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78. LAURACEAE (IN PART)

Family description and key to genera by H. van der Werff.

Trees, shrubs, rarely herbaceous, parasitic vines (*Cassytha*), evergreen. Leaves alternate, sometimes whorled, rarely opposite, simple, entire. Stipules lacking. Indument of simple, unicellular hairs or lacking. Inflorescences axillary, paniculate-cymose, umbellate, rarely spicate (*Cassytha*); rarely involucrate (*Litsea*). Flowers small, actinomorphic, bisexual or unisexual; if unisexual, plants dioecious; tepals in two whorls of three, equal or rarely unequal; stamens in 4 whorls of three, the innermost whorl usually staminodial or lacking, fertile stamens usually 9, less frequently 6 or 3; stamens of whorl III usually with two glands at the base of the filaments; anthers 4- or 2-celled, opening by valves. Receptacle shallow to tubular, not fused with ovary; ovary unicarpellate, unilocular; ovule one. Fruit a 1-seeded berry, seated on an unmodified pedicel or in a shallow to deep cup-shaped cupule or completely enclosed by the enlarged receptacle; endosperm absent.

Pantropical, best represented in tropical America and Asia and occurring from sea level to the tree line in wet forests; poorly represented in seasonally dry forests and in the temperate zones. Approx. 55 gen., 2500-3000 spp. In Mesomerica 18 genera are present. Several of the genera are better represented in South America and are in Mesoamerica confined to Panama, Costa Rica and adjacent Nicaragua (*Aniba*, *Caryodaphnopsis*, *Cryptocarya*, *Endlicheria*, *Rhodostemonodaphne* and *Williamodendron*). Two monotypic genera are endemic to Mesoamerica (*Gamanthera*, *Povedadaphne*), while one genus (*Litsea*) occurs predominantly in the northern part of Mesoamerica and is absent from South America.

1. Leafless parasitic vines.

5. *Cassytha*

1. Woody plants with normal leaves.

2. Flowers unisexual.

3. Stamens fused into a central column.

9. Gamanthera

3. Stamens free.

11. Litsea

4. Flowers in umbels.

4. Flowers in panicles.

8. Endlicheria

5. Anthers with 2 locelli.

5. Anthers with 4 locelli.

13. Ocotea

6. Locelli in 2 horizontal pairs.

6. Locelli in an shallow arc.

17. Rhodostemonodaphne

2. Flowers hermaphrodite.

7. Stamens 3.

10. Licaria

8. Anthers with 2 locelli.

8. Anthers with 4 locelli.

18. Williamodendron

7. Stamens 6 or more.

9. Anthers with 2 locelli.

10. Tepals unequal, the outer three 1/2 to 2/3 as long as the inner three.

14. Persea (*cuneata*)

10. Tepals equal or nearly so.

11. Floral tube well-developed and tepals spreading, flowers wider than the floral tube.

7. Cryptocarya

11. Floral tube shallow, poorly developed or, if well-developed, tepals incurved to erect and flowers not wider than floral tube.

12. Flowers tomentellous or pubescent outside; filaments of the stamens densely pubescent.

2. Aniba

12. Flowers glabrous or sparsely pubescent outside; filaments glabrous or partly pubescent, not uniformly densely pubescent.

13. Floral tube very short, scarcely visible at anthesis; tepals united at the base, falling off together in older flowers and leaving the pistil fully exposed.

3. Beilschmiedia

13. Floral tube about as long as the tepals; tepals not united at the base, falling off individually, leaving the pistil partially included in the floral tube.

1. Aiouea

9. Anthers with 4 locelli.

14. Leaves opposite and strongly tri- or tripliveined.

4. Caryodaphnopsis

14. Leaves alternate or clustered, pinnately veined or tripliveined.

15. Tepals unequal, the outer three less than $\frac{2}{3}$ the length of the inner three.

14. Persea

15. Tepals equal or nearly so.

16. Staminodia of whorl IV well-developed, with a distinct glandular or triangular tip; filaments of stamens at least as long as the anthers; stamens and inner surface of tepals never papillose.

17. Leaves tripliveined and domatia often present in the axils of the basal lateral veins; leaves alternate.

6. Cinnamomum

17. Leaves pinnately veined and domatia never present; leaves alternate or clustered.

14. Persea

16. Staminodia of whorl IV lacking, stipitiform or rarely with a distinct triangular tip; if such a tip is present, then filaments shorter than anthers and stamens and inner surface of tepals partly papillose.

18. Stamens columnar, with a flat tip; locelli located on the tips. **16. Povedadaphne**

18. Stamens flattened; locelli located on the inner or outer surface of the flattened anthers.

19. Glands at the base of the inner stamens enlarged, protruding between the outer stamens or forming a disc surrounding the stamens.

15. Pleurothyrium

19. Glands globose, not enlarged and not visible between the outer stamens nor forming a disc surrounding the stamens.

20. Inner surface of tepals papillose and locelli arranged in an arc; tepals united at the base and falling off in old flowers as a unit; tepals spreading at anthesis. **12. Nectandra**

20. Inner surface of tepals pubescent or glabrous, infrequently papillose and locelli arranged in 2 superposed pairs; tepals free, falling off individually in old flowers; tepals erect or spreading at anthesis. **13. Ocotea**

1. Aiouea Aublet

By. H. van der Werff.

Trees or shrubs. Leaves alternate, pinnately or tripliveined, domatia sometimes present. Inflorescences paniculate-cymose or by reduction racemose. Flowers bisexual; tepals 6, equal, sometimes persisting in fruit; stamens 9 (rarely 6), 2-celled, inner 3 stamens with a pair of glands near the base; staminodes present or lacking. Fruits seated on a shallow cupule, this with a single margin. 26 species. Neotropics.

Aiouea is probably a polyphyletic genus, with the South American species derived by reduction of the number of anther cells from 4 to 2 from *Cinnamomum* and the Mesoamerican species derived by the same process from *Ocotea*. For this floristic treatment *Aiouea* is maintained as a genus for practical reasons.

Bibliography: Renner, S. *Fl. Neotrop.* 31: 85-117 (1982).

1. Twigs hollow.

7. A. vexatrix

1. Twigs solid.

2. Leaves glaucous below; tepals papillose on the inner surface (see *Nectandra hypoleuca*).

2. Leaves not glaucous; tepals glabrous or pubescent on the inner surface.

3. Leaves tripliveined; some leaves with pit domatia at the base of the basal lateral veins.

4. A. obscura

3. Leaves pinnately veined; pit domatia lacking.

4. Terminal buds glabrous.

5. Inflorescences widely branched, 15-25 × 10 cm (see *Ocotea laetevirens*).

5. Inflorescences sparsely branched to racemose, to 8 × 3 cm.

6. Leaves 9-19 × 3-9 cm.

2. A. guatemalensis

6. Leaves 2-5(-7) cm × 1-2 cm..

5. A. parvissima

4. Terminal buds pubescent.

7. Leaves obovate, the apex obtuse or rounded, the base often decurrent along the petiole.

8. Leaves broadly obovate, 10-15 cm wide; inflorescences sparsely pubescent (see *Ocotea rivularis*).

8. Leaves obovate, to 11 cm wide; inflorescences glabrous.

1. A. costaricensis

7. Leaves elliptic, the apex acute or acuminate, the base not decurrent along the petiole.

9. Inflorescences 8-16 cm; domatia absent (see *Ocotea laetevirens*).

9. Inflorescences to 6 cm; domatia (as small axillary tufts of hairs) present or absent.

10. Hairs on terminal buds and young shoots appressed. **6. A. talamancensis**

10. Hairs on the tips of the branches and terminal buds erect (lens needed!).

11. Leaves rarely exceeding 5 cm; lateral veins indistinct; domatia lacking.

5. A.

parvissima

11. Leaves usually more than 7 cm; lateral veins easily seen; domatia, as axillary tufts of hairs, present. **3. A. inconspicua**

1. Aiouea costaricensis (Mez) Kostermans, *Recueil Trav. Bot. Néerl.* 35: 73 (1938). *Bellota costaricensis* Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 27 (1889).
Holotype: Costa Rica, *Hoffmann 857* (B, destroyed).

Trees or shrubs, rarely exceeding 15 m. Twigs ridged, moderately densely appressed pubescent when young, glabrescent with age, solid; terminal buds densely appressed pubescent. Leaves 8-24 × 2.5-11 cm, obovate, alternate, chartaceous to coriaceous; the base cuneate or acute, often decurrent on the petiole, the margin flat or slightly recurved near the base, the apex obtuse to rounded; the upper surface glabrous, the lower surface glabrous or sparsely appressed pubescent; gland dots inconspicuous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface; pinnately veined, lateral veins 6-8 pairs; domatia lacking; petioles 5-10 mm, sparsely appressed pubescent or glabrous, canaliculate. Inflorescences 5-20 cm, paniculate-cymose, glabrous or nearly so, in the axils of leaves. Flowers 4 mm in diameter, greenish-yellow, pedicels 3-4 mm. Tepals 1.2 mm, equal, ovate, glabrous on both surfaces, half-erect at anthesis; stamens 9, all 2-celled, the outer 6 c. 1 mm, glabrous or with a few hairs near the base of the filaments, the anthers with introrse cells, anthers longer than the filaments; inner three 1.3 mm, the pubescent filaments as long as the anthers, the cells opening extrorse, filaments with 2 globose glands near the base; staminodia not seen; pistil glabrous, c. 2 mm, the style a little longer than the ovary; receptacle cup-shaped, glabrous or with some hairs in the upper part. Fruits 1.5 × 1.1 cm, ellipsoid, seated in a shallow, bowl-shaped cupule, to 9 mm in diameter, the tepals often

persisting as teeth on the single-margined cupule. *Montane forests*. CR (*van der Werff et al.* 14035, MO); P (*McPherson* 8971, MO). 1100-2500 m. (Endemic.)

Aiouea costaricensis is readily recognized by its 2-celled stamens, obovate and clearly petiolate leaves and its montane habitat. It can only be separated from *Ocotea insularis* (Meissner) Mez by its 2-locellate (4-locellate in *Ocotea*) stamens and is almost certainly derived from that species. Plants from the Osa Peninsula in Costa Rica with 2-celled stamens and large obovate leaves with short petioles resemble *O. rivularis* Standl. & Williams and are included in that species.

2. *Aiouea guatemalensis* (Lundell) Renner, *Fl. Neotr.* 31: 93 (1982); *Aniba guatemalensis* Lundell, *Wrightia* 4: 98 (1968). Isotype: Guatemala, *Contreras* 7941 (MO).

Shrubs or small trees, to 10 m. Twigs terete or striate, smooth, solid, glabrous; terminal buds glabrous. Leaves 9-19 × 3-9 cm, alternate, narrowly elliptic, oblong or broadly elliptic, chartaceous, the base obtuse or acute, the margin flat, the apex acute or acuminate, acumen to 1.5 cm; glabrous on both surfaces; gland dots conspicuous on upper surface of young leaves, midrib, alteral veins and tertiary venation weakly raised on the upper surface, more strongly so on the lower surface; domatia lacking; pinnately veined, lateral veins 6-9 pairs; petioles 6-15 mm, terete, glabrous. Inflorescences 2-8 cm, few-flowered, racemose or only with first order branches, these consisting of a single cyme, glabrous or nearly so; in the axils of bracts near the tips of the branches or along leafless short-shoots. Flowers 2-2.5 mm in diameter, glabrous or with a few small hairs, yellowish, pedicels 1-1.5 mm. Tepals 6, c. 1 mm, equal, erect at anthesis, ovate to broadly ovate, glabrous on the inner surface; stamens 9, all 2-celled, 1 mm, glabrous or with a few hairs near the base, the outer 6 with introrse cells, the inner 3 with extrorse cells, connectives not or slightly protruding beyond anther cells, inner stamens with 2 glands near the base; staminodia not seen; pistil glabrous, 1.5 mm, the ovary c. 1 mm, receptacle cup-shaped, glabrous inside. Fruit 2.3 × 1.3 cm, ellipsoid, seated in a shallowly bowl-shaped cupule, this 1 cm in diameter, with an entire margin, the tepals not persisting; pedicel gradually widened into the cupule. *Rain forest*. Ch (*Breedlove* 31285, CAS); G (*Contreras* 10244, MO). 1600 m. (Endemic.)

Aiouea guatemalensis is a poorly known species, best recognized by the combination of 2-celled stamens and glabrous terminal buds. The petioles are relatively thick and dark-colored. Its relationships are not clear. Plants with larger leaves can be confused with specimens of *Ocotea laetevirens* with bilocellate stamens, but that species differs in its larger inflorescences and the pubescent filaments of the stamens.

Two collections from Chiapas (*Breedlove 24867, 31285, CAS*) are provisionally placed here. They differ in having more coriaceous leaves with the reticulation more prominently raised and in more pubescent flowers. They share few-flowered inflorescences, flowers with 9 two-celled stamens (staminodia are present as well and these have also been observed in other collections of *A. guatemalensis*) and glabrous terminal buds. Altitude is not mentioned on the collections from Guatemala and has been taken from the Chiapas collections.

3. *Aiouea inconspicua* van der Werff, *Ann. Missouri Bot. Gard.* 74: 401 (1987).
Holotype: Mexico, Veracruz, *Dorantes 2929* (MO). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 74: 402 (1987).

Shrub or small tree to 15 m. Twigs terete, solid, minutely puberulous with very short, erect hairs when young, so becoming glabrous; terminal buds densely tomentellous, the hairs erect and covering the surface entirely. Leaves 7-16 × 2-4 cm, alternate, chartaceous, elliptic to elliptic-lanceolate; the base acute, margin flat, apex acute or acuminate, acumen to 1 cm, glabrous on both surfaces except for the small domatia, clearly and densely gland dotted on the lower surface, less clearly so on the upper surface; midrib immersed, lateral veins slightly impressed, tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised or immersed on the lower surface; small domatia usually present in the axils of the basal lateral veins; pinnately veined, the lateral veins arching upwards and becoming loop-connected; petioles 5-9 mm, flat above, with a similar indument as the twigs. Inflorescences 2-4 cm, racemose or with a few cymes, minutely puberulous, in the axils of bracts. Flowers 2-3 mm in diameter, yellowish, pedicels c. 2 mm. Tepals 6, equal, c. 1 mm, ovate, glabrous, more or less erect at anthesis; stamens 9, all 2-celled, c. 1 mm, the filaments somewhat pubescent, outer 6 opening introrse, inner 3 opening extrorse and

with 2 glands at the base; staminodia not seen; pistil glabrous, 1 mm, the style very short; receptacle cup-shaped, glabrous inside. Fruits 18×15 mm, broadly ellipsoid, cupules shallow, 8 mm in diameter, gradually narrowed in the pedicel, with a single margin; tepals not persistent. *Lowland rain forest*. Ch (Martínez S. 11860, MO). 100-500 m. Mexico [Veracruz], Mesoamerica.)

Aiouea inconspicua is best recognized by the very short, erect indument on the young twigs, the rather thin leaves with slightly impressed, loop-connected lateral veins and the numerous gland dots on the lower leaf surface. Most collections are with fruits; the few-flowered inflorescences and small flowers make it difficult to find flowering material. When flowers are available, the 2-locellate stamens help in the identification.

4. *Aiouea obscura* van der Werff, *Ann. Missouri Bot. Gard.* 75: 402 (1988).

Holotype: Costa Rica, *Hammel et al.* 15197 (MO). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 75: 403 (1988).

Small trees, to 8 m. Twigs terete, solid, glabrous, slender; terminal buds glabrous. Leaves $12-18 \times 2.5-4$ cm, alternate, membranaceous to chartaceous, narrowly elliptic to oblong, the base acute, the margin flat, the apex acute or acuminate, acumen to 1.5 cm, glabrous on both surfaces, gland dots visible on the upper leaf surface, tripliveined, with the second pair of lateral veins arising near the middle of the laminae, the lateral veins in the distal half weakly loop-connected, midrib, lateral veins and tertiary venation weakly raised or immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; pit domatia present in the axils of the basal lateral veins in some of the leaves of each specimen seen, the margins of the pit domatia glabrous; lateral veins 3-5 on each side; petioles 1-1.5 cm, terete, glabrous. Inflorescences 8-15 cm, paniculate-cymose, glabrous, in the axils of bracts near the tips of the branches. Flowers 3 mm in diameter, pale green, glabrous, pedicels 8-10 mm. Tepals 6, equal, 2 mm, broadly elliptic, glabrous on both surfaces, stamens 9, all 2-celled, 1-1.2 mm, the filaments pubescent, especially those of the inner 3 stamens, connectives slightly protruding beyond the anther cells, outer 6 stamens with introrse cells, inner 3 with extrorse cells and with 2 globose glands near the base; staminodia not seen; ovary 1 mm, glabrous, gradually narrowed into the short style; receptacle shallow, glabrous

inside. Fruits 2.8×1.8 cm, ellipsoid, seated in a shallow to platelike cupule, this to 1.5 cm in diameter and with an entire margin, tepals not persisting in the fruiting stage; pedicel gradually thickened towards the cupule. *Lowland and lower montane rain forest.* CR (Hammel et al. 17008, MO). 50-1000 m. (Endemic.)

Aiouea obscura is easily identified by its tripliveined leaves which dry dark green, its ptdomatia, and the lax inflorescences with relatively long pedicels. It resembles *Ocotea tenera* Mez & J.D. Smith, with which it shares the lax inflorescences, dark drying leaves and shape of the cupules, but *O. tenera* has pinnately veined leaves and 4-celled stamens. Still, I consider *O. tenera* as the closest relative of *A. obscura*. Most collections of *A. obscura* come from the Osa Peninsula, while one collection comes from higher altitude near Tinamaste.

5. *Aiouea parvissima* (Lundell) Renner, *Fl. Neotr.* 31: 96 (1982). *Aniba parvissima* Lundell, *Wrightia* 4: 31 (1969). Isotype: Guatemala, *Contreras 6204* (MO).

Shrubs or small trees, to 6 m. Twigs angular or ridged, solid, near the very tips sparsely pubescent, the hairs erect, soon becoming glabrous; terminal buds pubescent near the base, distally often glabrous. Leaves $1.5-5(-7) \times 0.7-2$ cm, elliptic to ovate-elliptic, alternate, coriaceous; the base acute, margin flat, apex bluntly acute, glabrous on both surfaces, gland dots not visible, midrib, lateral veins and tertiary venation raised on both surfaces, pinnately veined, lateral veins indistinct, approximately 7-10 on each side; petioles 2-4 mm, canaliculate, with a similar indument as the twigs. Inflorescences 2-5 cm, racemose or with a few cymes along the main axis, sparsely pubescent, the hairs erect, in the axils of bracts. Flowers 2-3 mm in diameter, whitish, pedicels 1-2 mm. Tepals 6, equal, 1.2 mm, ovate-elliptic, with a few appressed hairs on the outer surface, glabrous on the inner surface, half-erect at anthesis; stamens 9, all 2-celled, c. 1 mm, glabrous or with a few hairs near the base, the outer 6 opening introrse, inner 3 opening extrorse and with 2 globose glands near the base; staminodia not seen but said to be present; pistil 1 mm, glabrous, the style much shorter than the ovary; receptacle cup-shaped, mostly glabrous but with a fringe of hairs around its rim. Fruit 11×9 mm, cupule shallow, almost platelike, 4 mm in diameter, the pedicel swollen; tepals sometimes

persistent on the cupule. *Rain forest. G (Lundell & Contreras 20783, MO)*. No altitude given. (Endemic.)

Aiouea parvissima is easily recognized by its small, coriaceous, leaves, its indistinct lateral veins, bilocellate stamens and the raised reticulation on upper and lower leaf surface. The slender, angled twigs with an erect indument when young also help in the identification. This species is only known from a handful collections in Guatemala, all made by Contreras or Lundell & Contreras and does not seem to be closely related to an *Ocotea* species.

6. *Aiouea talamancensis* W. Burger, *Fieldiana Botany, N.S.* 23: 37 (1990).

Holotype: Costa Rica, *Molina et al. 18359 (F)*.

Small trees, to 10 m. Twigs terete or ridged, solid, sparsely appressed pubescent when young, soon becoming glabrous; terminal buds appressed pubescent. Leaves 2.5-8 × 0.8-2.4 cm, alternate, elliptic to narrowly elliptic, stiffly chartaceous; the base acute, margin flat, apex acute or shortly acuminate, the upper surface glabrous, lower surface glabrous or very sparsely appressed pubescent; gland dots visible on the upper leaf surface, midrib somewhat raised, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation more or less immersed on the lower surface; domatia (as axillary tufts of hairs) sometimes present; pinnately veined, lateral veins 3-6 pairs; petioles 3-7 mm, canaliculate, sparsely appressed pubescent to glabrous. Inflorescences 2-6 cm, racemose or with a few cymes along the central axis, in the axils of bracts or leaves, sparsely appressed pubescent or glabrous. Flowers 2-3 mm in diameter, greenish white, pedicels 2-4 mm. Tepals 1.2 mm, ovate, equal, with a few hairs or glabrous outside, glabrous inside, half erect at anthesis; stamens 9, all 2-celled, outer stamens 1 mm, glabrous, the anther a little longer than the filament, inner stamens 1.2 mm, glabrous, the filament as long as the anther, 2 globose glands present at the base of the inner stamens; staminodia not seen; pistil glabrous, 1.6 mm, the ovary a little longer than the style; receptacle cup-shaped, glabrous inside. Fruits 18 × 9 mm, ellipsoid, cupule shallow, bowl-shaped, 5 mm in diameter, with a single margin and the tepals not persisting. *Montane forest. CR (Davidse & Herrera 29178, MO)*. 1600-2300 m. (Endemic.)

Aiouea talamancensis is an inconspicuous and poorly known species best recognized by its small leaves, 2-celled stamens and montane habitat. Fruiting collections will be very difficult to identify. There does not seem to be a close counterpart for *A. talamancensis* in *Ocotea* and I have no suggestions for its relationships. I have not seen the type and base my concept on 2 collections cited by Burger (*Davidse & Herrera 29178* and *Chacon & Herrera 1574*).

7. *Aiouea vexatrix* van der Werff, *Ann. Missouri Bot. Gard.* 75: 404 (1988).
Holotype: Panama, Cerro Campana, *McPherson 9226* (MO). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 75: 406 (1988).

Small trees, to 7 m. Twigs angular, minutely brownish puberulous, becoming glabrous and round with age, hollow, often with pores giving access to the hollow center, terminal buds small, moderately to densely appressed pubescent. Leaves 13-27 × 3.5-9 cm, alternate, elliptic to slightly obovate, chartaceous to membranaceous, base and apex acute, the margins flat, glabrous on both surfaces, gland dots sometimes visible on the upper leaf surface, pinnately veined, midrib and lateral veins immersed, tertiary venation immersed or slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; lateral veins 6-8 on each side; domatia lacking; petioles 1-1.5 cm, weakly canaliculate or flat above, with a similar indument as the twigs. Inflorescences 4-9 cm, glabrous or minutely puberulous near the base, panicle-cymose, secondary and tertiary branchlets usually flattened. Flowers 3 mm in diameter, greenish, glabrous, the pedicels c. 2 mm long. Tepals 6, 2 × 1.7 mm, equal, glabrous, erect at anthesis; stamens 9, all 2-celled, 1.5 mm, the anthers c. 0.9 mm, with a small sterile tip; outer 6 stamens with the cells introrse, inner 3 with the cells extrorse, glands present at the base of the inner stamens; staminodia lacking; pistil 1.5 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, glabrous inside. Fruit ellipsoid to narrowly ellipsoid, 20 × 9 mm, seated in a shallow cupule, this 8 mm in diameter, with a simple margin and the tepals persisting as triangular lobes c. 3 mm. *Lowland rain forest and cloud forest.* P (*Croat 17203*, MO). 200-1000 m. (Endemic.)

Aiouea vexatrix is easily recognized by its hollow twigs, rather large, chartaceous to membranaceous leaves which often dry dark green, cupules with persistent tepals and

its flowers with 2-celled anthers. It is only known from the Cerro Campana - Cerro Jefe area and along the Santa Rita Ridge Road. It is closely related to *Ocotea atirrensis* Mez & J.D. Smith, and thus is another example of the polyphyletic character of the genus *Aiouea* (van der Werff, 1988).

2. *Aniba* Aublet

By H. van der Werff.

Trees or shrubs. Leaves alternate, less frequently whorled, pinnately veined, axillary tufts of hairs or domatia lacking. Inflorescences cymosely paniculate, lateral flowers of a cyme always strictly opposite. Flowers bisexual; tepals 6, equal (rarely outer 3 smaller than the inner 3), usually tomentellous, persisting on the young fruits, but not enlarging in the fruiting stage; stamens 9, in 3 whorls of 3 (rarely 6 in 2 whorls of 3), 2-celled, the inner 3 stamens with 2 glands at the base of the filaments, the filaments usually densely pubescent; staminodes of whorl 4 minute or absent. Fruit seated in a distinctly cup-shaped cupule, this with a single (rarely a double) margin. 44 spp. Neotropics.

Aniba can be readily recognized by its small flowers with erect or incurved tepals, and its 9 2-celled stamens with frequently broad, densely pubescent stamens. In nearly all species the tepals and stamens persist on young fruits and this makes identification of fruiting specimens to genus possible. Several species have whorled leaves, while others have the lower leaf surface covered by fine papillae, giving the surface a mat, pale green appearance. Because the flowers are relatively uniform in the genus, species are often separated by vegetative or small floral differences. This makes recognition of species difficult. *Aniba* is represented in Mesoamerica by several species, each known from few collections. The available material is not sufficient for the description of new taxa and does not quite match the South American species. Therefore, several taxa remain unnamed, even though they probably represent undescribed species. More collections are needed to solve these problems.

Bibliography: Kubitzki, K. *Fl. Neotrop.* 31: 1-84 (1982).

1. Leaves whorled.

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| 2. Lower leaf surface moderately to densely puberulous. | 5. A. sp. 1 |
| 2. Lower leaf surface glabrous or nearly so. | |
| 3. Leaves gradually narrowed towards the base, at the base abruptly rounded. | |
| | 1. A. bracteata |
| 3. Leaf base acute. | 3. A. puchury-minor |
| 1. Leaves evenly distributed along the twigs. | |
| 4. Leaves moderately to densely puberulous on the lower surface. | 5. A. sp. 1 |
| 4. Leaves glabrous or nearly so on the lower surface. | |
| 5. Lower leaf surface microscopically papillose, appearing dull, yellowish-green. | |
| | 2. A. cinnamomiflora |
| 5. Lower leaf surface not microscopically papillose. | 4. A. venezuelana |

1. Aniba bracteata (Nees) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 66 (1889). *Aydendron bracteatum* Nees, *Syst. Laur.* 256 (1836). Type: St. Vincent, *Collector unknown* in Herb. Schott.

Trees, to 25 m. Twigs angular, minutely puberulous when young, soon glabrescent, terminal buds densely and minutely appressed pubescent. Leaves 12-35 × 3-10 cm, chartaceous, clustered at the the tip of the branches, gradually narrowed towards the base, at the base abruptly rounded; the apex acute or acuminate; narrowly elliptic or elliptic-obovate, glabrous on both sides, the lower surface not papillose, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; lateral veins 10-20 pairs, arching upwards near the margin and frequently loop-connected with the distal vein; petioles 3-5 mm, thick, with a similar indument as the twigs. Inflorescences 10-20 cm, densely tomentellous. Flowers c. 2.5 mm in diameter. Tepals equal, tomentellous outside, glabrous inside, c. 1.2 mm, erect or somewhat incurved at anthesis; stamens c. 0.7 mm, the outer 6 with the anther cells introrse-lateral, the connective protruding beyond the anther cells, the filament pubescent and narrower than the anther; inner 3 stamens with the cells extrorse and two glands at the base of the filaments; staminodia not seen; pistil c. 1.6 mm, pilose or glabrous; receptacle glabrous or pilose inside. Fruit 2.2 × 1.2 cm, ellipsoid, seated in a deeply cup-shaped cupule, 1 × 1.2 cm. *Lowland rain forests*. P (*de*

Nevers & Herrera 5121, MO). 350 m. (Mesoamerica, Puerto Rico, Nevis, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent.)

Aniba bracteata can be easily recognized by its clustered, glabrous leaves which are gradually narrowed towards the base and abruptly rounded at the base. The two Panamanian collections share these leaf characters with typical *A. bracteata*, but differ in their distribution (the species was only known from the lesser Antilles) and the flowers are not constricted at the base of the tepals. *Aniba robusta* has also glabrous, clustered leaves narrowed towards the base and abruptly rounded at the base, but this is a montane species from Venezuela and the Andean countries and has coriaceous leaves, flowers constricted at the base of the tepals and a glabrous receptacle (the flowering collection from Panama has the receptacle densely pubescent inside). It also has slightly larger flowers than *A. bracteata*. Because *A. bracteata* is a rather variable species, the panamanian collections are best placed under *A. bracteata* until more collections become available.

2. *Aniba cinnamomiflora* C.K. Allen, *Mem. New York Bot. Gard.* 10: 49 (1963).
Type: Venezuela, *Maguire & Politi 28476* (NY). Illustr.: Allen, *Mem. New York Bot. Gard.* 10: 46 t. 30 (1963).

Trees to 15 m. Twigs angled or ridged, minutely tomentellous when young, soon glabrescent; terminal buds densely tomentellous. Leaves 5-15 × 2.5-6 cm, evenly distributed along the twigs, firmly chartaceous to coriaceous, elliptic or lanceolate, the base acute or obtuse, the apex acute or acuminate, the acumen to 1.5 cm, glabrous, the lower surface microscopically papillose, yellowish-green; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation immersed on the lower surface; lateral veins 6-9; petioles 0.7-1.6 cm, with a similar indument as the twigs. Inflorescences in the axils of cataphylls at the base of young growth, to 6 cm, minutely tomentellous. Flowers c. 2 mm in diameter, yellow or pale green. Tepals c. 1 mm, erect at anthesis, pubescent outside, glabrous inside, stamens c. 0.7 mm, the outer 6 with filaments as wide as the anthers, inner 3 stamens with two globose glands at the base; staminodia not seen; pistil slender, c. 1.5 mm, pubescent except for the glabrous base, receptacle deep, densely pubescent inside.

Fruit ellipsoid, c. 2×1.5 cm, seated in cup-shaped cupule, 1×1.5 cm, the cupule warty near the base and often split by the enlarging fruit. *Montane rain forests*. CR (*Herrera 1920*, MO); P (*McPherson 8399*, MO). 1100-1300 m. (Mesoamerica, Venezuela.)

Aniba cinnamomiflora is a montane species best recognized by its papillose, yellow-green lower leaf surfaces. Based on the key in Kubitzki (1982) it is part of a group of four species with papillose leaves found in montane cloud forest which are poorly known. Two species have slightly smaller flowers (ca. 1.5 mm in diameter versus c. 2 mm in diameter) and the third, not known to me, is described as having fruits to 4 cm (2 cm in *A. cinnamomiflora*). A few collections from lowland forest in Panama will key to *A. cinnamomiflora* because of their papillose lower leaf surfaces. These are *Garwood 944 & 960*, from the Darien coast (one sterile, the other with one flower, differing from *A. cinnamomiflora* in the longer and denser pubescence on the young twigs) and *Sytsma 1367* from the Sta. Rita Ridge Road (differing in its narrower, more coriaceous leaves). Without additional collections these specimens cannot be identified with confidence.

3. *Aniba puchury-minor* (Martius) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 70 (1889). *Ocotea puchury-minor* Martius, *Repert. Pharm.* 35: 172 (1830). Type: Brazil, *Martius s.n.* (B).

Trees, to 15 m. Twigs somewhat angular, minutely brown-tomentellous; terminal buds densely, minutely appressed pubescent. Leaves $10-24 \times 4.5-8.5$ cm, chartaceous, elliptic, the base acute, the apex acute or shortly acuminate; midrib and lateral veins immersed or slightly impressed, tertiary venation not visible on the upper surface, midrib and lateral veins raised, tertiary venation scarcely visible on the lower surface; the upper surface glabrous, the lower surface glabrous or with some minute, appressed hairs; not papillose, lateral veins 6-9 pairs; petioles 1.5-2.5 cm, with the same indument as the twigs, slightly thickened in the lower half. Inflorescences 2-12 cm, in the axils of cataphylls, densely and minutely pubescent. Flowers 1.5-2.5 mm in diameter, yellow or greenish. Tepals $0.7-1 \times 0.9-1.4$ mm, wider than long, pubescent outside, glabrous inside, erect or incurved; outer 6 stamens c. 0.6-1 mm, the filaments pubescent and wider than the anthers, the anther cells introrse, the connectives slightly protruding beyond the anther cells; inner 3 stamens as long as the outer 6, the cells opening extrorse, filaments

pubescent and connective protruding beyond the cells; staminodes not seen; pistil glabrous, c. 1.8 mm, the ovary gradually narrowed into the style, receptacle deep, the lower part glabrous, the upper part pubescent. Fruit 3×1.5 cm, seated in a cup-shaped cupule, 1×1.5 cm, this warty or verrucose outside. *Lowland rain forest*. P (Hartman 12507, MO). 0-200 m. (Mesoamerica, Colombia, Ecuador, Peru, Brazil).

Aniba puchury-minor can be recognized by its clustered leaves with an acute base. The indument on the lower leaf surface is very inconspicuous and can be readily overlooked. I am not certain if the specimens from Colombia west of the Andes and Panama belong to *A. puchury-minor*; they differ from collections from the Amazonian lowlands in having smaller flowers (ca. 1.5 mm vs. 2-2.5 mm in diameter) and in having the base of the petioles thickened. Further study is needed to determine if these differences are significant or simply reflect variations within a species.

4. *Aniba venezuelana* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 63 (1889). Type: Venezuela, *Funk & Schlim* 569 (P).

Trees to 25 m. Twigs angular, densely and minutely brown-tomentellous, the indument wearing off with age; terminal buds densely and minutely brown-tomentellous. Leaves $14-28 \times 4.5-8$ cm, evenly distributed along the twigs, firmly chartaceous, elliptic or narrowly elliptic, the base acute to obtuse, the apex usually acuminate, the acumen to 1 cm, glabrous or nearly so on both surfaces, the lower surface not microscopically papillose; midrib and lateral veins immersed, tertiary venation not visible on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation scarcely visible on the lower surface; lateral veins 6-9 pairs; petioles 1-1.7 cm, with a similar indument as the twigs. Inflorescences 6-16 cm, in the axils of cataphylls at the base of seasonal growth, densely and minutely tomentellous. Flowers greenish, 1.8-2.2 mm in diameter. Tepals c. 1×0.6 mm, broadly elliptic, pubescent outside, glabrous inside, erect at anthesis; outer 6 stamens c. 0.7 mm, somewhat incurved, the filaments pubescent, about as wide as the anther, anthers with introrse cells, the connective not or scarcely protruding beyond the anther cells; inner 3 stamens c. 0.5 mm, the anther cells extrorse-lateral, the filaments pubescent, with two glands near the base; staminodia not seen; pistil c. 1.5 mm, slender, pubescent; receptacle deep, pubescent inside. Fruits 3×1.5 cm,

ellipsoid, seated in deeply cup-shaped cupules, these 1.3×1.8 cm, warty; young fruits almost completely enclosed in the cupules. *Lowland rain forests*. N (*Rueda 5183*, MO); CR (*Herrera 2211*, MO). 0-300 m. (Mesoamerica, Colombia, Venezuela.)

Aniba venezuelana is best recognized by its evenly distributed leaves which are not papillose below. It is not uncommon in the Caribbean lowlands of Costa Rica and adjacent Nicaragua. A few collections from higher altitude in Costa Rica, with shorter inflorescences and somewhat papillose leaves are provisionally included here. A collection from the Osa peninsula (*Aguilar 2407*, MO) will also key to *A. venezuelana*, but differs in having sparsely grey-pubescent twigs and narrower leaves with fewer lateral veins. It is likely an undescribed species; the single fruiting specimen is not enough for a description.

I use the name *Aniba venezuelana* with some hesitation for the Mesoamerican specimens. Only three collections were cited by Kubitzki (1982), two from the coastal mountains in Venezuela and one from the Pacific lowlands in Colombia. Because this species is so poorly known, it is difficult to either include or exclude the Mesoamerican specimens from *A. venezuelana*. More material from the type locality is needed to better understand this species.

The description given here is based on the Costa Rican specimens and not on the few South American specimens.

5. *Aniba* sp. A.

Tree, 25 m. Twigs angular or ridged, densely brown-tomentellous, glabrescent with age; terminal buds densely pubescent. Leaves $10-15 \times 4-6$ cm, elliptic or obovate, firmly chartaceous, more or less clustered at the tips of the branches, the base obtuse or acute, the apex shortly acuminate, the upper surface sparsely appressed pubescent, the indument denser along the main veins, the lower surface densely to moderately tomentellous, not papillose; lateral veins 9-12; petioles 7-12 mm, with a similar indument as the twigs. Inflorescences and flowers unknown. Infructescences 10-16 cm, minutely tomentellous. Immature fruits nearly fully enclosed in the cupules; these roundish, c. 13×13 mm, warty, with old tepals and stamens attached to the cupule; tepals c. 1.5 mm, pubescent outside, glabrous inside except for the pubescent base; outer stamens c. 1,5

mm, the filament slender, pubescent, the anther cells opening introrse, the connective not protruding beyond the anther cells, inner stamens c. 1 mm, the filaments densely pubescent, the glands attached above the base. *Lowland rain forest*. P (Dwyer 10545, MO). (Endemic.)

This probably undescribed *Aniba* species can best be recognized by its tomentellous indument on the lower leaf surface, which is unique among the Mesoamerican species of *Aniba*. It does not match any of the species accepted by Kubitzki; it resembles somewhat *A. hostmanniana* and *A. williamsii*, but differs in its indument and smaller leaf size. The single collection is not sufficient for the description of a new species.

3. *Beilschmiedia* Nees

Hufelandia Nees, *Bellota* Gay excl. *Bellota costaricensis* Mez.

By S. Nishida.

Trees or rarely shrubs. Leaves alternate or opposite, rarely clustered, pinnately veined. Inflorescences paniculate or racemose, with terminal branches of the panicles not strictly cymose. Flowers bisexual; tepals 6, usually equal, ovate to elliptic, usually deciduous; stamens 9 or 6 (always 9 in Mesoamerica), filaments usually shorter than the anthers; anthers 2-celled, first and second whorls introrse, third whorl extrorse to almost introrse, glands of the innermost three stamens globose; staminodia 3 in fourth whorl or absent, or rarely 6 in third and fourth whorls (always 3 in the fourth whorl in Mesoamerica), staminodia in fourth whorl sagittate or deltoid; ovaries superior; receptacles flat to shallowly cupulate. Fruits ellipsoid, spherical or pyriform, usually purple-black, lacking cupule. c. 250 spp. Pantropical.

Bibliography: Allen, C.K. *J. Arnold Arbor.* 26: 280-434 (1945). Burger, W.C. & van der Werff, H. *Fieldiana Bot. N. S.* 23: 39-43 (1990). Kostermans, A.J.G.H. *Recueil. Trav. Bot. Néerl.* 35: 834- 928 (1938). Nishida, S. *Ann. Missouri Bot. Gard.* 86: 657-701 (1999).

1. Leaves opposite. Minor venation pattern on lower leaf surface coarse, areoles (smallest areas of the leaf tissue surrounded by minor veins) larger than 1.5 mm in diameter.

2. Floral pedicels (1.5-)3-7 mm long. Leaf apex acute. Petioles concolorous with twigs.

3. B. brenesii

2. Floral pedicels 0.5-2 mm long. Leaf apex usually acuminate. Petioles usually darker than twigs.

5. B. hondurensis

1. Leaves alternate, spirally clustered, or rarely sub-opposite. Minor venation pattern usually fine, areoles smaller than 0.7 mm in diameter.

3. Hairs on terminal buds and twigs appressed or ascending; short and straight.

4. Minor leaf veins immersed on upper surface (the pattern usually visible). Leaves glaucous below.

5. Leaves 2-4(-6) cm wide. Petioles 1-1.5 cm. Leaf base cuneate. **10. B. pendula**

5. Leaves 4-8(-14) cm wide. Petioles 1.5-2.5(-3) cm. Leaf base usually cordate to obtuse.

14. B. towarensis

4. Minor leaf veins raised on upper surface. Leaves usually not glaucous below.

6. Areoles angular with branched free-ending veinlets inside. Fruit pedicels not constricted at the apex.

4. B. costaricensis

6. Areoles rounded seldom with free-ending veinlets inside. Fruit pedicels weakly constricted at the apex.

7. B. mexicana

3. Hairs on terminal buds and twigs erect; short and curly, or long and straight or wavy.

7. Leaves (14-)18-30 cm.

8. Fruits c. 15 cm. Anther apex pubescent. Petioles (2.5-)3-4 cm. **2. B. anay**

8. Fruits 3.5-4.5 cm. Anther apex glabrous. Petioles (0.7-)1.5-2.5(-3.5) cm.

1. B.

alloiophylla

7. Leaves 4-16.5 cm.

9. Fruits spherical. Leaves usually wider than 2/3 of the length.

10. Secondary leaf veins 11 to 14 pairs. Petioles 2-3 cm.

8. B. ovalioides

10. Secondary leaf veins 5 to 9 pairs. Petioles 1-1.5 cm.

9. B. ovalis

9. Fruits usually ellipsoid. Leaves narrower than 2/3 of the length.

11. Secondary leaf veins immersed on the lower surface (venation pattern visible).

6. B.

immersinervis

11. Secondary leaf veins raised on the lower surface.

12. Leaves 1.4-4cm wide.

12. B. steyermarkii

12. Leaves 4-7.5 cm wide.

13. Leaves chartaceous. Lower leaf surface usually not glaucous. **11. B. riparia**

13. Leaves coriaceous. Lower leaf surface glaucous.

13. B. tilaranensis

1. Beilschmiedia alloiophylla (Rusby) Kosterm., *Rec. Trav. Bot. Néerl.* 35: 849 (1938). *Ocotea alloiophylla* Rusby, *Descr. S. Amer. Pl.*: 21 (1920). Isolectotype (designated by Konstermans, 1938): Colombia, *Smith 2104* (MO!).

Trees, to 25 m tall. Terminal buds and twigs densely pubescent with erect, short and curly, or long and straight hairs. Leaves (15-)18-30 × (7-)9-13(-17) cm, clustered or alternate, elliptic to obovate, firmly chartaceous; secondary veins (10-)11-16(-18) pairs, raised below, minor venation pattern fine, almost immersed (the pattern poorly visible) or slightly raised above, raised below; upper leaf surface almost glabrous, lower leaf surface pubescent with straight to curly hairs or glabrous; lower leaf surface glaucous; base cuneate or obtuse, apex acute to acuminate; petioles (0.7-)1.5-2.5(-3.5) cm. Inflorescences (4-)8-25 cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-0.7 mm, pedicels of the central flowers up to 2 mm. Flowers c. 2.5 mm, green to creamy; anther apex glabrous. Fruits 3.5-4.5 × 1.5-2.5 cm, ellipsoid, purple-black; fruit pedicels apically constricted, or rarely not constricted. *From evergreen lowland forests to montane wet forests.* CR (*Morega 337*, INB); P (*McPherson 12122*, MO). 50-1900 m. (Mesoamerica, Venezuela, Colombia, Ecuador.)

Beilschmiedia alloiophylla is a complex species with variable indumentum. Collections from Panama District (900 m alt.), from high elevations (700-1900 m) in Costa Rica and Panama (excluding the one from Panama District), and from lower elevations (below 350 m alt.) on the Osa Peninsula likely represent different species respectively.

2. *Beilschmiedia anay* (S.F.Blake) Kosterm., *Rec. Trav. Bot. Néerl.* 35: 847 (1938). *Hufelandia anay* S.F.Blake, *J. Wash. Acad. Sci.* 9: 459 (1919). Holotype: Guatemala, *Popenoe 754* (US!). Illustr.: Blake, *J. Wash. Acad. Sci.* 9: 460 (1919); Burger, & van der Werff., *Fieldiana Bot. N. S.* 23: 20 (1990).

Trees, to 40 m tall. Terminal buds and twigs usually densely pubescent with erect, short and curly, or long and wavy or straight hairs, twigs rarely glabrescent with age. Leaves (14-)18-28 × 11-15 cm, alternate, rather clustered around the terminal buds, broadly elliptic to ovate, chartaceous; secondary veins 12 to 17 pairs, raised below, minor venation pattern fine, immersed above (the pattern partially visible), slightly raised or almost immersed below (the pattern visible); upper leaf surface glabrous or pubescent with wavy hairs along the midrib, lower leaf surface pubescent with erect, short curly hairs or long wavy hairs; lower leaf surface often glaucous; base obtuse to round, rarely cuneate, apex acute, rarely cuspidate; petioles (2.5-)3-4 cm. Inflorescences 5-10 cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-1 mm, pedicels of the central flowers up to 4 mm. Flowers c. 3 mm, yellowish; anther apex pubescent. Fruits to c. 15 cm, ellipsoid to pyriform; fruit pedicels unknown. Flowering Apr-May. *Montane mesophyll forests or deciduous forests.* G (*Johnson 170*, MO). 100- 920 m. (Mexico [Puebla, Veracruz], Mesoamerica.)

Beilschmiedia anay is reported to have pyriform fruits (Blake, 1919), but the fruit shape character should be confirmed through more relevant material.

3. *Beilschmiedia brenesii* C.K.Allen, *J. Arnold Arbor.* 26: 415 (1945). Holotype: Costa Rica, *Brenes 6214* (F!).

Trees, to 20 (-35) m tall. Terminal buds and twigs almost glabrous or pubescent with ascending or appressed, straight hairs. Leaves (4-)6-9(-12) × 1.7-4.2(-6) cm, opposite, elliptic, coriaceous; secondary veins 7 to 13 pairs, raised below, minor venation pattern coarse, slightly raised or almost immersed above, raised below; leaf surface glabrous on both sides; lower leaf surface not glaucous; base cuneate, apex acute, rarely

obtuse; petioles 0.5-0.8 cm, concolorous with twigs. Inflorescences 3-9 cm, usually clustered around terminal buds or on short leafless shoots, paniculate, sparsely pubescent; floral pedicels of the lateral divisions (1.5-)3-5 mm, pedicels of the central flowers up to 7 mm. Flowers 2.5-4 mm, greenish-yellow to creamy; anther apex glabrous. Fruits ellipsoid c. $3.3 \times c. 1.8$ cm; fruit pedicels not constricted. Flowering Dec- Feb. *Montane humid forests*. CR (Smith 2717, F); P (McPherson 15312, MO). 520-1800 m. (Endemic.)

Beilschmiedia brenesii is placed under a synonym of *B. pendula* in Burger and van der Werff (1990), but *B. brenesii* is distinguished from *B. pendula* by its opposite leaves with coarse venation pattern, and fruit pedicels not constricted at the apex.

4. *Beilschmiedia costaricensis* (Mez & Pittier) C.K.Allen, *J. Arnold Arbor*. 26: 415 (1945). *Hufelandia costaricensis* Mez & Pittier, *Bull. Herb. Boiss. II*, 3: 228 (1903) (excl. Pittier 1863 fide Kostermans). Isolectotype (designated by Konstermans, 1938): Costa Rica, *Tonduz 11713* (CR!).

Beilschmiedia rohliana Lasser, *Cryptocarya kostermansiana* C.K.Allen.

Trees, to 30 m tall. Terminal buds and twigs pubescent with appressed to ascending, short and straight hairs, less densely pubescent when old. Leaves 5-13 (-18) \times 2.5-8 cm, alternate, elliptic, usually chartaceous; secondary veins 6-9(-10) pairs, raised below, minor venation pattern fine to intermediate in size, areoles angular with branched free-ending veinlets inside, raised on both sides; leaf surface glabrous on both sides or rarely lower leaf surface sparsely pubescent with appressed to ascending hairs, lower leaf surface not glaucous; base cuneate, apex acute to acuminate, rarely obtuse; petioles 1-1.5(-2) cm. Inflorescences 2-10(-16) cm, axillary, paniculate, sparsely pubescent; floral pedicels of the lateral divisions (0.3-)0.7-1.5 mm, pedicels of the central flowers up to 4 mm. Flowers 2-3 mm, creamy to whitish; anther apex glabrous. Fruits 3-4(-5) \times 1.5-2(-3) cm, ellipsoid; fruit pedicels not apically constricted. *Premontane forests to cloud forests*. CR (*Haber & Bello 6531*, MO); P (*McPherson 10125*, MO). 100-2300m. (Mesoamerica, Venezuela, Colombia, Ecuador, N. Peru.)

Beilschmiedia costaricensis is placed under a synonym of *B. pendula* by Burger and van der Werff (1990), but *B. costaricensis* differs from *B. pendula* in having non-glaucous leaves with minor veins raised on the upper surface and fruit pedicels not constricted at the apex.

There is a wider variation in the leaf and inflorescence size among specimens of this species outside of Mesoamerica.

5. *Beilschmiedia hondurensis* Kosterm., *Rec. Trav. Bot. Néerl.* 35: 854 (1938).
Isotype: Belize, *Schipp 1262* (F!).

Trees, to 30 m tall. Terminal buds pubescent with appressed or slightly ascending, straight hairs. Twigs glabrous. Leaves (5-)8.3-13.2(-18) × (1.5-)2.9-4.6(-6.5) cm, opposite, elliptic, firmly chartaceous; secondary veins (7-)9-12(-14) pairs, slightly raised below, minor venation pattern coarse, slightly raised above, raised below; leaf surface glabrous on both sides; lower leaf surface not glaucous; base cuneate, apex acuminate, rarely acute; petioles 0.5-1(-1.2) cm, darker than or rarely concolorous with twigs. Inflorescences 3-6 cm, in axils of leaves or around terminal buds, paniculate with few branches, sparsely pubescent or almost glabrous; floral pedicels of the lateral divisions 0.5-1.0 mm, pedicels of the central flowers up to 2 mm. Flowers c. 3 mm, anther apices glabrous. Fruits 2.3-3 × c. 1.3 cm (immature?), ellipsoid; fruit pedicels apically constricted or rarely not constricted. Flowering Feb. *Wet tropical forests to montane forests*. Ch (*Breedlove & Smith 31417*, MEXU); G (*Lundell 19280*, MO); B (*Holst 4435*, BM); H (*Thomas 412*, MO). (200-)750-1850 m. (Mexico [Oaxaca], Mesoamerica.)

