vix 1.5 mm. longo, totidemque lato: perianthii lobis 3 late ovatis margine erosulis, glandulis obovoideis simplicibus subsimplicibusve cum lobis alternis, ovario in carinis corniculato, stylo fere ad basem 3-partito, cruribus vix papillosis simplicibus recurvis, semine ca. 1.75 mm. longo, 1.5 mm. lato, carunculato, pallide ochraceo-brunneo laevissime reticulato.

URUGUAY: Paysandú, Chapicuy, banks of the Río Uruguay, Sta. Sofia, *Rosengurtt B-4169.*

This is a remarkable species agreeing with none of the sections in the genus, and certain to become the type of a new one in the future. The persistent large petaloid appendages of the ♀ flower, the corniculate ovary, the subsessile stamens borne in a subentire perianth are characteristic.

Sapium P. Browne

Sapium contortum sp. nov.

Arbuscula ad 60 cm. alta contorta, ramulis nigricantibus glaberrimis. Foliis subchartaceis ellipticis vel ovato-ellipticis, 3–8 cm. longis 1–3 cm. latis, basi latius rotundatis, apice abrupte acuminatis, margine obscure serrato-denticulatis hinc inde glandulis majoribus auctis, nervis latius adscendentibus ca. 8–12-jugis, petiolo gracili ca. 1 cm. longo, glandulis petiolaribus plus minusve elongatis retroflexis, stipulis rotundatis margine profunde scariosis alabastra vegetativa apice inflexo tegentibus ca. 2 mm. longis latisque. Inflorescentiis ♂ tantum visis apicalibus ad 8 cm. longis, floribus glomerulatis 7–13, glomerulis basi glandulis elongatis 2–3 fultis, perianthio generis, vix 1.5–2 mm. longo.

VENEZUELA: Amazonas: Puerto Ayacucho, *Williams 15891*.

This species thrives on exposed rocky ledges, and is unusually low-growing for the genus. It might prove to be a local form of *S. Aubletianum* (Muell.-Arg.) Huber, the leaf of which, according to Huber's figure (in Bull. Herb. Boiss., sér. 2, 6: 363. *f. 23.* 1906) is also obscurely serrate and bears scattered large glands. However, the foliage of *S. Aubletianum* (Muell.-Arg.) Hub. should in no case be shorter than 10 cm., and the character of the leaf margin in this group is not primarily a specific one. I have no material at present representing *Sapium guaricense* Pitt., *S. naiguatense* Pitt., and *S. paucistamineum* Pitt., but find nothing in the descriptions to indicate that they may be dangerously close to my new species. To judge from fragments of *Spruce 511*, originally determined in the Paris herbarium as representing *S. prunifolium* Kl., it seems probable that Klotzsch's species is the same as *S. Aubletianum* (Muell.-Arg.) Huber.

Euphorbia Linnaeus

Euphorbia zerioides Boiss. in DC. Prodr. 15(2): 58. 1862.
Euphorbia chiapensis Brandeg. in Univ. Calif. Publ. Bot. 6: 54. 1914. syn. nov.

As revealed by a comparison of *Purpus 6895*: Chiapas, Sierra de Tonala, and *Galeotti 3741*, the two species are absolutely synonymous.

Euphorbia segoviensis Boiss. in DC. Prodr. 15(2): 58. 1862.
Euphorbia Sloanei L. C. Wheel. in Cact. Succ. Jour. 11: 44. *fig.* 1939. syn. nov.

No difference exists between *Andrieux 105* and *Palmer 139* which may be said to be of significance, the two specimens being distinguished only by details of the pubescence, and the length of the petaloid appendages.

Euphorbia radians Benth. Pl. Hartweg. 8. 1839; Boiss. in DC. Prodr. 15(2): 74. 1862.
Euphorbia Stormiae Croiz. in Rev. Sudamer. Bot. 6: 13. 1939. syn. nov.

The differences that separate Bentham's species from my own are seemingly of little account. This species is treated by Boissier, op. cit. 71, 74, under Sect. *Poinsettia*, and by Wheeler, in Amer. Midl. Nat. 30: 482. 1943, under Subg. *Poinsettia*. A glance at material representing *E. lancifolia* Schlecht. and its allies might suggest that *E. radians* Benth. probably falls, on the contrary, under Boissier's Sect. *Dichilium*, that is, under Wheeler's Subg. *Agaloma*.

Chamaesyce S. F. Gray emend. Croizat

Chamaesyce arequipensis sp. nov.

Multiceps humilis erecta tota patule hispida, internodiis 1–2 cm. longis vel ultra. Foliis carnosulis ovatis vel rotundato-ovatis 1–1.5 cm. longis, 1 cm. latis sub lente subeveniis 3-nervis, margine subintegris apice tantum obscure lateque dentatis, petiolo 1–2 mm. longo, stipulis obscuris. Cyathiis in axillis solitariis, pedicello ad 4 mm. longo fultis late campanulatis ca. 2 mm. longis 1.3 mm. latis glandulis subhippocrepicis 4 conspicue appendiculatis appendice albicante inciso-dentata, laciniis ca. 3–4, ovario elongato-trigono hispidulo albicante, stylorum cruribus 3 fere ad medium partitis, basi in columnam brevissime coalitis, stigmatibus capitato-globosis; seminibus, videtur, ellipsoideis acuminatis, albicantibus, testa videtur sublaevi.

PERU: Arequipa: Prov. Camana, 4 km. from Caraveli on the road to Atico, alt. 1800–1900 m., *Metcalf 30341.* (U. S. Natl. Herb.).

The habit of this new species is reminiscent of that of *C. oranensis* Croiz. of Argentina, and *C. Barberiana* Croiz. of Paraguay.

Chamaesyce rochaensis sp. nov.

Annua vel pérennans repens tota pilis albidis intricatis sat grosse lanulosa caulibus prostratis crassitie fili emporetici minoris vel gracilioribus internodiis 1–2.5 cm. longis, stipulis interpetiolaribus profunde partito-fissis. Foliis bene anisomeris ellipticis rotundatisve emaculatis cum petiolulo vix 1–2 mm. longo ad 1 cm. longis vel brevioribus margine (apice rotundato praesertim) sub lente grossius serratis fabrica haud coriacea. Cyathiis subsolitariis ob internodia abbreviata sub apices sat congestis campanulatis vix 1 mm. longis pedicello ca. 1–1.25 mm. longo, glandulis appendice petaloidea minima praeditis, capsula rotundato-trigona tota lanulosa ad 2 mm. longa lataque, semine carinato-ellipsoideo maturo pallide brunneo haud acuminato sublaevi, scilicet rugis subnullis lente acri caute inquirendis, ad 1.3 mm. longo, 0.65 mm. lato.

URUGUAY: Rocha, Fortaleza Sta. Theresa, "rara in uliginosis," *Rosengurtt B-2645* (TYPE); same locality, *Lombardo 2488.*

This is one of the forms commonly placed in the herbarium under *Euphorbia thymifolia.* It differs, however, from Indian material, such as *Metz* (*Hoehnacker*) *67,* cited by Boissier in DC. Prodr. 15(2): 47. 1852, in its much larger capsules, its more robust habit, heavier pubescence and larger cyathia. It is not the same as *C. oranensis* Croiz. and *C. portucasadiana* Croiz., both of which are stouter plants with a different pubescence and other floral characters.

Chamaesyce lutulenta sp. nov.

Annua vel perennans radice recta subsimplici descendente quam parte epigea ut videtur majore insignis, cauliculis fili crassitie vel subgracilioribus ad 3–5, vix 2–4-ies partitis, totis, ut visis, nec ultra 5 cm. longis indumento lanoso albicante hispidulis. Foliis sat laxe lanosis suborbicularibus anisomeris ca. 0.5–0.7 cm. longis totidemque latis parte supera praesertim sub lente grosse denticulato-serratis emaculosis, petiolulo vix 1 mm. longo vel minore, stipulis interpetiolaribus late triangularibus denticulato-fissis. Cyathiis subsingulis purpurascentibus glabratis glabrisve arcte campanulatis vix ultra 1 mm. longis, glandulis rotundatis exappendiculatis (interdum margine albicanti-incrassatis), ovario rotundato-trigono glabro vix 1 mm. magno, semine ellipsoideo haud acutato nigricante sublaevi.

URUGUAY: Florida, Est. Timote, Estancia Sta. Clara del Dr. Gallinal, rare in moist localities, *Rosengurtt B-1654.*

This diminutive new species is strongly reminiscent on the whole of the North American *Chamaesyce Fendleri* (Torr. & Gray) Small, but is laxly hispid-lanose and has rounder dentate-serrate leaves.

EXPLANATION OF PLATE I

FIG. 1. *Croton poecilanthus* Urb. Section through ♂ flower in bud, showing position of anthers in vernation characteristic of *Croton* L. FIG. 2. *Croton corylifolius* Lam. Section through ♂ flower at anthesis, showing nature and position of the stamens (only few left) characteristic of *Croton* L. FIG. 3. *Moacroton trigonocarpus* (Griseb.) Croiz., ♀ flower. FIG. 4. *Moacroton trigonocarpus* (Griseb.) Croiz. Styles and stigmas at anthesis seen from above. FIG. 5. *Moacroton Leonis* Croiz., ♂ flower at anthesis seen from above. FIG. 6. *Moacroton Leonis* Croiz. Stamen seen from the side (in slight foreshortening). FIG. 7. *Croton poecilanthus* Urb., ♀ flower; left, a style. FIG. 8. *Croton corylifolius* Lam., ♀ flower; right, a style.

ARNOLD ARBORETUM,
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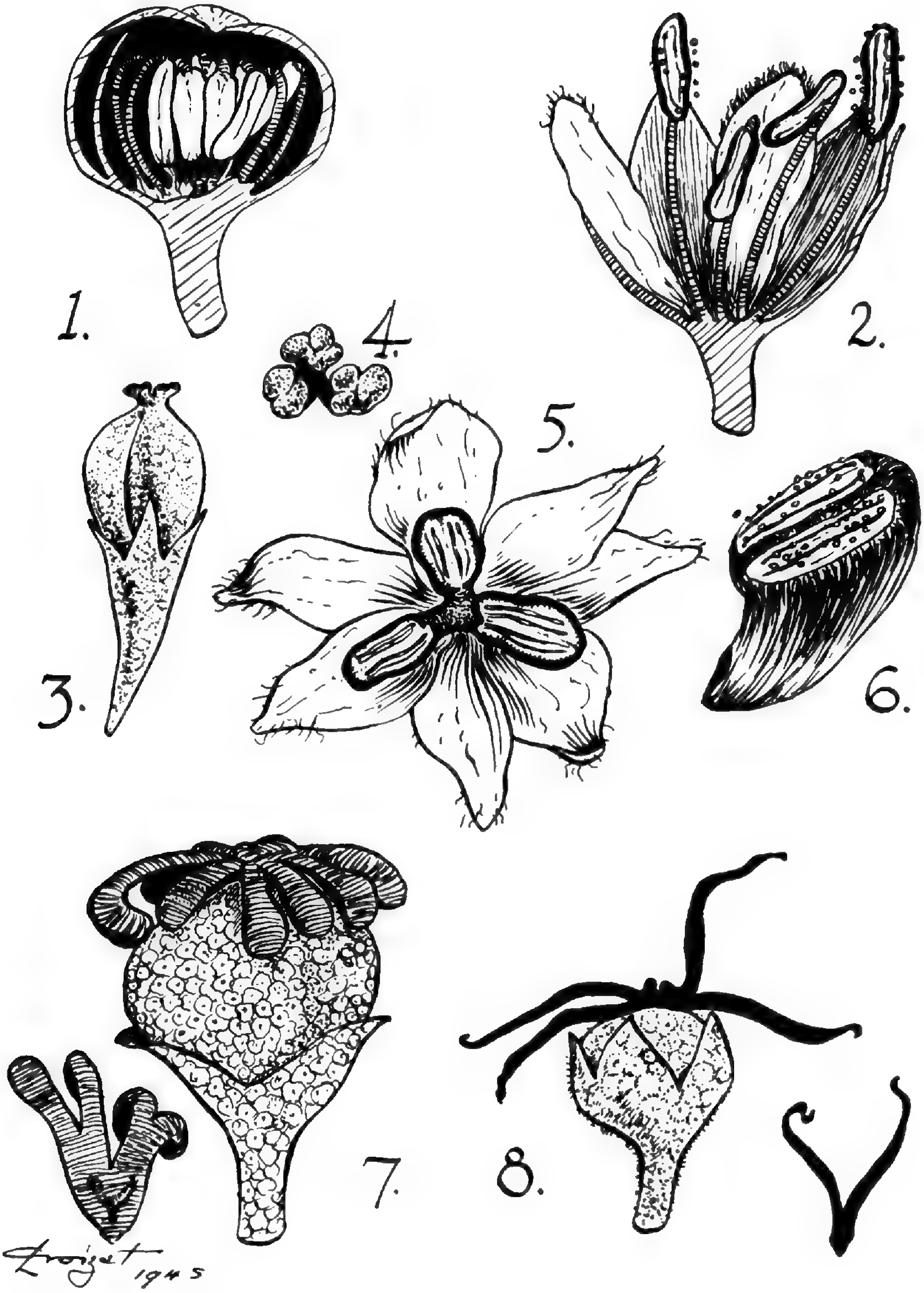

EUPHORBIACEAE FROM THE AMERICAS

NOTES ON THE FLORA OF KUNG PING SHAN, KWANGTUNG

F. P. Metcalf*

Recent expeditions to Indo-China during the years 1936, 1939, and 1940, undertaken jointly by the Botanical Survey, Lingnan University, and the Arnold Arboretum, Harvard University, resulted in the collection of approximately 2800 numbers, each number with abundant duplicates. Of these, about three hundred and fifty were actually collected in Kwangtung Province. Kung Ping Shan is located in the extreme western part of Kwangtung Province, a few miles north of the Tonkin border.

This collection was made by Tsang Wai-Tak during July, August, and September, 1936, from two localities, Na Leung and Kung Ping Shan, Fang Cheng District, located on the north side of the river that separates Kwangtung from Tonkin, northeast of the town of Tung Hing, Kwangtung, and about equidistant between the sea-coast of Kwangtung at the Tonkin border and the Kwangsi boundary.

This region, so close to both the Tonkin (Indo-China) and the Kwangsi borders, would be expected to have a flora somewhat similar to both these regions, but an unusual aspect of the problem is the fact that the flora is apparently more closely related to that of Hainan than to those of central, eastern, or northern Kwangtung. Of the species recorded in this paper as new to Kwangtung, about ten were formerly known only from Hainan, eight were previously known from both Hainan and Tonkin, and ten were known only from Tonkin.

In this paper notes are given on 32 species that are here first reported from Kwangtung, representing the following genera: *Tacca, Hedyosmum, Ficus, Artocarpus, Boehmeria, Helicia, Talauma, Fissistigma, Desmodium, Walsura, Dichapetalum, Elaeocarpus, Flacourtia, Homalium, Clethra, Diospyros, Anodendron, Xylinabariopsis, Heterostemma, Tabernaemontana, Erycibe, Premna, Gomphostemma, Rhynchotechum, Hedyotis, Lasianthus, Nauclea, Paederia, Uncaria, Wendlandia,* and *Xanthophytum.* Of these 32 species, about 20 are actually new to China proper. The genera *Talauma* and *Xylinabariopsis* are here first recorded from Kwangtung and China. In addition, distributional or technical notes are included on species of *Itea, Prunus, Turpinia, Schizomussaenda, Urophyllum,* and *Pentaphragma.*

These notes constitute only a preliminary report, as the novelties, of which there are about ten, need further study. In addition, some special groups, such as the Euphorbiaceae, Lauraceae, Caprifoliaceae, and Thea-

*This paper was prepared by Dr. Metcalf on the basis of a Milton-Clark Fund Grant, Harvard University, to Dr. E. D. Merrill, Director of the Arnold Arboretum, for use in assisting him in working up the large accumulated collections of Chinese material at that institution. Other papers will follow.

ceae are being taken care of by specialists, while the species of *Ormosia* and *Sabia* are reported in Sargentia 3: 1–120. 1943. It is probable that in this small collection from Kwangtung at least twenty per cent of the species will represent new records for the province.

TACCACEAE

Tacca Esquirolii (H. Lév.) Rehder, Jour. Arnold Arb. 17: 64. 1936.

Clerodendron Esquirolii H. Lév. Rep. Sp. Nov. 11: 298, 302. 1912; Fl. Kouy-Tchéou 439. 1915.

Tacca Paxiana Limpr. Pflanzenr. 92 (IV. 42): 16. 1928; Pei, Mem. Sci. Soc. China 1: 162. 1932.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26661,* Aug. 15–24, 1936. New to Kwangtung. Previously recorded from Kweichow, Yunnan, and Tonkin.

CHLORANTHACEAE

Hedyosmum orientale Merr. & Chun, Sunyatsenia 3: 36. 1940.

Hedyosmum nutans sensu Merr. Lingnan Sci. Jour. 5: 59. 1928; Groff, Lingnan Sci. Jour. 11: 87. 1930; *non* Swartz.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26692,* Aug. 15–24, 1936. The first record for Kwangtung and China proper. Formerly known only from Hainan.

MORACEAE

Ficus fistulosa Reinw. in Blume, Bidjr. 470. 1825; King, Ann. Bot. Gard. Calcutta 1: 114. *t. 150, 151.* 1888; Hook. f. Fl. Brit. Ind. 5: 525. 1888.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26829,* Sept. 10–18, 1936. The first record for Kwangtung and China. Formerly known from India to Burma, Indo-China, and the Malay Archipelago.

Ficus sikkimensis Miquel, Ann. Mus. Lugd.-Bat. 3: 225, 292. 1867; King, Ann. Bot. Gard. Calcutta 1: 89. *t. 113.* 1888; Hook. f. Fl. Brit. Ind. 5: 521. 1888.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26856,* Sept. 10–18, 1936. The first record for Kwangtung. Formerly known from Sikkim to the Khasia Hills in India, and Yunnan.

Artocarpus tonkinensis A. Chev. ex Gagnep. Bull. Soc. Bot. France 73: 90. 1926; Merr. Lingnan Sci. Jour. 6: 275. 1930, op. cit. 7: 303. 1931.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26749,* Aug. 25–30, 1936. YUNNAN: Szemao, *Henry 13015.* The first record for Yunnan, and the first as a wild plant in Kwangtung. Formerly known from Tonkin and Hainan; cultivated in Kwangtung.

This species seems to be very close to *Artocarpus Petelotii* Gagnep., which was described by him at the same time as *A. tonkinensis.* Specimens from Indo-China, determined as representing *A. Petelotii,* have very similar but somewhat more pubescent leaves.

URTICACEAE

Boehmeria macrophylla D. Don, Prodr. Fl. Nepal. 60. 1825; Wedd. in DC. Prodr. 16(1): 209. 1869; Hook. f. Fl. Brit. Ind. 5: 577. 1888.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26844*, Sept. 10–18, 1936. The first record for Kwangtung.

As usually interpreted, this species is reported from India, Indo-China, and Yunnan. The Yunnan and Indo-China material undoubtedly represents the same form as this Kwangtung specimen. There is, however, some question as to whether or not this represents the same species as that described by D. Don from Nepal; unfortunately we have seen no material from the classical locality.

PROTEACEAE

Helicia silvicola W. W. Smith, Notes Bot. Gard. Edinb. 10: 181. 1918.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26665*, Aug. 15–24, 1936.

This species was previously known only from the type locality, Szemao, Yunnan. Two specimens of *Henry 13075*, the type collection, are available for study; these are in flower. The Kwangtung specimen has mature fruits, of which a description follows:

Fruit ovoid to ellipsoid, 6–8 mm. long and 4–6 mm. wide, minutely and closely rufous-puberulent, with persistent style 15–18 mm. long, and short, rather stout pedicels 4–6 mm. long.

MAGNOLIACEAE

Talauma Candollii Blume, Bidjr. 1: 9. 1825; Hook. Bot. Mag. 72: *t. 4251*. 1846.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26656*, Aug. 15–24, 1936.

This represents the first record for the genus from China and from Kwangtung. The species ranges from Java, Sumatra, and Borneo to the Malay Peninsula, Siam, and Indo-China. The cited specimen closely matches a specimen collected by Sargent in Java and *Pierre 742* from Cambodia, Indo-China.

ANNONACEAE

Fissistigma polyanthum (Wall.) Merr. Philip. Jour. Sci. 15: 135. 1919; Merr. & Chun, Sunyatsenia 5: 59. 1940.

Uvaria polyantha Wall. List No. 6467. 1832, ***nomen nudum***.

Melodorum polyanthum Hook. f. & Thoms. Fl. Ind. 121. 1851; King, Ann. Bot. Gard. Calcutta 4: 131. *t. 172A*. 1893.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26503, 26667*, July–August, 1936. The first record for this species from Kwangtung. Formerly known from Assam to northern Burma, Siam, Indo-China, Hainan, and Kwangsi.

SAXIFRAGACEAE

Itea amoena Chun, Sunyatsenia 1: 258. 1934, Ic. Pl. Sin. 5: 19. *t. 219*. 1937.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26510, 26675*, July–August, 1936.

This represents the second collection for this province, the type being from Shap-Man-Tai Shan, a mountain on the Kwangtung-Kwangsi border. The species is to be expected in Tonkin, Indo-China, as the present collection was made only a few miles north of the border. Also known from Kwangsi (*Ching 8059*).

ROSACEAE

Prunus Fordiana Dunn, Jour. Bot. **45**: 402. 1907; Dunn & Tutcher, Kew. Bull. Add. Ser. **10**: 93. 1912; Groff, Lingnaam Agr. Rev. **2**: 12. 1924; Merr. Lingnan Sci. Jour. **5**: 87. 1930, in nota, sub *Prunus phaeosticta* (Hance) Maxim.

KWANGTUNG: Na Leung and Kung Ping Shan, along the Kwangtung-Tonkin border, *W. T. Tsang 26588, 26590, 26627, 26741,* August, 1936. HAINAN: Tai Un, *CCC 7742* (*McClure*); Paak Shek Shan, *LU 17444* (*Tsang*); Chim Shan, *Fung 20182;* Manning and Poting, *How 71520, 71653, 72723.*

This species was based on a specimen collected by Dunn's collector at Sanning, southern Kwangtung. Apparently this is its second collection in Kwangtung, though the species has been credited to Hainan. It has been confused with *Prunus phaeosticta* (Hance) Maxim., both having black-punctate leaves, but in *P. Fordiana* Dunn the apex is acuminate, not caudate-acuminate, the veins are obscure, and the fruit is larger, 8 mm. long, and ellipsoid rather than globose.

LEGUMINOSAE

Desmodium longipes Craib, Kew Bull. **1910**: 20. 1910; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 570. 1920.

Desmodium pulchellum sensu Williams, Bull. Herb. Boiss. II. **5**: 20. 1904, *non* Bak. (fide Schindler).

Desmodium tonkinense Schindler, Bot. Jahrb. **54**: 53. 1917.

Phyllodium longipes Schindler, Rep. Sp. Nov. **20**: 270. 1924.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26511, 26702,* July–August, 1936; also Sie-lung, Loting, *Y. Tsiang 1141,* Sept. 14, 1928.

This is the first record for this species from Kwangtung and China. Formerly known from Siam and from Cambodia, Laos, Cochinchina, Annam, and Tonkin, in Indo-China. The species has been confused with both *Desmodium pulchellum* (Linn.) Benth. (*Phyllodium pulchellum* Desv.) and *Desmodium elegans* (Lour.) Benth. (*Phyllodium elegans* Desv.), but it is easily distinguished from both of these by the much larger bracts (3.5 cm., not 1–1.5 cm.) and the larger leaves. In the size of the bracts it resembles *Desmodium Kurzii* Craib, a species of Siam, Burma, and China (Kwangsi), but it is readily separated from that species by the fact that the trifoliolate leaves have leaflets that are very variable in size: in *Desmodium longipes* Craib the terminal leaflet is very much larger than the two lateral leaflets, while in *D. Kurzii* Craib the three leaflets are all approximately of the same size.

MELIACEAE

Walsura robusta Roxb. Hort. Beng. 32. 1814, *nomen nudum,* Fl. Ind. ed. 2,**2**: 386. 1832; Pellegr. in Lecomte, Fl. Gén. Indo-Chine **1**: 785. 1911; Merr. Lingnan Sci. Jour. **14**: 20. 1935.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26690,* August 12–24, 1936. The first record for Kwangtung. Formerly known from India to Burma, Indo-China, Yunnan, and Hainan.

DICHAPETALACEAE

Dichapetalum hainanense (Hance) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 348. 1896; Merr. Lingnan Sci. Jour. 5: 105. 1930.
Chailletia hainanensis Hance, Jour. Bot. 23: 322. 1885.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along Kwangtung-Tonkin border, *W. T. Tsang 26818,* Sept. 10–18, 1936.

This represents the first record of this species for Kwangtung and China proper; formerly known only from Hainan. The species is rather close to *Dichapetalum tonkinense* Engl., recorded from Hainan and from Tonkin, Indo-China. It can usually be separated from that species by the fact that the lower surfaces of the leaves are rather uniformly pubescent, the pubescence not being confined to the midrib and secondary nerves as in *D. tonkinense* Engl. The leaves also average slightly smaller.

ELAEOCARPACEAE

Elaeocarpus hainanensis Oliver in Hook. Ic. Pl. 25: *t. 2462.* 1896; Merr. Lingnan Sci. Jour. 5: 123. 1928.

KWANGTUNG: Na Leung, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26636,* Aug. 1–10, 1936. Formerly known only from Hainan.

STAPHYLEACEAE

Turpinia glaberrima Merr. var. **stenophylla** Merr. & Perry, Jour. Arnold Arb. 22: 552. 1941.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26739,* Aug. 25–30, 1936. This number is the type collection of the variety, which also occurs in Kwangsi. The species occurs in Kwangtung, Kwangsi, Hainan, and Indo-China.

FLACOURTIACEAE

Flacourtia Rukam Zoll. & Mor. Syst. Verz. 33. 1854; King, Jour. As. Soc. Beng. 59(2): 117. 1890; Merr. Philip. Jour. Sci. 10: Bot. 329. 1915, op. cit. 29: 401. 1926, op. cit. 30: 411. 1926, Lingnan Sci. Jour. 5: 132. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26837,* Sept. 10–18, 1936. Indo-China to Malaysia, Polynesia, the Philippines, and Yunnan and Hainan in China. New to Kwangtung.

Homalium Petelotii Merr. Jour. Arnold Arb. 21: 377. 1940.

KWANGTUNG: Na Leung, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26568,* Aug. 1–10, 1936. Formerly known only from the type collection, *Pételot 5983,* from Tonkin, Indo-China. New to China and to Kwangtung.

CLETHRACEAE

Clethra annamensis F. Dop, Bull. Soc. Bot. France 75: 732. 1928, et in Lecomte, Fl. Gén. Indo-Chine 3: 717. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26761,* Sept. 1–9, 1936. Formerly known only from Annam and Quang-tri, Indo-China. New to China and to Kwangtung.

EBENACEAE

Diospyros potingensis Merr. & Chun, Sunyatsenia 5: 164. 1940.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26705,* Aug. 25–30, 1936.

The cited specimen apparently represents this species. It differs slightly from the type in having proportionately longer and narrower leaves of a slightly different color, but the color difference may be due to the method of drying. If it is correctly named, this is the first record of the species for Kwangtung. Formerly known from Hainan and Hupeh.

APOCYNACEAE

Anodendron punctatum Tsiang, Sunyatsenia 2: 129. 1934, op. cit. 3: 140. 1936.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26724,* Aug. 25–30, 1936. Formerly known only from three collections from Hainan. A species readily recognized by its punctate leaves.

Xylinabariopsis napeensis (Quintaret) comb. nov.

Micrechites napeensis Quintaret, Compt. Rend. Acad. Sci. 134: 438 (Seance du lundi 17 Février; received Harvard College Library, March 21). 1902.

Xylinabaria Reynaudi Jumelle, Rev. Cult. Colon. 11: 228. 1902.

Ecdysanthera napeensis Pierre, Rev. Cult. Colon. 11: 228. 1902.

Parabarium napeense Jumelle, in Spire, Caoutch. Indo-Chine 33. 1906.

Xylinabariopsis Reynaudi Pitard in Lecomte, Fl. Gén. Indo-Chine 3: 1261. 1933.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26523, 26643,* July–August, 1936.

It is difficult to understand why Pitard used the specific epithet *Reynaudi,* when both Pierre and Jumelle had already accepted the earlier epithet *napeense.* Formerly known from Annam, Laos, and Tonkin (Indo-China), and hence new to both China and Kwangtung.

ASCLEPIADACEAE

Heterostemma oblongifolium Constantin in Lecomte, Fl. Gén. Indo-Chine 4: 120. 1912; Merr. Lingnan Sci. Jour. 5: 153. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26857,* Sept. 10–15, 1936. Formerly known only from Laos, Indo-China, and Hainan, and hence new to both the Chinese mainland and Kwangtung.

Tabernaemontana bufalina Lour. Fl. Cochinch. 117. 1790; Pitard in Lecomte, Fl. Gén. Indo-Chine 3: 1160. 1933; Merr. Trans. Am. Philos. Soc. II. 24(2): 312. 1935 (Comment. Lour. Fl. Cochinch.).

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26547, 26654,* July–August, 1936. Previously known from Indo-China and Hainan, and hence new to the Chinese mainland and to Kwangtung.

CONVOLVULACEAE

Erycibe hainanensis Merr. Philip. Jour. Sci. 21: 353. 1922, Lingnan Sci. Jour. 5: 153. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26640,* Aug. 15–24, 1936. Formerly known only from Hainan.

VERBENACEAE

Premna Maclurei Merr. Lingnan Sci. Jour. 6: 330. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26657,* Aug. 15–24, 1936. Formerly known only from Hainan.

LABIATAE

Gomphostemma leptodon Dunn, Notes Bot. Gard. Edinb. 8: 170. 1913, op. cit. 6: 190. 1915; T. Doan in Lecomte, Fl. Gén. Indo-Chine 4: 1036. 1936.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26790, 26825,* Sept., 1936. Formerly known only from Kwangsi (*Morse 257*) and from Tonkin, Indo-China; new to Kwangtung.

GESNERIACEAE

Rhynchotechum ellipticum (Wall.) A. DC. in DC. Prodr. **9**: 285. 1845, ***in nota;*** C. B. Clarke, Commel. Cyrtandr. Bengal. *t. 91.* 1874 (***Rhyncotechum***), in DC. Monogr. Phan. **5**: 198. 1893; Hook. f. Fl. Brit. Ind. **4**: 373. 1884; Merr. Lingnan Sci. Jour. **13**: 71. 1934.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26854,* Sept. 10–18, 1936. Formerly known from India and Hainan; the first record for the Chinese mainland and Kwangtung.

RUBIACEAE

Hedyotis obliquinervis Merr. Lingnan Sci. Jour. **14**: 56. 1935.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26518, 26644,* July–August, 1936. Previously known only from the type collection, *Lau 452,* from Fung Leng, Ngai District, Hainan. Additional collections of this species from Hainan are: *Lau 1265,* Tai Tin Shan, Changkiang District, *Liang 62029,* Yaichow, *Gressitt 960,* Ta Hau, and without definite locality, *Liang 64974* and *66230* and *Wang 32842.* The first record for the Chinese mainland and for Kwangtung.

Lasianthus Koi Merr. & Chun, Sunyatsenia **2**: 47. 1934.

KWANGTUNG: Na Leung and vicinity, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26558,* July 24–31, 1936. Previously known only from the type collection, *Ko 52243,* from Tingnan, Hainan. *Liang 54368* and *65280* and *Wang 35807,* from Hainan, without definite locality, also represent this species.

The original description was based on a flowering specimen. The following description of the fruit is based on *Tsang 26558.*

Fruit sessile, subglobose, black, subglabrous, 5 mm. long and about 4 mm. wide, capped by persistent calyx-lobes; lobes of calyx lanceolate, glabrous toward base, but covered with numerous, prominent, whitish, jointed hairs above the middle.

Schizomussaenda dehiscens (Craib) Li, Jour. Arnold Arb. **24**: 100. 1943.

Mussaenda dehiscens Craib, Kew Bull. **1916**: 263. 1916; Pitard in Lecomte, Fl. Gén. Indo-Chine **3**: 174. *fig. 12, 2–3.* 1923; Chun, Sunyatsenia **1**: 306. 1934.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26513, 26576, 26668,* July–August, 1936.

While this note was originally prepared to record the species as *Mussaenda dehiscens* Craib as occurring in Kwangtung, Dr. Li's findings have been accepted. The species extends from Burma, Siam, and Indo-China to Yunnan, Kwangsi, and Kwangtung, having first been recorded from the latter province by Chun, without any citation of specimens, and by Li, who cites *Liang 69546* from Shih Wan Tai Shan. *Schizophragma macrosepalum* Hu (1930) and *Emmenopterys Rehderi* Metcalf (1932) are synonyms, according to Dr. Li, both of these genera belonging to the Saxifragaceae.

Nauclea officinalis Pierre ex Pitard in Lecomte, Fl. Gén. Indo-Chine **3**: 26. 1922, ***in syn.***; Merr. & Chun, Sunyatsenia **5**: 188. 1940.

Sarcocephalus officinalis Pierre ex Pitard, l. c.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26867*, Sept. 10–18, 1936. Formerly known from Indo-China and Hainan.

Paederia verticillata Blume, Bidjr. 968. 1825; Merr. Bibl. Enum. Born. Pl. 580. 1921, Enum. Philip. Fl. Pl. 3: 570. 1923.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26751, 26787, 26874*, Aug.–Sept., 1936. A widespread species, known from the Malay Peninsula to Java and the Philippines. The first record for China and for Kwangtung.

Uncaria scandens (Sm.) Hutch. in Sargent, Pl. Wils. 3: 406. 1916; Merr. Lingnan Sci. Jour. 11: 59. 1930; Rehder, Jour. Arnold Arb. 16: 319. 1935.

Nauclea scandens Sm. in Rees, Cyclop. 39: no. 9. 1819.

Uncaria pilosa Roxb. Fl. Ind. ed. 2. 1: 520. 1832; Hook. f. Fl. Brit. Ind. 3: 32. 1880; Pitard in Lecomte, Fl. Gén. Indo-Chine 3: 47. 1922.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26833*, Sept. 10–18, 1936. Also known from India and Indo-China, and from Yunnan, Kweichow, and Hainan, China. The first record for Kwangtung.

Urophyllum chinense Merr. & Chun, Sunyatsenia 2: 19. 1934.

KWANGTUNG: Na Leung and Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26512, 26770*, July and Sept., 1936.

This species is the only representative of this genus known from China proper, and it was formerly known only from the type collection, *Tso 23555*, from Sup Man Ta Shan, along the Kwangtung-Kwangsi border. One of the two collections cited above is in bud; the original description was based on a fruiting specimen only. A description of the young flowers is here added.

Buds ovoid, noticeably constricted at the base, glabrous; calyx saucer-shaped or broadly and shallowly campanulate, 5-lobed, the lobes broadly ovate-triangular, with glandular margins; pedicels filiform, about 6 mm. long, puberulent.

Wendlandia tinctoria DC. subsp. **orientalis** Cowan, Notes Bot. Gard. Edinb. 16: 268. 1932, op. cit. 18: 184. 1934.

Wendlandia glabrata auctt., in part, *non* DC.

KWANGTUNG: Na Leung, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26542*, July 24–31, 1936. Formerly known from India, Siam, Indo-China, and from Yunnan and Kwangsi in China; new to Kwangtung.

Xanthophytum ferrugineum (DC.) Merr. Mitt. Inst. Bot. Hamb. 7: 270. 1937.

Metabolos ferrugineus DC. Prodr. 4: 436. 1830.

Xanthophytum Villarii Vidal, Rev. Pl. Fasc. Filip. 150. 1886.

Xanthophytum fruticulosum sensu Merr. Philip. Jour. Sci. 4: Bot. 328. 1909, Enum. Philip. Fl. Pl. 3: 492. 1923, *non* Reinw.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 28721*, Aug. 25–30, 1936. KWANGSI: Shap Man Taai Shan, near Iu Shan village, Siangsze District, along the Kwangtung border, *W. T. Tsang 22306*, May 16, 1933. New records for both Kwangtung and Kwangsi, and also for China.

These specimens are associated with the Philippine species, which has only recently been segregated from the form of Java, Borneo, and Sumatra, on account of the differences in the inflorescences. The specimens seems to agree fairly well with the Philippine plant, but when flowering material becomes available, some other disposition of them may prove to be desirable.

CAMPANULACEAE

Pentaphragma spicatum Merr. Philip. Jour. Sci. **21**: 511. 1922. Lingnan Sci. Jour. 5: 181. 1930.

KWANGTUNG: Kung Ping Shan, Fang Cheng District, along the Kwangtung-Tonkin border, *W. T. Tsang 26862,* Sept. 10–18, 1936.

This species was originally based on two specimens, one from Tung Sing, Kwangtung (*K. K. Tsoong 1907*), and the other from Ng Chi Leng, Hainan (*CCC 8675* [*McClure*]). This is apparently the second record of the species for Kwangtung.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

AN APPARATUS TO MAINTAIN A SURFACE FILM OF WATER FOR USE IN VEGETATIVE PROPAGATION

KARL A. GROSSENBACHER*

With three text-figures

VEGETATIVE propagation has long been of practical importance to nurserymen and others engaged in work with plants. The development of the theory of the hormone mechanism of root formation and availability of synthetic chemicals for treatment of cuttings has greatly increased the amount of work being done with vegetative propagation. Plant physiologists are interested in the phenomena of root formation as well as in the use of cuttings as a source of uniform experimental material. In the study of genetics of trees vegetative propagation becomes a valuable tool for the more accurate estimate of individual clones.

Doran (1) presents a summary of the work with trees and shrubs as well as an extensive bibliography. The standard practice has been to shade or cover propagating beds and to sprinkle the cuttings to prevent them from drying out during the period of root formation. Where leafless stems can be used, there is less evaporating surface and maintaining cuttings is a much simpler problem. For many species, however, it is necessary to use leafy cuttings, and their maintenance presents many problems. The water content must be kept up. They must have sufficient light to function properly and fungi must be controlled.

Raines (3) reports on a spray chamber technique for handling plant materials which promises to lead to new developments. Mitchell et al. (2) developed an out-of-door modification used to maintain cuttings in full sunlight. They found the most favorable environment for the propagation of slash pine (*Pinus caribaea* Morel.) to be "well drained sand . . . 75° – 90° F. . . . fine spray of water . . . on 5 minutes out of each 10-minute cycle for 10 to 12 hours each day." Others have pointed out that spray humidification in greenhouses has extended the limits of propagation of plants which are difficult to root (5).

Preliminary work in the greenhouses of the Harvard Biological Laboratories indicated that cuttings of several forest trees responded better in fuller exposure to sunlight than in the more conventional shaded beds. Tests were made with mechanical humidifiers as well as with intermittent spray. During the summer of 1944 an apparatus was developed and operated at the Harvard Forest. Taking advantage of full sunlight, out-of-

*This work has been financed by the Maria Moors Cabot Foundation for Botanical Research of Harvard University and was carried out at the Harvard Forest. The author wishes to thank C. T. Brown, Jr., S. H. Spurr, and P. R. Gast for their aid in the development and construction of this apparatus.

door propagating beds were equipped with a sprinkler system and an automatic control mechanism. This apparatus was designed to give maximum surface wetting with a minimum amount of water and was actually controlled by the evaporation of water from a surface film.

Cuttings of various forest trees were maintained in excellent condition. Satisfactory rooting was obtained with cuttings of red maple (*Acer rubrum*), sugar maple (*A. saccharum*), and paper birch (*Betula papyrifera*). No satisfactory rooting was obtained during the relatively short 6–8 week period with cuttings of hemlock (*Tsuga canadensis*), red pine (*Pinus resinosa*), white pine (*P. Strobus*), or white spruce (*Picea glauca*).

APPARATUS

Propagation beds, as illustrated in *Fig. 1,* were built with gravel drainage and heating coils, allowing a 6-inch depth of builders' sand for planting cuttings. Sprinkler pipes were placed 10 ft. apart (every two beds) with flat misting nozzles (#.031F, Spray Engineering Co., Somerville, Mass.) every 3 ft. They are oscillated by a motor-driven crank, connected by rods to lever arms clamped directly on the pipes. The oscillating pipes are connected by loops of garden hose. The water supply (40 lb. pressure) is controlled by a single solenoid valve. An emergency by-pass with a normally open solenoid valve has been installed to supply constant spray in the event of any power failures.

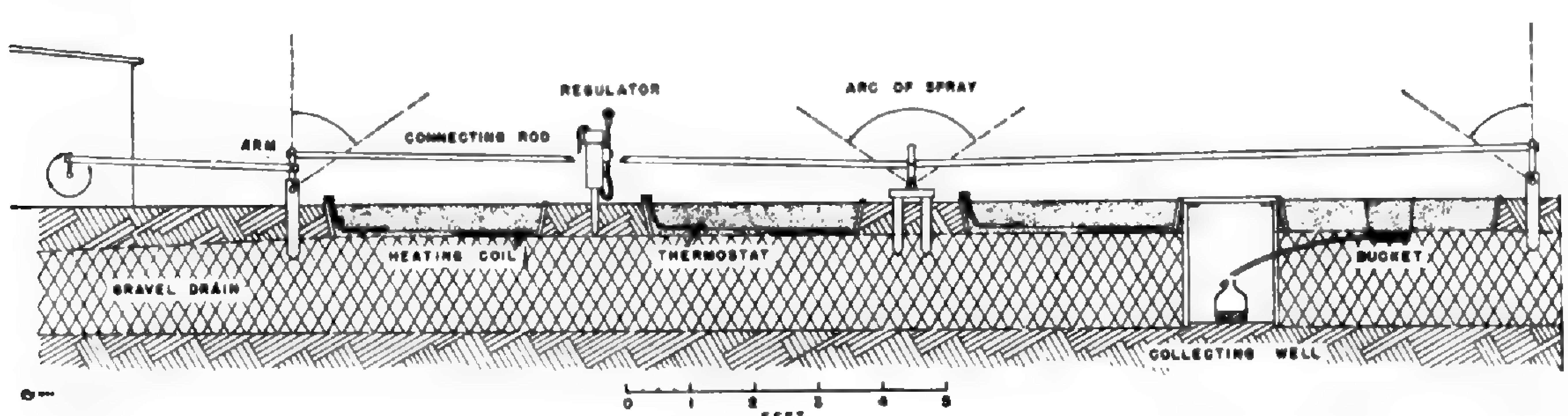

FIG. 1. Diagram of propagating beds.

The regulator, shown in *Fig. 2,* consists of a Livingston black bulb atmometer (B. E. Livingston, Riderwood, Md.) connected to a water-oil-mercury column. When a small amount of water is lost from the evaporating surface, the mercury moves up, making contact with the platinum wire activating the relay. This starts the oscillating motor and opens the solenoid valve. The regulator is so placed that water from the sprinklers falls on the evaporating surface, thereby replacing the water lost and opening the circuit. A distilled water reservoir is connected into the water column through a mercury safety valve to prevent undue water tension from developing in the regulator in case of mishap. By applying air pressure gently to the distilled water, the walls of the bulb can be conveniently flushed.

In order to reduce electrical action in the mercury-oil-platinum switch as

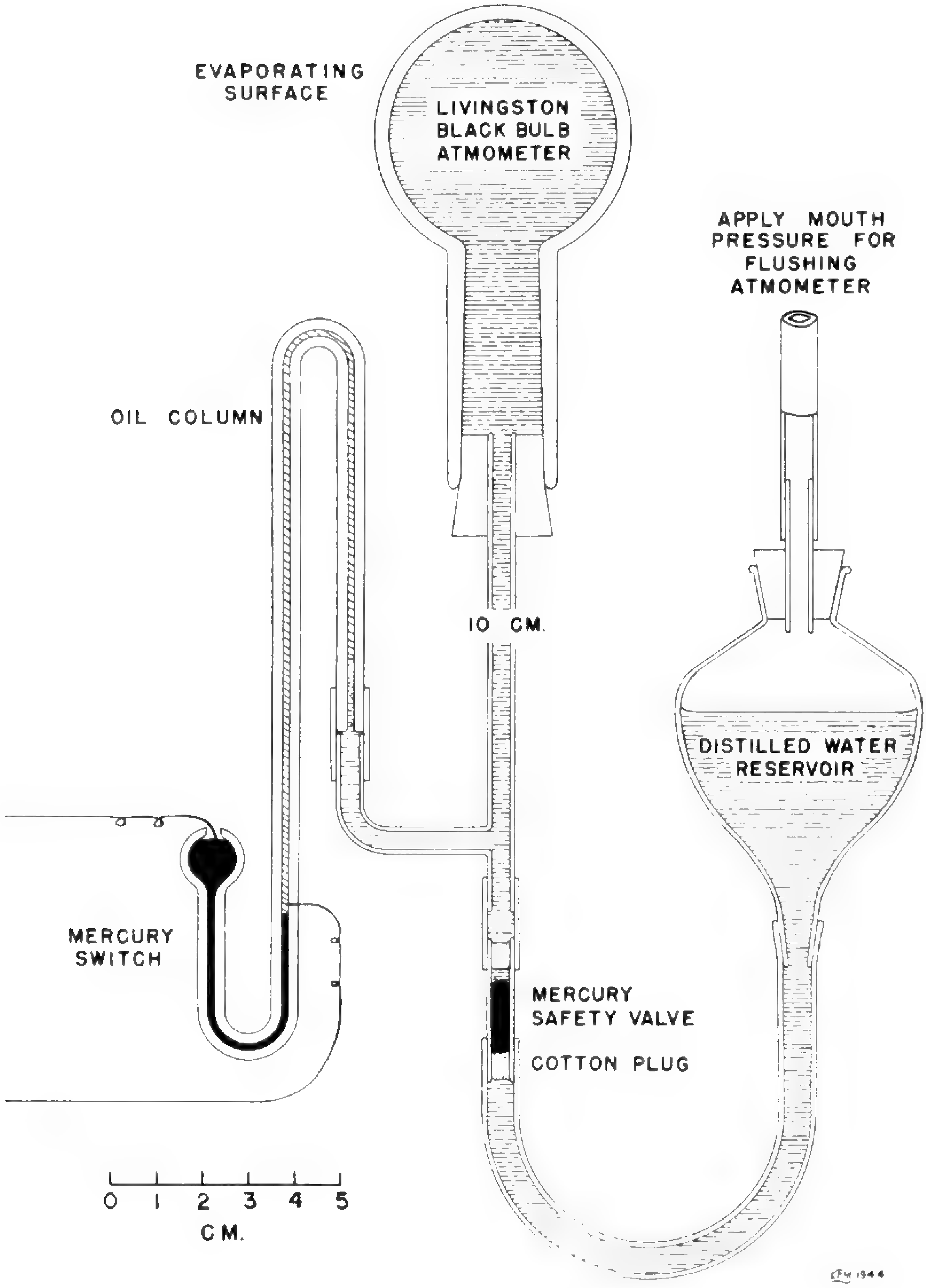

FIG. 2. Detail of regulator.

well as to assure uniformity of behavior, a two-coil, locking relay is used (Cenco #99740). The activator current is drawn directly from the 110-volt A.C. line with the load, relay coil, motor, and solenoid valve, in series. A single low amperage impulse (1/120 sec.) is enough to lock the relay in the on-position. A separate coil and circuit is used to open the relay, and the necessary impulse is drawn in a similar manner from the A.C. line. The circuit is closed by a contact point on a wooden idler wheel, which is driven by the crank shaft of the oscillating mechanism. While the idler wheel makes one revolution in 30 seconds, the crank shaft makes 5, thereby giving five sweeps of the sprinklers per 30-second period. The momentum of the apparatus is sufficient to carry the contact points past the make-position, opening the off-circuit and clearing the relay for the next starting impulse. A small amount of chattering occurs if water from the sprinkler has not opened the starter circuit during the 30-second on-period. With the regulator placed midway between pipes and well within the range of several nozzles, this can only happen occasionally in dry windy weather.

This regulator mechanism has two fundamentally weak aspects. The evaporating surface and porous walls of the atmometer tend to accumulate deposits of materials dissolved in the spray water. Also, the electric current causes sludge to form at the junction of the oil and mercury. Though satisfactory contact is made when relatively large amounts of sludge have accumulated, the sludge can be expected eventually to cause trouble. The present apparatus has been operated for more than three months without interruption.

PERFORMANCE

The oscillation of the sprinkler pipes can be adjusted to give satisfactory cover of the beds by changing the lever arms and connecting rods, etc. The two edge sprinkler pipes are set to supply a single bed with a short arc, thus giving a heavy watering to compensate for the effects of the wind. The center pipe swings through a larger arc, watering a bed on each side.

The regulator can be adjusted to give a wide range of performance. In order to maintain a film of surface water, the mercury in the outer arm of the mercury switch is put enough higher than the contact point nearly to balance the weight of water in the column supplying the bulb, thereby maintaining almost a free water surface on the bulb. Excess water drains off, and only a slight evaporation is necessary to start the sprinklers.

With this arrangement, the sprinklers turn on every 2 to 2½ minutes in bright dry weather, less frequently in cloudy weather, and only occasionally during the night. This means that the sprinklers are turned on about 240 times a day, or they run for about 2 hours out of the day, delivering 500 gallons over an area of about 500 sq. ft. (allowing for edge effects). This is equivalent to a rainfall of about 1.6 inches. However, a large portion of this water is actually lost by evaporation or blown away by the wind.

Records of sprinkler frequency were obtained with an independent circuit operating a chronograph. The drainage of water through the propagating bed was measured from three sampling buckets, as shown in *Fig. 1.*

Atmospheric temperature and humidity records were obtained in a standard weather shelter some 75 yards from the beds. Sample data for August 28, 1944, are presented in *Fig. 3*. The low temperature and high humidity of the preceding night kept the sprinkler off, and the drainage rate was therefore very low. As the day advanced, and the temperature rose and the humidity fell, the sprinkler came on more often, reaching by nine o'clock a fairly constant rate of 25 to 30 times per hour (highest recorded rate: 36 times per hour). The drainage for the 9 to 5 period reached the large amount of .326 cc per cm^2 per hour, being one of the highest drainage rates observed. As night came on and the humidity increased, the sprinkler

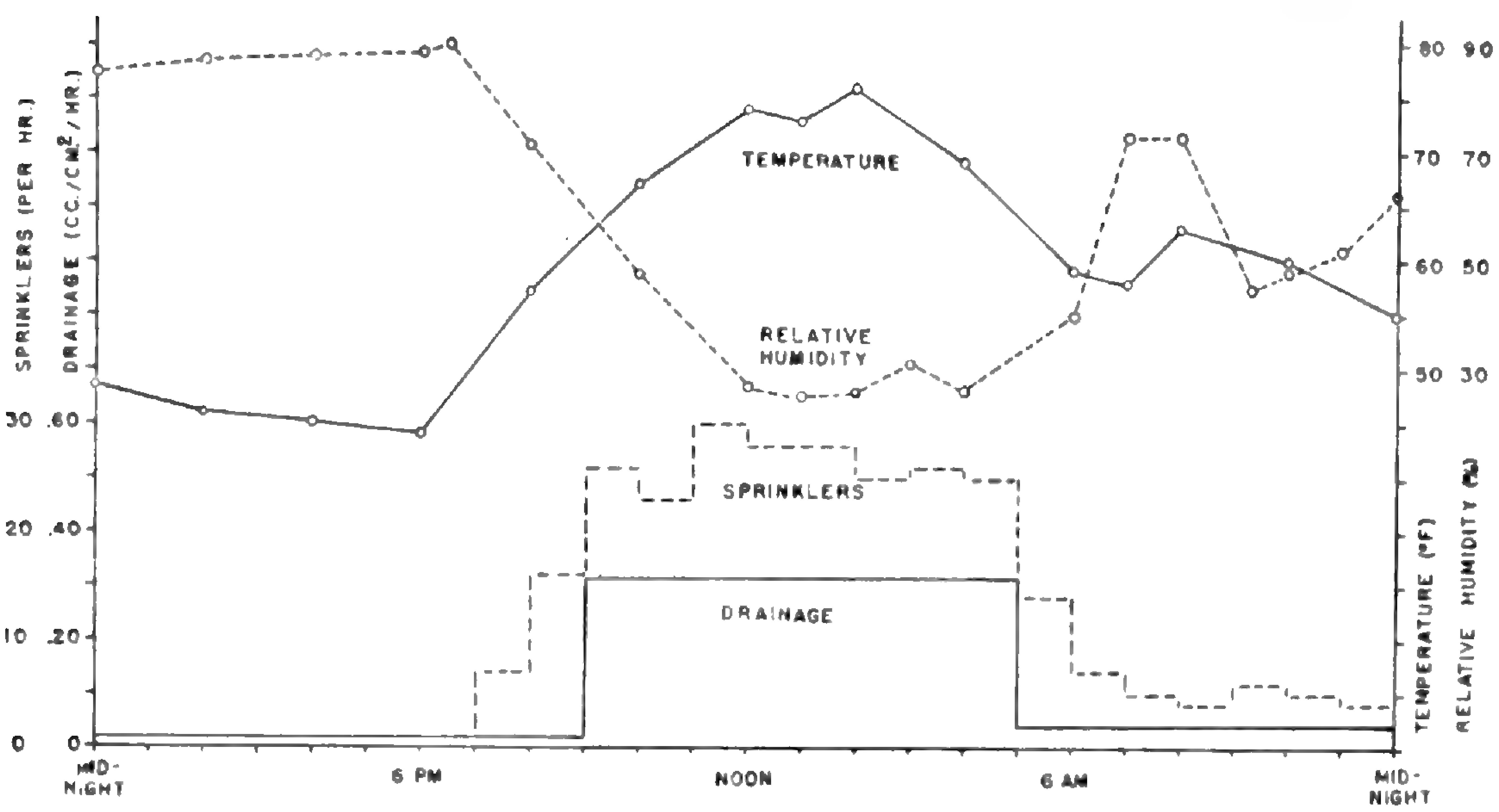

FIG. 3. Relation of sprinkler rate and drainage rate to relative humidity and temperature on August 28, 1944.

rate decreased. However, the humidity did not get as high as the preceding night, and the sprinkler rate leveled off at 4 to 6 times per hour. The unusual drop in humidity was reflected in the 9 P.M. to 10 P.M. sprinkler rate. Drainage for the overnight period was higher than for the previous night, as a result of the higher sprinkler rate.

ADAPTATION TO OTHER USES

The combination of regulator and locking relay with A.C. circuits seems to open up a new field for the use of porous bulbs, cones, or soil points to regulate watering mechanisms. As in the present case, the regulator may be activated by the drying effects of the atmosphere; or, in soil or sand, by the tension of the water film. The latter arrangement would enable one to construct automatic irrigating devices which would respond to the water tension in the soil, rather than merely the drying effects of the atmosphere.

Possibly controls of this type can be of value in certain industrial processes.

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THE GENERIC NAME PETALONEMA

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THE GENERIC name *Petalonema* has the fortunately unusual distinction of having been used by various authors since the beginning of the present century for no fewer than four different genera of plants, belonging to as many families. The present investigation was undertaken in order to ascertain whether one of the four, *Petalonema* Gilg, a small African genus of Melastomataceae, was validly named or not.

The four homonymous genera are as follows:

1. *Petalonema* Correns in Flora **1889**: 346. *t. 15, figs. 4–21.* July 1889 (Cyanophyceae—Scytonemataceae).
2. *Petalonema* Gilg in Engl. & Prantl, Nat. Pflanzenf. Nachtr. 264. 1897 (Melastomataceae).
3. *Petalonema* Schlechter in Repert. Sp. Nov. **13**: 543. 1915 (Asclepiadaceae).
4. *Petalonema* A. Peter in Abh. Ges. Wiss. Göttingen, n. f. **13**(2): 84. 1928 (Balsaminaceae).

PETALONEMA Correns

The type of this genus is *Oscillatoria alata* Carm. ex Grev. Scottish Crypt. Fl. 4: *t. 222.* 1826. Upon this species Berkeley (Gleanings of British Algae 23. *t. 7, fig. 2.* 1833) based his new genus *Petalonema, P. alatum* being the only included species. According to the International Rules of Botanical Nomenclature (Art. 20, exceptions), the starting point of legitimate nomenclature of the Nostocaceae heterocysteae is Bornet and Flahault's Revision (1886-88); in this work (Ann. Sci. Nat. Bot. VII. 5: 110. 1887) *Petalonema* is included under *Scytonema* in synonymy and is therefore not validly published.

To ascertain the date of the first valid and legitimate publication of *Petalonema* is a matter of some difficulty. Geitler (in Engl. & Prantl, Nat. Pflanzenf. ed. 2. 1b: 151. 1942) cites it as of "Berkeley . . . ex Kirchner in E.P. 1. Aufl. I. la (1898) 79"; this, however, is certainly not the earliest date. Wolle (Fresh-water Algae of the U. S. 267. 1887) took up *Petalonema* Berk. and described it. It will be noticed that Wolle's book and the relevant portion of Bornet and Flahault's Revision were published in the same year, and I have so far failed to find out which is the earlier. In view of the chronological doubt concerning Wolle's publication, it seems more satisfactory to accept that of Correns in Flora (1889). Correns, though he gives no formal diagnosis of *Petalonema,* on p. 346 clearly contrasts its characters with those of *Scytonema.* Mr. A. D. Cotton kindly undertook to give me his view on the validity of Corren's publication and, after discussion with Miss E. M. Wakefield, wrote that they were both of the opinion that the paragraphs in question "clearly describe *Petalonema* and validate its publication."

PETALONEMA Schlechter

Realizing that *Petalonema* Schlechter was a later homonym of *Petalonema* Gilg, Quisumbing (in Philip. Jour. Sci. 41: 342. 1930) bestowed the new name *Schlechterianthus* on the former genus. It is desirable to note, however, that *Schlechterianthus* is merely an orthographic variant of the previously published ficoidaceous genus *Schlechteranthus* Schwantes (in Monatsschr. Deutsch. Kakt.-Ges. 1: 16. 1929). Realizing this, Merrill (in Philip. Jour. Sci. 60: 33. 1936) renamed the Philippine *Schlechterianthus* as *Quisumbingia.*

Petalonema A. Peter

Peter (l. c.) distinguished his genus from *Impatiens* L. by its possession of filiform appendages to the petals descending into the spur. G. M. Schulze, in a paper entitled "Zur Gattung *Petalonema* Peter," in Repert. Sp. Nov. **39**: 21–22. 1935, considered that this character was insufficient to justify generic separation and therefore reduced Peter's genus to *Impatiens.* Both Schulze (l. c.) and Mansfeld (on p. 36 of the same volume) noted that Peter's genus was a later homonym of that of Gilg; but neither botanist was evidently aware of the yet earlier algal genus. If *Petalonema* Peter is maintained as a distinct genus, it will have to be renamed.

Petalonema Gilg

From the discussion under *Petalonema* Correns it is clear that *Petalonema* Gilg is a later homonym of the former genus. *Petalonema* Correns has been employed in several recent standard algological works on the continent, e. g. by Kirchner in Engl. & Prantl, Nat. Pflanzenf. 1a: 79. 1900; by Geitler in Pascher, Süsswasserfl. Deutschl. Österr. u. d. Schweiz **12**: 261. 1925, in Rabenh. Kryptog. Fl. ed. 2. **14**: 788. 1932 (five species are dealt with here), and in Engl. & Prantl, Nat. Pflanzenf. ed. 2. **1b**: 151. 1942. The current use of *Petalonema* Correns and the fact that *Petalonema* Gilg is a small genus of restricted distribution make it evident that the latter is not a suitable candidate for conservation. It is therefore proposed to rename *Petalonema* Gilg as follows:

Neopetalonema nom. nov.

Petalonema Gilg in Engl. & Prantl, Nat. Pflanzenf. Nachtr. 264. 1897, et in Engl. Monogr. Afr. Pfl.-Fam. u. -Gatt. 2: 28. 1898; Engl. Pflanzenw. Afr. 3(2): 755. 1921; non Correns nec Schlechter nec A. Peter.

Neopetalonema pulchrum (Gilg) comb. nov.

Petalonema pulchrum Gilg, ll. cc.; Engl. l. c.

Gilg at first made *Petalonema* feminine, but later correctly changed its gender to neuter; the new generic name coined above will have the same gender (Int. Rules, Art. 72, examples).

A second species of *Petalonema, P. glanduligerum* Pellegr. in Bull. Mus. Nat. Hist. Nat. Paris **30**: 326. 1924, has been described from the French Congo. I have seen no material of this and am therefore at present unwilling to rename it.

In conclusion I must sincerely thank Mr. A. D. Cotton, Professor F. E. Fritsch, and Miss E. M. Wakefield for help with the algological part of this study.

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LASTING PROPERTIES OF CUT FOLIAGE[1]

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THE LENGTH of time that cut branches will retain their normal appearance and methods of increasing this period of time are of vital concern in modern warfare. Foliage is the principal raw material of military camouflage, and the way it is handled may well affect the life of the soldier or even the outcome of the battle. Simple guides to the use of cut foliage in camouflage, based upon extensive experimentation, have been prepared by the Harvard Camouflage Committee.[3] The present paper covers certain technical aspects of this research which may be of interest to the botanist and of value in peace time to those engaged in transplanting, in vegetative propagation, and in the use of fresh plant material.

SPECIES SURVEY

That cut branches of different species of plants vary a great deal in their ability to retain their normal appearance is apparent to the most casual observer. Nevertheless, little work has been done to evaluate carefully the lasting properties of the common plants, and to ascertain how long the foliage of a particular plant will retain its normal appearance under various conditions. Tests carried out indoors or in the greenhouse are of little value in predicting the behavior of plants exposed to full sunlight, high temperatures, and drying winds.

To supply this information, several thousand tests have been carried out with plants of the northeastern United States at the Harvard Forest, Petersham, Mass., with European and Asiatic species at the Arnold Arboretum, Jamaica Plain, Mass., and with tropical foliage at the United States Plant Introduction Garden, Coconut Grove, Florida. No attempt was made to cover all the important species of any region, but an effort was made to secure a representative sampling of the most common plants. Most of the

[1]This paper is a partial report of the results of investigations carried out by the Harvard Camouflage Committee, a voluntary inter-departmental organization of Harvard University, comprised of staff members of the Maria Moors Cabot Foundation for Botanical Research, Harvard Forest, Biological Laboratories, and Arnold Arboretum. The coöperating institutions made available the necessary facilities and covered all expenditures of the Committee.

[2]The authors wish to acknowledge the coöperation of the United States Plant Introduction Garden at Coconut Grove, Florida, and that of camouflage officers in the Corps of Engineers and other branches of the United States Army. Among the members of the Harvard Camouflage Committee, I. W. Bailey, Ernest Ball, P. R. Gast, R. J. Lutz, E. D. Merrill (Chairman), K. V. Thimann, and R. H. Wetmore gave freely of their time and energy to those phases covered by the present report.

[3]Harvard Camouflage Committee. Using cut foliage for camouflage. 2 manuals, 17 pp. and 19 pp. Illus. Harvard Forest, Petersham, Mass. 1943.

tropical plants tested were lowland species, particularly those native to coastal regions.

Sprays of cut foliage of a uniform size (6 to 8 feet in Petersham and 3 to 5 feet elsewhere) were exposed on stakes or racks to full sunlight and all weather conditions. Careful notes of the condition of the plants were taken several times a day during the critical stages of drying, and daily at other times until the branches were completely withered. Each species was tested with at least two treatments: (1) base of branch suspended in air, and (2) base of branch immersed in water. Every treatment was replicated (five times in Petersham and three times elsewhere) and was repeated until reasonably consistent results were obtained.

The greatest difficulty encountered in these species surveys was that of developing a system of rating foliage condition that would give comparable results throughout the great variety of plants tested. Cut foliage reacts in many ways to drying out and death. Many plants brown; others, like *Viburnum*, blacken; still others, like *Eucalyptus* and some palms, whiten; and others, like pin cherry, develop autumn coloration. Some crisp, while others merely wilt. After initial trials, the following classification was set up and successfully used in dividing all plants into five broad classes of drying.

Class I. Normal. No evidence of wilting or injury.

Class II. Slight wilt. Essentially normal in appearance but evidence of drying such as (1) slight drooping of leaves, (2) marked wilt of young growing tips only, or (3) slight discoloration, usually on undersides of leaves only.

Class III. General wilt. Foliage wilted, but little or no (less than ten percent) crisping. Obviously abnormal in appearance, but foliage still essentially green and soft. Browning largely confined to undersides of leaves.

Class IV. Partially crisp. Marked crisping and discoloration of foliage, but more than fifty percent of leaves essentially green and soft.

Class V. Crisp. More than fifty percent of leaves crisp and discolored. Discoloration may consist of browning, blackening, whitening, autumn coloration, or merely marked fading.

During a given test, all foliage passed from Class I to Class V. At the time of each observation, a single rating was given for each species unless the variation was so great that single branches of the same species fell into different classes. The time necessary to pass through various classes was different for different plants. This difference might be used to explore certain physiological properties of species. The dividing line between Class II and III was taken as the limit of usefulness of plant material to be recommended for camouflage purposes. Selecting of any other point would result in a different ranking of species.

As a result of these surveys, it was possible to rate the relative lasting qualities of the different species, both with and without water (Tables 1 and 2). The values given for each plant cannot be considered as exact, since the lasting qualities of any plant are affected by many factors. The relative ranking of the different species, however, is reasonably accurate, and the values presented are a good indication of the number of days each species will last if exposed to full sunlight in the middle of the growing

TABLE 1.

LASTING OF CUT TEMPERATE FOLIAGE

Days in sunlight without water	Species	Days in sunlight with water
12 or more	Picea Abies (Norway spruce)	14–21
	Pinus resinosa (red pine)	14–21
	Pinus silvestris (Scotch pine)	12–16
	Pinus Strobus (white pine)	10–14
6–12	Picea glauca (white spruce)	14–21
	Juniperus communis (common juniper)	14–21
2–6	Tsuga canadensis (hemlock)	4–10
	Larix decidua (European larch)	4–8
	Larix Kaempferi (Japanese larch)	4–8
1–2	Malus pumila (apple)	6–10
	Ligustrum vulgare (common privet)	6–10
	Ligustrum ovalifolium (California privet)	6–10
	Vaccinium spp. (blueberry)	4–8
	Quercus velutina (black oak)	3–6
	Quercus borealis (red oak)	3–6
	Crataegus Oxyacantha (English hawthorn)	2–4
	Acer saccharum (sugar maple)	2–3
	Acer rubrum (red maple)	2–3
	Acer campestre (European maple)	2–3
½–1	Syringa vulgaris (lilac)	6–10
	Fagus sylvatica (European beech)	5–8
	Fagus grandifolia (American beech)	3–6
	Quercus robur (English oak)	3–6
	Quercus petraea (durmast oak)	3–6
	Quercus alba (white oak)	2–4
	Castanea dentata (chestnut)	2–4
	Tilia platyphyllos (large-leaved linden)	2–4
	Tilia cordata (small-leaved linden)	2–4
	Acer pseudoplatanus (sycamore maple)	2–3
¼–½	Prunus pennsylvanica (pin cherry)	3–6
	Acer pennsylvanicum (moosewood)	2–3
	Ginkgo biloba (ginkgo)	2–3
	Platanus acerifolia (London plane)	1–3
	Fraxinus excelsior (European ash)	1–3
	Prunus serotina (black cherry)	1–2
	Prunus Padus (European bird cherry)	1–2
	Alnus rugosa (smooth alder)	1–2
	Alnus glutinosa (black alder)	1–2
	Betula lutea (yellow birch)	1–2
	Betula papyrifera (paper birch)	1–2
	Betula populifolia (gray birch)	1–2
	Liriodendron tulipifera (tulip tree)	1–2
	Populus nigra (black poplar)	½–2
	Ulmus americana (American elm)	½–1
	Ulmus procera (English elm)	½–1
	Carya ovalis (small pignut hickory)	½–1

TABLE 1. (*Continued*)

Days in sunlight without water	Species	Days in sunlight with water
0–¼	Rhus typhina (staghorn sumac)	3–6
	Viburnum cassinoides (withe-rod)	½–2
	Populus grandidentata (big-toothed aspen)	½–2
	Populus tremuloides (trembling aspen)	0–½
	Fraxinus americana (white ash)	0–½
	Juglans cinerea (butternut)	0–½
	Robinia pseudoacacia (black locust)	0–½
	Salix nigra (black willow)	0–½
	Salix fragilis (crack willow)	0–½
	Salix pentandra (bay willow)	0–½
	Sambucus canadensis (elder)	0–½
	Ailanthus spp.	0–½

season. These species surveys, covering more than one hundred different kinds of plants of the north temperate and tropic zones, reveal a number of phenomena, some commonplace and expected; others, rather surprising.

Tropical species reacted much the same as temperate ones. The range in number of days that plants would retain a normal appearance in sunlight is about the same, both in trials with water and in trials without. Plants from the tropics, as a group, seemed to respond to water about the same as temperate plants, a few profiting immensely, most lasting two or three times as long with water as without, and some incapable of taking up sufficient water to prolong the fresh appearance. The amount of water required to keep a cut branch alive is considerably less than the amount transpired by the same branch before being cut. A cut six-foot branch will ordinarily require up to a quart or more of water the first day, and decreasing quantities thereafter until the branch is dead. Coniferous foliage ordinarily requires less water than hardwood foliage, probably because of its better protection against water loss.

Temperate Zone Foliage

The most obvious generality that may be stated upon the basis of temperate zone tests is the common observation that conifers of all types retain their normal appearance far longer than hardwoods. The poorest conifer tested (larch) lasted longer than the best hardwood (apple).

The other obvious tendency is that plants of the same genus tend to have similar lasting qualities regardless of species, locality, or origin. Certain genera were particularly consistent in this regard, among them being *Larix, Ligustrum, Alnus, Betula, Ulmus,* and *Salix.* In all cases, variation within the genus was far less than variation between the genera.

Species of several genera were more or less consistent, but yet reacted differently in various degrees. In some genera, species characteristic of drier sites — plants whose structure was better adapted to retaining moisture — apparently remained fresh the longest. Thus, red pine was somewhat better than Scotch pine, which, in turn, was definitely superior to white pine. A number of European species seemed to be somewhat better than their American counterparts, possibly because they had developed in a drier climate. Among these were European beech, European bird cherry, European ash, and European black poplar. This was not universally true, however, for the American maples lasted as well as the European hedge maple, and considerably longer than the European sycamore maple with its large thin leaves. The foliage of the latter, though, lasted longer than did the similar foliage of the American moosewood. When supplied with water, all five maples tested remained fresh for about the same period.

Among the oaks, the northern red oak was superior to the white oaks, both European and American, when tested in the absence of water. That the red oak group as a whole has greater lasting powers than the white oak group was substantiated by repeated tests not indicated in Table 1. With water supplied, little difference in reaction was noted.

Among the temperate species, the response to added water was relatively consistent. Practically all species benefited markedly from water except for a few plants which wilted and withered nearly as quickly with water as without. The response of staghorn sumac to a supply of water was exceptional. Cut sumac foliage would wilt the first day after being placed in water. Then, surprisingly enough, it would begin to recover. For several days thereafter, the leaflets would remain turgid, the plant being apparently normal except for a droop of the rachis. No other species tested showed this recovery from leaf-droop and wilt.

Tropical Zone Foliage

Tropical plants varied a great deal in their capacity to absorb water and in their lasting properties. Certain genera, such as *Casuarina*, *Ixora*, *Eugenia*, and *Eucalyptus*, lasted as much as five to fifteen times as long with water as without. Many others tested apparently were totally unable to utilize water (Table 2).

In one respect, tropical species behaved rather differently from temperate plants. Because of the large size and weight of many of the leaves, abnormal appearance was often first manifested by marked wilting of the petioles and consequent leaf droop, rather than by a change in the leaf itself. For instance, the leaves of the India rubber tree remained normal for two to four days after cutting, although petiole wilting rendered the plant abnormal in appearance in half that time. In the case of *Pandanus*, the leaves remained normal for six to twelve days, although severe stem droop occurred in half that period.

Among the palms, the coconut was among the several that lasted well. Others, however, whitened or drooped very soon after being cut. Foliage that was thick, heavy, shiny, and leathery, such as that of *Ficus*, *Rhizophora*, *Hernandia*, and *Barringtonia*, was moderately long-lived. Branches of these species were among those that drooped badly long before the leaves had begun to dry noticeably.

TABLE 2.

LASTING OF CUT TROPICAL FOLIAGE

Days in sunlight without water	Species	Days in sunlight with water
3–6	Calophyllum inophyllum (palo maria)	8–16
	Aralia spp.	8–16
	Cocos nucifera (coconut)—entire tree	8–16
	Cocos nucifera (coconut)—separate fronds	4–8
	Caryota spp. (fishtail palms)—separate fronds	4–8
	Ptychosperma spp. (MacArthur palm)—separate fronds	4–8
	Pandanus tectorius (screw pine)	3–6
1–3	Casuarina equisetifolia (Australian pine)	8–16
	Ixora spp.	8–12
	Mangifera indica (mango)	2–4
	Pongamia pinnata	2–4
	Acacia spp.	2–4
	Musa sapientum (banana)	1–3
	Ficus bengalensis (banyan)	1–3
½–1	Eugenia Jambos (rose apple)	8–16
	Barringtonia asiatica	2–4
	Livistona spp. (fan palms)—separate fronds	2–4
	Hernandia peltata	2–4
	Melaleuca leucodendron	2–4
	Morinda citrifolia	2–4
	Ficus elastica (India rubber tree)	1–2
	Guettarda spp.	½–1
	Rhizophora Mangle (mangrove)	½–1
	Sterculia foetida	½–1
¼–½	Eucalyptus algeriensis	4–8
	Corypha elata (giant fan palm)—separate fronds	1–2
	Hevea brasiliensis (rubber tree)	1–2
	Aleurites moluccana (candle nut)	½–1
	Terminalia Catappa (Indian almond)	½–1
	Thespesia populnea	½–1
0–¼	Dodonaea viscosa	1–2
	Bambusa spp. (bamboo)	½–1
	Hibiscus tiliaceus	¼–½
	Styloma pacifica (palm)—separate fronds	¼–½
	Erythrina spp.	0–¼

Few generalities can be drawn concerning the lasting of tropical foliage. This is due to the immense number of species in this zone and to the great difference in their size, structure, and growth habits. The fifty or sixty genera actually tested are sufficient only to tell us something of the range of lasting properties, of the reaction of some of the more important species, and of techniques useful in prolonging the lasting qualities of plants similar to those tested.

SELECTION AND HANDLING OF CUT FOLIAGE

The length of time that foliage of a given species will last is affected by

(1) the size of the branch, (2) the part of the tree from which it is cut, (3) the time of day, and (4) the time of year the branch is cut. The importance of these factors was repeatedly demonstrated.

The larger the branch, the longer it will last. This applies both to branches with and without water. For instance, a twenty-foot red oak tree, cut at the base and guyed upright in a canvas-lined hollow filled with water, lasted about ten days, while few red oak branches lasted more than six days. Small sprigs of red oak foliage ordinarily drooped in two or three days. Similar results were obtained with hemlock in many repetitions. In Florida, entire coconut trees cut at the base and placed in water lasted about twice as long as separate fronds. The superior lasting qualities of entire trees and large branches as compared to small branches is probably due to the water supply available in the reservoir of the trunk and large limbs. This water is drawn upon by the foliage long after the water supplied is no longer taken up through the base of the cut stem.

That the part of the tree whence the branch came affects the lasting of the foliage is easily demonstrable, but the results obtained are difficult to explain. In the case of temperate zone species tested, foliage grown in full sunlight lasts longer when cut than foliage grown in partial shade. Sprout foliage of red oak, red maple, and yellow birch grown in full sunlight lasted longer than shade-grown branches of the same species. This phenomenon is to be expected, as the leaves of the former type are better protected against water loss, having thicker blades, thicker cuticle, and fewer stomata. Yet tests in Florida showed that the upper sun-grown foliage of *Pongamia*, *Sterculia*, and the India rubber tree definitely did not last as long as the low shade-grown branches from the same trees.

It has long been known that foliage cut in bright sunlight and supplied with water withers more quickly than foliage cut during cloudy periods or at night and similarly treated. This fact was confirmed by tests with six northeastern hardwoods. In all cases, foliage cut at 5 A.M. lasted longer than that cut at 11 A.M. The greatest difference occurred in red oak. Branches of this tree cut at 5 A.M. lasted six days; at 7 A.M., four days; and at 11 A.M., two days. This effect was observed only when branches were supplied with water, and can be satisfactorily explained by air lock, a phenomenon discussed below.

As would be expected, immature foliage is poorer in lasting quality than hardened mature foliage. It follows that branches cut in the spring will not last as long as those cut later in the season. Hardwood branches cut in the fall, however, are inferior in their lasting qualities to those cut in mid-summer. This is because cutting the branch is apt to hasten autumn coloration, as in cherry and sumac; and, more important, is apt to hasten leaf abscission (many species). The rapid drop of leaves in autumn-cut branches more than compensates for the low loss of water from the mature foliage in cool weather.

Experiments with the use of synthetic plant hormones (auxins) indicated that, in certain instances, these substances had beneficial effects on the lasting qualities of cut foliage. It has been well established that auxin treatment retards the formation of the abscission layer, a principle utilized commercially by apple growers, and this retardation apparently may lengthen the life of branches cut in the fall. Also, auxin spray seems to maintain higher water content in leaves. It is further possible that auxin treatment influences metabolism, but it is difficult to determine whether the influence is direct or whether auxin influences metabolism by increasing water content by retarding abscission layer formation. The effect of the auxin treatment was observed in certain instances when branches were sprayed with water solutions (ca. 0.01%), but was more pronounced when applied in similar concentrations in combination with a wax emulsion spray (see below).

SUPPLY OF WATER

Cut foliage can be kept alive for extended periods as long as its moisture content can be maintained. The problem of supplying water is the limiting factor in the preservation of cut foliage. Once water no longer reaches the leaves, wilting and crisping quickly occur.

Plugging

Simply supplying water to the cut bases of branches does not necessarily keep the foliage fresh, as most plants have a wound reaction which plugs the cut stem and prevents water from reaching the leaves. The nature of this plugging is variable. It may be structural plugging, such as the development of tyloses and gum-like plugs in the vessels; it may be due to secretions such as latex and resin; it may be due to external agents such as bacteria and fungi; or it may be due to bubbles of gas in the vessels.

That plugging of vessels with tyloses and gum-like deposits is correlated with the cessation of water uptake in certain temperate plants was determined morphologically by Prof. R. H. Wetmore and Prof. I. W. Bailey, of Harvard University. In red oak, heavy tylosis formation takes place within a few days after cutting. In red maple, gum-like "amber" plugs develop in a similar period of time, mostly in the basal six inches. Both tyloses and "amber" plugs were formed very rapidly in willow.

In resinous plants, accumulations of exuded resin tend to seal off cut faces exposed to air. When the cut face is immediately placed in water, however, resin does not appear to interfere seriously with water uptake. Secretions of various tropical plants were much more troublesome. In particular, the latex of *Ficus, Hevea,* the mucilaginous sap of *Musa,* and similar secretions in representatives of other genera, tend to become suspended in the water, and in turn are drawn into vessels, where they form plugs at the first cross-wall.

It was further observed that films caused by bacterial accumulations occurred on the cut surfaces of stems containing no toxic substances such as tannin. These might well hinder water uptake, as would also extensive fungal activity.

In cut branches, air bubbles enter the vessels, forming "air locks," which presumably plug the stem and reduce water uptake. When the stem is cut, transpiration immediately draws air up through the cut surface into the stem. If the stem is then placed in water, the air is confined within and will form bubbles at the first effective cross-wall. This explains why foliage cut before sunrise lasts longer than that cut at mid-day. In full sunlight, the heavy transpiration of foliage draws air into the stem as soon as the stem is cut. Consequently, regardless of how quickly the stem is placed in water, enough air has entered the stem to form an air lock. Early in the morning, or at any other time that the transpiration rate is low, little or no air enters the stem if the cut base is promptly immersed in water.

Recutting

It is possible to prevent the formation of an air lock by cutting the branch under water. When bent through a pail of water and severed from the tree by being cut under water, aspen and white ash branches took up two to three times as much water as controls cut in the air. This enables them to last longer.

Such a procedure, though sound, is not very practicable. Once a branch cut in air has been placed in water, however, it can be recut under water advantageously. This will remove any plugging in the basal portion of the stem, whether due to tyloses, secretions, bacteria, or air locks.

The efficacy of the recutting treatment depends upon the species involved. It materially lengthens the life of those in which plugging occurs largely at the base, and is naturally of little value when plugging occurs throughout the stem. In trials at Petersham, the life of cut branches of sugar maple, red maple, beech, yellow birch, and hemlock was materially lengthened by recutting under water. Red oak, chestnut, sumac, and pin cherry were not materially aided. The results obtainable by recutting under water are occasionally spectacular. In one instance, a sugar maple branch taken in midwinter was kept alive for three months. By a combination of recutting and the basal injection of water with pressures up to 15 lbs. per square inch, a full crop of leaves was grown and maintained for many weeks.

Apparently species with a long functional vessel length are not helped by recutting, as the air locks and other plugs are not confined to the base of the stem. By testing cut segments of stems with eight to fifteen pounds air pressure applied to one end and collecting the air bubbles under water at the other, it was possible to calculate the approximate functional length of open vessels. This length was several feet or more for red oak, Lombardy poplar, white ash, elm, cherry, and ailanthus; several inches for red maple, sugar maple, yellow birch, and black walnut. In conifers, the tracheids are so short that such measurements were not made. The longest functional vessel lengths observed were 35 feet for red oak and 20 feet for Lombardy poplar.

Recutting a cut stem in air proved better than no treatment but inferior to recutting under water. This is to be expected, as the structural basal plugs are removed by the treatment, but air locks are not prevented from being reformed.

The lasting properties of lactiferous plants can be materially lengthened by washing the latex off the wound until it stops running, and also, to a lesser extent, by charring the base of the cut branch to coagulate the latex in the latex tubes, thereby preventing it from plugging the vessels.

Purity of Water

Water purity greatly influences the lasting of foliage, because impurities tend to clog up cut stems, thus reducing the rate of the water supply. This was demonstrated by trials at Petersham with sugar maple, red oak, beech, and hemlock. The reaction of sugar maple was typical. It lasted six days when supplied with water from a deep driven well; four days with clear, swift-flowing river water; three days with sphagnum swamp water; and two days with water from a stagnant pool. Water uptake for all species was closely correlated with lasting qualities.

In Florida, tests were carried out to see whether certain coastal species could be maintained with sea water. *Pongamia* and *Hernandia* were injured by salt water, and separate fronds of coconut quickly browned. Entire cut coconut trees and *Casuarina* were successfully maintained. In the case of coconut trees, the stem apparently filtered out the salt before the salt reached the foliage. Mangrove was successfully maintained in salt water as well as in fresh water only if the bases were cut under water and maintained there.

Extensive exploratory tests carried out by Dr. P. R. Gast and by the authors failed to reveal any chemical or combination of chemicals which when added to the water supply was much more effective in prolonging the fresh appearance of cut foliage than the use of water alone.

Method of Supply

The most obvious and most practicable means of supplying water to cut foliage is through cut bases. Water may also be made available to the plant in other ways.

Merely placing the cut bases in moist soil is sufficient to prolong the life of coniferous branches. A certain amount of water is supplied by capillary action, although this method is much inferior to standing the cut base in clean water. The value of placing coniferous stems in the ground was demonstrated by a number of tests, both indoors and outdoors, one of which is detailed in Table 3. Hardwoods require so much water that they are not helped by this treatment.

Water was also supplied through incisions in the stem, either made by a sharp blade or by an auger, and through the stubs of cut laterals. In the experiment summarized in Table 3, the amount of water taken up by hemlock foliage through cut bases and cut laterals was roughly proportional to the surface area of the sapwood exposed in the cuts. The most successful treatment, exclusive of wax treatments, was that in which water was supplied both through the cut base and a cut lateral.

Cut foliage can be maintained for long periods of time by placing the bases in sand and preventing the tops from drying out with an intermittent spray. In such a case, the rate of water loss is reduced to a very low level,

TABLE 3.

WATER SUPPLY AND WAX TREATMENT OF CUT HEMLOCK TREES[1]

Treatment	Water content[2] (percent)				Water uptake in 17 days (cc. per gr. total dry wt.)	Leaf fall (percent)	
Base in	13 days	27	40	80		40 days	80
Air	34	12	7	3		100	100
	37	14	8	3		100	100
Soil	49	36	24	3		10	100
	49	39	19	11		30	100
Air—one lateral	42	17	7	3	.047	100	100
with water	42	19	8	3	.051	100	100
Air—two laterals	44	31	14	3	.057 + .064	96	100
with water	41	21	9	3	.031 + .057	100	100
Water	54	55	40	3	.854	0	100
	55	55	48	3	.717	0	100
Water—one lateral	54	55	55	38	.607 + .059	0	0
with water	56	56	56	8	.738 + .076	0	70
Air—sprayed	48	31	18	3		40	100
with Dowax[3]	41	34	9	3		100	100
Air—sprayed	48	45	40	7		0	95
with wax solution[4]	46	44	44	5		0	30
Water—sprayed	54	54	49	4	.582	0	95
with Dowax	53	53	48	5	.464	0	95
Water—sprayed	54	56	57	40	.259	0	3
with wax solution	55	55	56	43	.393	0	6

[1]Tree six to eight feet tall placed in large room on December 16, 1942. Average daily range in temperature, 45 to 60° F. Average relative humidity, 50%.

[2]Original water content, average for all trees, 54%. All values below 35% represent fallen needles.

[3]One part Dowax to four parts water.

[4]One part paraffin to one part petrolatum to eight parts kerosene.

and enough water is taken up by the leaves to make up any deficit which may occur. The stems may be heavily plugged, but the development of new xylem will re-establish translocation after roots are formed. An automatic apparatus to accomplish this was constructed at the Harvard Forest, which maintained leafy cuttings of various species for the entire growing season.[4] Maintenance of this type is of no value in camouflage, but is a promising tool in the rooting of leafy cuttings.

REDUCTION OF WATER LOSS

Inasmuch as loss of water is the primary cause of the death of cut foliage, it follows that any method which reduces water loss without otherwise affecting the plant will increase the period of normal appearance. The principal way of accomplishing this is to coat the foliage with a non-toxic substance, usually a wax or a mixture containing wax.

In the course of the present investigations, a great deal of exploratory work was carried on to investigate the possibilities of this type of treatment. A large number of substances were tried in many combinations under a variety of conditions. Although no material was found which could be highly recommended, enough was learned to reveal the limitations and possibilities of this means of reducing water loss.

A satisfactory coating must have two properties: it must form a thin pliable inconspicuous film capable of markedly reducing water loss, and it must be non-toxic to the living tissue of the plant. Unfortunately, these two characteristics rarely occur together.

The effectiveness of a film in reducing water loss may be determined by observations of the lasting quality of branches, by measuring water uptake, by measuring changes in total plant weight, and by determining moisture content. Observation suffices only to distinguish living foliage from dying and dead foliage. Water uptake may be used as an index of water loss, especially for longer time periods. Thus, in Table 3, the hemlocks sprayed with wax solution required less water and lasted better than trees sprayed with Dowax. Moisture content, whether determined directly from samples, or indirectly by measuring the loss of weight of a drying cut branch, is an index of the ability of the coating to reduce water loss. This, too, is illustrated in Table 3.

Death of living tissue is indicated by color and structural changes which markedly alter the normal appearance of the plant. Any substance causing the death of tissue, therefore, is undesirable as a protective coating. Toxicity is governed by a large number of factors, such as temperature, method of application, and chemical composition of the coating. Chemicals toxic to foliage even in a low concentration are not necessarily toxic in combination, as in the case of ammonium hydroxide in Emulsion B, Table 4. Most of the coatings tried in the present investigation proved to be toxic in one way or another. Conifers are much more resistant to

[4]Grossenbacher, Karl A. An apparatus to maintain a surface film of water for use in vegetative propagation. Jour. Arnold Arb. 26: 206–211. 1945.

TABLE 4.

TESTS IN FULL SUNLIGHT WITH WAX EMULSION DIPS ON BRANCHES SUPPLIED WITH WATER

Species	Control	Dowax[1]	Emulsion A[2]	Emulsion B[3]
	Average number of days before reaching Class III			
Red oak	4	6	8	5
White oak	3	5	8	6
Chestnut	4	2	6	5
Beech	4	3	6	3
Paper birch	2	1½	3	2
Elm	1	1	1	1
Aspen	0	0	1	0

[1]One part Dowax to three parts water.

[2]Paraffin, 7.7g.; Duponol WS, 2.3g.; linseed oil, 3.5ml.; glue, 1.0g.; water, 200ml.

[3]Candellila wax, 5.0g.; Neomerpin, 1.0g.; Ammonium hydroxide, 4.0g.; kerosene, 4.2ml.; water, 6.3ml. Concentrate diluted, one part to three parts water.

toxic effects than hardwoods. The development of a non-toxic coating is the principal difficulty in solving the problem of how effectively to reduce water loss and maintain living foliage.[5]

Coatings fall into two general classes: solutions and emulsions. Solutions of various waxes in organic solvents are highly effective in preventing water loss. Most of the solvents, however, are highly toxic to living tissue. The most promising solution used was a mixture of one part paraffin and one part petrolatum in eight parts of kerosene. This proved extremely effective in preventing water loss (Table 3), and of low toxicity when sprayed on foliage at such a temperature that the film solidified as soon as it was formed. It was very toxic, however, when used at higher temperatures, or when applied as a dip. In these cases, greater penetration occurred, and penetration of any coating was found to be conducive to toxicity.

Emulsions have a basic advantage over solutions in that they may be applied in a non-toxic medium — water. Among the emulsions tested, a commercial preparation known as Dowax proved reasonably efficient in prolonging the life of conifers but not of many hardwoods (Tables 3 and 4). It was toxic in varying degrees with several of the plants tried. Experiments made by Dr. P. R. Gast in Florida indicated that its use materially prolonged the life of fronds of the cabbage palm (*Sabal palmetto*) and the leafy foliage of blackjack oak (*Quercus marilandica*). Auxin treatment, as mentioned above, apparently lengthened the life of cut foliage somewhat when used with Dowax on branches supplied with water. This

[5]Comar, C. L., and Barr, C. G. Evaluation of foliage injury and water loss in connection with use of wax and oil emulsions. Plant Physiology **19**: 90–104. 1944.

emulsion was developed by E. J. Miller[6] and contains a wax, an ammonium salt of a drying acid, and a colloidal earth.[7]

Emulsion A (Table 4, footnote 2) was the most promising developed in the present investigations. It is a non-ammonical mixture but inconvenient in that it cannot be prepared in a concentrated form. For hardwood foliage it was of low toxicity and highly effective in reducing water loss. This emulsion was developed by Dr. Ernest Ball, of Harvard University, who participated actively in the development of satisfactory coatings.

Emulsion B (Table 4, footnote 3), an ammonical mixture which could be prepared in a concentrated form, was also effective in reducing water loss. The emulsifiers used in this and other emulsions, as well as certain other chemicals, were provided by the E. I. Dupont de Nemours Company.

All the coatings mentioned above are effective only when water is supplied to the treated foliage. Without water, improvement was noted only in certain cases. The lasting of conifers could usually be lengthened somewhat. Emulsions A and B also helped certain hardwoods, such as red oak and paper birch. This limited effect in the absence of water is to be expected, inasmuch as a protective coating is of value only in reducing water loss to a rate comparable with that of water uptake, thus keeping the plant tissue alive. If water is not supplied, a protective coating can lengthen life only a short time by retarding the loss of water already present in the plant.

SUMMARY

Extensive investigations were carried out to determine how long cut foliage of different species will retain its normal appearance under various conditions, and how the life of cut foliage can be maintained.

More than one hundred representative species of the northeastern United States, western Europe, Asia, and the tropics were tested and classified as to their lasting qualities, both with and without a supply of water.

Conifers proved to be greatly superior to hardwoods in their lasting qualities. Plants of the same genus tended to have similar lasting qualities regardless of their geographic origin.

The range in lasting qualities of tropical species was much the same as that of temperate plants. In the tropics, however, because of the large size and weight of many of the leaves, abnormal appearance of drying foliage often was first manifested by marked wilting of the petioles and consequent leaf drooping, rather than by a change in the leaf itself.

A number of factors involving the selection and handling of cut foliage affect their lasting qualities. The larger the branch, the longer it will last. Foliage grown in full sunlight generally lasts longer than shade-grown foliage, although upper sun-grown branches of certain tropical species were found to be inferior to lower limbs grown in the shade. Mature foliage

[6]Miller, E. J., Meilson, J. A., and Bandemer, Selma L. Wax emulsions for spraying nursery stock and other plant materials. Michigan Agr. Exp. Sta. Spec. Bull. 282. 39 pp. 1937.

[7]U. S. Patent no. 2,013,063.

lasts better than immature, but late season foliage does not last as well because of abscission layer formation. In certain instances, auxin treatment has beneficial effects on the lasting qualities of cut foliage, both in retarding abscission and in maintaining water content.

Supplying water generally increases the life of foliage two to four times. Water ceases to reach the leaves, however, in a few days, due to plugging of the stem. This plugging may be due to tyloses or gum-like deposits in the vessels, to secretions, such as latex or resin, to bacteria or fungi, or to air locks—bubbles of air in the vessels. By cutting foliage when the transpiration rate is low (during rains, early in the morning, etc.), plugging from initial air locks can be minimized.

In plants with functionally short vessels, where plugging occurs mainly in the basal portion of the stem, recutting the stem under water will remove the plug and materially increase the life of the foliage.

Cut foliage lasts best in pure water, as solid particles clog the vessels and chemical impurities may injure the living tissues. Salt water (sea water), however, successfully maintained cut branches of a few tropical coastal plants.

No chemical or combination of chemicals was found which would increase the lasting of cut foliage.

Water can be successfully applied to cut branches through the base, through cut laterals, and through stem incisions.

The reduction of water loss by means of a non-toxic coating will materially increase the life of cut foliage. Despite extensive experiments, no highly successful coating was developed. Several coatings however, were satisfactory under certain conditions. Among these coatings were one solution of paraffin and petrolatum and two emulsions: a non-ammonical one with paraffin, and an ammonical one with candellila wax. Waxy coatings are particularly effective when the treated foliage is supplied with water. The most satisfactory coatings approximately double the life of many species.

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PLANTAE PAPUANAE ARCHBOLDIANAE, XVI*

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With eleven text-figures

THE FOLLOWING genera are considered in this article: *Urophyllum, Pachystylus, Canthium, Antirhea, Timonius, Mastixiodendron, Coffea, Ixora, Versteegia, Coprosma, Coelospermum, Morinda,* and *Galium.* We still have *Psychotria* and its closely related genera to be included in another paper, and that, we hope, will complete the Rubiaceae until such time as certain specialists can give the collections their attention.

RUBIACEAE (in part)

Urophyllum Wallich

Urophyllum umbelliferum Val. Nova Guin. Bot. **14**: 262, *t. 29A*. 1925.

BRITISH NEW GUINEA: Fly River, 528 mile Camp, *Brass 6646,* May 1936, alt. 80 m., plentiful in undergrowth on ridges (tree 4 m. high; flowers green; ripe fruit black, fleshy, about 1 cm. long).

Described from Netherlands New Guinea. This collection is not so pubescent as the original, and the petioles are slightly longer than those shown in the plate, yet these are only minor variations. The calyx-lobes vary in length, being 2–4 mm.; in the open flower the corolla-tube is 4 mm. long and practically glabrous, and the lobes are 3–3.5 mm. long and pilose on the outside.

Pachystylus K. Schumann

Pachystylus Guelcherianus K. Schum. in Schumann & Hollrung, Fl. Kaiser Wilhelms Land 133. 1889; Schumann & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 574. 1900.
Tarenna Guelcheriana (K. Schum.) Val. Bot. Jahrb. **60**: 85. 1925.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13886,* Apr. 1939, alt. 120 m., rain-forest of lower mountain slopes (undergrowth tree 2.5 m. high). BRITISH NEW GUINEA: Oroville Camp, Fly River, *Brass 7401,* Aug. 1936, plentiful in rain-forest undergrowth (tree 2–3 m. high; flowers cream-colored).

Described from Northeast New Guinea, and previously reported from

* Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. **26**: 1–36. 1945.

Netherlands New Guinea. Although the genus was reduced to *Tarenna* Gaertner by Valeton, Bremekamp believes it should be maintained as a separate genus, and from our little available material we agree with his point of view.

Canthium Lamarck

Canthium suborbiculare (White) comb. nov.
Plectronia suborbicularis White, Proc. Linn. Soc. N. S. Wales **51**: 296, *t. 17*. 1926, Jour. Arnold Arb. **10**: 268. 1929.

Known only from Papua.

Canthium cymigerum (Val.) B. L. Burtt, Kew Bull. **1936**: 463. 1936.
Plectronia cymigera Val. Bot. Jahrb. **61**: 54. 1927.

NORTHEAST NEW GUINEA: Maboro, *Schlechter 19513,* May 20, 1909, in forest. SOLOMON ISLANDS: Bougainville: Kugimaru, Buin, *Kajewski 1805,* June 1930, alt. 150 m., rain-forest (tree up to 20 m. high; leaves dark glossy green; fruit 9 mm. long, 1.2 cm. broad, 6 mm. thick); Koniguru, Buin, *Kajewski 2111,* Aug. 1930, alt. 900 m., rain-forest (tree up to 10 m. high; fruit 6 mm. long, 1 cm. broad); Ysabel: Tasia, *Brass 3286,* Dec. 1932, coastal rain-forests (small tree with drooping branches; leaves shining, the lower surface very pale; flowers white).

In the original publication of this species the type-number is given as *17513,* so that either the number on our duplicate was copied wrong or there was an error in publication. It does not seem possible that both Schlechter's numbers could have been collected in the same place in the same month, unless an exceptionally large collection was made. There are two unbroken leaf-tips in the Schlechter specimen cited which tend to be broadly and obtusely acuminate. In the Solomon Islands material the leaves are ovate-elliptic, up to 10 mm. broad, more abruptly rounded at the base, and rather abruptly obtusely acuminate.

Canthium odoratum (Forst. f.) Seem. Fl. Vit. 132. 1866.
Coffea odorata Forst. f. Prodr. 16(no. 94). 1786.

BRITISH NEW GUINEA: Mabaduan, *Brass 6539,* April 1936, common in small scrubby rain-forest patches in savanna-forests (tree 5–6 m. high).

This fruiting collection shows a very close resemblance to the Polynesian material. The secondary venation of the leaves is more obvious in the material above cited than in the other specimens at hand, the fruit is more strongly rugose on the outside, and the semicircular pyrenes have a very deep indentation on the inner surface.

Canthium graciliflorum sp. nov.

Arbuscula 4–5 m. alta; ramulis ultimis 4-angulatis demum subrotundatis, minute puberulis, internodiis 1.5–4 cm. longis; stipulis valde inaequalibus, altera 2 mm. longa, altera 4 mm. longa, basi latis, ensiformibus; foliis lanceolatis utrinque angustatis, 3–4.7 cm. longis, 1–1.8 cm. latis, apice anguste obtusis, basi in petiolo 2–3 mm. longo attenuatis, subcoriaceis, supra subnitidis, olivaceis, subtus opacis, interdum costa versus basim minute puberulis, ceterum glabris, nervis lateralibus utrinsecus ± 4 oblique adscendentibus marginem versus arcuatim confluentibus, utrinque inconspicuis; corymbis axillaribus bifurcatis vel trifurcatis, 1.5–1.7 cm. longis latisque; floribus plerumque breviter pedicellatis; ovario subgloboso glabro vix 1 mm. longo; calycis limbo brevissimo, minute 5-dentato; corollae tubo 1 mm. longo, fauce pilis reflexis barbato, lobis 2.5 mm. longis, linearibus, patentibus vel reflexis; staminibus fauce insertis, filamentis 1.5 mm. longis, antheris sagittatis, 1.5 mm. longis, apice apiculatis; stylo circiter 4 mm. longo; stigmate mitriforme, apice bilobato; fructibus non visis.

British New Guinea: Tarara, Wassi Kussa River, *Brass 8596* (type), Dec. 1936, common and conspicuous in brushy rain-forest fringing river (slender tree 4–5 m. tall; branches semi-erect; leaves smooth and shining; very numerous cream-colored flowers).

This species is related to *Canthium odoratum* (Forst. f.) Seem., but the leaves are narrower and without domatia; the inflorescence is much shorter and the flowers are slightly smaller in all the parts. In some ways, particularly in the outline of the leaves and their tendency to shine, the plant suggests one passing in Australia as *Canthium lucidum* Hook. & Arn., which perhaps more correctly should be known as *C. lamprophyllum* F. v. Muell. Here again in comparison the Papuan material is less coarse in every way than the Queensland collections. In the Gray Herbarium is a small fragment from Hooker's herbarium collected on Gambier Island by Beechey labelled *C. lucidum* Hook. & Arn. The fragment is probably from the type or an isotype and there is no question in our minds that it is identical with *C. odoratum* (Forst. f.) Seem., but it is scarcely the same as the Australian material so-named.

Canthium brevipes sp. nov.

Arbuscula 3–5 m. alta; ramulis in sicco atro-cinereis vel brunnescentibus, novellis nigrescentibus, glabris, internodiis 2–4 cm. longis; stipulis brevibus, 1–2 mm. longis, caducis; foliis ellipticis vel oblongo-ellipticis, 7–12 cm. longis, 2.2–4.5 cm. latis, utrinque aequaliter angustatis, apice obtusis vel obtuse acuminatis, basi cuneatis, chartaceis, in sicco supra atro-fuscis, subtus olivaceis, glabris, nervis lateralibus utrinsecus 6–8 utrinque manifestis non prominulis in axillis domatia minuta foventibus; floribus in tuberculis axillaribus 1–9-umbellatis; pedicellis 2–3 (–6 in fructu) mm. longis; ovario subgloboso, cum calyce ± 1.5 mm. longo; calycis tubo inconspicuo, margine minute dentato ciliato; corollae tubo 3–4 mm. longo intus retrorse pubescente, fauce et lobis basi villosis, lobis 2.2–2.5 mm. longis, lanceolatis acutis; antheris circiter 1 mm. longis, sessilibus, in fauce insertis, apice mucronatis; stylo glabro, 4 mm. longo; stigmate mitriforme, apice ± reflexo; fructibus usque 1.9 cm. latis et 1.1 cm. longis, divaricatim bilobatis facie fructum *Guioae* admonentibus; pyrenis extus rugulosis, oblique semirotundis latere ventrali incisis; seminibus valde curvatis.

British New Guinea: Lake Daviumbu, Middle Fly River, *Brass 7470,* Aug. 1936, rain-forest, common in lakeshore undergrowth (tree 3–5 m. high; fruit red); Penzara, between Morehead and Wassi Kussa Rivers, *Brass 8443* (type), rain-forest (small tree fringing a permanent waterhole; flowers yellow).

Canthium brevipes is closely related to *C. Valetonianum* S. Moore, if we have rightly interpreted the latter species. In the former the veins of the leaves are closer together; the fruit is broader and at the apex has a broad shallow depression not characteristic of Moore's species. At a glance the fruit somewhat suggests that of certain species of *Guioa* in contour; in fruit the pedicel is only 6 mm. long, whereas in the other species which we have seen the pedicel has elongated to 1 cm. or more in length. This group of species with umbellate flowers needs a revision from a specialist's point of view.

Canthium korrense (Val.) Kanehira, Bot. Mag. Tokyo **46**: 671. 1932.
Plectronia korrensis Val. Bot. Jahrb. **63**: 311. 1930.

SOLOMON ISLANDS: Florida (N'Gela): North end of the island, *Brass 3510*, Jan. 1933, alt. 75 m., hill rain-forests (tree 5 m. tall, with close gray bark; flowers white or pale yellow; fruit smooth, pale red); Guadalcanal: Mamassa, Konga, *Kajewski 2479*, Feb. 1931, alt. 400 m., rain-forest (tree up to 18 m. high, on banks of freshwater creeks; fruit dull red when ripe, 1.2 cm. long, 1.4 cm. broad).

This material seems to be a very good match for the description and material collected at Ponape. The flowers are perhaps nearer 6 mm. long rather than 4 mm. as given in the original description.

Canthium longiflorum (Val.) comb. nov.
Plectronia longiflora Val. Bot. Jahrb. **61**: 56. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13971*, Apr. 1939, alt. 50 m., rain-forest subject to occasional flooding (undergrowth tree 6 m. tall; flowers white). BRITISH NEW GUINEA: Tarara, *Brass 8509*, Dec. 1936, common in rain-forest undergrowth (shrub 2 m. high; fruit pink).

Described from Northeast New Guinea. The second specimen cited is in fruit only but seems to fit better here than elsewhere at present.

Canthium Schlechterianum nom. nov.
Plectronia nitens Val. Bot. Jahrb. **61**: 57. 1927.

NORTHEAST NEW GUINEA: Yoangen, *Clemens 6492*, June 1937, alt. about 1250 m.

This collection agrees with Valeton's description except that the corolla-lobes are about 12 mm. long rather than 5 mm. The specific epithet *nitens* is pre-empted in the genus *Canthium*. The species is known only from New Guinea, and only in the flowering stage.

? **Canthium megistocarpum** sp. nov.

Arbor parva; ramulis brunnescentibus, novellis in sicco atro-olivaceis, glabris; internodiis 3–7.5 cm. longis; stipulis inaequalibus, 5–10 mm. longis, basi latis, ensiformibus; foliis oblongo-lanceolatis, 18–27 cm. longis, 5.5–7.5 cm. latis, apice longe acuminatis, acumine 1–2 cm. longo, basi cuneatis, chartaceis, glabris, nervis lateralibus utrinsecus 8 vel 9 supra leviter impressis, subtus prominulis, venis inconspicue manifestis, laxis; petiolo circiter 9 mm. longo; floribus non visis; fructibus pyriformibus, in sicco 7 cm. longis, 4.5 cm. diametro; pyrenis 2, endocarpio osseo extus irregulariter tuberculato; semine pendulo ad tertium superum ovarii longitudinis affixo.

NETHERLANDS NEW GUINEA: 2 km. southwest of Bernhard Camp, Idenburg River, *Brass 13476* (TYPE), March 1939, alt. 800 m., small tree of rain-forest substage (large pyriform green pithy fruit up to 10 cm. long and 7.5 cm. in diameter).

This species may be related to *Canthium Schlechterianum* Merr. & Perry (*Plectronia nitens* Val.), but up to the present the only comparable parts are the foliar characters, one having very large flowers, the other very large fruits. Valeton's species, if we have correctly interpreted it, has equal stipules and firmer, broader, and shorter leaves with shorter petioles. Supplementary material of both species is greatly needed.

? Canthium aurantiacum sp. nov.

Arbor parva, usque 5 m. alta; ramulis novellis atro-fuscis, glabris; internodiis 1.5–3 cm. longis; stipulis subaequalibus, 5–10 mm. longis, basi latis, apice elongato-ensiformibus; foliis oblongo-lanceolatis, 12.5–14.5 cm. longis, 3.7–4.5 cm. latis, apice breviter acuminatis, acumine obtusiusculo, basi anguste cuneatis vel acutis, glabris, coriaceis, nervis lateralibus utrinsecus 6–8 oblique adscendentibus, utrinque manifestis non prominulis, venis obscuris; petiolo circiter 8 mm. longo; floribus non visis; tuberculis in axillis foliorum 2- vel 3-cicatricosis; fructibus in sicco obovoideis 4 cm. longis, 2.5 cm. diametro, leviter rugulosis; pyrenis 2, endocarpio osseo extus irregulariter tuberculato; semine pendulo ad tertium superum ovarii longitudinis affixo; embryone 2.5 cm. longo, teretiusculo, recto, cotyledonibus brevibus, radicula supera.

British New Guinea: Kubuna, *Brass 5580* (type), Nov. 1933, alt. 100 m., ridge-forest substage (small tree 5 m. high; leaves thick, smooth; fruit solitary in axils, orange-yellow, about 4.5 cm. long, 3 cm. or more in diameter).

The leaves of this species are smooth and thicker than are those of most species of *Canthium* from New Guinea; the tubercles in the axils of the leaves are very short and have 2 or 3 scars on the ends, probably indicating the number of flowers or fruits borne there. The fruit is very large compared with that of the other New Guinean species except one, but *C. glabrum* Bl. of Malaysia has fruit as large or larger. In the latter species, however, the leaves are larger, thinner, and broader than in the New Guinean material.

Antirhea Commerson

S. Moore, Jour. Bot. 65: 266. 1927, and Fosberg, Sargentia 1: 121. 1942, include within their concept of the genus *Timonius* DC. plants with fruits characterized by a 4–10-loculed putamen. The latter character, coupled with a persistent calyx and a corolla with imbricate lobes, belongs to the concept of the genus *Antirhea* Commers. As far as we may judge from the material at hand the genus is a valid one. Valeton, Bull. Dép. Agr. Ind. Néerl. 26: 12. 1909, indicates the similarity of the inflorescences in the entire tribe Guettardeae, in which case one would naturally look for generic differences in the fruits. S. Moore simply indicates that *Brass 946* is apparently a new species of *Timonius,* suggesting its resemblance to *T. subcoriaceus* Val. but noting that the center of the fruit is occupied by a star-shaped woody mass containing 9 pyrenes. We believe that another genus is represented when the fruit contains a putamen (a hardened concrete mass containing the seeds) or, as Fosberg calls it, a fused stone. In the case of *Timonius Kajewskii* (Guill.) Fosb., at least as to the fruiting specimen cited by Fosberg, the pyrenes cohere very closely, but the walls of the adjoining pyrenes maintain their identity; this is apparent in a cross-section of the fruit which shows a definite line between adjacent pyrenes. In *Timonius Smithii* Fosb., from Fiji, the fruit does not contain separate pyrenes as such, but a putamen with 10 locules. Since the latter is a character of *Antirhea* Commers. rather than of *Timonius* DC., the Fijian plant should be called **Antirhea Smithii** (Fosb.) comb. nov. (*Timonius Smithii* Fosb. l.c.).

Antirhea tenuiflora Benth. Fl. Austr. 3: 418. 1867; F. M. Bail. Queensl. Fl. 3: 760. 1900.

BRITISH NEW GUINEA: Tarara, Wassi Kussa River, *Brass 8525, 8585*, Dec. 1936, common in undergrowth of rain-forest (shrub of weak habit 2–5 m. high; leaf-nerves pale; flowers white; fruit red, ovoid).

These collections are intermediate between two Queensland specimens in our herbarium and agree reasonably well with the description of this species. This seems to be the first record of the presence of the genus in New Guinea.

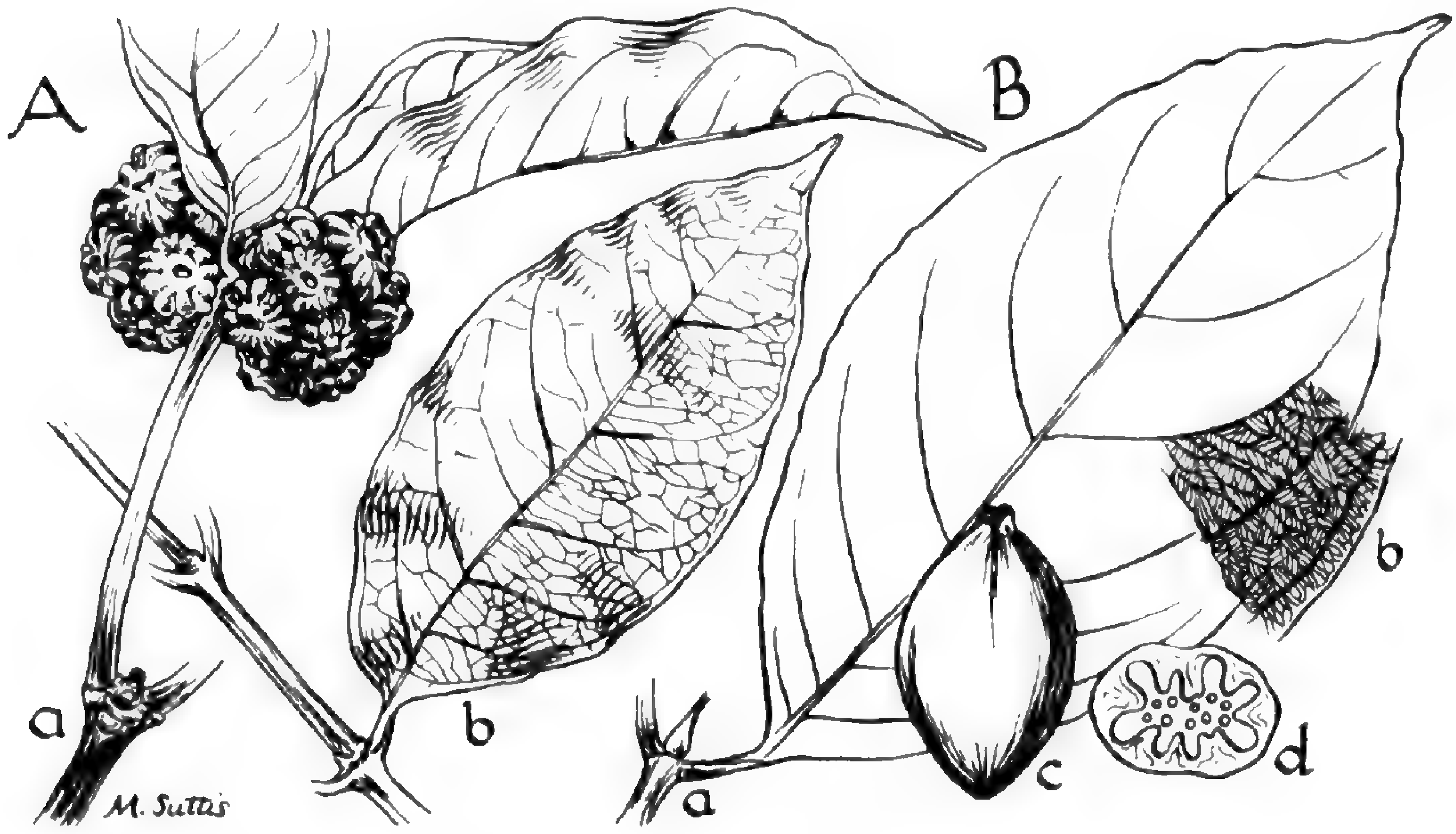

FIG. 1. A. *Morinda costata* Merr. & Perry: *a*. habit, × ½; *b*. leaf, × ½. B. *Antirhea megacarpa* Merr. & Perry: *a*. leaf and terminal bud, × ½; *b*. enlarged portion of leaf to show detail of venation; *c*. fruit, × ½; *d*. cross-section of fruit, × ½.

Antirhea megacarpa sp. nov. FIG. 1, B.

Arbor ± 9 m. alta; ramulis cinereis, novellis compressis, internodiis 1.5–5 cm. longis; supra juxta cicatricem novellam stipularum hirtellis; stipulis 6 mm. longis, carinatis, pubescentibus, cito caducis; alabastris lateraliter compressis; foliis ellipticis utrinque angustatis, 8–20 cm. longis, 3–9 cm. latis, apice obtuse acuminatis, basi cuneatis, chartaceis, supra glabris, subtus costa nervisque consperse adpresse hirtellis, nervis lateralibus utrinsecus ± 9 adscendentibus et arcuatis, supra impressis, subtus prominulis, venis irregulariter positis, utrinque tenuiter prominulis, reticulo laxo, subtus areolis subparallele striatulis; petiolo 1.2–2.5 cm. longo; floribus non visis; fructibus ovoideis, 3.8 cm. longis, 2.5 cm. diametro, calycis lobis (1.5 mm. longis) coronatis; mesocarpio fibris praedito; putamine duriusculo, valde et irregulariter longitudinaliter 8- vel 9-costato, 10-loculato, 3 cm. longo, 1.7 cm. diametro.

BRITISH NEW GUINEA: Ihu, Vailala River, *Brass 946* (TYPE), Feb. 1926, rain-forest (tree 30 feet tall; bark thick, dark and flaky; flowers solitary, axillary; fruit red).

This plant is so very different from any of the species of *Antirhea* Commers. described from the southwestern Pacific that, in spite of the lack of flowers, we have described it. The very large fruit and the rather prominent venation of the leaves are its best characters.

Timonius de Candolle

In our work here we are accepting the older concept, also adopted by Valeton, that *Timonius* DC. has fruits with numerous pyrenes, and retaining in *Guettarda* L. and *Antirhea* Commers. those plants having fruits with a 4–10-loculed putamen. Of the approximately 50 species of *Timonius* DC. already described from Papuasia, we believe there are 18 species represented in the Papuasian material at hand. Not finding ourselves able to match the remaining collections with the descriptions, they are here presented as new. *Timonius merokensis* Wernham ought to be re-examined as to generic status. The few pyrenes with very small seeds (suggesting thick walls) call to mind the genus *Bobea* Gaudich., or rather *Nelitris* Gaertner, since the latter is the earlier published name. There is considerable variation in the number of pyrenes, and it has not always been easy to express the arrangement of the pyrenes within the fruit. In transverse section across the middle of the fruit, pyrenes may appear to be vertical, horizontal, or obliquely arranged. Most fruits in which the pyrenes are vertical do not have a very large number of pyrenes, and these may be massed, as it were, in the center of the fruit with a fairly fleshy sarcocarp surrounding them, or they may be distributed nearer the margin, the center of the fruit apparently being more or less spongy; fruits usually with numerous pyrenes may show them in horizontal position (if the pyrenes are abundant enough) or obliquely pendulous, those in the lower part of the fruit, of course, being always pendulous and vertical. Seemingly very early in the development of the flower the locules lose their identity as such, and hence the number, which we believe in most cases agrees with the number of stigmas, is not given in our descriptions. In some instances where the pyrenes appear to be vertical we have counted them in the cross-section; in the others, unless the pyrenes were fairly large and could easily be counted separate, we have tried to give the number of rows in the cross-section and also the number from the apex to the base as they appear in a longitudinal section. In any case, we again note the considerable variation in number.

Timonius avenis Val. Bull. Dép. Agr. Ind. Néerl. **26:** 46. 1909, Nova Guin. Bot. **8:** 473, *t. 72A.* 1911, Bot. Jahrb. **61:** 36. 1927.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12913,* Feb. 1939, alt. 1200 m., rain-forest epiphyte (tree 5 m. tall); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13310,* March 1939, alt. 900 m., frequent in open situations in mossy forest (slender tree 5–7 m. high); same locality, date, and altitude, *Brass 13628,* common high epiphyte in rain-forest (tree 5 m. high; branches upright; leaves concave). BRITISH NEW GUINEA: Mount Tafa, *Brass 5046,* Sept. 1933, alt. 2400 m., common in valley and lower slope forests (tree 15–20 m. high, with dense pale foliaged crown, *Ficus*-like in appearance; leaves thin, glabrous, glossy, pale beneath, obscurely nerved; flowers white; fruit compressed, fleshy, dark shining red).

The first three collections cited unquestionably belong to the same species. The leaves are much stiffer than those of the plants which we take for typical *T. avenis* Val. but they do not differ essentially from the description or the plate. The collection from Mount Tafa has more obtuse leaves than those from Netherlands New Guinea, the peduncles and the calyces are somewhat shorter, and the upper surface of the leaves is not so definitely striate as in typical *T. avenis* Val. As we do not have much material for comparison, it seems best for the present to place the collection here.

Timonius pubipetalus (Val.) comb. nov.

Timonius avenis var. *pubipetalus* Val. Bot. Jahrb. **61**: 37 (as *pubipetala*). 1927.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 12592,* Feb. 1939, alt. 1200 m., rare on slopes of primary forest (tree 18 m. tall, 39 cm. diameter; wood dark red; flowers white); same locality, date, and altitude, *Brass 12878,* subsidiary tree in rain-forest (22 m. high; leaves pale beneath; flowers white); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13687,* March 1939, alt. 850 m., bank of rain-forest stream (much branched tree 10 m. high; flowers brownish). BRITISH NEW GUINEA: Fly River, 528 mile Camp, *Brass 6804,* May 1936, alt. 80 m., epiphyte in forest-canopy (small tree or shrub; stipules and corolla pubescent).

Brass 6804 differs from the other collections cited in having definitely whitish pubescent terminal buds, and the upper surface of the leaves is lightly striulate; the fruits are deeply 6–8-sulcate. The other collections are all staminate; all the corollas are pubescent; the leaves are larger than given for the type, 5.5–12 cm. long, 1.5–3.5 cm. broad, and the cuticle is not striate on the upper surface. The material seems to be quite distinct from *Timonius avenis* Val. as we understand that species. In *Brass 12878* the terminal bud is slightly appressed-pubescent.

Timonius belensis sp. nov. FIG. 2, A.

Arbor 12–19 m. alta, glaberrima; ramulis fuscis; internodiis 1.5–6 cm. longis, novellis valde compressis; stipulis 3–5 cm. longis, oblongo-lanceolatis sensim acuminatis; foliis oblongo-oblanceolatis vel anguste ellipticis, 5.5–15 cm. longis, 1.8–5.5 cm. latis, apice acutis, basi cuneatis, in petiolo angustatis, tenuiter coriaceis, costa supra impressa, subtus prominente, nervis lateralibus utrinsecus 7–9 utrinque vix perspicuis, cuticula striata, striis ut nervis fere aequaliter manifestis; petiolo 0.6–2 cm. longo; inflorescentiis ♂ non visis; floribus ♀ solitariis axillaribus, pedunculatis, pedunculo 5–7 mm. longo; ovario et calyce urceolato, calyce vix 1 mm. longo, membranaceo, truncato; corollae tubo 4 mm. longo, 2 mm. lato, lobis 10–12, oblongo-linearibus, acutis, 3 mm. longis; staminibus 10–12, 3 mm. longis, apice vix exsertis; fructibus depresso-globosis, 7 mm. longis, 10 cm. diametro, apice calycis tubo brevi coronatis; pyrenis $\pm$ 72 vel multis, fere verticalibus, exterioribus paulo obliquis.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass & Versteegh 11110,* Nov. 1938, alt. 2250 m., frequent substage tree of primary forest (tree 19 m. high, 31 cm. diameter; bark gray-brown; fruits green); same locality, *Brass 11527* (TYPE), Nov. 1938, alt. 2400 m., common in old secondary forest (tree 12–15 m. high).

This species is an ally of *Timonius avenis* Val.; it has much larger leaves, striate on both surfaces, and inconspicuous primary veins. The foliar characters appear to be more clearly cut than those of the flower or fruit.

Timonius modestus sp. nov. Fig. 2, B.

Arbor parva epiphytica, alabastris, corollis et interdum pedunculis puberulis vel cinereo-pubescentibus exceptis glabra; internodiis 1–4 cm. longis, novellis compressis; stipulis usque 5.5 cm. longis, oblongo-lanceolatis, longe acuminatis, extus praecipue secus mediam cinereo-puberulis vel pubescentibus interdum glabris; margine ± vernicosis; foliis tenuiter coriaceis vel valde chartaceis, ellipticis vel leviter obovatis. 4–12 cm. longis, 2–6.5 cm. latis, apice minute et obtuse acuminatis, vel breviter acutis, basi cuneatis vel in petiolum angustatis, latissimis paulo ultra medium, in sicco margine saepissime leviter crispulis, nervis lateralibus occultis, cuticula supra dense striata, subtus striis vix manifestis; petiolo 0.8–1.5 cm. longo; inflorescentiis axillaribus, pedunculatis, pedunculo usque 1.5 cm. longo, ♂ ramosis, 5–7-floris; floribus sessilibus; calyce glabro, tubulato, 2 mm. longo, trun-

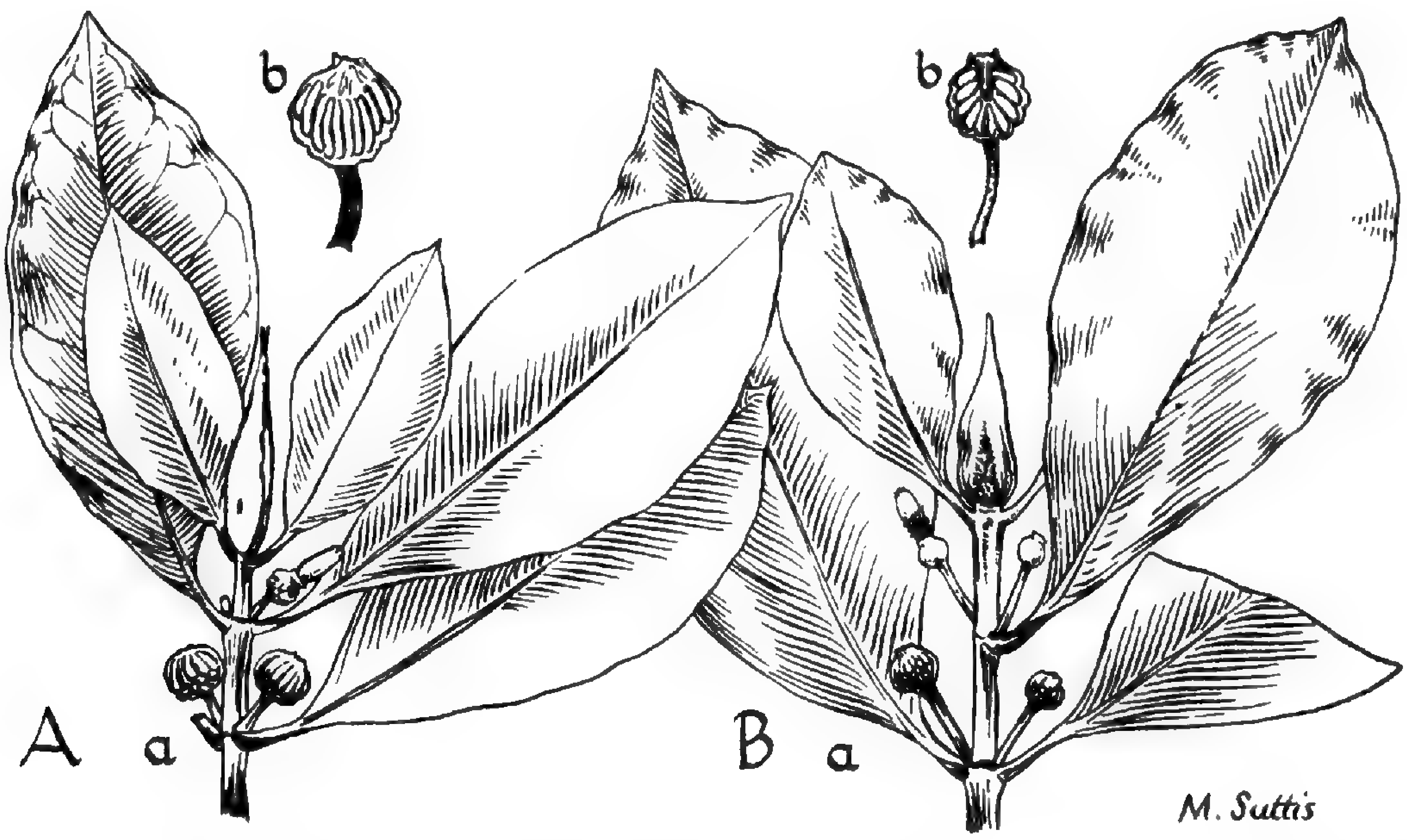

Fig. 2. A. *Timonius belensis* Merr. & Perry: *a.* habit, × ½; *b.* longitudinal section of fruit, × 1. B. *Timonius modestus* Merr. & Perry: *a.* habit, × ½; *b.* longitudinal section of fruit, × 1.

cato; corollae tubo 1 cm. longo, extus pubescente, lobis 4, ovatis, obtusis vel acutiusculis, extus pubescentibus, 3 mm. longis; antheris 7 mm. longis, apice tantum exsertis; stylo 3 mm. longo; floribus ♀ solitariis, ovario et calycis tubo urceolatis, 4 mm. longis; corollae tubo extus pubescente, 4–5 mm. longo, lobis 8 oblongis, 3.5 mm. longis, extus pubescentibus; stylo crasso, 6 mm. longo stigmatibus 8 terminato; fructibus depresse globosis, circiter 1 cm. diametro; pyrenis probabiliter ± 90, oblique pendulis, longitudinaliter ex apice ad basim 6 compacte superpositis, parvis.

British New Guinea: Fly River, 528 mile Camp, *Brass 6748* (type), May 1936, alt. 80 m., common in forest-canopy (epiphytic small tree; flowers white; immature fruit obscurely ribbed, somewhat compressed); Palmer River, 2 miles below junction Black River, *Brass 7076,* June 1936, alt. 100 m., small epiphytic tree common in forests.

This species closely approaches *Timonius avenis* Val. but it has pubescent buds and corollas, larger leaves, and pyrenes more obliquely arranged than in Valeton's species.

Timonius carstensensis Wernh. Trans. Linn. Soc. II. Bot. 9: 73. 1916.

BRITISH NEW GUINEA: East Mount Tafa, *Brass 4077*, May 1933, alt. 2350 m., edge of a small burnt-over clearing in mossy forest (erect branching bush 2 m. tall; branches shining gray-brown; leaves thick, pale green; flowers white; fruit green, somewhat compressed, costate); Murray Pass, Wharton Range, *Brass 4705*, Aug. 1933, alt. 2840 m., one of the rarer forest trees (spreading pale-barked tree, in appearance much like a *Ficus;* leaves above dark and shining, beneath yellowish; flowers white).

Until these can be compared with the type, it seems better to place the two cited collections here rather than elsewhere. In one collection the stipules are densely appressed-villous inside, while in the other they seem to be glabrous except for the colleters at the base.

Timonius scabriflorus (Val.) comb. nov.

Timonius avenis var. *scabriflorus* Val. Bot. Jahrb. 61: 37 (as *scabriflora*). 1927.

NORTHEAST NEW GUINEA: Yunzaing, *Clemens 3568 bis* (perhaps an error for *3586 bis*), *3586A*, July 1936, alt. 1350 m., in forest.

Fortunately we have at hand an isotype of Valeton's variety. It seems preferable to us to consider it as worthy of specific rank. It is true that the upper surface of the leaves is striulate much as in *Timonius avenis* Val., but the pubescence on the lower surface, the branchlets, the terminal buds, the floral axes, the petioles, and the corolla is a considerable departure from that of the species. In addition, the staminate flowers appear to have the anthers included, and the pyrenes are obliquely pendulous from the central column of the fruit. The staminate inflorescence has 3–5 flowers; peduncle 3–5 mm. long, the branches about 3 mm. long; calyx membranous, about 1 mm. long, truncate; corolla not yet in full anthesis, outside shortly hirsute to the tips of the lobes, the tube cylindric or slightly narrowed at the throat, 9 mm. long, the lobes ovate, acute, 3 mm. long; anthers 6 mm. long, inserted about 4 mm. above the base of the corolla, but included as indicated by the slightly constricted throat of the corolla, the style about 4 mm. long, glabrous. In one fruit 90 pyrenes were counted, in the longitudinal section of another there were 6–7 pyrenes from the apex to the base of the fruit. In a cross-section of the fruit the pyrenes tend to slide apart at an oblique angle rather than be cut directly across as in *T. avenis* Val.

Timonius trichanthus sp. nov. FIG. 3, C.

Arbor parva; ramulis fusco-cinereis, apicem versus dense et breviter hirsutis, pilis patentibus, internodiis 1–4 cm. longis, novellis compressis; stipulis 1.5–3 cm. longis dense patenti-hirsutis, oblongo-lanceolatis, acuminatis; foliis 4.5–11 cm. longis, 1.5–4 cm. latis, anguste ellipticis vel oblongo-lanceolatis, apice breviter acuminatis vel acutis, basi cuneatis vel obtusis, tenuiter coriaceis, supra glabris vel costa puberulis, subtus (costa densius) regulariter haud dense breviter hirsutis; costa supra impressa, subtus prominente, nervis lateralibus utrinque obscuris; petiolo 6–12 mm. longo, hirtello; inflorescentiis axillaribus, pedunculatis, ♂ saepissime 5-floris; pedunculo 5 mm. longo hirtello, ramis circiter 4 mm. longis; calyce truncato, 1.5 mm. longo, hirsuto; corolla tantum in alabastro visa, tomentella, crassiuscula, tubo 4 mm. longo, lobis 4, obtusis, 2 mm. longis; antheris 3.5 mm. longis in tubo medio insertis, in anthesi exsertis; stylo 2 mm. longo; floribus ♀ solitariis; pedunculo 1–1.5 cm. longo, hirtello; ovario glabro 3 mm. longo; calyce truncato, 1 mm. longo, hirsuto; corolla in alabastro tantum visa, tomentella, crassiuscula, tubo 6 mm. longo, lobis 6, 2 mm. longis; antheris 6, 2.5 mm. longis, in parte superiore tubi insertis vix exsertis; stylo crassiusculo, 5 mm. longo, stigmatibus 6 terminato, glabro; fructibus depresse globosis, calycis tubo coronatis, 6 mm. longis, 7 mm. diametro, 6-sulcatis; pyrenis 45, verticalibus.

Northeast New Guinea: Ogeramnang, *Clemens 4747*, Dec. 1936, alt. ± 1750 m., along trail; vicinity of Bulung River, Nomanenem Camp, *Clemens 5206*, Jan. 1937, alt. 900–1500 m., hill trail; Matap, *Clemens 11158B* (type, isotype in Herb. Univ. Michigan), Feb.-Apr. 1940, alt. 1500–1800 m. (tree 7–10 cm. diameter; flowers white; fruit green).

This species is closely related to *Timonius scabriflorus* (Val.) Merr. & Perry. It may be distinguished by the difference in the leaf-outline; in the latter species the leaves are more sharply tapering both toward the apex and the base, the pubescence is of shorter hairs, the terminal buds tend to be much less shaggy in appearance, the calyx is glabrous, and the pyrenes are obliquely pendulous, while the ♂ flower-buds are fairly sharply acute. In our species, on the other hand, the leaves are not so sharp toward the apex and the base, the terminal buds are shaggy to the naked eye, the calyx is pubescent with fairly long appressed hairs, the pyrenes are vertical and completely fill the cross-section of the fruit, being about half as many as in the other species, while the ♂ flower-buds are obtuse.

Timonius trichanthus var. **dolichophyllus** var. nov. Fig. 3, D.

Foliis elongatis, oblongo-lanceolatis, 7–17 cm. longis, 1.5–4.5 cm. latis, alabastro terminali adpresse sericeo-pubescente.

Netherlands New Guinea: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12398* (type), Jan. 1939, alt. 1500 m., rain-forest, common on banks of a stream (spreading, 5–6 m. high).

Apart from the longer and narrower leaves and the appressed sericeous pubescence of the terminal bud, this collection seems to agree with the type of the species. The calyx is slightly less pubescent, but the pubescence is present on most of the young fruits and the pyrenes show the same regular arrangement which characterizes the species.

Timonius trichocladus sp. nov. Fig. 3, B.