Some, if not all, Mexican collections of *Beilschmiedia hondurensis* approach *B. brenesii* in the petioles concolorous with twigs, acute leaf apex, and fruit pedicels not constricted at the apex. The most discriminating character between the two species is the length of the floral pedicels, but it is not confirmed clearly because only one collection in *B. hondurensis* reveals flowers in good condition. More fertile material of *B. hondurensis* is needed to distinguish *B. hondurensis* from *B. brenesii*.

6. *Beilschmiedia immersinervis* Sach. Nishida, *Ann. Missouri Bot. Gard.* 86: 678 (1999). Holotype: Costa Rica, *Guindon & Brenes 36* (MO!). Illustr.: Nishida, *Ann. Missouri Bot. Gard.* 86: 679 (1999).

Trees, to 30 m tall. Terminal buds and twigs pubescent with erect, short curly hairs, twigs less densely pubescent to almost glabrous when old. Leaves 6-10(-13) × 2-4(-6) cm, alternate to sub-opposite, rather clustered near the terminal buds, oblanceolate to elliptic, firmly chartaceous; secondary veins 7-10 pairs, immersed below, minor venation pattern fine, immersed and hardly visible above, almost immersed or very slightly raised below; leaf surface glabrous on both sides; lower leaf surface glaucous; base attenuate to cuneate, apex acute, rarely obtuse; petioles 0.7-1.5 cm. Inflorescences 2-6 cm, axillary, paniculate with few branches, pubescent; floral pedicels of the lateral divisions c. 1 mm, pedicels of the central flowers up to 3 mm. Flowers c. 2.8 mm, greenish-yellow; anther apex pubescent. Fruits c. 2.5 × c. 1.5 cm, ellipsoid; fruit pedicels slightly constricted at the apex, or almost not constricted. Flowering Dec-Jan. *Premontane humid forests*. CR (*Pennington & Póveda 11416*, CR). 300-1400 m. (Endemic.)

Collections of *Beilschmiedia immersinervis* are sometimes identified as *B. pendula*, probably because of the similar leaf shape. *Beilschmiedia immersinervis* can be separated from *B. pendula* by its erect and curly hairs on the terminal buds and anthers pubescent at the apex.

7. *Beilschmiedia mexicana* (Mez) Kosterm., *Rec. Trav. Bot. Néerl.* 35: 846 (1938). *Hufelandia mexicana* Mez, *Jahrb. Königl. Bot. Gart. Berl.* 5: 20 (1889). Lectotype (designated by Kostermans, 1938): Mexico. Veracruz, *Müller 1460* (K!).

Linociera areolata Lundell

Trees, to 25 m tall. Terminal buds and twigs pubescent with appressed hairs or glabrescent. Leaves 5-13(-19) × 3-8(-10) cm, alternate, elliptic, sometimes asymmetric, chartaceous; secondary veins in 6-11 pairs, raised below, minor venation pattern fine, areoles rounded and lacking free-ending veinlets inside, minor veins usually raised on both side; leaf surface glabrous on both sides; lower leaf surface usually not glaucous; base cuneate, apex acute to obtuse, rarely acuminate; petioles 0.5-2 cm. Inflorescences 1-10(-16) cm, axillary, paniculate, sparsely pubescent or almost glabrous; floral pedicels of the lateral divisions (0.3-)1-1.5 mm, pedicels of the central flowers up to 4(-5.5) mm. Flowers c. 2.5 mm; anther apex glabrous. Fruits 2.5-3(-4) × c. 1.5 cm, ellipsoid; fruit pedicels slightly constricted at the apex. *Montane mesophyll forests or semideciduous forests*. Ch (Méndez G. & Shilom 7686, MO); B (Holst et al. 5236, MO). 800-1780 m. (S. Mexico, Mesoamerica.)

8. *Beilschmiedia ovalioides* Sach. Nishida, *Ann. Missouri Bot. Gard.* 86: 686 (1999). Holotype: Mexico, Oaxaca, *Lorence & Cedillo 4078* (MEXU!). Illustr.: Nishida, *Ann. Missouri Bot. Gard.* 86: 687 (1999).

Trees, to 35 m tall. Terminal buds and twigs densely pubescent with rusty, erect short curly hairs. Leaves (8-)11-16 × 5-10 cm, alternate, broadly elliptic to obovate, sometimes slightly asymmetric, coriaceous; secondary veins 11-14 pairs, raised below, minor venation pattern fine, immersed above, slightly raised or immersed below (venation pattern visible below); upper leaf surface glabrous, lower leaf surface puberulent with short erect hairs; lower surface usually glaucous; base obtuse to cuneate, apex acute to acuminate; petioles 2-3 cm. Inflorescences 4.5-12 cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-0.7 mm, pedicels of the central flowers up to 1 mm. Flowers c. 3 mm, greenish-yellow; anther apex glabrous. Fruits 3-4 × 3-4 cm spherical; fruit pedicels not constricted at the apex. Flowering May-Aug. *Montane mesophyll forests*. Ch (Martínez et al. 19456, MO). 1850-2750 m. (Mexico [Oaxaca], Mesoamerica.)

Beilschmiedia ovalioides approach *B. ovalis* in the similar indumentum, venation pattern, flower structure, and fruit shape. However, *B. ovalioides* can be distinguished from *B. ovalis* by its longer petioles, larger leaves with hairs remaining even when old.

9. *Beilschmiedia ovalis* (S.F.Blake) C.K. Allen, *J. Arnold Arbor.* 26: 418 (1945). *Hufelandia ovalis* S.F. Blake, *Jour. Wash. Acad. Sci.* 9 :461 (1919). Holotype: Costa Rica, *Pittier 2040* (US!). Illustr.: Burger, & van der Werff., *Fieldiana Bot. N. S.* 23: 18 (1990).

Beilschmiedia austin-smithii (Standl.) C.K. Allen, *Persea austin-smithii* Standl.

Trees, to 30 m tall. Terminal buds and twigs pubescent with erect short curly hairs, twigs less densely pubescent to glabrous when old. Leaves 4-10(-14) × 3-8(-10.5) cm, alternate, ovate to broadly elliptic, coriaceous; secondary veins 5-9 pairs, raised below, minor venation pattern fine, immersed or slightly raised above, slightly to conspicuously raised below; leaf surface glabrous on both sides, rarely partly pubescent when young; lower surface glaucous; base obtuse to round, apex obtuse; petioles 1-1.5 cm long. Inflorescences 3-15 cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-1.2 mm, pedicels of the central flowers up to 2 mm. Flowers c. 3 mm, yellowish; anther apex glabrous. Fruits c. 3.5 × c. 3.5 cm (or bigger), spherical; fruit pedicels not apically constricted. *Cloud forests.* H (*Thomas 584*, MO); CR (*Smith NY675*, NY); P (*Allen 3490*, MO). 1800-2800 m. (Endemic.)

10. *Beilschmiedia pendula* (Sw.) Hemsl., *Biol. Cent.-Amer., Bot.* 3: 70 (1882). *Laurus pendula* Sw., *Prodr.*: 65 (1788). *Hufelandia pendula* (Sw.) Nees, *Plantarum Laurinarum Secundum Affinitates Naturales Expositio*: 22 (1833). Isolectotype (designated by Kontermans, 1938): Jamaica, *Swartz s.n.* (BM!).

Hufelandia thomaea Nees

Trees, to 30 m tall. Terminal buds and twigs pubescent with appressed straight hairs, twigs glabrescent when old. Leaves 6-11 × 2-4(-6) cm, alternate, elliptic to oblanceolate, firmly chartaceous; secondary veins 7-9(-10) pairs, raised or rarely almost immersed below, minor venation pattern fine, immersed above (the pattern partially visible), almost immersed or slightly raised below; upper leaf surface glabrous, lower leaf surface glabrous or rarely sparsely pubescent with appressed hairs; lower leaf surface glaucous; base cuneate, apex acuminate or very rarely acute to obtuse; petioles 1-1.5 cm. Inflorescences 3-9 cm, axillary, paniculate with few branches, almost glabrous or sparsely pubescent; floral pedicels of the lateral divisions 0.5-1 .5 mm, pedicels of the central flowers up to 4 mm. Flowers 2-3 mm, greenish yellow to whitish; anther apex glabrous. Fruits 2-3.5 × c. 1.5 cm, ellipsoid; fruit pedicels strongly constricted at the apex. Flowering usually Mar. *Montane forests*. H (*Aguilar & Evans 4073*, MO); N (*Stevens et al. 20891*, MO); CR (*Herrera 5861*, MO); P (*Stern & Chambers 173*, NY). (200-)600-1520 m. (Mesoamerica, Colombia, Venezuela, Ecuador, the Greater Antilles, Leeward Islands, Windward Islands.)

Beilschmiedia pendula is often confused with *B. costaricensis* and *B. mexicana* because of the similar pubescence type, leaf shape, flower structure, and fruit shape. However, *B. pendula* can be distinguished from *B. costaricensis* and *B. mexicana* by the leaves glaucous below, minor veins almost immersed on the upper leaf surface and fruit pedicels strongly constricted at the apex.

There is a wider variation in the leaf and inflorescence size among specimens of this species outside of Mesoamerica, especially from the West Indies.

11. *Beilschmiedia riparia* Miranda, *Anales Inst. Biol. Univ. Nac. México* 24: 75 (1953). Holotype: Mexico, Chiapas, *Miranda 6872* (MEXU!). Illustr.: Miranda, *Anales Inst. Biol. Univ. Nac. México* 24: 76 (1953).

Persea primatogena L.O. Williams & A.R. Molina

Trees, to 40 m tall. Terminal buds and twigs pubescent with erect, long and straight to wavy hairs, twigs less densely pubescent or rarely glabrous when old. Leaves 7-16.5 × 4-7.5 cm, alternate, rarely sub-opposite, elliptic rarely ovate, sometimes asymmetric, chartaceous; secondary veins 8-13 pairs, raised below, minor venation pattern fine, immersed above (the pattern visible), slightly raised below; upper leaf surface glabrous, lower leaf surface pubescent with erect, straight to wavy hairs when young, glabrous or pubescent on the major veins when old; lower leaf surface usually not glaucous; base cuneate, rarely obtuse, apex acute to obtuse; petioles 1-2 cm. Inflorescences 2-14 cm, axillary or rarely clustered on the buds, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-0.7 mm, pedicels of the central flowers up to 1.5(-2) mm. Flowers 2-3 mm, white to creamy; anther apex usually pubescent. Fruits c. 4 × 1.5 cm, ellipsoid; fruit pedicels constricted at the apex. Flowering Jan-May. *Along a stream in semi-deciduous forests or mixed cloud forests.* Ch (Bachem et al. 1000, MO); H (von Hagen & von Hagen 1257, NY); N (Moreno 21657, MEXU). 480-1500 m. (S. Mexico, Mesoamerica.)

12. Beilschmiedia steyermarkii C.K.Allen, *J. Arnold Arbor.* 26: 417 (1945).

Holotype: Guatemala, *Steyermark 44494* (F!).

Trees, to 27 m tall. Terminal buds and twigs pubescent with erect, short curly hairs, twigs less densely pubescent when old. Leaves 5-10 × 1.5-4 cm, alternate, elliptic to narrowly ovate, often asymmetric, coriaceous; secondary veins 7 or 8 pairs, slightly raised below, minor venation pattern fine, immersed above (sometimes the pattern visible), slightly raised below; leaf surface glabrous on both sides, base and apex acute, rarely apex obtuse; petioles 1-1.7 cm. Inflorescences 4-8 cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-1 mm, pedicels of the central flowers up to 3 mm. Flowers c. 2.4 mm; anther apex glabrous. Fruits unknown. Flowering Mar. *Habitat unknown.* G (Contreras 9448, MO). 300-400 m. (Endemic.)

13. *Beilschmiedia tilaranensis* Sach. Nishida, *Ann. Missouri Bot. Gard.* 86: 694 (1999). Holotype: Costa Rica, *Guindon & Brenes 40* (MO!). Illustr.: Nishida, *Ann. Missouri Bot. Gard.* 86: 695 (1999).

Trees, to 20 m tall. Terminal buds and twigs pubescent with erect short curly hairs, twigs less densely pubescent when old. Leaves 6-13 × 4-7 cm, alternate, obovate or rarely elliptic, coriaceous; secondary veins 7 to 11 pairs, raised below, minor venation pattern fine, immersed above, raised below; leaf surface glabrous on both sides; lower leaf surface glaucous; base cuneate, apex obtuse; petioles 1-2 cm. Inflorescences 5-12 cm, axillary, paniculate, sparsely pubescent; floral pedicels of the lateral divisions 0.5-1 mm, pedicels of the central flowers up to 2 mm. Flowers c. 2.3 mm, creamy; anther apex glabrous. Fruits 5.5-6.5 × 2-2.5 cm, ellipsoid or obovoid; fruit pedicels not apically constricted. Flowering Apr. *Premontane forests*. CR (*Gómez 9800*, CR); P (*Hammel 6286*, MO). 1100-1580 m. (Endemic.)

Some specimens of this species were placed in *Beilschmiedia ovalis* by Burger and van der Werff (1990) with a comment that they have atypical leaves for *B. ovalis* and might belong to another undescribed species. *Beilschmiedia tilaranensis* is distinguished from *B. ovalis* by its obovate leaves and ellipsoid fruits.

14. *Beilschmiedia towarensis* (Meisn.) Sach. Nishida, *Ann. Missouri Bot. Gard.* 86: 696 (1999). *Hufelandia towarensis* Meisn. in DC, *Prodr.* 15 (1): 65 (1864). Syntype: Venezuela, *Fendler 1094* (NY!).

Aniba pseudo-coto (Rusby) Kosterm., *Ocotea pseudo-coto* Rusby.

Trees, to 25(-40) m tall. Terminal buds and twigs pubescent with appressed straight hairs, twigs less densely pubescent when old. Leaves 8-18(-25) × 4-8(-14) cm, alternate, ovate to broadly elliptic or broadly obovate, coriaceous to firmly chartaceous; secondary veins (7-)8-10(-11) pairs, raised below, minor venation pattern fine, immersed above (the pattern sometimes slightly visible), almost immersed below (the pattern visible); upper leaf surface glabrous, lower leaf surface pubescent with appressed short

straight hairs; lower leaf surface glaucous; base cordate to obtuse, rarely cuneate, apex acuminate, rarely acute; petioles 1.5-2.5(-3) cm. Inflorescences 4-15(-23) cm, axillary, paniculate, pubescent; floral pedicels of the lateral divisions 0.5-1.5 mm, pedicels of the central flowers up to 3 mm. Flowers 2-3 mm, yellowish white; anther apex glabrous. Fruits 2.5-3.5 × 1.5-2 cm, ellipsoid; fruit pedicels usually constricted at the apex. Flowering Nov-Apr. *Premontane wet forests to cloud forests*. CR (*Peralta s.n.*, CR); P (*Croat 5813*, MO). 200-1700 m. (Mesoamerica, Colombia, Venezuela, Ecuador, Bolivia.)

Beilschmiedia towarensis is broadly based on two specimen groups, one with shorter petioles, ovate leaves, pubescent ovaries and fruit pedicels not apically constricted, another with longer petioles, elliptic leaves, glabrous ovaries and fruit pedicels apically constricted. The specimens from Mesoamerica usually belong to the latter group.

Excluded taxa

Beilschmiedia sulcata (Ruiz & Pav.) Kosterm., *Recueil. Trav. Bot. Néerl.* 35: 850 (1938). *Laurus sulcata* Ruiz & Pav., *Fl. Peruv.* 4: 356 (1804). *Hufelandia sulcata* (Ruiz & Pav.) Nees, *Linnaea* 21: 494 (1848). *Persea sulcata* (Ruiz & Pav.) Meisn. in DC, *Prodr.* 15 (1): 54. 1864. Isotype: Peru, *Ruiz s.n.* (F!).

Burger and van der Werff (1990) placed some specimens from Costa Rica under the name of *Beilschmiedia sulcata*. However, *B. sulcata* is an imperfectly known species, which was drawn as having 4-celled anthers in the protologue but has no fertile specimens confirming this character.

Beilschmiedia zapoteoides (Lundell) Kosterm., *Reinwardtia* 6: 156 (1962). *Endlicheria zapoteoides* Lundell, *Wrightia* 1: 145 (1946). Holotype: Mexico. Chiapas, *Matuda 5153*, (TEX!).

Beilschmiedia zapoteoides is an imperfectly known species, having only type collections that appear to be abnormal.

4. *Caryodaphnopsis* Airy-Shaw

By H. van der Werff.

Trees. Leaves opposite, tripliveined or pinnately veined; domatia lacking. Inflorescences in the axils of normal leaves, paniculate-cymose, the lateral flowers of a cyme strictly opposite. Flowers bisexual, tepals strongly unequal, the outer 3 much smaller than the inner 3, free, deciduous in the fruiting stage. Stamens 9 (rarely 6), 4-celled (rarely 2-celled), the innermost whorl represented by 3 staminodia. Fruit seated on an unmodified pedicel, a cupule absent. Approx. 15 spp., Costa Rica, South America, tropical Asia.

Caryodaphnopsis is readily recognized by its opposite leaves and flowers with strongly unequal tepals.

Bibliography: van der Werff, H. & Richter, H.G. *Caryodaphnopsis* Airy-Shaw (Lauraceae), a genus new to the Neotropics. *Syst. Bot.* 10(2): 166-173 (1985).

1. *Caryodaphnopsis burgeri* Zamora and Poveda, *Ann. Missouri Bot. Gard.* 75: 1160 (1988). Isotype: Costa Rica, *Zamora et al.* 1208 (MO!).

Trees, to 30 m. Twigs glabrous or slightly appressed pubescent when young, more or less terete, the terminal buds densely appressed pubescent. Leaves 8-19 × 3-7.5 cm, (narrowly) elliptic, chartaceous, glabrous on both surfaces or with some appressed hairs on the lower surface, strongly tripliveined, the lateral veins reaching the tip of the leaf, the midrib and lateral veins impressed on the upper surface, raised on the lower surface, the tertiary venation immersed or weakly raised on the lower surface; the base acute or cuneate, the margins not thickened, the apex acute or acuminate; petioles 8-15 mm, flattened above, rounded below. Inflorescences not known. Flowers rotate, c. 10 mm in diameter, outer tepals 1 mm, inner ones 5 mm, the stamens 5 mm, the inner 3 stamens with 2 glands attached a little above the base of the filaments, the pistil 4 mm, sparsely pubescent, the style slender. Fruit 15 × 13 mm, smooth. *Lowland rain forest*. CR (*Zamora et al.* 1208, MO); P (*Peralta* 606, MO). 0-500 m. (Endemic.)

The two known collections from Panama are sterile and their identification is therefore tentative.

5. *Cassytha* L.

By H. van der Werff.

Herbaceous parasitic vines. Leaves strongly reduced, scale-like, alternate. Inflorescences axillary, spicate. Flowers bisexual; tepals unequal, the outer 3 much smaller than the inner 3, persistent in the fruiting stage. Stamens 9, all 2-celled. Fruit enclosed in the accrescent floral tube, the tepals persisting as a small crown on top of the floral tube. 17 spp. Pantropical.

Characteristic are the vining, parasitic habit, and the lauraceous flowers (trimerous, locelli opening by valves).

Bibliography: Weber, J.Z. A taxonomic revision of *Cassytha* (Lauraceae) in Australia. *J. Adelaide Bot. Gard.* 3(3): 187-262 (1981).

1. *Cassytha filiformis* L., *Sp. Pl.* 35 (1753). Lectotype (designated by Weber 1981): Rheede, *Hort. Ind. Malab.* 7: t. 44 (1688).

Cassytha americana Nees, *C. dissitiflora* Meisn., *C. paradoxae* Proctor.

Slender-stemmed herbaceous vines to several m long. Stems glabrous or sparsely pubescent, with elliptic haustoria. Leaves 1-2 × 1 mm, alternate, glabrous or with a few hairs, sessile. Inflorescences axillary, spicate or reduced to 1 or 2 sessile flowers. Flowers c. 2 mm, subtended by 3 small bracts; outer 3 tepals c. 0.7 mm, inner 3 c. 1.5 mm; stamens 1-1.4 mm; pistil c. 1.3 mm, glabrous. Fruits 5-7 × 4-6 mm, surrounded by the floral tube. *Coastal vegetation, dry scrub.* Ch (*Breedlove 20135*, MO); Y (*Espejo et al. 1324*, MO); C (*Martinez S. & Tellez 2993*, MO); QR (*Cabrera C. et al. 7686*, MO); B (*Schipp 819*, MO); G (*Tenorio 14575*, MO); H (*Nelson & Romero 4232*, MO); N (*Stevens & Moreno 19399*, MO); CR (*Grayum et al. 8064*, MO); P (*Hammel 4536*, MO). 0-400 m. (United States, Mexico, Mesoamerica, Colombia, Venezuela, Guyanas, Bolivia, Brasil, Cuba, Haiti, Jamaica, Puerto Rico, Virgin Isl., Turks, Caicos Isl., Cayman Isl., Bahamas, Trinidad, Tobago, Asia, Africa, Australia, Pacific.)

This herbaceous, parasitic vine can only be confused with *Cuscuta* spp., but the latter has entirely different flowers and fruits. *Cassytha paradoxae* was said to differ

from *C. filiformis* in having solitary flowers and slightly thinner stems. However, even a paratype of *C. paradoxae* has some paired flowers and I consider it as a depauperate form of *C. filiformis*. If one wants to recognize the depauperate plants as a distinct species, *C. dissitiflora* is probably the correct name.

6. *Cinnamomum* Schaeff.

By Paco?

7. *Cryptocarya* R. Br.

By H. van der Werff.

Trees. Leaves alternate, pinnately veined, domatia absent. Inflorescences in axils of leaves, more or less paniculate-cymose, but lateral flowers of the cymes usually not strictly opposite; flowers bisexual; tepals equal, their bases united in a short tube, deciduous with age; stamens 9, all 2-celled, the inner 3 stamens with two glands at the base of the filaments; fruit completely enclosed by the enlarged floral tube with only a very small apical pore, this with a single margin; enlarged floral tube at maturity of the fruit longitudinally ribbed. Approx. 350 spp. Costa Rica, South America, Madagascar, Tropical Asia, Australia, Pacific.

Cryptocarya is unique among Neotropical Lauraceae because the fruits are completely enclosed in the longitudinally ribbed floral tube and because the flowers have a short floral tube.

Bibliography: Kostermans, A.J.G.H. Revision of the Lauraceae II: *Cryptocarya*. *Rec. Trav. Bot. Neerl.* 34: 557-575 (1937).

***Cryptocarya* sp. A.**

Tree, 10 m. Twigs glabrous or nearly so, slightly ridged; terminal buds appressed pubescent. Leaves 6-11 × 2-3 cm, elliptic, chartaceous, glabrous on both surfaces, the tertiary venation reticulate, more or less immersed on the upper surface, raised on the lower surface, the base acute, margin thickened, somewhat cartilaginous, the apex acute to acuminate, petioles 7-10 mm, glabrous, more or less canaliculate above, rounded

below. Inflorescences and flowers unknown. Infructescences 5-10 cm, glabrous or with some appressed hairs, with 1-4 fruits. Fruits c. $15 \times 7-10$ mm, elliptic, crowned with the short, dried floral tube. CR (*Rivera 1447*, MO). Elev. ??????. (Endemic.)

This is the only collection of *Cryptocarya* from Mesoamerica. The South American species (mostly from S. Brasil) are poorly known; a few collections are known from Venezuela, Ecuador and Peru, but these remain unidentified. Without flowers, reliable identifications are not possible.

Excluded species:

Cryptocarya kostermansiana C.K. Allen = *Beilschmiedia costaricensis* (Mez & Pittier)C.K. Allen

Cryptocarya hintonii C.K. Allen = *Prunus* sp.

8. *Endlicheria* Nees

By H. van der Werff.

Dioecious trees or shrubs. Leaves alternate or infrequently whorled, pinnately or tripliveined; axillary tufts of hairs rarely present. Inflorescences in the axils of normal leaves, cymosely paniculate, the lateral flowers of a cyme always strictly opposite. Flowers unisexual; tepals equal, free; male flowers with 9 2-celled stamens (1 S. American species has 6 2-celled and 3 4-celled stamens) and a pistillode, female flowers with 9 staminodes and a pistil. Fruits seated on a variously shaped cupule, from platelike to distinctly cup-shaped, usually smooth and glabrous, with a single margin. (1 S. American species with a densely golden brown pubescent cupule). A predominantly South American genus of about 40 species extending into Panama and Costa Rica. In need of a revision.

Endlicheria includes all Neotropical species with unisexual flowers and 2-celled stamens. The genus is very likely not monophyletic. Some species resemble *Rhodostemonodaphne* species very closely (for instance the *E. sericea* complex and the *R. grandis* complex or *E. vinotincta* and *R. celiana*) and one recently described species, *Rhodostemonodaphne revolutifolia* Madrinan, has staminate flowers with 6 2-celled and

3 4-celled stamens, while the pistillate flowers have 9 4-celled staminodes. Other *Endlicheria* species, for instance *E. punctulata*, resemble *Ocotea* species and finally a group of species (such as the *E. verticellata* group) does not show a resemblance to other genera. Thus, *Endlicheria* is a genus of convenience and species placed in it are not necessarily closely related.

Bibliography: Kostermans, A.J.G.H., *Rec. Trav. Bot. Neerl.* 34: 500-557 (1937).
Note: In the *Lauraceae* treatment for the *Flora Costaricensis* (Burger & van der Werff, 1990) the authors included provisionally an *Endlicheria* sp., based on one fruiting and several sterile collections. I cannot identify this taxon with confidence to genus and therefore cannot include it in this treatment

1. Lower leaf surface densely appressed pubescent, the indument shiny and covering the surface completely. **4. *Endlicheria sericea***

1. Lower leaf surface sparsely appressed pubescent or glabrous, the surface always (partially) visible.

2. Flowers depressed globose, wider than long; tepals erect or pointing inwards at anthesis; flowers rather densely and minutely appressed pubescent.

2. *Endlicheria formosa*

2. Flowers turbinate, longer than wide; tepals spreading at anthesis; flowers glabrous, sparsely appressed pubescent or coarsely pubescent.

3. Inflorescences and flowers rather densely pubescent, the hairs ascending, coarse and covering most of the surface. **5. *Endlicheria* sp.**

3. Inflorescences and flowers glabrous or sparsely, minutely and appressed pubescent, the surface entirely or mostly visible.

4. Reticulation on upper leaf surface immersed; leaves to 12 cm; flowers and inflorescences glabrous. **3. *Endlicheria jefensis***

4. Reticulation on upper leaf surface raised; leaves more than 20 cm; flowers and inflorescences minutely appressed pubescent. **1. *Endlicheria browniana***

1. *Endlicheria browniana* Mez, *Jahrb. Bot. Gart. Berlin* 5: 115 (1889).

Aydendron macrophyllum Meissner, *Prodr.* 15(1): 92 (1864). Holotype: Panama, *Seemann 1094bis* (K).

Small trees, to 15 m. Twigs angular, densely and minutely appressed pubescent when young, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 20-35 × 8-16, broadly elliptic to elliptic, chartaceous, the base acute to obtuse, the apex acuminate, the acumen to 3 cm, apex rarely rounded, midrib and lateral veins immersed or slightly impressed, tertiary venation raised on the upper surface, midrib prominently raised, often with a sharp ridge, lateral veins raised and tertiary venation weakly raised on the lower surface; upper surface glabrous, lower surface glabrous or with some minute, appressed hairs; lateral veins 6-9 pairs; gland dots not obvious; petioles 1.5-3 cm, with a similar indument as the twigs. Inflorescences 5-10 cm, minutely appressed pubescent. Flowers yellow or creamy-white, 3-4 mm in diameter. Tepals c. 1 mm, spreading, sparsely and minutely pubescent outside, sparsely pubescent inside; male flowers with outer 6 stamens triangular, c. 0.5 mm, inner 3 stamens columnar, fused, c. 0.6 mm, all stamens glabrous; glands and pistillode not seen; female flowers with 9 staminodes, these 0.2-0.3 mm, sparsely pubescent; pistil c. 1.5 mm, glabrous, the stigma conspicuous, peltate or somewhat lobed; receptacle urceolate, glabrous inside. Fruit ellipsoid-oblong, c. 4 × 2 cm, seated in a cup-shaped cupule, c. 1-1.5 × 2 cm. *Lowland rain forests*. P (Sytsma 994, MO). 50-600 m. (Mesoamerica, Colombia, Ecuador).

Endlicheria browniana is best recognized by its large leaves with raised reticulation on the upper leaf surface and the turbinate flowers with spreading tepals. It can be confused with *Endlicheria formosa*, but the latter species has narrower, acute (not acuminate) leaves and depressed globose flowers with erect or incurved tepals; its cupules are bowl-shaped, not cup-shaped as in *E. browniana*. Fruiting material of *Rhodostemonodaphne kunthiana* differs in having more or less oblong leaves with more lateral veins (6-9 versus 9-14) and in having a brownish, more or less erect indument on twigs and leaves.

2. *Endlicheria formosa* A.C. Smith, *Phytologia* 1(3): 118 (1935). Isotype: Brazil,

Krukoff 5156 (MO).

Trees, to 25 m. Twigs angular, moderately to sparsely appressed pubescent, quickly becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 17-35 × 5-10 cm, alternate, firmly chartaceous, (narrowly) elliptic or elliptic- obovate, the base acute or cuneate, the apex acute or infrequently shortly acuminate; midrib and lateral veins immersed, tertiary venation raised on the upper surface, midrib prominently raised, lateral veins raised and tertiary venation weakly raised on the lower surface; mature leaves glabrous or with some scattered appressed hairs on the lower surface; oil cells not visible; petioles 1.5-4 cm, with a similar indument as the twigs. Inflorescences axillary, 6-12 cm, at the base sparsely and minutely appressed pubescent, the indument becoming dense towards and on the flowers. Flowers 2-3 mm in diameter, pale yellow, depressed globose. Tepals c. 1 mm, the inner 3 slightly shorter than the outer 3, moderately to densely appressed pubescent outside, glabrous inside, erect or incurved, leaving only a small opening; male flowers; outer 6 stamens (narrowly) triangular, c. 0.8 mm, inner 3 stamens (broadly) triangular, c. 0.8 mm, filaments lacking, lowers half of all stamens pubescent, glands not seen, pistillode minute, columnar, c. 0.3 mm; female flowers: staminodes 9, broadly triangular, c. 0.4 mm, the base pubescent, pistil c. 1.5 mm, ellipsoid, glabrous, the style much shorter than the ovary. Fruits 4 × 2 cm, ellipsoid, seated on a (at maturity) shallowly bowl-shaped cupule, this 18 × 6 mm; immature cupules vary from deeply cup-shaped to cup-shaped. *Lowland to midelevation rain forests*. CR (Herrera 4967, MO); P (McPherson & Merello 8131). 200-750 m. (Mesoamerica, Colombia, Ecuador, Peru, Brasil.)

Endlicheria formosa can be recognized by its depressed globose flowers with erect or incurved tepals and its large leaves with raised reticulation. It can be confused with *E. browniana* and differences between the two species are discussed under the latter.

3. *Endlicheria jefensis* van der Werff, *Fl. Neotrop.* 91: 38 (2004). Holotype: Panama, *McPherson 8493* (MO!).

Tree, 8 m. Twigs terete, sparsely appressed pubescent on young parts, soon becoming glabrous; terminal buds densely white pubescent. Leaves 8-15 × 2.5-5 cm, elliptic, alternate, firmly chartaceous; the leaf base acute or slightly decurrent on the petiole, the apex acuminate, acumen to 1 cm, the margin flat or somewhat recurved on

older leaves; upper surface with midrib, lateral veins and tertiary venation slightly raised to immersed, lower surface with midrib and lateral veins raised and tertiary venation slightly raised; glabrous on both surfaces or with a few hairs on the lower surface; gland dots not visible on mature leaves; lateral veins 3-6, arching upwards towards the margin and becoming slightly loop-connected; petioles 0.7-1.5 cm, sparsely appressed pubescent or glabrous. Inflorescences 4-10 cm, axillary, glabrous or with a few appressed hairs. Flowers c. 4 mm in diameter, white. Male flowers infundibuliform, glabrous, the tepals spreading, c. 1.6 mm, broadly ovate, glabrous inside or with some small papillae, especially along the margin, outer 6 stamens c. 0.6 mm, broadly triangular, a filament lacking, glabrous; inner 3 stamens c. 0.5 mm, columnar, fused; glands, staminodia and pistillode not seen. Female flowers and fruits not known. *Lower montane rainforest*. P (McPherson 8493, MO). 600 m. (Endemic.)

Endlicheria jefensis is only known from the type collection. Characteristic are the glabrous stems and leaves, the immersed tertiary venation, and the infundibuliform flowers with spreading tepals and the sessile, triangular stamens of which the inner three are fused.

4. *Endlicheria sericea* Nees, *Linnaea* 8: 38 (1833). Isotype: Trinidad, *Sieber 175* (MO).

Small tree, to 12 m. Twigs ridged, densely appressed pubescent, the surface not visible on young twigs, the indument becoming less dense with age; terminal buds densely appressed pubescent. Leaves 12-30 × 6.5-12 cm, firmly chartaceous, (broadly) elliptic to elliptic-ovate, the base acute or obtuse, the apex acute or acuminate, the margin flat; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib prominently raised, lateral veins raised and tertiary venation slightly raised or immersed on the lower surface; the upper surface sparsely and inconspicuously appressed pubescent or glabrous, the lower surface densely, shiny appressed pubescent, the indument covering the surface completely; gland dots not visible on mature leaves; lateral veins 5-7, not loopconnected petioles 2-4 cm, ridged, with a similar indument as the twigs. Inflorescences axillary, 7-14 cm, densely sericeous. Flowers 1.5-2 mm in diameter, green or pale red, male flowers clubshaped, with the tepals c. 1 mm, erect,

glabrous inside or with a few hairs near the base, the outer 6 stamens c. 0.6 mm, with a short filament, glabrous or nearly so; inner 3 stamens 0.8 mm, columnar, the lower half densely pubescent on the back, glands globose, attached near the base; pistillode c. 0.5 mm, stipitiform, glabrous, receptacle densely pubescent inside; female flowers clubshaped to tubular, the tepals erect, glabrous inside or with some hairs near the base, staminodia c. 0.4 mm, the outer 6 glabrous, the inner 3 pubescent near the base, pistil c. 2 mm, pearshaped, glabrous; receptacle densely pubescent inside; fruits 20×12 mm, ellipsoid, seated in a shallowly cup-shaped cupule, this 8×18 mm. *Lowland and midelevation rainforest. P (McPherson 10000, MO). 300-1000 m. (Mesoamerica, Colombia, Venezuela, Suriname, French Guiana, Ecuador, Peru, Bolivia, Brasil.)*

Endlicheria sericea is easily identified by its dense, sericeous pubescence on the twigs and lower surface of the twigs. The species, as accepted here, has a wide distribution, occurs in a variety of habitats and very likely several species form the *E. sericea* complex. Until a detailed study has been made, I accept a wide circumscription of *E. sericea*. The description given here is based on Panamanian specimens solely, but even in Panama one can discern some variation; the collections from Cerro Jefe have a denser, more golden indument than the the collections from Darien and Bocas del Toro.

5. *Endlicheria* sp.

Small trees, to 8 m. Twigs terete or somewhat angular, moderately appressed or ascending pubescent, the indument becoming sparser with age; terminal buds densely appressed or ascending pubescent. Leaves $9-14 \times 3-5$ cm, alternate, chartaceous, (narrowly) elliptic; the base acute to obtuse, the apex acuminate, the acumen to 1.5 cm, the margin flat; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; the upper surface glabrous or with some appressed hairs when young, the lower surface sparsely appressed pubescent or, with age, glabrous or nearly so; gland dots visible or not; lateral veins 3-4, free or slightly loopconnected; petioles 1-1.5 cm, with a similar indument as the twigs. Inflorescences 3-5 cm, axillary, moderately to densely appressed pubescent. Flowers 5 mm in diameter, the tepals spreading at anthesis; male flowers: tepals 1.5 mm, glabrous on the inner surface, outer 6 stamens c. 1 mm, with a short,

narrow, pubescent filament; inner 3 stamens ca.1.2 mm, columnar, fused; glands and pistillode not seen. Female flowers and fruits not known. *Lowland rainforest*. P (Mori 7708, MO). 300-400 m. (Endemic.)

This species can be recognized by its rather small leaves, appressed pubescence on twigs and lower leaf surface and stamens with a short, but distinct filament. Floral characters suggest a relationship with *E. paniculata* (Spr.) Macbride, a widespread and variable species from S. America, but that species has erect pubescence on twigs and leaves. Although the two Panamanian collections probably represent an undescribed species, it should only be described when more material is available and when the species of the *E. paniculata* group (such as *E. acuminata* Kostermans and *E. anomala* (Nees)Mez) have been studied in detail.

9. *Gamanthera* van der Werff

By H. van der Werff.

Trees. Leaves alternate, pinnately veined; domatia absent. Inflorescences in the axils of normal leaves, paniculate, the flowers arranged in tight clusters. Flowers unisexual or possibly unisexual and bisexual on the same plant. Tepals unequal, the inner 3 shorter than the outer 3, united in the lower part, persistent in fruit; stamens 3, but completely fused in a synandrium, the number of locelli 3, 2 or 1. Pistillode lacking in staminate flowers; pistillate flowers with a synandrium which may or may not be functional. Fruit seated in a cup-shaped cupule, this with a conspicuous double margin, which initially is spreading but becomes reflexed at maturity; the double margin is strikingly undulate-lobed. 1 sp. Costa Rica.

Unique features of *Gamanthera* are the completely fused stamens with the reduced number of locelli and the presence of staminate and pistillate (or bisexual) flowers on the same plant. Other noteworthy characters are cupules with a reflexed, undulate double margin and the bracts surrounding the vegetative buds.

Bibliography: van der Werff, H. and Endress, P.K. *Gamanthera* (Lauraceae), a new genus from Costa Rica. *Ann. Missouri Bot. Gard.* 78: 401-408 (1991); Kostermans, A.J.G.H. Reduction of *Gamanthera* to *Licaria* (Lauraceae). *Taxon* 42: 853-854 (1993).

1. *Gamanthera herrerae* van der Werff, *Ann. Missouri Bot. Gard.* 78: 401 (1991). Holotype: Costa Rica, *Herrera 1228* (MO!).

Licaria herrerae (van der Werff) Kostermans.

Trees, 8 m. Twigs terete, densely brown-tomentellous, with whorls of scars from fallen bracts, terminal buds covered by bracts, the outer ones pubescent, the inner ones glabrous. Leaves 12-20 × 5-8 cm, alternate, chartaceous, the midrib on the upper surface tomentellous, otherwise glabrous above; lower surface with the midrib and lateral veins brown-tomentellous, the lamina with erect hairs; venation immersed on the upper surface, midrib and lateral veins raised on the lower surface, the tertiary venation weakly raised; the base cuneate, the margin not thickened, the apex acute or shortly acuminate; petioles 1-1.5 cm, brown-tomentellous, flattened above, rounded below. Inflorescences to 7 cm, axillary, brown-tomentose, with scars of fallen bracts at the base. Flowers 4-4.5 mm, sessile or nearly so, tepals erect, pubescent; synandrium 2 mm, formed by fusion of 3 stamens, pistil glabrous; receptacle glabrous inside. Fruit c. 1.5 cm, ellipsoid, exserted c. 1 cm from the cupule. *Lowland rain forest*. CR (*Herrera 1228*, MO). 80-200 m. Endemic.

This species is known from only one tree; collections from other trees are needed to better understand the reproductive biology of this species.

10. *Licaria* Aubl.

By Lorrea?

11. *Litsea* Lamark

By. H. van der Werff.

Trees or shrubs. Leaves alternate, rarely opposite, usually pinnately veined, domatia lacking. Inflorescences single in the axils of leaves or several in the axils of cataphylls along leafless shortshoots, flowers arranged in umbels, these enclosed by bracts when immature. Flowers unisexual and plants dioecious; staminate flowers with 9-12 stamens, the anthers 4-celled, all locelli opening introrse, a pistillode present; pistillate flowers

with 9-12 threadlike staminodia. Fruits seated in cupule, this ranging from small, platelike to rather deeply cup-shaped. Well represented in tropical Asia with 200 + species; one species in the Flora Mesoamericana region.

Litsea is a large and in Tropical Asia difficult genus, with problems both in species and generic delimitation. However, only a few species are present in the New World, where the genus can be recognized easily by the unisexual flowers arranged in umbels.

1. *Litsea glaucescens* Kunth in Humb., Bonpl. & Kunth, *Nov. Gen. & Sp.* 2: 133 (1817). *Tetranthera glaucescens* (Kunth) Spr. Type: Mexico, *Humboldt & Bonpland* s.n.

Litsea acuminatissima Lundell, *L. cervantesii* Kunth, *L. flavescens* Bartlett, *L. glaucescens* var. *flavescens* (Bartlett) C.K. Allen, *L. glaucescens* var. *major* (Meissner) Hemsley, *L. glaucescens* var. *racemosa* (Meissner) Hemsley, *L. glaucescens* var. *subcorymbosa* (Meissner) Hemsley, *L. glaucescens* var. *subsolitaria* (Meissner) Hemsley, *L. guatemalensis* Mez, *L. matudai* Lundell, *L. neesiana* (Schauer) Hemsley, *L. neesiana* var. *corymbifera* (Meissner) Hemsley, *L. neesiana* var. *villosa* (Mart. & Gal.) Hemsley, *L. orizabae* (Mart. & Gal.) Mez, *Persea orizabae* Mart. & Gal., *Tetranthera glaucescens* (Kunth) Sprengel, *T. glaucescens* var. *major* Meissner, *T. glaucescens* var. *racemosa* Meissner, *T. glaucescens* var. *subcorymbosa* Meissner, *T. glaucescens* var. *subsolitaria* Meissner, *T. neesiana* Schauer, *T. neesiana* var. *corymbifera* Meissner, *T. neesiana* var. *villosa* (Mart. & Gal.) Meissner, *T. villosa* Mart. & Gal.

Dioecious shrubs or trees, to 20 m. Twigs terete or striate, glabrous or sparsely to densely pubescent, the hairs usually erect, curled, often the young twigs clearly more densely pubescent than the twigs of last year's growth; terminal buds glabrous or pubescent, often protected by bracts and in that case twigs with scars of fallen bracts at the base of seasonal growth. Leaves 4-10 × 1.5-5 cm, alternate, firmly chartaceous, narrowly elliptic, elliptic or ovate-elliptic, rarely lanceolate; the base acute or rounded, the margin flat, the apex acute; upper surface glabrous or sparsely pubescent with erect hairs; lower surface glaucous or green, glabrous, appressed pubescent or tomentose, sometimes the lower surface completely covered by the tomentose indument; pinnately or obscurely tripliveined, midrib, lateral veins and the finely reticulate tertiary venation

weakly raised on the upper surface, midrib raised or weakly raised, lateral veins and tertiary venation more or less immersed on the lower surface; lateral veins 4-8, sometimes difficult to discern; petioles 0.5-2.5 cm, flat or canaliculate above, with a similar indument as the twigs. Inflorescences 1-1.8 cm, consisting of a single umbel surrounded by decussate bracts which are deciduous at anthesis; umbels with 5-7 flowers, with sometimes one flower separated from the central group of flowers by a bract; umbels single in the axils of leaves or several along short, leafless shoots on the axils of leaves, these shoots with a terminal vegetative bud; umbel stalk glabrous or variously pubescent. Flowers unisexual, 5 mm in diameter, yellow or white, pedicels c. 2 mm, glabrous to densely pubescent; male flowers: tepals 6, c. 2 mm, glabrous or nearly so, shortly united at the base, spreading at anthesis, stamens 9, all 4-celled, opening introrse, 2.5-3 mm, the anther 1.3-1.7 mm, glands present at the base of the inner 3 stamens, staminodia as long as the glands, stipitiform; pistillode present, 1 mm, glabrous, receptacle glabrous inside; pistillate flowers: staminodia 9, c. 1.4 mm, threadlike, glands present at the base of the inner 3 staminodia, pistil 2 mm, glabrous, the style as long as the ovary, stigma discoid, conspicuous, receptacle glabrous inside. Fruits roundish, to c. 1.3 cm in diameter, seated on a small, disc-like cupule, this 5 mm in diameter, the floral parts persisting in young fruits, but eventually breaking off. *Semi-evergreen and evergreen montane forests*. Ch (Breedlove 9591, MO); G (Contreras 11033, MO); ES (Calderon 2456, MO); H (House 1190, MO); CR (Morales 4241, MO). 800-2500 m. (Mexico, Mesoamerica.)

As accepted here, *Litsea glaucescens* is a very variable species, but easily recognized by its unisexual flowers arranged in umbels. Several species and varieties have been recognized by earlier authors, based on variation in indument (glabrous or nearly glabrous plants placed in *L. glaucescens* s. str., plants with tomentose indument on the leaves placed in *L. neesiana* or *L. orizabae*, plants with strigose indument in *L. guatemalensis*), lower leaf surface glaucous or not (not glaucous in *L. flavescens*), arrangement of umbels (umbels single or 2-3 together in *L. glaucescens* var. *subsolitaria*, arranged along leafless short shoots in other taxa). It is possible to recognize several taxa which differ in only one character, but because these one character taxa vary widely in other characters and distribution, it seems best to accept only one variable species. When looking at the extremes only, this solution appears wrong; glabrous, tripliveined plants as

Breedlove 37058 (MO) look entirely different from *House 1190* (MO), which has the lower leaf surface completely covered by a tomentose indument and which has pinnately veined leaves. However, the number of intermediate specimens is far greater than the number of extremes.

12. *Nectandra* Rolander ex Rottboell

By H. van der Werff.

Trees or shrubs. Leaves alternate, rarely opposite (*N. oppositifolia*), pinnately veined, axillary tufts of hairs or domatia sometimes present. Inflorescences cymosely paniculate, lateral flowers of a cyme always strictly opposite. Flowers bisexual; tepals 6, equal, papillose on the inner surface, united at the base and falling as a unit in old flowers; stamens 9, in 3 whorls of three, 4-celled, the cells arranged in an arc or rarely in 2 pairs, inner 3 stamens with 2 glands at the base of the filaments; staminodes 3, small. Fruit seated on a shallow or cup-shaped cupule, this with a single margin. 114 spp..

Neotropics.

Nectandra has been traditionally separated from *Ocotea* by the position of the anthercells (in an arc in *Nectandra*, in 2 pairs in *Ocotea*). This character works quite well for the species with nearly sessile anthers with a sterile tip. This group of species forms the majority of *Nectandra*, but is rather poorly represented in Mesoamerica. Most Mesoamerican species have small anthers with the cells not clearly arranged in an arc. More useful characters to separate those *Nectandra* species from *Ocotea* are the following: *Nectandra* species have the inner surface of the tepals papillose (sometimes also pubescent near the base), whereas *Ocotea* species have the inner surface of the tepals pubescent or glabrous, but not papillose (species of the *Ocotea helicterifolia* group often have the margin of the tepals papillose, but not the inner surface) and in *Nectandra* the tepals are united at the very base and fall off as a unit, whereas in *Ocotea* species the tepals are free and fall off individually. Thus, young fruits of *Nectandra* lack tepals at the cupule, while in *Ocotea* tepals may persist on the cupule. Unfortunately, exceptions occur. A few species placed in *Ocotea* have papillose anthers with a conspicuous sterile tip but with the anther cells placed in 2 pairs.

Bibliography: Rohwer, J. *Fl. Neotrop.* 60: 1-333 (1993).

1. Anther cells arranged in two pairs and anthers large, 1.4-2.5 mm; flowers pink.
2. Outer stamens dorsally pubescent. **10. N. leucocome**
2. Outer stamens dorsally glabrous. **1. N. ambiguens**
1. Anther cells arranged in a shallow arc or, if more or less in two pairs, anthers much smaller; flowers white or greenish white.
3. Connective of the anthers prolonged beyond the anther cells into a sterile, usually triangular tip; base of tepals never pubescent at inner surface.
4. Leaves opposite or subopposite. **19. N. oppositifolia**
4. Leaves alternate.
5. Base of the leaves with reflexed lobes. **22. N. reticulata**
5. Base of leaves flat or inrolled, but never with reflexed lobes.
6. Lower leaf surface with erect hairs. **2. N. belizensis**
6. Lower leaf surface with appressed hairs or glabrous.
7. Indument on young twigs rather dense, largely obscuring the surface.
8. Lateral veins 3-6 pair. **21. N. ramonensis**
8. Lateral veins 7-13 pairs. **11. N. lineata**
7. Indument on young twigs rather sparse, the surface largely visible.
9. Flowers 4-7 mm in diameter; sterile tip of the anthers inconspicuous. **28. N. turbacensis**
9. Flowers 6-11 mm in diameter; sterile tip of anthers well developed. **8. N. hihua**
3. Connective of the anthers not prolonged beyond the anther cells, anther cells occupying almost the entire anther; base of tepals sometimes pubescent at inner surface.
10. Leaf base inrolled and flowers large, 8 mm or more in diameter. **24. N. rudis**
10. Leaf base plane or if somewhat inrolled, flowers smaller.
11. Lower leaf surface with predominantly erect hairs.
12. Leaves 14-22 cm, uniformly erect-pubescent on lower surface; ovary and young fruit pubescent; flowers 7-9 mm in diameter. **23. N. roberto-andinoi**

12. Leaves 5-12 cm, erect indument mostly confined to major veins on lower surface; ovary and fruits glabrous; flowers 4-6.5 mm in diameter. **12. N. longicaudata**
11. Lower leaf surface with predominantly appressed hairs or glabrous.
13. Filaments of stamens glabrous or nearly so.
14. Young twigs densely pubescent, the indument completely covering the surface.
15. Inner surface of the tepals and stamens sparsely papillose; leaves lanceolate or narrowly ovate, gradually tapering in a long apex. **7. N. cuspidata**
15. Inner surface of the tepals and stamens densely papillose; leaves elliptic, without a long tapering apex. **4. N. cissiflora**
14. Young twigs moderately or sparsely pubescent, the surface always partially visible.
16. Inner surface of the tepals hairy at the base; if sparsely hairy, the anthers with the cells arranged nearly in two pairs.
17. Mature leaves to 3 cm wide, 3-5.5 times longer than wide. **26. N. salicina**
17. Mature leaves 4-11 cm wide, 1.5-3 times longer than wide. **20. N. purpurea**
16. Inner surface of the tepals without hairs at the base or if a few hairs present, then the anther cells arranged in a shallow arc.
18. Small tufts of hairs present in the axils of some of the lateral veins; leaves glaucous below. **9. N. hypoleuca**
18. Axillary tufts of hairs lacking; leaves not glaucous below. **16. N. membranacea**
13. Filaments hairy, at least on the adaxial side of the outer stamens.
19. Anthers of the outer 6 stamens 0.7-1.0 mm.
20. Mature leaves 1-4 cm wide.
21. Young twigs sparsely pubescent or glabrous. Axillary tufts of hairs lacking on lower leaf surface. **26. N. salicina**
21. Young twigs with a rather dense indument of brownish hairs. Axillary tufts of hairs usually present on lower leaf surface. **27. N. smithii**
20. Mature leaves 5-10 cm wide.
22. Flowers densely white pubescent outside, the indument covering the surface completely. **17. N. miraflores**
22. Flowers inconspicuously pubescent outside, the surface largely visible between the pubescence. **6. N. cufodontisii**

19. Anthers of the outer 6 stamens 0.3-0.5 mm.

23. Anther cells arranged nearly in two pairs or the lower two much larger than the upper two. Filaments $\frac{3}{5}$ the length of the anther or longer. Tepals elliptic.

20. N. purpurea

23. Anther cells arranged in an arc, all about the same size. Filaments less than half as long as the anthers. Tepals elongate.

24. Hairs on vegetative buds and young twigs whitish or pale yellowish or sparse to absent.

25. Twigs 3-5 mm thick 5 cm below the terminal bud and at least some of the petioles more than 17 mm.

14. N. lundellii

25. Twigs less than 3 mm thick 5 cm below the terminal bud; if thicker than 3 mm, petioles shorter.

26. Indument on flower buds dense, white, completely covering the surface; lower leaf surface with some appressed, rather long hairs.

15. N. martinicensis

26. Indument on flower buds moderately dense to sparse, not conspicuously white, the surface visible between the hairs; lower leaf surface with some short, appressed hairs, or glabrous.

27. Young fruits puberulous; flowers sparsely pubescent.

13. N. longipetiolata

27. Young fruits glabrous; flowers moderately or densely pubescent.

28. Inflorescences in the axils of cataphylls, arranged along leafless shortshoots or below the terminal buds.

5. N. coriacea

28. Inflorescences in the axils of normal leaves, sometimes also in the axils of cataphylls, but not arranged along leafless shortshoots.

25. N. salicifolia

24. Hairs on vegetative buds and young twigs brownish or reddish, usually (moderately) dense; if greyish brown, then very dense and persistent.

29. Most leaves up to two times longer than wide; upper and lower leaf surfaces discoloured, the upper surface grey green, the lower dark brown.

3. N. bicolor

29. Most leaves more than twice as long as wide; if upper and lower leaf surfaces discoloured, then the upper surface darker than the lower surface.

30. Indument on young twigs relatively long (many hairs more than 0.3 mm) and dense (epidermis either completely covered or only visible when hairs are erect or ascending).

31. Gland dots (collapsed oil cells) on upper surface forming a distinct pinprick pattern.

Midrib slightly raised on upper leaf surface.

29. N. umbrosa

31. Gland dots on upper surface not visible to distinct, but not forming a distinct pinprick pattern. Midrib not raised on upper leaf surface.

32. Indument not completely covering the surface of young twigs, but partly visible between the erect or ascending hairs. Lower leaf surface frequently with erect hairs, this best visible on midrib or lateral veins.

12. N. longicaudata

32. Indument completely covering the surface of young twigs. Lower leaf surface with appressed hairs or glabrous.

18.N. nitida

30. Indument on young twigs short (hairs not longer than 0.2 mm) or, if longer, the surface of the twigs visible between the appressed hairs.

33. Pistil frequently more or less pubescent. Midrib slightly raised on the upper leaf surface. Gland dots forming a distinct pinprick pattern. From Costa Rica southwards.

29. N. umbrosa

33. Pistil glabrous. Midrib immersed on the upper surface. Gland dots, if visible, rather widely spaced and not forming a close pinprick patter. From Nicaragua northwards.

25. N. salicifolia

1. Nectandra ambigens (Blake) C.K. Allen, *J. Arnold Arbor.* 26: 371 (1945).
Phoebe ambigens Blake. *Contr. U.S. Natl. Herb.* 24: 3 (1922). Holotype: Honduras,
Whitford & Stadtmiller 7 (US).

Nectandra venosissima Lundell, *Ocotea venosissima* (Lundell) Lundell.

Trees, 30 m. Twigs angular, moderately to sparsely appressed pubescent, soon becoming glabrous; terminal buds densely appressed pubescent. Leaves 8-20 × 2.2-6 cm, chartaceous, (narrowly) elliptic, the base acute, the apex acute or obtuse, the margins flat or nearly so; the midrib and lateral veins slightly raised on the upper surface, more so on lower surface; tertiary venation distinctly raised on both surfaces, reticulate; both surfaces glabrous or with some appressed hairs below, axillary tufts of hairs present in axils of the lowermost lateral veins; lateral veins 5-8 pairs; oil cells visible or weakly visible on upper surface, not visible on lower surface; petioles 10-25 mm, with similar indument as the twigs. Inflorescences 10-18 cm, in axils of normal leaves, sparsely

appressed pubescent, the indument becoming denser and more erect towards the flowers. Flowers 11-18 mm in diameter, pink. Tepals 4.5-6.5 mm, spreading, broadly elliptic, densely white- pubescent outside, densely papillose and with some pubescence near the base inside; stamens 1.8-2.5 mm, the filaments to 0.5 mm, pubescent, the anthers weakly papillose; pistil 1.5-2.0 mm, glabrous, receptacle rather shallow, glabrous or nearly so inside. Fruit 14-22 × 12-16 mm, cupule 11-13 mm in diameter, c. 5 mm high, shallowly bowl-shaped and longitudinally ridged. *Lowland rain forests*. G (*Contreras 6915*, MO); H (*Hazlett 3104*, MO). 50-500 m. (Mexico [Veracruz], Mesoamerica.)

This species and *Nectandra leucome* are distinctive in their large, pink flowers, and large anthers with the cells arranged in two pairs. *Nectandra leucome* differs in having pubescent anthers and more densely pubescent twigs and inflorescences.

2. *Nectandra belizensis* (Lundell) C.K. Allen, *J. Arnold Arbor.* 26: 400 (1945). *Phoebe belizensis* Lundell, *Contr. Univ. Michigan Herb.* 6: 20 (1941). Isotype: Belize, *Gentle 3304* (MO!).

Nectandra schippii C.K. Allen.

Trees, 16 m. Twigs terete or slightly angular, densely brown tomentose; terminal buds densely brown tomentose. Leaves 8-20 × 3-8 cm, chartaceous, elliptic to oblong, the base obtuse or infrequently attenuate and at the very base obtuse, the apex shortly acuminate or acute, the margin plane; midrib, lateral veins and tertiary venation immersed on upper surface, raised on lower surface; upper surface glabrous except the pubescent midrib and some hairs on the lateral veins, lower surface pubescent, hairs erect, the surface mostly visible, pubescence denser along the lateral veins and tomentose along the midrib, axillary tufts of hairs sometimes present; lateral veins 6-9 pairs; gland dots not visible on mature leaves; petioles 5-11 mm, densely pubescent. Inflorescences 5-12 cm, in axils of cataphylls or normal leaves, (densely) tomentose. Flowers 5-8 mm in diameter, white. Tepals 2.2-3.2 mm, elliptic, spreading, sparsely to moderately pubescent outside, weakly papillose inside; stamens c. 0.8 mm, papillose, without hairs, the anther cells in a shallow arc; pistil c. 1.4 mm, glabrous; receptacle bowl-shaped, pubescent inside. Fruit 8 × 6 mm, cupule 5 × 7 mm, cup-shaped. *Lowland rain forests*. B (*Gentle*

3281, MO); CR (*Utley & Utley 4046*, MO); P (*Galdames 2599*, MO). 0-300 m. (Mesoamerica, Colombia).

Characteristic are the tomentose twigs, leaves with erect pubescence and anthers with a sterile tip. Specimens of *Nectandra reticulata* with poorly developed lobes at the base of the leaves differ in having much more densely pubescent flowers.

3. *Nectandra bicolor* Rohwer, *Fl. Neotrop.* 60: 79 (1993). Isotype: Panama, *McPherson 9804* (MO). Illustr.: Rohwer, J.G., *Fl. Neotrop.* 60: 79, t. 20 (1993).

Small trees, to 10 m. Twigs more or less angled, rather densely appressed brown pubescent, but soon becoming glabrous with age; terminal buds densely brown pubescent. Leaves 3-6 cm, firmly chartaceous, (broadly) elliptic; the base obtuse, less frequently acute, the apex obtuse or bluntly acuminate, the margin slightly recurved; midrib and lateral veins more or less immersed, tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface; the upper surface glabrous or with some appressed hairs at the base of the midrib, the lower surface with some appressed hairs, especially near the base, or glabrous; lateral veins 3-5 pairs; gland dots not visible on mature leaves; axillary tufts of hair present; petioles 3-6 mm, with similar indument as the twigs. Inflorescences 5-8 cm, in the axils of normal leaves, sparsely to moderately appressed pubescent. Flowers 4.5-6 mm in diameter, white. Tepals 1.7-2.5 mm, moderately appressed pubescent on the outside, papillose and hairy towards the base on the inside; stamens c. 0.8 mm, the pubescent filament c. 0.3 mm, the anthers glabrous or with a few hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil c. 1 mm, glabrous, the receptacle shallow, with a few hairs inside. Fruit c. 18 × 8 mm, the cupule shallow, c. 7 mm in diameter, gradually narrowed in the pedicel. *Cloud forest*. P (*McPherson 9741*, MO). 800-1000 m. (Endemic.)

Nectandra bicolor can be recognized by its leaves, bicolorous with the upper surface lighter in color than the lower surface, and relatively broad, not more than twice as long as wide. It is restricted to cloud forests on Cerro Jefe in Panama.

4. *Nectandra cissiflora* Nees, *Syst. Laurin.* 296 (1836). Lectotype (designated by Rohwer, 1993): Peru, *Poeppig 3061* (GZU). Illustr.: Allen, C.K., *Ann. Missouri Bot. Gard.* 35: 59 t. 37 (1948) (as *Nectandra paulii*).

Nectandra paulii C.K. Allen.

Trees, to 35 m. Twigs distinctly ridged, densely pubescent, the hairs appressed or ascending, the surface completely covered; terminal buds densely pubescent. Leaves 10-25 × 4-11 cm, elliptic to slightly obovate, chartaceous; base acute to obtuse, apex acute or acuminate, margin plane or recurved at the base; midrib, lateral veins and tertiary venation immersed on upper surface, midrib and lateral veins raised on lower surface, tertiary venation immersed or nearly so; upper surface glabrous or with some appressed hairs along the major veins and midrib, lower surface sparsely appressed pubescent, more densely along the major veins; lateral veins 6-10 pairs; gland dots not visible; axillary tufts of hairs not present; petioles 10-25 mm, with similar indument as the twigs.

Inflorescences 8-35 cm, in the axils of normal leaves or cataphylls, moderately to densely pubescent, the hairs appressed or erect. Flowers 3.3-5 mm in diameter, white. Tepals 1-2 mm, the outside more or less appressed pubescent, the inside densely papillose without hairs at the base, more or less spreading; stamens to 0.7 mm, densely papillose, the filaments very short, without hairs, the anthers broad, slightly emarginate, a sterile tip lacking, the anther cells filling the entire anther; pistil c. 1 mm, glabrous; receptacle shallow, glabrous inside. Fruit 13-18 × 7-15 mm, cupule c. 10 mm in diameter, shallowly bowl-shaped. *Wet forests.* Ch (*Martinez S. 18186*, MO); G (*von Tuerckheim 8262*, MO); H (*Hawkins & Merello 781*, MO); CR (*Hammel 11168*, MO); P (*Croat 14989*, MO).

100-1000 m. (Mexico [Veracruz], Mesoamerica, Guyanas, Ecuador, Peru, Brazil, Bolivia.)

Distinctive are the densely pubescent, clearly ridged twigs.

5. *Nectandra coriacea* (Sw.) Grisebach, *Fl. Brit. W. I.* 281 (1860). *Laurus coriacea* Sw., *Prodr.* 65 (1788). Holotype: Jamaica, *Swartz s.n.* (S).

Nectandra willdenoviana Nees, *Ocotea coriacea* (Sw.) Britton, *O. lundellii* Standley.

Shrubs or small trees, to 15 m. Twigs roundish or somewhat ridged, initially moderately or sparsely appressed pubescent, soon glabrescent, terminal buds white appressed pubescent. Leaves 6-14 × 2-6 cm, firmly chartaceous, elliptic to lanceolate; the base acute to obtuse, the apex acute or somewhat acuminate, the margin flat; midrib and lateral veins immersed, tertiary venation (slightly) raised on the upper surface, midrib raised, lateral veins and tertiary venation slightly raised on the lower surface; upper surface glabrous, lower surface glabrous or with a few appressed hairs; lateral veins 5-8 pairs; gland dots not or poorly visible; axillary tufts of hair usually lacking in mesoamerican specimens; petioles 4-12 mm, glabrous. Inflorescences 2-10 cm, in axils of cataphylls, below the terminal buds or along leafless shortshoots, infrequently also in the axils of normal leaves, moderately sparse appressed pubescent to glabrous. Flowers 4-8 mm in diameter, white, fragrant. Tepals 2-4 mm, sparsely pubescent or towards the tip papillose outside, papillose and with some hairs towards the base inside; stamens 0.5-0.8 mm, including a pubescent filament 0.1-0.3 mm, the anthers sparsely papillose and often abaxially with some hairs, the anther cells in a shallow arc, a sterile tip lacking; pistil 1-1.3 mm, glabrous, the receptacle shallow, glabrous or nearly so. Fruit 9-18 × 7-11 mm, cupule shallowly bowl-shaped, to 7 mm in diameter. *Seasonally dry forests on limestone derived soils.* Y (Cabrera 11357 bis, MO); C (Cabrera 2460, MO); QR (Cabrera 2564, MO); B (Gentle 1206, MO); G (Contreras 9045, MO); H (Gaumer 54, US). 0-500 m (very few collections with altitude mentioned). (United States, Mesoamerica, Colombia, Bahamas, Cuba, Cayman Islands, Jamaica, Haiti, Dominican Republic, Puerto Rico, Virgin Islands, Leeward Islands, Windward Islands.)

Nectandra coriacea resembles *N. salicifolia* closely, but differs mainly in having the inflorescences in the axils of cataphylls. The bark of herbarium specimens is frequently quite pale, more so than in *N. salicifolia*. Also, the two species have a different distribution; *N. coriacea* occurs in dry forests on limestone derived soils in the Yucatan peninsula, and adjacent Belize and Guatemala (the single collections from Honduras and Colombia come from caribbean islands), while *N. salicifolia* is more common on non-limestone derived soils farther away from the coasts.

6. *Nectandra cufodontisii* (O.C. Schmidt) C.K. Allen, *J. Arnold Arbor.* 26: 393 (1945). *Ocotea cufodontisii* O.C. Schmidt, *Arch. Bot.* 11: 50 (1935). Isotype: *Cufodontis 315* (F).

Ocotea seibertii C.K. Allen.

Trees, to 25 m. Twigs angular, sparsely appressed pubescent, glabrescent with age; terminal buds densely appressed pubescent. Leaves 10-25 × 5-10 cm, elliptic, firmly chartaceous; the base acute to obtuse, the apex acute or acuminate, the margin flat; midrib and lateral veins immersed or weakly raised on the upper leaf surface, tertiary venation raised; midrib, lateral veins and tertiary venation raised on the lower surface; upper surface glabrous, lower surface glabrous or with a few appressed hairs; lateral veins 5-7 pairs; gland dots not visible on mature leaves; small axillary tufts of hair present or lacking; petioles 8-25 mm, with similar indument as the twigs. Inflorescences 5-20 cm, in the axils of normal leaves or cataphylls, at the base sparsely, towards the tip moderately appressed pubescent. Flowers 4.5-6 mm in diameter, white or yellowish. Tepals 1.6-2.2 mm, moderately appressed pubescent, the surface visible between the hairs on the outside, densely papillose and towards the base pubescent on the inside; stamens 1-1.4 mm, the hairy filaments to c. 0.4 mm, the anthers sparsely papillose to glabrous, the anther cells in a shallow arc; a sterile tip absent; pistil 1.5-2 mm, glabrous; receptacle bowl-shaped, glabrous or with a few appressed hairs inside. Fruits 20-30 × 17-27 mm, cupule at maturity platelike, c. 1 cm in diam, lenticellate, petiole not swollen. *Montane forests.* CR (*Hammel & Grayum 14088*, MO); P (*Lao 351*, MO). 1300-2700 . (Endemic).

Nectandra cufodontisii is vegetatively similar to *N. mirafloris*; differences are discussed under the latter species. The montane habitat, often lustrous leaves with raised tertiary venation and the moderately to sparsely pubescent flowers are good characters for *N. cufodontisii*.

7. *Nectandra cuspidata* Nees & Martius, *Syst. Laurin.* 330 (1836). Lectotype (designated by Rohwer, 1993): Brazil, *Martius s.n.* (M). Illustr.: Allen, C.K., *Ann. Missouri Bot. Gard.* 35: 47 t.29 (1948) (as *Nectandra gentlei*)

Nectandra gentlei Lundell, *N. membranacea* (Sw.) Griseb. ssp. *cuspidata* (Nees) Rohwer.

Trees, to 30 m. Twigs terete or slightly angular, densely brown pubescent, the indument consisting of very short, erect hairs with a smaller number of longer, erect hairs, the longer hairs often wearing off with age, the indument covering the surface of young twigs entirely; terminal buds densely brown pubescent. Leaves 8-18 × 1.5-6 cm, lanceolate, ovate-lanceolate or elliptic, chartaceous; base acute, apex gradually tapering into a long tip, margin at the base usually recurved or inrolled; upper surface moderately and minutely appressed pubescent to glabrous, lower surface moderately to densely, but often inconspicuously appressed pubescent, the indument denser along the midrib; midrib, lateral veins and tertiary venation immersed on upper surface, midrib and lateral veins raised, tertiary venation immersed on lower surface; lateral veins 3-7 pairs; gland dots usually not visible; axillary tufts of hairs not present; petioles 4-15 mm, with similar indument as the twigs. Inflorescences 4-14 cm, moderately to sparsely pubescent, the hairs erect to appressed. Flowers 3-4 mm in diameter, white or yellow-green. Tepals 1.2-2 mm, (sparsely) appressed pubescent outside, sparsely papillose and without hairs inside, spreading; stamens c. 0.7 mm, papillose at the tip, otherwise glabrous, sterile tip not present, the anther cells arranged in an arc; pistil c. 1.4 mm, glabrous; receptacle urceolate, glabrous inside. Fruit 8-14 × 6-10 mm, cupule c. 6 mm in diameter, shallowly bowl-shaped. *Various vegetation types*. T (*Conrad 2983*, MO); Ch (*Martinez S. 8271*, MO); B (*Davidse & Brant 32328*, MO); G (*Martinez S. 22693*, MO); H (*Standley 54734*, F); N (*Little 25144*, MO); P (*de Nevers 6098*, MO). 100-1200 m. (Mexico [Oaxaca, Veracruz], Mesoamerica, Colombia, Venezuela, Guyana, Suriname, Ecuador, Peru, Bolivia, Brazil, Paraguay.)

Nectandra cuspidata is very similar to narrow-leaved specimens of *Nectandra membranacea* and the two are often confused. They are best separated by the indument on the twigs: very dense, with short, erect and longer erect hairs in *N. cuspidata*, and sparser, with mostly appressed hairs in *N. membranacea*.

8. *Nectandra hihua* (Ruiz & Pavon) Rohwer, *Fl. Neotrop.* 60: 196 (1993).
Laurus hihua Ruiz & Pavon, *Fl. Peruv.* 4: t. 366 (1804). Holotype: Ecuador, *Ruiz & Pavon s.n.* (MA).

Nectandra albiflora Lundell, *N. glabrescens* Bentham, *Sassafridium macrophyllum* Rose.

Trees, to 40 m. Twigs more or less angular, sparsely and finely appressed pubescent, soon becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 10-30 × 3-12 cm, elliptic or oblong, chartaceous; base attenuate to obtuse, apex acuminate or acute, margin plane or inrolled near the base, midrib and lateral veins immersed on upper surface, raised on lower surface, tertiary venation immersed on both surfaces; uppersurface glabrous or, when immature, with scattered appressed hairs, these mostly along the midrib, lower surface glabrous or sparsely appressed pubescent; lateral veins 6-9 pairs; oil cells sometimes visible in immature leaves, not in mature leaves; axillary tufts of hairs present or absent; petioles 7-20 mm, glabrous or nearly so. Inflorescences 4-16 cm, usually in axils of normal leaves, sparsely appressed pubescent, the pubescence denser towards the flowers. Flowers 6-11 mm in diameter, white. Tepals 2-5 mm, spreading, elliptic, moderately to sparsely appressed pubescent outside, densely papillose inside, without hairs at the base; stamens 1-1.4 mm, papillose, with a sterile tip, the anther cells in a shallow arc; pistil 1-1.5 mm, glabrous; receptacle cup-shaped, glabrous or with some appressed hairs inside. Fruit 9-13 × 9-11 mm, cupule 1-4 mm high, 5-10 mm in diameter, bowl-shaped. *Lowland and montane forests.* T (*Rovirosa* 35, US); Ch (*Breedlove* 48557, MO); C (*Cabrera* 14928, MO); B (*Gentle* 7787, MO); G (*Contreras* 8924, MO); H (*Gentry et al.* 7524, MO); ES (*Standley* 22225, MO); N (*Castro* 128, MO); CR (*Herrera* 4817, MO); P (*Croat* 12520, MO). 0-1300 m. (Mexico [Colima, Guerrero, Jalisco, Michoacan, Morelos, Nayarit, Oaxaca, Veracruz], Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Bolivia, Brazil, Paraguay, Cuba, Haiti, Dominican Republic, Puerto Rico, Jamaica.)

Nectandra hihua can be recognized by its sparsely pubescent twigs and rather large flowers with anthers with a sterile tip. It can be confused with *N. turbacensis*, which has a similar indument on its twigs, but which differs in having smaller flowers and a less developed sterile tip on the anthers. Fruits of *N. turbacensis* are usually seated in a clearly

cup-shaped cupule, whereas the cupule of *N. hihua* is shallowly bowl-shaped. *Nectandra turbacensis* may also have pit domatia, not just axillary tufts of hairs, but the pit domatia are not always developed. *Nectandra lineata* is also close, but differs in its more densely pubescent twigs and the type of axillary tufts of hair (in *N. hihua* these hairs generally sprout from the midrib and lateral veins and spread over the glabrous lamina spot, while in *N. lineata* the hairs generally sprout from the lamina).

The name *Nectandra globosa* has been frequently applied to *N. hihua*, but Rohwer (1993) found *N. globosa* to be a South American species.

Of the several syntypes of *Nectandra glabrescens*, most belong to *N. hihua*, but at least one, Barclay 2055 from Nicaragua, belongs to *N. lineata*. Rohwer (1993) selected as lectotype for *N. glabrescens* Beechey s.n. (K), which is *N. hihua* and *N. glabrescens* is therefore now a synonym of *N. hihua*.

9. *Nectandra hypoleuca* Hammel, *J. Arnold Arbor.* 67: 126 (1986). Isotype: Costa Rica, Hammel 9111 (MO).

Trees, to 15 m (rarely 30 m). Twigs ridged when young, terete when older, moderately appressed pubescent, sometimes with some longer, spreading hairs, glabrescent; terminal buds densely, more or less appressed pubescent. Leaves 10-28 × 5-10 cm, elliptic, chartaceous; base acute or obtuse, apex acuminate or acute, margin flat; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised on the lower surface, tertiary venation immersed or very inconspicuously raised on the lower surface; upper surface glabrous, lower surface sparsely appressed pubescent to glabrous, glaucous; lateral veins 5-8 pairs; gland dots visible above on young leaves, not visible on mature leaves; axillary tufts present; petioles 10-20 mm, with similar indument as the twigs. Inflorescences 4-20 cm, in the axils of cataphylls or normal leaves, sparsely to moderately more or less appressed pubescent. Flowers 4-5 mm in diameter, white, fragrant. Tepals 1.6-2.4 mm, half-erect, sparsely appressed pubescent outside, densely papillose inside, without hairs; stamens 0.6-1.0 mm, minutely papillose, the anther cells in a shallow arc or (in collections from the Osa Peninsula) the outer 6 anthers with 2 cells, a sterile tip lacking; pistil 1.2-1.6 mm, glabrous; receptacle cup-shaped, glabrous or nearly so inside. Fruit 15-20 × 7-10 mm,

cupule shallowly bowl-shaped, 6-10 mm in diameter. *Wet lowland forests*. CR (*Gentry 1118*, MO). 0-200 m. (Endemic.)

Nectandra hypoleuca is best recognized by its glaucous lower leaf surfaces and axillary tufts of hairs. Collections from the Pacific slope differ from those from the Atlantic slope in having the outer 6 stamens with 2-celled anthers (instead of the normal 4-celled anthers). Although this is a highly unusual feature, these specimens fit otherwise well in *N. hypoleuca* and I don't think it is necessary to create a new taxon for these specimens.

10. *Nectandra leucocome* Rohwer, *Fl. Neotrop.* 60: 90 (1993). Holotype: Mexico, A. Gomez P. 302 (US). Illustr.: Rohwer, J., *Fl. Neotrop.* 60: 91 (1993).

Trees, 30 m. Twigs angular, when young rather densely whitish pubescent with appressed to ascending hairs, slowly glabrescent; terminal buds densely appressed pubescent. Leaves 12-35 × 4-12 cm, (narrowly) elliptic to oblong, chartaceous, the base acute to attenuate, the apex shortly acuminate or acute, the margin flat, sometimes near the base slightly recurved; midrib and lateral veins immersed on upper surface, raised on lower surface, tertiary venation raised on both surfaces, reticulate, upper surface glabrous or with some appressed hairs, especially along the midrib, the lower surface sparsely appressed pubescent, axillary tufts of hairs not seen; lateral veins 6-12 pairs; glands dots visible on upper surface; petioles 11-22 mm, with similar indument as twigs. Inflorescences 10-20 cm, in axils of normal leaves, rather densely white-pubescent, the hairs erect, curly. Flowers 10-12 mm in diameter, pink. Tepals 3.5-4.3 mm, spreading, densely pubescent outside, densely papillose and with some hairs near the base inside; stamens c. 2 mm, the filaments 0.2-0.5 mm, pubescent, anthers dorsally pubescent, scarcely papillose, the cells in two rows, not filling the entire anther, but leaving a sterile margin; pistil c. 2 mm, glabrous; receptacle shallow, glabrous inside. Fruit 28-15 mm, cupule 12 × 8 mm, cup-shaped, longitudinally ridged. *Lowland rain forests*. Ch (*E. Martinez S. et al. 24809*, MO). 200-500 m. (Endemic.)

Characteristic are the large, pink flowers and the pubescent anthers. See also discussion under *Nectandra ambigens*.

11. *Nectandra lineata* (Kunth) Rohwer, *Fl. Neotrop.* 60: 209 (1993). *Ocotea lineata* Kunth in Humb., Bonpl. & Kunth, *Nov. Gen. Sp.* 2: 131 (1817). Holotype: Venezuela, *Humboldt & Bonpland s.n.* (P).

Nectandra amazonum Nees var. *oerstedii* Meissner, *N. fuscobarbata* (Mez) C.K. Allen, *N. glabrescens* Benth. var. *fuscobarbata* Mez, *N. petenensis* Lundell.

Trees, 30 m. Twigs more or less angular, rather densely minutely pubescent, the hairs appressed or frequently erect; terminal buds densely pubescent, the hairs minute and mostly erect. Leaves 10-25 × 4-8 cm, lanceolate to elliptic, chartaceous; base acute to obtuse, apex acuminate or acute, margin plane, but frequently recurved at the very base; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised on lower surface, tertiary venation weakly so; sparsely appressed pubescent on the upper surface, moderately to sparsely appressed pubescent on the lower surface, gradually glabrescent with age; lateral veins 7-13 pairs; oil cells rarely visible; axillary tufts of hair usually present; petioles 8-17 mm, when young densely, finely pubescent, glabrescent with age. Inflorescences 5-15 cm, in the axils of normal leaves, moderately densely pubescent, the hairs erect or appressed. Flowers 5-9 mm in diameter, white. Tepals 2-3.8 mm, elliptic, spreading, moderately pubescent outside, papillose inside, without hairs; stamens 0.8-1.4 mm, papillose, with a sterile tip, the anther cells arranged in a shallow arc; pistil 1-1.4 mm, glabrous; receptacle cup-shaped, glabrous or with a few appressed hairs. Fruit 10-12 × 7-10 mm, cupule c. 6 mm in diameter, shallow, almost disk-like or to 1.5 mm deep. *Lowland or montane forests.* Ch (*Dominguez V. 219*, MO); G (*Lundell 17791*, MO); H (*Croat & Hannon 64130*, MO); ES (*Shannon 5003*, US); N (*Stevens 22619*, MO); CR (*Haber 262*, MO); P (*Croat 12848*, MO). 0-1300 m. (Mesoamerica, Colombia, Venezuela, Ecuador, Peru.)

Among the Mesoamerican species of *Nectandra*, *N. lineata* is best recognized by its rather densely pubescent twigs, leaves with relatively many lateral veins and its rather large flowers. Differences with *N. hihua* and *N. ramonensis* are discussed under these species. The name *N. globosa* has been frequently applied to this species.

12. *Nectandra longicaudata* (Lundell) C.K. Allen, *J. Arnold Arbor.* 26: 383 (1945). *Phoebe longicaudata* Lundell, *Bull. Torrey Bot. Club* 64: 548 (1937). Lectotype (designated by Rohwer, 1993): Belize, *Lundell 6833* (MICH).

Nectandra savannarum (Standley & Steyermark) C.K. Allen, *Phoebe savannarum* Standley & Steyermark

Small trees, to 10 m. Twigs somewhat ridged, moderately pubescent with erect or ascending hairs, the surface of the twigs visible, (soon) glabrescent; terminal buds densely pubescent. Leaves 5-10 × 2-4.5 cm, chartaceous, (narrowly) elliptic, the base acute or obtuse, the apex acuminate, the margin flat or slightly recurved; midrib, lateral veins and tertiary venation immersed or tertiary venation slightly raised on the upper surface, midrib and lateral veins rather prominently raised, tertiary venation slightly raised on the lower surface; upper surface glabrous or with some appressed hairs, lower surface very sparsely pubescent with mostly erect or ascending hairs, these best visible along midrib and lateral veins, to glabrous; lateral veins 3-5 pairs; gland dots visible or not; axillary tufts of hair present; petioles 4-10 mm, with a similar indument as the twigs. Inflorescences 2-7 cm, in the axils of normal leaves or cataphylls, sparsely to moderately pubescent with erect or ascending hairs. Flowers 4.5-6.5 mm in diameter, white. Tepals 1.7-3 mm, spreading, sparsely or moderately appressed pubescent outside, papillose with some hairs towards the base inside; stamens 0.5-0.8 mm, the hairy filaments c. 0.2 mm, anthers glabrous or with some hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil 1-1.2 mm, glabrous; receptacle shallow, pubescent inside. Fruit 10-20 × 8-10 mm, cupule bowl-shaped, to 6 mm in diameter, the pedicel somewhat thickened. *Evergreen forests.* Ch (Martinez S. 18221, MO); B (Gentle 8651, MO); G (Marshall et al. 431, MO); H (Yuncker et al. 8762, MO). 0-300 m. (Mexico, Mesoamerica).

Nectandra longicaudata is best recognized by the combination of erect or ascending hairs which do not cover the surface completely, on the twigs and the erect or ascending hairs on the lower leaf surface, especially on the midrib and lateral veins. Specimens with a denser indument on the twigs approach *N. nitida*, but the latter species has only appressed hairs on the lower leaf surface, while specimens of *N. longicaudata* with a dense indument show clearly erect or ascending hairs on the lower leaf surface.

13. *Nectandra longipetiolata* van der Werff, *Fieldiana Bot. N.S.* 23: 60 (1990).

Holotype: Costa Rica, *Grayum & Hammel 5769* (MO).

Small trees, to 8 m. Twigs roundish, with some appressed hairs immediately below the tip, very soon glabrescent; terminal buds appressed pubescent. Leaves 9-17 × 5-8 cm, (broadly) elliptic, chartaceous; the base obtuse or acute, the apex acute, the margin flat; the midrib immersed, lateral veins and tertiary venation raised on the upper surface, midrib prominently raised, lateral veins and tertiary venation raised on the lower surface; glabrous on both surfaces except for the occasional presence of axillary tufts of hairs; lateral veins 5-8 pairs; gland dots on mature leaves not visible; petioles 10-25 mm, glabrous. Inflorescences 3-7 cm, in the axils of cataphylls, glabrous or sparsely appressed pubescence, reddish. Flowers 6-7 mm in diameter, white. Tepals c. 2.5 mm, spreading to reflexed in old flowers, sparsely, minutely pubescent outside, papillose and towards the base somewhat hairy inside; stamens 0.8-1 mm, the filaments short, pubescent, the anthers glabrous or with a few hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil 1.2-1.4 mm, glabrous or finely and minutely papillose; receptacle bowl-shaped, glabrous inside. Fruit c. 18 × 10 mm, finely puberulous, cupule bowl-shaped, c. 7 mm in diameter, the peduncle swollen. *Wet lowland forest. CR (Herrera 2231, MO). 40-200 m. (Endemic.)*

Nectandra longipetiolata is a rare species, known from only 4 collections. Useful characters are the rather broad, pale green leaves with relatively long petioles, the few-flowered, sparsely pubescent to glabrous inflorescences, and the puberulous fruits. In Costa Rica, *N. umbrosa* can also have slightly puberulous fruits, but this species has clearly glanddotted leaves. The indument on the fruits remains visible on almost mature fruits, especially in the protected wrinkles of the surface.

14. *Nectandra lundellii* C.K. Allen, *J. Arnold Arbor.* 26: 381 (1945). *Persea*

gentlei Lundell, *Contr. Univ. Michigan Herb.* 6: 18 (1941). Isotype: Belize, *Gentle 3288* (F).

Phoebe gentlei (Lundell) Standley & Steyermark

Trees, mostly to 25 m but occasionally taller (to 45 m). Twigs angular, 3-6 mm in diameter 5 cm below the tip, moderately to densely appressed pubescent when young,

glabrescent with age; terminal buds densely appressed pubescent. Leaves 16-30 × 7-15 cm, elliptic, firmly chartaceous; the base acute to obtuse, the apex acuminate, the margin flat; midrib and lateral veins immersed or slightly raised, tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface; the upper surface glabrous and often lustrous, lower surface glabrous or sparsely appressed pubescent; lateral veins 7-14 pairs; gland dots not visible on mature leaves; axillary tufts of hair present or absent; petioles 15-25 mm, with similar indument as the twigs.

Inflorescences 8-20 cm, mostly in the axils of cataphylls, less frequently in the axils of normal leaves, sparsely to densely appressed pubescent. Flowers 5.5-8.5 mm in diameter, white, fragrant. Tepals 2-3.5 mm, elliptic to elongate, densely pubescent outside, densely papillose and hairy towards the base inside; stamens 0.7-0.9 mm, the filaments 0.2-0.3 mm, pubescent, the anthers papillose and with some hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil 1.2-1.5 mm, with a few hairs at the base, receptacle bowl-shaped, with some appressed hairs inside. Fruits 18-22 × 11-17 mm, cupule shallowly cup-shaped, c. 1 cm in diameter, the pedicel scarcely swollen. *Lowland rain forests*. Ch (González-Espinosa *et al.* 789, MO); B (Gentle 8670, MO); G (Lundell & Contreras 20683, MO); H (Hazlett 2767, MO). 100-500 m. (S. Mexico, Mesoamerica.)

Nectandra lundellii is best recognized by its rather large, lustrous leaves with raised reticulation, rather thick twigs and densely pubescent flowers. *Nectandra ambigens* occurs in the same area and has also rather large, lustrous leaves with raised reticulation. This species differs vegetatively in having narrower leaves and in its sparsely pubescent and quickly glabrescent twigs; the flowers of the two species are quite different, being much larger (ca. 1.5 cm in diameter) and pink (not white) in *N. ambigens*. Most specimens of *N. lundellii* from Mesoamerica lack axillary tufts of hair and have, when dry, rather dark green leaves, while specimens from Veracruz have usually axillary tufts of hair and, when dry, pale green leaves. There are several exceptions (plants from Veracruz with dark green leaves and without domatia, plants from Guatemala with pale green leaves without domatia and plants from Chiapas and Honduras with dark green leaves with domatia) and recognizing the specimens from Veracruz as a distinct taxon does therefore not seem justified.

15. *Nectandra martinicensis* Mez, *Mitt. Bot. Vereins Kreis Freiburg* 47/48: 421 (1888). Isolectotype: Trinidad, *Sieber 99* (MO).

Nectandra tabascensis Lundell, *N. woodsoniana* C.K. Allen, *Ocotea tabascensis* (Lundell) Howard

Trees, to 20 m. Twigs angular, moderately appressed or ascending pubescent, glabrescent with age; terminal buds densely white pubescent. Leaves 12-20 × 3.5-7 cm, narrowly elliptic, chartaceous; the base attenuate to obtuse, the apex acute or slightly acuminate, the margin flat; midrib immersed, lateral veins and tertiary venation raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; upper surface glabrous or with some appressed hairs at the base of the midrib, lower surface with some scattered, appressed hairs, these to 0.6 mm; lateral veins 7-11 pairs; gland dots on the upper surface visible in young leaves, indistinct on mature leaves and on lower leaf surface; axillary tufts of hair present; petioles 6-15 mm, with a similar indument as the twigs. Inflorescences 7-20 cm, mostly in the axils of normal leaves, infrequently in the axils of cataphylls, moderately to sparsely appressed pubescent. Flowers 4-6.5 mm in diameter, white. Tepals 2-2.8 mm, spreading, outside densely white pubescent, inside densely papillose and pubescent towards the base; stamens 0.6-0.8 mm, the hairy filament 0.2-0.3 mm, the anthers glabrous or the outer 3 with some hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil 1-1.5 mm, glabrous, receptacle bowl-shaped, glabrous inside or nearly so. Fruit 12-15 × 8-12 mm, cupule shallowly bowl-shaped, to 7 mm in diameter. *Evergeen forests*. T (*Matuda 3299*, F); Ch (*Mendez G. 9071*, MO); B (*sine coll. 14*, F); ES (*Calderon 1117*, MO); N (*Stevens 4727*, MO); CR (*Skutch 2634*, MO); P (*Croat 22484*, MO). 20-1000 m. (Mexico [Guerrero, Jalisco, Nayarit], Mesoamerica, Colombia, Venezuela, Ecuador.)

Nectandra martinicensis is best recognized by its densely white-pubescent buds and flowers, its generally non-lustrous leaves with some scattered, long hairs on the lower surface, and the quickly glabrescent twigs.

16. *Nectandra membranacea* (Sw.) Grisebach, *Fl. Brit. W.I.* 282 (1860). *Laurus membranacea* Sw., *Prodr.* 65. 1788. Holotype: Jamaica, *Swartz s.n.* (S). Illustr.: Allen, C.K., *Ann. Missouri Bot. Gard.* 35: 55 t. 34 (1948) (as *Nectandra standleyi*).

Nectandra skutchii C.K. Allen, *N. standleyi* C.K. Allen.

Trees, to 35 m. Twigs angular, moderately to sparsely pubescent, the hairs very short and predominantly appressed, the surface visible between the hairs; terminal buds densely appressed pubescent. Leaves 8-25 × 3-9 cm, elliptic, lanceolate or ovate-elliptic, chartaceous; base attenuate to rounded, apex acuminate, margin flat to inrolled (mostly revolute) at the base; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised on lower surface, tertiary venation inconspicuously raised or immersed on lower surface; upper and lower surface sparsely appressed pubescent to glabrous, the hairs denser along the major veins; lateral veins 3-7 pairs; gland dots usually not visible; axillary tufts of hairs lacking; petioles 5-15 mm, with similar indument as the twigs. Inflorescences 5-20 cm, in the axils of normal leaves, moderately to sparsely appressed pubescent. Flowers 3-5 mm in diameter, white or yellowish. Tepals 1.2-2 mm, moderately appressed pubescent, papillose and without hairs inside, spreading; stamens 0.6-0.8 mm, sparsely papillose, filaments not hairy, sterile tip of the anthers lacking; pistil 1.2-1.8 mm, glabrous; receptacle urceolate, glabrous or nearly so inside. Fruit 8-14 × 8-14 mm, cupule to 11 mm in diameter, shallow, frequently lenticellate. *Various habitats.* N (*Grijalva & Rios 3497a*, MO); CR (*Herrera 670*, MO); P (*Mori & Kallunki 2996*, MO). 100-1500 m. (Mexico [Veracruz], Mesoamerica, Colombia, Venezuela, Ecuador, Peru, Bolivia, Brazil, Cuba, Haiti, Dominican Republic, Puerto Rico, Jamaica, Leeward & Windward Islands, Trinidad, Tobago.)

Nectandra membranacea can be easily confused with *Nectandra cuspidata*; differences are discussed under the latter species.

17. *Nectandra miraflores* van der Werff, *Ann. Missouri Bot. Gard.* 75: 410 (1988). Holotype: Nicaragua, *Neill 329* (MO).

Trees or shrubs, to 15 m (rarely to 25 m). Twigs angular, sparsely appressed pubescent, glabrescent; terminal buds densely appressed pubescent, the hairs white. Leaves 10-23 × 5-10 cm, elliptic, firmly chartaceous; the base acute to obtuse, the apex acute; the margin flat; midrib and lateral veins immersed on the upper surface, the tertiary venation raised; midrib, lateral veins and tertiary venation raised on the lower surface; the upper surface or nearly so, lower surface with a few appressed hairs, soon

becoming glabrous; lateral veins 6-10 pairs; gland dots poorly or not visible; axillary tufts of hairs usually present; petioles 7-18 mm, with a similar indument as the twigs. Inflorescences 5-15 cm, in the axils of cataphylls or normal leaves, near the base sparsely appressed pubescent, the indument becoming denser towards the flowers. Flowers 7.5-9.5 mm in diameter, white. Tepals 2.2-3.5 mm, densely white pubescent outside, densely papillose inside, with some hairs towards the base; stamens 0.8-1.2 mm, papillose, with a short (to 0.2 mm), hairy filament, the cells arranged in a shallow arc, a sterile tip absent; the pistil c. 1.5 mm, glabrous, receptacle bowl-shaped, glabrous inside. Fruit 20-22 × 15-18 mm, cupule shallow to almost plate-like, 8 mm in diam, the pedicel swollen. *Montane forests*. N (*Moreno 472*, MO). 1200-1600 m. (Endemic).

Nectandra mirafloris can be recognized by its densely pubescent flowers and rather large leaves with clearly raised tertiary venation. It is restricted to montane forests in Nicaragua. *Nectandra cufodontisii*, known from Costa Rica and Panama, is vegetatively and in fruit very similar, and differs only from *N. mirafloris* in having sparsely pubescent flowers.

18. *Nectandra nitida* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 461 (1889).

Lectotype (designated by Rohwer, 1993): Panama, *Hayes 133* (K).

Nectandra glandulosa Lundell, *N. matudae* Lundell, *N. perdubia* Lundell, *Pleurothyrium glandulosum* (Lundell) Lundell.

Shrubs or trees to 25 m. Twigs initially angled or ridged, becoming roundish, densely brown, appressed or ascending pubescent, terminal buds densely brown pubescent. Leaves 7-22 × 2.5-7 cm, (narrowly) elliptic, chartaceous; the base attenuate to obtuse, the apex acuminate or acute, the margin flat; midrib, lateral veins and tertiary venation more or less immersed on the upper surface, midrib prominently raised, lateral veins raised and tertiary venation more or less immersed on the lower surface; upper surface glabrous or with some appressed hairs, especially towards the base, lower surface with small appressed hairs or nearly glabrous; lateral veins 4-8 pairs; gland dots visible or not; axillary tufts of hairs present; petioles 3-13 mm, with a similar indument as the twigs. Inflorescences 3-15 cm, in the axils of normal leaves or cataphylls, moderately (to densely) brown appressed pubescent. Flowers 3.5-6 mm in diameter, white. Tepals 1.5-3

mm, spreading, appressed pubescent outside, papillose and hairy towards the base inside; stamens 0.4-0.8 mm, the (sparsely) pubescent filaments c. 0.2 mm, the anthers glabrous or with a few hairs abaxially, the anther cells in an arc, a sterile tip lacking; pistil 1-1.4 mm, glabrous, receptacle shallow, glabrous or pubescent inside. Fruit 8-15 × 6-12 mm, cupule bowl-shaped, to 7 mm in diameter, pedicel thickened or not. *Evergreen or seasonally dry forests*. T (*Matuda 3576*, F); Ch (*Matuda 5934*, MO); QR (*Duran 2740*, MO); B (*Gentle 1692*, MO); G (*Harmon & Dwyer 2783*, MO); N (*Neill 1985*, MO); CR (*Pittier 11490*, F); P (*Croat 14601*, MO). 0-2000 m. (Mexico, Mesoamerica.)

Nectandra nitida is a common species from Nicaragua northwards and is best recognized by the combination of its densely, brownish pubescent twigs and the absence of the distinct pinprick pattern of the gland dots on the upper leaf surface. Its upper leaf surface is frequently lustrous. In Costa Rica and Panama *N. nitida* is largely replaced by *N. umbrosa*. I include in *N. nitida* *N. matudae*, a species kept separate by Rohwer (1993).

19. *Nectandra oppositifolia* Nees, *Linnaea* 8: 47 (1833). Lectotype (designated by Meissner, 1866): Brazil, *Sello 5722* (B).

Trees, 20 m. Twigs often somewhat flattened, ridged, densely reddish-brown tomentulose, terminal buds densely reddish-brown tomentulose. Leaves 10-25 × 3-9 cm, (narrowly) elliptic, chartaceous; base acute, rarely obtuse, the apex acuminate, the margin plane; midrib, lateral veins and tertiary venation immersed on upper surface, raised on lower surface; upper surface pubescent with short, erect, curly hairs, the indument denser along midrib and lateral veins, becoming glabrous with age, lower surface pubescent with short, erect, curly hairs, becoming reddish tomentulose along lateral veins and midrib, axillary tufts of hairs absent; lateral veins 8-12 pairs; gland dots not visible; petioles 8-20 mm, with similar indument as the twigs. Inflorescences 4-12 cm, in the axils of normal leaves, densely reddish-brown tomentulose. Flowers 9-12 mm in diameter, white; tepals 3.5-5 mm, spreading, densely reddish-brown pubescent outside, densely papillose inside without hairs near the base; stamens 1-2 mm, filaments very short, anthers densely papillose, with a large sterile tip, the cells in a shallow arc; pistil 1.8-3 mm, glabrous or the style papillose, the receptacle deeply urceolate, glabrous or with a few hairs inside. Fruit 13-15 × 11 mm, cupule 7-11 mm high, 13-17 mm in diameter, deeply cup-shaped.

Lowland rain forests. P (McDade 774, MO). Altitude unknown. (Mesoamerica, Colombia, Brazil.)

This is the only species of *Nectandra* in Mesoamerica with opposite or subopposite leaves. The few Panamanian collections are not typical, but intergrade with *Nectandra reticulata*. The latter species differs in its reflexed lobes at the base of the leaves.

20 *Nectandra purpurea* (Ruiz & Pavon) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 443 (1889). *Laurus purpurea* Ruiz & Pavon, *Fl. Peruv.* 4: t. 351 (1804). Isotype: Peru, Ruiz & Pavon s.n. (F).

Nectandra latifolia (Kunth) Mez, *N. polita* Nees var. *oerstedii* Meissner, *Ocotea flexuosa* Rusby.

Shrubs or trees to 20 m. Twigs somewhat angular, moderately to sparsely appressed pubescent, glabrescent; terminal buds densely appressed pubescent. Leaves 11-25 × 5-10 cm, elliptic, chartaceous; the base acute to obtuse-rounded, the apex acute or shortly acuminate; the margin flat; midrib and lateral veins immersed, tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on lower surface; upper surface glabrous, lower surface glabrous or with some appressed hairs; lateral veins 6-10 pairs; gland dots poorly or not visible; axillary tufts of hairs present or absent; petioles 4-14 mm, with a similar indument as the twig. Inflorescences 4-16 cm, in axils of normal leaves or cataphylls, moderately pubescent with appressed to ascending hairs. Flowers 3-5 mm in diameter, white. Tepals 1.2-2 mm, elliptic, spreading, the outside moderately to densely pubescent, sometimes somewhat papillose, especially the inner tepals, the inside papillose and towards the base pubescent; the stamens 0.8-1.1 mm, the glabrous or hairy filaments 0.3-0.6 mm, the anthers glabrous or with some papillae, the anther cells almost in two rows or with the lower two cells much greater than the upper two; a sterile tip lacking; pistil 1.1-1.6 mm, glabrous or nearly so; the receptacle bowl-shaped, glabrous or with a few hairs inside. Fruits 15-26 × 8-13 mm, cupule bowl-shaped or cup-shaped, 5-8 mm in diameter. *Evergreen forests*. N (*Oersted* 12, B); CR (*Grayum* 8898, MO); P (*Hammel et al.* 6874, MO). (Mesoamerica, Colombia, Venezuela, Guayana Francesa, Ecuador, Peru, Bolivia, Brazil.)

As with other species of the *Nectandra coriacea* complex, *N. purpurea* is not easy to identify. Its flowers have relatively short and wide tepals (length less than twice the width), stamens with relatively long filaments and anther cells arranged in an *Ocotea*-like fashion (the cells are almost in two rows rather than in an arc). Some populations cannot be placed with certainty, for instance specimens from Chiapas and Guatemala which have small flowers with *N. purpurea*-like stamens, but with more elongate tepals and narrower leaves. These specimens are intermediates between *N. purpurea* and *N. salicifolia* and may represent an undescribed species. Rohwer (1993) did not describe these as a new species because the *N. coriacea* complex is still poorly understood and I follow him in this. *Breedlove 28566* (MO) is a member of this group. Vegetatively, *N. purpurea* can resemble *N. cufodontisii* closely, but differs in its less coriaceous leaves ; its stamens with relatively long, glabrous filaments and with the anther cells arranged almost in 2 pairs separate the two species best.