Arbor usque 18 m. alta; ramulis dense hispidulis, cinereis, internodiis 1–5 cm. longis, valde compressis; stipulis glabris, usque 3 cm. longis, oblongo-lanceolatis, acuminatis; foliis oblongo-lanceolatis vel obovato-lanceolatis, 3–9.5 cm. longis, 1.5–3.5 cm. latis, apice acutis vel breviter acuminatis, basi ± anguste cuneatis vel in petiolo attenuatis, in sicco margine leviter recurvis, tenuiter coriaceis, supra glabris, cuticula patenti-striata (striis subparallelis hinc inde flexis), subtus glabris vel costa accumbente pilosis, cuticula inconspicue striata, margine versus basim interdum pilosis, nervis lateralibus obscuris; petiolo 5–10 mm. longo, sparsim piloso vel glabro; inflorescentiis axillaribus, pedunculatis, pedunculo 6 mm. longo, glabro vel sparsim pubescente, ♂ trifloris, flore medio sessili, lateralibus pedicellatis; floribus glabris, calyce tubulato, 2 mm. longo, truncato vel minute dentato; corollae tubo 7 mm. longo, lobis 4 mm. longis, ovatis, acutiusculis; antheris 4 partim exsertis; stylo brevi; flore ♀ solitario; calyce truncato, 1.5 mm. longo; corolla (in alabastro) 6 mm. longa, tubo

4 mm. longo, lobis 5, ovatis, acutiusculis; antheris inclusis; stylo 4 mm. longo, glabro, crassiusculo; stigmatibus 5 brevibus; fructibus globosis, circiter 1 cm. diametro; pyrenis verticalibus, 25–30 vel pluribus.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9504*, Aug. 1938, alt. 3225 m., common tree in mossy closed forest of more sheltered hollows (8–10 m. tall; leaves convex; flowers white); same locality, *Brass 9505* (TYPE), Aug. 1938, alt. 3225 m., locally abundant in forest undergrowth (tree 3 m. high; leaves somewhat convex; flowers white; fruit black, laterally compressed, ± 1.1 cm. long); 9 km. northeast of Lake Habbema, *Brass & Versteegh 10486*, Oct. 1938, alt. 2950 m., rare in old secondary forest (tree 15 m. tall, 29 cm. diameter; flowers white); same locality, *Brass 10568, 10642*, alt. 2800 m., rare in mossy forest, common in old secondary forest (tree 5–15 m. high); same locality, *Brass & Versteegh 11102*, Oct. 1938, alt. 2700 m., rare in mossy forest (tree 18 m. high, 29 cm. diameter; bark rough, brown; fruits green).

This species certainly belongs to the same alliance as *Timonius avenis* Val. Its most striking character is the coat of dense short rather stiffish spreading hairs covering the upper part of the branchlets. The striations

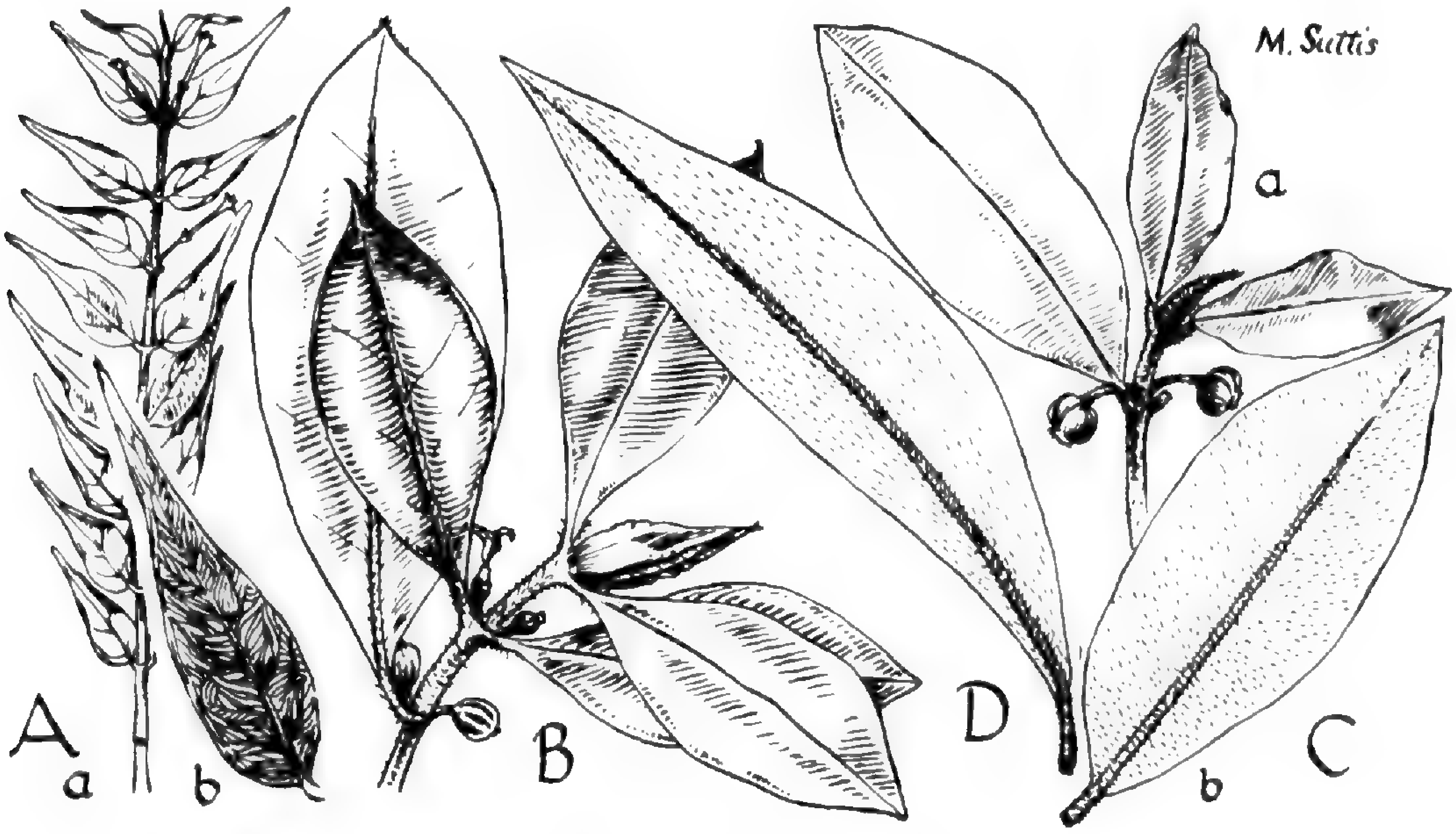

FIG. 3. A. *Timonius virgatus* Merr. & Perry: *a*. habit, × ½; *b*. leaf, × 1, showing detail of venation. B. *Timonius trichocladus* Merr. & Perry: habit, × ½. C. *Timonius trichanthus* Merr. & Perry: *a*. habit, × ½; *b*. leaf, × ½, showing lower surface. D. *Timonius trichanthus* var. *dolichophyllus* Merr. & Perry: leaf, × ½, showing lower surface.

on the upper surface of the leaf are not so close together as in *T. avenis* Val., spreading in direction rather than ascending, and not quite so distinct. The lower surface may be glabrous or on the midrib especially toward the base of the leaf may be seen weak accumbent hairs, a continuation of those on the petiole, as it were; the same type of hair also appears on the very lower margin in younger leaves, but in some specimens both leaves and petioles are glabrous.

Timonius virgatus sp. nov. FIG. 3, A.

Frutex epiphyticus, 1–1.5 m. altus; ramis cinereis, ramulis ultimis gracilibus 1 mm. diametro, hirtellis, compressis, sub foliorum insertione manifeste incrassato-nodosis, internodiis 1–2 cm. longis; stipulis glabris vel apice barbatis, 4–6 mm. longis, attenuatis, cito caducis; foliis tenuiter coriaceis, lanceolatis, 1–3.8 cm. longis, 0.4–1 cm. latis, apice caudato-acuminatis, acumine 0.5–1.3 cm. longo in parte inferiore 2–3 mm. lato, basi subrotundatis vel obtusis, in sicco margine leviter revolutis, utrinque glabris vel subtus costa adpresse hirtellis, nervis lateralibus infra medium folium utrinsecus 2 utrinque submersis, in axillis barbellatis, sursum nullis, venis obscuris, cuticula utrinque striulata vel minute lineato-rugosa; petiolo 1–2 mm. longo; inflorescentiis ♂ trifloris, floribus bracteatis, lateralibus pedicellatis, flore medio sessili; pedunculo ± 1 cm. longo, glabro; calyce 4-dentato, 1–1.5 mm. longo, glabro; corollae tubo (sub anthesin) 6 mm. longo, glabro, lobis ovatis obtusis, 1 mm. longis, extus pubescentibus; antheris 2.5 mm. longis, apice exsertis; stylo 4 mm. longo; floribus ♀ solitariis, pedunculatis, bracteatis, bracteis crassiusculis, ovatis, 1 mm. longis; pedunculo ± 1 cm. longo, glabro; ovario et calyce 2.5 mm. longo, calyce 4-dentato, dentibus acutis; corollae tubo 7 mm. longo, glabro, lobis obtuse ovatis, 1.5 mm. longis latisque, extus pubescentibus; antheris 2 mm. longis, inclusis; stylo 8 mm. longo, consperse pilosulo, stigmatibus 4 vel 5 terminato; fructibus haud carnosis, ovoideis, circiter 5 mm. diametro, calyce coronatis; pyrenis ± 14, verticalibus, confertis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12404* (TYPE), Jan. 1939, alt. 1800 m., very common epiphyte in mossy forest (weak, straggling shrub 1–1.5 m. tall; flowers red; fruit immature).

Three already described species, *Timonius filipes* Wernh. and var. *acuminatissima* Wernh., *T. caudatus* Val., and *T. minutifolius* Val., are very closely connected with *T. virgatus*. In leaf-size our species falls within the limits of that given for *T. caudatus* Val., which in turn overlaps the measurement of the smaller leaves of *T. filipes* Wernh. and the largest leaves of *T. minutifolius* Val. In all three the ovary is hairy, while in *T. virgatus* the ovary is glabrous, as is also the corolla-tube, even in bud only the lobes being sericeous on the outer surface; the leaves are equally striulate on both surfaces. A comparison of the types as well as a series of collections are really necessary to determine what are really specific differences and what are only environmental variations.

Timonius longitubus sp. nov. FIG. 4, B.

Arbor epiphytica vel terrestris; ramulis crassiusculis 4–7 mm. latis, obtuse angulatis vel compressis; internodiis brevibus, 7–10 mm. longis, novellis dense adpresse pubescentibus; stipulis 6–8 cm. longis, lanceolatis, attenuato-acuminatis, extus sparsim pilosis vel fere glabris, intus glabris, caducis; foliis ellipticis vel leviter obovato-ellipticis, 12–20 cm. longis, 6–9 cm. latis, in tertio supero latioribus, apice acutis vel brevissime acuminatis et interdum mucronatis, basi anguste cuneatis, glabris, tenuiter coriaceis vel chartaceis, nervis lateralibus utrinsecus 5–7 utrinque prominulis, adscendentibus et arcuatis, cuticula supra sub lente minute dense striatula, striulis in areolis parallelis, subtus levi; petiolo 2.5–3.5 cm. longo, atro-brunnescente; inflorescentiis axillaribus, ♂ semel dichotomis, pedunculo 1 cm. longo, ramis 1 cm. longis; floribus ± 7, glabris, sessilibus; calyce subtubulato, 1 cm. longo, 4 mm. diametro, intus basi pubescente et glanduloso; corollae tubo 1.6 cm. longo, lobis 4, 9 mm. longis, linearibus; antheris 6 mm. longis, prope tubo medio insertis; floribus ♀ solitariis, (alabastro tantum viso) glabris, pedunculo 1–2 cm. longo; ovario globoso 6 mm. diametro; calyce tubulato, 6 mm. longo; corolla 1.5 cm. longa, lobis 8; staminibus 16 (8 quam reliquis longioribus); stylo brevi, stigmatibus plurimis terminato serie duplici superpositis, 8 quam reliquis longioribus; fructibus in sicco 1–1.5 cm. diametro, globosis, apice calycis tubo coronatis; pyrenis numerosissimis, in fructu transverse secto ± 32, longitudinaliter ex apice ad basim ± 20 compacte superpositis.

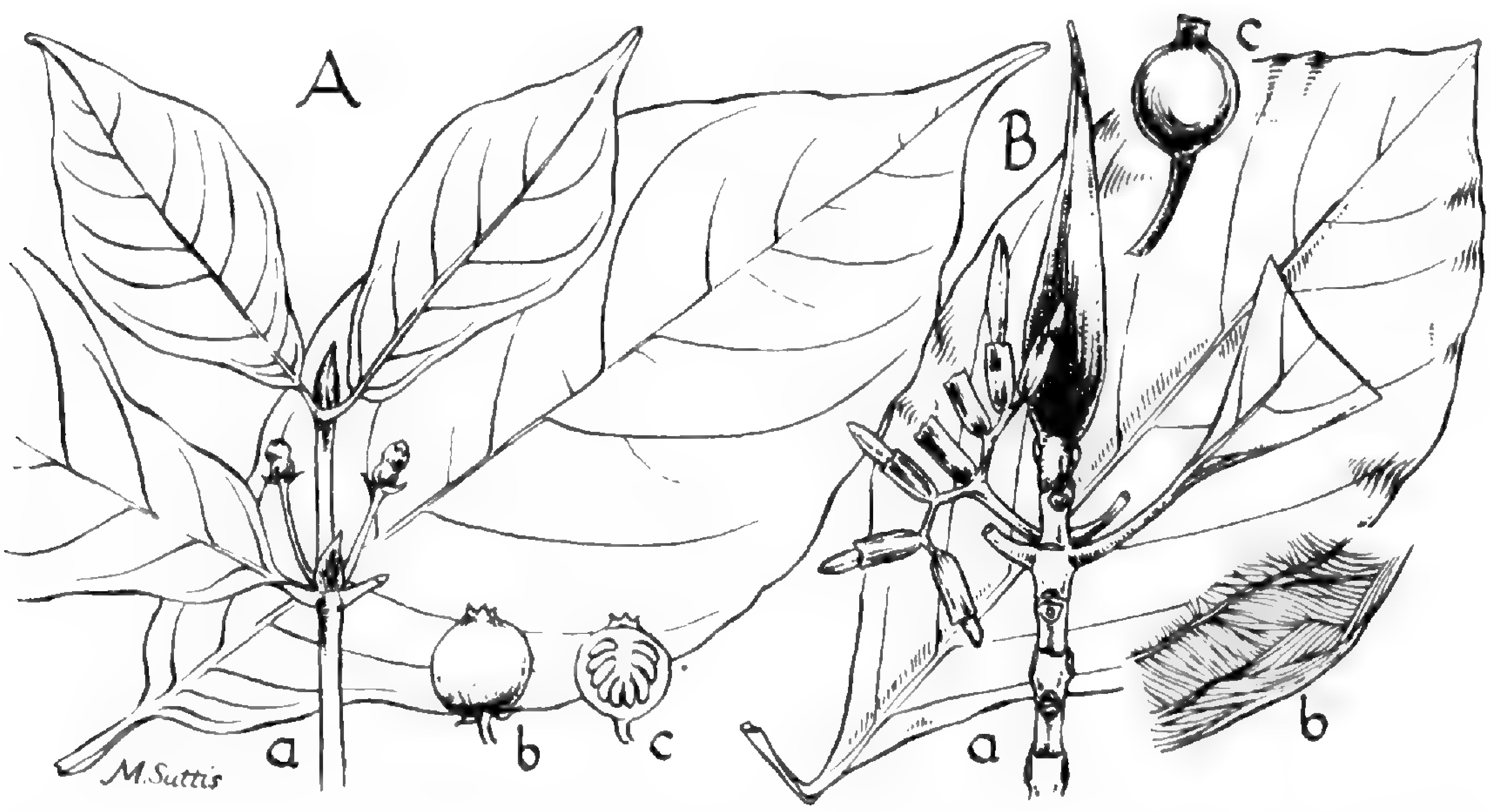

FIG. 4. A. *Timonius solomonensis* Merr. & Perry: *a.* habit, × ½; *b.* fruit, × ½; *c.* longitudinal section of fruit, × ½. B. *Timonius longitubus* Merr. & Perry: *a.* habit, × ½; *b.* enlarged portion of leaf to show detail of venation; *c.* fruit, × ½.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2009,* Aug. 1930, alt. 800 m., rain-forest, common (small tree growing as a parasite on larger trees; fruit pink when ripe, 2.5 cm. long, 2.5 cm. diameter, crowned by the tubular calyx); Ysabel: Kakatio, *Brass 3244,* Dec. 1932, alt. 900 m., rain-forest, common (small compact tree growing on other trees; leaves rather fleshy; stipules and falling leaves red; flowers cream-colored); Tiratona, *Brass 3316* (TYPE), Dec. 1932, alt. 600 m., rain-forest, common (tree 15 m. tall; leaf-nerves very pale; flower white; fruit soft, fleshy, smooth, purple-red); Guadalcanal: Uulolo, Tutuve Mt., *Kajewski 2541,* April 1931, alt. 1200 m., rain-forest, common (small tree growing on a larger tree, usually from a cavity; fruit yellow-green when ripe, length 2 cm., diameter 1.9 cm.; for pains in the stomach the bark is macerated and applied to the affected spot).

We are at a loss at present to suggest a closely related species. *Timonius longitubus* appears to be readily distinguished by the rather long terminal bud, the glabrous character apart from the dense pubescence on the new internodes and the sparse pubescence of the stipules covering the buds, the long tubular calyx, and the very numerous and small pyrenes.

Timonius solomonensis sp. nov. FIG. 4, A.

Arbor parva gracilis; ramulis maturis pallidis glabris, novellis compressis, hirtellis, internodiis 1–3 cm. longis; stipulis triangularibus, breviter acuminatis, 5–7 mm. longis, basi 5–6 mm. latis, extus hirtellis, intus adpresse villosis, subpersistentibus; foliis ellipticis vel obovatis, chartaceis, 6–19 cm.

longis, 3–8.5 cm. latis, utrinque angustatis vel interdum 2–5 cm. supra basim subabrupte vel sensim angustioribus, apice acuminatis, acumine circiter 1 cm. longo, obtusiusculo, basi obtusis vel cuneatis, supra costa puberulis, subtus costa venisque hirtellis, novellis consperse minute hirtellis, nervis lateralibus utrinsecus 7–10, patenti-adscendentibus, supra impressis, subtus perspicuis, venis subclathratis vix prominulis, reticulo sub lente manifesto; petiolo 7–20 mm. longo, breviter hirtello; floribus ♂ ignotis; floribus ♀ solitariis (alabastris juvenilibus tantum visis), pedunculatis, dense tomentosis, bracteatis; pedunculo 1–1.5 cm. longo; bracteis ovatis vel triangularibus ± 3 mm. longis, caducis; ovario depresse globoso; calyce urceolato 5- vel 6-dentato; corolla ut videtur 8-lobata; staminibus 8; stylo verisimiliter apice in 8 lobis stigmaticis diviso; fructibus depresse globosis, apice calycis tubo persistente coronatis, ± 1.5 cm. diametro, dense tomentellis fere velutinis; pyrenis ± 38, in fructu longitudinaliter secto ex apice ad basim 4 compacte superpositis.

SOLOMON ISLANDS: Ysabel: Meringe, *Brass 3349,* Dec. 1932, lowland rain-forest (slender small tree; leaves with pale nerves; fruit striate, very pale green); San Cristoval: Hinuahaoro, *Brass 2885* (TYPE), Sept. 1932, alt. 800 m., rain-forest (small tree; flowers white; fruit green, 1.5 cm. diameter, striate).

Timonius solomonensis appears to be most like *T. laevigatus* Val. In the former wherever there are leaves there are also stipules, indicating a tendency for them to persist longer than usual; in Valeton's species the stipules have already fallen, also the adult leaves are glabrous and shortly petioled, while in ours the adult leaves are hirtellous on the midrib and main veins of the lower surface; again Valeton describes the pyrenes as few in the center of a fruit 2 cm. in diameter, a character hardly comparable to that in our species. Possibly if abundant material were available these differences might be bridged, but until that time we are regarding them as distinct species.

Timonius nitens sp. nov. FIG. 5, B.

Arbor usque 21 m. alta, gemmis et corollis aureo-sericeis, ceterum glabris; internodiis compressis griseis, 1–2 cm. longis; stipulis 1.5–4 cm. longis, basi 6 mm. latis, versus apicem sensim attenuatis, extus aureo-sericeis, intus glabris basi colleteribus confertis praeditis, cito caducis; foliis ellipticis vel oblanceolato-ellipticis, 6.5–13 cm. longis, 3–7 cm. latis, basi rotundatis vel subtruncatis, apice breviter et obtusissime acuminatis, acumine 5 mm. longo, 5–7 mm. lato, in sicco margine interdum undulatis, novellis margine aureo-pubescentibus, cito glabratis, maturis glabris, coriaceis, supra nitidulis, nervis lateralibus utrinsecus 8–10 utrinque prominulis, in axillis domatiiferis et interdum minute barbatis, domatiis minutis, reticulo irregulare, supra inconspicuo, subtus manifesto; petiolo 4–6 mm. longo, nigrescente; inflorescentiis ♂ immaturis tantum in axillis foliorum superiorum, floribus confertis (3 vel 4), pedunculis 5 mm. longis, calycis tubo campanulato, 3 mm. longo, intus pilosulo, extus sparsim pilosulo, margine leviter lobato, lobis usque 1 mm. longis; corolla extus sericea, tubo 4 mm. longo, lobis 4 mm. longis, oblongis; antheris in tubo medio insertis, 3 mm. longis; stylo 3 mm. longo; floribus ♀ singulis vel pedunculis trifloris; bracteis subnullis; pedunculo 1–1.5 cm. longo; ovario circiter 4 mm. longo, subgloboso, glabro; calycis tubo 2.5 mm. longo, extus consperse pilosulo, intus pilosulo, lobis

5 vel 6, usque 1.5 mm. longis obtusis; corollae tubo 6–7 mm. longo, extus aureo-sericeo, lobis 8, circiter 3 mm. longis, extus sericeis; staminibus 8 in tubo medio insertis; stylo 5 mm. longo, sparsim pilosulo, crasso (1–2 mm.), stigmaticis lobis 8, circiter 2–3 mm. longis; fructibus subglobosis, 1 cm. diametro, calyce persistente coronatis, longitudinaliter sulcatis et rugulosis; pyrenis numerosissimis, in fructu transverse secto 16–20, longitudinaliter ex apice ad basim 10 compacte superpositis.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass & Versteegh 10488, 10488A*, Oct. 1938, alt. ± 2680 m., frequent in old secondary forest (tree 21 m. tall, 28 cm. diameter; bark smooth, soft brown; flowers white); same locality, *Brass 10994, 10995* (TYPE), Oct. 1938, alt. 2650 m., in secondary forest on old landslip (tree 12 to 15 m. high; leaves shining).

This species in leaf-outline and glabrousness is somewhat suggestive of *Timonius compressicaulis* (Miq.) Boerl. from Sumatra. It is readily distinguished by the shorter and fewer-flowered inflorescences and the more numerous pyrenes.

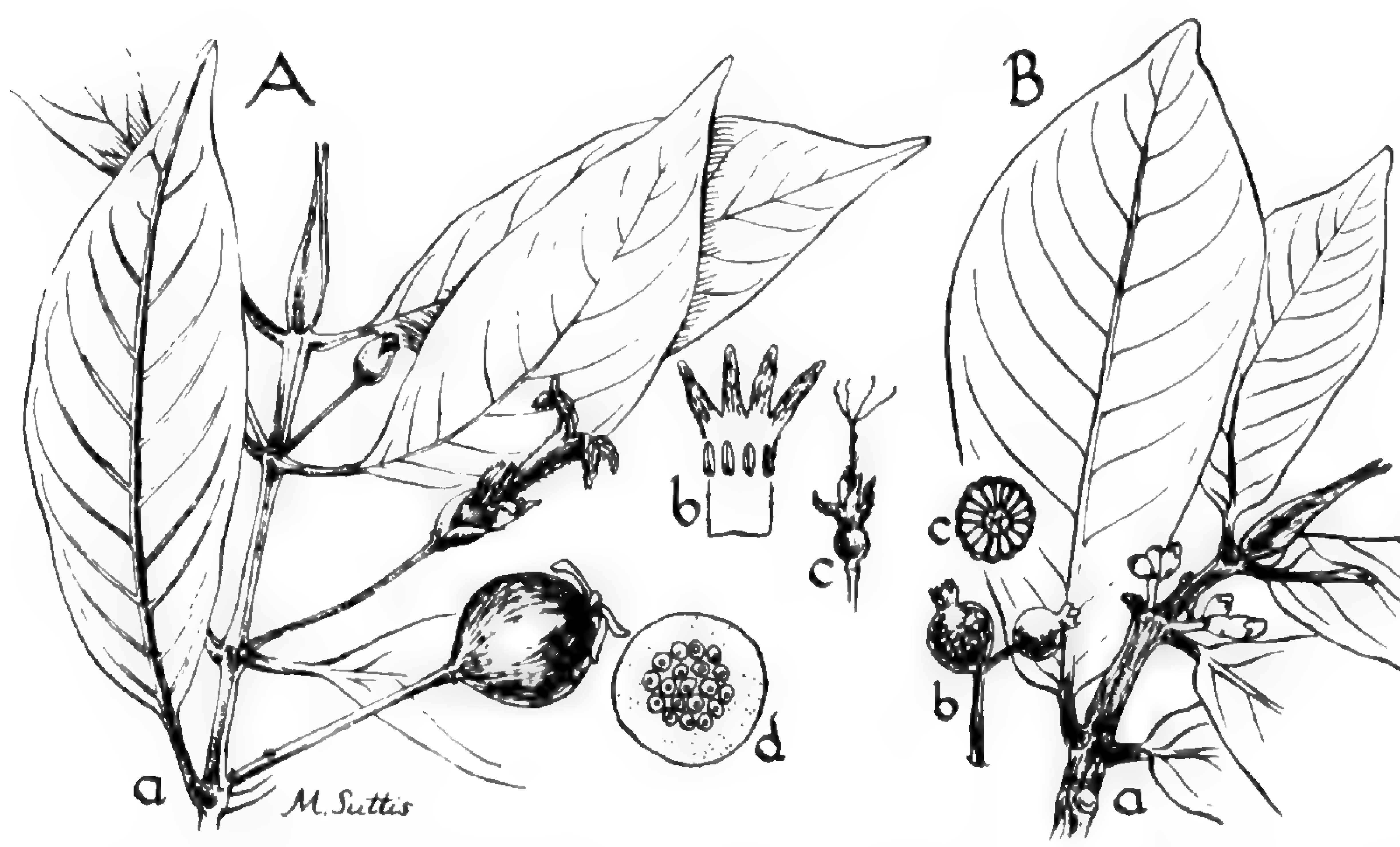

FIG. 5. A. *Timonius bracteatus* Merr. & Perry: *a.* habit, × ½; *b.* corolla, × ½, laid open; *c.* flower with corolla removed, × ½; *d.* cross-section of fruit, × ½. B. *Timonius nitens* Merr. & Perry: *a.* habit, × ½; *b.* infructescence, × ½; *c.* cross-section of fruit, × ½.

Another collection (*Brass 11748*, Balim River, Dec. 1938, alt. 1800 m.; tree 3–4 m. high scattered over open grassy slopes and common in sparse secondary forest) is an excellent match for this species except for the following characters: ♂ inflorescence profusely flowered, the calyx-lobes 2 mm. long, the corolla-tube about 8 mm. long, the lobes 3 mm. long. Whether these represent variations within a species we are not prepared to say. This is by far the best staminate collection of the group, but we preferred to describe matched material from the same locality, and apparently no similar pistillate material was collected from this locality.

Timonius imitans sp. nov. Fig. 6, B.

Arbor 23 m. alta; ramis atro-fuscis; internodiis 0.5–2 cm. longis, novellis compressis, internodio distali et alabastro terminali adpresse aureo-pubescentibus; stipulis 1–2 cm. longis, oblongo-lanceolatis, cito caducis; foliis 4–12 cm. longis, 2–5 cm. latis, lanceolatis vel anguste ellipticis, utrinque angustatis, apice acuminatis, acumine circiter 1 cm. longo, obtusiusculo, basi in petiolo 7–12 mm. longo angustatis, tenuiter coriaceis, utrinque glabris, nervis lateralibus utrinsecus 6–8 utrinque prominulis, oblique adscendentibus, venis et reticulo sub lente aequaliter manifestis, sub oculo inconspicuis; inflorescentiis ♂ axillaribus, ramosis, pedunculatis, pedunculo circiter 1 cm. longo, novellis aureo-puberulis cito corolla excepta glabratis; floribus confertis, paucis (5–7); calyce subcampanulato, novello apice leviter angustato, demum ut videtur fisso quasi inaequaliter 5-lobato, intus pubescente; corolla in alabastro tantum visa, 8 mm. longa, lobis 4; antheris 4; stylo glabro; disco hinc alto; inflorescentiis ♀ trifloris; floribus non visis; fructibus immaturis fere glabris, globosis, circiter 8 mm. diametro, apice calyce persistente coronatis; pyrenis numerosissimis, in fructu transverse secto 16, longitudinaliter ex apice ad basim circiter 10 compacte superpositis.

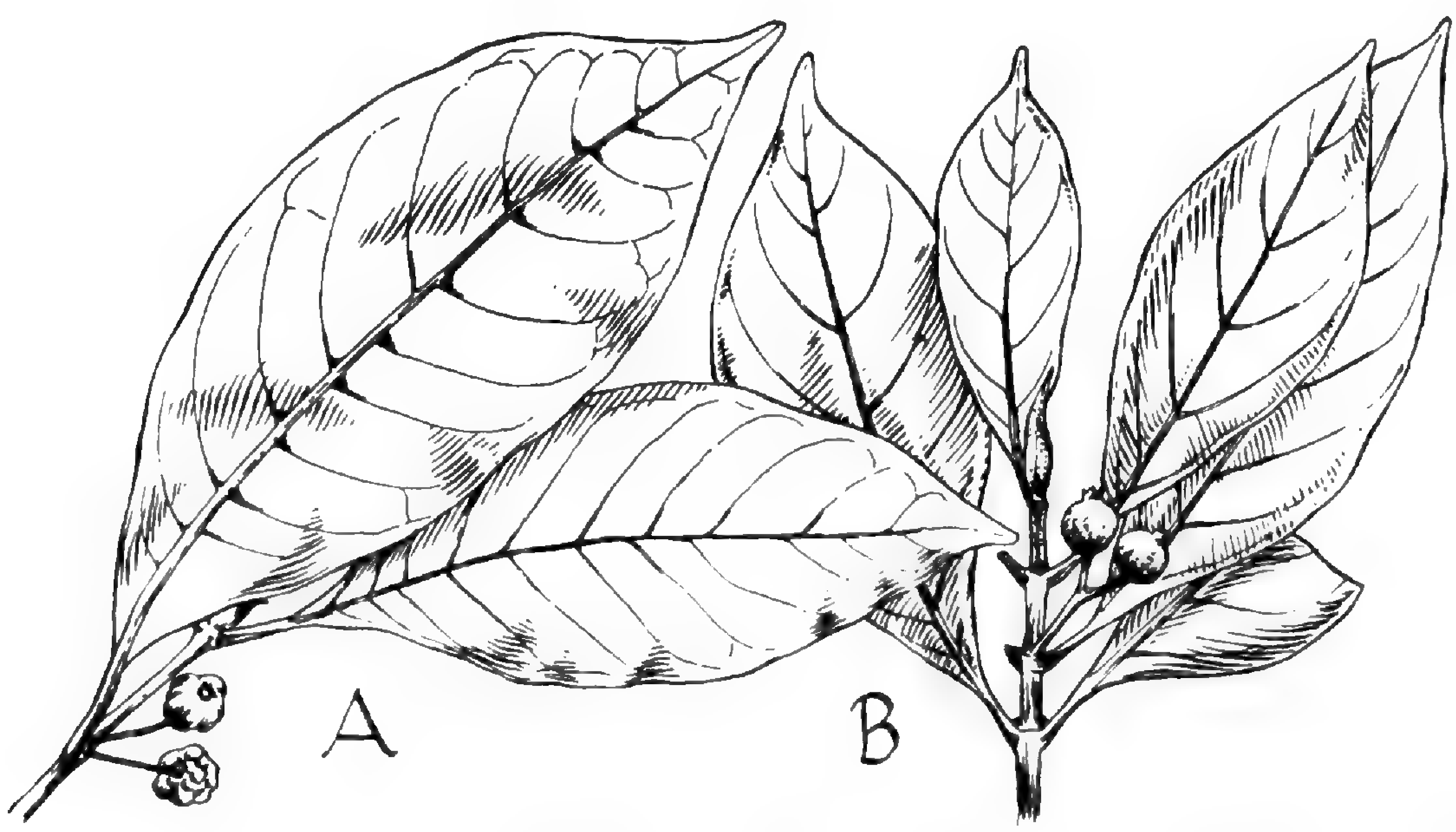

Fig. 6. A. *Timonius decipiens* Merr. & Perry: habit, × ½. B. *Timonius imitans* Merr. & Perry: habit, × ½.

Netherlands New Guinea: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 12515* (type), Feb. 1939, alt. 1500 m., frequent on forested slopes (tree 23 m. high, 40 cm. diameter; bark gray; fruits green).

Timonius imitans is most like *T. nitens,* described above. The leaves are different in outline, the former having a longer acuminate apex, and a longish cuneate base as if narrowed into the slender petiole; in the latter species the leaves are rounded or subtruncate at the base and have a short stout petiole. Both have similar terminal buds, but in *T. imitans* the distal node is pubescent also; in the other species, of which we have several collections, the distal node is glabrous. Unfortunately the staminate inflorescences are not sufficiently developed in either for comparison; the fruits are very much alike.

Timonius decipiens sp. nov. FIG. 6, A.

Arbor parva; ramulis atro-cinereis; internodiis 0.7–3 cm. longis, novellis valde compressis, pubescentibus; stipulis 4–6 mm. longis, triangularibus, acuminatis, extus ± pubescentibus, intus villosulis; foliis 7–13 cm. longis, 2.8–5.5 cm. latis, chartaceis, elliptico-lanceolatis vel oblongo-lanceolatis, apice breviter acuminatis, acumine 0.5–1 cm. longo, obtusiusculo, mucronato, basi anguste cuneatis, undique costa subtus sparsim adpresse pilosula excepta glabris, nervis lateralibus utrinsecus 8–10 oblique patentibus et arcuatis, supra manifestis, subtus vix prominulis in axillis barbellatis, venis et reticulo sub lente manifestis; petiolo 0.5–1.5 cm. longo, fere glabro; inflorescentiis non visis; fructibus pedunculatis, pedunculo 1.5–2 cm. longo, pubescente, minute et sparsim pubescentibus, depresse globosis, 1.2 cm. diametro, circiter 1 cm. longis, ± 4-sulcatis, apice calyce persistente (tubo 1–1.5 mm. longo, lobis 4 circiter 1 mm. longis, triangularibus, acutiusculis, intus pubescentibus) extus sparsim pubescente coronatis; pyrenis 20–28, suboblique pendulis.

NORTHEAST NEW GUINEA: Yunzaing, *Clemens 3984* (TYPE), Aug. 1936, alt. 1350 m., in forest (small tree with green fruit); Ogeramnang, *Clemens 4502,* alt. 1800 m., in forest.

Timonius decipiens is most like *T. flavescens* (Jack) Baker and *T. oblongus* Val. in general habit. The two last mentioned species have fruits with vertical pyrenes. In *T. flavescens* there is a very definite arrangement of the pyrenes within the pericarp, which is a distinguishing character. In *T. oblongus* the leaves are smaller and glabrous, but the main difference is in the number and arrangement of the pyrenes.

Timonius oblongus Val. Bot. Jahrb. **61:** 49. 1927.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12497,* Feb. 1939, alt. 2150 m., forest undergrowth of a gully (tree 2.5 m. high; unopened flowers red; fruit red, soft, depressed-globose, ± 1.5 cm. diameter).

This specimen, although coming within the limits of the description of *Timonius oblongus* Val., differs from it in having red instead of white to golden-brown fruits. The flower-buds, although not yet open, are relatively large and approaching anthesis: peduncle 1.5–2 cm. long, very slender; bracts at the base of the ovary 2 mm. long, lance-linear, appressed-pilose; ovary about 2 mm. long, sparsely short-pilose; calyx-tube about the same length and 4-dentate, also appressed-pilose within; corolla (in bud) 11 mm. long, of which about 4 mm. belongs to the lobes, sparsely appressed-pubescent; anthers linear, 3 mm. long, attached about at the middle of the tube; style with 4 stigmatic lobes; a cross-section of the ovary shows 14 vertical "locelli" with an ovule in each.

Timonius bracteatus sp. nov. FIG. 5, A.

Arbor 8–11 m. alta; ramulis gracilibus, atro-brunnescentibus; internodiis 1–2 cm. longis, novellis valde compressis, adpresso-hirtellis cito glabratis; stipulis 1.5–2.5 cm. longis, attenuato-acuminatis, extus praecipue in medio minute pubescentibus, intus medio glandulosis et subvillosis, margine utrinque glabris; foliis chartaceis, lanceolatis, 6–15 cm. longis, 2–5.5 cm.

latis, apice acutis vel breviter et obtuse acuminatis, basi cuneatis, novellis utrinque sericeis, maturis fere glabris vel subtus pilis brevibus adpressis sparsim indutis, nervis lateralibus utrinsecus 9–11 supra manifestis, subtus prominulis, reticulo subobscuro, cuticula utrinque inconspicue et minute striulata; petiolo 0.8–2 cm. longo, ± adpresse pubescente; inflorescentiis pedunculatis, juvenilibus involucro late ovato acutato-clauso inclusis, ♂ trifloris, sericeo-villosulis; calycis tubo 5 mm. longo, lobis 4, oblongis, 5–6 mm. longis; corollae tubo 1.5 cm. longo, lobis 1 cm. longis, oblongis, obtusis; antheris 5 mm. longis, apice tantum exsertis; stylo circiter 10 mm. longo, pilosulo; floribus ♀ solitariis; pedunculo 2–3.5 cm. longo; calycis tubo 2 mm. longo, lobis ± 5 mm. longis, oblongis; corollae tubo 1.5 cm. longo, lobis circiter 1 cm. longis; antheris in parte superiore tubi insertis, non exsertis, 5 mm. longis; stylo 1.5 cm. longo, pilosulo, gracili; stigmatibus 4, circiter 9 mm. longis, fere filamentosis; fructibus in sicco 2.5 cm. diametro, globosis, apice calycis lobis reflexis coronatis, adpresse pilosulis; sarcocarpio circiter 5 mm. crasso; pyrenis ± 21, in medio fructu confertis, verticalibus.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 11982,* Jan. 1939, alt. 1790 m., occasional on slopes of primary forest (tree 11 m. tall, 39 cm. diameter; bark 2 mm. thick, brown, shallowly fissured; flowers white); same locality, *Brass 12234* (TYPE), Jan. 1939, alt. 1700 m., rain-forest of ravines (substage tree 8 m. high; flowers cream-colored, fleshy; fruit hard, green, to 3 cm. diameter).

Although *Timonius bracteatus* looks like a very distinct species, from descriptions alone it is somewhat difficult to decide what species with vertical pyrenes may be most nearly related. *Timonius laevigatus* Val. has a fruit similar in size but lacks the long calyx-lobes characteristic of our species; there are also foliar differences. The vegetative characters suggest *T. subcoriaceus* Val., but the arrangement of the pyrenes immediately removes the species from that alliance.

Timonius xanthocarpus sp. nov. FIG. 7, B.

Arbor 4 m. alta; ramulis tomentosis; internodiis 1.5–2 cm. longis, ultimis compressis; stipulis circiter 1.3–1.7 cm. longis, lanceolatis, acuminatis, extus aureo-tomentosis, intus adpresse villosis, caducis; foliis ellipticis, 5.5–16 cm. longis, 2–6.5 cm. latis, utrinque angustatis, basi cuneato-obtusis, apice breviter acuminatis interdum mucronatis, valde coriaceis, supra glabris, costa nervisque hirtellis, subtus consperse hirtellis, costa nervisque breviter patenti-hirsutis vel hirtellis; nervis lateralibus utrinsecus 9–14 supra impressis, subtus prominentibus, venis interdum clathratis, irregulariter positis, supra impressis, subtus prominulis; petiolo 7–10 mm. longo, tomentuloso; floribus ♂ non visis; floribus ♀ solitariis, pedunculatis, bracteatis, axillaribus, pedunculo 1–1.5 cm. longo, hirtello vel tomentuloso; bracteis 5–6 mm. longis, linearibus, hirtellis; ovario globoso, 4 mm. diametro, hirtello; calyce dense hirtello, tubo 2 mm. longo, lobis 4, 7–10 mm. longis, lineari-subulatis; corolla adpresse villosula, tubo 1 cm. longo, lobis linearibus, circiter 10 mm. longis; antheris 4 mm. longis, dorso setuloso, in tubo medio insertis; stylo 8 mm. longo, hirtello, stigmatibus 4 terminato; fructibus ellipsoideis, immaturis, 1.5 cm. longis, 1.2 cm. latis, calycis lobis coronatis, hirtellis, obtuse 4-angulatis; pyrenis ± 20 verticalibus.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12226* (TYPE), Jan. 1939, alt. 1750 m., open places in forest, not common (tree 4 m.

high; leaf-nerves deeply impressed above, prominent beneath; flower yellow; fruit immature, 4-ridged).

Timonius xanthocarpus should be compared with *T. Klossii* Wernham. From the description it seems to differ in the following points: *T. Klossii* has chartaceous leaves with a subacute apex and petiole scarcely 2 cm. long, and the stipules are sericeous toward the margin, otherwise glabrous. Wernham does not say whether the anthers are glabrous, or as in our species setulose on the back; this character ought to be the same whether in ♂ or in ♀ flowers. The pyrenes are cruciately arranged, as in *T. flavescens* (Jack) Baker, in the angles or lobes of the fruits, not in the center as described for *T. villosus* Val. from New Guinea. *Timonius xanthocarpus* is well marked by the coriaceous leaves with prominent venation, the yellow pubescence of the younger parts, the flowers, and the fruits, and the fairly large flowers with linear bracts at the base and with linear calyx-lobes; the hairs on the back of the anthers are not a common character in the species which we have examined.

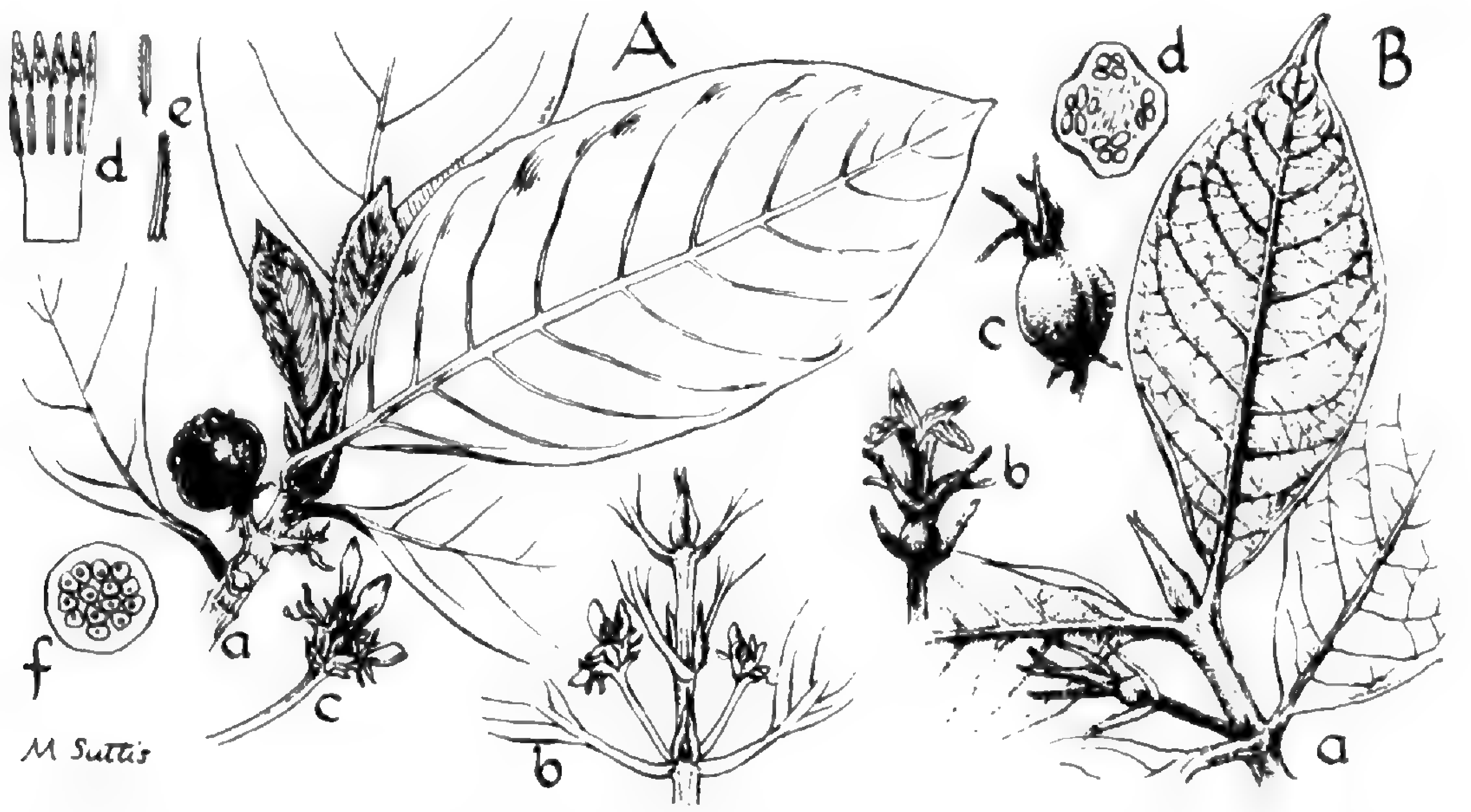

FIG. 7. A. *Timonius strumarius* Merr. & Perry: *a.* habit, × ½; *b.* part of branch, × ½, showing stipules; *c.* ♂ inflorescence, × ½; *d.* corolla, × 1, laid open; *e.* stamens, enlarged; *f.* cross-section of fruit, × ½. B. *Timonius xanthocarpus* Merr. & Perry: *a.* habit, × ½; *b.* flower, × ½; *c.* fruit, × ½; *d.* cross-section of fruit, × ½.

Timonius strumarius sp. nov. FIG. 7, A.

Arbor parva; ramulis teretibus brunnescentibus; internodiis novellis compressis, ± sericeo-hirtellis, saepe sulcatis; stipulis 1–1.3 cm. longis, basi 5 mm. latis, acuminatis vel acutis, extus medio sericeo-hirtellis, intus medio adpresse villosulis et glandulosis, margine utrinque fere glabris, caducis; foliis ellipticis vel leviter obovato-ellipticis, 9–15 cm. longis, 4–6.5 cm. latis, apice subabrupte et breviter acuminatis, acumine usque 5 mm. longo, vel acutis, basi cuneatis, chartaceis, novellis utrinque dense adpresso-pilosis, cito glabratis, maturis supra brunnescentibus, fere glabris, subtus pallide olivaceis, sparsim (costa nervisque densius) pilosis; nervis lateralibus utrinsecus 8–11 oblique patentibus, venis inconspicuis; petiolo 0.7–1.8 cm.

longo, ± piloso; inflorescentiis ♂ axillaribus pedunculatis, interdum ramosis, bracteatis, floribus sericeis, confertis, pedunculo 0.7–2 cm. longo, sericeo; calycis tubo 3 mm. longo, lobis 4–5 mm. longis, 1 mm. latis, corollae tubo 11 mm. longo (prope anthesin), lobis 5, circiter 4.5 mm. longis; antheris supra basim tubi 7 mm. insertis, dorso sparsim setuloso; stylo 6 mm. longo, pubescente; floribus ♀ solitariis axillaribus, pedunculatis, bracteatis, sericeis; pedunculo 5–8 mm. longo; calycis tubo 1 mm. longo, lobis 3–4 mm. longis, 1–2 mm. latis; corolla 4- vel 5-lobata (alabastro tantum viso); staminibus in tubo medio insertis, antheris dorso setulosis; stylo hirtello, stigmatibus 4 (et uno breviore) terminato; fructibus depresso-globosis, 13 mm. diametro, fere glabris, calycis lobis reflexis et disco protuberante coronatis; pyrenis verticalibus 12–14, valde lignosis.

British New Guinea: Lake Daviumbu, Middle Fly River, *Brass 7742*, Sept. 1936, common substage tree in inferior rain-forest (bark thin, suberose; leaf-nerves deeply impressed above, prominent below; flowers white); Gaima, Lower Fly River (east bank), *Brass 8293* (type), November 1936, edge of sago swamp in rain-forest (small tree 3 m. tall; leaf-nerves impressed above, prominent beneath; fruit up to 1.8 cm. diameter); same locality, *Brass 8338*, common in rain-forest and savanna-forest contact-zone (tree 5–6 m. high; bark brown, fibrous-flaky; flowers cream-colored).

This species is very close to *Timonius Branderhorstii* Val. We have separated the two on account of the differences in the fruit. In the plate of Valeton's species the lobes are longer and narrower than in the Brass collections and not at all strongly reflexed, nor is there any indication of the protrusion of the disk, a character well marked in the material before us. The fruit of Valeton's species is described as densely sericeous, but in our species only the young fruits of the type-collection are sericeous; in the more mature fruits most of the pubescence has disappeared except for a remnant on the calyx and disk.

Timonius bougainvillensis sp. nov. Fig. 8, B.

Arbor usque 15 m. alta; ramulis fuscis, gracilibus, internodiis 1–3 cm. longis, novellis glabris vel consperse hirtellis; stipulis 1.5–3.5 cm. longis, longe acuminatis, glabris, cito caducis; foliis oblongo-lanceolatis, 3.5–9.5 cm. longis, 1.6–3 cm. latis, basi obtusis vel obtuse cuneatis, apice acuminatis et interdum mucronatis, utrinque glabris vel subtus costa sparsim hirtellis, valde chartaceis, nervis lateralibus utrinsecus 7–10 patenti-adscendentibus arcuatis, supra manifestis, subtus prominulis, reticulo inconspicuo, cuticula supra manifeste vel inconspicue lineato-striulata, subtus levi; petiolo 1–1.3 cm. longo, fusco; inflorescentiis ♂ non visis; floribus ♀ solitariis vel interdum cymosis; pedunculo 7–11 mm. longo, glabro; bracteis subnullis; calyce tubulato, truncato, 2 mm. longo, glabro; corolla lobis extus sparsim pubescentibus exceptis glabra, in alabastro juvenili 8 mm. longa, lobis 6; staminibus 6; stylo brevi stigmatibus 12 terminato serie duplici superpositis, 6 quam reliquis longioribus; fructibus glabris, in sicco ± 6 mm. diametro, apice calycis tubo coronatis; pyrenis in fructu longitudinaliter secto ex apice ad basim 8–9 compacte superpositis.

Solomon Islands: Bougainville: Kupei Gold Field, *Kajewski 1677* (type), *1750*, April 1930, alt. 900 m., rain-forest (trees up to 15 m. high; flowers white; fruit globular with a tubular end, 9 mm. long, 11 mm. diameter); Koniguru, Buin, *Kajewski 2049*, Aug. 1930, alt. 1000 m., rain-forest (epiphytic tree; flower white; fruit 7 mm. long, 1 cm. diameter).

This species tends to be almost entirely glabrous; the flower looks somewhat like that of *Timonius avenis* Val. except that the bud is shorter and stouter than in the latter species. The only pubescence that appears on the flower is at the apex of the bud, apparently on the corolla-lobes; the truncate calyx is not quite so short as in the New Guinean species; and of course the leaves with their definite venation at once set it apart as distinct. It may be allied to *T. appendiculatus* Merr., from the Philippines, but that species lacks the distinctly acuminate apex of the leaf.

FIG. 8. A. *Timonius novo-guineensis* Warb.: *a.* habit, × ½; *b.* ♀ inflorescence (young), × ½; *c.* infructescence, × ½. B. *Timonius bougainvillensis* Merr. & Perry: *a.* habit, × ½; *b.* fruit, × ½; *c.* longitudinal section of fruit, × ½.

Timonius Versteegii Val. Bull. Dép. Agr. Ind. Néerl. **26:** 39. 1909, Nova Guin. Bot. **8:** 475. 1911.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7026,* June 1936, alt. 100 m., rain-forest undergrowth (small tree 3 m. tall; leaves flat, pale below; fruit large, red, costate, ovoid-globose, ± 4 cm. long and 3.5 cm. diameter, solitary in axils).

There can be scarcely any doubt that this is the species previously reported from Netherlands New Guinea. The only variation we see from the description is in the slightly more slender calyx-lobes crowning the fruit (lobes 2.5 cm. × 3 mm.); the peduncle supporting it is 6 mm. long; the fruit contains about 19 pyrenes vertically arranged.

Timonius Roemeri Val. Nova Guin. Bot. **8:** 476. 1911.

NETHERLANDS NEW GUINEA: Nabire, *Kanehira & Hatusima 11515,* Feb. 1940, on the edge of high rain-forest (plant 5 m. high; fruit white).

This specimen has only a fruit and two leaves with stipules at the apex of the stem. The bracts are 4 cm. long, appressed-pilose within, and the upper margin is frayed and broken; they do not entirely cover the fruit. The latter is globose, 4 cm. in diameter, crowned by 8 strongly reflexed calyx-lobes about 2 cm. long; the pyrenes are obliquely arranged in series; outside of the pyrenes the epicarp is about 5 mm. thick.

Timonius rivularis sp. nov. FIG. 9, A.

Arbor usque 16 m. alta; ramulis sulcatis, glabris, internodiis 0.7–2.5 cm. longis; stipulis 2–4 cm. longis, sensim attenuatis, extus sericeo-pilosis, cito caducis; foliis lanceolatis, 11–18 cm. longis, 3–5 cm. latis, basi et apice acuminatis, chartaceis, supra glabris vel utrinque consperse (subtus costa et venis densius) adpresse pilosis, nervis lateralibus in axillis barbellatis, utrinsecus 12 vel 13 supra manifestis, subtus prominulis, adscendentibus, reticulo supra inconspicuo, subtus sub lente distincto, in areolis parallelo-lineatis; petiolo 1–2 cm. longo, sparsim piloso, cito glabrato; inflorescentiis ♂ tantum visis, 2–5(–7)-floris, axillaribus, pedunculatis, pedunculo 2–2.5 cm. longo, glabro, semel dichotomis, ramis 1–1.5 cm. longis, adscendentibus, floribus sessilibus; calyce tubulato, 7 mm. longo, extus consperse intus densius pubescente; corollae tubo sericeo, 1.5 cm. longo, lobis 5, oblongis, 7 mm. longis, extus sericeis; staminibus 5 in parte superiore tubi insertis, 6 mm. longis, inclusis; stylo 6 mm. longo, glabro.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7252* (TYPE), July 1936, alt. 100 m., plentiful in older seral forests on the sandy river-banks (tree attaining 15–16 m.; leaves thin, flat, with conspicuous lateral nerves; flowers white).

FIG. 9. A. *Timonius rivularis* Merr. & Perry: *a*. habit, × ½; *b*. enlarged portion of leaf showing detail of venation. B. *Timonius melanophloeus* Merr. & Perry: habit, × ½.

None of the species described, except *Timonius Timon* (Spreng.) Merr. (which has definite calyx-lobes), seems to be greatly like this collection. It is readily distinguished by the truncate and almost glabrous calyx, the long slender leaves with fairly numerous ascending nerves, and the very fine hairs which appear on the younger parts, but mostly soon disappear. The venation of the lower leaf-surface shows a definite pattern.

Timonius melanophloeus sp. nov. FIG. 9, B.

Frutex 1 m. altus; caulibus pluribus, teretibus, atro-purpureis; ramulis fuscis adpresse pubescentibus, internodiis 1–3.5 cm. longis, novellis compressis; stipulis 4 mm. longis, ovatis, acutis vel acuminatis, extus sericeis, intus villosulis; foliis 4–8 cm. longis, 1–2.5 cm. latis, lanceolatis, basi rotundato-cuneatis, apice sensim longe acuminatis, coriaceis, supra costa puberula excepta glabris, subtus consperse puberulis, costa densius pubescente, nervis lateralibus utrinsecus 7–9 utrinque aequaliter manifestis, patenti-adscendentibus et arcuatis, reticulo utrinque manifesto; petiolo 3–5 mm. longo, pubescente; inflorescentiis ♂ tantum visis, pedunculatis, pedunculo 1.5–3 cm. longo, ± puberulo, trifloris; floribus sericeis, medio sessile, lateralibus pedicellatis, pedicello 3 mm. longo; calycis tubo 1 mm. longo, lobis 4, ovatis, 1 mm. longis; corollae tubo 8 mm. longo, 1 mm. diametro, lobis 3 mm. longis, 4, oblongis; staminibus 3.5 mm. longis in parte superiore tubi insertis; stylo glabro brevi.

SOLOMON ISLANDS: Ysabel: Cape Prieto, *Brass 3475* (TYPE), Jan. 1933, alt. 200 m., open sun-parched slopes, common (shrub or bush 1 m. high; stems several from a thick woody base; bark dark purple; flowers cream-colored).

Perhaps the species is to be related to *Timonius subsessilis* Val. of Netherlands New Guinea, but the latter has larger and entirely glabrous leaves. This collection seems to be best characterized by the very dark bark of the branchlets, which tend to have a cinereous appearance on account of the very fine pubescence covering them; the stipules are usually present on the last two nodes; the flowers are very slender, and the leaves are fairly small as well as conspicuously acuminate.

Timonius densiflorus Val. Bot. Jahrb. 61: 39. 1927.

BRITISH NEW GUINEA: Iaritari, *Brass 707*, November 1925, alt. 450 m., foothill-forest stream (small compact tree about 4.5 m. tall, with green fruit).

Vegetatively this collection agrees very well with that of an isotype of *Timonius densiflorus* Val. This is the ♀ plant with infructescences pedunculate (peduncles about 1.5 cm. long) and once or twice dichotomous in the upper axils; fruits globose, ± 6 mm. in diameter, crowned by the remnants of the calyx-lobes; pyrenes in about 16 rows, obliquely pendulous from the apex of the fruit.

Timonius kaniensis Val. Bot. Jahrb. 61: 42. 1927. FIG. 10.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 8842*, June 1938, alt. 50 m., rain-forest substage (tree 15 m. tall; leaf-nerves prominent beneath); Bernhard Camp, Idenburg River, *Brass 13894*, April 1939, alt. 120 m., rain-forest of lower mountain-slopes (subsidiary tree 15 m. high; flowers white).

After preparing a description for these collections we have decided that they fall too near *Timonius kaniensis* Val. to be kept separate, at least until one has an opportunity to examine an isotype, if one should be extant. The shape of the leaves is more like that given for *T. latifolius* Lauterb. & K. Schum., where the leaves are somewhat abruptly narrowed toward the base and truncate or subcordate at the very base; however, they are about the same size as those described for *T. kaniensis* Val. Furthermore, the inflorescence is bracteate, on a short peduncle, and has very short branches. Our specimens are not in similar stages for comparison, the type being a ♀ plant with young flower-buds. *Brass 8842* is a ♀ plant with fruit and one dried corolla attached, and the other collection is a ♂ plant with the inflorescences mostly in young bud. We add the following data from the material at hand: ♀ inflorescence twice dichotomous; corolla outside appressed-sericeous, the tube 6 mm. long, the lobes 7, oblong, about 4 mm. long; anthers inserted near the middle of the tube; style 6–7 mm. long, pubescent; stigmas partly broken; fruit hirsute, depressed-globose, about 9 mm. diameter, crowned by 4 or 5 calyx-lobes which are about 5 mm. long; the pyrenes are numerous, obliquely pendulous; in a median longitudinal section of the fruit on either side are ± 6 pyrenes compactly superposed from the apex to the base of the fruit. The staminate inflorescence is branched but the branches are short and the flowers crowded, the same tomentulose or somewhat hirtellous pubescence is present on the outside of the bracts and flowers as in the ♀ inflorescence. The bracts are oblong-ovate or ovate, 4–6 mm. long, and subtend the branches as well as each individual flower; calyx-tube 1.5–2 mm. long, the lobes 4, ovate, acutish, 1.5–2 mm. long; corolla-tube 4.5 mm. long, the lobes 4, oblong, 2.5 mm. long, the anthers

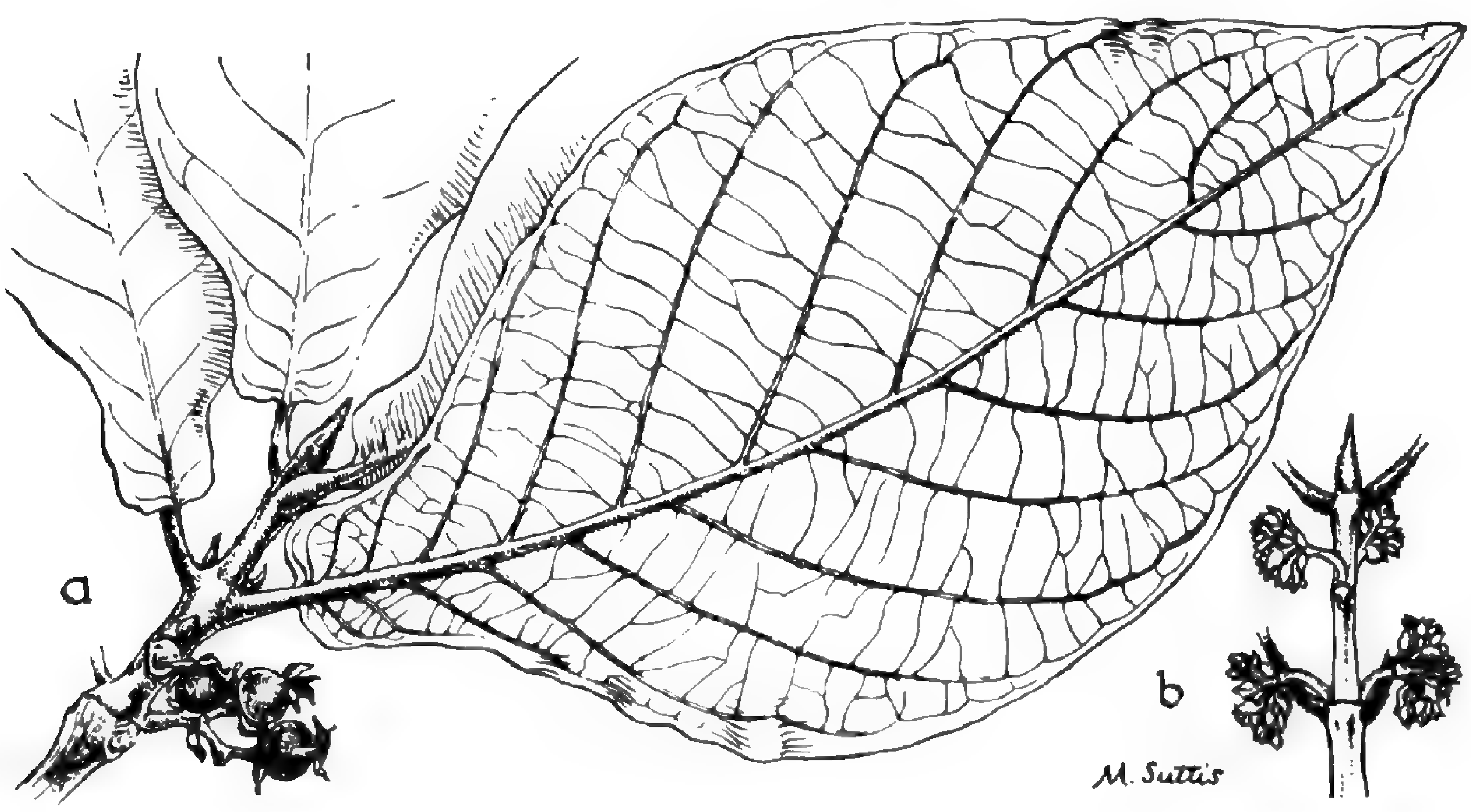

FIG. 10. *Timonius kaniensis* Val.: *a*. habit, × ½; *b*. portion of branch showing ♂ inflorescence, × ½.

3 mm. long, the apex barely exserted; style short, pubescent. Most of the flowers are in young bud. The ♂ inflorescence very closely resembles that of *T. oblanceolatus* Val., but in the latter the bracts are more quickly deciduous, and the pubescence is of appressed short stiffish hairs rather than spreading in all directions as in our collections. The base of the leaf is different too, but this holds only as to the specimens cited, not as to the two descriptions. We are fortunate to have at hand an isotype of *T. oblanceolatus* Val.

Timonius novo-guineensis Warb. Bot. Jahrb. **13**: 434. 1891; Schumann & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 567. 1900; Val. Bot. Jahrb. **61**: 47. 1927. FIG. 8, A.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 8896, 8897,* June 1938, alt. 10–20 m., in seral shrubberies, plentiful in gravel-beds of river (shrub usually with several stems, erect to 2.5–3 m.; leaves smooth and shining; flower-buds white).

The flowers of both staminate and pistillate plants are immature, as are also the fruits. In the collections cited the leaves are not so definitely acuminate as in the isotype, and they are somewhat more coriaceous; the plants also are not quite so pubescent, but these are all minor differences and are noted here to indicate the variation.

Timonius jobiensis Wernh. Jour. Bot. 56: 131. 1918.

NETHERLANDS NEW GUINEA: Roemberpon Island, 60 miles south of Manoekwari, *Kanehira & Hatusima 13299*, March 1940, in rocky strand-forest (plant 3 m. tall; flower white).

The type was collected on the island of Japen (Jobi). Previously known only from the type collection.

Mastixiodendron Melchior

In Jour. Arnold Arb. 23: 416. 1942, we called attention to the fact that *Mastixiodendron* Melchior belongs to the Rubiaceae rather than to the Cornaceae. Not long ago we were checking Blumea for some other information, and a paragraph on the genus *Mastixiodendron* caught our eye. At once we realized that here was an overlooked item. Danser, in his monograph of the Cornaceae of the Netherlands Indies (Blumea 1: 69. 1934), apparently anticipating the occurrence of the genus in that region, had already pointed out that *Mastixiodendron* belongs not to the Cornaceae but to the Rubiaceae. He suggested that Melchior had been misled by the choripetalous corolla and then said that he had been unable to ascertain to his satisfaction whether the corolla was choripetalous or not. In the material of two species which we have at hand the corolla-lobes are thick and stiff, the bud is practically square at the base, and in the open flowers of these the petals appear to be separate. In the third species, which has oblong buds, the petals are obviously separate to the base. *Mastixiodendron* has now been found in Halmahera, all three parts of New Guinea, the adjacent island of Japen, Banika in the Russell group of islands in the Solomon Islands, and in Fiji (see A. C. Smith in Jour. Arnold Arb. 26: 108–110. 1945).

Mastixiodendron Stoddardii sp. nov.

Verisimiliter arbor; cortice griseo-brunnescente longitudinaliter ruguloso; ramis teretibus, novellis compressis, glabris; foliis ellipticis, 12.5–17 cm. longis, 5–7 cm. latis, chartaceis vel tenuiter coriaceis, utrinque angustatis, apice obtusiusculis vel brevissime et obtuse acuminatis, basi cuneatis et in petiolum breviter decurrentibus, in sicco fuscis vel olivaceis plerumque subtus pallidioribus, glabris, costa supra interdum anguste canaliculata, subtus prominente, nervis lateralibus utrinsecus $\pm$ 17 utrinque prominulis patentibus prope marginem anastomosantibus, reticulo venularum utrinque manifesto; petiolo 2–3 cm. longo; stipulis oblongo-lanceolatis, 1.3–2 cm. longis, cito caducis; inflorescentiis in axillis foliorum summorum dispositis, 9 cm. longis, cymo-paniculatis; pedunculo et ramis glabris, pedunculo $\pm$ 4 cm., ramis circiter 2.5 cm. (summis 1 cm.) longis; pedicellis 3 mm. longis, minute puberulis vel glabris; bracteis minutis cito caducis; alabastro ovoideo, 4-angulato; calycis lobis 4, circiter 1 mm. longis, triangularibus, acutis; petalis 4, in sicco 4 mm. longis, 2.5 mm. latis, ovatis, obtusiusculis, extus glabris, intus dense pubescentibus, pilis longis crassiusculis, crispule intertextis; staminibus 2 mm. longis, 4, filamentis apicem versus leviter attenuatis; ovario 1–1.5 mm. longo, depresso, obtuse 4-angulato, stylo 1 mm. longo.

SOLOMON ISLANDS: Russell group: Banika, *Stoddard 12* (TYPE) (received at A. A. Aug. 1944). Three collections from NETHERLANDS NEW GUINEA (Bernhard Camp, Idenburg River, *Brass & Versteegh 13563,* alt. 225 m., and 2 km. southwest of Bernhard Camp, *Brass & Versteegh 13502,* alt. 800 m., rain-forest; Japen Island, *Neth. Ind. For. Serv. bb.30355*) are either conspecific or closely related.

The New Guinean material differs from the Banika Island collection in having stiffer leaves, with a more definitely marked obtuse acumen, and a more obviously reticulate upper surface. The latter may be due to an inherent difference in the plants or it may possibly be owing to different methods of drying. None of the New Guinean material is sufficiently advanced in the flowering stage to show anything of the inflorescence. The fruits on the specimens are abnormal because of insect damage, but they show a fairly definite pattern in cross-section; there is much less fibrous tissue in the pericarp of these than in the fruits of *Mastixiodendron Smithii* described below, and more cancellate tissue; the apex of the fruit is at most convex, not prominently protruding as in the other New Guinean species. The flower of *M. Stoddardii* is very like that of *M. pachycladon* (K. Schum.) Melch., but the former is readily distinguished by its smaller and obtusely acuminate leaves. It somewhat resembles the Fijian material (here again the leaves are obtuse), but the latter is readily distinguished by the papillate rather than pubescent upper surface of the petals.

Named for the collector, Lieut. C. H. Stoddard of the U. S. Navy.

Mastixiodendron Smithii sp. nov.

Arbor 20 m. et ultra; cortice brunnescente vel cinereo, longitudinaliter ruguloso; ramis teretibus, novellis valde compressis, glabris; foliis ellipticis vel leviter obovatis, 9–21 cm. longis, 4.5–10 cm. latis, supra medium latissimis, apice breviter et obtuse acuminatis, acumine 3–5 mm. longo, basi elongato-cuneatis, in sicco brunnescentibus vel subtus olivaceis, glabris, subnitidulis, costa supra plana, subtus prominente, nervis lateralibus utrinsecus 10–14 utrinque prominulis prope marginem anastomosantibus, venulis manifestis non prominulis; petiolo 2–3 cm. longo; stipulis 1.5–2.5 cm. longis, oblongo-lanceolatis, cito caducis; inflorescentiis in axillis foliorum summorum dispositis, ± 13 cm. longis latisque, paniculatis; ramis valde divaricatis, infimis 3 cm. longis, pedunculo 4 cm. longo, pedicellis 3–4 mm. longis; bracteis minutis, caducis; alabastro oblongo, 7 mm. longo; ovario et calyce vix 3 mm. longo, glabro, calyce 4-dentato, dentibus triangularibus vix 1 mm. longis, acutis; petalis 4 liberis, 5 mm. longis, extus puberulis, intus fere basim pilosis, prope medium pilis longioribus; staminibus 4 mm. longis; disco 1.5 mm. longo, minute puberulo; stylo 2 mm. longo, glabro; fructibus ellipsoideis, 4–4.5 cm. longis, 2 cm. diametro, apice disco coronatis, 2-locularibus; pericarpio fibroso hinc inde cancellato.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 12517,* Feb. 1939, alt. 1200 m., occasional in primary forest (tree 32 m. tall, 61 cm. diameter; bark black, fairly smooth; wood yellow; fruit green). NORTHEAST NEW GUINEA: Yunzaing, *Clemens 3723,* July 1936, alt. about 1500 m., hill in forest (tree 19–22 m. tall; fruit gray-green); Ogeramnang, *Clemens 5154* (TYPE), Jan. 1937, alt. about 1750 m.

Named for Dr. A. C. Smith, because of his special interest in and work on this genus.

The fruit of this species differs from that of *Mastixiodendron pachycladon* (K. Schum.) Melch. in that it is very much larger and has a much thicker and fibrous pericarp with here and there what appears to be aeriferous tissue. The fruit is more or less pointed at both ends rather than rounded as in Melchior's species. Then too the leaves have a very short obtuse acumen, whereas in *M. pachycladon* the leaves are broadly rounded at the apex. *Mastixiodendron Stoddardii* Merr. & Perry may be readily distinguished by the smaller leaves, the ovoid rather than oblong flower-buds, and the smaller fruits, but it is to be noted that in the New Guinean material of that species, or a closely allied one, the fruits also have a pericarp with cancellate tissue.

Coffea Linnaeus

With no good material of *Coffea* (*Lachnostoma*) in our herbaria for study or comparison, and with three species described from New Guinea transferred to some other genus or left in an uncertain position, we hesitate even to try to name the material at hand. Temporarily we are disposing of it thus:

Coffea apoda (Val.) Bremekamp, Bull. Jard. Bot. Buitenz. III. 16: 276. 1940; vel aff. *Ixora apoda* Val. Ic. Bogor. 4: *t. 341.* 1912.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12821, 13026,* Feb. 1939, alt. 1200 and 1250 m., rain-forest undergrowth, rare (shrub 1 m. high; calyx-lobes red; corolla white).

Described from Obi Island; the New Guinean collections, if not identical, are too close to be separated without material for comparison.

Coffea (*Lachnostoma*) ?

BRITISH NEW GUINEA: Baroka, Makeo District, *Brass 3743,* April 1933, alt. 30 m., brushy rain-forest (abundant shrub of somewhat scandent habit; foliage dull green; fruit immature); Rouna, *Carr 12389,* May 1935, alt. about 450 m., brink of stream in very steep hill-forest (tree about 1.8 m. tall; fruit black-purple); Kanosia, *Carr 11220,* Feb. 1935, alt. about 15 m., secondary forest (tree about 2 m. tall).

In this material the fruit seems to be terminal on short lateral branches. There is a strong resemblance to the plate of *Coffea madurensis* Teysm. & Binn. in Teysmannia 11: 31. 1900. The general habit suggests *C. bengalensis* Roxb., and strangely enough we found the latter species recorded from Sunday Island [Torres Strait]. We believe the whole group is in need of detailed and careful study.

Ixora Linnaeus

With the aid of Bremekamp's excellent work on the genus *Ixora* Linn., we have placed our unnamed collections with considerable ease. We note here two new species and the extension of the range of *I. Kerstingii* Lauterb. & K. Schum. from Northeast and Netherlands New Guinea into British New Guinea.

Ixora Kerstingii Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 571. 1900; Brem. Bull. Jard. Bot. Buitenz. III. 14: 305. 1937.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13830,* Apr. 1939, alt. 150 m., rain-forest of lower mountain-slopes (undergrowth tree 3 m. high; flowers white). BRITISH NEW GUINEA: Kubuna, *Brass 5623,* Nov. 1933, alt. 100 m., rare in rain-forest undergrowth (bush about 2 m. tall; pendent panicles with pale yellow flowers).

Ixora cordata sp. nov.

Arbor 4–6 m. alta; ramis brunnescentibus, teretibus vel compressis, internodiis 3–8 cm. longis; petiolo 3–5 mm. longo, crassiusculo; foliis chartaceis vel tenuiter coriaceis, oblongo-lanceolatis, 12.5–19 cm. longis, 4.5–6.5 cm. latis, apice acutis vel acuminatis, basi cordatis, nervis lateralibus utrinsecus 9–11 utrinque prominulis, venulis utrinque manifestis, reticulo laxo supra manifesto, subtus inconspicue manifesto; stipulis brevibus, ovatis, arista quam vagina breviore munitis, intus parte inferiore pilosis; inflorescentiis terminalibus, multifloris; axi, ramis et pedicellis puberulis; pedunculo 4–7 cm. longo; axi inflorescentiae ± 10 cm. longo, internodio infimo 3–6 cm. longo; ramis infimis oppositis, circiter 7 cm. longis, divaricatis; pedicellis 2–4 mm. longis; bracteis infimis anguste lanceolatis, 5 mm. longis; bracteolis filiformibus inconspicuis; ovario et calyce 2 mm. longo; calyce minute lobato; corollae tubo 8 mm. longo, fauce glabro, lobis 6–7 mm. longis, 3 mm. latis, obtusiusculis; filamentis 2 mm. longis, antheris 5 mm. longis, mucronatis; stylo 10 mm. longo secus medium sparsim piloso; stigmatibus 3 mm. longis; fructibus depresse globosis, 7 mm. longis, 9 mm. diametro.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12860* (TYPE), Feb. 1939, alt. 1200 m., common on rain-forest slopes (tree 4–6 m. high; flowers pink; peduncles and pedicels red; fruit red); 2 km. southwest of Bernhard Camp, Idenburg River, *Brass 13613,* Mar. 1939, alt. 700 m., common in rain-forest undergrowth (tree 4–5 m. high; fruit red).

In general aspect this species resembles *Ixora amplexifolia* K. Schum. & Lauterb., but there are several differences. The reduced leaves near the base of the peduncle are lacking; even in fruit the ultimate branchlets and pedicels are puberulent or minutely spreading-pubescent; the flowers are smaller and more numerous at the apices of the branches than in the specimens we have of the earlier species; and also the lobes of the calyx are scarcely at all marked in our species, but perfectly obvious in the related one. The leaves in the second specimen cited are a little larger (23–34 × 6–10 cm.) than in the type collection and more deeply cordate; the fruit is smaller (fruiting specimen only), but in neither is the fruit ripe.

Ixora ensifolia sp. nov.

Frutex 1 m. altus, pauciramosus; ramis gracilibus circiter 1.5 mm. diametro, cortice griseo vel pallide brunneo; foliis sessilibus (petiolo vix 1 mm. longo), chartaceis, linearibus vel subensiformibus, 20–31 cm. longis, 1.2–1.5 cm. latis, apice sensim angustatis, acuminatis, basi auriculatis, supra subnitidulis, nervis lateralibus supra prominulis utrinsecus ± 35, tamen sicut venulis laxe reticulatis (subtus tantum manifestis) supra prominulis; stipulis 5–10 mm. longis, ovatis et longe aristatis, axilla pilosis; inflorescentiis pendentibus terminalibus, laxe paniculatis, e floribus ± 25 compositis; pedunculo ± 16 cm. longo, 2 mm. supra basim bracteis 9 mm. longis vel foliis rudimentariis munito; axi inflorescentiae ad minimum 15 cm. longo, ramis infimis ± 12 cm. longis, oppositis, divaricatis, superioribus brevioribus et plerumque suboppositis; pedicellis ± 1.5 cm. longis; bracteis lanceolatis 2–2.5 mm. longis; bracteolis vix 1 mm. longis, ab ovario remotis; ovario 1.5 mm. longo, glabro; calyce vix 1 mm. longo, lobis late ovatis; corollae tubo 4 mm. longo, fauce glabro; lobis 9 mm. longis, 1.5 mm. latis, acutis; filamentis 2 mm. longis, antheris 8 mm. longis, aristatis, basi profunde fissis; stylo (parte inclusa pilosa 1 mm. supra basim excepta) 7 mm. longo, stigmatibus 2 mm. longis.

BRITISH NEW GUINEA: Dieni, Ononge Road, *Brass 3941* (TYPE), May 1933, alt. 500 m., common in rain-forest (shrub about 1 m. high with a few slender spreading branches; panicles pendent; petals green in bud; peduncle and pedicels reddish).

The plant appears to belong to *Ixora* sect. *Macropus* Brem. and is related to *I. leptopus* Brem., if we have correctly interpreted the latter species. Both seem to have the same type of inflorescence. The species is readily distinguished by the long slender auriculate subensiform sessile leaves and the very open inflorescence.

Versteegia Valeton

Versteegia aff. **cauliflora** (Lauterb. & K. Schum.) Val. Nova Guin. Bot. 8: 484. 1911, in nota.

Psychotria cauliflora Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 574. 1900.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7065,* June 1936, alt. 100 m., ridge-forest undergrowth (small tree 4 m. high, with soft glabrous leaves; fruit red, compressed-globose, 4 cm. diameter, solitary on trunk below the branches).

This genus as known at present consists of two described species and a third very briefly set forth in a key. The present collection has leaves with longer petioles and depressed-globose fruits in contrast to the short petioles and ovoid fruits of *Versteegia cauliflora* (Lauterb. & K. Schum.) Val. However, since we have only a single specimen with a single fruit, it seems unwise to try to carry the determination further.

Coprosma J. R. & G. Forster

Even with the aid of Oliver's recent monograph on the genus *Coprosma* we have found it difficult to dispose satisfactorily of the collections at hand. With flowers so much alike, the question of distinguishing intrinsic characters from differences brought about by variation in habitat has constantly bothered us. However, for purposes of distribution we have assigned the species as best we can, leaving their ultimate disposition for the specialist. The following key will show at a glance what we have taken to be good characters:

Corolla tubular; flowers solitary, terminal; plant prostrate..........*C. Archboldiana.*
Corolla campanulate; flowers solitary or clustered; upright shrubs.
 Leaves obtuse..*C. divergens.*
 Leaves acute or cuspidate.
  Branches and stipules entirely glabrous.
   Leaves mostly ternate, glabrous..............................*C. papuensis.*
   Leaves opposite, the midrib beneath sparsely hirtellous.........*C. Wollastonii.*

Branchlets pubescent; stipules pubescent or glabrous with a thick margin of hairs.
 Leaves mostly ternate; stipules with processes 1–2 mm. long and glandular at the apex .... *C. Brassii.*
 Leaves opposite; stipules dentate, the teeth apparently being glands along the margin.
  Stipules pubescent outside; midrib of leaves sparsely hirtellous beneath.
   Leaves smaller, 9–12 × 3–3.5 mm .... *C. Lamiana.*
   Leaves larger, 16–35 × 3–8 mm .... *C. habbemensis.*
  Stipules glabrous with a thick margin of hairs; leaves glabrous .... *C. novoguineensis.*

Coprosma divergens Oliver, Records Dominion Museum [N. Zeal.] 1: 44. 1942.

Brass collected two numbers (*4215* and *4216*) of this species, one ♂, the other ♀; it would seem that the numbers were mixed when duplicates were distributed, as no. *4216* in the Arnold Arboretum set is from a ♂ plant. However, the two are so much alike that the only difference we can see is that one has stamens where the other has styles, the calyx and corolla being alike in the two plants.

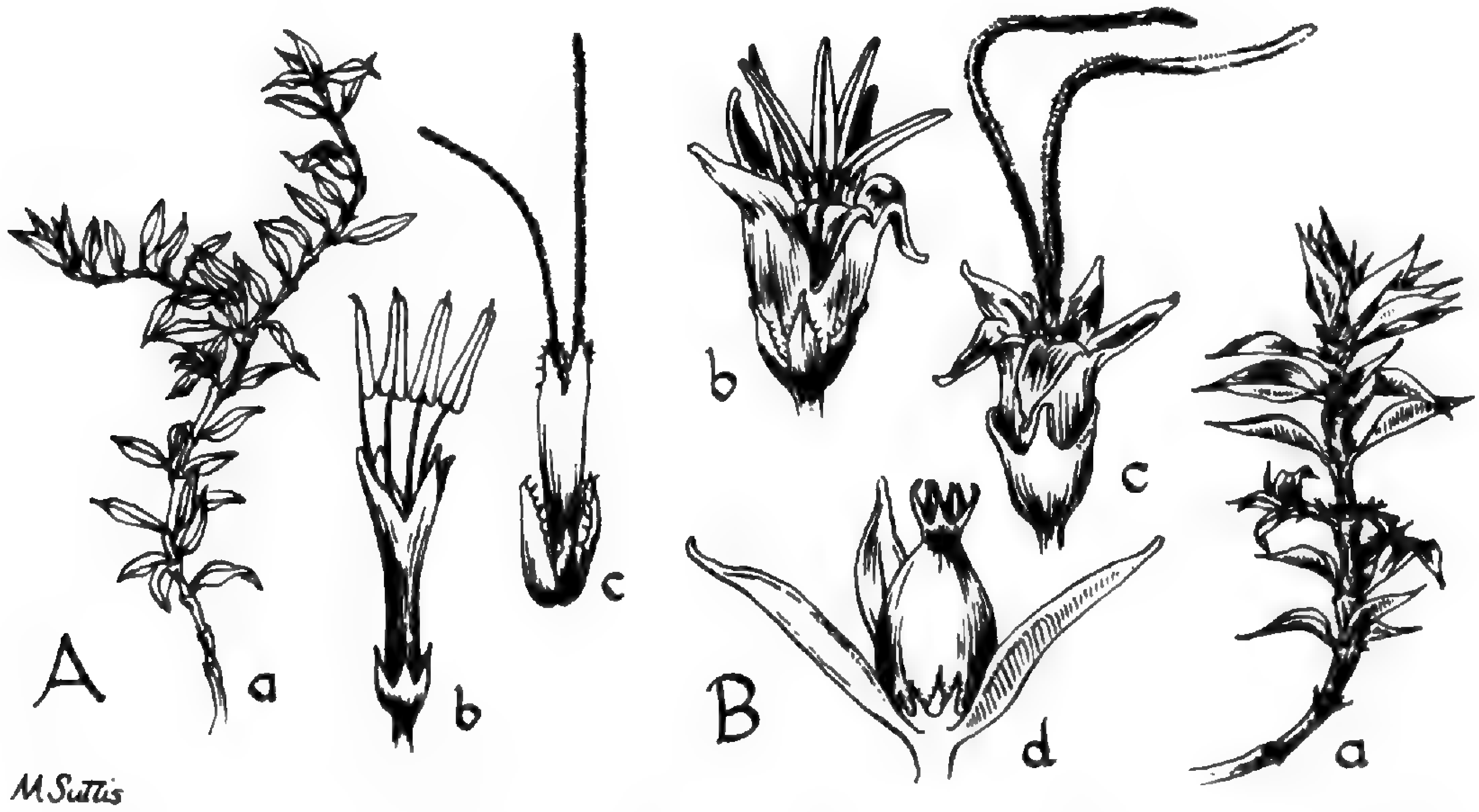

FIG. 11. A. *Coprosma Archboldiana* Merr. & Perry: *a.* habit, × ½; *b.* ♂ flower, × 2½; *c.* ♀ flower, × 2½. B. *Coprosma Brassii* Merr. & Perry: *a.* habit, × ½; *b.* ♂ flower, × 2½; *c.* ♀ flower, × 2½; *d.* fruit, × 2½.

Coprosma Archboldiana sp. nov. FIG. 11, A.

Frutex prostratus; caulibus minute hirtellis vel glabris, ramosis; internodiis 4–10 mm. longis; foliis oppositis, lineari-lanceolatis, 0.6–1 cm. longis, 2.5–3 mm. latis, apice acutis, basi in petiolo marginato 1–3 mm. longo fere 1 mm. lato angustatis, margine consperse ciliatis, pilis brevibus, utrinque glabris minute rugulosis, costa tantum manifesta; stipulis cum petiolorum basibus connatis, vaginantibus, margine minute dentatis, ciliatis; floribus sessilibus terminalibus; ♂: calyce brevi, inaequaliter 4-dentato, minute ciliato; corolla tubiforme, tubo 7 mm. longo, lobis 2 mm. longis, lanceolatis; staminibus 4, filamentis 1.2 cm. longis, antheris sagittatis apiculatis, 3–4 mm. longis; ♀: calyce 4-lobato, lobis 2–4 mm. longis, plerumque 2 quam reliquis brevioribus, sparsim ciliatis; corolla tubiforme, tubo 7 mm. longo, lobis lanceolatis, 2 mm. longis, costa et apice sparsim ciliatis; staminibus nullis; stylis 2, 1.5–2 cm. longis, minute papillosis; baccis globosis, 6 mm. diametro.

NETHERLANDS NEW GUINEA: 5 km. east of Wilhelmina-top, *Brass 9411,* Aug. 1938, alt. 3650 m., matted on exposed rock-faces; 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9817,* Sept. 1938, alt. 3400 m., alpine grassland, dwarf shrub prostrate on sandy beaches of a stream; 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9831* (TYPE), Sept. 1938, alt. 3560 m., pendent in great cushion-like masses on moist semi-shaded cliffs (fruit red, globose, soft, fleshy).

Coprosma Archboldiana appears to be related to *Coprosma ernodeoides* A. Gray and to the group of *Coprosma pumila* (*C. pumila* Hook. f., *C. nivalis* Oliver, *C. Petriei* Cheesem.). *Coprosma Archboldiana* differs from all of these in the definitely lobed calyx of the ♀ flower. The stipules are very short and some of the younger ones under a lens seem to be minutely denticulate. The calyx of the ♂ flower appears to have four teeth of unequal length, but in between these are minute denticulations which might possibly suggest that the calyx is a transitional form. The corollas of both ♂ and ♀ flowers are alike in size and shape in the New Guinean material. In the species mentioned above the corolla of the ♀ flower is always shown as the smaller in Oliver's monograph. Nevertheless it must be noted that the habit, the relative size of the leaves, the solitary terminal flowers, and the trumpet-shaped corolla all indicate a close relationship among these species.

Coprosma Brassii sp. nov. FIG. 11, B.

Frutex 1.5–2.5 m. altus, ramosus; ramulis ultimis plerumque ternatim verticillatis, obtuse 3-angulatis, patenti-hirtellis, pilis brevibus, internodiis 3–10 mm. longis, partim stipulis obtectis; foliis ternatim verticillatis, 1–1.7 cm. longis, 0.4–0.7 cm. latis, lanceolatis vel ovatis, rigide coriaceis, apice cuspidatis, basi in petiolo 1–2 mm. longo angustatis, utrinque glabris, margine minute papillosis vel erosulis; costa tantum manifesta, supra impressa subtus prominente; stipulis firmis extus glabris, circiter 2 mm. longis, in axillis supra folia breviter connatis, margine fimbriatis, processibus inaequalibus centrali longiore (2 mm. longo, 0.2 mm. lato), margine pubescentibus, pilis ± densis 0.2 mm. longis; floribus sessilibus solitariis vel 4 ad apicem ramulorum; ♂ : calyce ± turbinato, 4–6-dentato, dentibus circiter 2 mm. longis, acutis, minute ciliatis vel glabris; corolla campanulata, tubo 3–4 mm. longo, lobis ovatis aequilongis, recurvis vel patentibus; staminibus 4–6, exsertis, antheris 4 mm. longis, apiculatis; ♀ : calyce ± turbinato, 4–6-dentato, dentibus 1.5 mm. longis, glabris; corolla campanulata, tubo 2–3 mm. longo, lobis circiter 3 mm. longis; staminibus partim inclusis vel inclusis, parvis; stylis 2, ± 1.5 cm. longis, minute papillosis; baccis ellipsoideis, circiter 6 mm. longis (calyce persistente inclusis), 4 mm. diametro.

NETHERLANDS NEW GUINEA: 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9807, 9809,* Sept. 1938, alt. 3400 m., occasional in forest-edges (robust shrub 2 m. high; fruit red); 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9842, 9843* (TYPE), Sept. 1938, alt. 3560 m., very abundant on forest-borders (large weak shrub of brownish appearance, 1.5–2.5 m. tall); 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10221, 10304,* Sept. 1938, alt. 3800 m., common in glades and forest-borders, subalpine forest (lax shrub 1.5–2 m. high).

This species seems to belong to the group of *Coprosma sundana,* according to Oliver's monograph. In nos. *9807* and *9809* the branchlets are nearly glabrous, but the collections do not seem to differ from the others in any other character. The dominant arrangement of both leaves and branchlets is ternate, although we have noted one node with only opposite leaves, also in another plant there is one verticil containing four rather than three branches. One flower of the type has three styles, but all others examined have two. The flowers are terminal and solitary or surrounded by three younger buds probably axillary at the next node, the internode between being so short as to give the appearance of four flowers clustered together. At the base of each flower is a whorl of reduced leaves and their stipules. The distinctive characters of the species are: the ternate arrangement of the leaves, their glabrousness, and under a lens the minutely eroded margin which appears as if it might have been papillate (possibly pubescent) or glandular; and the fimbriately margined stipules forming a very short sheath, the processes glabrous on the outside but the margin hairy (scarcely in a single line as cilia), the middle one being the longest of five or seven which extend from the margin of a single stipule.

Coprosma habbemensis sp. nov.

Frutex 3–5 m. altus, ramosus; ramulis minute hirtellis; internodiis 0.5–1.3 cm. longis; foliis oppositis, subcoriaceis, oblongis, 1.6–3.5 cm longis, 0.3–0.8 cm. latis, apice acutis et minute cuspidatis, basi in petiolo 1.5–3 mm. longo angustatis, margine ciliolatis, supra glabris, subtus costa sparsim patenti-hirtellis, nervis lateralibus obscuris vel interdum subtus manifestis utrinsecus 7–10; stipulis firmis triangularibus, 2–3 mm. longis, supra folia 1 mm. connatis, versus apicem margine glandulis 3 vel 4 dentatis, extus minute hirtellis, margine dense breviter ciliatis; floribus solitariis vel 2 vel 3 ad apicem ramulorum; ♂ : calyce 4(–6)-dentato, dentibus inaequalibus ± 1 mm. longis, glabris, margine minute ciliatis; corolla campanulata, tubo ± 2.5 mm. longo, lobis 4(–6), anguste ovatis aequilongis; staminibus 4 exsertis, antheris circiter 5 mm. longis, apice mucronulatis, basi sagittatis; ♀ : calyce ut in ♂ ; corolla campanulata, tubo ± 2 mm. longo, lobis 3–4 mm. longis; staminibus parvis, filamentis brevissimis, antheris inclusis; stylis 2, circiter 1.5 cm. longis, minute papillosis; baccis in sicco ellipsoideis, circiter 7 mm. longis et 5 mm. diametro.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9367,* Aug. 1938, alt. 3225 m., common in open parts of subalpine forest (tree or shrub 3–4 m. high); 9 km. northeast of Lake Habbema, *Brass 10587* (TYPE), *10588, 10929,* Oct. 1938, alt. 2800 m., abundant in forest second growths on landslips, native clearings, and openings (scrambling shrub 2–5 m. high; fruits orange in no. *10587,* red in no. *10929*).

This species is closely related to *Coprosma Wollastonii* Wernh. from the Carstensz Mountains; in fact, we have hesitated for some time whether to consider this a more pubescent form of *C. Wollastonii* or a distinct species. The peculiar combination of characters of Wernham's species (leaves scabrous above, midrib beneath clothed with scattered stiff hairs, hispid margin, glabrous stipules, glabrous branchlets), as well as the characters found in *C. novoguineensis,* have finally influenced us to believe that this is a distinct species. Apart from the size of the leaves, the longer hairs on the midrib beneath, the more conspicuous stipules, and the much more open habit, *C. habbemensis* is very similar to *C. Lamiana* Oliver.

Coprosma novoguineensis sp. nov.

Frutex plerumque 1–1.5 m. altus, ramosissimus; ramulis ultimis brevibus, pubescentibus; internodiis brevissimis saepissime stipulis fere obtectis; foliis oppositis, in sicco rigide subcoriaceis, confertis, lanceolatis vel ovatis, 0.6–1.5(–2.2) cm. longis, 0.2–0.6 cm. latis (in specimine typico 0.6–0.8 × 0.2–0.3 cm.), apice cuspidatis, cuspide 1–1.8 mm. longa, basi rotundatis vel obtusis deinde subabrupte in petiolo 0.5–1 mm. longo angustatis, utrinque glabris, costa supra impressa, subtus prominula, nervis lateralibus obscuris vel interdum sub lente utrinsecus 3 vel 4 inconspicue manifestis; stipulis firmis, obtuse ovatis, 2(–3) mm. longis, margine denticulatis (dentibus ± caducis) etiam dense pubescentibus, pilis 0.2 mm. longis, patentibus, ceterum glabris; floribus solitariis vel 2 vel 3 ad apicem ramulorum; ♂: calyce 4- vel 5-dentato, dentibus circiter 1 mm. longis, glabris vel in margine inferiore et inter dentes minute ciliatis; corolla campanulata, tubo 3 mm. longo, lobis 4 vel 5, anguste ovatis aequilongis; staminibus 4 vel 5, filamentis 6 mm. longis, antheris 4 mm. longis, mucronulatis; ♀: calyce et corolla ut in ♂; staminibus inclusis parvis; stylis 2, circiter 9 mm. longis, minute papillosis; baccis ellipsoideis, circiter 5 mm. longis et 3 mm. diametro.

NETHERLANDS NEW GUINEA: 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9705, 9706, 9707*, Sept. 1938, alt. 3400 m., grassy place (shrub 1.5 m. high; flowers brownish, the anthers somewhat violet; ripe fruits orange); 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9933*, Sept. 1938, alt. 3740 m., in edge of forest, not common (very slender sparsely foliaged tree 3.5 m. high); same locality, *Brass & Myer-Drees 9939* (TYPE), *9940*, Sept. 1938, alt. 3900 m., plentiful on grassy summits (shrub 1 m. high; fruit red, fleshy); 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10378, 10380*, alt. 3700 and 3750 m., in marginal shrubberies of subalpine forest; Lake Habbema, *Brass 9028, 9063, 9144, 9145, 13736A*, Aug. 1938, alt. 3225 m., abundant in shrubberies bordering forest (loose straggling shrub 1.5–2.5 m. high).

The collections from Mount Wilhelmina are fairly uniform except for nos. *9933* and *9706*. The first has leaves 1.5 × 0.5 cm., the second 1 × 0.6 cm.; apart from these two collections, the rest have leaves 0.6–0.9 × 0.2–0.4 cm. tending to dry very loosely folded along the midrib. All have very short internodes and are profusely branched, thus giving the impression of a compact habit. In the collections cited from Lake Habbema we can find no real differences. The glands or teeth along the margins of the stipules do not seem to have shrunk as much as in the Mount Wilhelmina material, and the specimens show both a compact and a loose habit; there is a wide variation in leaf-size, the two extremes being no. *9145* with leaves 1.3–2.2 × 0.2–0.5 cm., and no. *9028* with leaves 0.7 × 0.4 cm., the latter having very crowded nodes and the stipules also being short; in no. *9145*, on the other hand, the nodes are 5–10 mm. long, and the stipules are also long. In practically all the collections the yellowish stipules are conspicuous. *Coprosma Lamiana* Oliver, collected at the base of Doorman-top, differs only in the longer pubescence of the branchlets, the dense pubescence of the stipules (on account of which there is practically no line of demarcation between stipules and branchlet at the base of the stipules), and the few short hairs on the midrib beneath.

Coelospermum Blume

Coelospermum reticulatum (F. v. Muell.) Benth. Fl. Austr. 3: 425. 1867; F. M. Bailey, Queensl. Fl. 3: 769. 1900.

Pogonolobus reticulatus F. v. Muell. Fragm. Phytogr. Austr. 1: 56. 1859.

BRITISH NEW GUINEA: Tarara, Wassi Kussa River, *Brass 8565*, December 1936, more or less gregarious on savanna-forest ridges (stiff erect shrub growing to 30–100 cm. from a somewhat fleshy rootstock; flowers white; leaves opposite and in 3's).

Previously reported from Queensland and North Australia.

Morinda Linnaeus

Morinda costata sp. nov. FIG. 1, A.

Planta scandens glabra; ramulis subteretibus, internodiis 2–7 cm. longis, novellis compressis; stipulis in vaginam brevissimam connatis, inconspicuis; foliis 6–11.5 cm. longis, 2.5–4.5 cm. latis, oblongo-lanceolatis, apice sensim acuminatis, acumine obtuso, basi rotundatis vel obtusis, interdum in petiolum angustatis, coriaceis, nervis lateralibus utrinsecus 5 vel 6 inter se remotis, patentibus versus marginem arcuatis et conjunctis, utrinque prominulis, subtus in axillis domatiiferis, reticulo laxo utrinque sub lente distincte manifesto; petiolo 6–12 mm. longo; inflorescentiis non visis; syncarpiis in ramis terminalibus sessilibus, oppositis, subglobosis, ± 3.5 cm. diametro, 12–17-carpiis; baccis circiter 8 mm. ultra basim connatis; bacca singula circiter 1.5 cm. longa, parte superiore libera (circiter 1–1.3 cm. diametro), crassiuscula, irregulariter 4- vel 5-angulata, longitudinaliter sulcata, pyrenis 4 subosseis, oblongis vel obovatis, circiter 8 mm. longis, complanatis.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 13012* (TYPE), Feb. 1939, alt. 1200 m., frequent in rain-forest (large canopy liane; fruit red, costate).

Morinda costata seems to be most like *M. Grayi* Seem., from Fiji, but the leaves have shorter petioles, and the syncarps are much larger and sessile in the New Guinean material. Among the New Guinean species *M. costata* is somewhat like *M. glomerata* (Blume) Miq., but in the latter the syncarps are short-pedunculate, the berries are smaller, and there is practically no thin calyx-margin, i. e. the entire wall is thickened around a cup-shaped opening about 5 mm. in diameter; in *M. costata*, on the other hand, there is a thin calyx-margin about 2 mm. wide projecting beyond the fleshy free costate part of the berry, leaving an opening at the apex about 3 mm. in diameter.

Morinda glomerata (Blume) Miq. Fl. Ind. Bat. 2: 247. 1857; Val. Nova Guin. Bot. 8: 515. 1911.

Sphaerophora glomerata Blume, Mus. Bot. Lugd.-Bat. 1: 179. 1850.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 9003*, July 1938, large rain-forest liane. BRITISH NEW GUINEA: Budatobara, *Brass 772*, Dec. 1925, alt. about 90 m., liane in rain-forest. SOLOMON ISLANDS: Ysabel: Tasia, *Brass 3273*, Dec. 1932, large liane in lowland rain-forest.

These collections are all in fruit but seem to match the description fairly well; the species has been reported previously only from Netherlands New Guinea.

Morinda jasminoides A. Cunn. in Hook. Bot. Mag. 61: *t. 3351.* 1834; F. M. Bailey, Queensl. Fl. 3: 768. 1900.

NETHERLANDS NEW GUINEA: Angi, Arfak Mountains, *Kanehira & Hatusima 13798,* April 1940, alt. 1900 m., scandent in thicket by Iray, Lake Giji. BRITISH NEW GUINEA: Bella Vista, Central Division, *Brass 5443,* Nov. 1933, alt. 1450 m., in forest (small climber with cream-colored flowers on a globose receptacle; fruit orange-yellow, 1.2–1.3 cm. diameter).

The above cited material seems to be a very good match for the Australian collections of this species at hand.

Morinda salomoniensis Engl. Bot. Jahrb. 7: 478. 1886; Val. Bot. Jahrb. 61: 154. 1927.

NORTHEAST NEW GUINEA: Ogeramnang, *Clemens 4835,* Jan. 1937, alt. about 1750 m., forest-hills (vine; fruit red); Sarawaket, Camp Kilanda, *Clemens 5236,* alt. 2100 m. BRITISH NEW GUINEA: Mafulu, *Brass 5187,* Oct. 1933, alt. 1250 m., in tall forest (large liane with rigid branchlets; leaves very dark green; fruit red).

These collections all seem to agree with the description of *Morinda salomoniensis* Engl.; there is only one character shown here which is not mentioned in the original description: the corolla-tube as well as the throat is hairy within.

Morinda hirtella sp. nov.

Planta scandens; ramis hirtellis, brunnescentibus vel viridescentibus; internodiis novellis compressis, ± angulatis; stipulis hirtellis, novellis probabiliter tubulatis cito uno latere fissis, 3–4 mm. longis, truncatis; foliis ellipticis, 4–10 cm. longis, 1.8–5.5 cm. latis, vel interdum oblongo-lanceolatis, 11 × 3.4 cm., tenuiter coriaceis, apice plerumque abrupte acuminatis, interdum obtusis cum acumine 3–10 mm. longo acuto, basi rotundatis vel novellis cuneatis, supra sparsim et breviter hirtellis, subtus (costa et nervis densius) non dense hirtellis, nervis lateralibus utrinsecus 7–9 oblique ascendentibus, supra manifestis, subtus prominulis, reticulo utrinque manifesto, subtus sub lente fere prominulo; petiolo 6–10 mm. longo, gracili, hirtello; inflorescentiis terminalibus, umbellatis vel subumbellatis; capitulis parvis ± 9-floris, pedicellatis, pedicellis 11–20, gracilibus, ± 1.5 cm. longis, hirtellis; floribus ut videtur unisexualibus; calyce cupuliformi, integro glabro; corolla extus puberula; tubo 1 mm. longo, lobis 3–5, circiter 4 mm. longis, oblongis, intus dense longe albo-barbatis, apice glabris; staminibus 3–5 tubo inter lobos insertis, filamentis brevibus, antheris 2.5 mm. longis dorso ad basim affixis; stylo non viso; disco prominente; capitulis fructiferis in sicco circiter 10 mm. diametro, 6–8 mm. altis; baccis in parte superiore vix liberis, pyrenis 3 vel 4 obovatis, dorso convexis, osseis.

NORTHEAST NEW GUINEA: Above Heldsbach, *Clemens 1957,* March 1936, alt. ± 600 m., vine on roadside (fruit vivid orange). BRITISH NEW GUINEA: Lower Fly River, east bank opposite Sturt Island, *Brass 7984* (TYPE), rain-forest, large canopy liane of the ridges (branches corrugated; flowers green).

This is another of the species with umbellate inflorescences, in some ways suggesting *Morinda mollis* A. Gray, of Polynesia, but with many more pedicels to the umbel and with glabrous calyces. With so little material we are unable to say whether the species always has unisexual flowers or not, but in the six flowers (taken from two heads in different umbels) examined we did not find even a rudimentary style; the corolla is mostly 4- or 5-lobed, but occasionally 3-lobed ones were observed.

Morinda micrantha Val. Bot. Jahrb. **61:** 153. 1927.

British New Guinea: Lake Daviumbu, Middle Fly River, *Brass 7756*, Sept. 1936, rain-forest substage liane (fruit-heads orange-yellow, less than 1 cm. diameter); Tarara, Wassi Kussa River, *Brass 8505, 8675*, Dec. 1936, Jan. 1937, large liane, common in rain-forests (flowers green; fruits orange-colored, 5–8 mm. diameter).

Described from Northeast New Guinea. The three cited collections indicate the variation in the species; the leaves vary from 5 to 11 cm. in length and 2–5.7 cm. in breadth, the leaf-tips in some instances with an acumen 1 cm. long, in others almost rounded with a mucro 2 mm. long; the umbels have 10–20 pedicels each bearing a 5–9-flowered head; the corolla-tube is about 1 mm., the lobes 2.5 mm. long.

Morinda oligocephala sp. nov.

Frutex scandens glaber; ramulis subteretibus; internodiis 2.5–5 cm. longis, novellis gracilibus; stipulis parvis, late ovatis, obtusis, caducis; foliis 5–10 cm. longis, 2–5 cm. latis, anguste ellipticis vel ovato-ellipticis, apice breviter acuminatis vel acutis, basi rotundato-cuneatis vel late obtusis, tenuiter coriaceis vel rigide chartaceis, nervis lateralibus utrinsecus 6–8 utrinque perspicuis patenti-adscendentibus, versus marginem arcuatis et confluentibus, subtus in axillis domatiiferis, reticulo laxo utrinque prominulo; petiolo 5–10 mm. longo, canaliculato; inflorescentiis umbellatis, terminalibus et interdum in axillis foliorum superiorum dispositis; capitulis 2- vel 3-floris, pedicellatis, pedicellis 4, circiter 5 mm. longis; calyce vix 0.5 mm. longo, minute 4- vel 5-dentato; corollae tubo 4 mm. longo, extus glabro, intus pubescente, lobis 4 vel 5, oblongis, 5 mm. longis, extus glabris, intus dense albo-barbatis; staminibus 4 vel 5 tubo inter lobos insertis, filamentis brevissimis, antheris subsessilibus, 2.5 mm. longis; stylo 7 mm. longo, stigmatibus 2, 3 mm. longis; vel filamentis 4 mm. longis, antheris 2.5 mm. longis, stylo 4 mm. longo, stigmatibus 3 mm. longis; capitulis fructiferis non visis.

British New Guinea: Tarara, Wassi Kussa River, *Brass 8490* (type), Dec. 1936, underbrush of light rain-forest (climbing shrub; flowers cream-colored).

This species is readily distinguished by the rather prominently reticulate leaves, the predominantly 4-pedicelled umbels, and the few-flowered heads. The umbels are sessile, subtended by two leaves, but these sometimes have fallen, giving the impression at first glance of a pedunculate umbel.

Galium Linnaeus

Galium asperifolium Wall. Fl. Ind. 1: 381. 1820; van Steenis, Bull. Jard. Bot. Buitenz. III. 13: 247. 1934.

Netherlands New Guinea: Angi, Arfak Mountains, *Kanehira & Hatusima 13666*, April 1940, alt. 1900 m., in open wet grassy field on inundation-area of Iray River running to Lake Giji.

According to van Steenis the species is known from SE. Asia, Sumatra, Java, and the Philippines.

Galium innocuum Miq. Fl. Nederl. Ind. 2: 341. 1857; van Steenis, Bull. Jard. Bot. Buitenz. III. 13: 247. 1934.

Netherlands New Guinea: Lake Habbema, *Brass 9286*, Aug. 1938, alt. 3225 m., scrambling to 50 cm. on tall marsh grass, common.

Van Steenis gives the range of this species as the Philippines, the Moluccas, Java, and Sumatra. This seems to be the first record of it from New Guinea.

Galium novoguineense Diels, Bot. Jahrb. 62: 493. 1929; van Steenis, Bull. Jard. Bot. Buitenz. III. 13: 247. 1934.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9511, 9548*, Aug. 1938, alt. 3225 m., occasional in moist forest-edges; 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9859*, Sept. 1938, alt. 3560 m., pendent on mossy trees in forest-edges, common.

Previously collected only in Northeast New Guinea (Sarawaket).

Galium australe DC. Prodr. 4: 608. 1830; Benth. Fl. Austr. 3: 446. 1867; F. M. Bailey, Queensl. Fl. 3: 782. 1900.

BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4730*, Aug. 1933, alt. 2840 m., common on wet banks of a creek flowing through grassland. Australia.

Galium rotundifolium Linn. Sp. Pl. 108. 1753, sensu lato.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10731*, Oct. 1938, alt. 2800 m., spreading and ascending herb massed on a native clearing in the forest. BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4736, 4945*, Aug. 1933, alt. 2840 m., plentiful amongst coarse grass on banks of a grassland creek, also a few plants in a fern-brake on the edge of the forest.

Probably *Brass 9321* from Lake Habbema is also a depauperate form. This is perhaps the same species which F. v. Mueller designated as *Galium javanicum* Miq. The whole complex is in need of careful study by a specialist of the group.

Galium subtrifidum Reinw. in Blume, Bijdr. 944. 1826; DC. Prodr. 4: 594. 1830.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11423*, Nov. 1938, alt. 2200 m., trailing and pendent to a meter [in length] on a dry face of limestone in the forest; Angi, Arfak Mountains, *Kanehira & Hatusima 13590, 13820*, April 1940, alt. 1900 m., in open marsh by Lake Gita, and in secondary forest at Iray. BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4946*, Aug. 1933, alt. 2840 m., bank of an open grassland gully, rare.

The collections seems to be a good match for a Javanese collection so-named by van Steenis.

Galium bryoides sp. nov.

Planta perennis glabra; caulibus numerosis, ramosis, caespitosis, decumbentibus vel humifusis, probabiliter 7–10 cm. longis; ramis quadrangulatis, internodiis 1–5 mm. longis; foliis quaternis, sessilibus, lineari-lanceolatis 2.5–4 mm. longis, 0.4–0.8 mm. latis, apice attenuato-acuminatis et mucronulatis, basi leviter angustatis, margine planis, patentibus vel recurvatis, supra enerviis, subtus 1-nerviis, luce permeante laxe reticulato-venosis; floribus axillaribus solitariis, pedunculis sub anthesin subnullis, fructiferis usque 0.5 mm. longis; corolla rosea, 4-partita, lobis vix 1 mm. longis, ovatis; staminibus quam lobis brevioribus; stylis 2 distinctis, stigmate capitato; fructibus circiter 1 mm. longis, glabris et sub lente minute papillatis; embryone tantum leviter curvo.

BRITISH NEW GUINEA: Mount Albert Edward, southwestern slope, *Brass 4416* (TYPE), July 1933, alt. 3680 m., several plants in a wet grassland hollow, rare (flowers pink).

This is a very distinct plant readily recognized by the glabrous character, the small and slender leaves, the matted habit, the very short peduncles, and the glabrous fruits.

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MORPHOLOGY AND RELATIONSHIPS OF TROCHODENDRON AND TETRACENTRON
II. INFLORESCENCE, FLOWER, AND FRUIT

CHARLOTTE G. NAST AND I. W. BAILEY

With five plates

INTRODUCTION

THE FIRST paper (4) of this series dealt with the morphology of the stem, root, and leaf of *Trochodendron* and *Tetracentron* and with significant palaeobotanical data. The present paper will deal with the morphology of the inflorescence, the floral organs, and the fruit, and will conclude the series with a general discussion of the relationships of these remarkable dicotyledons. In so doing, we shall present evidence in support of Dr. Smith's (10) conclusion regarding the close affinities between the two genera.

INFLORESCENCE

TROCHODENDRON. The buds of this genus have numerous scales. When a vegetative bud expands, the smaller outer scales soon drop off, but the inner larger cataphylls are persistent for a season and become separated by internodal elongation. A pseudoverticillate cluster of leaves of varying sizes develops above these cataphylls, and the axis terminates in a maturing bud. The growth of such a vegetative shoot obviously is monopodial.

When a flower bud of *Trochodendron* expands, the numerous cataphylls are early deciduous, and the stem is extended as the primary axis of an inflorescence, *Fig. 1*. This rachis usually, but not invariably, terminates in a flower. It bears numerous elongated bracts, in the axils of most of which secondary flower-bearing axes are formed. In certain cases, the lowermost of these structures are branched, thus giving rise to tertiary floral axes, *t. fl., Fig. 1*. Even when the rachis terminates in a flower, the uppermost bracts tend to be reduced in size and have no flowers in their axils. Elongated bracteoles do not develop on secondary axes except where these axes are branched. A vegetative bud occurs in the axil of the last sterile scale at the base of the inflorescence, *ax. b., Fig. 1*. This bud extends the vegetative part of the shoot, which, therefore, is of a sympodial type.

It is evident, accordingly, that the inflorescence of *Trochodendron* is terminal and that it is a raceme-like pleiochasium with occasional tertiary floral axes. The occurrence of such tertiary axes and the not infrequent absence of a terminal flower render difficult the acceptance of Wagner's (12) interpretation of the inflorescence as an interrupted "primanpleiochasium."

TETRACENTRON. The vegetative buds of the long shoots of *Tetracentron* have two elongated scales, occasionally reduced to one in the axillary bud closest to the apex of the shoot. Within the bud scales there is a tiny leaf, having a terminal bud primordium enclosed within its stipular flange. The extension of the shoots is by monopodial development.

The flower buds of *Tetracentron* are borne on short shoots, and at first are enclosed within the stipular flanges of a leaf (*o. lf.*) as illustrated in *Fig. 3.* Each matured flower bud has two scales, within which are an incipient inflorescence (*infl. ax.*) and a short axis bearing a small leaf (*lf.*) enclosed within an enveloping scale (*br. 3*). The subsequent development of the short axis, *Fig. 2*, crowds the inflorescence into an apparently lateral position. That the inflorescence actually is terminal and the leaf-bearing shoot axillary is indicated, however, by topographical relationships within the flower bud, *Fig. 3.* The occurrence of a bud (*ax. b.*) in the axil of the leaf (*o. lf.*) demonstrates that the flower bud is terminal. Similarly, the occasional formation of a rudimentary bud in the axil of the lower bud scale (*br. 1*) indicates that the inflorescence is terminal and that the short leaf-bearing axis is lateral, i.e. develops from a bud in the axil of the inner scale (*br. 2*) of the flower bud. Such an interpretation of the morphology of the short shoot is supported by the orientation of the scale (*br. 3*) of the inner axillary bud (*t. m.*). This scale is set at right angles to the scales (*br. 1* and *2*) of the flower bud, and its orientation in relation to the axis of the inflorescence is the same as that of the scales of axillary buds to the axis of long vegetative shoots.

The apical primordium (*t.m.*) of the leaf-bearing axillary shoots forms the flower bud of the next year. It is evident, accordingly, that the inflorescences of *Tetracentron* are terminal and that the development of the short shoots is sympodial. The inflorescence is a spike with numerous sessile flowers, each subtended by a minute bract, *Fig. 4, br.* The flowers tend to be arranged in false whorls. Four decussate bracts are usually present at the apex of the axis, but occasionally the rachis may terminate in a flower.

FLOWERS

PERIANTH. The sessile, tetramerous flowers of *Tetracentron, Fig. 4,* have four sepals oriented opposite to the stamens. The flowers of *Trochodendron* generally are considered to be without a perianth, but Hutchinson (7), in defining the Trochodendraceae (*Euptelea* and *Trochodendron*), states that sepals are absent or very minute. Most of the axillary flowers of the inflorescence have a pair of tiny, unvascularized[1] scales, *br., Figs. 6* and *7,* that commonly are attached to the base of the torus or less frequently at a somewhat lower level. The terminal flower of the rachis may have three or four of these rudimentary appendages. The higher levels of attachment suggest that the scales may be vestiges of a calyx. It should be noted in this connection, however, that the broad bases of the scales are decurrent and embossed, *Fig. 7,* as are those of the bracts on the rachis and of elon-

[1] In contrast to the normal elongated bracts and bracteoles of the inflorescence, which have a single vascular strand. The minute bracts of *Tetracentron* also have a single trace.

gated bracteoles on branched secondary, flower-bearing axes. Furthermore, the androecium is perigynous and the stamens appear to be attached to the dorsal surfaces of the carpels. The subtending scales may, therefore, be rudimentary bracteoles that have been upwardly displaced onto the surface of the receptacle. It is unfortunate that there are no vascular strands in these structures to aid in their interpretation.

ANDROECIUM. The numerous stamens of *Trochodendron* are borne individually upon cushions that tend to be linearly arranged on more or less embossed and decurrent ridges of the dorsal surface of the carpels, *Figs. 6* and *7*. The four stamens of *Tetracentron* are borne alternately to the carpels and do not exhibit external evidences of perigyny.

The stamens of the two genera are, however, of a fundamentally similar morphological type. The filaments terminate in a relatively massive instead of a much constricted connective as in *Drimys* (Bailey and Nast, 2), and the four sporangia are not conspicuously protuberant as in many dicotyledons. The endothecium is neither as restricted as in *Degeneria* and *Himantandra* (1) nor as extensive as in the Winteraceae, where it completely jackets the sporangia. In *Tetracentron* and *Trochodendron*, it is a continuous subepidermal layer, not only external to the sporangia, but also extending across the adaxial and abaxial sides of the connective, *Figs. 22* and *23*. It differentiates first in the region of the sporangia and subsequently in the connective. Its maturation in *Trochodendron* is completed before dehiscence of the pollen, whereas its differentiation in the connective of *Tetracentron* may be markedly retarded. Dehiscence is longitudinal-lateral, giving to the anther a bivalvular appearance.

POLLEN. Van Tieghem (11) described the pollen of *Trochodendron* as simple, spherical grains with three pores, the pollen of *Tetracentron* as simple, somewhat flattened pentagonal grains with smooth surfaces and having five pores. He provided no illustrations, and his descriptions are inadequate and quite inaccurate in the case of *Tetracentron*.

As indicated in *Figs. 24* and *25*, the pollen of both genera are tricolpate with papillate, crest-like thickenings on the floor of each furrow. The grains have a conspicuous reticulately thickened outer surface, the appearance of which changes at different focal levels. If the outermost surface of the reticulation is brought into focus, the ridges are rather broad and the pits are small. At a lower focal level, the ridges appear quite narrow and the pits considerably wider. This difference in surface views is due to the conformation of the ridges and can be most convincingly demonstrated in thin sections of pollen grains cut at right angles to their surface. Such a section, one micron in thickness, is illustrated in *Fig. 26*. The basal part of the ridges is very narrow, whereas the external part is much thicker, appearing almost bulbous in sectional view. The ridges project outward from a thick relatively homogeneous layer of the exine, within which is a thin, very hyaline layer, presumably the intine. It is the latter layer that forms the floor of the furrows and supports the crest-like thickenings of papillate exine.

Although the pollen grains of *Tetracentron* and *Trochodendron* are entirely unlike those of the Magnoliaceae and other ranalian families having monocolpate and derived types of pollen, they are of a general morphological type that occurs at times in other dicotyledonous families, e.g. in *Disanthus* (*Fig. 27*) of the Hamamelidaceae.

GYNOECIUM. The carpels of *Tetracentron* and *Trochodendron* are laterally concrescent, with free styles, *Figs. 4* and *7*. As in *Degeneria*, the section *Tasmannia* of *Drimys*, and *Himantandra*, the megasporophylls are adaxially folded or conduplicate with their ventral (upper) surfaces closely approximated, *Figs. 9* and *12*, thus leaving a cleft-like opening into the locule. The margins of the carpels are free except at the base of the syncarpous gynoecium, *level A*, *Fig. 7*. The conduplicate form of the carpel is not confined to the region of the locule but occurs throughout the style, *Figs. 10* and *13*.

The carpels have a conspicuous dorsal bulge which is greatly accentuated in *Tetracentron*, *d. blg.*, *Figs. 4*, *12* and *13*, and is nectariferous according to van Tieghem (11) in *Trochodendron*, *Fig. 7*. Insects evidently are attracted to this succulent parenchymatous region, for the dorsal bulge has frequently been chewed away in herbarium specimens of *Trochodendron*, *Fig. 6*.

In *Tetracentron*, where abaxial deformation of the carpels does not occur until after anthesis, the placentae are oriented parallel to the vertical axis of the flower and the ovules are set at right angles to this axis. In *Trochodendron*, where more or less abaxial deformation occurs prior to anthesis, the numerous ovules are set at right angles to the placentae, which are oriented in various diagonal positions in relation to the vertical axis of the flower, *Fig. 7*. The placentae are situated in the upper part of the locule, and particularly in the case of *Trochodendron* far back from the free margins of the conduplicate megasporophyll, *Fig. 9*.

OVULES. The ovules of *Trochodendron* are considered by van Tieghem (11) to have a unique development and morphological form, unlike that of any other known representative of the angiosperms. Each ovule has a pronounced sub-chalazal extension, *Fig. 15*, in which the vascular strand (or the procambium) makes a "hair-pin" turn. The nucellus and integuments develop laterally instead of terminally on the ovulary lobe, *Fig. 14*. The sub-chalazal projection, therefore, is actually an extension of the apex of the ovulary lobe and not to be confused with the unvascularized sub-chalazal emergences of *Bilbergia* and other genera.

Our observations, based upon somewhat inadequate herbarium material, tend to support van Tieghem's generalizations regarding the ovules of *Trochodendron*, and indicate that homologous, but less accentuated, characters occur in the ovules of *Tetracentron*. The sub-chalazal extension is present in ovules at an early stage of development where no procambium is discernible, *Fig. 14*, and also in younger ovules with incipient integuments and no evidences of a megaspore.

The matured ovules have two integuments. The outer one consists of three layers of cells in both *Tetracentron* and *Trochodendron,* and is more massively developed at the micropylar end of the ovules. The inner integument is composed of two layers of cells.

VASCULARIZATION OF THE FLOWER. The elongated pedicel of *Trochodendron* contains a eustele composed of a varying number of vascular bundles. These bundles tend to increase in number toward the base of the flower. They branch and anastomose, forming new interfascicular regions as in the pedicel of *Drimys* (Nast, 8). Certain of them become cortical bundles[2], *cor. b., Fig. 7,* at the base of the receptacle. They are variable in number, commonly about as numerous as the stamen-bearing ridges on the dorsal surface of the carpels. Each of the cortical bundles tends to give rise to three or four traces, one for each of the stamens of a particular ridge. Occasionally the cortical bundles branch and form twice as many staminal traces. Rarely does the individual trace of a stamen arise directly from the eustele.

The dorsal traces of the carpels diverge from the eustele at a level slightly below that of the base of the locules, *d.t., Fig. 7.* They usually are discrete strands, although occasionally one may arise from a stelar bundle common to it and either a ventral or cortical bundle. The dorsal trace forms, *level B, Fig. 7,* two lateral branches, *l.d.t., Figs. 7* and *8.* Toward the upper part of the carpel, the median and lateral dorsal strands divide and anastomose, forming a network of strands (*Fig. 7* shows the network of half of one carpel). A number of tiny branches of the dorsal strands extend a short distance into the parenchymatous dorsal bulge of the carpels and end blindly, *a, Figs. 7* and *9.*

The bundles which ultimately form the ventral traces of the carpels usually arise from stelar bundles that are common to them and to the cortical bundles which form the traces of the stamens, *Fig. 7, right.* At the level of the bases of the carpels, there is one of these bundles in each of the septa formed by the lateral concrescence of carpels, *v.b., Fig. 7.* At a higher level, *level B, Figs. 7* and *8,* these bundles divide, their halves becoming ventral traces of the adjacent carpels, *v.t., Fig. 7.* Most of the ovules are vascularized by branches of the two ventral traces. However, a dorsal strand anastomoses with each ventral bundle and the uppermost ovules are, therefore, vascularized by these fused strands, as in many of the Winteraceae (Bailey and Nast, 3).

The bundles of the eustele at the base of the sessile flowers of *Tetracentron* become abruptly and almost simultaneously dissociated into traces. The four large and very short outermost bundles, which are basically cortical, *cor. b., Fig. 11,* produce four calycine traces, one to each sepal, and four staminal traces, one to each stamen. Occasionally a sepal may have an extra trace, *Fig. 12.* The vascularization of the carpels is fundamentally similar to that of the carpels of *Trochodendron.* Ordinarily there is a large dorsal trace, *d.t., Fig. 11,* in the base of each carpel. This trace forms three strands, *Fig. 11, carpel at right,* which divide, *Fig. 11,* anastomose, *Fig. 12,*

[2] For definition of term refer to Nast (8).

and may redivide, *Fig. 13.* There are, in addition, four bundles which form ventral traces. At the base of the carpels, one of these bundles occurs in each of the septa of the laterally concrescent carpels. As in *Trochodendron,* these bundles divide to form ventral traces of adjacent carpels, *Figs. 11* and *12.* Both the ventral and the dorsal strands extend upward to the apex of the style. There is no fusion of ventral and dorsal strands in the vascularization of ovules, as in *Trochodendron,* possibly owing to the reduction in size of the carpels and in the number of ovules.

FRUIT AND SEED

The fruit of *Trochodendron* is a follicetum with ventral, loculicidal dehiscence. It is somewhat flattened at the apex, *Fig. 6,* with the styles of the follicles bent outwardly, forming spur-like appendages. In the development of the fruit the conduplicate ventral side of the sporophyll enlarges disproportionately to the dorsal side, thus displacing the styles and causing the fruit to become flattened at the distal end. The placentae, which are in a diagonal position in the flower, *Fig. 7,* assume in the fruit an apical or horizontal orientation with the seeds pendent in the locules. The fertile and interspersed sterile seeds are in two rows, one row on each placenta. The raphes or dorsal sides of the seeds are arranged back to back. This orientation of the seeds is the same as that of the ovules, which are heterotropous according to Agardh's terminology (Gray, 6, p. 282).

The fruits of *Tetracentron,* although superficially very different, are essentially similar in structure. The fruit of *Tetracentron* also dehisces loculicidally. However, the abaxial deformation of the megasporophyll, due to the extreme development of the conduplicate ventral side, is much more exaggerated in *Tetracentron* than in *Trochodendron.* The dorsal side or bulge, *d. blg., Figs. 4* and *5,* retains approximately its original size. The ventral side, however, increases to such an extent that the styles, which are upright in the flower, assume a basal position, *Figs. 4* and *5.* There is also greater growth on the ventral or grooved sides of the styles than on the dorsal sides, so that the styles also curve abaxially, thus producing four hooked spurs in the fruit. With the over-extention of the ventral sides of the sporophylls, the placentae are brought from a vertical position at anthesis to a horizontal and apical position in the fruit. The seeds are thus pendent, with their dorsal sides or raphes back to back, as in *Trochodendron.*

The seeds of the two genera are strikingly similar in their anatomy. In both *Trochodendron* and *Tetracentron,* the raphe forms an embossed ridge throughout the length of the seed. Within this ridge is the raphe-bundle, which is surrounded by thick-walled cells, *Figs. 18* and *19.* The subchalazal ends of the seeds are extended into a projection which is vascularized, *Figs. 16* and *17.* The funiculus is fairly short, with the micropylar end of the outer integument greatly enlarged and encroached upon it. The average size of the seed of *Tetracentron* is slightly smaller than that of *Trochodendron.*

Van Tieghem (11) and Netolitzsky[3] (9) report two seed coats in *Trochodendron.* According to van Tieghem, the internal coat arises from the inner integument of the ovule and is composed of two layers of thin-walled, colorless cells. The outer seed coat is brown and has three layers, of which the medium is sclerous and arises from the outer integument of the ovule. In the case of *Tetracentron,* he merely mentions that the seed has a thick external integument, lacunous and soft.

Our observations on the seed coats do not agree with van Tieghem's descriptions. The three-layered outer integument of the ovule matures into an outer seed coat of thin-walled cells in both *Trochodendron* and *Tetracentron, Figs. 18, 19,* and *21a.* In *Trochodendron,* the cells of the innermost layer of the external seed coat have thickened (cutinized?) anticlinal walls and a thickened external (i.e. adjacent to the inner seed coat) periclinal wall. It has, therefore, typical epidermal characteristics. The cells of the other two layers become flattened radially, *Fig. 19,* but are greatly extended longitudinally, giving a striated appearance to the body of the matured seed when cleared in NaOH. In *Tetracentron,* this inner layer is only slightly thickened, but the outer seed coat forms ridges by increase in size and number of its cells. These cells grow and expand into any available space between the seeds, which are tightly packed in the fruit. The resulting ridges give a winged appearance to the seeds of *Tetracentron, Figs. 16* and *18, opposite raphe.*

The external layer of the inner seed coat of both genera is sclerenchymatous. The cells are small in cross sectional diameter, *Figs. 18, 19,* and *21a,* but greatly elongated, *Fig. 20.* This layer or sclerotesta also appears striated, due to its elongated cells, and is readily visible in cleared seeds, *Figs. 16* and *17.* Internal to the sclerotesta are thin-walled cells which are derived from the inner layer of the internal integument and the nucellus of the ovule.

The endosperm, which constitutes the greatest volume of the seed, is composed of thin-walled, isodiametric cells. The tiny embryo, embedded in the endosperm at the micropylar end of the seed, is either undifferentiated or has incipient cotyledonary development, *Fig. 20.*

In the sterile seeds, the endosperm is usually absent (a small amount is present in occasional sterile seeds of *Tetracentron*). Often the sclerenchymatous layer is all that remains of the inner seed coat. The inner layers of the outer seed coat, especially of *Trochodendron,* become densely sclerenchymatous. The numerous sterile seeds of *Trochodendron* are darkly and conspicuously castaneous.

RELATIONSHIPS

Although *Tetracentron* and *Trochodendron* differ conspicuously in their habit of growth, in the form and vascularization of their leaves, and in the grosser characters of their inflorescences and flowers, they exhibit many peculiarities of internal structure, organization, and development that are

[3] Netolitzsky's description is apparently taken from van Tieghem.

fundamentally similar and that serve to differentiate these plants from other woody ranalian genera.

As emphasized in the first paper (4) of this series, the woods of *Tetracentron* and *Trochodendron* are remarkably similar and differ from those of other known angiosperms, including the vesselless Winteraceae. Particularly significant in this connection are transitions from typical transverse to diagonal and longitudinal planes of cell division in the maturation of wood parenchyma strands. This aberrant trend of cytological specialization is much exaggerated in *Tetracentron*.

The secondary phloems of the two genera are of the same morphological type. They do not have the precocious flaring of the multiseriate rays and the early stratification into narrow, alternating arcs of soft bast and fibers that occur so characteristically in the Magnoliaceae (sensu stricto), Degeneriaceae, and Annonaceae. Nor is there a sclerification of the multiseriate rays close to the cambium, as in *Euptelea* and many Winteraceae.

Although typical leaves of adult *Trochodendron* are exstipulate with multilacunar nodal attachments and commonly without buds in their axils, the earlier leaves formed by seedlings resemble the leaves of *Tetracentron* in having trilacunar nodal attachments and sheathing leaf bases that enclose axillary buds. Furthermore, the stomata of the two genera are of a peculiar and similar structural type.

There are similar tendencies toward reduction of internodal elongation both in the vegetative axes and the inflorescences, leading in *Trochodendron* to the periodic formation of pseudoverticils of leaves and to the clustering of axillary flowers on the upper part of the rachis, and in *Tetracentron* to the production of short shoots and of false whorls of sessile flowers on the rachis.

The complex patterns of vascularization of the flowers are essentially similar in both genera. The form of the open, conduplicate, laterally concrescent carpels is fundamentally the same. There is a similar abaxial deformation of the follicles which is merely more extensive in *Tetracentron* than in *Trochodendron*. The placentation, stamens, pollen, ovules, and seeds exhibit minor differences only. The vascularized, sub-chalazal projections of the ovules and seeds appear to be as unique among angiosperms as is the structure of the vesselless xylem.

The totality of the developmental, anatomical, and other morphological similarities between *Trochodendron* and *Tetracentron* is so large as to leave no doubt regarding the close affinities of the two genera. Whether the plants should be placed in a single family or in two separate but closely related monotypic families depends upon the taxonomic emphasis that is placed upon obvious differences in their foliage, inflorescences, and flowers.

As will be shown in subsequent papers by Dr. Smith and ourselves, the genus *Euptelea* exhibits no significant similarities to *Tetracentron* and *Trochodendron* in any of its vegetative or reproductive parts and, therefore, cannot be associated with *Trochodendron* in the Trochodendraceae.

It should be emphasized in conclusion that there are no cogent evidences of close relationship between either *Tetracentron* or *Trochodendron* and the Magnoliaceae (sensu stricto), Degeneriaceae, Himantandraceae, Winteraceae, Schisandraceae, Cercidiphyllaceae, or Eucommiaceae.

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EXPLANATION OF PLATES

PLATE I

Ax. b., axillary bud; *br.*, bract; *br. sc.*, bract scar; *d. blg.*, dorsal bulge; *f. w.*, floral whorl; *infl. ax.*, inflorescence axis; *infl. sc.*, inflorescence scar; *lf.*, leaf; *lf. sc.*, leaf scar; *n. br.*, naked bract; *o. lf.*, old leaf; *pd.*, peduncle; *st. pd.*, stamen pad; *st. sc.*, stamen scar; *sty.*, style; *t. m.*, terminal meristem; *t. fl.*, tertiary flower; *v. su.*, ventral suture.