Croat (1978) used the name *N. purpurascens*, an unpublished name, for collections from Barro Colorado island which are here placed under *N. umbrosa*.

21. *Nectandra ramonensis* Standley, *Publ. Field Mus. Nat. Hist. , Bot. Ser.* 18: 453 (1937). Holotype: Costa Rica, *Brenes 17018* (F). Illustr.: C.K. Allen, *Ann. Missouri Bot. Gard.* 35: 46 t. 28 (1948).

Trees, 20 m. Twigs angular, finely and rather densely pubescent, the hairs appressed or ascending, covering most or all of the surface when young, glabrescent with age; terminal buds densely pubescent. Leaves 5-13 × 2.5-5 cm, elliptic, (thinly) chartaceous; the base acute or attenuate, apex acuminate or acute, margin plane or slightly recurved near the base; midrib and lateral veins immersed on upper surface, raised on lower surface, tertiary venation immersed on both surfaces; upper surface with some appressed hairs, more so along the midrib, becoming glabrous with age, lower surface sparsely appressed pubescent, axillary tufts of hairs usually present; lateral veins 4-6 pairs; oil cells only visible in young leaves; petioles 3-12 mm, with similar indument as the twigs. Inflorescences 5-12 cm, in the axils of normal leaves, finely pubescent, the hairs ascending or erect. Flowers 7-10 mm in diameter, white or greenish white. Tepals 2.7-3.8 mm, spreading, moderately or sparsely appressed pubescent outside, densely

papillose inside, without hairs; stamens 1-1.5 mm, papillose, the filaments very short, anthers with a sterile tip, the anther cells in a shallow arc; pistil c. 1.2-1.7 mm, glabrous; receptacle bowl-shaped, with appressed hairs near the base, otherwise glabrous. Fruit 12-7 mm, cupule 5-6 mm high, 8 mm in diameter, cup-shaped. Moderately dry forests. CR (*Gomez et al.* 22697, MO); P (*Hammel 1783*, MO). 100-1500 m. (Endemic.)

Nectandra ramonensis is best recognized by its rather small leaves with few lateral veins and the fairly densely pubescent young twigs. The peduncles are quite long, usually twice as long as the branched part of the inflorescences.

22. *Nectandra reticulata* (Ruiz & Pavon) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 404 (1889). *Laurus reticulata* Ruiz & Pavon, *Fl. Peruv.* 4: t 348 (1804). Lectotype (designated by Rohwer, 1993): Peru, *Ruiz & Pavon s.n.* (MA). Illustr.: Ruiz & Pavon, *Fl. Peruv.* 4: t.348 (1804); Allen, *Ann. Missouri Bot. Gard.* 35: 60 (1948).

Trees, to 40 m. Twigs angular, densely brown tomentulose; terminal buds densely brown tomentulose. Leaves 14-35 × 5-11 cm, elliptic, chartaceous; base acute to rounded, apex acute or acuminate, margin reflexed near the base, forming two lobes; midrib, lateral veins and tertiary venation immersed on upper surface, clearly raised on lower surface; upper surface with erect, curly hairs, densely so along midrib, lower surface pubescent, the hairs erect, curly, the indument denser along the major veins, the leaf surface remaining visible; lateral veins 8-14 pairs; gland dots not visible; petioles 7-25 mm, with a similar indument as the twigs. Inflorescences 6-20 cm, brown tomentulose. Flowers 8-14 mm in diameter, white; tepals 3.5-6 mm, elliptic, spreading, outer 3 densely pubescent outside, inner 3 with a narrow, pubescent, central band, otherwise papillose, all 6 densely papillose inside, without hairs; stamens 1.2-2 mm, densely papillose, the filament very short, the anthers with a large sterile tip, the anther cells in a shallow arc; pistil 2-3 mm, mostly glabrous, but occasionally pubescent; receptacle deeply urceolate, densely pubescent inside. Fruit 9-20 × 6-11 mm, cupule 6-11 mm deep, 7-14 mm in diameter, cup-shaped. *Lowland and montane forests.* T (*Rovirosa 338*, NY); Ch (*Hernandez G. 2032*, MO); G (*Contreras 10441*, MO); H (*Record H 69*, US); N (*Moreno 18988*, MO); CR (*Liesner 5021*, MO); P (*McPherson 12232*, MO). 0-1700 m. (Mexico

[Veracruz, Oaxaca], Mesoamerica, Colombia, Venezuela, Suriname, French Guyana, Ecuador, Peru, Bolivia, Brazil.)

This species can even vegetatively be identified by its pubescent leaves with reflexed lobes at the base.

23. *Nectandra roberto-andinoi* (C. Nelson) C. Nelson, *Ceiba* 42(1): 35 (2001[2002]). *Pleurothyrium roberto-andinoi* C. Nelson, *Phytologia* 72(6): 402 (1992). Isotype: Honduras, *Nelson & Andino 13119* (MO).

Trees, 15 m. Twigs slightly angular or terete, densely brown pubescent, the hairs erect and completely covering the surface, the indument wearing off with age; terminal buds densely brown pubescent. Leaves 14-22 × 7-10 cm, (broadly) elliptic, chartaceous; base acute or obtuse, apex shortly acuminate, margin plane; midrib, lateral veins immersed, tertiary venation immersed or slightly raised above, midrib and lateral veins clearly raised, tertiary venation raised on lower surface; upper surface with some appressed or erect hairs, these denser along midrib, lower surface moderately to sparsely pubescent, the hairs erect, denser along midrib and lateral veins; lateral veins 5-7 pairs; oil cells clearly visible on the upper surface of young leaves, less so on older ones; axillary tufts of hairs present; petioles 7-11 mm, with similar indument as the twigs. Inflorescences 5-15 cm, in the axils of normal leaves or cataphylls, densely pubescent, the hairs erect and appressed. Flowers 7-9 mm in diam, white or yellowish. Tepals c. 3 mm, narrowly elliptic, pubescent outside, papillose and somewhat pubescent at the base inside, more or less spreading or half-erect; stamens c. 0.7 mm, anthers glabrous or nearly so, filaments pubescent, anther cells in a sharp arc, filling the entire anther; pistil c. 1.2 mm, more or less hairy; receptacle shallow, glabrous or nearly so inside. Young fruit 8 × 6 mm, pubescent; cupule c. 7 mm in diameter, shallowly bowl-shaped. *Montane forests*. H (*Nelson & Andino 12797*, MO). 850-1000 m. (Endemic.)

Two other collections of this species were discussed by Rohwer (1993) under *Nectandra nitida*. *Nectandra roberto-andinoi* differs from that species by its broader leaves with erect indument on the lower surface. *Nectandra longicaudata* has also some erect hairs on the lower leaf surface, but this indument is much sparser and shorter than found in *N. roberto-andinoi*; it also differs in having smaller leaves. *Nectandra roberto-*

andinoi is only known from 5 collections and additional collections from Honduras might show that it intergrades with related species.

24. *Nectandra rudis* C.K. Allen, *J. Arnold Arbor.* 26: 401 (1945). Holotype: Mexico, *Matuda 470* (GH).

Trees, 30 m. Twigs angular, moderately appressed pubescent when young, soon glabrescent; terminal buds densely white appressed pubescent. Leaves 13-25 × 5-10 cm, elliptic, firmly chartaceous; base attenuate due to the revolute margins, these sometimes decurrent on the petiole, apex acute; midrib and lateral veins immersed on upper surface, raised on lower surface, tertiary venation raised on both surfaces; upper surface glabrous, lower surface glabrous or with some appressed hairs, these mostly along the midrib; lateral veins 7-10 pairs; gland dots not or scarcely visible; axillary tufts of hairs present; petioles 10-27 mm, with similar indument as the twigs. Inflorescences 5-20 cm, in the axils of normal leaves, moderately densely white pubescent, the hairs appressed to ascending. Flowers 8-11 mm in diameter, white. Tepals 3-4 mm, densely white tomentulose outside, densely papillose and with some hairs near the base inside, spreading; stamens 1-1.2 mm, papillose, the outer 6 also dorsally pubescent, a sterile tip absent, the anther cells arranged in a sharp arc; pistil 1.6-2 mm, glabrous; receptacle bowl-shaped, glabrous inside. Fruit 20-29 × 18-23 mm, cupule 10-13 mm in diameter, disk-like. *Montane forests.* Ch (*Miller et al. 2688*, MO); G (*Williams 14342*, F); ES (*Tucker 1318*, F). 1600-2500 m. (Endemic.)

Nectandra rudis is readily recognized by its large leaves with revolute base and large flowers. *Ocotea chiapensis* is another montane species from Chiapas with revolute leaf bases and has been confused with *Nectandra rudis*. *Ocotea chiapensis* differs from *N. rudis* in having the tepals rather sparsely appressed pubescent on the outer surface, in its much larger domatia and in its glabrous (not papillose) stamens.

25. *Nectandra salicifolia* (Kunth) Nees, *Syst. Laur.* 302 (1836). *Ocotea salicifolia* Kunth in Humb., *Bonpl. & Kunth, Nov. Gen. Sp.* 2: 132 (1817). Lectotype (designated by Rohwer, 1993): Mexico, *Humboldt & Bonpland 3880* (P).

Nectandra cayoana Lundell, *N. colorata* Lundell, *N. loesneri* Mez, *N. sanguinea* Rottboel var. *lanceolata* Meissner.

Shrubs or trees to 25 m. Twigs roundish or slightly angular, moderately appressed pubescent to almost glabrous, terminal buds densely whitish appressed pubescent. Leaves 6-18 × 2-7 cm, lanceolate or elliptic, chartaceous; base acute or obtuse, apex acute or slightly acuminate, the margin flat; midrib immersed, lateral veins and tertiary venation slightly raised on the upper surface, the midrib raised, lateral veins and tertiary venation slightly raised on the lower surface; upper surface glabrous, lower surface glabrous or sparsely appressed pubescent; lateral veins 4-9 pairs; gland dots visible or not on both sides of the leaf; axillary tufts of hair frequently present, but sometimes absent; petioles 5-15 mm, with a similar indument as the twigs. Inflorescences 3-12 cm, mostly in the axils of normal leaves, sometimes also in the axils of cataphylls, moderately appressed to ascending pubescent to glabrous. Flowers 4-8 mm in diameter, white. Tepals 1.5-4 mm, spreading, moderately to sparsely pubescent outside, papillose and towards the base (somewhat) hairy inside; stamens 0.6-0.8 mm, the hairy filament 0.1-0.3 mm, the anthers papillose near the tip or without papillae, sometimes abaxially pubescent, the anther cells in a shallow arc, a sterile tip lacking; pistil 1-1.6 mm, glabrous, the receptacle shallow, glabrous or with a few hairs inside. Fruit 9-14 × 8-12 mm, cupule variable, from shallowly bowl-shaped to cup-shaped, to 7 mm in diameter. *Seasonal evergreen or semi-deciduous forests*. T (*Fernandez N. 1340*, MO); Ch (*Matuda 4264*, MO); C (*Collins 47 a*, US); B (*Gentle 1410*, MO); G (*Lundell 19074*, MO); H (*Yuncker et al. 6144*, MO); N (*Molina 20454*, MO). 0-2300 m. (Mexico, Mesoamerica.)

Nectandra salicifolia is a variable species and most specimens which do not fit in related, relatively better defined species, have been placed in this species. These related species differ either in indument characters (pubescence on twigs denser and brownish) or, in the case of *N. umbrosa*, in having a dense pinprick pattern of gland dots on the mature leaves. Rohwer (1993) discusses several intermediates between *N. salicifolia* and related species. *Nectandra colorata*, recognized by Rohwer (1993) as a distinct species, is here treated as a synonym of *N. salicifolia*. The name *Nectandra sanguinea* has often been applied to *N. salicifolia* but Bernardi (1967) pointed out that this was not correct.

26. *Nectandra salicina* C.K. Allen, *J. Arnold Arbor.* 26: 385 (1945). Holotype: Costa Rica, *Brenes 4206* (F).

Nectandra davidsoniana C.K. Allen.

Trees to 20 m, but often flowering when much smaller. Twigs slightly angular, sparsely appressed pubescent with white hairs, soon becoming glabrous, terminal buds appressed white pubescent or subglabrous. Leaves 5-11 × 1-3 cm, lanceolate, (firmly) chartaceous; base acute or attenuate, apex acute or acuminate, margin flat, frequently thickened; midrib, lateral veins and tertiary venation raised on both surfaces; upper surface glabrous, lower surface glabrous or with a few appressed white hairs along the midrib; lateral veins 5-8 pairs; axillary tufts of hairs lacking; gland dots poorly visible; petioles 4-12 mm, glabrous or with a few white, appressed hairs. Inflorescences 3-12 cm, in the axils of cataphylls or normal leaves, sparsely appressed pubescent or glabrous, red. Flowers 4.5-7 mm in diameter, white. Tepals 2-3 mm, spreading, sparsely appressed pubescent to glabrous outside, finely papillose and towards the base pubescent inside; stamens 1-1.5 mm, the filaments hairy, 0.2-0.3 mm, the anthers glabrous, without a sterile tip, anther cells in a shallow arc; pistil 1.5-2 mm, glabrous; receptacle shallow, glabrous or nearly so. Fruit 15-22 × 12-17 mm, cupule shallowly bowl-shaped, to 1 cm in diameter, pedicel thickened. *Montane forests*. Ch (*Ton 3411*, F); CR (*Haber & Bello 3699*, MO); P (*McPherson 10334*, MO). 600-1500 m. (Endemic.)

Distinctive for this species are lanceolate, (nearly) glabrous leaves without domatia, the sparsely pubescent or glabrous twigs and the montane habitat. It can be confused with *Nectandra smithii*, which differs in having small domatia, pubescent twigs and slightly wider leaves. In the Monteverde area in Costa Rica both species occur, but intermediates have not been collected. I follow Rohwer (1993) in assigning a single collection from Chiapas to *N. salicina*, although we both have misgivings about it. *Nectandra salicina* is rather common in Costa Rica, but even in Panama it is rarely collected.

The MO isotype of *N. davidsonia* is vegetatively a good match for specimens of *N. salicina* from the Chiriqui province in Panama. Rohwer (1993) mentioned that the type had juvenile flowers and immature fruits, which makes identification with any confidence difficult. Therefore, I prefer to ignore small floral differences between the

type of *N. davidsoniana* and *N. salicina* and, based on vegetative similarities, treat *N. davidsoniana* as a synonym of *N. salicina*, a species known from the area where the type of *N. davidsoniana* was collected.

27. *Nectandra smithii* C.K. Allen, *J. Arnold Arbor.* 26: 370 (1945). Isotype: Costa Rica, A. Smith H-541 (MO).

Trees, to 20 m. Twigs more or less angular, (densely) pubescent with appressed, brownish hairs; terminal buds densely pubescent. Leaves 5-12 × 1.5-3.5 cm, elliptic to lanceolate, chartaceous, the base acute, the apex acuminate or acute; margin flat, sometimes thickened; midrib, lateral veins and tertiary venation weakly raised on the upper surface, slightly more so on the lower surface; upper surface glabrous or (especially when young) with appressed hairs on the midrib, the lower surface sparsely appressed pubescent, especially along the midrib; lateral veins 4-7 pairs; glands dots frequently clearly visible and forming a dense pinprick pattern on the upper surface, scarcely visible on the lower surface; axillary tufts of hairs usually present; petioles 5-12 mm, with similar indument as the twigs. Inflorescences 2-8 cm, mostly in axils of normal leaves, sometimes in the axils of cataphylls, moderately appressed pubescent, reddish. Flowers 4-7 mm in diameter, white. Tepals 1.6-2.5 mm, spreading, appressed pubescent outside, finely papillose and towards the base pubescent inside; stamens 0.8-1.3 mm, the hairy filament 0.1-0.3 mm, the anthers glabrous, the anther cells in an arc, sterile tip absent; pistil c. 1.5 mm, glabrous, the receptacle shallowly bowl-shaped, with some appressed hairs inside. Fruit c. 15 × 10 mm, cupule shallow, c. 6 mm wide, the peduncle thickened. *Montane forests.* CR (*Dryer 1333*, MO). 1100-1700 m. (Endemic.)

Nectandra smithii is restricted to montane forests in central Costa Rica. Plants with more coriaceous leaves approach *N. salicina* and differences between the two are discussed under the latter species. Plants with more chartaceous leaves can be confused with *N. umbrosa*; these plants have the more conspicuous pattern of gland dots on their leaves. These two species can be separated by the size of the stamens (smaller in *N. umbrosa*); the indument on the inner surface of the tepals consists in *N. umbrosa* of short papillae, in *N. smithii* of longer, almost hairlike papillae. Young fruits of *N. umbrosa* are

often somewhat hairy, while they are glabrous in *N. smithii*. Sterile specimens are almost impossible to identify.

28. *Nectandra turbacensis* (Kunth) Nees, *Syst. Laur.* 316 (1836). *Ocotea turbacensis* Kunth in Humb., Bonpl. & Kunth, *Nov. Gen. Sp.* 2: 129 (1817). Lectotype (designated by Rohwer, 1993): Colombia, *Humboldt & Bonpland 1396* (P).

Nectandra mopanensis Lundell, *N. nervosa* Mez, *N. panamensis* Mez, *N. turbacensis* (Kunth) Nees var. *mexicana* Meissner.

Trees, to 35 m. Twigs slightly angular, sparsely appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 6-22 × 2.5-6.5 cm, elliptic to lanceolate, chartaceous; base attenuate to obtuse, apex acuminate or acute, margin flat, rarely recurved at the base of the leaf, midrib, lateral veins and tertiary venation immersed on upper surface, midrib and lateral veins raised on lower surface, tertiary venation less so or immersed; upper surface glabrous or nearly so, lower surface sparsely appressed pubescent to glabrous; lateral veins 4-7 pairs; gland dots visible or not; axillary tufts of hairs frequently present, sometimes with pit domatia; petioles 5-18 mm, with similar indument as twigs. Inflorescences 4-18 cm, in the axils of cataphylls, along leafless short shoots or less frequently in axils of normal leaves, sparsely appressed pubescent to glabrous. Flowers 4-7 mm in diameter, white. Tepals 1.8-2.5 mm, spreading, sparsely appressed pubescent to almost glabrous outside, densely papillose inside, without hairs; stamens 0.5-1 mm, papillose, the anther cells in a shallow arc, small sterile tip present; pistil 1.5-1.9 mm, glabrous; receptacle bowl-shaped, glabrous inside. Fruit 10-20 × 6-12 mm, cupule 3-7 × 7-12 mm, (deeply) cup-shaped, frequently lenticellate. *Moderately dry forests*. Ch (*Breedlove 50893*, MO); B (*Dwyer 12756*, MO); G (*Jones & Facey 3457*, US); H (*Croat & Hannon 64130a*, MO); CR (*Herrera 4968*, MO); P (*Carrasco 21*, MO). 0-1700 m. (Mexico [Veracruz], Mesoamerica, Colombia, Venezuela, Peru, Bolivia, Brazil, Cuba, Haiti, Dominican Republic, Jamaica, Puerto Rico, Virgin Islands, Trinidad.)

Characteristic are the sparsely pubescent twigs, relatively large flowers and the relatively narrow leaves. Differences with related species are discussed under *N. hihua*.

29. *Nectandra umbrosa* (Kunth) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 462 (1889). *Ocotea umbrosa* Kunth in Humb., Bonpl. & Kunth, *Nov. Gen. Sp.* 2: 128 (1817). Lectotype (designated by Rohwer, 1993): Without locality, *Humboldt & Bonpland s.n.* (P).

Shrubs or mostly small trees, rarely reaching 35 m. Twigs roundish, initially moderately to sparsely appressed or ascending pubescent, the hairs usually brownish; terminal buds densely appressed pubescent. Leaves 4-20 × 2-7.5 cm, elliptic to lanceolate, chartaceous; the base obtuse to acute, the apex acuminate, the margin flat; midrib, lateral veins and tertiary venation slightly raised on the upper surface, midrib raised, lateral veins and tertiary venation slightly raised on the lower surface; upper and lower surface glabrous or with some appressed hairs, indument if present denser along the midrib; lateral veins 4-8 pairs; gland dots readily visible on the upper surface and forming a dense pinprick pattern, sometimes also visible on the lower surface; axillary tufts of hair present or absent; petioles 4-13 mm, with a similar indument as the twigs. Inflorescences 2.5-15 cm, in the axils of normal leaves, infrequently in axils of cataphylls, moderately to sparsely ascending pubescent. Flowers 3-6.5 mm in diameter, white or greenish. Tepals 1.5-2.7 mm, moderately pubescent, sometimes with some papillae, on the outside, papillose and hairy towards the base inside; stamens 0.5-0.8 mm, filaments c. 0.2 mm, hairy, anthers glabrous, the anther cells in an arc, a sterile tip lacking; pistil c. 1 mm, glabrous or with a few hairs, receptacle shallow, glabrous or with a few hairs. Fruit 9-17 × 9-14 mm, often with a few hairs, cupule shallow, to 10 mm in diameter, gradually narrowed into the pedicel. *Evergreen forests. CR (Croat 36346, MO); P (Liesner 1372, MO) 0-1500 m. (Mesoamerica, Colombia.)*

Nectandra umbrosa is a rather common species in Costa Rica and Panama. Rohwer (1993) cites one collection each from Honduras and Nicaragua, but I have not seen these specimens. This species is best recognized by the dense pattern of gland dots on the upper leaf surface and slightly raised midrib on the upper leaf surface. Specimens from higher altitude have smaller leaves and can be confused with *N. smithii*; the latter species differs also from *N. umbrosa* in having a glabrous ovary and glabrous fruits and in having larger stamens. Croat (1978) listed collections of *N. umbrosa* from Barro Colorado island as *N. purpurascens* and *N. savannarum*.

13. *Ocotea* Aublet

By H. van der Werff.

Trees or shrubs. Leaves alternate, rarely whorled, usually pinnately veined, domatia (pits, cavities or tufts of hair in the axils of the lowermost lateral veins) sometimes present. Inflorescences in the axils of leaves, rarely in the axils of cataphylls, paniculate-cymose, the lateral flowers of a cyme strictly opposite, rarely inflorescences by reduction racemose. Flowers perfect or unisexual; if unisexual, the plants dioecious. Tepals equal, usually deciduous in fruit. Perfect flowers with 9 4-celled stamens, the outer 6 opening introrse, the inner 3 opening extrorse, the anther cells arranged in two pairs; inner stamens with 2 glands at the base of the filaments; staminodia absent or present, if present 3, stipitiform and small; pistillate flowers with 9 staminodia, staminate flowers with or without a pistillode. Fruits seated in a variously shaped cupule, this mostly cup-shaped with a single margin, but occasionally with a double margin or reduced to a small plate; tepals rarely persisting on the cupules. 300 species or more. Neotropics, Africa, Madagascar.

Ocotea is a large and variable genus. In Mesoamerica species with perfect flowers predominate and these are best recognized by the 9 4-celled stamens with the anther cells arranged in two pairs and the small, stipitiform staminodia (or these are lacking). These species can be confused with *Nectandra* and differences are discussed under the latter genus. They can also be confused with *Cinnamomum*, which possesses relatively large staminodia with a glandular apex and which frequently has tripliveined leaves. The species with unisexual flowers can be confused with *Endlicheria* (which has 2-celled stamens) or *Rhodostemonodaphne* (with 4-celled stamens and the anther cells arranged in a shallow arc). Even in pistillate flowers one can usually see the rudimentary anther cells and their position on the staminodia.

Ocotea is by far the largest genus of the Lauraceae in the Neotropics and species delimitation is at times still difficult.

1. Stamens tongue-shaped, with a distinct, sterile tip, moderately to densely papillose; filaments lacking or very short.

2. Lowermost pair of lateral veins with conspicuous pocket domatia.

41. *O. holdridgeana*

2. Leaves without conspicuous pocket domatia.

3. Twigs and usually the leaves densely pubescent.

4. Leaves whorled.

97. *O. verticillata*

4. Leaves evenly distributed along the twigs.

5. Lower leaf surface completely covered by the indument, the hairs short and curled.

65. *O. pharomachrosorum*

5. Lower leaf surface not completely covered by the indument, but partly or almost completely visible.

6. Leaves elliptic, to 6 cm wide; petioles 5-9 mm.

46. *O. klepperiae*

6. Leaves obovate or obovate-elliptic, 5-17 cm wide; petioles 1.5-4 cm.

7. Inflorescences paniculate-cymose; pistil densely pubescent.

82. *O. sinuata*

7. Inflorescences racemose; pistil glabrous.

13. *O. botrantha*

3. Twigs and leaves glabrous or nearly so.

8. Twigs hollow.

9. Shrub or small tree to 8 m. Leaf bases plane, not revolute. Inflorescences to 15 cm.

Fruits ca. 2×1 cm, cupule c. 1 cm in diameter, cup- to bowl-shaped, very weakly double-margined, the outer margin c. 0.5 mm wide.

24. *O. dendrodaphne*

9. Trees to 20 m. Leaf bases slightly revolute. Inflorescences to 5 cm. Fruits c. 5×3.5 cm, cupule c. 5 cm in diameter, bowl-shaped, with a conspicuous double margin, this c. 1 cm wide.

57. *O. morae*

8. Twigs solid.

10. Inflorescences about as long as the leaves, sparsely pubescent; leaf bases plane, not revolute; fruits 2×1 cm, cupule to 1.2 cm in diameter, with a double margin, the outer margin c. 2 mm wide.

95. *O. veraguensis*

10. Inflorescences much shorter than the leaves, densely pubescent; leaf bases slightly revolute; fruits ca. 5×3.5 cm, cupule c. 5 cm in diameter, with a conspicuous double margin, this c. 1 cm wide.

57. *O. morae*

1. Stamens not tongue-shaped, usually rectangular, without a sterile tip, not papillose (or rarely with papillae on the margin); filaments usually present.

11. Lower leaf surface completely hidden by the indumenta.

12. Flowers unisexual; leaf base inrolled and decurrent along the entire length of the petiole.

16. *O. calophylla*

12. Flowers perfect; leaf base plane or if inrolled and decurrent, most of the petiole distinct.

13. Leaf base inrolled and shortly decurrent on the petiole.

81. *O. salvinii*

13. Leaf base plane and not decurrent.

14. Indument of the lower leaf surface pale brown or whitish.

15. Domatia absent; flowers 6 mm in diameter, tepals 2-2.5 mm.

80. *O. salvadorensis*

15. Domatia present as axillary tufts of hairs; flowers 4 mm in diameter, tepals 1.5 mm.

42. *O. incana*

14. Indument of the lower leaf surface reddish brown.

16. Receptacle glabrous inside; tepals papillose on the inner surface; leaves 9-16 cm.

79. *O. rufescens*

16. Receptacle appressed pubescent inside; tepals pubescent on the inner surface; leaves 7-10 cm (see discussion under *O. salvadorensis*).

11. Lower leaf surface glabrous or partly covered by the indumenta.

17. Twigs hollow, often inhabited by ants.

18. Inflorescences and flowers densely brown-tomentellous; leaves broadly obovate, coriaceous, with raised reticulation.

44. *O. jefensis*

18. Inflorescences and flowers glabrous or sparsely puberulous; leaves (narrowly) elliptic or obovate, (firmly) chartaceous, reticulation immersed or raised.

5. *O. atirrensis*

17. Twigs solid.

19. Flowers unisexual.

20. Lower leaf surface with erect hairs, discernable to the touch.

21. Surface of the twigs partially visible between the hair.

50. *O. macropoda*

21. Indument completely covering the surface of the young twigs.

22. Laminae slightly decurrent on the petiole; laminae and petioles not sharply offset; tertiary venation on the lower leaf surface scalariform and clearly raised; indument on young twigs shaggy. **30. O. fendleri**

22. Base of laminae obtuse, clearly differentiated from the petiole; tertiary venation on lower leaf surface scarcely raised and not scalariform; indument on young twigs very short, erect. **6. O. atlantica**

20. Lower leaf surface glabrous or with appressed hairs.

23. Twigs sharply angular; upper leaf surface with raised, minute reticulation.

7. O. aurantiodora

23. Twigs rounded or slightly angular; upper leaf surface without raised reticulation or with coarse reticulation.

24. Pistil pubescent; cupule plate-like, with a double margin. **31. O. floribunda**

24. Pistil glabrous; cupule various, but not plate-like and with a double margin.

25. Pitdomatia present in the axils of the lateral veins of some leaves, the domatia not pubescent. **60. O. oblonga**

25. Pitdomatia absent (but axillary tufts of hairs sometimes present).

26. Axillary tufts of hairs present on the lower leaf surface; tepals persistent on the cupule; oil glands readily visible on the upper leaf surface as black dots.

78. O. rubrinervis

26. Axillary tufts of hairs lacking; tepals deciduous or persistent in fruit; oil glands not or scarcely visible.

27. Twigs densely and minutely grey appressed pubescent, the hairs small and scarcely individually visible; indument on the inflorescences and pedicels notably denser than on the flowers. **49. O. leucoxydon**

27. Twigs sparsely pubescent, individual hairs visible, or glabrous; inflorescences and flowers glabrous or density of indument on flowers and inflorescences about the same.

28. Filaments of the outer 6 stamens fused with the tepals; inflorescences and flowers glabrous. **17. O. cernua**

28. Filaments of the outer 6 stamens free; inflorescences and/or flowers sparsely pubescent.

29. Leaves 7-25 cm, the tertiary venation slightly raised on the upper surface; lateral veins immersed on the upper surface. **71. O. puberula**

29. Leaves 4-11 cm, the tertiary venation immersed on the upper surface; lateral veins slightly impressed on the upper surface. **2. O. adela**

19. Flowers hermaphroditic.

30. Lower leaf surface and young twigs with predominantly erect hairs, these discernable to the touch.

31. Leaf bases decurrent on the petiole and usually inrolled.

32. Young twigs appressed pubescent, the indument moderate or sparse and always part of the surface visible; inner surface of tepals glabrous or nearly so. **25. O. dentata**

32. Young twigs with erect or ascending hairs, the surface (nearly) completely covered; inner surface of tepals pubescent.

33. Leaf bases prominently recurved; lateral veins 9-12. **84. O. stenoneura**

33. Leaf bases scarcely if at all recurved or inrolled; lateral veins 4-8.

34. Indument on lower leaf surface predominantly erect; leaves 10-20 cm.

37. O. hartshorniana

34. Indument on lower leaf surface predominantly appressed ; leaves 5-12 cm.

56. O. monteverdensis

31. Leaf bases not decurrent on the petiole, usually flat.

35. Outer surface of tepals densely pubescent, the surface completely covered by the indument; if inner 3 tepals with less indument on the upper half, then at least outer 3 tepals densely pubescent.

36. Flowers 10-14 mm in diameter. **33. O. gomezii**

36. Flowers less than 8 mm in diameter.

37. Inflorescences few-flowered, racemose or with some lateral branches ending in a cyme; leaves coriaceous. **70. O. pseudopalmana**

37. Inflorescences many-flowered, the lateral branches several times divided; leaves coriaceous or chartaceou.

38. Petioles c. 30 mm. **3. O. amplifolia**

38. Petioles up to 15 mm.

39. Leaves coriaceous, densely ferruginous pubescent on the lower surface; cupule with entire margin; leaf apex obtuse or very shortly acuminate. **23. O. darcyi**
39. Leaves chartaceous, moderately to sparsely golden brown pubescent on the lower surface; tepals persisting on the cupule; leaf apex acuminate. **55. O. mollifolia**
35. Outer surface of all tepals glabrous or variously pubescent; if variously pubescent, the surface of the tepals always partially visible.
40. Inflorescences racemose or rarely with a few lateral cymes.
41. Midvein, lateral veins and tertiary venation clearly impressed (leaves rugose. **22. O. corrugata**
41. Venation immersed or raised, not impressed (leaves not rugose.
42. Outer surface of tepals glabrous; anthers sessile. **34. O. gordonii**
42. Outer surface of tepals (sparsely) pubescent; stamens with filaments 1/3 or more of the length of the anthers.
43. Hairs on the lower surface of leaves ascending, covering most of the lamina; indument grey. **54. O. mollicella**
43. Hairs on the lower leaf surface erect, most of the lamina visible; indument brown or ferruginous. **73. O. purpurea**
40. Inflorescences paniculate-cymose.
44. Leaves clustered.
45. Outer surface of the tepals glabrous. **14. O. bourgeauviana**
45. Outer surface of the tepals pubescent.
46. Petioles to 6 mm long; leaves 15-25 × 5-6 cm; indument of twigs yellowish brown. **89. O. tonii**
46. Petioles at least 10 mm; leaves 10-15 × 6-7 cm; indument of twigs brown. **20. O. congregata**
44. Leaves alternate, evenly distributed along the twigs.
47. Flowers at anthesis 2-3 mm in diameter; tepals erect; inner surface of tepals and stamens glabrous. **61. O. oblongifolia**
47. Flowers at anthesis 5-10 mm in diameter; tepals spreading or half erect; inner surface of tepals and/or stamens partially papillose or pubescent.
48. Receptacle pubescent inside.
49. Leaves elliptic, to 15 cm. **12. O. betazensis**

49. Leaves obovate, 20-40 cm.

50. Indument covering young twigs and inflorescences completely.

93. O. valerioides

50. Surface of twigs and inflorescences visible between the indumenta. **48. O. lentii**

48. Receptacle glabrous inside.

51. Outer surface of the tepals pubescent.

63. O. patula

51. Outer surface of the tepals glabrous.

52. Inner surface of the tepals pubescent; filaments distinct, c. 1/3 the length of the anthers.

53. Leaves to 10 cm, the tips obtuse, acute or shortly acuminate. **68. O. praetermissa**

53. Leaves 10-20 cm, acuminate or gradually narrowed into a slender tip.

14. O. bourgeauviana

52. Inner surface of the tepals glabrous; anthers sessil.

54. Surface of the young twigs completely covered by the indument; cupule cup-shaped.

92. O. valeriana

54. Surface of young twigs partially visible between the indument; cupule shallowly bowl-shaped or platelike.

38. O. helicterifolia

30. Lower leaf surface and young twigs glabrous or with predominantly appressed hairs, rarely with sparse erect hairs, but these not discernable to the touch.

55. Leaf bases inrolled and/or decurrent on the petiole or reflexed, or leaves subsessile with the base weakly recurved; free petiole usually absent or very short.

56. Flowers densely reddish pubescent and terminal buds glabrous or finely appressed pubescent distally.

88. O. tonduzii

56. Flowers grey pubescent or glabrous; terminal buds uniformly pubescent or rarely glabrous.

57. Leaves (27-)30-50 cm, the apex usually rounded; domatia lacking.

76. O. rivularis

57. Leaves less than 30, usually less than 25 cm, apices obtuse or rounded; domatia lacking or present.

58. Leaf bases reflexed, the lobes frequently covering the midrib; flowers glabrous.

27. O. endresiana

58. Leaf bases decurrent or inrolled, but not reflexed; flowers usually puberulous.

59. Flowers 4-5 mm in diameter.

60. Outer surface of the tepals densely whitish pubescent, the surface completely covered; vernation lines visible on the lower leaf surface; receptacle (deeply) cup-shaped.

32. O.

glaucosericea

60. Outer surface of the tepals moderately pubescent, the surface partly visible; vernation lines not visible; receptacle bowl-shaped.

18. O. chiapensis

59. Flowers 2.5-3 mm in diameter.

61. Leaves 5-10 cm wide, obovate, glabrous or with a few appressed hairs on the lower leaf surface; tertiary venation not or scarcely raised on upper leaf surface.

43. O. insularis

61. Leaves to 5 cm wide, elliptic or oblong, appressed pubescent or glabrous on the lower leaf surface; tertiary venation immersed or raised.

62. Leaf base cuneate or acute, moderately or weakly reflexed, not decurrent on the petiole; leaves sessile.

43. O. insularis s.l.

62. Leaf base decurrent on the petiole, usually inrolled; leaves petiolate.

63. Tertiary venation raised on the upper surface and leaf tips obtuse and leaf bases inrolled.

8. O. austinii

63. Tertiary venation not or rarely raised on the upper surface; if raised, leaf tips acute or acuminate and/or leaf bases decurrent, but not inrolled.

64. Apparent petiole due to decurrent, inrolled leaf bases 4-5 cm; flowers sparsely pubescent.

69. O. producta

64. Apparent petiole to 3 cm, usually shorter; indument of flowers various.

99. O. whitei

55. Leaf bases not inrolled or decurrent on the petiole, this usually distinct.

65. Tepals (partially) papillose on the inner surface and tepals glabrous or sparsely puberulent outside and tepals spreading at anthesis; tepals usually longer than 3 mm

66. Hairs on the lower leaf surface erect (check along midrib and lateral veins).

67. Inflorescences racemose; young twigs densely pubescent with minute, erect hairs.

66. O. pittieri

67. Inflorescences paniculate-cymose; young twigs moderately to densely appressed pubescent. **75. O. rhytidotricha**
66. Hairs on lower leaf surface appressed or lacking.
68. Stamens with filaments at least as long as the anthers; outer stamens curved inwards. **64. O. pausiaca**
68. Stamens with filaments less than half as long as the anthers; outer stamens straight.
69. Pit domatia present in the axils of the lowermost lateral veins. **4. O. arcuata**
69. Pit domatia lacking, axillary tufts of hairs sometimes present.
70. Inflorescences densely and minutely brownish pubescent, the surface covered or nearly so. **77. O. rubriflora**
70. Inflorescences sparsely or moderately pubescent, the surface largely visible.
71. Leaf margin at the base (narrowly) reflexed or inrolled. **67. O. platyphylla**
71. Leaf margin at the base flat or nearly so.
72. Inflorescences paniculate, with at least a few 3-flowered lateral cymes, rarely racemose but then with flowers 6.5 mm or more in diameter and leaves drying greenish.
73. Indument on twigs brown and more or less persistent; indument on peduncle moderately dense.
74. Lateral veins 6-9. Guatemala and Chiapas. **51. O. magnifolia**
74. Lateral veins 4-5. Costa Rica. **100. Ocotea sp. A**
73. Indument on twigs pale and becoming quickly sparse with age; indument on peduncle rather sparse.
75. Flowers 4.5-5.5 mm in diameter; lowlands. **9. O. bajapazensis**
75. Flowers 6.5 - 9 mm in diameter; montane forests, mostly above 900 m. **40. O. heydeana**
72. Inflorescences racemose; leaves drying dark green or flowers less than 5 mm in diameter.
76. Indument on young twigs dense and consisting of short, erect hairs. **66. O. pittieri**
76. Indument on young twigs of variable density and consisting of appressed, rarely somewhat ascending hairs.
77. Receptacle densely pubescent inside. Costa Rica. **15. O. brenesii**

77. Receptacle sparsely or very sparsely pubescent inside. Chiapas, Guatemala.

1. O. acuminatissima

65. Tepals glabrous or pubescent on the inner surface; outer surface glabrous or variously pubescent; tepals usually erect or half erect at anthesis; tepals usually less than 3 mm.

78. Lower leaf surface with pitted domatia, cavities with a small slitlike or roundish orifice, in the axils of the basal lateral veins or along the lower lateral veins; orifice usually glabrous, rarely with a fringe of hairs.

79. Domatia at least once, often several times, their diameter away from the midrib; three or more pairs of domatia present in each leaf; domatia with a fringe of hairs.

10. O. barbatula

79. Domatia adjacent to or less than their diameter away from the midrib; domatia present in the axils of several pairs of lateral veins or only in the axils of the basal pair; domatia usually glabrous.

80. Flowers sparsely appressed pubescent; inflorescences moderately densely appressed pubescent.

36. O. haberi

80. Flowers glabrous; inflorescences glabrous or nearly so.

81. Leaves tripliveined; domatia only present in the lowermost pair of lateral veins.

94. O. vanderwerffii

81. Leaves pinnately veined; domatia often present in the axils of more than one pair of lateral veins or along the lateral veins.

82. Terminal buds glabrous.

83. Leaves broadly elliptic, 17-27 × 8-15 cm.

29. O. euvenosa

83. Leaves elliptic, 5-18 × 1.5-7 cm.

84. Tepals spreading at anthesis; leaves, when dry, yellowish green, the midrib often lighter in color than the laminae.

98. O. viridiflora

84. Tepals erect or half erect at anthesis; leaves, when dry, dark green to blackish, the midrib concolorous with the laminae.

87. O. tenera

82. Terminal buds pubescent.

85. Leaf apices obtuse to rounded; leaves coriaceous; domatia conspicuous, restricted to the axils of the lowermost pairs of lateral vein.

72. O. pullifolia

85. Leaf apices acute; leaves papyraceous to coriaceous, if coriaceous, domatia small and found along the lowermost lateral veins.

86. Leaves papyraceous, glanddotted on the upper surface and very dark when dry.

87. O.

tenera

86. Leaves firmer, not visibly glanddotted on the upper surface; green to very dark green when dry.

87. Tertiary venation on lower leaf surface immersed or nearly so; leaves coriaceous to firmly chartaceous, dark green when dry.

45. O. jorge-escobarii

87. Tertiary venation on lower leaf surface raised; leaves chartaceous, black or yellowish green when dry.

88. Inflorescences to 20 cm; leaves black when dry, the midrib very dark.

11. O. bernoulliana

88. Inflorescences to 10 cm; leaves yellowish green when dry, the main veins often lighter in color than the lamina.

53. O.

meziana

78. Lower leaf surface without pitdomatia; axillary tufts of hairs in a small depression sometimes present.

89. Terminal buds glabrous (sometimes a few hairs present along the margins of the bracts surrounding the buds).

89. Flowers and inflorescences glabrous.

96. O. verapazensis

90. Flowers and distal parts of inflorescences sparsely or moderately, minutely pubescent.

91. Leaves 15-35 × 7-15 cm, leaf base rounded, rarely obtuse or subcordate; tepals erect or nearly so at anthesis.

83. O. standleyi

91. Leaves 10-15 × 4-5 cm, leaf base acute; tepals spreading at anthesis.

52. O. matudai

89. Terminal buds pubescent.

92. Twigs densely pubescent, the surface completely covered by the erect or ascending hairs.

21. O. contrerasii

92. Twigs glabrous, sparsely pubescent or, if densely pubescent, the hairs appressed.

93. Leaves, when dry, yellow-green, rarely darker green; tertiary venation forming a raised reticulum on the lower leaf surface; midrib and lateral veins usually lighter in color than the surrounding leaf tissue. **47. O. laetevirens**

93. Leaves, when dry, dark green; tertiary venation not forming a raised reticulum on the lower leaf surface; major veins concolorous with or darker than the leaf tissue.

94. Tepals to 1 mm and inflorescences moderately to sparsely pubescent, the hairs ascending to erect. **58. O. multiflora**

94. Tepals at least 1.5 mm; if rarely shorter (1.3-1.5 mm), then inflorescences very sparsely pubescent with appressed hairs.

95. Inflorescences densely pubescent, the surface largely or completely covered by the indumenta.

96. Leaf apices rounded or obtuse; axillary tufts of hairs lacking on the lower leaf surface. **19. O.**

chrysobalanoides

96. Leaf apices acute or acuminate; axillary tufts of hairs present on the lower leaf surface.

97. Leaves obovate, to 4 cm wide, drying green; twigs, when young, alate or sharply angled; lower leaf surface sparsely pubescent, the hairs short, erect and inconspicuous. **28. O. eucuneata**

97. Leaves elliptic or oblanceolate; when widest above the middle, drying black; twigs ridged or angular; lower leaf surface sparsely appressed pubescent or glabrous.

98. Leaves to 2.5 cm wide, oblanceolate or narrowly obovate-elliptic, drying black; tepals c. 1.5 mm. **59. O. nigrita**

98. Leaves 2.5-8 cm wide, elliptic or narrowly elliptic-obovate, drying green to dark green; tepals c. 2 mm. **91. O. uxpanapana**

95. Inflorescences sparsely or moderately pubescent, the surface largely or entirely visible.

99. Young twigs densely pubescent, the hairs erect; inflorescences 15-20 cm, with a similar erect indument as the twigs; domatia lacking. **86. O. subalata**

99. Young twigs appressed pubescent or nearly glabrous; if with some erect hairs, these extremely short and their orientation scarcely visible; inflorescences usually shorter than 15 cm; domatia, as axillary tufts of hairs or shallow pits, often present.

100. Leaves lanceolate; domatia consisting of shallow pits, these glabrous or with a pubescent margin. **26. O. effusa**

100. Leaves elliptic, ovate or elliptic-obovate; domatia, if present, axillary tufts of hairs.

101. Leaves 13-25 × 4-8 cm, the tertiary venation raised on the lower surface.

35. O. guatemalensis

101. Leaves generally smaller than 12 × 5 cm; if occasionally to 15 cm, the tertiary venation immersed on the lower surface.

102. Leaves elliptic to oblong, the apices rounded or blunt; domatia consisting of tufts of hairs, at least their own diameter away from the midrib. **39. O. heribertoii**

102. Leaves ovate, obovate or elliptic, the apices acute or acuminate; domatia, when present, in the axils of the lateral veins close to the midrib.

103. Leaves ovate, distally tapering into a long and slender apex.

104. Domatia present as axillary tufts of hairs; outer surface of tepals glabrous.

62. O. parvula

104. Domatia absent; outer surface of tepals sparsely pubescent. **85. O. strigosa**

103. Leaves (broadly or narrowly) elliptic, without a long, slender apex.

105. Flowers pubescent, the indument covering the tepals almost completely; leaves drying green to dark green; domatia, when present, not visible without magnification.

74. O. racemiflora

105. Flowers glabrous or nearly so; leaves drying dark green; domatia (as axillary tufts of hairs) visible without magnification. **90. O. truncata**

1. Ocotea acuminatissima (Lundell) Rohwer, *Bot. Jahrb. Syst.* 112: 379 (1991).
Phoebe acuminatissima Lundell, *Contr. Univ. Mich. Herb.* 6: 19 (1941). Isotype:
Mexico, Chiapas, *Matuda 2107* (NY!).

Cinnamomum acutatatum Kostermans, nom. nov. for *Phoebe acuminatissima*
Lundell; *C. siltepecanum* (Lundell) Kostermans; *Phoebe saxchanalensis* Lundell; *P.*
siltepecana Lundell.

Trees, to 15 m. Twigs terete or ridged, solid, moderately to densely appressed pubescent, the terminal buds densely appressed pubescent. Leaves 8-12 × 2-4 cm, alternate, chartaceous, lanceolate, elliptic to elliptic-ovate, pinnately veined, the base acute, margin flat, apex acute, the upper surface glabrous, the lower surface sparsely appressed pubescent to glabrous, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface, domatia as small axillary tufts of hairs frequently present; lateral veins 5-9; petioles 8-14 mm, with a similar indument as the twigs, flat or nearly so above. Inflorescences 2-5 cm, racemose, moderately to sparsely appressed pubescent, in the axils of normal leaves. Flowers 6-8 mm in diameter, white, perfect. Tepals 2-3 mm, spreading at anthesis, sparsely appressed pubescent to almost glabrous outside, papillose on the inner surface, outer stamens 1.4 mm, papillose, the filaments very short, free, the anther cells arranged in 2 pairs, introrse, the cells filling the entire anther, inner 3 stamens 1.2 mm, papillose, the cells extrorse, in 2 pairs, the filaments 0.1-0.2 mm, globose glands present at the base of the inner stamens, staminodia present, with a glandular tip, pistil c. 2 mm, glabrous, the style half as long the ovary, receptacle cup-shaped, with a few appressed hairs inside. Fruit ellipsoid, 1.5 × 1 cm, cupule shallowly bowl- to platelike, 6 mm in diameter, with a single margin and without persistent tepals, the pedicel thickened in fruit. *Montane forests*. Ch (*Breedlove 48693*, MO); G (*Steyermark 33156*, F). 900-2700 m. (Endemic.)

Included in *Ocotea acuminatissima* are all specimens from Chiapas and Guatemala with racemose inflorescences, papillose inner surface of the tepals, spreading tepals at anthesis and a sparse appressed indument on the lower leaf surface (or almost glabrous leaves). These specimens vary in leaf shape from lanceolate to elliptic and also the amount of pubescence on the twigs is variable. However, there are enough intermediates between the extremes to make splitting this species impracticable, but once more collections are available, the concept of *O. acuminatissima* accepted here might be shown to be too broad.

2. *Ocotea adela* van der Werff, *Novon* 11: 501 (2001). Holotype: Panama, Prov. Panama, *Croat 13049* (MO!)

Dioecious shrub or small tree, to 8 m. Twigs ridged, solid, sparsely to moderately puberulous, the hairs very short and ascending to erect; terminal buds densely, yellowish pubescent, the hairs very short and ascending to erect, completely covering the buds. Leaves 4-11 × 2.3-5 cm, chartaceous, elliptic to ovate-elliptic, alternate, pinnately veined, the base acute, the margin plane, the apex acute or shortly acuminate, both surfaces glabrous, or a few minute, erect hairs present along the midrib; midrib and lateral veins slightly impressed, tertiary venation immersed and not discernable on the upper surface, midrib and lateral veins raised, tertiary venation scarcely raised or immersed on the lower surface; domatia lacking; lateral veins 4-6; petioles 5-10 mm, flat or shallowly canaliculate above, with a similar indument as the twigs. Inflorescences 3-7 cm, racemose or with short lateral branchlets terminating in a cyme, the pistillate inflorescences shorter and with fewer flowers than the staminate ones, sparsely pubescent to subglabrous, in the axils of leaves. Flowers 3-4 mm in diameter, greenish-yellow, unisexual. Male flowers: tepals 1.5 mm, broadly elliptic to triangular, glabrous on both surfaces or with a few appressed hairs near the base of the inner surface, erect or half erect; stamens 9, 4-celled, the outer 6 1.2 mm, the filament free, 0.4 mm, glabrous, the cells arranged in 2 rows, a sterile tip lacking, introrse, inner 3 the same size, but the cells extrorse, glands present at the base of the filaments, staminodia not seen, pistillode 1.6 mm, glabrous, slender, sometimes with a dark tip indicating a stigma, receptacle narrow, rather deep, with some appressed hairs inside; pistillate flowers: tepals as in male flowers, staminodia 9, 0.6 mm, pistil glabrous, 2.5 mm, the style 0.5 mm, receptacle deep, sparsely appressed pubescent inside. Fruits subglobose, 8 × 7 mm, the cupule shallowly bowl-shaped, 6 mm in diameter, the tepals persistent on the cupule, the margin simple, pedicel conically thickened towards the cupule. *Lower montane forest*. P (Galdames & Guerra 1940, MO). 500-900 m. (Endemic.)

Ocotea adela is, as the name suggests, not a striking species. Currently, it is only known from the Cerro Jefe-Cerro Azul area near Panama City. Among the Panamanian species it is best recognized by its unisexual flowers, short, nearly glabrous inflorescences, leaves with slightly impressed lateral veins and midrib, the shallow cupules with persistent tepals and the thickened pedicels in fruit. Its closest relative is probably the South American *O. camphoromea* Rohwer.

3. *Ocotea amplifolia* (Mez & J. D. Smith) van der Werff, *Novon* 11: 510 (2001) .
Phoebe amplifolia Mez & J.D. Smith, *Bot. Gaz.* 19: 261 (1894). Isotype: Guatemala,
Heyde & Lux 3033 (GH!). Illustr.: Mez & Smith, *Bot. Gaz.* 19, t. 24 (1894).

Cinnamomum amplifolium (Mez & J.D. Smith) Kostermans.

Trees, size unknown. Twigs angular, solid, densely brown-tomentellous, the surface completely covered by the indument; terminal buds densely brown-tomentellous. Leaves 20-30 × 8-13 cm, alternate, elliptic to broadly elliptic, firmly chartaceous, pinnately veined, the base acute, margin recurved towards the base, the apex acute, the upper surface glabrous except for remnants of tomentellous indument along the major veins, the lower surface sparsely to moderately densely pubescent with erect, curled hairs, the surface readily visible between the hairs, the indument tomentellous on the midrib and lateral veins, discernable to the touch, midrib, lateral veins and tertiary venation immersed or slightly impressed on the upper surface, raised on the lower surface; domatia lacking; lateral veins 8-11; petioles 3 cm, shallowly canaliculate, with a similar indument as the twigs. Inflorescences 10-15 cm, paniculate-cymose, densely brown-tomentellous, the surface not visible, in the axils of leaves. Flowers 6-7 mm in diameter, hermaphrodite. Tepals c. 3.5 mm, the outside densely pubescent and the surface not visible, the inside moderately densely pubescent, the surface partially visible; tepals at anthesis more or less spreading; outer 6 stamens 1.2 mm, the filament short, free, c. 0.2 mm and with a few hairs; inner 3 stamens 1.5 mm, the filament 0.5 mm, evenly pubescent, glands conspicuous at the base of the filaments of the inner stamens; staminodia 1 mm, pubescent; pistil c. 2 mm, glabrous, the ovary twice as long as the style; receptacle bowl-shaped, glabrous inside. Fruits ellipsoid, 3.5 × 1.5 cm (detached); cupule not seen. *Montane forest. G (Heyde & Lux 3033, GH!). 3000 m. (Endemic.)*

This species is only known from the type collection and the measurements therefore do probably not accurately reflect the range in this species. It is easily recognized by the long petioles, dense indument on the twigs, inflorescences and outer surface of the tepals. The dense indument on the outer surface of the tepals is also found in a few species in Costa Rica and Panama but these differ as follows: *Ocotea gomezii* has much larger flowers, *O. mollifolia* has shorter petioles and straight erect hairs on the

lower leaf surface and *O. campanae* has a ferruginous indument and also shorter petioles. Allen (1945) cited a second collection from Guatemala as *O. amplifolia*. This collection, Steyermark 43641 (F), differs from *O. amplifolia* in having sparsely pubescent tepals and the indument on the lower leaf surface restricted to the major veins and not occurring on the laminae. It represents an unknown species.

4. *Ocotea arcuata* Rohwer, *Bot. Jahrb. Syst.* 112: 380 (1991). Holotype: Panama, Mori et al. 6883 (MO!). Illustr.: Rohwer, *Bot. Jahrb. Syst.* 112: 381 (1991).

Small trees, to 5 m. Twigs terete or slightly angular, solid, moderately densely to sparsely appressed pubescent, the surface partially visible; terminal buds densely appressed pubescent. Leaves 8-16 × 4-8 cm, alternate, elliptic, thinly chartaceous or membranaceous, pinnately veined, base obtuse, apex acuminate, acumen 0.5-1.5 cm, midrib, lateral veins and tertiary venation immersed or midrib and lateral veins slightly impressed on the upper surface, raised on the lower surface; upper surface glabrous or with some appressed hairs on the base of the midrib, lower surface glabrous or with a few appressed hairs; very short, erect hairs sometimes present along the major veins on the lower leaf surface; margin plane; pit domatia (cavities with a small opening) present in the axils of the lowermost lateral veins; lateral veins 4-6, reaching upwards and becoming loop-connected towards the margin; petioles 6-18 mm, sulcate above, with a similar indument as the twigs. Inflorescences 3-7 cm, moderately to sparsely appressed pubescent, paniculate-cymose, in the axils of leaves or bracts near the tips of the branches. Flowers 4 mm in diameter, white, perfect. Tepals 2-2.5 mm, elliptic, on the outside with a few appressed hairs, inside papillose, stamens 1.0-1.2 mm, the filament very short, free, anthers finely papillose, outer 6 stamens with the cells opening introrse, a sterile tip lacking, inner 3 with the cells opening extrorse, staminodia 3, 0.4 mm, triangular, the base hairy; pistil 1.6 mm, glabrous, the style half as long as the ovary, receptacle bowl-shaped, pubescent inside. Fruit ellipsoid, 3 × 1.5 cm, cupule trumpetshaped, 1 cm in diameter, with a single margin, tepals deciduous in fruit, gradually narrowed into the pedicel. *Lower montane forest. P (McPherson 9195, MO). 300-550 m. (Endemic.)*

Ocotea arcuata is rarely collected and only known from the Santa Rita Ridge Road and the El Llano-Carti Road in Panama. The almost glabrous leaves with pit domatia are diagnostic for this species. Its closest relatives in Panama are *O. pausiaca*, which has stamens with long filaments, and *O. rubriflora*, which has a very dense and short indument on its twigs.

5. *Ocotea atirrensis* Mez & J.D. Smith, *Bot. Jahrb. Syst.* 30, *Beibl.* 67: 18 (1901). Type: Costa Rica, *Donnell-Smith 4930* (US!).

Ocotea paullii Allen, *O. pedalis* Mez, *O. pentagona* Mez, *O. wedeliana* Allen.

Shrubs or small trees, to 10 m. Twigs (sharply) angular or winged, minutely appressed pubescent or glabrous, hollow, often inhabited by ants; terminal buds densely and minutely appressed pubescent. Leaves 10-50 × 3-15 cm, (narrowly) elliptic to (narrowly) obovate or oblong, membranaceous to firmly chartaceous, alternate, pinnately veined, the base rounded to acute, the margin plane, the apex obtuse to acuminate, the acumen to 2 cm, midrib, lateral veins and tertiary venation immersed or midrib somewhat impressed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised to immersed on the lower surface, the tertiary venation sometimes contrasting with the darker lamina tissue; glabrous on both surfaces, domatia lacking; lateral veins 5-12; petioles 5-18 mm, glabrous, sulcate. Inflorescences 10-30 cm, in the axils of leaves or cataphylls, paniculately cymose, minutely appressed pubescent to glabrous, the branchlets flattened. Flowers 2-2.5 mm in diameter, greenish-white or creamy, hermaphrodite. Tepals c. 1 mm, ovate-elliptic, slightly spreading to erect at anthesis, minutely appressed pubescent or glabrous. Stamens 9, the outer 6 0.7-1.0 mm, the filament half as long as the anther, with a few minute hairs, the upper pair of locelli often smaller than the lower pair; inner 3 stamens as the outer 6, but on the side facing the pistil with a tuft of whitish, short hairs at the upper part of the filament; anther cells arranged in two pairs, anthers without a sterile tip; globose glands present at the base of the filaments of the inner 3 stamens; staminodia not seen. Pistil c. 1.5 mm, glabrous, style as long as the ovary; receptacle cup-shaped, glabrous inside. Fruits 2-3.5 cm, ellipsoid, seated on a small cupule with a single margin, bowl- to shallowly cup-shaped, the tepals

sometimes persisting as small lobes on the cupule. *Lowland and montane wet forests*. N (Neill 3368, MO); CR (Morales 128, MO); P (Gentry 6817, MO). 50-1200 m. (Endemic.)

The angular, hollow twigs, stamens without a sterile tip and the small cupules make identification of this species relatively easy. *Ocotea dendrodaphne* also has hollow twigs, but its stamens have a conspicuous sterile tip and its cupules are cup-shaped with a small double margin. *Ocotea atirrensis* is a variable species in which 3 other species recognized as distinct species in Burger & van der Werff (1990) are included. These species, *O. paullii*, *O. nicaraguensis* and *O. wedeliana*, were separated based on characters as leaf texture (coriaceous vs. chartaceous), color of dried leaves (green vs. very dark green), stems angular vs. strongly angular and cupule with or without persistent tepals. Inspection of all available collections has shown that they cannot be reliably divided into distinct entities based on these characters and no new characters have been found which allow recognition of distinct taxa in this complex. Some general trends have been found, such as fruiting specimens have more coriaceous leaves than flowering specimens, and specimens from higher altitudes have smaller, more coriaceous leaves than specimens from the lowlands, but these differences are clinal and not bi- or trimodal. Some populations seem distinct, for instance the specimens from the Reserva Biologica Carara (Costa Rica) have entirely glabrous flowers (most other collections have sparsely pubescent flowers), but the fact that occasional specimens from other localities have also nearly glabrous flowers suggests that the recognition of distinct taxa within a variable complex using such weak characters is not wise. Therefore, I have adopted a much wider concept of this species than found in earlier publications.

6. *Ocotea atlantica* van der Werff. *Novon* 11: 504 (2001). Holotype: Honduras, Atlantida, *Zamora 1744* (MO!).

Trees to 25 m tall. Twigs terete or slightly angular, solid, densely brown-tomentose when young, the surface not visible, glabrescent with age; terminal buds densely brown tomentose. Leaves 12-23 × 3.5-9 cm, alternate, chartaceous, (narrowly) elliptic, pinnately veined, the base acute to obtuse, the margin plane, the apex acuminate or acute, the acumen to 1 cm, the upper surface glabrous except for the tomentellous midrib, the lower surface pilose and soft to the touch, the indument denser along the

veins and on the midrib tomentose; midrib, lateral veins and tertiary venation immersed or the major veins slightly impressed on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; domatia lacking; lateral veins 5-8, the distal ones sometimes loopconnected near the margin; petioles 1-2.5 cm, terete, with a similar indument as the twigs. Inflorescences 2-10 cm, brown-tomentellous, paniculate-cymose or by reduction racemose, in the axils of leaves. Flowers unisexual, cream colored, 3-3.5 mm in diameter, moderately to sparsely appressed pubescent, the indument less dense than on the inflorescence branchlets. Male flowers: Tepals c. 1 mm, broadly elliptic, sparsely appressed pubescent outside, glabrous inside, outer 6 stamens c. 0.8 mm, glabrous, the filaments free, the anther c. 0.6 mm, the cells introrse, arranged in 2 pairs, a sterile tip lacking; inner 3 stamens like the outer ones, but with 2 globose glands near the base of the filaments and the anther cells extrorse; staminodia not seen; pistillode 1 mm, glabrous, threadlike, with a stigma; receptacle small, pocket-like, pubescent inside; female flowers: tepals as in male flowers or with some pubescence on the inner surface, united at the base and falling off as one unit in old flowers, staminodia 9, 0.5 mm, the inner 3 with 2 glands near the base; pistil 1.5 mm, glabrous, with a distinct stigma; receptacle glabrous inside. Fruits roundish, c. 8 × 6 mm, cupule shallowly bowl-shaped, lenticellate, with a single margin, the tepals deciduous, the pedicel swollen. *Lowland rain forests*. H (*Evans 1064*, MO); N (*Rueda 5653*, MO); CR (*Hammel 20710*, MO). 50-400 m. (Endemic.)

Ocotea atlantica is restricted to wet lowland forests on the Atlantic slopes of Costa Rica, Nicaragua and Honduras. It is one of the very few *Ocotea* species with unisexual flowers endemic to Mesoamerica. The shallow, lenticellate cupule and the flowers with a much sparser indument than found on the peduncles and inflorescence branchlets point to a relationship with the widespread *Ocotea leucoxylon*. However, that species lacks the pilose indument on the lower leaf surface and the tomentose or tomentellous indument on the young twigs and inflorescences.

One collection from Cerro Pirre, Panama (*Herrera 889*, MO) will also key to *O. atlantica*, due to its unisexual flowers, erect indument on leaves and dense pubescence on the stems. It differs from *O. atlantica* in its poorly defined petioles due to the somewhat decurrent leaf bases and in its raised, scalariform tertiary venation on the lower leaf

surface. The only known collection has pistillate flowers and more collections, with staminate flowers and fruits, are needed for a description.

7. *Ocotea aurantiodora* (Ruiz & Pavon) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 295 (1889). *Laurus aurantiodora* Ruiz & Pavon, *Fl. Peruv.* 4: t. 349 (1804-1830). Type: Peru, *Ruiz & Pavon s.n.* (B).

Small trees, to 15 m. Twigs strongly angular, solid, moderately to sparsely appressed pubescent, glabrescent with age, solid, terminal buds densely appressed pubescent. Leaves 13-35 × 4-10 cm, alternate, firmly chartaceous, elliptic, pinnately veined, the base cuneate and often somewhat decurrent, the margin towards the base recurved, the apex acute or shortly acuminate, the upper surface glabrous, the lower surface moderately dense to sparsely appressed pubescent; upper surface with midrib and lateral veins somewhat impressed, the tertiary venation raised and forming a fine mesh, the lower surface with the midrib prominently raised, lateral veins and tertiary venation raised, the leaf margin often recurved; domatia lacking; lateral veins 9-14; petioles to 10 mm, with a similar indument as the twigs, the upper side flat or broadly canaliculate. Inflorescences 10-20 cm, moderately densely pubescent, the hairs appressed or ascending, paniculate-cymose, in the axils of distal leaves. Flowers unisexual, c. 3 mm in diameter. Tepals moderately densely appressed pubescent outside, glabrous or nearly so inside, 1-1.5 mm, broadly elliptic, erect or slightly spreading at anthesis. Male flowers: outer 6 stamens c. 1.2 mm, glabrous, the filament half as long as the anther, free, the cells arranged in 2 pairs, introrse, filling the entire anther; inner three stamens as long as the outer ones, glabrous, tightly pressed together and with the filaments fused; glands present, closely pressed together and almost forming an annular disk; staminodia not seen; pistillode threadlike, the lower part appressed pubescent, the upper half glabrous; receptacle cup-shaped, pubescent inside; female flowers: staminodia 9, c. 0.6 mm, glabrous, the filaments free, pistil glabrous, c. 1.7 mm, receptacle cup-shaped, glabrous inside. Fruits ellipsoid to ovoid, c. 8 mm, cupule cup-shaped, 6 mm in diameter and 5 mm high, with a single margin, tepals often persisting on the cupule in young fruit, falling off later. *Lowland and lower montane wet forest.* N (Robleto 676, MO); CR

(*Smith 15313*, MO); P (*Galdames et al. 3301*, MO). 0-600 m. (Mesoamerica, Colombia, Venezuela, French Guiana, Brazil, Ecuador, Peru, Bolivia.)

Ocotea aurantiodora can be recognized by its sharply angular twigs, the small, raised reticulation formed by the tertiary venation, the unisexual flowers and small, cup-shaped cupules. Almost all South American specimens included in the distribution of the species have been identified as *O. longifolia* Kunth. which is almost certainly a synonym of *O. aurantiodora*. Occasionally the lower leaf surfaces are slightly glaucous and faint venation lines are sometimes visible on more pubescent leaves; these lines are never as clearly visible as in *O. calophylla*, a close relative of this species.

8. *Ocotea austinii* C. Allen, *J. Arn. Arbor.* 26: 350 (1945). Isotype: Costa Rica, *Smith A 125* (MO!).

Ocotea irazuensis Lundell.

Trees, to 20 m. Twigs angular or ridged, solid, glabrous to densely appressed pubescent, terminal buds densely appressed pubescent. Leaves 8-14 × 3-4.5 cm, alternate, elliptic to oblong, coriaceous, pinnately veined, the base decurrent on the petiole and inrolled, the margin recurved towards the base, apex obtuse or acute, midrib; lateral veins and tertiary venation raised on both surfaces; upper surface glabrous or with some appressed hairs along the midrib, frequently shiny, lower surface moderately to densely appressed pubescent, somewhat sericeous, venation lines frequently visible on the lower surface, axillary tufts of hairs or glabrous depressions in the axils of lateral veins present or absent; lateral veins 6-9; apparent petioles 1-2 cm, flat above, with a similar indument as the twigs. Inflorescences 7-18 cm, paniculate-cymose, sparsely to densely appressed pubescent. Flowers 4 mm in diameter, green or yellow, perfect. Tepals 2-3 mm, appressed pubescent outside, the surface largely or completely covered by the indument, inner surface moderately to sparsely pubescent, somewhat spreading at anthesis, spreading in old flowers, outer 6 stamens 1.5 mm, the filament with a few appressed hairs, half as long as the anther, free, the cells arranged in 2 rows, opening introrsely, filling the entire anther, inner 3 stamens 2 mm, the filament with some hairs, especially dorsally, 0.7 mm, the cells arranged in 2 rows, lateral-extrorse, staminodia not seen, pistil 2 mm, glabrous, the ovary as long as the style, receptacle cup-shaped, pubescent inside.

Fruits ellipsoid, 3×1.5 cm, cupule platelike, to 1.5 cm in diameter, with a single margin, the tepals sometimes persisting in young fruits. *Montane forests*. CR (*Proctor 32355*, MO); P (*Todzia 2590*, MO). 2000-3000 m. (Endemic.)

Ocotea austinii is best recognized by the raised tertiary venation on the upper leaf surface and the coriaceous, rather small, frequently oblong leaves. The leaf base is always decurrent on the petiole and inrolled. It can be confused with *O. glaucosericea*, but that species has larger (to 21 cm), less coriaceous leaves, densely pubescent flowers and its receptacle is generally glabrous inside. It is also related to *O. whitei* and *O. skutchii*, but these species lack the raised tertiary venation on the upper leaf surface and have less coriaceous leaves.

9. *Ocotea bajapazensis* Lundell, *Wrightia* 6: 8 (1978). Isotype: Guatemala, *Lundell & Contreras 20946* (F!). Illustr.: Lundell, *Wrightia* 6: pl. 18 (1978).

Small tree, to 8 m. Twigs angular, solid, sparsely appressed pubescent with short, white hairs; terminal buds densely white pubescent, the surface completely covered. Leaves $11-18 \times 4-7$ cm, elliptic, chartaceous, alternate, pinnately veined, the base acute, margin flat, the apex acute or slightly acuminate, the upper surface with some scattered, appressed hairs, soon becoming glabrous, but some hairs persisting along the major veins, lower surface with some appressed hairs, these denser along the major veins, the laminae becoming glabrous with age; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; domatia in the form of small axillary tufts of hairs frequently present; lateral veins 4-7, petioles 10-15 mm, sulcate, with a similar indument as the twigs. Inflorescences 4-13 cm, sparsely appressed pubescent, often with a few of the inflorescence bracts developed into normal leaves, paniculate-cymose, in the axils of normal leaves. Flowers 4.5 - 5.5 mm in diameter, white, fragrant, perfect. Tepals 2-2.5 mm, spreading at anthesis, glabrous outside, inner surface of the inner 3 tepals uniformly papillose inside, outer 3 tepals with a basal triangular papillose patch, otherwise glabrous, outer 6 stamens 1.2 mm, densely papillose, the cells in 2 pairs, opening introrse, the cells filling the entire anther, the filaments free, inner 3 stamens 1.2 mm, the cells in 2 pairs, extrorse-lateral, glands present at the base of the very short filaments, staminodia not

seen, pistil 1.8 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, pubescent inside. Tepals deciduous in old flowers. Fruit and cupule unknown. *Lowland rain forest*. G (Lundell & Contreras 20886, MO). 100-300 m. (Endemic.)

Ocotea bajapazensis can be recognized by the combination of sparsely appressed pubescent twigs, paniculate-cymose inflorescences and rather small flowers. It closely resembles *O. heydeana*, which differs mainly in having larger flowers and occurring at higher altitudes. These differences are not strong, but the alternative, merging *O. heydeana* and *O. bajapazensis*, would be a species with an uncommonly large variation in flower size. I prefer, as Rohwer (1991) did, to recognize *O. bajapazensis* as a distinct species.

10. *Ocotea barbatula* Lundell, *Wrightia* 5: 336 (1977). Isotype: Guatemala, Lundell & Contreras 19444 (MO!).

Tree, to 16 m. Twigs terete or angled, solid, moderately to sparsely appressed pubescent, becoming glabrous with age, solid; terminal buds densely appressed pubescent. Leaves 6-11 × 2-3.5 cm, alternate, chartaceous, elliptic, pinnately veined, the base acute, the margin flat, the apex acute or acuminate, the acumen to 1 cm, the upper surface glabrous, the lower surface with some appressed hairs, becoming glabrous with age; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface, the tertiary venation forming a fine mesh, the major veins often lighter in color than the lamina; lateral veins 6-8; domatia present as pits with a pubescent margin, one or several times their diameter away from the midrib; petioles 5-14 mm, weakly canaliculate, with a similar indument as the twigs. Inflorescences 3-6 cm, glabrous or nearly so, paniculate-cymose, in the axils of leaves. Flowers 2-2.5 mm in diameter, yellowish, perfect. Tepals 1.5 mm, broadly elliptic, glabrous or nearly so on both surfaces, erect at anthesis; outer 6 stamens glabrous, c. 1 mm, the filaments free, the cells in 2 rows, opening introrse and filling the entire anther, inner 3 stamens with the same length, the back of the filament pubescent, otherwise glabrous, 2 globose glands present at the base of the filaments, the cells in 2 pairs, opening lateral-extrorse; staminodia not seen; pistil 1.8 mm, the style distinct and about as long as the ovary, the receptacle cup-shaped, appressed pubescent in the upper part, glabrous in the lower part.

Fruits 1.7×1.1 cm, ellipsoid, the cupule disk-shaped, with a single margin, to 1 cm in diameter, the tepals not persistent, the pedicel distinctly widened towards the cupule. *Wet forest. G (Lundell & Contreras 20916, MO). Altitude ?.* (Endemic.)

Ocotea barbatula is similar to *O. meiziana*, but can be identified by its pitdomatia with a pubescent margin which are well away from the midrib. I have some doubt if this character is sufficient for the separation of two species. A number of specimens placed in *O. meiziana* have small domatia along the lateral veins, while in others these secondary domatia are lacking. This suggests that the distribution of domatia is variable and leaves the pubescent margin of the domatia as the only character separating *O. barbatula* from *O. meiziana*.

11. *Ocotea bernoulliana* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 275 (1889).
Isotype: Guatemala, *Bernoulli & Cario 2590 (U!)*.

Tree, to 11 m. Twigs angular, solid, glabrous; terminal buds glabrous. Leaves $10-16 \times 3.5-6.5$ cm, chartaceous, glabrous, elliptic, alternate, dark green when dry, pinnately veined, the base acute, the margin plane, the apex acute or acuminate, acumen to 1 cm, midrib, lateral veins and tertiary venation raised on both surfaces, conspicuous pitdomatia with a slit-like opening present in the axils of several lateral veins, smaller pitdomatia present along the basal lateral veins, the domatia with a glabrous margin, lateral veins 4-6, petioles 7-12 mm, glabrous, flat above. Inflorescence 21 cm, glabrous, panicle-cymose. Flowers 2.5-3 mm in diameter, perfect. Tepals 1.7 mm, ovate, glabrous on both surfaces, erect to half erect at anthesis, stamens 9, 4-celled, the outer 6 1 mm, the filament half as long as the anther, free, sparsely pubescent, the anther glabrous, anther cells opening introrse, filling the entire anther, the inner 3 about as long, the filament very short, rather densely pubescent, glands present at the base of the filaments, staminodia stipitiform, pubescent, pistil glabrous, 1.7 mm, the style about as long as the ovary, receptacle deep, pubescent inside. Fruit 2.5×1.5 cm, seated in a deep, cup-shaped cupule, this 2.5 cm in diameter, 2 cm, narrowed into the pedicel, the cupule with 6 prominent, longitudinal ribs, these terminating in a blunt tooth; margin of the cupule simple. *Montane forests. Ch (Matuda 17659, CAS); G (Steyermark 37643, F). 1000-1600 m.* (Endemic.)

Ocotea bernoulliana can be recognized by the following combination of characters: glabrous twigs, leaves, terminal buds and flowers; leaves with conspicuous pitdomatia in the axils of the lateral veins and smaller pitdomatia along the lateral veins; leaves dark green when dry and deep cupules with 6 prominent longitudinal ridges. This species is rarely collected and the type collection is the only one I have seen with flowers. Its closest relative is *Ocotea vanderwerffii*, which differs mainly in having pitdomatia only in the axils of the basal lateral veins, in having tripliveined leaves and a shallow, almost platelike cupule. Most collections of *O. vanderwerffii* come from lower altitudes (150-700 m), although a few come from 1000-1300 m.

12. *Ocotea betazensis* (Mez) van der Werff, *Novon* 9: 572 (1999). *Phoebe betazensis* Mez. Syntype: Mexico, Oaxaca, *Liebmann 23* (C!). Illustr.: van der Werff, *Novon* 9: 573 (1999).

Ocotea mexicana (Meissner) Hemsley var. *diminuta* (Meissner) Hemsley;
Oreodaphne mexicana Meissner var. *diminuta* Meissner.

Trees, to 20 m. Twigs terete or slightly angular, solid, densely brown tomentellous-tomentose, the indument completely covering the young branches, solid; terminal buds densely tomentellous-tomentose. Leaves 8.5-18 × 4.5-7.5 cm, alternate, firmly chartaceous, (broadly) elliptic, pinnately veined, the base obtuse or rounded, rarely acute, the margin plane, the apex obtuse, acute or shortly acuminate; upper surface sparsely pubescent when young, the hairs erect, soon becoming glabrous, the indument persisting on the midrib and lateral veins, the lower surface sparsely to moderately pubescent, the hairs erect, discernable to the touch, the surface well visible, midrib and lateral veins densely pubescent, axillary tufts of white hairs sometimes present on the lower surface; lateral veins 5-7; petioles 12-23 mm, roundish above, with a similar dense pubescence as the twigs. Inflorescences 4-12 cm, paniculate-cymose, sparsely to moderately hirsute, the surface well visible, in the axils of leaves or cataphylls. Flowers 7-9 mm in diameter, white or yellow, perfect. Tepals c. 3 mm, elliptic, glabrous outside, glabrous inside or with a few hairs near the base, spreading at anthesis; outer 6 stamens 1.2 mm, the filament half as long to equally long as the anther, free, glabrous, the cells introrse and arranged in 2 rows, a sterile tip lacking, inner 3 stamens 1.8 mm, the

filament 0.8 mm, glabrous, the cells in 2 rows, extrorse-lateral, staminodia 3, stipitiform, 0.6 mm, pubescent, pistil glabrous, 2 mm, the style c. 0.7 mm, the receptacle cup-shaped, glabrous or pubescent inside. Fruit broadly ellipsoid, 1.5 × 1.3 cm, cupule shallow, almost plate-like, 1 cm in diameter, with a single margin, the tepals not persistent, the pedicel thickened. *Upper montane forests*. 2000-2600 m. (Mexico [Oaxaca], to be expected in Chiapas.)

Ocotea betazensis can be recognized by its (broadly) elliptic leaves, relatively long petioles, well developed filaments of the stamens and the dense indument of young twigs. It has been usually included in *O. helicterifolia*, but that species has frequently obovate leaves, shorter petioles, a hirsute indument of the twigs which usually does not completely obscure the surface of the twigs and nearly sessile anthers. The indument of the twigs is the best character to identify fruiting specimens. In some specimens the inner surface of the receptacle is glabrous, in others pubescent; in most related species this character does not vary.

13. *Ocotea botrantha* Rohwer, *Bot. Jahrb. Syst.* 112(3): 375 (1991). Isotype: Mexico, *Matuda 1880* (MO!).

Persea matudae Lundell.

Trees, to 25 m. Twigs angular or terete, densely whitish tomentose when young, the indument turning darker and wearing off with age, solid, terminal buds densely tomentose. Leaves 15-22 × 6-17 cm, (broadly) obovate, chartaceous, alternate, pinnately veined, the base cordate to acute, the margin plane, the apex (shortly) acuminate, the acumen to 1.5 cm; the upper surface glabrous or sparsely pubescent when young, the lower surface moderately to densely pubescent, the hairs erect, discenable to the touch, and the surface visible between the hairs, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib strongly raised, lateral veins and tertiary venation raised on the lower surface; domatia absent; lateral veins 8-10; petioles 2-4 cm, flat to sulcate on the upper side. Inflorescences 6-18 cm, racemose, in the axils of leaves or cataphylls, densely to moderately pubescent. Flowers 1.2-1.4 cm in diameter, white, perfect. Tepals c. 5 mm, elliptic, spreading at anthesis, outside of the outer 3 tepals densely pubescent, the inner 3 tepals with a pubescent, triangular patch, inside of the outer

3 tepals with papillose, triangular patch, otherwise glabrous, the inner 3 tepals densely papillose; outer 6 stamens c. 3 mm, tongue-shaped, sessile, papillose, the sterile tip c. 1 mm, the anther cells introrse, arranged in two pairs, inner 3 stamens c. 3 mm, tongue-shaped, sessile, papillose, the anther cells lateral, two glands present at the base of the stamens, staminodia not individually visible, apparently fused with the glands and forming a ring above the receptacle; pistil glabrous or sparsely pubescent, receptacle pubescent inside. Fruits 1.5×1 cm, glabrous, cupule cup-shaped, c. 1.5 cm in diameter, with a single margin, tepals and stamens often present on young cupules. *Montane wet forest*. Ch (*Lorea* 5526, MO); G (*Williams et al.* 40699, MO); ES (*Standley* 22968, MO). 800-2400 m. (Endemic.)

Ocotea botrantha can be easily recognized by its racemose inflorescences, large flowers with tongue-shaped stamens and its densely pubescent twigs. It is closely related to *O. sinuata*, which differs in having paniculate-cymose inflorescences and densely pubescent pistils.

14. *Ocotea bourgeauviana* (Mez) van der Werff, *Novon* 9: 574 (1999). *Phoebe bourgeauviana* Mez. Isotype: Mexico, Veracruz, *Bourgeau* 2234 (MO!). Illustr.: van der Werff, *Novon* 9: 573 (1999).

Cinnamomum chinantecorum (Schultes) Kostermans; *Nectandra longicuspis* Lundell; *Phoebe chinantecorum* Schultes.

Tree, to 25 m. Twigs terete, densely hirsute, solid, the surface slightly visible between the hairs. Leaves $10-20 \times 3.5-6$ cm, chartaceous, narrowly elliptic to narrowly elliptic-obovate, clustered or a few leaves scattered along the twigs, pinnately veined, the base acute or obtuse, the margin plane, the apex acuminate, acumen to 1.5 cm, or acute, the upper surface moderately erect pubescent when young, soon becoming glabrous, the indument denser and tomentellous along the midrib, the lower surface moderately pubescent with erect hairs, the surface mostly visible between the hairs, the indument discernable to the touch, denser along midrib and lateral veins, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins clearly raised, tertiary venation somewhat raised on the lower surface, domatia absent, lateral veins 6-9, petioles 6-9 mm, flat above, with a similar dense indument as the twigs. Inflorescences 5-

10 cm, paniculate-cymose, in the axils of leaves or cataphylls, sparsely to moderately pubescent with erect hairs. Flowers 5-6 mm in diameter, yellowish or cream-colored, perfect. Tepals 2 mm, elliptic, glabrous on the outer surface, pubescent on the inner surface, especially near the base, sometimes papillose distally, spreading at anthesis; outer 6 stamens c. 1.2 mm, filament short, 0.3 mm, free, with some coarse hairs as well as at the base of the stamen, a sterile tip absent, the cells introrse, arranged in 2 pairs, inner 3 stamens 1.1 mm, the filament 0.3 mm, glabrous or with a few hairs, the cells extrorse, arranged in 2 pairs, glands present at the base of the filaments, staminodia 3, pubescent, poorly visible between the hairs on the top of the receptacle; pistil 1.2 mm, glabrous, style short, 0.2 mm, receptacle deeply cup-shaped, glabrous or pubescent inside. Fruit ellipsoid, 1.6×1 cm, pedicel gradually broadened into the plate-like cupule, this 0.6 cm in diameter, with a single margin; tepals not persistent. *Lowland and montane forests*. Ch (*Breedlove 50583*, CAS); B (*Davidse 36160*, MO); G (*Contreras 11186*, MO); H (*Brant & Hazlett 2871*, MO). 100-1200 m. (Mexico [Oaxaca, Veracruz], Mesoamerica.)

Ocotea bourgeauviana can be recognized by the combination of clustered leaves, and the tepals which are glabrous on the outside and pubescent on the inside. Occasionally, leaves can be somewhat alternate and such plants resemble *O. helicterifolia* vegetatively; they differ from *O. helicterifolia* in the pubescent inner surface of the tepals and the smaller flowers and stamens. The narrowly elliptic, clustered leaves are also found in *O. tonii*, but that species has the outside of the tepals pubescent and larger flowers (5-6 mm vs 9-10 mm in diameter). The two collections from Guatemala and Honduras had the inside of the receptacle pubescent, while the Mexican collections have a glabrous receptacle. Because no other differences were found between these specimens, I have included them in one species. If additional differences would be found in the future (fruiting material is, for instance, not known from Guatemala or Honduras), the name *Nectandra longicuspis* is available for the Guatemalan/Honduran taxon. Provisionally placed here are also some collections from Veracruz which differ from *O. bourgeauviana* in having a glabrous inner surface of the tepals and slightly smaller flowers (4-5 mm in diameter). These specimens have a pubescent inner surface of the receptacle. They differ in only one character (the glabrous tepals) from *O.*

bourgeauiana and I prefer to have at least two good differences for the recognition of a new species.

15. *Ocotea brenesii* Standley, *Publ. Field Mus. Nat. Hist., Bot. Ser.* 18: 454 (1937). Holotype: Costa Rica, *Brenes 13653* (F!).

Nectandra brenesii (Standley) C.K. Allen.

Trees, usually to 12 m, but occasionally taller (to 28 m). Twigs ridged or terete, solid, moderately to sparsely appressed pubescent; terminal buds densely appressed pubescent. Leaves 7-16 × 3-6 cm, thinly chartaceous, elliptic, alternate, pinnately veined, the base obtuse to acute, the margin flat, the apex acuminate or acute, glabrous on the upper surface, very sparsely pubescent on the lower surface, the hairs appressed and denser along the major veins; midrib and lateral veins immersed, tertiary venation immersed or slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; domatia lacking; lateral veins 4-6; petioles 10-15 mm, sulcate, with a similar indument as the twigs. Inflorescences 2.5-7 cm, sparsely appressed pubescent, racemose, in the axils of leaves. Flowers 6-9 mm in diameter, white, perfect. Tepals 3-4 mm, glabrous outside, weakly papillose inside, spreading at anthesis, outer 6 stamens c. 1.5 mm, papillose, the filaments short, 0.3 mm, free, the cells opening introrse, arranged in 2 pairs and filling nearly the entire anther; inner 3 stamens with same dimensions, the cells arranged in 2 pairs, lateral-extrorse, filaments with 2 globose glands at the base and also with a few spreading hairs near the base, staminodia not seen, pistil 1.8 mm, glabrous, the style slightly shorter than the ovary, the receptacle cup-shaped and appressed pubescent inside. Fruit ellipsoid, 3 × 1 cm, cupule shallow, almost platelike, 1 cm in diameter, the tepals not persistent, with a single margin, the pedicel gradually thickened towards the cupule. *Montane forests*. CR (*Alvarado 108*, MO); P (*Quiroz 717*, MO). 700-2000 m. (Endemic.)

The racemose inflorescences and appressed indument of the young twigs characterize *Ocotea brenesii*. Other useful characters are the relatively large, glabrous flowers with spreading tepals and the small, platelike cupule seated on a swollen pedicel. It resembles *O. pittieri*, but the latter species has an erect indument on the young twigs as well as domatia in the form of axillary tufts of hairs.

16. *Ocotea calophylla* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 298 (1889).

Type: Colombia, *Jervise s.n.* (K).

Ocotea fulvescens Standley & Steyermark, *Pleurothyrium velutinum* Meissner.

Trees to 20 m. Twigs angular, densely reddish brown pubescent, the hairs appressed and ascending, completely covering the surface, turning brown with age, solid; terminal buds densely, more or less sericeous pubescent. Leaves 10-20 × 4-7 cm, (narrowly) elliptic, coriaceous, alternate, pinnately veined, the base revolute and decurrent along the petiole, thus the leaves appearing sessile, the margin recurved or inrolled towards the base, the apex acute; the upper surface densely to sparsely appressed pubescent, becoming glabrous with age, the lower surface densely appressed sericeous pubescent or the hairs partially ascending, discernable to the touch, the surface not visible, venation lines clearly visible on the lower surface; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation immersed on the lower surface; domatia lacking; lateral veins 10-13; petioles indistinct due to the decurrent leaf bases. Inflorescences 8-25 cm, paniculate-cymose, densely reddish-brown pubescent, in the axils of leaves. Flowers c. 10 mm in diameter, pale green or pale yellow, unisexual. Tepals c. 4 mm, elliptic, densely pubescent outside, pubescent and papillose towards the apex and margin inside, sometimes the pubescence restricted to the base of the tepals; spreading at anthesis. Male flowers with the outer 6 stamens c. 2-2.5 mm, the anther c. 1.4 mm, stamens glabrous, filaments free, the cells in 2 pairs, filling the entire anther, introrse, inner 3 stamens c. 3 mm, anthers about as long as the filaments, glands present at the base of the filaments; staminodes not seen; pistillode c. 4 mm, slender, glabrous; receptacle glabrous inside; female flowers with 9 staminodes, these c. 1-1.3 mm, glabrous, the anther cells visible, but not opening, inner 3 staminodes with 2 large glands at their base; pistil c. 4 mm, glabrous, receptacle glabrous inside. Fruits 2-2.5 cm, ellipsoid, cupule shallowly bowl-shaped, 1-1.3 cm in diameter, with a single margin, the tepals not persistent. *Upper montane forests. CR (Leon 2166, MO). 2600-3000 m. (Mesoamerica, Colombia, Venezuela, Ecuador.)*

Ocotea calophylla is a striking species and easily recognized by its densely pubescent leaves with revolute base; the venation lines on the leaves and its upper

montane habitat. The pubescence of the leaves can vary from sericeous-appressed to more or less ascending. The four collections I have seen from Costa Rica had an appressed-sericeous indument on the leaves. Pistillate flowers can be readily recognized as unisexual, because the staminodia are small and the anther cells remain closed. Staminate flowers have a well-developed pistillode and these flowers may well appear perfect; the pistillode is however very slender and does not contain an ovary.

17. *Ocotea cernua* (Nees) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 377 (1889). *Oreodaphne cernua* Nees, *Syst. Laur.* 424 (1836). Syntype: Martinique, *Sieber 106* (MO!)

Shrub or tree to 20 m. Twigs somewhat angular or terete, solid, glabrous or initially sparsely appressed pubescent, solid, terminal buds rather densely appressed pubescent. Leaves 6-15 × 3-6 cm, oblong, elliptic or broadly elliptic, chartaceous, alternate, pinnately veined, rarely weakly tripliveined, acute to obtuse at the base, the margin plane, acuminate or caudate at apex, acumen to 2 cm, glabrous or nearly so, midrib, lateral veins and tertiary veins immersed on the upper surface, immersed or slightly raised on the lower surface; domatia lacking; lateral veins 3-6 pairs, the basal pair sometimes stronger developed than the more distal ones; petioles 6-20 mm glabrous, canaliculate. Inflorescences 4-14 cm, glabrous, paniculate-cymose, in the axils of leaves. Flowers 3-4 mm in diameter, yellowish, fragrant, unisexual. Tepals c. 1.5 mm, elliptic-ovate, glabrous on both surfaces or with some papillae along the margin, half erect at anthesis. Male flowers: stamens 9, glabrous, the outer 6 c. 0.7 mm, filaments largely fused with the tepals, the anthers glabrous, locelli opening introrse, filling the entire anther; inner 3 stamens c. 1 mm, with 2 globose glands at the base, the filament lacking almost completely, the anther cells opening extrorse (the lower pair) or lateral (the upper pair); staminodia not seen; pistil minute or lacking; receptacle urceolate, pubescent inside; female flowers: staminodia 9, c. 0.5 mm, the inner 3 with 2 small, globose glands at the base, pistil c. 1.5 mm, glabrous, the style very short, receptacle urceolate, glabrous inside, in old flowers the tepals united at the base and falling off as a unit. Fruit ellipsoid, 15 × 10 mm, seated in a (deeply) cup-shaped cupule, 10 mm wide and 6-7 mm high, with a single margin; tepals not persistent on the cupule. *Evergreen lowland forest*. T (Cowan

2046, CAS); Ch (*Gonzalez-Espinosa et al. 1006*, MO); B (*Proctor 36013*, MO); G (*Contreras 4300*, MO); H (*Yunker et al. 8788*, MO); N (*Little 25445*, MO); CR (*Stevens et al. 25112*, MO); P (*Croat 8186*, MO). 0-700m. (Mexico, Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Bolivia, Brasil, Guadeloupe, Dominica, Martinique, St. Lucia.)

Ocotea cernua is easily recognized by its nearly glabrous twigs, leaves, inflorescences and flowers, unisexual flowers which are often somewhat reflexed or nodding, the rather deeply cup-shaped cupules and the weakly tripliveined leaves (although this is not always the case). The species is widely distributed and therefore variable. The flowers are often described as fragrant; I found them to have a strong lemon-like scent.

18. *Ocotea chiapensis* (Lundell) Standley & Steyermark, *Publ. Field Mus. Nat. Hist., Bot. ser. 23: 114* (1944). *Nectandra chiapensis* Lundell, *Contr. Univ. Michigan Herb.* 6: 12 (1941). Type: Mexico, Chiapas, *Matuda 2042* (isotype MO!).

Trees to 25 m. Twigs angular, solid, densely appressed pubescent when young, the indument becoming sparser with age; terminal buds densely sericeous. Leaves 11-21 × 3.5-8 cm, firmly chartaceous, elliptic to elliptic-obovate, alternate, pinnately veined, the base inrolled and decurrent on the petiole, the margin inrolled towards the base, the apex acute or shortly acuminate, midrib, lateral veins and tertiary venation slightly raised on the upper surface or the midrib immersed, midrib, alteral veins and tertiary venation raised to slightly raised on the lower surface, upper surface glabrous, lower surface sparsely to moderately appressed pubescent; domatia present and usually conspicuous as axillary tufts of hairs; petioles with decurrent and inrolled leaf bases 2-3 cm, with a similar indument as the twigs. Inflorescences 12-20 cm, paniculate-cymose, moderately to sparsely appressed pubescent or puberulous, in the axils of leaves. Flowers 5-6 mm in diameter, greenish, perfect. Tepals moderately appressed pubescent and somewhat papillose outside, densely so inside, 1.8 mm, elliptic, spreading at anthesis, outer 6 stamens 1.2 mm, the filament pubescent, c. 0.4 mm, free, the cells arranged on 2 overlapping pairs and filling the entire anther, inner 3 stamens 1.5 mm, dorsally with some hairs at the junction of the filament and the anther, the cells in 2 pairs, the upper

pair lateral, the lower extrorse, 2 globose glands present at the base of the filaments of the inner stamens, staminodia stipitiform, 0.3 mm, with a few hairs, pistil 2 mm, glabrous, the style as long as the ovary, receptacle shallowly cup-shaped, glabrous or pubescent inside. Fruit ellipsoid, 2 × 1 cm, the cupule initially shallowly cup-shaped, becoming flat, platelike at maturity, margin single and without persistent tepals. *Montane forests*. Ch (*Matuda 4579*, MO); G (*Castillo 2052*, MO). 1000-2800 m. (Mexico [Guerrero], Mesoamerica.)

Ocotea chiapensis is quite similar to *O. glaucosericea*, but the latter species has a denser indument on leaves and flowers (the flowers are white-pubescent), usually lacks domatia and has a deeper cup-shaped receptacle and cupule, with the tepals semipersistent. The distribution of the 2 species does not overlap; *O. chiapensis* is known from Mexico and Guatemala, while *O. glaucosericea* is only known from Costa Rica and Panama. The relatively large flowers and leaves with decurrent, inrolled base are characteristic for both species.

19. *Ocotea chrysobalanoides* (Lundell) Lundell, *Wrightia* 5: 35 (1974). *Persea chrysobalanoides* Lundell. Isotype: Mexico, Chiapas, *Matuda 5582* (MO!).

Trees, to 10 m. Twigs ridged and angular, solid, densely and minutely grey appressed pubescent, the indument covering the twig entirely; terminal buds not seen, but probably densely grey pubescent. Leaves 9-18 × 5.5-10 cm, elliptic to slightly obovate-elliptic, coriaceous, alternate, pinnately veined, the base obtuse or acute, shortly decurrent on the petiole, but a distinct petiole present, the margin flat, the apex obtuse to rounded, glabrous on both surfaces, midrib, lateral veins and tertiary venation raised on both surfaces, but more prominently so on the lower surface; domatia lacking; lateral veins 8-12; petioles 1-1.8 cm, thick, flat above, with a similar indument as the twigs. Inflorescences to 21 cm, paniculate-cymose, axillary, densely and minutely pubescent, the indument covering the inflorescences almost completely. Flowers 4-5 mm in diameter, perfect. Tepals c. 3 mm, broadly elliptic, densely pubescent on both surfaces, half-erect at anthesis; stamens 9, 4-celled, the outer 6 c. 1.5 mm, glabrous or with a few hairs on the filaments, the filaments 2/3 the length of the anther, free, the cells arranged in 2 pairs, filling the entire anther, opening introrse; the inner 3 c. 1.8 mm, glabrous or with a few

hairs, the filaments with 2 glands near the base, about as long as the anther, the anther cells opening extrorse; staminodia present, c. 0.8 mm, with a triangular apex, pubescent. Pistil glabrous, 2 mm, the style as long as the ovary; receptacle cup-shaped, appressed pubescent inside. Fruits and cupule not known. *Montane rain forest*. Ch (*Matuda 5582*, MO). 2000 m. (Endemic.)

Ocotea chrysobalanoides is only known from the type collection and its relationships remain unclear. It can be recognized by its leaves, with obtuse to rounded apices, pubescent receptacles, large staminodia, and the dense, grey indument on twigs and inflorescences.

20. *Ocotea congregata* van der Werff, *Novon* 9: 574 (1999). Holotype: Mexico, Chiapas, *Shilom Ton 8930* (MO!). Illustr.: van der Werff, H., *Novon* 9: 573 (1999).

Small trees, to 15 m tall. Twigs terete, solid, densely brown-tomentose or tomentellous, the hairs erect and twisted, covering the surface of the young twigs completely; terminal buds densely brown-tomentose. Leaves 9-17 × 4-7 cm, elliptic to broadly elliptic, firmly chartaceous, clustered, pinnately veined, the base rounded or obtuse, rarely acute, the margin plane, the apex obtuse to acute, midrib and lateral veins impressed, tertiary venation weakly impressed on the upper surface, midrib and major veins prominently raised, smaller veins raised on the lower surface; upper surface moderately pubescent when young, the hairs erect, soon becoming glabrous, the pubescence denser and persisting along the major veins, lower surface moderately densely pubescent, the hairs erect and discernable to the touch, the surface readily visible between the hairs, the indument denser and tomentose along the midrib and lateral veins; domatia lacking; petioles 10-25 mm, round, with a similar indument as the twigs. Inflorescences 5-12 cm, paniculate-cymose, the flowers in compact clusters, densely hirsute-tomentose, mostly in the axils of bracts, infrequently in the axils of leaves. Flowers 7-9 mm in diameter, white, perfect, the receptacle densely pubescent outside. Tepals 3 mm, elliptic, the outside moderately to sparsely pubescent, the inside pubescent near the base, otherwise glabrous, spreading at anthesis, outer 6 stamens 1.6 mm, sessile or nearly so, with a few hairs near the base, otherwise glabrous, the cells arranged in 2 pairs, introrse, at the tip with a narrow, sterile border, inner 3 stamens 1.7 mm, the

filament 0.5 mm, with a few hairs, the cells in 2 pairs, extrorse-lateral, glands present at the base of the filaments, staminodia 3, minute, stipitiform, hidden between the hairs on the top of the receptacle; pistil 1.5 mm, glabrous, the style 0.4 mm, receptacle cup-shaped, appressed pubescent or glabrous inside. Fruit ellipsoid, 2×1.3 cm, the cupule deeply cup-shaped when young, bowl-shaped at maturity, 1 cm in diameter, with a single margin, the tepals deciduous. *Montane forests. Ch (Mendez Ton 9594, MO). 800-1400 m. (Endemic.)*

Ocotea congregata, named after the erect stamens grouped in a rather tight cluster, is currently only known from the Mexican state of Chiapas and occurs between 800-1370 m altitude. It can be recognized by the slightly bullate, loosely clustered leaves, the pubescent flowers arranged in paniculate-cymose inflorescences, the brown to dark brown indument on the twigs and the rather long (10 mm or more) petioles. Its closest relative is *Ocotea tonii*, which differs in its narrower, longer leaves, shorter petioles (to 6 mm) and the yellowish brown indument on the young twigs.

21. *Ocotea contrerasii* Lundell, *Wrightia* 5: 337 (1977). Isotype: Guatemala, *Lundell & Contreras 19588* (MO!).