FIG. 1. *Trochodendron*. Diagrammatic drawing of an inflorescence. FIG. 2. *Tetracentron*. Diagrammatic drawing of an opening floral bud on a short shoot; internodes elongated. FIG. 3. *Tetracentron*. Diagram of floral bud. FIG. 4. *Tetracentron*. Flower, approx. × 26. FIG. 5. *Tetracentron*. Fruit, approx. × 29. FIG. 6. *Trochodendron*. Fruit, approx. × 7.

PLATE II

A., vascular strands in dorsal bulge; *br.*, bract; *cor. b.*, cortical bundle; *d.b.*, dorsal bundle; *d.t.*, dorsal trace; *fil.*, filament of stamen; *l.d.b.*, lateral-dorsal bundle; *ov. t.*, ovulary trace; *st. cu.*, staminal cushion; *st. sc.*, staminal scar; *st. t.*, staminal trace; *v.b.*, ventral bundle; *v. t.*, ventral trace.

FIG. 7. *Trochodendron*. Flower; two carpels removed at *level A* and two removed at *level B* to show cross sectional view; perpendicular shading lines indicate cut surfaces; epidermal surface represented by stippling; only half of dorsal vascular system shown in one carpel; approx. × 18.

PLATE III

A., vascular strands in dorsal bulge; *cor. b.*, cortical bundle; *d.b.*, dorsal bundle; *d. blg.*, dorsal bulge; *d.l.b.*, dorsal-lateral bundle; *d.l.t.*, dorsal-lateral trace; *d.t.*, dorsal trace; *l. se. b.*, lateral sepal trace; *ov. t.*, ovulary trace; *se.*, sepal; *se. t.*, sepal trace; *st.*, stamen; *st. t.*, stamen trace; *v. t.*, ventral trace.

FIG. 8. *Trochodendron*. Transverse section of flower from region comparable to *level B* in Fig. 7, × 12. FIG. 9. The same. Transverse section through placentae, × 12. FIG. 10. The same. Transverse section through styles, × 12. FIGS. 11–13. *Tetracentron*. Transverse sections through flower comparable to sections in Figs. 8–10, approx. × 31.

PLATE IV

Em., embryo; *end.*, endosperm; *fu.*, funiculus; *i. int.*, inner integument; *mi.*, micropyle; *o. int.*, outer integument; *ov. b.*, ovulary bundle; *ra.*, raphe; *sc. l.*, sclerenchymatous layer.

FIG. 14. *Tetracentron*. Young ovule, approx. × 114. FIG. 15. *Trochodendron*. Young ovule, approx. × 76. FIG. 16. *Tetracentron*. Fertile seed cleared in NaOH, approx. × 24. FIG. 17. *Trochodendron*. Fertile seed cleared in NaOH, approx. × 24. FIG. 18. *Tetracentron*. Transverse section through middle of fertile seed, approx. × 8½. FIG. 19. *Trochodendron*. Transverse section through middle of fertile seed, approx. × 8½. FIG. 20. *Tetracentron*. Longitudinal section of micropylar end of fertile seed, approx. × 8½. FIG. 21. *Trochodendron*. Transverse section through middle of sterile seed, approx. × 8½. FIG. 21a. *Trochodendron*. Transverse section through outer seed coat and sclerenchymatous layer of fertile seed, approx. × 764.

PLATE V

FIG. 22. *Trochodendron*. Transverse section through anther, × 126. FIG. 23. *Tetracentron*. Transverse section through anther, × 103. FIG. 24. *Trochodendron*. Pollen grain, *pap.*, papillae; *rid.*, ridges of reticulation, × 1390. FIG. 25. *Tetracentron*. Pollen grain, × 1390. FIG. 26. *Trochodendron*. Section of pollen grain showing structure of wall, approx. × 1675. FIG. 27. *Disanthus cercidifolius* Maxim. Pollen grain, × 1390.

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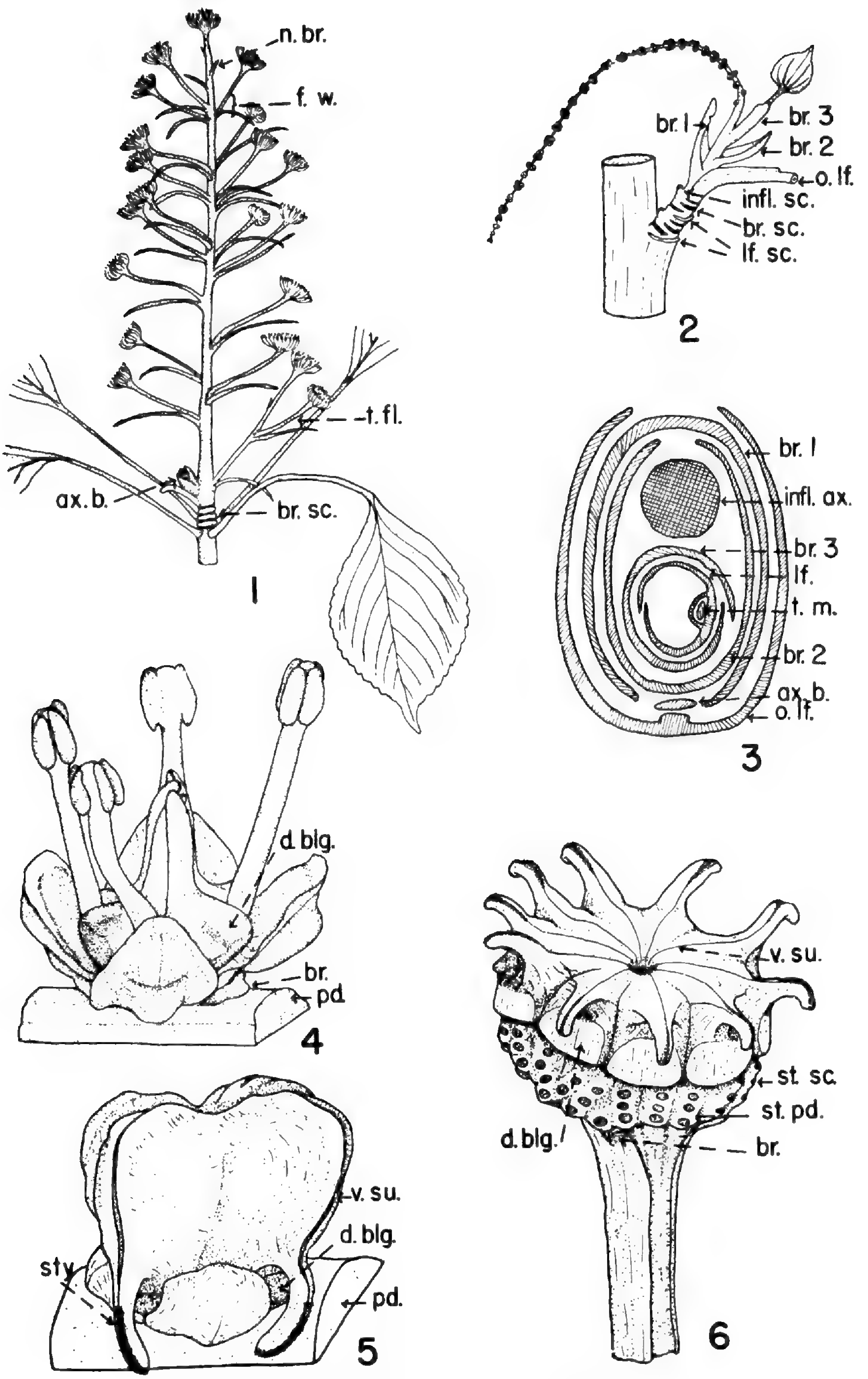
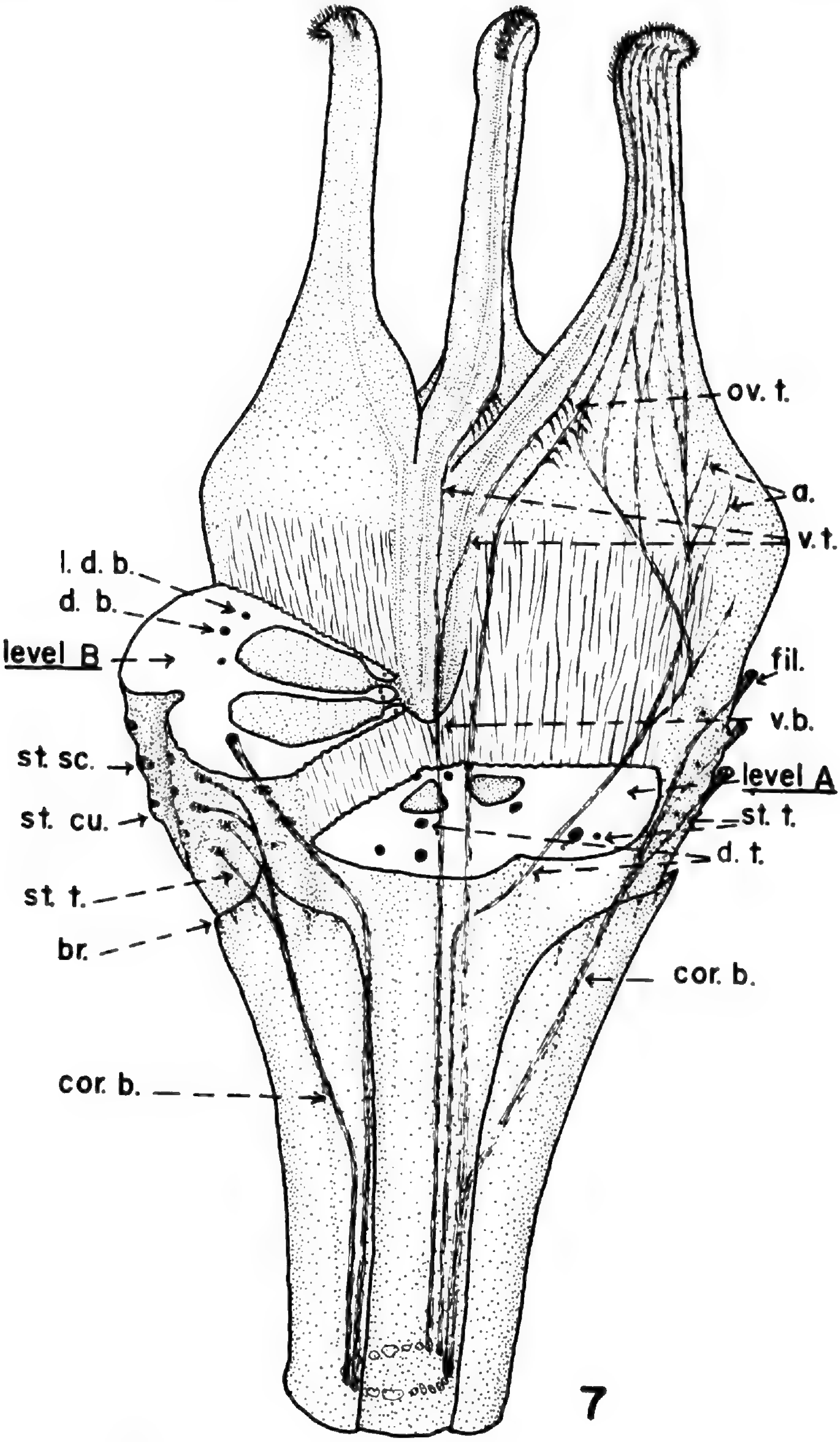


Morphology of Trochodendron and Tetracentron



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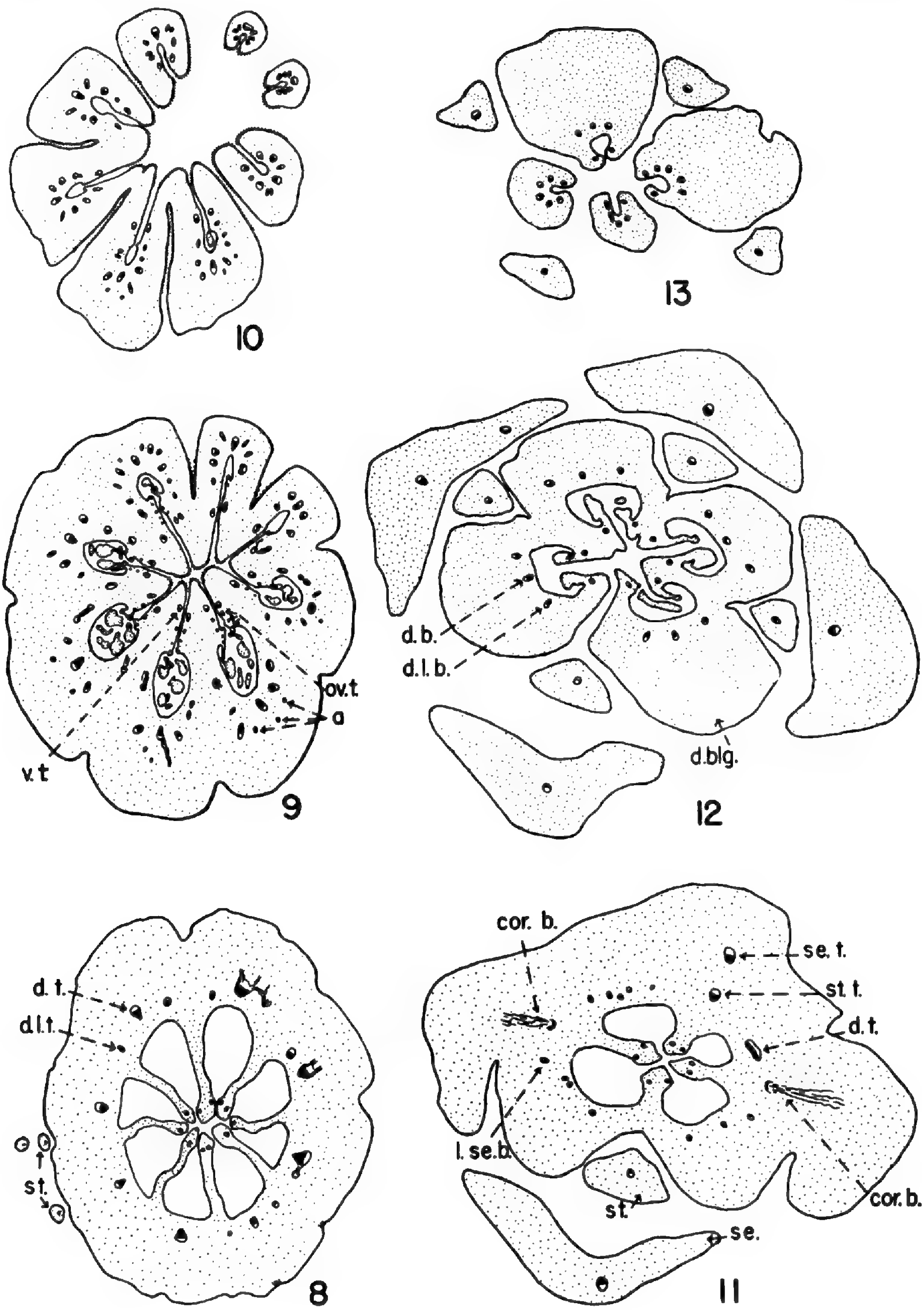

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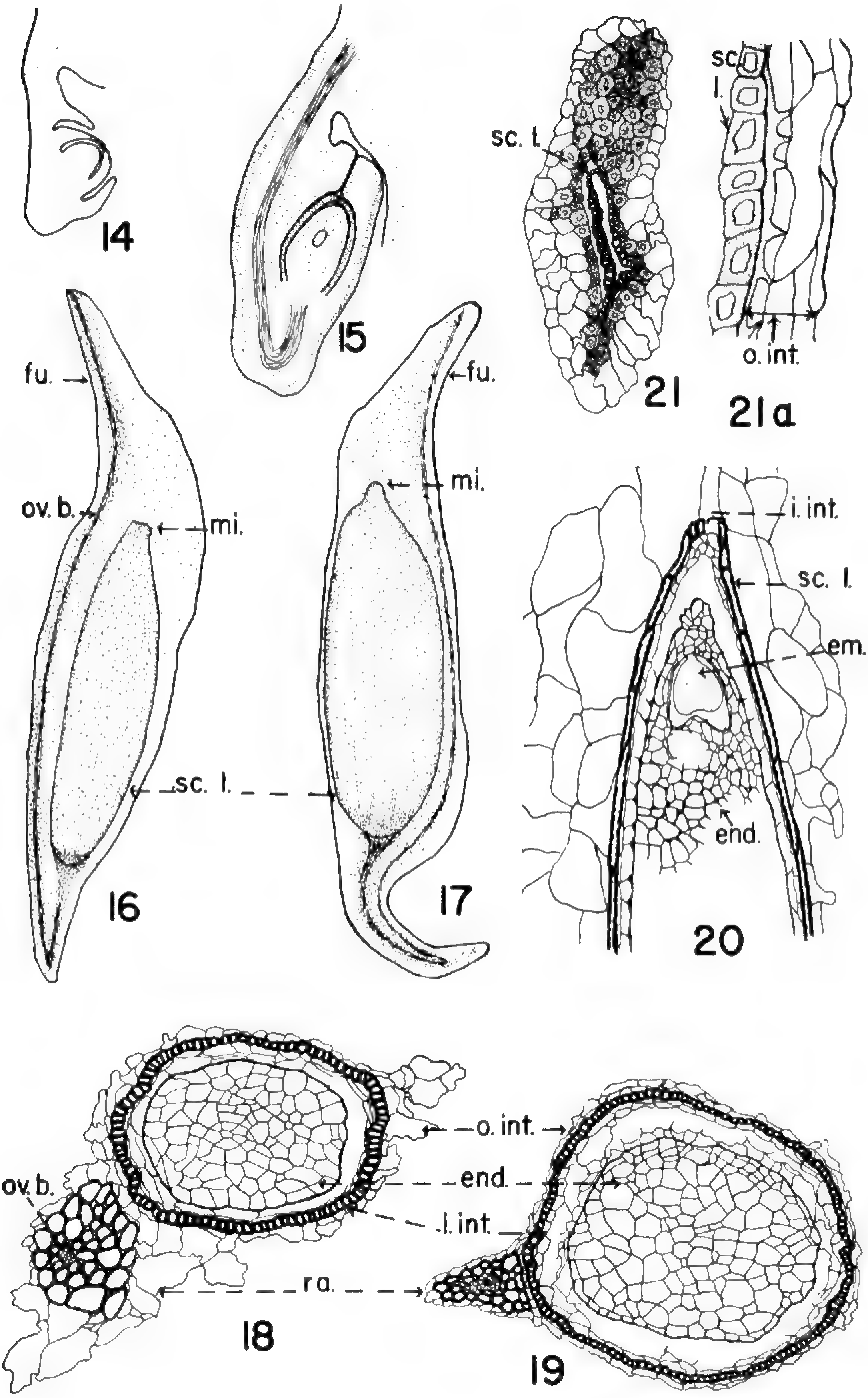

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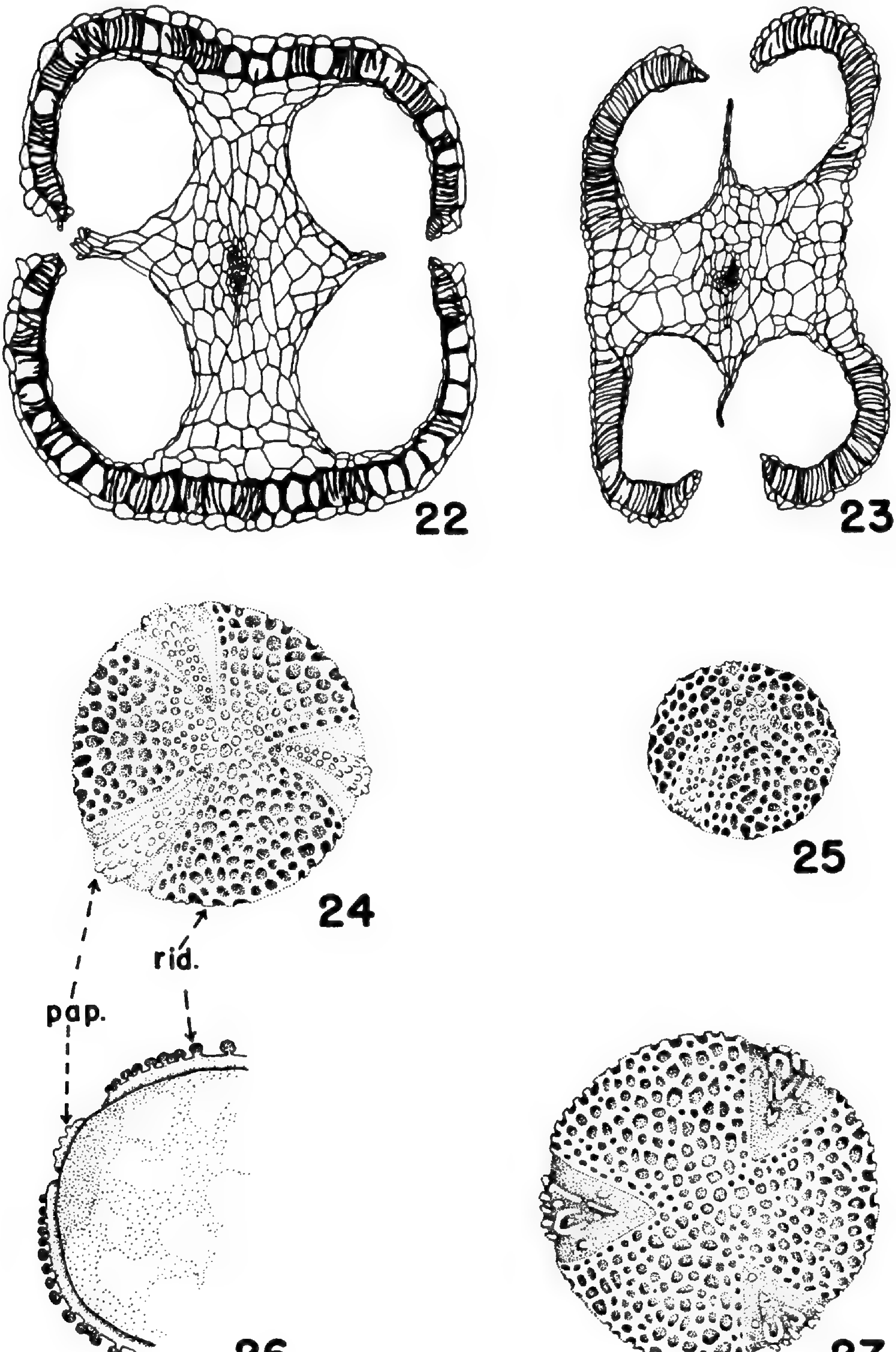

Morphology of Trochodendron and Tetracentron

MORACEAE, HIPPOCASTANACEAE ET VITACEAE, NOMINA CONSERVANDA

Alfred Rehder

Comparatively little attention has been paid to names of families and their validity under the International Rules of Botanical Nomenclature. The only proposal for the conservation of names of families is the list of 186 names proposed by J. Lanjouw and T. A. Sprague on pp. 64–65 of the Synopsis of Proposals concerning Nomenclature prepared by T. A. Sprague and submitted to the Sixth International Botanical Congress at Amsterdam in 1935. This list was voted upon at the Congress and adopted without change (see Proc. Sixth Intern. Bot. Congr. 1: 358. 1936). The list, however, contains only names employed by Bentham and Hooker f., Genera Plantarum, and also some by Engler & Gilg, Syllabus der Pflanzenfamilien (ed. 9 & 10), formed according to Art. 23 of the Rules and the few exceptions conserved under Art. 23, Exceptions (1) and (3). The conservation of additional names was left by the last Botanical Congress to the Special Committee for Phanerogamae and Pteridophyta (see op. cit. 358, 381).

The three names proposed here for conservation are not included in the list referred to above, as they were not used by Bentham and Hooker, but they have been generally accepted by most recent authors, including Engler & Gilg, and they would be the correct names for the three families if each of them were not antedated by an older validly published and correctly formed name. Like these three, a number of other family names proposed by Horaninov have been entirely overlooked and have been credited to later authors, as Myricaceae, Juglandaceae, Calycanthaceae, Loganiaceae, Scrophulariaceae, and others.

Moraceae Lindley, Veg. Kingd. 266 (1846), sensu stricto. — Bureau in De Candolle, Prodr. 17: 211 (1873), sensu stricto. — Engler in Nat. Pflanzenfam. III. 1: 66 (1889). — Nakai, Fl. Sylv. Kor. 19: 90 (1933), with many synonyms. — Nomen conservandum

versus

Artocarpaceae Horaninov, Prim. Lin. Syst. Nat. 62 (1834). — Lindley, Veg. Kingd. 269 (1846), sensu stricto. — Bureau in De Candolle, Prodr. 17: 280 (1873), sensu stricto.

Urticeae ord. II. *Artocarpeae* De Candolle in Lamarck & De Candolle, Fl. Franç. ed. 3, 3: 318 (1805).

Urticeae Agardh, Aphor. Bot. 203 (1825), p. p.

Moreae Endlicher, Prodr. Fl. Norfolk. 40 (1833), nom.; Gen. Pl. 277 (1836).

Urticaceae 1. *Artocarpeae* Reichenbach, Handb. Nat. Pflanzensyst. 172 (1837), nom. subnud.

Urticaceae subord. *Moreae* Gray, Bot. Text-book, 356 (1842).

Urticaceae subfam. *Ficeae* Presl, Wšeob. Rostl. 2: 1365 (1846).

Moraceae subfam. *Moroideae* et *Artocarpoideae* A. Braun in Ascherson, Fl. Prov. Brandenb. 1: 57 (1864).

As the name Moraceae has been used by all authors who considered the family distinct from Urticaceae, it seems advisable to conserve it for that important family, which includes a number of genera of great economic importance. The name Artocarpaceae Horan. (emend.) would then be valid only as the name of a separate family distinct from Moraceae, as used by Lindley in 1846 and by Bureau in 1873; in his original concept Horaninov used the name in a wider sense, including *Morus* and related genera.

Hippocastanaceae Torrey & Gray, Fl. N. Am. 1: 250 (1838). — Pax in Nat. Pflanzenfam. III. 5: 273 (1895). — Nomen conservandum

versus

Paviaceae Horaninov, Prim. Lin. Syst. Nat. 100 (1834).

Sapindaceae Jussieu in Ann. Mus. Hist. Nat. Paris, 18: 476 (1811), p. p.

Hippocastaneae De Candolle [Théor. Élém. Bot., ed. 2, 44 (1819) "Hippocastanées"]; Prodr. 1: 597 (1824).

Castaneaceae Link, Enum. Pl. Hort. Berol. 1: 354 (1821), nom. subnud.; a name apparently based on *Castanea,* though not in the sense of Miller; it is not cited by Link as one of the constituent genera.

Sapindaceae 3. *Sapindeae* a. *Hippocastaneae* Reichenbach, Handb. Nat. Pflanzensyst. 285 (1837).

Aesculeae Presl (1820) ex Presl, Wšeob. Rostl. 1: 217 (1846).

Sapindaceae trib. *Paviariae* Horaninov, Char. Ess. Fam. Reg. Veg. 182 (1847).

Sapindaceae subord. *Sapindeae* Bentham & Hooker f., Gen. Pl. 1: 389 (1862), p. p.

Sapindaceae subfam. *Hippocastanoideae* A. Braun in Ascherson, Fl. Prov. Brandenb. 1: 53 (1864).

Sapindaceae 2. *Hippocastanae* Drude in A. Schenk, Handb. Bot. 3,2: 390 (1887).

As the name Hippocastanaceae has been used since 1838 by all authors who considered the family distinct from Sapindaceae, and as the name Paviaceae, though validly published by Horaninov in 1834, has never been taken up, as far as I know, by any author, it seems advisable to conserve the name Hippocastanaceae for this well known, though small family, of ornamental trees and shrubs widely planted throughout the temperate zone.

Vitaceae Lindley, Nat. Syst. Bot., ed. 2, 30 (1836). — Gilg in Nat. Pflanzenfam. III. 5: 427 (1896). — Nomen conservandum

versus

Leeaceae Horaninov, Prim. Lin. Syst. Nat. 95 (1834).

Vites Jussieu, Gen. Pl. 267 (1798). — Lindley, Introd. Nat. Syst. Bot. 119 (1830).

Sarmentaceae Ventenat, Tabl. Règ. Vég. 3: 167 (1799).

Viniferae Jussieu in Mém. Mus. Hist. Nat. Paris, 3: 444 (1817).

Ampelideae Humboldt, Bonpland & Kunth, Nov. Gen. 5: 223 (fol. ed. p. 172) (1821). — De Candolle, Prodr. 1: 627 (1824). — Bentham & Hooker f., Gen. Pl. 1: 386 (1862).

Celastraceae . . . *Cisseae* Horaninov, Tetractys Nat. 32 (1843), nom.

Cissaceae Horaninov, Char. Ess. Fam. Reg. Veg. 184 (1847).

Ampelidaceae Lowe, Man. Fl. Madeira, 80 (1868).

As Vitaceae is the only name formed according to the Rules which has been generally accepted, while Leeaceae has not been taken up by any author and moreover is based on a genus not typical of the family, it seems advisable to conserve the name Vitaceae. Horaninov himself abandoned the name in his two later works, making the group in 1843 under the name Cisseae a subdivision of Celastraceae, and in 1847 raising it as Cissaceae again to the rank of a family.

If one were to follow the proposal made by Sprague in 1922 (in Jour. Bot. 60: 69–73), the two last family names discussed would be valid without conservation as Hippocastanaceae (DC.) Torr. & Gray and as Vitaceae (Juss.) Lindl. Sprague brings forward the argument that the priority of a name of a family dates from the first valid publication of a name with any plural ending based on a generic name, even if it consists of the plural form of that generic name. In such cases the change to the ending -aceae is supposed to be an orthographic correction and the original author is to be cited in parentheses. Sprague's proposal, however, conflicts with long-established usage and the very spirit of the Rules. The use of parenthetical authors is specifically restricted by Art. 49 to changes of rank of genera and groups below genera, and of transfers of groups below the genus with or without change of rank, but with no alteration in the name or epithet itself. According to that article, a citation like Hippocastanaceae (DC.) Torr. & Gray could mean only that Torrey & Gray transferred a family named by De Candolle as Hippocastanaceae from one higher group (ordo of Art. 12 and of Recomm. VIII and IX) to another. Hippocastaneae DC. and also Vites Juss. are not valid family names according to Art. 23; they have no standing, and if transferred could have no validity. Orthographic corrections or changes in the spelling of a name do not call for the citation in parentheses of the original author; they should be indicated by citing the original spelling in quotation marks after the citation of the correct name, or in a note beneath it.

In regard to transfers of names of groups above genera (see note on pp. 68 and 78), it would seem to be in the spirit of the Rules to make the citation of the parenthetical author obligatory for transfers of the correct names of subdivisions of families. This could be done by a proposal to insert in the second paragraph of Art. 49 the word "family" before genus, so that the paragraph would read: "The same holds when a subdivision of a family, a genus, a species, or a group of lower rank is transferred to another family, genus or species with or without alteration of rank."

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STUDIES IN THE LAURACEAE, VI*
PRELIMINARY SURVEY OF THE MEXICAN AND CENTRAL AMERICAN SPECIES

CAROLINE K. ALLEN

THE PRESENT paper was undertaken as groundwork for the presentation of the Lauraceae in the Flora of Panama, which is being published in fascicles by Dr. Robert E. Woodson, Jr., in the Annals of the Missouri Botanical Garden. Dr. A. J. G. H. Kostermans has published in detail on the smaller genera of Lauraceae of this hemisphere. Consequently the present treatment of these genera will not be as detailed as those on which he has not worked. Unfortunately, at the outbreak of World War II Dr. Kostermans had on loan in Utrecht a large number of specimens of Lauraceae from various American herbaria. From the material at hand it is apparent that a great deal of field work on the group is necessary. More complete and better collections from regions heretofore little collected are important in order to supplement data already available and to aid in the solution of distributional problems. In passing, mention should be made of the imperative need of corroborative morphological studies in the group.

In each of the four major genera of the Lauraceae represented in our region, namely *Nectandra, Ocotea, Persea,* and *Phoebe,* the majority of the species clearly belong to the genera under which they are treated. There are, however, a few species in each genus of which the characters appear to overlap. It is not my belief that these represent new genera, but that the lines between the genera are not as yet very clearly defined. An attempt has been made to evaluate the characters used in delimiting the genera and, where these characters overlap, to place the entity in question in that genus with which it seems to have the greatest number of characters in common. The majority of instances of overlapping occurs among the four genera mentioned. One species of *Ocotea,* however, has double-margined cupules that are typical of *Licaria,* but the flowers are definitely those of *Ocotea.* In the main, the species themselves are clear-cut. On the other hand, there is in each genus at least one entity which appears to be widespread and variable throughout Mexico and Central America. The variations are manifest in the size of the leaves, inflorescences, and flower-parts. Extremes of variation occur seemingly as a result of change in geographical or ecological influences. It should be kept in mind that to date our collections from Mexico and Central America are too scattered to admit of a sweeping reduction of species described from these different areas. In *Litsea glaucescens,* more completely collected than any of the other members of the family, one sees the trend toward a single variable species. The

* For No. V in this series see Jour. Arnold Arb. 23: 444–463. 1942.

situation in *Litsea* nevertheless is hardly typical for other genera in this region. *Litsea* is the only genus which occurs in the arid northern areas of Mexico, south through Central America, and which has no representatives in South America. The genus *Persea* extends north in the same region, in Mexico, but is found in South America. The central portion of Costa Rica seems to have given rise to the largest number of endemic species. Until such time as Mexico and Central America are well represented in herbaria, the presence of few widespread variable species as opposed to several very closely related but separate species is a matter of conjecture. There has been heretofore an almost wholesale linkage of Central American and Colombian entities. Very probably there is a definite and logical connection, but very possibly this connection has been over-worked and is not as common an occurrence as has been supposed. This may be illustrated by the South American species of *Persea caerulea* and *Nectandra Pichurim,* neither of which occurs in Central America, but both of which have been reported as common to both areas. Again, it is necessary to have available more material than is at hand at present before disposing of these distributional problems with any degree of accuracy. In the course of this study many specimens which are too fragmentary or incomplete for satisfactory description have been set aside until such time as more complete material will be available.

An effort has been made to locate on modern maps as many as possible of the localities cited, and the present spelling has usually been used. Numerous labels of Purpus' plants mention Zacuapán. This is on recent maps clearly Axouacapán. From the latter locality to Cordoba numerous small localities given by Purpus have been located. The collector Austin Smith mentions various zones on his labels. This zoning is not botanical, but ornithological, being determined by the presence or absence of certain key birds. Mention should be made of the term "apparent petiole", which is used to describe the basal part of a leaf-blade which is narrowly decurrent and recurved for so long a distance at its base that the lower portion of the blade seems to form with the midrib an extremely long petiole. The apex of certain fruits frequently dries smooth and is not wrinkled as is the remainder of the surface. This smooth unwrinkled portion sometimes dries in such a way as to split the outer layer of the exocarp, forming a star-shaped pattern. The measurements of the flower-parts were made with the aid of a micrometer device, and some variation in respect to measurement is to be anticipated.

I wish to thank the directors and curators of the following herbaria for their courtesy in lending material for study: Arnold Arboretum (A), Chicago Natural History Museum (Ch), Gray Herbarium (GH), University of Michigan (Mich), Missouri Botanical Garden (Mo), New York Botanical Garden (NY), University of Texas (Tex), United States National Herbarium (US), Yale School of Forestry (Y). The parenthetical letters indicate the place of deposit of the cited specimens. I am particularly indebted to Dr. P. C. Standley, of the Chicago Natural History Museum, for his helpful and careful selection of interesting material from Guatemala.

At this time I should especially like to acknowledge my gratitude to the late Dean S. J. Record, of the Yale School of Forestry, for his kind interest in this study.

KEY TO THE MEXICAN AND CENTRAL AMERICAN GENERA OF LAURACEAE

A. Foliose trees or shrubs, not parasitic.
  B. Anthers four-celled.
    C. Inflorescences variously paniculate, with no involucre.
      D. Staminodia large, cordate, stipitate.
        E. Perianth-lobes usually unequal or at most subequal; usually lower cells of the anther touching upper at their sides. . . . . 1. *Persea.*
        E. Perianth-lobes equal; usually lower cells of the anther touching upper at their bases. . . . . 2. *Phoebe.*
      D. Staminodia small, inconspicuous or occasionally lacking.
        E. Flowers perfect or dioecious; perianth-lobes not reflexed at anthesis, thin in texture; cells of the anthers arranged in two planes, one above the other. . . . . 3. *Ocotea.*
        E. Flowers always perfect; perianth-lobes usually fleshy, papillose and reflexed at anthesis; cells of the anthers arranged in an arc. . . . . 4. *Nectandra.*
    C. Inflorescences racemose or fasciculate, with involucre. . . . . 5. *Litsea.*
  B. Anthers two-celled.
    C. Flowers dioecious. . . . . 9. *Endlicheria.*
    C. Flowers hermaphrodite.
      D. Flowers with three fertile stamens; fruits subtended by cupules with double or triple margins. . . . . 11. *Licaria.*
      D. Flowers with nine fertile stamens; fruits subtended by naked pedicels or by cupules with single margins.
        E. Staminodia very well developed; perianth-lobes deciduous entirely; fruits subtended by naked pedicels.
          F. Perianth-tube short and shallow; style short, thick, conical, obtuse; stigma almost inconspicuous; perianth-lobes deciduous; fruits seated on scarcely enlarged pedicels. . . . . . 6. *Beilschmiedia.*
          F. Perianth-tube conspicuous, slender, urceolate, constricted below lobes; style longer than ovary, thick, conical; stigma small, truncate, discoid, conspicuous; fruits completely surrounded by enlarged thickened perianth-tube with only a minute pore at the apex, crowned by remnants of the perianth-lobes. . . . . 10. *Cryptocarya.*
        E. Staminodia inconspicuous or absent; perianth entirely or in part persistent; fruits subtended by cupules with single margins.
          F. Stigma well developed, peltate; leaf-blades yellow-green on drying; fruits subtended by fleshy cupule and pedicel. . . . . 7. *Aiouea.*
          F. Stigma minute, hardly conspicuous; leaf-blades not yellow-green on drying; fruits subtended by woody cupule and pedicel. . . . . 8. *Aniba.*
A. Parasitic herbs, with leaves reduced to scales. . . . . 12. *Cassytha.*

1. Persea Miller

Persea Miller, Gard. Dict. ed. 8. 1768; Gaertner f., Fruct. & Sem. 3: 222. 1805; H.B.K. Nov. Gen. & Sp. 2: 125 [157]. 1817; Meissner in DC. Prodr. 15[1]: 43. 1864; Bentham in Bentham & Hooker f. Gen. Pl. 3: 156. 1880; Hemsley, Biol. Centr. Am. Bot. 3: 71. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 134. 1889; Kostermans in Meded. Bot. Mus. Utrecht 25: 12. 1936.

DISTRIBUTION: A tropical American genus, with the exception of a single species from the Canary Islands. A few species are native to the United States, from Virginia and the Carolinas south to Florida and Texas, but these species do not occur in Mexico. The West Indian species seem to have nothing in common with other tropical species of the genus. One link which binds all tropical localities is the avocado pear, *Persea americana*, which, as the species proper or in one of its many forms, is to be found cultivated generally throughout the Americas.

Persea is comprised of trees or shrubs with evergreen penninerved leaves which vary in texture from chartaceous to heavily coriaceous and are usually pubescent to some degree. The axillary commonly paniculate inflorescences bear perfect flowers up to 9 mm. long, the customary length for the genus being 4–5 mm. The 3 outer perianth-lobes are generally shorter than the inner and almost always persist in fruit. There are four staminal whorls, the first three of which are usually fertile. The four-celled anthers are borne on slender hairy filaments two or three times as long as the anthers. The cells of the anthers of the first series are introrse, whereas those of the third are extrorse, or the two upper cells may be lateral and the lower extrorse, the filaments being distinctly biglandular near the base. The four cells of the anthers are in two planes, the bases of the two upper cells laterally tangential to the apices of the two lower cells. The staminodia of the fourth cycle are conspicuous, cordate-sagittate, and stipitate, often pubescent throughout, the stipes generally densely so. The ovary is subglobose, pubescent or glabrous, topped by a slender usually pubescent style that is equal to or more than the length of the ovary. The fruit is small and globose or, in the case of the avocado-type, large, fleshy, and obovoid, borne for the most part on the spreading perianth-lobes and pedicels, generally not enlarged as compared with those of the other genera of the Lauraceae. Only occasionally are the perianth-lobes deciduous.

KEY TO THE SPECIES OF PERSEA

A. Leaf-blades not more than 12 cm. long.
  B. Lower leaf-surface completely glabrous.
    C. Lower leaf-surface glaucescent; lateral nerves diverging from the costa at an angle of 35–55° .... 1. *P. longipes*.
    C. Lower leaf-surface not glaucescent; lateral nerves diverging from the costa at an angle of 90° or slightly less .... 2. *P. Steyermarkii*.
  B. Lower leaf-surface not glabrous.
    C. Leaf-blades ochraceous-sericeous beneath, not more than 7.5 cm. long; lateral nerves diverging from the costa at an angle of about 90° .... 3. *P. Brenesii*.
    C. Leaf-blades ferruginous-tomentose beneath, up to 9 cm. long; lateral nerves diverging from the costa at an angle of 20–45° .... 4. *P. pachypoda*.
A. Leaf-blades not less than 12.5 cm. long.
  B. Leaf-blades never sessile and subcordate.
    C. Ovary pubescent.
      D. Leaves anise-scented, with long petioles one-half the length of the thin elliptic blades; perianth persistent or subpersistent .... 5a. *P. americana* var. *drymifolia*.
      D. Leaves not anise-scented, with petioles not more than one-quarter the length of the chartaceous or coriaceous blades, varying from elliptic to ovate.

E. Inflorescence, young branchlets, and lower leaf-surface not densely golden-brown-sericeous.
F. Branchlets yellow-tomentellous, becoming glabrous or subglabrous; lower leaf-surface subglaucous; lateral nerves 4–14 pairs; blades variable, usually elliptic, up to 10.5 cm. broad, acuminate; fruits variable in shape........................5. *P. americana.*
F. Branchlets and lower leaf-surface densely brown-tomentose; lateral nerves 8–15 pairs; leaf-blades irregularly elliptic or obovate-elliptic, up to 10–15 cm. broad, obtuse or abruptly acuminate; fruits obovoid (slender and bottle-necked).....6. *P. Schiedeana.*
F. Branchlets fulvo-pubescent, becoming glabrous; leaves glaucescent beneath and floccose-tomentose; lateral nerves 7 or 8 pairs; blades ovate, acuminate, up to 7.5 (–8) cm. broad; fruits depressed-globose(?)...........................7. *P. floccosa.*
E. Inflorescence, young branchlets, and lower leaf-surface densely golden-brown-sericeous...........................8. *P. flavifolia.*
C. Ovary glabrous.
D. Inflorescence loosely paniculate or loosely subcorymbose.
E. Leaf-blades sometimes obovate or elliptic or broadly round-elliptic.
F. Inflorescence not less than 8 (usually 10–12) cm. long; largest leaf-blades usually at least 10, occasionally 15 cm. broad....... ....9. *P. Donnell-Smithii.*
F. Inflorescence not more than 7 cm. long; largest leaf-blades not more than 8 cm. broad.
G. Leaf-blades 9–13 × 3.2–7 cm.; lateral nerves up to 8 pairs; fruits black...........................10. *P. Chamissonis*
G. Leaf-blades 10–20 × 5–8 cm.; lateral nerves 14–16 pairs; fruits glaucous-blue.....................11. *P. cinerascens.*
E. Leaf-blades never obovate.
F. Branchlets, lower leaf-surface, and inflorescence densely ferruginous-tomentose.......................9. *P. Donnell-Smithii.*
F. Branchlets, lower leaf-surface, and inflorescence not densely ferruginous-tomentose.
G. Leaf-blades rigidly coriaceous or chartaceous; inflorescences numerous and more or less corymbose, densely pubescent.
H. Perianth-lobes decidedly unequal.
I. Lower leaf-surface and inflorescence subsericeous; petioles up to 4.5 cm. long; leaf-blades not more than 10.5 cm. broad; fruits 7 mm. diam., subtended by remnants of scarcely thickened perianth-lobes..12. *P. Liebmanni.*
I. Lower leaf-surface and inflorescence shortly tomentellous; petioles up to 2 cm. long; leaf-blades not more than 6.5 cm. broad; fruits at least up to 3.5 cm. diam., subtended by a thickened subcampanulate cupule..... ....13. *P. vesticula.*
H. Perianth-lobes equal or subequal.
I. Largest leaf-blades not more than 15 cm. long, glaucescent beneath; petioles up to 2 cm. long; branchlets yellowish-pubescent to glabrous; inflorescence equal to or slightly shorter than the leaves.......14. *P. pallida.*
I. Largest leaf-blades up to 33 cm. long, not glaucescent beneath; petioles not more than 1.5 cm. long; branchlets glabrous; inflorescence much shorter than leaves.. ....15. *P. rigens.*
G. Leaves pergamentaceous; inflorescences not numerous and corymbose but spreading-paniculate, fulvo-sericeous........ ....16. *P. Skutchii.*

D. Inflorescence with compact shortly branched panicles more or less compressed into a subpyramidal or subcapitate structure at the tips of the peduncles.
E. Lower leaf-surface densely pubescent; blades of largest leaves not less than 6, usually 8 cm. broad.
F. Lower leaf-surface flavo-sericeous; petioles to 4.5 cm. long; inflorescence flavo-sericeous, not more than 6 cm. long (rarely 7 cm.) .... 8. *P. flavifolia.*
F. Lower leaf-surface whitish or flavo-tomentose, not sericeous; petioles to 3.5 cm. long; inflorescence whitish- or flavo-tomentose, up to 10 cm. long .... 17. *P. Hintonii.*
E. Lower leaf-surface glabrous or glabrescent (or sericeous to glabrescent), glaucescent beneath; blades of largest leaves not more than 5.5 cm. broad.
F. Leaf-blades elliptic, shortly acuminate or acute, not more than 15 × 5 (occasionally 8) cm.; lateral nerves 6–10 pairs.
G. Leaf-blades glabrous, the margin undulate, the lower surface subglaucous; lateral nerves 6–8 pairs; inflorescence not more than 6 cm. long; fruits blackish, seated on the remnants of partially deciduous perianth-lobes .... 1. *P. longipes.*
G. Leaf-blades sericeous to glabrescent, glaucescent beneath; lateral nerves 8–10 pairs; inflorescence up to 10 cm. long; fruits with bluish bloom, seated on the patent persistent perianth-lobes .... 18. *P. veraguasensis.*
F. Leaf-blades lanceolate-elliptic, subobtuse, subacute to acuminate, not more than 4.5 cm. broad; lateral nerves 10–14 pairs.
G. Petioles not more than 2 cm. long; lateral nerves up to 14 pairs, usually obscure beneath; reticulation if present very inconspicuous .... 19. *P. podadenia.*
G. Petioles up to 3.5 cm. long; lateral nerves 10–12 pairs and fairly conspicuous above, very much so beneath; reticulation conspicuous, particularly beneath .... 20. *P. Standleyi.*
B. Leaf-blades sessile and subcordate .... 21. *P. sessilis.*

1. **Persea longipes** (Schlechtendal) Meissner in DC. Prodr. 15^1: 55. 1864; Standley in Contr. U. S. Nat. Herb. 23: 291. 1922.

Laurus longipes Schlechtendal in Linnaea 7: 390. 1832.

Distribution: Known only from Vera Cruz, Mexico.

Mexico: Vera Cruz(?): Hacienda de la Laguna, *Schiede 59* (fr., photo. of type, Ch, NY). Vera Cruz: Mirador, 3/1842, *Liebmann Lauraceae 72* (fl., Ch), *756* ? (fl., Ch).

The Liebmann numbers last cited bear the determination *P. brevipes*, but since the number *72* is cited by Mez in his monograph under *P. longipes* and agrees with the description, it is safe to assume that the name on the label is erroneous. The flowering specimens cited show densely crowded leafy branchlets blackish brown and striate, with long (up to 3.3 cm.) gracefully petioled leaves (2.5–10 [–13] cm. × 1.5–5.5 cm.) chartaceous and glabrous, the midrib impressed above and the lateral nerves obscure, the surface somewhat areolate. The midrib and nerves are slightly more prominent beneath, being brownish against the subglaucescent lower leaf-surface. The inconspicuous lateral nerves, 6–8 pairs, usually diverge at an angle of 45°, but vary from 35–55°. The short rather few-flowered panicles (6 cm. long) are narrow, subtended by glabrous dark brown slender peduncles up to 4 cm. long. The flowers are ferruginous-sericeous with the inner lobes of the perianth twice as long as the outer. The stamens of the outer series are ± 2.4 mm. long, the pubescent filaments equalling in length the ovate rounded anthers, with the two upper cells smaller than the lower. Those of the inner series are ± 2.6 mm. long, the filaments biglandular, the anthers narrower. The staminodia are ± 1.25 mm. long, broadly cordate, borne on pubescent stipes one-half the entire length. The glabrous gynaecium is up to 3 mm. long, and the subglobose ovary is about one-third the length of the entire gynaecium. The slender style is topped by a small inconspicuous discoid stigma.

The nearest relatives of this species seem to be the Mexican *P. podadenia*, the palish leaf-blades of which are more regularly elliptic or oblong-elliptic, 6–15 × 2–4 cm., with petiole up to 2 cm. long and with 14 pairs of lateral nerves, and the Costa Rican and Panamanian species *P. veraguasensis*. From the former it is readily separated by the broadly and irregularly elliptic leaf-blades with undulate margins, 2.5–10 (–13) × 1.5–6.5 cm., with petiole up to 3.3 cm. long and with 6–8 pairs of lateral nerves. From the latter species it is separated by the leaf-blades of more uniform shape, not undulate at the margin, very glaucous and lightly pubescent on the lower leaf-surface, with usually more than 8 pairs of lateral nerves, the dark venation being very conspicuous. The branchlets are covered with a slight puberulence, and the inflorescence is densely clothed with a subferruginous somewhat sericeous pubescence. The blackish (fide Meissner) fruits of *P. longipes*, to judge from the photograph of the type, are subtended by the remnants of the perianth-lobes, the tips of which have broken off, rather roughly and irregularly, showing only the line of decurrence on the tube — a characteristic in common with *P. podadenia*. The bluish glaucous fruits of *P. veraguasensis*, on the other hand, are subtended by the somewhat enlarged remains of the persistent pubescent perianth-lobes, which are always patent and often slightly reflexed.

2. **Persea Steyermarkii**, sp. nov.

Arbor parva ad 10.5 m. alta, ramulis apice dense foliosis glabris atrorubescentibus striatis mox griseis rugosulis vadose sulcatis. Folia alternata, petiolis atro-rubescentibus glabris striatis canaliculatis ad 2 cm. longis et 1 mm. vel minus latis, laminis utrinque glabris coriaceis in sicco supra viridescenti-brunneis, subtus pallidis (caeruleo-argenteis fide coll.), lanceolato-ellipticis vel oblongo-ellipticis, 6.2–10.5 cm. longis et 2.5–4 cm. latis, basi obtusis, apice rotundatis vel acutis saepe emarginatis, penninerviis, costa supra satis impressa subtus valde elevata, nervis 6- vel 7-paribus nonnihil obscuris pallidis supra leviter impressis subtus leviter elevatis angulo ad 80° divergentibus, rete venularum utrinque conspicuo. Inflorescentia axillaris (foliis deciduis) foliis brevior subverticillata, paniculata, 3–4(–5) cm. longa, pauciflora, pedunculo rubescente glabrescente striato gracili ad 3 cm. longo. Flores ad 5.5–8 mm. longi, pedicellis minute gracilibus adpresse pubescentibus ad 7–10 mm. longis, perianthio campanulato flavo-viridescente fragrante fide coll., lobis reflexis nonnihil crassis leviter papillosis exterioribus ± 4.5 mm. longis interioribus ± 6 mm. longis; staminibus loculis superioribus quam inferioribus brevioribus ± 4.25 mm. longis, antheris truncato-ovatis longitudine subdimidio staminium aequantibus filamentis pubescentibus; staminibus ser. III antheris emarginatis, biglandulosis, glandulis conspicuis reniformibus stipitatis, antheris subaequalibus; staminodiis conspicuis, $\pm$ 3.5 mm. longis cordatis stipitatis, stipite pubescente crasso; gynaecio pubescente $\pm$ 4.25 mm. longo, ovario late ovoideo vel subgloboso, stylo leviter quam ovario longiore, stigmate subcapitato conspicuo. Fructus ignotus.

DISTRIBUTION: Known only from type-locality.

GUATEMALA: San Marcos: Trail between Finca El Porvenir and San Sebastian, upper slopes of Volcán Tajumulco, alt. 1300–1400 m., March 1, 1940, *Steyermark 37061* (fl., TYPE, Ch) (small tree 9–10.5 m.; leaves ascending, erect, coriaceous, pale or olive-green above, blue-silvery-green beneath with depressions between lateral veins, the margins revolute; flowers sweet-scented, the petals yellow-greenish, the pedicels pale green, the anthers deep yellow).

This species, with branchlets densely foliose at the apex, seems to have no particular affinity. Its floral characters seem to be near those of *P. americana* and its relatives, but the general habit indicates perhaps a relationship to the species *P. longipes* and *P. Standleyi.*

3. **Persea Brenesii** Standley in Field Mus. Publ. Bot. **18**: 458. 1937.

DISTRIBUTION: Forests or pastures of Costa Rica, known only from the type-locality.

COSTA RICA: Alajuela: La Palma de San Ramón, alt. 1150 m., *Brenes 4451* (fl., TYPE not seen).

This species is one of the smallest-leaved species of *Persea*. The most salient features seem to be the dense ochraceous-sericeous pubescence found on the leafy thick angled branchlets, the petioles 10–14 mm. long, and the lower surface of the small (5.5–7.5 $\times$ 1.5–2.5 cm.) obtuse or acutish oblong leaf-blades glabrous above with the costa and nerves slightly impressed and elevated beneath. The lateral nerves are about 6 pairs diverging from the costa at right angles or more narrowly ascending. The inflorescences are axillary few-flowered corymbs slightly longer than the leaves and densely ochraceous-sericeous, with flowers sessile or shortly and thickly pedicellate. The inner oblong-ovate obtuse almost 5 mm. long lobes of the perianth are longer than the oval or ovate exterior lobes. The fruits, apparently immature, are globose, glabrous, and measure 1 cm. in diameter.

The description seems to place the species in the vicinity of *Persea pachypoda,* from Mexico, if it is not actually conspecific with it. The type cannot be located at present.

4. **Persea pachypoda** Nees in Linnaea **21**: 490. 1848.
Oreodaphne Benthamiana Nees in Linnaea **21**: 521. 1848.
Phoebe Hartwegii Meissner in DC. Prodr. **15**^{1}: 30. 1864.
Persea Hartwegii Hemsley, Biol. Centr. Am. Bot. **3**: 72. 1882.
Phoebe Benthamiana Mez in Jahrb. Bot. Gart. Berlin **5**: 195. 1889.
Phoebe pachypoda Mez in Jahrb. Bot. Gart. Berlin **5**: 196. 1889; Standley in Contr. U. S. Nat. Herb. **23**: 294. 1922.

DISTRIBUTION: Mexico.

MEXICO: ? "Bei el bruco, *Ehrenberg 942,* Arbor, fructu eduli, Apugato cimaron incolis." (fr., fragm. of TYPE of *Persea pachypoda,* Ch). Guanajuato: *Hartweg 84* (fl., fragm. of type of *Oreodaphne Benthamiana,* and syntype of *Phoebe Hartwegii,* NY). San Luis Potosí: Minas de San Rafael, Bagre, June 1911, *Purpus 5338, 5457* (fl., Ch).

NATIVE NAMES: "Aguacate cimarrón," "Apugato cimarrón" (Mexico).

This small-leaved species has apical branchlets covered with a dense pale ferruginous tomentum, later becoming fuscous and black. The oblong or oblong-lanceolate acutish or round-apiculate leaf-blades are coriaceous, cuneate at the base, and measure 9.5 × 3(–5) cm. They are densely ferruginous-tomentose throughout, becoming less so with age, with a tomentose petiole up to 2 cm. long. The 4–6 pairs of lateral nerves are rather obscure although slightly elevated above, but, like the costa, are prominently elevated beneath, and diverge from the costa at an angle of between 20 and 30 (–45)°. The short densely ferruginous-tomentose axillary inflorescence, up to 6.5 cm. long, consists of several depauperate panicles which are shortly branched and almost corymbose, borne on long peduncles up to 4 cm. in length. The densely tomentose flowers are about 6 mm. long, subsessile or borne on pedicels slightly more than 1 mm. long. The outer perianth-lobes are ovate and acuminate, with 5 prominent veins, ± 3.5 mm. long, and the inner are rather elliptic, acute, and ± 5 mm. long. The two inner series of stamens are ± 3 mm. long, the pubescent filaments being slightly longer than the apiculate anthers. The stamens of the third series are biglandular and measure ± 4 mm., the stipitate subreniform glands nearly equalling the anthers. The staminodia are stipitate, ± 1.5 mm. long in their entirety, ovate, cordate, and about one-half again as long as the rather stout pubescent stipes. The gynaecium is glabrous and measures ± 4 mm., is ellipsoid, and almost as long as the slender style, which is topped by a conspicuous subpeltate stigma.

As has been noted under *P. Brenesii*, the nearest connection seems to be with that species.

5. **Persea americana** Miller, Gard. Dict. ed. 8. 1768; Blake in Jour. Wash. Acad. Sci. **10**: 12, *fig. 1, A*. 1920; Standley in Contr. U. S. Nat. Herb. **23**: 290. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925; Standley in Contr. U. S. Nat. Herb. **27**: 183. 1928, in Trop. Woods **21**: 17. 1930, in Field Mus. Publ. Bot. **10**: 201. 1931; Skutch in Torreya **32**: 85–94, *figs. 1, 2*. 1932; Standley & Record in Field Mus. Publ. Bot. **12**: 144. 1936; Standley in Field Mus. Publ. Bot. **18**: 457. 1937.

Laurus persea Linnaeus, Sp. Pl. 370. 1753.

Persea gratissima Gaertner f., Fruct. & Sem. **3**: *222, pl. 221*. 1805.

Persea edulis Rafinesque, Sylva Tellur. 134. 1838.

Persea gratissima var. α *vulgaris* Meissner in DC. Prodr. **15**^{1}: 53. 1864.

Persea gratissima var. γ *macrophylla* Meissner, l.c.

Persea gratissima var. β *oblonga* Meissner, l.c.

Persea persea Cockerell in Bull. Torrey Bot. Club **19**: 95. 1892.

Persea amplifolia Mez ? sensu Record in Trop. Woods **10**: 21. 1927; Standley in Trop. Woods **21**: 17. 1930; non Standley & Calderón, 1925.

DISTRIBUTION: Native probably of Mexico and Central America, and possibly the West Indies; now planted profusely throughout these regions and all tropical and subtropical countries.

NATIVE NAMES: "Aguacate" (general term throughout Central America, of Aztec origin); "Ahuacate," "Avocado," "Aguacate oloroso" (Vera Cruz, Oaxaca); "On" (Yucatan Maya); "Aguacate xinene," "Xinene" (Oaxaca); "Tonalahuate" (Morelos, Vera Cruz); "Aguacatillo" (Michoacán, Jalisco). Many other names are reported by Standley (1928) as being common in South America where the species is cultivated. He also gives numerous Indian names (1937).

This widely cultivated tree of the tropics is outstanding for its ovate-oblong or obovate-oblong coriaceous dark green leaves, 10–20 cm. long and 3–10 cm. broad, crowded at the branchlet-tips, slightly shining above and dull glaucous beneath, pubescent to glabrous throughout with yellow venation prominent beneath, subtended by long (1.5–5 cm.) petioles, yellow or yellow-green, pubescent, becoming glabrous. The axillary subterminal inflorescences are paniculate, many-flowered, densely and shortly pubescent, bracteate, the pubescent bracts shortly tomentose and fugacious. The small (0.5–1.5 cm. diam.) flower is borne on a yellowish green pedicel, densely and shortly tomentose and up to 0.5 cm. long. The lobes of the perianth are yellowish green or light yellow, densely silky-tomentose within and without, rarely glabrescent, persistent, 3–6 mm. long and 2–3 mm. wide. The outer lobes are shorter and more narrow than the ovate-oblong or lanceolate inner lobes. The stamens of the two outer series have ovoid or ovoid-oblong acuminate or narrowed and obtuse anthers that are introrse; the flat pilose filaments are 2.5–3.5 mm. long. Those of the inner series are longer, with extrorse anthers, and the filaments bear at the base two short-stiped ovoid glands. The staminodia are short-stiped. The pubescent gynaecium, 4–5.5 mm. long, consists of an ovoid ovary bearing a filiform style topped by a discoid stigma. The large usually oblique globose or pear-shaped edible fruits are yellowish green or tinged with purple when ripe, shining, glabrous, 7–20 cm. long and 7–10 cm. in diameter. The rind is shining and coriaceous; the flesh is thick, oily, pulpy, sweetish to taste, about 1.5–2 cm. thick.

5a. **Persea americana** var. **drymifolia** (Schlechtendal & Chamisso) Blake in Jour. Wash. Acad. Sci. **10**: 15. 1920; Standley in Contr. U. S. Nat. Herb. **23**: 291. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925.

Persea drymifolia Schlechtendal & Chamisso in Linnaea **6**: 365. 1831; Meissner in DC. Prodr. **15**[1]: 53. 1864; Trabut in Rev. Hort. **1908**: 296, *fig. 110*. 1908.

Distribution: Mexico, known only from the type-locality.

Mexico: Vera Cruz: Papantla, March, *Schiede & Deppe 1140* (fl., isotype of *P. drymifolia*, Mo).

Native names: "Aguacate oloroso" (Mexico).

This variety of *P. americana* from Mexico has smaller leaves and fruits, the leaves giving forth the odor of anise when crushed. The fruit is supported by persistent or somewhat persistent perianth-lobes, a character which Blake mentions as differing from that of *P. americana*. The true avocado, on the other hand, according to Mez' description, has "lobes persistent or subdeciduous."

In the case of *P. americana* and allied species and varieties, further work in the field is necessary for a comprehension of the variability that most certainly abounds in the group. This seems to be particularly true where cultivation has occurred.

The branchlets are blackish, angular-striate, and becoming glabrescent. The leaves are alternate or subopposite, with long slender glabrous petioles 1–2 (–3) cm. long and 1 mm. in diameter, slightly canaliculate. The blades are elliptic, acute or acuminate, with cuneate or sometimes somewhat obtuse base; they measure 6–12 (–15) cm. long and 2–4.5 (–5.7) cm. broad, are pergamentaceous, in the dried state above greenish brown and glabrous, beneath glaucous and scattered-pilose. The costa above is impressed and glabrous, beneath elevated and brownish with slight pilosity. The lateral nerves vary from 6 to 9, not always in opposite pairs, and are obscure above and slightly elevated and brownish-pilose beneath. They diverge from the costa at an angle of about 45°. The reticulation is indistinct and loose throughout. The subterminal inflorescence is lightly clothed with a fulvous pubescence and is shorter than the leaves, measuring up to 9 cm. in length, with a peduncle 2–4 cm. long. The pubescent flower is borne on a slender pedicel up to 6 mm. long, and the subequal everywhere pubescent elliptic lobes are membranaceous. The first and second series of stamens are pubescent and about 3.5 mm. long, the ovate obtuse anthers with introrse cells being slightly longer than the slender filaments. The two lower cells are about twice the size of the upper. This is true also of those of the anthers of the third series, which are extrorse, whereas the two upper cells are lateral. The filaments of the third series are once and a half again as long as the anthers and bear at the base two lateral stipitate glands which appear to be cordate and are equal in length to the supporting stipes. The fourth series or staminodia are ± 1.25 mm. long, cordate, and borne on thick pubescent stipes half the entire length. The gynaecium measures approximately 3.5 mm. in length and is pubescent throughout. The ovoid to subglobose ovary is shortly stipitate and bears a slender style which is twice its length. The stigma is obliquely peltate and conspicuous.

6. **Persea Schiedeana** Nees, Syst. Laurin. 130. 1836; Blake in Jour. Wash. Acad. Sci. **10**: 16, *fig. 1, B.* 1920; Standley in Contr. U. S. Nat. Herb. **23**: 289. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925; Standley in Trop. Woods **21**: 17. 1930; Standley in Field Mus. Publ. Bot. **10**: 201. 1931; Standley & Record in op. cit. **12**: 144. 1936; Standley in op. cit. **18**: 458. 1937.

Persea sp. Schlechtendal & Chamisso in Linnaea **6**: 365. 1831.

Persea gratissima var. δ *Schiedeana* Meissner in DC. Prodr. **15**¹: 53. 1864.

Persea Pittieri Mez in Bot. Jahrb. **30**: Beibl. 67: 15. 1901.

DISTRIBUTION: Forests of Mexico and Central America.

MEXICO: Vera Cruz: Forests of Misantla, *Schiede* (fl., TYPE of *P. gratissima* var. δ *Schiedeana* not seen); Barranca de Fortin near Cordoba, *Woronow 3127* (fl., Ch). Mexico: Acatitlán, *Hinton 3167* (fl., GH). Michoacán: Llano, Coalcomán, *Hinton 12987* (fl., GH). Oaxaca: Ubero, *L. Williams 9151* (sterile, A). Chiapas: Between Copainaba and Coapilla, *Woronow & Juzepczuk 1666* (fl., Ch). GUATEMALA: Huehuetenango: Northwest of Malacatancito, at km. 8 of the highway from Huehuetenango, in brushy quebrada in oak-forest, *Standley 82186* (fl., Ch). Alta Verapaz: Near San Juan Chamelco, in pine-forest, *Standley 92204* (fr., Ch); near Cobán, in wet thicket, *Standley 69432* (fr., Ch). Izabal: Los Amates, *Kellerman 7145* (fl., Ch). HONDURAS: Tegucigalpa: Mont. de la Flor, near the river, *C. & V. W. von Hagen 1232* (sterile, NY). Yoro: El Porlillo Grande, *C. & V. W. von Hagen 1005* (sterile, NY). BRITISH HONDURAS: Stann Creek: Middlesex, *Stevenson V (Y8932)* (fl., Y). NICARAGUA: N. E. without locality: *Englesing 162* (fl., Y). COSTA RICA: Guanacaste: About houses in Nicoya, *Tonduz 13794* (fl., A). Alajuela: Palmira, region of Zarcero, *A. Smith H.327* (fl., Ch). Cartago: In valley of Rancho Redondo, Volcán Irazu, alt. 1500 m., *Pittier* (Herb. Inst. Costa Rica) *1156* (fl., type of *P. Pittieri* not seen); Rancho Redondo near San José, *Popenoe 989* (fr., Ch); without locality, in 1905, *Wercklé* (fl., Ch). PANAMA: Chiriquí: Vicinity of Cerro Punta, *P. H. Allen 1534* (sterile, Mo); Bajo Chorro, Boquete, *Davidson 304* (fr., Ch), *427* (fl., A, Ch, Mo). Panama: Isla Taboga, *P. H. Allen 1288* (fl., Mo).

NATIVE NAMES: "Aguacate" (Mexico, British Honduras, Costa Rica); "Aguacatón" (Panama); "Chalté," "Chaucte" (Guatemala); "Chinini" (Mexico); "Chuche" (Guatemala, San Salvador); "Chuti" (Honduras); "Coyó," "Coyocté," "Coyoté" (Guatemala); "Guaco" (Honduras); "Kiyau," "Kiyó," "Kotyó," "Shucte" (Guatemala); "Wild Pear" (British Honduras); "Yas" (Costa Rica).

This species, once considered a variety of *P. americana,* seems to warrant specific rank. The closest affinity is no doubt the common avocado, but the differences are significant. Popenoe (U. S. Dept. Agric. Bull. 743: 37. 1919) makes the comment that, although the fruits of the two entities resemble each other, the tree is distinct in foliage and floral characters. I agree also with Popenoe that the avocado group needs more intensive study in the field.

The branchlets of *P. Schiedeana,* as well as the lower surfaces of the young leaf-blades, are brown-tomentose. The leaf-blades are usually half as broad as long, up to 24 cm. long and 15 cm. broad; the petioles are up to 3 cm. long. The blades are irregularly elliptic and often obovate-elliptic, shining above and loosely reticulate, glaucescent and finely tomentose beneath. The base is frequently almost truncate and is usually rounded, the apex rounded, acute, or abruptly acuminate. The lateral nerves, of which there are 8–15 pairs, ascend at a variety of angles from the costa, 75–80° at the base and 45 or even 35° in the upper portion of the blades. The usually heavily pubescent subterminal numerous paniculate inflorescences bear persistent bracts and are shorter than the leaves, frequently appearing almost sessile, usually less than 10 cm. long, occasionally up to 15 cm. The flower, 6–8 mm. long, is borne on a slender pedicel almost equaling it in length. The narrowly ovate or lanceolate-ovate perianth-lobes are subequal and very pubescent without. The outer lobes measure 4–5.9 mm., the inner 4.5–6.4 mm. The stamens are ± 3.8 mm. long and bear ovate obtuse anthers with the two upper cells smaller, sometimes about half the size of the two lower cells. The slender filaments are pubescent and twice as long as the anthers. The filaments of the inner series bear glands that are cordate-stipitate (the stipes equal to the glands), and are about one-third the entire length of the stamens. The fourth series consists of cordate staminodia borne on hairy stipes more than half the length of the staminodia. The pubescent gynaecium is ± 3.8 mm. long, the slender style more than twice the length of the ovoid ovary. The fruits, of which I have not seen mature specimens, seem to be obovoid (slender and bottle-necked), and in the early stages very pubescent, later becoming glabrescent and roughened. The perianth-lobes increase somewhat in size and thickness and persist at the base of the fruits, subtended by the thickened and enlarged pedicels, also becoming glabrescent.

7. **Persea floccosa** Mez in Jahrb. Bot. Gart. Berlin 5: 148. 1889; Blake in Jour. Wash. Acad. Sci. 10: 15. 1920; Standley in Contr. U. S. Nat. Herb. 23: 290. 1922.

DISTRIBUTION: Mexico, in forests.

MEXICO: Puebla: Near Chinantla, ***Liebmann 85*** (fl., photo. of TYPE, Ch, NY, US). Chiapas: Ventana, near Siltepec, ***Matuda 4545*** (fr., A, NY); Rodeo, in virgin forest near Siltepec, ***Matuda 4559*** (fl., A, NY).

NATIVE NAME: "Aguacate cimarrón" (Mexico).

This species is characterized by the fulvous pubescence of the young branchlets, which soon become glabrescent and blackish red, with very prominent lenticels, and the dense ferruginous-lanose (according to the author) pubescence of the young leaves. Adult leaves are densely and manifestly foveolate-punctate and subglabrous above, while beneath they are glaucescent- and floccose-tomentose. They vary from 11–17 cm. long and 4.8–7.5 cm. broad, and are usually elliptic or occasionally narrowly elliptic, the base obtuse or cuneate, the apex somewhat acuminate, with 7 or 8 pairs of lateral nerves diverging from the costa at an angle of 35°, the lower pairs of which are often irregularly arcuate and almost at right angles. The erect stout pyramidal inflorescence is up to 11 cm. long, the peduncle nearly half its length, and covered with a dense subferruginous pubescence. The flowers are densely pubescent, up to 5 mm. long, the pedicel 1–3 mm. The perianth-lobes are elliptic, rather acute, densely pubescent, the inner up to 3.4 mm. long, the outer slightly less. The stamens are about 2 mm. long, the slender pubescent filaments are approximately one-third longer than the ovate obtuse anthers, the two upper cells of which are smaller than the two lower ones. The stamens of the inner series bear conspicuous stipitate subglobose glands at the base. The pubescent staminodia are ± 1 mm. long, the stipes being one-half the entire length. The pubescent gynaecium is ± 2.4 mm. long, the ellipsoid ovary only slightly shorter than the slender style that bears an inconspicuous discoid stigma. The fruits, unknown to Mez, seem to be rather depressed-globose, measuring 3.5 cm. long and about 4 cm. broad, brownish in the dried state and verrucose, subtended by the remnants of the spreading lobes of the perianth, the whole supported by an enlarged glabrous pedicel 6 mm. long and 5 mm. in diameter at the apex.

Persea floccosa has an affinity with *P. americana* and *P. Schiedeana,* but the smaller depressed-globose fruits are very different. The leaves are on the whole smaller than those of the two latter species, as are the flowers. The inflorescences are longer, accordingly, being nearly the length of the leaves. A study of more complete material may very well show this to be a form of *P. americana*.

8. **Persea flavifolia** Lundell in Contr. Univ. Mich. Herb. **6**: 17. 1941.

DISTRIBUTION: Known only from the type-locality and vicinity.

MEXICO: Chiapas: Mt. Ovando, April 9–12, 1937, *Matuda 1821* (fl., A, Ch, TYPE — Mich), *2651* (fl., A, Ch, NY).

This tree is remarkable for the stout branchlets, which are conspicuously angled, becoming striate-sulcate, early covered with a golden-sericeous tomentum, which becomes fuscous and eventually glabrescent. The older branchlets are conspicuously cicatricose. The petioles are golden-sericeous, striate, and up to 4.5 cm. long. The leaf-blades are coriaceous, elliptic-oblong or lanceolate-oblong, the base rounded or obtuse, the apex acute or obtusely subacuminate. They measure up to 21 cm. long and 8.5 cm. broad, early sparsely pubescent, soon glabrous, the surface yellow-green, the lower surface conspicuously golden-brown-sericeous. The costa is slightly impressed above and elevated beneath, everywhere golden-brown-sericeous. The lateral nerves, of which there are 7–12 pairs, are inconspicuous above but slightly elevated beneath. The reticulation is obscure throughout. The inflorescence is axillary and subterminal, consisting of numerous short compact many-flowered densely golden-brown-sericeous panicles not more than 4–6 (–7) cm. long. The flowers are 5–6 (–10) mm. long, including the short stout pubescent pedicel. The outer lobes are ovate or orbicular, ± 2.2 mm. long, thickly hairy within and densely sericeous without, those of the inner cycle being lanceolate-elliptic and up to ± 3.5 mm. long. The stamens of the two outer series are ± 2.2 mm. long, the ovate roundish anthers being shorter than the pubescent filaments. Those of the inner series are ± 3 mm. long, the filaments bearing conspicuous reniform stipitate glands. The upper cells of the anthers are smaller than the lower, those of the outer series being introrse, the upper cells of the inner series being lateral and the lower extrorse. The staminodia are ± 1.25 mm. long, cordate, ovate, the pubescent stipes being more than one-half the entire length. The glabrous to pubescent gynaecium is ± 3.2 mm. long, the subellipsoid glabrous or pubescent ovary shorter than the slender style topped by a large conspicuous capitate stigma. The fruit, of which I have seen no specimen, is globose, black, 1 cm. in diameter, the perianth-lobes being persistent.

Lundell relates this striking species to *P. Benthamiana* from Brazil. It appears also to have a close relationship to *P. podadenia,* also from Mexico, in spite of the occasional presence of pubescence on the ovary. The persistent sericeous pubescence of the leaf-blades and their shape separate it from the latter at once. *Mexia 1632,* a young fruiting specimen from Jalisco, may possibly belong here. The fruit seems very small and the infructescence still heavily pubescent. The leaves are on the whole small for this species, but the infructescence is shorter than that of *P. podadenia,* the only other possibility, and the lower part of the branchlet is heavily cicatricose — a characteristic of *P. flavifolia.*

9. **Persea Donnell-Smithii** Mez in Donnell Smith, Enum. Pl. Guatem. 2: 67. 1891, nom. nud.; in Arb. Kgl. Bot. Gart. Breslau 1: 113. 1892.

Distribution: Mexico and Guatemala, in mountain-forests at 1220–2000 meters altitude.

Mexico: Vera Cruz: Near Mirador, *Liebmann 11* (syntype, not seen). Chiapas: Coapilla, *Juzepczuk 1699* (fr., Ch); Pinada, Siltepec, *Matuda 1942* (fr., A, NY); in virgin forest, Letrero, near Siltepec, *Matuda 4355* (fl., young fr., A, NY); near Rancho Fenix, Hacienda Monserrate, *Purpus 10526, 13080, 14302* (fl., Ch). Guatemala: Alta Verapaz: Chicoyonito, alt. 1310 m., April, 1889, *J. D. Smith 1718* (fl., isosyntype, Mo); between Cobán and San Cristóbal, *Cook & Doyle 89* (fl., Ch); Cobán, *Johnson 646* (fr., Ch); near Cobán, *Standley 69166, 69315* (fl., Ch); large swamp east of Tactic, *Standley 92394, 92520* (fl., Ch). Baja Verapaz: Region of Patal, *Standley 69565* (fl., Ch).

Native names: "Aguacate," "Sacsí" (Guatemala).

The nearest relative of this species seems to be *P. Chamissonis,* from Mexico. A short discussion of the points of difference is given under that species. Mez places *P. Donnell-Smithii* near *P. floccosa,* which to me seems, on account of its fruit characters, to be allied with the *P. americana* complex.

This species is striking because of the large (up to 18 cm. long and 12 [–15] cm. broad) coriaceous elliptic or obovate leaves, the lower surface of which is covered with a dense ferruginous tomentum, as are the stout petioles which measure up to 4 cm. in length and are frequently as thick as 5 mm. in diameter. The blades are often unequal at the base, cuneate or rounded, the apex usually rounded. The inflorescence, up to 10 cm. long though often only 4 cm. long, is narrowly subpyramidal-paniculate and is covered with a dense ferruginous tomentum, as is the infructescence. The flower has thick fleshy lobes that are hairy inside and densely tomentose without and are definitely spreading. The outer lobes are orbicular and up to 3 mm. long, the inner ovate-elliptic and nearly twice the length of the outer. The two outer series of stamens are ± 3.8 mm. long, the pubescent filaments being longer than the broadly ovate anthers. The stamens of the inner series are ± 4.25 mm. long, the anthers narrowly oblong, the two upper cells lateral, the lower laterally extrorse. The filaments bear conspicuous reniform stipitate basal glands. The staminodia are ± 1.25 mm. long, obscurely sagittate, the stipes more than one-half the entire length, the whole densely pubescent. The seemingly glabrous gynaecium, 4–5 mm. long, consists of a globose ovary surmounted by a slender style twice its length and bearing a conspicuous subtriangular stigma. The fruits are shining, globose, strongly apiculate, about 12 mm. diam., and borne on the persistent perianth-lobes which are somewhat enlarged, still heavily tomentose, and spreading to a diameter of 12 mm. The short tomentose pedicel is enlarged also to 3 mm. long and 2 mm. in diameter.

10. **Persea Chamissonis** Mez in Jahrb. Bot. Gart. Berlin 5: 168. 1889; Standley in Contr. U. S. Nat. Herb. 23: 292. 1922; Lundell in Contr. Univ. Mich. Herb. 7: 12. 1942.

DISTRIBUTION: In the forests of Mexico.

MEXICO: Vera Cruz: Chiconquiaco, *Schiede* (fr., fragm. of SYNTYPE, Ch). Puebla: Near Chinautla, *Liebmann 1* (photo. of SYNTYPE, Ch, NY); Chinautla, in May 1841, alt. 2135 m., *Liebmann s.n.* (fl., fr., Ch, Mo).

The present species is distinguished by the ferruginous-tomentose branchlets that eventually become glabrate and blackish brown. The leaf-blades, with long petioles up to 3 cm. long (according to the collector), slightly canaliculate, and cinereous-tomentose, are alternate, usually obovate or elliptic, 9–13 cm. long, 3–7 cm. broad, chartaceous above and densely pubescent, becoming glabrescent, scattered- and spreading-pilose with longish hairs except for the costa, beneath somewhat glaucous and more crisped-pilose. The blade is densely and conspicuously reticulate on both surfaces and there are 6–8 pairs of lateral nerves diverging at an angle of 45°. The fruits are black, globose, apiculate, about 10–11 mm. in diameter, seated on the enlarged and rather horizontally spreading still densely ferruginous-tomentose lobes of the perianth, which form with the expanded tomentose tube about 1 mm. high a cupule about 12 cm. in diameter, and are subtended by the enlarged tomentose pedicel about 3 mm. long and 1.5 mm. broad.

Very close to *P. Chamissonis* is *P. Donnell-Smithii*, which differs in having its consistently larger leaf-blades (up to 17 cm. long and 12 cm. wide) heavily coriaceous and densely tomentose. They do not show prominent reticulations and are borne on a stout petiole up to 4 cm. long and 4–5 mm. thick, covered with a dense ferruginous and presently cinereous tomentum. The lateral veins of *P. Chamissonis* tend to ascend less arcuately than those of *P. Donnell-Smithii*. I have seen no inflorescence of *P. Chamissonis*, but presumably it is short. The inflorescence of *P. Donnell-Smithii* is longer than the infructescence of the former.

11. **Persea cinerascens** Blake in Jour. Wash. Acad. Sci. 10: 18, *fig. 2.* 1920; Standley in Contr. U. S. Nat. Herb. 23: 289. 1922.

DISTRIBUTION: Mexico, known only from the type.

MEXICO: Vera Cruz: Zacuapán, June, 1916, *Purpus 7671* (fl., TYPE not seen), *8144* (fr., not seen).

Blake has related this species to *P. Liebmanni* Mez, noting that it differs in its larger flowers, longer anthers, staminodial glands glabrous on the inner face, and larger fruits.

This tree has branchlets densely sordid-rufescent and pilose-tomentose, becoming fuscous and sparingly pubescent. The chartaceous leaves crowded on the young branchlets have blades that measure 10–20 × 5–8 cm., are elliptic to oval-oblong or obovate, acute or short-pointed but blunt at the apex, with a cuneate base, above obscurely foveolate, sordidly pilose-tomentose chiefly on the costa and lateral nerves, beneath cinerascent, heavily so on the nerves, and prominently reticulate. The lateral nerves are 14–16 pairs and diverge from the costa at an angle of 45–65°. The petioles measure up to 3 cm. long. The axillary inflorescence is sordidly pilose-tomentose, 5–7 cm. long, paniculate, narrowly subpyramidal. The flowers are borne on stout pedicels up to 1 mm. long; the perianth is 7–8.5 mm. long, densely pilosulous-tomentose, with elliptic-oblong obtuse lobes, the outer somewhat shorter than the inner. The stamens of the two outer series are 4.5–4.8 mm. long, those of the inner series 5.2 mm. long, with biglandular filaments. · The pubescent filaments are almost two-thirds the length of the stamens. The staminodia are 3 mm. long, the cordate apiculate apical gland, glabrous on the inner surface and pilose dorsally, presenting an unusual feature. The ovary is ± 1.5 mm. long, ellipsoid, glabrous, with a slender glabrous style more than twice its length. The fruits are subglobose, glaucous-blue, about 12 mm. diam., subtended by the persistent perianth-lobes which are slightly thickened to form a cupule 1 mm. high and 4.5 mm. in diameter.

12. **Persea Liebmanni** Mez in Jahrb. Bot. Gart. Berlin 5: 166. 1889; Standley in Contr. U. S. Nat. Herb. 23: 292. 1922.

DISTRIBUTION: Known only from the type.

MEXICO: Oaxaca: Near Chinantla and Trapiche de la Concepción, *Liebmann 115* (SYNTYPE not seen), *116* (fl., fr., photo. of SYNTYPE, Ch, NY).

According to the description, this species is set apart by having the angular branchlets appressed-yellowish-tomentellous and becoming glabrate and blackish brown in age. The sparse chartaceous leaf-blades, almost glabrous above and appressed-tomentellous-subsericeous beneath, are ovate or elliptic or elliptic-lanceolate, cuneate and often oblique at the base, and acuminate or subacute at the apex, measuring 14–26 × 3.8–10.5 cm., and borne on a petiole up to 4.5 cm. long, plane or slightly canaliculate. The 8–12 pairs of lateral nerves diverge from the costa at an angle of 35–45°. Above there is noticeable a prominent areolation, which beneath shows up as a loosely prominulous reticulation. The sericeous-tomentellous inflorescence is a many-flowered pyramidal panicle shorter than the leaves, about 15 cm. long, the peduncle up to 8 cm. long. The flowers, also subsericeous, are up to 5 mm. long, with the outer lobes one and one-half times shorter than the inner. The pilose filaments almost equal the subrectangular-oval anthers or are slightly longer. The staminodia are conspicuous, liguliform-sagittate, and densely pilose, the stipes being about one-half the entire length. The glabrous ovary is globose, twice as long as the style, which is topped with a discoid stigma. The fruit is globose, glaucescent-blackish, up to 7 mm. in diameter, seated on the spreading persistent and slightly enlarged perianth-lobes.

According to Blake, the only species known to which this has an affinity is *P. cinerascens*, of which unfortunately no material is available.

13. **Persea vesticula** Standley & Steyermark in Field Mus. Publ. Bot. 23: 116. 1944.

DISTRIBUTION: Volcanic mountain-slopes of Guatemala.

GUATEMALA: Huehuetenango: Cerro Huitz, between Mimanhuitz and Yulhuitz, Sierra de los Cuchumatanes, *Steyermark 48571* (fr., Ch). San Marcos: Top of escarpment, between La Vega ridge along Río Vega and northeast slopes of Volcán de Tacaná, near the Mexican boundary, alt. 2500–3000 m., Feb. 20, 1940, *Steyermark 36207* (fl., TYPE, Ch). El Progreso: In cloud-forest, Sierra de las Minas, hills north of Finca Piamonte, *Steyermark 43558* (sterile, Ch).

NATIVE NAME: "Canok" (Huehuetenango).

The species so recently described by Standley and Steyermark has not turned up in any other collection. It is distinctive at once for its sturdy pubescent densely foliose branchlets, bearing rigidly coriaceous leaf-blades glabrous to glabrescent above and minutely pubescent beneath, borne on stout petioles 1–2 cm. long, the margin slightly recurved, particularly at the base, oblong-elliptic, 10–17 × 3.5–6.5 cm. The lateral nerves are 9 or 10 (–12) pairs and faintly visible above and definitely elevated beneath, diverging at an angle of approximately 45°. The subterminal profusion of robust inflorescences, almost forming a single corymbose structure at the tips of the branchlets, is many-flowered and ferruginous-tomentose. The flowers are 12–14 mm. in diameter, the outer perianth-lobes subtriangular, thickly pubescent, ± 3.4 mm. long, the inner ± 7.25 mm. long, elliptic. The stamens are ± 4.7 mm. long, the ovate obtusely apiculate anthers almost as long as the filaments. The anthers of the third series are more oblong-rounded, with pubescent filaments and two stipitate glands about one-fourth the length of the entire stamens. The staminodia are irregularly petaloid, sagittate, stipitate, dorsally pubescent, measuring ± 2.2 mm. in length, the stipes about equal to one-half the length of the staminodia. The gynaecium is ± 5 mm. long. The slender style is twice as long as the glabrous ellipsoid to subglobose ovary and is topped by a capitate conspicuous stigma. The subglobose fruit measures 3.5 cm. in diameter and is borne in a thick subverrucose cupule 12 cm. in diameter, 5 mm. long, and ± 2 mm. deep. The supporting pedicel is about 5 mm. long and 8 mm. in diameter at the apex.

Standley and Steyermark relates this species to *P. longipes,* but in my opinion it is more closely allied to the *P. americana* complex, the inflorescence and large fruit indicating this. The thickened and ligneous fruit-cupule, however, is certainly not typical of the *Persea* species of this region.

14. **Persea pallida** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. 3: 231. 1903; Standley in Field Mus. Publ. Bot. 18: 458. 1937.

DISTRIBUTION: Costa Rica, known only from the type.

COSTA RICA: Puntarenas: Valle de Coto, alt. 1400 m., *Pittier* (Herb. Inst. Costa Rica *11111*) (fl., TYPE not seen) (flowers in February).

Only a flowering specimen of this species was described. The stout branchlets, early pruinose with short yellowish pubescence, later become glabrous. The chartaceous sparse penninerved leaf-blades, 15 × 6 cm., are densely prominulous-reticulate, pale to almost glaucescent beneath, and are subtended by slightly canaliculate petioles up to 2 cm. long. The corymbose inflorescence is entirely covered with a remarkable white indument. The flowers are about 4 mm. long and borne on very short and thick pedicels 2–3 mm. long. The lobes are elliptic, thick and fleshy, broadly acute; the filaments of the stamens are shorter than the broad well rounded and emarginate or obtuse anthers. The anthers of the stamens of the third series are laterally dehiscent and are large, fleshy, and sessile. The slender style is three times as long as the subglobose glabrous ovary and bears a large often triangular stigma.

The nearest affinity of this species is the following new species, also from Costa Rica and found in adjacent Panama as well. Mez remarks that superficially one is reminded of the habit of *Phoebe glaucescens* from India, but that a careful study reveals relationship to the Andean species *Persea ferruginea* and *P. vestita,* neither of which latter are available at present.

15. **Persea rigens**, sp. nov.

Arbor ad 30 m. alta ramulis robustis, brunneis vel maculato-brunnescentibus, sulcatis, glabris. Folia alternata vel subverticillata, petiolis brunneis vel fuscis, crassis haud canaliculatis, glabris, ad 1.5 cm. longis et 3 mm. latis, laminis utrinque glabris, juventute membranaceis, mox rigide coriaceis, in sicco olivaceo-viridescentibus, ellipticis, 20–25 (–33) cm. longis et ad 12 cm. latis, basi cuneatis, apice obtusis vel haud obtuse subacuminatis, penninerviis, nervis 7- vel 8(–9)-paribus supra leviter subtus conspicuiore elevatis, angulo 45–55° divergentibus, costa supra subplana subtus conspicue elevata, utrinque satis minute reticulatis. Inflorescentia paniculis numerosis composita, paniculis ad 5 ex axilla quave folii decidui summi, dense griseo- vel fulvo-albescentibus, ad 10 cm. longis et 2 cm. latis, pedunculis ad 6 cm. longis. Flores ad 4 mm. longi, campanulati, dense tomentosi, pedicellis ad 4 mm. longis pubescentibus, lobis subaequalibus crassis tomentosis ad 3 mm. longis; staminibus ser. I & II plus minusve variabilibus saepe subpetaloideis, ± 1.25–2.2 mm. longis filamentis pubescentibus, ser. III ± 2.2 mm. longis biglandulosis, glandulis stipitatis; staminodiis stipitatis subcordatis, ± 1.7 mm. longis; gynaecio ovario ovoideo glabro ± 2.8 mm. longo, quam stylo ⅔ longiore. Infructescentia robusta glabrescens vel glabra, ad 15 cm. longa, rubescens. Fructus ignotus. Pedicellus incrassatus, rugosus, ad 7 mm. longus et 5 mm. latus, apice loborum reliquis, ad 7 cm. diam. insignitus.

Distribution: Costa Rica and adjacent Panama.

Costa Rica: Without locality, in 1943, *Little 6075* (fl., type, Ch). Panama: Bocas del Toro: Daytonia Farm, region of Almirante, Feb. 2, 1928, *G. P. Cooper 458* (*Y12076*) (fr., Ch, Y) (tree 18 m. high, 35 cm. diam., said to reach 30 m. and 95 cm. diam., with stout horizontal branches at top; used for boards and rough lumber).

Native name: "Timber Sweetwood" (Panama).

The dense many-panicled inflorescences of this species present a striking appearance, clothed with a heavy grayish or fulvous-white tomentum. As many as four panicles up to 10 cm. in length arise from a single axil of leaves that are early deciduous. Unfortunately, Cooper's number has no fruit attached, but the enlarged peduncles and pedicels of the infructescence bearing the remains of the perianth-lobes leave no doubt that the specimen is conspecific with the Costa Rican tree.

The species is near *P. pallida,* but differs in not having corymbose inflorescences and in its large leaf-blades, 33 × 12 cm., only slightly paler beneath and not glaucescent, with petioles not more than 1.5 cm. long. The perianth-lobes are not elliptic but broadly ovate, and the pedicel is equal to if not longer than the flowers. The ovary is ovoid instead of subglobose and is two-thirds the length of the entire gynaecium, instead of one-fourth as in *P. pallida*. The type of stamen is not typical for *Persea*, but the species seems to belong in the genus.

16. **Persea Skutchii**, sp. nov.

Arbor ad 21 m. alta, ramulis rubescentibus striatis, juventute pallide et adpresse ferrugineo-tomentosis, mox glabris. Folia alternata vel subverticillata petiolis gracilibus leviter canaliculatis brunneis ad 3.5 cm. longis, laminis supra glabris subtus sparse pubescentibus, pergamentaceis, in sicco supra pallide viridescentibus subtus pallide brunnescentibus, ellipticis vel late ellipticis, 10–17 cm. longis et 3 (–7.5) cm. latis, basi rotundatis vel cuneatis, interdum obliquis, apice obtusis vel acutis vel acuminatis, saepe emarginatis, margine plus minusve undulatis, penninerviis, costa supra impressa subtus elevata pubescente, nervis ad 12-paribus brunnescentibus utrinque plus minusve planis, angulo 67–56° divergentibus, utrinque rete venularum minuto et obscure prominulo. Inflorescentia axillaris paulo laxe paniculata, minute sericeo-fulvo-pubescens, ad 12 cm. longa. Flores ad 6 mm. longi, campanulati, dilute flavescentes, pedicellis ad 5 mm. longis gracilibus pubescentibus, lobis exterioribus late ovatis membranaceis pubescentibus ± 1.5 mm., interioribus lanceolatis pubescentibus ± 5 mm. longis; staminibus ser. I & II ± 3.4 mm. longis antheris oblongis quam filamentis pubescentibus plusquam triplo longioribus, ser. III ad ± 3.5 mm. longis biglandulosis glandulis stipitatis; staminodiis crassis utrinque pubescentibus subcordatis, stipitatis, ± 2.7 mm. longis; gynaecio glabro ± 3.4 mm. longo, ovario ovoideo basi leviter constricto, longitudine quam stylo breviore, stigmate conspicue triangulari-peltato. Fructus nigrescens lucidus, globosus, inconspicue apiculatus, ad 7 mm. diametro, glaber, pedicello aliquid incrassato apice ad 2 mm. diametro sparse pubescente apice plus minusve 6 mm. diametro, loborum reliquis ornato.

DISTRIBUTION: Costa Rica and Panama, 300 to 1675 meters altitude.

COSTA RICA: Puntarenas: Buenos Aires, *Tonduz 6680* (fl., Ch). Alajuela: Edge of wooded ravine in Pacific tropical zone, Atenas, *A. Smith P.2479* (fl., A). San José: In clearings, vicinity of El General, *Skutch 3117* (fl., A, NY); basin of El General in clearing, alt. 675–900 m., March 1940, *Skutch 4812* (fl., TYPE, A) (tree 15 m.; flowers yellowish); Cerro de Pratli, Escazú, *Solis 183* (fl., Ch); Santa María de Dota, *Stork 2416* (fr., Ch). PANAMA: Coclé: Vicinity of El Valle, south rim (dry), *P. H. Allen 1781* (fr., Mo, NY); hills south of El Valle de Anton, *P. H. Allen 2498* (fr., A).

NATIVE NAME: "Aguacatillo" (Costa Rica).

This species is akin to *P. caerulea*, from South America, but may be separated from it by the inflorescences being shorter than the leaves and by the less erect lateral nerves. The leaves are usually acute or subacuminate rather than rounded-obtuse, as those of *P. caerulea*. The blackish (in the dried state) fruits are depressed-globose, lack entirely the bloom of those of the latter species, and do not measure more than 8 mm. in diameter at the most.

17. **Persea Hintonii**, sp. nov.

Arbor magna [?], ad 5 m. alta, ramulis flavo- vel fulvo-tomentosis mox sparse griseo-tomentosis demum glabrescentibus fusco-brunneis, subsulcatis. Folia alternata, petiolis flavo-tomentosis ad 3.5 cm. longis canaliculatis, laminis supra glabris costa pubescente excepta subtus utrinque sparse cano- vel flavo-tomentosis, coriaceis, supra in sicco pallide viridescentibus, subtus glaucis, oblongo-ellipticis, 15–20 cm. longis et 5–6.5 (–8) cm. latis, basi rotundatis vel cuneatis et obliquis, apice rotundatis, obtusis vel acutis et minute apiculatis, penninerviis, costa plus minusve conspicua leviter impressa subtus satis elevata utrinque flavescente et pubescente, nervis 10–12(–15)-paribus supra obscurissime leviterque elevatis, subtus satis elevatis et conspicuis flavescentibus angulo 35–45° divergentibus, rete venularum supra obscuro subtus satis conspicuo. Inflorescentia axillaris, compacte paniculata vel subcapitata, 3–5.5 (–10) cm. longa, dense fulvo- vel flavo-tomentosa, pedunculo ad 5.5 cm. longo. Flores ad 7.5 mm. longi, confertissimi, perianthio campanulato, lobis exterioribus crassis ovatis extus pubescentibus ± 2.7 mm. longis, interioribus lanceolatis extus utrinque intus apice pubescentibus ± 4.7 mm. longis; staminibus ser. I & II ± 2.15 mm. longis, antheris ovatis saepe obtuse breviterque acuminatis variabilibus saepe quam filamentis pubescentibus plusquam duplo longioribus, ser. III ± 3.4 mm. longis biglandulosis, glandulis stipitatis; ubique loculis superioribus parvissimis, ser. I & II introrsis, ser. III laterali-extrorsis; staminodiis anguste ovatis graciliter stipitatis ± 1.7 mm. longis pubescentibus; gynaecio glabro ± 3.8 mm. longo, ovario subgloboso leviter stipitato, quam stylo 1½ breviore, stigmate conspicuo peltato. Fructus immaturus(?) atro-violascens ellipticus, apiculatus, 5–8 mm. diam., glaber, cupula loborum tomentosorum incrassatorum subtentus, pedicello incrassato breviter flavo-pubescente ad 2 mm. longo et lato.

DISTRIBUTION: Known only from Mexico.

MEXICO: Jalisco: Stream-side, San Sebastian, trail from Hacienda del Ototal to Hacienda La Indrilla, *Mexia 1699* (fl., GH). Puebla: Near Honey Station (Trinidad), *Pringle 8938* (fl., GH). Mexico: Temascaltepec: Temascaltepec, on hill, alt. 1700 m., March 27, 1933, *Hinton 3533* (fl., TYPE, GH) (large tree), *Hinton 4024* (fr., GH); Llano, Tejupilco, *Hinton 3980* (fr., GH). Guerrero: San Antonio-Buenos Aires, Montes de Oca, hill, *Hinton 14027* (fl., GH); by stream in oak-forest, Chilacayote-Soledad, Mina, *Hinton 14195* (fl., GH).

NATIVE NAME: "Laurel cimarrón" (Temascaltepec).

The new species is conspicuous for the fulvous or golden-brown pubescence found on the young branchlets, the lower surface of the usually very pale green leaves, and the inflorescence itself.

This species seems to stand alone. There are features that apparently relate it to *P. longipes* and *P. podadenia,* i.e., the inflorescence-characters, but a glance at the infructescence destroys this connection. The shape of the leaves, the difference in stigma and style, and the enlarged perianth-lobes persistently surrounding the fruit without being reflexed also separate this species from *Persea podadenia.*

18. **Persea veraguasensis** Seemann, Bot. Voy. Herald 193. 1854; Meissner in DC. Prodr. 15[1]: 51. 1864, as *P. veraguensis;* Standley in Contr. U. S. Nat. Herb. 23: 291. 1922.

Persea caerulea sensu Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925; Standley in Contr. U. S. Nat. Herb. 27: 183. 1928, in Field Mus. Publ. Bot. 18: 458. 1937; non Mez.

Persea laevigata var. *β caerulea* Meissner in DC. Prodr. 15[1]: 49. 1864, excl. spec. S. Amer.; sensu Hemsley, Biol. Centr. Am. Bot. 3: 72. 1882.

DISTRIBUTION: In woods of Costa Rica and south into Chiriquí, Panama, at altitudes of 600–2300 meters.

COSTA RICA: Without locality, *Oersted 7* (cited by Meissner under *P. laevigata β caerulea,* not seen); Patarrá, *Orozco 341* (fl., Ch). Alajuela: Open woodland of subtropical zone in semi-shade, Palmira, Alfaro Ruiz, *A. Smith H.964* (fl., A, Ch, NY). PANAMA: Chiriquí: Bajo Mono, Boquete, *Davidson 516* (fr., A, Ch, Mo); savannas of Boquete, *Davidson 753* (fl., A, Ch, Mo); Volcán de Chiriquí, *Seemann 863* (fr., TYPE of *P. veraguasensis* not seen); Río Chiriquí Viejo Valley near El Volcán, *P. White 213* (fr., Mo); in the open llanos, about a mile from Bambite, valley of the upper Río Chiriquí Viejo, *P. White 334* (fr., Mo).

NATIVE NAMES: "Aguacatillo," "Aguacate de Mico" (Standley).

This tree varies from 3 to 25 m. high, with the base 50 cm. diam., according to the collectors. The branchlets are heavily striate, angled, early densely subferruginous-sericeous, presently glabrescent and atro-rubescent or mottled green-brown. The chartaceous leaf-blades are oblong-elliptic or elliptic, often with a rhomboid base, acute, acuminate, or obtuse, dark green with lustre above, glabrescent and pale beneath or glaucescent with sericeous pubescence which may not persist. The costa above is slightly elevated and canaliculate, and the 8–10 pairs of slender lateral nerves are obscure above and conspicuous beneath. The petiole is slender to robust and rusty-pubescent to glabrescent, only faintly canaliculate, and measures to 2.5–3 cm. in length. The inflorescence consists of axillary few-flowered ferruginous-sericeous-tomentose panicles shorter than the leaves, borne on fairly stout sericeous peduncles up to 6 cm. long. The densely pubescent flowers are up to 4 mm. long, sessile or borne on pubescent pedicels less than 1 mm. long; the fleshy lobes, buff to tawny-olive according to the collectors, are unequal, the elliptic outer lobes measuring ± 1.25 mm. and the lanceolate-elliptic inner ones ± 2.15 mm. The stamens measure up to ± 2.15 mm., the hairy filaments slightly longer than the ovate or oblong anthers of the first two series. The anthers of the third series are oblong and the filaments are biglandular. The fourth series or staminodia are thin, flat, ligulate, and hairy, ± 1.7 mm. long. The gynaecium is ± 3.4 mm. long, the glabrous ovoid ovary only slightly stipitate, being nearly as long as the sparsely pubescent style, which is topped by a smallish spreading discoid stigma. The fruits are globose, apiculate, with a bluish bloom, and measure 10–11 mm. in diameter. They are subtended by a cupule formed by the persistent spreading and slightly enlarged pubescent perianth-lobes (pale green), which are supported by the slightly enlarged pubescent dark red pedicel now measuring up to 3 mm.

This species has been masquerading under the name of *P. caerulea,* which species was illustrated by Ruiz & Pavon as *Laurus caerulea* (Laurographia *t. 2.* 1802) from Peru, which is said to occur in Colombia, Venezuela, and Bolivia as well. This latter species, however, has inflorescences many-flowered, branched and spreading, and longer than the leaves. The leaf-blades are 8-23 cm. in length, with the petioles and nerves red. The fruits are less than 1 cm. in length and are seated on the persistent perianth-lobes, which are scarcely enlarged, but finally spreading or reflexed, supported by the hardly enlarged pedicel.

The nearest affinity in our locality is *P. podadenia,* found only in Mexico.

19. **Persea podadenia** Blake in Contr. Gray Herb. n.s. 52: 62. 1917; Standley in Contr. U. S. Nat. Herb. 23: 291. 1922.

Persea podadenia var. *glabriramea* Johnston in Contr. Gray Herb. n.s. 70: 69. 1924.

DISTRIBUTION: In the woods of northern Mexico, predominantly up to 1050 m. altitude, and also in the mountains of Oaxaca and Vera Cruz; possibly in British Honduras.

MEXICO: Sonora: Oak canyon near water, in the upper Sonoran region, Tepopa, Río Mayo, *Gentry 2235* (fl., A); oak-forest in moist canyon, Curohui, Río Mayo, *Gentry 3661* (fl., A, Ch); vicinity of Alamos, *Rose, Standley & Russell 13084* (fl., GH). Chihuahua: Side of a canyon in the oak-country of the upper Sonoran region, Batopilillas, Río Mayo, *Gentry 2620* (fr., A). Tamaulipas: La Vegonia, vicinity of San José, *Bartlett 10034* (fr., GH). Nuevo Leon: Scattered along arroyo in pine-oak wood, Potrero Redondo west to Puerto a Laguna Sanchez and beyond, Municipio de Villa Santiago, *C. H. Mueller 2119* (fr., A); along arroyo bottoms on trails between Potrero Redondo and Laguna Sanchez, Municipio de Villa Santiago, *C. H. Muller 2736* (sterile, GH), *C. H. Muller 2751* (fr., GH). Durango: San Ramón, April 21–May 18, 1906, *E. Palmer 119* (fl., ISOTYPE of *P. podadenia*, Ch, Mo). Vera Cruz: Orizaba, *Botteri 81* (type of *P. podadenia* var. *glabriramea* not seen). Oaxaca: Zempoaltepec, *Liebmann 768* (*Lauraceae 79*) (fl., Ch.). ?BRITISH HONDURAS: Stann Creek: All Pines, *Schipp 566* (fr., Ch, GH, NY).

NATIVE NAMES: "Laurel" (Jalisco); "Laurel," "Laurel de la sierra" (Sonora); "Salsafras" (Nuevo Leon).

Persea podadenia, a small tree or shrub, may be recognized at once by its lanceolate acutish to acuminate greenish leaves 6–15 cm. long and 2–4 cm. broad, that are glabrous and very smooth in texture, except for the slightly impressed costa on the upper surface, and beneath glaucescent with the heavy costa elevated and the delicate lateral nerves slightly so. The nerves number up to 14 pairs and usually diverge from the costa at an angle of about 45–55°. The slender pubescent to glabrous petioles are striate and canaliculate, measuring up to 2 cm. long and 1–1.5 mm. wide. The short inflorescences barely reach to one-third the length of the leaves. They are paniculate or subcapitate and completely covered with a dense golden-brown-sericeous pubescence. The flowers are about 5 mm. long including the short pedicels. The broadly ovate acute outer perianth-lobes are hairy throughout, ± 2.15 mm. long, the inner elliptic-ovate, ± 3 mm. long. The stamens of the two outer series are ± 1.7 mm. long, the ovate roundish anthers about equalling the thick pubescent style and with the cells all introrse. Those of the inner series have anthers that are oblong, the upper cells lateral, the lower laterally extrorse, and the filaments bear two subsessile reniform glands near the base. The staminodia are ± .8 mm. long, subovate, very pubescent. The stipes equal one-half the entire length. The glabrous gynaecium is ± 2.6 mm. long, the ovary ellipsoid, almost equalling the rather thick style, which is topped by a conspicuous subcapitate stigma. I have not seen the fruit of the type, but additional material shows an ellipsoid to subglobose apiculate purple-glaucous fruit subtended by perianth-lobes which have become somewhat enlarged and lignified. The lobes persist and are slightly reflexed, or their tips slough off leaving only the tube showing the line of decurrence of the lobes.

The variety described by Johnston seems from the description to be merely a variation of the species not worthy of varietal rank. I have not seen the type, which is from Orizaba, nor have I seen any material from that region which would seem to answer the description. Possibly the British Honduras specimens may match the type.

20. **Persea Standleyi,** sp. nov.

Arbor 7.5–12 m. alta, ramulis atro-rubescentibus striatis glabrescentibus dense foliosis. Folia alternata vel subverticillata, petiolis leviter pubescentibus striatis rubescentibus satis gracilibus, ad 3.5 cm. longis et 2 mm. latis, laminis utrinque glabris coriaceis in sicco viridescenti-brunneis, lanceolatis vel oblanceolatis, ad 20 cm. longis et 4.5 cm. latis, basi obtusis saepe obliquis, apice obtusis vel attenuato-acutis vel acutis vel subacuminatis, penninerviis, costa supra leviter impressa subtus valde elevata, nervis 10–12-paribus supra obscuris subtus leviter elevatis angulo 35–45° divergentibus, rete venularum supra obscuro subtus plus minusve prominulo subareolato. Inflorescentia axillaris subcapitata, foliis brevior, ad 5 cm. longa, brunneo-fulvo-sericea, pauciflora, pedunculo ad 3 cm. longo pubescente. Flores immaturi, brevipedicellati, perianthio fulvo-sericeo-tomentoso, lobis distincte 5-nervatis ovatis extus dense pubescentibus exterioribus ± 2.15 mm. longis interioribus ± 3 mm. longis; staminibus ser. I & II ± 2.15 mm. longis, antheris ovato-oblongis apiculatis, quam filamentis pubescentibus duplo longioribus, ser. III ± 2.6 mm. longis, antheris anguste ovatis obtusis filamentis pubescentibus aequalibus conspicue biglandulosis; staminodiis ovatis pubescentibus ± 0.8 mm.; gynaecio glabro ad 3 mm. longo, ovario subgloboso longitudine ⅓ gynaecii aequante brevistipitato, stigmate conspicuissime triangulari angulis decurrentibus. Fructus immaturus(?) viridis, globosus, apiculatus, 9 mm. diam., perianthii lobis pubescentibus nonnihil rigidis incrassatis (?) plus minusve persistentibus subtentus, pedicello incrassato pubescente.

DISTRIBUTION: In forests on volcanic slopes of Guatemala at an altitude of 1500–2100 m., and possibly in the region of volcanoes of Vera Cruz, Mexico.

MEXICO: Vera Cruz: Nogales, *Matuda 1118* (fl., A). GUATEMALA: Chiquimula: Volcán Quezaltepeque, 3–4 miles northeast of Quezaltepeque, *Steyermark 31491* (fr., Ch). Sololá: Trail between slopes of Volcán Santa Clara and town of San Pedro, alt. 1900–2100 m., June 6, 1942, *Steyermark 47130* (fl., TYPE, Ch) (tree 12 m.; leaves firmly membranous, deep green above, paler green beneath).

Persea Standleyi approaches *P. podadenia,* but may be separated from it by the generally larger non-glaucescent longer-petioled leaf-blades, which are subareolate-reticulate beneath, and by the lesser number of lateral nerves diverging at a smaller angle from the costa. It is possible that more complete material may prove *P. Standleyi* to be an extreme variation of *P. podadenia.*

The species is named for Dr. Paul C. Standley, who, through his collections and floristic work, has contributed greatly to our knowledge of Mexican and Central American trees and shrubs.

21. **Persea sessilis** Standley & Steyermark in Field Mus. Publ. Bot. **23:** 115. 1944.

DISTRIBUTION: Guatemala, in the mountains, at 2100–2400 m. altitude.

GUATEMALA: Zacapa: Upper slopes, Sierra de las Minas along Río Repollal to summit of mountain, alt. 2100–2400 m., Jan. 12, 13, 1942, *Steyermark 42487* (fr., TYPE, Ch) (shrub 1.5 m., leaves firmly chartaceous-subcoriaceous, dull green above, with yellow midrib, blue-silvery beneath; peduncle dull rose; fruit green, shining).

This shrub, with its stout terete densely foliose branchlets, may be easily distinguished by its lanceolate-oblong coriaceous leaves, acute to acuminate at the apex and attenuate but distinctly cordate at the base, borne on thick stout petioles so short as to make the leaves appear sessile. In the dried state, the leaf-blades are greenish brown above, castaneous-brownish beneath, the stout costa bright-castaneous, slightly impressed above and exceedingly prominent beneath. The lateral nerves, which number up to 20 pairs, are impressed and rather obscure above but delicately elevated and prominent beneath, and for the most part ascend at an angle of 55–65°, with the exception of the basal pairs which are almost at right angles to the costa. The loose reticulation is obscure on the upper and prominent on the lower surface, whereas the minute areolation apparent on the upper surface is less so on the lower. The infructescence shows the remnants of a sericeous pubescence, is shorter than the leaves (about 10–12 cm. long), and seems to be cymose-paniculate with ascending branchlets. The fruits are immature, according to Standley, green, shining, globose, about 1 cm. in diameter, and borne on the expanded and patent perianth-lobes that still persist and are pubescent. The expanded pedicel is dull rose, according to the collector.

There seems to be a relation between this species and *Persea Standleyi*, also from Guatemala. The most striking difference is the occurrence of sessile leaves in the former.

Doubtful Species of Persea

Persea psychotrioides Sprengel, Syst. Veg. 2: 269. 1825.

The type of this Mexican species has not been seen, but Mez says that it belongs with *Phoebe psychotrioides*.

Species Excluded from Persea

Persea amplexicaulis Schlechtendal & Chamisso = Phoebe amplexicaulis (Schlechtendal & Chamisso) Mez.
Persea amplifolia Mez in Standley & Calderón = Phoebe amplifolia Mez & J. D. Smith.
Persea Austin-Smithii Standley = Beilschmiedia sp.
Persea effusa Bentham & Hooker = Ocotea effusa (Meissner) Hemsley.
Persea effusa Hemsley = Phoebe effusa Meissner.
Persea Gentlei Lundell = Nectandra sp.
Persea Hartwegii (Meissner) Hemsley = Phoebe pachypoda (Ness) Mez.
Persea Matudai Lundell = Nectandra sinuata Mez.
Persea mexicana Hemsley = Phoebe mexicana Meissner.
Persea ? Orizabae Martens & Galeotti = Litsea glaucescens var. subsolitaria (Meissner) Hemsley.
Persea salicifolia (Nees) Hemsley = Phoebe salicifolia Nees.

2. Phoebe Nees

Phoebe Nees, Syst. Laurin. 98. 1836; Meissner in DC. Prodr. 15^1: 29. 1864; Mez in Jahrb. Bot. Gart. Berlin 5: 180. 1889.

Distribution: In this hemisphere in tropical and subtropical regions; found in Mexico, Central America, the West Indies, and South America. Many species occur in eastern Asia, the number of species increasing in India, and also in Malaysia and the Philippines, with a few species in New Guinea.

The trees or shrubs of *Phoebe* in Mexico and Central America have alternate or subverticillate leaves that are penninerved or triplinerved. They vary in shape, size (not more than 30 cm., usually below 12 cm. long), and texture of the leaf-blades, as well as in pubescence. The inflorescences are paniculate with no involucre. The flowers are perfect, the tube short or lacking entirely. The usually equal perianth-lobes are thin or occasionally fleshy, persistent or deciduous. The stamens of the two outer series bear anthers that are usually regularly obtusely ovate, the large introrse cells occupying the anther almost completely, the two lower cells touching the upper at their bases. The stamens of the inner or third series bear anthers that are extrorse or the two lower cells are extrorse and the two upper cells are laterally extrorse. The staminodia are conspicuous, stipitate-cordate, the stipes often pubescent. The glabrous (in this area) gynaecium consists of a subglobose or ellipsoid ovary, with a conspicuous style that is equal to or shorter than the ovary. The stigma is variable, capitate, discoid or obtuse. The fruit is ellipsoid or subglobose, and borne in a shallow cupule that frequently bears the remnants of the perianth-lobes on the margin. The cupule is seated on an enlarged pedicel which is usually expanded considerably at the apex.

KEY TO THE SPECIES OF PHOEBE

A. Leaf-blades triplinerved or subtriplinerved.
  B. Leaf-blades subtriplinerved or triplinerved, not more than 11 cm. long.
    C. Leaf-blades elliptic, usually definitely caudate-acuminate.
      D. Young branchlets, leaves, and inflorescence densely ochraceous-tomentellous; largest leaf-blades very broadly elliptic.........1. *P. Tonduzii.*
      D. Young branchlets, leaves, and inflorescence not ochraceous-tomentellous; largest leaf-blades elliptic.
        E. Inflorescence longer than leaves.
          F. Subtriplinervation obscure; all axils glandular-pubescent; leaf-blades subcoriaceous, not more than 13 cm. long; branchlets glabrous at maturity..............................2. *P. effusa.*
          F. Triplinervation conspicuous; only lowermost axils glandular-pubescent; leaf-blades usually definitely coriaceous, 15–17 cm. long; branchlets fulvo-tomentellous, becoming glabrescent...3. *P. costaricana.*
        E. Inflorescence shorter than leaves.
          F. Petioles to 9 mm. long; leaf-blades subcoriaceous to chartaceous; fruits seated fully exposed on enlarged perianth-tube...4. *P. Barbeyana.*
          F. Petioles to 2.5 cm. long; leaf-blades coriaceous; base of fruits immersed in shallow cupule.....................5. *P. Brenesii.*
    C. Leaf-blades lanceolate, oblong-lanceolate or ovate-lanceolate, acutish or acuminate, not caudate-acuminate.
      D. Apex of the leaf-blades long-falcate-acuminate; largest blades up to 22 cm. long.......................................6. *P. longipes.*
      D. Apex of the leaf-blades not falcate-acuminate; largest blades not more than 13 cm. long.
        E. Panicles never more than 6 cm. long; largest leaf-blades not longer than 9 cm. long and 2–3 cm. broad.
          F. Leaf-blades glabrous, concolorous; reticulation elevated above...7. *P. subtriplinervia.*
          F. Leaf-blades rufescent beneath and glaucous; reticulation minute, the veins deeply impressed above...............8. *P. salicifolia.*
        E. Panicles 6.5–12 cm. long, long-pedunculate; largest leaf-blades not less than 11 cm. long, usually not less than 15 cm. long.
          F. Leaf-blades areolate, glabrous..................9. *P. areolata.*
          F. Leaf-blades not areolate, softly pubescent beneath.10. *P. Arsenei.*
  B. Leaf-blades usually definitely triplinerved; largest leaf-blades not less than 11 cm. long, usually not less than 15 cm. long.
    C. Inflorescence shorter than the leaves.

D. Inflorescence composed of numerous subterminal and axillary spike-like racemose panicles up to 15 cm. long with numerous whitish gray-pubescent flowers.................................11. *P. mexicana.*

D. Inflorescence composed of axillary rather few-flowered short loose panicles usually less than 10 cm. long, more or less glabrous.

E. Leaf-blades narrowly elliptic or lanceolate, subacuminate or acute, inconspicuously reticulate, chartaceous, the base cuneate; largest leaf-blades not more than 15 cm. long..........12. *P. Ehrenbergii.*

E. Leaf-blades elliptic, acuminate or caudate-acuminate, loosely and inconspicuously reticulate (almost scalariform), chartaceous or subcoriaceous, rounded or obtuse toward the base, the extreme base narrowly cuneate; largest leaf-blades 18–20 cm. long.............. ....13. *P. neurophylla.*

C. Inflorescence longer than the leaves.

D. Subtriplinervation obscure; all axils glandular-pubescent; leaf-blades subcoriaceous, not more than 13 cm. long; branchlets glabrous at maturity..2. *P. effusa.*

D. Triplinervation conspicuous; only lowermost axils glandular-pubescent; leaf-blades usually definitely coriaceous, 15–17 cm. long; branchlets fulvo-tomentellous, becoming glabrescent............3. *P. costaricana.*

A. Leaf-blades penninerved, never triplinerved or subtriplinerved.

B. Largest leaf-blades 15–18–25 cm. long, never linear-lanceolate; leaves frequently subverticillate.

C. Base of leaf-blades cuneate, the apex caudate-acuminate; blades never more than 6 cm. broad, elliptic or lanceolate.............14. *P. chinantecorum.*

C. Base of leaf-blades obtuse, rounded or cordate or auriculate, the apex not caudate-acuminate.

D. Broadest part of the leaf-blade below the middle, the blades more or less attenuate toward the apex.

E. Leaf-blades glabrous, sessile and amplexicaul...15. *P. amplexicaulis.*

E. Leaf-blades pubescent beneath, shortly petiolate.......16. *P. mollis.*

D. Broadest part of the leaf-blade at or above the middle.

E. Leaf-blades oblong, oblong-ovate, elliptic, obovate-elliptic, or obovate-oblong, never auriculate at the base, but obtuse, rounded or cordate or recurved.

F. Apex of the leaf-blades obtuse or rounded.

G. Inflorescence not more than 11 cm. long, pubescent or glabrescent; petioles usually 5 mm. long.........17. *P. Smithii.*

G. Inflorescence not less than 15 cm. long, glabrous or pubescent; petioles 1–2.5 cm. long.

H. Leaf-blades not more than 6 cm. broad and oblong-ovate or obovate-elliptic; inflorescence branching from the base, many-flowered and glabrescent..........18. *P. obtusata.*

H. Leaf-blades not less than 7–8 cm. broad, obovate; inflorescence not branched from the base, comparatively few-flowered and pubescent................19. *P. Valeriana.*

F. Apex of the leaf-blades not obtuse or rounded. 20. *P. helicterifolia.*

E. Leaf-blades elliptic, not more than 17 cm. long, auriculate at the base, rigidly coriaceous, above shining green, glabrous, loosely and conspicuously reticulate, beneath densely minutely appressed brightly ferruginous-tomentellous..........................21. *P. Salvini.*

E. Leaf-blades elliptic, recurved at the base, up to 32 cm. long, the nervation tomentellous and areolate above, ferruginous-tomentose beneath.......................................22. *P. amplifolia.*

B. Largest leaf-blades usually not more than 13–14 cm. (rarely 15) cm. long; leaves never subverticillate.

C. Leaf-blades obovate or elliptic.
D. Lower surface of the leaf-blades closely appressed-ferruginous-tomentellous, the base auriculate............................21. *P. Salvini.*
D. Lower surface of the leaf-blades not closely appressed-ferruginous-tomentellous, the base not auriculate.
E. Leaf-blades 13.5 × 5.5 cm.; apex abruptly and obtusely acuminate, glabrous....................................23. *P. padiformis.*
E. Leaf blades not more than 8 × 3 cm.; apex variable.............
....24. *P. psychotrioides.*
C. Leaf-blades lanceolate, linear- or broadly lanceolate or elliptic, never obovate.
D. Leaf-blades attenuately linear-lanceolate, the largest not more than 2.3 cm. broad at most.
E. Leaf-blades glabrous; lateral nerves 5–7 pairs; branchlets glabrous or at most only slightly pubescent................25. *P. chiapensis.*
E. Leaf-blades minutely pubescent beneath; lateral nerves 12–16 pairs; branchlets minutely pubescent..................26. *P. tampicensis.*
D. Leaf-blades not attenuately linear-lanceolate, the largest not less than 2.3 cm. broad.
E. Lateral nerves 7–11 pairs.
F. Leaves glabrous............................27. *P. pallescens.*
F. Leaves sericeous beneath.................28. *P. acuminatissima.*
E. Lateral nerves 3–5 pairs (7 at most).
F. Pubescence of branchlets and lower leaf-surface soft.
G. Largest leaf-blades not more than 2.3 cm. broad............
....29. *P. mollicella.*
G. Largest leaf-blades not less than 2.7 cm. broad............
..................................30. *P. Bourgeauviana.*
F. Pubescence of branchlets and lower leaf-surface rough; reticulation conspicuous throughout....................31. *P. Pittieri.*

1. **Phoebe Tonduzii** Mez in Bot. Jahrb. 30: Beibl. 67: 15. 1901; Standley in Field Mus. Publ. Bot. 18: 460. 1937.

DISTRIBUTION: Known only from the forests of central Costa Rica, at an altitude of 1800 m.

COSTA RICA: San José: Tree of the forests near El Copey, alt. 1800 m., Feb. 1898, *Tonduz 11735* (fl., ISOTYPE, Ch).

NATIVE NAME: "Aguacatillo blanco" (Costa Rica).

This species cannot be confused with any other known from this region, because of the minute mustard-yellow (ochraceous) tomentum clothing the young branchlets and the entire inflorescence. The leaves are similar to those of *P. costaricana,* but are not more than 10 cm. long and 4.5 cm. broad and of a yellowish green color above, paler and brownish beneath. They are heavily coriaceous, at first thinner and covered with yellowish pubescence which soon disappears, broadly elliptic, subcaudate-acuminate at the apex, cuneate at the base. The blades are strongly triplinerviate, the venation impressed above and prominently elevated beneath. The lateral veins number about 4 or 5 pairs, and the reticulation is more prominent beneath than above. The lowermost pair of lateral nerves bears in the axils densely pubescent glands. The inflorescence, with the flowers still in bud, consists of few-flowered axillary or subterminal panicles up to 13 cm. long clustered at the tips of long peduncles up to 8 cm. long. The flowers have thick hairy ovate lobes, the stamens of the two outer series with the elliptic mucronate anthers equalling the slender filaments. The stamens of the inner series bear two reniform stipitate glands at the base of the filaments. The staminodia are broadly ovate, cordate, and sharply caudate-acuminate, equal in size to the stout pubescent stipes. The glabrous ovary is subglobose.

2. **Phoebe effusa** Meissner in DC. Prodr. 15[1]: 33. 1864; Standley in Contr. U. S. Nat. Herb. 23: 295. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925.
Persea effusa Hemsley, Biol. Centr. Am. Bot. 3: 71. 1882, non Benth.
Phoebe effusa γ *parvifolia* Meissner, l.c.

DISTRIBUTION: In forests of Mexico, in Vera Cruz and Michoacán, presumably very common, up to 2000 m. altitude.

MEXICO: Vera Cruz: About Vera Cruz and Jalapa, *Linden 13* (fl., SYNTYPE of *P. effusa* not seen), *14* (fl., SYNTYPE of *P. effusa* not seen, photo., GH), *78* (fl., SYNTYPE of *P. effusa* not seen, fragm., NY); Orizaba, in 1854, *Botteri 1039* (isosyntype of *P. effusa* γ *parvifolia*, NY); Mirador, *Liebmann 776* (*Lauraceae 44*) (fl., Ch); Totutla, *Liebmann* (*Lauraceae 48*) (fl., GH); Rancho & Barranca Remudadero, *Purpus 11163, 14184* (fl., Ch); open forests and creek-banks, Zacuapán, *Purpus 14320* (fl., Ch), *16364* (fl., Ch). Michoacán: Mt. San Miguel, Tancitaro, *Leavenworth & Hoogstraal 1071* (fl., GH, NY).

NATIVE NAMES: "Pimento," "Canelito" (Standley, 1925).

This species is one which is difficult to separate from *P. costaricana.* In both of these species there is a triplinerviate condition of the leaves, which is, however, much more pronounced in *P. costaricana* than in *P. effusa.* The latter has faintly striate terete branchlets which are fulvo-tomentellous, becoming glabrescent with age. The branchlets of *P. costaricana* are striate, sulcate, or even angled, and become quite glabrous at maturity. The leaves of *P. effusa* are variable in shape and size, the blades chartaceous to subcoriaceous, 6–13 cm. (according to the original description) long and 2–5.5 cm. broad, the base cuneate, the apex obtuse or acute to caudate-acuminate or abruptly acuminate, all variations of the apex frequently occurring on the same sheet. The lateral nerves vary from 3–6 pairs, all of equal size and all bearing pubescent glands in their axils, or the lowermost may be subtriplinerviate. The blades are glabrous throughout except for the midrib, supported by slender, canaliculate, pubescent petioles usually up to 1 cm. in length. The leaves of *P. costaricana* are also variable, having thickly coriaceous blades which measure 8–17 cm. in length and 3–6 cm. in width, with about the same variation in the apex that occurs in the leaf-blades of *P. effusa.* The base of the leaf-blades of *P. costaricana* is more attenuately cuneate. The lateral nerves usually number 4 pairs, the lowermost pair often being extremely conspicuous and bearing pubescent glands in their axils, whereas the upper pairs are obscure and glandless. The petioles are usually stout, glabrous or glabrescent, and are up to 15 mm. in length. In both species under discussion the slender loosely flowered paniculate glabrous inflorescences are usually longer than the leaves (up to 18 cm. long), and are borne on slender peduncles which make up at least half their entire length. There is a tendency for the pedicels of the flowers of *P. effusa* to be longer than the perianth; whereas those of *P. costaricana* are about equal to the perianth, rarely surpassing it. In spite of the closeness of the two entities, they seem to be separate species. No fruiting specimens are yet known of *P. effusa.*

3. **Phoebe costaricana** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. 3: 230. 1903; Standley in Field Mus. Publ. Bot. 18: 459. 1937.

DISTRIBUTION: Known in Costa Rica, from the type-locality at 640–1200 m. altitude and in Alajuela, and in Chiriquí Province, Panama, at 1000–1700 m. altitude.

COSTA RICA: Puntarenas: Canas Gordas, alt. 1200 m., Feb. 1897, *Pittier 11107* (fl., ISOTYPE, GH, NY). Alajuela: Hills above Santiago, near San Ramón, *Brenes 14404* (fl., GH). PANAMA: Chiriquí: Bajo Mono, Boquete, *Davidson 583* (fl., A, Ch, Mo); forests about Boquete, *Pittier 2998, 3146* (fl., Ch); Finca Lérida to Boquete, *Woodson, Allen & Seibert 1099* (fr., A, Ch, NY, Mo).

NATIVE NAMES: "Sigua," "Sigua blanca" (Panama).

Under *P. effusa* there is a discussion of its relationship to *P. costaricana*. The fruiting specimens from Chiriquí show loose spreading infructescences that are still slender, bearing large ellipsoid definitely apiculate fruits about 2 cm. long and 1 cm. broad. The cyathiform or subhemispherical sometimes urceolate cupule bears the remnants of the enlarged persistent perianth-lobes. The enlarged tube is frequently constricted just below the lobes. The cupule is up to 9 mm. long, rarely 1 cm. in diameter at the widest portion (below the apex of the tube), and about 5 mm. deep, and the pedicel is 6–10 mm. long and expanded at the apex to 3 mm. in diameter.

4. **Phoebe Barbeyana** Mez in Jahrb. Bot. Gart. Berlin 5: 209. 1889; Standley in Contr. U. S. Nat. Herb. 23: 295. 1922.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Vera Cruz: Near Orizaba, May 12, 1866, *Bourgeau 2436* (fl., fr., TYPE not seen, fragm. & photo., Ch, photo., NY); Orizaba, August 1866, *Bourgeau, s.n.* (fr., Ch).

This little known species bears branchlets that are yellowish-pubescent at the apex, becoming glabrous, brown and early angled, presently becoming terete. The leaves are subcoriaceous, elliptic, the base cuneate, the apex caudate-acuminate, glabrous above, somewhat shining, olive-green-brown, beneath opaque and glabrous except for the pubescent glands in the axils of the lowermost lateral nerves and sometimes the upper pairs. The leaves are penninerved, with a subtriplinerviate condition obscure on the upper surface but very conspicuous beneath. The lateral nerves number 3–5 pairs and are more or less obscure above but delicately prominent beneath, the lowermost pair being the most conspicuous. The costa is impressed above and more prominent beneath. The blade, 8–11 cm. long and 3.6–4.5 cm. broad, is subtended by a canaliculate minutely pubescent petiole up to 9 mm. long. Mez described the inflorescence as glabrous and subracemose-paniculate, shorter than the leaves. The flowers are glabrous with a short perianth-tube. The ovate acute outer lobes are slightly shorter than the inner. The glabrous filaments are one-third shorter than the anthers, which are broadly ovate, rounded at the apex, manifestly constricted at the margin over the lower cells. The staminodia are very large, broadly cordate, acuminate, glabrous with pilose stipes. The ovary is glabrous, subglobose, attenuate into a style which is almost longer, thick-cylindrical at the apex, with a subdiscoid obtuse stigma. The fruit, thickly ellipsoid, measures 11 mm. long and 8 mm. in diameter, and is seated on the lobes of the perianth, distended at the base, and the subhemispherical thickened pedicel.

Phoebe Barbeyana seems to be related to *P. neurophylla*, from Costa Rica, but has much smaller though more coriaceous leaves. The fruits of the two species are not unlike.

5. **Phoebe Brenesii** Standley in Field Mus. Publ. Bot. **18**: 459. 1937.

DISTRIBUTION: Central Costa Rica at 600–1000 m. altitude, and in Chiriquí Province, Panama, at 1140 m. altitude.

COSTA RICA: Alajuela: Near San Ramón, *Brenes 377* (*538*) (fl., Ch); Piedades near San Ramón, *Brenes 4896* (fr., Ch); "San Pedro," near San Francisco de San Ramón, *Brenes 6675* (fl., Ch); La Palma de San Ramón, *Brenes 6810* (fl., Ch); between San Miguel and La Palma de San Ramón, Feb. 14, 1933, *Brenes 17048* (fl., TYPE, Ch); Atenas, in Pacific tropical zone, in open pasture, clay-loam, *A. Smith P.2445* (fl., A). PANAMA: Chiriquí: Boquete, *Davidson 641* (fr., A, Ch, Mo).

This tree has slender angled branchlets that early lose their fulvo-tomentellous pubescence and become striate and glabrescent. The coriaceous elliptic or oblong-elliptic (rarely broadly elliptic) abruptly acuminate or caudate-acuminate leaves are triplinerved and except for the pubescent venation become glabrous very early. They are borne on slender glabrous petioles up to 2.5 cm. long, and they are up to 10 cm. long and 4 (–5) cm. broad. They bear axillary pubescent glands in the lowermost pair of lateral nerves. The inflorescence is loosely paniculate, glabrous or glabrescent, up to 12 cm. long, and usually shorter than the leaves. The peduncles are slender, glabrous, and not more than 7 cm. long. The glabrous flowers are about 3.4 mm. long, borne on pedicels ± 2 mm. long. The ovate perianth-lobes are thinnish and ± 2.5 mm. long. The two outer series of stamens measure ± 1.7 mm. long, the oblong somewhat emarginate anthers being twice the length of the slender filaments. The inner stamens, ± 2.15 mm. long, with their more narrow anthers equalling the filaments, bear two reniform stipitate glands near the base of the filaments that almost equal the anthers in length. The cordate staminodia are ± 1.4 mm. long, the pubescent stipes being almost one-half the entire length. The glabrous gynaecium, measuring ± 2.4 mm., consists of a subglobose ovary topped by a stout style slightly longer than the ovary and bearing a conspicuous capitate stigma. The fruit is oblong-ellipsoid, 12 × 5 cm., seated in a shallow cupule 5 mm. long and 5 mm. broad at the apex and 2 mm. deep, the remnants of the partially deciduous perianth-lobes forming the shallow cupule. The pedicel is thickened and up to 5 mm. long, expanding slightly toward the apex.

This species is similar to *P. mexicana* in foliage, but is at once separated by the loose spreading inflorescence, *P. mexicana* having a more spike-like strict panicle. It also recalls *P. costaricana,* but the leaves are much smaller, and the inflorescence less heavily flowered as well as shorter.

6. **Phoebe longipes** Johnston in Contr. Gray Herb. n.s. **70**: 69. 1924.

DISTRIBUTION: Mexico, known only from the type-locality.

MEXICO: Puebla: Along the river near Honey Station (Trinidad), May 6, 1904, *Pringle 8829* (fl., TYPE, GH).

This species belongs with the triplinerved group with inflorescences shorter than the leaves, but it could never be confused with any other known species in this complex. The entire plant seems to be glabrous, except for the suggestion of pubescence in the axils of the lowermost pairs of lateral nerves. The branchlets are conspicuously alate and expanded at the nodes, with a glaucous bloom which early disappears. The leaf-blades are pale green above, paler beneath, the reddish brown venation frequently standing out in contrast, like the petioles, branchlets, peduncles, and pedicels. The blades are lanceolate or oblong or narrowly ovate-lanceolate, the tips falcate-acuminate or caudate-acuminate, the bases cuneate or rounded (rarely), measuring 12–22 cm. long and 4–5.5 cm. broad. The lateral veins, except for the lowermost pairs which are triplinerved, are rather inconspicuous, numbering up to 6 pairs. The reticulation is obscure above but conspicuous and almost areolate beneath. The petioles are sturdy enough, early glaucous, and measure up to 2.5 cm. The few-flowered very slender inflorescences are axillary, up to 7 cm. long, borne on filiform peduncles up to 3 cm. long. The flowers, also with a pruinose bloom, are campanulate, almost 5 mm. long, borne on slender filiform pedicels frequently as long as 1.5 cm. The perianth-lobes are thin, membranaceous, ovate, acute, ± 2.8 mm. long. The stamens of the two outer series are ± 2.8 mm. long, and consist of slender filaments pubescent at the base and somewhat longer than the ovate obtuse anthers. The stamens of the inner series (± 2.6 mm. long) bear two large conspicuous basal glands which equal the oblong obtuse anthers. The filaments are about one and one-third the length of the entire stamens. The staminodia are triquetrous and conspicous, about 1.25 mm. long overall, borne on stout stipes that are pubescent and equalling one-half the entire length. The glabrous gynaecium measures ± 3 mm. The ovoid-ellipsoid ovary about equals the slender style, which is topped by a conspicuously three-parted stigma.

7. **Phoebe subtriplinervia** (Meissner) Standley in Contr. U. S. Nat. Herb. 23: 294. 1922.

Oreodaphne subtriplinervia Meissner in DC. Prodr. 15[1]: 125. 1864.

Ocotea subtriplinervia Hemsley, Biol. Centr. Am. Bot. 3: 74. 1882.

Phoebe Galeottiana Mez in Jahrb. Bot. Gart. Berlin 5: 200. 1889.

DISTRIBUTION: Known only from the syntypes, from Mexico.

MEXICO: Vera Cruz: Near Jalapa, *Galeotti 7061* (fl., fragm. of ISOSYNTYPE of *Oreodaphne subtriplinervia*, NY); Mirador, *Linden 17* (fl., SYNTYPE of *O. subtriplinervia* not seen).

According to the original description, this is a very glabrous species. The single leaf available is coriaceous, lanceolate, acuminate, obscurely subtriplinerviate, and with the exception of the more prominent costa, slightly elevated above and very conspicuously so beneath, the venation is everywhere of about the same size and prominence. The blade is glabrous throughout except for the pubescent axillary glands of the lowermost lateral nerves. The margin is undulate and the blade is up to 6.5 cm. long and 1.5 cm. broad, the broadest portion below the middle. It is subtended by a slender canaliculate glabrous petiole up to 1 cm. long. The entire blade throughout is prominently reticulate. Meissner describes the racemes as axillary and subterminal, about 2.5 cm. long, 5-flowered, with nodding pedicels (peduncles?) up to 6.5 mm. long. The white or yellow flowers are 1 line long, and the lobes of the perianth are deciduous. From the cited fragment of the Galeotti number, I find the flower to be about 2 mm. long, supported by a slender almost glabrous pedicel nearly twice its length. The broadly ellipsoid perianth-lobes are ± 1.7 mm. long and thickish, with a suggestion of papillae near the apex. The two outer series of stamens are ± .8 mm. long, the almost square anthers nearly once and a half times the length of the fairly slender filaments. The stamens of the inner series are 1 mm. long and bear at the base of the filaments two very conspicuous and spreading sessile glands. The gynaecium is glabrous, ± 1.25 mm. long, consisting of a scarcely stipitate subglobose ovary equalling the tapering style, which is capped with an inconspicuous stigma decurrent down one side of the style.

With the scanty material at hand it is impossible to say with certainty what the affinity of the entity may be. Possibly it is somewhere near *P. salicifolia* or its allies.

8. **Phoebe salicifolia** Nees in Linnaea 21: 488. 1848; Standley in Contr. U. S. Nat. Herb. 23: 295. 1922.

Persea salicifolia Hemsley, Biol. Centr. Am. Bot. 3: 72. 1882.

DISTRIBUTION: Central Mexico; very little material available.

MEXICO: State unknown, near Regla, *Ehrenberg 875* (fl., fragm. of TYPE, Ch): Hidalgo: Jacala, in deep ravine, *Chase 7311* (fr., Ch, GH, NY).

This species, so little known, has branchlets that become glabrescent and are first somewhat angled, later terete and finely striate. The leaves are lanceolate to oblong-lanceolate, acuminate or subacute, subtriplinerved, glabrous above except for the costa, subcoriaceous, glaucous, pale green in dried state, paler beneath, the blades up to 9 cm. long and 2 (–3.2) cm. broad. The reticulation is minute, the veins deeply impressed above and prominently elevated beneath. The costa is impressed above and conspicuously elevated beneath. The 4 or 5 pairs of lateral nerves are inconspicuous above and slightly more conspicuous beneath, except for the long lowermost pair, in the axils of which are pubescent glands. The inflorescence is not more than 4 cm. long, slender, glabrous, axillary, with a long peduncle, few-flowered. The flowers are glabrous, campanulate, up to 3.3 mm. long, with a slender pedicel ± 4.25 mm. long. The ovate perianth-lobes measure ± 2.15 mm. long and are thinnish and hairy inside near base. The two outer series of stamens measure ± 1.25 mm., the oblong mucronate anthers equalling the slender filaments. The stamens of the inner series are slightly longer, ± 1.5 mm., and bear two reniform short-stipitate glands at the base of the filaments almost the length of the anthers. The staminodia are ± 1 mm. long, triangular, with pubescent stipes more than half the entire length of the staminodia. The gynaecium is glabrous, ± 1.7 mm. long, the globose ovary not quite equalling the slender style in length. The stigma is conspicuous, almost peltate. The fruit is subglobose-ellipsoid and dark purple in the dried state, 13 × 10 mm., and seemingly slightly stipitate. It is seated on a cupule which is infundibuliform and measures 6 mm. long and 6 mm. broad at the apex. The pedicel is thickened and about 4–5 mm. long. The perianth-lobes, persisting at the apex of the shallow cupule for about 2 mm. in depth, presently break off irregularly, leaving a flat disk to which the stipe of the fruit is attached.

The nearest relatives of the species are *P. areolata* and *P. Arsenei*. Their differences will be discussed under the latter species.

9. **Phoebe areolata** Lundell in Contr. Univ. Mich. Herb. 7: 13. 1942.

DISTRIBUTION: In the mountains of Mexico and in British Honduras.

MEXICO: Chiapas: Saxchanal, Sierra Madre, alt. 2700 m., July 1, 1941, *Matuda 4296* (fl., A, TYPE — Mich, NY). BRITISH HONDURAS: Stann Creek: Mountain ridges, 19 mile, Stann Creek Valley, *Schipp 971* (fr., Ch, GH, NY); Pine Peak, Cockscomb branch of South Stann Creek, *Stevenson XII, XVI* (fl., Ch).

Outstanding are the glabrous conspicuously areolate ovate-lanceolate leaves of this species. The blades are rounded at the base and acuminate at the apex, up to 11 cm. long and 4 cm. broad, supported by glabrous canaliculate petioles up to nearly 1 cm. long. The costa is slightly impressed, but brownish and conspicuous against the green blade above, and the lateral nerves are obscure. Beneath both are elevated. The lateral nerves are 4–6 pairs, all bearing pubescent glands in their axils, the lowermost pair simulating a triplinerviate condition. The axillary rather few-flowered paniculate inflorescences, up to 12 cm. long, are very sparsely pubescent, and are borne on rather slender reddish brown peduncles up to 7 cm. long. The campanulate flowers, about 3.5 mm. long, are subtended by long (7 mm.) pedicels and the ovate lobes are fairly fleshy. The two outer series of stamens are ± 1.9 mm. long, the ovate apiculate anthers being only slightly shorter than the filaments. The anthers of the inner series of stamens, which measure ± 2.15 mm., are oblong, and the filaments bear two small subbasal stipitate glands. The ovate acuminate staminodia are ± 1 mm. long, with pubescent thick stipes somewhat less than half the entire length. The glabrous ellipsoid ovary nearly equals the style, which is crowned by a conspicuous peltate stigma.

The closest affinities of the species are with *P. salicifolia* and *P. Arsenei.* A discussion will be found under the latter species.

10. **Phoebe Arsenei,** sp. nov.

Arbor, ramulis fulvo-tomentosis deinde glabrescentibus valde striatis. Folia alternata, petiolis fulvo-tomentosis canaliculatis ad 1.3 mm. longis et 1.5 mm. latis, laminis juventute utrinque molliter pubescentibus mox supra glabris nitidis subtus molliter pubescentibus, subcoriaceis, in sicco pallide viridibus vel viridi-brunneis, ellipticis, ad 13 cm. longis et 4 cm. latis, basi cuneatis vel leviter obtusis, apice acuminatis vel obtuse acuminatis raro emarginatis, penninerviis vel subtriplinerviis, costa supra impressa pubescente subtus elevata, nervis lateralibus 5–7 paribus leviter elevatis, rete venularum supra minuto et valde impresso, subtus conspicue prominulo. Inflorescentia axillaris et subterminalis paniculata ad 10 cm. longa, glabra, pauciflora, longipedunculata, pedunculo gracili ad 7 cm. longo leviter pruinoso. Flores ad 3 mm. longi, brevipedicellati, pedicellis ad 2.5 mm. longis gracilibus, perianthio campanulato, lobis ovatis acutis membranaceis, ± 2.15 mm. longis ad basin incrassatis; staminibus ser. I & II ± 1.1 mm. longis, antheris ovato-ellipticis obtusis filamentis crassis pubescentibus duplo longioribus, ser. III ± 1.7 mm. longis biglandulosis, glandulis reniformibus stipitatis antheris oblongis emarginatis aequalibus; staminodiis ovatis membranaceis brevistipitatis, basi pubescentibus, ± 1 mm. longis; gynaecio glabro ± 1.9 mm. longo, ovario subgloboso stylo subaequali, stigmate subcapitato conspicuo. Fructus ignotus.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Michoacán: Vicinity of Morelia, Rincón, alt. 1950 m., April 11, 1909, *Arsène 2448* (fl., TYPE — GH, NY).

This species seems to be very near *P. areolata* and *P. salicifolia.* It is separated from the former by its softly pubescent lower leaf-surface and branchlets and its conspicuously reticulate lower leaf-surface. *Phoebe areolata* is practically glabrous throughout, the axils of the very prominent triple-nerves at the base show conspicuous pubescent glands, and the blades are conspicuously areolate. The shorter inflorescence and leaves of *P. salicifolia* separate the two species.

11. **Phoebe mexicana** Meissner in DC. Prodr. 15[1]: 31. 1864; Standley in Contr. U. S. Nat. Herb. 23: 294. 1922, in Trop. Woods 21: 17. 1930, in Field Mus. Publ. Bot. 10: 201. 1931; Standley & Record in op. cit. 12: 144. 1936; Standley in op. cit. 18: 459. 1937; Yuncker in op. cit. 9: 290. 1940.

Persea cinnamomifolia Hemsley, Biol. Centr. Am. Bot. 3: 71. 1882, non H.B.K.

Phoebe mexicana var. *Bourgeauana* Mez in Jahrb. Bot. Gart. Berlin 5: 214. 1889.

DISTRIBUTION: Generally throughout southwestern Mexico and Central America, at varying altitudes from 15 m. along the coast to 2800 m. in the mountains of Guatemala.

MEXICO: Vera Cruz: In the valley of the city of Cordoba, April 20, 1866, *Bourgeau 2302* (fr., isotype of *P. mexicana* var. *Bourgeauana*, Ch); Fortuño, Coatzacoalcos River, *L. Williams 8920* (fr., A, Ch, NY), *9142* (sterile, A); near Jalapa, *Galeotti 7026* (SYNTYPE of *P. mexicana* not seen); Mirador, *Linden 20* (fl., SYNTYPE of *P. mexicana*, fragm. & photo., Ch, photo., NY), *Liebmann Lauraceae 70* (fl., NY), *71* (fl., GH), *75* (fl., Ch), *77* (fl., GH); Zacuapán, rocky plains, *Purpus 5991* (fl., GH), *14328* (fl., Ch). Oaxaca: Vicinity of Cafetal Concordia, *Morton & Makrinius 2444* (young fruit, Ch). Chiapas: Escuintla, *Matuda 1082, 2632* (fl., A, NY). GUATEMALA: Huehuetenango: Cerro Cananá, between Nucapuxlac and Cananá, Sierra de los Cuchumatanes, *Steyermark 49045* (fr., Ch). Retalhuleu: Vicinity of Retalhuleu, *Standley 88624* (fl., Ch). HONDURAS: Comayagua: River bank on plains near Siguatepeque, *Yuncker, Dawson & Youse 5811* (fr., GH). Tegucigalpa: Mont. de la Flor, pine and oak region near river, *C. & V. W. von Hagen 1227* (sterile, NY). Yoro: Subirana, in open semi-tropical valley, *C. & V. W. von Hagen 1051* (sterile, NY); vicinity of Coyoles, in the Aguan River valley, *Yuncker, Koepper & Wagner 8630* (fr., Ch, GH, NY). Atlántida: In deep forest near Lancetilla, *Yuncker 4945* (fr., Ch). BRITISH HONDURAS: El Cayo: Opposite Vaca on hillside, *Gentle 2499* (fl., A, NY). Stann Creek: Middlesex, along creek in broken ridge, *Gentle 2941* (fr., A, NY); Big Eddy Ridge, in broken ridge, *Gentle 3549* (fr., A, NY). Toledo: Hope Creek, along river-bank, *Schipp 281* (fr., Ch, GH, NY). COSTA RICA: San José: Near the River Virilla, on old trail from Heredia to San José, *Brenes 20560* (fr., Ch); between the graveyard Calvo and the Río María Aguilar, *Rojas 404* (fl., Ch); vicinity of El General, *Skutch 4042* (fr., A, NY); vicinity of San José, *Standley 47344* (fl., Ch). Alajuela: Atenas, in Pacific tropical zone in clay-loam pasture, *A. Smith P.2440* (fl., A); Alajuela, in the mountains, *Torres 115* (fl., Ch). PANAMA: Canal Zone: Near Culebra, *Pittier 3438* (fl., GH); hospital grounds at Ancon, *Pittier 3957* (fr., GH).

NATIVE NAMES: "Aguacatillo" (Honduras, Costa Rica); "Aguacate negro" (Honduras); "Boy Job," "Wild Pear" (British Honduras).

This species is distinct because of the numerous strict raceme-like panicles with very short branchlets which are borne so close to the main axis as to give a spike-like appearance to the panicles. The branchlets are reddish black and sulcate, becoming striate and glabrous at maturity. The leaf-blades are coriaceous with varying degrees of pubescence, usually entirely glabrous above and often so beneath except for the pubescent glands in the axils of the lower pair of lateral nerves. The blades are elliptic, lanceolate or oblong-lanceolate, cuneate at the base or somewhat obtuse or rounded, usually acuminate to caudate-acuminate at the apex, up to 15 (–26) cm. long and 5 (–10) cm. broad. The margin is very often slightly undulate, and the costa is impressed above and very prominently elevated beneath. The lateral nerves are except for the lowermost pair rather obscure, less so beneath than above, and they number up to 7 pairs. The lowermost are conspicuous and diverge from the costa at an angle of about 25°, ascending nearly to the middle of the blade before reaching the margin. The uppermost pairs diverge at an angle of about 55°. The petioles are stout, canaliculate, glabrescent to glabrous, and measuring up to 2 cm. in length.

The numerous inflorescences are many-flowered, pubescent to glabrescent, reddish, with peduncles not more than 5 cm. and usually much less in length. The small white flowers are sessile to shortly pedicellate and fulvous-pubescent. The flowers are 3–4 mm. long, campanulate, with perianth-lobes thin, ovate, and ±2.6 mm. long. The stamens are ± 2.15 mm. long, the slender filaments about equalling the elliptic anthers. The filaments of the inner series of stamens bear two subreniform stipitate glands at their bases, equalling about one-third the entire length of the stamens. The glabrous gynaecium, ± 2.6 mm. long, consists of a subglobose to obovate substipitate ovary topped by a slender style one and a third times longer than the ovary. The stigma is conspicuous, dilated, and discoid. The glabrous fruits are slightly obovoid, apiculate, about 1 cm. long and 7 mm. broad, seated on a glabrous cupule that is campanulate, about 5 mm. long, 7 mm. broad, and ± 2 mm. deep, which bears the rather brittle remains of the perianth-lobes. The pedicel is enlarged somewhat to about 5 mm. long.

The variety, according to Mez, differs from the species in bearing leaf-blades which are always obtusish at the base, perianth-lobes which remain erect in fruit, pedicels less thickened, and fruits that are definitely subglobose, 8 mm. long and 6 mm. broad. This variation does not seem to warrant a varietal status. To my mind it is merely another manifestation of the species proper.

12. **Phoebe Ehrenbergii** Mez in Jahrb. Bot. Gart. Berlin 5: 201. 1889; Standley in Contr. U. S. Nat. Herb. 23: 294. 1922.

Phoebe Hartmanii Johnston in Contr. Gray Herb. n.s. 70: 69. 1924.

DISTRIBUTION: Known only from northwestern and central Mexico, 450–1960 m. altitude, in arroyos.

MEXICO: Sonora: Arroyos of the tropical Sonoran regions, Vinata, Río Mayo, *Gentry 1478* (fr., A, Ch); deep canyon-bottom in short-tree forest, Arroyo Gochico, Río Mayo, *Gentry 3629* (fl., A, Ch), *3630* (fr. & young fr., A, Ch). Chihuahua: Batopilas, April, 1892, *Hartman 1029* (fl., young fr., isotype of *Phoebe Hartmanii,* Mo); Ocampo River, Río Mayo headwaters, *LeSueur 1246* (abnormal fl., Ch, GH). Sinaloa: *Ortega 4617* (abnormal fl., Ch). Jalisco: Arroyo de los Hornos, Hacienda del Ototal, w. of San Sebastian, Sierra Madre Occidental, common along streamside, *Mexia 1803* (fr., A, Ch, GH). Mexico: Temascaltepec, *Ehrenberg 712* (fl., fragm., TYPE of *P. Ehrenbergii,* Ch, photo., Ch, NY); Rincón, *Hinton 378* (abnormal fl., GH, NY), *3032* (abnormal fl., GH); Ypericones, *Hinton 3895* (abnormal fl., fr., GH); Berros, *Hinton 5771* (fl., fr., GH); Carboneras, *Hinton 6826* (abnormal fl., GH).

NATIVE NAMES: "Aguacatillo" (Mexico); "Bebelama" (Sonora).

Some of the cited specimens have been placed in *Persea,* and many sheets have also been identified as *Sassafridium macrophyllum,* the type of which is none other than the widespread *Nectandra globosa.* An examination of the type-material of the two species *P. Ehrenbergii* and *P. Hartmanii* seems to place the entity in the triplinerved group of *Phoebe.*

The entire tree seems to be glabrous, the young branchlets striate, somewhat angled, losing their early tomentellous condition. The elliptic or occasionally oblong leaf-blades are pale green, chartaceous, glabrous, measuring up to 15 cm. long and 4–5 cm. broad. They are usually cuneate at the base, occasionally obtuse, and the apex is acute or acuminate. The midrib and lowermost lateral nerves are more conspicuous than the delicate upper lateral nerves, which number as many as 5 pairs. The minute reticulation is obscure on the upper surface and less so on the lower. The inflorescence is slenderly paniculate, up to 12 cm. long, few-flowered, and more or less pruinose. The somewhat pruinose flowers are nearly 5 mm. long, subtended by slender pedicels of equal length or slightly longer. The subequal perianth-lobes are elliptic, thin, slightly pubescent at the inner surface near the base, and ± 2.8 mm. long. The stamens are ± 1.7 mm. long, the ovate or oblong anthers equalling the stoutish filaments. Those of the inner series bear two reniform subsessile glands at the base about one-third the length of the entire stamen. The staminodia are nearly sessile, ovate, cordate, and ± 0.8 mm. long. The glabrous gynaecium is 2.5–3 mm. long, the globose ovary being about ⅔ the entire length. The slender style is topped by a conspicuous capitate stigma. The fruit is ellipsoid, minutely apiculate, measuring 12 × 8 mm., subtended by a shallow spreading reddish pruinose cupule 4–6 mm. long and 8 mm. broad at the flat disk-like apex. The pedicel is about 3 mm. long and slightly enlarged. The perianth-lobes approaching anthesis develop an abscission layer about one-half their length, and the upper half is early deciduous. The lower portion of the lobe persists well into the fruiting stage, and finally when the fruit is mature falls off. The specimens from Jalisco are somewhat like *P. longipes* in leaf-shape, and possibly may eventually prove to be the fruiting stage of that species. More material is needed to be able to determine this, however.

13. **Phoebe neurophylla** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. **3**: 231. 1903; Standley in Field Mus. Publ. Bot. **18**: 460. 1937.

DISTRIBUTION: Costa Rica, in forests and on river-banks at varying altitudes up to 1900 m. Possibly in Mexico at very low altitudes.

MEXICO: Oaxaca: (?) In llanos, Tuxtepec, Chiltepec, and vicinity, *Martínez-Calderón 119* (fl., A). COSTA RICA: Puntarenas: On the banks of the River Hur, valley of the Diquis, alt. 800 m., March 15, 1898, *Pittier 12054* (fr., ISOTYPE, US) (small tree). Alajuela: Continental divide 2 miles n.w. of Zarcero, at edge of forest in rich humus, *A. Smith 142* (fl., Ch). San José: Vicinity of El General, *Skutch 3844* (fl., A, NY), *4329* (fr., A, Ch, NY).

This species is very near *P. costaricana* in vegetative characters. The chartaceous to coriaceous elliptic leaf-blades, rounded or obtuse toward the base, the extreme base narrowly cuneate, the apex acuminate or acuminate-caudate, up to 21 cm. long and 7 (–8) cm. broad, are glabrous except for the distinctly pubescent glands in the axils of the lowermost pair of lateral nerves. The upper pairs of lateral nerves are obscure, numbering 3 or 4 and obscurely camptodromous, giving the impression of a typically triplinerviate leaf. Transverse venation is usually fairly inconspicuous. The axillary and subterminal inflorescence, unlike that of *P. costaricana,* is short, not longer than 6 cm., and is glabrous throughout and comparatively few-flowered, with peduncles not more than 2 cm. long. The whitish campanulate flowers are about 4 mm. long, the thin ovate acute lobes almost equalling the tube, and are subtended by slender filiform pedicels up to 5 mm. long. The two outer series of stamens are approximately 1.9 mm. long, the rounded ovate anthers almost as long as the slender filaments. The inner series measure ± 2.15 mm. long, the large conspicuous glands almost equalling one-half the length of the entire stamens. The large conspicuous staminodia are subcordate, ± 1.25 mm. in length, the thick stipes equalling one-half the entire length. The glabrous gynaecium is about 3 mm. long, the style one and one-third times the length of the subglobose ovary. The stigma is spreading, discoid, and conspicuous. The fruit is a green ellipsoid apiculate berry, 18 × 12 mm., subtended by a flaring shallow red cupule, more or less minutely rugose, with an entire margin. The cupule is less than 5 mm. long, 1.3 cm. in diameter, and not more than 2–3 mm. deep. The enlarged pedicel is up to 12 mm. long and is expanded to 5 mm. at the apex.

14. **Phoebe chinantecorum** Schultes in Bot. Mus. Leafl. Harvard Univ. **9**: 170. 1941.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Oaxaca: Dark forest, San Juan Lalana, Choapam, alt. 550 m., May 8, 1939, *Schultes & Reko 827* (fl., ISOTYPE, GH) (small slender weak tree).

NATIVE NAME: "Mo-gwu" (Oaxaca).

This little known species has slender branchlets, as well as petioles, clothed with a dense ferruginous tomentum, the former bearing at the apex a subverticillate whorl of large elliptic or lanceolate-elliptic chartaceous leaves slightly petiolate or subsessile, cuneate at the base and caudate-acuminate at the apex. The blades measure up to 20 cm. in length and 6 cm. in width, the upper surface shining and glabrous except for the pubescent costa, the lower densely pubescent on the venation. The few-flowered subpyramidal paniculate inflorescences are up to 6.5 cm. long (or more?), the slender pubescent peduncle up to 4.5 (–6) cm. The campanulate flowers are about 3.5 mm. long, equalling the slender glabrescent pedicels. The oblong lobes are fleshy, ± 2.5 mm. long. The somewhat petaloid stamens of the two outer series measure ± 1.25 mm.; the anthers are subsessile and more or less oblong, the connective tissue occupying the upper third of the anthers. Those of the inner series have anthers obovate, longer than the stout pubescent filaments bearing two sessile glands equalling them in length. The staminodia are cordate, ± 0.7 mm. in length, the stipes almost the entire length. The glabrous gynaecium is ± 1.5 mm., the ovoid or subglobose ovary shortly stipitate and bearing a short thick style with the subcapitate stigma at its apex.

Very probably the species is but a variation of the widespread *P. helicterifolia*. Further collections may show a line of development toward this type.

15. **Phoebe amplexicaulis** (Schlechtendal & Chamisso) Mez in Jahrb. Bot. Gart. Berlin **5**: 216. 1889; Standley in Contr. U. S. Nat. Herb. **23**: 293. 1922.

Persea amplexicaulis Schlechtendal & Chamisso in Linnaea **5**: 90. 1830; Nees, Syst. Laurin. 137, 672. 1836 (excl. var.), in Linnaea **21**: 490. 1838; Meissner in DC. Prodr. **15**^{1}: 54. 1864 (excl. var.); Hemsley, Biol. Centr. Am. Bot. **3**: 71. 1882.

DISTRIBUTION: Known only from the mountains of Mexico.

MEXICO: Mexico: Cerro Colorado, in mountains, *Schiede & Deppe 87* (fr., TYPE of *Persea amplexicaulis* not seen, photo., GH).

The single collection of this species may very possibly be a fruiting specimen of *P. mollis* which has become glabrous with age. The variation of leaf-base shape in this complex is so great that one might reasonably expect to find within a species sessile amplexicaul leaves grading into shortly petiolate cordate leaves. Until the type of *P. amplexicaulis* is available for direct comparison, I shall maintain it as a distinct species.

Schlechtendal and Chamisso describe the leaf-blades as glabrous, coriaceous, as opposed to those of the latter species *P. mollis*, subsessile, oblong, cordate-amplexicaul at the base, long-acuminate into an obtuse acumen with a slight margin. The leaves measure nearly 12 cm. long and about 2 cm. broad. The axillary few-flowered cymes are long-pedunculate, with the peduncles filiform, the entire cymes measuring nearly 6.5 cm. long. The fruit is less than 1 cm., and the flowers unknown.

16. **Phoebe mollis** Mez in Jahrb. Bot. Gart. Berlin 5: 192. 1889; Standley in Contr. U. S. Nat. Herb. 23: 293. 1922.

DISTRIBUTION: Known only from Mexico and western Guatemala at 1300–2100 m. altitude.

MEXICO: Without locality, *Haenke s.n.* (fl., TYPE not seen), possibly an isotype (labeled *1562* in Ch). GUATEMALA: San Marcos: Above Finca El Porvenir, on "Todos Santos Chiquitos," lower south-facing slopes of Volcán Tajumulco, *Steyermark 37201* (fl., Ch). Suchitepéquez: Upper forested slopes of barranco by Loma Grande, above Finca El Naranjo, on Volcán Santa Clara, *Steyermark 46854* (fl., Ch).

Phoebe mollis is near *P. amplexicaulis* in leaf-shape, and eventually, with more material for study, may prove to be a flowering specimen of that species. The branchlets are heavily fulvous-tomentose. The coriaceous or subcoriaceous leaf-blades are oblong-lanceolate, rounded or cordate at the base, and long-acuminate at the apex, measuring up to 18 cm. long, although usually 10–15 cm., and 5–6 cm. broad, subtended by stout tomentose petioles up to 1 cm. long. The impressed costa is visible above and frequently tomentose; the lateral nerves are obscure and number upwards of 10 pairs, diverging at an angle of 60–80°, and are inconspicuous like the reticulation. Beneath, the costa and lateral nerves are conspicuously elevated and tomentose, and the reticulation for the most part prominent. The slender few-flowered paniculate inflorescence is early heavily fulvous-tomentose, later becoming glabrescent. The slender peduncle is up to 8 cm. long. The pubescent flowers are about 3 mm. long with pedicels ± 1.7 mm. Their perianth-lobes are broadly rotund-ovate, subacute, rather thick and ± 1.7 mm. long. The rotund-ovate anthers of the two outer series of stamens are about twice the length of the filaments, the entire length being ± 1 mm. long. Those of the inner series are more or less obtusely ovate, with two sessile basal glands the length of the filaments. The original description mentions sagittate stipitate staminodia. The flowers I have dissected are not fully developed and show at most thin strap-shaped structures. The glabrous ovary is topped by a short style and more or less inconspicuous stigma.

17. **Phoebe Smithii**, sp. nov.

Arbor ad 15 m. alta, ramulis sulcatis dense fulvo-tomentosis vel glabrescentibus. Folia alternata vel subverticillata, juventute membranacea plus minusve molliter pubescentia, mox coriacea et sparse pubescentia dense praesertim nervationibus, petiolis robustis dense fulvo-pubescentibus ad 5 mm. longis, laminis ellipticis vel obovatis vel oblongo-ellipticis, 11–15 (–20) cm. longis et 5–6 (–8) cm. latis, basi cordatis, obtusis, vel rotundatis, apice rotundatis, obtusis, vel obtuse subacuminatis, penninerviis, costa supra leviter subtus conspicue elevata, nervis lateralibus 8–10-paribus supra leviter subtus prominule elevatis, angulo 35–45° divergentibus, rete venularum supra obscuro subtus laxo et conspicuo. Inflorescentia axillaris et subterminalis paniculata, pedunculo et rhachi satis pubescentibus, ramulis ultimis et floribus glabris glaucis. Flores magni 5–6 mm. longi et 15 mm.

diam., pedicellis gracilibus ad 7 mm. longis; perianthii lobis ellipticis carnosis intus papillosis ad 4.5 mm. longis; staminibus ser. I & II ± 1.9 mm. longis, filamentis brevibus, antheris subreniformibus et subpetaloideis; staminibus ser. III antheris subrectangularibus filamentis conspicue biglandulosis aequantibus; staminodiis conspicuis ovatis brevistipitatis, ± 1 mm. longis; gynaecio glabro ± 2.5 mm. longo subgloboso ovario brevistipitato stylo subaequali; stigmate conspicue discoideo. Fructus ellipsoideus minute apiculatus 3 cm. longus et 1.8 cm. latus, cupula hemisphaerica 1 cm. longa et 1.5 cm. diam. et 6 mm. alta subtentus, pedicello robusto 8 mm. longo et utrinque 4 mm. diam.

DISTRIBUTION: Known only from Alajuela and San José in Costa Rica, at 1800–2200 m. altitude.

COSTA RICA: Alajuela: Hills above Baranca de Zarcero, at edge of forest, March 22, 1938, *A. Smith P.C. 367* (fl., TYPE, Ch) (tree 15 m.; leaves coriaceous, shining, flowers cream-yellow; fruit green; cupule crimson), *H. 523* (fl., Ch); Zarcero, Alfaro Ruiz, *A. Smith 10072* (fr., A). San José: El Tablazo de San José, *Valerio 34* (fr., Ch).

This species, with its fulvous-tomentose sulcate branchlets, has characteristics very like those of *P. Valeriana*. It also recalls the variable *P. helicterifolia,* but is easily separated by the much shorter inflorescences with a glaucous bloom.

18. **Phoebe obtusata** Lundell in Contr. Univ. Mich. Herb. 6: 21. 1941.

DISTRIBUTION: Known only from type-locality.

MEXICO: Chiapas: Buena Vista, near Escuintla, Jan. 1938, *Matuda 1887* (fl., TYPE, Mich).

This species is related to the *P. helicterifolia* complex but may be separated by the longer very full-flowered inflorescences, which are subterminal and branch profusely. The usually smaller leaves with obtuse or rounded apices and the shorter less harsh pubescence also serve to distinguish Lundell's species.

The stout branchlets are densely fulvous-tomentose. The leaves are alternate or subverticillate at the apex of the branchlets, the blades oblong-ovate to obovate-elliptic, up to 16 cm. long and about 6 cm. broad, rounded or obtuse at the base, occasionally subcordate, the apex obtuse or rounded. The petioles are stout, densely tomentose, up to 1.2 (–1.5) cm. long. The costa and nerves are impressed above and would be obscure were it not for the pubescence persisting on them after the upper surface of the leaf becomes glabrous or glabrescent. Beneath, they are conspicuously elevated and densely tomentose. The lateral nerves number to 9 or 10, the extreme upper pairs obscure, and diverge from the costa at an angle of about 45°. The axillary or subterminal inflorescence consists of a main terminal stalk or panicle (to 22 cm. long) with 1–3 shorter panicles (8–15 cm. long) branching from the base of the peduncle, which is short, stout and pubescent. The pubescence disappears toward the apex of the inflorescence. The entire inflorescence has a purplish cast extending to the perianth-tube. The flower is similar to that of *P. helicterifolia*. In fact, it is probable that more abundant collections will prove the two entities to be conspecific, with only geographical or ecological variation.

19. **Phoebe Valeriana** Standley in Field Mus. Publ. Bot. 18: 460. 1937.

DISTRIBUTION: Costa Rica, in forests at 1050–1800 m. altitude.

COSTA RICA: Alajuela: Region of Zarcero, upper tropical zone within Atlantic cloud-forest, *A. Smith H. 268* (fl., Ch, NY); La Peña, Alfaro Ruiz, Caribbean cloud-forest, *A. Smith P. 2120* (fl., A); woods of Los Angeles de San Ramón, near La Paz, *Brenes 4185* (*197*) (fl., Ch); Los Angeles and La Paz de San Ramón, *Brenes 6099* (fl., fr., Ch). San José: Forests of El Copey, Feb. 1898, *Tonduz 11746* (fl., TYPE, Ch, fr., US); Santa Maria de Dota, *Stork 2405* (fr., Ch).

NATIVE NAME: "Quizarrá" (Costa Rica).

The species has stout angled sulcate branchlets covered with a dense yellowish or brownish tomentum, eventually becoming more or less glabrescent. The petioles are canaliculate, thick, and equally tomentose, up to 2.5 cm. long. The subcoriaceous blades are obovate or occasionally oblong, 12–15 (–21) cm. long and 4–8 (–11) cm. broad, the base obtuse to cuneate, occasionally rounded, the apex rounded and sometimes emarginate to abruptly and shortly acuminate. The upper surface is scattered-pilose, the venation densely pubescent; the lower is more densely and softly tomentose. The costa and lateral nerves, of which there are 8 pairs diverging at an angle of about 45°, are slightly elevated above and prominently so beneath. The inflorescences are numerous tomentose axillary panicles up to 17 cm. long, the stout peduncles up to 8 cm. long, the subtending leaves frequently deciduous. The flowers are large, up to 5 mm. long and 8.5 mm. in diameter, the lobes spreading. The lobes are thin, elliptic, acute or obtuse, up to 4.25 mm. long. The stamens of the two outer series are ± 1.7 mm. long, the anthers almost sessile, ovate, apiculate. Those of the outer series are ± 2.15 mm. long, and the subrectangular anthers are only slightly longer than the stout filaments that bear two conspicuous subglobose subsessile glands. The staminodia are ± 0.8 mm. long, conspicuous, ovate or triangular, the stipes one-half the entire length. The glabrous gynaecium is ± 2.5 mm. long, the subglobose shortly stipitate ovary bearing a stout style and conspicuous capitate stigma of almost equal length. The fruit is subobovate-elliptic, obtusely apiculate, 3.3 cm. long and 1.5 cm. broad, including the stout stipe, which is about 6 mm. long and 7 mm. in diameter at the apex. The subtending cupule is hemispherical, about 12 mm. long, 13 mm. in diameter, and 6 mm. deep. The pedicel is short, not more than 3–4 mm. long, and about 6 mm. in diameter at the apex.

Standley relates the species to *P. betazensis,* a synonym of *P. helicterifolia.* It is also closely allied to the Mexican species *P. obtusata,* which has smaller leaf-blades and a more copiously flowered inflorescence branched from the base and glabrescent.

20. **Phoebe helicterifolia** (Meissner) Mez in Jahrb. Bot. Gart. Berlin **5**: 193. 1889; Standley in Contr. U. S. Nat. Herb. **23**: 294. 1922, in Trop. Woods **21**: 17. 1930; Standley & Record in Field Mus. Publ. Bot. **12**: 144. 1936; Yuncker in Field Mus. Publ. Bot. **9**: 290. 1940.

Oreodaphne mexicana Meissner in DC. Prodr. **15**[1]: 118. 1864.
Oreodaphne mexicana var. α *subsessilis* Meissner, l.c.
Oreodaphne mexicana var. β *longipes* Meissner, l.c.
?*Oreodaphne mexicana* var. γ *diminuta* Meissner, l.c.
Oreodaphne helicterifolia Meissner in op. cit. 123.
Ocotea helicterifolia Hemsley, Biol. Centr. Am. Bot. **3**: 73. 1882.
Ocotea mexicana Hemsley, l.c.
Ocotea mexicana var. α *subsessilis* Hemsley, l.c.
Ocotea mexicana var. β *longipes* Hemsley, l.c.
Ocotea mexicana var. γ *diminuta* Hemsley, l.c.

Phoebe betazensis Mez in op. cit. 192.
Phoebe nectandroides Mez in op. cit. 194.

DISTRIBUTION: Southern Mexico and Guatemala, in lowland forests at low altitudes of 250–450 m., and higher up in pastures or in pine-forests up to 1440 m.

MEXICO: Vera Cruz: Orizaba, *Botteri 1018* (fl., type of *Oreodaphne mexicana* var. *β longipes* not seen, fragm., NY). Guerrero: Montes de Oca, Barranca, San Antonio-Buenos Aires, *Hinton 14014* (fl., GH). Oaxaca: In Sierra San Pedro-Nolasco, Talea, *Galeotti 7004* (fl., isosyntype of *Oreodaphne mexicana* var. *α subsessilis*, Ch), *Juergensen 575* (fl., type of *Oreodaphne mexicana* var. *γ diminuta* not seen), *937* (fl., syntype of *Oreodaphne mexicana* var. *α subsessilis* not seen); in forest between Ozumazin and Río Chiquito, *Schultes & Reko 726* (fr., GH). Chiapas: San Bartolo, alt. 150 m., Feb. 1840, *Linden 1641* (fl., ISOTYPE of *Oreodaphne helicterifolia*, photo., GH, NY); along stony brooks or mountain-streams, Fenix, *Purpus 10086* (fl., NY), *10356* (fl., GH). GUATEMALA: Alta Verapaz: Cobán, *H. Johnson 578* (fr., Ch), *Standley 69379* (fl., fr., Ch), *69525* (fl., A, Ch), *71446* (fl., A, Ch, NY), *91546* (fl., Ch), *von Tuerckheim 2164, 8454* (fl., GH, NY); along Río Carchá, between Cobán and San Pedro Carchá, *Standley 89985* (fl., Ch); between Cobán and Finca Chimoté, near Rubeltein, *Steyermark 44207* (fl., Ch); lowland forest in valley, "pantano," 2½ miles west of Cubilgüitz, *Steyermark 44280* (fl., Ch); Cerro de Agua Tortuga (Sahacoc), vicinity of Cubilgüitz, *Steyermark 44648* (fl., fr., Ch).

The present species is variable in practically every locality where it is known to occur. It varies in leaf-shape and size as well as in density of tomentum, but there can be no doubt that all of the specimens cited fall into the same species. The branchlets are densely or with age more sparsely clothed with a soft yellowish- or brownish-fulvous tomentum. The oblong, elliptic or obovate, obovate-elliptic or obovate-oblong usually membranaceous leaves are alternate or in whorls about the apex of the branchlets. The leaf-blades have one consistent characteristic: they are usually broadest through or above the middle. The blades are covered with a pubescence, the length of the hairs variable, becoming less with age, and more dense on the venation. The base is cordate to rounded, occasionally merely obtuse, and the apex is acuminate or abruptly acuminate, the acumen very short or up to 1.5 cm. long, obtusely or very sharply caudate. The blades are 9–15 (–25) cm. long and 2–9 (–12) cm. broad, and are subtended by a short stout densely tomentose peduncle at most up to 1 cm. long, frequently so short on the upper leaves as to make them appear sessile. The costa and lateral nerves, of which there are 8 or 9 (rarely –12) pairs, diverging at an angle of about 45° (the short lowermost almost at right angles), are impressed above but conspicuous because of the pubescence. They are elevated and densely pubescent beneath. The reticulation is obscure above and slightly more prominent beneath. The paniculate inflorescence is axillary and loosely few-flowered, usually up to 25 cm. long, with a purplish color conspicuous on the stem and flowers, the latter frequently exhibiting a purplish bloom on the entire surface. The inflorescence is scattered-pubescent toward the apex and borne on a long comparatively slender pubescent peduncle up to 13 cm. long. The flower is 5–6 mm. long, borne on a slender pedicel of about the same length or shorter. The strap-like or narrowly elliptic rather thick perianth-lobes are about 3 (–4) mm. long, spreading and reflexed at anthesis. The two outer series of stamens consist of elliptic or rotund-elliptic anthers, almost petaloid in some instances, ± 1.5–2.5 mm. long, with very short filaments. Those of the inner series are more or less oblong, almost equalling the filaments, bearing two sessile or slightly stipitate conspicuous sometimes spongy glands nearly the size of the anthers. The staminodia vary, stipe-like to ovate, up to ± 0.8 mm. long, the slender stipe one-half their entire length. The glabrous ovary is more or less globose, usually slightly longer than the rather thick style with its usually conspicuous subcapitate stigma, the entire gynaecium measuring up to 3.2 mm. The infructescence has become thickened, occasionally longer, and often less pubescent. The fruits are black, glabrous, ellipsoid, apiculate, 2.4 × 1.7 cm., and are seated on a shallow cyathiform red cupule 3–4 mm. long, 7 mm. broad, and 2–3 mm. deep. The thickened pedicel is up to 9 mm. long expanded to about 4 mm. at its apex.

The nearest relationships are apparent in the species *P: amplexicaulis, P. mollis,* and *P. obtusata,* all from Mexico, for discussion of which see these species.

21. **Phoebe Salvini** (Mez) Lundell in Contr. Univ. Mich. Herb. 6: 23. 1941.
Ocotea Salvini Mez in Jahrb. Bot. Gart. Berlin 5: 264. 1889.

DISTRIBUTION: Guatemala and southern Mexico, up to 2800 m. altitude.

MEXICO: Chiapas: Rodeo, near Siltepec, in virgin forest, *Matuda 4578* (fr., A, NY). GUATEMALA: Without locality, *Aguilar 492* (fr., Ch). Quiché: In remnant of cloud-forest, Nebaj, *Skutch 1679* (fl., A, Ch). Chimaltenango: Volcán de Fuego, near Calderas, alt. 2590 m., 1873–4, *Salvin* (fl., TYPE of *Ocotea Salvini* not seen, fragm., Ch); region of Los Positos, above Las Calderas, *Standley 80191* (fl., fr., Ch). Sololá: Volcán San Pedro, north-facing slopes toward Lago de Atitlán, above village of San Pedro, in damp cloud-forest dripping with mosses and hepatics, *Steyermark 47215* (sterile, Ch).

From the leaf-fragment at Chicago, it is apparent that Standley's number *80191* is without question the species concerned. The minute ferruginous tomentum which clothes the young angled and striate branchlets and lower leaf-surface, petioles, and inflorescence is in striking contrast to the bright shining green glabrous or slightly scattered pubescent upper leaf-surface which is very conspicuously reticulate. The coriaceous leaf-blades are elliptic, auriculate at the base and acute to acuminate at the apex, 9–17 cm. long and 4–9.5 broad, subtended by stout canaliculate pubescent petioles up to 2 cm. long. The venation above is conspicuously yellow against the green surface of the blade, the costa and the 5–8 pairs of lateral nerves being slightly elevated. On the lower surface the venation is covered by the ferruginous tomentum, although it is conspicuously elevated. The robust ferruginous-tomentellous inflorescence, shorter than the leaves, is usually less than 8 but sometimes up to 10 cm. long, with its stout branches and peduncle (to 4.5 cm. long) conspicuously striate. The tomentellous flowers are 3–5 mm. long, subtended by pedicels of equal length. The elliptic lobes are fleshy and more or less papillose, up to 3 mm. long. The two outer series of stamens are ± 1.5 mm. long, with short stoutish filaments slightly pubescent at the base and one-half the length of the broadly oblong anthers. The stamens of the inner series are ± 1.7 mm. long, the somewhat squarish anthers equalling the filaments which bear at their bases two compressed sessile glands about one-third the length of the entire stamens. The glabrous gynaecium, ± 2.5 mm. in length, consists of a subglobose or broadly ellipsoid ovary more than twice the length of the stout style, which is topped by a triangular rather inconspicuous stigma. The fruit is ellipsoid, 3 × 2.3 cm., seated on flattened disk-like cupule 3 mm. long, 14 mm. broad, and 1–2 mm. deep, which is very woody with a thickened almost double margin. The subtending pedicel is also enlarged to 1.5 cm. in length and 6 mm. in width at the apex.

22. **Phoebe amplifolia** Mez & J. D. Smith in Bot. Gaz. 19: 261, *t. 24.* 1894.

Persea amplifolia Mez in Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925.

DISTRIBUTION: Guatemala and from Costa Rica.

GUATEMALA: Quiché: El Jute, alt. 3050 m., April, 1892, *Heyde & Lux 3033* (fl., ISOTYPE, GH, NY). El Progreso: Between Finca Piamonte and top of Montaña Piamonte, along Joya Pacayal, *Steyermark 43641* (fl., Ch). COSTA RICA: San José: Near Rancho Redondo, near San José, *Popenoe 984* (fl., Ch).

This species has very stout branchlets that are deeply sulcate and clothed with a fine close ferruginous tomentum. The canaliculate petioles are also sulcate, and are minutely tomentose and up to 3.2 cm. long. The coriaceous blades are elliptic, the base cuneate and recurved, the apex shortly and abruptly acuminate, 28–30 cm. long and 13–16 cm. broad. The upper surface is glabrous except for the persistent pubescence scattered along the venation and densely so on the costa and lateral nerves.The costa is slightly elevated above near the base and conspicuously so throughout on the lower surface. The lateral nerves, of which there are 8–12 conspicuous pairs diverging at an angle of 45–60°, are impressed above and prominently elevated beneath. The reticulation is obscure and impressed above and conspicuously elevated beneath. The inflorescence is axillary, densely tomentose, rather few-flowered, up to 13 cm. long, the stout peduncle up to 9 cm. The large flowers are nearly 5 cm. long and densely tomentose, with a short pedicel not more than 3 mm. long. The thick fleshy lobes are densely pubescent and papillose, and are ± 3.8 mm. long. The stamens of the two outer series are ± 1.7 mm. long, the almost quadrate rounded anthers about three times the length of the filaments. Those of the inner series are ± 1.9 mm. long and the filaments bear two conspicuous sessile glands at the base. The staminodia are ± 1.25 mm. long, ovate, the pubescent stipes almost one-half the entire length and often bearing near the apex two small roundish sessile glands. The glabrous gynaecium is ± 2.5 mm. long, the subglobose ovary slightly longer than the slender style, which bears a conspicuous triangular stigma. The ellipsoid fruit is 3 cm. long and 2 cm. broad and, according to the authors, is subtended by a thick subpateriform cupule that is obscurely double-margined and gradually narrows into the strongly enlarged pedicel.

The nearest relative of the species is *P. Salvini,* from which it is easily distinguished by the usually smaller leaves of the latter, which are covered on the lower surface with a finely appressed dense bright ferruginous tomentum, and the base of which is conspicuously auriculate rather than merely recurved.

23. **Phoebe padiformis** Standley & Steyermark in Field Mus. Publ. Bot. 23: 117. 1944.

DISTRIBUTION: Known only from the eastern part of Guatemala, at an altitude of 570 m.

GUATEMALA: Quezaltenango: Colomba, *Skutch 1358* (fl., A, Ch, NY, US), alt. 570 m., Oct. 4, 1934, *Skutch 1367* (fl., A, TYPE — Ch, NY, US) (tree 15 m. high and about 32 cm. diam.; crown full and rounded; bark smooth, brown; flowers greenish white).

This grayish species has striate fulvous-tomentose branchlets which are quickly glabrous. The chartaceous leaf-blades are elliptic or oblong-elliptic or occasionally oblanceolate- and obovate-elliptic, more or less obtusely acuminate, and supported by pubescent or glabrescent sulcate petioles up to 12 mm. long. The blades are up to 13 cm. long and 5.5 cm. broad, greenish on the upper surface and brownish on the lower. A slight pubescence is apparent on both surfaces when very young, but it quickly disappears except for occasional remnants on the midrib above and beneath. The base is cuneate and the apex acute or acuminate to subcaudate-acuminate. The costa is impressed above and elevated beneath as are the 6 (–8) pairs of lateral nerves, which bear pubescent glands in their axils on the lower surface, and which diverge from the costa at an angle of about 45°. The loosely paniculate axillary and subterminal inflorescences are pubescent, becoming glabrous, shorter than the leaves (usually not longer than 8 cm.), and the branches are very narrow, giving a spicate appearance. In this respect the species resembles *P. mexicana,* but it differs in the smaller leaves which are penninerved rather than triplinerved, and in the more glabrous inflorescence. The flowers are about 3.4 mm. long and are borne on pedicels only slightly longer. The ovate acute thin perianth-lobes measure ± 2.5 mm. long. The two outer series of stamens are ± 1.5 mm. long, the filaments shorter than the oblong rounded anthers. The stamens of the inner series are ± 2.4 mm. long, the anthers more narrowly oblong and shorter than the thick filaments, which have two conspicuous stipitate reniform glands at their bases. The conspicuously ovate cordate staminodia are ± 1.25 mm. long, the thick pubescent stipes almost one-half the entire length. The glabrous gynaecium is ± 2.4 mm. long, with the very slender style, topped by an inconspicuous discoid stigma, equalling the subglobose ellipsoid ovary.

24. **Phoebe psychotrioides** (H.B.K.) Mez in Jahrb. Bot. Gart. Berlin 5: 191, *t. 3, fig. 43.* 1889; Standley in Contr. U. S. Nat. Herb. 23: 293. 1922.

Ocotea psychotrioides H.B.K. Nov. Gen. & Sp. 2: 129 [162]. 1817.

Distribution: Eastern Mexico, in Vera Cruz.

Mexico: Vera Cruz: Near Jalapa, in moist valleys, alt. 1244 m., *Humboldt & Bonpland 4434* (fl., type of *Ocotea psychotrioides* not seen); near Vera Cruz, *Sumichrast 940* (fr., NY); Orizaba, *Botteri 1040* (fl., NY); Matlaluca, *Liebmann* (*Lauraceae 69*) (fl., GH); Mirador, *Liebmann* [*14941*] (fl., Ch); open damp forests, Zacuapán, *Purpus 2959* (fl., Ch, GH, NY); forests near Tecomatla, *Purpus 10460* (fr., NY); rocky slopes, Barranca de Tenampa, *Purpus 16400* (fl., Ch).

This species may eventually be found to be a variation of *P. Pittieri* or of *P. Bourgeauviana.* Seemingly it differs from these in that its leaves are more elliptic than lanceolate and occasionally are obovate-elliptic. The flowers seem to be on the whole much smaller, although they show a tendency toward reflexed lobes typical of the two latter species. A study of the type may settle the question of relationship.

This very tall tree has terete glabrous branches and slender branchlets that are sulcate and pale subferruginous-pubescent. The slender petioles, also pubescent, are short, not more than 5 mm. long at most. The leaf-blades are lanceolate, the base cuneate and the apex shortly and abruptly subacuminate or subacute, 5 (–7) cm. long and 2 (–2.5) cm. broad, chartaceous or subcoriaceous, the upper surface smooth and shining, the lower pubescent to glabrous, the venation only slightly elevated above and prominently so beneath, everywhere more or less pubescent. The costa and lateral nerves, of which there are 7 pairs diverging arcuately from the costa at an angle of 45°, are obscure above but rather prominent beneath. The reticulation is obscure above and somewhat prominent beneath. The inflorescences are narrowly or racemosely paniculate, axillary or subterminal, not more than 6.5 cm. long, the slender peduncle up to 1.5 cm. long and glabrescent. The flowers are about 3 mm. long, supported by filamentous glabrescent pedicels not more than 2 mm. long. The tube is very short and the lobes elliptic, obtuse, pubescent, rather thin, and measuring ± 2.15 mm. long. The stamens of the two outer series are ± 1.25 mm. long, the ovate or almost quadrate anthers usually not much longer than the filaments, which are pubescent at the base. Those of the inner series are ± 1.7 mm. long, the rectangular anthers equalling the filaments that bear two subsessile globose glands at the base. The staminodia are usually up to ± 0.8 mm., occasionally longer, are ovate and borne on stipes equalling one-half their entire length. The glabrous gynaecium is ± 1.7 mm. long, the ovoid ovary about equalling the style, which bears a stigma which is subcapitate or flat but dilated, in any case conspicuous. The fruit of *Purpus 10460,* which seems to agree with the flowering material in foliage-characters, is ellipsoid-subglobose, minutely apiculate, up to 12 mm. long and nearly 10 mm. broad, subtended by a flat disk-like cupule (bearing remnants of the lobes of the perianth) about 1.5 mm. long and 8–9 mm. in diameter, the supporting pedicel slightly enlarged to sometimes nearly 15 mm. in length and expanded at the apex to 4 mm. in diameter.

25. **Phoebe chiapensis** Lundell in Contr. Univ. Mich. Herb. 6: 21. 1941.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Chiapas: Mt. Ovando, Dec. 1937, *Matuda 2064* (fl., ISOTYPE, A, NY) (tree 7–8 m. high, 20 cm. diam.).

This species is striking with its slender reddish branchlets, petioles, and inflorescences, that are sparsely glabrescent. The midvein of the almost linear-lanceolate acuminate glabrous leaves is also reddish in contrast to the green color of the blade. The costa is prominent beneath, whereas the delicate lateral nerves, of which there are 5–7 pairs, are fairly obscure throughout. The reticulation is apparent on both surfaces. The leaves measure up to 10 cm. long and 2 cm. broad and the slender petioles are slightly more than 1 cm. long. The axillary few-flowered inflorescence is up to 5 cm. long and glabrous. It bears flowers which have ovate acute perianth-lobes and are borne on pedicels that are sometimes 8 mm. long. The stamens of the two outer series are ± 1.25 mm. long, the pubescent filaments somewhat shorter than the oblong obtuse anthers. Those of the inner series are ± 1.7 mm. long and bear two subsessile glands at the base of the filaments. The staminodia are subovate, ± 1.15 mm. long, with very short pubescent stipes. The glabrous gynaecium consists of a subglobose ovary, slightly longer than the tapering style, and a conspicuous capitate stigma. The fruit is unknown.

Lundell has related this species to *P. pallescens* and *P. salicifolia.* The former has leaves that are lanceolate or elliptic, with the lateral nerves numbering upwards of ten. The inflorescence of *P. pallescens* is twice as long as that of *P. chiapensis.* The latter species may be easily separated from *P. salicifolia* by its penninerved leaves which show no trace of a tendency to a triplinerved condition. The convex reticulation of the leaf-blades of

P. salicifolia is not to be found in the leaves of *P. chiapensis*. Floral characters also separate the latter from the two above-mentioned species. Just where one would place the species is a question that may not be solved until more and better material is available. The type-specimen is injured by galls, which in many cases are apt to distort the structure typical of a given species.

26. **Phoebe tampicensis** (Meissner) Mez in Jahrb. Bot. Gart. Berlin 5: 200. 1889; Standley in Contr. U. S. Nat. Herb. 23: 294. 1922.

Oreodaphne tampicensis Meissner in DC. Prodr. 15^1: 136. 1864.

Ocotea tampicensis Hemsley, Biol. Centr. Am. Bot. 3: 74. 1882.

Phoebe angustata Blake in Contr. Gray Herb. n.s. 52: 63. 1917. (sphalm., in Ind. Kew. *Ocotea*).

Distribution: Mexico, chiefly in Tamaulipas and San Luis Potosí, from 300–500 m. altitude.

Mexico: Tamaulipas: Near Tampico, *Berlandier 132* (fl., fragm. of TYPE of *Oreodaphne tampicensis,* NY); vicinity of Victoria, alt. 320 m., Feb. 1–April 9, 1907, *E. Palmer 80* (fl., type of *P. angustata,* GH, isotype, NY); Sierra near Victoria, Jaumave, *von Rozynski 719* (fl., Ch, NY), *750* (fl., Ch); Cuesta del Abra, *LeSueur 147* (fr., Ch). San Luis Potosí: Valles, San Luis Potosí, *Kenoyer A. 606* (fr., Ch); limestone hills, Las Palmas, *Pringle 3794* (fr., GH). Oaxaca: Choapam, coffee plantation to north, Yaveo, *Mexia 9140* (fl., GH, NY).

Phoebe tampicensis, like the preceding species, has attenuately linear-lanceolate leaf-blades cuneate at the base and acuminate at the apex, which are chartaceous to subcoriaceous and measure up to 13.5 cm. long and up to 2.3 cm. broad. They are early pubescent but soon glabrous throughout except for occasional pubescent glands in the axils of the lateral nerves. They are subtended by a minutely pubescent soon glabrous slender petiole which may be light yellowish and may measure up to 1.3 cm. long. The midrib is visible above but conspicuously elevated beneath, whereas the lateral nerves and reticulation are everywhere obscure. The lateral nerves number 12–16 pairs, diverging at an angle of about 40° The inflorescence consists of axillary loose many-flowered slightly pubescent panicles not more than 3 (–7) cm. long, with a peduncle not more than 2 cm. long. The flowers are broadly campanulate, about 3 mm. long, equalling the slender slightly pubescent pedicels. The perianth-lobes are elliptic, rather thick, and ± 2.5 mm. long. The two outer series of stamens are ± 1.25 mm. long, the subquadrangular anthers twice the length of the rather thick filaments. The stamens of the third or inner series are ± 1.5 mm. long, bearing conspicuous stipitate glands which, as well as the filaments, equal the quadrangular emarginate anthers. The glabrous gynaecium measures ± 1.9 mm. long, the ellipsoid ovary nearly twice the length of the rather thick style, which is topped by a slightly enlarged subcapitate stigma. The fruit is broadly ellipsoid, apiculate, olive-greenish, glabrous, up to 1.8 cm. long and 1.3 cm. broad, very smooth on drying, seated on a flat disk-like cupule about 1 mm. long and 5 mm. in diam., which is subtended by the enlarged pedicel to about 6 mm. in length and 3 mm. in diameter at the apex.

The species is most closely related to *P. acuminatissima* Lundell, from which it differs in its linear-lanceolate leaves with more numerous and more obscure lateral nerves and larger fruit. The floral structure of the two species is very dissimilar.

27. **Phoebe pallescens** Mez in Jahrb. Bot. Gart. Berlin 5: 218. 1889; Standley in Contr. U. S. Nat. Herb. 23: 293. 1922.

DISTRIBUTION: Known only from the type-locality, in Mexico.

MEXICO: Vera Cruz: Near Orizaba, in 1855, *F. Mueller 90* (fl., fr., ISOTYPE, NY).

This species stands out because of the glabrous character of its slender reddish striate branchlets and its glabrous lanceolate or elliptic leaves, which are glaucous beneath. The leaf-blades are chartaceous, greenish brown above, the base obtuse to cuneate, often oblique, the apex subacute to acuminate, with a slender canalicuate petiole up to 17 mm. long, and measure up to 10 cm. long and 3.3 cm. broad. The midrib is reddish yellow, impressed above and elevated beneath. The lateral nerves are indistinct above and only delicately elevated beneath, numbering up to 11 pairs. The reticulation is everywhere apparent. The glabrous loose subpyramidal paniculate few-flowered slender inflorescences are up to 10 cm. long, equalling or slightly longer than the leaves, the peduncle being as long as 8 cm. The subcampanulate flowers are up to 2.15 mm. long, and outstanding because of the long slender pedicels reaching a length of 8 mm. The ovate lobes are very thin, measuring ± 1.9 mm. long. The stamens of the two outer series are ± 1 mm. long and the ellipsoid apiculate anthers are twice the length of the filaments. The stamens of the inner series are ± 2.15 mm. long, with the oblong-ovate anthers equalling the stout filaments, which bear two conspicuous reniform shortly stipitate glands at the base, not quite equalling the filaments in length. The glabrous gynaecium measures ± 1.5 mm., the subglobose ovary longer than the slender style, which bears a discoid subtriangular stigma at its apex, according to Meissner. He notes that the fruit is abnormally large, seated on the greatly enlarged cylindrical pedicel with the lobes deciduous. I have not seen a fruiting specimen.

The affinity seems to be with *P. acuminatissima* and with *P. mollicella*, from the first of which species it is separable by the glabrous leaves and from the second by the larger number of lateral nerves.

28. **Phoebe acuminatissima** Lundell in Contr. Univ. Mich. Herb. 6: 19. 1941.
Phoebe saxchanalensis Lundell in op. cit. 7: 14. 1942.

DISTRIBUTION: In the mountains of Chiapas, Mexico, at 2700 m., and Guatemala at 250–2000 m. altitude.

MEXICO: Chiapas: Mt. Ovando, Dec. 1937, *Matuda 2107* (fl., ISOTYPE of *P. acuminatissima*, A, NY) (tree 5 m., 15 cm. diam.); Sierra Madre, Saxchanal, in virgin forest, *Matuda 4311* (fr., isotype of *P. saxchanalensis*, A, NY) (small tree 5 m. high). GUATEMALA: Quezaltenango: Lower south-facing slopes of Volcán Santa María, between Finca Pirineos and Los Positos, between Santa María de Jesús and Calahuaché, *Steyermark 33750, 33752* (fr., Ch); slopes and ridges between Quebrada Chicharro and Montaña Chicharro, on southeast-facing slopes of Volcán Santa María, *Steyermark 34356* (fr., Ch). Sacatepéquez: Wooded slope above Dueñas, *Standley 63141* (fl., Ch). Suchitepéquez: At edge of ravine, Finca Moca, *Skutch 2099* (fl., A). Santa Rosa: With pine on upper slopes near the sulfur deposits, Volcán Tecuamburro, along trail to San Francisco Tecuamburro on summit of volcano, north of Chiquimulilla *Steyermark 33156* (fl., Ch).

The small tree of 5 m. described from Chiapas by Lundell in Guatemala reaches a height of 20 m. The very slender branchlets are early covered with a fine grayish- or fulvous-sericeous pubescence which becomes darker and less conspicuous with age. The young leaves also bear the same type of pubescence, which disappears entirely from the upper surface at maturity but persists on the lower. The membranaceous lanceolate long-acuminate leaf-blades (up to 12.5 × 3 cm.) are supported by slender pubescent petioles 10–17 mm. long. The base is cuneate and often unequal. The costa is impressed above and conspicuously elevated beneath, whereas the slender lateral nerves are scarcely visible above and hardly more so beneath. There are upwards of 19 obscurely visible pairs of lateral nerves diverging from the costa at an angle of 45–55–70°. Frequently the pubescent glands present at their junction are made conspicuous by the infiltration of extraneous matter. The few-flowered axillary minutely pubescent panicles, shorter than the leaves (4–5 [–7] cm.), arise on almost filiform peduncles up to 3.5 cm. long. The thick fleshy heavily papillose-tomentose perianth-lobes are ± 2.5 mm. long, oblong and reflexed at anthesis. The stamens of the two outer series are ± 1.25 mm. long, the ovate obtuse anthers somewhat longer than the slender filaments. Those of the inner series are about 1.5 mm. long, the subquadrate anthers equalling the filaments bearing at the base two subsessile subglobose glands. The ovate staminodia are ± 0.4–0.8 mm. long, borne on slightly longer pubescent stipes. The subglobose glabrous ovary is slightly longer than the style, which is topped by a conspicuous peltate stigma. The glabrous fruits are ellipsoid-obovoid, up to 12 mm. long and 7 mm. broad, subtended by a cupule which is about 2 mm. long, 5 mm. in diameter, and about 1 mm. in depth. Lundell gives larger measurements, so presumably the sheet at Michigan has fruit in a more advanced stage. The pedicel is enlarged and about 5 mm. long, the apex expanded to about 3 mm. in diameter.

The nearest relative is *P. mollicella,* from Costa Rica, which may be at once distinguished by its smaller leaves with fewer pairs of lateral nerves and shorter petioles. The pubescence of the latter species is consistently more yellowish than gray, a feature which alone would not carry much weight. Also the flowers are greater in number, and their structure differs materially.

29. **Phoebe mollicella** Blake in Contr. Gray Herb. n.s. 52: 64. 1917; Standley in Field Mus. Publ. Bot. 18: 459. 1937.

Distribution: Known only from the forests of Costa Rica, up to an altitude of 2135 m.

Costa Rica: Alajuela: Zarcero, Alfaro Ruiz, in clay-loam, in half-shade on hill-slope of open forest of upper tropical zone, *A. Smith P.2309* (fl., A), edge of woodland, *A. Smith P. 2392* (fl., A); Guadaloupe de Alfaro Ruiz, *A. Smith 4178* (fr., Ch); Zarcero, *A. Smith 10068* (fl., fr., A). San José: Vicinity of Santa María de Dota, *Standley 42421, 42426* (fl., Ch); forests of El Copey, alt. 1800 m., Feb. 1898, *Tonduz 7353* (Herb. Nat. Costa Rica *11676*) (fl., Ch, type — GH, NY). Cartago: Southeastern slope of Irazu, *Stork 3177* (fr., Ch).

Native names: "Quizarrá," "Quizarrá amarillo," "Madera buena" (Costa Rica).

The species is distinguished at once by the soft pale ferruginous tomentum which clothes the young branchlets and leaves and the lower surface of the mature leaf-blades. The branchlets are conspicuously striate and slender. The leaf-blades are chartaceous, smooth and shining above, elliptic, occasionally lanceolate-elliptic, cuneate at the base and acuminate to obtuse at the apex, measuring 5–8.5 cm. in length and 1.3–2.3 cm. in width. The lateral nerves, of which there are usually 6 pairs, diverge at an angle of about 35–45°. The venation above is pubescent and conspicuous though scarcely elevated. Beneath it is elevated and heavily tomentose. The short few-flowered tomentose inflorescences, not more than 5 cm. long, are borne on peduncles up to 2.5 cm. The lobes of the perianth are spreading and reflexed, about 2.5 (–3) mm. long, rather heavy in texture, elliptic and obtuse. The two outer series of stamens are about 1.3–2 mm. long, the ovate obtuse anthers slightly longer than the filaments. The stamens of the inner series measure about 1.5 mm. long, the oblong anthers equalling the slender filaments, which bear at the base two sessile glands about one-third the length of the entire stamen. The glabrous gynaecium is ± 2.8 mm. long, the ellipsoid ovary with a style one-third its length topped by a more or less triangular conspicuous stigma. The fruit is oblong-ellipsoid, glabrous, 2 cm. long and 1.3 cm. broad, black, with primrose yellow base or "eye" (according to the collector Stork), the campanulate cupule green or reddish to scarlet, about 2 mm. long, 6 mm. broad at the flaring undulate apex, and 1 mm. deep, with the pedicel about 5 mm. long enlarged at the tip to 3 mm. in diameter.

The nearest species is *P. acuminatissima,* from Mexico and Guatemala. The relationship has been discussed under that species.

30. **Phoebe Bourgeauviana** Mez in Jahrb. Bot. Gart. Berlin 5: 194. 1889; Standley in Contr. U. S. Nat. Herb. 23: 294. 1922.

Phoebe purpurea Mez in Jahrb. Bot. Gart. Berlin 5: 196. 1889.

DISTRIBUTION: Southern Mexico through Guatemala, at an altitude of 1300–3000 m., to Honduras at a lower altitude of 1050 m.

MEXICO: Vera Cruz: Vallée de Cordoba, April 9, 1866, *Bourgeau 2234* (fl., fr., ISOTYPE of *P. Bourgeauviana,* Ch, GH). GUATEMALA: Quiché: San Miguel Uspantán, *Heyde & Lux 3089* (fl., GH). Huehuetenango: Jacaltenango, mountain-slopes, *C. & E. Seler 2598* (fl., GH). Alta Verapaz: Mountains east of Tactic, on road to Tamahú, *Standley 71282* (fl., Ch); large swamp east of Tactic, in forest, *Standley 92314* (fl., Ch), *Steyermark 43966* (fl., Ch); in mountain-forests near Laraxquia, *von Tuerckheim 371* (fl., photo. of type of *P. purpurea,* Ch, GH); Cobán, *von Tuerckheim 1651* (fl., GH). Baja Verapaz: Mountain-side north of divide north of Santa Rosa, *Standley 69883* (fl., Ch). San Marcos: Río Vega, near San Rafael and Guatemala-Mexico boundary, Volcán Tacaná, *Steyermark 36267* (fl., Ch). El Progreso: Between Calera and middle slopes of quebradas of Volcán Siglo, *Steyermark 43020* (fr., Ch). Zacapa: Upper reaches of Río Sitio Nuevo, *Steyermark 43237* (fr., Ch). Chiquimula: Middle slopes of Montaña Norte to El Jutal, on Cerro Brujo, southeast of Concepción de las Minas, *Steyermark 31072* (fr., Ch); Volcán Quezaltepeque, 3–4 miles northeast of Quezaltepeque, *Steyermark 31442* (fr., Ch). HONDURAS: Comayagua: Vicinity of Siguatepeque, *Standley 56055* (fl., Ch); on river-banks, plains, *Yuncker, Dawson & Youse 5777* (fr., Ch, GH).

This species is a variable one, the branchlets clothed with a ferruginous tomentum often with a purplish cast, of varying length, density, and shade The chartaceous leaves are lanceolate to lanceolate-elliptic, acuminate to subcaudate-acuminate, glabrous to glabrescent and somewhat shining above, except for the pubescent costa, and softly tomentose beneath. The blades measure 7–10 (–12) cm. long and 2–3.5 (–5) cm. broad, and are subtended by pubescent petioles up to 11 mm. long. The costa and lateral nerves, which number no more than 7 pairs diverging at an angle of 45–35° from the costa, usually are visible above but very prominently elevated beneath. The loose reticulation is obscure above and apparent beneath. Pubescent glands are borne beneath in the axils of the lateral nerves. The pubescent to glabrescent few-flowered inflorescences are much shorter than the leaves, measuring not more than 7 cm. in length, the slender peduncle not more than 5 cm. long. The flowers are purplish on drying, about 4–5 mm. long, borne on pedicels of almost the same length. The spreading or at times reflexed lobes of the perianth are elliptic, obtuse, pubescent, up to 3 mm. long. The two outer series of stamens vary from ± 1.25–2.7 mm. long, with anthers that are petaloid, subrhomboid to ovate, obtuse, subsessile or with short filaments. The stamens of the inner series are ± 1.25 mm. long, with oblong anthers equalling the filaments and only slightly exceeding the conspicuous sessile glands at the base. The staminodia vary from triquetrous to cordate, ± 0.8–1.25 mm. long, the stipes equalling one-half the entire length. The glabrous gynaecium varies in size up to ± 2.15 mm. long, the ovoid or elliptic ovary being more than twice the length of the stout short style, which is topped by an often somewhat decurrent triangular conspicuous stigma. The fruits are ellipsoid-subobovate, apiculate, up to 2 cm. long and 1 cm. broad, green turning purple-black, seated on a cupule which is rose-red at maturity. The glabrous cupule is cyathiform, about 4 mm. long, 7 mm. broad at the flaring slightly undulate apex, and 1.5 mm. deep. The enlarged pedicel is up to 1 cm. long and 4 mm. broad at the apex.

The nearest relative of the species is *P. Pittieri* from Costa Rica and northwestern Panama. The latter differs from *P. Bourgeauviana* in the rough quality of the pubescence on the leaves, which are never more than 9 cm. long, usually around 7 cm., and 2.5–3 cm. broad. The reticulation of the leaves is far more prominent and the lateral nerves never more than 5 pairs. The flowers are similar to those of *P. Bourgeauviana.* The fruits are smaller and frequently borne on a longer pedicel.

31. **Phoebe Pittieri** Mez in Bot. Jahrb. **30**: Beibl. 67: 16. 1901; Standley in Field Mus. Publ. Bot. **18**: 460. 1937; Lundell in Contr. Univ. Mich. Herb. **6**: 22. 1941.

Distribution: Woods of Costa Rica and Panama, at an altitude of 1050–2200 m.

Costa Rica: Alajuela: Woods, La Palma de San Ramón, *Brenes 5334* (*483*) (fr., Ch), *5405* (*549*) (sterile, Ch), *5416* (fl., Ch); moist woods on the hills of Santiago near San Ramón, *Brenes 14464* (sterile, GH); Palmira, Alfaro Ruiz, in sub-tropical zone, in wet loam at edge of swamp, in semi-shade, *A. Smith H.522, H. 679* (fl., Ch). San José: Forests of El Copey, *Tonduz 11893* (fl., photo. of type, GH). Panama: Chiriquí: Cloud- and rain-forest of Cerro Horqueta, *C. & V. W. von Hagen 2031, 2070* (fl., fr., A, Mo), *2022* (fl., A, Mo).

The branchlets of this species are fulvous- or yellowish-tomentose, the very young ones somewhat sericeous, becoming fuscous with age, and harsh to the touch. The leaf-blades rarely exceed 7 cm., occasionally 9, in length and 2.5–3 cm. in breadth; they are lanceolate or elliptic with cuneate base, acuminate to obtusely acute apex, and a canaliculate pubescent petiole up to 10 mm. long. The upper surface is smooth and almost shining, the lower roughly pubescent. The lateral nerves, diverging from the costa at a 35–45° angle, usually number 5 pairs and are inconspicuous above but elevated beneath, frequently with inconspicuous axillary glands. The loose reticulations are slightly more prominent beneath than above. The few-flowered pubescent to glabrescent axillary inflorescence is not more than 5.5 cm. long, the peduncle not more than 2 cm. The white (purplish in dried state) flowers are somewhat like those of *P. Bourgeauviana,* being spreading-campanulate, up to 5 mm. long, with slender pedicels to 8 mm. The elliptic lobes are thick, papillose, up to 3 mm. long and often reflexed in anthesis. The two outer series of stamens measure ± 1.7 mm. long, the roundish anthers equalling the filaments. The stamens of the inner series have oblong anthers equalling the filaments and the large sessile spongy glands at the base of the latter. The staminodia are ± 1 mm. long, ovate, subcordate, the stipes slightly more than one-half the entire length. The glabrous gynaecium is ± 2.8 mm. long and has an obovoid or subglobose ovary slightly narrowed at the base and one-third longer than the style, which bears an inconspicuous discoid stigma. The fruits are greenish to purple, ellipsoid, glabrous, 12 × 9 cm., and seated in a flaring undulate fluted cyathiform reddish cupule about 5 mm. long, 9 mm. diam., and 3 mm. deep. The enlarged pedicel is upwards of 1 cm. long and expanded to 4 mm. at the apex.

The nearest relative of the species is *P. Bourgeauviana,* under which species is a discussion concerning the two entities.

Doubtful Species and Varieties of Phoebe

Phoebe effusa β **areolata** Meissner in DC. Prodr. 15[1]: 33. 1864.

Mez cites *Linden 19,* the type, from Jalapa, Mexico, under *Nectandra sanguinea.* The type is not available at this time.

Phoebe granatensis β? **Oerstedii** Meissner in DC. Prodr. 15[1]: 32. 1864.

Mez cites the type of this, from Volcán Barba, Costa Rica, *Oersted 4,* under *Phoebe mexicana* Meissner. I have not seen the type.

Phoebe mayana Lundell in Amer. Midl. Nat. **29:** 473. 1943.

I have not been able thus far to match this fruiting specimen with any material at hand. It is somewhat doubtful whether or not this is the correct genus. The generic lines of fruiting characters are not yet as clear-cut as it is to be hoped that future study may render them. For this reason, it is difficult to determine the genus of a specimen on fruiting characters alone. At present, since I cannot relate the species to any known entity, I am not including it in the general treatment or the key. Possibly it may belong to *Beilschmiedia.*

Species Excluded from Phoebe

Phoebe Benthamiana Mez = Persea pachypoda Nees.
Phoebe Hartwegii Meissner = Persea pachypoda Nees.
Phoebe insularis Meissner — Ocotea insularis (Meissner) Mez.
Phoebe pachypoda Mez = Persea pachypoda Nees.

3. Ocotea Aublet

Ocotea Aublet, Pl. Guian. 2: 780, *t. 310.* 1775; Hemsley, Biol. Centr. Am. Bot. 3: 72. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 219. 1889.

Oreodaphne Nees, Pl. Laurin. [Progr.] 15. 1833, in Linnaea 8: 39. 1833, Syst. Laurin. 380. 1836; Meissner in DC. Prodr. 15[1]: 111. 1864.

Dendrodaphne Beurling in Vet. Akad. Handl. Stockholm **1854:** 145. 1856.

Sassafridium Meissner in DC. Prodr. 15[1]: 171. 1864.

Distribution: Throughout the American tropics from Mexico through Central America, with the greatest number of species occurring in South America.

Trees or shrubs usually with alternate leaves varying from membranaceous to rigidly coriaceous, the blades from 9 cm. to 55 cm. long, and equally as variable in shape and pubescence. The reticulation of the leaf-blades of this genus is an important diagnostic character. Occasionally the decurrence and recurving of the leaf-bases into the broad petioles is manifest. The inflorescences are usually paniculate, and bear usually in this area flowers that are perfect. There are three species, as far as can be ascertained from the material at hand, that have dioecious flowers. In the perfect flowers the perianth-tube may be conspicuous or almost entirely absent. The lobes may be fleshy or thin in texture, and are, for the most part, equal or at most subequal, usually deciduous, although they may persist in some species as remnants crowning the expanded perianth-tube in fruit. Generally speaking, the stamens of the two outer series bear variously shaped anthers that are sessile or borne on glabrous or pubescent filaments of varying length. The anthers may be petaloid and papillose, exhibiting a substantial connective, or they may have no perceptible connective tissue present. Usually the four introrse cells are arranged in two planes, one above the other. Those of the inner series have longer filaments accordingly, which always bear two sessile or stipitate glands which vary in size and shape, often so large that they appear confluent. The four cells of the anthers are sometimes all extrorse; sometimes the two upper are lateral or lateral-extrorse, the two lower being wholly extrorse or rarely lateral-extrorse. If staminodia are present they are usually stipitate, linear-lanceolate, or very occasionally ovate, pubescent or glabrous but invariably thin in texture. The gynaecium is usually glabrous, the style rarely being slightly pubescent, and of varying length. The stigma may be small, inconspicuous, and discoid, or large, conspicuous, peltate or triangular, and slightly decurrent at the angles. In species with dioecious flowers, the ♀ flower shows staminodia replacing the first three series of stamens found in the perfect flowers. The staminodia may have well developed anthers, but usually they are smaller, not much broader than the filaments and with the cells evident though often malformed. The gynaecium develops as in the perfect flowers. The ♂ flowers have well developed stamens, but either lack the gynaecium entirely or have an aborted small linear structure, the different parts being indeterminate; or the ovary is as slender as the style, but topped by an extremely large stigma. The fruit is ellipsoid or globose, borne in a usually simple-margined cupule, although in a very few species the margin is inconspicuously double. The cupule may be flat and disk-like, the margin undulating, or hemispherical and plane, or variously 6-lobed, the lobes being the remnants of the persistent perianth-lobes.

KEY TO THE SPECIES OF OCOTEA

A. Largest leaf-blades not less than 20 cm. long.
  B. Leaf-blades heavily coriaceous and densely and conspicuously reticulate and shining above.
    C. Leaf-blades pubescent beneath.
      D. Leaf-blades decurrent at the base, strongly recurved and closely appressed-pubescent; petioles not canaliculate........1. *O. stenoneura.*
      D. Leaf-blades not decurrent at the base nor recurved, but pubescent; petioles shallowly canaliculate.........................2. *O. Cooperi.*

C. Leaf-blades glabrous beneath and heavily coriaceous........3. *O. Seibertii.*

B. Leaf-blades, if densely reticulate, not conspicuously so and not shining above; texture various.

C. Leaf-blades beneath conspicuously ferruginous- or subferruginous-tomentose; venation conspicuously pubescent; inflorescence densely ferruginous- or subferruginous-tomentose.

D. Leaf-blades coriaceous; reticulation usually obscured beneath by a fine tomentum; branchlets stout; lateral nerves 8 or 9 pairs..4. *O. palmana.*

D. Leaf-blades membranaceous, with long subferruginous pubescence on venation beneath; reticulation conspicuous; branchlets slender; lateral nerves 7–10 pairs..................................5. *O. mollifolia.*

C. Leaf-blades glabrous or glabrescent beneath, not conspicuously ferruginous- or subferruginous- or brownish-tomentose.

D. Leaf-blades definitely obovate.

E. Base of leaf-blades decurrent, sometimes very conspicuously so and recurved..6. *O. Ira.*

E. Base of leaf-blades never conspicuously decurrent or recurved.

F. Leaf-blades not more than 9 cm. broad.

G. Axillary glands absent or so minute and inconspicuous as to be unobserved.

H. Branchlets glabrous; cupule of thin texture, brittle about the margin; fruit globose, 1 cm. diam.....7. *O. Wedeliana.*

H. Branchlets brownish-pubescent; cupule woody; fruit ellipsoid, 2.5 cm. diam.......................8. *O. subalata.*

G. Axillary glands conspicuous.

H. Cupule very shallow, lobed, 7 mm. diam.; fruit oblong-ellipsoid, to 2 cm. long; branchlets frequently dark brownish-pubescent; style twice the length of ovary; leaves not shining beneath.......................9. *O. eucuneata.*

H. Cupule thick, woody, entire, 1.5 cm. diam.; fruit ellipsoid, at least 2.5 cm. long; branchlets glabrous; style shorter than ovary; leaves shining beneath....10. *O. verapazensis.*

F. Leaf-blades not less than 10 cm. broad (usually 15–20 cm.).

G. Branchlets sturdy, heavily angled; blades shortly obtusely acuminate...........................11. *O. nicaraguensis.*

G. Branchlets terete, only young slightly angled; apex of the blades rounded or very obtuse or rarely acute or shortly abruptly subacuminate...................12. *O. Standleyi.*

D. Leaf-blades elliptic or oblong or oblong-elliptic or oblanceolate.

E. Leaf-blades not less than 12 cm. broad............12. *O. Standleyi.*

E. Leaf-blades not more than 10 cm. broad.

F. Leaf-blades membranaceous..................13. *O. atirrensis.*

F. Leaf-blades not membranaceous.

G. Leaf-blades coriaceous, brownish or castaneous..14. *O. Paulii.*

G. Leaf-blades chartaceous, greenish.

H. Leaf-blades smooth on upper surface, pale...15. *O. Dendrodaphne.*

H. Leaf-blades with conspicuous reticulation throughout, not pale green above...................10. *O. verapazensis.*

A. Largest leaf-blades not more than 17 cm. long (rarely 20, in *O. eucuneata*).

B. Leaf-blades variable, usually not obovate but elliptic or lanceolate-elliptic or variations of these shapes, acute or rounded, always chartaceous; margin always finely undulate, appearing crisped on drying; petioles usually blackish; bark grayish...16. *O. veraguensis.*

B. Leaf-blades obovate; margin not consistently finely undulate.

C. Leaf-blades with bases decurrent or recurved.

D. Leaf-blades membranaceous and with 3–6 pairs of conspicuous ellipsoid densely grayish-pubescent axillary glands............17. *O. chiapensis.*
D. Leaf-blades not membranaceous; glands, if present, few pairs and very inconspicuous.
E. Reticulation everywhere prominent; leaves shining above, appressed-sericeous, becoming glaucescent and glabrescent beneath...18. *O. Austinii.*
E. Reticulation not prominent; leaves not shining above nor ferruginous-pubescent beneath.
F. Leaves sessile, the blades broadly decurrent and recurved; cupule entire, pubescent; axillary glands not narrowly ellipsoid; apparent petiole 2–3 cm. long.....................19. *O. Endresiana.*
F. Leaves shortly petiolate, the blades narrowly decurrent and recurved; pubescent axillary glands not narrowly ellipsoid; cupule 6-lobed; apparent petiole not more than 1.5 cm. (rarely 2.5 cm.). ....20. *O. Tonduzii.*
F. Leaves shortly petiolate, the blades narrowly decurrent and recurved; cupule entire; pubescent axillary glands when present conspicuously narrowly ellipsoid; apparent petiole to 2.5 cm. long...21. *O. Skutchii.*
C. Leaf-blades with bases not decurrent or recurved.
D. Largest leaf-blades not less than 15 cm. long............8. *O. subalata.*
D. Largest leaf-blades not more than 12 cm. long (except *O. eucuneata*).
E. Leaf-blades coriaceous; reticulation minute but conspicuous; nervation very prominently elevated beneath and reddish yellow..22. *O. rubrinervis.*
E. Leaf-blades not coriaceous; reticulation not conspicuous; nervation elevated but not strikingly conspicuous beneath.
F. Lateral nerves up to 7 pairs; branchlets pale buff-gray; cupule thick, woody, the margin undulate, 13 mm. diam.; flowers dioecious (?).................................23. *O. subsericea.*
F. Lateral nerves 7–12 pairs; branchlets fuscous; cupule shallow, cyathiform, lobed, of thinnish texture; flowers monoecious...9. *O. eucuneata.*
B. Leaf-blades not obovate.
C. Leaf-blades not more than 2.5 cm. broad.
D. Reticulation and lateral nerves prominent throughout; apex of blades acuminate ....24. *O. Klotzschiana.*
D. Reticulation and lateral nerves very obscure; apex caudate-acuminate...25. *O. effusa.*
C. Leaf-blades not less than 3.5 cm. broad (usually broader).
D. Leaf-blades definitely oblong and rigidly coriaceous; inflorescence up to 16 cm. or more long.
E. Leaf-blades not more than 11 cm. long, densely ferruginous-sericeous beneath; inflorescence to 25 cm. long..............18. *O. Austinii.*
E. Leaf-blades not less than 12 cm. long, glabrous throughout; inflorescence up to 16 cm. long.........................14. *O. Paulii.*
D. Leaf-blades not oblong, or, if oblong, definitely not rigidly coriaceous; inflorescence usually not more than 12–13 cm. long.
E. Leaf-blades oblong or oblong-elliptic, membranaceous or chartaceous or subcoriaceous; apex always caudate-acuminate or abruptly obtusely acuminate.
F. Flowers perfect; inflorescence few- to many-flowered...26. *O. Bernoulliana.*
F. Flowers dioecious; inflorescences usually many and many-flowered.
G. Fruit 1.5 cm. long; cyathiform cupule covering ⅓ its length...27. *O. cernua.*

G. Fruit 2.5 cm. long; disk-like cupule with undulating margin not covering fruit..........................28. *O. tenera.*

E. Leaf-blades elliptic or lanceolate-elliptic or oblong-elliptic, never membranaceous; apex abruptly acuminate to obtuse but not usually caudate.

F. Branchlets at the apex ferruginous-tomentellous, becoming brownish and glabrous; buds ferruginous- or yellowish-tomentellous......................................29. *O. paradoxa.*

F. Branchlets at the apex not ferruginous-tomentellous; buds not ferruginous- or yellowish-tomentellous.

G. Leaf-blades subcoriaceous, shining, paler beneath, everywhere prominently reticulate.....................30. *O. Matudai.*

G. Leaf-blades not subcoriaceous or shining or paler beneath, the reticulation various.

H. Lateral nerves 4–6 pairs; inflorescence 4–9 cm. long...... ....31. *O. Meziana.*

H. Lateral nerves 8–10 pairs; inflorescence usually 12–15 cm. long.

I. Flowers dioecious; branchlets blackish............... ....32. *O. pyramidata.*

I. Flowers perfect; branchlets greenish.33. *O. laetivirens.*

1. **Ocotea stenoneura** Mez & Pittier in Bull. Herb. Boiss. II. 3: 233. 1903.

DISTRIBUTION: Known only from the type-locality and adjoining areas in Costa Rica, 650–975 m. altitude, in forests.

COSTA RICA: San José: Hills near Las Vueltas, alt. 650–700 m., Feb. 1899, *Tonduz 13377* (fr., photo. of LECTOTYPE of *O. stenoneura,* Ch, GH); forests of Las Vueltas, Tucurrique, *Tonduz 12953* (fr., GH); forest in vicinity of El General, *Skutch 3014* (fl., A, NY).

NATIVE NAME: "Ira Zopilote" (Costa Rica).

This species has stout conspicuously angled densely ferruginous-tomentose branchlets bearing leaves densely spiraled near the apex. The unusual petioles are actually very short and stout, less than 5 mm. long, but the conspicuously decurrent and recurved leaf-base forms an apparent petiole that is up to 2.5 (–3) cm. long, 6–7 mm. broad and closely and minutely appressed-ferruginous-tomentose throughout. The leaf-blades are coriaceous, obovate to elliptic, with the base cuneate (due to the recurved lower portion) and the apex shortly, abruptly, but very sharply acuminate, measuring 18–24 cm. in length and up to 9 cm. in breadth. The upper surface is shining and conspicuous for its pattern of regular venation and the minute conspicuous reticulation. The lower surface is glaucous and densely clothed with a soft fine ferruginous pubescence. The costa above is impressed and glabrous except for the lowermost portion; beneath it is thickly and prominently elevated and pubescent. The lateral nerves, of which there are 10–14 pairs, ascend without curving to the margin, and are evenly spaced and almost parallel with each other. They diverge from the costa at an angle of about 35°. The inflorescence is robust, densely ferruginous-tomentose, up to 25 cm. long, heavily flowered, the flowers densely tomentose throughout, practically sessile, campanulate, 5–6 mm. long, the fleshy and hairy perianth-lobes being up to 2.15 mm. long. The tube is very hairy within. The stamens of the two outer series are up to ± 1.25 mm. long, with the roundish anthers nearly equalling the stocky pubescent filaments. Those of the inner series are squarish, the filaments bearing laterally two round conspicuous basal glands that are almost equal to the anthers in size.

The glabrous gynaecium is about ± 2.8 mm. long, the ellipsoid ovary nearly twice the length of the style, bearing an inconspicuous stigma. The stout infructescence may measure up to 25 cm. in length, still densely ferruginous-tomentose, according to the authors, but only grayish-pubescent and not as thickly so as is the case in the flowering stage. The fruit is subglobose, apiculate, roughish and minutely tuberculate near the apex, up to 2 cm. in diameter, and supported by a flat disk-like cupule about 12 mm. in diameter, the margin undulate and (according to Mez and Pittier) frequently bearing the remnants of the perianth-lobes. The gynophore is perceptible in the bottom of the empty cupule, although it is less than 1 mm. high. The stout woody pedicel is 5 mm. or more long and 3.5 mm. in diameter.

The relationship of this species will be discussed under *O. Seibertii* and also under *O. Cooperi*. In connection with the latter species, I discuss my selection of *Tonduz 13377* as the lectotype of *O. stenoneura*.

2. **Ocotea Cooperi**, sp. nov.

Ocotea stenoneura Mez & Pittier in Bull. Herb. Boiss. II. 3: 233. 1903, quoad *Cooper 10217*, excl. *Tonduz 13377;* sensu Standley in Field Mus. Publ. Bot. 18: 456. 1937.

Arbor(?), ramulis valde angulatis dense ferrugineo-tomentosis deinde griseo-tomentosis sulcatis. Folia alternata, petiolis robustis pubescentibus leviter canaliculatis, 1.5 mm. longis et 3 mm. latis, laminis supra glabris basi costae excepta, lucidis, subtus glaucescentibus molliter tomentosis, membranaceis, in sicco supra brunneo-olivaceis, oblongis, (15–) 35 cm. longis et (5–) 9.5 cm. latis, basi rotundatis vel obtusis, apice acuminatis, penninerviis, costa supra impressa basi pubescente subtus robusta valde elevata utrinque pubescente, nervis 10–15-paribus supra subobscuris subtus satis elevatis pubescentibus angulo 45–60° divergentibus, rete venularum utrinque prominulo. Inflorescentia axillaris et subterminalis, paniculata, foliis apicalibus deciduis, ad 20 cm. longis, ferrugineo-tomentosa, multiflora, pedunculo ad 7 cm. longo ferrugineo-tomentoso. Flores ad 5 mm. longi, pedicellis 2–3 mm. longis perianthii tubo urceolato intus glutinoso, lobis late ovatis vel subtriangularibus subexpansis crassis vel sublignosis ± 1.7 mm. longis; staminibus ser. I & II late spathulatis ad ± .6 mm. longis antheris oblongo-truncatis filamentis aequalibus, ser. III ± .8 mm. longis conspicue biglandulosis, glandulis sessilibus et antheris filamentis aequalibus; staminodiis lanceolatis gracilibus pubescentibus ± .6 mm. longis; gynaecio glabro ± 2.5 mm. longo, ovario conspicue stipitato, late ovoideo gynaecii dimidium longitudine parum excedente, et stylo robusto duplo longiore, stigmate triangulari subdiscoideo conspicuo styli lateribus decurrente. Fructus ellipsoideus, minute apiculatis, 3.5 cm. longus et 1.8 cm. latus, cupula lignosa subhemisphaerica rugosula ad 1.5 cm. longa, 2 cm. diam., et 11 mm. alta, margine suberosa tenui subtentus, pedicello crasso ad 1 cm. longo apice 5 mm. expanso.

Distribution: Costa Rica and adjacent Panama at 675–900 m. altitude.

Costa Rica: Limón?: Santa Clara, *J. J. Cooper 10217* (fr., isosyntype of *Ocotea stenoneura*, US). San José: El General, *Skutch 4757* (fl., A, Ch, NY). Panama: Bocas del Toro: Changuinola Valley, *G. P. Cooper & G. M. Slater 96* (*Y10277*) (fl., Ch, type — GH, Y); Cricamola, region of Almirante, *G. P. Cooper 498* (fl., Ch).

Native names: "Quizarra amarillo" (Costa Rica); "Sweetwood," "Yaya" (Panama).

The urceolate tube and spatulate anthers of the rather lignified and often exceedingly large inflorescence distinguish this species from others known from this area. It is of course most nearly related to *O. stenoneura* Mez & Pittier. Since their description agrees with *Tonduz 13377* rather than with the other syntype, *Cooper 10217*, the former was retained as the lectotype of *O. stenoneura*, and the latter placed with Costa Rican and Panamanian specimens with which it seems to belong. The long apparent petioles with the blades decurrent for almost their entire length, and conspicuously recurved, separate *O. stenoneura* from *O. Cooperi*, as well as the smaller globose fruit subtended by the shallow disk-like undulate-margined cupule.

3. **Ocotea Seibertii**, sp. nov.

Arbor 22.5–30 m. alta, ramulis griseis mox griseo-rubescenti-maculatis angulatis mox striatis vel sulcatis juventute pubescentibus mox glabrecentibus vel glabris. Folia alternata, glabra, petiolis ± gracilibus vel robustis, glabris, canaliculatis, ad 12 (–17) mm. longis et 2 (–2.5) mm. latis, laminis utrinque glabris interdum basi subtus costa nervisque exceptis, coriaceis, in sicco viridescentibus, supra valde subtus haud nitidis, ellipticis, 12 15 (–21) cm. longis et 4.5–6 (–9) cm. latis, basi cuneatis interdum leviter obliquis apice leviter obtuso-acuminatis, margine recurvatis, penninerviis, costa satis crassa supra leviter subtus valde elevata rubescente vel flavescente, nervis 6 (–9)-paribus supra haud subtus conspicuiore elevatis angulo 35–45° divergentibus, rete venularum juventute utrinque satis conspicuo mox supra laxe subtus valde minute conspicuo. Inflorescentia axillaris, paniculata, ad 13 cm. longa, juventute pubescens mox glabrescens, rubescens, longipedunculata, pedunculo ad 6 cm. longo. Flores ad 3 mm. longi, pedicellis ad 3 mm. longis, gracilibus, perianthio vadose infundibuliformi, lobis ± oblongis, subacutis, crassis, extus pubescentibus intus dense papilloso-pubescentibus, ± 2.8 mm. longis, staminibus ser. I & II ± 1.25 mm. longis, antheris oblongo-subrectangularibus filamento duplo longioribus, ser. III ± 1.7 mm. longis, conspicue biglandulosis, glandulis staminibus partem tertiam aequantibus; staminodiis subsessilibus ± .6 mm. longis ovatis; gynaecio glabro ± 2.15 mm. longo, ovario subgloboso vel obovoideo, stylo aequali, stigmate discoideo conspicuo. Fructus viridis, fide coll. globosus vel leviter obovoideus, apiculatus, rugosulus, 2.3 × 2 cm., cupula subcampanulata rugosula glabra rubra, 5 mm. longa, 3 mm. diam., et 3 mm. alta, margine undulata, gynophorio bene incrassato ad 2 mm. longo et 6 mm. diam. subtentus, pedicello incrassato glabro, 4–8 mm. longo.

DISTRIBUTION: Lowland forests of Costa Rica and Panama.

COSTA RICA: Alajuela: Lecheria on Poás, alt. 2285 m., July 30, 1932, *Stork 3377* (fl., TYPE, Ch) (tree 22.5–30 m.; felled for lumber); forests of El Copey, *Tonduz 11939* (fr., GH). PANAMA: Chiriqui: Valley of the Upper Río Chiriquí Viejo of Monte Lirio, *R. J. Seibert 308* (fr., A, Ch, Mo, NY); Chiriquí Viejo Valley, *G. White 96* (fr., Ch, GH, Mo).

NATIVE NAMES: "Quisarrá," "Quizarrá" (Costa Rica); "Sigua amarilla" (Panama).

The nearest affinities of *O. Seibertii* seem to be *O. stenoneura* and *O. Cooperi*, both of which are easily separable because of the tomentum on the lower leaf-surface. The fruit of *O. Cooperi* is ellipsoid and borne in deep subhemispherical cupules. That of *O. stenoneura* is globose and borne on more disk-like cupules, than that of *O. Seibertii*.

4. **Ocotea palmana** Mez & J. D. Smith in Bot. Gaz. **33**: 258. 1902; Standley in Field Mus. Publ. Bot. **18**: 455. 1937.

DISTRIBUTION: Costa Rica and Panama at about 1500 m. altitude.

COSTA RICA: Alajuela: Los Angeles and La Paz de San Ramón, *Brenes 6092* (fl., Ch). San José: In the forests of La Palma, alt. 1500 m., Nov. 1898, *Tonduz 7374* (*12652* Herb. Nat. Costa Rica) (fl., ISOTYPE, GH, NY); Platanares Moravia, *W. W. & H. E. Rowlee 210* (sterile, NY); La Palma, *W. W. & H. E. Rowlee 233* (fl., Ch). PANAMA: Bocas del Toro: Fish Creek Mts., vicinity of Chiriquí Lagoon, *von Wedel 2264* (fr., A).

NATIVE NAME: "Ira mangle" (Costa Rica).

The stout branchlets of this species are angled and densely, shortly, and minutely ferruginous-tomentose. The leaves are borne on thick petioles that are also pubescent, striate, and up to 3 cm. long and 4 mm. broad. The blades are rigidly coriaceous, obovate, cuneate at the base, rounded, and very shortly, abruptly, and obtusely acuminate to acutely acuminate at the apex, measuring up to 25 cm. long and 14 cm. broad. The blades are glabrous above, except for the venation, and beneath are covered with a dense fine close ferruginous tomentum. The broad costa is scarcely elevated above, though prominently so beneath. The lateral nerves, of which there are 8–10 pairs, are slender and delicately and slightly elevated above and conspicuously so beneath and diverge at an angle of about 55°. The inflorescence is stout, densely ferruginous-tomentose, axillary, paniculate, rather few-flowered, about 8 cm. long, the peduncle not more than 2 cm. long. The flowers are large, 5–6 mm. long and about 12 mm. in diameter, and densely tomentose, the ovate lobes almost leathery, ± 3.8 mm. long. The stamens of the outer series have short filaments and the anthers are ovate or rounded; those of the inner series are longer, with the filaments nearly equalling the oblong rounded anthers and completely covered by the large sessile roundish basal glands equalling the anthers in size. The glabrous gynaecium consists of an ellipsoid ovary topped by a rather stout style of nearly equal length bearing a capitate stigma. The fruiting specimen from Panama has branchlets that are less ferruginous- than tawny-brown-tomentose, and thicker shorter petioles subtending blades that are more rounded at the base and less pubescent. The fruit is green, ellipsoid, oblong, up to 3.5 cm. long and 1.6 cm. broad, subtended by a pink cupule that is subcampanulate and very thin-margined, up to 6 mm. long, about 15 mm. in diameter, and about 5 mm. deep, the supporting pedicel nearly 2.5 cm. long and expanded to nearly 1 cm. in diameter at the tip.

The species is related to *O. mollifolia,* under which it is further discussed.

5. **Ocotea mollifolia** Mez & Pittier in Bull. Herb. Boiss. II. **3**: 233. 1903; Standley in Field Mus. Publ. Bot. **18**: 455. 1937.

DISTRIBUTION: Known only from the type-locality.

COSTA RICA: Limón: Hacienda Victoria, forests of the plains of Zent, alt. 200 m., Feb., 1900, *Pittier 16031* (fl., fr., TYPE not seen), *16030* (fl., GH).

This species has slender striate terete branchlets densely clothed with a fine close short ferruginous tomentum, which persists on the short rather thick petioles measuring not more than 7 mm. in length. The chartaceous blades are subelliptic or usually obovate-elliptic, with the base cuneate and the apex abruptly short- or long-caudate-acuminate, measuring up to 24 cm. long and to 9 cm. broad. They are glabrous above except for the midrib and covered beneath with a soft pubescence which is conspicuously ferruginous on the venation. The costa and lateral nerves, of which there are about 10 pairs, diverging at an angle of 35–45°, are very slightly elevated above and prominently so beneath. The reticulation, visible above, is very conspicuous beneath. The very slender inflorescence is axillary or subterminal, paniculate, few-flowered, shortly densely ferruginous-pubescent throughout, up to 9 cm. long, the weak peduncle not more than 5 cm. long at most. The flowers are about 4 mm. long, subtended by a slender pedicel of equal length, both densely ferruginous-pubescent. The equal perianth-lobes (subequal according to Mez) are broadly ovate, acute (almost round according to Mez), thick, fleshy and slightly papillose within, nearly 3 mm. long. The stamens of the two outer series are ± 1.25 mm. long, the ovate anthers papillose at their round or obtuse tips, and only slightly longer than the broad pubescent filament which gradually expands toward its junction with the anther. Those of the inner series are ± 1.7 mm. long, the anthers oblong and equal to the pubescent filaments, which are covered one-half their length by large subsessile glands that are almost confluent. The gynaecium is ± 2.15 mm. long, the ellipsoid glabrous ovary slightly longer than the tapering pubescent style, which bears a conspicuous distinctly capitate stigma. The fruit, according to Mez, is large, ellipsoid, up to 3.5 cm. long, and about 1.5 cm. in diameter.

Although the type is not available for study, the number collected by Pittier presumably at the same time in essentials agrees precisely with the type. Mez mentions the shorter flower and the unequal lobes of the perianth, both characters which may vary in the same inflorescence. He mentions *O. Salvini* and *O. palmana* as being near *O. mollifolia*, but differing because of the strongly pilose style. The former has been transferred by Lundell to the genus *Phoebe*. The latter is generally a far more robust species in foliage and inflorescence-characters.

6. **Ocotea Ira** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. 3: 232. 1903; Standley in Field Mus. Publ. Bot. 18: 455. 1937.

DISTRIBUTION: Costa Rica and adjacent Panama, in the lowlands, or at not more than 200 m. altitude.

COSTA RICA: Limon?: Llanuras de Santa Clara, alt. 200 m., June, 1899, *Pittier 7608* (*13999* Herb. Nat. Costa Rica) (fl., LECTOTYPE, US). PANAMA: Bocas del Toro: Region of Almirante, Cricamola Valley, *G. P. Cooper 532* (fr., Ch, NY); Water Valley, *von Wedel 720* (fl., A); vicinity of Chiriqui Lagoon, *von Wedel 1382* (fl., A). Chiriquí: in lowlands, *Cooper & Slater 218* (*Y 10571*) (sterile, Y); Progreso, *Cooper & Slater 309* (*Y 10660*) (fl., Ch, Y).

NATIVE NAMES: "Ira" (Costa Rica); "Aguacaton" (Panama).

This species has branchlets that early lose their closely appressed brownish almost sericeous pubescence, becoming glabrous, angled, and darkish. The leaves are borne on petioles that are strongly or in some cases slightly winged, the blade being decurrent and recurved for nearly 4 cm., forming an apparent petiole; or the distinctly winged petiole may measure up to 1 cm. in length. The blades are subcoriaceous to rigid, glabrous to glabrescent, with frequently inconspicuous axillary glands, obovate, attenuately cuneate at the base and recurved, the apex abruptly and obtusely cuneate. They are up to 25 cm. long and 9.5 cm. broad. The costa is broad and conspicuous above, although slightly impressed, and prominently elevated beneath. The slender lateral nerves, of which there are 9–12 pairs, are very slightly elevated above and more so beneath, diverging at an angle of about 35–45°, curving toward the marginal region, the reticulation being inconspicuous above and conspicuous and frequently pubescent beneath. The inflorescence is axillary and subterminal, paniculate, many-flowered, brownish-pubescent, becoming glabrous, up to 15 cm. long, the stout peduncle up to 7 cm. long. The flowers are small, ± 2.15 mm. long, pubescent without, the slender pubescent pedicel about the same length; the rather thick papillose ovate acute lobes are ± 1.4 mm. long. The stamens of the two outer series are ± 1.25 mm. long, the ovate obtuse anthers scarcely longer than the slender filaments. Those of the inner series are ± 1.7 mm. long, the subrectangular truncate anthers not quite equalling the pubescent filaments, with two subglobose subsessile glands about half the length of the filaments. The glabrous gynaecium measures up to ± 2.4 mm., the subellipsoid ovary slightly longer than the slender style with a subtriangular subdiscoid stigma. Mature fruit of the species is unknown.

Mez & Pittier cite two syntypes, the number cited above, *Pittier 7608* (*13999*), and the number *10415*. The latter certainly corresponds not to the description of *O. Ira,* but to that of *O. cuneata* (*O. Tonduzii*). It does not match the only other number cited. Mez himself says that no. *10415* differs from *O. cuneata* (*O. Tonduzii*) and is more nearly related to *O. pedalifolia, O. pentagona,* and *O. insularis,* but differs from them in shape of leaves, the inflorescence, and smaller flowers. The species seems to me to be closely allied with the group of specimens of which *O. Tonduzii* is a member, because of the decurrent leaf-bases and the shape of the blades, although it does differ presumably in floral characters and the shape of the cupule. The leaves of the *O. Tonduzii* group (according to the original description) are on the whole much smaller than those of *O. Ira*.

7. **Ocotea Wedeliana,** sp. nov.

Arbor 3–12 m. alta, ramulis minute et inconspicue pubescentibus mox glabris, plus minusve angulatis vel alatis, brunneis, rubescentibus vel griseis. Folia petiolis saepe robustis canaliculatis pubescentibus ad 1 cm. longis, laminis membranaceis opacis juventute fulvo-sericeis celerrime glabris, obovatis vel ellipticis basi cuneatis apice obtusis acuminatis vel longe caudato-acuminatis, ad 26 cm. longis et 9.5 cm. latis, penninerviis, costa supra impressa subtus elevata, nervis lateralibus 8 vel 9 paribus, supra leviter subtus prominenter elevatis, angulo 35–45° divergentibus, rete venularum supra obscuro subtus satis prominulo. Inflorescentia axillaris vel subterminalis paniculata ad 12 cm. longa, glabrescens, pauciflora, pedunculo gracili ad 7.5 cm. longo. Flores fulvo-pubescentes, ad 3.5 mm. longi, pedicellis gracilibus ad 4.25 mm. longis, perianthii tubo conspicuo, lobis late ovatis acutis crassis ± 2.15 mm. longis; staminibus ser. I & II ± 1.25 mm. longis antheris ovatis obtusis 4-plo filamentis robustis pubescentibus longioribus, ser. III ± 1.5 mm. longis antheris basi pubescentibus anguste ovatis filamentis biglandulosis duplo longioribus, glandulis reniformibus conspicuis sessilibus filamentis aequalibus; staminodiis nullis; gynaecio glabro ± 1.7 mm. longo, ovario subgloboso stylo gracili aequali, stigmate conspicuo discoideo. Fructus globosus, glaber, viridis, ad 1 cm. diam., cupula vadosa undulata rubra ad 2 mm. longa et alta et 8 mm. diam. subtentus, pedicello rubro glabrescente ad 8 mm. longo et 2 mm. diam. apice expanso.

DISTRIBUTION: Known only from Bocas del Toro, northern Panama, at 375 m. altitude.

PANAMA: Bocas del Toro: Without locality, *Wedel 388* (fr., A), *G. P. Cooper 399* (fl., fr., Ch, TYPE — GH) (tree 12 m., diam. 10 cm., with long clear very slender bole; receptacle reddish, fruit green with white meaty pulp inside), *399a* (fl., Ch, NY); Buena Vista Camp, on Chiriquí Trail, *Cooper 603* (*Y 12236*) (fr., Ch, NY).

NATIVE NAME: "Sigua" (Panama).

This species is not, in foliage and floral characters, so very different from *O. nicaraguensis*, the principal difference being in the texture and size of the leaf-blades.

8. **Ocotea subalata** Lundell in Lloydia 4: 48. 1941.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Chiapas: Volcán Tacaná, on north side, alt. 2100 m., April 2, 1939, *Matuda 2957* (fl., fr., ISOTYPE, A, Ch, NY).

This species, known only from the type-material, has branchlets that are brownish-hirsute, becoming glabrescent, angled (subalate), and striate. The leaves have petioles that are hirsute, canaliculate, and up to 2 cm. long. The blades are glabrous above and glabrescent beneath, chartaceous, narrowly obovate or broadly oblanceolate, the base cuneate or almost obtuse, the apex usually abruptly and obtusely acuminate, 8–21 cm. long and 4–8.3 cm. broad. The broad costa is only slightly depressed above and prominently elevated beneath; the lateral nerves, of which there are 6–9 pairs, are obscure above and also prominently elevated beneath, the reticulation being minute and conspicuous throughout. The inflorescence is axillary, few-flowered, paniculate, pubescent to glabrescent, up to 12 (–?) cm. long, the blackish glabrescent peduncle measuring up to 7 cm. in length. The flowers are brownish-hirsute, about 2.5 mm. long, and borne on pedicels to 4 mm. long. The specimens at hand bear flowers that are too little developed for satisfactory dissection, but the author describes a short perianth-tube, ovate obtuse lobes, filaments about half as long as the ovate obtuse anthers and sparsely appressed-puberulent, the filaments of the inner series bearing conspicuous sessile glands, the ovary glabrous, somewhat longer than the style, the latter sparsely puberulent. The inflorescence expands in the fruiting stage to a rather robust structure up to 25 cm. long with a stout peduncle. The shining black ellipsoid fruits measure up to 2.5 cm. long and 1.7 mm. in diameter, and are subtended by an exceedingly shallow undulating woody cupule 3–4 mm. long and deep and about 1 cm. in diameter. The sturdy pedicel is glabrous, longitudinally rugose, and up to 2.5 cm. long, expanded equally throughout to a diameter of about 3–4 mm.

The nearest relative of *O. subalata* seems to be *O. verapazensis,* but the latter is easily distinguished by the differences in fruit-characters, particularly the deeper and even more woody cupule, and the presence of conspicuous glands. There is a superficial resemblance to *O. Wedeliana,* but again the small globose fruit of the latter, supported by a small unlignified cupule, unquestionably separate the two entities.

9. **Ocotea eucuneata** Lundell in Contr. Univ. Mich. Herb. 6: 16. 1941.

DISTRIBUTION: From British Honduras along high ridges south to Guatemala, along rivers and in mountains up to 1200–2000 m. altitude.

GUATEMALA: Huehuetenango: Cerro Chiblac, between Finca San Rafael and Ixcán, Sierra de los Cuchumatanes, *Steyermark 49183* (fl., Ch). Izabal: Along Río Tameja, *Steyermark 41769* (fr., Ch), *41797* (fr., Ch). BRITISH HONDURAS: Stann Creek: Middlesex, in high ridge, Oct. 27, 1939, *Gentle 3068* (fl., ISOTYPE, A, NY) (a large tree about 75 cm. in diameter; flowers creamish).

NATIVE NAME: "Timbersweet" (British Honduras).

A species with slender branchlets minutely, shortly, and inconspicuously pubescent, becoming glabrous and angled. The petioles also are slender and minutely pubescent, canaliculate, up to 1.5 cm. long at most. The blades are very thinly membranaceous, obovate, the base attenuately cuneate, the apex abruptly acuminate, up to 16 (occasionally 23) cm. long and 5 (occasionally 8) cm. broad, glabrescent on both surfaces. The costa and lateral nerves, of which there are 8 or 9 pairs diverging at an angle of about 35°, with inconspicuous pubescent axillary glands, are very slightly elevated above and very prominently so beneath. The inflorescence is axillary-subterminal, paniculate, grayish-pubescent to glabrous, up to 9 cm. long, the comparatively stout peduncle no more than 2.5 cm. long. The pubescent flowers are small, not more than 2.5 mm. long, the slender pedicel 3 mm. or less long. The perianth-tube is conspicuous, the ovate acutish lobes thinnish, up to 1.8 mm. long. The stamens of the two outer series are almost 1 mm. long, the ovate roundish anthers slightly longer than the pubescent filaments. Those of the inner series are somewhat longer, the anthers more oblong, the filaments bearing two subreniform conspicuous stipitate glands at the base. The glabrous gynaecium is ± 2.15 mm. long, the subglobose ovary surmounted by a slender style twice its length and bearing a conspicuous capitate stigma at its apex. The infructescence often retains the pubescence of the early stage. The fruit is oblong, slender, dull green, according to the collector, up to 2 cm. long and 6–10 mm. broad, subtended by a shallow lobed brittle cupule that is dull red, measuring up to 2 mm. long and deep and 8–9 mm. in diameter. The pedicel is enlarged to nearly 5 mm. long and is expanded to about 3 mm. in diameter at the apex. The branchlets of the fruiting specimens are much more densely pubescent than those of the flowering material.

The species is most nearly related to *O. subsericea*. It may be distinguished from this species by its leaves reaching a length of not less than 15 cm., as opposed to 12 cm. in *O. subsericea,* and by its much smaller thinner cupule.

10. **Ocotea verapazensis** Standley & Steyermark in Field Mus. Publ. Bot. 23: 114. 1944.

DISTRIBUTION: Known only from Guatemala, usually in wet forests at an altitude of 50 m. along river-banks in Izabal, and at 300–2000 m. in the mountains of Alta Verapaz and San Marcos.

GUATEMALA: Alta Verapaz: Dense wet forest in mountains east of Tactic, on road to Tamahú, *Standley 71163* (fl., Ch), April 9, 1939, *71421* (fl., fr., TYPE, Ch) (tree 6 m.; flowers green; cupule red). Izabal: Along Río Tameja, *Steyermark 41789* (fr., Ch). San Marcos: Between Finca El Porvenir and Loma Corona on forested slopes 9 miles northwest of El Porvenir, southwest-facing slopes of Volcán Tajumulco, *Steyermark 37752* (fl., Ch).

The branchlets of this species are distinctly angled and in the early stages are glabrescent and dark brown, shortly becoming glabrous, mottled dark brown, and pale buff-brown. The petioles are, on the mature branchlets, yellowish brown, canaliculate, and sturdy, measuring up to 1.5 cm. long. The chartaceous blades are opaque above, shining beneath, oblong-elliptic or obovate-lanceolate, the base cuneate and often very narrowly and obscurely decurrent and recurved for half a millimeter's length, the apex abruptly and usually shortly obtusely acuminate, 14–24 (–27) cm. long and 4.5–7 (–8) cm. broad. The costa is often yellowish or reddish, slightly elevated but conspicuous above and more prominently so beneath. The lateral nerves, numbering up to 9 at most, are inconspicuous above and prominently elevated beneath, diverging arcuately at an angle of about 35–45°, sometimes with rather inconspicuous axillary glands. The minute reticulation is obscure above but very conspicuous beneath. The rather weak axillary or subterminal inflorescence is very slender, rather few- to many-flowered, up to 15 cm. long, glabrous for the most part, with a peduncle that is not more than 5 cm. long, usually less. The glabrous flowers are up to 2.5 mm. long, the slender pedicel less than 3.5 mm. long, the perianth very narrowly campanulate, the lobes elliptic, acutish, ± 1.9 mm. long, rather thick. The stamens of the two outer series are ± 0.9 mm. long, the anthers ovate, nearly twice the length of the filaments, with the short connectives obtusely but shortly acuminate. Those of the inner series are ± 1.3 mm. long, the anthers ovate with short obtuse connectives, the filaments bearing two conspicuous basal subsessile glands. The slender linear attenuate pubescent staminodia are ± 0.55 mm. long. The glabrous gynaecium is about 1.4 mm. long, the ellipsoid ovary nearly twice the length of the slender style bearing an inconspicuous stigma. The fruit is shining, ellipsoid, up to 2.5 cm. long and 1.8 mm. broad, subtended by a red woody fluted cupule that is 6 mm. long, up to 1.5 cm. in diameter, and about 4 mm. deep. The pedicel is longitudinally grooved, about 1.5 cm. long, and expanded to 8 mm. in diameter at the apex.

The species in floral structure recalls *O. laetivirens*, but has a much more robust habit and coarser bark and infructescences.

11. **Ocotea nicaraguensis** Mez in Jahrb. Bot. Gart. Berlin 5: 238. 1889.

Ocotea pentagona Mez in Bot. Jahrb. **30**: Beibl. 67: 17. 1901.

Ocotea pedalifolia Mez in op. cit. 19.

DISTRIBUTION: Costa Rica and adjacent Nicaragua, at 200–915 m. altitude.

NICARAGUA: San Juan del Norte: Near San Juan, along the southern boundaries, *Friedrichsthal 627* (fr., photo. of TYPE of *Ocotea nicaraguensis,* Ch, NY). COSTA RICA: Alajuela: Banks of the Río Naranjo, near San Mateo, alt. 200–250 m., March, 1893, *Tonduz 7613* (fr., isosyntype of *Ocotea pentagona,* US); margins of "La Quebrada" Machuca, in "La Calera" de San Ramón, *Brenes 22644* (7) (fl., Ch). Limón: Forests of Shiroes, Talamanca, alt. 100 m., Feb., 1895, *Pittier & Tonduz 9172, 9179* (fl., fr., isosyntypes of *Ocotea pedalifolia,* US). San José: Vicinity of El General, *Skutch 2813* (fl., GH, NY); in forest on ridge overlooking Canaan, between Rivas and peak of Chirripó Grande Mt., *Danforth 38* (*Y 32963*) (fl., Y). Cartago: Near Turrialba, *Tonduz 7106, 8362* (fl., syntypes of *O. pentagona* not seen); bank of Río Tuis, *Pittier 11347* (fl., GH).

The present species has usually very characteristically angled rather stout glabrous branchlets that are early minutely ferruginous-tomentellous, presently becoming grayish or reddish brown, smooth, and often even more sharply angled. The enormous leaves have very stout dark canaliculate petioles which are tomentose on the ventral surface and measure up to 1.5

cm. long. The blades are heavily coriaceous, more or less opaque above, slightly darker beneath, obovate-elliptic or oblanceolate, the base obtuse, subrounded, or cuneate, often attenuately so, the apex abruptly and shortly acutely or obtusely acuminate. They measure up to 55 cm. long, although they are usually about 30 cm., and vary from 6–15 cm. in breadth. The costa is exceedingly broad (up to 5 mm.), usually only slightly elevated above and more prominently so beneath. The lateral nerves, of which there are 10–12 (–15) pairs, with the lowermost and uppermost obscure, are slightly elevated above and more prominently so beneath, and diverge from the costa at an angle of 35–55°. The reticulation is very prominent beneath, slightly less so above. The axillary and subterminal paniculate inflorescence, 15–30 cm. in length, is glabrous or glabrescent, borne on a stout brownish or reddish brown angled striate peduncle up to 10 cm. long. The flowers are up to 2.5 mm. long, glabrescent without; the glabrous to glabrescent slender pedicel is up to 5 mm. long, the tube well defined, the ovate or broadly ovate acute thinnish lobes ± 1.7 mm. long, and frequently broader than long at the base. The stamens of the two outer series have the anthers ovate, frequently with a definite connective, measuring ± 1.5 mm. overall, about twice the length of the pubescent filaments. Those of the inner series are ± 1.7 mm. long, the more narrowly ovate anthers three times the length of the filaments, which bear at the base two conspicuous ovate cordate short stipitate glands which are about half the length of the anthers. The glabrous gynaecium is ± 2.4 mm. long, the ovoid ovary about equal to the stout style topped with the discoid stigma. The ellipsoid smooth shining fruit, about 17 mm. long and 1 cm. broad, is borne on a shallow irregularly lobed cupule not more than 2 mm. long and deep and 8 mm. in diameter. The expanded deeply aciculate pedicel is up to 5 mm. long and 3–4 mm. broad at the tip.

Tonduz 7613 is annotated, presumably by Mez, as *"Ocotea paradoxa* Mez, n. sp.," but it is the syntype of *O. pentagona* and is a very good match for *Pittier & Tonduz 9172*, the fruiting syntype of *O. pedalifolia*. Although only a photograph of the type of *O. nicaraguensis* is at hand, I am reasonably certain of the numbers being conspecific.

12. **Ocotea Standleyi**, nom. nov.

Phoebe macrophylla Standley & Steyermark in Field Mus. Publ. Bot. 23: 116. 1944, non Mez.

DISTRIBUTION: Known at present only from Guatemala, at an altitude of 1200–2700 m., usually in wet forests.

GUATEMALA: Alta Verapaz: Southeast of Tactic, in wet forest, alt. about 1500 m., March 30, 1939, *Standley 70009* (fl., fr., TYPE, Ch); wet forest near Tactic, above the bridge across Río Frío, *Standley 90429* (sterile, Ch); wet mixed forest, mountains along road between Tactic and the divide on road to Tamahú, *Standley 91326* (fl., Ch). San Marcos: Wet forest, Barranco Eminencia, road between San Marcos and San Rafael Pie de la Cuesta, in upper part of the barranco between Finca La Lucha and Buena Vista, *Standley 86538* (sterile, Ch). Quezaltenango: Dense mixed forest, along old road between Finca Pirineos and Patzulín, *Standley 86927* (fr., Ch).

This large tough-leaved tree or large shrub has stout branchlets that are slightly angled, striate, glabrous, and castaneous or reddish brown. The heavy glabrous subcanaliculate petioles are the same color, which continues up into the stout broad costa, and they measure up to 2.5 cm. long and about 3 mm. in thickness. The blades are heavily coriaceous, glabrous throughout, elliptic or obovate-elliptic, the base obtuse or rounded and occasionally with a slight tendency toward being cordate, the apex rounded or obtuse or possibly shortly abruptly subacuminate, up to 30 cm. long and 12 cm. broad. The costa is conspicuous above, although impressed slightly, the lateral nerves, of which there are upwards of 12 pairs, diverging at an angle of about 45°, are slightly elevated above, and both costa and nerves are prominently elevated beneath. The reticulation is apparent although not prominent above, but conspicuously so beneath. The inflorescence is surprisingly slender for such leathery foliage, consisting of axillary panicles that are glabrescent, becoming glabrous, up to 14 cm. long, rather comparatively few-flowered, the peduncle up to 5.5 cm. long. The flowers and pedicels are each about 3 mm. long and pubescent. The tube is well developed and the lobes are broadly ovate (broader than long), thick, and ± 1.9 mm. long. The stamens of the two outer series are ± 1 mm. long, the subovate anthers only slightly longer than the slender filaments. Those of the inner series are ± 1.7 mm. long, the anthers being oblong or rectangular and equalling the filaments, which are completely covered by enormous lobed glands arising from the base. The staminodia are slender stipitate bodies, pubescent toward the base, the apical portion subrhomboid, measuring in their entirety about 0.6 mm. long. The glabrous gynaecium measures ± 1.7 mm. long, the subglobose ovary equalled by the tapering style, which bears a subtriangular stigma that is decurrent. The fruit is green (subcastaneous in the dried state), ellipsoid, minutely apiculate, measuring up to 2 cm. long and 1.5 cm. broad, supported by a shallow cupule that is woody, cyathiform, roughly subferruginous-verruculose, and measuring 5–7 mm. long, 12 mm. in diameter, and 3 mm. deep; the pedicel is thickened and also verruculose, measuring up to 1 cm. long and about 4 mm. in diameter at the apex.

The size and texture of the leaves suggest *O. nicaraguensis,* but the smaller fruit of the latter has a lobed less woody cupule, and the floral structure differs.

13. **Ocotea atirrensis** Mez & J. D. Smith ex Mez in Bot. Jahrb. **30**: Beibl. 67: 18. 1901; Standley in Field Mus. Publ. Bot. **18**: 454. 1937.

DISTRIBUTION: Costa Rica and adjacent Panama, usually at an altitude of 700–850 m., though it is found as high as 1550 m.

COSTA RICA: Alajuela: San Luis de Zarcero, in shady forest of Pacific cloud-forest zone, *A. Smith H.577* (fl., Ch); Villa Quesada, San Carlos, shade of Caribbean rain-forest, *A. Smith H.1737* (fl., A, Ch); La Palma de San Ramón, *Brenes 20596* (fl., Ch); near Río Naranjo, *Pittier* (Herb. Inst. Costa Rica *7592 b*) (fl., SYNTYPE not seen). Cartago: Vicinity of Pejivalle, in forest, *Skutch 4591* (fl., A); Atirro, alt. 700 m., March, 1894, *J. D. Smith 4930* (fr., ISOSYNTYPE, US). PANAMA: Bocas del Toro: Vicinity of Chiriquí Lagoon, *von Wedel 1399* (fl., A).

NATIVE NAME: "Quizarrá" (Costa Rica).

This species is characterized by rubescent angled branchlets that are early covered with a dense minute ferruginous pubescence which quickly disappears, leaving the branchlets glabrescent or glabrous. The leaves are borne on stout canaliculate petioles, glabrescent except for the residue of dense pubescence in the groove, and up to 1.5 cm. long. The blades are glabrous to glabrescent, membranaceous, opaque above and darker beneath, oblong or oblanceolate-elliptic, the base roundish, obtuse or obtusely cuneate, the apex caudate-acuminate, up to 38 cm. long and 10–13 cm.

broad. The broad costa is impressed above and the lateral nerves, of which there are 12–16 pairs, diverging at an angle of 45°, are rather obscure, but all are elevated prominently beneath. The reticulation is visible, although only slightly raised above but prominently so beneath. The axillary paniculate inflorescence is 15–20 cm. long, pubescent, becoming glabrescent, the peduncle up to 8 cm. long. The glabrescent flowers are up to 3 mm. long, with a short glabrescent pedicel not more than 2 mm. long. The lobes are thinnish, ovate-elliptic or even broadly ovate, obtuse, papillose within, ± 1.25 mm. long. The stamens of the two outer series measure about 0.8 mm., the ovate subrotund or obtuse anthers being twice the length of the filaments. Those of the inner series are ovate, obtuse, ± 1.25 mm. long, the anthers supported by filaments slightly shorter and bearing two subreniform sessile glands at the base. The glabrous gynaecium is ± 1.7 mm. long, the ovoid to subglobose ovary equalling the style, that bears an obtuse usually inconspicuous stigma at its apex. The black fleshy ellipsoid fruit measures up to 3.3 cm. long and at least 1.5 cm. broad. The cupule seems to be a shallow disk-like undulate-margined structure measuring up to 8 mm. in length and diameter, and less than 2 mm. deep. The supporting pedicel is very short and slightly enlarged to 2 mm. at the apex. A better prepared fruiting specimen of the species may change this concept of the cupule-structure and dimensions.

Ocotea atirrensis stands out because of the very long oblanceolate leaves, which are membranaceous. The species is perhaps more nearly related to *O. Paulii* than to any other of this region, but it is easily separated by the texture of the leaves and the different type of reticulation.

14. **Ocotea Paulii**, sp. nov.

Arbor ad 15 m. alta, ramulis angulatis brunneis mox griseis glabris sulcatis. Folia alternata, glabra, petiolis robustis glabris atro-rubescentibus 1 (— 1.5) cm. longis et 1.5–2.5 mm. latis, laminis utrinque glabris, coriaceis, in sicco plus minusve viridescenti-brunneis, oblongis, ad 20 cm. longis et 5–6.5 cm. latis, basi cuneatis, saepe abrupte cuneatis, apice abrupte et obtuse acuminatis vel rotundatis vel obtusis, interdum emarginatis, penninerviis, costa utrinque crassa rubescente supra satis subtus conspicue elevata, nervis 8–12-paribus supra inconspicue subtus conspicue elevatis angulo 35° divergentibus, rete venularum utrinque nonnihil prominulo. Inflorescentia axillaris vel subterminalis, late paniculata, ad 25 cm. longa, rubescens, glabrescens, multiflora, pedunculo rubescente, ad 6 cm. longo. Flores ad 2 mm. longi, pedicellis ± 2 mm. longis, gracilibus, perianthio campanulato, pallide flavescente, lobis late ovatis obtusis membranaceis, ± 1.25 mm. longis; staminibus ser. I & II ± 1 mm. longis, antheris ovatis filamento duplo longioribus, ser. III ± 1.25 mm. longis, antheris ovato-quadratis, filamentis conspicue biglandulosis, glandulis stipitatis antheris subaequalibus; staminodiis nullis; gynaecio glabro, ± 1.7 mm. longo, ovario late ovoideo vel subgloboso stylo aequali, stigmate conspicuo. Fructus atratus (in sicco), oblongus, 18–20 × 10–11 mm., cupula subhypocrateriformi rugosula, glabra, ± 2 mm. longa et 5–6 mm. diam., 1 mm. alta, margine undulata, subtentus, pedicello satis incrassato, glabro, 3–4 mm. longo.

Distribution: Panama, at an altitude up to 1100 m., and Costa Rica, up to 1450 m.

COSTA RICA: Alajuela: San Luis de Zarcero, edge of Pacific watershed cloud-forest, *A. Smith H.633* (fl., Ch); woods, La Palma de San Ramón, *Brenes 5590* (*181*) (fl., Ch). PANAMA: Chiriquí: Between Cerro Vaca and Hato del Loro, *Pittier 5395* (fl., Ch). Coclé: Vicinity of El Valle, alt. 600–1000 m., Dec. 8, 1938, *Paul H. Allen 1211* (fl., Ch, TYPE — GH, Mo) (tree 15 m.; flowers pale yellow); south rim (dry), *Allen 1775* (fr., Ch, GH, Mo, NY); region south of El Valle de Anton, *Allen 2848* (fl., A).

The nearest affinity of *O. Paulii* is *O. atirrensis*, but the new species is quickly distinguished by the coriaceous leaf-blades which are bright brown on drying. The apex of the blades of *O. atirrensis* is definitely caudate.

15. **Ocotea Dendrodaphne** Mez in Jahrb. Bot. Gart. Berlin **5:** 238. 1889; Standley in Contr. U. S. Nat. Herb. **27:** 183. 1928.

Dendrodaphne macrophylla Beurling in Vet. Akad. Handl. Stockholm **1854:** 145. 1856.

Ocotea Quisara Mez & J. D. Smith in Bot. Gaz. **33:** 259. 1902; Standley in Field Mus. Publ. Bot. **18:** 456. 1937.

Ocotea ovandensis Lundell in Contr. Univ. Mich. Herb. **6:** 16. 1941.

DISTRIBUTION: Mexico through Guatemala, Honduras, and Costa Rica to Panama, from 200 to about 1250 m. altitude.

MEXICO: Chiapas: Mt. Ovando, Dec. 17, 1936, *Matuda 444* (fl., isotype of *O. ovandensis*, A, NY), *1839* (fr., A, NY). GUATEMALA: Quezaltenango: Colomba, in coffee plantation, *Skutch 1980* (fl., A, Ch, NY), by roadside, *Skutch 2007* (fl., A, Ch). HONDURAS: Province unknown, in forest near Bolet's plantation, *P. Wilson 351* (sterile, GH). Atlántida: Tela, near Lancetilla, *Bangham 214* (fr., Ch). COSTA RICA: Alajuela: Villa Quesada, San Carlos, in Caribbean rain-forest, *A. Smith F. 1765* (sterile, fl., A, Ch), *1771* (fl., A, Ch); Suere, *A. Smith F. 1849* (sterile, fl., A, Ch). Limón?: La Emilia, Llanuras de Santa Clara, alt. 250 m., April, 1896, *J. D. Smith 6751* (fl., isosyntype of *O. Quisara*, GH); La Concepcion, Llanuras de Santa Clara, alt. 250 m., Feb. 1896, *J. D. Smith 6756* (fr., isosyntype of *O. Quisara*, GH). Cartago: Volcán de Turrialba, *Tonduz 9020* (fr., Ch); Atirro, alt. 600 m., April, 1896, *J. D. Smith 6753* (syntype of *O. Quisara* not seen). PANAMA: Colón: Near Puerto Bello, *Billberg s.n.* (fl., TYPE of *Dendrodaphne macrophylla* not seen). Coclé: Hills north of El Valle de Anton, vicinity of La Mesa, *P. H. Allen 2299* (fr., Ch).

NATIVE NAMES: "Quisara" (Costa Rica); "Sigua" (Panama, fide Standley).

This species is striking because of the usually silvery-gray angled branchlets, early closely and minutely pubescent but soon glabrous. The blackish stout canaliculate glabrous petioles up to 2 cm. long offer a contrast to the branchlets. The blades are chartaceous, glabrous throughout, or with a few dark hairs persisting at the base on the lower surface, usually pale green to light brown in the dried state, elliptic or oblong-elliptic, the base obtuse or abruptly cuneate, rarely rounded and abruptly cuneate, the apex variable, obtuse, or acutish, or even acuminate to caudate-acuminate. The blades measure up to 30 cm. long and up to 10 cm. in breadth. The robust costa is slightly impressed above and prominently elevated beneath. The lateral nerves number 9 or 10 pairs and are delicately and imperceptibly elevated above and more prominently beneath, diverging at an angle of about 45°. The upper surface of the blades is very smooth, showing no sign of the minute and dense reticulation which is characteristic of the lower surface. The inflorescence consists of numerous subterminal puberulous much-branched panicles usually 9–10 (–15) cm. long and many-flowered, the peduncles not more than 4.5 cm. long and usually less. The flowers vary in size from 4–6 mm. long, the elliptic or oblong or ovate-elliptic fleshy papillose lobes rounded or obtuse and up to 5 mm. long. The stamens of the two outer series are ± 2.8 mm. in length, the ovate acutish or obtuse petaloid anthers borne on exceedingly short stout filaments, the upper third of the anthers being connective tissue. Those of the inner series are longer, ± 3.2 mm., and the filament is also longer, being about one-third the entire length of the stamen, and bearing two small subsessile glands at the base of the anther. Wherever staminodia have been observed, they are cordate, subsessile, and ± 0.6 mm. long. The glabrous gynaecium is ± 2.4 mm. long; the ovary is probably ovoid, there being seemingly no distinct line of demarcation between it and the stout style, which is topped by a usually conspicuous stigma varying from capitate to decurrent. The fruit is ellipsoid, black, ± 2.3 cm. long and 1.2 cm. broad, borne in a glabrous woody cyathiform cupule that is 1 cm. long, 6 mm. deep, and 14 mm. in diameter, with a shallowly and obscurely lobed and slightly undulate double margin, subtended by a thickish striate pedicel up to 6 mm. long and pubescent to glabrous.