Tree, to 20 m. Twigs terete, solid, densely pubescent, the hairs erect or ascending, covering the surface of young twigs completely; terminal buds completely covered by erect or ascending, whitish hairs. Leaves $9-14 \times 3-4.5$ cm, elliptic, subchartaceous, alternate, pinnately veined, the upper surface glabrous or with a few scattered appressed hairs, these more numerous along the major veins, the lower surface with some ascending or appressed hairs, glabrescent, midrib and lateral veins pubescent, the hairs erect, not discernable to the touch, the hairs denser and longer in the axils of the lateral veins; leaf base and apex acute or the apex acuminate; leaf margin flat; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface, the major veins lighter in color than the surrounding laminae, especially in older leaves; lateral veins 7-9; domatia present as axillary tufts of hairs; petioles 7-12 mm, with a similar indument as the twigs, flat above. Inflorescences 3-6 cm, moderately to rather densely pubescent, the hairs ascending or erect, racemose, with less than 10 flowers. Flowers 4 mm in diameter, yellow-green, perfect. Tepals c. 1.8 mm, moderately pubescent on both surfaces, half erect at anthesis; stamens 9, all 4-celled, outer 6 1.2 mm, the

anther twice as long as the filament, filament dorsally pubescent, free, anther cells in 2 rows, opening introrse, filling the entire anther; inner 3 stamens 1.2 mm, the filament half as long as the anther and with 2 globose glands near the base, dorsally together with the lower half of the anther densely pubescent; staminodia not seen; pistil 2 mm, glabrous, the ovary gradually narrowed into the style, receptacle deeply cup-shaped, the basal part glabrous, the upper 2/3 appressed pubescent. Fruits ellipsoid, 3 × 1.5 cm (to 4 cm long fide Lundell), cupule 1.5 cm in diameter, shallow, the tepals persisting as small teeth on the single margin. *Rain forests*. G (Lundell & Contreras 20942, MO). Altitude ?. (Endemic.)

Ocotea contrerasii is a rarely collected species, related to *O. meiziana*. It is best recognized by the dense indument on the twigs, with erect or ascending hairs, and the spreading hairs along the major veins on the lower leaf surface. The indument on the twigs is rather persistent and is also readily visible on fruiting specimens.

22. *Ocotea corrugata* van der Werff. *Novon* 9: 574 (1999). Isotype: Mexico, Oaxaca, *Wendt et al.* 6765 (MO). Illustr.: van der Werff, H. *Novon* 9: 573 (1999).

Small tree, to 4 m. Twigs terete, solid, densely brown-tomentellous, the surface of the young twigs not visible; terminal buds densely tomentellous. Leaves 7-14 × 2.5-7 cm, elliptic to broadly elliptic, firmly chartaceous, alternate, pinnately veined, the base variable, from acute/obtuse to rounded, the margin plane, the apex acute or obtuse, the upper surface sparsely pubescent with erect or ascending hairs when young, soon becoming glabrous, the lower surface sparsely pubescent, the hairs erect and discernable to the touch, the indument denser and tomentellous along the major veins, midrib, lateral veins and tertiary venation impressed on the upper surface, strongly raised on the lower surface, the leaves bullate/rugose, lateral veins 5-7, domatia absent, petioles 7-15 mm, flat above, with a similar indument as the twigs. Inflorescences 3-5 cm, densely hirsute, racemose, less than 10-flowered, the flowers grouped near the tip of the inflorescence. Flowers 7-8 mm in diameter, cream-colored, perfect. Tepals 3 mm, elliptic, on both surfaces pubescent near the base, otherwise glabrous, spreading at anthesis; outer 6 stamens 1.5 mm, the filaments c. 0.4 mm, free, with some hairs near the base, otherwise glabrous, the cells introrse, arranged in 2 pairs, a sterile tip lacking, inner 3 stamens 1.5 mm, the filament 0.4 mm, with 2 glands near the base, the cells in 2 rows, the upper row

lateral, the lower one lateral extrorse, staminodia 3, clavate, with a few hairs, difficult to see among the hairs on the rim of the receptacle, pistil glabrous, c. 1 mm, the style very short, receptacle cup-shaped, appressed pubescent inside. Fruit and cupule unknown.

Montane forests. 1100-1300 m. (Mexico [Oaxaca], to be expected in Chiapas.)

Ocotea corrugata can be immediately recognized by its rugose leaves; it is the only species in the *O. helicterifolia* complex and may well be the only centro-american *Ocotea* species with such leaves. Additionally, the racemose inflorescences and pubescent inside of the receptacle are useful characters. Although it has not yet been found in Chiapas, it occurs so close to or on the Isthmus of Tehuantepec, that inclusion in the *Flora Mesoamericana* seems justified.

23. *Ocotea darcyi* van der Werff. *Novon* 11: 505 (2001). Isotype: Panama, *Correa & Montenegro 10176* (MO!).

Trees to 20 m. Twigs angular, solid, densely ferruginous tomentellous, the surface completely covered by the indument, terminal buds densely ferruginous tomentellous. Leaves 9-15 × 4-7 cm, alternate, coriaceous, pinnately veined, obovate to obovate-elliptic, the base acute to cuneate, flat, the margin plane, the apex obtuse or with a very short acumen, the upper surface sparsely or moderately pubescent, but soon becoming glabrous except for the tomentellous major veins, the lower surface densely ferruginous pubescent, the hairs erect, discernable to the touch, the surface visible between the hairs, the major veins densely tomentellous and completely covered by the indument; midrib, lateral veins and tertiary venation immersed on the upper surface, raised to prominently raised on the lower surface; domatia lacking; petioles 5-8 mm, with a similar indument as the twigs. Inflorescences 10-20 cm, paniculate-cymose, many-flowered, densely ferruginous tomentellous, the surface completely covered by the indument, mostly in the axils of bracts near the tips of the twigs, less frequently in the axils of leaves. Flowers 4-4.5 mm in diameter, perfect. Tepals 1.5 mm, densely pubescent on both surfaces, half-erect at anthesis; stamens 9, 4 celled, the outer 6 0.9 mm, the filament c. 0.4 mm, free, pubescent, the anther glabrous, the cells arranged in 2 pairs, opening introrse, a sterile tip lacking, inner 3 stamens 1.1 mm, the filament and the base of the anther pubescent, the cells arranged in 2 pairs, the lower pair opening extrorse, the upper pair lateral, glands

present at the base of the filaments, staminodia not seen, pistil glabrous, 2 mm (but already developing into young fruit); receptacle cup-shaped, with a ring of hairs in the upper part, otherwise glabrous. Fruits globose, 1-1.4 cm in diameter, cupule very shallow to plate-like, 9 mm in diameter, with a single margin, the tepals not persisting. *Montane forest*. P (Galdames et al. 3891, MO). 700-1000 . (Endemic.)

Ocotea darcyi can be confused with *O. pseudopalmana*, but differs in its multi-flowered and much-branched inflorescences, its ferruginous indument, and smaller flowers. *Ocotea darcyi* is probably more closely related to *O. stenoneura*; the two species share a similar indument (the hairs on the leaves of *O. pseudopalmana* are much shorter and not as straight), fruit shape and cupule shape, the dense pubescence on inner and outer surface of the tepals and the ladder-like pattern of the intersecondary veins. However, *O. stenoneura* differs in its inrolled and decurrent leafbases, its acute leaf apices and its elliptic leaf shape.

24. *Ocotea dendrodaphne* Mez, *Jahrb. Koenigl. Bot. Gart Berlin* 5: 238 (1889).
Type: Panama, *Billberg s.n.* (S).

Dendrodaphne macrophylla Beurl., *Ocotea ovandensis* Lundell, *O. quisara* Mez & J.D. Smith.

Small trees to 10 m, rarely to 20 m. Twigs angular, minutely appressed pubescent when young, soon glabrescent, hollow, the upper part frequently with slits or holes, often with ants living inside; terminal buds densely, minutely appressed pubescent. Leaves 14-40 × 5-14 cm, elliptic, firmly chartaceous, alternate, pinnately veined, the base acute or obtuse, the margin plane, the apex acute to acuminate, the acumen to 1 cm, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation more or less immersed on the lower surface; domatia lacking; lateral veins 5-11; petioles 8-35 mm, glabrous or nearly so, sulcate above. Inflorescences 3-15 cm, paniculate-cymose, minutely pubescent, in the axils of cataphylls. Flowers c. 8 mm in diameter, white, perfect. Tepals c. 5 mm, elliptic, somewhat spreading at anthesis, sparsely appressed pubescent outside, minutely papillose to subglabrous and with some hairs near the base inside; outer 6 stamens 2.5-3 mm, narrowly tongue-shaped, sessile or with a short pubescent filament; anther cells

arranged on two pairs, sterile tip 0.7 mm, inner 3 stamens of the same length, the cells lateral, with two glands near the base, staminodia c. 1 mm, stipitiform; pistil c. 2 mm, glabrous; receptacle cup-shaped, rather densely pubescent inside. Fruits ellipsoid, 2-2.5 × 1 cm, cupule cup-shaped, 1.4 cm wide, 0.7 cm high, sparsely pubescent inside, apparently with a single margin, but the outer margin erect and concealing the shorter inner margin. *Lowland and montane wet forest*. T (Cowan 4673, MO); Ch (Breedlove 35304, MO); G (Skutch 2007, MO); H (Brant & Hazlett 2888, MO); N (Moreno 23376, MO); CR (Beach 1318, MO); P (Gentry 7459, MO). 50-1300 m. (Mexico [Oaxaca, Veracruz], Mesoamerica).

Ocotea dendrodaphne is the only *Ocotea* species in Mesoamerica with tongue-shaped stamens and hollow, ant-inhabited twigs. Its closest relative is *O. veraguensis* and differences between the two species are discussed under the latter.

25. *Ocotea dentata* van der Werff, *Fieldiana Botany*, n.s. 23: 79. 1990.

Holotype: Costa Rica, Gomez & Herrera 23653 (MO!). Illustr.: Burger & van der Werff, *Fieldiana Botany* n.s. 23: 33 (1990).

Tree, to 25 m. Twigs (strongly) angular, sparsely to moderately appressed pubescent, glabrescent with age, solid or infrequently hollow, terminal buds densely to sparsely appressed pubescent. Leaves 18-35 × 6-12 cm, alternate, obovate to elliptic-obovate, firmly chartaceous to coriaceous, pinnately veined, the base decurrent on the petiole and inrolled, the margin inrolled towards the very base, the apex obtuse or shortly acuminate, the upper surface glabrous, the lower surface sparsely pubescent with erect or ascending hairs, the indument discernable to the touch, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib prominently raised, lateral veins and tertiary venation (weakly) raised on the lower surface; domatia lacking; lateral veins 9-12; petioles to 2 cm, but sometimes difficult to measure due to the decurrent leaf bases, with a similar indument as the twigs, (shallowly) canaliculate. Inflorescences 10-25 cm, paniculate-cymose, moderately densely puberulous, the hairs erect or ascending, in the axils of leaves or cataphylls. Flowers perfect, greenish or yellowish, more or less erect at anthesis, 3-4 mm in diameter; tepals 1.5-2 mm, broadly ovate, the outer 3 densely puberulous outside, the inner 3 with a puberulous base, otherwise subglabrous, all tepals

glabrous inside except for a few hairs near the base; stamens 9, all 4-celled, the outer 6 c. 1 mm, the filaments 0.2 mm, free, pubescent, the anther glabrous, with the cells introrse, a sterile tip lacking, inner 3 c. 1.4 mm, the filament with a pubescent patch near the tip on the dorsal side, the anther glabrous, the cells extrorse, the lower pair larger than the upper pair, glands present at the base of the inner stamens, staminodia not seen, pistil 1.8 mm, glabrous, the ovary 0.7 mm, receptacle cup-shaped, with some hairs near the top; fruit ellipsoid 10×8 mm, cupule cup-shaped, c. 8 mm in diameter, with a single margin, the tepals persisting on the cupule. *Lowland and montane wet forest*. N (Sandino 4492, MO); CR (Bello 1311, MO); P (Lao 94, MO). 100-1000 m. (Endemic.)

Ocotea dentata can be recognized by its leaves with decurrent, inrolled bases and with a rather sparse, erect indument and by the appressed pubescence of the twigs. Additional characters are the persistent tepals in the fruiting stage and the obovate-elliptic leaves. The other species with an erect indument on the leaves and with decurrent, inrolled leafbases have a denser and predominantly erect indument on the twigs. *Ocotea dentata* seems to be restricted to the Atlantic slopes of Nicaragua, Costa Rica and Panama.

26. *Ocotea effusa* (Meissner) Hemsley, *Biol. Centr. Amer. Bot.* 3: 73 (1882). *Oreodaphne effusa* Meissner, *Prodr.* 15(1): 120 (1864). Syntype: Mexico, *Jürgensen 906* (BM!).

Trees, to 20 m. Twigs ridged, sparsely appressed pubescent, soon becoming glabrous, solid; terminal buds densely appressed white pubescent. Leaves 6-10.5 \times 1.5-2.5 cm, lanceolate, chartaceous, alternate, pinnately veined, the base acute, the margin flat, and the apex finely acute or acuminate, the upper surface glabrous or with some appressed hairs along the midrib when very young, the lower surface sparsely appressed pubescent when young, soon becoming glabrous; midrib slightly raised, lateral veins and tertiary venation immersed on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface; domatia present as small, shallow pits, these with glabrous or pubescent margins; lateral veins weakly developed and difficult to count, about 7-10; petioles 6-9 mm, glabrous or with a few appressed hairs, canaliculate. Inflorescences 5-10 cm, paniculate-cymose, sparsely appressed pubescent or glabrous, in

the axils of bracts or leaves. Flowers 2.5-3 mm in diameter, yellowish green, fragrant, perfect. Tepals 1.5 mm, ovate-lanceolate, sparsely pubescent outside, glabrous inside, half erect at anthesis; stamens 9, 4-celled, 1.4 mm, sterile tip absent, the filaments about as long as the anthers, free, glabrous or with a few appressed hairs, outer 6 anthers with the cells in 2 rows, opening introrse, inner 3 with the cells opening extrorse-lateral, filaments of the inner 3 stamens with 2 glands near the base; staminodia 0.8 mm, stipitiform, pubescent; pistil glabrous, 1.4 mm, the style half as long as the ovary; receptacle bowl-shaped, glabrous inside. Fruits 12 × 8 mm, ellipsoid, the cupule bowl-shaped, 7 mm in diameter, the margin simple; tepals deciduous in fruit. *Lowland and montane rain forest*. B (*Gentle 2926*, MO); G (*Steyermark 49373*, F). 200-2000 m. (Mexico [Oaxaca, Veracruz], Belize, Guatemala, reported from Chiapas.)

Ocotea effusa is best recognized by its lanceolate leaves with shallow, often pubescent, pitdomatia on the lower surface. The large, pubescent staminodia are also a useful character. Provisionally included in *O. effusa* are several collections from higher altitudes (1700-2000 m) from Oaxaca (Cerro Salomon) and Chiapas (Cerro Tres Picos, *Mendoza 2167*, MO) which differ in having smaller cupules with persistent tepals. Flowers are not available at this time; it is likely that these plants represent an undescribed species.

The description given here is based on specimens from lower elevations.

27. *Ocotea endresiana* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 257. 1889.
Holotype: Costa Rica, *Endres 223* (K!).

Trees, to 25 m. Twigs angular, solid, glabrous or sparsely appressed pubescent and soon glabrescent, terminal buds appressed pubescent or glabrous. Leaves 10-30 × 4-20 cm, coriaceous, alternate, obovate, pinnately veined, gradually narrowed towards the base and at the base reflexed and decurrent on the petiole, the margin recurved towards the base, the apex rounded to shortly acuminate, midrib, lateral veins and tertiary venation immersed on the upper surface or the tertiary venation slightly raised, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface, both surfaces glabrous or the lower surface with a few appressed hairs, domatia present as axillary tufts of hair, lateral veins 5-10, free petioles 0.5 cm, due to decurrent, reflexed

leaf bases, glabrous. Inflorescences 10-25 cm, glabrous, paniculate-cymose, in the axils of leaves or bracts towards the tips of the twigs. Flowers 3-4 mm in diameter, greenish, glabrous, perfect. Tepals 1.4 mm, elliptic, on the inner with very short, papillae-like hairs, outer 6 stamens c. 1 mm, glabrous, the anthers twice as long as the free filaments, the cells arranged in 2 pairs, opening introrse, inner 3 stamens 1.2 mm, the filaments dorsally pubescent but the anthers glabrous, the filaments a little shorter than the anthers, upper pair of cells opening lateral, the lower pair extrorse, 2 glands present at the base of the filaments, staminodia not seen, pistil glabrous, 2 mm, the style slightly longer than the ovary, receptacle cup-shaped, glabrous inside. Fruits 8-15 × 7-10 mm, ellipsoid, cupule a shallow cup, c. 8 mm in diameter, with a simple margin; tepals deciduous in the fruiting stage. *Montane and lowland forests*. CR (*Solomon 19240*, MO); P (*Folsom 5049*, MO). 200-1500 m. (Endemic.)

Distinctive for *O. endresiana* is the combination of glabrous leaves, inflorescences and flowers, reflexed leaf bases, and the cupules without persistent tepals. Nearly all collections from Costa Rica have well developed domatia, but domatia are less conspicuous or lacking in the collections from Panama. Specimens with large leaves can be confused with *O. rivularis* from the Osa Peninsula in Costa Rica, but that species has puberulous flowers and lacks domatia.

28. *Ocotea eucuneata* Lundell, *Contr. Univ. Mich. Herb.* 6: 16 (1941). Isotype: Belize, Stann Creek Distr., *Gentle 3068* (MO!).

Large trees. Twigs winged or sharply angular when young, becoming angular with age, solid, very sparsely appressed pubescent, becoming glabrous; terminal buds slender, finely and densely appressed pubescent. Leaves 8-14 × 2.8- 4.7 cm, obovate, chartaceous, alternate, pinnately veined; the base cuneate, the margin flat or inrolled, the apex acute to acuminate, the upper surface glabrous, lower surface sparsely pubescent, the hairs short, erect, denser along the major veins, not discernable to the touch; midrib and lateral veins slightly raised, tertiary venation immersed on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface; domatia present as shallow depression fringed with erect hairs; lateral veins 6-8; petioles 7-12 mm, glabrous, canaliculate above. Inflorescences to 8.5 cm, paniculate-cymose, in the axils of leaves,

near the base sparsely puberulous, near the flowers moderately to densely puberulous, the hairs short and erect. Flowers c. 3 mm in diameter, creamy, perfect. Tepals 1.5 mm, elliptic, moderately to densely puberulous outside, moderately to sparsely puberulous inside, more or less spreading at anthesis; stamens 9, 4-celled, the outer 6 0.8 mm, the cells arranged in 2 rows and filling the entire anther, opening introrse, the pubescent, free filaments as long as the anthers; inner 3 stamens c. 1 mm, the pubescent filaments with 2 globose glands near the base, filaments slightly shorter than the anthers; staminodia not seen; pistil 3mm, glabrous, the style twice as long as the pistil; receptacle deeply cup-shaped, glabrous inside. Fruit and cupule unknown. *Lowland rainforest*. B (*Gentle 3068*, MO). 200 m. (Endemic.)

Ocotea eucuneata is only known from the type collection. Distinguishing features for this species are the obovate leaves, the sparse, erect indument on the lower leaf surface, this best seen along the major veins, the long, slender style and the winged or sharply angled young twigs. Fruiting collections are desired for a better understanding of its relationships. The Guatemalan specimens cited by Allen (1945) as *O. eucuneata* do not belong here.

29. *Ocotea euvenosa* Lundell, *Wrightia* 4: 157 (1971). Holotype: Guatemala, *Contreras 4678* (LL!).

Ocotea venosa Lundell non Gleason.

Tree, 17 m. Twigs angular, solid, glabrous; terminal buds glabrous. Leaves 17-27 × 8-15 cm, chartaceous, broadly elliptic, alternate, pinnately veined, the base obtuse, margin plane, apex acute or shortly acuminate, acumen to 1 cm, drying dark, nearly black, glabrous on both surfaces, midrib, lateral veins and tertiary venation raised on both surfaces, pitdomatia present in the axils of the lowermost lateral veins, lateral veins 5-7; petioles 1.5-2 cm, flat above, glabrous. Inflorescences c. 25 cm, paniculate-cymose, glabrous, in the axils of leaves. Flowers not seen, hermaphrodite. Tepals c. 2 mm, ovate, glabrous on both surfaces; outer stamens 1.2 mm, 4-celled, glabrous, the anther slightly longer than the filament; inner stamens the same length, glabrous, the filament as long as the anther, 4-celled, the cells opening extrorse-lateral, filaments with 2 globose glands at the base; staminodia not seen; pistil glabrous; receptacle (enclosing young fruits) deeply

cup-shaped, glabrous inside. Fruits and cupule unknown; tepals deciduous in very young fruiting stage. *Rainforest. G (Contreras 4678, LL)*. Altitude not indicated. (Endemic.)

Ocotea euvenosa is a rarely collected species of which I have only seen the type specimen. This specimen has very young fruits on which remnants of the floral parts are present and the description is based on this incomplete material. Diagnostic are the large, dark green to black drying leaves with pinnate venation and pitdomatia in the axils of the lowermost lateral veins. The specimen is entirely glabrous; although the terminal buds were not present on the type, I described them as glabrous based on Lundell's statement that the plant is entirely glabrous. *Ocotea euvenosa* is closely related to *O. bernouilliana*, which differs in its smaller, narrower leaves with pitdomatia not only in the axils of the lowermost lateral veins, but also along the lateral veins, and to *O. vanderwerffii*, which differs in its smaller, tripliveined leaves.

30. *Ocotea fendleri* (Meissner) Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 152 (1986). *Gymnobalanus fendleri* Meissner, *Prodr.* 15: 142 (1864). Holotype: Venezuela, *Fendler 2395 (G-DC)*

Trees, to 20 m. Twigs terete or angular, solid, densely, shaggy, reddish-brown pubescent, the surface completely covered by the indument, the hairs becoming matted and less erect with age; terminal buds densely pubescent, the surface completely covered. Leaves 10-17 × 4-7 cm, chartaceous, elliptic, alternate, pinnately veined, the base acute and decurrent on the petiole, the margin plane or slightly inrolled, the apex shortly acuminate or acute, the acumen to 1 cm; the upper surface at maturity nearly glabrous, but some shaggy hairs persisting along the major veins, when young, near the base rather densely shaggy pubescent, distally sparsely appressed pubescent; the lower surface sparsely pubescent, the hairs erect and discernable to the touch, the indument denser along the major veins, these becoming tomentose; midrib and lateral veins weakly raised, tertiary venation immersed on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface, the tertiary venation frequently scalariform; domatia lacking; petioles 8-15 mm, with a similar indument as the twigs, weakly canaliculate above. Inflorescences 5-10 cm, paniculate-cymose, moderately pubescent, the hairs erect, in the axils of leaves. Flowers 3-4 mm in diameter, green or yellow, unisexual. Tepals c. 1.5

mm, elliptic, moderately pubescent on both surfaces or the inner surface sparsely pubescent, at anthesis half erect, but in old flowers spreading; staminate flowers: stamens 9, 4-celled, the outer 6 1 mm, the filament very short, free and with a few hairs, the anther cells in 2 pairs, introrse, the locelli filling the entire anther, the anther glabrous; inner 3 1.5 mm, the filament 0.4 mm, with a few hairs, the anther cells extrorse, small glands present at the base of the filaments; staminodia not seen; pistillode (or pistil ?) glabrous, 1.5 mm, the style 1 mm and clearly distinct from the ovary, a stigma present; pistillode completely hidden by the inner stamens in the staminate flowers; receptacle cup-shaped, appressed pubescent inside; pistillate flowers: staminodia 9, c. 0.5 mm, the anther cells not developed, pistil 1.5 mm, glabrous, the style as long as the ovary, the stigma raised above the level of the staminodia, pistil larger and thicker than in the staminate flowers; receptacle cup-shaped, glabrous or with a few appressed hairs inside. Fruits ellipsoid, 1.5×1 cm, the cupule small, plate-like, 0.5 cm in diameter, with a single margin, the tepals not persistent. *Montane rain forest*. P (Herrera 889, MO). 1000-1100 m. (Mesoamerica, Venezuela, French Guyana.)

Ocotea fendleri is known in Mesoamerica from only two collections, one pistillate and one sterile; therefore the identification is best considered tentative. Among the Mesoamerican species with unisexual flowers it can best be recognized by its dense, shaggy pubescence on the young twigs, the decurrent leaf bases, the erect indument and the raised, scalariform, tertiary venation on the lower leaf surface. The specimens from Venezuela (the type is from Venezuela) differ in having larger leaves (to 22 cm), petioles to 2 cm and a slightly shorter, paler indument on twigs and leaves. However, it seems for the time being best to identify the Panamanian collection as *O. fendleri*.

31. *Ocotea floribunda* (Sw.) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 325. 1889. *Laurus floribunda* Sw., Prodr. 65 (1788). Type: Jamaica, Swartz s.n. (S).

Trees, to 30 m. Twigs angular, sparsely appressed pubescent when young, soon glabrescent, solid, terminal buds densely grey appressed pubescent. Leaves 7-18 \times 2-7 cm, alternate, elliptic to obovate, firmly chartaceous, pinnately veined, the base acute to cuneate, the margin plane, the apex acute or shortly acuminate, glabrous or nearly so on both surfaces, midrib slightly raised, lateral veins and tertiary venation immersed on the

upper surface, midrib raised, lateral veins and tertiary venation slightly raised or immersed on the lower surface; domatia lacking; lateral veins 5-8; petioles 5-15 mm, with a similar indument as the twigs, shallowly canaliculate on the upper surface. Inflorescences 5-15 cm, in the axils of leaves or cataphylls, sparsely to densely puberulous, paniculate-cymose. Flowers unisexual, 6-7 mm in diameter, yellow green, the tepals 2.5 – 3 mm, broadly ovate, spreading at anthesis, sparsely to moderately appressed pubescent on both surfaces; male flowers: outer 6 stamens 2-2.5 mm, sparsely pubescent, the filaments free, as long as the anthers, the anther cells arranged in 2 pairs, introrse, filling the entire anther; inner 3 stamens 2-3 mm, sparsely pubescent to glabrous, the filament about as long as the anther, the cells in 2 pairs, lateral-extrorse, the filaments with 2 globose glands near the base, staminodia not seen, pistillode slender, c. 2.5 mm, (sparsely) pubescent, receptacle shallow, pubescent; female flowers: staminodia 9, c. 1 mm, glands present at the base of the innermost staminodia, pistil c. 3 mm, ovary glabrous, style (densely) pubescent, rounded base of the tepals persisting in the fruiting stage, receptacle cup-shaped, glabrous. Fruits roundish, c. 15 mm in diameter, cupule c. 8 mm in diameter, flat, platelike, with a double margin, the remnants of the tepals often persisting in fruit. *Lowland and montane wet forests*. N (Seemann 141, BM); CR (Herrera 5002, MO); P (Correa et al. 11171). 100-1400 m. (Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Brazil, Antillas.)

Distinctive for *Ocotea floribunda* are the pubescent pistil, thick, platelike cupule, and the large, unisexual flowers. The species is widespread and variable in the amount of indument on twigs, inflorescences and flowers but it is not at all certain that this variation is of any taxonomic significance.

32. *Ocotea glaucosericea* Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 144 (1986).
Isotype: Panama, *Davidson 531* (MO!).

Nectandra hypoglauca Standl. ex C.K. Allen non *Ocotea hypoglauca* (Nees) Mez.

Trees, to 30 m. Twigs angular or ridged, solid, densely grey pubescent with appressed or ascending hairs, the surface not visible; terminal buds densely grey pubescent. Leaves 9-21 × 3.5-9 cm, alternate, stiffly chartaceous, elliptic to obovate-

elliptic, pinnately veined, towards the base gradually narrowed, inrolled and decurrent along the petiole, the apex obtuse or acute, the upper surface glabrous or with appressed hairs along the midrib, the lower surface moderately densely to sparsely appressed pubescent, the surface always partially visible, midrib, lateral veins and tertiary venation raised on both surfaces, domatia lacking, lateral veins 6-10, petioles poorly defined due to decurrent leaf bases, to 3 cm, with a similar indument as the twigs. Inflorescences 10-22 cm, densely pubescent with curly, ascending hairs, the surface not visible, paniculate-cymose, in the axils of normal leaves. Flowers 5-6 mm in diameter, creamy white, perfect. Tepals 2 mm, broadly ovate, the outer surface densely pubescent, the surface not visible, the inner surface of the inner tepals densely pubescent and not visible, of the outer tepals slightly less densely pubescent and often partially visible; outer stamens c. 1 mm, the filaments much shorter than the anthers, free, pubescent dorsally, the cells arranged in 2 overlapping, introrse pairs, a sterile tip absent; inner stamens 1.3 mm, the filaments 0.3 mm, somewhat pubescent, cells arranged in 2 pairs, the upper pair lateral, the lower pair extrorse, glands present at the base of the filaments of the inner stamens, staminodia minute, pubescent, scarcely exceeding the glands; pistil 2mm, glabrous, the ovary gradually narrowed into the style, style 0.7 mm, receptacle cup-shaped, glabrous or with some hairs in the upper part. Fruit 3 × 1.5 cm, ellipsoid, cupule initially cup-shaped, with persisting tepals, at maturity the cupule flat or a shallow bowl, 1.5-2 cm in diameter, with a single margin and without persistent tepals. *Montane forests*. CR (Vargas 946, MO); P (Galdames 2931, MO). 1500-2000 m. (Endemic.)

Ocotea glaucosericea is similar to *O. chiapensis* and the differences between the two species are discussed under the latter. Large leaved forms of *O. whitei* and *O. austinii* can also be confused with *O. glaucosericea*, but differ in having smaller flowers and in the case of *O. whitei*, lacking the raised tertiary venation on the upper leaf surface. Flowers and inflorescences of *O. austinii* are less densely pubescent than in *O. glaucosericea* and the surface usually remains visible. Bernardi treated this species as a synonym of *O. caracasana* (Nees) Mez, from the coastal mountains of Venezuela. I regard the two as different species: in *O. glaucosericea* the hairs on the lower leaf surface are strictly appressed, and rather long (to 0.4 mm), the anthers are slightly longer than wide and have a tuft of white hairs at their base (both in the inner and outer stamens)

while in *O. caracasana* the hairs are much shorter and somewhat ascending and the anthers are slightly broader than long and do not have a tuft of hairs at the base.

33. *Ocotea gomezii* Burger, *Fieldiana Botany, n.s.*, 23: 81 (1990). Isotype: Costa Rica, *Gómez-Laurito et al. 11450* (MO!).

Small tree, to 10 m. Twigs roundish, solid, densely ferruginous tomentellous, the surface completely covered; terminal buds densely ferruginous tomentellous. Leaves 10-25 × 6-16 cm, broadly elliptic, firmly chartaceous, pinnately veined, alternate or grouped near the tips of the twigs, the margins sometimes inrolled in the lower half, the base rounded or obtuse, the apex acute or acuminate, the acumen to 2 cm; the upper surface glabrous except for the tomentellous midrib and lateral veins, lower surface pubescent, the hairs erect and discernable to the touch, the surface visible, the pubescence denser and tomentellous along the major veins; midrib and lateral veins slightly raised, tertiary venation slightly raised and forming a fine reticulum on the upper surface, the upper surface a little shiny; midrib and lateral veins prominently raised, tertiary venation raised on the lower surface; domatia lacking; lateral veins 5-8; petioles 12-25 mm, with a similar indument as the twigs. Inflorescences 10-20 cm, densely tomentellous, the surface not visible, paniculate-cymose, in the axils of cataphylls at the tips of the branches, the infructescences along the twigs but not in the axils of leaves. Flowers 10-14 mm in diameter, yellowish, perfect. Tepals 5-7 mm, elliptic, the outer 3 densely pubescent outside, the inner 3 with a basal, triangular densely pubescent patch, the distal part with a dense, papillose indument; inner surface densely papillose and pubescent at the base, spreading at anthesis; stamens 9, 4-celled, the outer 6 2-3 mm, filaments c. 1.4 mm, free, densely pubescent, anther glabrous, a sterile tip lacking, the cells introrse, inner 3 stamens similar in size, the filaments also densely pubescent, the cells extrorse, filaments with 2 glands at the base, staminodes lacking, receptacle cup-shaped, densely pubescent inside; pistil 3 – 3.5 mm, glabrous. Fruits 2.5 × 1.5 cm, pubescent when immature, ultimately becoming glabrous, cupule conical, 1 cm, with a single margin, the tepals persisting as 5 mm long lobes on the cupule. *Montane rain forest. CR (Herrera 504, MO). 800-1400 m. (Endemic.)*

Ocotea gomezii is a very distinctive species by virtue of its large flowers, dense pubescence on twigs, flowers and leaves, cupule with large, persistent tepals and pubescent fruits. Provisionally placed here is a collection from Panama (Chiriqui, Fortuna Dam, *McPherson 12585*, MO). This collection differs in its reduced inflorescence (a raceme almost contracted in an umbel), its pubescent pistil and its more coriaceous, slightly bullate leaves. This collection may well represent an undescribed species, but more collections are needed for a description.

34. *Ocotea gordonii* van der Werff. *Novon* 9: 575 (1999). Holotype: Panama, Chiriqui, *McPherson 10421* (MO!). Illustr.: van der Werff, *Novon* 9: 576 (1999).

Small trees, to 10 m tall. Twigs terete, solid, densely tomentose, the surface not or scarcely visible between the hairs; terminal buds densely tomentose. Leaves 12-22 × 5-8 cm, alternate and evenly distributed along the twigs, chartaceous, pinnately veined, narrowly to broadly elliptic, the margin flat or sometimes folded downwards, the base acute or obtuse to almost rounded, the tip acuminate with an acumen to 2 cm or acute, the upper surface with some erect, curled hairs when young, but this indument rapidly wearing off, the hairs denser and becoming tomentose along the major veins, the lower surface copiously pubescent, the hairs erect and soft to the touch, denser and tomentose along the midrib and lateral veins, midrib and lateral veins somewhat impressed, tertiary venation slightly raised on the upper surface, midrib, lateral veins and tertiary venation raised or clearly raised on the lower surface; domatia absent; lateral veins 6-8; petioles 8-14 mm, flattened on the upper side, with a similar indument as the twigs. Inflorescences 8-16 cm, racemose, moderately densely to sparsely pubescent, the hairs erect or spreading, to 0.6 mm; in axils of bracts or, less frequently, of normal leaves. Flowers 8-10 mm in diameter, glabrous, white, fragrant, perfect. Tepals 6, 4-4.5 mm, elliptic, spreading at anthesis, the outer 3 with a basal triangular papillose patch, otherwise glabrous, the inner 3 uniformly papillose on the inner surface; stamens 9, 4-celled, the outer 6 weakly papillose, the cells arranged in 2 rows, opening introrse-lateral, the anthers sessile or nearly so, sterile tip short, 0.2-0.3 mm, inner 3 stamens 1.5 mm, the anther sessile, the cells arranged in 2 rows, lateral extrorse, the anthers weakly papillose and with a few hairs near the base, glands present at the base of the inner 3 stamens,

staminodia not seen, receptacle cup-shaped, pubescent inside. Fruits and cupules not known. Flowers: February-April. *Montane forests*. P(*McPherson 10573*, MO). 1000-1150 m. (Endemic.)

Ocotea gordonii is part of the *Ocotea helicterifolia* complex because of the papillose inner surface of the tepals, the relatively large flowers, the long spreading indument of stems and leaves and the spreading tepals. Vegetatively, there is a resemblance between *O. gordonii* and *O. valeriana* and *O. helicterifolia*, both of which occur in Costa Rica. These two species have paniculate-cymose inflorescences and glabrous receptacles. Two other species from Costa Rica and Panama, *O. lentii* and *O. valeroides*, have pubescent receptacles like *O. gordonii*, but differ in their paniculate-cymose inflorescences and obovate leaves.

35. *Ocotea guatemalensis* Lundell, *Wrightia* 5: 339 (1977). Isotype: Guatemala, *Lundell & Contreras 19754* (MO!).

Trees, to 20 m. Twigs angular, at first finely appressed pubescent, but soon becoming glabrous, drying dark, solid; terminal buds densely and finely appressed pubescent. Leaves 13-25 × 4-8 cm, firmly chartaceous, elliptic or broadly elliptic to elliptic-oblong, alternate, pinnately veined; the base obtuse or acute, the margin flat, the apex obtuse or blunt; the upper surface with midrib, lateral veins and tertiary venation slightly raised, the lower surface with midrib, lateral veins and tertiary venation raised; glabrous on the upper surface, very sparsely appressed pubescent on the lower surface, becoming glabrous with age; domatia present as axillary tufts of hairs; lateral veins 8-12 pairs; petioles 7-12 mm, with a similar indument as the twigs, canaliculate. Inflorescences 5-15 cm, paniculate-cymose, sparsely appressed pubescent, the indument denser towards the flowers and almost completely covering the surface of the pedicels; in the axils of bracts or leaves. Flowers 4-5 mm in diameter, yellow-green, perfect. Tepals 1.5-2 mm, ovate, moderately to densely pubescent outside, sparsely pubescent inside, half erect to spreading at anthesis; stamens 9, 4-celled, 1.2-1.4 mm, glabrous or with a few hairs at the base of the filaments, these free, a little shorter than the anthers, sterile tip of the anthers lacking, the outer 6 with the cells arranged in 2 rows and opening introrse, the inner 3 with the upper pair opening lateral and the lower pair opening extrorse, glands

present at the base of the filaments of the inner 3 stamens; staminodia not seen; pistil 2 mm, glabrous, the style half as long as the ovary; receptacle shallow, glabrous inside. Fruit and cupule not known. *Rain forest. G (Lundell & Contreras 19747, F!)*. Altitudinal distribution unknown. (Endemic.)

Ocotea guatemalensis is only known from 3 collections, all from the Dept. of Baja Verapaz in Guatemala. It is best recognized by its rather large, dark drying leaves with conspicuous domatia and raised reticulation on the lower leaf surface and that fact that the indument of flowers and pedicels is much denser than near the base of the inflorescence. The leaf bases are frequently obtuse. Its relationships may be with the *O. insularis* group, based on the flattened branchlets of the inflorescences, but it lacks the tufts of hairs on the ventral side of the filaments of the inner 3 stamens, which otherwise characterize the *O. insularis* group.

Provisionally included here are a few collections from the Pacific coast of Costa Rica and adjacent Panama (*Herrera 5404*, buds; *Lobo 16*, buds; *Herrera 6078*, flowers, from Costa Rica; *McPherson 11081*, flowers; *McPherson 12587*, fruits; *Churchill et al. 4602*, fruits, from Panama; all collections at MO). These collections differ in having less pubescent flowers (quite sparsely pubescent in *McPherson 11081*) which are also smaller (ca. 3 mm in diameter). There is some variation in density of the indument among those collections and it seems premature to describe another new species based largely on flower size when so few collections are available.

36. *Ocotea haberi* van der Werff, *Novon* 11: 505 (2001). Holotype: Costa Rica, *Haberet al. 11093* (MO!)

Trees, to 20 m tall. Twigs angular, moderately to sparsely appressed pubescent, becoming glabrous with age, solid; terminal buds densely appressed pubescent. Leaves 6-16 × 2-5 cm, chartaceous to papyraceous, alternate, elliptic to obovate-elliptic, pinnately veined, the base acute to cuneate, margin plane, the apex obtuse, acute or shortly acuminate, acumen to 8 mm, upper leaf surface glabrous except the sometimes appressed pubescent midrib, lower surface sparsely appressed pubescent to glabrous, the indument denser along the midrib, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised or

immersed on the lower surface; pit or pocket domatia present in the axils of the basal lateral veins, these usually visible on the upper leaf surface; lateral veins 3-6; petioles 6-13 mm, canaliculate, sparsely appressed pubescent or glabrous. Inflorescences 4-10 cm, racemose or with several cymes near the base of the inflorescences and the distal part racemose, moderately to sparsely appressed pubescent, in the axils of leaves. Flowers 4 mm in diameter, yellow, perfect. Tepals c. 1.7 mm, sparsely appressed pubescent outside, sparsely to moderately pubescent inside, half erect at anthesis, stamens 4-celled, the cells arranged in 2 pairs, a sterile tip lacking, outer 6 stamens 1.2 mm, glabrous, the anther 0.7 mm, filament free, the cells opening introrse; inner 3 stamens 1.4 mm, glabrous or with the filaments pubescent, the anther c. 1.0 mm, as wide as the filament, the cells opening extrorse, the filaments with 2 glands at the base; staminodia 3, narrowly cylindrical, pistil slender, 1.7 mm, glabrous, the ovary much shorter than the style; receptacle deeply cup-shaped, pubescent inside. Fruits 15 × 7 mm (described as green and probably immature), ellipsoid; cupule deeply cup-shaped, the tepals sometimes persisting, with a single margin. *Montane forest*. CR (*Haber 11158*, MO); P (*Allen 1907*, MO). 800-1400m. (Endemic.)

Ocotea haberi is an inconspicuous species, best recognized by the combination of pubescent flowers, pit or pocket domatia (often the opening is much smaller than the domatium) and the pubescent inside of the receptacle. The other species with pit domatia have glabrous flowers and a glabrous inside of the receptacle. The immature cupules are deeply cup-shaped unlike cupules of the other species with pit domatia, but it is not certain that mature cupules remain cup-shaped. One collection with galled inflorescences has fruits seated in shallow cupules, but these fruits and cupules might be diseased and atypical. The twigs of dried specimens have frequently very lightcolored bark, while the other species in the *O. meiziana* group tend to have darker colored twigs. *Ocotea haberi* is only known from montane forests in Costa Rica and Panama.

37. *Ocotea hartshorniana* Hammel, *J. Arnold Arbor.* 67: 128 (1986). Isotype: Costa Rica, *Hammel 11932* (MO!).

Trees to 30 m. Twigs ridged or angular, solid, densely reddish-brown tomentellous, the surface completely covered by the indument; terminal buds densely

reddish-brown tomentellous. Leaves 10-20 × 4-10 cm, alternate, (narrowly) obovate to (narrowly) elliptic, chartaceous, pinnately veined, the base flat, decurrent on the petiole or rarely acute, the apex acute or acuminate, the acumen to 1.5 cm; upper surface glabrous or with some curled hairs along the midrib, lower surface with short, erect or ascending hairs, but surface visible between the hairs, the indument denser along the main veins and becoming tomentellous, more or less discernable to the touch, frequently glaucous, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; domatia lacking; lateral veins 4-8; petioles to 2 cm, but not always distinct due to the decurrent leaf bases. Inflorescences 8-18 cm, paniculate-cymose, densely reddish-brown pubescent, the surface completely covered by the indument, in the axils of normal leaves. Flowers 3-4 mm in diameter, tan or yellowish inside, perfect. Tepals 1.5 mm, broadly elliptic or ovate, densely pubescent on both surfaces, half erect at anthesis; stamens 9, 4-celled, the outer 6 1 mm, the filament c. 0.3 mm, free, pubescent, the anthers with the cells arranged in 2 pairs, introrse, a sterile tip lacking, inner 3 stamens 1.2 mm, the filaments c. 0.4 mm, pubescent, 2 glands present at the base of the filaments, the cells arranged in 2 pairs, the lower pairs extrorse, the upper pair lateral-extrorse; staminodes not seen; pistil 2 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, (sparsely) pubescent inside. Fruits ellipsoid, 15 mm long (probably immature), cupule deeply cup-shaped, 15 × 15 mm, the margin simple, entire; tepals deciduous in fruit. *Lowland rain forest. CR (Folsom 9930, MO); P (Churchill & de Nevers 4324, MO). 100-300 m. (Endemic.)*

Ocotea hartshorniana is best recognized by its erect or ascending indument on the lower leaf surface, the dense, reddish-brown indument on the twigs and inflorescences, and the decurrent leaf bases. It resembles *O. stenoneura*, but that species has inrolled, not flat leaf bases; it is also very close to *O. monteverdensis*. The latter species has predominantly appressed pubescence on the lower leaf surface, smaller leaves and shorter petioles. It occurs at higher altitudes than *O. hartshorniana*. The differences between *O. hartshorniana* and *O. monteverdensis* are rather weak. It is quite well possible that additional collections from the Caribbean slope may demonstrate that the lowland *O. hartshorniana* gradually changes into the montane *O. monteverdensis* and

that these 2 species need to be merged. I have only seen one collection from higher altitude (*Haber 11522* (MO), between 960-1700 m) with the erect pubescence of *O. hartshorniana* and therefore do not yet merge the two species.

38. *Ocotea helicterifolia* (Meissner) Hemsley, *Biol. Centr. Amer. Bot.* 3: 73 (1882). *Oreodaphne helicterifolia* Meissner, *Prodr.* 15: 123. 1864. Isotype: Mexico, Chiapas, *Linden 1641* (K!).

Nectandra corzoana Lundell, *Ocotea mexicana* (Meissner) Hemsley var. *subsessilis* (Meissner) Hemsley, *O. mexicana* (Meissner) Hemsley var. *longipes* (Meissner) Hemsley, *O. tenejapensis* Lundell, *Oreodaphne mexicana* Meissner var. *subsessilis* Meissner, *O. mexicana* Meissner var. *longipes* Meissner, *Phoebe helicterifolia* (Meissner) Mez, *P. nectandroides* Mez, *P. obtusata* Lundell.

Trees, to 20 m. Twigs terete, solid, densely brown-hirsute, the hairs erect, usually straight and the surface almost entirely covered by the indument; terminal buds densely tomentose. Leaves 8-30 × 3.5-11 cm, alternate, chartaceous, narrowly to broadly elliptic or obovate, frequently broadest above the middle, pinnately veined, the base acute, obtuse, rounded to cordate, the margin plane, the apex obtuse, acute or acuminate, midrib and lateral immersed or slightly impressed, tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; upper surface sparsely to moderately pubescent, the hairs erect and discernable to the touch, or glabrous, lower surface moderately to sparsely pubescent, the hairs erect and discernable to the touch, most of the surface visible between the hairs, the indument denser along the major veins; domatia absent; lateral veins 5-13; petioles 4-15 mm, flat above, with a similar indument as the twigs. Inflorescences 6-30 cm, (sparsely) hirsute, the hairs erect, the surface well visible, paniculate-cymose, in the axils of leaves or cataphylls. Flowers 5-8 mm in diameter, white or yellowish, perfect. Tepals 2-3 mm, elliptic, glabrous on both surfaces or the inner surface somewhat papillose, spreading at anthesis; outer 6 stamens 1-1.5 mm, sessile or nearly so, glabrous, the cells introrse and arranged on 2 pairs, a sterile tip lacking, inner 3 stamens 1-1.5 mm, the filaments 0.2 mm, glabrous or with a few hairs, the cells lateral-ectorse, arranged in 2 pairs, glands present at the base of the filaments, staminodia 3, small, 0.3 mm, hidden between the

glands; pistil c. 2 mm, glabrous, the style 0.6 mm, receptacle cup-shaped, glabrous inside. Fruits ellipsoid, 2.5×1.5 cm, cupule at maturity very shallow, almost platelike, 1 cm in diameter, with a single margin, tepals deciduous in fruit; immature cupules cup-shaped; pedicels swollen in fruit. *Montane or lowland (in Costa Rica) forests.* Ch (*Shilom Ton 5902*, MO); B (*Allen 15209*, MO); G (*Williams et al. 40390*, MO); H (*Williams 15760*, MO); N (*Moreno 21103*, MO); CR (*Herrera 4866*, MO). 1000-1900 m, in Costa Rica 50-600 m. (Mexico, Mesoamerica.)

Ocotea helicterifolia is a widespread and vegetatively variable species. I include here all specimens with paniculate-cymose inflorescences, glabrous flowers, a glabrous inner surface of the receptacle, alternate leaves and a hirsute indument on twigs and leaves. The differences with the similar *O. valeriana* and *O. betazensis* are discussed under those species. The fact that species placed in *O. helicterifolia* here have been described in *Ocotea*, *Phoebe* and *Nectandra* and the variation in leaf shape found in *O. helicterifolia* has led to an extensive synonymy. Specimens placed in *N. corzoana* and *P. obtusata* have leaves with an obtuse to subcordate base, but in floral characters these specimens do not differ. Although extremes in leaf shape can be recognized easily, the number of collections with leaves intermediate between the extremes made me reject leaf shape as a species character in this complex. The strongest case for acceptance of a taxon in this complex based on leaf shape can be made for the Costa Rican collections: they have clearly obovate leaves, gradually narrowed towards the base and at the base abruptly rounded; moreover, they occur on lower altitudes. Floral characters do not separate these specimens from other collections of *O. helicterifolia*. Provisionally included here is *Ocotea tenejapensis* Lundell, only known from the type collection. This collection differs from typical *O. helicterifolia* in having the outer stamens with filaments 1/3 as long as the anthers, a very sparsely pubescent lower leaf surface and in often having small axillary tufts of hairs on the lower leaf surface. I have not found other collections with these characters and consider *O. tenejapensis* as an aberrant form of *O. helicterifolia*.

39. *Ocotea heriberto* Wendt, *Lundellia* 1: 40 (1998). Isotype: Mexico, Oaxaca, *Wendt et al. 6871* (MO!). Illustr.: Wendt et al., *Lundellia* 1: 42 (1998).

Trees, to 40 m. Twigs ridged, minutely and sparsely appressed pubescent, soon glabrescent, solid; terminal buds white appressed pubescent. Leaves 7-15 × 2.5-5 cm, firmly chartaceous, elliptic to elliptic-oblong, alternate, pinnately veined; the base acute or cuneate, the margin flat, the apex obtuse or blunt, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper surface, the tertiary venation often not visible on the upper surface; midrib raised, lateral veins and tertiary venation immersed to slightly raised on the lower surface; domatia, as tufts of white hairs, often present near the base of the lateral veins, but usually their diameter or more away from the midrib; lateral veins 6-10; petioles 8-20 mm, glabrous or nearly so, canaliculate above. Inflorescences 2-7 cm, paniculate-cymose, sparsely appressed pubescent or glabrous, in the axils of bracts. Flowers 2.5-4 mm in diameter, pale green, perfect. Tepals 1.5-2.3 mm, sparsely appressed pubescent on the outer surface, more densely so on the inner surface, erect or half erect at anthesis; stamens 9, 4-celled, the outer 6 1.0-1.5 mm, the filaments slightly shorter than the anthers, free, sparsely pubescent, anthers without a sterile tip, the cells in 2 rows, opening introrse, inner 3 1.5-1.8 mm, the filaments about as long as the anthers, sparsely pubescent, 2 glands present at the base, staminodia 0.8 mm, stipitiform or with a thickened tip; pistil 2.5 mm (in old flower), glabrous, the style about as long as the ovary; receptacle cup-shaped, glabrous inside. Fruit c. 2.5 cm in diameter, roundish; cupule bowl-shaped, 3.5 cm in diameter, warty or strongly warty on the outer surface, with a single margin; tepals not persistent in fruit. *Lowland rain forest*. 200-300 m. (Mexico [Oaxaca], to be expected in Chiapas.)