There are differences between the material collected in Mexico and Guatemala and that of Costa Rica. For example, the flowers of specimens collected in the former area are smaller than those of the southern area. The fruits, also, are smaller and the cupules subtending them are shorter. Nevertheless, it seems advisable to combine the two, since the differences are merely of degree.

The nearest relative of the species appears to be the smaller-leaved *O. veraguensis*, which has essentially the same floral structure, the style being more pronounced, the same incipiently double-margined cupule, and blackish petioles contrasting with the grayish angled branchlets and bearing leaf-blades that show no reticulation on their upper surface.

16. **Ocotea veraguensis** (Meissner) Mez in Jahrb. Bot. Gart. Berlin 5: 240. 1889; Standley in Contr. U. S. Nat. Herb. 23: 295. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 85. 1925; Standley in Field Mus. Publ. Bot. 12: 457. 1937.

Sassafridium veraguense Meissner in DC. Prodr. 15^1: 171. 1864.

Ocotea Bakeri Blake in Contr. Gray Herb. n.s. 52: 65. 1917.

Ocotea escuintlensis Lundell in Contr. Univ. Mich. Herb. 6: 15. 1941.

Distribution: General in forests throughout the regions along the Pacific coast (Pacific tierra caliente) from Mexico to Panama, usually at a very low altitude; occasionally found inland at higher altitudes (up to 1200 m.). The wood is used in some localities for construction. Some parts of the tree are used by the natives of Nicaragua as a tonic.

Mexico: Sinaloa: El Castillo, Mazatlán, *Ortega 6913* (fr., Ch). Nayarit (Tepic): San Blas, *Lamb 611* (fr., GH, NY). Guerrero or Michoacán: Botella, *Langlassé 656* (fl., GH). Guerrero: Mountains around Acapulco, *Gamon 6* (sterile, Y). Chiapas: Tonalá, in undergrowth along the banks of the river, *C. & E. Seler 1886* (fr., GH); near Tapana and La Junta in the high forest of the river-bed, *C. & E. Seler 1889* (fl., GH, NY); Escuintla, May 3, 1936, *Matuda 654* (fl., type of *O. escuintlensis*, Mich); San Pedro, *Mell 558* (fr., NY). Guatemala: Guatemala: Río Ocosito, *J. D. Smith 2608* (fl., fr., GH, NY). Escuintla: Below Las Lajas, common in damp forest, *Standley 64785* (fl., A). El Salvador: Dept. unknown, Cerro del Guayabal, *S. Calderón 1971* (fl., GH). Ahuachapán: Sierra de Apaneca, in forest in the region of Finca Colima, *Standley 20178* (sterile, GH). La Libertad: Comasagua, *S. Calderón 1390* (fr., GH). San Jacinto: Cerro de San Jacinto, *S. Calderón 2258* (fl., fr., GH, NY); in forest near summit of Cerro de San Jacinto, near San

Salvador, *Standley 20638* (fl., GH, NY). San Vicente: In quebrada, vicinity of San Vicente, *Standley 21668* (fl., GH, NY). Usulután: Berlín, *S. Calderón 2146* (fl., GH, NY). NICARAGUA: Without locality, *Wright s.n.* (fr., NY); Prov. unknown, Volcán Mombacho, *Baker 2493* (fl., type of *O. Bakeri*, GH). COSTA RICA: Guanacaste: Roadsides south of Liberia, *Dodge & Thomas 6312* (fl., NY); near Nicoya, *Tonduz 13809* (fl., GH), *13845* (fr., GH). Alajuela: Atenas, in the Pacific tropic zone in half-shade on edge of woodland in clay-loam, *A. Smith P.2464* (fl., A). PANAMA: Chiriquí: Vicinity of San Felix, *Pittier 5278* (fl., GH, NY). Veraguas: Near Veraguas, *Bridges* (SYNTYPE of *Sassafridium veraguense* not seen), *Warscewicz* (fl., photo. of SYNTYPE of *Sassafridium veraguense*, Ch, GH). Coclé: Penonome and vicinity, *R. S. Williams 236* (fr., NY). Panama: Rio Las Lajas, *P. H. Allen 1611* (fl., fr., GH, Mo, NY).

NATIVE NAMES: "Aguacatillo" (Costa Rica); "Canelillo" (Costa Rica); "Canelito" (El Salvador); "Canelo" (Costa Rica, El Salvador); "Laurel" (Mexico); "Palo colorado" (Nicaragua); "Pimientillo" (El Salvador); "Pimiento" (El Salvador); "Quisarrá" (Costa Rica); "Sigua canelo" (Panama).

This coastal species has branchlets that are finely gray- or tawny-sericeous, very quickly becoming pale gray, glabrous, and striate. The blackish stout canaliculate glabrescent petioles, up to 1 (sometimes to 1.5) cm. long, often make a striking contrast with the smooth grayish branchlets. The blades of the leaves are chartaceous to subcoriaceous, early soft grayish-pubescent below, becoming entirely glabrous, the margin in the dried state usually conspicuously minutely undulate or crisped. The color is uniformly a pale grayish green and the upper surface is very smooth. The blades are variable in shape, being elliptic, lanceolate-elliptic, oblong, oblong-elliptic, and finally rarely obovate, the base obtuse or cuneate, the apex rounded-obtuse or obtusely acute. The costa is very prominent above and beneath, although only slightly elevated above and more conspicuously so beneath. The lateral nerves, of which there are 6 or more obscure pairs, are not visible above and only faintly so beneath. The reticulation is not visible above and is very inconspicuous beneath. The inflorescence is axillary, paniculate, grayish-pubescent to glabrescent, many-flowered, the ultimate branchlets frequently giving the appearance of simulating a head-like formation. The entire length of the panicle varies from 3 to 13 cm., the peduncle sometimes attaining a length of 9 cm. The flowers are pubescent, up to 5 mm. long and more than twice that in diameter at anthesis, are supported by slender pubescent pedicels to 6 mm. long, and show a well developed tube. The lobes are oblong, obtuse or acutish, thick, fleshy, papillose, up to 3 mm. long. The stamens of the two outer series are ± 2.4 mm. long, the petaloid ovate anthers nearly sessile, the protruding papillose connective occupying at least the upper third of the anther. Those of the inner series are often slightly longer than the outer ones, the anthers being subtended by short filaments which bear at the base two conspicuous short-stipitate or sessile glands that are nearly the length of the anthers. The staminodia are variable, being absent or, if present, linear or consisting of a definite stipitate ovate head, always pubescent, from ± 0.6 to ± 0.9 mm. long. The glabrous gynaecium also varies, sometimes reaching a length of ± 2.15 mm., the ellipsoid to subglobose ovary usually twice the length of the tapering style with its usually conspicuous triangular stigma. The fruit of the species is very poorly represented in collections. It seems to be (immature?) greenish or light brown, not very firm in texture, ellipsoid, apiculate, up to 1.7 cm. long and about 1 cm. broad, subtended by a shallow thinnish cupule about 5 cm. long, 12 mm. in diameter, and about 3–4 mm.

deep. The margin is distinctly double, as in the genus *Licaria* — in fact the species has a superficial resemblance to *L. misantlae*. The outer margin is somewhat thickened and undulate, the inner is plain, paler in color, minutely pubescent, and protrudes beyond the outer for less than 1 mm. The pedicel is up to 1 cm. long, enlarging toward the apex to about 3 mm. in diameter.

The grayish branchlets, the blackish petioles, and the smooth gray-green leaf-blades recall to mind the larger-leaved species *O. Dendrodaphne*. The floral structure is of the same type, and the fruits are subtended by double-margined cupules. The consistently extremely large leaves of *O. Dendrodaphne,* however, preclude the possibility of its being a variety of the more widely spread *O. veraguense*.

Meissner cites as syntype *Oersted 10,* which is a *Litsea,* but Mez cites *Oersted 12* and *13,* from Costa Rica. I have seen neither of these syntypes. Most of the specimens from El Salvador show larger stamens, ± 1.25 mm. in length, and frequently these are equipped with glands similar to those of the stamens of the third or inner series. Occasionally a specimen (i.e., *A. Smith P.2464*) will have flower-parts that are extra large throughout.

17. **Ocotea chiapensis** (Lundell) Standley & Steyermark in Field Mus. Publ. Bot. **23**: 114. 1944.

Nectandra chiapensis Lundell in Contr. Univ. Mich. Herb. **6**: 12. 1941.

DISTRIBUTION: Known only from type-locality and vicinity in Mexico and from adjacent Guatemala.

MEXICO: Chiapas: At Cerro Laguna, Mapastepec, January, 1938, *Matuda 2042* (fl., ISOTYPE, A, Ch, NY); Rodeo, near Siltepec, *Matuda 4579* (fl., A). GUATEMALA: San Marcos: Along river, between La Vega ridge along Río Vega and northeastern slopes of Volcán Tacaná, to 3 miles from Guatemala-Mexico boundary, in vicinity of San Rafael, *Steyermark 36195* (fl., Ch).

This species has stout cicatricose branchlets that are angled at first and brownish-sericeous, becoming glabrescent and eventually grayish brown. The leaves are supported by pubescent apparent petioles up to 2 and sometimes 3 cm. long, formed by the decurrent blades which are strongly recurved. The blades themselves are early membranaceous, becoming heavily chartaceous, at first densely sericeous, very soon glabrous except for the lower leaf-surface and the exceedingly conspicuous ellipsoid pubescent glands that occur in nearly all of the axils of the lateral nerves. The blades are usually obovate-elliptic, occasionally oblong-elliptic, up to 15 cm. long and 7.5 cm. broad, the base (not including the decurrent petiole) rounded or cuneate, the apex acutish or subacuminate. The broad costa is only slightly elevated above and conspicuously so beneath. The tenuous lateral nerves, of which there are 9–12 pairs, are faintly outlined above but slightly elevated beneath. The reticulation is obscure above and slightly prominulous beneath. The inflorescence is axillary, often few-flowered, brownish-sericeous, up to 15 cm. long, the stout pedicel attaining a length of 5 cm. The flowers are ± 3.5 mm. long and about 6 mm. in diameter, the pedicel ± 1.7 mm. long, the subequal thick ovate acutish papillose lobes reflexed and ± 2.15 mm. long. The stamens of the two outer series are about 1.25 mm. long, the elliptic rounded anthers twice the length of the filaments. Those of the third series are ± 1.5 mm. long, the oblong rounded anthers slightly pubescent at the base and only slightly longer than the filaments that bear conspicuous basal glands. The staminodia are pubescent, ± 0.6 mm. long, either stipe-like or occasionally ovate. The glabrous gynaecium measures ± 2.15 mm., the ellipsoid ovary slightly longer than the slender style topped by a conspicuous peltate stigma.

The species probably belongs near *O. Austinii,* but may be separated by the smaller less robust and less pubescent inflorescence and the more prominent reticulation of the leaf-blades, as well as by the presence of very large conspicuous axillary glands.

18. **Ocotea Austinii,** sp. nov.

Arbor 10–18 m. alta, ramulis striatis, juventute minute brunneo-sericeo-pubescentibus mox griseo- vel atrato-pubescentibus deinde glabrescentibus. Folia alternata, subverticillata, juventute supra glabra, margine et costa exceptis subtus dense et crasse ferrugineo-sericeo-pubescentia, petiolis alatis crassis pubescentibus, 1.5 (–2.5) cm. longis et 4–5 mm. latis, laminis coriaceis in sicco supra brunneis vel viridescenti-brunneis nitidis subtus ferrugineis, opacis, oblongo-ellipticis vel ellipticis vel leviter obovato-ellipticis, 7.5–9 (–11) cm. longis et 3–4.5 cm. latis, basi cuneatis in petiolum decurrentibus ibique valde recurvatis, apice obtusis vel leviter et obtuse subacuminatis, penninerviis, costa supra satis subtus conspicue elevata, utrinque pubescente, nervis 7–10 paribus supra aeque et regulariter leviter elevatis concoloribus, subtus pubescentibus obscuris angulo 45° divergentibus, interdum glandulis obscuris in nervorum lateralium axibus, rete venularum supra aeque et regulariter elevato subcancellato. Inflorescentia axillaris anguste paniculata, subcapitata, pauciflora, robusta, dense sericeo-ferrugineo-pubescentia, ad 8 cm. longa et ad 2 cm. lata, longipedunculata, pedunculis 3–5 cm. longis. Flores ± 2.5 mm. longi, sessiles vel pedicellati, pedicellis ± 2.5 mm. longis, perianthio campanulato (urceolato-campanulato, fide coll.), sulfureo-flavescente, fide coll. (vel viridescenti-flavescente), lobis late ovatis acutis crassis, dense pubescentibus, 3 mm. longis; staminibus ser. I & II ± 1.9 mm. longis, antheris filamentis aequalibus, ser. III ± 2.15 mm. longis, antheris filamentis aequalibus, conspicue biglandulosis, glandulis sessilibus, antheras aequantibus; staminodiis nullis; gynaecio glabro, ± 2.5 mm. longo, ovario subgloboso vel obovoideo, longitudine ultra ½ gynaecii aequante, stigmate triangulari, conspicuo. Fructus late obovoideus atro-olivaceus, minute canescenti- vel griseo-canescenti-punctatus, fide coll. 28 × 20 mm., cupula vadosa rubra subcampanulata vel maturitate interdum infundifuliformi, nonnihil verruculosa glabra vel glabrescente rugosula, 6–7 cm. longa et ad 1.5 cm. lata, ± 3 mm. diam. subtentus, pedicello glabro rugosulo aciculato ± 1 cm. longo.

DISTRIBUTION: In cloud-forests or cleared pasture-land of Costa Rica and in rain- and cloud-forests of the adjacent areas of Panama, at an altitude of 1765 to 2300 m. in Costa Rica and at 1980 m. in Panama. The wood is used for lumber in Panama.

COSTA RICA: Alajuela: Alfaro Ruiz, Palmira, region of Zarcero, in rich clay-loam and semi-shade, alt. 1765 m., August 14, 1935, *Austin Smith A.125* (fl., TYPE, Ch) (forest tree 15 m., base 1 m; bark light brown, roughened, cambium-layer rufous-brown, sapwood cream-colored; leaves coriaceous, polished on upper surface, lighter green below; flowers sulphur-yellow, with an expanse of 4 mm., urceolate-bell-shaped, stigma and anthers green, maturing to dark brown), *A. Smith A.504* (fl., Ch), *H.1181* (fl., Ch). San José: Near Camp Empalme in oak cloud-forest, along the w. slope of the Continental Divide, about 29 km. S. of Cartago, *Little 6007* (*F.S.95042*) (fr., A). PANAMA: Chiriquí: In rain-forest, Bajo Chorro, Boquete, *Davidson 268* (fr., A, Ch, Mo); cloud-forest, Cerro Horqueta, *C. & V. W. von Hagen 2128* (fr., A, Mo).

NATIVE NAME: "Sigua Canela" (Panama).

The exceedingly prominent and regular more or less cancellate reticulation of the leaf-blades of this species separate it from the related species *O. Endresiana, O. Tonduzii,* and *O. Skutchii.* The blades also differ in the sericeous pubescence and succeeding glaucescent aspect of the lower surface.

19. **Ocotea Endresiana** Mez in Jahrb. Bot. Gart. Berlin 5: 257. 1889; Standley in Field Mus. Publ. Bot. 18: 455. 1937.

DISTRIBUTION: Known only from Costa Rica.

COSTA RICA: Without locality, *Endres 223* (fl., TYPE not seen). Alajuela: La Palma de San Ramón, *Brenes 6317* (fl., Ch); Los Angeles de San Ramón, *Brenes 16227* (fl., Ch); Piedades Sur (La Palma) de San Ramón, *Brenes 17172* (fr., Ch).

NATIVE NAME: "Maranón" (Costa Rica).

A species that is very difficult to separate, without dissection of the flower, from *Aiouea.* The stout cicatricose branchlets are dark brown, glabrous, and subterete. The leaves are sessile, the blade narrowing about 2–3 cm. above the base and becoming strongly recurved, forming a broad apparent petiole the same length and 5–6 mm. broad. The blades are coriaceous, glabrous throughout except for axillary pubescent glands below, obovate, obtuse or rounded for the most part, up to 12 cm. long and 5.5 cm. broad. The broad costa and the slender lateral nerves, of which there are 6–9 pairs diverging at an angle 35–45°, are obscure above and more prominent, particularly the costa, beneath. The reticulation is very obscure above and conspicuously prominent beneath. The stout inflorescence is axillary or subterminal, glabrous, rather many-flowered, paniculate, 5 (–14) cm. long, the peduncle 2–3 (–6) cm. long. The flowers are ± 2.5 mm. long, glabrous, supported on slender pedicels 2 (–4) mm. long. The ovate acute lobes are fleshy and up to ± 2.5 mm. long. The stamens of the two outer series are up to ± 1.25 mm. long, the ovate roundish anthers only slightly longer than the somewhat stout filaments. Those of the inner series are ± 1.7 mm. long, the more narrowly ovate anthers surpassed slightly by the filaments which bear two large subglobose sessile glands at the base. The glabrous gynaecium is ± 2.4 mm. long, the ellipsoid ovary only slightly exceeding the stout style in length, the whole topped by a discoid inconspicuous stigma. (Mez describes the ovary of the type-specimen as being subglobose and one-half again longer than the almost slender erect style with discoid-obtuse stigma.) The fruit (that of *Brenes 17172,* the vegetative characters of which match Mez' description of *O. Endresiana*) is ellipsoid, apiculate (immature?), up to 1 cm. long and 7 mm. broad, and is borne in a shallow woody cupule with an entire margin, 3–5 mm. long and about 5–6 mm. in diameter and not more than 1 mm. deep; the thickened pedicel is not more than 2 mm. or so long and 3–4 mm. in diameter at the apex.

The species is separated from *O. Tonduzii* by the very broad decurrent and recurved sessile blades, forming a much longer apparent petiole, and in fruit by the entire cupule.

20. **Ocotea Tonduzii** Standley in Field Mus. Publ. Bot. 18: 456. 1937.

Ocotea cuneata Mez in Jahrb. Bot. 30: Beibl. 67: 17. 1901, non Gomez, 1894.

DISTRIBUTION: Costa Rica, in forests from 640 to 1200 m. altitude.

NATIVE NAME: "Ira" (Costa Rica).

COSTA RICA: Province unknown, near Rancho Flores, *Tonduz 2142* (fl., SYNTYPE of

O. cuneata not seen). Heredia: On banks of the Río Segundo, alt. 2000 m., *Tonduz* (Herb. Inst. Costa Rica) *1739* (fl., SYNTYPE of *Ocotea cuneata* not seen). San José: Vicinity of El General, *Skutch 4303* (fr., A, Ch, NY). Cartago: Forests of Quebrada Honda, near Juan Viñas (Atlantic), *Tonduz 10415* (fr., isosyntype of *O. Ira*, US).

The fruiting material above matches very well with the description given by Standley. It is with little hesitation that the numbers are placed here. The branchlets are glabrous, grayish, almost checkered, very thick, and angled toward the tips. The leaves are subsessile, the base of the blade decurrent and strongly recurved, making an apparent petiole up to 2.5 cm. long. The coriaceous glabrous blades are opaque, obovate, attenuately cuneate at the base and rounded or very inconspicuously and shortly acuminate at the apex. They measure up to 15 cm. long and 7 cm. broad (those of *Tonduz 10415* are much smaller). The costa is impressed above but prominent beneath. The lateral nerves, of which there are upwards of 8 pairs, are delicately elevated above and more prominently so beneath. The reticulation is obscure throughout. The inflorescence, according to Mez, is stoutly scopiform-paniculate, the pedicels 0.5–1.5 mm. long, the bracteoles deciduous. The flowers are 2.5–3.5 mm. long, the perianth-tube barely distinct from the pedicel and gradually merging into it. The lobes are broadly ovate, rotund or acutish. The filaments are glabrous and those of the inner series have two large glands at the base, irregularly and incised-lobed. The ovary is subglobose and the stigma discoid. The ellipsoid fruits are 1.5 cm. long and .8 mm. broad, borne in woody cyathiform red cupules still crowned with the remnants of the perianth-lobes, 4–6 mm. long, about 8 mm. in diameter, and about 4 mm. deep. The pedicel is very short, not more than 2 mm. long and expanded to the same width at the apex.

Ocotea Tonduzii is very close to *O. Endresiana*, but may be separated from the latter by the very short petiole, narrowly decurrent blades, the 6-lobed cupule, and the pubescent axillary glands. The fruiting material of this species is often confused with that of *Aniba*, and it is very difficult to enumerate the points of difference.

The confusion of numbers cited by Mez under *O. Ira* is taken up under that species.

21. **Ocotea Skutchii**, sp. nov.

Arbor ad 27 m. alta, ramulis brunneis angulatis mox griseis sulcatis. Folia alternata, juventute fulvo-sericeo-pubescentia mox glabrescentia vel glabra, petiolis conspicue alatis, alis recurvatis, inconspicue pilosis vel glabris, ad 2.5 cm. longis et basi 2 mm. apice ad 8 mm. latis, laminis supra glabris, subtus sparse et inconspicue pubescentibus, satis coriaceis, in sicco supra viridescentibus subtus pallidioribus vel subglaucescentibus, ellipticis vel leviter obovato-ellipticis, 10.5 (–13) cm. longis et 4–4.5 (–5.5) cm. latis, basi cuneatis, in petiolum decurrentibus ibique valde recurvatis, apice abrupte obtuse acuminatis, penninerviis, costa supra haud impressa subtus valde elevata, costa nervisque utrinque conspicue flavescentibus vel albescentibus, interdum costa subtus rubescente, nervis 8 vel 9 paribus supra leviter impressis subtus elevatis, angulo 45° divergentibus, interdum glandulis obscuris in nervorum lateralium axibus; rete venularum supra haud subtus satis prominulo. Inflorescentia axillaris, late et laxe paniculata, ad 16 cm. longa, pubescens, pedunculo ad 6 cm. longo. Flores

2.5–3 mm. longi, pedicellis ad 5 mm. longis, gracilibus, perianthio campanulato, flavescente fide coll., lobis late ovatis, crassis, ± 1.7 mm. longis; staminibus ser. I & II ± 1 mm. longis antheris ovatis rotundatis filamentis duplo longioribus, ser. III ± 1.5 mm. longis conspicue biglandulosis, glandulis subglobosis stipitatis; staminodiis nullis; gynaecio glabro ± 1.8 mm. longo ovario ellipsoideo stylo gracili duplo longiore, stigmate parvissimo inconspicuo. Fructus non visus viridis, fide coll., cupula rubra vadosa leviter campanulata minute verruculosa crassa glabra ad 1 cm. longa, 9 mm. diam., 3 mm. alta subtentus, pedicello glabro, striato, ad 7 mm. longo.

Distribution: Known only from Costa Rica, at 700–1680 m. altitude.

Costa Rica: Heredia (?): Vicinity of Vara Blanca, north slope of Central Cordillera, between Poás and Barba volcanoes, *Skutch 3755* (fr., A, NY). San José: Vicinity of El General, alt. 700 m., Dec. 1936, *Skutch 3062* (fl., type — GH, NY) (tree 27 m.; flowers yellowish).

Native name: "Ira rosa" (Costa Rica).

This species may be separated from *O. Tonduzii* and *O. Endresiana* by a combination of characters, such as the short petiolate leaves with the blades only narrowly decurrent on the petioles, the apparent petiole up to 2.5 mm. long, axillary glands either absent or if present conspicuous for being narrowly ellipsoid, and the entire cupule.

22. **Ocotea rubrinervis** Mez in Jahrb. Bot. Gart. Berlin 5: 351. 1889.

Distribution: Panama, and south to Peru and Bolivia; probably occurring in the intervening areas. Not mentioned by Kostermans in Pulle's Flora of Surinam.

Panama: Without locality, *Duchassaing* (syntype not seen). San José Island, Perlas archipelago, Gulf of Panama (about 55 miles SSE. of Balboa), in mixed forest along South Road (S^2 area), *Johnston 111, 133, 250, 415, 497* (fl., A), 556, 563, 604, 655 (fr., A). [Peru: San Martin: Near Tarapoto, *Spruce 4580* (photo. of syntype, GH).]

The species is described as having young branchlets pilose at the apex, the adult ones glabrous, cinereous, terete. The branchlets of the Johnston specimens are densely dark brown-pubescent, becoming glabrous and at length cinereous. The short canaliculate petioles are also pubescent, becoming glabrescent, and measure to 1 cm. long as opposed to Mez' description. The blades of Mez' description are foveolate and glabrous above, pilose beneath. Those of Johnston's collections are scattered-pubescent near the base, rather reticulate above, glabrescent beneath except for the pubescent axillary glands. The blades are elliptic or broadly elliptic, the base subrounded, obtuse or cuneate, the apex shortly obtusely acuminate or obtusely acute, measuring to 11 cm. long and up to 7 cm. in breadth, larger on the whole than the specimens of Mez' description. The costa and lateral nerves, of which there are 4–6 pairs, are impressed above and prominently elevated and yellowish beneath. The inflorescence is axillary or subterminal, slender, the branches of the panicle narrowly racemose, glabrescent for the most part, the flowers grayish-pubescent rather than ferruginous-pilose. The staminate flowers are yellow, about 3 mm. or less long, and sessile or borne on a short pedicel less than 1 mm. long. The ovate acutish lobes are rather thick and ± 2.15 mm. long. The stamens of the two outer series are ± 1.5 mm. long, the ovate obtuse to roundish anthers slightly longer than the filaments. Those of the inner series are slightly larger and have anthers more narrowly ovate, supported by filaments completely covered on the dorsal side by the conspicuous fused sessile glands borne at the base. The slender transparent staminodia, less than one-half a millimeter in length, are oblanceolate. Mez says that all staminodia are aborted in his material. The aborted glabrous gynaecium is ± 1.9 mm. long, subcylindrical, the basal part bulging only slightly, and the apex bearing a conspicuous (triangular according to Mez) stigma depressed above.

Although there are discrepancies and Johnston's material does not precisely match the description of Mez' species, the two are so close that it seems unwise, at least until the types are available, to describe Johnston's collections as new.

23. **Ocotea subsericea** Standley in Field Mus. Publ. Bot. **18**: 456. 1937.

DISTRIBUTION: Costa Rica and Panama, at an altitude of about 1250 m.

COSTA RICA: Alajuela: La Palma de San Ramón, 1250 m. alt., March 30, 1929, *Brenes 6789 (665)* (fl., Ch, TYPE). PANAMA: Coclé: North rim of El Valle, *P. H. Allen 1907* (fr., Ch, GH, Mo, NY).

This species was described from a specimen which seemingly is not only from a branch that is very young, but growing in an unexposed situation. The branchlets are minutely but densely appressed-yellowish-buff-sericeous-tomentose, angled, becoming grayish, glabrous, terete, and striate-sulcate. The petioles of the leaves are also pubescent, slender, subcanaliculate, and up to 1.5 cm. long. The blades of the type are thinly membranaceous, those of the adult leaves more thickly membranaceous, elliptic, the base cuneate, the apex abruptly and obtusely acuminate, up to 12 cm. long and 4.5 cm. broad. The costa is minutely elevated above and conspicuously so beneath. The lateral nerves, of which there are 6–8 pairs, diverge at an angle of about 45°, and bear more or less inconspicuous axillary glands. The inflorescence is axillary, paniculate, rather few-flowered, densely but closely pubescent, up to 6.5 cm. long, the glabrescent flowers up to 3 mm. long, spreading-campanulate, the pedicel 2–4 mm. long. The ovate acutish lobes are fleshy and papillose within, ± 2.15 mm. long. The stamens of the two outer series are ± 1.25 mm. long, and the anthers are ovate, truncate, almost equalled by the stout filaments. Those of the inner series are oblong, the filaments covered with conspicuous sessile glands. The slender (undeveloped, or maybe this is the staminate flower of a dioecious species) glabrous gynaecium is ± 2.15 mm. long, the narrow ovary blending imperceptibly into the stout style that bears a conspicuous peltate stigma. The fruit is pointedly ovoid, black, up to 2.5 cm. long and 1.5 cm. broad near the base, supported by a flat almost disk-like woody cupule separated from the fleshy fruit, at least on drying, about 1.5 cm. in diameter and slightly undulate. The enlarged pedicel (as well as the cupule) is pale brownish-buff, deeply furrowed and verruculose, measuring up to 1 cm. in length and 5 mm. in diameter throughout.

The relationship of the species to *O. cucuneata* is discussed under that species.

24. **Ocotea Klotzschiana** (Nees) Hemsley, Biol. Centr. Am. Bot. **3**: 73. 1882; Mez in Jahrb. Bot. Gart. Berlin **5**: 273. 1889.

Oreodaphne Klotzschiana Nees in Linnaea **21**: 523. 1848.

DISTRIBUTION: Known only from Mexico.

MEXICO: State unknown, "Bei El Banco," *Ehrenberg 943* (fl., fragm. of TYPE, Ch); *Hartweg 383* (fl., cited by Mez, photo., Ch).

This entity (a tree according to Ehrenberg; a shrub 2–3 m. high according to Hartweg) has terete branchlets that are sparsely pilose near the apex, quickly becoming glabrous and black-brown. The petioles are up to 15 mm. long and canaliculate. From the fragment the blades appear to be oblong-elliptic (or in the photo. lanceolate or elliptic-lanceolate), the base cuneate, the apex acuminate (long-acuminate in the photo.). They are chartaceous, shining above, and everywhere very prominently and coarsely reticulate, measuring up to 9 cm. long and 2.8 cm. broad. The costa is conspicuous though not elevated above, and very prominent beneath. The lateral nerves are obscured by the prominent reticulation but appear to number 4–6 pairs, diverging at an angle between 30° and 50° and bearing beneath conspicuous axillary pubescent glands. The axillary paniculate many-flowered inflorescence, up to 5 cm. long, is described as pubescent, and the peduncle is 1 cm. or less in length. The flowers are about 2.5 mm. long and pubescent, the slender pubescent pedicel not more than 2–3 mm. long. The thinnish ovate acutish lobes are ± 2.15 mm. long. The stamens of the two outer series are ± 1 mm. long, the anthers are almost rectangular-ovate and twice the length of the filaments. Those of the inner series are ± 1.7 mm. long, the almost equal filaments bearing conspicuous ovate glands that are stipitate and almost the length of the filaments. The staminodia are linear, acuminate, pubescent, ± 0.6 mm. long. The glabrous gynaecium is ± 2.25 mm. long, the subglobose-ovoid ovary topped by a slender style of equal length which flares into a discoid very conspicuous stigma. The fruit is unknown at present.

This little collected and little known species is one of the smallest-leaved species found in this area, sharing this character with *O. effusa,* from southern Mexico, adjacent Guatemala, and British Honduras. In addition it is outstanding because of its shining prominently reticulate leaf-blades, which are chartaceous.

25. **Ocotea effusa** (Meissner) Hemsley, Biol. Centr. Am. Bot. 3: 73. 1882; Standley in Contr. U. S. Nat. Herb. 23: 296. 1922; Lundell in Contr. Univ. Mich. Herb. 6: 15. 1941.

Oreodaphne effusa Meissner in DC. Prodr. 15^1: 120. 1864.

DISTRIBUTION: Southern Mexico, Guatemala, and British Honduras, in forests.

MEXICO: Oaxaca: Near San Pedro Nolasco, Talea, etc., 1843–44, *Juergensen 906* (fl., fragm. of TYPE, Ch, photo., Ch, NY). (Probably Oaxaca): Monte Mistan, 184–, *Galeotti s.n.* (fl., Ch, GH, US). Chiapas: Damp forest, mountains east of Fenix, *Purpus 10309* (fl., NY), *10690* (fl., GH). GUATEMALA: Huehuetenango: Between Ixcán and Río Ixcán, Sierra de los Cuchumatanes, *Steyermark 49373* (fr., Ch). BRITISH HONDURAS: Stann Creek: In high ridge on hillside, Middlesex, *Gentle 2926* (fr., A, NY); Mountain Cow Ridge, *Gentle 3266* (fl., A, NY).

This slender dainty-leaved species has slender terete obscurely striate branchlets that are early sericeous but quickly lose their pubescence, becoming glabrous almost at once. The petioles are delicate, canaliculate, and glabrous, measuring up to 5 mm. and occasionally almost approaching a centimeter in length. The thinly membranaceous almost shining blades are glabrous throughout except for the costa beneath, the base lanceolate and attenuately cuneate, the apex attenuately and obtusely caudate-acuminate. The costa is slightly but conspicuously elevated above and beneath.

The numerous pairs of lateral nerves are so obscure that it is difficult to count them. The reticulation is not visible above and although present beneath is very obscure. The tenuous weak inflorescence is axillary or subterminal, paniculate, glabrous, few-flowered, up to about 12 cm. long, and the peduncle is up to 5.5 cm. The tenuous flowers are about 3 mm. long subtended by filamentous pedicels that are sometimes as long as 5 mm. The perianth-tube is well developed, and the ovate acutish lobes are thin in texture, ± 1.7 mm. long. The stamens of the two outer series are ± 1.25 mm. long, the rectangular-ovate roundish anthers nearly twice the length of the slender sometimes pubescent filaments. Those of the inner series are ± 1.7 mm. long, the anthers more slender, and with the subequal filaments bearing two distinct subglobose sessile glands at the base. The staminodia are linear, pubescent, and ± 0.7 mm. long. The glabrous gynaecium is ± 1.7 mm. long, the ellipsoid-subglobose ovary about equalling the attenuate style bearing a subcapitate obtuse stigma. The fruit is ellipsoid, apiculate, up to 14 mm. long and 9 mm. broad, subtended by a shallow flaring cupule up to 4 mm. long, 6 mm. in diameter, and not more than 1.5 mm. deep, the margin only slightly undulate. The pedicel is almost 1 cm. long, expanded at the apex to 4 mm. in diameter.

The slender aspect of the inflorescence and the dainty thread-like pedicels of the small flowers of this species separate it immediately from the only other near relative, *O. Klotzschiana*. Also the leaf-blades, with prominent costa above and the reticulation very obscure, are in contrast to the conspicuous reticulation of *O. Klotzschiana* throughout.

26. **Ocotea Bernoulliana** Mez in Jahrb. Bot. Gart. Berlin 5: 275. 1889.

DISTRIBUTION: Guatemala, Honduras, and British Honduras, up to 2000 m. altitude.

GUATEMALA: Huehuetenango: Cerro Chiblac, between Finca Rafael and Ixcán, Sierra de los Cuchumatanes, *Steyermark 49181* (fr., Ch). Alta Verapaz: Damp forest, region of Chelac, northeast of Carchá, *Standley 70367* (fl., Ch), *70523* (fl., Ch). Quezaltenango?: Near Mujulia (Majulia), *Bernoulli & Cario 2590* (fl., fr., TYPE not seen). HONDURAS: Yoro: Near Progreso, Farm 42, *Hottle 83* (fl., Ch); *C. & V. W. von Hagen 1118* (fr., Ch, NY). Atlántida: Lancetilla Valley, near Tela, *Standley 56721* (fl., Ch). BRITISH HONDURAS: Orange Walk: Roaring Creek, *Lundell 325, 370* (fr., Ch). Stann Creek: In high ridge on hillside, Big Eddy Ridge, *Gentle 3351* (fr., A, NY); Middlesex, along river-bank, *Schipp 399* (fr., GH, NY). Toledo: Eldorado, *Schipp 398* (fr., Ch); Silkgrass Reserve, Hope Creek Road, ½ m. n. Silkgrass Camp, *Stevenson 167* (fr., Ch).

NATIVE NAMES: "Aguacatillo" (Honduras); "Canoj" (Guatemala); "Laurel," "Timbersweet" (Br.tish Honduras).

The present species has dark reddish brown glabrous branchlets that are rather slender and striate. The slight petioles are dark, canaliculate, and glabrous, measuring up to 1.5 cm. long. The blades are membranaceous, rarely subcoriaceous, glabrous, usually oblong-elliptic, the base narrowly cuneate or occasionally roundish and abruptly cuneate at the very base, the apex usually caudate-acuminate, 13 (–18) cm. long and 5 (7) cm. broad. The costa is slightly elevated above and conspicuous, more prominently so beneath. The slender lateral nerves, of which there are 4–6 (–8 rarely) pairs, are slightly elevated above, more conspicuously so beneath, the upper pairs diverging at an angle of 25–35°, the lower about 45°. The minute and regular reticulation, although very obvious above, is much more conspicuous beneath. The inflorescence is glabrous, axillary, consisting of usually not more than one (occasionally three) few-flowered panicles, not more than 10 cm., borne on long slender peduncles not more than 6.5 cm. long. The small flowers are perfect, glabrous, and up to 3 mm. long according to Mez (the ones at hand, being in bud, do not measure more than 2.15 mm.). The perianth-tube is conspicuous, the thickish lobes elliptic or ovate, ± 2.15 mm. long. The stamens of the two outer series are ± 1 mm. long, with long ovate obtuse nearly sessile anthers. Those of the inner series are ± 1.25 mm. long, with rectangular or square anthers borne on short filaments about one-half their length and having at the base two short-stipitate cordate glands equalling the filaments in length. The staminodia, when present, are attenuately linear and pubescent, ± 0.6 mm. long. The glabrous gynaecium is ± 1.7 mm. long, the globose ovary equalling the rather sturdy style topped by a triangular-peltate stigma. The fruit is practically identical with that of the preceding species, which see for a discussion of relationships.

27. **Ocotea tenera** Mez & J. D. Smith ex Mez in Bull. Herb. Boiss. II. 3: 234. 1903; Standley in Field Mus. Publ. Bot. 18: 456. 1937.

Distribution: Known only from Costa Rica, for the most part from the Atlantic tierra caliente, at 200 m. altitude along the coast to 1250 m. inland.

Costa Rica: Alajuela: Region of Zarcero, in shade on humid hill-slope of Pacific cloud-forest, *A. Smith 159* (fl., Ch), *A.228* (♀ fl., A, Ch); San Pedro de San Ramón, *Brenes 3617* (*153*), *4200* (*212*) (fr., Ch), *4439* (*224*) (♀ fl., Ch). Limón: Forest of Shiroes, Talamanca, *Pittier & Tonduz 9184* (fr., isosyntype, US); along Banana River (Bananita), near Port Limón, *Pittier 3633* (♀ fl., Ch); Llanuras de Santa Clara in the plantations at La Colombiana, *Pittier 7607* (Herb. Nat. Costa Rica *13396*) (♀ fl., isosyntype, Ch, US). Cartago: Turrialba, alt. 570 m., June, 1895, *Tonduz 8330* (syntype not seen).

Native names: "Aguacatillo," "Quisarrá lantisco" (lentisco?) (Costa Rica).

This species, also belonging in the *O. cernua* complex, has dark glabrous branchlets that on the whole seem to be somewhat stouter than those of *O. cernua*. The petioles are dark, slender, canaliculate and glabrous, up to 1 cm. in length. The membranaceous blades are elliptic-oblong or occasionally elliptic, the base cuneate or broadly so (occasionally obtuse or roundish), the apex caudate-acuminate, up to 16 cm. long and usually not more than 5 cm. broad. The broad costa and slender lateral nerves, of which there are usually 6 (–8) pairs diverging arcuately at an angle of about 45°, are obscure above and elevated beneath. The delicate reticulation is also rather obscure above and prominent beneath. The inflorescence is axillary, slender, glabrous, paniculate, usually less than 8 cm. long, occasionally to 12 cm., the slender peduncle usually not more than 2 cm. long, occasionally to 4 cm. The flowers, seemingly ♀, are glabrous, up to 3 mm. long, the tube fairly conspicuous, the lobes ovate or broadly ovate, acutish, and ± 1.7 mm. long, thinnish or occasionally thick. The staminodia of the two outer series are ± 1 (–2.15) mm. long and usually show poorly developed anthers, as do those of the third series, which have small ovate sessile basal glands. The filaments are usually very broad and as long as if not longer than the anthers. The staminodia of the fourth series, when present, are scale-like and lanceolate. The glabrous gynaecium is ± 1.7 mm. long, the ellipsoid ovary narrowing gradually into the tapering style that is only about half its length and topped by a conspicuous subcapitate stigma. The fruit is 2.5 cm. long and about 1.3 cm. broad, shining-black and glabrous, subtended by a flat flaring disk-like undulate-margined cupule not more than 3 mm. long and 1 cm. in diameter, the pedicel seemingly up to 1.5 cm. long and expanded to 5 mm. at its apex.

There is a discrepancy between the description of Mez and the specimens cited here. Also, some of the Costa Rican sheets seem to show flowers that appear almost perfect. It is possible that examination of the type in connection with the types of the other two species of this group, namely *O. cernua* and *O. Bernoulliana,* may clarify the delimitation of the flowering phase of these three entities. Certainly the fruit of *O. tenera* is distinct from that of the other two species.

28. **Ocotea cernua** (Nees) Mez in Jahrb. Bot. Gart. Berlin **5**: 377. 1889; Standley in Contr. U. S. Nat. Herb. **23**: 295. 1922, in op. cit. **27**: 183. 1928, in Trop. Woods **21**: 17. 1930, in Field Mus. Publ. Bot. **10**: 201. 1931; Standley & Record in Field Mus. Publ. Bot. **12**: 143. 1936; Standley in op. cit. **18**: 454. 1937; Yuncker in op. cit. **9**: 290. 1940.

Oreodaphne cernua Nees, Syst. Laurin. 424. 1836.

Oreodaphne Sieberi Meissner in DC. Prodr. 15^1: 137. 1864, at least in part.

Ocotea Sieberi Hemsley, Biol. Centr. Am. Bot. **3**: 73. 1882.

DISTRIBUTION: Southern Mexico, Central America, and West Indies, and, according to Meissner, in South America.

MEXICO: Vera Cruz: Fortuña, Coatzacoalcos River, *L. Williams 8441* (♂ fl., A, Ch), *8953* (♂ fl., A, Ch, NY). Tabasco: Teapa, alt. 90 m., May, 1840, *Linden 1601* (♀ fl., fragm. of syntype of *Oreodaphne Sieberi,* NY), *1607* (syntype of *Oreodaphne Sieberi* not seen). GUATEMALA: Without locality (eastern portions of Verapaz and Chiquimula), *Watson 450* (♂ fl., GH). HONDURAS: Atlántida: In open forest, foothills near the Cangrejal River, *Yuncker, Koepper & Wagner 8788* (fr., Ch, NY). BRITISH HONDURAS: Stann Creek: On hillside, Stann Creek Valley, 15 miles, *Gentle 2120* (fr., A, NY); in high ridge, Middlesex, *Gentle 2767* (♂ fl., A, NY); Big Eddy Ridge, *Gentle 3310* (♂ fl., A, NY); Stann Creek Railway, 15 mile, *Schipp 161* (♂ fl., Ch, GH, NY). COSTA RICA: Puntarenas: Playa Blanca, Golfo Dulce, *Valerio 397* (♂ fl., Ch). Alajuela: Guadaloupe de Zarcero, *A. Smith A.556* (♂ fl., A). San José: Forests of Las Vueltas, Tucurrique, *Tonduz 13366* (♂ fl., GH, NY); vicinity of El General, *Skutch 4270* (♂ fl., A, NY), *4738* (♂ fl., A, Ch). Cartago: Tuis, near Turrialba, *Pittier 11251* (♂ fl., GH). PANAMA: Bocas del Toro: Changuinola Valley, *Cooper & Slater 105* (*Y 10286*) (♂ fl., Ch, GH, NY); Island Potrero, *Dunlap 568* (♂ fl., Ch, GH); Water Valley, *von Wedel 803* (fr., GH, Mo). Chiriquí: Without locality, *Cooper & Slater 262* (Y 10615) (fr., Y). Canal Zone: Barro Colorado Island, Shannon Trail, *Shattuck 535* (fr., Ch), Drayton Point, *Shattuck 1140* (fr., Ch); shore of cove s. from Lock site, *Woodworth & Vestal 471* (♂ fl., A, Ch). Darién: Along the Sambú River, above tide-limit, *Pittier 5692* (♂ fl., Ch).

NATIVE NAMES: "Aguacatillo" (Mexico, Honduras, British Honduras); "Laurel" (Tabasco); "Laureo de bajo" (Campeche); "Sigua," "Sigua amarillo" (Panama); "Timbersweet" (British Honduras).

This species has branchlets which are early pubescent but quickly glabrous, angled or striate, terete. The petioles of the leaves are slender, canaliculate, glabrous, up to 12 mm. long. The blades are chartaceous or subcoriaceous, glabrous throughout, usually oblong-elliptic, the base, generally speaking, roundish or obtuse with the extreme portion abruptly cuneate, the apex abruptly or gradually acuminate, usually caudate-acuminate. They measure up to 16 cm. long and 6.5 cm. broad. The costa is conspicuous above, although not as prominently elevated as beneath. The delicately etched lateral nerves, of which there are 4–6 pairs, are obscure above but more prominent beneath, the lowermost pairs usually being the longest. The lowermost pairs diverge at an angle of about 25–35° from the costa, and the upper at an angle of about 45°. The reticulation is obscure above and less so beneath. The inflorescence consists of numerous many-flowered branching axillary glabrous panicles bearing small flowers. The glabrous ♂ flowers are yellowish, very small, not more than 2 mm. long at most, and borne on slender sometimes thread-like pedicels up to 4 mm. long. The thin perianth-lobes are ovate, obtusish or acute, ± 1.7 mm. long. The stamens of the two outer series are ± 0.8 mm. long, the ovate-triangular obtuse anthers almost sessile. Those of the inner series are more narrowly ovate and borne on short filaments which have two basal suborbicular compressed glands that are sessile. The glabrous aborted gynaecium is linear, not measuring more than 0.8 mm. in length. The ♀ flowers superficially seem very much like the ♂ flowers. The stamens, however, are much smaller and seemingly sterile (not more than 0.8 mm. long), those of the inner series biglandular. The glabrous gynaecium is ± 1.5 mm. long, the ellipsoid-subglobose ovary attenuate into an extremely brief style which bears a conspicuously three-parted stigma. The fruit is black, ellipsoid, apiculate, up to 14 mm. long and 9 mm. broad, the lower third is encased in a more or less snug-fitting hemispherical somewhat woody cupule that is about 6 mm. long, 11 mm. in diameter, and 3–4 mm. deep. The supporting pedicel is up to 7 mm. long and expanded at the tip to 2 mm. in diameter.

Neither Meissner's syntypes (except *Linden 1601*) of *Oreodaphne Sieberi* nor Nees' syntypes are available, and so for the present Mez' interpretation will be accepted, and *O. cernua* considered as a widespread species extending to the West Indies and South America.

The two nearest relatives seem to be *O. Bernoulliana,* with perfect flowers, from Guatemala, which is so similar that one suspects that it may be a different manifestation of *O. cernua* with dioecious flowers; and *O. tenera,* which also is dioecious, but whose fruits are larger and subtended by a flat shallow cupule with an undulate margin.

29. **Ocotea paradoxa** Mez in Bot. Jahrb. 30: Beibl. 67: 16. 1901; Standley in Field Mus. Publ. Bot. 18: 455. 1937.

Distribution: Known only from the type-collection, from Costa Rica.

Costa Rica: Alajuela: In woods near River Naranjo, alt. 200–300 m., *Tonduz* (Herb. Inst. Costa Rica) *7648* (fl., type not seen).

Mez described the species as a tree or shrub with the branchlets slightly ferruginous-tomentellous at the apex, becoming quickly glabrate, brown, terete, with ferruginous- or yellowish-tomentellous buds, the cortex slightly aromatic. The petioles are up to 10 mm. long, incised-canaliculate, glabrous, supporting sparse, glabrous, chartaceous leaves entirely glabrous in the adult stage and dull opaque olivaceous-green, elliptic, the base short- or long-acute, the apex shortly or sometimes very shortly acuminate, measuring up to 13 cm. long and 6.5 cm. broad, with an almost plane margin. The venation is almost smooth or minutely prominulous-reticulate above and manifestly prominulous-reticulate beneath. The inflorescence is loose, 10-flowered, subcinereous- or subferruginous-tomentellous. The flowers are 1.2 mm. in diameter, borne on pedicels 5–10 mm. long, the bracts deciduous. The lobes spread like those of *Nectandra,* and are ligulate, narrowing gradually toward the apex, finally becoming roundish. The stamens have foliaceous anthers which are acute, the connective long-produced between the cells. Those of the inner series have shortly stipitate pulvinate glands that are for a conspicuously long distance connate with the filaments. The staminodia are aborted; the ovary is ovoid, drawn out into a short conical style; the stigma is large, subdiscoid. The fruit is unknown.

Mez notes that this species is to be put in the subgenus near *O. Dendrodaphne* and *O. veraguensis,* conspicuously differing in entire habit, few-flowered and racemose inflorescence, and floral glands. It keys out to be near the last three discussed species above, but nonetheless, from the description it would seem to be a variant of *O. veraguensis.*

30. **Ocotea Matudai** Lundell in Bull. Torr. Bot. Club **69**: 388. 1942.

DISTRIBUTION: Known only from type-locality.

MEXICO: Chiapas: Mt. Ovando, western slope near Escuintla, alt. 1800 m., July 1–16, 1940, *Matuda 4221* (fl., A, TYPE — Mich, NY, US) (tree, 7 m.; flowers white).

Another species known only from the type-collection, with very slender branchlets early angled, glabrescent, and reddish, presently terete, striate, glabrous, and brownish or maculate-reddish gray. The petioles are dark reddish, slender, canaliculate, glabrous, and up to 2 cm. long. The blades glabrous and shining above, paler beneath, subcoriaceous, oblong-elliptic or oblong-lanceolate, the base obtuse to cuneate, the apex obtuse or obtusely acute, to 15 cm. long and up to 6 cm. broad. The costa is impressed above and elevated beneath. The lateral nerves, of which there are 6–9 pairs, are slightly elevated above and very prominently though slenderly so beneath, diverging at an angle of about 45–55° and bearing axillary pubescent glands beneath that are fairly conspicuous. The reticulation is conspicuous above and beneath. The inflorescence is axillary and subterminal, paniculate, glabrous to glabrescent, many-flowered, up to 7 cm. long, usually branched to the base, at most the peduncle not more than 1 cm. long. The pubescent flowers measure up to 3 mm. long, spreading to 7 mm. in diameter, borne on slender pedicels up to 4 mm. The elliptic or oblong lobes are up to 3 mm. long, pubescent within and without. The stamens of the two outer series are up to ± 1.25 mm. long, the oblong-ovate sometimes petaloid anthers only slightly longer than the filaments and sometimes bearing conspicuous connective tissue. Those of the inner series bear subreniform stipitate basal glands equalling the filaments. The staminodia are slender, thin, linear-lanceolate, ± 0.8 mm. long. The glabrous gynaecium measures ± 2.15 mm. long, the ovate slightly stipitate ovary a little longer than the rather thick style topped by a subpeltate conspicuous stigma.

The species-relationships are discussed under *O. laetivirens.*

31. **Ocotea Meziana,** sp. nov.

Arbor 7–30 m. alta, ramulis viridescentibus glabris striatis angulatis. Folia alternata, juventute canescenti-sericeo-pubescentia subito glabra, petiolis gracilibus glabris leviter canaliculatis ad 1.3 cm. longis et 1 mm. latis, laminis utrinque glabris chartaceis, in sicco viridescentibus ellipticis, ad 15 cm. longis et 5 cm. latis, basi attenuato-cuneatis, apice abrupte acuminatis vel plus minusve acutis vel obtuse acutis, penninerviis, costa utrinque inconspicue et leviter elevata, nervis 4–6-paribus utrinque inconspicue et leviter elevatis angulo 35–45° divergentibus, rete venularum supra satis subtus minute perprominulo. Inflorescentia axillaris, paniculata, ad 9 cm. longa, (?) sparse pubescentia subito glabra vel glabrescens, pauciflora, pedunculata, pedunculo ad 5.5 cm. longo glabro. Flores ad 3.5 mm. longi, pedicellis ad 3 mm. longis, gracillimis, perianthio campanulato flavescente, lobis oblongo-ovatis acutis, membranaceis, ad 2.15 mm. longis; staminibus ser. I & II ± 2.15 (–2.6) mm. longis, pubescentibus, antheris filamentis aequalibus, ser. III ± 2.15 mm. longis conspicue biglandulosis, glandulis antheris subreniformibus stipitatis subaequalibus; staminodiis nullis vel linearibus pubescentibus ad ± 1 mm. longis; gynaecio glabro ad ± 2.4 mm. longo, ovario gynaecii dimidium longitudine parum excedente, stigmate discoideo parvo sed conspicuo. Fructus ignotus.

Distribution: In the upper tropical or Caribbean rain- or cloud-forest of Costa Rica, at an altitude varying from 825 to 2100 m.

Costa Rica: Alajuela: La Peña de Zarcero, *A. Smith H.309* (fl., Ch); Zarcero, edge of woodland, in semi-shade, in stiff clay-loam, upper tropical zone, continental divide, alt. 1615 m., *A. Smith H.359* (fl., type, Ch) (tree 10.5 m., base 34 cm., bark brown, slightly roughened; leaves thin but firm, dark green above, glabrous, shining; flowers cup-shaped, oil-yellow), *A. Smith H.407* (fl., Ch); La Brisa de Zarcero, *A. Smith H.443* (fl., Ch); Villa Quesada, San Carlos, *A. Smith F.1774* (fl., Ch), *P.2596* (fl., A); Tapeseo, Alfaro Ruiz, *A. Smith P.2615* (fl., A). Heredia: Vicinity of Vara Blanca, north slope of Central Cordillera, between Poás and Barba volcanoes, *Skutch 3745* (fl., A).

This species is, as mentioned above, related to *O. laetivirens*.

32. **Ocotea pyramidata** Blake ex T. S. Brandegee in Univ. Calif. Publ. Bot. 7: 326. 1920.

Distribution: Known only from the type-locality in Mexico.

Mexico: Vera Cruz: Zacuapán, Nov., 1919, *Purpus 8456* (fl., isotype, GH, NY) (large tree).

The present species has branchlets dark reddish black, angled, deeply sulcate, early covered with a thin ferruginous tomentum which quickly disappears, leaving them entirely glabrous. The leaves are supported by dark slender glabrescent petioles up to 2.5 cm. long. The blades, unfortunately in both specimens at hand from the type-collection, are riddled presumably by some sort of leaf-miner. Seemingly they are glabrous above and only slightly pubescent on the lower venation, chartaceous in texture, oblong-elliptic or elliptic, the bases cuneate or cuneate-rounded and minutely and inconspicuously recurved, the apex, according to the original description, obtuse. The costa is impressed above and conspicuously elevated beneath. The lateral nerves, of which there are 8 (?) pairs, are delicately traced above and elevated beneath, diverging at an angle of about 45°. The very fine pattern of the minute reticulation is present but not conspicuous throughout the blade. The numerous axillary and subterminal racemose-paniculate inflorescences are many-flowered, subferruginous-tomentose, shortly becoming glabrescent, up to 8 (–12) cm. long, the short peduncle not more than 1 cm. long. The glabrescent to glabrous ♂ flowers are up to 4 cm. long, subcampanulate, and subtended by a slender glabrescent pedicel not 2 mm. long. The perianth-lobes are up to 3 mm. long, very thin, elliptic, obtuse or rounded. The stamens of the two outer series are ± 1.5 mm. long, the ovate subrotund anthers twice the length of the stout filaments. Those of the inner series are ± 2.15 mm. long, the subrectangular anthers equalled by the filaments, bearing two subreniform spreading subsessile glands that are almost their entire length. The aborted ovary is very narrowly lanceolate, up to ± 0.5 mm. long and topped by a subcapitate stigma.

Blake did not relate this species to any known from Mexico. It is very possible that some of the collections later described from this region may be conspecific, but it is difficult to match diseased foliage such as is found in the type of this species.

33. **Ocotea laetivirens** Standley & Steyermark in Field Mus. Publ. Bot. 23: 114. 1944.

DISTRIBUTION: Guatemala, and the forests of Costa Rica, at altitudes up to 2000 m.

GUATEMALA: Huehuetenango: Cerro Chiblac, between Finca San Rafael and Ixcán, Sierra de los Cuchumatanes, alt. 1200–2000 m., July, 1942, *Steyermark 49189* (fl., TYPE, Ch) (vine; leaves membranous, deep green above, paler beneath), *49378* (fl., fr., Ch). COSTA RICA: Alajuela: Region of Zarcero, in forest, *A. Smith H.517* (fl., Ch) (clay-loam, in forest below oak-level in shade); Guadaloupe de Alfaro Ruiz, *A. Smith 4182* (abnormal fl., Ch).

This species has the young branchlets early pubescent but very quickly glabrous, conspicuously greenish, striate and angled. The leaves are supported by stout or slender (in the type) petioles 1–1.7 mm. long, often yellowish, sometimes dark, canaliculate. The blades are chartaceous, conspicuously greenish, elliptic or oblong-elliptic, the base cuneate, the apex acuminate or acutish or obtuse, usually 16 (–18) cm. long and 7 cm. broad. The costa is rather conspicuous and yellowish above, although slightly elevated, but beneath is prominently elevated. The lateral nerves, of which there are 8 or 9 pairs, are obscure above but conspicuously prominently elevated and yellowish beneath, diverging at an angle of about 45–55°. The loose reticulation is rather obscure throughout. The inflorescence is axillary, paniculate, many-flowered, early finely and inconspicuously grayish-pubescent, becoming glabrous, about 15 cm. long and borne on a peduncle up to 9 cm. long. The flowers are pubescent to glabrescent, 2–3 mm. long, the pedicels not more than 4 mm. long. The perianth-lobes are elliptic to ovate, obtusish, thick, ± 2.5 mm. long. The stamens of the two outer series are ± 1.7 mm. long, the broadly ovate anthers obtuse or rounded and not quite twice the length of the stout filaments. Those of the inner series have anthers that are more narrowly ovate, the connectives rounded and slightly projecting, the almost equal filaments bearing conspicuous globular-squarish glands about one-third the length of the entire stamen. The staminodia are ± 0.8 mm. long, very slender, attenuately linear-lanceolate, and pubescent. The glabrous gynaecium is ± 2.5 mm. long, the ellipsoid ovary nearly twice the length of the slender style that bears a small capitate stigma. The fruit is unknown, but the cupule attached to *Steyermark 49378* is woody (rose-red according to the collector), rather thinnish, campanulate, and up to 5 mm. long and 1.2 cm. in diameter, the pedicel grooved and expanded to 1.5 cm. long and 6 mm. in diameter at the apex. Both the cupule and the pedicel are brownish-verruculose.

The species, like the preceding, seems to have no near relatives, although it has characteristics in common with *O. Matudai* and *O. Meziana*. It is easily separated from both because of foliage-characters and the habit of the branchlets.

Doubtful Species and Varieties of Ocotea

Ocotea insularis (Meissner) Mez in Jahrb. Bot. Gart. Berlin 5: 271. 1889; Standley in Field Mus. Publ. Bot. 18: 455. 1937.

Phoebe insularis Meissner in DC. Prodr. 15^1: 33. 1864.

Distribution: Cocos Island, according to Pittier, characteristic of the forests of the northern and western part of the island, at an altitude of 10–200 m.

Costa Rica: Cocos Island: Without data, *Menzier* (fl., fr., type not seen), *Pittier 16257* (fr., GH); Wafer Bay, *Howell 10185* (fl., Ch).

This species, which seemingly inhabits only Cocos Island, has stout reddish brownish glabrous branchlets that are pronouncedly alate and striate. The petioles are about 5 mm. long, stout, canaliculate, and glabrous. The blades are subcoriaceous or chartaceous, glabrous except for the pubescent axillary glands, obovate, the base cuneate and decurrent, forming apparent petioles sometimes up to 1 cm. longer than the actual petioles, the apex very slightly and abruptly obtusely subacuminate. They measure up to 19 cm. long and 7 cm. broad, the stout costa deeply impressed above, especially near the base, and conspicuously elevated beneath. The lateral nerves, of which there are about 9 pairs, are impressed and very slightly elevated above and more conspicuously elevated beneath, diverging at an angle of 35–40°. The reticulation is fairly conspicuous on the upper surface and more prominently so on the lower. The inflorescence is axillary and subterminal, paniculate, many-flowered, and, according to Mez, scarcely ferruginous-tomentellous, up to 10 cm. long, the glabrous alate striate peduncle up to 2.5 cm. long. The flowers are 3 mm. long, minutely and sparsely pubescent, the short pedicel ± 2.15 mm. long. The tube is conspicuous and the thinnish ovate acute lobes are ± 2.15 mm. long. The stamens of the two outer series are ± 1.7 mm. long, the ovate obtuse or roundish anthers shorter than the broad pubescent filaments. Those of the inner series are ± 1.9 mm. long, the anthers subrectangular, the filaments bearing sessile subglobose glands at the base. The glabrous gynaecium is ± 2.4 mm. long, the subglobose (subobovoid) ovary only slightly longer than the cylindrical style with a rather conspicuous discoid (obtuse) stigma. The fruit is ellipsoid, glabrous, 13 cm. long and 6 cm. broad, and irregularly subtended by a 6-lobed rugose cupule about 7 mm. long, 9 mm. in diameter, and about 5 mm. deep, the subalate pedicel being 5 mm. long and expanded to 3.5 mm. diameter at the apex.

The affinity of this species seems to be with the group containing *O. Ira, O. Tonduzii, O. Endresiana,* etc., but the narrowly decurrent recurved blades, the variation in size and texture of the blades, among other characteristics, segregate the species. It is not included in the key, for the flora of Cocos Island is quite distinct from that of the mainland.

Ocotea psychotrioides Billberg ex Meissner in DC. Prodr. 15^1: 150. 1864.

This species is treated as a synonym of *Nectandra globosa* by Mez. Along with the type, *Billberg 321,* from Costa Rica, he also cites *Oersted 16, 17,* and *18,* also from Costa Rica, which numbers may very well be syntypes of *Nectandra amazonum* var. δ *Oerstedii.* None of these have been seen for study.

Ocotea puberula Nees var. **truncata** (Meissner) Mez in Jahrb. Bot. Gart. Berlin 5: 344. 1889.

Strychnodaphne puberula var. γ ? *truncata* Meissner in DC. Prodr. 15^1: 143. 1864.

Ocotea puberula Nees, Syst. Laurin. 472. 1836, p.p.; Standley in Contr. U. S. Nat. Herb. **23**: 295. 1922.

DISTRIBUTION: Known only from the type-locality.

MEXICO: Vera Cruz: Without locality, *Schiede 1142* (syntype of *Ocotea puberula*, and cited by Mez under the variety, not seen).

Ocotea sanguinea J. S. Presl, [Wšeobecný] Rostl. 2: 60. [1846].

This species, according to Mez, is synonymous with *Nectandra sanguinea*. Index Kewensis follows Mez and lists it also from Mexico and the West Indies. I have supplied the bracketed portion of the citation. The volume in question does not contain *Ocotea sanguinea*, although two other *Ocoteae* are mentioned. Possibly the following reference is meant, even though the entity to which Mez has referred *Ocotea sanguinea* does not occur in Bohemia, the locality taken up in Berchtold and Presl: Berchtold, F. G, von, & Presl, J. S., Prirez. Rostlin, 3 vols. 195. pl. 1823 [-35].

SPECIES AND VARIETIES EXCLUDED FROM OCOTEA

Ocotea Brenesii Standley = NECTANDRA sp.
Ocotea campechiana Standley = LICARIA CAMPECHIANA (Standley) Kostermans.
Ocotea Cufodontisii O. C. Schmidt = NECTANDRA sp.
Ocotea globosa Schlechtendal & Chamisso = NECTANDRA GLABRESCENS Bentham.
Ocotea helicterifolia (Meissner) Hemsley = PHOEBE HELICTERIFOLIA (Meissner) Mez.
Ocotea latifolia H.B.K. = NECTANDRA LATIFOLIA (H.B.K.) Mez.
Ocotea mexicana (Meissner) Hemsley = PHOEBE HELICTERIFOLIA (Meissner) Mez.
Ocotea mexicana var. α *subsessilis* (Meissner) Hemsley = PHOEBE HELICTERIFOLIA (Meissner) Mez.
Ocotea mexicana var. β ? *longipes* (Meissner) Hemsley = PHOEBE HELICTERIFOLIA (Meissner) Mez.
Ocotea mexicana var. γ *diminuta* (Meissner) Hemsley = PHOEBE HELICTERIFOLIA (Meissner) Mez.
Ocotea perseifolia Mez & J. D. Smith = NECTANDRA sp.
Ocotea psychotrioides H.B.K. = PHOEBE PSYCHOTRIOIDES (H.B.K.) Mez.
Ocotea rubriflora Mez = NECTANDRA sp.
Ocotea salicifolia H.B.K. = NECTANDRA GLABRESCENS Bentham.
Ocotea Salvini Mez = PHOEBE SALVINI (Mez) Lundell.
Ocotea striata Buck = MYRODIA cf. FUNEBRIS L. (ex Gürke), fide Mez.
Ocotea subtriplinervia (Meissner) Hemsley = PHOEBE SUBTRIPLINERVIA (Meissner) Standley.
Ocotea tampicensis (Meissner) Hemsley = PHOEBE TAMPICENSIS (Meissner) Mez.
Ocotea Whitei Woodson = NECTANDRA sp.

(*To be concluded*)

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STUDIES IN THE LAURACEAE, VI

PRELIMINARY SURVEY OF THE MEXICAN AND CENTRAL AMERICAN SPECIES

Caroline K. Allen

Concluded from page 364

4. Nectandra Rolander

Nectandra Rolander ex Rottboell in Act. Univ. Hafn. 1: 267. 1778; Grisebach, Fl. Brit. W. Ind. 281. 1860; Meissner in DC. Prodr. 15[1]: 146. 1864; Hemsley, Biol. Centr. Am. Bot. 3: 74. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 393. 1889.

Distribution: Tropics of America, the bulk of the species occurring in South America, particularly in the Andes, with about 38 in Central America and Mexico, and a few in the West Indies, the fringe of the latter just touching the mainland of Florida.

The genus consists of trees or shrubs with various types of glabrous or pubescent foliage. The alternate leaves have blades that are membranaceous to rigidly coriaceous, lanceolate, elliptic, or obovate, often with variously expanded and recurved leaf-bases. The blades are usually penninerved, rarely subtriplinerved, the reticulation being obscure to extremely conspicuous. Pubescent axillary glands are frequently conspicuous on the lower surface. The inflorescences are usually paniculate, axillary or subterminal, with peduncles of varying length, the bracts deciduous, with the pubescence variable. The flowers are always perfect in the species found in this area. The tube may be conspicuous or almost entirely lacking. The equal lobes are lanceolate to elliptic, ovate or occasionally obovate, usually fleshy and papillose, occasionally membranaceous, almost always spreading or reflexed at anthesis, and usually deciduous. The stamens of the outer series are either fleshy, petaloid, papillose, and ovate, or quadrate or orbicular, with conspicuous connective-tissue, or they are reniform or subreniform, frequently emarginate, with no apparent connective tissue, the cells occupying the entire anther. The four cells are always introrse and usually are arranged in an arc-like formation, very rarely this arc is obscure. The anthers are sessile or borne on filaments of varying length and thickness, often pubescent, particularly at the base. The stamens of the third or inner series are usually quadrate;

in the flowers bearing the petaloid outer series, the inner also may be fleshy and papillose, with truncate connectives; in other cases, they are not fleshy or papillose and the connectives are inconspicuous. The four cells are arranged in two horizontal planes; those of the upper plane are lateral or laterally extrorse; those of the lower plane are usually extrorse. The staminodia when present are for the most part stipe-like; occasionally they bear well developed heads of varying shape. The gynaecium is, except in a very few instances, completely glabrous, the ovary globose or depressed-globose, rarely ellipsoid or ovoid. The style is usually short, but occasionally may be even the length of the ovary, and bears a discoid or triangular or occasionally a peltate conspicuous stigma. The fruit is ellipsoid, globose, or oblong, borne in a more or less shallow usually woody cupule formed by the enlarged perianth-tube usually with simple margin, occasionally bearing the remnants of the perianth-lobes. This is uniformly subtended by an enlarged pedicel.

KEY TO THE SPECIES OF NECTANDRA

A. Leaf-blades not recurved at all at the base, or decurrent, not auriculate or cordate or even rounded at the base generally.
  B. Largest leaf-blades never more than 9 cm. long.
    C. Largest leaf-blades up to 7 cm. long and 2 cm. broad, lanceolate-elliptic, varnished-shining above, the reticulation somewhat obscure..1. *N. Davidsoniana.*
    C. Largest leaf-blades up to 9 cm. long and 3.5 cm. broad, elliptic, not varnished-shining above, the reticulation very conspicuous...............2. *N. Smithii.*
  B. Largest leaf-blades never less than 10 cm. long.
    C. Anthers of the two outer series of stamens fleshy, petaloid, papillose, never emarginate, the upper third consisting of connective tissue, the remaining space occupied by the cells.
      D. Anthers of two outer series ovate or quadrate, the cells not forming a perfect arc; leaves membranaceous.
        E. Anthers of the two outer series definitely ovate; largest leaf-blades not more than 14 (usually 12) cm. long; lateral nerves 4 or 5 pairs........ ....3. *N. Brenesii.*
        E. Anthers of the two outer series definitely quadrate; largest leaf-blades not less than 15 (up to 26) cm. long; lateral nerves 7–12 pairs.
          F. Leaf-blades shining above, densely and prominently reticulate throughout, elliptic, the base cuneate..............4. *N. ambigens.*
          F. Leaf-blades somewhat shining above, with loose very obscure reticulation throughout, elliptic, oblong-elliptic or ovate-elliptic, the base roundish or obtuse usually...................5. *N. rubriflora.*
      D. Anthers of two outer series ovate-orbicular or suborbicular, the cells forming a perfect arc; leaves not membranaceous.
        E. Young branchlets, lower surface of leaf-blades, and inflorescence densely and conspicuously ferruginous-tomentose; leaf-blades elliptic. ....6. *N. Schippii.*
        E. Young branchlets, lower surface of leaf-blades, and inflorescence not densely and conspicuously ferruginous-tomentose.
          F. Young branchlets, young leaves, and inflorescence densely fulvous- or brownish-tomentose; blades obovate; anthers of two outer series truncate; cupule hemispherical.....................7. *N. Austinii.*
          F. Young branchlets, young leaves, and inflorescence not densely fulvous- or brownish-tomentose; blades not obovate; anthers of two outer series not truncate; cupule cyathiform.

G. Leaf-blades pale green, usually with the venation and reticulation showing whitish, often with large ellipsoid axillary pubescent glands on the lower surface, but conspicuous on both surfaces.................................8. *N. panamensis.*

G. Leaf-blades not pale green with conspicuous whitish venation and reticulation; axillary glands if present rather inconspicuous.

H. Leaf-blades with lateral nerves 8–12 pairs.....9. *N. globosa.*

H. Leaf-blades with lateral nerves 4–6 (–7) pairs...10. *N. ramonensis.*

C. Anthers of two outer series of stamens not fleshy, petaloid, or papillose, but quadrate or reniform, subreniform, or suborbicular, and frequently emarginate, the cells occupying the entire anther.

D. Anthers quadrate, sometimes apiculate.................11. *N. Heydeana.*

D. Anthers reniform or subreniform or suborbicular.

E. Greatest width of leaf-blades at and below the middle, the blade tapering only toward the apex..........................12. *N. Gentlei.*

E. Greatest width of leaf-blades exactly at the middle, the blade tapering toward the base and the apex equally or the leaf-blades obovate.

F. Largest leaf-blades not less than 7 cm. broad.

G. Pubescence (when present on the young branchlets, lower surface of the leaf, buds, petioles, and inflorescence) predominantly canescent, not sericeous; petioles not longer than 1.5–2 cm..13. *N. Woodsoniana.*

G. Pubescence (when present on young branchlets, leaf-buds, petioles, and inflorescence) fulvous-sericeous; petioles to 3 cm. long; flowers white and fragrant..............14. *N. Lundellii.*

F. Largest leaf-blades not more than 6.5 cm. broad, usually 5 cm., rarely 8 cm.

G. Lateral nerves 3–5 (–6) pairs; leaf-blades often subtriplinerved.

H. Leaf-blades subtriplinerved, not more than 11.5 cm. long, usually less, the apex long-acuminate.....15. *N. savannarum.*

H. Leaf-blades not subtriplinerved, 12–14 cm. long, the apex long-caudate........................16. *N. longicaudata.*

G. Lateral nerves not less than 6 pairs, usually 7–9.

H. Inflorescence usually glabrous; leaf-blades usually lanceolate-elliptic, 11–14 (–20) cm. long and 5 (–6.5) cm. broad.

I. Leaf-blades not caudate at the apex.

J. Leaf-blades always lanceolate-elliptic, not more than 2–3.5 cm. broad, always long-acuminate at the apex; reticulation prominent on the lower surface of the blades.

K. Leaf-blades glaucous above, reddish green beneath; fruit 10 × 6 mm.; cupule verruculose...17. *N. nervosa.*

K. Leaf-blades grayish green throughout, or brownish, paler beneath; fruit 20 × 18 mm.; cupule not verruculose.....................18. *N. salicina.*

J. Leaf-blades usually elliptic or lanceolate-elliptic, not less than 4 cm. broad, the apex variable; reticulation prominent throughout.

K. Leaf-blades coriaceous and pale, the reticulation obscuring lateral nerves on the upper surface...................................19. *N. coriacea.*

K. Leaf-blades chartaceous, brownish or green, the reticulation not obscuring lateral nerves on the upper surface..................20. *N. salicifolia.*

I. Leaf-blades caudate at the apex......21. *N. fuscobarbata.*

H. Inflorescence variously pubescent.

- I. Young branchlets golden- or ferruginous-sericeous or subferruginous-tomentose.
  - J. Reticulation scarcely apparent on upper surface of leaf-blades.
    - K. Leaf-blades chartaceous; axillary glands absent; young branchlets and young leaf-blades golden-"glittering"-tomentose..............22. *N. nitida.*
    - K. Leaf-blades coriaceous; axillary glands conspicuously pubescent; young branchlets and young leaves subferruginous-tomentose...23. *N. perdubia.*
  - J. Reticulation exceedingly prominent throughout.
    - K. Leaf-blades oblong-elliptic, caudate-acuminate; fruit globose.....................24. *N. latifolia.*
    - K. Leaf-blades elliptic, acuminate; fruit ovoid-ellipsoid........................25. *N. Cufodontisii.*
- I. Young branchlets not golden- or ferruginous-sericeous or subferruginous-tomentose, sometimes glabrous.
  - J. Inflorescence and branchlets grayish- or fulvous-sericeous.........................26. *N. tabascensis.*
  - J. Inflorescence shortly pilose; branchlets glabrous...... ....27. *N. Loeseneri.*

A. Leaf-blades recurved at the base and decurrent, or auriculate and recurved, or cordate and recurved.

- B. Base of leaf-blades decurrent and recurved, not auriculate.
  - C. Largest leaf-blades about 20–22 cm. long, membranaceous or coriaceous.
    - D. Lateral nerves 8–12 pairs; petiole not thickened............8. *N. globosa.*
    - D. Lateral nerves 4–6 pairs; petiole less than 1 cm. long, only slightly thickened.
      - E. Leaf-blades not more than 4.5 cm. broad; blades narrowly ovate-lanceolate, attenuately acuminate at the apex.........12. *N. Gentlei.*
      - E. Leaf-blades not less than 5 cm. broad; blades oblong-elliptic, abruptly obtusely acuminate at the apex......................28. *N. Skutchii.*
  - C. Largest leaf-blades not more than 17 (–18) cm., usually less than 15 cm., long, coriaceous, subcoriaceous, or chartaceous.
    - D. Branchlets, lower leaf-surface, and inflorescence densely woolly ferruginous-tomentose.....................................6. *N. Schippii.*
    - D. Branchlets, lower leaf-surface, and inflorescence not densely woolly ferruginous-tomentose.
      - E. Petioles not thickened; leaf-blades only slightly decurrent at the base and very slightly recurved for less than 5 mm.
        - F. Anthers more or less ovate, obtuse, with fleshy papillose connectives; fruit ellipsoid...........................9. *N. ramonensis.*
        - F. Anthers subreniform, subemarginate; fruit globose..29. *N. Standleyi.*
      - E. Petioles variously thickened; leaf-blades conspicuously decurrent and recurved at the base up to 4–5 cm.
        - F. Largest leaf-blades not more than 5.5, usually 4, cm. broad.
          - G. Base of leaf-blades narrowed and recurved, making an apparent petiole 4–5 cm. long.........................30. *N. producta.*
          - G. Base of leaf-blades narrowed and recurved into an apparent petiole not more than 3 cm. long at most.........31. *N. Whitei.*
        - F. Largest leaf-blades not less than 5, usually more than 6, cm. broad.
          - G. Leaf-blades usually shining above and heavily reticulate; anthers ovate and acutish, the connective tissue comprising the upper quarter of the anthers; stigma borne on a well defined style; cupule and pedicel 2.5 cm. long.............32. *N. hypoglauca.*

G. Leaf-blades not shining, inconspicuously reticulate above; anthers subreniform, the cells occupying the entire anther; stigma sessile.................................33. *N. Paulii.*

B. Base of leaf-blades cordate or rounded, conspicuously or sometimes slightly recurved as well, never decurrent.

C. Leaf-blades oblong-lanceolate or elliptic, rounded, or subcordate; young branchlets and inflorescence, if pubescent, ferruginous- or subferruginous-tomentose.

D. Leaf-blades chartaceous, subferruginous-tomentose beneath, the surface not prominently reticulate; inflorescence softly and loosely subferruginous-tomentose...34. *N. belizensis.*

D. Leaf-blades rigidly coriaceous, glabrous throughout, prominently reticulate above and shining; inflorescence glabrous...................35. *N. rudis.*

C. Leaf-blades obovate to obovate-oblong, cordate or at least rounded, not recurved usually; pubescence of branchlets and inflorescence never ferruginous-tomentose, but tawny, if present at all.

D. Leaf-blades membranaceous, glabrous or glabrescent beneath at most..... ....36. *N. platyphylla.*

D. Leaf-blades coriaceous or subcoriaceous, tawny-tomentose beneath; fruit densely pubescent on lower half.........................37. *N. sinuata.*

B. Base of leaf-blades definitely auriculate and recurved, the recurved auricles often overlapping conspicuously beneath...........................38. *N. reticulata.*

1. **Nectandra Davidsoniana**, sp. nov.

Arbor, ramulis foliosis fulvo-sericeo-pubescentibus celerrime glabrescentibus mox glabris, ramulorum cortice revera colore rubescenti-brunneo epidermate tenuissimo secedibili griseo velato. Folia alternata, petiolis gracilibus canaliculatis ad 8 mm. longis, laminis utrinque glabris membranaceis, supra lucidis, in sicco viridescentibus vel brunneis subtus pallidioribus, lanceolatis vel elliptico-lanceolatis, 5–6 (–7) cm. longis et 13–17 (–22) mm. latis, basi cuneatis, apice obtusis vel obtuse acuminatis, penninerviis, costa supra inconspicua subtus leviter elevata, nervis plerumque 4-paribus supra obscuris subtus leviter elevatis angulo 35–45° divergentibus, rete venularum supra inconspicuissimo subtus haud conspicuo. Inflorescentia parva gracilis axillaris inconspicua, depauperata paniculata, glaberrima, pauciflora (ad 5-flora), pedunculo gracili glabro ad 2 mm. longo. Flores ad 4 mm. longi, pedicellis ad 3 mm. longis gracilibus, perianthio campanulato gilvo, lobis ±2.8 mm. longis, membranaceis papillosis; staminibus ser. I & II ±1 mm. longis antheris oblongo-globosis, filamento gracili triplo longioribus, ser. III ±1.25 mm. longis, antheris oblongis biglandulosis, glandulis brevistipitatis antheris et filamentis aequalibus; staminodiis triangularibus pubescentibus ±0.6 mm. longis; gynaecio glabro ±1.5 mm. longo, ovario ovoideo stipite triplo longiore, stylo duplo longiore, stigmate discoideo conspicuo. Fructus ignotus, niger, fide coll., receptaculo rubro, fide coll., glabro, hypocrateriformi, disco plano 1 cm. diam. subtentus, pedicello subverruculoso, ad 1 mm. longo et utrinque 4 mm. lato, margine integro.

DISTRIBUTION: Known only from the type-locality.

PANAMA: Chiriquí: Chiquero, Boquete, alt. 1830 m., April 11, 1938, *M. E. Davidson 564* (fl., fr., TYPE — A, Ch) (tree; flowers cream; fruits black, with red receptacle).

The new species is somewhat like *N. salicifolia* in aspect, but the leaves are smaller than any known representative of that species. The floral structure too is not unlike, the greatest divergence being the subglobose anthers of the two outer series, as opposed to the subreniform anthers characteristic of *N. salicifolia* and its allies. The fruit unfortunately is lacking on the specimens of *N. Davidsoniana* found in the herbaria of the Arnold Arboretum and the Chicago Museum, but the cupule is present. According to the collector, the fruit is black, and it is subtended by a red woody cupule that is hypocrateriform.

2. **Nectandra Smithii**, sp. nov.

Arbor 10–17 m. alta, ramulis foliosis minute subferrugineo-pubescentibus celerrime griseis striatis deinde griseis verruculosis. Folia alternata, petiolis gracilibus glabrescentibus canaliculatis (5–) 7–10 (–12) mm. longis, laminis utrinque glabris, basi costae excepta, membranaceis, in sicco utrinque brunneis, supra nonnihil lucidis, ellipticis, 6–8 cm. longis et 3–4 cm. latis, in petiolum leviter decurrentibus, basi cuneatis raro obtusis, apice acutis vel breviter subcaudato-acuminatis, penninerviis, costa pubescente utrinque conspicua subtus elevata, nervis plerumque 5-paribus supra paulo subtus valde prominulis angulo 35–45° divergentibus, glandulis conspicuis fulvo-pubescentibus in nervorum lateralium axillibus, rete venularum utrinque perconspicuo. Inflorescentia axillaris, brevis, paniculata, 2–3 (–5.5) cm. longa, glabrescens, pauciflora, brevipedunculata, pedunculo gracili 1–2 cm. longo. Flores ad 3.5 mm. longi, pedicellis 1.5–2 mm. longis gracilibus, perianthio subcampanulato albo(?) vel gilvo, lobis oblongis obtusis crassis papilloso-tomentosis, 2.5–3 mm. longis; staminibus ser. I & II ±0.8 mm. longis antheris subreniformibus filamento duplo longioribus, ser. III ±1.25 mm. longis antheris filamentis conspicue biglandulosis glandulis aequalibus; staminodiis oblanceolatis acutis ±0.6 mm. longis; gynaecio glabro ±1.7 mm. longo, ovario late ovoideo, stylo brevi robusto, stigmate triangulari. Fructus niger, subglobosus, minute apiculatus, ad 1 cm. diam., cupula vadosa tumescente ad 4 mm. longa, 6 mm. diam., et 2 mm. alta subtentus, pedicello 4–5 mm. longo apice ad 3 mm. diam. expanso.

DISTRIBUTION: Costa Rica, in the Caribbean cloud-forest at 1600-1700 m. altitude, and in Panama up to 800 m.

COSTA RICA: Alajuela: La Palma de San Ramón, *Brenes 6825* (fl., Ch); Zapote de San Carlos, region of Zarcero, growing at edge of woodland in semi-shade in Caribbean cloud-forest, alt. 1600 m., March 26, 1938, *A. Smith H.541* (fl., TYPE — A, Ch) (tree 10 m. high, base 25 cm.; bark gray, roughened by large well spaced dots, the cambium-layer yellowish; leaves shining; flowers in axillary racemes, the pedicels and round buds pink or red; petals white); La Peña de Zarcero, *A. Smith H.590* (fl., A, Ch). PANAMA: Coclé: Vicinity of El Valle, *P. H. Allen 774* (fr., Ch, GH, Mo). Panama: Residual forest in rolling grassland, trail from Campana to Chica, Cerro Campana, *P. H. Allen 2652* (fr., A).

This species, also, seems to have its affinity with the variable *N. salicifolia*. The foliose branchlets, the consistently few pairs of lateral nerves, and the prominent reticulation of the small leaves set it apart from the well known species. The bulging cupule which fits snugly about the very base of the fruit is another differentiating character.

3. **Nectandra Brenesii** (Standley), comb. nov.
Ocotea Brenesii Standley in Field Mus. Publ. Bot. 18: 454. 1937.

DISTRIBUTION: Known only from Costa Rica.

Costa Rica: Alajuela: La Palma de San Ramón, *Brenes 5535 (127)* (fl., Ch), woods and pastures; Cataracts of San Ramón, March-April, 1931, *Brenes 13653* (fl., type, Ch); Caribbean cloud-forest, Zapote de San Carlos, region of Zarcero, *A. Smith H.469* (fl., Ch, NY); continental divide, Zarcero, *A. Smith H.516* (fl., Ch), *A.571* (fl., Ch), *4102* (fl., Ch), *4171* (fl., Ch); Suere, San Carlos, Caribbean rain-forest, on edge of ravine, *A. Smith H.1687* (fl., Ch); Tapeseo, Alfaro Ruiz, *A. Smith P.2620* (fl., A); Palmira, in fog-zone, *A. Smith 4202* (fl., Ch). Heredia(?): Vicinity of Vara Blanca, north slope of Central Cordillera, between Poás and Barba volcanoes, *Skutch 3736* (fl., fr., A, NY).

The branchlets of this species are slender, somewhat angled, striate, and early clothed with a close sericeous pubescence varying from buff or tawny to a deeper almost subferruginous color. The leaves have slender grayish-pubescent petioles that are canaliculate and measure up to 12 mm. long. The blades are membranaceous, elliptic, shining above, dull beneath, the base obtuse or almost rounded, the apex acuminate to abruptly obtusely acuminate or subcaudate. They measure up to 8–12 (–14) cm. long and 3.5–6 (–8) cm. broad, and at maturity show a slight close persistent pubescence, sparse on the blade as a whole but dense near the costa and nerves. The costa is impressed above and very prominently elevated beneath. The lateral nerves, of which there are 4 (or 5) pairs, diverging from the costa at an angle of 35–45°, are slightly elevated above and more prominently so beneath, bearing only a slight suggestion of axillary glands. The inflorescence is a short few-flowered cymose panicle, sparsely and inconspicuously pubescent, becoming glabrescent, up to 6(–8) cm. long, with a slender peduncle up to 4 cm. long. The flowers are large, measuring almost 5 mm. long and 12 mm. in diameter, the tube short, the lobes thick, fleshy, elliptic, up to 4.25 mm. or more long. The two outer series of stamens are ±1.9 mm. long, with anthers ovate, obtuse, borne on stout filaments one-quarter the length of the stamens. The connective is well developed, about one-third the entire length of the anther. The stamens of the third series are more or less oblong, bearing at the base of the filaments two sprawling somewhat depressed sessile glands that are about the height of the filaments, only wider. The staminodia are ovate, ±0.8 mm. long, borne on pubescent stipes slightly more than half the entire length. The glabrous gynaecium is ±2.7 mm. long, the depressed-globose ovary twice the length of the rather stout style which bears a triangular slightly decurrent flat stigma. The only fruiting material cited does not exactly match the remainder of the specimens in foliage-characters. The leaves are shorter, more narrowly elliptic, and are definitely caudate. The fruit is lacking on the specimen, but the subtending cupule (seemingly immature) is smooth, purplish, very shallow, about 7 mm. long and 7–8 mm. in diameter at the apex; the long pedicel is 1.5 cm., smooth and expanding to join the cupule with no visible line of demarcation. The young fruits are very similar to those of *N. savannarum,* but the flowers on the same branch show the characters of *N. Brenesii.*

The same reason may be given for transferring this species from *Ocotea* to *Nectandra* that is offered in the case of the next, *Phoebe ambigens.* I am at a loss to suggest the true affinity of this species.

4. **Nectandra ambigens** (Blake), comb. nov.

Phoebe ambigens Blake in Contr. U. S. Nat. Herb. 24: 3, *pl. 2.* 1922; Record in Trop. Woods 10: 21. 1927; Standley in Trop. Woods 21: 719. 1930.

Distribution: Eastern Guatemala and Honduras.

GUATEMALA: Without locality, *Kuylen G.54 (1) (Y 8885)* (sterile, Y); Hopi Farm, *Kuylen G.149 (Y 10508)* (fl., NY, Y). Izabal: Las Playitas, *Whitford & Stadtmiller 32* (sterile, GH). San Marcos: Finca El Porvenir, on Potrero Matasán along Río Cabús, Volcán Tajumulco, *Steyermark 37643* (fr., Ch). HONDURAS: Copán: Rodezno, *Whitford & Stadtmiller 7* (fl., ISOTYPE, GH, Y). Colón (?): El Limón, *Whitford & Stadtmiller 26* (sterile, Y).

NATIVE NAMES: "Aguacatillo" (Guatemala); "Ajio," "Guambo" (Honduras).

This species has branchlets that are finely and sparsely grayish-pubescent, becoming glabrous, and angled, becoming grayish-striate. The leaves have stout petioles 2 (–2.8) cm. long and sparsely pubescent to glabrescent. The blades are subcoriaceous, shining above and beneath, usually elliptic, cuneate at the base, obtuse or shortly obtusely acuminate, 9.5–26 cm. long and 3.5–10 cm. broad. The thick costa and lateral nerves, of which there are 7 or 8 (–9) pairs diverging at an angle of about 45°, are slightly elevated above and more so beneath. Blake mentions axillary tufts being frequently present, but on the material at hand they are almost imperceptible. The dense and prominent reticulation on both surfaces of the leaf is one of the most striking characteristics of the species. The glabrescent inflorescence is axillary, few-flowered, up to 15 cm. long, the stout peduncle up to 7.5 cm. long. The most arresting feature of the species is the presence of large flowers up to about 8 mm. long and 15 mm. in diameter at anthesis, densely grayish-pubescent without, the spreading lobes bright-castaneous at anthesis, and subtended by a slender pubescent pedicel up to 9 mm. in length. The tube is short, the lobes broadly elliptic, up to 7 mm. long and about 5 mm. broad, fleshy and papillose within. The stamens of the two outer series are ±2.5 mm. long, the almost quadrate anthers are rounded at the apex and nearly sessile. Those of the inner series measure nearly 3 mm. long, the anthers square, truncate at the apex, the filaments nearly half the entire length and bearing near the base two conspicuous subglobose sessile glands. The staminodia are ovate, subsessile (in the type), and ±1.25 mm. long. The glabrous gynaecium is ±2.15 mm. or more long, the depressed-globose ovary equalling in length the stout style topped by a broad conspicuous subtriangular decurrent stigma. The Steyermark specimen from Guatemala shows a large fruit which is green (probably not fully ripe), ellipsoid, apiculate, the entire apex conspicuously smooth, 2.5 (–3) cm. long and 1.7 cm. broad, subtended by a sharply lobed woody verrucose cupule 1 cm. long, over 2 cm. in diameter, and 8–9 mm. deep. The enlarged pedicel is 1.5 cm. long, expanded to nearly 1 cm. diameter at the apex.

Kuylen G. 149, from Guatemala, shows staminodia that are more stipitate than those of the type, but in other respects it matches the type-material. In spite of the presence of staminodia, the other characters of the flower indicate that *Nectandra* is the genus to which the entity belongs. The large flower recalls that of *N. globosa,* but the anthers have a less developed connective, and the style is longer. Also the foliage-characters are entirely different.

5. **Nectandra rubriflora** (Mez), comb. nov.

Ocotea rubriflora Mez in Jahrb. Bot. Gart. Berlin 5: 279. 1889; Standley in Contr. U. S. Nat. Herb. 23: 296. 1922.

Ocotea perseifolia Mez & J. D. Smith in Bot. Gaz. 20: 10. 1895; Standley in l. c.

Ocotea persicifolia Mez & J. D. Smith, in Index Kewensis, Suppl. I. 1906, sphalm.

DISTRIBUTION: Eastern Mexico, Guatemala, and British Honduras, at low altitudes, from 20 to 60 m.

MEXICO: Oaxaca: Chiltepec and vicinity, Tuxtepec, in llanos, *Martínez-Calderón 49, 469* (fl., A). Tabasco: Teapa, *Linden* in 1840 (fl., photo. of TYPE of *Ocotea rubriflora,* Ch); San Sebastian, *Rovirosa 475* (fl., Ch). GUATEMALA: Izabal: Izabal, alt. 36 m., April, 1889, *J. D. Smith 1807* (fl., isotype of *Ocotea perseifolia,* US). BRITISH HONDURAS: Stann Creek: Middlesex, along river-bank, *Schipp 381* (fl., Ch, GH, NY).

This species has branchlets that are angled and clothed with a close short pubescence which verges on a ferruginous shade, or perhaps more tan. The leaves are borne on petioles up to 3 cm. long, canaliculate and glabrescent. The blades are chartaceous to subcoriaceous, broadly elliptic or oblong-elliptic, roundish to obtuse or even cuneate at the base, acuminate to shortly acuminate or subcaudate at the apex, up to 26 cm. long and up to 12 cm. broad, shining above, glabrous or very minutely and inconspicuously pubescent beneath, greenish brown throughout in the dried state. The costa is conspicuous though impressed above, frequently slightly pubescent toward the base on both surfaces, and very prominently elevated beneath. The 10–12 pairs of lateral nerves are often reddish, only slightly elevated above but more so beneath, and diverge from the costa at an angle of about 45° or occasionally 60°. The reticulation of the blade is loose, prominent above and beneath. The inflorescence consists of axillary or subterminal panicles 9 (–15) cm. long, clothed with the same minute pubescence that covers the branchlets, and borne on a stout peduncle 4 (–9) cm. in length. The flowers, usually with a reddish tinge, are large, up to 4.5 mm. in length and 8–9 mm. in diameter, the ovate obtuse perianth-lobes fleshy and papillose, ±3–3.8 mm. long. The stamens are ±1.25 mm. long, and the anthers are thick, papillose, square or parabolical, with the apex often emarginate, borne on stout very short filaments pubescent at the base. The filaments of the inner series of stamens bear at the base sessile glands, which are seemingly compressed-subreniform or subglobose. No staminodia are present. The glabrous gynaecium is ±1.7 (–2.15) mm. long, the ellipsoid or subglobose ovary topped by a very short stout style with a subcapitate stigma at its apex. No fruit is known.

The species resembles superficially *N. Lundellii.* The flowers of *N. rubriflora,* as the name indicates, are usually reddish, whereas those of *N. Lundellii* are white and, the collectors note, very fragrant. The squarish stamens — more or less petaloid and densely papillose — present a further distinguishing character.

6. **Nectandra Schippii,** sp. nov.

Arbor 10.5 m. alta, ramis griseis glabris, ramulis dense ferrugineo-tomentosis. Folia alternata subverticillata, juventute utrinque ferrugineo-tomentosa, petiolis robustis ferrugineo-tomentosis, ad 5–10 (–15) mm. longis et 2.5 mm. latis, laminis supra glabris costa et nervis exceptis, subtus ferrugineo-tomentosis, coriaceis, in sicco viridescenti-brunneis, ellipticis, (6–) 12–14 cm. longis et (2.5–) 5 (–6) cm. latis, basi acutis, rotundatis, vel subcordatis, apice subobtusis vel rotundatis et emarginatis, saepe longe vel abrupte acuto-acuminatis, penninerviis, costa supra satis impressa et pubescente, subtus conspicuissime elevata et ferrugineo-tomentosa, nervis (6–) 8- vel 9-paribus supra impressis subtus elevatis et pubescentibus, angulo 45°

divergentibus, rete venularum supra satis impresso subtus elevato et pubescente. Inflorescentia axillaris, juvenili bracteis adhuc onusta, ad 6.5 cm. longa, ferrugineo-tomentosa, cymoso-paniculata, pauciflora, longipedunculata, pedunculo ad 4.5 cm. longo. Flores leviter fragrantes, immaturi, pedicellis brevibus pubescentibus, perianthio albo, lobis crassis, papilloso-tomentosis; staminibus ser. I & II subreniformibus apice rotundatis filamentis crassis et latis brevibus, ser. III subreniformibus biglandulosis, glandulis magnis sessilibus antheris aequalibus; staminodiis brevistipitatis bene conspicuis; gynaecio glabro, ovario stylo duplo longiore, stigmate parvo inconspicuo. Fructus ignotus.

DISTRIBUTION: Known only from the type-locality.

BRITISH HONDURAS: Stann Creek: Rare in dense shade on bank along Big Creek, alt. 30 m., Dec. 3, 1931, *Schipp 856* (fl., Ch, TYPE — GH, NY) (tree 10.5 m., diam. 23 cm., wood cream-colored, close-grained; flowers white, slightly fragrant).

The flower-structure of this species is very similar to that of *N. globosa.* The branchlets, however, with their dense conspicuous woolly covering of ferruginous-tomentose pubescence, differ widely. The bright tomentum after a period wears off to a thin rather straggling layer of grayish inconspicuous pubescence that dwindles to a mere glabrescent state. The fragrant flowers resemble those of *N. globosa.*

7. **Nectandra Austinii,** sp. nov.

Arbor 7.5–13 m. alta, ramulis valde sulcatis fulvo- vel pallide brunneo-tomentosis. Folia alternata, juventute utrinque dense fulvo-tomentosa vel brunneo-tomentosa, petiolis robustis tomentosis canaliculatis, 1 2 cm. longis et ad 4 mm. latis, laminis supra glabris basi costae excepta, subtus hinc inde consperso-pubescentibus nervatione dense fulvo-pubescentibus, coriaceis, in sicco supra pallide olivaceis, subtus atro-brunnescentibus, obovatis, 13 (–22) cm. longis et 7 (–12.5) cm. latis, basi cuneatis saepe obliquis, interdum obtusis, apice rotundatis vel obtusis vel leviter breviterque obtuse acuminatis, penninerviis, costa supra leviter impressa subtus leviter elevata, nervis plerumque 7-paribus supra leviter impressis subtus leviter elevatis angulo (35–) 45 (–55)° divergentibus, rete venularum supra obscuro subtus conspicuo atrato-pubescente delineato. Inflorescentia axillaris anguste paniculata, 4–8 cm. longa, dense fulvo-tomentosa, pauciflora, longipedunculata, pedunculo ad 4 cm. longo satis gracili. Flores immaturi, ad 4 mm. longi, glabri, pedicellis brevibus ad 1 mm. longis pubescentibus, gracilibus, perianthio subcampanulato(?), lobis ellipticis nonnihil crassis glabris $\pm$2.15 mm. longis, staminibus ser. I & II $\pm$1 mm. longis, antheris subsessilibus, connectivo conspicuo truncato, ser. III $\pm$1.25 mm. longis, filamentis brevibus biglandulosis, glandulis parvis staminis partem tertiam aequantibus; staminodiis lanceolatis brevibus $\pm$0.5 mm. longis; gynaecio glabro $\pm$1.7 mm. longo, ovario ellipsoideo stylo duplo longiore, stigmate conspicuo. Fructus immaturus (?) viridis, oblongus vel oblongo-obovatus, 2.5–4 (fide coll.) $\times$ 1–1.5 cm., cupula hemisphaerica rubra rugosula glabra, ad 1 cm. longa et diam. et ad 5 mm. alta subtentus, pedicello incrassato glabro aciculato, ad 7 mm. longo et ad 3 mm. lato.

DISTRIBUTION: Known only from the cloud-forests of Alajuela in Costa Rica, at an altitude of 1600–2345 m.

COSTA RICA: Alajuela: Alfaro Ruiz, La Peña, *A. Smith P.2114* (fl., A); Tapeseo, in mold and loam in half-shade in Caribbean cloud-forest, alt. 1650 m., Jan. 6, 1940 *Austin Smith P.2226* (fl., TYPE, A) (tree 11 m., trunk base 38 cm.; bark neutral-brown with raised dots; crown broad; leaves chartaceous, thickened, subrigid, opaque green, paler below with fine reticulation; drupe green, fig-form); region of Zarcero, *A. Smith A.240* (fr., Ch).

The new species superficially has characters in common with *N. sinuata*, but the flowers are smaller and more delicate, with their anthers truncate and the ovary glabrous; the leaf-blades are less densely tomentose and their bases are not cordate or conspicuously rounded.

8. **Nectandra panamensis** Mez in Jahrb. Bot. Gart. Berlin 5: 443. 1889.

DISTRIBUTION: Central part of Panama, at 30–100 m. altitude.

PANAMA: Canal Zone: Near Gorgona and Maume, *Wagner s.n.* (fl., photo. of TYPE, GH); Darién, *MacBride 2703* (fr., Ch, Mo). Panama: Around Alhajuela, Chagres Valley, forests, on dry limestone, *Pittier 2398* (fl., Ch, GH, NY); vicinity of Pacora, *P. H. Allen 1126* (fl., Ch, GH, Mo), *2033* (fl., A).

The branchlets of this species are glabrous with only a faint suspicion of pubescence at the apex, greenish, becoming brownish, angled, becoming terete and striate. The leaves have glabrous canaliculate petioles up to 1 cm. long. The blades are membranaceous or chartaceous, pale greenish in the dried state, glabrous, narrowly elliptic or elliptic-lanceolate, the base cuneate, the apex acutish or subacuminate or often obtusely long-acuminate, 15–20 cm. long and not more than 5.5 cm. broad. The costa is plane above, though conspicuous because of its yellowish color, and is elevated beneath. The lateral nerves, of which there are 5–7 (–9) pairs, are yellowish and slightly elevated above but more conspicuously so beneath, diverging at an angle of 25–35 (–45)° and usually bearing in their axils very conspicuous large ellipsoid pubescent glands which are conspicuous on the upper surface of the blade as well. The glabrescent paniculate axillary or subterminal infloresence is up to 12 (–19) cm. long, much-branched near the base, with a very short peduncle. The white flowers are pubescent, and measure about 3.5 mm. long and up to 8 mm. in diameter, the slender pedicel up to 4 (–6, according to the author) mm. long. The perianth-lobes are fleshy, hairy, and up to 3 mm. long. The two outer series of stamens are ±0.8 mm. long, the anthers are broadly ovate, obtuse or somewhat depressed-globose, the connective tissue is apparent, and the filaments are very short and thick. The stamens of the inner series are ±1.25 mm. long and consist of subrectangular anthers that are broader than long and borne on rather stout filaments with two conspicuous sessile basal glands that are almost larger than the anthers themselves. The staminodia are very thin, ovate, ±0.6 mm. long, the stipe about equalling half the entire length. The glabrous gynaecium is ±1.7 mm. long, the ovary ellipsoid with a very short stout style topped by a conspicuous triangular stigma. The fruit (probably immature) is borne in a cyathiform cupule up to 6 mm. long, 9 mm. in diameter, and 4 mm. deep. The supporting pedicel is up to 5 mm. long and scarcely broader at the apex than at the base.

The species is reminiscent of *N. Gentlei*, also to be found in this area. The leaf-shape, however. and the type of venation distinguish it from the above-mentioned species. There are points of difference between the species-description and the specimens cited, but I can find no major features which bar the numbers from inclusion in Mez' species.

9. **Nectandra globosa** (Aublet) Mez in Jahrb. Bot. Gart. Berlin 5: 415. 1889, excl. syn.
Laurus globosa Aublet, Pl. Guian. 1: 364. 1775.
Sassafridium macrophyllum Rose in Contr. U. S. Nat. Herb. 1: 355. 1895.

DISTRIBUTION: West Indies, Mexico, and Central America.

MEXICO: Sinaloa: San Ignacio, Arroyo del Agua Colgada, *Ortega 715* (fl., Ch). Nayarit (Tepic): Santiago, *Lamb 614* (fl., GH). Colima: Manzanillo, *E. Palmer 1033* (fl., isotype of *Sassafridium macrophyllum*, GH, NY). Guerrero: Banks of the Río Tecpán, *Langlassé 740* (fl., GH). Oaxaca: Tuxtepec, Chiltepec, and vicinity, in llanos, *Martínez-Calderón 292* (fl., A); Pinotepa to Jamiltepec, *Nelson 2347* (fl., GH); Jamiltepec, *Conzatti 4404* (fl., NY). GUATEMALA: Without locality, *Brigham s.n.* (fl., GH). Petén: Above El Cambio, along Río Cancuen, between La Concordia and El Cambio, *Steyermark 45892* (fl., Ch). Alta Verapaz: Cubilgüitz, *von Tuerckheim 7964* (fl., GH, NY); wet wooded ravine, along Río Carchá, between Cobán and San Pedro Carchá, *Standley 89878* (fl., Ch), at edge of river, *90010* (fl., Ch). Izabal: Near mouth of Río Polochic, *Maxon & Hay 3788* (fl., NY), *von Tuerckheim 1222* (fl., NY). Guatemala: *Aguilar 499* (fr., Ch). Chimaltenango: Iztapa, *J. R. Johnston 1169* (fl., Ch). Retalhuleu: In wet thicket, *Standley 66695* (fl., Ch). Suchitepéquez: Vicinity of Mazatenango, stream-bank, *Maxon & Hay 3477* (fl., Ch); near Santo Domingo, south of Mazatenango, stream-bank, *Standley 88900* (fr., Ch). Escuintla: Concepción, *J. D. Smith 2095* (fr., GH); Escuintla, *Hayes s.n.* (fl., GH); south of Río Burrión, northeast of Escuintla, road-side, *Standley 89626* (fr., Ch). Santa Rosa: Río de La Plata, *Heyde & Lux 4261* (fl., GH, NY); about Guazacapán, in damp forest, *Standley 78677* (fl., Ch); wet forested quebrada, Río de la Cruz, east of Taxisco, *Standley 79005* (fl., Ch); road-side, region of Capulín, south of Los Cerritos, on road to El Ahumado, *Standley 79623* (fl., Ch). HONDURAS: Tegucigalpa: Mont. de la Flor, river-bank in pine-region, *C. & V. W. von Hagen 1135* (sterile, NY). Yoro: Near Progreso, Farm 42, *Hottle 85* (fl., Ch), *106* (fl., Ch). BRITISH HONDURAS: Toledo: "Forest Home," Punta Gorda, in open pasture, *Schipp 1037* (fl., GH, NY); forest, Moho River, *Peck 553* (fl., GH); Temash River, *Stevenson & Smart 126, 130* (*Y 19785*) (fl., Ch, Y). EL SALVADOR: Ahuachapán: Vicinity of Ahuachapán, *Standley 19883, 20280* (fl., GH). Sonsonate: Vicinity of Izalco, *Standley 22225* (fl., GH, NY). La Libertad: Santa Tecla, *S. Calderón 1419* (fl., GH, NY). Usulután: Triunfo, *Shannon 5003* (fl., GH). NICARAGUA: Chinandega: Chinandega, *Baker 2015* (fl., Ch, GH, NY). COSTA RICA: Guanacaste:Near Nicoya, *Tonduz 13806* (fl., GH), *Valerio 495* (fr., Ch). Puntarenas: Santo Domingo, *Tonduz 7153* (Herb. Nat. Costa Rica *10047*) (fl., GH); between Puerto Jiminez and Santo Domingo, *Brenes 12278* (*757*) (fr., Ch). Alajuela: Cataracts of San Ramón, *Brenes 13664* (fl., Ch); Alajuela, *J. D. Smith 6755* (fl., GH); in forest of Pacific tropical zone, Atenas, *A. Smith 2465* (fl., A). San José: Vicinity of El General, *Skutch 3836* (fl., A, NY). PANAMA: Without locality, *Hayes 1021* (fl., NY), *Mell s.n.* (fr., NY). Bocas del Toro: Changuinola Valley, *Dunlap 215* (fl., Ch), *Cooper & Slater 86* (*Y 10267*) (fl., Ch). Chiriquí: San Felix, *Pittier 5145* (fl., Ch). Coclé: Above Penonome, *R. S. Williams 257* (fl., NY), *319* (fl., fr.; NY), *530* (fl., NY). Canal Zone: Gatun Lake, near laboratory, *Wetmore & Abbe 17* (A, Ch, GH), *43* (fl., A, Ch, GH), *314* (fl., A, Ch); alluvial bottom near Bohio, *Maxon 4772* (fl., Ch); vicinity of Miraflores Lake, *G. White 191* (fl., Ch, GH), *P. White 276* (fl., Ch, GH); between Miraflores and Corozal, *Pittier 2495* (fl., NY); near lake, vicinity of Cocoli River, *P. White 95* (fr., Ch, GH, Mo); Barro Colorado Island, *M. Brown 40, 68, 72, 188* (fl., Ch), *Shattuck 314, 458, 807* (fl., Ch), *C. L. Wilson 2* (fl., Ch); along Río Fató, in forests and thickets, *Pittier 3873* (fr., NY). Panama: Vicinity of Arraijan, *P. H. Allen 1622* (fl., Ch, GH, Mo, NY); Chepo, *Kluge 27* (fl., Ch). Darién: Chepigana, Tucuti, *M. E. & R. A. Terry 1391* (fl., A, Ch, Mo).

NATIVE NAMES: "Aguacate del monte" (El Salvador); "Aguacatillo" (Mexico, Honduras, British Honduras, Costa Rica); "Canelon" (El Salvador); "Quizarrá," "Quizarrá quina" (Costa Rica); "Sangre blanco" (Honduras); "Sweetwood" (Panama); "Timbersweet," "Wild Pear" (British Honduras).

This species, as it occurs in Mexico and Central America, has branchlets that are closely and minutely subferruginous-pubescent, in the early stages angled and flattened at the nodes, later becoming reddish brown, striate, and glabrous. The leaves are borne on stout petioles up to 1.5 cm. long, minutely pubescent to glabrous and canaliculate. The blades are coriaceous, shining above and dull beneath, with obscure reticulation, early minutely pubescent, becoming glabrescent to glabrous, elliptic to oblong-elliptic, the base rounded or sharply cuneate, the latter appearance due to the lower centimeter of the leaf-base being recurved, the apex long-acuminate. The costa is slightly impressed above and rather conspicuous and elevated beneath. The lateral nerves are inconspicuous above and slightly elevated beneath, numbering 8–12 pairs and diverging at an angle of 30–45°, frequently bearing pubescent glands in their axils. The stout paniculate inflorescence measures up to 20 cm. long, is minutely subferruginous-pubescent to glabrescent, many-flowered, usually widely branching, the peduncle varying from very short to 8 cm. in length. The flowers are very large and conspicuous, up to 12 mm. in diameter, with reflexed lobes that are very fleshy, papillose within and pubescent without, 4–5 mm. long, elliptic or obovate-elliptic, acutish or obtuse at the apex. The two outer series of stamens are ±1.25 (–1.5) mm. long, with the sessile or subsessile anthers rounded or broadly rounded-ovate, the fleshy papillose connective often one-third the entire length. The stamens of the inner series are ±1.7 mm. long, the broad anthers narrowing slightly into thick filaments almost one-half their length and bearing at the base two conspicuous spreading sessile glands almost the length of the anthers. The almost triquetrous staminodia are ±1 mm. long, the thick stipe nearly one-half the entire length. The glabrous gynaecium measures ±1.7 mm. long, the subglobose ovary two-thirds the entire length. The short style is topped by a triangular discoid or obtuse stigma. The globose apiculate fruit, about 1 cm. in diameter, is subtended by a very shallow cupule up to 2 mm. long, 8 mm. in diameter, and 2 mm. deep, with the margin usually entire and thin. The pedicel is up to 5 mm. in length and expanded to 3 mm. in diameter at the apex.

It is not certain at the present moment that *N. globosa* is the correct binomial for the species involved. Kostermans (Meded. Bot. Mus. Utrecht **25**: 19, 54. 1936) believes that Aublet's name *globosa* should replace *N. antillana* of Meissner, the West Indian entity not occurring in Surinam, and that Mez' *N. globosa* should be reduced under *N. Pisi.* Until types are available for study, the species from Mexico and Central America may continue to go under the name of *N. globosa.*

There can be no doubt that *Sassafridium macrophyllum* Rose belongs with this species. The earlier described *Sassafridium veraguense* is an *Ocotea.*

10. **Nectandra ramonensis** Standley in Field Mus. Publ. Bot. 18: 453. 1937.

Distribution: Costa Rica and adjacent Panama.

Costa Rica: Alajuela: Near San Ramón, *Brenes 353* (*478*) (fl., Ch); San Pedro de San Ramón, on the side toward San Francisco, *Brenes 6612* (*478*) (fl., Ch); on the trail to San Francisco, *Brenes 6660* (fl., Ch); San Francisco and San Pedro de San Ramón, Feb. 7, 1933, *Brenes 17018* (fl., type, Ch); Río Jesús de San Ramón, *Brenes 14988* (fl., Ch); La Calera de San Ramón, on the trail to La Calera, *Brenes*

21990 (fl., Ch); between Santiago and San José de San Ramón, *Brenes 6834* (fr., Ch); La Palma de San Ramón, *Brenes 6819* (fl., Ch). PANAMA: Prov. unknown, Sabana de la Tortuga, *Pittier 3307* (fr., Ch). Chiriquí: Boquete, *Davidson 566* (fl., Ch, Mo). Coclé: Vicinity of El Valle, *P. H. Allen 1635* (fl., Ch, GH, Mo, NY); north rim of El Valle, *Alston* (*Allen?*) *1858* (fr., Ch, GH, Mo, NY).

This species is very close to *N. globosa,* occurring insofar as is known at present in Costa Rica and Panama. A similar pubescence clothes the young branchlets and leaves. The branchlets however at maturity are usually grayish, the outer cortex sometimes flaking off to reveal a dark reddish brown color. The leaves are subtended by short slender pubescent petioles less than 1 cm. long. The blades are sericeous beneath in the early stages, later becoming minutely pubescent. The adult leaf-blades are shining above, dull beneath, elliptic, occasionally oblong-elliptic, the base obtuse and/or the lowermost portion attenuately cuneate, frequently almost decurrent and recurved. The apex is obtuse to acutish or acuminate, the costa and lateral nerves slightly impressed above and somewhat obscure, slightly elevated beneath. The lateral nerves number not more than 4 or 5 pairs, diverging from the costa at an angle of 35–45° and bearing pubescent glands in their axils. The inflorescence consists of fewer-flowered axillary or subterminal panicles minutely subferruginous-sericeous-tomentellous and up to 8 cm. long at most, with long stout peduncles frequently up to 6 cm. long. The flowers are similar to those of *N. globosa* in structure. The fruits are ellipsoid rather than globose, 1.5 cm. long and 9 mm. in diameter, subtended by deeper cupules 4–5 mm. long, 8–10 mm. in diameter, and 2–3 mm. deep. The pedicel is about 5 mm. long and 3–4 mm. in diameter at the apex.

11. **Nectandra Heydeana** Mez & J. D. Smith in Bot. Gaz. 19: 262, *t. 25.* 1894; Standley & Calderón, Lista Prelim. Pl. Salvador 84. 1925.

DISTRIBUTION: Guatemala and Honduras, at 900–1360 m. altitude.

GUATEMALA: Alta Verapaz: Along Río Carchá, near San Pedro Carchá, *Standley 92158* (fl., Ch). Santa Rosa: Santa Rosa, alt. 900 m., Nov. 1892, *Heyde & Lux 4260* (fl., ISOSYNTYPE, GH, NY), Jan. 1893, *Heyde & Lux 4578* (fl., ISOSYNTYPE, GH, NY). HONDURAS: Tegucigalpa: Along river, Mont. de la Flor, Guarabuqui, *C. & V. W. von Hagen 1275* (fr., Ch, NY).

NATIVE NAME: "Aguacatilla" (Honduras).

The present species, so little collected to date, has branchlets which are early close fulvous-pubescent, later glabrescent, angled, becoming striate. The leaves are borne on slender petioles up to 2 cm. in length which are subcanaliculate and fulvous- or grayish-pubescent. The blades are glabrous except for the pubescent axillary glands beneath, elliptic, sometimes oblong-elliptic, the base cuneate or obtuse or even almost rounded, the apex abruptly acuminate or obtuse, up to 19 cm. long and to 8 cm. broad. The costa is impressed and conspicuous above and the lateral nerves, of which there are usually 7 or 8 pairs, are very slightly elevated and conspicuous above, whereas both are conspicuously elevated beneath. The lateral nerves diverge from the costa at an angle of 35–45°, and the reticulation is prominent throughout. The axillary inflorescence is few-flowered, glabrous, paniculate, up to 7 cm. long, and is borne on a slender peduncle up to 5 cm. long. The flowers are large, almost 4 mm. long and up to 7 mm. in diameter, the slender filamentous pedicels glabrous and up to 5 mm. long. The broadly elliptic lobes are rather fleshy, ± 3.8 mm. long, and papillose on the inner surface. The stamens of the two outer series are ±1.25 mm. long, with anthers that are almost square or broadly ovate, truncate, nearly sessile, sometimes mucronate. Those of the inner series are ±1.7 mm. long, the squarish anthers somewhat emarginate, the two upper cells definitely lateral. The filaments are one-half as long as the anthers and bear laterally at the base two broad spreading glands about half their length and twice as broad as long. The staminodia are ovate, ±0.6 mm. long and densely shaggy-pubescent. The glabrous gynaecium is ±2.5 mm. long; the subglobose or broadly ovoid ovary is not quite twice the length of the style with its almost peltate conspicuous stigma.

The fruit of the Honduran specimen is ellipsoid, greenish black in the dried state, up to 2.5 cm. long and 1.8 cm. broad, subtended by a shallow woody flaring cupule not more than 6 mm. long, 1 cm. in diameter, and less than 3 mm. deep. The expanded pedicel, also woody, reaches a length of 9 mm. and a breadth of 5 mm. at its apex.

The species may be said to show a slight relationship to *N. Woodsoniana,* but the grayish pubescence of the many-flowered inflorescence of the latter separates it immediately. The fruits of the two species are entirely different, that of *N. Woodsoniana* being much smaller and with a more shallow cupule.

12. **Nectandra Gentlei** Lundell in Contr. Univ. Mich. Herb. **6:** 13. 1941.

DISTRIBUTION: Southern Mexico, Guatemala, Honduras, British Honduras, and Panama.

MEXICO: Oaxaca: Ubero, *L. Williams 9377* (fr., A, Ch, NY). GUATEMALA: Petén: La Libertad, *Lundell 2578* (fr., Ch, NY). Huehuetenango: Wooded slopes bordering Río Lacandon, between Ixcán and Río Ixcán, Sierra de los Cuchumatanes, *Steyermark 49354* (fl., Ch). Alta Verapaz: Cubilgüitz, *von Tuerckheim 8578, 8579* (fl., GH, NY); woods between Finca Cubilgüitz and Hacienda Yaxcabanal, *Steyermark 44827* (fr., Ch); wet forest, above Tamahú, *Standley 70932* (sterile, A). BRITISH HONDURAS: Belize: Forest near Manatee Lagoon, *Peck 196* (fl., GH). Stann Creek: Mullins River, in high ridge on river-bank, *Gentle 3456* (fl., ISOTYPE, A, NY); Middlesex, *Schipp 337* (fl., Ch, GH, NY); Stann Creek Railway, 10 mile, *Schipp 164* (fr., GH, NY). Toledo: In forest, *Peck 574* (fl., GH). HONDURAS: Near Puerto Sierra, *P. Wilson 558* (fr., Ch, GH, NY). PANAMA: Province unknown, Cana and vicinity, *R. S. Williams 797* (fr., NY). Chiriquí: El Pedregal de David, *Pittier 5117* (fl., Ch). Coclé: Above Penonome, *R. S. Williams 617* (fr., NY). Canal Zone: Vicinity of Miraflores Lake, *P. White 243* (fl., Ch, GH, Mo); Ancon Hill, *Killip 3032* (fl., Ch), *Standley 26376* (fr., GH); near Quarantine Station, *Pittier 2076* (fr., Ch); Hospital Grounds, *Pittier 2733* (fr., GH); between Corozal and Ancon, *Pittier 2639* (fr., NY); Balboa, hillside, west side of Canal, *Rowlee & Stork 987* (fl., NY). San José Island: Perlas archipelago, Gulf of Panama (about 55 miles SSE of Balboa), *Johnston 82* (fl., A), *221* (fl., A), *270* (young fr., A), *521, 699, 716* (fr., A).

This species has angled branchlets that early are covered with a close short subtomentellous pubescence of a pale ferruginous or brownish color, presently becoming fuscous, and eventually the branchlets being glabrescent to glabrous, dark reddish brown, and striate. The leaves are supported by petioles up to 1.5 cm. long, canaliculate, and brown-tomentellous. The chartaceous lanceolate leaf-blades appear cuneate at the base but actually are rounded or even subauriculate, the extreme bases being usually tightly recurved. The apex of the blade is attenuate into a slender acumen which may or may not be caudate. The blades measure up to 20 cm. long and to 4.5 (–5) cm. broad, the broadest part of the blade being at or below the middle. The blades are early sericeous throughout, but soon become glabrescent to glabrous above, remaining shortly but persistently pubescent beneath. The costa and lateral nerves alike are slightly impressed and rather inconspicuous above, being prominently elevated beneath. The lateral nerves number 4–6, occasionally 7 or 8, and diverge arcuately from the costa at an angle of about 45°. At a distance of 1–1.5 cm. from their origin they ascend abruptly and follow the outline of the leaf almost parallel with the midrib. The inflorescence is axillary, paniculate, subferruginous- or brown-tomentellous, becoming glabrescent, measuring up to 8 (–12) cm. in length, the peduncle reaching a length of 4 (–6) cm. The flowers are yellow or white, sometimes fragrant, up to 3 mm. long and 5.5 mm. in diameter, the perianth-tube being well defined, constricted at the apex, and about 1 mm. long. The lobes are usually elliptic, ±1.7 (–2.15) mm. long, rather thick and papillose at the tip. The stamens of the two outer series are ±0.6–.8 mm. long, the anthers subreniform-globose, almost sessile. Those of the inner series are ±0.8 (–1) mm. long, with almost square anthers slightly emarginate, with large conspicuous and contiguous glands borne at the base of the short filaments. The slender, stipitate, often pubescent staminodia are variable, lanceolate, oblanceolate, or even ovate. The glabrous gynaecium is ±1.7 mm. or less long, the style slightly longer than the ovoid ovary, and topped by a conspicuous triangular slightly decurrent stigma. The fruit is subglobose, about 8 mm. in diameter, glabrous and black at maturity. It is subtended by a thin shallow cupule not more than 3 mm. long, 6 mm. in diameter, and usually less than 2 mm. deep, glabrous and with an entire margin. The pedicel is less than 5 mm. long and expanded at the apex to about 2 mm. in diameter.

Nectandra Pichurim (H.B.K.) Mez, in which Mez included *N. cuspidata* Nees, was interpreted by him to include specimens collected from Mexico south to Brazil and Venezuela. Kostermans (Meded. Bot. Mus. Utrecht **25**: 21. 1936) believes *N. cuspidata* to be distinct from *N. Pichurim* because of the difference in the type of pubescence, the number of primary nerves, the cupule-shape, etc. It is my belief that the Mexican and Central American entity is to be separated from *N. cuspidata* also on floral characters as well as foliage. The apex of *N. cuspidata* is attenuate but always obtuse. Further collections may show an intergradation of all of these characters. *Nectandra membranacea,* from the West Indies, has also been confused with the species under discussion. A glance at the original description of the latter immediately precludes the possibility of their being identical, for Grisebach gives the leaf-blades as ovate-oblong or elliptic with an abruptly acuminate apex. The texture of the leaf and the recurved base recall *N. globosa,* but the small flowers separate it at once from the latter.

13. **Nectandra Woodsoniana**, sp. nov.

Arbor 7–15 m. alta, ramulis breviter adpresse fulvo-tomentellosis, mox glabrescentibus brunnescentibus demum angulatis striatis glabris griseis. Folia alternata, petiolis plus minusve atris ad 1.5 (–2) mm. longis canaliculatis pubescentibus vel glabrescentibus, laminis glabrescentibus vel glabris glandulis axillaribus exceptis, in sicco griseo-viridibus, ellipticis vel oblongo-ellipticis, ad 24 cm. longis et 8 cm. latis, basi cuneatis, apice obtusis acutis vel acuminatis, penninerviis, costa supra conspicua leviter impressa subtus elevata, nervis lateralibus 7 vel 8 (–10)-paribus supra leviter subtus valde elevatis angulo 45 vel 35° divergentibus, rete venularum supra leviter subtus conspicue elevato. Inflorescentia axillaris vel subterminalis, ad 20 cm. longa, paniculata, dense et adpresse griseo-pubescens mox glabrescens, multiflora, pedunculo ad 10 cm. longo. Flores ad 3 mm. longi, pedicellis 2–3 mm. longis pubescentibus, perianthio albo, lobis ellipticis vel ovatis vel anguste obovatis, ±2.5 mm. longis, carnosis, intus papillosis, extus pubescentibus; staminibus ser. I & II ±0.6–.8 mm. longis, antheris subreniformibus filamento robusto duplo longioribus, ser. III ±0.9–1.25 mm. longis, antheris quadratis filamentis biglandulosis aequalibus, glandulis antheris longitudine aequalibus; staminodiis ±0.6 mm. longis ovatis obtusis stipite robusto dimidio breviore; gynaecio glabro ±1.7 mm. longo, ovario ovoideo longitudine ¾ gynaecii aequante, stylo brevi stigmate discoideo conspicuo. Fructus ad 15 mm. longus et 10 mm. latus, in sicco atrorubescens, ellipsoideus, cupula vadosa discoidea lignosa, glabra vel glabrescente rugosula, ad 2 mm. longa, 5–6 mm. diam., et 1 mm. alta subtentus, pedicello incrassato striato glabrescente ad 2 mm. longo.

Distribution: El Salvador, Costa Rica, and Panama, from an altitude of 1800 m. in Costa Rica to 670 m. farther south, and finally in central Panama as low as 20–90 m.

El Salvador: Ayutuxtepeque, *S. Calderón 1117* (fl., GH, NY). Costa Rica: Province unknown, Las Nubes, *Valerio 1451* (fl., Ch). Guanacaste: Obrededores de Tilarán, *Brenes 15617* (fl., Ch). Alajuela: Hills about San Pedro de San Ramón, *Brenes 5826* (fr., Ch), *16824* (fr., Ch), *19203* (fl., Ch); San Francisco de Guadaloupe, *Pittier 11490* (fr., Ch). Limón: Monte Verde, *Stork 1688* (fr., Ch). San José: Río Virilla, *Brenes 14296* (fl., Ch); Escasú, *Valerio 1327* (fl., Ch); vicinity of El General in a bushy clearing, *Skutch 2634* (fl., GH, NY), *4374* (fl., A, NY); Potrero of Don José, Barrantes near S. Isidro del General, alt. 720 m., June 30, 1932, *Stork 3059* (fl., type, Ch). Panama: Canal Zone: Mamei Hill, *Pittier 3803* (fl., GH); vicinity of Salamanca Hydrographic Station, Río Pequení, *Woodson, Allen & Seibert 1620* (fl., A, Mo, NY).

Native names: "Tepeaguacate" (El Salvador); "Laurel," "Quisarrá" (Costa Rica).

Nectandra Woodsoniana is striking because of its gray-green foliage and long grayish-pubescent inflorescence. The species is very near *N. martinicensis,* from the West Indies, but the latter has leaves that are 18 × 5.3 cm., the margin of the blades recurved. The filaments are pilose, the anthers depressed-orbicular and slightly papillose, the apex rounded, and there are large staminodia present.

The species is named for Dr. Robert E. Woodson, Jr., whose contributions toward making known the flora of Panama are of the greatest value.

14. **Nectandra Lundellii**, nom. nov.

Persea Gentlei Lundell in Contr. Univ. Mich. Herb. **6**: 18. 1941, not *Nectandra Gentlei* Lundell (1941).

Phoebe Gentlei Standley & Steyermark in Field Mus. Publ. Bot. **23**: 117. 1944.

Distribution: Known only from British Honduras.

British Honduras: Stann Creek: Middlesex, *Hope 3* (*Y 4798*) (fl., Ch, Y), *Gentle 2896* (fl., fr., A, NY), *2949* (fl., A, NY); in Stann Creek Valley on high ridge, March 30, 1940, *Gentle 3288* (fl., isotype of *Persea Gentlei,* Ch, NY) (tree 30 cm. in diam.; flowers white, fragrant); Big Eddy Ridge, *Gentle 3308* (fl., A, NY), *3343* (fr., A). Toledo: In open places on river-bank, Río Grande, *Schipp 1164* (fr., Ch, GH, NY).

Native names: "Ca'ca'woung," "Timbersweet," "Wild Pear" (British Honduras).

This tree has young branchlets that are densely tawny-sericeous, becoming more darkly pubescent and finally glabrescent with age. The leaves are borne on stout petioles up to 2 cm. long and up to 4 mm. in width. The blades are coriaceous or subcoriaceous, shining above and glabrous, beneath dull and minutely but definitely pubescent at maturity, elliptic or oblong-elliptic, cuneate at the base or obtusely cuneate, the apex usually abruptly acuminate, up to 32 cm. long and to 14.5 cm. broad. The costa is deeply impressed above and thickly and prominently elevated beneath. The 8–13 pairs of lateral nerves are very lightly elevated above and more so beneath and slightly pubescent, diverging from the costa at an angle of about 45–55°. The reticulation is very prominent above and more delicately so beneath. The inflorescence is axillary or subterminal, paniculate, tawny-sericeous, up to 18 cm. long, the stout glabrescent peduncle up to 8 cm. long. The fragrant white flowers are shortly sericeous-tomentose, becoming glabrescent, up to 4 mm. long. The obovate-orbicular lobes are ±3.5 mm. in length, reflexed at anthesis, thick and papillose. The stamens of the two outer series are ±0.8 mm. long, the squarish anthers subtended by very short stout filaments. Those of the third series are 1 mm. long, with anthers almost rectangular, about twice the length of the filaments, which bear subsessile conspicuous glands at the base equalling the anthers in size. The staminodia are fairly conspicuous, ±0.8 mm. in length, the subtriquetrous tips equalling the rather stout stipes. The glabrous gynaecium measures ±1.25 mm. in length, the globose ovary topped by a nearly sessile rather inconspicuous discoid stigma. The fruit is blackish, ellipsoid, glabrous, up to 2.5 cm. long and 1.3 cm. broad, borne on a flaring irregularly lobed woody glabrous cupule 8–10 mm. long and to 17 mm. in diameter at the apex, and about 5 mm. deep. The supporting pedicel is not more than 5 mm. long and expanded to 4–5 mm. at the apex.

This species is very similar to *N. rubriflora;* for a further discussion of the similarity to that species see the preceding pages. The cupules of the Schipp number are entire and not lobed, and the leaves are less coriaceous, but other than this the specimens match *N. Lundellii.*

15. **Nectandra savannarum** (Standley & Steyermark), comb. nov.

Phoebe savannarum Standley & Steyermark in Field Mus. Publ. Bot. 23: 118. 1944.

DISTRIBUTION: In Guatemala, at an altitude below 400 m. except for the specimens collected in the cloud-forest in Chiquimula, where the altitude is given as 500–1500 m., and mountain-slopes and coastal plains of Honduras and British Honduras.

GUATEMALA: Alta Verapaz: Along stream bordering forest south of savanna between base of Cerro Chinajá at Sachaj and Sacacao, alt. 150–180 m., April 6, 1942, *Steyermark 45712* (fl., TYPE, Ch) (tree 9 m.; leaves firmly membranous, deep green and shining above, dull and paler green beneath; flowers white); near the top of wooded ridge, vicinity of Cubilgüitz, 1½–2 miles south of Cubilgüitz, *Steyermark 44428* (fl., Ch); south of Cubilgüitz, *Steyermark 44499* (fl., Ch). Izabal: Along stream between Milla 49.5 and ridge 6 miles from Izabal, Montana del Mico, *Steyermark 38625* (fl., Ch); wet thicket near Puerto Barrios, *Standley 73043* (sterile, Ch). Chiquimula: Cloud-forest on top, Cerro Tixixí (Tishishí), 3–5 miles north of Jocotán, *Steyermark 31567* (fr., Ch). HONDURAS: Atlántida: On bank of the Danto River, lower slopes of Mt. Cangrejal, back of La Ceiba, *Yuncker, Koepper & Wagner 8762* (fl., Ch, NY). BRITISH HONDURAS: Belize: Mullins River Road, *Schipp 79* (fl., fr., Ch, GH, NY); Gracie Rock, Sibun River, *Gentle 1572* (fl., NY). Stann Creek: Big Eddy River, in high ridge, *Gentle 3488* (fl., A).

NATIVE NAMES: "Laurel" or "Lavrel" (Guatemala); "White laurel" (British Honduras).

This species, originally described under *Phoebe,* has slender branchlets early covered with a close brownish pubescence that presently disappears, leaving the branchlets dark brown or eventually grayish. The leaves are borne on slender petioles that are pubescent and slightly canaliculate, reaching a length of 6, rarely 8, mm. The blades are glabrous, chartaceous to subcoriaceous, elliptic to oblong-elliptic, occasionally ovate-elliptic, obtusely caudate-acuminate, the acumen as long as 1 cm., the base cuneate or obtusely cuneate or almost rounded, up to 8.5 (–11.5) cm. long and 3.5 (–4.5) cm. broad, the costa impressed but conspicuous above, the 4 or 5 pairs of lateral nerves inconspicuous above, except the basal pair, all elevated beneath. The lower pair or pairs of lateral nerves usually diverge from the costa at an angle of about 35°, whereas the upper less conspicuous pairs diverge at an angle of 45° or more. The appearance simulates a subtriplinerved condition. The reticulation is loose and obscure above but more closely knit and prominent beneath. The glabrescent few-flowered inflorescence consists of an axillary panicle up to 4 cm. long, subtended by a slender glabrescent peduncle up to 2 cm. in length. The white flowers are pubescent and up to 3 mm. long, the diameter 8.5 mm., the filamentous pedicel 2–3 mm. long. The elliptic thick lobes are about 3 mm. long and papillose within. The two outer series of stamens are ±0.8 mm. long, consisting of subreniform often emarginate anthers borne on thick very short filaments. Those of the third series are ±1 mm. long, with squarish anthers slightly longer than the filaments, which bear two roundish short-stipitate glands at their bases. The staminodia are usually stipe-like, ±0.6 mm. long. The glabrous gynaecium measures ±1 mm. long, the depressed-globose short-stipitate ovary nearly twice the length of the style, which bears at its apex a peltate conspicuous stigma. The immature (?) fruit is subglobose, apiculate, borne in a cyathiform coral-orange, according to the collector, cupule, up to 4 mm. long, to 8 mm. in diameter, and 3–4 mm. deep, undulate or often bearing the persistent remains of the enlarged lobes of the perianth. The pedicel measures up to 8 mm. long and has expanded to 3 mm. in diameter at the apex.