Ocotea heriberto is only known from 2 collections from the Isthmus of Tehuantepec, but is likely also present in lowland forests in Chiapas. The description of the flowers is based on old flowers and the measurements of young flowers are probably somewhat smaller. This species can be recognized by its smooth leaves with an obtuse apex, the domatia which are well away from the midrib, and, in fruit, by the large (to 4.5 cm in diameter when fresh) fruits and the bowl-shaped, large cupules. It is not clear what its relationships might be; there are no other species in the area with similarly shaped or sized fruits and cupules. The large size of the trees, which makes collecting difficult, might explain why so few collections have been made of this species.

40. *Ocotea heydeana* (Mez & J.D. Smith) Bernardi, *Candollea* 22: 93 (1967).
Nectandra heydeana Mez & J. D. Smith, *Bot. Gaz.* 19: 262 (1894). Syntype: Guatemala,
Heyde & Lux 4260 (MO!).

Trees, to 30 m. Twigs angular, solid, sparsely to moderately appressed pubescent; terminal buds densely appressed pubescent, the surface completely covered. Leaves 9-18 × 4-8 cm, (narrowly) elliptic, chartaceous, alternate, pinnately veined, the base obtuse or acute, margin flat, the apex acute to slightly acuminate, the upper and lower surfaces glabrous or nearly so, the indument denser along the major veins, midrib and lateral veins immersed, tertiary venation slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; small axillary tufts of hairs sometimes present; lateral veins 6-8; petioles 15-20 mm, sulcate, with a similar indument as the twigs. Inflorescences 6-12 cm, with some scattered appressed hairs, paniculate-cymose, sometimes with one or two bracts of the inflorescence developed in normal leaves, in the axils of leaves or cataphylls near the tip of the branches. Flowers 6.5-9 mm in diameter, white, perfect. Tepals 3-4 mm, spreading at anthesis, glabrous outside, inner surface of the inner 3 tepals uniformly papillose, of the outer 3 tepals with a triangular, basal, papillose patch; outer 6 stamens 1.5 mm, nearly sessile, papillose, the cells in 2 pairs, opening introrse and filling nearly the entire anther; inner 3 stamens 1.5 mm, columnar, the cells in 2 pairs, lateral-extrorse, 2 large glands present at the base, staminodia stipitiform, 0.3 mm, pistil 1.6 mm, glabrous, the style half as long as the ovary, receptacle cup-shaped, sparsely appressed pubescent inside. Fruits ellipsoid, 27 × 15 mm, cupule very shallowly bowl-shaped to platelike, 1 cm in diameter, with a single margin and without persistent tepals, the pedicel somewhat thickened. *Montane rain forest. G* (*Heyde & Lux 4578*, MO); *ES* (*Davidse et al. 37453*, MO); *H* (*Molina 23335*, F). 600-1900 m. (Endemic.)

Ocotea heydeana can be recognized by its relatively large, glabrous (or nearly so) flowers, paniculate inflorescences with at least some lateral cymes near the base of the inflorescence and the sparsely pubescent twigs. It can be confused with *O. bajapazensis*, which has smaller flowers and occurs at lower altitudes and with *O. magnifolia*, which has a denser indument on the twigs. More good collections of the species in the *O.*

heydeana complex are needed to test our currently accepted species concepts; differences between the some of the species seem sometimes weak.

41. *Ocotea holdridgeana* Burger, *Fieldiana Bot. N.s.* 23: 83. 1990. Isotype: Costa Rica, *Lent 1677* (MO!).

Trees, to 15 m. Twigs roundish, appressed gray-pubescent, very soon becoming glabrous, solid; terminal buds densely appressed pubescent. Leaves 8-18 × 2-6 cm, alternate, elliptic, chartaceous, tripliveined or somewhat pinnately veined, the base acute or rarely obtuse, the margin flat, the apex acute to acuminate; the upper surface glabrous, the lower surface glabrous or with some scattered appressed hairs, these denser along the midrib and lateral veins; midrib, lateral veins and tertiary venation immersed or slightly raised on the upper surface, raised on the lower surface; conspicuous domatia (rather deep pockets with stiff hairs at the edges) present in the axils of the lowermost pair of lateral veins and visible as bulges on the upper surface; lateral veins 3-5, the basal pair more strongly developed than the more distal ones; petioles 8-18 mm, with a similar indument as the twigs, (narrowly) canaliculate. Inflorescences in the axils of cataphylls near the tips of the branches, rarely in the axils of leaves, 3-8 cm, racemose, moderately densely appressed pubescent. Flowers 1 cm in diameter, hermaphrodite, white, fragrant. Tepals 4-5 mm, elliptic, glabrous outside, the outer 3 with a basal and apical triangular papillose patch inside, the inner 3 with a papillose inner surface, spreading at anthesis, outer 6 stamens 2-2.5 mm, weakly papillose, the filament 0.3 mm, free, the anther with the cells arranged in 2 pairs, these introrse, a sterile tip of the stamens present, this 0.4-0.5 mm long; inner 3 stamens 2.2 mm, the hairy filament c. 0.4 mm, the cells in 2 pairs, lateral-extrorse, glands present at the base of the inner stamens; staminodia not seen, but said to be small and present; pistil glabrous, 2 mm, the style as long as the ovary; receptacle shallow, pubescent inside. Fruit ellipsoid, 2.5 × 1.5 cm, cupule shallowly bowl-shaped, gradually narrowed to wards and into the pedicel; the margin simple and tepals deciduous in fruit. *Montane wet forests. CR (Jimenez et al. 1052, MO); P (McPherson 9444, MO). 1600-2400 m. (Endemic.)*

Ocotea holdridgeana is readily recognized by its conspicuous pocket domatia in the axils of the basal pair of lateral veins, the large flowers, and the large stamens with a

sterile tip. Its relationships are probably with *O. brenesii*, which differs in the lack of domatia and smaller flowers; both species have a racemose inflorescence, an infrequent character in *Ocotea*. The cupule shape and the papillose indument of the tepals and stamens also suggest a relationship with *O. brenesii* and its allies.

43. *Ocotea insularis* (Meissner) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 271. 1889. *Phoebe insularis* Meissner, *Prodr.* 15: 33 (1864). Isotype: Costa Rica, Cocos Island, *Menzies s.n.* (MO!)

Aiouea lundelliana C.K. Allen, *Ocotea floccifera* Mez & Sodiro, *O. ira* Mez & Pittier.

Trees, to 25 m. Twigs angled or ridged, solid, glabrous or sparsely appressed pubescent, terminal buds sparsely to moderately appressed pubescent. Leaves 8-25 × 5-12 cm, alternate, chartaceous to coriaceous, elliptic to obovate, pinnately veined, the base attenuate, infrequently inrolled and (shortly) decurrent on the petiole, the margin plane, the apex rounded to shortly acuminate, midrib, lateral veins and tertiary venation immersed on the upper surface, slightly raised on the lower surface, the upper surface glabrous, the lower surface glabrous or sparsely appressed pubescent, domatia consisting of tufts of hairs often present in the axils of the lateral veins, lateral veins 6-10, petioles to 1,2 cm, flat or slightly canaliculate above, with the same indument as the twigs. Inflorescences 8-20 cm, paniculate-cymose, in the axils of normal leaves. Flowers 2.5 - 3.5 mm in diameter, greenish or creamy, perfect. Tepals 1.5 mm, ovate, moderately to sparsely pubescent outside, less pubescent to glabrous on the inner surface, erect to half erect at anthesis, outer 6 stamens 1.5 mm, the free filament half as long as the anther, glabrous, the cells arranged in 2 pairs, opening introrse, a sterile tip lacking, inner 3 stamens 1.5 mm, the filament half as long as the anther, with a tuft of whitish hairs at the transition of filament to anther, cells extrorse, arranged in 2 pairs; staminodia not seen; pistil 1.6 mm, glabrous, the ovary about as long as the style, receptacle bowl-shaped, glabrous inside. Fruit ellipsoid, 20 × 10 mm, cupule a shallow bowl, to 12 mm in diameter, with a single margin, tepals rarely persisting on the cupule. *Lowland and montane forests*. CR (*Stevens 14131*, MO); P (*Croat 22225*, MO). 100- 2000 m. (Mesoamerica, Colombia, Ecuador.)

Ocotea insularis is a variable species best recognized by its rather large leaves with a decurrent, sometimes inrolled leaf base, the frequently rounded or obtuse leaf apices, the small flowers with usually erect tepals, and the tufts of hairs on the backs of the inner stamens. Lowland collections have larger, more chartaceous, slightly obovate or elliptic leaves, while montane collections have stiffer, obovate leaves with rounded apices. The presence of persistent tepals on the cupules and of domatia is not correlated with other characters. Collections from Colombia and Ecuador have rather large leaves (to 35 cm), these more coriaceous at higher altitudes, and may or may not have persistent tepals on the cupules or domatia.

Montane populations often have smaller, more coriaceous leaves; these are known from Monteverde in Costa Rica and Cerro Jefe, Cerro Campana, Cerro Gaital and Cerro Tute in Panama. These montane populations can vary also in indument (from white-pubescent to almost glabrous inflorescences and flowers) and in fruit (from narrowly ellipsoid, to 4 cm long to broadly ellipsoid, to 1.5 cm). Giving these populations taxonomic recognition would create only very weakly defined species and I therefore prefer to recognize *O. insularis* as a very variable species.

Closely related species are *O. whitei*, an equally variable species, but with smaller, elliptic leaves with an inrolled base, *O. endresiana*, with strongly reflexed leaf bases, *O. rivularis*, restricted to the Osa Peninsula in Costa Rica and with larger leaves than *O. insularis* and to *O. glaucosericea*, which has larger, densely pubescent flowers. Future studies may show that the concept of *O. insularis* accepted here is too broad and that it is better to split this taxon.

??. *Ocotea iridescens* Lorea-Hern. & van der Werff. Isotype: Mexico, Oaxaca, *Salomón Maya 3018* (MO!).

Treelets, to 7 m. Twigs terete, solid, densely appressed or somewhat ascending pubescent, the surface completely covered, becoming glabrous with age; terminal buds densely whitish pubescent, the surface completely covered. Leaves 6-11 × 1.7-4.5 cm, elliptic, alternate, chartaceous, pinnately or tripliveined; the base acute, the margin plane, the apex acuminate, the acumen to 1.5 cm; the upper surface glabrous, the lower surface densely and minutely appressed pubescent, the surface completely covered by the

silvery-whitish indument, this turning light brown with age; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins slightly raised, tertiary venation not evident on the lower surface; domatia present as axillary tufts of hairs, sometimes also a few along the lateral veins; petioles 6-10 mm, flat above, with a similar indument as the twigs. Inflorescences 4-7 cm, paniculate-cymose, few-branched, lax, densely appressed pubescent. Flowers 4 mm in diameter, yellowish, perfect. Tepals 1.5 mm, elliptic, sparsely pubescent on the outer surface, with some appressed hairs near the base and slightly papillose near the apex on the inner surface, spreading at anthesis; stamens 9, 4-celled, glabrous, c. 1 mm, the anther about as long as the free filament, the outer 6 with the cells in 2 pairs, opening introrse, a sterile tip lacking, the inner 3 with the cells opening lateral-extrorse and with 2 globose glands near the base of the filaments; staminodia present, 0.7 mm, with a triangular tip, several hairs attached near the base of the filaments and the filaments appearing pubescent; pistil 1 mm, glabrous, the style much shorter than the ovary; receptacle shallow, pubescent inside. Fruits 14 × 9 mm, ellipsoid, cupule shallow, with a spreading, simple margin, tepals not persistent in fruit, fruiting pedicels clearly swollen. *Montane forest*. 1400-1600 m. (Mexico [Oaxaca].)

The nearest relatives of *O. iridescens* are not obvious. The spreading tepals, the swollen fruiting pedicel and the presence of small papillae on the inner surface of the tepals point towards the *O. heydeana* group in the sense of Rohwer (1991). One species allied to this group, *O. pharomachrosorum*, has also a dense, light-colored indument on the lower leaf surface. Although the species of the *O. heydeana* group have larger flowers and larger stamens, I think *O. iridescens* has its relationships with this group. Among the Mexican species of *Ocotea*, *O. iridescens* is readily identified by its dense, minute and light-colored indument on the lower leaf surface, its acuminate leaves, the slender inflorescences and the thickened pedicel in fruit. The three collections of *O. iridescens* all come from Oaxaca, but two have been collected nearly on the border with Chiapas and it seems very likely that this species occurs in Chiapas as well.

44. *Ocotea jefensis* van der Werff, *Novon* 11: 506 (2001). Holotype: Panama, *Carrasquilla* 2123 (MO!).

Small tree, to 15 m. Twigs thick, prominently angled, minutely and rather densely appressed pubescent when young, glabrescent with age, hollow, with exit holes for the twig-inhabiting ants; terminal buds densely appressed pubescent. Leaves 16-21 × 8-12 cm, alternate, broadly obovate, coriaceous, pinnately veined, the base decurrent on the short petiole, the margin recurved towards the base, the apex obtuse to rounded, glabrous on both surfaces, midrib broad and immersed, lateral veins immersed and tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface, domatia lacking, lateral veins 7-9; petioles not distinct due to the decurrent, inrolled leaf bases, 5-10 mm, flat. Inflorescences 15-20 cm, sparsely pubescent near the base but towards the flowers progressively denser tomentellous, the hairs very short and spreading; in the axils of leaves; paniculate-cymose; the branchlets angular or flattened. Flowers hermaphrodite, c. 4 mm in diameter. Tepals 1.3 mm, ovate to elliptic, rather densely and minutely pubescent outside, glabrous inside, outer 6 stamens c. 1 mm, glabrous, the filament c. 0.3 mm, the anther cells introrse in 2 pairs; inner 3 stamens as long as the outer ones, with a few hairs on the distal part of the filament, the lower 2 cells extrorse, the upper 2 latrorse, glands present at the base of the filaments of the inner 3 stamens; staminodia not seen; pistil c. 1.5 mm, glabrous; receptacle cup-shaped, glabrous inside. Immature fruits largely enclosed in the deeply cup-shaped cupule, at maturity fruits narrowly ellipsoid, 15 × 6 mm, the cupule small, bowl-shaped, 5-6 mm tall and 6 mm wide, with a single margin; tepals not persistent. *Lowland and montane wet forests*. P (Mori 7745, MO). 200-900 m. (Endemic.)

Ocotea jefensis is a member of the *O. insularis* group sensu Rohwer (1986) based on the flattened inflorescence branches and the tuft of hairs on the distal, inner side of the filaments of the inner 3 stamens. Within this group it shares with *O. atirrensis* s.l. the hollow, ant-inhabited twigs, but differs in its tomentellous flowers and inflorescences, in its indistinct petioles due to the decurrent, incurved leaf bases and the coriaceous, broadly obovate leaves with the raised tertiary venation. With *O. insularis* s.l. the new species shares the obovate leaf shape with decurrent base, but it differs from *O. insularis* in its thick, hollow twigs, the coriaceous leaves with raised tertiary venation and the tomentellous flowers and inflorescences. *Ocotea tonduzii*, a montane species from Costa Rica, can also be confused with *O. jefensis*. Like *O. jefensis*, *O. tonduzii* has glabrous,

obovate leaves with raised tertiary venation and tomentellous flowers, but it differs in its solid, glabrous twigs, its largely or entirely glabrous terminal buds, the less pubescent inflorescences and the pubescence on the inner surface of the tepals.

45. *Ocotea jorge-escobarii* C. Nelson, *Ceiba* 25: 173 (1984). Isotype: Honduras, Olancho, *Nelson & Soto 8188* (MO!).

Trees, to 20 m. Twigs angular, sparsely appressed pubescent, becoming glabrous with age, solid; terminal buds densely white pubescent, the hairs appressed and completely covering the buds. Leaves 9-15 × 3.5-6 cm, coriaceous or firmly chartaceous, elliptic to elliptic-obovate, alternate, pinnately veined, the base acute or cuneate, the margin plane, the apex bluntly acute, the upper surface glabrous, the lower surface glabrous or with a few appressed hairs, mostly along the midrib, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation immersed on the lower surface, pit domatia present, mostly along the basal lateral veins, occasionally also in the axils of the basal lateral veins, their openings roundish and glabrous; lateral veins 5-8; petioles 7-13 mm, flat above, glabrous or with a few appressed hairs. Inflorescences 10-15 cm, paniculate-cymose, glabrous, in the axils of leaves. Flowers 5 mm in diameter, greenish, perfect. Tepals 1.6 mm, the outer surface glabrous, inner surface of the outer 3 tepals sparsely appressed pubescent, of the inner 3 tepals glabrous, mostly erect, but in old flowers spreading and ultimately falling off; stamens all 4-celled, the cells arranged in 2 pairs, a sterile tip lacking, outer 6 stamens 1.8 mm, the filaments free, pubescent, about as long as the anthers, the cells opening introrse; inner 3 stamens as the outer 6, but the cells opening lateral-extrorse and the filaments with 2 large glands at the base; staminodia present, as long as the glands, with a few hairs; pistil 2.2 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, glabrous inside, with a fringe of hairs distally. Fruits c. 2.5 × 2 cm, ellipsoid, cupule 2.5 cm in diameter, deeply cup-shaped, often with 6 thickened, longitudinal ribs and gradually narrowed in the pedicel, margin simple. *Montane wet forest*. H (*Mejia 138*, MO); N (*Montenegro s.n.*, MO). 1000-1500 m. (Endemic.)

Ocotea jorge-escobarii is best recognized by its rather dark green, stiff leaves with pitdomatia along the lateral veins and its large, ribbed cupules. It can be confused

with *O. meiziana*, which differs in its thinner, yellowish green drying leaves, shorter inflorescences (not more than 10 cm), shallow to almost platelike cupules and the raised reticulation on the lower leaf surface. Also closely related is *O. pullifolia*, which differs in its coriaceous dark leaves with an obtuse to rounded apex and large pit domatia restricted to the axils of the basal lateral veins. A few collections from Nicaragua placed here are unusual in the pale green color of the dried leaves (as found in *O. meiziana*), but in leaf texture, fruit and cupule size they agree with typical *O. jorge-escobarii*.

46. *Ocotea klepperiae* van der Werff. *Novon* 11: 508 (2001). Isotype: Costa Rica, *Hammel 22068* (MO!).

Trees, to 8 m. Twigs terete, solid, densely pubescent, the hairs erect and completely covering the surface; terminal buds similarly densely pubescent. Leaves 8-16 × 3-6 cm, elliptic, chartaceous, alternate, pinnately veined, the base obtuse or acute, the margin plane, the apex acute or slightly acuminate, the upper surface glabrous, the lower surface sparsely pubescent, the hairs erect and discernable to the touch, the indument denser along the lateral veins and largely or entirely covering the midrib; midrib and lateral veins immersed but visible, tertiary venation immersed and not visible on the upper surface, midrib and lateral veins raised, tertiary venation moderately raised on the lower surface; domatia absent; lateral veins 5-7 pairs; petioles 5-9 mm, with a similar indument as the twigs, canaliculate, the indument wearing off with age and then petioles darker in color than the twigs. Inflorescences 5-8 cm, densely pubescent, the surface completely covered by the erect hairs, paniculate-cymose, in the axils of bracts mostly near the tips of the twigs, less frequently in the axils of bracts along the twigs. Flowers 1 cm in diameter, perfect. Tepals 4-4.5 mm, narrowly elliptic to oblong, spreading at anthesis, densely pubescent on both surfaces, stamens 9, densely covered with hair-like papillae, the outer 6 2.5 mm, tongue-shaped, the sterile tip c. 1 mm, the cells arranged in 2 pairs and introrse, the inner 3 2.5 mm, columnar, the cells extrorse-lateral, in 2 pairs, with 2 glands 1-1.5 mm at their base, the glands covering part or most of the lower pair of anther cells; staminodia absent or rarely one present, then 1.5 mm, stipitate, with a glands at the base; pistil 2.5 mm, glabrous, the style 1 mm; receptacle deeply cup-shaped,

densely pubescent inside. Fruit and cupule unknown. *Lowland rain forest*. CR (*Harmon 82*, MO). 10-300 m. (Endemic.)

The tongue-shaped, papillose stamens with a sterile tip, large flowers and the position of the inflorescences in axils of bracts near the tips of the branches places this new species in the subgenus *Dendrodaphne*. It differs from the other species in this subgenus in its dense indument on twigs, inflorescences and flowers. *Ocotea klepperae* further differs from the common *O. veraguensis* and *O. dendrodaphne* in having shorter inflorescences with fewer flowers.

The indument of twigs, inflorescences and flowers is less dense on the second collection, *Harmon 82*; in other characters, such as the few-flowered inflorescences and obtuse leaf base, it agrees with the type collection.

47. *Ocotea laetevirens* Standley & Steyermark, *Field Mus. Publ. Bot.* 23: 114 (1944). Isotype: Guatemala, *Steyermark 49378* (US!).

Ocotea clarkei Lundell.

Trees, to 15 m. Twigs terete or angled, glabrous to sparsely appressed pubescent, solid, terminal buds moderately to densely appressed pubescent. Leaves 12-25 × 5-11 cm, elliptic to elliptic-obovate, alternate, chartaceous, pinnately veined, the base acute, margin plane and apex acute or shortly acuminate, the upper surface glabrous, lower surface glabrous or with a few appressed hairs, midrib and lateral veins immersed, tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface, leaves usually drying yellowish green, the venation with a paler color than the laminae, domatia lacking or present as axillary tufts of hairs, lateral veins 5-8 pairs, petioles 8-20 mm, glabrous or nearly so, flat or weakly canaliculate above. Inflorescences 8-25 cm, paniculate-cymose, glabrous or sparsely appressed pubescent, mostly in the axils of leaves. Flowers 3.3-4 mm in diameter, pale yellowish, perfect. Tepals 1.2 mm, elliptic, glabrous or sparsely pubescent on the both surfaces, half erect at anthesis; stamens 9, 4-celled, the outer 6 1.4 mm, with the cells arranged in 2 pairs, opening introrse, a sterile tip lacking, the filaments free, shorter than the anthers, glabrous or pubescent; inner 3 of the same size, but with the cells opening lateral-extrorse and the pubescent or glabrous filaments with 2 large glands at the base; staminodia

lacking or stipitiform, pubescent, to 0.7 mm; pistil glabrous, 1.5 mm, the ovary gradually narrowed into the style, receptacle cup-shaped, glabrous or appressed pubescent inside. Fruits to 28x15 mm, ellipsoid, the cupule shallow to deeply cup-shaped, with a single margin, tepals not persistent. *Lowland and montane rain forests*. Ch (Clarke 38, CAS); G (Steyermark 49189, F); H (Davidse et al. 34535, MO); CR (Marin 346, MO); P (Gentry 2978, MO). 100-3000 m. (Mexico, Mesoamerica.)

Ocotea laetevirens as accepted here is a variable species and includes all specimens of the *O. meiziana* group with glabrous or sparsely appressed pubescent leaves, pubescent terminal buds, and without domatia or with domatia as axillary tufts of hairs. It is similar to *O. meiziana*, but this species has generally smaller leaves and pitdomatia on the lower leaf surface. The paucity of collections from Honduras, Guatemala and Chiapas makes it impractical to divide the variable *O. laetevirens* into more sharply defined species. The specimens from Costa Rica are less pubescent than the types of *O. laetevirens* and *O. clarkei*, but even within Costa Rica the lowland specimens differ from the high altitude specimens as Chavarría 758 (MO) in having chartaceous (not coriaceous) leaves and in having shallower cupules. Unfortunately, flowering collections with such coriaceous leaves are not yet known. Thus, the present circumscription of *O. laetevirens* is may well be too broad and needs to be revised once more specimens from Mexico, Guatemala, Honduras and Nicaragua are available. Collections from Cerro Campana in Panama, the Osa Peninsula and the Monteverde area in Costa Rica have 2-celled stamens but are otherwise indistinguishable from *O. laetevirens* and are provisionally included in this species. The alternative, describing these collections as new species of *Aiouea* while they are clearly very closely related to *O. laetevirens*, would create more confusion than clarity.

48. *Ocotea lentii* Burger, *Fieldiana Botany n.s.* 23: 86 (1990). Isotype: Costa Rica *Lent 794* (MO!).

Shrubs or small trees to 8 m. Twigs terete, rather densely pilose, the hairs erect, stiff, the surface visible between the hairs, solid; terminal buds densely pilose. Leaves 18-40 × 8-16 cm, alternate, firmly chartaceous, obovate or obovate-elliptic, pinnately veined, the base obtuse or rounded, the margin plane, the apex shortly acuminate or obtuse, the

upper surface glabrous or with some erect hairs, these denser along the midrib and lateral veins, the lower surface moderately pubescent with erect, long (c. 1 mm) hairs, these discernable to the touch, most of the surface visible, the indument denser along the major veins, but not completely covering these; midrib, lateral veins and tertiary venation more or less immersed on the upper surface, midrib prominently raised, lateral veins and tertiary venation raised on the lower surface; domatia absent; lateral veins 7-12; petioles 10-20 mm, sulcate above, with a similar indument as the twigs. Inflorescences 10-20 cm, paniculate-cymose, sparsely pubescent with erect or ascending hairs, mostly in the axils of cataphylls. Flowers c. 10 mm in diameter, yellow, whitish or light green, perfect, sparsely pubescent on the outside. Tepals 4 mm, elliptic, the inner surface pubescent near the base, otherwise papillose, spreading at anthesis; stamens 9, 4-celled, the outer 6 1.5-2 mm, the filament c. 0.5 mm, free, with a few hairs, the anther glabrous, without a sterile tip, the anthers arranged in 2 pairs, but the lower pair extending next to the upper pair; inner 3 stamens c. 1.8 mm, the cells extrorse-lateral, the filaments 0.6 mm, with a few hairs, glands present at the base of the filaments of the inner stamens, staminodia 3, minute, pubescent; pistil 2.2 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, densely pubescent inside. Fruits ellipsoid, 5 × 2.5 cm, cupule initially deeply cup-shaped, at maturity shallow, almost platelike, 1.5 cm in diameter, with a single margin and tepals deciduous. *Montane forests*. CR (Herrera 8938, MO). 700-1400 m. (Endemic.)

Ocotea lentii can be recognized by its large, obovate leaves, the sparsely pubescent inflorescences, the pubescent receptacles and the large fruits. Due to its large leaves, specimens consist rarely of more than a few leaves with a short piece of twig; it is possible that the leaves are more clustered than alternate. A few of the twigs have a soft core and may become hollow with age, but the growing tips are all solid. Differences with similar species are discussed under *O. valeroides*.

Provisionally placed here is *Quesada 941* (MO), a fruiting collection. It agrees reasonably well with *O. lentii*, but was collected at only 100 m altitude, much lower than any of the other collections of *O. lentii*.

49. *Ocotea leucoxylon* (Sw.) Laness., *Pl. util. Col. Franc.* 156 (1886). *Laurus leucoxylon* Sw., *Prodr.* 65 (1788). Holotype: Jamaica, Swartz *s.n.* (S).

Ocotea lenticellata Lundell; *O. subsericea* Standley.

Trees, to 25 m, but frequently flowering when only 5-8 m. Twigs angular, solid, densely grey appressed pubescent, glabrescent with age, the hairs minute and covering the surface almost completely on the young shoots; terminal buds densely appressed pubescent. Leaves 10-25 × 30-9 cm, elliptic to oblong, stiffly chartaceous, alternate, pinnately veined; the base acute or obtuse, the margin sometimes revolute, the apex acute or acuminate, the acumen to 2 cm, the upper surface glabrous, the lower surface glabrous or minutely appressed pubescent; midrib, lateral veins and tertiary venation immersed on the upper surface, this smooth; midrib and lateral veins raised, tertiary venation immersed or slightly raised on the lower surface; domatia lacking; lateral veins 4-8; petioles 1-2 cm, weakly canaliculate, with a similar indument as the twigs. Inflorescences 4-12 cm, paniculate-cymose, densely to moderately dense appressed pubescent, in the axils of leaves. Flowers 3-4 mm in diameter, white, unisexual. Male flowers: tepals c. 2 mm, sparsely appressed pubescent outside, glabrous inside, spreading or half-erect at anthesis, stamens 9, 4-celled, the outer 6 c. 0.8 mm, glabrous, the filaments 0.2 mm, free, the cells opening introrse, a sterile tip lacking, inner 3 stamens with the same dimensions, the cells opening extrorse-lateral, glands present at the base of the inner 3 stamens, staminodes not seen, pistillode 1.8 mm, slender, glabrous, with a small discoid stigma, receptacle deeply cup-shaped, pubescent inside; female flowers: staminodia 9, 0.5 mm, glabrous, the inner 3 with 2 glands at the base, pistil 1.2 mm, glabrous, the style 0.4 mm, the stigma discoid, receptacle deeply cup-shaped, glabrous inside. Fruits subglobose, c. 12 mm in diameter, cupule shallowly bowl-shaped, 8 mm in diameter, the pedicel often thickened and lenticellate; margin simple; tepals deciduous in fruit. *Lowland and montane evergreen forests.* Ch (*Martinez S. 18866*, MO); B (*Holst 5744*, MO); G (*Contreras 10291*, MO); CR (*Bello 1281*, MO); P (*McPherson 7891*, MO). 200-1600 m. (Mexico, Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Brasil, Tortola, Cuba, Jamaica, Dominican Republic, Puerto Rico, Antigua, Montserrat, Guadeloupe, Dominica, Martinique, Grenada, Trinidad.)

Diagnostic for *Ocotea leucoxylon* are the unisexual flowers, leaves with smooth upper surface, the minute appressed, grey indument on the young twigs and the small, almost platelike cupules. However, when the fruits are still immature, the cupules are deeper and cup-shaped. Frequently, the pedicels are swollen and lenticellate in fruit. *Ocotea leucoxylon* is a widespread species and rather variable. Some collections (but not all) from Cerro Jefe in Panama have smaller, narrower leaves with an inrolled base and larger flowers, while the fruiting collections upon which *O. lenticellata* is based, have deeper cupules than normal. However, separating these populations from *O. leucoxylon* will only result in a proliferation of ill-defined species and I prefer to treat *O. leucoxylon* in a wider sense. *Ocotea subsericea* is placed here following Burger & van der Werff (1990); the holotype of that species (*Brenes 6789*, F!) is in bud and has very immature leaves, making a positive identification next to impossible.

??. *Ocotea macrantha* van der Werff, *Novon* 11: 508 (2001). Holotype: Costa Rica, *Aguilar 4688* (MO!).

Trees, 20 m. Twigs ridged to angular, solid, densely and minutely brown tomentellous, the surface completely covered and individual hairs scarcely recognizable; terminal buds completely covered with the same indument. Leaves 19-26 × 7-12 cm, alternate, chartaceous, elliptic, pinnately veined, the base obtuse, rarely acute, the margin flat, the apex acuminate or acute, acumen to 2 cm, the upper surface glabrous except for some minute hairs on the major veins, the lower surface sparsely to moderately minutely puberulous, the individual hairs scarcely visible, the indument denser and becoming tomentellous along the major veins, midrib and lateral veins immersed, tertiary veins slightly raised on the upper surface, midrib prominently raised, lateral veins raised and tertiary venation weakly raised on the lower surface; domatia absent; lateral veins 7-10; petioles 2-3 cm, sulcate, with a similar dense, brown indument as the twigs. Inflorescences 9-17 cm, densely and minutely brown tomentellous, the surface completely covered, paniculate-cymose, in the axils of normal leaves. Flowers 10-12 mm in diameter, pale green, perfect. Tepals 4-5 mm, elliptic, spreading at anthesis, the outer 3 sparsely to moderately puberulous outside and with a basal triangular papillose patch, otherwise glabrous inside, the inner 3 tepals densely and coarsely papillose on both

surfaces, sometimes appearing floccose on the outer surface; stamens 1.6 mm, densely papillose, sessile or nearly so, the outer 6 with the cells arranged in 2 pairs, opening introrse, a sterile tip lacking, the inner 3 with the lower pair of cells extrorse, the upper pair lateral, small glands present at the base of the filaments of the inner 3 stamens, staminodia not seen; pistil 3-4 mm, glabrous, the style a little shorter than the ovary; receptacle deeply cup-shaped, densely appressed pubescent inside. Fruit ellipsoid, 28 × 14 mm, the cupule bowl-shaped, 14 mm in diameter, the tepals not persisting and with a single margin; pedicel slightly thickened in fruit. *Lowland rain forest. CR (Aguilar 4785, MO). 100-200 m. (Endemic.)*

Vegetatively, *Ocotea macrantha* is very similar to *O. rubriflora*; the peculiar short and dense indument of the twigs and inflorescences is not found in any other species of the *O. heydeana* group and the pubescent outer surface of the tepals, shared by both species, is also very unusual in the group. Flowering material of *O. macrantha* can be readily identified by the size of the flowers: 10-12 mm in diameter for *O. macrantha* vs. 6-7 mm in *O. rubriflora*.

50. *Ocotea macropoda* (Kunth) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 348. 1889. *Persea macropoda* Kunth in Humb., *Bonpl. & Kunth, Nov. Gen. Sp.* (quarto ed.) 2: 160 (1817). Holotype: Colombia, *Humboldt & Bonpland s.n.* (P).

Ocotea babosa Allen

Trees, to 30 m. Twigs angular, moderately to densely pubescent, the hairs curled, erect, solid; terminal buds densely tomentellous. Leaves 12-25 × 6-12 cm, alternate, (firmly) chartaceous, broadly elliptic to elliptic or ovate-elliptic, pinnately veined, the base obtuse, the margin flat, the apex acute or obtuse, the upper surface with some scattered hairs when young, soon glabrescent, but midrib and lateral veins sometimes pubescent; the lower surface sparsely to moderately densely pubescent, the hairs erect and curled, discernable to the touch, the indument denser along midrib and lateral veins; midrib and lateral veins immersed to slightly impressed, tertiary venation slightly raised on the upper surface; midrib, lateral veins and tertiary venation raised on the lower surface; domatia lacking; lateral veins 5-7; petioles 10-25 mm, with a similar indument as the twigs, the upper side flattened. Inflorescences 7-12 cm, in the axils of leaves,

paniculate-cymose, puberulous or densely puberulous, the hairs curled and erect, the branchlets roundish. Flowers greenish yellow, unisexual, 5-6 mm in diameter, male flowers: tepals 1.5 mm, ovate-elliptic, glabrous or nearly so outside, inside distally glabrous but pubescent near the base; outer 6 stamens c. 2 mm, glabrous, the filament free, slightly shorter than the anther, the cells introrse, arranged in two rows, sterile tip lacking, inner 3 stamens 2 mm, the filament with a few hairs, as long as the anther, and with 2 globose glands near the base, the lower 2 cells extrorse, the upper 2 introrse, staminodia not seen, pistillode threadlike, glabrous; female flowers: tepals as in male flowers, staminodia 9, 0.8-1.0 mm, glabrous, inner 3 staminodia with 2 small glands at the base of the filaments, pistil glabrous, 3 mm long in old flowers and probably smaller at anthesis; receptacle cup-shaped and glabrous inside in old flowers. Fruits roundish, c. 1 cm in diameter, seated on a plate-like cupule with a single margin; tepals deciduous. *Lowland and montane forests. CR (Zamora 2342, MO); P (Correa et al. 8431, MO). 100-800 m. (Mesoamerica, Colombia, Venezuela, Ecuador.)*

Ocotea macropoda is best recognized by the combination of unisexual flowers and erect indument on twigs, leaves and flowers. This combination of characters also occurs in *O. atlantica*, but the latter species has smaller flowers (3.5 vs 5-6 mm in diameter) and a denser indument on the twigs (covering the surface completely in *O. atlantica* vs. the surface visible in *O. macropoda*). Also, *O. macropoda* has a thin, platelike cupule and a smooth pedicel, while *O. atlantica* has a turbinate, swollen pedicel, often with lenticels, but lacks a platelike cupule. This species is found over an unusual wide range of altitudes, from 100 m in Costa Rica to 2600 m in Ecuador. Nearly all collections in South America come from 2000 m or higher but there is one collection from Colombia made at 1450 m. These high altitude collections have a somewhat denser indument on twigs and leaves and less indument in the flowers. However, the single collection from Panama was made at 800-900 m and connects the lowland collections from Costa Rica with the high altitude collections from South America. Still, the species is poorly known; all staminate specimens come from Mesoamerica, while all pistillate collections come from South America and it is possible that more collections will show that the Mesoamerica and South American specimens are better treated as distinct

species. The Costa Rican collections were previously identified as *O. babosa*, which I regard as a synonym of *O. macropoda*.

51. *Ocotea magnifolia* (Lundell) Lundell, *Wrightia* 5: 341 (1977). *Nectandra magnifolia* Lundell, *Wrightia* 4: 103 (1969). Isotype: Guatemala, *Contreras* 7865 (MO!).

Nectandra thornei Lundell.

Trees, to 20 m. Twigs angular or ridged, solid, moderately dense to densely appressed pubescent, the hairs very short and largely covering the surface of the twigs; terminal buds densely appressed pubescent, the surface entirely covered by the hairs. Leaves 17-24 × 5-10 cm, alternate, chartaceous, (broadly) elliptic to elliptic-ovate, pinnately veined; the base obtuse, rarely rounded or acute, the margin flat, the apex acute to acuminate, the upper surface glabrous, the lower surface with some minute, appressed hairs along the major veins, otherwise glabrous, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; domatia lacking; lateral veins 6-9; petioles 15-30 mm, sulcate, with a similar indument as the twigs. Inflorescences 4-12 cm, paniculate-cymose, rather densely and minutely appressed pubescent, the surface largely covered. in the axils of normal leaves. Flowers 6-7 mm in diameter, yellowish, fragrant, perfect. Tepals 3 mm, ovate-elliptic, glabrous outside, inner three densely papillose inside, outer three with a basal triangular papillose patch inside, spreading at anthesis; anthers 1 mm, densely papillose, the outer 6 with the cells introrse, arranged in 2 pairs and filling nearly the entire anther, the filaments very short or lacking; the inner 3 with lateral cells arranged in 2 pairs, glands present at the base of the filaments of the inner 3 stamens; staminodia not seen; pistil 2 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, glabrous or appressed pubescent inside. Fruit 2 × 1 cm, ellipsoid, cupule deeply cup-shaped, c. 1 cm deep and 1 cm wide, the margin simple and without persistent tepals. *Lowland rain forest*. Ch (*Hernandez G.* 1421, MO); G (*Contreras* 7865, MO). 100-200 m. (Endemic.)

Ocotea magnifolia is a poorly known and not clearly defined species. Its most distinctive character is the indument on twigs and inflorescences, which is denser than in *O. heydeana* and sparser than in *O. rubriflora*. Fruiting material is best identified by

comparison with specimens of *O. heydeana* and *O. rubriflora*. The two known flowering collections (cited above) differ from each other in the pubescence on the inside of the receptacle: in the type collection the receptacle is glabrous, in the collection from Chiapas it is clearly pubescent. More collections of the species in this complex are needed and may result in different species circumscriptions.

52. *Ocotea matudai* Lundell, *Bull. Torrey Bot. Club* 69: 388 (1942). Isostype: Mexico, Chiapas, *Matuda 4221* (F!).

Small trees, to 10 m. Twigs terete or slightly ridged, solid, glabrous; terminal buds glabrous. Leaves 10-16 × 3.5-6 cm, elliptic, chartaceous, alternate and evenly distributed along the twigs, pinnately veined, the apex and base acute, the margin flat, glabrous on both surfaces except for the axillary tufts of hairs on the lower leaf surface, midrib and lateral veins immersed, tertiary venation weakly raised on upper surface, midrib raised, lateral veins and tertiary venation weakly raised on lower surface, pinnately veined, domatia present as conspicuous tufts of hairs, lateral veins 7-10; petioles 1.2-1.8 cm, weakly canaliculate, glabrous. Inflorescences 3-10 cm, paniculate-cymose, branched from the very base, sparsely and in the distal parts moderately pubescent, the hairs very short and ascending to erect, in the axils of bracts near the tips of the twigs or in the axils of leaves. Flowers 4-5 mm in diameter, white, perfect. Tepals 1.4-1.6 mm, elliptic, sparsely pubescent on the outer surface, with a few hairs near the base and weakly papillose near the tip on the inner surface, spreading to reflexed at anthesis; stamens 9, all 4-celled, outer 6 stamens 1.3 mm, glabrous, the filament free, the anther 1 mm, the cells more or less arranged on 2 rows, opening introrse, a sterile tip lacking; inner 3 stamens with the same length, the anther as long as the filaments, the cells lateral, filaments with 2 glands near the base, staminodia minute, 0.3 mm, stipitiform, glabrous. Pistil 1.5 mm, glabrous, the ovary gradually narrowed into the style; receptacle shallowly cup-shaped, glabrous inside. Fruits and cupule unknown. *Montane rain forests*. Ch (*Matuda 4221*, F). 1300-2700 m. (Endemic.)

Ocotea matudai is rarely collected and known from very few collections. It is best recognized by its glabrous terminal buds and leaves and flowers with spreading tepals at anthesis. The minute, predominantly erect indument on the distal parts of the

inflorescences is also a useful character. The elliptic, rather narrow tepals which are slightly papillose near the tip are rare on *Ocotea*, but more common in *Nectandra* and it is possible that this species is better placed in the latter genus. Additional collections are needed to solve this problem.

53. *Ocotea meiziana* C.K. Allen, *J. Arnold Arbor.* 26: 360 (1945). Isotype: Costa Rica, *Smith H359* (MO!).

Trees, to 20 m. Twigs angular or ridged, solid, initially moderately to sparsely appressed pubescent, soon becoming glabrous with age; terminal buds densely white appressed pubescent. Leaves 7-16 × 3-5.5 cm, elliptic or narrowly elliptic, chartaceous, alternate, pinnately veined, the base acute, margin plane, the apex bluntly acute or bluntly acuminate, the upper surface glabrous, the lower surface glabrous or with a few appressed hairs, these mostly near the base along the midrib; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface; small pit domatia present along the basal lateral veins, larger pit domatia occasionally present in the axils of the lowermost lateral veins; lateral veins 4-6; petioles 5-15 mm, flat above, with a few appressed hairs or glabrous. Inflorescences 3-10 cm, glabrous, paniculate-cymose, in the axils of leaves. Flowers 2.5-3.2 mm in diameter, yellow, perfect. Tepals 1.8 mm, ovate, glabrous on both surfaces, erect to half erect at anthesis; stamens 4-celled, the cells arranged in 2 pairs, outer 6 stamens 1.2 mm, the filament free, sparsely pubescent and about as long as the anther, the cells opening introrse, a sterile tip lacking, inner 3 stamens 1.5 mm, the filament dorsally pubescent, slightly longer than the anther, cells lateral-extrorse, base of the filaments with 2 large glands, staminodia not seen; pistil 2 mm, glabrous, the style slender, 1 mm; receptacle bowl- or cup-shaped, glabrous or with a few hairs inside. Fruit 2.5 × 1.5 cm, ellipsoid, cupule a flaring disc, 1.2 cm in diameter, with a single margin and the tepals deciduous; pedicel thickened towards the cupule. *Wet lowland and montane forest.* H (*Hawkins & Merello 771*, MO); N (*Rueda 8603*, MO); CR (*Haber 9835*, MO); P (*Quiroz 718*). 100-1800 m. (Endemic.)

Ocotea meiziana can be recognized by its greenish drying leaves, small pit domatia along the lateral veins and occasionally larger pit domatia in the axils of the lateral veins, the pubescent terminal buds and the glabrous flowers. It is quite similar to

O. viridiflora, which differs in its glabrous terminal buds, finely acute leaf apices and its shorter, few-flowered inflorescences. Specimens from Cerro Campana (Panama) are provisionally included in *O. meiziana*. These specimens have generally stiffer leaves without pit domatia; one collection with a few flowers has 2-celled stamens. The general aspect, color of the leaves, raised venation on the lower leaf surface, cupule and fruit are a good match for *O. meiziana*. Flowering collections are needed in order to determine the correct status of these plants.

Lowland collections from Costa Rica are also similar to *O. laetevirens*, but the latter species lacks pit domatia (it has usually shallow depressions fringed with hairs or lacks domatia altogether).

54. *Ocotea mollicella* (Blake) van der Werff, *Fieldiana Bot.*, n.s. 23: 88 (1990). *Phoebe mollicella* Blake, *Contr. Gray Herb.* 52: 64-65 (1917). Holotype: Costa Rica, *Tonduz 11676* (GH!). Illustr.: van der Werff, *Novon* 9: 578 (1999).

Cinnamomum mollicellum (Blake) Kostermans.

Trees to 15 m. Twigs terete or slightly angular, solid, densely puberulous or tomentellous, the indument covering the surface almost completely; terminal buds densely tomentellous. Leaves 3-8 × 1-2.5 cm, alternate, firmly chartaceous, elliptic to narrowly elliptic, pinnately veined, the base acute, the margin flat, the apex acute; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed or very weakly raised on the lower surface; upper surface glabrous except for the grey-tomentellous midrib, lower surface moderately densely grey-pubescent, the hairs short, ascending to somewhat erect, the surface visible between the hairs, the indument discernable to the touch; domatia (as small axillary tufts of white hairs) present or absent; lateral veins 3-6; petioles 6-12 mm, flat or slightly sulcate above, with a similar indument as the twigs. Inflorescences to 6 cm, racemose, moderately to densely pubescent with ascending or erect hairs, the surface visible between the hairs, in the axils of cataphylls or leaves. Flowers 5-6 mm in diameter, greenish yellow, hermaphrodite, glabrous or nearly so outside. Tepals 2 mm, elliptic, with a few scattered hairs on the outside, pubescent at the very base but otherwise glabrous on the inside, spreading at anthesis; outer 6 stamens 1 mm, glabrous, the

filament 1/3 as long as the anther, free, the cells arranged in 2 pairs, introrse, filling the entire anther and a sterile tip lacking; inner 3 stamens 1 mm, glabrous, the filament 1/3 as long as the anther, the cells in 2 pairs, lateral-extrorse, glands present at the base on the filaments; staminodia 3, 0.5 mm, inconspicuous; pistil 2 mm, glabrous, the style as long as the ovary; receptacle shallow, bowl-shaped, glabrous inside, but with a ring of hairs at the upper rim. Fruits ellipsoid, 2 × 1 cm, cupule a shallow cup, c. 6 mm wide, with a single margin and deciduous tepals; the pedicel thickened in fruit. *Montane forests*. CR (*Poveda 455*, MO). 1400-2300 m. (Endemic.)

Ocotea mollicella is readily recognized by its racemose inflorescences, elliptic to narrowly elliptic leaves with soft, grey pubescence and the densely pubescent twigs. There are no species with which it can be confused. *Ocotea mollicella* is not frequently collected.

55. *Ocotea mollifolia* Mez & Pittier, *Bull. Herb. Boissier, ser. 2, 3: 233* (1903).
Holotype: Costa Rica, *Pittier 16031* (B).

Trees, to 25 m. Twigs terete or slightly angular, solid, densely tomentellous, the hairs brown and covering the surface completely; terminal buds densely tomentellous. Leaves 12-25 × 5-15 cm, alternate, chartaceous, obovate to broadly elliptic-obovate, pinnately veined, the base acute, obtuse to rounded, the margin flat, the apex acuminate, acumen to 1.5 cm, rarely apex rounded, the upper surface sparsely pubescent to glabrous except for the pubescent major veins, the lower surface moderately pubescent, the hairs erect, discernable to the touch, the surface visible between the hairs, the major veins densely pubescent; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface; domatia lacking; petioles 4-15 mm, with a similar indument as the twigs. Inflorescences 6-20 cm, densely brown-tomentellous, the surface not visible, paniculate-cymose, mostly in the axils of bracts near the tips of the branches, rarely in the axils of leaves. Flowers 3-6 mm in diameter, yellowish, perfect. Tepals c. 2 mm, broadly elliptic, densely pubescent outside, glabrous or nearly so inside, erect to half erect at anthesis; stamens 9, 4-celled, outer 6 c. 1 mm, the pubescent filament half as long as the glabrous anther, free, anther cells arranged in 2 pairs, opening introrse, a sterile tip lacking, inner 3 stamens the same size as the outer 6, also with pubescent filaments, the

cells in 2 pairs, lateral-extrorse, with 2 large bean-shaped glands at the base of the filaments, staminodes not seen, pistil 1.5 mm, glabrous, the ovary gradually narrowed into the style, receptacle cup-shaped, pubescent inside. Fruits narrowly ellipsoid at maturity, 3.5×1.3 cm, the cupule shallowly cup-shaped, with a single margin, the tepals persisting as 6 lobes on the cupule. *Lowland and montane wet forests. CR (Hammel 16776, MO); P (McPherson 11134, MO). 50-1000 m (Endemic.)*

Ocotea mollifolia can be recognized by its densely pubescent twigs, pubescent, chartaceous leaves, manyflowered inflorescences and the persistent tepals on the cupule. The leaf base can be quite variable, ranging from acute to abruptly rounded. Differences with *O. pseudopalmana* are discussed under the latter species. It can be confused with *O. darcyi*, but the latter species has coriaceous leaves, a much denser, ferruginous pubescences on the leaves and lacks the persistent tepals on the cupule.

56. *Ocotea monteverdensis* Burger, *Fieldiana Bot. n.s.* 23: 89 (1990). Isotype: Costa Rica, *Hartshorn 1900* (MO!).