Although the flowers of the type possess staminodia that are conspicuous, a character of the genus *Phoebe,* the shape of the anthers and the gynaecium as a whole place the species under *Nectandra.*

16. **Nectandra longicaudata** (Lundell), comb. nov.

Phoebe longicaudata Lundell in Bull. Torrey Bot. Club 64: 548. 1937.

Distribution: British Honduras, Guatemala, and eastern Mexico, usually in advanced forests.

Mexico: Chiapas: Javalinero, Palenque, *Matuda 3643* (fl., A, Ch, NY). Guatemala: Izabal: Bay of Santo Tomás, between Escobas and Santo Tomás, *Steyermark 39231* (fr., Ch). British Honduras: El Cayo: On hillside, Vaca, *Gentle 2474* (fr., A, NY); in advanced forest, on limestone hill, Valentin, *Lundell 6401* (fr., GH, NY); in riparian and marginal forest near San Augustin, Mountain Pine Ridge, August, 1936, *Lundell 6757* (fr., syntype not seen), *6833* (fl., syntype not seen). Stann Creek: All Pines, in broken forest-clumps, *Schipp 571* (fr., Ch, GH, NY). Toledo: Near Jenkins Creek in hammock in pine-ridge, north of Monkey River, *Gentle 4094* (fl., A).

Native name: "Aguacatillo" (British Honduras).

I have seen no type-material of this species, but *Lundell 6401,* cited by Lundell, doubtless represents the species described. The branchlets are early pubescent (rufous-pilose), becoming glabrescent to glabrous with age, and slightly sulcate. The leaf-blades, with flat petioles up to 1 cm. long, are coriaceous, elliptic, up to 14 cm. long and 4.5 (–6.2) cm. broad, with often oblique cuneate bases and acuminate to caudate-acuminate apices. The costa and 4 or 5 pairs of lateral nerves are impressed above and elevated beneath, the lateral nerves bearing pubescent glands in their axils and diverging from the costa at an angle of 35–45°. The blades are everywhere reticulate. The few-flowered inflorescences are not longer than 4.5 cm. and are pubescent, becoming glabrescent. The flowers are about 4 mm. long, borne on slender pubescent pedicels up to 3 mm. The elliptic perianth-lobes are ±3.5 mm. long and are spreading and often reflexed. The stamens of the two outer series are ±0.8 mm. long, the anthers subsessile and subreniform. Those of the inner series are rectangular, slightly longer than the filaments, which are sparsely pubescent at the base and bear conspicuous sessile glands the length of the filaments. The staminodia are cordate, up to 0.7 mm. long, the slender pubescent stipes more than half the entire length. The glabrous gynaecium is ±1.5 mm. long, the subglobose ovary slightly stipitate, with a short style topped by a discoid stigma. The ellipsoid or subglobose apiculate black fruit, 12 × 9–10 mm., is seated on a shallow cyathiform cupule not more than 2 mm. long and 6 mm. broad at the apex, and about 1 mm. deep. The subtending pedicel is enlarged to about 7 mm. in length and 2.5 mm. in width at the apex.

The nearest relatives of the species may be found, generally speaking, in the *N. salicifolia* complex. Specifically *N. longicaudata* resembles *N. savannarum,* from the same general area, from which it is readily distinguished by the persistent ferruginous pubescence of the young branchlets and the rather decided tendency toward a subtriplinerviate condition. The leaves of *N. savannarum* are on the whole smaller, not more than 11.5 cm. long at most. *Schipp 571* has leaves that are more heavily coriaceous, varnished-shining above, and more heavily and more conspicuously reticulate. The fruit is oblong-elliptic, consistently 16 × 8 mm., the infructescence as a whole being more robust than that of the other specimens.

Gentle 1572, cited by Lundell under *Phoebe longicaudata,* seems to belong with *N. savannarum.*

17. **Nectandra nervosa** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. **3**: 235. 1903; Standley in Field Mus. Publ. Bot. **18**: 453. 1937.

DISTRIBUTION: Costa Rica, known only from the type-locality.

COSTA RICA: Puntarenas: Terraba, at the mouth of the river on the banks, *Tonduz* (Herb. Inst. Costa Rica) *6758* (fr., TYPE not seen).

Slender glabrous branchlets and shortly pilose buds characterize this species, known only from the type. The glabrous leaves are borne on slender canaliculate petioles up to 8 mm. long. The blades are broadly lanceolate or elliptic-lanceolate, acute at the base, very acuminate at the apex, chartaceous, 13 cm. long and 3.5 cm. broad, above in the dried state glaucous, below reddish green, everywhere densely and very prominently reticulate. The inflorescence is unknown, but the infructescence is longer than the leaves (three or more times) and is glabrous, with the fruit-bearing pedicel enlarged up to 10 mm. in length. The ellipsoid fruit is 10 mm. long and 6 mm. in diameter, subtended by a semi-globose acutely simple-margined cupule which in the dried state is verruculose.

The affinity of the species is noted under *N. salicina*.

18. **Nectandra salicina**, sp. nov.

Arbor 5–8 m. alta, ramis dense foliosis, griseis, sulcatis, glabris, ramulis brunneis mox griseis, striatis, angulatis. Folia alternata vel saepe subopposita, petiolis alatis gracilibus glabris canaliculatis, 5–10 mm. longis et 1 mm. latis, laminis utrinque glabris, supra lucidis subtus minus, coriaceis, in sicco viridibus vel interdum brunneis, subtus saepe leviter pallidis, lanceolatis, ad 10 (–11) cm. longis et 2–2.5 (–3.4) cm. latis, basi attenuato-cuneatis, apice acutis vel attenuato-acuminatis saepe attenuato-obtuso-acuminatis, penninerviis, costa supra obscura subtus conspicue elevata, nervis 6 vel 7-paribus utrinque obscuris angulo 25–35° divergentibus, rete venularum nunc utrinque conspicuo nunc supra inconspicuo. Inflorescentia axillaris, paniculata, 8–9 (–12) cm. longa, glabra, pauciflora, gracilis, longipedunculata, pedunculo 6–8 cm. longo, glabro. Flores ad 3 mm. longi, pedicellis ad 5 mm. longis, tenuibus, perianthio vadose subcampanulato, cano, lobis oblongis recurvatis crassis intus et apice extus dense papilloso-tomentosis, ad 3 mm. longis; staminibus ser. I & II ±0.9 mm. longis et latis, antheris reniformibus plerumque filamento duplo longioribus, ser. III ±1.25 mm. longis, conspicue biglandulosis, glandulis et filamentis antheris subaequalibus; staminodiis conspicuis triangularibus stipitatis ±0.6 mm. longis; gynaecio glabro ±1.5 mm. longo, ovario subgloboso stylo duplo longiore, stigmate plerumque triangulari conspicuo. Fructus viridis, fide coll., subglobosus, apiculatus, 20 × 18 mm., cupula rubra minute verruculosa, fide coll., glabra, ad 6 mm. longa, 10–12 mm. lata, et 2–3 mm. alta, margine undulata, subtentus, pedicello incrassato glabro, in sicco aciculato, ad 1 cm. longo.

Distribution: In Alajuela Province of Costa Rica at 850–1000 m. altitude, in Guanacaste Province at an altitude of 500–600 m., and in the cloud-forest of Cerro Horqueta, Boquete District, Chiriquí, Panama, at 1980 m. altitude.

Costa Rica: Guanacaste: Vicinity of Tilarán in moist forest, *Standley & Valerio 44506* (fl., Ch). Alajuela: Near San Ramón, *Brenes 371* (*515*) (fl., Ch); hedges, along road between San Miguel and La Palma de San Ramón, alt. 900–950 m., Feb. 7, 1925, *Brenes 4206* (*218*) (fl., type, Ch) (tree 5–7 m. with conical-globose crown; flowers small, white, in terminal clusters of 2 to 3-flowered cymes); woods, Piedades of San Ramón, alt. 1000 m., June 21, 1925, *Brenes 4272*(*57*) (fr., Ch) (small tree 5–6 m., fruits green, pendent; cupule vivid red, same length as the peduncle, round or nearly so, small); hedges, woods, San Miguel de San Ramón, *Brenes 5393* (*537*) (fl., Ch); Piedades Sur (Quebrada Honda), about La Palma de San Ramón, *Brenes 5846* (fr., Ch); between "Pata de Gallo" and Santiago de San Ramón, *Brenes 6650* (fl., Ch); Camino at Calera and Calera de San Ramón, *Brenes 18942* (fl., Ch); [hills of San Pedro de San Ramón, *Brenes 20332* (fl., Ch)]; Barranca of San Ramón, *A. Smith P.2351* (fl., A). Panama: Chiriquí: Cerro Horqueta, Boquete, *C. & V. W. von Hagen 2118* (fr., fragm., A, Mo).

Native names: "Aguacatillo" (Costa Rica); "Sigua blanca" (Panama).

This species seems to be near *N. nervosa* Mez & Pittier. The latter, however, has broadly lanceolate or elliptic-lanceolate leaves up to 13 cm. long, glaucous above and reddish green beneath. The inflorescence is squarrosely tripinnately paniculate. The fruit is ellipsoid, 10 × 6 mm., with a semi-globose acutely simple-margined cupule, verruculose in the dried state. These characters separate the two entities at once.

19. **Nectandra coriacea** (Swartz) Grisebach, Fl. Brit. W. Ind. 281. 1860; Mez in Jahrb. Bot. Gart. Berlin 5: 459. 1889; Allen in Addisonia 22: 9, *pl. 709.* 1943.

Laurus coriacea Swartz, Prodr. 65. 1788; Fl. Ind. Occ. 710. 1800.

Nectandra Willdenoviana Nees, Syst. 321. 1836; Meissner in DC. Prodr. 15^1: 165. 1864.

Ocotea Lundellii Standley in Carnegie Inst. Washington Publ. 461: 56. 1935; Standley & Record in Field Mus. Publ. Bot. 12: 143. 1936.

DISTRIBUTION: Florida, West Indies, Yucatan peninsula, British Honduras, and Guatemala.

[JAMAICA: Without locality or collector, (TYPE of *Laurus coriacea* not seen).] MEXICO: Yucatán: without locality, *Gaumer 23980* (fl., Ch, GH, NY), *24248* (fl., Ch, GH), *24274* (fl., GH, NY), *24290* (fl., Ch), *24337* (fl., Ch); Cozumel, *Gaumer 85* (fl., Ch); Chichen Itza, off Kaua road in advanced deciduous forest, *C. L. & A. A. Lundell 7435* (fl., A); Lake Chichankanab, *Gaumer & Sons 23655* (fl., Ch), *23668* (fl., Ch, GH). Campeche: Hacienda San Pablo, near Champoton, Morelos, *Collins 47a* (fl., NY); Tuxpeña, *Lundell s.n.* (fl., Ch), *1071* (fr., Ch), *1367* (fl., NY). GUATEMALA: Petén: Lake Petén, *Lundell 3195* (fl., Ch), Ixlu ruins, Lake Petén, June 15, 1933, *Lundell 4359* (fl. type of *Ocotea Lundellii,* Ch); Uaxactún, *Bartlett 12335* (fl., A, Ch, NY), *12547* (fl., A, Ch, NY). Alta Verapaz: Woods southeast of Finca Yalpemech, near Alta Verapaz-Petén boundary line, *Steyermark 45216* (sterile, Ch). Izabal: Río Dulce, between Livingston and 6 miles up river on north side (right hand side going up river), *Steyermark 39402* (fl., Ch). BRITISH HONDURAS: Orange Walk: Coastal region at Honey Camp, *Lundell 423* (fr., Ch, NY); Belize: Maskall,*Gentle 1206* (fl., A, Ch, GH, NY), *1216* (fl., A, Ch, GH, NY). Toledo: Jacinto Hills, in shaded valley, *Schipp 1206* (fl., Ch, GH, NY).

NATIVE NAMES: "Laurel" (Campeche); "Sweetwood" (Jamaica, British Honduras).

This species, as it occurs in our area, has branchlets that vary from brownish and striate to a striking silver-gray. The alternate leaves are borne on petioles that are usually 1 cm. or less in length (7–14 mm.), canaliculate, and glabrous. The blades are coriaceous, glabrous, lanceolate-elliptic or lanceolate-oblong, the base cuneate, the apex obtusely acute or obtusely acuminate, the acumen varying in length from very short and abrupt to nearly 1 cm. The blades measure up to 12 cm. long and 6 cm. broad (usually 7–9 $\times$ 3.5–4 cm.). The venation of this species is the most outstanding feature. The costa is prominent, though slightly submersed above, and very prominently elevated beneath. The 6–8 pairs of lateral nerves diverge from the costa at an angle of 45° and are slightly arcuate. The lateral nerves, however, are usually obscured by the very conspicuous over-all rather loose elevated reticulation of the blades. This reticulation usually draws the attention before the lateral nerves are noted. The inflorescence varies from few to many axillary or subterminal panicles not more than 6 (–8) cm. long, either sparsely or densely flowered. The white flowers are 5–8 mm. in diameter, the elliptic lobes heavily papillose, $\pm$3.6 mm. in length. The two outer series of stamens consist of nearly sessile anthers which are reniform and slightly emarginate, measuring $\pm$0.6 mm. in length. The stamens of the inner series are longer, $\pm$0.8–1 mm. long, the squarish anthers borne on filaments almost their equal in length, which bear two large subreniform sessile glands nearly the width of the anthers. The staminodia are triquetrous, $\pm$0.8 mm. long, borne on slender pubescent filaments that are nearly two-thirds the length of the entire structure. The gynaecium is glabrous, $\pm$1.7 mm. long. The subglobose or subovoid ovary is about twice the length of the stout style, which is topped by a conspicuous capitate stigma. The fruit is black, ovoid or subglobose, apiculate, 1 (–1.5) cm. long and 6 mm. wide, at maturity supposedly nearly the same width. The fruit is subtended by a shallow cyathiform cupule 3–4 mm. long and 6–7 mm. in diameter at the undulating apex, and 2.5 mm. deep. The supporting pedicel is up to 8 mm. long, expanding to 2 mm. in diameter at the apex.

The nearest affinity of the species is the entity which heretofore has passed as *Nectandra sanguinea* Rottb. The difference in the fruiting cupule, the venation, and coriaceous texture of the leaves set the species apart. Standley notes that *Ocotea Lundellii* is most nearly related to *Ocotea Catesbyana* Sargent from southern Florida. The latter was based on *Laurus Catesbyana* Michaux, which was once included erroneously under *N. coriacea*. Although the superficial resemblance is striking, the structure of the flowers, particularly the reniform anthers, immediately places the species in *Nectandra.*

20. **Nectandra salicifolia** (H.B.K.) Nees, Syst. Laurin. 302. 1836, in Linnaea **21**: 506. 1848.

Ocotea salicifolia H.B.K., Nov. Gen & Sp. **2**: 132 [166]. 1817; Hooker & Arnott, Bot. Voy. Beechey 309. 1841.

Ocotea globosa sensu Schlechtendal & Chamisso in Linnaea **6**: 366. 1831.

Nectandra sanguinea sensu Nees, Syst. Laurin. 318. 1836, quoad spec. Mex., non Rolander ex Rottboell; Meissner in DC. Prodr. **15**[1]: 164. 1864, quoad spec. Mex.; Hemsley, Biol. Centr. Am. Bot. **3**: 75. 1882; Mez in Jahrb. Bot. Gart. Berlin **5**: 457. 1889, quoad spec. Mex. & C. Am.

Nectandra glabrescens Bentham, Bot. Voy. Sulphur 161. 1846; Walpers, Ann. **1**: 575. 1849; Meissner in DC. Prodr. **15**[1]: 165. 1864; Hemsley, Biol. Centr. Am. Bot. **3**: 74. 1882; Mez in Jahrb. Bot. Gart. Berlin **5**: 425. 1889, excl. spec. S. Am. & W. Ind.; Standley in Contr. U. S. Nat. Herb. **23**: 297. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 84. 1925; Record in Trop. Woods **10**: 21. 1927; Standley in Field Mus. Publ. Bot. **10**: 200. 1931; Standley & Record in Field Mus. Publ. Bot. **12**: 142. 1936; Yuncker & Record in Field Mus. Publ. Bot. **17**: 363. 1938.

Nectandra sanguinea var. *angustifolia* Schlechtendal in Linnaea **19**: 257. 1847.

Nectandra sanguinea var. *β lanceolata* Meissner in DC. Prodr. **15**[1]: 164. 1864; Hemsley, Biol. Centr. Am. Bot. **3**: 75. 1882.

DISTRIBUTION: Mexico and Central America, at varying altitudes and in diverse habitats.

MEXICO: Without locality, *Galeotti B.8* (fl., Ch), [*718*] (fl., Ch); *Haenke* [*1540*] (fr., NY); *Leibold 108* (fl. type of *N. sanguinea* var. *angustifolia* not seen). San Luis Potosí: El Banito, 7 mi. south of Valles, *Leavenworth 189* (fl., Ch, GH); semi-desert road-side south of Valles, *Leavenworth 223* (fl., Ch, GH, NY); Tamasopo Cañon, *Pringle 3541, 3725* (fl., GH, NY); Tamazunchale, *Edwards 602* (young fr., Ch). Vera Cruz: Hacienda de la Laguna, *Schiede 57* (fr., Mo); Papantla, *Schiede & Deppe 1144* (fl., cited by Schlechtendal and Chamisso as *O. globosa,* Mo); road from Papantla to Zamora, *Goldman 88* (fl., GH); Colipa, *Liebmann s.n.* (fl., GH, NY); Jalapa, [*Schiede?*] (fr., GH); Mirador, *Liebmann s.n.* (fr., GH); Zacuapán, *Purpus 2023* (fr., Ch, GH), *14151, 14327* (fl., Ch); Barranca de Panoya, *Purpus 8425, 8503* (fl., GH); Remulatero, *Purpus 8741* (fl., GH, NY); Remudadero, *Purpus 8955* (fl., GH, NY), *10965* (fl., Ch); banks of Río de los Pescados, near Puente Nacional, *Purpus 11166* (fl., Ch); Orizaba, *Botteri 34, 302* (fl., GH), *986* (fl., NY), *1081, 1193* (fl., GH), *Millspaugh Herb. s.n.* (fl., Ch), *Purpus 1324* (fl., GH, NY); Cordoba, *Bourgeau 1961* (fl., Ch, GH, NY), *Orcutt 3344* (fl., Ch); Cuitláhuac, *Matuda 1417* (fl., A). Mexico: Temascaltepec, Salitre-Canitas, wet barranca, *Hinton 3816* (fl., A, NY). Guerrero: La Aguila, *Langlassé 250* (fl., GH); Acapulco, *Humboldt & Bonpland s.n.* (fr. ?, TYPE of *Ocotea salicifolia* not seen), *E. Palmer 164* (fr., GH), *582* (fl., GH, NY). Oaxaca:

Tuxtepec, Chiltepec and vicinity, in llanos, *Martínez-Calderón 376* (fl., A); Piedras Negras, Pochutla, *Conzatti, Reko & Makrinius 3203* (fl., GH); Yaveo, trail west to Río Yaveo; Choapam, understorey in open forest, *Mexia 9175* (fl., Ch, GH, NY); Tepenixtlahuaca á Rio Verde, *Conzatti 4385* (fr., NY). Tabasco: Mercedes, Balancan, *Matuda 3027* (fl., A, Ch); Tenosique, *Matuda 3402* (fl., A, Ch, NY). Chiapas: Santa Rosa, near Escuintla, in advanced forest, *Matuda 4264* (fl., A, NY); Malpaso, near Siltepec, in advanced forest, *Matuda 4522* (fl., A). GUATEMALA: Petén: El Paso, *Lundell 1528* (fl., NY); Uaxactún, near aguada, *Bartlett 12355* (fl., Ch); Santa Cruz, *12371* (fl., Ch), *12724* (fl., Ch); La Libertad and vicinity, *Aguilar 91* (fl., A), *280, 387* (fl., NY), *Lundell 2113, 2176* (fl., Ch); along Río Santa Izabal, between mouth of Río Sebol and El Porvenir, *Steyermark 45847* (fl., Ch); along Río Cancuen, between El Cambio and mouth of Río Machaquila, *Steyermark 45921* (fl., Ch). Alta Verapaz: Between Sachaj and Sacacac, *Steyermark 45130* (fl., Ch); along Río Semococh, between Semococh and Chajamayic, *Steyermark 45731* (fl., Ch); along Río Sebol, between Sebol and Carrizal, north of Sebol, *Steyermark 45757* (fl., Ch); Cubilgüitz, *von Tuerckheim 8577* (fl., GH, NY). Baja Verapaz: Sierra de las Minas, San Augustine, *Kellerman 7628* (fr., Ch). Izabal: Río Dulce, between Livingston and 6 miles up river, on north side (right hand side going up river), *Steyermark 39397* (fl., Ch); bank of Río Dulce, *C. L. Wilson 406* (fl., Ch). Quezaltenango: Colomba, *Skutch s.n.* (fl., Ch), *1286* (fl., A, NY), *1363* (fl., A, Ch). HONDURAS: Without locality, forest along Highland Creek, Puerto Sierra, *P. Wilson 145* (fl., NY). Comayagua: Thicket above the plains of Siguatepeque, *Yuncker, Dawson & Youse 6144* (fl., Ch, GH, NY). Yoro: In open forest on margin of small stream on mountain-slopes near the village of Los Flores, in the Aguan River valley, near Coyoles, *Yuncker, Koepper & Wagner 8161* (fl., Ch, GH, NY), *8162* (fl., Ch). Atlántida: On the mountain-slopes and coastal plains, in forest, foothills near the Cangrejal River, in the vicinity of La Ceiba, *Yuncker, Koepper & Wagner 8680* (fr., Ch, GH, NY). BRITISH HONDURAS: Without locality, *Castillo 16* (fl., Ch, Y), *Gentle 174* (fl., Ch), Northern River, *Gentle 1035* (fl., NY). Corozal: High ridge, San Joaquin, *Gentle 8* (fr., Ch), *4748* (fr., Ch, GH, NY). Orange Walk: Roaring Creek, *Lundell 448* (fl., Ch); Honey Camp, *Meyer 54* (fr., Ch). El Cayo: Bank of Belize River, *Gentle 2232* (fl., A, NY). Belize: Little Cocquericot, Belize River, *Lundell 4361* (fr., Ch), *4362* (fl., Ch, NY), *4363* (fr., Ch); Maskall Pine Ridge, *Gentle 1055* (fl., GH, NY), *1275* (fr., Ch, NY); Sibun River, *Gentle 1410* (fr., Ch, NY), *1511* (fl., NY), Gracie Rock, *1524* (fl., NY). Stann Creek: Forest Guard, Freshwater Creek, *Kelly 2* (fl., Ch, GH, NY); Moho River, in wet forest, *Peck 737* (fl., GH). COSTA RICA: San José: Vicinity of El General, *Skutch 4172* (fl., A, NY), *4328* (fl., A, Ch, NY), *4905* (fl., A, Ch, NY).

NATIVE NAMES: "Aguacate" (Vera Cruz); "Aguacatillo" (Michoacán); "Laurel" (Vera Cruz, Yucatán, British Honduras); "Piesito de Paloma" (Mexico); "Timbersweet" (British Honduras).

This is one of the most variable of the *Nectandrae*, which has been known heretofore as *N. sanguinea* Rottb., and is of all species in our area the most widely collected. Originally the species *Nectandra sanguinea* was described from Surinam. Nees extended the range to Martinique, other islands of the West Indies, and Mexico, describing a variety from St. Vincent. He included *Laurus globosa* Aublet from Guiana in the synonymy. Meissner followed Nees, adding another variety from Mexico which included in part *Schiede 57* and in toto *Ocotea salicifolia* H.B.K. Mez segregated *Laurus globosa* Aublet, under the binomial *Nectandra globosa*. According to Kostermans (Meded. Bot. Mus. Utrecht **25**: 20. 1936), Mez did not see the type of *N. sanguinea*, based on Rolander's specimen. Kostermans intimates that the latter name belongs to *N. Pisi* from Surinam, and that *N. sanguinea* as interpreted by Mez (presumably the Mexican, Central American, and West Indian material) does not occur in Surinam. A complete understanding of the synonymy involved must perforce await examination of the types of the species in question, when they are once more available for study. Insofar as may be ascertained from the specimens at hand, the correct epithet for the Mexican and Central American material appears to be *N. salicifolia* (H.B.K.) Nees. There can be no question of Mez' segregation of *Laurus globosa* Aublet as *Nectandra globosa,* for the shape of the anthers of the latter places it in a different category entirely from *N. salicifolia.*

Nectandra salicifolia, then, may be described as a tree or shrub with branchlets that are angled, becoming terete, striate, brownish and becoming grayish, or sometimes reddish and becoming brown. They are early whitish-pubescent, later becoming glabrous and often shining. The leaves vary considerably, with the petioles up to 1 cm. long, canaliculate, glabrous or glabrescent. The blades are chartaceous to coriaceous, lanceolate, lanceolate-elliptic, or elliptic, cuneate at the base and either acute or obtusely acute or obtusely acuminate at the apex. They measure (4–) 5.5–16 (–20) cm. long and (2–) 3–5 (–9) cm. broad and are glabrous except for pubescent glands in the axils of the lateral nerves on the lower leaf-surface, which are sometimes very conspicuous or often entirely lacking. The costa is impressed above, very prominent beneath; the 5–9 pairs of lateral nerves are slightly elevated beneath and diverge at an angle of 35–45° from the costa. The reticulation of the blade is usually very conspicuous throughout. The subterminal or axillary inflorescences are shorter or occasionally longer than the leaves and are up to 10 cm. long. They may be comparatively few-flowered single panicles or, as is usually the case, many-flowered broad and branching subcorymbose panicles. In the early stages they are whitish-pubescent but shortly become glabrescent or glabrous. The flower is usually between 3 and 4 mm. long (occasionally 5 mm.), with scarcely any noticeable tube, and is supported by a slender pubescent pedicel 3–4 mm. long. At anthesis the perianth-lobes are spreading (the flower being sometimes to 1 cm. in diameter) and reflexed. The lobes are lanceolate-elliptic, occasionally elliptic, usually obtuse, up to 3 (sometimes 5) mm. long, fleshy, pubescent on the outer surface and papillose within. The stamens of the two outer series are ±0.6 (rarely ±0.8) mm. long and nearly half again as broad. The anthers are reniform, frequently emarginate, sessile or with very short filaments. The stamens of the third series are longer, with the anthers almost square and emarginate at the tip. The two upper cells are lateral, whereas the two lower are extrorse. The filaments bear at their base two large conspicuous glands almost as long as the anthers. The slender small triangular or triquetrous staminodia are usually ±0.6 mm. long, borne on stipes nearly ⅔ their entire length and almost the same width as the staminodia. The glabrous gynaecium is ±1.25 (sometimes ±1.9) mm. long. The subglobose ovary is usually three times the length of the short style, which is topped by a flat inconspicuous stigma. The fruit is subglobose to (immature?) ellipsoid, minutely apiculate, to 11 mm. long and 8 mm. in diameter, glabrous, black, subtended by an almost disk-like shallow woody cupule about 1 mm. long and 5 mm. in diameter, glabrous and only slightly undulate. The cupule is supported by the enlarged pedicel about 5 mm. long, expanded to 3 mm. in breadth at the apex.

Most specimens collected are in the flowering stage and show variations which are definitely within the limits of the species. Occasionally specimens are found in which no staminodia are seen, but this is not usual. The length of the short filament supporting the anther varies considerably. The greatest amount of variation occurs in the specimens from Acapulco, which have larger flowers than the other Mexican specimens.

21. **Nectandra fuscobarbata** (Mez), comb. nov.

Nectandra glabrescens var. *fuscobarbata* Mez in Jahrb. Bot. Gart. Berlin 5: 425. 1889.

Arbor 6–12 m. alta, ramulis brunneis minute sparse pubescentibus mox griseis glabris striatis. Folia alternata, juventute sparse pubescentia mox glabrescentia deinde glabra, petiolis tenuibus, canaliculatis, supra sparse pubescentibus, ad 1 cm. longis et 1 mm. latis, laminis utrinque glabris basi costae subtus excepta, membranaceis, in sicco brunneis vel viridescenti-brunneis, lanceolato-ellipticis, ad 15 cm. longis et ad 5 cm. latis, basi per-attenuato-cuneatis, apice longe caudato-acuminatis, penninerviis, costa supra leviter subtus conspicue elevata, nervis 4–6 (–8)-paribus utrinque plus minusve obscuris angulo 55° divergentibus, glandulis inconspicuis in nervorum lateralium axillis, rete venularum utrinque leviter prominulo. Inflorescentia axillaris laxe paniculata, ad 15 cm. longa, sparse pubescens, pedunculo brunneo sparse pubescente, ad 5 cm. longo. Flores ad 3 mm. longi, pedicellis pergracilibus pubescentibus, ad 3 mm. longis, perianthio campanulato albo vel pallide viridescente, lobis oblongis reflexis papilloso-pubescentibus, ±2.5 mm. longis; staminibus ser. I & II ±0.6 mm. longis, antheris subreniformibus longitudine ⅔ filamentis gracilibus basi pubescentibus aequalibus, ser. III ±1 mm. longis conspicue biglandulosis, glandulis stipitatis antheris oblongis et filamentis aequalibus; staminodiis ovatis stipitatis, basi pubescentibus, ±0.6 mm. longis; gynaecio glabro, ±1.25 mm. longo, ovario ovoideo-globoso longitudine plusquam stylo minusquam gynaecii aequante, stigmate capitato conspicuo. Fructus abnormalis(?) subglobosus, apiculatus, conspicue griseo-sericeus, minute papillosus, ±7 mm. diam., cupula vadosa glabra minute verruculosa sub-campanulata 3 mm. longa et 5 mm. diam. subtentus, pedicello ad 5 mm. longo apice ad 3 mm. diam. expanso.

DISTRIBUTION: Known only from Panama.

PANAMA: Without locality, *Hayes 487* (TYPE of *N. glabrescens* var. *fuscobarbata* not seen). Bocas del Toro: Fish Creek Hills, vicinity of Chiriquí Lagoon, *von Wedel 2431* (fl., A); Isla Colon, *von Wedel 2866* (fl., A), *2969* (fl., A); Flat Rock, region of Almirante, *G. P. Cooper 551* (fr., Ch, GH, NY).

NATIVE NAME: "Rock Sweetwood" (Panama).

This entity, seemingly a segregate of *N. salicifolia*, because of the single character of fuscous barbate hairs in the axils of the leaves, has flower-structure similar to that of the latter species. Examination of a large amount of material from Mexico and Central America of the species proper shows many numbers with pubescent glands in the axils of their lower leaf-surfaces. The bases of the filaments as well as the stipes of the staminodia are pubescent. The ovary is glabrous, but the fruit is pubescent. I am inclined from the general aspect of the fruiting material from Bocas del Toro to believe that these are not normal fruits.

22. **Nectandra nitida** Mez in Jahrb. Bot. Gart. Berlin 5: 461. 1889; Standley in U. S. Nat. Herb. 23: 297. 1922.

DISTRIBUTION: Mexico and Panama.

MEXICO: Without locality, western part, *Haenke s.n.* (SYNTYPE not seen). PANAMA: Canal Zone: Near Barbacans station, *Hayes 133* (SYNTYPE not seen).

This species seems to stand out for its golden-"glittering"-tomentose young branchlets, eventually becoming cinereous, glabrous, and terete, and its golden-lanuginose buds. The petioles are not more than 6 mm. in length, are canaliculate, subtending chartaceous leaf-blades that in young stages are sericeous-lanuginose, golden, and glittering. See *N. latifolia* for discussion.

23. **Nectandra perdubia** Lundell in Lloydia 4: 47. 1941.

DISTRIBUTION: Mexico and Central America, for the most part at fairly low altitudes. Frequently to be found along stream-banks.

MEXICO: Michoacán: Coalcomán, *Hinton 13667* (fr., GH), *13668* (fl., GH), *13856* (fl., GH), *13918* (fl., GH). Oaxaca: Vicinity of San Juan Guichicovi, *Nelson 2725* (fl., fr., Ch); Ubero, *L. Williams 9492* (fl., A, Ch, NY). Tabasco: Boca Cerro, Tenosique, July 1–5, 1939, *Matuda 3576* (fl., ISOTYPE, A, Ch, NY). GUATEMALA: Petén: Uaxactún, *Bartlett 12708* (fl., Ch); Santa Teresa, Subin River, *Lundell 2735* (fr., Ch); La Libertad, *Lundell 3348* (fr., Ch), *3716* (fl., Ch). Alta Verapaz: Vicinity of Secanquim, *Pittier 178* (fl., Ch); vicinity of caves, southwest of Lanquín, *Steyermark 44073* (fr., Ch); along route no. 5 between Chirriacté and Semococh, *Steyermark 46352* (fl., Ch). Izabal: Río Dulce, 2–4 miles west of Livingston, on south side (left hand side going up river), *Steyermark 39538* (fl., Ch). HONDURAS: Copán: Along trail from El Paraiso to La Florida, *Pittier 8468* (fl., NY). BRITISH HONDURAS: Without locality, hill-bank, *Record B.H.30* (*Y 8798*) (fr., Y). El Cayo: El Cayo and vicinity, *Chanek 58, 61* (fl., Ch). Belize: Gracie Rock, Sibun River, *Gentle 1692* (fl., A, NY). Stann Creek: In valley, Big Eddy Ridge, *Gentle 3543* (fl., A, NY). COSTA RICA: Puntarenas: Puerto Jiminez de Osa (Golfo Dulce), *Brenes 12163* (*642*) (fl., Ch); woods on sea-shore, Golfito de Osa, *Brenes 12314* (*793*) (fl., Ch). San José: Near San José, edge of Río Virilla at Uruca, *Tonduz 7271* (Herb. Nat. Costa Rica *10104*) (fl., GH, NY). Cartago: Río Turrialba, *J. D. Smith 4932* (fl., GH).

NATIVE NAMES: "Aguacatillo" (Mexico); "Bastard Timbersweet," "Laurel" (British Honduras).

A species near *N. nitida,* according to the author, but distinguished from it by the narrower leaves which are less reticulate and more smooth and shining on the upper surface. The younger branchlets and inflorescences retain their pubescence longer than do those of *N. nitida.* The latter, as well as *N. perdubia,* has the same basic floral structure as is found in *N. salicifolia.*

The species has striate branchlets which are clothed with a minute close brownish-ferruginous tomentum which rubs off early, leaving them dark gray or occasionally darker brown. The leaves are borne on stout tomentose scarcely canaliculate petioles up to 1 cm. long. The lanceolate to elliptic, acuminate to subcaudate, leaf-blades are cuneate at the base and measure up to 17 cm. long and 6 cm. broad. The upper surface is early pubescent, but shining at maturity, the 7–9 lateral nerves diverging at an angle of about 35°, and the costa impressed and not prominent. The lower surface is everywhere minutely pubescent at maturity, with scattered floccose pubescence in addition, particularly about the region of the veins, which bear more or less pubescent inconspicuous axillary glands beneath. The lateral nerves and costa are prominently elevated beneath and pubescent. The lower surface is definitely but loosely reticulate. The inflorescences are axillary and subterminal many-flowered panicles, densely covered with a minute ferruginous tomentum which becomes less with age. They are subtended by sericeous foliose bracts which presently are deciduous. The flowers are 5.5–7.5 mm. in diameter, the tube short, the elliptic perianth-lobes rather thin or sometimes thickish, fleshy and papillose, up to 3.5 mm. long, tomentose without. The stamens of the two outer series are ±0.8 mm. long, the subreniform anthers once and a half or twice the length of the stout filaments, which are sometimes pubescent. Those of the inner series are ±1.25 mm. long and have anthers which are almost square, emarginate, the two upper cells lateral, the lower extrorse. The filaments nearly equal the anthers in length and bear at the base two large subreniform sessile glands nearly the length of the anthers. The staminodia are ±0.6 mm. long, variable, often triquetrous, the usually somewhat slender stipe nearly half the entire length. The glabrous gynaecium measures ±1.25 mm., the subglobose ovary constricted at the base and about three times the length of the slender style which bears at its apex a usually conspicuous subcapitate stigma. The fruit (immature?) appears to be small (6.5–10 mm. long and 5.5–8 mm. broad), subglobose, apiculate, subtended by a shallow cyathiform cupule 1.5–3 mm. long, up to 7 mm. in diameter, and less than 2 mm. deep. The slightly enlarged pedicel is up to 5 mm. long and expanded to 3 mm. at the apex.

24. **Nectandra latifolia** (H.B.K.) Mez in Jahrb. Bot. Gart. Berlin 5: 454. 1889.
Ocotea latifolia H.B.K. Nov. Gen. & Sp. 2: 133 [169]. 1817.

DISTRIBUTION: Central America from Nicaragua through Panama, south through Colombia to Brazil, according to Mez.

PANAMA: Canal Zone: Without locality, *Christopherson 132* (fl., NY); hills near Gatun Station, Panama R.R., Feb. 7, 1860, *Hayes s.n.* (fl., GH, US), *59* (fr., GH); Gatun Lake at turning point from canal, *Bangham 425* (fr., Ch); Chagres, *Fendler 54* (fl., Ch, GH, Mo, US); Barro Colorado Island, *Aviles 113* (fr., Ch), *950* (fl., Ch), *L. H. & E. Z. Bailey 92* (fl., Ch), *307* (fr., Ch); *Woodworth & Vestal 692* (fl., A, Ch). [COLOMBIA: Cundinamarca: High plains of Bogotá, *Humboldt & Bonpland* (fr., TYPE not seen).]

This species is very distinct because of its foliage characters. The leaves have petioles 6–12 mm. long, pubescent to glabrous, and canaliculate. The blades, becoming glabrous except for inconspicuous axillary glands, are chartaceous to subcoriaceous, very shining above, dull beneath, elliptic, the base cuneate to roundish, the apex caudate-acuminate, and they measure about 12 (–15) cm. long and 3.5 (–6) cm. broad. The costa and lateral nerves (4–6 pairs) are somewhat obscure above, elevated beneath, and diverge from the costa at an angle of 35–50 (–55)°. The minute reticulation likewise is exceedingly prominent above and beneath. The subcorymbose-paniculate axillary and subterminal branching inflorescences, minutely pubescent, becoming glabrous, measure up to 9 (–13) cm. in length, the peduncle up to 5 cm. long. The flowers measure about 6 mm. in diameter, with thick papillose perianth-lobes, which are elliptic-ovate and ±2.15–2.5 (–3.4) mm. long. The stamens of the two outer series are ±0.6–0.8 (–1) mm. long, the anthers subreniform, slightly emarginate, twice the length of the rather stout filaments. Those of the inner series are

±.8 (−1) mm. long, the squarish anthers about equalling the filaments, which bear conspicuous sessile glands nearly the size of the anthers. The staminodia are ovate, ±0.6 mm. long, the stipes nearly one-half to two-thirds their entire length. The glabrous gynaecium is ±1.25 mm. long, the subglobose ovary nearly three times the length of the thick short style that is topped by a subcapitate stigma. The subglobose black fruit is about 1 cm. in diameter and is seated on a shallow cupule not more than 2 mm. long, 6 mm. in diameter, and 0.5 mm. deep, the margin slightly and finely undulate. The pedicel is enlarged to 3–4 mm. long and 2.5 mm. in diameter at the apex.

Mez placed *Fendler 54* under *N. latifolia,* originally described from Colombia, and it seems to agree fairly well with the description. The species *N. nitida,* described from Mexico and the Canal Zone as well, seems to be very close to the so-called *N. latifolia,* differing in leaf-blades that are prominently reticulate above and in the young stage scarcely sericeous beneath, the absence of axillary glands, the branchlets that are sparkling golden-tomentose and the buds that are golden-lanuginose. The flowers also are golden-brown-tomentellous, but their structure is not strikingly different from those of *N. latifolia.* Examination of the types of both species in question is necessary before an accurate disposal may be made of the material at hand.

25. **Nectandra Cufodontisii** (O. C. Schmidt), comb. nov.

Ocotea Cufodontisii O. C. Schmidt in Arch. Bot. Forli **11**: 50. 1935.

DISTRIBUTION: Known only from Costa Rica.

COSTA RICA: Alajuela: Alfaro Ruiz, La Brisa de Zarcero, in loam and mold in semi-shade of forest in subtropical zone, *A. Smith H.969* (fl., Ch, NY), *H.972* (fl., A, Ch); Palmira, *A. Smith P.2036* (fl., fr., A). Cartago: On the southwest slope of Volcán Irazú, at the mouth near San Isidro, alt. 2000 m., May 30, 1930, *Cufodontis 315* (fl., fr., ISOTYPE, Ch, photo., Ch, NY) (tree 10 m., with broad crown; flowers greenish).

The young branchlets of this species are angled or almost sulcate, at first subferruginous-sericeous, becoming glabrescent, presently glabrous and grayish. The leaves are borne on canaliculate petioles pubescent and up to 1.5 cm. in length. The blades are elliptic or, according to the author, subovate-lanceolate, acuminate, the base cuneate, chartaceous to subcoriaceous, up to 13 cm. long and 5 cm. broad. The upper surface, according to the author, is somewhat opaque, whereas the lower is almost shining, the entire surface glabrous except for the pubescent axillary glands. The costa and lateral nerves, of which there are 7–9 pairs diverging from the costa at an angle of 35–45°, are very slightly elevated on the upper and more so on the lower surface. The entire surface is conspicuously reticulate. The rather few-flowered axillary or subterminal panicles are minutely subferruginous-pubescent, up to 12 cm. long, and borne on slender pubescent peduncles up to 7 cm. long. The greenish flowers are spreading-campanulate, the heavy fleshy papillose oblong-ovate perianth-lobes measuring up to 3 mm. in length. The stamens of the two outer series are ±1.5 mm. long, the rounded ovate-globose anthers supported by short stout filaments pubescent at the base and one-quarter the entire length of the stamens. Those of the third series measure ±1.7 mm. and have anthers that are almost square or subtrapezoid, the filaments almost equalling the anthers and bearing two large conspicuous sessile glands at the base that equal them in length.

The author does not mention the staminodia, which are conspicuous, cordate, ±0.6 mm. in the type, with the stipes one-half the entire length. Occasionally the staminodia are also biglandular, and occasionally only scale-like. The glabrous gynaecium measures ±2.15 mm., the subglobose or broadly ovoid ovary more than equalling the stout style, which bears an often conspicuous capitate stigma. The fruit is ovoid-elliptic, up to 2.5 cm. long and about 1.5 cm. broad, borne in a shallow almost disk-like cupule, which is glabrescent, brown, striate (in the dried state), about 2 mm. long, 7 mm. in diameter, and 0.75 mm. deep, the margin undulate. The supporting pedicel is glabrescent, also brown and striate, not more than 4 mm. long and expanded to 2 mm. at the apex.

A fruiting specimen, *Standley 47364* from near San José, has young fruits that resemble those of the type, but the leaves do not show the minute reticulation of those of the latter. Schmidt relates the species to *Ocotea insularis*. To my mind, it is more nearly related to *Nectandra latifolia*, differing in the elliptic acuminate rather than oblong-elliptic caudate leaf-blades, the shorter, ovate-oblong rather than strap-shaped perianth-lobes, and the ovoid-ellipsoid instead of globose fruits.

26. **Nectandra tabascensis** Lundell in Lloydia 4: 48. 1941.

DISTRIBUTION: Known only from Mexico.

MEXICO: Jalisco: Santa Cruz de Vallanta, wooded ravine on mountain-side, *Mexia 1264* (fr., GH, NY). Guerrero: Montes de Oca, by the river, *Hinton 10589* (fl., GH), *11473* (fr., GH). Tabasco: La Palma on the San Pedro de Martir River, near the Petén border, Balancan, *Matuda 3299* (fl., ISOTYPE, A, GH, NY).

NATIVE NAMES: "Aguacatillo," "Aguacatillo blanco" (Guerrero).

This species is similar in floral structure to *N. salicifolia* and also to *N. Woodsoniana*. The young branchlets, early fulvous-sericeous-tomentellous, later become glabrescent, dark brown, and striate. The petioles are slender, up to 1 cm. long and sericeous, becoming glabrescent. The leaf-blades are chartaceous, lanceolate-elliptic or lanceolate-oblong, cuneate at the base, the apex acute or subacuminate, sparsely grayish-pubescent throughout, more conspicuously so along the midrib, up to 20 cm. long and 5 cm. broad. The costa and lateral nerves, of which there are 11–13 pairs, are slightly elevated on the upper and more prominently so on the lower surface. The reticulation is loose and conspicuous throughout. The inflorescence is axillary, whitish-pubescent, becoming glabrescent, subcorymbose-paniculate or paniculate, up to 11 cm. long, and subtended by a slender sparsely pubescent peduncle up to 6 cm. long. The flowers are whitish-tomentellous, about 3 mm. long and about 6 mm. in diameter at anthesis, subtended by a slender pubescent pedicel up to 3 mm. long. The perianth-tube is conspicuous and the lobes are slightly unequal, rather fleshy, the outer broadly elliptic or ovate and the inner oblong, ±2.5 mm. long. The stamens of the outer series are roundish-subreniform, sometimes emarginate, ±0.75 mm. long, the anthers slightly longer than the stout filaments. Those of the inner series are ±0.8 mm. long, the squarish anthers about equalling the filaments in length. The filaments bear at the base two subglobose sessile glands nearly the length of the anthers. The broadly ovate staminodia measure ±0.4 mm. and are borne on short stipes that are about one-third the entire length of the staminodia. The glabrous gynaecium is ±1 mm. long, the subglobose ovary twice the length of the short stout style that is topped by a rather inconspicuous stigma. The material from Guerrero and Jalisco does not exactly match the type-collection, but the variation appears to be intra-specific. From *Hinton 11473* and *Gentle 1264,* the fruits seem to be black with a bloom, glabrous, broadly ellipsoid, apiculate, and borne in a shallow sparsely pubescent cyathiform cupule 2 mm. long at most, 7 mm. in diameter, and about 1 mm. deep, with a minutely undulate margin. The subtending pedicel is pubescent, short, and thick, 2–3 mm. long and about 1.5 mm. in diameter at the apex.

The narrower leaves with more numerous lateral nerves and more persistent pubescence separate this species from the Costa Rican and Panamanian *N. Woodsoniana.* The floral structure is very like that of *N. salicifolia,* but the foliage characters are quite different.

27. **Nectandra Loeseneri** Mez in Bull. Herb. Boiss. II. 5: 243. 1905.

DISTRIBUTION: Reported only from type-locality and vicinity in Vera Cruz and adjacent Tamaulipas, along the northeastern coast of Mexico.

MEXICO: Tamaulipas: Coastal dunes north of Tampico, *LeSueur 146* (fl., Ch), *Pringle 7685* (fl., GH); vicinity of Gómez Fárias, *E. Palmer 272* (fl., GH). Vera Cruz: Island of Juana Ramirez, about 56 km. south of Tampico, *E. Palmer 458* (fl., GH); vicinity of Pueblo Viejo, 2 km. south of Tampico, *E. Palmer 360* (fr., Ch, GH, NY); in the primeval forest, between Cazones and Tuxpam, Jan. 4, 1903, *C. & E. Seler 3696* (fl., photo. of TYPE, GH); Cazones, *Mell s.n.* (fl., NY); Coatzacoalcos, isthmus of Tehuantepec, *C. L. Smith 985* (fl., GH, NY), *1116* (fl., NY).

NATIVE NAME: "Laurel" (Vera Cruz).

The branchlets of this species are slender, glabrous, terete, and, according to Mez, shining. The leaves are borne on slender petioles which are glabrous, canaliculate, and about 1 cm. long. The blades are chartaceous, shining above, elliptic, cuneate at the base and obtuse or shortly and obtusely acuminate at the apex. They measure up to 11 (rarely –17) cm. long and 3–4 (rarely –9) cm. broad, the loose reticulation being prominent on both surfaces. The costa and lateral nerves, of which there are 5–7 pairs, are very slightly elevated above and prominently so beneath. The lateral nerves diverge from the costa at an angle of 25–35 (–45)° and bear in their axils conspicuous pubescent glands. The inflorescence consists of more or less subcorymbose panicles 8–10 cm. long, with few or many flowers, shortly pubescent and borne on long peduncles up to 6 cm. The flowers are about 3 mm. long with a diameter up to 8 mm. The perianth-tube is very short, the lobes oblong-elliptic, ±3.5 mm. long, rather thick, and papillose on the inner surface. The stamens of the two outer series are ±0.8 mm. long, with subreniform anthers nearly twice as long as the stout pubescent filaments. Those of the third series are ±1 mm. long and have anthers which are squarish, emarginate, the two upper cells lateral, the two lower lateral-extrorse, the anthers equalling the filaments in length. The filaments bear two large sessile glands nearly the size of the anthers. The staminodia are small, ±0.8 mm. long, more or less triquetrous, subtended by stipes pubescent at the base, which are nearly two-thirds the entire length. The glabrous gynaecium is ±1.4 mm. long, the ovary ellipsoid-ovoid, four times the length of the short stout style with its flat triangular stigma. The fruiting specimen *Palmer 360* seems to match very well the other material. The fruit is globose, apiculate, black in the dried state, about 12 mm. in diameter, subtended by a shallow cyathiform cupule 3 mm. long, 5 mm. broad, and about 1 mm. deep, with a slightly undulating margin. The pedicel is somewhat slender, up to 5 mm. long and expanded to about 1.5 mm. at the apex.

Although there is only a photograph of the type for comparison, there seems no doubt that the cited numbers may be safely referred to the above species. The nearest relative is *N. salicifolia*. The shape of the leaves and the rather more conspicuous reticulation recall the characters of *N. coriacea*, but in the latter the leaf-blades are more heavily coriaceous and the venation obscured by the reticulation. The floral characters are definitely those of *N. salicifolia*.

28. **Nectandra Skutchii**, sp. nov.

Arbor ad 23 m. alta, ramulis sparse et minutissime ferrugineo-pubescentibus mox atro-rubescentibus glabris sulcatis angulatis. Folia alternata, petiolis minute adpresse subferrugineo-pubescentibus canaliculatis, ad 1 cm. longis et 2 mm. latis, laminis supra glabris subtus basi costae excepta glabris, membranaceis, in sicco supra pallide viridescentibus subtus minus pallidis, oblongo-ellipticis, ad 20 cm. longis et 6.5 (–7) cm. latis, basi attenuato-cuneatis, in petiolum decurrentibus ibique recurvatis, apice subcaudato-acuminatis, penninerviis, costa utrinque castanea supra impressa subtus valde elevata, nervis 4–6-paribus castaneis, subtus obscuris impressis subtus elevatis arcuatis angulo 35–45° divergentibus, rete venularum utrinque obscuro et leviter subcancellato. Inflorescentia axillaris anguste paniculata, ad 8.5 cm. longa, minute adpresse pubescens, pauciflora, pedunculo ad 2.5 cm. longo. Flores ad 2.5 mm. longi, pedicellis ad 2 mm. longis, pubescentibus, perianthio infundibuliformi, albo, lobis oblongis obtusis reflexis crassis papilloso-tomentosis, ±1.7 mm. longis; staminibus ser. I & II ±0.7 mm. longis, antheris subreniformibus emarginatis filamentis flabelliformibus aequalibus, ser. III ±0.8 mm. longis, obovatis emarginatis biglandulosis, glandulis et antheris filamentis aequalibus; staminodiis ±0.4 mm. longis, stipitatis, subtriquetris; gynaecio glabro ±1.7 mm. longo, ovario globoso 1½ stylo longiore, stigmate conspicuo discoideo. Fructus globosus, apiculatus, in sicco brunneus, ad 10 mm. diam. cupula vadose et patente subcampanulata conspicue verrucosa tenui erosa leviter undulata glabra 5–6 mm. longa, 10–12 mm. lata, et 3 mm. alta subtentus, pedicello incrassato verrucoso glabro 7–10 mm. longo.

DISTRIBUTION: Known only from Costa Rica, at altitudes of 670–850 m.

COSTA RICA: San José: Vicinity of El General, alt. 850 m., July, 1936, *Skutch 2668* (fl., TYPE — GH, NY) (tree 23 m.; flowers white), *4182* (fr., A, NY).

The affinity of this species is with the *N. globosa* group, in spite of the difference in floral structure, namely the subreniform anthers and the longer style.

29. **Nectandra Standleyi**, sp. nov.

Arbor 6–13 m. alta, ramulis novellis minute et dense fulvo- vel subferrugineo-pubescentibus, angulatis, mox glabrescentibus, striatis griseis vel atro-brunneis. Folia alternata, petiolis satis robustis fulvo-tomentosis canaliculatis ad 1.5 cm. longis, laminis supra minute et inconspicue pubescentibus mox glabris, subtus utrinque minute adpresse pubescentibus, coriaceis, in sicco brunneis, ellipticis, ad 16 (–17) cm. longis et 4.5 (–6) cm. latis, basi obtusis vel subrotundatis imis recurvatis et ut videtur cuneatis, apice attenuato-acuminatis vel caudato-acuminatis, penninerviis, costa supra impressa subtus elevata, nervis 4 (raro –8)-paribus, supra impressis subtus elevatis, angulo 25–35° divergentibus, rete venularum utrinque obscuro. Inflorescentia axillaris vel subterminalis fulvo- vel griseo-pubescens, paniculata, multiflora, ad 15 (–20) cm. longa, pedunculo ad 6 mm. longo. Flores ad 3 mm. longi, pedicellis 2 mm. longis pubescentibus, perianthio albo vel fulvo-flavescente, fide coll., campanulato, lobis reflexis carnosis ellipticis rotundatis ±1.7 mm. longis extus pubescentibus intus papillosis; staminibus ser. I & II ±0.6 mm. longis, antheris subreniformibus subemarginatis subsessilibus, ser. III ±1 mm. longis, antheris truncatis, subemarginatis, filamentis aequalibus lateraliter glandulis basi conspicuis subglobosis filamentis subaequalibus; staminodiis subovoideis ±0.6 mm. longis, stipitibus dimidio aequalibus; gynaecio glabro, ovario stylo paulo longiore, stigmate subtriangulari discoideo conspicuo. Fructus subglobosus 1 (–1.3) cm. diam. (viridis, fide coll.), cupula campanulata glabra verrucosa margine irregulariter vadose lobata, ad 6 mm. longa, 12 mm. diam., et 3 mm. alta subtentus, pedicello robusto verrucoso ad 8 mm. longo et 4–5 mm. diam. apice expanso.

DISTRIBUTION: Costa Rica and adjacent Panama.

COSTA RICA: Alajuela: San Luis de Zarcero, *A. Smith 164* (fl., Ch); region of Zarcero, *A. Smith A.243* (fl., A, Ch, NY); (La Cidra) de San Ramón, *Brenes 3850 (3)* (fr., Ch); without precise locality, presumably San Ramón, *Brenes 4061* (fl., TYPE, Ch); Piedades near San Ramón, *Brenes 4344* (fl., Ch); hills of San Pedro de San Ramón, *Brenes 4780 (565), 4794 (579), 5019 (175)* (fl., Ch), *5443 (36)* (fr., Ch); Cerro de Palma de San Ramón (El Socoro), *Brenes 5714, 5733, 5831 (423), 16833* (fl., Ch). San José: La Caja, *Valerio 1326* (fl., Ch). Cartago: El Muñeco, on Río Navarro, *Standley & Torres 50908* (fr., Ch). Limón(?): La Concepcion, Llanuras de Santa Clara, *J. D. Smith 6757* (fr., GH). PANAMA: Bocas del Toro: Cricamola, near Almirante, *G. P. Cooper 488* (fl., Ch, NY); vicinity of Chiriquí Lagoon, Big Bight, *von Wedel 2884;* Isla Colon, *von Wedel 2967* (fl., A).

NATIVE NAMES: "Aguacatillo," "Quizzerá," "Guizarrá quina" (Costa Rica); "Sigua" (Panama).

This species is very similar to *N. globosa* and *N. ramonensis* in foliage-characters, differing from the former in having fewer pairs of lateral nerves, from the latter in having larger leaf-blades, and from both by its smaller flowers with the anthers devoid of the large papillose connective characteristic of the two above-mentioned species. The long stout style, which equals or subequals the length of the ovary and is topped by a conspicuous somewhat triangular discoid stigma, presents further differentiating characters. The fruiting cupule is less shallow in *N. Standleyi* and has a tendency to be subglobose.

The specimens from Chiriquí Lagoon are doubtfully referred to this species, because of the variation in the leaf-shape and the presence of pubescence on the small staminodia.

30. **Nectandra producta**, sp. nov.

Arbor ad 30 m. alta, ramulis argenteo-fulvo-sericeo-pubescentibus striatis valde angulatis. Folia alternata longipetiolata, petiolis conspicue alatis gracilibus vadose canaliculatis pubescentibus ad 5 cm. longis, ut videtur, et ad 3.5 cm. latis, laminis juventute conspicue puncticulatis, lucidis, supra glabris subtus minute molliter et inconspicue pubescentibus, membranaceis vel chartaceis, in sicco viridibus, elliptico-lanceolatis vel leviter oblanceolato-ellipticis, ad (8–) 12 cm. longis et 2.5–4 cm. latis, basi attenuato-cuneatis, in petiolum longum decurrentibus ibique valde recurvatis, apice acutis vel attenuato-subacuminatis, penninerviis, costa supra flavescente conspicua subplana et basi pubescente subtus elevata pubescente, nervis ad 10–12-paribus supra tenuibus conspicuis flavescentibus subtus obscuris angulo 45–55° divergentibus. Inflorescentia axillaris paniculata, ad 15 cm. longa, leviter pubescens, multiflora, pedunculo ad 4 cm. longo. Flores 2.5–3 mm. longi, pedicellis ad 3 mm. longis gracilibus glabrescentibus, perianthio campanulato viridescente, lobis late ellipticis obtusis crassis dense papilloso-tomentosis, ±2.15 mm. longis; staminibus ser. I & II ±0.8 mm. longis, antheris longis aequidem ac latis filamento duplo longioribus, ser. III ±1.4 mm. longis biglandulosis, glandulis et antheris oblongis filamentis aequalibus; staminodiis anguste oblanceolato pubescente ad ±0.6 mm. longo; gynaecio glabro, ±2.4 mm. longo, ovario ellipsoideo stylo gracili aequali, stigmate discoideo satis conspicuo. Fructus ignotus.

DISTRIBUTION: Known only from the type-locality, in Costa Rica.

COSTA RICA: San José: In forest in the vicinity of El General, alt. 700 m., Jan. 1939, *Skutch 3906* (fl., TYPE — A, NY) (tree 30 m., with prop-roots; flowers greenish).

Nectandra producta, so-named because of the long apparent petioles, belongs in the same general vicinity with *N. Whitei* and *N. hypoglauca*. The branchlets are rather like those of the latter in that they are thick, angled, and fulvous-sericeous, becoming grayish and striate with age. The leaf-blades are similar in many respects to those of the former species, but are borne on extremely long apparent petioles of 5 cm. in length, formed by the narrowly and conspicuously decurrent leaf-base, being sericeous throughout. Even though the fruit is unknown, the species stands out for its unusual leaves, with the blades narrowly decurrent, forming an apparent petiole of so great a length.

31. **Nectandra Whitei** (Woodson), comb. nov.

Ocotea Whitei Woodson in Ann. Mo. Bot. Gard. **24**: 188. 1937.

DISTRIBUTION: Western Panama and Costa Rica, up to 2000 m. altitude.

COSTA RICA: Without locality, *Little 6059* (fr., Ch). Alajuela: Pastures of La Paz de San Ramón, *Brenes 4262* (*47*) (fr., Ch). Limón: Inland from Sequirres, *Stork 2809* (*Y 38450*) (fr., Y). PANAMA: Chiriquí: Valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, alt. 1300–1900 m., June 27–July 13, 1935, *Seibert 307* (fl., A, TYPE — Mo, NY) (tree 30 m.; flowers light greenish yellow; fruit green; cupule red; aromatic); trail from Paso Ancho to Monte Lirio, *P. H. Allen 1486* (fr., Ch, GH, Mo, NY).

NATIVE NAMES: "Ira," "Ira rosa" (Costa Rica); "Bambito" (Panama).

The present species has slender branchlets that are minutely and closely fulvo-sericeous, becoming glabrous, grayish, and striate. The actual petioles are slender, glabrous or glabrescent, and about 1 cm. long. The coriaceous blades are oblanceolate, narrowly attenuate at the base and recurved, giving the appearance of a long winged petiole of 3 cm., up to 12 cm. long and 3.5 cm. broad, with the broadest portion above the middle of the blade; the apex is obtuse or obtusely abruptly acuminate. The young leaves are early fulvo-sericeous, becoming glabrous above and less conspicuously pubescent beneath. The costa is slightly elevated above and more prominently so beneath, but conspicuous everywhere. The lateral nerves, of which there are up to 12 pairs, are not very conspicuous and diverge at an angle of 35–45°. The axillary or subterminal paniculate inflorescence is up to 13 cm. long, subtended by a stout reddish black peduncle up to 6 cm. long. The pubescent light greenish yellow flowers are about 3 mm. long, supported by a slender pubescent pedicel not more than 2 mm. long. The ovate-elliptic lobes are rather thick and ±2.15 mm. long. The two outer series of stamens are ±1 mm. long, the subglobose anthers twice the length of the stout filaments. The stamens of the inner series are ±1.25 mm. long, the squarish anthers almost equalled by the filaments and the two basal sessile subglobose glands. The glabrous gynaecium measures ±2.15 mm., the ovoid ovary slightly exceeding the rather stout style with its subtriangular flat decurrent stigma. The fruits are oblong or in the younger stages presumably ellipsoid, the apex in the dried state remaining conspicuously shining and unwrinkled, drying in a more or less regular star-shaped pattern, black at maturity, up to 4 cm. long and 1.5 cm. in diameter, the surface frequently tuberculate. The cyathiform red verrucose subtending cupule is up to 6 mm. long, 13 mm. in diameter, and 2–3 mm. deep, the margin gently undulating. The pedicel is verrucose, striate, up to 15 mm. long at times, and 6 mm. in diameter at the apex.

The long fruits distinguish this species from any other from the area under study. It is near *N. Paulii* and *N. producta,* distinguished from the latter by shorter apparent petioles, and from the former by its chartaceous leaf-blades that are much smaller and with more prominent reticulation, and by its shorter inflorescences.

32. **Nectandra hypoglauca** Standley, sp. nov.

Arbor 15–21 m. alta, ramulis fulvo-sericeis, mox griseis, striatis, juventute angulatis. Folia alternata, petiolis alatis robustis pubescentibus, 2 (–2.5) cm. longis et ad 4 mm. latis, laminis supra nitidis glabris basi costae excepta, subtus pubescentibus, glaucis, coriaceis, in sicco olivaceo-brunneis, obovato-ellipticis, ad 18 cm. longis et 8 cm. latis, basi attenuato-cuneatis, in petiolum decurrentibus ibique plus minusve valde recurvatis, apice rotundatis leviter obtuse et abrupte acuminatis, penninerviis, costa supra leviter impressa subtus satis elevata robusta, nervis 6–9 (–10)-paribus supra haud subtus nonnihil elevatis plus minusve castaneis angulo ±40° divergentibus, rete venularum supra utrinque conspicuo. Inflorescentia axillaris, juvenili bracteis adhuc onusta, paniculata, ad 18 cm. longa, dense fulvo-tomentosa, longipedunculata, pedunculis robustis striatis angulatis ad 8 cm. longis. Flores dense fulvo-tomentosi, ±3.5 mm. longi, pedicellis ad 4 mm. longis tomentosis, perianthio campanulato, canescente fide coll., fulvo-tomentoso, lobis ovatis obtusis crassis, ±2.5 mm. longis; staminibus ser. I & II ±1 mm. longis, antheris ovatis, connectivo antherae ⅓ longitudine aequante filamento duplo longioribus, ser. III ±1.25 mm. longis biglandulosis, antheris oblongis truncatis glandulis filamentisque duplo longioribus; staminodiis lato-lanceolatis ±0.75 mm. longis; gynaecio glabro ±1.7 mm. longo, ovario ovoideo-globoso stylo duplo longiore, stigmate peltato conspicuo. Fructus in sicco flavescenti-brunneo-maculatus, obovoideo-ellipticus, conspicue et obtuse apiculatus, 2.2 × 2 cm., cupula campanulata rugosa verrucosa glabra margine leviter undulata, ad 1 cm. longa, 1.7 cm. diam., et 5 mm. alta subtentus, pedicello incrassato glabro, ad 15 mm. longa apice ad 5 mm. lata.

Distribution: Known only from the type-locality, in Panama.

PANAMA: Chiriquí: Bajo Mono, Boquete, in rain-forest, alt. 1340 m., April 9, 1938, *Davidson 531* (fl., Ch, TYPE — Mo; fr., A, Ch) (tree 15–21 m.; flowers white).

Nectandra hypoglauca is similar to *N. Whitei* and *N. producta,* which see for discussion.

33. **Nectandra Paulii,** sp. nov.

Arbor ad 30 m. alta, ramulis robustis sulcatis minute fulvo-tomentosis mox griseo-pubescentibus vel glabrescentibus. Folia alternata juventute sparse adpresse minute fulvo-pubescentia mox glabrescentia demum glabra, petiolis robustis pubescentibus vadose canaliculatis ad 2 cm. longis et 4 mm. latis, laminis supra utrinque glabris basi costae excepta, subtus minute pubescentibus, juventute membranaceis mox coriaceis, in sicco supra viridescenti-brunneis, subtus pallidioribus subglaucis, ellipticis vel obovato-ellipticis, ad 15 cm. longis et 7 cm. latis, basi cuneatis, in petiolum decurrentibus ibique satis recurvatis, apice acutis, acuminatis, vel rotundatis, raro emarginatis, margine leviter recurvatis, penninerviis, costa robusta supra conspicua subtus valde elevata, nervis (6–) 7–8 (–9)-paribus supra conspicuis sed leviter impressis, subtus elevatis angulo 35–45° divergentibus, rete venularum utrinque obscuro. Inflorescentia axillaris, late paniculata, ad 30 cm. longa, pubescens, multiflora, longipedunculata, pedunculo robusto pubescente, ad 10 cm. longo. Flores ad 3 mm. longi, pedicellis 1–3 mm. longis gracilibus, perianthio hypocrateriformi albo, fide coll., lobis oblongis, reflexis, crassis, papilloso-tomentosis, ±2.5–3 mm. longis; staminibus ser. I & II ±0.6 mm. longis, antheris subreniformibus vel depresso-globosis filamento duplo longioribus, ser. III ±0.8 mm. longis conspicue biglandulosis, glandulis et antheris quadratis filamentis aequalibus; staminodiis oblanceolatis pubescentibus ±0.6 mm. longis; gynaecio glabro, ±1.25 mm. longo, ovario subgloboso, stylo subnullo, stigmate subsessili rotundato conspicuo. Fructus ellipsoideus, apiculatus, 28 × 17 mm., cupula rubra campanulata crassa verrucosa glabra ad 8 mm. longa, 15 mm. diam., et 5 mm. alta subtentus, pedicello incrassato pubescente striato, ad 1 cm. longo et apice 8 mm. lato.

DISTRIBUTION: In Costa Rica, up to 915 m. altitude, and in Chiriquí Province of Panama, at 1500–2000 m. altitude.

COSTA RICA: San José: Forests in the vicinity of El General, alt. 915 m., Feb. 1936, *Skutch 2605* (fl., TYPE — A, GH, NY) (tree 30 m.; flowers white). PANAMA: Chiriquí: Bajo Mono, mouth of Quebrada Chiquero, along Río Caldera, *Woodson, Allen & Seibert 1022* (fr., A, Ch, Mo, NY); vicinity of Cerro Punta, *Paul H. Allen 1572* (fr., Ch, GH, Mo).

The lack of well developed connective tissue of the outer series of anthers, and the sessile stigma and globose ovary distinguish the flowers of *N. Paulii* from those of *N. hypoglauca.* The fruiting pedicel is shorter than that of *N. hypoglauca,* and the fruit is ellipsoid rather than obovoid-ellipsoid.

34. **Nectandra belizensis** (Lundell), comb. nov.

Phoebe belizensis Lundell in Contr. Univ. Mich. Herb. 6: 20. 1941.

DISTRIBUTION: Known only from the type-locality and vicinity, in British Honduras.

BRITISH HONDURAS: Stann Creek: Creek-side, Mountain Cow Ridge, *Gentle 3281* (fr., A, NY); Mountain Cow Ridge, in high ridge, March 31, 1940, *Gentle 3304* (fl., ISOTYPE, A, NY) (tree 25 cm. diam.; flowers white); Big Eddy Ridge, *Gentle 3346* (fr., A, NY).

NATIVE NAMES: "Timbersweet," "White laurel" (British Honduras).

This tree, described under the genus *Phoebe*, certainly resembles the latter genus in habit-characters, particularly the species *P. helicterifolia*. The softly ferruginous-tomentose young branchlets and petioles are characteristic, as well as the oblong chartaceous to subcoriaceous pale leaf-blades with the rounded bases and abruptly and sharply acuminate apices. The blades are 11–22 cm. long and up to 8.5 cm. broad. The costa is impressed above and retains its early pubescence, whereas the lateral nerves, of which there are 6–8 pairs, are merely impressed, diverging at an angle of 45–55°. The reticulation, which is also impressed above and not too conspicuous, stands out prominently beneath. The few-flowered axillary inflorescences are up to 10 cm. long and borne on slender softly pubescent peduncles up to 5 cm. long. The white flowers are about 8–9 mm. in diameter, the thick ovate lobes up to 3 mm. long and pubescent without. The stamens of the two outer series are ±0.8 mm. long, the broadly obovate anthers are nearly sessile, and the connective is slightly prominent. Those of the inner series are ±1.25 mm. long, subrectangular, the large conspicuous glands equalling the filaments and anthers in length. The staminodia are thin, triangular, less than 0.4 mm. long. The glabrous gynaecium measures ±1.25 mm. long; the subglobose ovary is topped by a very short style bearing an inconspicuous discoid stigma. The fruit is glabrous, ellipsoid, apiculate, up to 1 (–1.3) cm. long and 6 (–?) mm. broad, the thin shallow pubescent to glabresent cupule not more than 4 mm. long and about 5 mm. in diameter, the slender pubescent to glabrescent pedicel from 5 mm. to 1 (–1.7?) cm. long.

The lack of conspicuous staminodia, the short-styled globose ovary, the form and development of connective-tissue in the anthers, and the shape of the anthers themselves all seem to point to the fact that this species should be included under *Nectandra*. The fruits of the numbers cited above appear to be immature.

35. **Nectandra rudis**, sp. nov.

Arbor(?), ramulis angulatis atro-brunneis verruculosis minute et obscure pubescentibus. Folia alternata, petiolis robustis glabrescentibus haud canaliculatis, ad 3 cm. longis et 4 mm. latis, laminis utrinque glabris percoriaceis in sicco brunneis, supra nitidis, ellipticis, ad 20 cm. longis et 8 cm. latis, basi cordatis recurvatis, apice ignotis, penninerviis, costa supra rubescente et leviter impressa subtus conspicue elevata, nervis ad 10-paribus supra rubescentibus leviter elevatis subtus elevatioribus angulo 35–45° divergentibus, rete venularum supra conspicuo subtus obscuro. Inflorescentia axillaris et subterminalis late paniculata, ad 13 cm. longa, minute adpresse pubescens, multiflora, pedunculo robusto ad 5 cm. longo. Flores ad 6 mm. longi, dense ferrugineo-pubescentes, pedicellis pubescentibus satis robustis ad 5 mm. longis, perianthio late campanulato, lobis late ellipticis obtusis (mox reflexis) crassis papilloso-tomentosis ad 4 mm. longis; staminibus ser. I & II ±1.25 mm. longis antheris subglobosis filamento basi pubescente duplo longioribus, ser. III ±1.25 mm. longis biglandulosis, antheris oblongis, glandulis aequalibus, longitudine ⅔ staminium aequantibus; staminodiis nullis; gynaecio glabro ±1.7 mm. longo, ovario globoso brevistipitato stylo approx. duplo longiore, stigmate parvo discoideo. Fructus ignotus.

DISTRIBUTION: Known only from type-locality.

MEXICO: Chiapas: Mt. Ovando, Dec. 29, 1936, *Matuda 470* (fl., TYPE, A).

This robust species, known only from the flowering specimen, seems to be distinct enough to warrant description without fruiting material. It is perhaps most nearly related to *N. sinuata,* in spite of the glabrous leaves and ovary and the roundish stamens with very little connective tissue protruding at the apex of the anthers.

36. **Nectandra platyphylla** (Lundell), comb. nov.

Phoebe platyphylla Lundell in Contr. Univ. Mich. Herb. 6: 23. 1941.

DISTRIBUTION: Known only from the type-locality, in Mexico.

MEXICO: Chiapas: Finca Suiza near Montecristo, Jan. 1938, *Matuda 1930* (fl., ISOTYPE, A, NY).

The branchlets of this tree are angled, at first dark and minutely puberulous, later becoming glabrous, terete, striate, and often grayish. The pedicels are rather slender, canaliculate, puberulous, and up to 1.5 cm. long. The membranaceous leaf-blades are yellowish green, at first minutely sericeous, becoming quickly glabrescent on both surfaces except for the frequent presence of pubescent axillary glands beneath. They are oblong-elliptic or obovate-elliptic, the base rounded and often abruptly cuneate with a tendency toward recurving, the apex obtuse or obtusely acuminate or occasionally acutish, and measure 9–25 cm. long and 4.5–11.5 cm. broad. The costa is slender, impressed above and somewhat elevated beneath. The lateral nerves, of which there are 6–12 slender pairs, are only slightly elevated above and little more beneath, visible but not conspicuous, and diverge at an angle of about 45°. (The isotype has leaves on the whole much smaller than the length and breadth given by Lundell.) The inflorescence is axillary, glabrous or at least glabrescent, up to 10 (–15) cm. long, few-flowered, the slender dark brownish red peduncle up to 6 cm. long. The white flowers are large, about 1 cm. in diameter, supported by filamentous pedicels up to 1 cm. long. The lobes are 4 (–5) mm. long, broadly elliptic, obtuse to rounded, fleshy, papillose, the tube short. The stamens of the two outer series are ±2.15 mm. long, with sessile anthers elliptic, obtuse, and petaloid. Those of the inner series have anthers that are subrectangular, rounded, and borne on filaments about one-third their length and completely covered by two conspicuously large glands that are as large as the anthers. The staminodia are subtriquetrous, stipitate, ±1 mm. long. The glabrous gynaecium is ±2.15 mm. long, compressed-globose, with a very short thick style topped by a triangular conspicuous stigma.

Lundell places this near *Phoebe ambigens,* from which it may be distinguished by leaf-blades that are more frequently obovate-elliptic than elliptic, membranaceous rather than subcoriaceous, and by smaller flowers, the styles of which are extremely short.

37. **Nectandra sinuata** Mez in Jahrb. Bot. Gart. Berlin 5: 402. 1889; Standley in Contr. U. S. Nat. Herb. 23: 297. 1922; Standley & Calderón, Lista Prelim. Pl. Salvador 84. 1925; Standley in Field Mus. Publ. Bot. 18: 453. 1937.

Persea Matudai Lundell in Lloydia 4: 49. 1941.

DISTRIBUTION: Southern Mexico through Central America.

MEXICO: Oaxaca: Vicinity of Cafetal Concordia, *Morton & Makrinius 2486* (fr., Ch); Cafetal San Antonio, Pochuntla, *Reko 6039* (fl., GH). Chiapas: Las

Cadenas, Escuintla, January 5, 1938, *Matuda 1880* (fl., isotype of *Persea Matudai,* A, Ch, NY). GUATEMALA: Quezaltenango: Coffee plantations, Colomba, *Skutch 1978* (fl., A, NY); Finca Pirineos, lower south-facing slopes of Volcán Santa María, between Santa María de Jesús and Calahuaché, *Steyermark 33234* (fl., Ch). Zacapa: Trail between Santa Rosalía de Mármol and Vegas, *Steyermark 42961* (fl., Ch). Chiquimula: Around the crater-lake, Volcán de Ipala, *Pittier 1874* (fl., GH). Guatemala: Near Finca La Aurora, *Aguilar 279* (fr., Ch). Sacatepéquez: Near Barranco Hondo, southeast of Alotenango, dry thicket, *Standley 64949* (fl., A, Ch). Retalhuleu: Near Retalhuleu, *Bernoulli & Cario 2581* (fl., TYPE of *Nectandra sinuata* not seen). Suchitepéquez: Finca Mocá, *Skutch 1489* (fl., Ch); *Bequaert 55* (fr., Ch, GH). Santa Rosa: Chiapas, *Heyde & Lux 4374* (fl., GH, NY). HONDURAS: Dept. unknown, Cerro del Guayabal, *S. Calderón 2012* (fl., GH). Ahuachapán: Vicinity of Ahuachapán, along stream, *Standley 19959* (fl., GH, NY); Sierra de Apaneca, in the region of Finca Colima, *Standley 20095* (fl., GH, NY). EL SALVADOR: San Salvador: Volcán de San Salvador, *S. Calderón 473* (fl., GH), *Standley 22968* (fl., GH, NY); cerro de San Jacinto, *S. Calderón 2248, Standley 20629* (fl., GH, NY). La Paz: Zacatecoluca, *S. Calderón 308* (fr., GH, NY). COSTA RICA: Alajuela: San Pedro de San Ramón, *Brenes 6817, 15090* (fl., Ch); San Francisco de Guadaloupe, *Pittier 12348* (fr., Ch, GH); Naranjo, Cerro del Espíritu Santo, in thicket in reddish clay-loam of Pacific tropic zone, *A. Smith P.2409* (fl., A); Alajuela, *J. D. Smith 6754* (fl., GH, NY). San José: About the Hacienda Belmira, near Santa María de Dota, *Tonduz 11651* (fl., Ch, GH). Cartago: Near Cartago, *Skutch 4687* (fl., A, NY).

NATIVE NAMES: "Aguacamico," "Aguacate amarillo," "Aguacate de mico" (El Salvador); "Aguacatillo" (Mexico); "Chipinahuaca," "Palo de Chipinahuaca" (El Salvador); "Palo de Tejón" (Mexico); "Quisarrá," "Quisarrá hedionda" (Costa Rica); "Tepeaguacate rojo" (Guatemala); "Trompillo," "Trompito" (El Salvador).

This is a very well known species occurring throughout most of Central America and adjacent Mexico. The stout angled branchlets are clothed with a fulvous or grayish tomentum. The densely tomentose pedicels are somewhat canaliculate, robust, and up to 3 cm. long. The oblong-elliptic or obovate blades are cordate at the base, the apex subobtuse, rounded or abruptly subacuminate or abruptly and sharply acuminate, 25 (–30) cm. long and 12 (–19) cm. broad, chartaceous, densely grayish- or fulvous-tomentose beneath and more sparsely pubescent above, the costa and nerves heavily tomentose. The costa and slender lateral nerves, of which there are 9–11 (–15) pairs diverging at an angle of 45–70 (–80)° (the lowermost almost at right angles), are conspicuous above because of their pubescence and are prominently elevated as well as pubescent beneath. The inflorescence is a stout subcorymbose or pyramidal many- or few-flowered axillary panicle, usually densely pubescent, up to 25 cm. long, the robust peduncle up to 16 cm. long. The large flowers are up to 1 cm. long and nearly 2 cm. in diameter, the tomentose pedicels 5–10 (–12) mm. long. The fleshy lobes are densely tomentose without and heavily papillose within, broadly ovate or elliptic, subacute to obtuse or round, reflexed at anthesis and in the dried state castaneous or occasionally dark brown. The two outer series of stamens are 3 mm. long, the elliptic or ovate anthers sessile or subsessile, usually variously petaloid, heavily papillose, the fleshy connective tissue of the anthers occupying at least one-third of their entire length. The stamens of the inner series are ±3.4–4 mm. long, oblong-truncate, the cells sublaterally extrorse and the filaments with conspicuous sessile basal glands about one-third the length of the stamens. The usually densely pubescent (sometimes glabrous) gynaecium is ±3 mm. long, the subglobose ovary equalling in length the stout style with its conspicuous subtriangular decurrent stigma. The ellipsoid fruit measures up to 2.5 cm. long and 17 mm. in width, the supporting campanulate glabrescent to glabrous cupule measuring up to 13 mm. long, 2.5 cm. in diameter, and about 10 mm. deep, the pedicel enlarged to 13 mm. long and about 11 mm. diameter at the apex. In the dried state the cupule flares away from the fruit instead of surrounding it closely. The upper half of the fruit is glabrous except for the entire tip, which is covered with persistent pubescence. Approximately the lower third to half, which is almost entirely hidden by the cupule, is densely fulvous-sericeous-tomentose.

The above description is applicable to the majority of specimens of the species. All of the material from San Salvador shows flowers with glabrous ovaries. Some of the Guatemalan specimens are less tomentose as to foliage and inflorescence in general. Nonetheless, it is apparent that they all belong under the same widely variable species.

38. **Nectandra reticulata** (Ruiz & Pavon) Mez in Jahrb. Bot. Gart. Berlin 5: 404. 1889; Standley in Contr. U. S. Nat. Herb. 23: 297. 1922, in Field Mus. Publ. Bot. 18: 453. 1937.

Laurus reticulata Ruiz & Pavon, Fl. Peruv. Chil. 4: *t. 348,* & Laurogr. *t. 23.* 1802.

DISTRIBUTION: Tropical America from Mexico into Central and South America.

MEXICO: Puebla: Zonquimistlan, *C. & E. Seler 3643* (fl., GH). Oaxaca: Chiltepec and vicinity, Tuxtepec, in llanos, *Martínez-Calderón 488* (fl., A). Chiapas: Escuintla, *Matuda 383* (fl., A, NY). GUATEMALA: Alta Verapaz: South of Cubilgüitz, in thickets, *Steyermark 44561* (fl., Ch); Hacienda Yaxcabnal, *Steyermark 45093, 45094* (fl., Ch); Cubilgüitz, *von Tuerckheim 7965* (fl., GH, NY). Quezaltenango: Colomba, in coffee plantations, *Skutch 1988* (fl., A, NY). Retalhuleu: Retalhuleu, *Kellerman 6587* (fl., Ch); vicinity of Las Delicias, south of Retalhuleu, *Standley 88121* (fl., Ch); vicinity of Retalhuleu, *Standley 88822* (fl., Ch). HONDURAS: Mosquitia(?): Black River Valley, *Record & Kuylen H. 69* (*Y 10015*) (fl., Y). NICARAGUA: Bluefields: Region of Braggman's Bluff, *Englesing 65,123* (fl., Ch). COSTA RICA: Alajuela: San Pedro de San Ramón, *Brenes 6586* (fl., Ch), *Tonduz 17692* (fl., Ch). San José: Vicinity of El General, in clearings, *Skutch 2490* (fl., A, NY). PANAMA: Bocas del Toro: Changuinola Valley, Island Potrero, *Dunlap 22a* (fl., Ch); Changuinola Valley, *G. P. Cooper 32* (*Y 10132*) (fr., Ch); region of Almirante, Cricamola along river, *Cooper & Slater 512* (fr., Ch). Canal Zone: Forest along the Rio Indio de Gatun, *Pittier 2775* (fl., GH, NY); in swampy woods, Lion Hill Station, *Hayes 467* (fl., US); Mindi, *Cowell 182* (fl., NY). [PERU: Without locality, *Pavon 504* (fl., ISOTYPE of *Laurus reticulata,* Ch).]

NATIVE NAMES: "Aguacatilla" (Honduras); "Chuala" (Guatemala); "Sweetwood" (Panama).

This widespread species is conspicuous for its densely ferruginous-tomentose branchlets and inflorescences. The stout petioles, up to 1.5 cm. long, as well as the lower surface of the leaf-blades, are densely tomentose. The blades are coriaceous, glabrous above except for the venation, lanceolate-elliptic or oblong-elliptic, the base auriculate and strongly recurved, the apex attenuate-acuminate, sometimes up to 30 cm. long, and as broad as 9 cm. The costa and lateral nerves are impressed and pubescent above, prominently elevated and densely pubescent beneath. The lateral nerves number up to 12 pairs and diverge at an angle of 35–45°. The reticulation is pronouncedly impressed above and conspicuously elevated beneath. The inflorescence is stout, axillary, many-flowered, ferruginous-tomentose, paniculate, usually with long peduncles up to 10 cm. long. The densely tomentose flowers are large, up to 7 cm. or more long and 10–15 mm. in diameter, the pedicel 4–5 mm. long, often less. The inner surface of the tube is frequently densely hairy. The fleshy tomentose lobes are ovate, obtuse or rounded, and papillose within, measuring nearly 6 mm. long, the inner being slightly shorter than the outer. The stamens of the two outer series are variable in size, up to ±2.4 mm. long, and the almost sessile anthers vary in size from depressed-globose to ovate and almost petaloid, the connective tissue occupying usually about half the length of the anther. The stamens of the inner series are also variable in length, up to ±2.5 mm., the anthers often squarish and emarginate or occasionally ovate; the filaments are sometimes almost equal in length to the anthers and always bear conspicuous spreading sessile glands at the base, nearly equal to the anthers in length. The linear-lanceolate staminodia are usually hairy, and are ±0.8 mm. long. The gynaecium is 3 mm. or under in length, and is for the most part densely pubescent, although in some cases it may be glabrescent or even glabrous. The ovate or ellipsoid ovary is slightly longer than the stout style, which is topped by a conspicuous subcapitate stigma. The fruit, of which I have no material at hand, is presumably ellipsoid, up to 13 mm. long and 8 mm. broad, subtended by a simple-margined cupule that is slender and subpateriform, and one-third the length of the fruit.

Although the specimens from Mexico and Central America vary considerably from each other and from the type from Peru, there seems no reason for setting them up as a new species. Kostermans (Meded. Bot. Mus. Utrecht **25**: 19. 1936) mentions the close relationship between *N. Laurel*, *N. rigida*, and *N. reticulata*, giving the densely sericeous-hirsute inner surface of the tube of the latter as a diagnostic character. Many of the specimens cited above are intermediate in this as well as other characters. All gradations of leaf-base, shade of pubescence, and internal floral structure are apparent in the material at hand. Eventually further study of South American collections may reveal different trends and make another disposition of the North and Central American specimens advisable.

Doubtful Species and Varieties of Nectandra

Nectandra mollis γ venosa Meissner in DC. Prodr. **15**[1]: 149. 1864.

This variety, described from Mexico, Central America, and South America, Mez reduces to *Nectandra reticulata* (Ruiz & Pavon) Mez. None of the syntypes are at hand for comparison; they include Oersted's collection from Costa Rica and *Schiede & Deppe 243* from Mexico.

Nectandra mollis β villosa Meissner in DC. Prodr. **15**[1]: 148. 1864.

This also is reduced by Mez to *Nectandra reticulata* (Ruiz & Pavon) Mez. The syntypes, from Mexico (*Schiede & Deppe 241, 1145*) and South America, are unavailable at present.

Nectandra polita β? Oerstedii Meissner in DC. Prodr. **15**[1]: 164. 1864.

The type, *Oersted 12*, from Nicaragua, has not been seen; Mez includes the variety under *Nectandra latifolia*.

Nectandra turbacensis γ mexicana Meissner in DC. Prodr. **15**[1]: 152. 1864.

Mez reduces this to *Nectandra rectinervia* Meissner. The syntypes, *Linden 16* and *Galeotti 7101*, from Mexico, are not available.

Nectandra amazonum var. δ **Oerstedii** Meissner in DC. Prodr. 15^1: 150. 1864.

The syntypes presumably are the numbers cited by Mez, under *Nectandra globosa, Oersted 16, 17, 18,* from Costa Rica. So far, they have not been available for study.

Species Excluded from Nectandra

Nectandra chiapensis Lundell = Ocotea chiapensis (Lundell) Standley & Steyermark.
Nectandra striata Nees = Myrodia cf. funebris L. (ex Gürke), fide Mez.

5. Litsea Lamarck

Litsea Lamarck, Dict. 3: 574. 1791; Hemsley, Biol. Centr. Am. Bot. 3: 76. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 474. 1889; Bartlett in Proc. Amer. Acad. 44: 597. 1909.

Tetranthera Jacquin, Hort. Schoenbr. 1: 59, *t. 113.* 1797; Meissner in DC. Prodr. 15^1: 177. 1864.

Malapoenna Kuntze, Rev. Gen. 2: 571. 1891.

Distribution: In mountain-forests of Mexico and Central America.

Small trees or shrubs not more than 6 m. high, with leaves lanceolate to elliptic with all intermediate forms, not more than 13 and usually less than 10 cm. long, or leaves ovate to orbicular and not more than 7 cm. long. The diagnostic character, however, lies in the dioecious flowers borne in small axillary subumbellate clusters on peduncles of varying lengths, usually not more than 2 cm., surrounded by an involucre that is quickly deciduous at anthesis. The floral parts are extremely variable in this unstable group, but in the main there are six perianth-lobes, occasionally aborted to fewer, equal or subequal in length. The ♂ flower usually bears three or four series of fertile stamens, the two inner of which are biglandular. The anthers are four-celled and are all introrse, though very occasionally in the inner cycles the lower locules appear to be lateral. A small aborted ovary may occur or be absent entirely. The ♀ flower has three or four series of three each of staminodia, the first two of which are usually without glands. The third and fourth, if present, bear at the base of the filament two glands which are often stipitate. The ovary is well developed in the ♀ flower. The fruit is a more or less globular berry, seated on a small scarcely changed perianth-tube, or on one that is thickened and enlarged to form a cupule or disc, which is seated on the enlarged pedicel.

The genus *Litsea* in America presents a pattern different from that of other genera of this hemisphere. There are two morphologically distinct divisions: first the group consisting of three species with leaves ovate or ovate-lanceolate to orbicular-ovate, showing bases rounded or subcordate, found only in Coahuila, Nuevo Leon, and San Luis Potosí; second, embracing the remainder of the genus, the group with leaves elliptic, lanceolate, linear, or oblong and all variations thereof, their bases not subcordate nor rounded, occurring from Chihuahua and Sinaloa south and east throughout Mexico and Central America.

Key to the Species of Litsea

A. Leaf-bases rounded or subcordate.

B. Young branchlets densely ferruginous-pubescent; lower surface of leaves tomentose; petioles pubescent; inflorescence densely ferruginous-pubescent; infructescence not more than 1.5 cm. long; fruit $\pm$5 mm. long............1. *L. Muelleri.*

B. Young branchlets glabrous or at most glabrescent; lower surface of leaves and petioles glabrous; inflorescence glabrous or glabrescent; infructescence not less than 1.5 cm. long; fruit 1 cm. or more long.

C. Leaf-blades ovate-lanceolate, the largest up to 7 cm. long, the apex acute..2. *L. Pringlei.*

C. Leaf-blades ovate or orbicular-ovate, the largest up to 4 cm. long, the apex acute, obtuse, or rounded...............................3. *L. parvifolia.*

A. Leaf-bases not rounded or subcordate.........................4. *L. glaucescens.*

B. Branchlets, petioles, and venation not conspicuously flavescent.

C. Leaf-blades usually oblong-elliptic or ovate-elliptic, glabrous to densely tomentose...........................4a. *L. glaucescens* var. *subsolitaria.*

C. Leaf-blades linear or at most linear-lanceolate to oblong, always glabrous.......................................4b. *L. glaucescens* var. *Schaffneri.*

B. Branchlets, petioles, and venation conspicuously flavescent...4c. *L. glaucescens* var. *flavescens.*

1. **Litsea Muelleri** Rehder in Jour. Arnold Arb. **16**: 449. 1935.
Litsea Tharpiana Standley in Field Mus. Publ. Bot. **17**: 247. 1937.

DISTRIBUTION: Mountains of Nuevo Leon, Mexico, at an altitude of 1500–2600 m.

MEXICO: Nuevo Leon: Sierra Madre Oriental, common in dense woods east side of divide, between San Francisco Canyon and Pablillo, 15 miles s.w. of Galeana, alt. 2600 m., May 14, 1934, *C. H. & M. T. Mueller 379* (♂ fl., TYPE of *L. Muelleri* — A, Mich, NY, Tex, US); Hacienda Pablillo, Galeana, August 18, 1936, *Taylor 188* (fr., type of *L. Tharpiana,* ♂ fl., Tex); cañon above Alamar, *C. H. & H. T. Mueller 689* (fr., A, Mich, NY, Tex, US).

This species is easily separated from the other species of *Litsea* with rounded or subcordate leaf-bases by the occurrence of a dense persistent pubescence on the young branchlets and petioles and a tomentum on the lower surface of the leaf-blades. The nearest relatives are to be found in the *L. parvifolia* complex, from Nuevo Leon and Coahuila, but separated by the ferruginous (sometimes becoming fuscous) pubescence on the young branchlets, and by the venation of the lower leaf-surface. On the whole, the lateral nerves are more ascending in *L. Muelleri,* the petioles longer and densely hairy, and the leaf-bases less pronouncedly cordate. The two entities described undoubtedly represent the same species.

2. **Litsea Pringlei** Bartlett in Proc. Amer. Acad. **44**: 598. 1909; Standley in Contr. U. S. Nat. Herb. **23**: 287. 1922.
Litsea novoleontis Bartlett in op. cit. 601; Standley in op. cit. 288.

DISTRIBUTION: Ridges in the Sierra Madre near Monterrey, Nuevo Leon, and in southwestern San Luis Potosí.

MEXICO: Without locality, April, 1926, *Runyon & Tharp 893, 1008* (sterile, fr., Tex). Nuevo Leon: Municipio de Villa Santiago, Cañon Marisio Arriba, Rancho Las Adjuntas, *C. H. Mueller 2042* (fr., GH); Cañon Diente, near Monterrey, *C. H. Mueller 2662* (fr., GH); Sierra Madre Oriental, waterway below Alamar, about 15 miles s.w. of Galeana, *C. H. & M. T. Mueller 620* (fr., NY, Tex, US); near Monterrey, *Pringle 2078* (fr., GH), *2837* (fr., type of *L. novoleontis,* GH); limestone ledges, Sierra Madre above Monterrey, alt. 800 m., March 8, 1906, *Pringle 10238* (♂, ♀ fl., TYPE of *L. Pringlei* — GH, NY, US) (shrub 1.3–2 m.), *Tharp 1835* (♀ fl., Tex, US). San Luis Potosí: Alvarez, Sept. 5–10, 1902, *E. Palmer 62* (♂ fl., fr., GH, NY, US); mountains, San José Pass, August 5, 1890, *Pringle 3146* (fr., NY, US).

NATIVE NAMES: "La Brel" (Nuevo Leon); "Laurel" (San Luis Potosí).

This shrub, 1.3–2 m. high, bears furcate branchlets which are densely or sparsely leafy and are reddish black or olivaceous in color. The coriaceous reticulate ovate-lanceolate leaf-blades are extremely variable in size, becoming as long as 7 cm., their tips often mucronulate, and their bases rounded to subcordate. The ♂ inflorescences are variable, which fact accounts for the description of the two species *L. Pringlei* and *L. novoleontis* from the same locality. In the former the 1–4 erectly pedunculate subumbellate ♂ inflorescences occur principally in the axils of terminal leaves, giving an appearance of dense flower-clusters. The ♂ inflorescences of the specimens described as *L. novoleontis* are single, axillary, and borne on slender nodding peduncles. The fruit is black, globose, about 11 mm. in diam., subtended by an expanded pedicel about 5 mm. long, and ±4 mm. in diam. The peduncle is only slightly enlarged.

3. **Litsea parvifolia** (Hemsley) Mez in Jahrb. Bot. Gart. Berlin **5**: 481. 1889; Bartlett in Proc. Amer. Acad. **44**: 601. 1909; Standley in Contr. U. S. Nat. Herb. **23**: 288. 1922.

Umbellularia parvifolia Hemsley, Biol. Centr. Am. Bot. **3**: 77. 1882.

Malapoenna parvifolia Kuntze, Rev. Gen. **2**: 571. 1891.

Litsea pedicellata Bartlett in Proc. Amer. Acad. **44**: 598. 1909; Standley in Contr. U. S. Nat. Herb. **23**: 287. 1922.

DISTRIBUTION: Mountains near Saltillo, Coahuila, and Monterrey, Nuevo Leon.

MEXICO: Coahuila: Abundant in mountains near Saltillo, July 30, 1848, *Gregg 314* (♀ fl., fr., ISOTYPE of *Umbellularia parvifolia*, GH) (shrub 1.5–3 m. tall); April 15–30, 1898, *E. Palmer 68* (♂ fl., GH), alt. 2100 m., April 12, 1906, *Pringle 10239* (♂ fl., type of *L. pedicellata* — GH, NY, US) (shrub 1.3–1.5 m.). Nuevo Leon: Monterrey, *C. H. & M. T. Mueller 301* (♀ fl., fr., Tex).

This is the earliest species of *Litsea* to be described from northern Mexico. The shrub, 1.3–3 m. in height, has ovate-lanceolate to orbicular leaf-blades, minutely mucronulate at the apex and rounded, subcordate or cordate at the base, more or less coriaceous, and heavily reticulate, not more than 4 (usually 3) cm. long. Characteristic is a bloom discernible on leaf-blade, stem, buds, and fruiting calyx, due to the presence of a thin film of minute, rapidly disappearing pubescence. The situation existing in *Litsea parvifolia* and *L. pedicellata* parallels that in *L. Pringlei* and *L. novoleontis*. The ♂ inflorescence of *L. parvifolia* is a single axillary subterminal umbel borne on slender more or less recurving peduncles. The flowers, 3 or 4 per umbel, are subtended by densely tomentose pedicels 2 mm. long. The ♂ inflorescences of *L. pedicellata* are more densely aggregated near the tips of the flowering branchlets, occurring in a few subumbellate axillary clusters and a heavily flowered terminal panicle up to 3 cm. long. There is a slender grace perceived in the branchlet of *L. pedicellata* that is wholly lacking in the more coarse and rather stiff aspect of *L parvifolia*. The leaf-blades of the type of the former are less heavily coriaceous and of a bluish green, with reticulations more prominent. In spite of these differences, there seems to be no sound reason for keeping up both species.

4. **Litsea glaucescens** H.B.K. Nov. Gen. & Sp. **2**: 133 [168]. 1817.

Small aromatic tree, the branchlets smooth, dark or reddish brown or olive, terete. Petioles slender, canaliculate, 5–20 mm. long, ±1 mm. in diameter; leaf-blades variable, usually thinly coriaceous, sometimes membranaceous, olive-green to dark brown above when dried, glaucous to glaucescent or at least paler beneath, usually elliptic-lanceolate or lanceolate, occasionally oblong or ovate-lanceolate, (4–) 7–9 (–12.5) cm. long and (1–) 2–3 (–3.5) cm. broad, attenuate to cuneate or obtuse at base, acute to acuminate or sometimes obtusish at apex, usually with a mucro of varying length, glabrous throughout or sometimes in young stages slightly pubescent above and more densely pubescent beneath, the venation yellowish or red-brown and except for the costa obscure above, the lateral veins usually ascending, slightly prominent beneath, occasionally with the marginal vein prominent, the entire surface frequently conspicuously areolate. ♂ inflorescences axillary, solitary or racemose umbels less than 2.5 cm. long, the peduncles 1 cm. or less in length, usually glabrous, the pedicels up to .5 cm. long and pubescent. Flowers 3–5 per umbel, often slightly pubescent, up to 4 mm. long; perianth-lobes 6, membranaceous, oblong or elliptic, usually 3 mm. long, the tube very short, the stamens 9. ♀ inflorescences axillary, solitary umbels up to 2 mm. long, the peduncles up to 1.5 cm. long; flowers 3–5 per umbel, 2–3 mm. long, often slightly pubescent, the perianth-lobes 6, membranaceous, usually elliptic, the tube very short, the staminodia usually 9. Fruit a globular berry up to 12 mm. in diameter, subtended by the enlarged usually glabrous tube and pedicel up to 7 mm. long, flaring at the tip to 2 mm. in breadth usually, sometimes the tube expanding to form a shallow cupule or disc up to 4 mm. in diameter.

Distribution: Northwestern Mexico, south and east to Guatemala, Honduras, and Costa Rica. The species occurs in every state of Mexico except Sonora and Durango in the northwest, and Coahuila and Nuevo Leon in the north central area, in which latter states it is replaced by the ovate-orbicular-leaved species. Type-material of the species was collected by Humboldt & Bonpland along the shores near Acapulco and in the mountains about Jalapa at 1280 m. altitude. The species in the broad sense occurs generally at an altitude of between 2000 and 3000 m. in forested mountainous regions, although to the north, where it abounds in the plains and along the coast, it descends to a much lower altitude. It is locally used for seasoning or flavoring for meats, soups, and other foods, and as a substitute for tea; it is used also as a medicine for colic pains, etc.

This widespread species, as *Tetranthera glaucescens,* was split into four varieties by Meissner (1864), the separation being made principally on the type of inflorescence. Hemsley (1882) listed also a second species *Litsea Neesiana* with two varieties. Mez (1889) submerged *L. glaucescens* var. *subsolitaria* (Meissner) Hemsley into the species proper, and elevated var. *major* Meissner to specific rank as *L. guatemalensis.* Bartlett (1909) set apart the Costa Rican collections as *L. flavescens,* and those from San Luis Potosí and Tamaulipas (*L. glaucescens* var. *subsolitaria*) as *L. Schaffneri,* in which he included *Parry & Palmer 798,* cited by Hemsley under *L. glaucescens* var. *subcorymbosa.*

It seems impossible at present to formulate any clear-cut species in this highly variable group. Careful study of the available material shows a single complex species which varies with each type of locality in which it has been collected. The typical variety, var. *subsolitaria* (the oldest varietal name extant applied to the type-material), was originally collected in Guerrero and Vera Cruz. Subsequent scattered collections have been recorded from nearly every state in Mexico, each showing slight variation from the variety. On the periphery of the range of the typical variety are two divergent groups of specimens which seem worthy of varietal rank. They may be easily recognized in most cases, but frequently specimens are found which show a gradation toward the typical variety. A treatment of the three varieties follows.

4a. **Litsea glaucescens** var. **subsolitaria** (Meissner) Hemsley, Biol. Centr. Am. Bot. 3: 76. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 477. 1889; Bartlett in Proc. Amer. Acad. 44: 599. 1909.

Litsea glaucescens H.B.K. Nov. Gen. & Sp. 2: 133 [168]. 1817; Mez in Jahrb. Bot. Gart. Berlin 5: 477. 1889; Bartlett in Proc. Amer. Acad. 44: 599. 1909.

Litsea Cervantesii H.B.K., op. cit. 134 [168].

Tetranthera glaucescens Sprengel, Syst. Veg. 2: 267. 1825.

Persea ? Orizabae Martens & Galeotti in Bull. Acad. Sci. Brux. 10^2: 358. 1843; Meissner in DC. Prodr. 15^1: 56. 1864; Hemsley, Biol. Centr. Am. Bot. 3: 72. 1882.

Tetranthera villosa Martens & Galeotti in Bull. Acad. Sci. Brux. 10^2: 359. 1843.

Tetranthera Neesiana Schauer in Linnaea 19: 712. 1847; Meissner in DC. Prodr. 15^1: 193. 1864.

Tetranthera glaucescens var. α *subsolitaria* Meissner in DC. Prodr. 15^1: 193. 1864, p.p.

Tetranthera glaucescens var. β *subcorymbosa* Meissner, l. c.

Tetranthera glaucescens var. γ *racemosa* Meissner, l. c.

Tetranthera glaucescens var. δ *major* Meissner, l. c.

Tetranthera Neesiana var. β *corymbifera* Meissner, l. c.

Tetranthera Neesiana var. γ *villosa* Meissner, l. c.

Litsea glaucescens var. β *subcorymbosa* Hemsley, Biol. Centr. Am. Bot. 3: 76. 1882.

Litsea glaucescens var. γ *racemosa* Hemsley, l. c.

Litsea Neesiana Hemsley, l. c.; Mez in Jahrb. Bot. Gart. Berlin 5:477. 1889; Bartlett in Proc. Amer. Acad. 44: 599. 1909; Standley in Contr. U. S. Nat. Herb. 23: 287. 1922.

Litsea Neesiana var. β *corymbifera* Hemsley, l. c.

Litsea Neesiana var. γ *villosa* Hemsley, l. c.

Litsea Orizabae Mez in Jahrb. Bot. Gart. Berlin 5: 479. 1889; Bartlett in Proc. Amer. Acad. 44: 599. 1909; Contr. U. S. Nat. Herb. 23: 287. 1922.

Litsea guatemalensis Mez in Jahrb. Bot. Gart. Berlin 5: 479. 1889; Bartlett in Proc. Amer. Acad. 44: 599. 1909.

Malapoenna glaucescens Kuntze, Rev. Gen. 2: 571. 1891.

Malapoenna guatemalensis Kuntze, l. c.

Malapoenna Neesiana Kuntze, l. c.

Malapoenna Orizabae Kuntze, l. c.

Litsea acuminatissima Lundell in Contr. Univ. Mich. Herb. 4: 3. 1940.

Litsea Matudai Lundell, op. cit. 5.

MEXICO: Without locality, *Humboldt & Bonpland s.n.* (♂ fl., type of *Litsea Cervantesii* not seen), *Aschenborn 349* (fl., type of *Tetranthera Neesiana* not seen), *Haenke [1539]* (♀ fl., NY). Chihuahua: Sierra Canelo, Río Mayo, *Gentry 2539* (fr., A). Sinaloa: Culiacán, August 27–Sept. 15, 1891, *E. Palmer 2770* (sterile, GH, US), ?*Montez & Salazar 1688* (sterile, US); Cerro del Viejo, San Ignacio, *Montez & Salazar 82* (♂ fl., US). Zacatecas: Plateado, *Rose 3650* (♀ fl., US). Nayarit (Tepic): In the Sierra Madre, near Santa Teresa, *Rose 3437* (sterile, US). Jalisco: Bolaños, *Rose 3746* (fr., US). Hidalgo: El Chico, *Lyonnet 727* (fr., A, NY, US); Real del Monte, March 22, 1849, *Gregg 639* (♂ fl., ISOSYNTYPE of *Tetranthera glaucescens* α *subsolitaria*, GH) (shrub; [fl.] yellowish); on Sierra de Pachuca, *Rose & Hay 5566* (fr., US). Vera Cruz: La Joya, Perote, *Balls 5520* (♀ fl., fr., A); near Jalapa, *Pringle 8156* (♂ fl., GH, NY, US), *Schiede & Deppe s.n.* (♂ fl., GH, NY); on eastern slopes of mountains near Jalapa, 1280 m. alt., *Humboldt & Bonpland s.n.* (♀ fl., SYNTYPE of *Litsea glaucescens* not seen); Mirador, *Liebmann* (*Lauraceae 60*) (♂ fl., US), August 1841, *Liebmann s.n.* (♂ fl., US), *Mohr s.n.* (♂ fl., US); San Cristóbal, Orisada [Orizaba], *Mohr* [*434*] (♂ fl., US); Orizaba, *Balls 4320* (♂ fl., A), *Bilimik 359* (♂ fl., GH, US), *Botteri 7* (♂ fl., GH, US), *108, 183* (fr., GH, US), *549* (♂ fl., GH), *Bourgeau 3128* (fr., GH), *Galeotti 252* (fl., type of *Persea ? Orizabae* not seen), *Liebmann* (*Lauraceae 65*) (♂ fl., cited by Mez under *Litsea Orizabae,* fragm., US), *Matuda 591* (sterile, A), *F. Mueller 308, 1307* (♂ fl., NY); Maltrata, May 6, 1937, *Matuda 1211* (fr., A, type of *Litsea acuminatissima*-Mich); various localities, *Schiede 58* (fr., NY). Puebla: Chinautla, alt. 2100–2400 m., May 1841, *Liebmann s.n.* (sterile, GH, US). Mexico: Temascaltepec, Pineda, *Hinton 3188* (♀ fl., NY, US); Las Cruces, *Hinton 3257* (♂ fl., A, US), *7223* (♀ fl., GH), Salitre-Canitas, *Hinton 3940* (fr., A). Michoacán: Sierra Torricillas, Coalcomán, *Hinton 12365* (♂, GH), *12800* (♂, GH), *15746* (♂, US). Guerrero: On shores near Acapulco, *Humboldt & Bonpland* s.n. (♀ fl., SYNTYPE of *Litsea glaucescens* not seen); Piedra Ancha-Tres Cruces, Galeana, *Hinton 15418* (♀ fl., GH). Oaxaca: Without locality, *Cuming* (♂ fl., isotype of *Tetranthera glaucescens γ racemosa,* NY); Talea, alt. 900 m., Feb. 184–, *Galeotti 257* (♂ fl., GH [as 2977], US) (fl. white-rose), alt. 1800 m., Oct. 184–, *Galeotti 258* (♀ fl., US) (fl. white); Villa Alta, *Schultes 637* (sterile, NY); Sierra de San Felipe, in forests and on small wooded plateaus in the mountains, alt. 2700–2900 m., on lime-ridges of Sola, alt. 2400–2600 m., and in the vicinity of Yavesia and Capulapán, alt. 2100–2600 m., *Galeotti 251* (fl., type of *Tetranthera villosa* not seen); Sierra de San Felipe, *Pringle 5679* (♂ fl., GH), *Conzatti & Gonzales 1120* (♀ fl., GH, US); mountains southeast of Miahuatlán, alt. 3050 m., *Nelson 2531* (♀ fl., GH, US); Cafetal San Rafael (Cerro Espino), *Reko 3562* (♂ fl., US). Chiapas: Between Huitztán and Oxchuc, *C. & E. Seler 2149* (♂ fl., GH, NY, US); Saxchanal, Sierra Madre, *Matuda 4284* (♂ fl., A, NY, US); Comitán, *Goldman 818* (♂ fl., US); between San Cristóbal, Las Casas, and Huitztán, *C. & E. Seler 2137* (♂ fl., GH); west side of Volcán de Tacaná, alt. 2800 m., March 30, 1939, *Matuda 2933* (♀ fl., fr., isotype of *Litsea Matudai,* A, GH, NY). GUATEMALA: Petén: San Pedro L[ake], *Texada 54* (♂ fl., US). Quiché: San Miguel Uspantán, *Heyde & Lux 3466* (♀ fl., US). Baja Verapaz: Montaña de San Ysidro-San Jerónimo, *Salas 491* (fr., US); dry, rocky hills n. of Santa Rosa, *Standley 69694* (sterile, NY). Huehuetenango: Sierra de los Cuchumatanes, above Chiantla, *Standley 65630* (♀, NY). San Marcos: Above Río Tacaná, near San Antonio, *Standley 66089* (sterile, A). Quezaltenango: Cerro Quemado, *Kellerman 5927* (♂ fl., US), *5935* (♂ fl., US); Cerro La Pedrera, south of Quezaltenango, *Standley 66450* (♂ fl., A, NY); slopes of Volcán de Santa María, above Palojunoj, *Standley 67526* (♀ fl., A). Guatemala: Volcán de Pacaya, above Las Calderas, *Standley 58448* (♀ fl., A). Sacatepéquez: Near San Juan, *Hartweg 613* (♂ fl., isotype of *Tetranthera glaucescens δ major,* US); San Rafael, *J. D. Smith 1276* (♂ fl., GH, US); slopes of Volcán de Agua, south of Santa María de Jesús, *Standley 59447* (♂ fl., A, NY), Volcán de Agua, *Kellerman 4953* (♂, US), *Maxon & Hay 3753* (♂, US); Santa María de la Antigua, *Pittier 13* (♂, US); hills of Finca Carmona, s.e. of Antigua, *Standley 63668* (sterile, US). Chimaltenango: Cerro de Tecpám, region of Santa Elena, *Standley 58756* (♂, NY, US); Barranco de la Sierra, s. e. of Patzúm, *Standley 61605* (♂, A, NY); Chichavac, *Skutch 253* (♂, US), *Salas 581* (♂, US). EL SALVADOR: Chalatenango: La Reina, *S. Calderón 2456* (♂, NY, US). San Salvador: Cultivated in Santa Tecla, *S. Calderón 1489* (♀, GH, NY, US). HONDURAS: Comayagua: Near El Achote, hills above plains of Siguatepeque, *Yuncker, Dawson & Youse 6370* (♂, GH).

NATIVE NAMES: "Laurel" (Vera Cruz, Mexico, Michoacán, Guerrero, Oaxaca, Chiapas, Baja Verapaz, Chimaltenango, Quezaltenango); "Laurill" (Zacatecas, Nayarit [Tepic], Jalisco); "Laurillo" (Michoacán); "Laurel de la Sierra" (Sinaloa); "Ziz-uch" (Chiapas); "Laurel aromatico" (Petén); "Laurel de especie" (El Salvador).

The specimen from Chihuahua occurs in the transition pine-oak country and, at first glance, seems to be at variance with the typical variety as we are most familiar with it. The leaf-blades are densely pubescent beneath, slightly smaller, acutish rather than acuminate, and oblongish lanceolate rather than elliptic. Otherwise, the number is similar to the other specimens found in the northern Mexican states.

The collections made in Sinaloa, Zacatecas, Nayarit, Jalisco, and Mexico are similar to those found in Hidalgo, and show a tendency toward specimens of the varietal segregate *Schaffneri* as found in Tamaulipas.

In Vera Cruz we find the typical variety in its truest sense. The lanceolate-elliptic acuminate leaf-blades measure 9.5 × 2.5–3 cm. and are abundant on the branchlets, bearing in their axils numerous short-pedunculate inflorescences, simple or branched. The original description of *Persea Orizabae,* from this region, is sketchy. Mez enlarges this to indicate a tree with large leaf-blades, comparatively speaking (7.5–3.5 cm.), ovate to lanceolate, albescent or softly cinereous-long-tomentose beneath. Except for the pubescence, which has been found to be extremely variable in this group, the fragment matches perfectly any number of specimens of typical *L. glaucescens* from Vera Cruz and Oaxaca.

The sterile Liebmann sheet from Puebla, not far from Orizaba, Vera Cruz, shows leaf-blades that are certainly broader than is usual with *L. glaucescens.* There can be no doubt that the sheet is lauraceous and probably a variant of this species. After one hundred years in an herbarium, the bark still has the characteristically pungent odor typical of many Lauraceae.

The specimens collected by Hinton in Michoacán have leaf-blades that are slightly broader in proportion to their length, and the veins are rather more arcuate than is the case of the majority of leaf-blades found on typical specimens. It is unfortunate that material from one of the type-localities of the typical variety is so scanty. The Hinton plant is not typical, for it possesses the largest-known leaf-blades of the genus in America (13 × 3.5 cm.). There is no doubt, however, that in spite of their oversize, the sheet belongs here. The Oaxacan material was collected very near the type-locality of the species and is similar to specimens found there. The material from Chiapas also ties up with that from Oaxaca and Vera Cruz. The elliptic or lanceolate-elliptic leaf-blades of the specimens are very conspicuously reticulate and shining. The branchlets are densely leafy and the inflorescences are very full-flowered.

The Guatemalan specimens differ from typical *L. glaucescens* in consistently having on the lower surface of the leaves a pubescence of varying density, sometimes early exhibiting a thick tomentum which later may be reduced to a few strigose hairs persisting about the costa and veins. The young branchlets also are pubescent in varying degrees, as are the petioles, peduncles, and pedicels. The leaves tend for the most part to be more elliptic than lanceolate. Again these specimens must be included in the species in the broad sense and not maintained as a separate species.

Schauer's description of the leaf-blades of *T. Neesiana* mentions the shining upper surface scattered with stellulate-pilose dots, a characteristic not found in the Lauraceae. The remainder of the description is typical of the genus, so probably the type of pubescence was erroneously reported.

4b. **Litsea glaucescens** var. **Schaffneri** (Bartlett), comb. nov.

Tetranthera glaucescens var. α *subsolitaria* Meissner in DC. Prodr. 15¹: 193. 1864, p.p.

Litsea Schaffneri Bartlett in Proc. Amer. Acad. 44: 600. 1909; Standley in Contr. U. S. Nat. Herb. 23: 288. 1922.

Litsea pallens Lundell in Contr. Univ. Mich. Herb. 4: 5. 1940.

DISTRIBUTION: Mountains of San Luis Potosí, Guanajuato, and Tamaulipas.

MEXICO: Tamaulipas: Cerro los Armadillos, vicinity of San José, *Bartlett 10389* (fr., GH, US); in shady gorges before arriving at Palmilla from Victoria to Tula, Nov. 1830, *Berlandier 2185* (=*765*) (isosyntype of *Tetranthera glaucescens* var. α *subsolitaria,* GH, NY); vicinity of Victoria, alt. 320 m., Feb. 1–April 9, 1907, *E. Palmer 208* (fr., GH, US), *Runyon 1008* (♀ fl., US); San Leucas, *Viereck 44, 585* (♂ fl., fr., US); Sierra near Victoria, alt. 1200 m., Feb. 1932, *von Rozynski 341* (♂ fl., isotype of *L. pallens,* NY, US). San Luis Potosí: Near Santa Barbara, *Hartweg 382* (♂ fl., US); near San Luis Potosí, Sept. 12–16, 1902, *E. Palmer 453* (♀ fl., A, US), May 24, 1905, *E. Palmer 647* (fr., GH, US), *Parry & Palmer 798* (♀ fl., fr., GH, NY, US); in mountains, San Miguelito, Sept. 1876, *Schaffner 23* (♂ fl., TYPE of *L. Schaffneri,* GH), *431, 463* (♂ fl., NY, US), *710* (♀ fl., ♂ fl., fr., GH). Guanajuato: Santa Rosa, *Dugès 231* (♂ fl., US), *1000* (♂ fl., GH).

NATIVE NAMES: "Laurel," "Sacred Laurel" (San Luis Potosí).

This aggregate is one of the extreme variants from the norm of *Litsea glaucescens.* The shrub bears slender foliose ochraceous branchlets, with narrowly lanceolate mucronulate leaves, acute at both ends, more or less coriaceous, glabrous and glaucous beneath, the venation inconspicuous except for the prominent midrib and reticulation. The leaf-blades vary in size, being 2–6 cm. × 5–12 mm. The inflorescences are usually solitary pedunculate umbels located in the axils of the leaves of terminal or lateral branchlets. The rather large globose and black fruits are about 12 mm. in diameter.

The specimens from Tamaulipas differ from those from the type-locality in their larger more acuminate leaf-blades, not glaucous but concolorous, with more prominent venation. Lundell notes the similarity between *L. pallens* and *L. Schaffneri.*

4c. **Litsea glaucescens** var. **flavescens** (Bartlett), comb. nov.

Litsea flavescens Bartlett in Proc. Amer. Acad. 44: 599. 1909; Standley in Field Mus. Publ. Bot. 18: 451. 1937.

DISTRIBUTION: Mountainous regions of Costa Rica, at an altitude of 1500–1900 m.

COSTA RICA: San José: Hills above Belmira, near Santa María de Dota, alt. 1600 m., Jan. 1898, *Tonduz 7352* (Herb. Nat. Costa Rica *11638*) (♂, ♀ fl., TYPE of *L. flavescens* — GH, NY, US), *Standley 42525* (♂ fl., US); Cuesta de Tarrazú, *Tonduz 7796* (♂ fl., US); in mountains of Candelaria, *Oersted 10* (♂ fl., US).

NATIVE NAME: "Lentisco."

This Costa Rican segregate is distinguished by the striking flavescent venation, particularly the prominent marginal vein, and the yellowish petiole apparent in the dried specimens, as well as the lack of glaucosity on the lower leaf-surface. Bartlett also mentions the smaller flowers and the tomentose pedicels as presenting specific differences. Both of these characters seem of too variable a nature to be criteria of specific importance.

Pubescence may be found on many specimens of the typical variety; and some of the Chiapas material shows a similarity of foliage-characters. Since no specimens have been collected as yet in the intervening areas, the entity is maintained for the present as a regional variety of *L. glaucescens.*

6. Beilschmiedia Nees

Beilschmiedia Nees in Wallich, Pl. As. Rar. 2: 61, 69. 1831, Syst. Laurin. 21, 192, 197. 1836; Meissner in DC. Prodr. 15[1]: 62. 1864; Kostermans in Rec. Trav. Bot. Néerl. 35: 847. 1938 (Meded. Bot. Mus. Utrecht 48: 847. 1938).

Hufelandia Nees, Pl. Laurin. Expos. 11 (n.9), 21. 1833, Syst. Laurin. 187, 674. 1836; Meissner in DC. Prodr. 15[1]: 65. 1864.

DISTRIBUTION: Tropical regions of both hemispheres.

KEY TO THE SPECIES OF BEILSCHMIEDIA

A. Leaf-blades on both surfaces prominently and loosely and often incompletely reticulate.
- B. Leaf-blades elliptic, not less than 7 cm. in width, glaucous beneath; fruits to 15 cm. in length. . . . . 1. *B. Anay.*
- B. Leaf-blades elliptic or lanceolate-elliptic, not exceeding 4–5 cm. in width, not glaucous beneath; fruits not more than 4 cm. long.
  - C. Branchlets and leaf-blades glabrous; leaf-blades long-acuminate, shining; venation loosely reticulate.
    - D. Branchlets gray, becoming red-brown or maculate, not corky; leaf-blades chartaceous, sharply caudate-acuminate, not pronouncedly undulate; fruit not constricted at base, not more than 3 cm. long. . . . . . . 2. *B. hondurensis.*
    - D. Branchlets gray, corky; leaf-blades coriaceous, obtusely acuminate, prominently undulate; fruit slightly constricted at base, up to 4 cm. long. . . . . 3. *B. Brenesii.*
  - C. Branchlets and leaf-blades yellowish brown-pubescent; leaves acutish to obtuse; venation incompletely reticulate. . . . . 4. *B. costaricensis.*

A. Leaf-blades on both surfaces prominently and completely reticulate, or the upper surface plane and the lower areolate.
- B. Leaf-blades concolorous, at least not glaucous beneath, glabrous; inflorescence few-flowered, subglabrous.
  - C. Upper surface of leaf-blades completely and conspicuously reticulate. . . . . 5. *B. mexicana.*
  - C. Upper surface of leaf-blades plane . . . . 6. *B. Steyermarkii.*
- B. Leaf-blades glaucous beneath, glabrescent at maturity; inflorescence densely flowered, tomentose-pilosulose.
  - C. Branchlets cinereous-puberulous; leaf-blades above sparsely and beneath more densely pilosulose with loose whitish hairs. . . . . 7. *B. ovalis.*
  - C. Branchlets ferruginous-tomentose; leaf-blades glabrous above, except for lower portion of midrib, and beneath pubescent along veins. . . . . 8. *B. Austin-Smithii.*

1. **Beilschmiedia Anay** (Blake) Kostermanns in Rec. Trav. Bot. Néerl. 35: 847. 1938 (Meded. Bot. Mus. Utrecht 48: 847. 1938).

Hufelandia Anay Blake in Jour. Wash. Acad. Sci. 9: 459, *fig. 1.* 1919.

DISTRIBUTION: From the forests of Central America, at an altitude of less than 300 m., to Colombia (according to Kostermans), at increasingly higher altitudes (2000 m.).

GUATEMALA: Alta Verapaz: Finca Chamá, *Popenoe 884* (fr., US), *H. Johnson 170* (fl., Ch, US). Suchitepéquez: In loamy soil of tropical forest at Finca Compromiso, Mazatenango, alt. about 365 m., Jan. 17, 1917, *Popenoe 754* (fl., fr., TYPE of *Hufelandia Anay,* US). Escuintla: Río Guacalate, *Standley 60223* (fl., Ch).

NATIVE NAMES: "Anay" (Guatemala); "Laurel canime" (Colombia, fide Kostermans).

This tree bears fruit of good flavor, similar to that of an avocado, but not oily, according to the collector.

2. **Beilschmiedia hondurensis** Kostermanns in Rec. Trav. Bot. Néerl. 35: 854. 1938 (Meded. Bot. Mus. Utrecht 48: 854. 1938).

DISTRIBUTION: At high altitudes in the interior of British Honduras.

BRITISH HONDURAS: Toledo: Temash River, *Kinloch 9a (Y 35111)* (sterile, Y); Camp 31, British Honduras-Guatemala Survey, alt. 630 m., April 7, 1934, *Schipp 1262* (fr., ISOTYPE, Ch, GH, NY) (small tree-like shrub, quite common in the interior at high altitudes; 7.5 m. high, 7.5 cm. diam.; fruit black).

This shrub, quite common according to the original collector, is represented at present only by a sterile specimen and the type, which is a fruiting branch from which most of the leaves and fruits have fallen on drying. The chartaceous, lanceolate to elliptic, long-acuminate leaf-blades, acutish at the base and prominently reticulate on both surfaces, measure up to 13.5 cm. in length and 4 cm. in width. The round canaliculate petiole is 5 (–9) mm. long. The short infructescences, up to 4 (–7.5) cm. long, bear somewhat enlarged peduncles about 5–6 mm. long and nearly 3 mm. thick, are a lightish rust-brown, rugulose in contrast to the smooth deeper red-brown young branchlets and the pale gray branches. The green or black (according to Schipp) smooth ellipsoid fruit attains a length of 3 cm. and a width of 1.5 cm.

3. **Beilschmiedia Brenesii**, sp. nov.

Arbor . . . ., ramulis griseis suberosis lucidis mox opacis, apicibus fusco-brunneis. Folia opposita (?), petiolis glabris verruculosis brunneis canaliculatis, 3–10 mm. longis, laminis glabris coriaceis supra lucidis, ellipticis, ad 8 cm. longis et 3.5 cm. latis, basi cuneatis, apice obtuse plus minusve abrupte acuminatis, margine recurvatis et laxe undulatis, penninerviis, costa supra tenuiter subtus crasse elevata, nervis 8-paribus supra et subtus delicate leviterque elevatis, rete venularum laxo supra conspicue subtus conspicuissime prominulo. Inflorescentia ignota. Infructescentia robusta, brevis, ad 7 cm. longa, pedunculis crassis et lignosis ramulis similibus aequalibusque, fructibus duobus tantum maturantibus. Fructus in sicco niger, lucidus, glaber, ellipsoideus, ad 4 $\times$ 2 cm., apice rotundatus, basi leviter constrictus, pedicello incrassato glabro, ad 10 mm. longo et 4 mm. lato.

DISTRIBUTION: Known only from the type-locality.

COSTA RICA: Alajuela: La Palma and El Socorro de San Ramón, July 24, 1928, *Brenes 6214* (fr., TYPE, Ch).

The new species is like none other from this hemisphere, but resembles very strikingly species of the genus found in eastern Asia. The nearest relative here is *B. hondurensis,* easily separated by the less rigidly coriaceous leaf-blades usually with sharply caudate-acuminate tips, the branchlets showing no corky tendency, and the much smaller fruit.

4. **Beilschmiedia costaricensis** (Mez & Pittier), comb. nov.

Hufelandia costaricensis Mez & Pittier ex Mez in Bull. Herb. Boiss. II, 3: 228. 1903 (excl. *Pittier 1863, 1873,* fide Kosterm.); Standley in Contr. U. S. Nat. Herb. 23: 292. 1922, in Field Mus. Publ. Bot. 18: 451. 1937.

DISTRIBUTION: Forests of Costa Rica, at an altitude of about 1800 m.

COSTA RICA: Alajuela: San Francisco and San Pedro de San Ramón, *Brenes 6605* (fl., Ch); La Peña de Zarcero, *A. Smith H. 592* (fl., Ch). San José: near Quebradillas, about 7 km. north of Santa María de Dota, *Standley 42865* (sterile, US); vicinity of El General, *Skutch 4389* (fr., A, Ch); San Isidro del General, *Stork 3121* (fr., Ch); forests of El Copey, alt. 1800 m., Feb. 1898, *Tonduz 11713* (fl., ISOSYNTYPE of *H. costaricensis*, US). Cartago: Hills near Navarro Valley, *Stork 1713* (fl., fr., Ch).

NATIVE NAME: "Quizarrá" (Costa Rica).

Kostermans separates the syntypes of *Hufelandia costaricensis* and places *Pittier 1863* under *B. Anay*. He associates *Tonduz 11713* with *B. mexicana*. From the material at hand it appears that the latter syntype of *H. costaricensis* differs from the sheets of *B. mexicana* in its larger leaf-blades, which are less variable in size, and present a more coarse and very prominent reticulation. The usual type of reticulation found in the family is a dense net-work of veinlets with seemingly no free "terminals" visible beneath the microscope in the dried state. The leaves of *B. costaricensis* show the veinlets with prominent free ends or terminals apparently forming an incomplete reticulum, whereas those of *B. mexicana* follow the usual pattern of complete reticulation. The inflorescences of the former are longer, rather more densely flowered, and somewhat pubescent as opposed to the few-flowered, glabrous inflorescences of *B. mexicana*. The flowers of *B. costaricensis* are slightly larger and possess longer tubes; they are pilose and bear staminodia that are long-acuminate. The flowers of *B. mexicana* are almost glabrous, with acute or abruptly acuminate staminodia. The fruit of *Beilschmiedia costaricensis* is ellipsoid, whereas that of *B. mexicana* is constricted at the base, a character which may eventually prove to be a variation due to age.

I have not seen *Pittier 1863*, a syntype of *H. costaricensis*, the number about which Kostermans is uncertain, although he places it under *B. Anay*. From the original description by Mez and Pittier, one may note differences between their species and *B. Anay*. For example, the leaf-blades of *H. costaricensis* are glabrous, concolorous, and in the dried state customarily fuscous-brown, whereas those of *B. Anay* are glabrous except for a sordid puberulence along costa and lateral veins, and are green above and glaucous beneath. The flowers of *B. Anay* are larger than those of *Hufelandia costaricensis* and the staminodia are triangular-acuminate and short-stipitate as opposed to the cordate, very long-acuminate staminodia of the latter. The ovary of *H. costaricensis* is ovoid, developing into a perfectly ellipsoid fruit, scarcely constricted toward the base and attaining a size of 3 cm. × 1.2 cm. The subglobose ovary of *B. Anay* becomes an ellipsoid, pyriform, glossy-skinned fruit about 15 cm. long and similar in aspect to the avocado pear (*Persea americana*). The differences in leaf and flower may very possibly be variations within the species. The discrepancy in size and shape of fruit may be due to the stage of development at which the specimen was collected. Presumably, Kostermans was of this opinion when he combined the two under *B. Anay*.

5. **Beilschmiedia mexicana** (Mez) Kostermans in Rec. Trav. Bot. Néerl. 35: 846. 1938 (Meded. Bot. Mus. Utrecht 48: 846. 1938).

Hufelandia mexicana Mez in Jahrb. Bot. Gart. Berlin 5: 20. 1889.

DISTRIBUTION: Mexico, and south to Colombia according to Kostermans.

MEXICO: Vera Cruz: Cosalapa, *Purpus 8745* (fl., US); Mirador, *Liebmann 711 (Lauraceae 16),* Totula, *Liebmann 713 (Lauraceae 18)* (fr., ISOSYNTYPES, US); Orizaba, *F. Mueller 1460* (fr., SYNTYPE of *H. mexicana* not seen). Mexico: Dos Puentes, *Liebmann 712 (Lauraceae 20)* (sterile, ISOSYNTYPE, US), *Liebmann (Lauraceae 17, 19, 21)* (SYNTYPES not seen).

This rather small-leaved tree, according to Kostermans, occurs in Mexico, Costa Rica, and Colombia. He places *H. costaricensis,* as exemplified by *Tonduz 11713,* in this species. I have not seen the syntype from Orizaba, nor have I seen any Costa Rican or Colombian specimens which are a match for the Mexican material cited by Mez in his original publication. In the main, the glabrous branchlets, the small, typically minutely reticulate leaf-blades of varying size, the glabrous inflorescences shorter than the leaves, and the ellipsoid fruit set this species apart. For a discussion of the relationship with *H. costaricensis,* which was reduced by Kostermans, see the latter species.

6. **Beilschmiedia Steyermarkii,** sp. nov.

Arbor 18–24 m. alta, ramulis brunneis, subferrugineo-pubescentibus mox glabrescentibus, leviter sulcatis. Folia alternata, supra glabra, subtus sparse pubescentia costis exceptis, petiolis brunneis paulo crassis glabrescentibus leviter canaliculatis, ad 1.5 cm. longis et 2 mm. latis, laminis coriaceis, in sicco supra flavo-brunnescentibus subtus olivaceis, fide coll., supra viridibus subtus caeruleo-griseo-viridibus, ellipticis, ad 10 cm. longis et 3.7 cm. latis, basi cuneatis vel obliquis, apice rotundatis, penninerviis, costa subtus conspicua haud elevata, nervis lateralibus ad 7-paribus supra impressis plus minusve obscuris, subtus leviter elevatis angulo 45° divergentibus, subtus minute et inconspicue areolatis. Inflorescentia axillaris et subterminalis, paniculata, ad 8 cm. longa, leviter et sparse ferrugineo-tomentosa, mox glabrescens(?), pauciflora, pedunculata. Flores ad 3 mm. longi, pedicellis ad 2 mm. longis gracilibus, pubescentibus, perianthio campanulato flavo-viridescente, lobis ovatis nonnihil crassis pubescentibus, ad ±1.7 mm. longis; staminibus ser. I & II ±1.5 mm. longis antheris ovatis truncatis quam filamentis duplo longioribus, connectivo papilloso ⅓ auctis antherae longitudine, ser. III oblongis truncatis minute biglandulosis; staminodiis ±1 mm. longis late ovatis abrupte acuminatis subcordatis stipitatis, stipite pubescente; gynaecio glabro ad ±1.7 mm. longo, ovario ovoideo quam stylo longiore, stigmate inconspicuo parvo. Fructus ignotus.

DISTRIBUTION: Known only from type-locality.

GUATEMALA: Alta Verapaz: South of Cubilgüitz, alt. 300–400 m., March 4, 1942, *Steyermark 44494* (fl., TYPE, Ch) (tree 18–24 m.; leaves deep green above, blue-gray-green beneath; calyx yellow-green).

This single Guatemalan specimen described above is characterized by glabrescent elliptic coriaceous leaf-blades that are yellow-brown on drying, and by few-flowered sparsely pubescent inflorescences up to 8 cm. long. The lack of reticulation on the upper leaf-surface sets the species apart from other members of the genus.

7. **Beilschmiedia ovalis** (Blake), comb. nov.

Hufelandia ovalis Blake in Jour. Wash. Acad. Sci. **9**: 461. 1919; Standley in Field Mus. Publ. Bot. **18**: 451. 1937.

DISTRIBUTION: Costa Rica, known only from the type-locality.

COSTA RICA: Alajuela: Volcán de Poás, alt. 2300 m., March, *Pittier 2040* (fr., TYPE of *H. ovalis* not seen).

Kostermans has reduced Blake's species to synonymy under *B. sulcata.* Kostermans did not see any flowers of the type of *Laurus sulcata* R. & P., but he found no difference between the sterile specimen and other Peruvian and Colombian material cited by him (Kostermans in Rec. Trav. Bot. Néerl. 35: 850. 1938 [Meded. Bot. Mus. Utrecht 48: 850. 1938]). He explains the drawing of the type in Ruiz & Pavon, Laurographie, *t. 356,* showing 4-celled anthers, by bringing forward the possibility of the presence of cells in the ablastic part of the connective. Kostermans' conclusions may very possibly be correct, but it is difficult to accept them without more widely collected material than is available at present.

8. **Beilschmiedia Austin-Smithii** (Standley), comb. nov.

Persea Austin-Smithii Standley in Field Mus. Publ. Bot. **18**: 1552. 1938.

DISTRIBUTION: Known only from the type-locality.

COSTA RICA: Alajuela: Palmira, Alfaro Ruiz, in a little swale at the edge of the forest, in a sunny position with eastern exposure, growing on clay-loam, April 30, 1937, *A. Smith 4168* (fl., TYPE, Ch) (a rare but notable tree 9 m. high, with same expanse, the bark obscurely gray, thick and corky; base of trunk 2 m. in diam., the main trunk broken off, with 2 laterals 20 cm. in diam.; bud-cluster yellowish; open flowers dull yellow-brown; leaves moderately lustrous on the upper surface).

This species is unusual at once for its densely foliose branchlets with very short internodes and its rounded, ovate or suborbicular, very small leaf-blades, not more than 7 cm. long (almost the smallest to be found in the genus), the upper surface of which is not reticulate. The long-pedunculate, many-flowered, loosely sordidly tomentose panicles are shortly branched and equal the leaves. The flower-structure is typically that of *Beilschmiedia,* with the nine fertile anthers two-celled, and with a well developed connective, particularly on the anthers of the third series. The large subcordate staminodia and the characteristic gynaecium mark the species as belonging to this genus. A sterile specimen in the Yale School of Forestry Herbarium bearing the collector's number *3,* and the note that it was collected on Holstein Farm, Costa Rica, and sent presumably from the United Fruit Co., Sept. 9, 1938, may belong to this species.

7. Aiouea Aublet

Aiouea Aublet, Pl. Guian. **1**: 310, **3**: *t. 120.* 1775; Nees, Syst. Laurin. 362. 1836; Meissner in DC. Prodr. 15^1: 82. 1864; Mez in Jahrb. Bot. Gart. Berlin 5: 28. 1889; Kostermans in Meded. Bot. Mus. Utrecht **46**: 37. 1938 (Rec. Trav. Bot. Néerl. 35: 37. 1938).

DISTRIBUTION: Mostly in South America, with one species in the West Indies and two in Central America.

KEYS TO THE SPECIES OF AIOUEA

A. Largest leaf-blades usually not more than 12 (–13) cm. long and 6 cm. broad; apex obtuse or rounded (only very occasionally obtusely and shortly acuminate); reticulation very conspicuous beneath. . . . . 1. *A. costaricensis.*

A. Largest leaf-blades up to 16 (–18) cm. long and 7.5 cm. broad; apex obtusely and shortly acuminate; reticulation only slightly prominent beneath. . .2. *A. Lundelliana.*

1. **Aiouea costaricensis** (Mez) Kostermans in Meded. Bot. Mus. Utrecht 46: 73. 1938 (Rec. Trav. Bot. Néerl. 35: 73. 1938).

Bellota costaricensis Mez in Jahrb. Bot. Gart. Berlin 5: 27, *t.3, fig.24.* 1889; Standley in Field Mus. Publ. Bot. 18: 450. 1937.

Boldus costaricensis Kuntze, Rev. Gen. 2: 569. 1891.

Distribution: Costa Rica, in wet woods and along river-banks on volcano-slopes, at an altitude of 1600–2400 m.

Costa Rica: Alajuela: San Pedro de San Ramón, *Brenes 22563* (fl., fr., Ch); La Brisa de Zarcero, Alfaro Ruiz, *A. Smith P.C. 268* (fl., Ch), *H. 442* (fl., Ch); Zarcero, *A. Smith P. 2316* (fl., A); Palmira, Alfaro Ruiz, *A. Smith H. 681* (fl., Ch), *4169* (fl., Ch); La Ventolera, on the southern slope of Volcán de Poás, *Standley 34579* (fr., US). Heredia: Cerro de las Caricias, north of San Isidro, *Standley & Valerio 52072* (fl., US); bank of Río Segundo, mountains of Volcán de Barba, *Tonduz 1794* (fr., US). San José: Highest Carpintera, *Stork 1399* (fr., Ch); Santa Maria, *Stork 1735* (fr., Ch); Candelaria, *Hoffman 857* (fl., type of *Bellota costaricensis* not seen, photo. at GH); El Tablazo de San José, *Valerio 33* (fl., Ch). Cartago: Near Camp Empalme, *Little 6023* (fr., A, Y).

Native names: "Ira," "Ira colorado," "Ira rosa" (Costa Rica).

At the present time this is the second representative of the genus to be found in Central America or Mexico. It reaches a height of 12–18 m., with a base up to 40 cm. in diameter. Typically, the specimens show the yellowish green color of the alternate leaves noticeable even in the dried state, and the loose, coarse, conspicuous reticulation more prominent on the lower than on the upper surface. The dark brown, minutely appressed-pubescent branchlets become glabrous, gray-rugose with age. The coriaceous leaf-blades, early pubescent and glabrous at maturity, are obovate-elliptic to spatulate, with the apex rounded to obtuse or obtusely acute, occasionally emarginate, and the base acutish, decurrent into a thick minutely appressed-pubescent rugulose petiole up to 1 cm. in length. The margin is recurved and the midrib is thick, broadened at the base and exceedingly prominent beneath. The glabrous inflorescence is a loose panicle, 5–15 cm. long, bearing numerous pale yellow glabrous obconical flowers. The broad fleshy perianth-lobes are as long as or slightly exceed the tube. The three outer rows of stamens are fertile; those of the third and inner row are larger, extrorse, and biglandular. The fourth row, according to Kostermans, consists of three thin, sagittate, stipitate staminodia, inserted below the stamens as is typical of the genus. I have seen no staminodia in the flowering specimens which I have examined. The fruit is ellipsoid, up to 15 mm. long and ±8 mm. in diam., green, subtended by a red fleshy cupule approximately 1 cm. deep and broad, topped by six distinct teeth, the remnants of the perianth-lobes which have enlarged with the tube.

2. **Aiouea Lundelliana**, sp. nov.

Arbor 12–30 m. alta, ramulis brunneo-griseis rugosulis verruculosis. Folia alternata, verticillata, juventute ferrugineo-sericeo-pubescentia mox glabra, petiolis alatis crassis glabris canaliculatis, ad 2 cm. longis et 4 mm. latis, laminis supra glabris, subtus leviter et obscure pubescentibus, coriaceis, in sicco utrinque brunneis, obovato-ellipticis, ad 16 (–18) cm. longis et 7.5 cm. latis, basi attenuato-cuneatis, in petiolum decurrentibus ibique valde recurvatis, apice rotundatis vel late acutis vel abrupte late et obtuse acuminatis, interdum emarginatis, margine recurvatis, penninerviis, costa supra haud subtus conspicue et crasse elevata, nervis 7- vel 8-paribus supra obscure impressis subtus elevatis angulo 45° divergentibus, rete venularum supra obscurissimo subtus prominulo. Inflorescentia axillaris, late paniculata, ad 20 cm. longa, glabrescens, multiflora, longipedunculata. Flores ad 3 mm. longi, pedicellati, pedicellis ad 3 mm. longis, gracilibus, perianthio subcampanulato, flavescenti-viridescente, fragrante, lobis ± oblongis nonnihil membranaceis pubescentibus, ± 1.9 mm. longis; staminibus ser. I & II ± 1.25 mm. longis, antheris filamentis aequalibus, ser. III ± 1.7 mm. longis, antheris leviter angustioribus, interdum 4-locularibus; staminodiis nullis; gynaecio glabro ± 2.15 mm. longo, ovario ovoideo stylo aequali, stigmate parvo inconspicuo. Fructus immaturus(?) viridis, oblongus, 16 × 8 mm., cupula campanulata plus minusve verruculosa crasse 6-dentata glabra 6–7 mm. longa, 3 mm. lata, et 6 mm. diam. subtentus, pedicello incrassato glabro 3 (–5) cm. longo.

DISTRIBUTION: Panama, up to 2000 m. altitude.

PANAMA: Chiriquí: In shady moist habitat, Río Chiriquí Viejo Valley, near El Volcán, just above the house near Colton's coffe finca, August 10, 1938, *P. White 225* (fl., TYPE, Mo) (tree 12–15 m. tall, 30–35 cm. in diam.; flowers yellowish green, fragrant); vicinity of Cerro Punta, *P. H. Allen 1570* (fr., Ch, GH, Mo) (tree 30 m.); rain-forest, Bajo Chorro, Boquete, *Davidson 435* (fr., A, Ch, Mo).

This species differs from the Costa Rican entity in having larger leaf-blades (up to 16 [–18] cm. long and up to 7.5 cm. broad) that are abruptly, obtusely, and shortly acuminate, with the reticulation on the lower surface only slightly prominent. The leaf-blades of *A. costaricensis* are usually not more than 12 (occasionally 13) cm. long and not more than 5 (occasionally 6) cm. broad. The apex is obtuse or rounded, very seldom abruptly and obtusely shortly acuminate, and the reticulation is strikingly conspicuous beneath.

The species is named for Dr. C. L. Lundell, who has contributed much to our knowledge of Central American Lauraceae.

8. Aniba Aublet

Aniba Aublet, Pl. Guian. 1: *327*, 3: *t. 126.* 1775; Mez in Jahrb. Bot. Gart. Berlin 5: 50. 1889; Kostermans in Rec. Trav. Bot. Néerl. 35: 866. 1938 (Meded. Bot. Mus. Utrecht 48: 926. 1938).

Aydendron Nees & Martius in Linnaea 8: 36. 1833, p.p.; Nees, Syst. Laurin. 22, 245, 675. 1836; Meissner in DC. Prodr. 15¹: 88. 1864.

DISTRIBUTION: Tropical South America east of the Andes, principally, with one species in Mexico and two in the West Indies.

1. **Aniba mexicana** Kostermans in Rec. Trav. Bot. Néerl. 35: 926. 1938 (Meded. Bot. Mus. Utrecht 48: 926. 1938).

DISTRIBUTION: Known only from the type-collections, from Oaxaca.

MEXICO: Oaxaca: Cumbre de Teotalcingo, *Liebmann (Lauraceae 104)* (fr., SYNTYPE not seen); San Rafael (Cerro Espino), alt. 800 m., *Reko 3563* (fr., SYNTYPE, US).

I have seen only one syntype of this native Mexican tree of whose position in the genus Kostermans is uncertain. He describes it as having thick, somewhat angled branchlets, minutely pilose toward the apex, presently glabrescent, cylindrical branches cinereous, glabrous, and studded with frequent conspicuous lenticels, and yellowish-hirsute buds. The alternate glabrous chartaceous leaf-blades are elliptic, 14–24 × 5–8 cm., the base acutish, the margin recurved and undulate, the apex distinctly acuminate, often abruptly so, the acumen verging toward caudate. Their upper surface is opaque, greenish, almost smooth, the costa prominent, the lateral nerves barely so, as well as the reticulation. The lower surface is, according to Kostermans, almost shining, densely prominulous-reticulate, the costa strongly prominent, and the lateral nerves 12–15 pairs, erect-spreading-arcuate, and prominent. The glabrous scarcely canaliculate petioles, 10–12 (–20) mm. long, are blackish in contrast to the gray branchlets. As yet the flowers have not been seen. The infructescence is a glabrous pyramidal subterminal panicle up to 5 cm. long. The fruit is ovoid-subglobose, truncate at the base, smooth, mucronulate, up to 12 mm. long and 10 mm. broad, subtended by a thickened, woody, hemispherical, subglobose cupule which is minutely verrucose, sparsely ferruginous-maculate, smooth-margined, measuring up to 15 mm. long, 17 mm. in diam., and 10 mm. deep. The pedicels are obconical, about 5 mm. long and 6 mm. in diameter at the apex.

Kostermans mentions that his species is near *Aniba citrifolia,* differing in form and texture of the leaves, but places it under "species incertae sedis." There can be no doubt, however, that this species is an *Aniba*. The simple margin of the cupule removes it from *Licaria,* and the woody cupule subtended by a short equally woody pedicel precludes the possibility of its belonging to *Endlicheria* or to *Aiouea*.

9. Endlicheria Nees[1]

Endlicheria Nees in Linnaea **8**: 37. 1833 (non Presl), Syst. Laurin. 365. 1836; Meissner in DC Prodr. **15**[1]: 172. 1864; Kostermans in Meded. Bot. Mus. Utrecht **25**: 41. 1936, in Rec. Trav. Bot. Néerl. **34**: 532. 1937 (Meded. Bot. Mus. Utrecht **42**: 532. 1937).

Distribution: Tropical Central and South America, as well as the West Indian Islands.

1. **Endlicheria Browniana** Mez in Jahrb. Bot. Gart. Berlin **5**: 115. 1889; Kostermans in Rec. Trav. Bot. Néerl. **34**: 532. 1937 (Meded. Bot. Mus. Utrecht **42**: 532. 1937).
Aydendron macrophyllum Meissner in DC. Prodr. **15**[1]: 92. 1864.
Oreodaphne glomerata Seeman, Fl. Panama in Bot. Voyage H.M.S. Herald 193. 1854.

Distribution: Known only from Panama.

Panama: Bocas del Toro: Fish Creek Mts., vicinity of Chiriquí Lagoon, *von Wedel 2257* (♂ fl., Mo). Darién: Cape Corrientes, on the sea-coast, *Seemann 1094, 1094 bis* (♂, ♀, type of *O. glomerata* not seen).

This single representative of the genus *Endlicheria* in Central America is a tree 20 m. high, with thick, subterete branchlets minutely yellowish-appressed-tomentellous, and with buds densely sericeous-tomentellous (or tomentose). The alternate coriaceous broadly elliptic acute, somewhat obtuse or shortly acuminate leaf-blades are 22–40 cm. long and 10–15 cm. wide, early silvery-sericeous, subtended by a stout obscurely canaliculate sulcate petiole that measures 1–2 cm. long and is densely sericeous-tomentellous. The upper surface of the leaves is green, glabrous, and shining, with prominent venation and coarse loose reticulation. The slightly arcuate

[1]For complete synonymy and discussion of the name *Endlicheria,* see Kostermans in Meded. Bot. Mus. Utrecht 25: 41. 1936.

lateral nerves are 8 or 9 pairs. The lower surface, at first densely silvery-sericeous, later becomes more sparsely sericeous. The paniculate few-flowered sericeous-tomentellous inflorescence is axillary and up to 15 cm. long, with rather thick short peduncles, and with pedicels up to 2 mm. long. The ♀ flowers are pink, pilose, 2.5–3 mm. long, with an urceolate tube 1.5 mm. long, slightly constricted at the apex, and with the inner surface sericeous-tomentellous. The equal perianth-lobes are erect-spreading, fleshy, somewhat flat, narrowly ovate, acutish, 1.5 mm. long, with the inner surface tomentellous. The stamens are in 3 series, minute (0.75 mm. long), well developed, substerile. The anthers are ovate, acutish or truncate with the connective distinctly protruding beyond the small cells. The filaments are very short, broad, and densely pilose, with minute basal glands present on the third series. The ovary is very large, immersed in the perianth-tube, densely verruculose (sericeous-tomentellous), thickly ovoid, attenuate at the apex into a short style with a distinct discoid subtriangular stigma. The fruit is unknown, but the subtending cupule is subhemispherical, rather smooth, up to 11 mm. in diameter and 8 mm. high, merging into the obconical pedicel, which is 1 cm. long.

The von Wedel number certainly seems to be a staminate flowering specimen of this species. The locality is comparable, both being along the Atlantic sea-board. The leaves and branchlets are similar. The inflorescence unfortunately is past anthesis and the flowers are mostly unattached. However, one finds a flower cream-colored, according to the collector, which is infundibuliform, measuring about 3 mm. long, supported by a very slender pedicel up to 2.5 mm. long. The tube is slightly urceolate. The six equal perianth-lobes are thin, oblong, acutish, slightly pubescent without, and up to ±1.7 mm. long. The two outer series of stamens are ±0.8 mm. long, broadly ovate with an obtuse connective, sessile, the anther-cells located just above the middle of the anther seemingly introrse but with a tendency toward becoming lateral, their outer margins coinciding with the margin of the anther. The stamens of the inner series are ±1 mm. long, ovate, but the apex almost narrowly truncate, the connective scarcely protruding, the extrorse sublateral cells located near the apex of the anther. The interior of the well-developed perianth-tube is so mucilaginous that it is difficult to separate the individual structures. No ovary or staminodia were seen.

10. **Cryptocarya** R. Brown

Cryptocarya R. Brown, Prodr. Fl. Nov. Holl. 1: 402. 1810; Nees in Wall. Pl. As. Rar. 2: 61, 69. 1831, Syst. Laurin. 192, 205. 1836; Meissner in DC. Prodr. 15[1]: 68. 1864; Kostermans in Rec. Trav. Bot. Néerl. **34**: 557. 1937 (Meded. Bot. Mus. Utrecht **42**: 557. 1937) [footnote noting a motion pending conservation of *Cryptocarya*].

DISTRIBUTION: Tropics of both hemispheres, with less than a dozen known species in South America, Central America, and Mexico.

KEY TO THE SPECIES OF CRYPTOCARYA

A. Leaf-blades elliptic, obtusely acuminate, not longer than 12.5 cm., the base cuneate; lateral nerves up to 8 pairs; reticulation apparent throughout...1. *C. Kostermansiana.*

A. Leaf-blades oblong, more or less sharply acuminate, the base cuneate or subcordate; lateral nerves up to 12 pairs; no reticulation apparent............*2. C. Hintonii.*

1. **Cryptocarya Kostermansiana**, sp. nov.

Arbor 8 m. alta, ramulis fuscis angulatis pallide ferrugineo-tomentosis mox sparse pubescentibus. Folia alternata vel subopposita, petiolis gracilibus pubescentibus ad 1.5 cm. longis et 2 mm. latis, laminis juventute sparse pubescentibus, mox glabris, pergamentaceis, subcoriaceis fide coll., concoloribus, ellipticis, ad 12.5 cm. longis et 5 cm. latis, basi cuneatis apice leviter et obtuse subacuminatis, penninerviis, costa nervis lateralibus ad 8-paribus, supra obscuris subtus satis elevatis, rete venularum utrinque tenui. Inflorescentia axillaris, paniculata, ad 10 cm. longa, minute et sparse pubescens, pedunculo ad 4 cm. longo glabrescente. Flores ad 3 mm. longi, pedicellis brevibus 1 mm. vel minus longis pubescentibus, perianthio subcampanulato pallide viridescente pubescente, tubo urceolato, lobis ovatis plus minusve crassis, pubescentibus, marginibus hyalinis, ± 1.25 mm. longis; staminibus ser. I & II ± 0.8 mm. longis, antheris ovatis quam filamentis duplo longioribus, ser. III ± 1.25 mm. longis, biglandulosis, connectivo subtruncato auctis; staminodiis ovato-acuminatis sessilibus pubescentibus, ± 0.8 mm. longis; gynaecio glabro ad ± 1.9 mm. longo, ovario ovoideo stylo aequali, stigmate obtuso inconspicuo. Fructus ignotus.

Distribution: Known only from the type-locality.

Costa Rica: Alajuela: Naranjo, in reddish clay-loam on grave-site with nearly open exposure, alt. 1150 m., Feb. 24, 1940, *A. Smith P. 2418* (fl., type, A) (tree 8 m., with trunk-base 30 cm., erect, the crown expanded, the bark light brown, finely granulate; leaves subcoriaceous, semi-rigid, dark green, opaque, glabrous, the venation rather faint; perianth campanulate, pale green, the pedicel and ovary bright green).

This species superficially resembles *Aiouea costaricensis,* but it is easily separated by the presence of staminodia and by the urceolate tube of the perianth. Although there is no doubt that this species belongs to the genus *Cryptocarya,* there is nothing very distinctive or characteristic about it as an entity. It is easily separable from the only other species from this region by the leaves. *Cryptocarya Hintonii* has definitely oblong leaf-blades much larger (to 20 cm.) and more or less cordate at the base.

The species is named for Dr. A. J. G. H. Kostermans, who has done more exhaustive work on the Lauraceae than any taxonomist of this century.

2. **Cryptocarya Hintonii**, sp. nov.

Arbor magna, ramulis rubescentibus leviter subpruinosis, mox fuscescentibus vel griseis, minute sed conspicue lenticellatis, rugosulis, glabris. Folia alternata, petiolis gracilibus glabris rubescentibus canaliculatis ad 1.5 cm. longis et 1.5 mm. latis, laminis utrinque glabris, leviter coriaceis, in sicco brunneis, oblongis, ad 20 cm. longis et 5 cm. latis, basi cuneatis vel saepe subcordatis, apice acuminatis, penninerviis, costa supra conspicue impressa, subtus crasse elevata, nervis lateralibus plus minusve 12-paribus, supra obscuris subtus obscurissimis, rete venularum utrinque obscuro. Inflorescentia ignota. Infructescentia nonnihil paulo incrassata, ad 8 cm. longa, rubescens, glaber. Fructus niger, lucidus, ellipticus, 22 $\times$ 16 cm., basi rotundatus, apice mucronatus, pedicello paulo incrassato rubescente ad 1 cm. longo, apice 2 mm. diam. expanso, insidens.

Distribution: Known only from the type-locality.

Mexico: Michoacán: Woods of Sierra Naranjillo, Coalcomán, alt. 1400 m., May 5, 1939, ***Hinton 13737*** (fr., TYPE, GH) (large tree; leaves poisonous to cattle?; flowers collected from same tree).

NATIVE NAME: "Ucaz."

This *Cryptocarya* from Mexico very distinctly recalls members of the genus found in the Pacific. Hinton speaks of flowers having been collected from the same tree. Unfortunately there were no flowers with the number at the Gray Herbarium. The habit and fruit bespeaks the genus *Cryptocarya*. Various characteristics easily separate the entity from the only other *Cryptocarya* from the area under study at the present time.

11. Licaria Aublet

Licaria Aublet, Pl. Guian. **1:** 313, **3:** *t. 121.* 1775; Kostermans in Meded. Bot. Mus. Utrecht **42:** 575–604. 1937 (Rec. Trav. Bot. Néerl. **34:** 575–604. 1937).

Misanteca Schlechtendal & Chamisso in Linnaea **6:** 367. 1831.

Acrodiclidium Nees, Laur. Expos. 13. 1833; Kostermans in Meded. Bot. Mus. Utrecht **37:** 719–754. 1936 (Rec. Trav. Bot. Néerl. **33:** 719–754. 1936).

Chanekia Lundell in Phytologia **1:** 177. 1937.

DISTRIBUTION: Mexico, Central and South America.

KEY TO THE SPECIES OF LICARIA

A. Leaf-blades caudate-acuminate.
- B. Leaf-blades 5–9.5 (–10.5) × 1.6–3.2 cm., lanceolate-oblong; petioles grayish-pubescent; inflorescences 2–3.5 cm. long; flowers white.......... 1. *L. caudata.*
- B. Leaf-blades 8–12 × 3–4 cm., elliptic; petioles glabrous; inflorescences 5–11 cm. long; flowers red at the base, yellow at the apex.......... 2. *L. Cufondontisii.*

A. Leaf-blades acuminate in varying degrees.
- B. Largest leaf-blades not less than 14 cm. long.
  - C. Inflorescences not in heads.
    - D. Lower surface of leaf-blades, petioles, and branchlets not heavily and conspicuously tomentose.
      - E. Largest leaf-blades up to 25 cm. long.
        - F. Panicles rusty-tomentellous; petioles up to 23 mm. long.......... 3. *L. excelsa.*
        - F. Panicles glabrous; petioles not more than 20 mm. long.......... 4. *L. glaberrima.*
      - E. Largest leaf-blades not more than 15 cm. long.
        - F. Lateral nerves diverging from the costa at an angle of ± 35°; apex usually sharply acuminate.......... 5. *L. Pittieri.*
        - F. Lateral nerves diverging from the costa at an angle of ± 45°; apex usually not sharply acuminate.......... 6. *L. Cervantesii.*
    - D. Lower surface of leaf-blades, petioles, and branchlets heavily and conspicuously tomentose.......... 7. *L. Peckii.*
  - C. Inflorescences in heads.......... 8. *L. capitata.*
- B. Largest leaf-blades not more than 12 cm. long.
  - C. Leaf-blades entirely glabrous, heavily coriaceous.......... 9. *L. coriacea.*
  - C. Leaf-blades pubescent beneath, more or less coriaceous.
    - D. Lower surface of leaf-blades and branchlets reddish brown-tomentose; petioles densely tomentose, 6 mm. long.......... 10. *L. mexicana.*
    - D. Lower surface of leaf-blades and branchlets appressed-whitish-sericeous, if at all pubescent; petioles finely minutely pubescent, usually 4–8 cm. long.......... 11. *L. campechiana.*

A. Leaf-blades acute or obtuse.
- B. Leaf-blades lanceolate (attenuate), not more than 2 cm. broad, coriaceous, the margin not crisped.......... 12. *L. lucida.*

B. Leaf-blades elliptic to (rarely) subobovate, up to 4.5 cm. broad, more or less chartaceous, the margin more or less crisped..................13. *L. misantlae.*

1. **Licaria caudata** (Lundell) Kostermans in Meded. Bot. Mus. Utrecht 42: 596. 1937 (Rec. Trav. Bot. Néerl. 34: 596. 1937).

Chanekia caudata Lundell in Phytologia 1: 178. 1937.

Acrodiclidium caudatum Lundell in Amer. Midl. Nat. 19: 428. 1938.

DISTRIBUTION: Forests of British Honduras, at an altitude of about 600 m., and adjoining Guatemala.

BRITISH HONDURAS: El Cayo: Arenal-Valentin road, in advanced forest, June–Aug. 1936, *Lundell 6183* (fl., ISOTYPE of *Chanekia caudata,* GH, NY) (tree 7 m., diam. 7.5 cm.; fls. white). Toledo: Camp 32, British Honduras-Guatemala Survey, *Schipp 1279* (fl., fr., A, GH, NY). GUATEMALA: Izabal: Bay of Santo Tomás, between Escobas and Santo Tomás, *Steyermark 39355* (fr., Ch); along Río Bonita, *Steyermark 41713* (fr., Ch).

This species is seemingly closely related to *Licaria Cufodontisii,* from Costa Rica, although the type of the latter is not available at present. The leaf-blades of *L. caudata,* however, usually measure less than 10 × 3.2 cm., are lanceolate-oblong, borne on petioles covered with a whitish pubescence, and the white-flowered inflorescences are never longer than 3.5 cm. On the other hand, the elliptic leaf-blades of *L. Cufodontisii* attain a length of 12 cm. and a width of 4 cm., and are borne on glabrous petioles, while the inflorescences are up to 11 cm. in length, bearing flowers which are red at the base and yellowish at the apex. The fruits of *L. caudata* are borne in cupules which measure about 4.5 mm. deep and flare about 1 cm. in diameter, the double margins being rather inconspicuous. The enlarged pedicel is up to 5 mm. long and increases from 1 mm. in diameter at the base to over 2 mm. at the apex. The cupule (to 7 mm. deep) of *L. Cufodontisii* is conspicuously though shallowly double-margined, the outer margin undulate. The cupule is subtended by a slender pedicel, enlarged to 3–4 mm. at the apex and up to 1 cm. long. Another superficial resemblance is noted between *L. caudata* and *L. coriacea* and is discussed under the latter species.

2. **Licaria Cufodontisii** Kostermans in Meded. Bot. Mus. Utrecht 42: 591. 1937 (Rec. Trav. Bot. Néerl. 34: 591. 1937).

Acrodiclidium Cufodontisii Lundell in Amer. Midl. Nat. 19: 428. 1938.

DISTRIBUTION: Costa Rica, known only from the vicinity of the type-locality.

COSTA RICA: Puntarenas: Peninsula Osa near Golfo Puerto Dulce, around Puerto Jiminez, on banks toward Sto. Domingo, *Cufodontis 187* (fl., TYPE not seen) (fl., Apr.); margins of tidal estuary between Puerto Jiminez and Sto. Domingo de Osa (Puerto Viejo), *Brenes 12262* (fl., Ch); Nicoya, *Tonduz 13863* (fr., GH).

Fructus ellipsoideus, in sicco nigrescens, cupula vadosa ad 8 mm. alta, 12 mm. diam., margine duplice et inconspicue valde proximo, exteriore leviter undulato, interiore integro, pedicellis crassis, apice 3 mm., 1.5 cm. longis.

Kostermans remarks that this species is near *L. triandra,* from the West Indies, differing in form and texture of the leaves and floral characters. The following differences between these two species are noted. The leaf-blades of the West Indian species are ovate- (rarely) or lanceolate-elliptic, subtended by petioles 10–14 mm. long, whereas the leaf-blades of the Costa Rican species are elliptic, with petioles less than 8 mm. in length. The pedicels of *L. triandra* are thickish, slightly pilose, becoming glabrous, 1.5 mm. long, as opposed to the slender, minutely and loosely cinereous-tomentellous pedicels, up to 3 mm. long, found in *L. Cufodontisii*. The flowering specimen of Brenes answers the description by Kostermans very well. The fruiting specimen differs only in the leaf-blades being more leathery and more robust. Both of these numbers show leaf-blades with a tendency toward an undulate margin. The fruit is ellipsoid, up to 12 mm. long, subtended by a shallow flaring cupule up to 8 mm. deep and to 12 mm. in diameter. The double margin is inconspicuous, the outer being only about 1 mm. lower than the upper and only slightly undulate. The pedicels are enlarged to 1.5 cm. long and 3 mm. broad at the apex.

Tonduz, on his label of no. *13863,* states that this number represents the fruiting specimen of no. *13809,* also from Nicoya. The latter is definitely a flowering specimen of *Ocotea veraguensis*. Its leaf-shape and venation, as well as its inflorescences, are entirely different from those of *Tonduz 13863*.

3. **Licaria excelsa** Kostermans in Meded. Bot. Mus. Utrecht **42**: 595. 1937 (Rec. Trav. Bot. Néerl. **34**: 595. 1937).

Acrodiclidium excelsum Lundell in Amer. Midl. Nat. **19**: 428. 1938.

DISTRIBUTION: Panama and adjacent Costa Rica.

COSTA RICA: Alajuela: Cataracts of San Ramón, *Brenes 13523* (fl., Ch). PANAMA: Chiriquí: Southern slope of the mountain in moist forest, Cerro de la Horqueta, near castle of Las Siguas, in 1911, *Pittier 3200* (fr., ISOTYPE, Ch) (large tree); rain-forest of Bajo Chorro, Boquete, *Davidson* 361 (fr., Ch).

NATIVE NAME: "Siguaton" (Panama).

This is one of the largest-leaved species to be found in Mexico and Central America. A large tree, the branchlets are thick, glabrous, almost shining, borne on smooth gray branches; the rigidly coriaceous leaf-blades also are glabrous and almost shining, elliptic, 20 (–24) × 5.5 (–8) cm., acuminate and shortly acute at the base. The stout glabrous petiole measures up to 23 mm. long. The axillary panicle, densely ferruginous-sericeous-tomentellous before anthesis, lengthens in fruit to 15 cm. and becomes glabrous. The fruit is smooth, ellipsoid-ovoid, subtended by a cupule almost hemispheric-cylindrical, 20 mm. high, 25 mm. in diameter, and 16 mm. deep, with an obscurely double margin. The outer margin is entire and thickened, the inner, extending less than 2 mm. above the outer, is thinner, exhibiting a tendency at intervals to split toward the base. The pedicels become enlarged up to 15 mm. long and 10 mm. diameter at the apex.

4. **Licaria glaberrima** (Lundell), comb. nov.

Acrodiclidium glaberrimum Lundell in Lloydia **4**: 46. 1941.

DISTRIBUTION: Mexico, known only from the type-locality.

MEXICO: Chiapas: Volcán de Tacaná, on north side, alt. 2100 m., April 2, 1939, *Matuda 2981* (fl., TYPE, Mich).

The complete glabrosity, coupled with just about the largest leaves known for the genus in this area, immediately sets this species apart. The coriaceous elliptic leaf-blades measure over 25 cm. long and up to 10 cm. broad, are acuminate, almost shining above and densely and very conspicuously reticulate beneath. The costa and lateral nerves are comparatively inconspicuous above, being either flush with the surface or slightly impressed. On the lower surface they are elevated and exceedingly prominent. The sturdy petioles, up to 2 cm. long, as well as the striate shining branchlets, are dark brown. No close affinity of this species has been discovered thus far.

5. **Licaria Pittieri** (Mez), comb. nov.

Misanteca Pittieri Mez in Bull. Herb. Boiss. II: 3: 230. 1903; Standley in Field Mus. Publ. Bot. 18: 452. 1937.

Misanteca costaricensis Johnston in Contr. Gray Herb. n. s. 70: 70. 1924.

DISTRIBUTION: Known only from Costa Rica.

COSTA RICA: Alajuela: Hills of San Pedro de San Ramón, *Brenes 5023, 5489* (fr., Ch); hills of Santiago, near San Ramón, alt. 1100 m., June 1, 1901, *Brenes 14403* (fl., type of *M. costaricensis,* GH) (tree 8–10 m.); woods above San Ramón, *Tonduz 17589* (fr., US). San José: Vicinity of Zapote, *Standley 40238* (fr., US); Santa María, *Stork 2332* (fl., Ch); Hacienda Belmira, near Santa María, alt. 1450 m., Jan. 1898, *Tonduz 11612* (fr., ISOTYPE of *M. Pittieri,* GH, US).

NATIVE NAME: "Quizarrá" (Costa Rica).

Kostermans includes both *M. costaricensis* and *M. Pittieri* under *Licaria limbosa,* a South American species. Although there is no specimen of the latter at hand, the fairly accurate drawing of *Laurus limbosa,* its basis, in Ruiz & Pavon, Flora Peruviana Laurographia, *plate 361,* shows the species to have a cupule with a less markedly double edge than the cupule of *L. Pittieri.* Also, the lateral nerves of the South American species are more arcuate than those of the Costa Rican specimens. The inflorescence of our species differs from that of *L. limbosa,* the axillary panicles of the latter ranging from 4 to 7 cm. in length. The distinctly subterminal panicles of *L. Pittieri* measure about 15 cm. long and 6–12 cm. broad.

6. **Licaria Cervantesii** (H.B.K.) Kostermans in Meded. Bot. Mus. Utrecht 42: 587. 1937 (Rec. Trav. Bot. Néerl. 34: 587. 1937).

Laurus Cervantesii H.B.K. Nov. Gen. & Sp. 2: 134 [169]. 1817.

Misanteca Juergensenii Mez in Jahrb. Bot. Gart. Berlin 5: 102. 1889; Standley in Contr. U. S. Nat. Herb. 23: 292. 1922.

Acrodiclidium Cervantesii Lundell in Amer. Midl. Nat. 19: 428. 1938.

DISTRIBUTION: Southern Mexico, along the coast, Guatemala, and British Honduras, at 250–750 m. altitude.

MEXICO: Guerrero: In mountains near Masatlán (Mazatlán), alt. 990 m., *Humboldt & Bonpland* (fr., photo. of TYPE of *Laurus Cervantesii,* Ch, NY); near Chilpancinao, Las Cajones, Acapulco, *Gamon 22* (fr., Y); Montes de Oca, Vallecitos, *Hinton 10194* (fl., fr.), *10273* (fr.), *10290* (fl.), *10291* (fr., GH). Oaxaca: Near Pinotepa, *Juergensen 176, 177* (syntypes of *Misanteca Juergensenii* not seen); Chinantla, Choapán, *Galeotti 260* (fl., fr., isosyntype of *Misanteca Juergensenii,* US); Juquila, Río Mapache, near Tepenixtlahuaca, *Conzatti 4366* (fr., US); Pochutla, Magdalena, *Conzatti, Reko & Makrinius 3205* (fr., GH); from Río Verde to Panixtlahuaca, *Nelson 2383* (fr., Ch); between Juquila and Nopala, *Nelson 2412* (fr., Ch). GUATEMALA: Alta Verapaz: Matacui, *J. D. Smith 1650* (fl., fr., US); near Tucurú, *Standley 70718* (fr., Ch). BRITISH HONDURAS: Belize: Belize River, *Record B.H. 51 (Y 8819)* (fr., NY, Y).

NATIVE NAMES: "Aguacatillo" (Guerrero); "Ahuacatillo" (Oaxaca).

Kostermans states that this species is very difficult to distinguish from *L. limbosa* of South America, the only difference being the free glands of the flower. Since he included *Misanteca costaricensis* and *M. Pittieri* (in my opinion a single species) under *L. limbosa*, it is sufficient at this time to mention the points of difference between *L. Cervantesii* and the Costa Rican entity. As one may note, the latter has a longer and a subterminal inflorescence as opposed to the short axillary panicles of *L. Cervantesii*. The Costa Rican species shows leaf-blades with the apex sharply acuminate and with lateral nerves diverging at an angle of about 34°, as opposed to the more broadly acuminate apex and nerves diverging at an angle of about 45° to be found in the leaf-blades of *L. Cervantesii*. The cupule of the latter species is on the whole more shallow (1 cm. long) and the entire inner margin often extends about 5 mm. above the outer deeply lobed margin. In the case of *L. Pittieri*, the cupule measures nearly 1.5 cm. long and the inner margin is about 2 mm. higher than the outer shallowly lobed margin. At maturity the exposed portion of the fruit of *L. Cervantesii* is longer than the subtending cupule, whereas the exposed portion of the fruit of *L. Pittieri* equals or measures less than the length of the cupule.

7. **Licaria Peckii** (Johnston) Kostermans in Meded. Bot. Mus. Utrecht **42**: 597. 1937 (Rec. Trav. Bot. Néerl. **34**: 597. 1937).

Misanteca Peckii Johnston in Contr. Gray Herb. n.s. **70**: 70. 1924.

Chanekia Peckii Lundell in Phytologia **1**: 178. 1937.

Acrodiclidium Peckii Lundell in Amer. Midl. Nat. **19**: 428. 1938.

DISTRIBUTION: Guatemala and British Honduras.

GUATEMALA: Petén: La Libertad and vicinity, *Aguilar 242* (fl., A, NY); Uaxactún, *Bartlett 12214* (fl., fr., A, NY, US), *12236* (fr., NY, US), *12550* (fl., NY, US); Carmelita, 1 m. south of village, on trail to Flores, *Egler 42–223* (fr., Ch); Chimah, *Lundell 3435* (fr., A, Ch); Cerro Ceibal (Chorro Ceibal or Cerro San Martín), between mouth of Río Santa Mónica and mouth of Río San Martín, on left side of Río Cancuen (west side of river going downstream), *Steyermark 46059* (fr., Ch); *46134* (fl., Ch). Alta Verapaz: La Tinta, *Maxon & Hay 3346* (fr., NY); woods between Finca Cubilgüitz and Hacienda Yaxcabanal, *Steyermark 44836* (fr., Ch); savanna north of Concepción, 3–5 miles southeast of Finca Yalpemech, near Alta Verapaz-Petén boundary line, *Steyermark 45236* (fr., Ch); vicinity of Finca Yalpemech, near Alta Verapaz-Petén boundary line, *Steyermark 45295* (fl., Ch). Izabal: Open slopes, vicinity of Quiriguá, *Standley 23764* (fl., NY); Río Dulce, between Livingston and 6 miles up river, on north side (right hand side going up river), *Steyermark 39406* (fl., Ch); Río Dulce, 2–4 miles west of Livingston, on south side (left hand side going up river), *Steyermark 39556* (fl., fr., Ch). BRITISH HONDURAS: Without locality, in 1905–07, *M. E. Peck 826* (fl., fr., TYPE of *M. Peckii* not seen). El Cayo: El Cayo and vicinity, *Chanek 140* (fl., Ch); Vaca, *Gentle 2341* (fr., A); Retiro, *Lundell 6315* (fr., GH, NY). Stann Creek: Freshwater Creek Reserve, *Pelly 2, 26 (Y. 23716)* (fr., Ch), *Stevenson V* (fr., Ch).

NATIVE NAME: "Senk-cul" (Guatemala).

Licaria Peckii is truly one of the most striking species of the family in Central America. The chartaceous, oblong, obovate-oblong, or sometimes elliptic leaf-blades show the midrib and lateral nerves deeply impressed above (with no noticeable reticulation), and elevated and pubescent beneath. The loose few-flowered racemose inflorescences with long peduncles stand out because of their thick covering of light brownish villous-hirsute pubescence. The same pubescence persists on the young branchlets also. The flowers themselves are unusual in being depressed, broad, and rather fleshy. The fruiting pedicel is more slender than is usually the case in the genus and the double-margined cupule is thinner and comparatively smooth on the outer surface.

8. **Licaria capitata** (Schlechtendal & Chamisso) Kostermans in Meded. Bot. Mus. Utrecht **42**: 592, *fig. 5*. 1937 (Rec. Trav. Bot. Néerl. **34**: 592. 1937).

Misanteca capitata Schlechtendal & Chamisso in Linnaea **6**: 367. 1831; Standley in Contr. U. S. Nat. Herb. **23**: 292. 1922, in Trop. Woods **21**: 17. 1930, in Field Mus. Publ. Bot. **10**: 200. 1931; Standley & Record in Field Mus. Publ. Bot. **12**: 142. 1936; Yuncker in Field Mus. Publ. Bot. **9**: 290. 1940.

Acrodiclidium glabrum Brandegee in Univ. Calif. Publ. Bot. **6**: 497. 1919.

Acrodiclidium capitatum Lundell in Amer. Midl. Nat. **19**: 428. 1938.

DISTRIBUTION: Southern Mexico, Guatemala, Honduras, and British Honduras.

MEXICO: Without locality, *Kerber 410* (fl., US). San Luis Potosí: Tamazunchale, *C.L. & A.A. Lundell 7129* (fr., NY). Vera Cruz: Huasteca, Wartenberg, near Tantoyuca, *Ervendberg 375* (fl., fr., GH); Jicaltepec, *Liebmann (Lauraceae 107)* (fr., US); Taso del Correo ad Río Tecoluta, *Liebmann 730 (Lauraceae 111)* (fr., GH); Barranca de Tenampa, Zacuapán, Sept. 1906, *Purpus 2068* (fr., isosyntype of *Acrodiclidium glabrum*, GH, NY, US), *Purpus 2354* (fl., GH, NY, US); Corral de Piedras, *Purpus 7802* (fl., fr., A, GH, NY, US), *Purpus 8096* (syntype of *Acrodiclidium glabrum* not seen), *Purpus 8143* (fr., isosyntype of *Acrodiclidium glabrum*, GH, NY), *Purpus 12050* (fr., A, NY); Misantla, *Schiede & Deppe 1148* (fl., fr., TYPE of *Misanteca capitata* not seen). Oaxaca: Between San Carlos and Pantanillo, Cordillera Centro-occidental, *Liebmann (Lauraceae 10)* (fr., US), *Liebmann 729 (Lauraceae 110)* (sterile, US); Tuxtepec, Chiltepec and vicinity, *Martínez-Calderón 123, 555* (fr., A). GUATEMALA: Alta Verapaz: Cubilgüitz, *von Tuerckheim (J.D.Smith 7885)* (fl., fr., GH, NY, US), *4085* (fl., US). HONDURAS: Atlántida: Vicinity of Tela, *Standley 54729* (fr., A, US); Lancetilla Valley, near Tela, *Standley 55798* (sterile, A, US); vicinity of La Ceiba, along Danto River, slopes of Mt. Cangrejal, *Yuncker, Koepper & Wagner 8716* (fr., GH, NY, US). Yoro: Sierra de Sulaco, *C. & V. W. von Hagen 1032* (sterile, NY); Pijol, Subirana, *C. & V. W. von Hagen 1327* (sterile, NY). BRITISH HONDURAS: El Cayo: Vaca, *Gentle 2412* (fl., A); Valentin, Camp 6, *Lundell 6408* (fr., GH, NY, US), *6539* (fr., GH, NY); Chalillo Crossing-Cohune Ridge Road, *Lundell 6551* (sterile, NY). Toledo: *Peck 802* (fl., GH); "Eldorado," Punta Gorda, *Schipp 990* (fr., A, GH, NY).

NATIVE NAMES: "Laurel," "Palo misanteco" (Vera Cruz); "Laurel de la Sierra" (Oaxaca); "Aguacatillo" (Honduras).

Probably the best known and most easily recognized species in the genus is *Licaria capitata*. Whether in flower or in fruit the long-pedunculate compact heads are distinctive. The very large (up to 25 × 10 cm.) elliptic acuminate leaf-blades are heavily coriaceous, usually more or less obscurely reticulate and shining above.

9. **Licaria coriacea** (Lundell) Kostermans in Meded. Bot. Mus. Utrecht **42**: 604. 1937 (Rec. Trav. Bot. Néerl. **34**: 604. 1937).

Chanekia coriacea Lundell in Phytologia **1**: 179. 1937.

DISTRIBUTION: In mountains and along river-banks of eastern Guatemala and western British Honduras.

GUATEMALA: Izabal: Bank of Río Dulce, *C.L. Wilson 376* (fl., Ch); along Río Dulce below junction with Río Tameja, *Steyermark 42015* (fl., Ch). Zacapa: Between Cerro de Monos and upper slopes of Monte Vergin, *Steyermark 42872* (fl., Ch). BRITISH HONDURAS: Toledo: Camp 31, British Honduras-Guatemala Survey, occasional in shady valley, also on hilltop in open places, alt. 630 m., Feb. 22, 1934, *Schipp 1282* (fr., ISOTYPE of *Chanekia coriacea*, A, GH, NY) (small tree 9 m., 22.5 cm. in diam.; flowers white; fruits black with red pedicels).

Kostermans, with only fruiting material at hand, identified this species with *L. triandra* of the West Indies; but he felt sure that it is a different entity because of its locality. If we may ignore the difference occasioned by the extremely coriaceous texture of the leaf-blades and a more acuminate rather than caudate-acuminate apex, there is apparent a striking similarity between this species and *L. caudata*, both described from approximately the same locality. *Schipp 1279*, cited by Lundell under *Chanekia caudata*, was collected very near the type-number of *L. coriacea*. The reticulation and venation of the leaf-blades of the two species is similar, as well as the bark of the branchlets. However, there is attached to the Gray Herbarium sheet of *L. caudata* (no. *1279*) an old fruit which definitely separates this species from *L. coriacea*. The fruit of the latter is ellipsoid, about 1.7 × 1.2 cm., abruptly short-apiculate, subtended by a shallow accrescent obviously double-margined verrucose cupule, 1.6–2.3 cm. in diam. and 1 cm. long, borne on a thick short peduncle not more than 3 cm. long, according to Lundell. The peduncles of the fruit on the Gray and Arnold specimens are not more than 1 cm. long. The old fruit of *L. caudata* is ellipsoid-ovoid and apiculate, 8–10 cm., subtended by a flat shallow slightly double-margined cupule, about 9 mm. in diam. and 2–3 mm. long, borne on a very slender, branched peduncle about 2 cm. long and 0.5 mm. thick.

10. **Licaria mexicana** (Brandegee) Kostermans in Meded. Bot. Mus. Utrecht **42**: 599. 1937 (Rec. Trav. Bot. Néerl. **34**: 599. 1937).

Acrodiclidium mexicanum Brandegee in Univ. Calif. Publ. Bot. **6**: 497. 1919.

Chanekia mexicana Lundell in Phytologia **1**: 181. 1937.

DISTRIBUTION: Known only from type-locality, and vicinity, in Mexico.

MEXICO: Vera Cruz: Zacuapán and vicinity, Nov. 1906, ***Purpus** 2293* (fr., Ch, GH); near Tlacoquintla, June 1917, *8081* (fl., ISOTYPE of *A. mexicanum*, A, Ch, GH), *8164* (fl., GH, NY, US), *8430* (fl., GH, NY, US), *8781* (fr., GH), *14335* (fl., fr., A).

The reddish brown tomentum clothing the lower leaf-surface, petioles, branchlets, and long peduncles of the inflorescence offers a good diagnostic character for the species. The branchlets are densely foliose. The small (8 × 2.5 cm.) oblong or elliptic leaf-blades are shortly petioled, and the slender paniculate inflorescences (about 7 cm. long and less than 1.5 cm. broad) are supported by long peduncles nearly 5 cm. in length. The fruit is subtended by a cupule whose margins approximate each other. The outer thickened and slightly undulating margin is usually shorter than the thin and entire inner margin.

11. **Licaria campechiana** (Standley) Kostermans in Meded. Bot. Mus. Utrecht **42**: 599. 1937 (Rec. Trav. Bot. Néerl. **34**: 599. 1937).

Phoebe campechiana Standley ex Lundell in Carnegie Inst. Wash. Publ. **436**: 312. 1934, nomen nudum.

Ocotea campechiana Standley in Carnegie Inst. Wash. Publ. **461**: 56. 1935; Standley & Record in Field Mus. Publ. Bot. **12**: 143. 1936.

Misanteca campechiana Lundell in Carnegie Inst. Wash. Publ. **478**: 209. 1937.

Chanekia campechiana Lundell in Phytologia **1**: 178. 1937.

Acrodiclidium campechiana Lundell in Amer. Midl. Nat. **19**: 428. 1938.

DISTRIBUTION: Mexico, Guatemala, and British Honduras.

MEXICO: Campeche: Tuxpeña, Feb. 6, 1932, ***Lundell** 1295* (fl., ISOTYPE of

Ocotea campechiana, GH, NY) (large tree), *Lundell 1380* (fl., Ch, GH, NY). Guatemala: Petén: La Libertad, *Lundell 3065* (fl., A), *3359* (fl., Ch, GH), *3409* (fl., Ch); Uaxactún, *Bartlett 12339* (fl., A, NY, US). British Honduras: Orange Walk: Indian Church, New River Lagoon, *C.S. Brown 31* (*Y 13682*) (fr., Ch, Y).

Native names: "Laurelillo" (Campeche); "Ektil," "Dzol," "Copal-chi" (Guatemala).

Licaria campechiana is striking for its appearance of extreme glabrosity. Careful examination, however, reveals closely appressed whitish-sericeous pubescence on the lower leaf-surface, petioles, and branchlets. The leaf-blades are lanceolate, more or less attenuately acuminate, coriaceous, with a midrib impressed above and very prominent beneath, and with obscure venation. The rather rigid, somewhat racemose-paniculate inflorescences are usually not longer than 2.5 cm., although occasionally they reach a length of 5 cm., of which the peduncle measures approximately one-half. I have not seen a fruit of this species but the cupule is about 1 cm. deep and 1.3 cm. in diameter, inconspicuously double-margined, and of rather thin texture. The enlarged pedicel measures nearly 2 mm. long and is about the same width at the apex.

12. **Licaria lucida** (Lundell), comb. nov.

Acrodiclidium lucidum Lundell in Contr. Univ. Mich. Herb. 7: 12. 1942.

Distribution: Known only from the type-locality.

Mexico: Chiapas: Santa Rosa, near Escuintla, in advanced forest, alt. 1600 m., June 20, 1941, *Matuda 4239* (fr., A, type — Mich, NY) (tree 10 m.).

Although no flowering collection has been made to date, the linear-lanceolate, acute to obtuse, shining, entirely glabrous leaves mark this species as differing from all other Mexican species. The nearest relative presumably is *L. campechiana*, from which it differs in its complete glabrosity and long-acute to obtuse rather than acuminate leaves. The fruit is small, ellipsoid-ovoid, 1 cm. long and ±8 mm. wide, subtended by a thickened more or less flaring lobed cupule ±1.5–2 cm. in diameter, ±1.5 cm. long, and ±0.5 cm. deep, seated on a pedicel about 4 mm. long and 2 mm. thick. Unlike the majority of fruits in this genus, that of *L. lucida* shows, in the dried state, the inner margin 5 mm. or less shorter than the thickened prominently lobed outer margin. The usual situation in the genus shows the outer margin reversed and undulating, exposing the inner margin rather than protruding beyond it. It is possible that this is due to the conditions under which the individual specimen was prepared. Further material will verify this. So far, there is no other specimen which matches the type.

13. **Licaria misantlae** (Brandegee) Kostermans in Meded. Bot. Mus. Utrecht 42: 602. 1937 (Rec. Trav. Bot. Néerl. 34: 602. 1937).

Acrodiclidium misantlae Brandegee in Univ. Calif. Publ. Bot. 6: 497. 1919.

Chanekia misantlae Lundell in Phytologia 1: 180. 1937.

Distribution: Known only from the type-locality, and vicinity, in Mexico.

Mexico: Vera Cruz: Near Misantla, *Purpus 8145* (fl., isotype of *A. misantlae*, GH, NY); Acasonica, August, 1919, *Purpus 8433* (fl., GH, NY).

This species is unique among the Mexican and Central American *Licariae* in having elliptic or obovate leaves, usually acute, obtuse or sometimes retuse, with crisped margins. Unusual too is the very coarse reticulation apparent on both surfaces of the leaves. No fruit is known for the species. The nearest resemblance superficially is found in *Ocotea veraguensis,* which, strangely enough, has double-margined cupules similar to those found in *Licaria.* The flowers, however, show unmistakably the *Ocotea* structure.

12. Cassytha Linnaeus

Cassytha Linnaeus, Sp. Pl. 35. 1753; Nees, Syst. Laurin. 641. 1836; Meissner in DC. Prodr. 15[1]: 252. 1864; Bentham & Hooker, Gen. Pl. 3: 164. 1880; Hemsley, Biol. Centr. Am. Bot. 3: 77. 1882; Mez in Jahrb. Bot. Gart. Berlin 5: 489. 1889.

1. **Cassytha filiformis** Jacquin, Sel. Stirp. Amer. 115, *t. 79.* 1763, et Pict. *t. 116.* 1780, et Am. Gew. 2: 133. 1786; Standley in Field Mus. Publ. Bot. **10**: 202. 1931; Standley & Record in op. cit. **12**: 142. 1936; Standley in op. cit. **18**: 450. 1937.

Cassytha americana Nees, Syst. Laurin. 644. 1836.

DISTRIBUTION: Tropics of the world, but not common in Central America.

This parasitic herb is unique in the family. In habit and general appearance it is similar to *Cuscuta,* of the Convolvulaceae, being yellowish throughout, with its leaves reduced to scales. The floral structure, however, is typically lauraceous.

ASIATIC SPECIES CULTIVATED IN TROPICAL AMERICA

Cinnamomum (L.) Nees & Ebermaier

Cinnamomum Camphora (L.) Nees & Ebermaier, Handb. Med. Pharm. Bot. 2: 430. 1831; Meissner in DC. Prodr. 15[1]: 24. 1864; Standley in Contr. U. S. Nat. Herb. 27: 183. 1928; Standley & Calderón, Lista Prelim. Pl. Salvador 84. 1925; Standley in Field Mus. Publ. Bot. **18**: 451. 1937.

DISTRIBUTION: Tropical Asia and Malaya. Cultivated in tropics throughout the world. Source of commercial camphor and also planted for ornamental purposes.

NATIVE NAME: "Alcanfor."

Cinnamomum zeylanicum Nees in Wallich, Pl. As. Rar. 2: 74. 1831; Standley in Contr. U. S. Nat. Herb. 27: 183. 1928; Standley & Calderón, Lista Prelim. Pl. Salvador 84. 1925; Standley in Field Mus. Publ. Bot. **18**: 451. 1937.

DISTRIBUTION: India and Malaya. Cultivated in tropics throughout the world. Source of commercial cinnamon and also planted for ornamental purposes.

NATIVE NAME: "Canela."

ADDENDA

Since the preceding was set in type, Dr. W. A. Dayton, of the U. S. Department of Agriculture Forest Service (USFS), has kindly made available to me additional material from Panama, as well as more complete and corrected data for material already cited. Some of these specimens are cited in the following notes. Also, Dr. I. M. Johnston has since made a supplementary collection in Panama, including a new species which is described below.

15. **Persea rigens** Allen in Jour. Arnold Arb. **26**: 297. 1945.

Little 6075, cited from Costa Rica, is actually from Panama. Very probably the species occurs in Costa Rica, but to date it has not been collected in that area.

PANAMA: Chiriqui: Near sawmill on Río Chiriquí Viejo, 3 km. n. of Camp El

Volcán, *Little 6057* (sterile, USFS), *6058* (fl., USFS), alt. 1310 m., March 5, 1943, *6075* (fl., TYPE–Ch, USFS) (tree 27 m.; "Pizarrá").

11a. **Phoebe Johnstonii,** sp. nov.

Arbor aromatica parva ad 15 m. alta, ramulis griseo-subsericeis mox glabrescentibus deinde glabris striatis rubescentibus. Folia alternata, petiolis pubescentibus mox glabris gracilibus canaliculatis rubescentibus ad 1.5 cm. longis; laminis glabris, subtus nervis et glandulis axillaribus exceptis, juventute membranaceis mox pergamentaceis, in sicco supra nitidis et olivaceo-viridescentibus, subtus pallidis, lanceolato-ellipticis, 8–14.5 cm. longis et 2.5–4.5 cm. latis, basi infima anguste cuneatis vel attenuate cuneatis, apice obtuse et attenuate acuminatis vel subcaudato-acuminatis, subtriplinerviis, costa pallide rubescente supra impressa subtus elevata, nervis lateralibus pallide rubescentibus 4–5-paribus, infimis conspicuis angulo 25–35° divergentibus, glandulis axillaribus conspicuis, superioribus obscurioribus angulo 45° divergentibus, glandulis axillaribus obscuris, rete venularum satis obscuro. Inflorescentia axillaris et subterminalis, multi-racemoso-paniculata vel raro late paniculata, ad 12 cm. longa, juventute flavo-albescens, deinde rubescens, pedunculo ad 2 cm. longo striato pubescente vel glabrescente. Flores ad 6 mm. longi, pedicellis ad 3 mm. longis, perianthio subcampanulato pallide flavo, lobis ovato-ellipticis vel elliptico-lanceolatis, membranaceis, subaequalibus, ±2.35–3 mm. longis pubescentibus; staminibus ser. I & II ±1.7 mm. longis, antheris ovatis filamentis aequalibus, ser. III ±2.15 mm. longis, antheris subovatis emarginatis biglandulosis, glandulis subsessilibus conspicuis reniformibus staminodiis subcordatis ovatis stipitatis, ±1.15 mm. longis; gynaecio glabro ±2.5 mm. longo, ovario ovoideo vel subgloboso stylo gracili subaequali, stigmate subcapitato satis conspicuo. Fructus ellipsoideus, glaber, viridis fide coll., minute apiculatus, 1 cm. longus et 7 mm. latus, cupula 5 mm. longa, 7 mm. diam., et 4 mm. alta perianthii lobis leviter incrassatis rubescentibus, fide coll., persistentibus coronata subtentus, pedicello incrassato rubescente ad 6 mm. longo.

DISTRIBUTION: Known only from the Canal Zone, Panama, at an altitude up to 80 m., and San José Island, in thickets and at edge of forest.

PANAMA: Canal Zone: Hospital grounds at Ancon, *Pittier 2750* (fl., GH). San José Island: (Perlas Archipelago, Gulf of Panama, about 55 miles SSE. of Balboa): *Johnston 505* (fr., A), *512* (fr., A), *553* (fl., fr., A), *583* (fr., A), *666* (fl., fr., A), *667* (fl., fr., A), M-area Road, April 11, 1945, *697* (fl., fr., TYPE, A) (tree 7.5 m. high, in thicket; flowers yellowish; fruit green, the cupule and pedicel reddish), *713* (fl., fr., A), *773* (fl., fr., A).

This species is most closely related to *Phoebe mexicana* and to *P. Ehrenbergii.* It is readily separated from the former by its shorter panicles, with flowers that are never whitish gray-pubescent, and by leaf-blades that are thinner in texture and on the whole more narrow. From the latter it may be distinguished by the many-flowered inflorescences usually not more than 8 cm. long, with flowers not more than 4 mm. long and never pruinose.

The position of this species may be indicated by the following revision of the original key occurring at the top of page 305:

D. Inflorescence composed of numerous subterminal and axillary spike-like racemose panicles up to 15 cm. long.

E. Panicles up to 15 cm. long; flowers usually whitish gray-pubescent..... ....11. *P. mexicana.*

E. Panicles usually less than 12 cm. long; flowers not whitish gray-pubescent..11a. *P. Johnstonii.*

D. Inflorescence composed of axillary and subterminal short loose few- to many-flowered panicles less than 10 cm. long and more or less glabrous.

E. Largest leaf-blades not more than 15 cm. long; lowermost pair of lateral nerves not conspicuous above the middle of the blade and less stout than the costa.

F. Inflorescence many-flowered, not more than 8 (rarely 12) cm. long; flowers not pruinose and not more than 4 mm. long...11a. *P. Johnstonii.*

F. Inflorescence few-flowered, up to 12 cm. long; flowers pruinose and nearly 5 mm. long............................12. *P. Ehrenbergii.*

E. Largest leaf-blades 18–20 cm. long; lowermost pair of lateral nerves conspicuous $\frac{2}{3}$ to $\frac{3}{4}$ the length of the blade and as stout as the costa...13. *P. neurophylla.*

22. **Ocotea rubrinervis** Mez; Allen in Jour. Arnold Arb. **26:** 353. 1945.

The nine Johnston numbers cited as "in mixed forest along South Road (S^2 area)," actually were collected in various areas on San José Island.

31. **Nectandra Whitei** (Woodson) Allen in Jour. Arnold Arb. **26:** 398. 1945.

Little 6059, cited as from Costa Rica, actually was collected in Panama.

PANAMA: Chiriquí: Vicinity of Camp El Volcán, *Little 6047* (fl., USFS), *6056* (young fr., USFS), *6059* (young fr., Ch, USFS), *6062, 6069* (young fr., USFS).

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STUDIES IN THE SAPOTACEAE, III
DIPHOLIS AND BUMELIA

Arthur Cronquist

A revision of certain groups of American Sapotaceae has been undertaken under the auspices of the Chicle Development Co. The present paper comprises a revision of the genera *Dipholis* and *Bumelia*. Current interpretations of the identity of the older types have in general been accepted, since these are in most cases not now available for study. In accordance with Article 19 of the International Rules of Botanical Nomenclature, names which were not validly published have rigorously been excluded from consideration. My concepts of intraspecific units have been given in a previous paper (Bull. Torrey Club 70: 265. 1943). Although a relatively large amount of material, measured by the standards of tropical botany, has been available for study, I keenly feel its inadequacy in a number of species; my confidence in the accuracy of my taxonomic interpretations varies in approximately direct proportion to the number of specimens seen.

I wish to acknowledge my thanks to Mr. B. A. Krukoff, under whose direction this study was prepared, and to the curators of the several herbaria who have provided essential assistance by kindly loaning specimens for study. The abbreviations used hereinafter to indicate these herbaria are as follows:

A — Arnold Arboretum, Harvard University.
CR — Museo Nacional de Costa Rica, San José.
Cu — Estacion Experimental Agronomica, Habana, Cuba.
F — Field Museum (Chicago Natural History Museum).
G — Gray Herbarium, Harvard University.
Mich — University of Michigan, Ann Arbor.
Mo — Missouri Botanical Garden, St. Louis.
NY — New York Botanical Garden.
PA — Philadelphia Academy of Natural Sciences.
PR — Tropical Forest Herbarium, U. S. Forest Service, Río Piedras, Puerto Rico.
US — United States National Herbarium, Washington, D. C.

DIPHOLIS

The genus *Dipholis* was founded in 1844 by Alphonse de Candolle, in the Prodromus, vol. 8, p. 188. The single species listed, *D. salicifolia*, necessarily becomes the type. This species has, incidentally, by far the widest distribution of any in the genus, and is biologically as well as nomenclaturally typical. *Dipholis* is antedated six years by *Spondogona* Raf. (Sylv. Tellur. 35. 1838), based on *Bumelia pentagona* Sw., which is now referred to *Dipholis salicifolia* on the authority of Radlkofer (Erg. Mon. Serjania, pp. 55–56. 1886). Swartz described the fruit as 5-angled, and Rafinesque, apparently without seeing the type, enlarged upon this description to say that it was also 5-seeded. A 5-seeded or even 5-angled fruit in *Dipholis salicifolia*, or any other known species of the genus, would be a monstrosity, and any name founded on such a specimen should be rejected under Article 65 of the Rules. I should not hesitate to recommend that *Dipholis* be conserved, were it necessary, but *Spondogona* can be rejected on another basis.

Dipholis is closely related to and evidently derived from *Mastichodendron*,[1] from which it differs primarily in the presence of lateral lobes on the corolla-lobes. Several other usual differences, none entirely constant, are found in the more petaloid staminodes, more nearly basal seed-scar, and frequently smaller leaves and fruit of *Dipholis*, the leaves lacking the deeply channeled midrib and petiolar pouch so commonly found in *Mastichodendron*. One species has been described as lacking the lateral lobes on the corolla-lobes, but in my opinion this species is better referred to *Bumelia*. The relationship and distinctions between *Dipholis* and *Bumelia* are discussed under the latter.

Dipholis is confined to the warmer parts of North America and reaches its greatest development in the Greater Antilles, where 10 of the 14 known species occur. Evolutionary trends in the genus are toward reduction in size of the plant, size of the leaves, size of the fruit, and number of flowers in a cluster, and toward the development of a truly basal seed-scar. The most primitive surviving species, such as *D. Stevensonii* and *D. minutiflora*, are good-sized trees with large leaves, large (2–3 cm.) fruits, numerous flowers in a cluster, and somewhat basilateral seed-scar. These species, particularly *D. Stevensonii*, are not far removed from the generic prototype. *Dipholis nigra* is closely allied to *D. minutiflora*, and may be nearly ancestral to *D. salicifolia*. *Dipholis Jubilla* and, from the description, *D. Bellonis* seem most likely to be related to *D. nigra*. *Dipholis parvifolia* and *D. durifolia* seem to be allied to *D. salicifolia*. The closely related species *D. montana* and *D. octosepala* are probably derived from the *D. nigra-salicifolia* stock. *Dipholis cubensis*, *D. repens*, and *D. ferruginea* form a closely knit group that is related to *D. montana*. *Dipholis sericea* is probably allied to the *D. cubensis* group.

Dipholis A. DC.

Unarmed shrubs or trees; leaves alternate, exstipulate, often small; primary lateral veins not very numerous, sometimes obscure; sepals mostly 5, sometimes 4–9; corolla 5(rarely 6)-lobed, each lobe with a pair of lateral lobes or appendages near its base; staminodes present, more or less petaloid, these and the appendages more or less erose, fimbriate, or laciniate; ovary

[1] The name *Mastichodendron*, as used by Lam (Rec. Trav. Bot. Néerl. 36: 521. 1939), is at this writing not yet validly published. It is intended to validate this name in another paper, publication of which may precede this paper.

glabrous, very rarely shortly appressed-hairy; ovules 5, attached basilaterally; young and mature fruit generally tapering abruptly to the short persistent style; fruit fleshy, mostly 1-seeded, not over about 3 cm. long; seed-scar very nearly basal, rarely evidently basilateral; endosperm well-developed.

Key to the Species

1. Fruit about 2 cm. long; leaves 8–12 cm. long; poorly known plant of Puerto Rico...
....5. *D. Bellonis*.
1. Fruit (where known) about 1 cm. long or less, except in some Jamaican and continental species; leaves various.
  2. Inflorescences borne on peduncles up to 15 mm. long, sometimes slightly branched; Oriente, Cuba...4. *D. Jubilla*.
  2. Inflorescences sessile, simple.
    3. Flowers numerous, commonly 8 or more in a cluster, generally borne at defoliated nodes, sometimes also in the axils.
      4. Fruit 12–30 mm. long; pedicels 4–15 mm. long; leaves often but not always retuse or rounded; sepals glabrous or hairy.
        5. Leaves densely and loosely rufous-hirsutulous beneath, eventually more or less glabrate; pedicels 10–15 mm. long; petioles 2.5–4 cm. long; sepals strongly and loosely hairy, about 3.5 mm. long or more; British Honduras.
....1. *D. Stevensonii*.
        5. Leaves glabrous or merely sericeous-strigose beneath, the hairs appressed; pedicels 4–10 mm. long; petioles 0.5–2 cm. long; sepals glabrous or with a few appressed hairs, at flowering time less than 2.5 mm. long.
          6. Fruit about 1.5–3 cm. long, yellow to purplish; leaves tardily glabrate beneath, the hairs silvery; continental.................2. *D. minutiflora*.
          6. Fruit 12–16 mm. long, black; leaves very soon glabrate, the hairs when present often reddish; Jamaica............................3. *D. nigra*.
      4. Fruit 6–10 mm. long; pedicels 1–4 mm. long; leaves acute or acuminate; sepals distinctly hairy; general distribution.......................6. *D. salicifolia*.
    3. Flowers few, commonly about 1–7 in a cluster, borne in the axils.
      4. Leaves strongly acuminate, closely and conspicuously reticulate-veiny; continental.
        5. Leaves about 6–10 cm. long, borne on petioles about 1.5–2.5 cm. long; pedicels 5–7 mm. long; sepals strongly and rather loosely ferrugineous, about 3–4 mm. long; British Honduras..........................7. *D. durifolia*.
        5. Leaves only 2.5–4 cm. long, borne on petioles about 3–7 mm. long; flowers subsessile, the sepals glabrous or slightly strigose, about 2 mm. long; Costa Rica...8. *D. parvifolia*.
      4. Leaves mostly obtuse or rounded, if evidently acuminate then not closely and conspicuously reticulate-veiny; Greater Antilles.
        5. Corolla at least 6 mm. long, or if perhaps sometimes not so, then the sepals 8 or 9; sepals commonly but not always more than 5; Jamaica.
          6. Outer 2 sepals essentially glabrous; fruit about 13–18 mm. long; veiny reticulum of the leaves scarcely raised; sepals 5–8.........9. *D. montana*.
          6. Sepals all hairy; fruit about 1 cm. long or less; veiny reticulum of the leaves evidently raised beneath; sepals 8 or 9...........10. *D. octosepala*.
        5. Corolla not over 4.5 mm. long; sepals 5, rarely 6; not of Jamaica.
          6. Leaves glabrous, sometimes sparsely hairy when young.
            7. Erect shrubs or trees; leaves 1.5–10 cm. long; Cuba, Hispaniola, and Puerto Rico.......................................11. *D. cubensis*.
            7. Creeping or prostrate shrub; leaves 1.5–2 cm. long; Hispaniola........
....12. *D. repens*.
          6. Leaves strongly rufous-sericeous beneath, eventually paler or glabrate; Dominican Republic.

7. Leaves 4–8 cm. long, 1.5–3 cm. wide, eventually glabrate; venation evident, raised..13. *D. sericea*.
7. Leaves 2–4 cm. long, 1–1.5 cm. wide, permanently hairy; venation obscure..14. *D. ferruginea*.

1. **Dipholis Stevensonii** Standl. Trop. Woods 11: 21. 1927.
Sideroxylon rufotomentosum Standl. Carnegie Inst. Wash. Misc. Publ. 461 (Bot. Maya Area 4): 79. 1935.

Tree up to 25 m. high; leaves elliptic or elliptic-obovate, rounded at the apex, about 10–22 cm. long and 6–12 cm. wide, strongly veiny, the primary lateral veins about 12–16 pairs, raised beneath; leaves densely and loosely hirsutulous-tomentose with rufous hairs at first, soon glabrate above, eventually more or less glabrate beneath; petioles 2.5–4 cm. long; flowers numerous in clusters at defoliated nodes, the pedicels about 10–15 mm. long, rufous-tomentose; mature flowers unknown, but maturing buds 5- or 6-merous, the sepals about 3.5 mm. long or more, the corolla-lobes 2 mm. long, the anthers 1.5 mm. long, the staminodes ovate, scarcely erose, nearly 1.5 mm. long, the lateral appendages narrow, entire or subentire, only 0.5–1 mm. long; fruit ellipsoid, about 16–25 mm. long, resembling that of *Mastichodendron;* seed up to about 16 mm. long, the scar basilateral, ellipsoid, 5 mm. long, the seed-coat about 1 mm. thick.

TYPE COLLECTION: *Stevenson s.n.*, British Honduras, 1927 (F—fragment, US).

LOCAL NAME: *Zapote faisan.*

DISTRIBUTION: British Honduras.

BRITISH HONDURAS: *Lundell 6200* (F, G, NY, US), *6252* (G, NY, US); *Schipp S674* (F, G, Mo); *Stevenson s.n.* (1926) (US).

The large veiny leaves, somewhat channeled midrib, relatively long petioles, relatively large fruit, and basilateral rather than basal seed-scar of this species are suggestive of *Mastichodendron,* to which it makes an approach, but the petaloid staminodes and the definite, if smaller than usual, lateral lobes on the corolla-lobes clearly indicate its place in *Dipholis*.

2. **Dipholis minutiflora** Pittier, Contr. U. S. Nat. Herb. 13: 464. 1912.
Sideroxylon Matudai Lundell, Phytologia 1: 221. 1937.
Bumelia tabascensis Lundell, Contr. Univ. Mich. Herb. 5: 22. 1940.
Sideroxylon Steyermarkii Standl. Field Mus. Publ. Bot. 22: 368. 1940.
Dipholis Matudai Lundell, Contr. Univ. Mich. Herb. 7: 43. 1942.

Tree up to 30 m. high; leaves elliptic-oblanceolate or narrowly elliptic-obovate, rounded to acutish at the apex, tapering to the base, about 6–20 cm. long and 2.5–10 cm. wide, with 10–20 pairs of primary lateral veins, glabrous above, finely white-strigose beneath, eventually glabrate; petioles about 0.5–1.5 cm. long; flowers very numerous in clusters at defoliated nodes, the pedicels slender, nearly glabrous, 5–8 mm. long; sepals 5, glabrous or nearly so at flowering time, about 1.4–2.2 mm. long; corolla about 4.5 mm. long, the 5 lobes 3.5 mm., their lateral appendages lance-ovate, acuminate, erose-laciniate, 1.5 mm. long on the inner margin; filaments firm, about 2–2.5 mm. long; anthers about 2 mm. long, sagittate to the middle or beyond; staminodes laciniate, 2.5–3 mm. long; fruit yellow, olive-green, or purplish, ovoid to subglobose, usually conical-acute at the apex, about 1.5–3 cm. long, with thin pulp; seeds about 14–18 mm. long, a little compressed, with broadly ellipsoid basal or basilateral scar 5 mm. long; seed-coat about 0.5 mm. thick.

TYPE COLLECTION: *Tonduz 11935,* forests of El Copey, Dota Mountains, Costa Rica, about 1800 m., February, 1898 (NY, US).

LOCAL NAMES: *Sapote prieto, nispero.*

DISTRIBUTION: State of Mexico, Mexico, to the Panama Canal Zone.

MEXICO: Mexico: *Hinton 4923* (G), *7700* (G). Guerrero: *Hinton 10416* (G). Tabasco: *Matuda 3455* (Mich, NY). Chiapas: *Matuda 571* (A, Mo, US), *4175* (A, F, NY). GUATEMALA: San Marcos: *Steyermark 37615* (F). Quezaltenango: *Steyermark 33858* (F). Suchitepéquez: *Steyermark 35409* (F). HONDURAS: Comayagua: *Edwards P-302* (A, F). Yoro: *von Hagen 1007* (F, NY). COSTA RICA: *Austin Smith 4184* (F); *Standley & Valerio 46505* (A, US), *46481* (US). PANAMA: Chiriquí: *Allen 1564* (F, G); *White 109b* (F, G); *Woodson, Allen & Seibert 995* (A, F). Canal Zone: *Allen 1314* (F, G, US).

3. **Dipholis nigra** (Sw.) Griseb. Fl. Brit. W. Ind. 400. 1861.
Bumelia nigra Sw. Prodr. 49. 1788.
Achras nigra Poir. in Lam. Encyc. Meth. 6: 532. 1804.
Dipholis nigra var. *brachyphylla* Urb. Symb. Ant. 5: 137. 1904.

Tree up to 15 m. tall; leaves elliptic or narrowly elliptic-ovate, commonly acute or acutish, sometimes obtuse or bluntly acuminate, glabrous, veiny, with evident reticulum, commonly 6–18 cm. long, 3–6.5 cm. wide, the petioles 1.5–3 cm. long; flowers numerous in clusters at defoliated nodes, the pedicels about 4–10 mm. long, essentially glabrous; sepals essentially glabrous, about 1.5–2 mm. long; corolla about 3.9–4.4 mm. long, the tube 1.1–1.5 mm.; corolla-lobes cordate-auriculate above the lateral lobes, which are shorter and broader than those of *D. salicifolia;* filaments up to 3 mm. long, stout, except for the tenuous tip, as in *D. salicifolia;* anthers about 1.4–1.8 mm. long, more evidently sagittate than in *D. salicifolia;* staminodes ovate, petaloid, erose, about 2 mm. long or more; style 1 mm. long or less, conical; fruit black, ellipsoid to ovoid-globose, 12–16 mm. long, up to 12 mm. thick.

TYPE COLLECTION: None given; reference to Browne, Hist. Jam. 201. 1756.

LOCAL NAME: *Red bullet* or *bully.*

DISTRIBUTION: Jamaica; reported, probably incorrectly, from Cuba.

JAMAICA: *Alexander s.n.* (1850) (G, US); *Britton 1105* (NY), *3688* (NY); *Harris 5388* (A, G, NY, US); *Miller 1389* (US); *Rehder s.n.* (Feb. 13, 1903) (A); *Hart 1057* (US); *Taylor 220* (NY).

4. **Dipholis Jubilla** Ekm. ex Urb. Symb. Ant. 9: 415. 1925.

Tree; leaves lanceolate or elliptic, glabrous nearly from the first, commonly 5–15 cm. long, 2–5.5 cm. wide, acute or acuminate, the primary lateral veins evident beneath, the secondary ones obscure, not forming an evident reticulum; petioles about 1–2.5 cm. long; flower-clusters borne on peduncles up to 15 mm. long, the inflorescence sometimes slightly branching; pedicels about 2–3 mm. long, finely ferrugineous; sepals finely and sparsely ferrugineous, 2.5 mm. long in bud; mature flowers and fruit unknown.

TYPE COLLECTION: *Ekman 8324,* "ad Alto de Iberia in cacumine montis cr. 1135 m.," November 12, 1916 (A, F, NY).

LOCAL NAMES: *Jubilla, juba prieto.*

DISTRIBUTION: Oriente, Cuba.

CUBA: Oriente: *Ekman 4249* (G, NY), *5574* (US), *9369* (NY), *15659* (G, US); *León 19877* (NY); *Roig 5316* (Cu), *6209* (Cu, NY).

The leaves of *D. Jubilla* are somewhat similar to those of *D. nigra,* but may be distinguished by the lack of an evident veiny reticulum.

5. **Dipholis Bellonis** Urb. Symb. Ant. 5: 137. 1904.

Leaves 8–12 cm. long, 2.5–4 cm. wide, ovate-oblong, acute at the base, acuminate at the apex, borne on petioles 1–2 cm. long; fruiting pedicels 10–15 mm. long; fruit obovoid, sometimes narrowly so, 18–20 mm. long, 10–15 mm. thick, violet-blackish. (Description taken from the original; no specimens seen.)

TYPE COLLECTION: *Bello,* near Furnias, Puerto Rico.

LOCAL NAME: *Varital.*

DISTRIBUTION: Known only from the type collection, Puerto Rico.

6. **Dipholis salicifolia** (L.) A. DC. in DC. Prodr. 8: 188. 1844.
Achras salicifolia L. Sp. Pl. ed. 2. 1: 470. 1762.
Bumelia salicifolia Sw. Prodr. 50. 1788.
Bumelia pentagona Sw. loc. cit.
Sideroxylon pauciflorum Lam. Tab. Encyc. 2: 42. no. 2459. 1793.
Achras pentagona Poir. in Lam. Encyc. Meth. 6: 533. 1804.
Sideroxylon salicifolium Gaertn. f. Carp. Suppl. 124. *t. 202.* 1805.
Spondogona nitida Raf. Sylv. Tellur. 35. 1838.
Sideroxylon pentagonum A. DC. in DC. Prodr. 8: 185. 1844.
Dipholis salicifolia var. *jamaicensis* Pierre in Urb. Symb. Ant. 5: 139. 1904.
Spondogona salicifolia House, Am. Midl. Nat. 7: 131. 1921.
?*Dipholis leptopoda* Urb. Ark. Bot. 22A(17): 70. 1929.

Large shrub, or more commonly a tree, sometimes nearly 25 m. high; leaves narrowly elliptic to elliptic-lanceolate or elliptic-oblanceolate, acute or acuminate at both ends, commonly 5–11 cm. long and 1.5–4 cm. wide, villosulous when young, but very soon glabrate, the petioles short, commonly 0.5–1.5 cm. long; flowers numerous in clusters at defoliated nodes or sometimes in the axils, the pedicels finely sericeous, about 1–4 mm. long; sepals finely hairy, about 1.4–3 mm. long; corolla about 3.3–4.5 mm. long, the tube 1.3–1.6 mm.; corolla-lobes rounded, elliptic, narrowed to a short claw-like base above the lateral lobes or appendages, which are acute or acuminate, lanceolate or ovate; staminodes ovate or broadly elliptic, petaloid, about 1.5–2 mm. long, more or less erose-laciniate; filaments about 1.5–2.5 mm. long, very stout and firm except for the short abruptly tenuous distal portion; anthers about 0.9–1.6 mm. long, exserted; ovary 5-loculate, glabrous or rarely slightly hairy, the style 1.5–2.5 mm. long; fruit black, with thin pericarp, broadly ellipsoid or subglobose, about 6–10 mm. long, with 1 or sometimes 2 or 3 seeds; seed-scar basal, circular or elliptic, 1 mm. in greatest diameter; seed-coat about 0.2–0.3 mm. thick, light to dark brown.

TYPE COLLECTION: None given; references to works of Sloane and Browne on Jamaica.

LOCAL NAMES: *White bullet* or *bully, mijico;* for many others see Symb. Ant. 5: 138. 1904.

DISTRIBUTION: Southern Florida; Bahama Islands; Greater Antilles; Virgin Islands, and sparingly through the Lesser Antilles to Guadeloupe and the Barbados Islands; southern Mexico, Guatemala, and British Honduras. Specimens from Florida are so numerous that I have cited only a small proportion of them.

U.S.A.: Florida: *Curtiss 1760* (A, NY, US), *5859* (NY, US); *Duckett 223* (A, F, NY, US); *Moldenke 750* (NY, US), *5701* (NY); *Pollard et al. 197* (NY, US);

Small & Mosier 5509 (NY), *5652* (NY), *5760* (NY), *6553* (NY), *6591* (NY, US); *Tracy 9252* (NY, US). BAHAMAS: *Brace 3893* (NY, US), *4620* (NY), *4932* (NY), *6737* (NY); *Britton 10* (NY, US), *112* (NY), *3376* (G, US), *6434* (NY, US); *Britton & Brace 188* (NY); *Britton & Millspaugh 2579* (NY), *5610* (NY); *Coker 257* (NY), *395* (NY); *Cooper 3* (NY); *Curtiss 148* (A, G, NY, US); *Earle 50* (NY); *Eggers 4106* (F, NY, US); *Northrop 326* (A, F, G, NY); *Small & Carter 8459* (G, NY, US); *Wight 143* (G, NY), *1905* (F); *Wilson 7438* (G, NY), *7725* (G, NY), *8172* (NY), *8287* (NY), *8422* (NY). CUBA: Isla de Pinos: *Britton, Wilson & León 15270* (G, NY, US). Habana: *León 8524* (NY), *10674* (NY); *León & Edmund 8764* (NY). Matanzas: *Britton & Wilson 14045* (US). Santa Clara: *Britton, Earle & Wilson 5888* (NY, US); *Britton & Wilson 5527* (NY); *Ekman 18353* (A); *Jack 4215* (A), *4351* (A), *4808* (A, US), *5608* (A, US), *5661* (A), *5675* (A, US), *6015* (A, US); *León 398* (NY); *Rehder 1119* (A); *Shafer 12310* (NY, US). Camaguey: *Shafer 436* (NY), *677* (G, NY, US), *934* (G, NY, US), *1045* (G, NY, US). Oriente: *Britton 1875* (NY); *Britton & Cowell 12613* (NY, US); *Britton, Cowell & Shafer 13065* (NY, US); *Ekman 4629* (G, US), *4894* (A, F, US), *7715* (NY), *8596* (F, G); *Shafer 1313* (NY), *1503* (NY, US); *Wright 1325* (G, NY, US). JAMAICA: *Alexander s.n.* (1850) (NY, US); *Britton 1887* (NY), *1949* (NY); *March s.n.* (NY); *Eggers 3509* (A, US); *Hansen s.n.* (1897) (A, F, US); *Harris 5511* (NY), *7070* (NY), *8642* (NY), *8949* (NY), *9616* (NY, US), *10170* (NY, US), *10806* (NY, US); *Hart 611* (NY); *Miller 1363* (US), *1413* (US); *Perkins 1264* (G); *Rothrock 141* (NY), *231* (F). HAITI: *Holdridge 987* (US); *Leonard 3204* (G, NY, US), *8870* (G, NY, US), *12376* (A, G, US), *14850* (NY, US), *15743* (A, G, NY, US). DOMINICAN REPUBLIC: *Abbot 1295* (G, US), *2248* (G, US), *2867* (G, US); *Ekman 14380* (US); *Fuertes 210* (A, G, NY, US); *Rose, Fitch & Russell 4233* (A, G, NY, US); *Scarff 2a* (F); *Wright et al. 305* (F). PUERTO RICO: *Britton & Brown 6367* (NY); *Britton & Marble 2333* (NY, US); *Holdridge 321* (PR); *Johnston* 909 (NY), *1862* (NY); *Sargent 438* (US); *Shafer 2761* (NY, US); *Sintenis 733* (G), *733b* (NY, US), *3640* (G, NY, US); *Stevenson 1862* (A, US). ST. JOHN: *Holdridge 132* (NY). TORTOLA: *Fishlock 401* (A, F, G, NY, US), *402* (A). ST. CROIX: *Thompson 759* (NY). ST. EUSTATIUS: *Boldingh 1168* (NY). GUADELOUPE: *Duss 2913* (A, F, G, NY, US); *Stehlé 2870* (US). MARIE GALANTE: *Stehlé 420* (NY). BARBADOS: *Bovell 468* (NY). ST. ANDREW (Barbados): *Bovell & Freeman 374* (NY). MEXICO: Vera Cruz: *Gaumer 2150* (G); *Purpus 2031* (NY, US). Puebla: *Purpus 3382* (F, US). Campeche: *Lundell 1346* (F, NY, US). Yucatán: *Flores s.n.* (1936) (F); *Gaumer s.n.* (1888) (F), *1047* (A, F, G, US), *2150* (A, F, US), *23516* (A, F, G, US), *23632* (A, F, G, US); *Lundell 7557* (A); *Seler 3993* (A, F, G, US). GUATEMALA: El Petén: *Bartlett 12679* (A, F, NY, US); *Lundell 3058* (F, G, US), *3098* (F), *3197* (F), *3354* (A), *3690* (F). BRITISH HONDURAS: *Karling s.n.* (1931) (A, F, US); *Lundell 3895* (F); *Schipp S-650* (A, F, G, NY).

Dipholis leptopoda Urb. & Ekm. was based on some immature specimens which have unusually few flowers for *D. salicifolia,* but which do not seem to belong anywhere else. The leaves are also broader and more obtuse than is general for the species, and it may eventually prove to be distinct.

7. **Dipholis durifolia** Standl. Carnegie Inst. Wash. Misc. Publ. 461 (Bot. Maya Area 4): 78. 1935.

Tree 6 m. high; leaves lanceolate, strongly acuminate, 6–10 cm. long, 1.5–2.5 cm. wide, quite glabrous at least at maturity, conspicuously and finely reticulate-veiny on both sides; petioles about 1.5–2.5 cm. long; flowers 1–6 in the axils, the stout ferrugineous pedicels 5–7 mm. long; sepals strongly ferrugineous, about 3.2–4 mm. long; corolla about 5 mm. long or more, the tube about equaling the lobes; staminodes petaloid, ovate, erose, about 2–2.5 mm. long; ovary glabrous, 5-celled, its style about 2–2.5 mm. long; fruit unknown.

TYPE COLLECTION: *Schipp 1202,* bare hilltop, Jacinte Hills, British Honduras, 700 feet, September 8, 1933 (A, F, G, NY).

DISTRIBUTION: Known only from the type collection, British Honduras.

This species and *D. parvifolia* are evidently closely related; their relationship to other species in the genus is uncertain, but *D. salicifolia* may be suggested as the nearest relative.

8. **Dipholis parvifolia** Standl. Field Mus. Publ. Bot. 18: 909. 1938.

Tree; leaves elliptic-lanceolate, long-acuminate, 2.5–4.5 cm. long, 1–1.5 cm. wide, glabrous, firm, closely and conspicuously reticulate-veiny on both sides, but the veins not much raised; petioles 3–7 mm. long; flowers borne singly or in very small groups in the axils, nearly sessile, the sepals about 2 mm. long, sparsely strigose or glabrous; fruit obovoid, about 17 mm. long.

TYPE COLLECTION: *Standley & Valerio 45525,* wet forest, Los Ayotes, near Tilarán, Guanacaste, Costa Rica, 600–700 m., January 21, 1926 (US).

DISTRIBUTION: Known only from the type collection, Guanacaste, Costa Rica.

9. **Dipholis montana** (Sw.) Griseb. Fl. Brit. W. Ind. 401. 1861.
Bumelia montana Sw. Prodr. 49. 1788.
Achras montana Poir. in Lam. Encyc. Meth. 6: 533. 1804.
Dipholis pallens Pierre & Urb. in Urb. Symb. Ant. 5: 136. 1904.
Dipholis lanceolata Pierre in Urb. Symb. Ant. 5: 136. 1904.

Shrub or small tree sometimes as much as 15 m. high; leaves elliptic to broadly or narrowly obovate, broadest at or generally above the middle, commonly 3–11 cm. long, 2–5.5 cm. wide, obtuse to abruptly short-acuminate, glabrous, veiny, but the reticulum scarcely raised; petioles about 3–10 mm. long; flowers in axillary clusters of about 2–7, the stout pedicels thinly strigose, 2–6 mm. long, elongating in fruit; sepals 5–8, the 2 outer glabrous or sparingly strigose, generally shorter than the others, about 2–4 mm. long, the inner evidently though finely sericeous-strigose, commonly 3–4 mm. long; corolla about 6.3 mm. long, the tube and bases of the staminodes thick and firm, the lobes and their appendages thin; corolla-tube about 3.2 mm. long or more; filaments about 1.5 mm. long or a little less, stout, tapering from the base; anthers about 0.8–1.1 mm. long; staminodes orbicular-obovate, about 1.5 mm. long, fimbriate, thickened toward the base; style about 1–2 mm. long, the stigma slightly expanded; ovary 5-loculate; fruit ellipsoid or ellipsoid-ovate, about 13–18 mm. long, 9–12 mm. thick; seed (from fruit 18 mm. long) 13 mm. long, 10 mm. thick, with basal or elliptic scar 3.5 mm. long; seed-coat dark brown, 0.4–0.6 mm. thick.

TYPE COLLECTION: None given.

LOCAL NAMES: *White bullet* or *bully, black bullet* or *bully.*

DISTRIBUTION: Jamaica.

JAMAICA: *Britton 270* (NY), *1107* (NY); *Harris 5340* (NY), *5355* (NY), *5370* (A, G, NY), *5704* (A, F, US), *5777* (NY), *6691* (A, NY, US), *6731* (NY, US), *9742* (NY, US), *9803* (NY, US), *10118* (NY, US), *10807* (A, G, NY, US); *Hart 533* (US), *642* (F, US); *Miller 1267* (US), *1297* (US); *Shreve s.n.* (May 16, 1906) (NY).

10. **Dipholis octosepala** Urb. Symb. Ant. 7: 324. 1912.

Tree up to 10 m. high; leaves rufous-tomentulose when young, later glabrate, elliptic to ovate or obovate, 9–12 cm. long, 4–6 cm. wide, obtuse to acuminate, the veins obscure above, raised and forming an evident reticulum beneath; petioles 1.5–2.5 cm. long; flowers about 2–4 in the axils, the stout pedicels up to 5 mm. long, rufous-hairy; sepals about 8 or 9, spiraled, all finely and loosely rufous-hairy, about 3–4 mm. long; mature corolla unknown; lateral appendages of the corolla-lobes erose-laciniate; staminodia well developed, fimbriate; fruit ellipsoid or subglobose, about 1 cm. long or a little less, with 1 or 2 seeds; seed-coat about 0.3 mm. thick.

Type collection: *Harris 10986,* "ultra Clarendon in sylvis Peckham dictis," July, Jamaica (NY).

Distribution: Jamaica, all of the collections from the same station.

Jamaica: *Harris 11049* (NY), *12798* (NY, US).

In its few-flowered clusters, stout pedicels, and numerous sepals, this species resembles *D. montana,* but differs in having all the sepals loosely hairy, in having a smaller fruit, and in the differently shaped thicker leaves with longer petioles and with raised veiny reticulum beneath.

11. **Dipholis cubensis** (Griseb.) Pierre in Urb. Symb. Ant. 5: 140. 1904.
Bumelia cubensis Griseb. Cat. Pl. Cub. 164. 1866.
Dipholis cubensis var. *oblongata* Pierre in Urb. Symb. Ant. 5: 140. 1904.
Dipholis domingensis Pierre & Urb. in Urb. Symb. Ant. 5: 140. 1904.
Dipholis Sintenisiana Pierre in Urb. Symb. Ant. 5: 139. 1904.
Dipholis angustifolia Urb. Symb. Ant. 7: 323. 1912.
Dipholis Ekmaniana Urb. Symb. Ant. 9: 416. 1925.

Much-branched shrub or small tree up to 10 m. tall; leaves firm, glabrous, oblanceolate to obovate or elliptic, acute at the base, rounded to acutish at the apex, about 2–10 cm. long and 6–30 mm. wide; petioles 2–10 mm. long; flowers about 1–4 in a cluster, the pedicels 2–20 mm. long, glabrous or hairy; sepals about 1.8–2.5 mm. long, glabrous or strigose; corolla about 2.7–3.7 mm. long, the lobes a little shorter than the tube, which sometimes bears scattered long red hairs; filaments about 0.5–1.6 mm. long; anthers about 0.8 mm. long; staminodes petaloid, erose or laciniate, less than 1 mm. long; style short and stout, about 0.4–0.7 mm. long; fruit purple or reddish, or perhaps sometimes green, about 5–13 mm. long and 3–7 mm. thick, oliviform-ellipsoid to ovoid; seed-scar basal, a little over 1 mm. wide; seed-coat about 0.4 mm. thick.

Type collection: *Wright 2921,* near Monteverde, Oriente, Cuba (G, Mo, NY, US — drawing).

Distribution: Pinar del Río and Oriente, Cuba, to Hispaniola and Puerto Rico.

Cuba: *Wright 1326* (G), *1327* (G). Pinar del Río: *Ekman 17527* (NY, US); *León 13200* (NY), *13837* (NY). Oriente: *Ekman 2296* (NY, US), *2713* (F), *5562* (G), *6017* (NY), *9330* (NY, US), *9407* (NY, US), *9886* (US), *10008* (NY), *14326* (A, F, G, US); *León 10828* (NY), *11959* (NY); *León et al. 10210* (NY); *Roig 47* (NY), *6550* (Cu); *Shafer 3033* (NY), *3461* (NY, US), *3563* (NY, US), *3801* (NY, US); *Wright 1637* (F, G). Haiti: *Buch 1857* (US), *1923* (US); *Cook, Scofield & Doyle 26* (US); *Ekman H9420* (US), *H10594* (US), *H1875* (US); *Holdridge 1384* (US); *Leonard 7591* (US), *8069* (US), *8387* (G, NY, US), *9545* (US), *13242* (NY, US), *13430* (NY, US), *13488* (A, US), *13489* (G), *14845* (US), *14867* (US), *15017* (US); *Nash 722* (NY), *822* (NY), *840* (NY); *Nash & Taylor 1415* (NY, US). Dominican Republic: *Ekman H11079* (US), *H13707* (US), *H13846* (US), *H15405* (US); *Fuertes 362* (A, G, NY, US), *577* (A), *1831* (A, NY); *Valeur 459* (A, US), *804* (A, NY, US). Puerto Rico: *Britton 7836* (NY); *Britton & Hess 2559* (NY, US); *Gerhart 321* (NY); *Gregory 388* (PR); *Sintenis 183* (G, NY, US).

There is considerable variation within this species in size and shape of the fruit, length of the pedicels, and distribution of the leaves, and at first I thought that several species, bolstered by geography, might be recognized on these bases. It now seems plain, however, that these characters are unstable, and that only one species is involved. It is possible that the plants from Hispaniola should be distinguished intraspecifically, from those of Cuba, on the basis of the usually smaller and less firm leaves, which tend to be well distributed along the twigs, instead of clustered at the ends. The Puerto Rican plants, however, have the leaves clustered at the ends of the twigs, like those from Cuba, while retaining the texture of those from Hispaniola.

12. **Dipholis repens** Urb. & Ekm. Ark. Bot. 22A(17): 70. 1929.

Creeping or prostrate shrub; leaves obovate or oblong-obovate, 1.5–2 cm. long, 6–11 mm. wide, or the upper smaller, acute at the base, rounded at the apex, glabrous except when very young; petioles 2–3 mm. long; flowers 1 or 2 in the axils, the pedicels 1–3 mm. long; sepals 5, the 2 outer glabrous, 1.5 mm. long, the 3 inner appressed-hairy, 2 mm. long; corolla white, fragrant, 4 mm. long, the lobes surpassing the tube; filaments scarcely 1 mm. long; style 1 mm. long; fruit brown-purple, obovate-oblong or ellipsoid, 5–6 mm. long, 3.5–4 mm. thick, 1-seeded. (Description abstracted from the original; no specimens seen.)

TYPE COLLECTION: *Ekman H6790,* "Cordillera de Bahoruco in Sierra de los Comisarios in pinetis ultra 1700 m. alt.," August, Barahona, Dominican Republic (US).

DISTRIBUTION: Haiti and the Dominican Republic.

This species is obviously related to *D. cubensis,* but differs in its creeping habit and smaller leaves.

13. **Dipholis sericea** sp. nov.

Planta lignosa; foliis firmiter chartaceis oblanceolatis vel anguste ellipticis, circiter 4–9 cm. longis et 1.5–3 cm. latis, apice rotundatis vel abrupte et breviter acuminatis, subtus primo rufo-sericeis demum glabratis, nervis lateralibus primariis et minus secundariis subtus elevatis perspicuisque, rete venularum laxo; petiolis circiter 3–8 mm. longis; floribus in axillis 1–4, pedicellis crassis ferrugineis circiter 2–4 mm. longis; sepalis plerumque 6 interdum 4, subtiliter et interdum sparse ferrugineis, late et valde imbricatis, circiter 3.5–3.7 mm. longis vel extimo plerumque manifeste breviore; corolla (in alabastro tantum visa) cum appendicibus fimbriatis staminodiisque cito caduca; ovario glabro in stylum 2 mm. longum abrupte contracto; fructu ignoto.

TYPE: *Ekman H14261,* Cordillera Central, prov. Santo Domingo, Villa Altagracia, top of Loma Marian Chicle, mossy thicket, about 825 m., Dominican Republic, January 6, 1930 (US).

DISTRIBUTION: Known only from the type collection, Dominican Republic.

Although mature flowers of *D. ferruginea* are not yet available, maturing buds indicate that its flowers are significantly smaller than those of *D. sericea.* The leaves of the two species differ conspicuously in size, shape, and venation.

14. **Dipholis ferruginea** Ekm. & Schmidt, Rep. Sp. Nov. 32: 94. 1933.

Large tree; leaves firm, narrowly elliptic, oblong, rounded at the apex, 2–4 cm. long, 1–1.5 cm. wide, glabrous, shining above, densely sericeous beneath, the hairs at first strongly rufous, later pale; petioles about 2–5 mm. long; flowers mostly 1 or 2 in the axils, the pedicels less than 6 mm. long, densely rufous-hairy.

Type collection: *Ekman H15406*, "Cordillera Central, prov. de Samana, Los Haitises, Boca del Infierno," limestone crags, light forest, characteristic, June 24, 1930, Dominican Republic (US).

Distribution: Known only from the type collection, Dominican Republic, but reported by the collector to be very common.

BUMELIA

The genus *Bumelia* was described in 1788 by Swartz, in his Prodr. Veg. Ind. Occ., p. 49. Of the seven species there included, four have been removed to *Dipholis* and one to *Mastichodendron*, leaving only *B. rotundifolia* and *B. retusa*. *Bumelia retusa*, being the more common and widespread of the two, may well stand as the nomenclatural type of the genus. *Bumelia* is antedated 11 years by *Robertia* Scop., but it has been conserved by an international botanical congress. Otto Kuntze rejected *Bumelia* in favor of *Lycioides* L. (1738), but, since he gave neither descriptions nor references to descriptions for his numerous transfers (other than *L. spinosum*), his names are not validly published and are here ignored. Rafinesque proposed for *B. tenax* a new genus *Sclerocladus*, which he later modified to *Sclerozus*, but this has universally and correctly been reduced to synonymy.

In 1923 Lecomte described a new species, *Bumelia Harmandii*, from Indo-China (Bull. Mus. Nat. Hist. Par. 29: 179). Its floral and vegetative characters would seem from the description to be wholly consonant with *Bumelia*, although the leaves are somewhat larger than those of any other known species of the genus. In the absence of fruits, its true generic position is uncertain. The genus *Bumelia* is otherwise strictly American.

Bumelia is related to and evidently derived from *Dipholis*, from which it differs primarily in the absence of endosperm. The differences between the two genera may be tabulated as follows:

Bumelia	Dipholis
Seeds without endosperm; cotyledons fleshy.	Seeds with endosperm; cotyledons thin.
Ovary usually hairy, occasionally glabrous.	Ovary nearly always glabrous.
Plant commonly spiny or thorny.	Plant unarmed.
Young and mature fruit commonly broadly rounded to subtruncate or even retuse at the apex.	Young and mature fruit commonly abruptly tapering to the style.
Lateral lobes of the corolla-lobes sometimes wanting.	Lateral lobes of the corolla-lobes always present.
Well-developed on the continent as well as in the West Indies.	Principal development in the Greater Antilles.

According to Record (Trop. Woods 59: 33. 1939) there is also some difference in the wood-anatomy.

Although *Bumelia* and *Dipholis* have almost universally been considered distinct, they were united by Baehni in his survey of the family (Candollea 7: 394–508. 1938). In that and subsequent works Baehni denies the significance of endosperm, pointing out that there are cases where the character is known to fail. All other characters in the family also fail on occasion, however, including the type of seed-scar, on which Baehni founds his subfamilies. The fact is that students of the group have repeatedly noted that the presence or absence of endosperm runs parallel to natural groupings which are otherwise discernible, and this is also the case with *Dipholis* and *Bumelia*. It is not ordinarily necessary to dissect a mature seed to distinguish between the two genera. Baehni's objection to the endosperm character seems also to be founded on the practical difficulties in determining its presence in herbarium specimens, a view with which I can sympathize but not agree.

Bumelia has a considerable number of widespread and highly variable species, and specific lines must frequently be drawn rather broadly. Even then constant tangible characters are all too few, although I have seen very little evidence of hybridization. Length of the pedicels has frequently been used as a specific character, but, except in certain cases of subsessile versus evidently pedicellate flowers, it appears to be of very little value. There is a great deal of variation in pubescence, and many species have been founded on pubescence characters. It is true that the kind and color of the pubescence are very helpful in delimiting the entities, but there is a strong tendency for the hairs to fade and fall off progressively with advancing maturity, so that the young leaves and twigs may be very different in appearance from more mature ones.

The species which occur in the United States have recently been revised by Clark (Ann. Mo. Bot. Gard. 29: 155–182. 1942), who recognized 14 species and several additional varieties. My observations as to the constancy of certain characters, such as the variegation of the seeds in several species, the glabrous ovary in *B. reclinata,* and the entire versus erose corolla-lobes in "*B. texana*" and related entities, are quite contrary to Clark's. I am able to recognize only 5 species in the United States; Asa Gray's treatment in the second edition of the Synoptical Flora is reasonably adequate to distinguish these. Not a single valid species of *Bumelia* seems to have been described from the United States since the appearance of Michaux's flora in 1803. Since Clark cites numerous specimens, and his entities are in general readily equated with mine, I am not citing specimens for the 5 species concerned. In general, all other specimens from outside the United States are cited, except those which belong to widespread species and bear incomplete data.

The most primitive surviving species of the genus is *B. persimilis*. The general similarity of this species to *Dipholis salicifolia* has several times been remarked, and it seems not to be accidental. *Bumelia persimilis* may very well be only slightly removed from the prototype of the genus. Evolutionary trends are toward reduction in size of the whole plant, in size of the leaves and prominence of their veiny reticulum, in size of fruits, and sometimes in the number of flowers in a cluster. I have found the construction of a satisfactory key more than ordinarily difficult. The one here presented follows the natural lines as nearly as possible, at the expense, in some cases, of serviceability in identification.

Bumelia Sw.

Shrubs or trees, commonly but not always spiny; leaves alternate or casually opposite, exstipulate, often small; primary lateral veins not very numerous, sometimes obscure; flowers mostly 5-merous throughout, sometimes casually 4- or 6-merous; corolla-lobes each with a pair of lateral lobes or appendages at the base, or these sometimes suppressed; staminodes present, petaloid, entire to erose or laciniate; ovary usually more or less hairy, sometimes glabrous; ovules solitary in the locules, ordinarily 5, attached basilaterally; young and mature fruit generally broadly rounded or subtruncate to even retuse at the apex; fruit fleshy, mostly 1-seeded, not over about 2.5 cm. long; seed-scar small, nearly basal; endosperm wanting.

Key to the Species

1. Corolla-lobes with lateral appendages (except rarely in South American *B. obtusifolia*).
  2. Fruit large, about 1.5–2.5 cm. long; Mexico to Venezuela.
    3. Fruit smooth, not gall-like; pubescence various.
      4. Leaves large, the larger mostly 5–12 cm. long; primary lateral veins about 10–30 pairs.
        5. Petioles mostly 2–10 mm. long; style 3–7 mm. long; leaves variable in pubescence, but not finely sericeous-strigose with tardily deciduous gray-white hairs beneath; sepals hairy or sometimes glabrous; Mexico to Venezuela..1. *B. persimilis.*
        5. Petioles mostly 10–20 mm. long; style mostly 2–3 (rarely 4) mm. long; leaves finely sericeous-strigose with tardily deciduous gray-white hairs beneath; sepals glabrous; Mexico only..................2. *B. laetevirens.*
      4. Leaves smaller, about 2–4.5 cm. long; primary lateral veins about 4–10 pairs; Queretaro, Mexico....................................3. *B. Altamiranoi.*
    3. Fruit gall-like, covered with short densely rufous-tomentose processes; twigs and lower leaf-surfaces finely velutinous-tomentose, at least when young; Oaxaca, Mexico..4. *B. eriocarpa.*
  2. Fruit smaller, about 6–15 mm. long.
    3. Leaves closely and conspicuously reticulate-veiny, the veins evidently raised; style short, about 0.8–2 mm. long; species of the United States and northeastern Mexico.
      4. Leaves either loosely woolly beneath or soon glabrate, the reticulum evident on both sides.
        5. Fruit 7–15 mm. long; ovary always hairy; Florida to Missouri, Arizona, and Mexico.
          6. Leaves loosely woolly-villous beneath (soon subglabrate in some chiefly far western forms), variable in size....................5. *B. lanuginosa.*
          6. Leaves finely silvery-strigose or -sericeous beneath when young, soon glabrate, the larger commonly 4–13 cm. long; extending west only to eastern Texas..6. *B. lycioides.*
        5. Fruit 4–7 mm. long; ovary often glabrous; leaves loosely hairy beneath when young, soon glabrate, the larger ones mostly 1.5–4.5 cm. long; Florida..7. *B. reclinata.*
      4. Leaves sericeous-tomentose beneath with usually tawny or rufous hairs, sometimes becoming merely sericeous-strigose in age, but only very rarely

glabrate, the pubescence obscuring the reticulum of the lower leaf-surfaces; South Carolina to Florida....................................8. *B. tenax.*

3. Leaves not conspicuously reticulate, or, if occasionally so, then the style more than 2 mm. long; species, except *B. celastrina,* not of the United States and northeastern Mexico.
 4. Leaves not fascicled, except rarely on older branches.
  5. Leaves smooth or more or less veiny, not finely reticulate-striate, nor with a peculiar texture; general distribution, except Hispaniola, Puerto Rico, and the Lesser Antilles.
   6. Leaves essentially glabrous from the first; Jamaica....10. *B. rotundifolia.*
   6. Leaves more or less pubescent, at least when young.
    7. Pubescence of the leaves gray, or in South American forms often slightly tawny; southern Mexico to Argentina.........9. *B. obtusifolia.*
    7. Pubescence of the leaves strongly rufous, at least when young.
     8. Leaves sericeous beneath, tardily glabrate; Bahamas, Cuba, Navassa, Jamaica, and along the mainland coast from southern Vera Cruz to British Honduras..................................11. *B. retusa.*
     8. Leaves merely strigose beneath, generally soon glabrate; San Luis Potosí to Guerrero, west to Baja California; Socorro.
      9. Leaves relatively large, about 4–8 cm. long; Socorro Island...12. *B. socorrensis.*
      9. Leaves smaller, about 2–4.5 (or in *B. verruculosa* 5.5) cm. long; mainland.
       10. Staminodia not all hooded; sepals not at all cartilaginous at the base; flowers relatively large, the corolla about 7.5 mm. long, the anthers 2.5–2.7 mm.; Baja California.....13. *B. peninsularis.*
       10. Staminodia more or less hooded; sepals cartilaginous at the base; flowers relatively small, the corolla about 4.5–5 mm. long, the anthers about 1.6–2 mm. long; Sinaloa and San Luis Potosí to Guerrero.
        11. Staminodia glabrous, laciniate-margined; twigs soon glabrate, not verruculose; Sinaloa to Guerrero.....14. *B. cartilaginea.*
        11. Staminodia villous, entire-margined; twigs soon becoming verruculose with the persistent firm bases of the hairs; San Luis Potosí..........................15. *B. verruculosa.*
  5. Leaves with a peculiar texture, due largely to the very fine reticulated striations trending parallel to the primary lateral veins, not otherwise reticulate; Hispaniola, Puerto Rico, Lesser Antilles, northern Venezuela, and coastal islands.....................................16. *B. obovata.*
 4. Leaves fascicled, or occasionally not so on vigorous young shoots of *B. celastrina.*
  5. Leaves with a peculiar texture, due largely to the very fine reticulated striations trending parallel to the primary lateral veins, not otherwise reticulate; Hispaniola, Puerto Rico, Lesser Antilles, northern Venezuela, and coastal islands..16. *B. obovata.*
  5. Leaves not with such a texture, not finely reticulate-striate; general distribution, except Puerto Rico and the Lesser Antilles.
   6. Fruit dark red, subglobose, less than 1 cm. long; hairs of the leaves and twigs rufous, at least when young; Cuba and Hispaniola...17. *B. glomerata.*
   6. Fruit blue-black, ellipsoid-cylindric, about 7–15 mm. long; hairs of the leaves and twigs gray, white, or wanting; not of Hispaniola, nor of Cuba except in Camaguey.
    7. Leaves, twigs, pedicels, and sepals finely gray-puberulent, sometimes eventually glabrate; Baja California and Sonora, Mexico...18. *B. occidentalis.*

7. Leaves, twigs, pedicels, and sepals glabrous from the first, or with only a few inconspicuous white strigose hairs when young; Texas and adjacent Mexico, south to Venezuela, and Florida, Bahamas, and Camaguey, Cuba.................................19. *B. celastrina.*

1. Corolla-lobes without lateral appendages, or sometimes a mere vestige remaining in *B. conferta;* Cuba and Hispaniola.
   2. Leaves essentially glabrous from the first; flowers 1–4 in a cluster.
      3. Leaves 1.5–3.5 cm. wide; pedicels about 6–10 mm. long; Cuba...20. *B. conferta.*
      3. Leaves 0.5–1.5 cm. wide; pedicels 2 mm. long or less; Hispaniola..21. *B. Picardae.*
   2. Leaves strongly rufous-hairy beneath at least when young, sometimes subglabrate in age; flowers various.
      3. Flowers about 5–25 in a cluster; leaves 1.5–2.5 cm. wide, the primary lateral veins evident beneath; Dominican Republic......................22. *B. integra.*
      3. Flowers solitary or 2 in the axils; leaves less than 1 cm. wide, only the midrib visible beneath; Oriente, Cuba............................23. *B. revoluta.*

1. **Bumelia persimilis** Hemsl. Biol. Centr. Am. Bot. **2**: 298. 1882.

Heavy-trunked spiny tree or large shrub, about 5–18 m. tall; leaves firm, ovate-oblong to elliptic or broadly elliptic-lanceolate, obtuse to more commonly acutish or acuminate, the larger about 5–12 cm. long and 2–5 cm. wide, from conspicuously velvety or spreading-villous with rufous hairs to finely strigose with rufous or gray hairs beneath when young, sooner or later generally more or less glabrate; primary lateral veins about 10–30 pairs, more or less evident, but not always sharply distinct from the larger secondary ones, the final reticulum evident or obscure, but not raised and conspicuous; petioles mostly 3–10 mm. long; flowers several or numerous in axillary clusters, from subsessile to sometimes borne on pedicels fully 1 cm. long; sepals densely rufous-hairy to glabrous, about 1.8–3.7 mm. long; corolla about 3–6 mm. long, the tube about 1.2–1.8 mm. long; anthers included or slightly exserted, 0.8–2 mm. long; staminodes about 1.7–3.8 mm. long, lanceolate to obovate, more or less laciniate; ovary short-pilose, especially near the base, to sometimes glabrous; style 3–7 mm. long; fruit oblong or ellipsoid to spheroidal, about 1.5–2.5 cm. long, reputedly sweet and edible.

Type collection: *Botteri 989,* Orizaba, Vera Cruz, Mexico (F — fragment, G, US).

Distribution: Chihuahua, Mexico, to Federal District, Venezuela.

1A. **Bumelia persimilis** subsp. **typica** nom. nov.

Bumelia persimilis Hemsl. Biol. Centr. Am. Bot. **2**: 298. 1882, sens. strict.
Bumelia leiogyna Donnell Smith, Bot. Gaz. **18**: 4. 1893.
Bumelia pleistochasia Donnell Smith, loc. cit.
Bumelia megaphylla Blake, Contr. Gray Herb. n. ser. **52**: 76. 1917.
Bumelia guatemalensis Standl. Trop. Woods **4**: 9. 1925.
Bumelia panamensis Standl., loc. cit.
Bumelia barba-tigris Pittier, Man. Pl. Us. Venez. 125. 1926.
Bumelia Lankesteri Standl. Trop. Woods. **31**: 40. 1932.
Bumelia Austin-Smithii Standl. Field Mus. Publ. Bot. **18**: 905. 1938.
Bumelia elexochitlensis Schultes & Conzatti, Leafl. Bot. Mus. Harv. Univ. **9**: 190. 1941.

Pubescence of the young twigs fine, appressed or a little loose, reddish or often gray, often sparse, that of the lower surfaces of the leaves fine, strictly appressed, and commonly soon deciduous, reddish or gray; corolla and style sometimes fully as long as in subsp. *subsessiliflora,* sometimes only about 3 mm. long; sepals and ovary sometimes glabrous; fruit commonly spheroidal, sometimes more elongate.

LOCAL NAMES: *Corpus espina, doncello, espino blanco, espino de crujo, ispundio, limoncello, morespino, porcupine tree, tempisquito, zapotillo de peña, zapotillo bravo.*

DISTRIBUTION: Vera Cruz and Oaxaca, Mexico, to Federal District, Venezuela.

MEXICO: *Haenke 1139* (F); *Haenke 1596* (F); *Haenke 1600* (F, NY); *Haenke 1601* (F, NY). Vera Cruz: *Purpus 13071* (A, F, Mo, NY). GUATEMALA: El Petén: *Egler 42–214* (F). San Marcos: *Steyermark 37199* (A, F). Quezaltenango: *Steyermark 34370* (F). Guatemala: *Aguilar 193* (F). Sacatepéquez: *Donnell Smith 1451* (G, NY, US); *Donnell Smith 2184* (G, NY, US); *Standley 58875* (F); *Standley 58898* (F). Escuintla: *Standley 64784* (A, F, NY). Jutiapa: *Standley 75645* (F); *Standley 76223* (F); *Standley 76304* (F); *Steyermark 31791* (F). BRITISH HONDURAS: *Peck 756* (G); *Schipp 1077* (A, F, G, Mich, Mo, NY); *Schipp 1339* (A, F, G, Mich, Mo, NY). EL SALVADOR: *Calderón 294* (NY, US); *Calderón 313* (G, Mo, NY, US); *Calderón 1554* (US). COSTA RICA: *Brenes 3874* (CR, F); *Lankester 1194* (F); *Lankester 1258* (F). Guanacaste: *Standley & Valerio 45491* (US); *Standley & Valerio 46426* (US). Alajuela: *Austin Smith H163* (F); *Austin Smith H229* (F); *Austin Smith H610* (F, US); *Austin Smith 2685* (US). Cartago: *Oersted 315* (US); *Standley 35881* (US). PANAMA: Panama: *Kluge 12* (F, NY, US). COLOMBIA: Atlántico: *Dugand 508-B* (US); *Elias 486* (NY, US); *Elias 698* (NY, US); *Elias 1170* (A, NY, US). Bolívar: *Killip & Smith 14487* (A, G, NY, US). VENEZUELA: *Tamayo 1155* (US). Zulia: *Tejera 57* (G, US). Federal District: *Pittier 5856* (NY); *Pittier 9163* (G, NY, US).

1B. **Bumelia persimilis** subsp. **subsessiliflora** (Hemsl.) comb. nov.
Bumelia subsessiliflora Hemsl. Biol. Centr. Am. Bot. 2: 299. 1882.
Bumelia arborescens Rose, Contr. U. S. Nat. Herb. 1: 339. 1895.
Bumelia stenosperma Standl. Contr. U. S. Nat. Herb. 23: 1117. 1924.
Bumelia Lesueurii Standl. Field Mus. Publ. Bot. 22: 365. 1940.

Pubescence of the young twigs dense, rufous, spreading, often coarsely velvety, that of the lower surfaces of the leaves similar but often longer, looser, and less reddish, and commonly becoming appressed before eventually falling; corolla and style seldom under 4.5 mm. long; sepals and ovary always more or less hairy; fruit commonly oblong or ellipsoid.

TYPE COLLECTION: *Galeotti 7198*, Guadalajara, Jalisco, Mexico, 3000 feet (F — fragment).

LOCAL NAMES: *Bebelama, cupia, cupilla.*

DISTRIBUTION: Chihuahua and Durango to Michoacán and Oaxaca, Mexico.

MEXICO: Chihuahua: *Gentry 2451* (F); *Hewitt s.n.* (A); *LeSueur 1160* (F); *LeSueur 1171* (G); *Lumholtz 528* (G); *Zing A13* (F). Sinaloa: *Ortega 223* (G, US); *Ortega 4241* (US); *Rose, Standley & Russell 13893* (G, Mo). Durango: *Gentry 5261* (G, Mo, NY). Colima: *Palmer 1123* (A, G, Mich, Mo, NY, US). Michoacán: *Leavenworth & Hoogstraal 1393* (Mo). Oaxaca: *Nelson 2548* (F, US).

Bumelia persimilis is one of the several species in the genus with very wide ranges. It is characterized by its large leaves, broadest at or below the middle, with relatively numerous lateral veins, and without a conspicuous raised reticulum, by its large fruit, and by its relatively long style. Herbarium specimens do not indicate an unusual amount of intraspecific variability, except in pubescence, on which two subspecies may be founded. Some specimens from Guatemala, which have mostly been passing as *B. pleistochasia*, have a slightly different aspect than most others of the species and tend to have smaller flowers. Field study may show that varietal recognition is warranted, but from the herbarium material it seems yet quite unjustified. *Bumelia Austin-Smithii* Standl., from Costa Rica, was described by the collector as having a pronounced nipple on the fruit, but it does not seem otherwise different. Careful field investigation may show the need for varietal recognition. *Bumelia stenosperma* Standl., described as having leaves only 1.5–3 cm. long, is merely subsp. *subsessiliflora* with the leaves young and not yet fully expanded. It should be noted that specimens of subsp. *subsessiliflora* with immature foliage have been collected in August, as well as in the spring, suggesting that some factor other than temperature, perhaps rainfall, has a controlling influence.

2. **Bumelia laetevirens** Hemsl. Biol. Centr. Am. Bot. 2: 298. 1882.
Bumelia mexicana Engl. Bot. Jahrb. 12: 519. 1890.
Bumelia Palmeri Rose, Gard. & For. 7: 195. 1894.
Achras olivacea Sesse & Moc. Fl. Mex. 91. 1894.

Spreading heavy-trunked tree much like *B. persimilis,* up to 15 m. tall, the herbarium specimens, at least, nearly always unarmed; leaves elliptic or ovate, broadly rounded to obtuse or acutish at the apex, firm, smooth and shining above, finely strigose or sericeous-strigose with tardily deciduous white hairs beneath, the larger commonly 6–12 cm. long and 2.5–6 cm. wide; venation much like *B. persimilis,* the secondary lateral veins sometimes a little more raised above; petioles about 10–20 mm. long; flowers numerous in axillary clusters, the pedicels commonly 2–8 mm. long; sepals glabrous, about 2–3.5 mm. long; corolla about 3–6 mm. long, the tube about 0.8–1.8 mm. long; anthers about 1–1.9 mm. long, slightly exserted; ovary sparsely pilose, especially below; style mostly 2–3 (rarely 4) mm. long; fruit black, subglobose, mostly 1.5–2 cm. long, edible.

TYPE COLLECTION: *Galeotti 7000,* Cordillera of Oaxaca, Mexico, at 3000 feet.

LOCAL NAMES: *Bebalama, cupia, tempesquistle.*

DISTRIBUTION: Sinaloa to Tamaulipas, south to Oaxaca and Vera Cruz, Mexico.

MEXICO: *Liebmann 311* (US); *Liebmann 312* (US); *Sesse, Mociño et al. 5151* (F). Sinaloa: *Collins & Kempton 69* (US); *Gentry 5494* (F, G); *Ortega 795* (F); *Ortega 4174* (US); *Ortega 4503* (US); *Ortega 4532* (US); *Ortega 5647* (US); *Ortega 5686* (US); *Ortega 5847* (G, US); *Ortega 6703* (F, Mo, US); *Palmer 1513* (G, NY, US); *Rose, Standley & Russell 13897* (G, Mo). Durango: *Goldman 334* (F, G, US). Tamaulipas: *LeSueur 644* (F); *LeSueur 648* (F); *Palmer 212* (G, Mo, NY, US). San Luis Potosí: *Palmer 48* (G, NY, US). Tepic: *Maltby 99* (US). Hidalgo: *Chase 7441* (F, G, Mo, NY). Vera Cruz: *Botteri 1014* (G, US); *Palmer 364* (G, Mo, NY, US). Mexico: *Matuda 1229* (A, Mich, Mo). Puebla: *Pringle 13872* (G, Mich, US); *Purpus 5849* (G, Mo, NY, US); *Rojans 4* (US); *Rose et al. 10140* (NY, US). Oaxaca: *Conzatti 2481* (F); *Conzatti 3459* (US); *Conzatti 4612* (US); *Conzatti 4618* (US).

This species is obviously related to *B. persimilis,* and none of the characters separating it from that species, sens. amplior., shows real discontinuity. I have seen no evidence of hybridization, however, and am convinced that the two are properly considered distinct. It should be noted that *B. persimilis* subsp. *typica,* which sometimes approaches *B. laetevirens* in pubescense, does not occur through most of the range of the latter.

3. **Bumelia Altamiranoi** Rose & Standl. Contr. U. S. Nat. Herb. 23: 1117. 1924.

Spiny tree or shrub; young twigs loosely tomentose with gray-white or at first tawny-rufous hairs; leaves ovate to elliptic-oblong, broadly rounded to acutish at the apex, 2.5–4.5 cm. long, 1.5–3 cm. wide, woolly-villous with persistent white hairs beneath, more finely hairy and eventually glabrate above; primary lateral veins about 4–10 pairs; secondary lateral veins forming a loose scarcely raised reticulum above; petioles about 3–6 mm. long; flowers unknown; fruit about 1.5–2 cm. long, subglobose, the pedicel 3 mm. long, woolly-villous, the persistent sepals about 3–4 mm. long, similarly white-hairy.

TYPE COLLECTION: *Rose, Painter & Russell 9725*, near Cadereyta, Queretaro, Mexico, August 21, 1905 (NY, US).

DISTRIBUTION: Known only from the type locality, Queretaro, Mexico. Another collection is *Altamirano 1644* (US).

This species resembles forms of the more northern *B. lanuginosa* in pubescence but it has smaller, less reticulate leaves, and larger fruit. It may also be compared to *B. persimilis*, which has larger leaves with more numerous lateral veins, and in which the pubescence, if spreading, is always rufous.

4. **Bumelia eriocarpa** Greenman & Conzatti, Field Mus. Publ. Bot. 2: 334. 1912.

More or less thorny; twigs coarse, finely velutinous-tomentose, at least when young; leaves narrowly elliptic, lance-elliptic, or elliptic-oblong, rounded at the apex, the larger commonly 5–9 cm. long and 18–30 mm. wide, smooth and shining above, densely and sometimes very finely velutinous-tomentose beneath with gray or sometimes tawny, persistent or tardily deciduous hairs; primary lateral veins about 5–12 pairs; secondary veins few, forming a loose reticulum above and beneath; petioles about 5–10 mm. long; flowers in clusters axillary to leaves or leaf-scars, subsessile, the pedicels less than 2 mm. long, tawny-tomentose; sepals about 2.5–3.5 mm. long, hairy like the pedicels; corolla about 5–6 mm. long, the tube 1.7–2 mm. long; anthers 2 mm. long; ovary densely long-hairy; style 4 mm. long; fruit 1.5–2 cm. long, ellipsoid-globose, gall-like in appearance, covered with very short densely rufous-tomentose processes; seed (from a fruit 2 cm. long) 1.6 cm. long, its scar nearly orbicular, basilateral, 6.5 mm. long.

TYPE COLLECTION: *Conzatti 1586*, Cerro San Antonio, 1700 m., October 28, 1906, Oaxaca, Mexico (F, NY, US).

DISTRIBUTION: Oaxaca, Mexico.

MEXICO: Oaxaca: *Conzatti 1772*, Cerro del Tule, 1700 m. (F, G); *Conzatti 2028*, Cerro San Antonio, 1600 m. (F); *Smith 159*, Mts. of Jayacatlán, 4500 ft. (G).

Although evidently related to *B. persimilis*, *B. Altamiranoi*, and *B. lanuginosa*, this species is readily distinguished by its gall-like fruit. Additional differences will be noted when it is compared with any one of the related species.

5. **Bumelia lanuginosa** (Michx.) Pers. Syn. 1: 237. 1805.

Shrub or tree about 1–15 m. tall, more or less thorny; leaves oblanceolate to sometimes obovate or elliptic, broadly rounded to sometimes acute at the apex, mostly 2–10 cm. long and 0.5–3.5 cm. wide, loosely woolly-villous with white to tawny or rufous hairs when young, soon glabrate above, persistently hairy to sometimes soon glabrate beneath, reticulate-veiny on both sides, sometimes fascicled; flowers more or less numerous in each cluster, the hairy or subglabrous pedicels 2–15 mm. long; sepals strongly hairy or nearly glabrous, 1.5–3.2 mm. long; corolla about 3–4.7 mm. long, the tube 1.3–2 mm. long; staminodes deltoid-ovate, about 1.9–2.7 mm. long, nearly equaling the corolla-lobes; anthers 1–1.5 mm. long; ovary pilose; style 1–1.5 mm. long; fruit obovoid to broadly ellipsoid or subglobose, commonly purplish-black, 7–12 mm. long.

TYPE COLLECTION: *Michaux,* Georgia.

DISTRIBUTION: Mostly in uplands, occasionally in bottoms; Florida to Missouri and Kansas, south to Texas, southern Arizona, and the northern tier of states in Mexico.

Key to the Subspecies

1. Larger leaves mostly 5–10 cm. long (occasionally smaller in ssp. *typica*); often over 5 m. tall; Florida to Missouri, Kansas, Oklahoma, eastern and central Texas, and Coahuila and Nuevo León, Mexico.
   2. Pubescence of the leaves persistently tawny or rufous; almost entirely east of the Mississippi River...ssp. *typica.*
   2. Pubescence of the leaves gray or nearly white, occasionally tawny at first, before the leaves are fully expanded; almost entirely west of the Mississippi River...ssp. *oblongifolia.*
1. Larger leaves mostly 2–5 cm. long; seldom over 4–5 m. tall; southwestern Oklahoma, through central and western Texas, to southern Arizona and the northern tier of states in Mexico...ssp. *rigida.*

5A. **Bumelia lanuginosa** subsp. **typica** nom. nov.
Sideroxylon lanuginosum Michx. Fl. Bor. Am. 1: 122. 1803.
Bumelia lanuginosa Pers. Syn. 1: 237. 1805, sens. strict.
Chrysophyllum ludovicianum Raf. Fl. Ludovic. 53. 1817.
Bumelia rufa Raf. New Fl. N. Am. 3: 29. 1836.
Bumelia ferruginea Nutt. N. Am. Sylva 3: 34. 1849.

Characters and distribution as given in the key.

5B. **Bumelia lanuginosa** subsp. **oblongifolia** (Nutt.) stat. nov.

Characters and distribution as given in the key.

TYPE COLLECTION: *Nuttall,* Arkansas (same as *B. oblongifolia* Nutt.) (PA).

5B1. **Bumelia lanuginosa** subsp. **oblongifolia** var. **oblongifolia** (Nutt.) Clark, Ann. Mo. Bot. Gard. 29: 163. 1942 (as *B.l.* var. *o.*).
Bumelia oblongifolia Nutt. Gen. 1: 135. 1818.
Bumelia arachnoidea Raf. New Fl. N. Am. 3: 28. 1836.
Bumelia tomentosa A. DC. in DC. Prodr. 8: 190. 1844.
Bumelia arborea Buckl. Proc. Phil. Acad. 1861: 461. 1862.

Pubescence not very dense, generally merely grayish; pedicels tending to be short and stout. Range of the subspecies.

5B2. **Bumelia lanuginosa** subsp. **oblongifolia** var. **albicans** Sarg. Jour. Arnold Arb. 2: 168. 1921 (as *B.l.* var. *a.*).

Pubescence of the leaves long, dense, white or nearly so, commonly less tangled than in var. *oblongifolia;* pedicels tending to be long and slender, with some conspicuously spreading hairs. Texas and southeastern Oklahoma, extending into Nuevo León.

TYPE COLLECTION: *Sargent s.n.,* Guadelupe River bottoms, Victoria, Victoria County, Texas, April 9, 1915 (A).

5C. **Bumelia lanuginosa** subsp. **rigida** (A. Gray) stat. nov.

Characters and distribution as given in the key.

TYPE COLLECTION: Same as *B. lanuginosa* var. *rigida* A. Gray.

5C1. **Bumelia lanuginosa** subsp. **rigida** var. **rigida** A. Gray, Syn. Fl. ed. 2. 2(1): 68. 1886 (as *B.l.* var. *r.*).

Bumelia rigida Small, Bull. N. Y. Bot. Gard. 1: 444. 1900.

Pubescence of the leaves persistent, or only in age partly deciduous; pedicels and sepals evidently hairy. Southwestern Oklahoma, through central Texas to northern Mexico, thence west to southern Arizona.

TYPE COLLECTION: Not specified, from among collections by *Wright, Palmer, Pringle*, and *Lemmon*.

5C2. **Bumelia lanuginosa** subsp. **rigida** var. **texana** (Buckl.) comb. nov.

Bumelia texana Buckl. Bull. Torrey Club 10: 90. 1883.

Bumelia monticola Buckl. op. cit. 91.

Bumelia riograndis Lundell, Contr. Univ. Mich. Herb. 8: 77. 1942.

Pubescence of the leaves finer and less dense than in var. *rigida*, soon largely deciduous except for a few hairs along the midrib; pedicels and sepals usually sparsely hairy or subglabrous, sometimes more evidently hairy. Southwestern Oklahoma, western and central Texas, and adjacent Mexico.

TYPE COLLECTION: *Buckley s.n.*, mountains near the lower crossing of the Pecos River on the road from Ft. Stockton to old Fort Lancaster and the head of Devil's River (NY).

The data on herbarium labels would indicate that subspecies *typica* and *oblongifolia* do not ordinarily ascend to more than about 1500 feet, while subspecies *rigida* seldom descends below that level. The range of variation in pubescence of subsp. *oblongifolia* and subsp. *rigida* is about the same, although the latter is much more often soon subglabrate than the former. The division of subsp. *oblongifolia* into var. *oblongifolia* and var. *albicans* is comparable to the division of subsp. *rigida* into var. *rigida* and var. *texana*, but the line is not drawn in just the same place. The var. *texana* is much less hairy than the average of its counterpart, var. *oblongifolia*. In each of these two subspecies, the two varieties share a large part of their range in common, but have entirely individual range-outlines. The varieties of ssp. *rigida* are fairly well defined, but clearly intergrade. As shown on Clark's map, var. *texana* occurs frequently through a large part of western Texas where var. *rigida* is apparently absent. The varieties of subsp. *oblongifolia*, on the other hand, are rather poorly defined, and the range of var. *albicans* is entirely included within that of var. *oblongifolia*. The typical subspecies is apparently always rather copiously hairy. The nearest thing to a subglabrate phase is furnished by *B. reclinata*, which also differs in its lower habit, smaller leaves, and smaller fruit, and seems quite distinct.

6. **Bumelia lycioides** (L.) Pers. Syn. 1: 237. 1805.

Sideroxylon spinosum Duham. Arb. 2: 260. 1755. Not *Bumelia spinosa* A. DC. 1844.

Sideroxylon lycioides L. Sp. Pl. ed. 2. 279. 1762.

Sideroxylon decandrum L. Mant. 48. 1767.

Robertia decandra Scop. Introd. 154. 1777.

Sideroxylon laeve Walt. Fl. Carol. 100. 1788.

Decateles lycioides Raf. Sylv. Tellur. 36. 1838.

Lycioides spinosum Kuntze, Rev. Gen. 2: 406. 1891.

Bumelia cassinifolia Small, Bull. N. Y. Bot. Gard. 1: 442. 1900.

Bumelia lucida Small, loc. cit., not Roem. & Schult.
Bumelia lycioides var. *virginiana* Fernald, Rhodora **38**: 439. 1936.
Bumelia lycioides var. *ellipsoidalis* Clark, Ann. Mo. Bot. Gard. **29**: 172. 1942.
Bumelia Smallii Clark, Ann. Mo. Bot. Gard. **29**: 172. 1942.

Shrub or small tree, about 1–10 m. tall, often thorny; young twigs glabrous; leaves mostly elliptic or elliptic-oblanceolate and narrowed to the acuminate to obtuse apex, occasionally obovate and broadly rounded, commonly 4–13 cm. long and 1–4.5 cm. wide, occasionally some of them smaller, conspicuously reticulate-veiny on both sides, glabrous above, glabrous or more commonly with a few short hairs chiefly along the midrib beneath, the very young leaves more evidently silvery, but the pubescence evanescent; flowers numerous, commonly about 20–60 in a cluster, the pedicels glabrous or slightly hairy, mostly 4–10 mm. long; sepals glabrous, or with a few reddish hairs within, about 1.4–2.9 mm. long; corolla 3.2–4 mm. long, the tube shorter than or sometimes equaling the lobes; anthers 1.2–1.7 mm. long; style about 1.1–2 mm. long; ovary short-hairy; staminodes ovate or rhombic-ovate, about 1.8–2.4 mm. long; fruit ellipsoid to obovoid or ellipsoid-globose, commonly 7–13 mm. long; seeds about 6–9 mm. long, commonly tan or light brown, occasionally a little variegated.

TYPE COLLECTION: None given; references to several older works.

DISTRIBUTION: River-banks and wet or dry woods; Florida to eastern coastal Texas, north to Arkansas, s. Missouri, s. Indiana, and s. Virginia.

Neither the shape of the fruit nor the shape of the leaf-apex, on which bases varieties have been proposed, shows sufficient constancy to furnish grounds for taxonomic segregation. *B. Smallii* is described by Clark as a small-leaved relative with the leaves only 2–5 cm. long, but several of the collections at the New York Botanical Garden so annotated by Clark have the larger leaves 4.5–8 cm. long, well within the normal range of variation in *B. lycioides*.

7. **Bumelia reclinata** (Michx.) Vent. Choix des Pl. *pl. 22*. 1803.

Low spiny often spreading or decumbent shrub about 0.4–2 m. tall, rarely a little taller; young twigs varying from sparsely white-hairy or subglabrous to densely rufous-tomentulose, eventually glabrate; leaves oblanceolate to nearly obovate or elliptic, rounded to occasionally retuse at the apex, about 0.5–5 cm. long and 0.2–2.5 cm. wide, evidently reticulate-veiny on both sides, hairy when young, the pubescence generally denser, looser, and woollier than in *B. lycioides,* but evanescent; flowers commonly less than 20 in each cluster, the pedicels about 3–13 mm. long, glabrous or appressed-hairy; sepals glabrous or appressed-hairy, mostly 1.3–2.1 mm. long; corolla about 2.6–3.9 mm. long, the tube shorter than the lobes; anthers about 0.6–1.1 mm. long; staminodes lance-elliptic to deltoid-ovate, about 1.3–1.8 mm. long; ovary glabrous or hairy; fruit subglobose, 4–7 mm. long.

TYPE COLLECTION: Michaux, "in dumetis ripariis Georgiae."

DISTRIBUTION: Low, often sandy ground; Florida, extending into southern Georgia. There is also in the Torrey Herbarium a single specimen labeled "Louisiana. Dr. Hale.", which apparently constitutes the sole basis for the frequent inclusion of Louisiana in the cited range.

7A. **Bumelia reclinata** var. **reclinata** (Michx.) comb. nov.
Sideroxylon reclinatum Michx. Fl. Bor. Am. **1**: 122. 1803.

Bumelia reclinata Vent. Choix des Pl. *pl. 22.* 1803, sens. strict.
Bumelia macrocarpa Nutt. N. Am. Sylva **3**: 34. 1849.
Bumelia lycioides var. *reclinata* A. Gray, Syn. Fl. 2(1): 68. 1878.
Bumelia microcarpa Small, Bull. N. Y. Bot. Gard. **1**: 440. 1900.

Pubescence white or grayish, not at all rufous, evanescent; young twigs generally only sparsely hairy; ovary glabrous or sometimes hairy. Range of the species.

7B. **Bumelia reclinata** var. **rufotomentosa** (Small) comb. nov.
Bumelia rufotomentosa Small, Bull. N. Y. Bot. Gard. **1**: 440. 1900 (as *B. rufomentosa*).

Pubescence strongly rufous, generally coarser than in var. *reclinata*, a few hairs commonly persisting on the lower leaf-surfaces until maturity; young twigs strongly rufous-tomentulose; ovary generally hairy. Local from Alachua to Orange and Hillsborough Counties, Florida.

TYPE COLLECTION: *Garber s.n.*, Tampa, Hillsborough County, Florida, May, 1876 (NY, US).

8. **Bumelia tenax** (L.) Willd. Sp. Pl. **1**: 1085. 1798.
Sideroxylon tenax L. Mant. 48. 1767.
Chrysophyllum carolinense Jacq. Obs. **3**: 3. *pl. 54.* 1768.
Sideroxylon sericeum Walt. Fl. Car. 100. 1788.
Sideroxylon chrysophylloides Michx. Fl. Bor. Am. **1**: 123. 1803.
Bumelia chrysophylloides Pursh, Fl. Am. Sept. **1**: 155. 1814.
Sclerocladus tenax Raf. Sylv. Tellur. 35. 1838.
Sclerozus tenax Raf. Aut. Bot. **2**: 73. 1840.
Bumelia megacocca Small, Bull. N. Y. Bot. Gard. **1**: 441. 1900.
Bumelia lacuum Small, Man. S. E. Fl. 1034. 1933.

Branching thorny shrub or small tree about 1–5 m. tall; young twigs puberulent to sericeous-tomentose with mostly rufous or tawny hairs; leaves oblanceolate to spatulate or sometimes nearly elliptic, rounded at the apex, mostly 1–8 cm. long and 0.4–3.5 cm. wide, glabrous and evidently reticulate-veiny on the upper surface, densely sericeous or sericeous-tomentose with mostly tawny or rufous hairs on the lower surface, the pubescence often obscuring the veins; flowers about 10–30 in a cluster, the clusters sometimes closely aggregated, the pedicels rufous-hairy to occasionally subglabrate, commonly 6–15 mm. long; sepals finely rufous-sericeous or -strigose, about 1.5–3 mm. long; corolla about 3.1–4.2 mm. long, the lobes a little longer than the tube; anthers about 1.1–1.5 mm. long; staminodes broadly ovate, about 1.5–1.9 mm. long; ovary shortly pilose; style about 1–1.5 mm. long; fruit obovoid to ellipsoid or subglobose, about 8–14 mm. long; seed solitary, about 6–9 mm. long, very smooth and shining, light brown, occasionally somewhat variegated.

TYPE COLLECTION: *Dr. Alexander Garden*, South Carolina, probably near Charleston.

DISTRIBUTION: Dry, often sandy soil; coastal plain, from South Carolina to Florida.

An uncommon but widely distributed form with the pubescence of the leaves merely silvery may be known as **Bumelia tenax** f. **anomala** (Sarg.) comb. nov. (*Bumelia lanuginosa* var. *anomala* Sarg. Jour. Arnold. Arb. **2**: 168. 1921; *Bumelia anomala* Clark, Ann. Mo. Bot. Gard. **29**: 169. 1942).

9. **Bumelia obtusifolia** Roem. & Schult. Syst. Veg. **4**: 802. 1819.

Large, more or less spiny shrub or small tree, up to 15 m. tall; twigs sericeous or sometimes loosely sericeous-tomentose with pale or sometimes rufous hairs when young, soon glabrate; leaves from oblanceolate to suborbicular, broadly rounded at the apex, gradually or abruptly tapering at the base, commonly 2–5 cm. long and 1–3 cm. wide, sometimes larger, as much as 9 cm. long and 4.5 cm. wide, sericeous or strigose beneath with gray or faintly rufous-tinted hairs when young, later glabrate, obscurely or sometimes more evidently veiny; flowers 1 — numerous in axillary clusters, subsessile or on pedicels up to 8 mm. long; sepals 1.3–3 mm. long, strigose or sericeous with gray hairs; corolla about 2.4–5.4 mm. long, its tube 0.5–2 mm. long; anthers 0.9–2 mm. long; staminodes from narrowly oblong and erose to ovate and subentire, sometimes hooded, about 1.5–3.2 mm. long; style about 1.5–4.6 mm. long; fruit ellipsoid-cylindric to subglobose, about 8–15 mm. long.

Type collection: *Humboldt* & *Bonpland*, "in ripa fluminis Amazonum, ad confluentem Chinchipen, alt. 200 h. (Prov. Jaen de Bracamoros)", at the north end of the present province of Cajamarca, Peru.

Distribution: Southern Mexico to northern Argentina.

Local names: *Has toch, chi cheh chehum, sinan-che, malermo, picurero, picuyú, caimito, piquillin, ivira-nina.*

9A. **Bumelia obtusifolia** subsp. **typica** nom. nov.
Bumelia obtusifolia Roem. & Schult. Syst. Veg. 4: 802. 1819, sens. strict.

Leaves about twice as long as wide, subelliptic to broadly oblanceolate or narrowly obovate; flowers in axillary clusters of about 1–5, the pedicels 2–4 mm. long; corolla 4.7–5.2 mm. long; style about 4 mm. long; staminodes ovate or oblong, subentire, more or less hooded.

Distribution: Ecuador and northern Peru.

Ecuador: Manabí: *Haught 3377*, abundant near the sea, between Salango and Puerto Lopez (NY, US).

9B. **Bumelia obtusifolia** subsp. **buxifolia** (Roem. & Schult.) stat. nov.
Bumelia buxifolia Roem. & Schult. Syst. Veg. 4: 802. 1819.
Bumelia Dunantii A. DC. in DC. Prodr. 8: 191. 1844.
Bumelia Cruegerii Griseb. Fl. Brit. W. Ind. 401. 1861.
Bumelia obtusifolia var. *buxifolia* Miq. in Mart. Fl. Bras. 7: 47. 1863.
Bumelia guatemalensis Standl. Trop. Woods 4: 9. 1925.
Bumelia Grisebachii Pierre in Urb. Symb. Ant. 5: 141. 1904.
Bumelia nicaraguensis Loes. Bot. Jahrb. 60: 367. 1926.
Bumelia conglobata Standl. Trop. Woods 31: 40. 1932.
Bumelia mayana Standl. Trop. Woods 31: 41. 1932.

Leaves mostly 1–2 times as long as wide, broadly elliptic to obovate or suborbicular; petioles generally conspicuously exceeding the pedicels; flowers more or less numerous in dense clusters; corolla about 2.4–5.4 mm. long; style about 1.5–4 mm. long; staminodes ovate, subentire, scarcely or not at all hooded.

Type collection: *Humboldt* & *Bonpland*, Cumaná, Sucre, Venezuela (NY—photo).

Distribution: Tabasco, Mexico, to Nicaragua; northern Colombia and Venezuela to Trinidad, chiefly near the coast.

Mexico: Tabasco: *Matuda 3034* (A, Mich). Campeche: *Lundell 1277* (A, F, G, Mich, Mo, NY, US); *Stewart 130* (G). Yucatán: *Gaumer 473* (A, F, Mich, Mo, NY, US); *Gaumer 1572* (F); *Gaumer 1791* (A, F, G, Mo, NY, US); *Gaumer 23238* (A, F, G, Mo, NY, US); *Gaumer 23845* (F, G, Mo, NY, US); *Lundell 7501* (A); *Schott 341* (F, US); *Schott 341A* (F); *Schott 341B* (F); *Seler 4937* (G, US); *Steere 1674* (Mich); *Stewart 258* (G). Quintana Roo: *Lundell 7717* (A); *Steere 2399*

(F, Mich). GUATEMALA: El Petén: *Bartlett 12290* (A, F, G, Mich, NY, US); *Bartlett 12593* (A, NY, F); *Bartlett 12739* (A, Mich, NY, US); *Lundell 2201* (Mich). Baja Verapaz: *Kellerman 6588* (F). Zacapa: *Steyermark 29363* (F). BRITISH HONDURAS: *Bartlett 13099* (Mich). HONDURAS: Comayagua: *Edwards 559* (A, F, US). Tegucigalpa: *Dyer 268* (US). NICARAGUA: *Wright s.n.* (G, US). Matagalpa: *Rothschuhe 463* (F — photo & fragment, G — photo, NY — photo). COLOMBIA: Magdalena: *Herbert Smith 2740* (A, G, NY); *Herbert Smith 2071* (A, G, NY, US). VENEZUELA: *Curran & Haman 810* (G, NY); *Curran & Haman 910* (A, G, NY, US); *Curran & Haman 1266* (G, US); *Tamayo 771* (US); *Tamayo 2083* (US). Zulia: *Curran & Haman 759* (G). Falcón: *Curran & Haman 564* (G, NY, US). Carabobo: *d'Heguert 861* (NY). Federal District: *Pittier 7765* (G, US); *Pittier 9206* (G, NY, US); *Pittier 12432* (A, NY, US); *Pittier 13386* (A, NY, US); *Pittier 13479* (US); *Rose 21830* (US); *Tamayo 1139* (US). Sucre: *Bond, Gillin & Brown 44* (NY); *Broadway 107* (G, NY, US); *Broadway 213* (G, NY, US); *Broadway 613* (G, NY, US); *Broadway 651* (G, NY, US); *Johnston 273* (G). TRINIDAD: *Britton & Bailey 2240* (G, NY, US); *Britton & Broadway 2633* (G, NY, US); *Britton & Hazen 817* (G, NY, US), *1725* (G, NY, US); *Britton et al. 2696* (NY, US); *Broadway 8085* (A); *Hart 2196* (NY, US).

9C. **Bumelia obtusifolia** subsp. **excelsa** (A. DC.) stat. nov.

Bumelia sartorum Mart. Herb. Fl. Bras. 233. 1837–40.
Bumelia rhamnoides Casar. Nov. Stirp. Bras. Dec. 64. 1843.
Bumelia excelsa A. DC. in DC. Prodr. **8**: 192. 1844.
Bumelia obtusifolia var. *excelsa* Miq. in Mart. Fl. Bras. **7**: 48. 1863.
Bumelia fragrans Ridley, Jour. Linn. Soc. **27**: 43. 1890.

Leaves mostly 1.5–3.5 times as long as wide, oblanceolate to elliptic or narrowly obovate; petioles scarcely if at all exceeding the pedicels; flowers in loose clusters of about 1–10; corolla about 3.3–4.7 mm. long, its tube only 0.6–1.5 mm. long; staminodes narrowly oblong to lance-ovate, erose, not hooded.

TYPE COLLECTION: *Blanchet 2162*, "in maritimis ca. Bahiam," Brazil.

DISTRIBUTION: Piauhy, Pernambuco, and Fernando do Noronha Island, Brazil, south to Rio de Janeiro, and inland to Paraguay, northern Argentina, and southern Bolivia.

BRAZIL: *Riedel 19* (US). Piauhy: *Luetzelburg 1643* (NY). Fernando do Noronha Island: *Ridley, Lea & Ramage 97* (G). Pernambuco: *Pickel 3386* (A, G). Bahia: *Blanchet 2763* (NY). Rio de Janeiro: *Glaziou 11159* (NY, US), *18439* (A, NY); *Riedel 543* (US). PARAGUAY: *Fiebrig 5392* (US); *Hassler 2153* (G), *7200* (A), *7250* (G), *11507* (A), *11811* (A, G, US), *12286* (A, G, US); *Kuntze s.n.* (in 1892) (NY); *Malme 1032* (G, NY, US). ARGENTINA: Jujuy: *Eyerdam & Beetle 22547* (G), *22548* (G); *Lillo 10792* (G), *10838* (G). Salta: *Eyerdam & Beetle 22896* (G), *22929* (G); *Parodi 9219* (G); *Rodriguez 54* (G); *Rodriguez 1129* (NY); *West 6147* (G). Tucumán: *Lillo 7208* (G); *Venturi 1059* (G, US); *Venturi 1530* (A, US); *Venturi 7588* (US). Formosa: *Jorgensen 2154* (G). Chaco: *Jorgensen 1954* (G, US); *Venturi 9768* (A, G, US). Corrientes: *Parodi 11922* (G). BOLIVIA (Southern): *Pflanz 693* (G).

The northern and southern phases of subsp. *buxifolia* show different trends of variation, but many individuals are quite indistinguishable in the herbarium. The more northern plants have a short style (1.5–3 mm.), often have relatively large leaves (to 9 × 4.5 cm.), and tend to have narrowly ellipsoid fruit. The southern ones have a longer style (to 4 mm.), seldom have the leaves over 5 cm. long, tend to have broader often subglobose fruit, and sometimes have the lateral lobes of the corolla-lobes conspicuously reduced or even obsolete. In spite of the apparent geographical disjunction of more than 600 miles, taxonomic segregation seems unwise until more stable distinguishing features are found.

Subspecies *excelsa* differs from ssp. *buxifolia* in an imposing array of features, none of which is quite constant. In addition to the characters given in the description, it frequently has the leaves more persistently pubescent beneath than does ssp. *buxifolia,* with hairs that may be slightly rufous-tinted, and tends to have a more nearly rotate, less campanulate corolla.

I have not seen the type of *B. obtusifolia,* but from the description and locality I think it should be associated with a single collection from Ecuador, which has narrow leaves and few flowers, like ssp. *excelsa,* but short pedicels and ovate entire staminodia like ssp. *buxifolia.* The Ecuadorean specimen also differs from both ssp. *buxifolia* and ssp. *excelsa* in having the staminodia more or less hooded. The flowers of *B. obtusifolia* were originally described as white, but, although collectors' notes for ssp. *buxifolia* and ssp. *excelsa* indicate white or greenish flowers, it is uncertain whether the color was noted by Humboldt in the field, or merely taken from the dried specimen by Kunth. The Ecuadorean specimen was noted by the collector to have yellow flowers; it is not known whether or not this color difference is significant.

10. **Bumelia rotundifolia** Sw. Prodr. Veg. Ind. Occ. 50. 1788.
Achras rotundifolia Poir. in Lam. Encyc. Meth. 6: 534. 1804.
Bumelia Purdiaei Urb. Symb. Ant. 5: 143. 1904.
Bumelia clarendonensis Urb. Rep. Sp. Nov. 13: 470. 1915.
Bumelia clarendonensis Urb. Rep. Sp. Nov. 21: 67. 1925, not 1915.
Bumelia peckhamensis Urb. Rep. Sp. Nov. 22: 93. 1925.

Small unarmed tree about 4–9 m. tall, essentially glabrous from the first, or the young twigs occasionally with some appressed evanescent white hairs; leaves firm, suborbicular or broadly elliptic to occasionally obovate, about 1.5–7.5 cm. long and 1–5 cm. wide, alternate or opposite, evidently veiny when young, less so with advancing age, often becoming very obscurely so, borne on short petioles about 3–7 mm. long; flowers in axillary clusters of about 3–12, the pedicels mostly 3–6 mm. long, glabrous; sepals glabrous, about 1–2.5 mm. long, firmly erect and becoming cartilaginous at the base, restricting the lateral growth of the base of the fruit; corolla about 3.2–3.9 mm. long; anthers 1.2–1.5 mm. long; staminodes about 1.5–1.8 mm. long; style about 2–3 mm. long; mature fruit unknown, but maturing fruit ellipsoid, about 7 mm. long.

TYPE COLLECTION: *Swartz,* Jamaica.

DISTRIBUTION: Jamaica.

JAMAICA: *Britton 2824* (NY), *3067* (NY); *Britton & Hollick 1865* (NY), *2220* (NY); *Harris 6169* (NY), *10035* (NY), *10165* (NY, US), *10386* (NY, US), *11040* (NY), *11111* (NY); *Purdie s.n.* (G, NY).

This species is related to *B. obtusifolia,* from which it differs in being essentially glabrous from the first, with the leaves becoming very firm, and in its distribution. The only other species of *Bumelia* that occurs on Jamaica is *B. retusa,* from which the present species likewise differs in being glabrous, with broader leaves that rarely taper to the base. One specimen

(*Walsingham s.n.* — NY) seems intermediate between *B. rotundifolia* and *B. retusa*, and may be a hybrid.

11. **Bumelia retusa** Sw. Prodr. Veg. Ind. Occ. 49. 1788.

Shrub or small tree about 1–6 m. tall, ordinarily nearly or quite unarmed; young twigs sericeous-strigose with rufous hairs which may later turn pale; leaves alternate or opposite, narrowly to broadly obovate or occasionally suborbicular, narrowed at the base, broadly rounded at the apex, mostly 1.5–5 (rarely 7) cm. long and 7–40 mm. wide, rather obscurely or scarcely reticulate, densely and finely sericeous-strigose with rufous hairs on both sides when young, very soon glabrate above, tardily so below, the hairs often turning pale before falling; petioles about 2–8 mm. long; flowers in axillary clusters of about 1–10, the pedicels 2–13 mm. long, sericeous-strigose with rufous hairs that eventually fade; sepals rufous-strigose, about 1.5–3.3 mm. long; corolla about 3.3–5.5 mm. long, the tube 1–2 mm. long; anthers 0.8–1.7 mm. long; staminodes ovate or lanceolate to rotund, erose or subentire, about 1.3–2.8 mm. long; style about 0.7–4.6 mm. long; fruit black, broadly ellipsoid or subglobose, about 6–12 mm. long.

TYPE COLLECTION: None given; stated to come from Jamaica.

DISTRIBUTION: Bahama Islands; Navassa Island; Jamaica; Santa Clara and Pinar del Río, Cuba; southern Vera Cruz to Yucatán and British Honduras. Chiefly or entirely in coastal areas.

11A. **Bumelia retusa** subsp. **typica** nom. nov.

Bumelia retusa Sw. Prodr. Veg. Ind. Occ. 49. 1788, sens. strict.
Achras retusa Poir. in Lam. Encyc. 6: 533. 1804.
Bumelia retusa var. *loranthifolia* Pierre in Urb. Symb. Ant. 5: 145. 1904.
Bumelia loranthifolia Britt. Bull. N.Y. Bot. Gard. 3: 447. 1905.
Bumelia bahamensis Britt. loc. cit.
Bumelia oblongata Urb. Symb. Ant. 6: 31. 1909.
Bumelia excisa Urb. Rep. Sp. Nov. 13: 471. 1915.
Bumelia Roigii Britt. & Small, Bull. Torrey Club 53: 461. 1926.
Bumelia navassana Urb. & Ekm. Ark. Bot. 22A(17): 71. 1929.

Flowers relatively small, the corolla mostly 3.3–4.5 mm. long, the anthers about 0.8–1.3 mm., the staminodes about 1.3–2 mm. long, the style about 0.8–3.3 mm. long. Bahamas, Cuba, Navassa, and Jamaica.

BAHAMAS: Abaco: *Brace 1565* (NY); *Brace 1543* (NY). Acklin's Island: *Brace 4366* (G, NY, US); *Brace 4476* (F); *Eggers 3924* (US). Andros: *Brace 5034* (NY); *Brace 5151* (NY); *Brace 5264* (NY); *Brace 5311* (NY); *Brace 5323* (NY); *Northrop 544* (A, F); *Small & Carter 8545* (G, NY, US); *Small & Carter 8612* (G, NY, US). Anguilla Isles: *Wilson 7955* (Mo, NY). Atwood Cay: *Wilson 7396* (G, NY). Berry Islands: *Britton & Millspaugh 2243* (NY). Caicos Group: *Millspaugh 9223* (G, NY). Cat Island: *Britton & Millspaugh 5964* (F, NY); *Wilson 7164* (G, NY). Crooked Island: *Brace 4600* (NY, US); *Brace 4698* (NY); *Rothrock 246* (F). Eleuthera: *Britton 6416* (NY); *Britton & Millspaugh 5412* (NY); *Britton & Millspaugh 5426* (F, NY); *Britton & Millspaugh 5433* (NY, F). Exuma Chain: *Britton & Millspaugh 2780* (NY); *Wilson 7894* (NY). Great Bahama: *Britton & Millspaugh 2565* (NY). Great Exuma: *Britton & Millspaugh s.n.* (NY). Great Ragged Island: *Wilson 7818* (G, NY); *Wilson 7864* (G, NY). Inagua: *Nash & Taylor 975* (NY); *Nash & Taylor 1282* (NY); *Nash & Taylor 1294* (NY). Little San Salvador: *Britton & Millspaugh 5664* (F, NY). Long Cay: *Brace 4071* (NY). Long Island: *Britton & Millspaugh 6301* (F, NY). Mariguana: *Wilson 7463* (G, NY). New Providence: *Britton 44* (NY); *Britton 88* (NY); *Britton & Brace 283* (G, NY, US); *Britton*

& Brace 290 (NY, US); *Britton & Brace 295* (NY, US); *Britton & Brace 315* (NY); *Britton & Brace 351* (NY, US); *Britton & Brace 538* (G, Mo, NY, US); *Curtiss 85* (A, G, Mo, NY, US); *Wilson 8175* (NY); *Wilson 8196* (NY); *Wilson 8225* (NY); *Wilson 8349* (NY). North Bimini: *Brace 3475* (NY). Rose Island: *Britton & Millspaugh 2131* (G, NY, US). Rum Cay: *Brace 3946* (NY). St. George's Cay: *Coker 315* (NY). Turk's Islands: *Millspaugh 9363* (G, NY). Watling's Island: *Britton & Millspaugh 6168* (F, NY); *Rothrock 295* (F, NY); *Wilson 7240* (G, NY); *Wilson 7261* (G, NY). CUBA: Pinar del Río: *Roig 3256* (Cu, NY, US); *Roig 3257* (NY). Habana: *Acuña 10942* (Cu). Santa Clara: *Ekman 18560* (A, F, G, Mo, NY, US). NAVASSA ISLAND: *Ekman 10811* (US). JAMAICA: *Britton 1153* (NY, US); *Britton 1244* (NY); *Britton 2544* (NY); *Harris 9729* (NY, US); *Harris 9734* (NY, US); *Harris 10380* (NY, US).

11B. **Bumelia retusa** subsp. **neglecta** subsp. nov.

A subsp. *typica* differt floribus majoribus, corolla 4.3–5.5 mm. longa, antheris 1.4–1.7 mm. longis, staminodiis 2.5–2.8 mm. longis, stylo 3.3–4.6 mm. longo.

TYPE: *Schipp 585,* open places at edge of mangroves, 5 feet elevation, All Pines, British Honduras, August 20, 1930 (F); isotypes, A, G, Mich, Mo, NY.

DISTRIBUTION: Along the coast from southern Vera Cruz to Yucatán and British Honduras.

MEXICO: Vera Cruz: *Charles L. Smith 1123,* Coatzacoalcos (US). Yucatán: *Gaumer 23210,* Yaxactun (Mo, US), *23338,* Mina de Oro (A, F, G, Mo, NY, US); *Goldman 594,* Progreso (US); *Lundell 7392,* Progreso (A); *Schott 313,* Progreso (F, Mo, US), *313a,* Celestun (F). Quintana Roo: *Gaumer 131,* Cozumel Island (G), *s.n.,* in 1836, Mugeres Island (US).

A few specimens of *B. retusa* from the Bahama Islands have very spiny twigs with reduced less than usually hairy leaves under 1 cm. long, thus seemingly approaching *B. glomerata*. They pass into the more typical forms of the species, however, and in one case the collector noted that they are young twigs from an otherwise apparently not unusual plant. Hybridity seems out of the question, since the only other species of *Bumelia* known to occur in the Bahamas is *B. celestrina,* which these plants do not resemble.

Urban and Ekman differentiated *B. navassana* from *B. retusa* by its opposite instead of alternate leaves, but it may be noted that the original description of *B. retusa* called for opposite leaves. The leaves may in fact be either alternate or opposite, even on the same plant. *B. Roigii* was described as having a relatively large fruit 1.5 cm. in diameter, but the fruit on the type may be abnormal, and those on the isotypes are smaller.

12. **Bumelia socorrensis** Brandegee, Zoe 5: 106. 1901.

Tree up to 25 m. tall, apparently unarmed except for sometimes a few short axillary spines; twigs finely sericeous-strigose with rufous hairs when young, soon glabrate; leaves broadly oblanceolate, about 4–8 cm. long and 1.5–3.5 cm. wide, tapering to the base, broadly rounded at the apex, finely rufous-strigose on both sides when young, later more or less glabrate, evidently reticulate at least beneath, but the veins not much raised, the primary lateral ones about 8–15 pairs, not always sharply separable from the larger secondary ones; petioles about 5–10 mm. long; flowers in axillary clusters of about 1–5, appearing short and bulky, the pedicels rufous-sericeous, about 1–4 mm. long; sepals more or less rufous-hairy.

about 2.3–3.5 mm. long; corolla about 4–5 mm. long, the tube thick, 1.5–2 mm. long, the lobes much thinner; staminodes about 2.5–3 mm. long; filaments coarse, the anthers only about 1.1–1.4 mm. long; ovary slightly 5-lobed, brown-hairy, its style about 2.8–4 mm. long; fruit reputedly ellipsoid, 12–14 mm. long and 8 mm. thick, dark blue.

TYPE COLLECTION: *Anthony s.n.*, Socorro Island, Mexico (G).

DISTRIBUTION: Socorro Island.

MEXICO: Socorro Island: *Barkelew 190* (A, G, Mo, NY, US); *Mason 1638* (A, G, US); *Solis 82* (US).

This species, while sharply distinct, seems to be allied to *B. persimilis* on the one hand and *B. peninsularis* on the other. It differs from the former in its characteristically oblanceolate broadly rounded leaves with fine appressed rufous pubescence, and in its somewhat smaller fruit. It differs from *B. peninsularis* in its larger size, larger more oblanceolate leaves with finer pubescence, and in its smaller flowers, particularly its smaller anthers. *B. socorrensis* is of course geographically remote from all others of the genus.

13. **Bumelia peninsularis** Brandegee, Zoe 5: 107. 1901.

Shrub 3–4 m. tall, much branched from the base, provided with short axillary spines; twigs pubescent with appressed rufous hairs when young, later glabrate; leaves elliptic, elliptic-ovate, or elliptic-oblong, about 2.5–4.5 cm. long and 1–2.5 cm. wide, broadly rounded at the apex, firm, evidently or obscurely reticulate, pubescent beneath, especially along the midrib, with coarse, conspicuously malpighian, appressed rufous hairs, at least a few of which commonly persist until maturity; petioles about 3–8 mm. long; flowers about 2–6 in axillary clusters, the pedicels nearly or quite glabrous, 4–8 mm. long; sepals about 4.2–5 mm. long, glabrous or nearly so, of the same texture throughout; corolla about 7.5 mm. long, its tube 2.3 mm. long; staminodes about 3.5 mm. long; anthers about 2.5–2.7 mm. long, slightly exserted; ovary short-hairy or reputedly glabrous, its style about 7 mm. long; fruit broadly ellipsoid, about 15 mm. long.

TYPE COLLECTION: *Brandegee s.n.*, Sierra de la Laguna, Cape Region, Baja California, Mexico, March 1892 (G, US).

DISTRIBUTION: Baja California, Mexico.

MEXICO: Baja California: *Brandegee s.n.*, in 1894 (US); *Purpus 261*, San Felipe, Cape Region, March, 1901 (Mo, US).

14. **Bumelia cartilaginea** sp. nov.

Frutex vel arbor parva usque ad 10 m. alta spinis brevibus axillaribus praedita, ramulis juvenilibus subtiliter rufo-sericeo-strigosis cito glabratis; foliis firmiter chartaceis ellipticis vel anguste obovato-ellipticis, vulgo 1.5–4.5 cm. longis et 8–22 mm. latis, apice late rotundatis vel subacutis, obscure vel perspicue reticulatis, subtus praecipue secus costam pilis adpressis rufis valde decidue strigosis (pilis paucis ad maturitatem persistentibus); petiolis 2–5 mm. longis; floribus in glomerulis axillaribus 1–6, pedicellis 2–5 mm. longis glabris vel glabratis; sepalis circiter 3–3.5 mm. longis, glabris vel pilis paucis rufis ornatis, parte basali acute circumscripta et cartilaginea, parte distali membranaceo-chartacea; corolla circiter 4.5–5 mm. longa, tubo 1.5–1.8 mm. longo, lobis suberectis; staminodiis 1.5–2 mm.

longis glabris eroso-laciniatis plus minusve cucullatis, inferne carinatis, superne complanatis plus minusve inflexis; antheris circiter 1.6–1.7 mm. longis; ovario glabro, stylo 3.7–5.2 mm. longo; fructu ignoto.

TYPE: *Salazar 857,* San Ignacio, Sinaloa, Mexico, 460 m., June 3, 1919, (US 1014209). What is evidently an isotype, also at US, bears the additional data *Montes* and *Salazar,* Arroyo del Palmar La Caña, shrub 3–4 m. high in moist shady places.

DISTRIBUTION: Sinaloa to Guerrero, Mexico.

MEXICO: Sinaloa: *Ortega 857,* La Caña, San Ignacio, in 1922 (F). Michoacán or Guerrero: *Langlassé 995,* Cuesta del Peregrino, terrain granitique, 500 m., April 15, 1899 (G). Guerrero: *Haenke 1594,* Acapulco (F, NY).

Bumelia cartilaginea has been confused with *B. peninsularis,* which has the flowers larger in all parts, with the sepals of the same texture throughout, and the staminodia not hooded. It is in some respects transitional between *B. peninsularis* and *B. verruculosa,* but it differs from the latter in its glabrous and less strongly hooded staminodia, which are erose-laciniate instead of entire-margined, in its suberect sepals and corolla-lobes, and in its soon glabrate not at all verrucose twigs. The known ranges of these three species are all quite distinct. An approach to the cartilaginous-based type of sepal so conspicuous in *B. cartilaginea* may sometimes be seen in *B. persimilis* and *B. socorrensis.* It should be pointed out that the bases of the sepals do not become evidently cartilaginous until the flowers have opened; maturing buds have the sepals apparently of the same texture throughout.

15. **Bumelia verruculosa** sp. nov.

Frutex spinosus, ramulis primo rufo-tomentosis demum basibus papillatis pilorum delapsorum verruculosis; foliis lanceolato-ellipticis vel elliptico-oblongis, circiter 2.5–5 cm. longis et 1–2 cm. latis, perspicue vel obscure reticulatis, apice obtusis vel late rotundatis, primo subtus praecipue secus costam pilis adpressis rufis strigosis mox glabratis; petiolis 2–5 mm. longis; floribus in glomerulis axillaribus circiter 3–6, pedicellis glabris vel subglabris 3–6 mm. longis; sepalis circiter 2.7–3 mm. longis, glabris vel pilis paucis rufis ornatis, parte basali firma et cartilaginea, parte terminali membranaceo-chartacea reflexa; corolla circiter 4.8–5 mm. longa, tubo 1–1.2 mm. longo, lobis reflexis; staminodiis cucullatis inflexis integris villosis circiter 1.7–2 mm. longis; antheris 1.8–2 mm. longis; ovario glabro, stylo 4–4.5 mm. longo; fructu ignoto.

TYPE: *Pringle 6984,* limestone hills, Las Palmas, near Tampico, San Luis Potosí, Mexico, March 7, 1899, 400 feet (US 1638968); isotypes at G, NY, US.

DISTRIBUTION: Known only from the type collection, San Luis Potosí, Mexico.

This species is superficially similar to *B. peninsularis* and *B. cartilaginea,* but it differs strikingly in its hooded, villous, entire-margined, inflexed staminodia, and in the persistent bases of the hairs of the twigs. It also differs in its strongly reflexed sepals and corolla-lobes, and in its known geographic distribution. Both the staminodes and the pubescence of the twigs are quite unique in the genus.

16. **Bumelia obovata** (Lam.) A. DC. in DC. Prodr. 8: 191. 1844.

Shrub or small tree commonly 2–6 m. tall, unarmed or sometimes strongly spiny; young twigs sericeous-strigose with rufous hairs, generally soon glabrate; leaves oblanceolate to broadly ovate or suborbicular, broadly rounded and sometimes obscurely wavy at the apex, cuneate at the base, commonly 1–3.5 cm. long and 3–33 mm. wide, occasionally some of them smaller, rufous-strigose beneath when young, sooner or later subglabrate, the hairs often fading before falling; leaf-surfaces, especially the upper, having a peculiar texture due largely to the fine slightly raised irregularly reticulate striations trending parallel to the primary lateral veins, not otherwise reticulate; flowers mostly about 2–10 in axillary clusters, from subsessile to borne on pedicels as much as 10 mm. long, the pedicels rufous-strigose to glabrous; sepals glabrous or more or less strigose, about 1.2–2 mm. long; corolla about 2.7–4.3 mm. long, the tube 0.7–1.3 mm. long; anthers 0.8–1.3 mm. long; ovary hairy or subglabrous; style about 2–4.5 mm. long; fruit subglobose to sometimes ellipsoid-cylindric, black, 5–12 mm. long.

TYPE COLLECTION: None given.

DISTRIBUTION: Hispaniola and Puerto Rico through the Lesser Antilles to Curaçao and Aruba, also rarely in northern Venezuela.

16A. **Bumelia obovata** var. **typica** nom. nov.

Sideroxylon obovatum Lam. Tab. Encyc. **2**: 42. 1793.
Bumelia cuneata Sw. Fl. Ind. Occ. **1**: 496. 1797.
Achras cuneifolia Poir. in Lam. Encyc. Meth. **6**: 534. 1804.
Sideroxylon cuneatum A. DC. in DC. Prodr. **8**: 181. 1844.
Bumelia parvifolia A. DC. in DC. Prodr. **8**: 190. 1844.
Bumelia obovata A. DC. in DC. Prodr. **8**: 191. 1844, sens. strict.
Bumelia myrsinifolia A. DC. in DC. Prodr. **8**: 192. 1844.
Bumelia obovata var. *portoricensis* Pierre in Urb. Symb. Ant. **5**: 143. 1904.
Bumelia obovata var. *thomensis* Pierre, loc. cit.
Bumelia heterophylla Urb. Symb. Ant. **7**: 326. 1912.

Usually essentially unarmed, only occasionally evidently spiny; pedicels mostly 2–10 mm. long, sparsely hairy or glabrous; sepals and ovary sparsely hairy or glabrous; style sometimes as much as 4.5 mm. long, often much less. Range of the species.

HAITI: *Ekman H3274* (US); *Nash & Taylor 1595* (NY, US). DOMINICAN REPUBLIC: *Bertero s.n.* (Mo, NY — fragment); *Ekman 14067* (US); *Fairchild 2622* (A, US); *Taylor 519* (NY). PUERTO RICO: *Britton 9106* (NY), *9648* (NY); *Britton & Brown 6025* (NY); *Britton, Cowell & Brown 4821* (NY, US), *4879* (G, Mo, NY, US); *Britton, Cowell & Hess 1657* (NY, US); *Britton & Shafer 1878* (NY, US); *Gregory 306* (NY), *408* (PR); *Hess 1668* (NY); *Miller 1631* (US); *Shafer 1998* (NY, US); *Sintenis 3400* (G, US), *3485* (Mo, NY, US), *3546* (US), *3780* (G, US), *4814b* (US). ST. THOMAS: *Britton 192* (NY); *Britton & Shafer 18* (NY, US); *Eggers 409* (G), *s.n.* (Mo, NY, US); *Holton s.n.* (NY); *Rose 3196* (NY). ST. JAN: *Britton & Shafer 526* (NY, US). TORTOLA: *Fishlock 136* (NY), *446* (NY, US), *447* (F); *Britton & Shafer 905* (NY, US). VIRGIN GORDA: *Beard 328* (A); *Britton & Fishlock 1116* (NY, US). ANEGADA: *Britton & Fishlock 960* (G, NY, US); *Fishlock 10* (F, G, NY, US). ST. CROIX: *Ricksecker 383* (G, Mo, NY, US). ST. MARTIN: *Boldingh 2765* (NY). ST. BARTHOLOMEW: *Forsstroem s.n.* (NY). BARBUDA: *Box 617* (US). ANTIGUA: *Box 847* (US), *1401* (A, US), *1511* (A, US). GUADELOUPE: *Bertero s.n.* (Mo); *Duss 2909* (NY). MARTINIQUE: *Duss 260* (NY). CURAÇAO: *Boldingh 5312* (NY); *Britton & Shafer 3109* (NY, US); *Curran & Haman 88* (G, NY), *158* (A, G, US), *205* (G, NY, US); *Potter 5118* (NY); *Realino s.n.* (Krukoff Herb.). ARUBA: *Boldingh 6494* (NY); *Curran & Haman 410* (G, US). BONAIRE: *Boldingh 7235* (NY), *7422* (NY). VENEZUELA: Aragua: Ocumare de la Costa, *Williams 12174* (US). Sucre: Paria Peninsula, *Bond, Gillin & Brown 262* (NY).

16B. **Bumelia obovata** var. **Krugii** (Pierre) comb. nov.
Bumelia Krugii Pierre in Urb. Symb. Ant. 5: 146. 1904.

Strongly spiny; more hairy than var. *typica,* the twigs, pedicels, and sepals finely sericeous-strigose with rufous hairs; leaves averaging smaller than in var. *typica;* flowers subsessile, the pedicels up to about 2 mm. long; ovary uniformly short-hairy; style apparently not over 3 mm. long. Puerto Rico.

Type collection: Not specified, from among *Sintenis 3472, 3473,* and *4813b,* "in Portorico prope Guanica in fruticetis litoralibus ad Salinas."

Puerto Rico: *Britton 9115* (NY), *9327* (NY), *9996* (NY); *Britton & Boynton 8295* (NY, US); *Britton & Cowell 1298* (NY); *Britton, Cowell & Brown 4897* (US), *4905* (Mo, NY, US); *Britton & Shafer 1837* (Mo, NY, US), *1908* (NY, US); *Gregory 650* (PR); *Shafer 2940* (NY, US); *Sintenis 3472* (Mo, NY), *3473* (G, US).

Bumelia obovata may be distinguished from all others of the genus by the peculiar leaf-texture, a character which, although perhaps more readily observed than described, is as nearly constant as any in the genus. It is presumably related to *B. obtusifolia.* Except at the borders of its range, in Hispaniola and Venezuela, no other species of *Bumelia* is known to occur in its area.

The variety *Krugii* is well separated from the ordinary nearly or quite unarmed forms of var. *typica.* However, several otherwise representative specimens of the latter from Hispaniola, one from Puerto Rico, one from Curaçao, and one of the two known collections from Venezuela resemble var. *Krugii* in being more or less spiny. Most of these specimens, it will be noted, come from outside the known range of var. *Krugii.* It is possible that a third variety could be established for these plants, but in view of their very spotty distribution I am reluctant to do so without further evidence. It seems not improbable that the type of the species is of this nature, since it was originally described by Lamarck as being spiny.

17. **Bumelia glomerata** Griseb. Mem. Am. Acad. II. 8: 518. 1862.
Bumelia horrida Griseb. Cat. Pl. Cub. 165. 1866.
Bumelia microphylla Griseb. Cat. Pl. Cub. 165. 1866.
Bumelia tortuosa C. Wright ex Sauvalle, Ann. Acad. Habana 6: 288. 1870.
?*Bumelia subintegra* Urb. & Ekm. Ark. Bot. 21A(5): 56. 1927.
Bumelia Buchii Urb. Ark. Bot. 21A(5): 56. 1927.
Bumelia pachyclada Urb. & Ekm. Ark. Bot. 21A(5): 57. 1927.
Bumelia lineolata Urb. & Ekm. Ark. Bot. 22A(17): 73. 1929.

More or less spiny shrub or small tree, sometimes less than 1 m. high, sometimes reaching 12 m.; young twigs finely rufous-strigose; leaves about 3–40 mm. long and 2–17 mm. wide, elliptic or broadly oblanceolate (especially when larger) to broadly obovate or suborbicular (especially when smaller), broadly rounded at the apex, thick and smooth, mostly fascicled, strigose beneath with mostly rufous hairs when young, later glabrate, the veins, except the midrib, generally visible only as faint furrows or not at all; flowers about 1–4 in a cluster, subsessile, the rufous-hairy pedicels up to about 2 mm. long; sepals about 1.1–2.2 mm. long, glabrous or rufous-strigose; corolla about 3.1–3.8 mm. long, the tube 1.2–1.5 mm. long; stamens included, the filaments only about 1 mm. long; anthers about 0.7–1 mm. long; staminodes ovate to reniform, about 1–1.3

mm. long; ovary with flattish to broadly rounded glabrous top and short-hairy to glabrous sides, the style 0.7–1.4 mm. long; fruit dark red, subglobose, less than 1 cm. long.

TYPE COLLECTION: *Wright 347,* eastern Cuba (G, NY).

DISTRIBUTION: Cuba and Haiti.

This species might conceivably be divided into 3 varieties, a typical one, only slightly spiny, with relatively large leaves that have the midrib raised and visible beneath nearly to the tip, one based on *B. horrida,* strongly spiny, with smaller leaves in which the midrib visibly extends scarcely beyond the middle, and an equally spiny but coarser variety based on *B. microphylla,* with very small leaves that have scarcely discernible midrib and tend to become coppery beneath. It is entirely possible, however, that these represent mere individual responses to variations in the severity of the habitat, and I am therefore unwilling to propose the new combinations that would be necessary. The specimens have been annotated as "typical phase," "*B. horrida* phase," and "*B. microphylla* phrase," and are so cited below.

Typical phase: CUBA: Isla de Pinos: *Britton, Britton & Wilson 15072* (NY, US). Pinar del Río: *Ekman 16577* (NY). Oriente: *Ekman 6264* (NY), *7893* (NY), *9624* (A, F, US), *19184* (G, NY, US); *Roig 4910* (Cu), *4992* (NY), *5185* (Cu, NY).

B. horrida phase: CUBA: *Wright 1922* (NY), *2922* (G, Mo, NY, US). Isla de Pinos: *Britton, Britton & Wilson 15377* (NY, US); *Ekman 12335* (US). Pinar del Río: *Britton & Cowell 9924* (NY); *Fors 4762* (Cu); *Roig 3966* (Cu). Habana: *Ekman 13271* (NY); *León 6010* (NY), *6256* (NY), *7172* (NY), *7591* (NY); *León & Roig 11445* (NY); *Wilson 13933* (NY, US). Santa Clara: *Britton, Earle & Wilson 4595* (G, NY, US); *Combs 734* (G, Mo, NY). Camaguey: *Ekman 15478* (US). Oriente: *Britton & Cowell 12705* (NY, US); *Britton, Cowell & Shafer 13064* (NY, US); *Ekman 2961* (US), *10204* (F). HAITI: *Ekman H 10004* (US); *Leonard 13267* (NY).

B. microphylla phase: CUBA: *Wright 2922a* (G, Mo, NY), *3623* (G). Habana: *León & Roig 2522* (Cu), *8150* (Cu). Matanzas: *León & Roig 4167* (Cu), *12950* (NY); *Ekman 16499* (NY), *17181* (US), *18592* (US). Santa Clara: *Ekman 18841* (G, NY). Oriente: *Ekman 19103* (G, NY, US); *Shafer 1234* (NY, US).

Bumelia subintegra Urb. & Ekm. was described as having the pubescence of the twigs spreading, instead of appressed as in *B. glomerata,* and is only doubtfully included here. I have not seen the type.

Bumelia glomerata seems to be related to *B. obovata,* the var. *Krugii* of which tends toward it. The leaves of *B. glomerata,* while differing from those of *B. obovata* in being thick, firm, smooth, and not at all veiny, as well as smaller, frequently show a suggestion of the fine raised striations so characteristic of the latter species. It is possible, however, that the relationship of *B. glomerata* is with *B. retusa* instead of with *B. obovata,* and occasional forms of *B. retusa* with spiny twigs and very small leaves are indeed difficult to distinguish from *B. glomerata.*

18. **Bumelia occidentalis** Hemsl. Biol. Centr. Am. Bot. 2: 298. 1881.
Bumelia fragrans Brandegee, Zoe 5: 106. 1901, not Ridley (1890).
Bumelia Brandegei Blake, Contr. Gray Herb. n.s. 52: 76. 1917.
Bumelia cuneifolia Jones, Contr. West. Bot. 18: 63. 1933–35.

Branching spiny shrub or small tree commonly 2–5 m. tall; leaves oblanceolate to obovate, elliptic-obovate, or rarely subrotund, tapering to the base, broadly rounded at the apex, about 8–30 mm. long and 2–20 mm. wide, scarcely or obscurely veiny, finely gray-puberulent especially beneath, eventually more or less glabrate; flowers several in axillary clusters, the pedicels about 4–20 mm. long, commonly appressed-puberulent like the leaves; sepals about 2.3–3.5 mm. long, grayish-puberulent or strigose; corolla about 4.5–5.2 mm. long, its tube 0.8–1.5 mm. long; anthers about 1.3–2.6 mm. long; style about 4.5–5.2 mm. long; fruit ellipsoid-oblong, blue-black, about 12–16 mm. long.

Type collection: *Coulter 934,* upper Sonora, Mexico.

Local name: *Bebelama.*

Distribution: Baja California and Sonora, Mexico.

Mexico: Baja California: *Brandegee s.n.* (April 9, 1889), San José de la Gracia (G, US); *Brandegee s.n.* (in 1893), Pescadero (A); *Brandegee s.n.* (May 7, 1897), San José del Cabo (G, US); *Gentry 4264,* Los Encinos, Sierra Giganta (G, Mo); *Johnston 3904,* Agua Verde Bay (A, G, Mo, NY, US); *Mason 1866,* Cape San Lucas (G, US); *Nelson & Goldman 7245,* near El Potrero (F, US); *Purpus 319,* Las Animas (Cape Region) (Mo, US); *Wiggins 5482,* north of Comondu (A). Sonora: *Coville 1676,* Torres (US); *Ferris 8729,* San Carlos Bay, north of Guaymas (NY, US); *Johnston 4296,* San Pedro Bay (A, G, NY, US); *Johnston 4367,* San Carlos Bay (G, US); *MacDougal & Shreve 6,* west of Ceruas Well (US); *Shreve 6054,* near Santa Rosa (F); *Shreve 6195,* north of Palma, between Guaymas and Hermosillo (US); *White 416,* Tonibabi hot springs, near Moctezuma (G); *Wiggins 6167,* between San Carlos and Santa Rosa, 45 miles west of Norio (US); *Wiggins 6482,* 63 miles north of Guaymas (Mich, US); *Wiggins 8293,* San Pedro, north of Tajitos (US).

This species is related to *B. celastrina,* from which it differs in its more copious and more persistent pubescence, longer pedicels, larger flowers with longer style and anthers, larger fruit, and more western disjunct distribution. *Bumelia fragrans* Brandegee (= *B. Brandegei* Blake), with shorter, less hairy pedicels, and broader sooner glabrate leaves than usual, is surely part of this species. Further collecting may conceivably warrant its varietal recognition; the specimens now available do not.

19. **Bumelia celastrina** H.B.K. Nov. Gen. et Sp. 7: 212. 1825.
Bumelia ferox Schlecht. & Cham. Linnaea 6: 392. 1831.
Bumelia spinosa A. DC. in DC. Prodr. 8: 191. 1844.
Bumelia angustifolia Nutt. N. Am. Sylva 3: 38. 1849.
Bumelia Eggersii Pierre in Urb. Symb. Ant. 5: 146. 1904.
Bumelia Schottii Britton, N. Am. Trees 777. 1908.
Bumelia affinis Blake, Contr. Gray Herb. n.s. 53: 45. 1918.

Shrub or small tree commonly 2–9 m. tall; leaves generally fascicled, except on vigorous young shoots, glabrous from the first, or with only a few very fine and inconspicuous white hairs when young, oblanceolate to obovate or sometimes nearly elliptic, broadly rounded at the apex, generally acute at the base, mostly 1–4 cm. long and 3–25 mm. wide, occasionally a little larger, firm, the veins not very prominent, the reticulum rather obscure or indiscernible; flowers about 3–10 in a cluster, the pedicles glabrous or with a few inconspicuous white hairs, about 2–7 mm. long; corolla about 3–4.5 mm. long, the short tube only 0.8–1.2 mm. long; anthers 1–1.5 mm. long; staminodes lance-elliptic to rhombic-ovate, about 2–3 mm. long; ovary pilose toward the base, glabrous above, the style about 2.5–4 mm.

long; fruit ellipsoid-cylindric, occasionally a little widened above, 7–13 mm. long, blue-black.

TYPE COLLECTION: *Humboldt & Bonpland,* "crescit in declivitate occidentali montium Mexicanorum, in convali Sopilote, inter Chilpansingo et Tasco, alt. 517 hex."

LOCAL NAMES: *Hapuche, caimito, coma, bebelamilla bagre.*

DISTRIBUTION: Southern Texas to Venezuela; Florida; Bahama Islands; Camaguey, Cuba.

MEXICO: Nuevo León: *Dodge 96* (NY, US); *Edwards 378* (F); *Gregg 196* (G, Mo); *Kenoyer 1173* (F); *Lozano 13904* (G, Mich, US); *Pringle 2787* (A, G, US); *Taylor 378* (Mo). Tamaulipas: *Bartlett 10565* (F); *Bartlett 10833* (F); *Bartlett 10784* (F, US); *Bartlett 11111* (F, G, US); *Berlandier 3048* (Mo); *LeSueur 340* (F, G). Sinaloa: *Ortega 6572* (US). Vera Cruz: *Müller 1855* (NY); *Seler 3711* (G, US); *Woronow 2099* (F). Oaxaca: *Reko 3677* (US); *Williams 9907* (F). Yucatán: *Flores 6* (F); *Gaumer 1313* (A, F, G, Mich, Mo, NY). Chiapas: *Bossé s.n.* (F); *Matuda 2702* (A, Mich, Mo, NY, US). GUATEMALA: San Marcos: *Steyermark 37776* (F). Progreso: *Standley 69035* (F); *Standley 69042* (A, F); *Steyermark 43859* (F). Zacapa: *Standley 74144* (F); *Standley 72004* (F). Retalhuleu: *Standley 66512* (F); *Standley 66643* (F); *Standley 87545* (F). Chiquimula: *Steyermark 31533* (F). EL SALVADOR: *Standley 20864* (G, NY, US); *Standley 21893* (G, NY, US). PANAMA: Coclé: *Pittier 4988* (G, NY, US). COLOMBIA: Bolívar: *Heriberto 95* (US). Magdalena: *Herbert Smith 423* (A, G, NY, US). VENEZUELA: Isla de San Carlos: *Curran & Haman 802* (G, NY, US). Falcón: *Curran & Haman 534* (A, G, NY, US). BAHAMA ISLANDS: Great Bahama: *Brace 3605* (NY); *Britton & Millspaugh 2737* (NY). New Providence: *Britton 6592* (NY, US); *Britton & Brace 326* (NY); *Eggers 4418* (A, US); *Millspaugh 2492* (NY). Andros: *Brace 4870* (NY); *Brace 5291* (NY); *Brace 6773* (NY); *Coker 202* (NY); *Northrop 666* (F, NY). Hog Island: *Wilson 8317* (Mo, NY). Rose Island: *Britton & Millspaugh 2157* (NY). Cat Cay: *Brace 3740* (NY). South Cat Cay: *Millspaugh 2420* (NY). CUBA: Camaguey: *Ekman 15476* (NY, G, US); *Ekman 15523* (NY); *Shafer 407* (G, NY, US); *Shafer 886* (NY, US); *Shafer 906* (NY, US).

The plants from Florida and the West Indies have the reticulum of the leaf a little more obscure, on the average, than others of the species, and are generally totally glabrous from the first, but the differences are minor and not sufficiently constant to warrant taxonomic recognition. An immature fruiting specimen from Oriente, Cuba (*Roig 5545* — Cu) seems nearest to *B. celastrina,* but has the young twigs evidently rufous-strigose.

20. **Bumelia conferta** (C. Wright) Pierre in Urb. Symb. Ant. 5: 144. 1904.
Sideroxylon confertum C. Wright in Sauvelle, Fl. Cub. 86. 1870.

Unarmed tree, or the young branches spiny; twigs rufous-strigose when young; leaves broadly elliptic, about 2–5 cm. long and 1.5–3.5 cm. wide, rounded or retuse at the apex, rounded or obtuse at the base, essentially glabrous from the first, not at all veiny, the primary lateral veins faint or obscure at maturity; flowers about 1–4 in a cluster, the pedicels glabrous, about 6–10 mm. long; sepals slightly strigose, becoming cartilaginous at the base; corolla (not seen by me) about 4.5 mm. long, the lateral lobes absent or vestigial; ovary short-hairy; style about 3–3.5 mm. long; mature fruit unknown, but a maturing one narrowly ellipsoid, about 9 mm. long.

TYPE COLLECTION: *Wright 2920,* in part, "a la orilla de los manglares Potrero Playitas, Bahia-Hondia," Pinar del Río, Cuba (G, NY, US — drawing). An entirely different plant, also bearing Wright's number *2920,* was made the type of *Daphnopsis cuneata* Radlk. (Mo).

DISTRIBUTION: Pinar del Río and Oriente, Cuba.

Cuba: *Wright 2928* (presumably in Pinar del Río) (G, Mo). Pinar del Río: *Ekman 17405* (US), *17435, Toscano* (Cu, NY, US). Oriente: Sierra Maestra, *Ekman 9389* (A, F, G, NY, US), *14206* (NY); *León 11022* (NY).

Bumelia conferta is closely related to *B. rotundifolia* and, at least in the herbarium, greatly resembles it, but it differs in the obsolescence of the lateral lobes of the corolla-lobes, in the more evidently hairy twigs and sepals, in having fewer flowers per cluster, and in having the leaves, on the average, less veiny. The known distribution of *B. conferta,* Oriente and Pinar del Río, Cuba, is perplexing and unexplained, but the specimens available from the two areas show no appreciable differences.

21. **Bumelia Picardae** Urb. Symb. Ant. 5: 148. 1904.

Spiny shrub about 2–3 m. tall; young twigs strigose with silvery or rufous hairs, very soon glabrate; leaves firm, oblanceolate or more commonly obovate to narrowly or broadly elliptic, obtuse or broadly rounded at the apex, more often narrowed at the base, about 6–30 mm. long and 4–15 mm. wide, silvery-strigose when young, very soon glabrate, the midrib raised beneath, the primary lateral veins visible only as faint furrows, especially beneath, or not at all, the upper surface smoother and shinier than the lower, subsessile, the petioles less than 3 mm. long; flowers about 1–3 in the axils, subsessile, the pedicels less than 2 mm. long; sepals about 1.5–2.9 mm. long, glabrous, generally green, especially toward the base; corolla about 3.2–4 mm. long, the tube 1.3–1.5 mm. long, the lobes without lateral lobes; anthers about 1–1.2 mm. long; staminodes ovate, about 1.3–1.7 mm. long; ovary short-hairy or subglabrous, the style about 1.2–1.9 mm. long; fruit narrowly ellipsoid, about 12–13 mm. long.

Type collection: *Picarda 1242,* "Haiti in Plaine," June (NY).

Distribution: Haiti and the Dominican Republic.

Haiti: *Ekman H2021* (US); *Leonard 10003* (G, NY, US), *14718* (A, G, US), *14899* (US), *15879* (NY, US). Dominican Republic: *Ekman 15576* (US).

Urban established a separate section *Bumeliopsis* for *B. Picardae,* based on the suppression of the lateral lobes of the corolla-lobes. Three other species (and occasionally a fourth) are now known to share this character, but it is doubtful that they are sufficiently closely related to form a natural section. *Bumelia Picardae* seems related to *B. obovata, B. conferta* is obviously close to *B. rotundifolia,* and *B. revoluta* and *B. integra* are of doubtful affinities, perhaps allied to *B. retusa.* All of these species are probably eventually derived from and not distinctly related to *B. obtusifolia,* in which the lateral lobes are occasionally suppressed.

22. **Bumelia integra** nom. nov.

Dipholis anomala Urb. Symb. Ant. 7: 325. 1912. Not *Bumelia anomala* Clark.

Unarmed tree; leaves obovate or elliptic, obtuse or rounded at the apex, tapering to the base, about 2.5–5 cm. long and 1.5–2.5 cm. wide, short-petiolate, very finely and densely rufous-strigose on both sides at first, very soon glabrate above, more tardily so beneath, not very veiny, only the midrib and primary lateral veins evident beneath, only the midrib above; flowers in dense axillary clusters of about 5–25, subsessile, the stout rufous-strigose pedicels 2 mm. long or less; sepals nearly glabrous; corolla about 3.2 mm. long, white, the lobes double the tube, without lateral lobes;

anthers about 0.9 mm. long; ovary appressed-hairy; style about 2.5 mm. long; fruit unknown.

TYPE COLLECTION: *Fuertes 1039,* "Barahona, ad El Hoyo," Dominican Republic, 700 m., Sept., 1911 (A, G, NY, US).

DISTRIBUTION: Known only from the type collection, Dominican Republic.

This species is transferred from *Dipholis* to *Bumelia* because of its hairy ovary and because suppression of the lateral lobes of the corolla-lobes, while occurring in several species of *Bumelia,* is otherwise unknown in *Dipholis.* More certain determination of its affinities awaits the collection of fruiting material.

23. **Bumelia revoluta** Urb. Symb. Ant. 9: 417. 1925.

Unarmed shrub or small tree about 3–4 m. tall; young twigs strigose-puberulent with rufous hairs; leaves firm, more or less revolute, obovate to narrowly oblong, about 7–25 mm. long and 2–6 mm. wide, green and shiny above, covered beneath with a dense rufous sericeous-tomentose pubescence, which becomes thinner, paler, and more strigose in age, not at all veiny above, only the midrib evident beneath, subsessile, the petioles about 1–3 mm. long; flowers 1 or seldom 2 in the axils, the rufous-hairy pedicels about 2–4 mm. long; sepals rufous-hairy, about 2.5 mm. long; corolla (not seen by me) about 3 mm. long, the lobes without lateral lobes; ovary pubescent; fruit unknown.

TYPE COLLECTION: *Ekman 15261,* "Sierra de Nipe prope Woodfred in fruticetis carrascales ca. 500 m.," Oriente, Cuba, September (NY).

DISTRIBUTION: Oriente, Cuba.

CUBA: Oriente: *Ekman 4034* (US); *Shafer 3181* (NY).

DOUBTFUL AND EXCLUDED SPECIES

Bumelia amazonica Krause, Notizbl. Bot. Gart. Berlin 6: 170. 1914. Dubious; possibly a *Pouteria;* type-photo seen.

Bumelia ambigua Ten. Sem. Hort. Neap. 1827. Nom. dub.

Bumelia argentea Roem. & Schult. Syst. 4: 499. 1819 = HEERIA ARGENTEA.

Bumelia Auzuba Roem. & Schult. l.c. = MASTICHODENDRON sp.

Bumelia borbonica Lodd. ex Loud. Hort. Brit. 69. 1830. Nom. dub.

Bumelia crenulata Spreng. Syst. 1: 665. 1825. Apparently not sapotaceous.

Bumelia cuneifolia Rudge, Pl. Guian. 1: 30. 1805 = CHRYSOPHYLLUM CUNEIFOLIUM.

Bumelia denticulata Raf. New Fl. Am. 3: 29. 1836. Not sapotaceous.

Bumelia depressa Urb. & Ekm. Ark. Bot. 22A(17): 73. 1929. Not sapotaceous.

Bumelia dulcifica Schum. & Thonn. Beskr. Gui. Pl. 130. 1827 = POUTERIA DULCIFICA, according to Baehni.

Bumelia foetidissima Willd. Sp. Pl. 1: 1086. 1797 = MASTICHODENDRON sp.

Bumelia laurifolia Standl. Trop. Woods 18: 31. 1929 = POUTERIA AMYGDALINA.

Bumelia lucida Roem. & Schult. Syst. 4: 499. 1819. Nom. dub.

Bumelia macrantha Willd. ex Roem. & Schult. Syst. 4: 802. 1819 = ARDISIA sp.

Bumelia Manglillo Willd. Sp. Pl. 1: 1087. 1797 = MYRSINE MANGLILLO.

Bumelia Mastichodendron Roem. & Schult. Syst. 4: 493. 1819 = MASTICHODENDRON sp.

Bumelia multiflora Roem. & Schult. Syst. 4: 498. 1819. Not sapotaceous.

Bumelia nervosa Vahl. Eclog. Am. 1: 28. 1796 = POUTERIA MACROPHYLLA.
Bumelia pallida Sw. Prodr. Veg. Ind. Occ. 49. 1788 = MASTICHODENDRON sp.
Bumelia pauciflora Roem. & Schult. Syst. 4: 493. 1819 = MASTICHODENDRON sp.
Bumelia pubescens Ten. Sem. Hort. Neap. 1827. Nom. dub.
Bumelia punctata Roem. & Schult. Syst. 4: 498. 1819. Not sapotaceous.
Bumelia serrata Pursh, Fl. Am. Sept. 1: 155. 1814 = PRUNUS CAROLINIANA.
Bumelia serrulata Raf. New Fl. Am. 3: 29. 1836. Not sapotaceous.
Bumelia strigosa Spreng. Syst. 1: 665. 1825. Nom. dub.
Bumelia undulata Raf. New Fl. Am. 3: 28. 1836. Probably not sapotaceous.

NEW YORK BOTANICAL GARDEN,
NEW YORK.

NOTES ON SOME CULTIVATED TREES AND SHRUBS, II*

ALFRED REHDER

Juglans nigra L. f. **laciniata**, f. nova.

Juglans nigra laciniata J. Hershey, Price list Nut Tree Nurseries p. 4 [1937] "Cut Leaf Black Walnut," cum descr. angl.; p. 6 [1940] *"J. Laciniata"*; p. 8 [1941] *"J. Nigra Laciniata,"* nom.

A typo speciei differt foliis bipinnatis, foliolis primi ordinis pinnatis, pinnulis utrinque 5–8 oblongo-lanceolatis vel lanceolatis serratis vel interdum plus minusve raro fere ad medium pinnatifidis basi decurrentibus, pinnula terminali pinnatifida vel plus minusve serrata.

CULTIVATED SPECIMENS: Arnold Arboretum, no. *309–41, E. J. Palmer,* Sept. 8, 1944 (plant received in 1941 from H. F. Stoke, Roanoke, Va.).

A very distinct form with bipinnate leaves finely dissected into lanceolate to linear-lanceolate and serrate to pinnatifid leaflets 1–3.5 cm. long and 4–11 mm. wide. In the shape of its foliage and in general appearance this form resembles somewhat *Rhus typhina* f. *dissecta* Rehder, but it is more finely dissected and more graceful; the tree certainly merits attention as a highly ornamental form.

With the exception of the laciniate form of the English Walnut, *Juglans regia* f. *laciniata* (Jacques) Schneider, no other form with lacinate leaflets was known in the whole family until the form of *J. nigra* described above was raised. The cut-leaved form of the English Walnut, from which *J. regia* f. *heterophylla* (Jacques) Schneider differs but little, is distinctly inferior as an ornamental plant to the cut-leaved Black Walnut, having a rather coarse, very irregularly shaped foliage, and moreover being more tender.

According to information kindly furnished by Mr. J. W. Hershey, the owner of the Nut Tree Nurseries at Downingtown, Pa., about thirty plants of this form were found in 1926 at the State Nursery at Milton, Pa., among seedlings raised from seed collected from normal Black Walnut trees in Buffalo Valley, east of the State Nursery. Unfortunately most of the seedlings got lost, but Mr. Hershey obtained one plant and, recognizing its ornamental value, propagated it so that he was able in 1937 to offer it for sale. The Arnold Arboretum received in 1941 a plant of this form from Mr. H. F. Stoke of Roanoke, Va., with the statement that it originated in Pennsylvania; this was probably obtained from the same source as Mr. Hershey's plant.

Juglans cordiformis Maxim. var. **ailantifolia** (Carr.), comb. nov.

Juglans Sieboldiana Maximowicz in Bull. Acad. Sci. St. Pétersb. **18**: 61 (in Mél. Biol. 8: 63) (1873). — Miyabe & Kudo, Icon. For. Trees Hokk. 65, *t.20* (1922). — Non Goeppert (1854), fossil.

* For no. I see p. 67 of this volume.

Juglans ailantifolia Carrière in Rev. Hort. 1878: 414, *fig. 85–86* (1878). — Little in Jour. Washington Acad. Sci. 33: 132 (1943).
Juglans macrophylla Carrière in op. cit. 415 (1878).
Juglans japonica Hort. ex Lavallée, Arb. Segrez. Icon. 1 [1880], pro syn.
Juglans ailantifolia var. *cordiformis* (Maxim.) Rehder in Jour. Arnold Arb. 26: 68 (1945).

When Little in 1943 (l. c.) drew attention to the fact that *J. Sieboldiana* Maxim. was antedated by *J. Sieboldiana* Goeppert of 1854 and took up the name *J. ailantifolia* Carr. for the species, I accepted his disposition and, considering *J. cordiformis* Maxim. a variety of *J. Sieboldiana,* I published the combination *J. ailantifolia* var. *cordiformis,* overlooking the fact that *J. cordiformis* Maxim. of 1873 has priority over *J. ailantifolia* Carr. of 1878 and should have been taken up when *J. Sieboldiana* Maxim. was invalidated by the older homonym of Goeppert. As there can be little doubt that *J. cordiformis* Maxim. and *J. Sieboldiana* Maxim. are conspecific and represent only variations in the shape of the fruit, the name *J. cordiformis* has to be taken up when *J. Sieboldiana* is rejected, which makes necessary the new combination proposed above. If, however, *J. cordiformis* and *J. Sieboldiana* Maxim. should be considered distinct species, the latter would become *J. ailantifolia* Carr.

Ulmus parvifolia Jacq. f. **pendens,** f. nova.

A typo recedit ramis elongatis laxe pendulis.

CULTIVATED in California: City Park, Covina, Los Angeles Co., southwest corner of 4th Street and San Bernardino Road, tree with trunk 3′ 9″ in circumference, with the head 50′ across, coll. *C. R. Tower,* Oct. 1944 (TYPE in herb. Arnold Arb. with photo. of habit); same locality, coll. *C. R. Tower,* Sept. 1944 (in herb. Arnold Arb.); John Galvin Park, Ontario, San Bernardino Co., coll. *C. R. Tower,* Sept. 1944, with photo. of habit showing a wide-spreading tree with somewhat less pendulous branches than the type tree (in herb. Arnold Arb.). There are also photographs in the collection of the Arnold Arboretum of this form from North Clementine St., Anaheim, Orange Co., and from the Roy F. Wilcox Nursery in Montebello, near Los Angeles.

The bark of the trunk and larger limbs is rather thin and scaly, the scales, when shedding, exposing a smooth lenticellate pale reddish layer of bark. The leaves are subcoriaceous, oblong-lanceolate, 3.5–5 cm. long and 9–20 mm. broad, acute or acuminate, unequal at the base, cuneate on one side and subcordate to rounded on the other. The photographs listed above show trees with a large spreading head to fifty feet wide or more, more or less flattened at the top without upright or ascending leaders, but with long and slender pendulous branches and branchlets.

This pendulous form raised in California (together with the typical form from seed received about twenty-five years ago from China) seems to be an unusual form in China, for the several photographs in our collection of *U. parvifolia,* taken in different parts of China, show trees of upright habit except in a photograph of trees taken in the grounds of the Temple of Heaven near Peking, which shows rather wide-spreading but not pendulous branches.

The epithet "pendens" has been chosen for this form to avoid confusion with *Ulmus parvifolia pendula* Hort. ex Dippel, Handb. Laubh. 2: 27

(1892), pro syn., a name which apparently had been used in nursery catalogues before Dippel cited it as a synonym of a form of *U. pumila* L.

Clematis triternata DC. f. **rubro-marginata** (Jouin), comb. nov.

Clematis rubro-marginata Jouin in Mitt. Deutsch. Dendr. Ges. **1907**(16): 236 (1907).
Clematis Flammula var. *rubro-marginata* Cripps ex Jouin, l. c. (1907), pro syn.
Clematis violacea var. *rubro-marginata* Rehder in Jour. Arnold Arb. **1**: 195 (1920); Man. Cult. Trees Shrubs, ed. 2, 217 (1940).

According to Graebner f. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5,3: 65 (1935), *C. triternata* DC. [1817] is identical with *C. violacea* A. DC. (1845), which makes necessary the transfer proposed above.

×**Spiraea Bumalda** Burvenich f. **pruhoniciana** (Kriechb.), Comb. nov.

×*Spiraea pruhoniciana* Kriechbaum in Gartenschönh. **6**: 38 (1925) "*S. japonica ovalifolia* × *Bumalda* "Anthony Waterer," nom. subnud. — Zeman ex Schneider in Silva Tarouca & Schneider, Uns. Freil.-Laubgeh. ed. 3, 433 (1931).

Spiraea pruhoniciana, being a hybrid between the same species as *S. Bumalda* (*S. japonica* × *albiflora*), though between different varieties or forms, cannot be classed under a separate binomial, but falls into the group of hybrids between *S. japonica* and *S. albiflora*.

Sorbus Aria f. **longifolia** (Pers.), comb. nov.

Crataegus Aria β. foliis oblongis Lamarck, Encycl. Méth. Bot. **1**: 82 (1783). — Poiret in Duhamel, Traité Arb. Arbust. France, éd. augm. [Nouv. Duhamel] **4**: 129, *t. 34* [1809] "C. Aria" in tab.
Pyrus Aria β. longifolia Persoon, Syn. Pl. **2**: 38 [1806].
Pyrus edulis Willdenow, Enum. Pl. Hort. Berol. 527 (1809).
?*Pyrus Aria β. acutifolia* De Candolle, Prodr. **2**: 636 (1825).
Crataegus longifolia "Duham. ed. nov. 4. t.34" [1809] ex De Candolle, l. c. (1825), pro syn.
Aria edulis Roemer, Fam. Nat. Reg. Veg. Syn. **3**: 124 (1847).
Sorbus edulis K. Koch, Dendr. **1**: 195 (1869).
Sorbus Aria var. *edulis* Wenzig in Linnaea, **38**: 54 (1874). — Schneider, Ill. Handb. Laubh. **1**: 687, *fig. 377h-i* (1906). — Rehder, Man. Cult. Trees Shrubs. ed. 2, 380 (1940).
Hahnia Aria f. [letter] *edulis* Dippel, Handb. Laubh. **3**: 375 (1893).
Hahnia Aria i. *angustifolia* Dippel, op. cit. 376 (1893), vix *Pyrus Aria angustifolia* Lindley (1827).
Sorbus longifolia Hedlund in Svenska Vetensk.-Akad. Handl. **35**,1: 82 (Monog. Sorbus) (1901).
Pirus Aria A. I. a. *edulis* Ascherson & Graebner, Syn. Mitteleur. Fl. **6**,2: 95 (1906).

If the two slightly differing forms with the epithet "*longifolia*" and those with the epithet "*edulis*" are united as is done, apparently with good reason, by Hedlund and by Ascherson & Graebner, the epithet of Persoon's name as the oldest will have to be accepted and makes necessary the new combination proposed above.

Rosa centifolia f. **Andrewsii**, nom. nov.

Rosa muscosa simplex Andrews, Roses, **1**: *t.* [*58*] [1810]. — Seringe, Mus. Helv. Hist. Nat. **1**: 18 [1818].
Rosa muscosa (*Muscosa simplex*) Thory in Redouté, Roses, **1**: 39, *t.* (1817).

This rose, the single-flowered form of the Moss Rose, was raised in the garden of the Countess de Vanda at Bayswater. England, and flowered there first in 1807, according to Miss Willmott's *Genus Rosa* (**2**: 347 [1912]).

It seems at present rare in gardens, and in our herbarium we have only a single specimen of this form from the garden of John Robinson, Salem, Mass., collected in 1889.

Rosa Koehneana (*R. carolina* × *rugosa*), nom. nov.

Rosa humilis × *rugosa* Koehne, Deutsche Dendr. 294 (1893), sine descr. — R. Keller in Ascherson & Graebner, Syn. Mitteleur. Fl. 6,1: 308 (1902), sine descr. — Willmott, Gen. Rosa, 1: *203*, *t.* (fl.), *t.* (fr.) [1911].

Rosa rugosa × *carolina* Rehder, Man. Cult. Trees Shrubs, 442 (1927); non Graebner (1902) = *R. Spaethiana* Graebn. [*R. palustris* × *rugosa*].

As almost all of the hybrids of *R. rugosa* have received binary names, this characteristic and ornamental hybrid also seems worthy of a name and may be named *R. Koehneana* for E. Koehne, the author of Deutsche Dendrologie and many other important contributions to dendrology, who first listed it, though without description.

Prunus avium f. **fastigiata** (Poiteau), comb. nov.

Cerasus avium fastigiata Poiteau & Turpin in Duhamel, Traité Arb. Fruit. 2: *C.* no. 5; *t. 298,* fasc. 50? [1828]. — Poiteau, Pomol. Franç. 1: 185, *t. 298* (1838–46).

Prunus vel *Cerasus avium pyramidalis* Hort. ex Dippel, Handb. Laubh. 3: 615 (1893), nom. altern.

Prunus avium lus. *pyramidalis* Ascherson & Graebner, Syn. Mitteleur. Fl. 6,2: 152 (1906).

This form was first observed in the garden of F. Cels near Paris in 1808 by Poiteau (l. c.), who describes it as a tree similar in habit to the Lombardy Poplar and bearing small yellow fruit. Whether Dippel's *Prunus avium pyramidalis* (l. c.) belongs here or represents another form of similar habit is doubtful, since he does not mention the color of the fruit and calls it a pyramidal form.

Prunus Vanioti H. Léveillé in Bull. Acad. Intern. Géog. Bot. 25: 45 (1915) "*Prunus* (*Padus*) *Vanioti*"; Cat. Pl. Yun-Nan, 234 (1917).

Prunus pubigera var. *Prattii* Koehne in Sargent, Pl. Wilson. 1: 67 (1911).

?*Prunus pubigera* var. *longifolia* Cardot in Notul. Syst. Herb. Mus. Hist. Nat. 4: 24 (1920).

?*Prunus Ohwii* Kanehira & Hatusima in Kanehira, Formos. Trees, 270, *fig. 220* (1936); in Trans. Nat. Hist. Soc. Formosa, 29: 156 (1939), pro syn. "*P. Ohwi.*"

CHINA. Szechuan: *A. E. Pratt 94* (syntype of *P. pubigera* var. *Prattii*); *R. P. Farges,* distr. Tchen-keou-tin; *E. H. Wilson 2845* (syntype of *P. pubigera* var. *Prattii*); *C. Schneider 1284, 1286, 3534; W. P. Fang 4159, 7315; F. T. Wang 21122, 22865, 23302; T. T. Yü 530, 613.* Kansu: *J. F. Rock 14857, 14883.* Hupeh: *E. H. Wilson 181* and *2337* (syntypes of *P. pubigera* var. *Prattii*). Yunnan: *J. M. Delavay,* Ma-eul-chan, in 1891 (type of *P. pubigera* var. *longifolia,* not seen); *E. E. Maire,* Ma-Kong, in 1912 (ISOTYPE of *P. Vanioti*); *C. Schneider 2093, 3340; G. Forrest 19511, 21132, 23080; J. F. Rock 3409, 3578, 3649, 3995, 4025, 4461, 5758, 6782, 8305, 8838, 10230, 17200, 23381.* Southeast Tibet: *G. Forrest 19002; J. F. Rock 22084.* FORMOSA: *Ohwi 3591* (type of *P. Ohwii,* not seen).

Of the three varieties of *P. pubigera* (Schneid.) Koehne distinguished by Koehne, the var. *Prattii* is identical with *P. Vanioti* H. Lév., which is the correct name for *P. pubigera,* since the latter is invalidated by the earlier homonym *P. pubigera* Steudel. Thus *P. pubigera* var. *Prattii* represents the typical variety of *P. Vanioti,* and typical *P. pubigera* (= *P. pubigera* var. *Potanini*) becomes a variety of *P. Vanioti*. As the list of specimens cited above shows, typical *P. Vanioti* is the most widely distributed of the three varieties which have been distinguished. There can be little doubt that *P. pubigera* var. *longifolia* Cardot, judging from the brief description and the region where it was collected, belongs to typical *P. Vanioti*. As to the Formosan *P. Ohwii* Kanehira, the figure published by Kanehira agrees well with *P. Vanioti* and the identification of the species by Kanehira and Hatusima with *P. pubigera* also shows that *P. Ohwii* belongs with this affinity; its widely separated locality is not as strange as it may seem, for there are other plants known as occurring in Formosa and Yunnan, and not in the intervening region, of which the most striking example is perhaps *Taiwania cryptomerioides* Hay. (see Wilson in Jour. Arnold Arb. 7: 58. 1926).

Prunus Vanioti var. **obovata** (Koehne), comb. nov.

Prunus pubigera var. *obovata* Koehne in Sargent, Pl. Wilson. **1**: 68, 196 (1911). — Rehder & Wilson in Sargent, Pl. Wilson. **3**: 425 (1917).

CHINA. Szechuan: *E. H. Wilson 1045* (SYNTYPE), *4036, 4185, 3521* (Veitch Exp.). Hupeh: *E. H. Wilson 186* (SYNTYPE). Chekiang: *R. C. Ching 1385*. Kiangsi: *E. H. Wilson 1675*.

This variety extends east to Chekiang and Kiangsi and is not found in Yunnan; it apparently represents the northeastern extension of the species.

Prunus Vanioti var. **Potanini** (Koehne), comb. nov.

Padus brachypoda (Batal.) Schneid. var. *pubigera* Schneider in Repert. Sp. Nov. Reg. Veg. **1**: 70 (1905); Ill. Handb. Laubh. **1**: 638 (1906).

Prunus pubigera Koehne in Verh. Bot. Ver. Brandenb. 52(1910): 106 (1911); in Sargent, Pl. Wilson. **1**: 67 (1911). — Rehder in Jour. Arnold Arb. **13**: 320 (1932); Man. Cult. Trees Shrubs, ed. 2, 478 (1940). — Non Steudel (1841).

Prunus pubigera var. *Potanini* Koehne in Sargent, Pl. Wilson. **1**: 68 (1911), 196 (1912).

CHINA. Szechuan: Southeast of Tachien-lu, *E. H. Wilson 988*, June and Sept. 1908 (SYNTYPE), *4133*, Oct. 1910. Northern Tibet: River Pa-sin-kou (Pa-seng-kou), above the village Tshzhumse (also spelled Tchumse?[1]), *G. N. Potanin*, July 1893 (SYNTYPE, not seen).

The area of this variety seems to be restricted to the extreme northwestern part of the range of the whole species and extends from the region near Tachien-lu to northeastern Tibet.

This variety, partly based on Potanin's specimen, includes the type of *Prunus pubigera* (Schneid.) Koehne, originally described as *Padus brachypoda* var. *pubigera* Schneider and based on Potanin's specimen which had been, according to Schneider, identified as *Padus cornuta*. When Koehne (l. c.) raised Schneider's variety to specific rank, he overlooked the older homonym of Steudel, Nomencl. Bot. ed. 2, **2**: 404 (1841) based on *Prunus pubescens* Poiret, Encycl. Méth. Bot. Suppl. 4: 584 (1816), a later homonym of Pursh, Fl. Am. Sept. **1**: 331 (1814). Poiret's name is validly published with a full description and the statement that the plant is cul-

[1] By Schneider, l. c. (1905) the name of the village is spelled Chusme, apparently a mistake or misprint; Komarov in his account of Potanin's travels (in Act. Hort. Petrop. **34**(2): 359, 1928) spells it Tshzhumse.

tivated in the Paris botanic garden and that its origin is unknown. It may be near or identical with *P. maritima* Marsh., which is mentioned by Poiret on p. 58 as *P. sphaerocarpa* Michx. with the synonym *P. pubescens* Pursh, but without seeing a specimen of Poiret's plant definite identification is not possible. In 1846 Heynhold, in his Nomencl. Bot. Hort. 2: 564, renamed Poiret's homonym *P. Poiretiana.*

Leguminosae subfam. **Lotoideae** (Luerssen), comb. nov.

Papilionaceae Scopoli, Fl. Carniol. 522 (1760, pref. Jun.). — Linnaeus, Philos. Bot. 37 (1763), nom. subnud. — Giseke, Praelect. Ord. Nat. Pl. 415 (1792). — Link, Handb. Erkenn. Gew. 2: 143 (1831). — Nom. Conserv. cf. Syn. Propos. Sixth Intern. Bot. Congr. 64 (1935) et Proc. Sixth Intern. Bot. Congr. 1: 358 (1936).

Leguminosae ord. *Papilionaceae* R. Brown in Flinders, Voy. Terra Austral. 2(App.): 552 (1814) "trib. *Legum.* ord. *P.*" — De Candolle, Prodr. 2: 94 (1825) "subord." — Lindley, Introd. Nat. Syst. Bot. 89 (1830) "trib." — Bentham & Hooker f., Gen. Pl. 1: 437 (1867) "subord."

Fabaceae Reichenbach, Handb. Nat. Pflanzensyst. 227 (1837). — Small, Fl. Southeast. U. S. 593 (1903).

Leguminosae fam. *Papilionatae* A. Braun in Ascherson, Fl. Prov. Brandenb. 67 (1864); Ascherson, Verz. Phaner. Gefässkr. Berlin 35 (Fl. Prov. Brandenb. pt. 2) "Fam. *P.*," pref. 1859 (1864). — Taubert in Nat. Pflanzenfam. III. 3: 184 [1892].

Papilionaceae subfam. *Lotoideae* (p. 379), subfam. *Hedysaroideae* (p. 380), subfam. *Vicioideae,* subfam. *Phaseoloideae* (p. 381) Luerssen, Grundzüge Bot. 379–381 (1877).

Leguminosae subfam. *Papilionoideae* Robinson & Fernald in Gray, Man. Bot. N. U. S. ed. 7, 500 (1908).

According to Art. 24 of the Rules of Botanical Nomenclature, names of subfamilies are taken from the names of one of the genera of the group with the ending -oideae. This excludes names of subfamilies such as Papilionaceae, Papilionatae and also Papilionoideae since they are not derived from the name of a genus of the group and the first two do not end in -oideae. Of the four subfamilies into which Luerssen divides the family Papilionaceae, forming in his arrangement together with the Mimosaceae and Caesalpiniaceae the order of Leguminosae, the name of the first and largest has been selected here as the name in an enlarged sense for the whole group considered by Luerssen as constituting the family Papilionaceae.

Adenocarpus decorticans Boissier in Bibl. Univ. Genève, n. sér. 13: 40 (Notice Ab. Pinsapo, 9) (March, 1838); Elench. Pl. Nov. Hisp. 32 (1838) "in bibl. univ. gen. febr. 1836" sphalm. pro 1838; Voy. Bot. Esp. 145, *t.41* (1839). — Willkomm & Lange, Prodr. Fl. Hisp. 3: 462 [1877].

Adenocarpus Boissieri Webb, Iter. Hisp. 52 (1838).[2]

Owing to a misprint or lapsus calami in Boissier's Elenchus of June, 1838, the publication of *Adenocarpus decorticans* has always been quoted without exact citation as "febr. 1836" which is obviously an error; there is no article by Boissier in the Bibliothèque universelle de Genève for the year 1836, and moreover, at that time he had not yet discovered the species, since he did not start his voyage through Spain until April, 1837. The first description of the species appeared in the February issue for 1838 of the

[2] Webb's synonym is only a renaming of Boissier's species, because he objected, for grammatical reasons, to the use of the present participle in the specific epithet.

Bibliothèque universelle de Genève (nouv. sér. vol. 13) in a list of nineteen (nos. 1–18) new species appended to his "Description d'une nouvelle espèce de sapin du midi de l'Espagne" (op. cit. 401–410), in which *Abies Pinsapo* is described. This appended list has been omitted from the reprint which appeared under the title "Notice sur l'Abies Pinsapo" in Ann. Sci. Nat. Bot. sér. 2, 9: 167–172 (1838). The omission of this list of nineteen names of new species from the reprint in Ann. Sci. Nat. Bot. may have been one of the reasons that their original publication was overlooked in almost all cases and not given in Index Kewensis, where they are mostly credited to Boissier's Elenchus published about three months later with amplified descriptions and some changes, but without exact citation of their previous publication, only referred to as "bibl. bot. gen. (febr. 1838)." Apparently Boissier had sent the manuscript of his Elenchus to the printer before he had seen the February issue of 1838 of the Bibliothèque universelle de Genève; otherwise he certainly would have given the exact citation for his new species. As it seems important to make available the correct record of these overlooked names, they are given in their original sequence in the following list with the addition of the citation from his Elenchus and in some cases with other additional notes.

List of new species published by Boissier in the February issue of vol. 13 (1838) of Bibliothèque universelle de Genève

The citation of these species in his Elenchus reads "febr. 1838," which refers evidently to the February issue and not to the date of publication, since that issue contains on p. 426–427 meteorological observations up to February 28 and therefore could not have been published before March.

1. *Abies Pinsapo* Boissier in Bibl. Univ. Genève, nouv. sér. 13: 402, 406 (March 1838); Elench. 84 (June 1838).
2. *Ranunculus acetosellaefolius* Boissier in op. cit. 406 (March 1838); Elench. 5 (June 1838).
3. *Vella spinosa* Boissier in op. cit. 407 (1838); Elench. 14 (1838).
3. *Alyssum longicaule* Boissier in op. cit. 407 (1838) = *Ptilotrichum longicaule* Boissier, Elench. 13 (1838).
4. *Lavatera oblongifolia* Boissier in op. cit. 407 (1838); Elench. 24 (1838).
5. *Adenocarpus decorticans* Boissier in op. cit. 407 (1838); Elench. 32 (1838).
6. *Adenocarpus grandiflorus* Boissier in op. cit. 407 (1838); Elench. 32 (1838), pro syn. = *A. Telonensis* DC.
7. *Genista versicolor* Boissier in op. cit. 408 (1838); Elench. 31 (1838).
8. *Anthyllis tejedensis* Boissier in op. cit. 408 (1838); Elench. 35 (1838).
9. *Leobordea lupinifolia* Boissier in op. cit. 408 (1838); Elench. 36 (1838).
10. *Geum heterocarpum* Boissier in op. cit. 408 (1838); Elench. 40 (1838).
11. *Saxifraga gemmulosa* Boissier in op. cit. 409 (1838); Elench. 43 (1838).
12. *Eryngium glaciale* Boissier in op. cit. 409 (1838); Elench. 44 (1838).
13. *Lonicera arborea* Boissier in op. cit. 409 (1838); Elench. 55 (1838).
14. *Artemisia granatensis* Boissier in op. cit. 409 (March 1838); in De Candolle, Prodr. 7: 298 (April 1838); Elench. 60 (June 1838).
15. *Gentiana Boryi* Boissier in op. cit. 410 (1838); Elench. 65 (1838).
16. *Sideritis glacialis* Boissier in op. cit. 410 (1838) = *Sideritis scordioides* var. *vestita* Boissier, Elench. 76 (1838).
17. *Holcus caespitosus* Boissier in op. cit. 410 (1838); Elench. 86 (1838).

18. *Festuca Lasto* Boissier in op. cit. 410 (1838); Elench. 92 (1838) "febr. 1832" sphalm.; "loc. et nom. vulg. excluso" pro syn. = *F. altissima* Boissier, non Allioni (1789) = *F. Boissieri* Janka in Oester. Bot. Zeitschr. 14: 341 (1864) = *F. drymea* B. *Boissieri* Ascherson & Graebner, Syn. Mitteleur. Fl. 2,1: 535 (1900).

Robinia leucantha, spec. nov.

Frutex ad 0.5 m. altus, laxe ramosus, stolonifer, ramulis hornotinis glabris vel basin versus glandulis stipitatis et setis tenuibus sparse obsitis, annotinis et vetustioribus brunneis lenticellatis inermibus vel partim spinis stipularibus 1–3 mm. rarius ad 1 cm. longis et gracilibus armatis. Folia ab initio glaberrima vel errumpentia pilis sericeis caducis vestita mox glabra, 7–11-foliolata, vel in turionibus ad 15-foliolata; petioli 2–4 cm. longi; foliola breviter petiolulata, ovali-ovata, 2–4 (rarius ad 6) cm. longa et 1.2–2 cm. lata, terminale interdum ad 3 cm. lata, apice rotundata et emarginata vel obtusa, mucronulata, basi truncata, rarius late cuneata, in ramulis robustioribus oblongo-ovata et saepius acutiuscula, subtus pallida, venis utrinsecus 5–7, stipellis petiolulis subaequilongis. Racemi 2–5 (rarius ad 8) cm. longi, 3–6-flori, rarius ad 8- vel 10-flori; pedicelli 4–6 (rarius ad 10) mm. longi, ut rhachis sparse glanduloso-setosi; calyx campanulatus, sparse glanduloso-pilosus et plus minusve puberulus vel villosulus, pallide viridis, apicem versus albescens, leviter bilabiatus, labio supero ad medium bifido, infero 3-lobato, lobis tubo subaequilongis 5–6 mm. longis triangulari-ovatis et plerumque longe acuminatis; corolla candida, ad 2.5 cm. longa, vexillo rotundato circ. 2 cm. diam. emarginato basi cordato, ungui 4–5 mm. longo, alis inaequaliter obovatis 15 mm. longis, auricula basali 2 mm. longa, ungui 7 mm. longo, carina 1.4 mm. longa, ungui 7 mm. longo; tubus staminalis 14 mm. longus; stylus recurvatus, apicem versus villosus; ovarium leviter complanatum, dense stipitato-glandulosum. Fructus non visus.

Affinis *R. nanae* Elliott sed foliis et ramulis glabris, corolla candida facile diagnoscitur.

North America: Georgia: 6 miles west of Dahlonega and near Dahlonega and 4 miles west of Porter Springs, Lumpkin Co., *W. W. Ashe*, May 18, 1926 (4 specimens in W. W. Ashe Herb., Univ. N. Carol.). Cultivated: Hort. W. W. Ashe, 1512 Park Ave., Washington, D. C., June 24, 1928 (sterile) and May 25, 1931, *W. W. Ashe*, W. W. Ashe Herb., Univ. N. Carol.); Kelsey Nursery, East Boxford, Mass., *H. P. Kelsey*, June 17, 1943; *A. Rehder*, June 18, 1945 (Herb. Arnold Arb., type).

This new species seems to be most closely related to *R. nana* Elliott, which belongs to a group of shrubby species with glandular ovary and pink or rose-colored to purple flowers (*Hispidae* Rydb.); it differs strikingly from these species in its pure white flowers and from *R. nana* also in its glabrous leaves and branchlets. Judging from specimens in Ashe's herbarium, now at the University of North Carolina in Chapel Hill, kindly loaned to the writer by Prof. W. C. Coker, this species was first collected in Lumpkin Co., Georgia, by Ashe, who transplanted it to his garden in Washington and later sent a plant to Mr. Harlan P. Kelsey, suggesting that this new species might be named after him; he apparently overlooked the fact that there was already a *Robinia Ashei* described in 1923 by Schallert in Torreya. The epithet *leucantha* proposed here for this species is intended to call attention to the fact that white flowers are unusual in the group *Hispidae,* the only plant with white or partly white flowers referred to this group being *R. albicans* Ashe, which is apparently a hybrid of *R. Pseudoacacia* and *R. Boyntoni* Ashe. The possibility that the plant described above might also be a hybrid with *R. Pseudoacacia* is excluded by its low stoloniferous habit and the densely glandular ovary.

The description of this new species is based chiefly on the living specimens from the Kelsey nursery at East Boxford, Mass., where it has been growing since 1927. These specimens have the leaves and young branchlets quite glabrous from the beginning and the calyx sparingly stipitate-glandular with the lower lobes long-acuminate and slightly longer than the tube; the branches are mostly unarmed or occasionally with short conical stipular spines. The specimens from Ashe's garden do not seem to be different, but the spontaneous specimens from Lumpkin County show some slight variation. The specimen from Porter Springs has the calyx rather densely villous and, like the rachis, lacking glandular-setose hairs, while the spines are slenderer and up to 5 mm. long; one of the specimens collected six miles west of Dahlonega has the pubescence of the calyx and rachis similar to the preceding specimen and pedicels only about 4 mm. long, while the other specimen has the calyx and rachis sparingly glandular-setose, the pedicels up to 10 mm. long, and the unfolding leaves silky-pubescent but soon becoming quite glabrous; the specimen from near Dahlonega has the unfolding leaves pubescent like the preceding, the calyx rather densely villous and almost without glandular setae, the rachis sparsely glandular-setose, and slender spines up to 10 mm. long. The flowers of all these specimens are apparently white, but on the labels there is no reference to the color of the flowers nor to the habit of the plants. As the differences between the several specimens are only slight and more or less intergrading, and as all the specimens are from a rather restricted area, they must be considered conspecific, representing an otherwise well defined species.

Vitis quinquangularis, nom. nov.

Vitis pentagona Diels & Gilg in Bot. Jahrb. **29**: 460 (1900). — Rehder in Sargent, Pl. Wilson. **3**: 428 (1917). — Non Voigt (1845), nec M. A. Lawson (1875).

Vitis Coignetiae sensu Diels in Bot. Jahrb. **29**: 461 (1900), non Planchon (1883).

Vitis ficifolia var. *pentagona* Pampanini in Nuov. Giorn. Bot. Ital. **17**: 116 (1910).

Vitis quinquangularis var. **bellula** (Rehder), comb. nov.

Vitis pentagona var. *bellula* Rehder in Sargent, Pl. Wilson. **3**: 428 (1917).

As the name *Vitis pentagona* is preoccupied by two earlier homonyms, namely *Vitis pentagona* (Roxb.) Voigt, Hort. Suburb. Calcutt. 28 (1845), based on *Cissus pentagona* Roxburgh, Fl. Ind. 426 (1820), and *V. pentagona* Lawson in Hooker f., Fl. Brit. Ind. 1: 646 (1875), it must receive a new name, for which the Latin translation of its Greek epithet has been chosen.

Rhododendron trichanthum, nom. nov.

Rhododendron villosum Hemsley & Wilson in Kew Bull. **1910**: 119 (1910). — Hutchinson in Rhododendron Soc., Spec. Rhodod. 770 (1930). — Non Roth (1807).

It seems to have been hitherto overlooked that *Rh. villosum* Hemsl. & Wils. is invalidated by an older homonym, namely *Rh. villosum* A. W. Roth, Bot. Bemerk. 159 (1807), which is a synonym of *Clerodendron fragrans* Jacquin (1798).

Fraxinus excelsior f. **aureo-pendula**, nom. nov.

Fraxinus excelsior var. *aurea pendula* Loudon, Arb. Brit. 2: 1217 (1838). — Schneider, Ill. Handb. Laubh. 2: 830 (1912) "var. *aurea* f. *pendula*." — Lingelsheim in Engler, Pflanzenreich, IV. 243(Heft 72): 50 (1920) "f. *aurea pendula*." — Non var. *pendula* Aiton (1789), nec var. *aurea* Willdenow (1811).

According to Art. 30 and Art. 55 of the Rules of Botanical Nomenclature, the quaternary combination must be reducible to a ternary combination, which in this case cannot be done, because there exists already the older ternary combination *F. excelsior* var. *pendula* Ait. (1838) and *F. excelsior* var. *aurea* Willd. (1811).

Kalmia latifolia f. **angustata**, f. nova.

A typo recedit foliis multo angustioribus, oblanceolatis vel lineari-oblanceolatis, 4–8 cm. longis et 5–10 mm. latis, basi sensim in petiolum attenuatis.

North America: New Jersey: Dennis township, Cape May County, one large clump, *H. A. Scribner,* March 21, 1944 (Herb. Arnold Arb.).

A specimen of the plant described above was sent to the writer last year by Mr. H. A. Scribner, Forest Supervisor of Belleplain State Forest, New Jersey, who stated that one large clump of this form was found in Dennis township by Forest Ranger Thomas Pettit. Rooted stems of this form were kindly sent this year by Mr. Scribner to the Arboretum for its living collection. There seems to be no reference to such a form in botanical or horticultural literature. Among the numerous specimens of *K. latifolia* in the herbarium of the Arnold Arboretum, there is only one specimen with leaves closely approaching this form, though not quite as narrow, representing a bud sport on a normal plant; the specimen was collected near Lanham, Maryland, by G. N. Collins & F. V. Coville, June 8 or 9, 1926, and consists of two branches from the same plant, one with normal and one with narrow leaves 8–15 mm. broad and 4.5–10 cm. long.

Arnold Arboretum,
Harvard University.

CARYA ALBA PROPOSED AS NOMEN AMBIGUUM

ALFRED REHDER

THE NAME *Carya alba* was first published by Nuttall as one of the species of his new genus *Carya* (Gen. N. Am. Pl. **2**: 220. 1818) without citation of the basonym, but it was apparently based either on *Juglans alba* L. (Sp. Pl. 997. 1753) or more likely on *J. alba* Michaux (Fl. Bor.-Am. **2**: 192. 1803), since he uses it in the restricted sense of the latter author. *Juglans alba* of Linnaeus comprises two species, as his citations show; those referring to Gronovius, Parkinson and Catesby represent, at least partly, the species called *J. tomentosa* by Poiret (1798) and by Michaux (1803), while the reference to Plukenet may represent the species called *J. ovata* by Miller (1768). These two epithets were transferred to *Carya* as *C. tomentosa* by Nuttall (1818) and as *C. ovata* by K. Koch (1869). Many authors, however, trying to retain the original epithet "*alba*," applied it differently to one of the two species included by Linnaeus in his *J. alba*. Crantz (1766) and Miller (1768) were the first ones definitely to restrict *J. alba* of Linnaeus to one species; Crantz by citing only Catesby as the type of *J. alba*, and Miller by separating the two species chiefly involved in the Linnaean *J. alba*. Of the authors who followed Miller in keeping the epithet *alba* for the species representing *C. tomentosa* (Poir.) Nutt. may be cited: K. Koch (1869) and Sargent (1922) as *Carya alba;* Britton (1888) and Sargent (1895) as *Hicoria alba;* Sargent (1889) as *Hicorius albus*. Of those authors who followed Michaux (1803) in using the epithet *alba* for the species representing *C. ovata* (Mill.) K. Koch may be cited: Rafinesque (1808) as *Scoria alba;* Nuttall (1818), Emerson (1846 and 1875), C. de Candolle (1864) and Engler (1887), as *C. alba*.

It is probably correct to consider the references to Parkinson, Catesby and Gronovius as representing the type of *Juglans alba* L. and therefore, in transferring the species to *Carya*, it should be named *C. alba*, but from the remarks above and the synonymy cited below, it appears that evidently the majority of authors followed Michaux and applied the epithet *alba* to the species called *C. ovata* (Mill.) K. Koch.

There also arises the question whether the name *C. alba* (Mill.) K. Koch (1869) should not be considered a later homonym of *C. alba* Nuttall (1818) and Emerson (1846) and be rejected according to Articles 54 and 61 of the Rules, or whether it should be called a misidentification. The latter assumption would presuppose typification of *J. alba* L., which can hardly be done with certainty, since the name is based not on herbarium specimens but upon insufficient descriptions by previous authors based chiefly on characters of the nut. For the same reason one can hardly accept *J. rubra* Gaertn. (1791) as validly published, since description and figure are based solely on the nut and would not constitute valid publication according to Art. 43; it should be classed as a *nomen subnudum* and rejected, otherwise it would supersede *J. tomentosa* Poir. of 1798. It therefore seems advisable, in order to avoid confusion and ambiguity through the use of the name *Carya alba,* to declare *Carya alba* a ***nomen ambiguum*** and to accept the two names *C. **tomentosa*** (Poir.) Nutt. and *C. **ovata*** (Mill.) K. Koch as the correct names for the two species involved, as has already been done by Rehder (1940) and L. H. Bailey (1941).

The two accepted names with their synonymy are given below, where complete citations of the names referred to in the discussion above will be found.

Carya tomentosa (Poir.) Nuttall, Gen. N. Am. Pl. **2**: 221 (1818). — Emerson, Rep. Trees Shrubs Mass. 194, *t.13* (1846); ed. 4, **1**: *222*, *t.* (1875). — C. de Candolle in De Candolle, Prodr. **16**,2: 143 (1864). — Engler in Nat. Pflanzenfam. III. 1: 25 [1887]. — Rehder, Man. Cult. Trees Shrubs, ed. 2, 123 (1940). — Bailey, Hortus Secund. 145 (1941).

Juglans alba Linnaeus, Sp. Pl. 997 (1753), p. p. — Crantz, Inst. Rei Herb. 1: 157 (1766). — Miller, Gard. Dict., ed. 7, *J.* no.4 (1768). — Willdenow, Sp. Pl. **4**: 457 (1805).

Juglans rubra Gaertner, Fruct. Sem. **2**: 51, *t.89, fig. k.* (1791), nom. subnud.

Juglans tomentosa Poiret in Lamarck, Encycl. Méth. Bot. **4**: 504 [1798]. — Michaux, Fl. Bor.-Am. **2**: 192 (1803). — Michaux f., Hist. Arb. For. Am. Sept. **1**: 184, *t.6* (1810).

Scoria tomentosa Rafinesque in Med. Repos. New York hex. 2, **5**: 352 (1808).

Carya tomentosa β maxima Nuttall, Gen. N. Am. Pl. **2**: 221 (1818).

Hicoria maxima (Nutt.) Rafinesque, Alsogr. Am. 67 (1838).

Carya alba (Mill.) K. Koch, Dendr. 1: 596 (1869). — Sargent, Man. Trees N. Am. ed. 2, 188, *fig. 178* (1922). — Non Nuttall (1818), nec Emerson (1846).

Hicoria alba (L.) Britton in Bull. Torrey Bot. Club, **15**: 283 (1888). — Sargent, Silva N. Am. **7**: 153, *t.346,347* (1895).

Hicoria alba var. *maxima* Britton, l. c. (1888).

Hicorius albus (L.) Sargent in Gard. & Forest, **2**: 460 (1889).

Carya ovata (Mill.) K. Koch, Dendr. 1: 59 (1869). — Sargent, Man. Trees N. Am. ed. 2, 183, *fig.174* (1922).

Juglans alba Linnaeus, Sp. Pl. 997 (1753), p. p. — Michaux, Fl. Bor.-Am. **2**: 193 (1803). — Pursh, Fl. Am. Sept. **2**: 637 (1814).

Juglans ovata Miller, Gard. Dict., ed. 8, *J.* no. 6 (1768).

Juglans alba ovata Marshall, Arbust. Am. 69 (1785).

Juglans compressa Gaertner, Fruct. Sem. **2**: 151, *t.89, fig. i* (1791), nom. subnud. — Willdenow, Sp. Pl. **4**: 458 (1805).

Juglans latifolia Poiret in Lamarck, Encycl. Méth. Bot. **4**: 503 [1798].

Juglans obcordata Poiret in Lamarck, op. cit. 504 [1798].

Scoria alba Rafinesque in Med. Repos. New York, hex. 2, **5**: 352 (1808), nom.

Juglans squamosa Michaux f., Hist. Arb. Am. **1**: 190, *t.7* (1810). — Nuttall, N. Am. Sylva, **1**: 80, *t.36* (1841). — Non Poiret [1798] = *J. glabra* (Mill.) Sweet.

Carya alba Nuttall, Gen. N. Am. Pl. **2**: 221 (1818), nom. — Elliott, Sketch Bot. S. Carol. **2**: 624 (1824). — Emerson, Rep. Trees Shrubs Mass. 191, *t.12* (1846); ed. 4, **1**: *217*, *t.* (1875). — C. de Candolle in De Candolle, Prodr. **16**,2: 142 (1864). — Engler in Nat. Pflanzenfam. III. 1: 25 [1887], nom. in obs.

Hicoria ovata Britton in Bull. Torrey Bot. Club, **15**: 283 (1888). — Sargent, Silva N. Am. **7**: 153, *t.346,347* (1895).

Hicorius ovatus Sargent in Gard. & Forest, **2**: 460 (1889).

Scoria ovata Macmillan, Metasperm. Minnesota, 178 (1892).

Arnold Arboretum
Harvard University

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1945

THE INSTITUTION was operated during the year within the limits of its income and a modest addition was made to its departmental balance from unexpended unrestricted income. It was expected that a deficit might develop because of a rather radical increase in the labor payroll, as we had to meet the University standards as to daily wages of skilled and unskilled labor, and no budgetary provision had been made to meet this increase. Also, on April 1, 1945, we took title to the Marian Roby Case estate in Weston, mentioned elsewhere in this report, and assumed the rather considerable maintenance costs involved, although the addition to income from Miss Case's generous bequest to endowment funds is not yet available as the estate has not yet been settled.

In addition to income from its restricted endowment, the extra-budgetary Gifts for Cultural Purposes Fund was increased by $2360.00 in the form of voluntary gifts from forty-eight individuals, while the special Publications Fund was increased by $10,120.00 from eighty-five contributors, including a very generous grant of $3000.00 from the Trustees of the Morton Arboretum, Chicago, in appreciation of the cordial relationships that have existed between the two institutions since that institution was organized in 1921. Because of the situation in reference to Professor Rehder's continued work on his Bibliographic Index project, it was felt that the least the Arnold Arboretum could do would be to underwrite the cost of publication of the extensive volume that will result. He has devoted practically full time to the preparation of the manuscript since his retirement from active service in 1940. Therefore, a limited appeal was made for contributions to the Publication Fund, and I am happy to state that this is now sufficiently ample for the purpose. No appeal was made for contributions to the Gifts for Cultural Purposes Fund, as it was not felt that this was justifiable under war conditions. One grant of $400.00 was received during the year from the Society of Sigma Xi to complete the amount needed for the Raup Alaska Military Highway expedition.

Invested funds remained at approximately the same level as during the preceding year, the regular additions to capital being made to the James Arnold Fund and to the Charles Sprague Sargent Fund in accordance with the terms of the gift. However, under the provisions of two wills now in probate, it is expected that the total endowment of the Arnold Arboretum will be very considerably increased during the coming year, as the two estates are closed.

Under the will of the late Miss Marian Roby Case of Weston, the Arnold Arboretum was indicated as a beneficiary to the extent of $150,000.00 to capital, and her real estate in Weston consisting of about ninety acres adjoining the estate of her sister, Miss Louisa W. Case, which was presented to the institution in 1942, with all the buildings, farm equipment, etc. The buildings are insured on the basis of a valuation of $79,000.00. For tax purposes the land was assessed on the basis of a valuation of about $37,000.00. In addition, she indicated the Arnold Arboretum to be the recipient of all of her residuary estate after certain specific bequests had been paid. This may prove to be the largest single gift to the institution in the seventy-three years of its existence. The other large bequest is that of Mrs. Katherine T. Balch, wife of the late John Balch of Milton, who made the Arnold Arboretum the beneficiary of one-half of her residuary estate, which may amount to more than $100,000.00. Both of these bequests were arranged within the past few years.

The conditions of gift are interesting. Mrs. Balch indicated that her gift should be utilized as far as possible for the support of practical horticulture and "for such uses as may reasonably add to the interest and enjoyment of the average visitor and the general beauty of the Arboretum." Miss Case stipulated in her will: "In connection with the gifts herein contained to the President and Fellows of Harvard College for the use of the Arnold Arboretum I impose no restrictions whatever except that the land or its proceeds and the pecuniary bequests shall be used for the general purposes of the Arnold Arboretum. It is, however, my earnest hope that the estate may be maintained and the bequests utilized to further the development of my land and the adjoining land recently presented by my sister, Miss Louisa W. Case, as an adjunct to the Arnold Arboretum in order that the work of that institution may be amplified in a non-urban center, and yet one that is reasonably close to the City of Boston." Our tentative plans for development of the two adjoining estates in Weston appear elsewhere in this report.

Staff. — The Arboretum suffered a very severe loss in the death of Mr. Louis V. Schmitt, Superintendent of Buildings and Grounds, on November 16, 1944. Mr. Schmitt had been associated with the institution continuously since 1905, was thoroughly conversant with his duties, very efficient, and always had the best interests of the Arboretum in mind. The place made vacant by his untimely death was filled on January 1, 1945, by the appointment of Mr. Robert G. Williams, a graduate of Cornell University, and former Superintendent of Parks, Greensboro, North Carolina. The technical staff remained as in the previous year, with Dr. Kobuski in active military service, still on leave of absence. Several of the younger men in the grounds department were also absent on military duties. Dr. H. M. Raup was promoted in rank to the position of Associate Professor of Plant Geography. Following the resignation of Mrs. Janet R. Sellars as librarian, Mrs. Lazella Schwarten was appointed to the position. Dr. Lawrence M. Ames, a staff member of the U. S. Department of Agriculture, who for nearly twelve years made his headquarters at the Arboretum, with office and other privileges, finished his work for the Department and left during the year.

Instruction. — The graduate student situation was unchanged, very few being in residence at the University. Dr. Johnston and Dr. Raup continued their special courses designed for both graduate and undergraduate students. No radical increase in instruction duties is anticipated until after the close of the war. Professor Bailey has devoted much time, with the assistance and advice of various staff members, to the preparation of a comprehensive report for the administration on botany at Harvard University, both within the Department of Biology and in the nine separately endowed research units, and covering the relationships of the separately endowed units to the University through the Department of Biology. The final report was submitted before the close of the year.

Buildings, grounds and horticulture. — No changes have been made in the buildings other than the minor repairs, painting, etc., necessary to maintain them in good condition. Some extra work has been involved with the acquisition of the several buildings on the Case estate in Weston.

As was the case last year, the plantings have suffered from lack of care due largely to the acute labor shortage, supplemented by a combination of circumstances beyond our control. At no time within the history of the Arboretum are signs of neglect more apparent than now. Unless constant attention be given to such items as trimming, pruning, removal of overgrown or malformed shrubs, trees, and vines and their replacement by others, weeding, spraying, fertilizing, grass cutting, and other standard maintenance practices, plantings quickly get out of hand. Until more labor is available, we cannot cope with this situation. It is a concomitant of the unsettled conditions brought about by the war and we will have to bear with it until after the close of hostilities.

Abnormal seasonal conditions and other circumstances added to our difficulties. There was little winter injury due to low temperatures, and there were but few, and not at all destructive, grass fires in the fall and spring because of the abundance of rainfall. A very heavy fall of wet snow on February 8 caused an extraordinary amount of limb breakage, it taking the entire grounds crew three weeks to take care of only the most obvious places by the necessary and often heavy pruning. Many of the shrubs were crushed to the ground and some of them will need very heavy pruning before they again become attractive in form. This delayed the normal spring rehabilitation campaign, but here again the season was against us, for the period of bloom commenced a full month ahead of the normal time. Following this unseasonably warm weather, there was a protracted wet season lasting into the summer months, thus favoring a most unusually lush growth of grass and coarse weeds. Without our knowledge, a large addition had been planned to the State Serum Laboratory building in the Bussey Institution grounds. The architect's plan had been finished and the contract let before we were informed. It so happened that the area selected for the building was fully occupied by our extensive nursery. Thus, on very short notice, we had to prepare a new nursery site and transfer all of the valuable stock from the old nursery. Because of the abnormally advanced season, we had but about a week in which to make this radical change. A week or two later it would have been impossible to move the stock with safety, as the spring growth had commenced or was about to commence. It was most fortunate that we learned of this projected building plan in time, otherwise our losses in valuable selected stock would have been very great. As it was, it put an additional strain on our relatively small grounds crew at a most critical time and further prevented them from giving proper attention to other maintenance matters.

Thus, largely because of war conditions, it has become increasingly difficult to maintain the living collections in an attractive condition. No new plants were added to the permanent living collections during the fall and spring planting seasons, and it is clear that plantings of new material should be kept at a minimum until the time arrives when we can properly care for what we have in place. Because of the limited amount of labor available, it has been necessary to concentrate the work on special projects and let the other areas remain with a minimum of care.

Special attention was given in the fall to the extensive shrub collection near the Forest Hills gate, as it had become badly overgrown. Each alternating grass walk was removed, and the soil was limed and heavily fertilized. All the shrubs were heavily pruned and the labels were replaced by new ones, these being set back from the walks so as to permit of machine cultivation. It is evident that this thorough renovation was justified, for the annual cost of maintaining this large collection was reduced by about one-half, due to the saving of hand labor. It is planned to continue this concentration of work for several years or until all of the large special collections have been renovated. The next one in line is the very large lilac collection, some clumps of which have become badly overgrown, while others have developed altogether too many sucker shoots.

A new nursery was established on prepared land between South Street and the railroad track, but this is only a temporary expedient. The nursery on the Case estate in Weston was enlarged, and some of our valuable stock in the old nursery, that had to be abandoned because of the projected building mentioned above, was transferred there.

In spite of war conditions, 447 living plants were received and established in our nurseries. At the same time, we received also nine lots of scions and eighty-nine lots of seeds. During the year 496 living plants were distributed, as well as 48 lots of scions and 22 packages of seeds; 175 trees and shrubs were presented to the Harvard Business School to be utilized in a planned improvement of its grounds.

In order to keep maintenance charges at a minimum on the Case estate until such time as income may be received from the Marian Roby Case bequest, certain changes are being made on the Weston property, chiefly in the elimination of certain types of plantings that scarcely fall within the field of the Arboretum. Thus one planting of about 700 named varieties of *Iris* has been eliminated, but the plants were not destroyed. A complete collection of these was sent, through Garden Clubs Services, Inc., to the Essex Sanatorium in Danvers for use in beautifying the grounds and to assist in the retraining of disabled veterans, chiefly psychiatric cases. A selected lot of about 100 of the better varieties was sent to the Rutland Training Center of the Central New England Sanatorium for the same purposes. About 500 varieties were presented to the Boston Park Department.

Further mechanical equipment has been acquired, including a new Fordson tractor with attachments for plowing, cultivating, and hay cutting, with view to further reducing the amount of hand labor needed to maintain the attractiveness of the grounds. We should now be able to take care of these items with our own force and equipment; formerly, for certain types of work, we had to arrange contracts with outside individuals or firms.

The Case Estates in Weston. — As previously reported, the estate of Miss Louisa W. Case in Weston, consisting of about 60 acres of land, a large residence, barns, and a very excellent and commodious greenhouse, was presented by her to the Arnold Arboretum in December, 1942. Miss Marian Roby Case of Weston, sister of Miss Louisa W. Case, redrew her will in 1943 in favor of the Arnold Arboretum as mentioned in the opening part of this report. This estate comprises about 90 acres of land and eight buildings of one type or another. Our very keen desire is to develop these two adjoining estates as an adjunct to the Arnold Arboretum and to concentrate there most of our experimental work, including some of that of the Bussey Institution and of the Cabot Foundation for Botanical Research, and a part of Dr. Mangelsdorf's corn breeding project, as excellent farm land is now fortunately available. It is expected that much of our propagating work will also be done at the Weston site and the material moved in to the Arboretum proper as needed.

An excellent opportunity is thus afforded for a general expansion of our experimental work, and at the same time a judicious planting of ornamental and useful trees and shrubs in Weston to augment those of the Arnold Arboretum. For many years it has been evident that the present Arboretum site is not suitable for certain types of work. It can and must be maintained as an attractive park, but with the very limited amount of really good land available, the present crowded condition of its plantings, the pressure of the population (for the Arboretum site adjoins a densely populated part of Boston), and a certain amount of vandalism that it is practically impossible to control properly, we are badly handicapped. With this opportunity now open in the strictly residential town of Weston, only twelve miles from the Arboretum in Jamaica Plain, we have the opportunity of greatly amplifying our experimental and propagating work, and of initiating lines of research that it has hitherto been impossible to develop on the original site. Again, in Weston we will not be subject to the population pressure, vandalism will be at a minimum, and the plantings will not be damaged by the smoke and dust of the city.

In anticipation of a definite plan of improvements for the Weston properties, about ten acres of the best farm land were plowed, fertilized, and cover-cropped in the spring in order to get the land into first-class condition for future operations. Seed beds have been prepared, hot beds installed, and nursery space expanded. Some general clearing has been prosecuted, certain decrepit trees and shrubs removed, and a definite policy of reducing actual agricultural operations in favor of experimental work and arboretum development actually initiated. Thus it seems to be clear that in future years the Weston property can be developed into a highly useful adjunct to the Arnold Arboretum, to serve not only the purposes of this unit, but also those of several of the other separately endowed botanical units as well as the Department of Biology of Harvard University, where certain types of research demand proper space and a reasonable amount of land. There we can closely control the situation without undue interference by certain elements of the general public; in its present site the Arboretum proper can never expect to maintain the strict control that is demanded in connection with experimental plantings.

The War Effort. — We have continued to coöperate with different government agencies in work on various botanical problems with which representatives of the armed services became involved, particularly in reference to the Southwest Pacific area, Micronesia, the Philippines, and in preparation for projected operations in China, Formosa, and other oriental countries. *Native Woods for Construction Purposes in the Western Pacific Region,* compiled by Dr. J. H. Kraemer, was issued by the Bureau of Yards and Docks, Department of the Navy, May, 1944, and a greatly amplified edition appeared in September, 1944, both restricted. The illustrations were prepared at the Arnold Arboretum and the basic lists were prepared here. A third volume, *Native Woods for Construction Purposes in the South China Sea Region,* unrestricted, appeared in January, 1945, in the preparation of which we also coöperated, although some of its illustrations were prepared at the Smithsonian Institution, in part based on material that we loaned for the purpose.

Dr. I. M. Johnston made two special trips to the tropical base of the Chemical Warfare Service in connection with certain problems with which that organization was concerned in connection with its tropical operations. This field work cannot at the present time be discussed further because of its confidential nature, but the large collections assembled by him will be the basis of a future technical paper when restrictions shall have been modified.

We have continued to receive and to report on botanical collections made by service men stationed here and there in the Old World tropics, shipments coming in all the way from Upper Burma to New Caledonia. It has so far been possible to report upon each lot within a day or two after the packages were received. Most of this work has fallen to the undersigned, who has also continued to lecture every two months to each group of trainees in the intensive course on tropical medicine at the Army Medical School in Washington. Work on the manuscript of *Plant Life of the Pacific World* was completed and the proofs were finished before the close of the year. The sales edition of this work is published by the Macmillan Company, but simultaneously a special unabridged Fighting Forces edition, pp. *298, 256 fig.,* was issued by the Infantry Journal, Washington, D. C., in its series of standard military books. This book is one of a series on various phases of natural history of the Pacific region, including individual volumes on the animals, native peoples, fishes and shells, reptiles, insects, birds, etc., following the publication of *The Pacific World,* edited by Fairfield Osborn, President of the New York Zoological Society, under the auspices of the American Committee for International Wild Life Protection. Each volume was oriented toward the needs of our service men stationed here and there in the Pacific region.

Botanical Survey of the Alaska Military Highway. — A second season's work was projected during the preceding year and the plans were outlined in the report for 1943–44. The personnel of the party and the sources and amounts of funds ($5300.00) provided to take care of field expenses were also indicated. The party of seven left for the field at the end of May and returned about the middle of September. The military authorities extended the same privileges as those provided during the summer of 1943, that is, free transportation on the road and commissary privileges. The results obtained in botany, ecology, geology, and archeology are significant. Work was concentrated on the upper part of the road from Fairbanks to Whitehorse, as the 1943 operations covered the southern part of the road from Dawson Creek to Whitehorse, but at the end of the season, the party came out via Dawson Creek, thus covering the entire length of the road, some 1500 miles. Approximately 13,000 botanical specimens were prepared, and this large collection, combined with the even larger one (15,000 specimens) made in 1943, will be studied as a whole and thus form the basis of a comprehensive report on the vegetation of the previously little known region traversed by the road.

Plant Breeding. — The more promising new hybrid trees and shrubs are being propagated for further testing and for distribution. Among the more recent productions are species hybrids of maples, honeysuckles, forsythias, lilacs, roses, apples, and cherries. Triploid forsythias have been produced by crossing the artificially induced tetraploids with diploids. Experimental work on polyploidy has been continued.

The more important genera of the Pomoideae are being used in an attempt to obtain rootstocks which will produce dwarf trees or otherwise modify the normal growth habit of the grafted stock. The grafting compatability of generic combinations in this subfamily of the Rosaceae has long been known but no systematic study has been made. *Crataegus, Chaenomeles, Cydonia, Aronia,* and *Sorbus* are being grown on *Malus* rootstocks and many more combinations are being made. Many of these will grow, as grafts, only for a year or two, but some of the progeny may prove to be of horticultural value. The large temporary orchard of hybrid crab apples established a few years ago on the Walter Street tract has served its purpose. The promising new hybrids have been segregated and the worthless stock removed.

Wood Anatomy. — Professor Bailey and Dr. Nast have continued their morphological investigations of the ranalian families in collaboration with Dr. Smith. Detailed anatomical and histological studies have been made of the stem, roots, leaves, floral organs, pollen, and seeds of the taxonomically puzzling genera *Tetracentron, Trochodendron,* and *Euptelea.* Although superficially dissimilar, *Tetracentron* and *Trochodendron* exhibit fundamentally significant similarities in their vesselless xylem, in their peculiar stomata, ovules, seeds, pollen, and internal floral structure. The genera should be placed in two separate, but closely related, families. *Euptelea* differs from these genera in the morphology of all of its organs and should be maintained as an independent family. There are no evidences of close genetic relationships between the Tetracentraceae, Trochodendraceae, or Eupteleaceae and such families as the Magnoliaceae, Winteraceae, or Schisandraceae.

The Herbarium. — During the year 14,281 specimens were mounted, of which 12,193 were inserted into the herbarium, which now contains a total of 630,137 specimens.

In continuation of the arrangement with the Gray Herbarium mentioned in the last report — the mounting of some of the accumulated Old World collections belonging to that institution — 2276 specimens were returned mounted. The mounting of specimens at the Arboretum continues at the rate of incoming material, a rate below normal due to war conditions. However, this has its compensation in that the mounting staff is able to devote considerable time to repairs of material already incorporated, many of the early collections having been placed in the herbarium inadequately strapped.

Incoming specimens numbered about 27,945. The bulk of this material was obtained by subsidy, purchase, or by collections of staff-members, but some of it came through exchanges (3,545), gifts (1,154), or for identification by our staff (2,190). Especially noteworthy collections were about 13,000 specimens obtained by Dr. Raup during his second season along the Alaska Military Highway, about 3,500 specimens gathered by Dr. Johnston on San José Island, Panama, and 2,491 specimens sent by Dr. J. Cuatrecasas from Colombia as the result of a trip partly financed by the Arboretum. Geographically, acquisitions may be broken down as follows: America north of Mexico, 13,684; Central America and Mexico, 4,273; West Indies, 918; South America, 3,532; Pacific Islands and Australasia, 1,742; Asia and Africa, 1,345; miscellaneous (mostly cultivated or North American), 2,451.

A total of 17,274 specimens was distributed to other American institutions, the bulk of this material going to other departments of Harvard University as inter-institutional transfers. To the Gray Herbarium were transferred 14,083 specimens, of which 9,648 were mounted; this last figure includes 7,835 Argentine specimens originally received from the Instituto Miguel Lillo, Tucumán, and mounted at the Arboretum over a period of two or three years. Thirty-five specimens were transferred to the Farlow Herbarium and a similar number to the Ames Orchid Herbarium at the Botanical Museum. To other American institutions the Arboretum sent 2,982 specimens in exchange, 101 specimens as gifts, and 38 specimens for identification. A total of 1,281 mounted illustrations of herbaceous plants and ferns was transferred to the Gray Herbarium for incorporation into the collections. Microfilm and publications to the equivalent value of 1,601 specimens were distributed. To summarize, the total number of specimens or their equivalent in illustrations, microfilm, or publications distributed by the Arboretum was 20,156.

Staff-members and students of ten American institutions requested and were granted 20 loans from the Arboretum, totaling 3,207 specimens and 97 clippings and illustrations. For study by members of our own staff, 33 loans consisting of 2,284 specimens were borrowed from eleven institutions.

A total of 1,652 cards was added to the catalogue of references to new species and other important literature dealing with woody plants, this catalogue now containing 138,650 cards. For the second successive year no additions were made to the collection of negatives representing types and critical specimens; this is partly due to the lack of adequate photographic equipment and partly to the fact that specimens which might normally be photographed are not now available on loan.

Crowding of specimens in the herbarium grows more critical each year, as no additional floor space or cases are available; as usual, only the most important material has been filed in the herbarium, the remainder being stored in a more or less inaccessible place. The usual number of clippings, typed descriptions, and illustrations was inserted into the herbarium.

Special studies were pursued by members of the herbarium staff, and the usual routine identifications were made. Professor Rehder continued to work on his Bibliography of Cultivated Trees and Shrubs, prepared several papers on detailed problems of nomenclature, and devoted considerable time to the assistance of other staff members and visitors who continue to seek his advice. Dr. Smith, in collaboration with Professor Bailey and Dr. Nast, completed work on certain small families of the Ranales and began a study of the Schisandraceae and its immediate allies; he also studied special groups of tropical collections. Dr. Johnston devoted most of his time to botanical work for the Chemical Warfare Service, making two extended trips to the tropical research center maintained by that organization. Data for publication will not be available until after the close of the present war. Dr. Raup has continued work on his assembled data on the vegetation of the Athabaska–Great Slave Lake region and on the Mackenzie Mountains, and excellent progress has been made in preparing the material for publication. Work on both of these projects was interrupted because of his absence during the summers of 1943 and 1944 in prosecuting a botanical survey of the Alaska Military Highway, mentioned elsewhere in this report. He has organized his very extensive botanical collections made during the two summers mentioned, some 28,000 specimens, in preparation for an intensive study of them. He has also, in association with the archeologist Mr. Frederick Johnson of Andover, reinitiated his study of the peat deposits in the Taunton River estuary, an interesting archeological site which is now covered by several feet of salt-marsh peat and is well below high tide. The joint report on this investigation has been completed and it will be published shortly. Dr. Kobuski, after nearly three years of military service, was granted an honorable discharge in June and will rejoin the Arboretum staff in the near future. Mr. Palmer continued his study of the genus *Crataegus* and also investigated the taxonomy of certain hybrid oaks. Dr. Allen completed her study of the Lauraceae of Central America and Mexico and prepared a revision of the group for this area. Dr. Perry's translation of Professor H. J. Lam's "Fragmenta Papuana" from the Dutch was completed and the English work was published as No. 5 of Sargentia; in addition she continued her study of the New Guinea material of the Richard Archbold Expeditions, mostly in the large family Rubiaceae. Dr. Croizat pursued his studies of the Euphorbiaceae, with special attention to groups from South America and the southwestern United States. I have continued certain types of bibliographic work, mentioned under bibliography in this report, continued to report on packages of botanical material sent in by service men from Upper Burma, Assam, the Philippines, Micronesia, New Guinea, Solomon Islands, and New Caledonia, and completed the proof reading of *Plant Life of the Pacific World.*

Bibliography. — Dr. Frans Verdoorn edited volumes one and two of the new Annales Cryptogamici et Phytopathologici, which is a continuation of the earlier Annales Bryologici; also edited by him are volume eight of the Chronica Botanica and volumes fifteen and sixteen of A New Series of Plant Science Books. The last volume, *Plants and Plant Science in Latin America,* is an extensive work prepared with the coöperation of nearly one hundred collaborators. It includes a revised edition of his list of Latin American plant science institutions and societies, which is used as a basic list by many agencies of the United States and foreign governments. He also continued to act as botanical adviser to the Board for the Netherlands Indies, Surinam and Curaçao, and to guide the activities of the Central Depository Library for the Netherlands Indies in New York City. During the year about 15,000 sheets were added to the master file of his major project, the Index Botanicorum, and a booklet describing the aims and scope of this project was issued in the fall of 1944 which resulted in his securing the services of many new collaborators.

Professor Alfred Rehder, retired, continued to work daily on his comprehensive Bibliographic Index, and it is expected that the very extensive manuscript will be completed and ready for publication before the middle of the coming year; well in excess of 2,000 pages of typescript is finished. Fortunately, funds are now available to cover the cost of publication of what will prove to be a very useful reference work. My own work has been largely bibliographical, in an attempt to complete the manuscript, now some 1,400 typed pages, of a comprehensive Index Rafinesquianus, and with corresponding problems in connection with the published works of William Bartram, H. L. Muhlenberg, and Amos Eaton. The total number of validly published generic and specific names in all of Rafinesque's known published works that remain unlisted in our standard indices will approximate 3,400. Work on this project led me to an examination of the published works of the other three early American botanists, and in their works it is now evident that there are also many unlisted technical names. A paper on the botanical names published by William Bartram was finished and is now in press, while work on the Muhlenberg and Eaton problems is well advanced.

The Library. — The library holdings were increased by 271 bound volumes and 144 pamphlets, making the totals in each group 45,834 and 13,606. Seven hundred and eleven typewritten cards were added to the main catalogue, 3664 printed cards to the Gray Herbarium index, while 817 slips supplementing the author and subject catalogue were added to the file. The very extensive series of photographs was increased by 200 items, while many orders were received for prints from our negatives. Inter-library loans have been extensive, a total of 510 volumes being loaned to or borrowed from 34 libraries in all parts of the country. This inter-library loan service is of great value to staff members of both this and other institutions, as well as to students, and the privilege is not abused. There have been no losses, although various rare items have of necessity been involved. The most outstanding gift was a magnificently bound eight-volume set of Sander's Reichenbachia from Mrs. Theodore Brown of Milton, and the rare three-volume elephant folio edition of the Audubon-Bachman Viviparous Quadrupeds of North America, from the late Miss Marian Roby Case of Weston.

Atkins Institution of the Arnold Arboretum. — The limitations mentioned in the report for the previous year prevailed, the plantings unfortunately being now in a somewhat deplorable condition. The chief factor here was the increased cost of labor, combined with the fact that the general plantings had been extended to such an extent that it was impossible to give them all proper care within the limits of the income available. No students were in residence because of war conditions, but a number of individuals interested in research and in economic problems visited the institution to secure information of one type or another.

About thirty new seed beds with cement borders were constructed to keep the soil from being washed down by heavy rains. Some of these were planned for vegetable growing, others for the development of seedlings of timber trees. In June there was delivered to the Soledad Company somewhat over 1,000 young teak trees to be used in the extension of its timber plantings. Seedlings of other important timber trees are available for future plantings.

In spite of an abnormally dry year, the rainfall being 42.69 inches, about ten inches below normal, a number of the larger specimens were moved from the nursery to their permanent places in the grounds, and this will be continued until the available material is taken care of. Opportunity was taken, because of the unusual dry period in May and June, when all of the ponds were empty, to check the dams and to make the necessary repairs.

During the year, 162 packages of seeds and 50 living plants were received from abroad, and seeds from 123 different species were collected in the garden to be used there. Distributions included 230 packages of seeds and 652 living plants. Of the latter, over 300 were sent to the Marine Corps base at Guantanamo to be used in landscaping the grounds, and 136 were presented to the Cuban Ministry of Agriculture.

The entire problem of the future development and utilization of the facilities available at Soledad for instruction, research, practical horticulture, and forestry has received considerable attention, one special short report having been prepared expressing my personal ideas on the subject, and the matter is further considered in the area survey report prepared for the administration by Professor I. W. Bailey.

The resignation of Mr. David Sturrock as Superintendent was accepted, effective at the end of June, 1945, and Mr. Frank G. Walsingham was promoted to fill the vacancy.

Publications. — The usual four numbers of the Journal included 35 technical papers, mostly by members of the Arboretum staff, and a fifth number of Sargentia, containing Dr. Perry's translation from the Dutch of Professor Lam's "Fragmenta Papuana," with two maps and 32 text-figures taken from the original, was published. The usual numbers of Arnoldia were issued. Several of the papers included in Arnoldia have been highly commended for their practicability, including one number on rapidly growing vines available in the United States, an outgrowth of certain phases of our earlier camouflage investigations, one on the Park Arboretum (how to establish a living war memorial) which has been widely reproduced, and one on the building up of bird populations through selecting food plants. The Massachusetts Audubon Society had 10,000 reprints of this prepared for its own use. As usual, a certain number of technical and popular papers were prepared by staff members and published in various periodicals. A bibliography of the papers published by staff members and students follows.

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