Trees, to 35 m. Twigs angular or ridged, brown-tomentellous, the surface completely covered by the indument, solid; terminal buds densely tomentellous. Leaves 5-12 \times 1.5-4 cm, alternate, stiffly chartaceous, elliptic or narrowly elliptic, pinnately veined, the base acute and decurrent on the petiole, the margin rarely somewhat inrolled, the apex acute or infrequently obtuse, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface, upper surface glabrous except for some persistent appressed indument on the midrib, especially near the base, the lower surface with a moderately dense appressed or ascending indument, this slightly discernable to the touch, the surface remaining largely visible; domatia absent; lateral veins 3-8; petioles not clearly recognizable due to the decurrent leaf bases, less than 1 cm. Inflorescences 6-14 cm, in the axils of leaves, paniculate-cymose, densely brown-tomentellous, the surface completely covered. Flowers yellowish, 4 mm in diameter, densely tomentellous outside, perfect. Tepals 1.5-2 mm, half erect at anthesis, puberulous on the inner surface; outer 6 stamens 1.2 mm, the filament half as long as the anther, free, pubescent on the outside, the anther cells introrse and arranged in 2 pairs, the upper pair smaller than the lower, a

sterile tip absent, inner 3 stamens 1.2 mm, the filament as long as the anther, pubescent, the upper pair of locelli lateral, the lower extrorse, 2 globose glands present at the base of the filament, staminodia not seen; pistil 1.5-2 mm, glabrous, receptacle cup-shaped, sparsely appressed pubescent inside. Fruit ellipsoid, 3×1.5 cm, cupule initially cup-shaped, at maturity flat and platelike, 1.5 cm in diameter, with a single margin; tepals deciduous in fruit. *Montane forests*. CR (*Haber 8521*, MO). 800-1500 m. (Endemic.)

Ocotea monteverdensis is very close to *O. hartshorniana* and the two differ mainly in the indument on the lower leaf surface (appressed or ascending in *O. monteverdensis*, erect in *O. hartshorniana*). Additional differences are the leaf size (10-20 cm in *O. hartshorniana*, 5-12 cm in *O. monteverdensis*) and the generally denser indument on the leaves in *O. monteverdensis*. These differences are not strong and collections from other sites than Monteverde and La Selva may well indicate that the two species should be merged.

57. *Ocotea morae* Gómez-Laurito, *Novon* 7: 145 (1997). Isotype: Costa Rica, *Gómez-Laurito & Mora 12817* (MO!). Illustr.: Gómez-Laurito, *Novon* 7(2): 146, t.1 (1997).

Trees, to 20 m. Twigs angular, minutely appressed pubescent, glabrescent with age, solid or hollow, terminal buds densely appressed pubescent. Leaves 18-28 \times 5-10 cm, elliptic or oblong, firmly chartaceous, alternate, pinnately veined, the base obtuse or acute, the margin slightly recurved, the apex obtuse or acute; the upper surface glabrous, the lower surface glabrous or with some small, appressed hairs, the upper surface with the midrib immersed or impressed near the base, lateral veins and tertiary venation immersed, lower surface with the midrib rather strongly raised, and lateral veins and tertiary venation weakly raised; domatia lacking; lateral veins 9-12; petioles 1.5-2 cm, strongly canaliculate, glabrous or nearly so. Inflorescences 2-8 cm, rather densely and minutely pubescent, paniculate-cymose, in axils of leaves or cataphylls. Flowers white, c. 1 cm in diameter, perfect. Tepals c. 4 mm, elliptic, spreading at anthesis, finely and rather sparsely pubescent outside, more or less papillose and pubescent at the base inside. Stamens c. 2 mm, the outer 6 sessile, with the cells arranged on two introrse pairs, tongue-shaped, the base pubescent, otherwise sparsely papillose, sterile tip c. 0.5 mm, the

inner 3 with lateral cells, glands not visible and probably fused with the base of the inner stamens; staminodia c. 0.5 mm, triangular, densely pubescent. Pistil c. 2 mm, glabrous; receptacle urceolate, densely pubescent inside. Fruits 5×3.5 cm, ellipsoid, cupule cup-shaped, 4-6.5 cm wide, 2 cm high, with a conspicuous double margin, this spreading and 1-1.5 cm wide, tepals deciduous in fruit. *Lowland and montane wet forests*. CR (Thomsen 1475, MO). 100-800 m. (Endemic.)

Ocotea morae is still poorly known and I have not seen good flowering specimens. Its placement in the subgenus *Dendrodaphne* is without hesitation because of its tongue-shaped stamens with a sterile tip and the cupule with a double margin. It can be confused with *O. dendrodaphne*, but differs in its habit (a 20 m tall tree) and in its inrolled leaf bases. Its large fruits and large double-rimmed cupules are very distinctive characters in *Ocotea*. A fruiting specimen (*Espinoza 848*, MO) had been previously identified as a *Licaria* species, a genus where cupules with a double margin are common. A recent collection from Panama (*Correa & Montenegro 9334*, MO) represents a probably undescribed species related to *O. morae*; its cupules are c. 3 cm in diameter, with a double margin, its fruits measure 3×2.5 cm and its leaf bases are rounded to obtuse. A few old stamens found on the cupule are tongue-shaped, with a sterile tip.

58. *Ocotea multiflora* van der Werff, *Novon* 6: 481 (1996). Holotype: Costa Rica, *Aguilar 791* (MO!).

Trees, to 45 m. Twigs slender, angular, lenticellate with age, glabrous or nearly so, solid; terminal buds white appressed pubescent. Leaves 6-9 \times 1.5-3 cm, narrowly elliptic to elliptic, alternate, chartaceous, pinnately veined, the base cuneate, slightly inrolled and decurrent on the petiole, the margin flat, the apex (bluntly) acute, gland dots readily visible on the lower leaf surface of flowering specimens, less visible on fruiting specimens, upper leaf surface glabrous, lower surface glabrous or with some appressed hairs, especially along the midrib, midrib, lateral veins and tertiary venation immersed on the upper surface, weakly raised on the lower surface; domatia lacking; lateral veins 12-17 pairs; petioles 4-7 mm, flat above, glabrous or with some appressed hairs. Inflorescences 6-10 cm, paniculate-cymose, in the axils of leaves, almost glabrous near the base, but towards the flowers progressively more puberulous, the hairs short, erect to

ascending. Flowers 2-2.5 mm in diameter, white, perfect. Tepals 0.8-1.0 mm, half erect at anthesis, moderately pubescent on the both surfaces, the hairs short, ascending to erect; stamens 9, 4-celled, the outer 6 0.6 mm, the anther sessile or nearly so, dorsally with some curled hairs, the cells opening introrsely, a sterile tip lacking, inner 3 0.8 mm, the filament pubescent and with 2 globose glands near the base, the anther cells lateral-extrorse; staminodia stipitate, 0.5 mm, pubescent; pistil glabrous, 2 mm, the style c. 0.5 mm, receptacle cup-shaped, glabrous inside; flowers pubescent inside at the insertion of tepals and stamens. Fruits 2 × 1.2 cm, ellipsoid, cupule small, plate-like, 5 mm in diameter, the margin simple and entire. *Lowland rain forest*. CR (Aguilar 4844, MO). 10-200 m. (Endemic.)

Ocotea multiflora is an inconspicuous species, best recognized by its rather small leaves with many pairs of lateral veins, small flowers, many-flowered inflorescences and its large size. It is only known from the Osa Peninsula in Costa Rica. The fruits of this species are obliquely attached to the cupules, a feature not known from other *Ocotea* species. Dissected fruits show no signs of insect damage and have well-shaped cotyledons.

59. *Ocotea nigrita* (Lundell) Lundell, *Wrightia* 5: 341 (1977). *Nectandra nigrita* Lundell, *Wrightia* 4: 132 (1970). Isotype: Guatemala, *Contreras 9465* (CAS!).

Trees, to 30 m. Twigs angular, solid, sparsely appressed pubescent, soon becoming glabrous; terminal buds densely appressed pubescent. Leaves 6-15 × 1.5-2.5 cm, oblanceolate, rarely narrowly obovate-elliptic, chartaceous, alternate, black when dry, pinnately veined, the base cuneate or acute, the margin flat or nearly so, the apex obtuse or bluntly acute; the upper surface glabrous, the lower surface glabrous or sparsely appressed pubescent; midrib, lateral veins and tertiary venation raised on both surfaces; domatia present as axillary tufts of hairs; lateral veins 7-10; petioles 6-12 mm, with a similar indument as the twigs, dlightly canaliculate above. Inflorescences 5-10 cm, paniculate-cymose, densely and minutely puberulous, the indument towards the flowers covering the surface completely, in the axils of cataphylls or normal leaves. Flowers 3-4 mm in diameter, creamy-white, perfect. Tepals 1.5 mm, densely puberulous on both surfaces, spreading at anthesis; stamens 9, 4-celled, outer 6 c. 1 mm, the pubescent, free

filament as long as the anther, the cells arranged in 2 rows, opening introrsely, a sterile tip lacking, inner 3 with the same dimensions, the filaments with 2 glands near the base, pubescent, as long as the anthers, the anthers pubescent at their lower edge, the cells in 2 rows, opening extrorse-latrorse; staminodia present, 0.6 mm, slender, stipitiform, glabrous and inconspicuous; pistil glabrous, 1.8 mm, the style slender, 0.7 mm; receptacle shallow, glabrous inside. Fruits and cupules unknown. *Lowland rain forest*. G (Lundell & Contreras 18984, MO). 100-300 m. (Endemic.)

Ocotea nigrita is an infrequently collected species only known from Guatemala. It is best recognized by the oblanceolate, black-drying leaves, the small, densely puberulous flowers and the tufts of hairs in the axils of the basal lateral veins. It can be confused with *O. uxpanapana*, a species with longer and wider leaves and larger flowers.

60. *Ocotea oblonga* (Meissner) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 367 (1889). *Mespilodaphne oblonga* Meissner, *Prodr.* 15: 107 (1864). Holotype: French Guyana, *Sagot 491* (G-DC).

Ocotea mayana (Lundell) Lundell; *Phoebe mayana* Lundell

Trees to 30 m. Twigs angular, sparsely to densely appressed pubescent, solid; terminal buds densely appressed pubescent, slender. Leaves 5-16 × 2-5 cm, obovate-elliptic to oblanceolate, firmly chartaceous, alternate, pinnately veined; the base cuneate, the lamina at the base recurved or slightly inrolled and decurrent on the petiole, the apex acute or obtuse; upper surface glabrous or with some appressed hairs when young, these frequently persisting on the basal part of the midrib, the lower surface very sparsely to moderately appressed pubescent, the surface visible; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation immersed and poorly or not visible on the lower surface; domatia present in the form of slits or circular pits which are frequently visible as small bumps on the upper surface; lateral veins 5-8; petioles 1-2 cm, often poorly differentiated from the decurrent leaf bases. Inflorescences 5-14 cm, paniculate cymose, moderately pubescent, the hairs appressed or ascending, in the axils of leaves. Flowers 3-4 mm in diameter, white, unisexual. Tepals 1.5-2 mm, broadly elliptic, moderately appressed pubescent outside, moderately to densely pubescent inside, half-erect to spreading at anthesis. Male

flowers: stamens 9, all 4-celled, a sterile tip lacking, the outer 6 with the anther cells arranged in two pairs, introrse, c. 1 mm, glabrous, the anthers slightly longer than the free filaments, inner 3 with the cells extrorse, 1.2 mm, glabrous, with 2 globose glands near the base, anthers slightly longer than the filaments; pistillode c. 1.4 mm, glabrous, slender, with a small stigma; staminodia absent; receptacle cup-shaped, appressed pubescent inside; female flowers: staminodia 9, c. 0.5 mm, glands at the base of the inner 3 staminodia present, pistil 1.7 mm, glabrous, the receptacle deeply cup-shaped, glabrous inside. Fruit 9-18 × 7-9 mm, seated on a shallow plate, this c. 7 mm in diameter, the pedicel gradually thickened into the platelike cupule, frequently lenticellate, the margin simple; tepals deciduous in fruit. *Evergreen lowland and montane forest*. B (*Gentle 4212*, MO); G (*Steyermark 44649*, F); CR (*Herrera 645*, MO); P (*Croat 16515*, MO). 0-1000 m. (Mexico, Colombia, Venezuela, Guyanas, Ecuador, Peru, Bolivia, Brasil, Puerto Rico, Trinidad.)

Ocotea oblonga can be easily recognized by the combination of unisexual flowers and leaves with pit or slit domatia. Such domatia are rare among the Lauraceae found in Mesoamerica. The plate-like cupules with thickened pedicels, which are frequently lenticellate, are also useful characters for identifying fruiting specimens. *Ocotea mayana* has been recognized as distinct from *O. oblonga* based on its glaucous lower leaf surfaces and consistent presence of domatia. Most collections of *O. oblonga* from South America have weakly developed domatia or lack domatia, but some (for example *Holm-Nielsen 801* from Ecuador) have also very prominent domatia and specimens with pale or glaucous lower leaf surfaces are not restricted to Mesoamerica. Therefore, *O. mayana* is here treated as a synonym of *O. oblonga*.

61. *Ocotea oblongifolia* van der Werff. *Novon* 11: 509 (2001). Holotype: Guatemala, *Walker 442* (US!).

Small tree, 6 m. Twigs terete, solid, densely light-brown pubescent with mostly erect, straight hairs, the surface of the twigs completely covered or nearly so; terminal buds completely covered by the dense, light-brown, erect indument. Leaves 9-13 × 3-5 cm, oblong to slightly ovate-oblong, chartaceous, alternate, pinnately veined, the base obtuse to subcordate, the margin flat, the apex gradually acute, the upper surface sparsely

pubescent with erect hairs, the indument much denser along the major veins, the lower surface densely pubescent with erect hairs, these soft to the touch, the surface partially visible between the hairs, the pubescence denser along the major veins and these clearly visible; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface; domatia lacking; lateral veins 7-10; petioles 6-8 mm, terete, with the same dense indument as the twigs. Inflorescences 4-6 cm, in the axils of leaves, paniculate-cymose, rather few-flowered, sparsely to moderately pubescent with erect hairs. Flowers 2-3 mm in diameter, cream colored, perfect. Tepals 1-1.2 mm, erect to half erect at anthesis, hypanthium and tepals sparsely pubescent on the outer surface, glabrous inside, stamens 9, all 4-celled, c. 0.7 mm, glabrous, anthers sessile or nearly so, the cells arranged in 2 superposed pairs, filling the entire anther and a sterile tip absent, outer 6 stamens with the cells opening introrse, inner 3 with the cells opening lateral-extrorse, glands present at the base of the inner 3 stamens, staminodia small, triangular, glabrous; pistil 1.5 mm, glabrous, receptacle deep, cup-shaped. Fruits and cupules not seen. *Montane forests*. G (Walker 442, US). 1400-1800 m. (Endemic.)

Ocotea oblongifolia can be readily recognized by the combination of oblong, densely pubescent leaves with an obtuse to subcordate base, and the small, hermaphrodite flowers. The soft, villous indument is similar to that found in the *O. helicterifolia* group, but the small flowers with erect to half erect tepals which lack the papillose indument so typical of the *O. helicterifolia* group, suggest it is not related to that group. Morphologically, *O. oblongifolia* is quite distinct and it is described based on only the type collection. Its relationships are not clear.

62. *Ocotea parvula* (Lundell) van der Werff, *Novon* 11: 510 (2001). *Phoebe parvula* Lundell, *Wrightia* 5: 343-344 (1977). Holotype: Mexico, Chiapas, *Ton 605* (LL!).

Cinnamomum parvulum (Lundell) Kostermans.

Shrub or small tree, to 7 m. Twigs terete, solid, moderately densely appressed pubescent, the indument becoming sparser with age; terminal buds densely sericeous. Leaves 3-8 × 1-2.5 cm, chartaceous, ovate or narrowly ovate, alternate, pinnately veined,

the base acute, margin plane, apex tapering into a slender tip, the upper surface glabrous, lower surface glabrous or with some appressed hairs, these mostly along the midrib; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation very slightly raised on the lower surface; domatia present as axillary tufts of hairs; lateral veins 3-4 pairs; petioles 5-9 mm, moderately appressed pubescent, flat or shallowly canaliculate above. Inflorescences to 5 cm, paniculate-cymose, appressed pubescent, in the axils of leaves, bracts often persisting at anthesis. Flowers 3-3.5 mm in diameter, perfect. Tepals 1.5 mm, lanceolate, glabrous on both surfaces, initially erect, but spreading in older flowers; stamens 9, all 4-celled, glabrous, a sterile tip lacking, the outer 6 1.2 mm, filaments free, as long as the anthers, the cells in 2 pairs and opening introrse, inner 3 1.5 mm, the filaments with 2 glands at the base and as long as the anthers; staminodia present, 0.8 mm; pistil glabrous, 1.5 mm, the style slightly shorter than the ovary; receptacle shallow, with a few appressed hairs and a ring of hairs on the rim. Fruits 17×7 mm, ellipsoid or narrowly ellipsoid, cupule 7 mm in diameter, shallowly bowl-shaped, with a single margin, the tepals sometimes persisting or, when fallen off, the margin slightly lobed; pedicel thickened in fruit. *Cloud forest*. Ch (*Breedlove 21508*, MO). 1800-2800 m. (Mexico [Oaxaca], Mesoamerica.)

Ocotea parvula is an infrequently collected species best recognized by its ovate leaves, gradually tapering into the apex, presence of domatia, glabrous tepals and the small inflorescences with the bracts frequently persisting. It is closely related to *O. strigosa*, a species from Nicaragua which see for differences between the two species. Provisionally placed here are several collections from 1000-1300 m altitude which differ in having a denser indument on the twigs and the inflorescences and in their pubescent flowers.

63. *Ocotea patula* van der Werff. *Novon* 9: 577 (1999). Holotype: Costa Rica, *Aguilar et al. 2715* (MO!). Illustr.: van der Werff, *Novon* 9: 578 (1999).

Small trees, to 8 m. Twigs terete or slightly ridged, solid, densely yellowish-brown tomentose when young, the surface completely covered by the indument, the indument becoming whitish with age, terminal buds densely yellowish-brown tomentose. Leaves $12-24 \times 9-14$ cm, broadly elliptic, chartaceous, pinnately veined, alternate, the

base obtuse to rounded, the margin plane, the apex obtuse or shortly acuminate, the upper surface with some erect hairs when young, soon glabrescent, the midrib and lateral veins tomentellous, the lower surface sparsely to moderately pubescent, the hairs erect, discernable to the touch, the indument denser and tomentellous along the midrib and lateral veins, midrib, lateral veins and tertiary venation immersed on the upper surface, raised to prominently raised on the lower surface, domatia lacking, lateral veins 7-8; petioles 17-26 mm, with a similar indument as the twigs, shallowly canaliculate on the upper surface. Inflorescences 10-16 cm, densely yellowish-brown tomentellous, paniculate-cymose, in the axils of cataphylls, rarely in the axils of leaves. Flowers c. 7 mm in diameter, white, hermaphrodite, sparsely to moderately pubescent. Tepals c. 2.5 mm, elliptic, spreading or somewhat reflexed at anthesis, the inner surface moderately to sparsely papillose; stamens 9, 4-celled, the outer 6 c. 1.2 mm, weakly papillose, the cells arranged in 2 pairs, introrse, a short (0.2 mm) sterile tip present, the anthers sessile or nearly so, inner 3 stamens as long as the outer 6, also weakly papillose, sessile or nearly so, the cells in 2 pairs, extrorse, glands present at the base, staminodia not seen. Pistil c. 1.5 mm, the style as long as the ovary, glabrous, receptacle cup-shaped, glabrous inside. Fruits and cupules not known. Flowers: December. *Montane forests*. CR (*Hammel 19217*, MO). 1000-1400 m. (Endemic.)

Ocotea patula is part of the *O. helicterifolia* group and resembles *O. valeriana*. However, it differs in its densely tomentellous inflorescences (with the surface entirely or almost entirely covered by the indument), by its shorter (2-3 mm vs. 6-8 mm), tomentellous pedicels and its pubescent flowers. It is only known from 2 collections from the same locality and is reported to grow on a limestone substrate.

64. *Ocotea pausiaca* Rohwer, *Bot. Jahrb. Syst.* 112: 387 (1991). Holotype: Panama, Colon, *Knapp 5782* (MO!). Illustr.: Rohwer, *Bot. Jahrb. Syst.* 112: 388 (1991).

Trees, to 10 m. Twigs angular, solid, densely to sparsely appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent, the surface covered by the indument. Leaves 5-11 × 2.5-5.5 cm, alternate, elliptic, firmly chartaceous, pinnately veined, the base obtuse to acute, the apex obtuse to acuminate, the margin flat, the upper surface glabrous, the lower surface glabrous or with a few

appressed hairs, especially along the major veins, midrib, lateral veins and tertiary venation slightly raised on the upper surface, sometimes the major veins slightly raised in a depression and appearing impressed, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface, domatia absent, lateral veins 4-6; petioles 7-15 mm, deeply canaliculate, with a similar indument as the twigs. Inflorescences 2-7 cm, moderately to densely appressed pubescent, in the axils of leaves or cataphylls and sometimes appearing terminal, paniculate or, in small inflorescences, racemose. Flowers 7-10 mm in diameter, white, fragrant, perfect. Tepals 4-5 mm, spreading at anthesis, glabrous outside or nearly so, finely papillose inside, the outer 3 tepals with the papillosity restricted to a basal triangular patch, stamens 1.5-2.2 mm, the filaments free, at least twice as long as the anthers, the outer 6 stamens strongly curved inwards, the cells in 2 pairs and opening introrse, a sterile tip lacking, the inner 3 stamens erect, the cells lateral-extrorse, staminodia 3, 1/3 to 1/2 as long as the inner stamens, clavate; pistil glabrous, 1.8 mm, the style as long as the ovary; receptacle shallowly cup-shaped, pubescent inside. Fruit and cupule unknown. *Montane forest. P (McPherson 9550, MO). 900-1500 m. (Endemic.)*

Ocotea pausiaca is a rare species restricted to Panama. Flowering specimens can be readily recognized by the peculiar stamens: the other species in the *O. heydeana* group of Rohwer have nearly sessile stamens and broad anthers, while *O. pausiaca* has stamens with long filaments, slender anthers and the outer 6 stamens are curved inwards. Vegetatively, it can be easily confused with small-leaved specimens of *O. rubriflora*, but the latter has a very dense, minute indument on the young twigs which completely covers the surface and with individual hairs not discernable, while the indument on young twigs of *O. pausiaca* is less dense, does not cover the surface completely and individual hairs can clearly be seen with moderate magnification.

65. *Ocotea pharomachrosorum* Gómez-Laurito, *Novon* 3: 31 (1993). Isotype: Costa Rica, San Jose, *Gómez-Laurito et al. 12160* (MO!). Illustr.: Gómez-Laurito, *Novon* 3: 32, t. 1 (1993).

Trees to 20 m. Twigs angular or ridged, densely grey-brown tomentellous, the surface completely covered by the felty indument, solid; terminal buds densely

tomentellous. Leaves 10-16 × 5-6.5 cm, elliptic or ovate, firmly chartaceous, alternate, pinnately veined, the base obtuse or acute, sometimes inequilateral, the margin plane, the apex acute to rounded; the upper surface initially sparsely tomentellous, but soon becoming glabrous and shiny, the lower surface densely matted, grey-brown tomentellous, the surface not visible, the indument slightly discernable to the touch; the upper surface with the midrib and lateral veins immersed or impressed and then leaves bullate, tertiary venation scarcely to moderately raised, the lower surface with midrib and lateral veins raised, tertiary venation not visible; domatia lacking; lateral veins 4-6; petioles 2-3 cm, with a similar (but usually sparser) indument as the twigs, longitudinally ridged, otherwise flat on the upper side. Inflorescences to 10 cm, paniculate-cymose, in the axils of distal leaves or cataphylls, densely grey-tomentellous, contrasting markedly with the dark drying flowers. Flowers c. 8 mm in diameter, white, fragrant, perfect. Tepals c. 4 mm, elliptic, half-erect, sparsely pubescent outside, papillose near the tip, otherwise glabrous inside; outer 6 stamens c. 2 mm, tongue-shaped, glabrous, the filament 0.1-0.2 mm, anther cells introrse, in two pairs, sterile tip present, c. 0.8 mm, inner 3 stamens c. 1.5 mm, the filament c. 0.2 mm with 2 glands near the base, the anther rectangular, the cells lateral-extrorse; staminodia c. 1 mm, clubshaped; pistil glabrous, c. 1 mm, receptacle cup-shaped, glabrous inside. Fruits 3 × 2 cm, ellipsoid, cupule bowl-shaped, c. 1.2 cm in diameter, with a single margin, tepals deciduous in fruit, the pedicel swollen. *Montane forests*. CR (*Herrera 7449*, MO); P (*Quiroz 719*, MO). 1800-2200 m. (Endemic.)

Ocotea pharomachrosorum is the only species which has tongue-shaped outer stamens with a sterile tip and densely tomentellous lower leaf surfaces. Other distinctive characters are the rather long petioles and the frequently inequilateral leaf bases. Its stamens suggest a relationship with the *Ocotea dendrodaphne* group, but other characters (glabrous stamens, single margined cupules, the dense pubescence) point to the *O. helicterifolia* group and I think its relationships are with the latter.

66. *Ocotea pittieri* (Mez) van der Werff, *Fieldiana Botany n.s.* 23: 92 (1990). *Phoebe pittieri* Mez, *Bot. Jahrb. Syst. Beibl.* 67: 16 (1901). Holotype: Costa Rica, *Tonduz 11893* (B).

Cinnamomum pittieri (Mez) Kostermans.

Small trees or shrubs. Twigs terete, solid, moderately to densely pubescent with very short, erect hairs, the surface largely or entirely covered; terminal buds densely white pubescent. Leaves 6-10 × 2.3-3.8 cm, chartaceous, elliptic, alternate, pinnately veined, the base acute, the margin flat, the apex acuminate, rarely acute, the upper surface glabrous, the lower surface glabrous except for short, erect hairs along the major veins, midrib, lateral veins and tertiary venation immersed on the upper surface, raised or slightly raised on the lower surface, domatia as axillary tufts of hair present, lateral veins 4-5, petioles c. 1 cm, flat above, with a similar dense indument as the twigs.

Inflorescences to 8 cm, sparsely to moderately pubescent, the hairs ascending, racemose, in the axils of leaves or bracts. Flowers 6-7 mm in diameter, white, perfect. Tepals sparsely appressed pubescent outside, papillose inside. spreading at anthesis; filaments of the outer 6 stamens very short; inner 3 stamens with large, globose glands at the base of the filaments; staminodia present, slender. Fruit and cupule unknown. *Montane forests*. CR (*Morales 3397*, MO). 1800-2200 m. (Endemic.)

Ocotea pittieri is characterized by its racemose inflorescences and the dense, short, erect indument on the young twigs. It is very close to *O. brenesii*, which differs in having an appressed indument on the twigs.

Ocotea pittieri is rarely collected and my description is based on Mez's original description and a second collection, which has only buds. The name *O. pittieri* was used in Burger & van der Werff (1990) for the species here treated as *O. praetermissa*.

67. *Ocotea platyphylla* (Lundell) Rohwer, *Bot. Jahrb. Syst.* 112: 390 (1991); *Phoebe platyphylla* Lundell, *Contr. Univ. Michigan Herb.* 6: 23 (1941). Isotype: Mexico, Chiapas, *Matuda 1930* (MO!).

Nectandra platyphylla (Lundell) C.K. Allen.

Trees, to 20 m. Twigs angular, solid, moderately to sparsely appressed pubescent, glabrescent with age; terminal buds densely whitish pubescent, the surface completely covered. Leaves 13-25 × 4-8 cm, alternate, thinly chartaceous, obovate-elliptic to elliptic, pinnately veined, the base obtuse to rounded, leaf margin at the base reflexed or inrolled, apex acute to shortly acuminate, upper surface glabrous, lower surface glabrous or with a

few appressed hairs along the major veins, midrib and lateral veins immersed, tertiary venation slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; domatia absent; lateral veins 9-14; petioles 1-2 cm, canaliculate, sparsely appressed pubescent. Inflorescences 5-10 cm, sparsely appressed pubescent to almost glabrous, paniculate-cymose, in the axils of leaves. Flowers 8-9 mm in diameter, perfect. Tepals 3.5 mm, broadly ovate, glabrous outside, minutely papillose inside, spreading at anthesis; outer stamens 1.6 mm, finely papillose, filament free, short, 0.3 mm, anther cells in 2 pairs, opening introrse and filling the entire anther, inner 3 stamens as outer ones except opening extrorse; glands present, partially fused with with the base of the filaments; staminodia 3, 0.2 mm, with a glandular tip; pistil 1.8 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, with a few hairs inside. Fruit 23×13 mm, ellipsoid, cupule bowl-shaped, 1 cm in diameter, with a single margin and without persisting tepals. *Montane forests*. Ch (*Lorea 5528*, MO); G (*Molina & Molina 12373*, F); ES (*Reyna 1444*, MO). 900-2600 m. (Endemic.)

Characteristic for this species are the inrolled or revolute leaf bases. Otherwise, it resembles *Ocotea heydeana* closely. The description of the fruit is based on the collection from El Salvador. This specimens differs from the Chiapas and Guatemalan collections in having tufts of hairs in the axils of the lowermost lateral veins and in having fewer (5-8) lateral veins.

68. *Ocotea praetermissa* van der Werff, *Novon* 6: 482 (1996). Holotype: Costa Rica, *Burger et al. 12065* (MO!). Illustr.: van der Werff, *Novon* 9: 578 (1999).

Shrubs or medium-sized trees to 15 m. Twigs terete, densely tomentellous when young, the indument ususally completely covering the surface, becoming glabrous with age, solid; terminal buds densely pubescent. Leaves 3-10 \times 1.5-4 cm, alternate, chartaceous, elliptic or obovate-elliptic, pinnately veined, base acute or infrequently obtuse, the apex acute or obtuse, the upper surface glabrous or nearly so, the lower surface (sparsely) pubescent, the hairs erect, usually discernable to the touch, denser along the main veins, axillary tufts of hairs frequently present, midrib, lateral veins and tertiary venation immersed or slightly raised on the upper surface, raised on the lower surface, lateral veins 3-6, petioles 5-12 mm, flat or shallowly canaliculate on the upper

surface and with a similar indument as the twigs. Inflorescences to 12 cm, paniculate-cymose, glabrous or with a few scattered hairs. Flowers 5-7 mm in diameter, glabrous, yellowish, perfect. Tepals 6, 2-2.5 mm, the inner surface pubescent, especially near the base, the margin frequently papillose, spreading at anthesis; stamens 9, 4-celled, the outer 6 1-1.4 mm, glabrous, the cells arranged in 2 rows, introrse, a sterile tip lacking, filaments free, from 1/3 to about as long as the anthers; inner 3 stamens 1.3 mm, glabrous, the filaments as long as the anthers, the cells in 2 rows, extrorse-lateral, glands present at the base of the filaments, staminodia usually present, 3, glabrous; pistil 2-2.5 mm, glabrous, the style half as long as the ovary, receptacle cup-shaped, glabrous inside. Fruit ellipsoid, 2.5 × 1.8 cm, cupule shallow, bowl-shaped, 1.3 cm in diameter, tepals sometimes persistent, margin simple, pedicel thickened in fruit. *Montane forests; rarely lower on exposed ridges.* CR (Rivera 260, MO); P (Hammel et al. 7013, MO). 2000-3200 m. (Endemic.)

Vegetatively, *Ocotea praetermissa* resembles *O. purpurea*; the latter species differs in its racemose inflorescences, and pubescent flowers. Until recently, many collections now included in *O. praetermissa* had been identified as *O. pittieri*, but that species has almost glabrous leaves, whereas the indument on the lower leaf surface of *O. praetermissa* is discernable to the touch.

69. *Ocotea producta* (C.K. Allen) Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 143 (1986). *Nectandra producta* C.K. Allen, *J. Arnold Arbor.* 26: 397-398 (1945).
Isotype: Costa Rica, *Skutch 3906* (MO).

Tree, 30 m. Twigs ridged, solid, densely, somewhat sericeous, appressed pubescent, the indument completely covering the surface, glabrescent with age; terminal buds densely sericeous pubescent. Leaves 12-17 cm, narrowly elliptic, alternate, chartaceous, pinnately veined, the base inrolled and long decurrent on the petiole, the margin inrolled towards the base, the apex acute, midrib, lateral veins and tertiary venation immersed on the upper surface, slightly raised on the lower surface, upper surface glabrous, lower surface moderately to sparsely appressed pubescent, domatia lacking; lateral veins 6-9; petioles not clearly separated from the lamina due to the decurrent, inrolled leaf bases, but the apparent petioles 4-5 cm long. Inflorescences 10-12

cm, in the axils of leaves, paniculate-cymose. Flowers 3-4 mm in diameter, greenish, perfect. Tepals 1.5 mm, elliptic, sparsely pubescent outside, moderately pubescent inside, half erect to spreading at anthesis, outer 6 stamens 0.8 mm, the anther as long as broad, the short, free filament and the base of the anther dorsally pubescent, the 4 cells arranged in an arc, opening introrse, a sterile tip lacking, inner 3 stamens 1 mm, the cells lateral-extrorse, the filaments united into a tube, staminodia not seen, pistil 1.5 mm, glabrous, receptacle glabrous inside, deeply cup-shaped. Tepals fused at the base and falling of as a unit in old flowers. Cupule and fruit not known. *Premontane forest*. CR (*Skutch 3906*, MO). 700 m. (Endemic.)

Ocotea producta is only known from the type collection. Distinctive are the long apparent petioles with the decurrent, inrolled leaf bases. The fused filaments of the inner 3 stamens are also an unusual character. Although the single known collection of this species can be regarded as an aberrant form of *Ocotea skutchii*, I accept it as a valid species because it possesses two distinctive characters, the long apparent petioles and the fused filaments of the inner 3 stamens.

70. *Ocotea pseudopalmana* Burger, *Fieldiana, Botany, n.s.* 23: 92 (1990).

Holotype: Costa Rica, *Lent 1679* (F).

Tree, to 30 m. Twigs angular, solid, densely brown-tomentellous when young, the surface completely covered, the indument wearing off with age; terminal buds densely brown-tomentellous. Leaves 8-20 × 3-9 cm, (broadly) elliptic or elliptic-oblong, alternate, coriaceous, pinnately veined, the base cuneate or obtuse, sometimes slightly decurrent and inrolled near the base, the apex obtuse or short-acuminate, the upper surface sparsely pubescent when young, more densely so along the midrib, becoming glabrous with age, the lower surface moderately to sparsely pubescent, the hairs erect, usually discernable to the touch, more densely pubescent and tomentellous along the major veins; midrib and lateral veins immersed, tertiary venation slightly raised on the upper surface, midrib and lateral veins prominently raised, tertiary venation raised on the lower surface; domatia sometimes present as axillary tufts of hairs; lateral veins 5-8; petioles 6-15 mm, with a similar indument as the twigs. Inflorescences 6-16 cm, densely brown tomentellous, the surface completely covered, in the axils of normal leaves,

racemose or paniculate-cymose. Flowers 6-8 mm in diameter, green or yellow, perfect. Tepals 3.5-4 mm, broadly elliptic, densely pubescent outside, the surface not visible, the inner surface sparsely pubescent, half-erect at anthesis; stamens 9, 4-celled, the outer 6 1.8 mm, the anther 1 mm, glabrous, the cells arranged in 2 pairs and opening introrse, a sterile tip absent, filaments 0.8 mm, pubescent; inner 3 2 mm, filaments pubescent, free, as long as the anthers, with 2 glands at the base, staminodia absent; pistil 3.5 mm, glabrous, the style as long as the ovary, receptacle deeply cup-shaped, glabrous inside. Fruit ellipsoid, 2.5 × 1.5 cm, cupule shallow, bowl-shaped, 1.3 cm in diameter, with a single margin, tepals deciduous, the pedicel thickened. *Montane forests*. CR (*van der Werff et al. 14041*, MO); P (*Aranda et al. 1224*, MO). 2200-2900 m. (Endemic.)

Diagnostic for *Ocotea pseudopalmana* is the combination of coriaceous leaves with erect indument on the lower surface, the fewflowered inflorescences and the rather large (6-8 mm in diameter) flowers. It can be confused with *O. mollifolia*, but this species has chartaceous leaves with an acuminate tip, smaller flowers (3-6 mm in diameter), occurs at lower altitudes (usually below 1000 m) and has persistent tepals on the cupule. Rarely a specimen of *O. mollifolia* may have a reduced inflorescence, resembling that of *O. pseudopalmana*, but the thinner texture of the leaves, the acuminate apex and the altitudinal distribution allow a correct identification. Another similar species is *O. campanae*, which differs in its multi-flowered, much-branched inflorescences, and its ferruginous indument.

Provisionally placed here are 4 collections which differ from *O. pseudopalmana* in having an appressed indument on the lower leaf surface and smaller leaves (to 10 cm). The 2 flowering collections (*Davidse & Pohl 1510* and *van der Werff et al. 14038*, both at MO) resemble *O. pseudopalmana* in their lax, few-flowered inflorescences and large flowers. However, *Davidse et al. 28550* (MO), cited in Burger & van der Werff (1990) as *O. pseudopalmana*, has appressed hairs on the lower leaf surface and leaf size typical for *O. pseudopalmana*. Because the 4 small-leaved collections also vary in the density of the indument, it seems best to place these collections for the time being under *O. pseudopalmana*, while noting that it is quite likely that they represent an undescribed species. Additional collections are needed to settle this question.

71. *Ocotea puberula* (Rich.) Nees, *Syst. Laurin.* 472 (1836). *Laurus puberula* Richard, *Actes Soc. His. Nat. Paris* 1: 108 (1792). Holotype: French Guyana, *Le Blond s.n.* (P).

Ocotea pyramidata Blake ex Brandegee.

Trees to 40 m. Twigs ridged or somewhat angular, glabrous, sparsely to moderately densely appressed or ascending pubescent, solid; terminal buds densely appressed or ascending pubescent. Leaves 7-25 × 3-10 cm, elliptic or broadly elliptic, chartaceous, alternate, pinnately veined, the base acute to obtuse, the margin flat, the apex obtuse to acuminate; glabrous on both surfaces or the lower surface with some appressed (rarely erect) hairs; midrib, and lateral veins immersed, tertiary venation raised and visible on the upper surface, midrib prominently, lateral veins regularly and tertiary venation weakly raised on the lower surface; domatia lacking; petioles 1-3 cm, glabrous or nearly so. Inflorescences 4-15 cm, paniculate-cymose, sparsely to moderately pubescent, the hairs appressed or ascending, in the axils of leaves. Flowers 4-5 mm in diameter, pale greenish, unisexual. Tepals 2-2.5 mm, broadly ovate, glabrous or with some appressed hairs near the base outside, subglabrous to moderately pubescent on the inside, erect to half-spreading at anthesis. Male flowers: stamens 9, 4-celled, glabrous, the outer 6 c. 2 mm, the filaments half as long as the anthers, free, the cells opening introrse, a sterile tip lacking, inner 3 2.4 mm, the filament 0.7 mm, sometimes with a few hairs, 2 globose glands present at the base of the filaments, staminodia not seen, pistillode c. 1.2 mm, glabrous; female flowers: staminodia 9, 0.8 mm, glabrous, glands present at the base of the inner 3 staminodia, all staminodia much shorter than the pistil; pistil 2 mm, glabrous, style as long as the ovary, stigma capitate, receptacle bowl-shaped, glabrous inside. Fruits subglobose, c. 8 mm in diameter, seated on a platelike cupule, 6-8 mm in diameter, with a single margin, tepals deciduous in fruit, the pedicel somewhat swollen, pedicel and cupule not lenticellate. *Lowland and montane evergreen forest.* Ch (*Breedlove* 52277, MO); CR (*Grayum et al.* 9104 MO); P (*Croat* 12805, MO). 0-1300 m. (Mexico, Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Bolivia, Brasil, Paraguay, Argentina.)

Ocotea puberula can be recognized by the combination of unisexual flowers, a somewhat raised reticulation on the upper leaf surface and rather large, (thinly)

chartaceous leaves. It can be confused with *O. leucoxylon*, but that species has the upper surface of the leaves smooth and has generally lenticellate cupules and/or pedicels. Like *O. leucoxylon*, it has a wide distribution and is somewhat variable in its vegetative characters, especially in its indument.

72. *Ocotea pullifolia* van der Werff. *Novon* 11: 509 (2001). Holotype: Costa Rica, *Herrera 4119* (INB).

Trees, to 25 m. Twigs angular, solid, the very tip sparsely to moderately appressed pubescent, but soon becoming glabrous; terminal buds densely appressed pubescent, the hairs white and often contrasting with the dark leaves and twigs. Leaves 7-15 × 2.5-5 cm, coriaceous, elliptic to obovate-elliptic, alternate or more closely together near the tips of the branches, pinnately veined, the base acute to cuneate, the margin flat or slightly inrolled, the apex obtuse or rounded, glabrous on both surfaces or with a few appressed hairs on the lower surface; midrib, lateral veins and tertiary venation immersed to raised on the upper surface, raised on the lower surface; domatia, as deep pits, usually present, few, in the axils of the basal lateral veins, not along the secondary veins, glabrous, visible as bulges on the upper surface; lateral veins 4-7; petioles 6-11 mm, glabrous, strongly ridged above. Inflorescences 4-7 cm, glabrous or very sparsely appressed pubescent, paniculate-cymose, in the axils of leaves. Flowers 4-5 mm in diameter, green, perfect. Tepals 1.8 mm, glabrous on both surfaces, spreading in old flowers; stamens 9, 4-celled, the outer 6 1.2 mm, glabrous, the filaments free, as long as the anthers, anther cells arranged in 2 pairs, introrse, a sterile tip lacking; inner 3 stamens as long as the outer 6, the anther cells opening extrorse, the filaments broad, as long as the anthers, with a patch of white hairs at the base of the anther on the side facing the pistil; filaments with 2 large glands at the base; staminodia not seen; pistil 1.5 mm, glabrous, the style about as long as the ovary; receptacle cup-shaped, glabrous inside. Fruits ellipsoid, 2.6 × 1.8 cm, cupule cup-shaped, 2 cm in diameter, 1 cm high, with a simple margin, the tepals not persisting. *Lower montane rain forest*. CR (*Aguilar 1211*, MO); P (*McPherson 9608*, MO). 200-1100 m. (Endemic.)

Ocotea pullifolia is closely related to *O. jorge-escobarii*, but differs in having domatia restricted to the axils of the basal lateral veins, in the small number of domatia

and in having the leaf apices obtuse. In *O. jorge-escobarii* the small domatia are found along the lateral veins, and the leaf apices are bluntly acute.

The domatia are more common in collections from Costa Rica than in those from Panama; sometimes only one leaf from a Panamanian specimen might show 1 or 2 domatia and in a few collections domatia are lacking altogether. In that case, the dark-drying leaves, the raised reticulation and the obtuse leaf apices make an identification possible. On Cerro Jefe in Panama *O. pullifolia* occurs together with *O. whitei* s.l. and the two can resemble each other strongly. They can be separated by the much larger cupules of *O. pullifolia*, and the more scalariform reticulation on the upper leaf surface found in *O. whitei* s.l.

73. *Ocotea purpurea* (Mez) van der Werff, *Novon* 9: 579 (1999). *Phoebe purpurea* Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 196 (1889). Isotype: Guatemala, von *Tuerckheim* 371 (K). Illustr.: van der Werff, *Novon* 9: 580 (1999).

Nectandra capituliforma Lundell.

Shrubs or trees to 20 m. Twigs terete, densely brown-tomentellous, the indument wearing off with age, but initially covering the surface completely, solid; terminal buds densely brown-tomentellous. Leaves 7-11 × 2-4 cm, narrowly to broadly elliptic, alternate, firmly chartaceous, pinnately veined, the base acute to obtuse, the margin flat, the apex acute or acuminate, acumen to 1.5 cm; midrib and lateral veins immersed, tertiary venation weakly raised on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; the upper surface sparsely pubescent, the hairs erect or ascending, or glabrous, the major veins often tomentellous, the lower surface sparsely to moderately pubescent, the hairs erect, discernable to the touch on young leaves, the pubescence denser along the major veins, these tomentellous, axillary tufts of hairs frequently present; lateral veins 4-8; petioles 5-14 mm, weakly sulcate to flat above, with a similar indument as the twigs. Inflorescences 5-10 cm, sparsely, moderately or rarely densely pubescent, the hairs erect, the surface usually visible, racemose or occasionally with some cymes along the lower part of the inflorescence, in the axils of leaves or cataphylls. Flowers 4-7 mm in diameter, white, yellowish or cream-colored, perfect. Tepals 2.5-3 mm, elliptic, sparsely pubescent

outside, papillose, glabrous or with a few hairs near the base inside, spreading or half erect at anthesis; outer 6 stamens c. 1.6 mm, the filament free, 1/3 to 1/2 as long as the anthers, the cells introrse, in 2 rows, a sterile tip lacking; inner 3 stamens c. 1.6 mm, the filament 0.6 mm, the cells lateral-extrorse, in 2 rows, glands present at base of the inner stamens, staminodia 3, 0.6 mm, the tip somewhat swollen, pistil 2 mm, glabrous, the style 0.5 mm; receptacle deeply cup-shaped, glabrous inside. Fruit broadly ellipsoid, 1.8×1.4 cm, the cupule at maturity a flaring disc on top of a swollen pedicel, 8 mm in diameter, with a simple margin, tepals sometimes persisting on young cupules, but eventually falling off. *Montane and upper montane forests*. Ch (*Shilom Ton 7399*, MO); G (*Contreras 11318*, MO); H (*Hazlett 582*, MO); P (*Aranda et al. 1261*, MO). 1400-2600 m. (Mexico [Oaxaca], Mesoamerica.)

Ocotea purpurea is readily identified by its usually racemose inflorescences, sparsely pubescent flowers and rather small (to 11 cm), elliptic leaves. Other species in the *O. helicterifolia* group with racemose inflorescences and pubescent flowers are a new species from Guerrero with large (about 20 cm), obovate leaves and *O. corrugata*. Specimens of *O. purpurea* have been frequently misidentified as *Phoebe bourgeauviana*, but that species has glabrous flowers and a paniculate-cymose inflorescence; I regard it as a synonym of *O. helicterifolia*.

Ocotea purpurea is a widespread and variable species. The specimens from Panama differ from the more northern populations in having few (mostly 4) lateral veins. There is also variation in the density of the pubescence on the leaves; the types of both *O. purpurea* and *Nectandra capituliforma* have a denser indument than most other collections, while some collections from Honduras have a rather sparse indument. I prefer to include all in a variable species instead of recognizing additional taxa based on weak, vegetative characters.

74. *Ocotea racemiflora* Lundell, *Wrightia* 4: 107 (1969). Holotype: Guatemala, Contreras 7904 (LL!).

Tree, 13 m. Twigs terete, solid, rather densely and minutely puberulous, the hairs very short, partially appressed, partially erect; terminal buds densely appressed pubescent, the hairs much longer and more lightly colored than those on the twigs.

Leaves 5-12 × 2.5-5 cm, subchartaceous, elliptic to broadly elliptic, alternate, pinnately veined, the base acute, the margin plane, the apex shortly acuminate, acumens to 1 cm, glabrous on both surfaces except for occasional tufts of hairs in the axils of the lateral veins, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; lateral veins 4-6; petioles 5-11 mm, with a similar indument as the twigs, weakly canaliculate above. Inflorescences to 3 cm, racemose, moderately appressed pubescent, in the axils of leaves. Flowers 2.5 mm in diameter, perfect. Tepals 1.5 mm, erect at anthesis, moderately appressed pubescent on both surfaces; stamens 9, 4-celled, c. 1.5 mm, the filaments free, about as long as the anthers, filaments with some hairs at the base, those of the inner 3 stamens with 2 glands at their base, anther cells of the outer 6 stamens opening introrse, those of the inner 3 opening extrorse, a sterile tip lacking, staminodia not seen; pistil glabrous, 2 mm. Fruits roundish, 1 mm in diameter, the cupule plate-like, 6 mm in diameter, with a single margin, the tepals persisting on the cupule; pedicel somewhat swollen in fruit. *Rain forest. G (Contreras 7904, MO)*. Altitudinal distribution not known. (Endemic.)

Ocotea racemiflora is only known from the type collection. The F and MO isotypes are fruiting, and the holotype has a few detached inflorescences in a pocket. Because so few flowers are available, I have taken the floral measurements from Lundell's description. Lundell considered the species to be dioecious. There are very few dioecious *Ocotea* species known from Mesoamerica and only one, *O. atlantica*, appears to be endemic. It is also very uncommon to find flowers and fruits together on one specimen and I assume that the lack of well-developed anther cells is due to the fact that the flowers are old and the flaps of the anther cells have fallen off. Therefore I accept *O. racemiflora* as a species with perfect flowers. The species is morphologically isolated; the flat, thin cupules with persistent tepals and the roundish fruits are not known from other species in Mesoamerica.

75. *Ocotea rhytidotricha* Rohwer, *Bot. Jahrb. Syst.* 112: 391 (1991). Holotype: Nicaragua, *Hall & Bockus 7919 (MO!)*.

Trees, to 20 m. Twigs angular, solid, moderately to densely appressed pubescent, becoming glabrous with age; terminal buds densely appressed pubescent. Leaves 10-20 × 5-14 cm, alternate, chartaceous, elliptic to broadly elliptic, pinnately veined, the base obtuse or rarely acute, the margin plane, the apex obtuse to shortly acuminate, the upper surface glabrous, except for some appressed pubescence on the major veins, lower surface sparsely pubescent with mostly erect hairs, these denser and better visible along the midrib and lateral veins, midrib, lateral veins and tertiary venation immersed on the upper surface or the tertiary venation slightly raised, midrib, lateral veins and tertiary venation slightly to moderately raised on the lower surface; domatia (as axillary tufts of hairs) usually present, but inconspicuous, petioles 1-2.5 cm (rarely to 4 cm), somewhat canaliculate on the upper side, with a similar indument as the twigs. Inflorescences 2-14 cm, sparsely to moderately appressed pubescent, paniculate-cymose, in the axils of leaves. Flowers 7-8 mm in diameter, white, perfect. Tepals 3 mm, broadly ovate, glabrous or with a few hairs outside, the outer 3 with a papillose, basal triangular patch, the inner 3 entirely papillose, spreading at anthesis; outer 6 stamens 1.2 mm, strongly papillose, the filaments very short and anthers appearing sessile, the cells arranged in 2 pairs, opening introrse, filling almost the entire anther, a sterile tip lacking; inner 3 stamens 1.2 mm, densely papillose, columnar, without a distinct filament, the cells in 2 pairs, extrorse or extrorse-lateral; pistil 2 mm, glabrous, the style 0.7 mm, receptacle cup-shaped, with some appressed hairs inside. Fruit ellipsoid, 3 × 1.7 cm, cupule platelike, 1 cm in diameter, with a single margin and the tepals not persisting in fruit. *Montane forest*. ES (Villacorta 704, MO); H (Yunker 6386, MO); N (Neill 2307, MO). 1200-1600 m. (Endemic.)

Ocotea rhytidotricha is best recognized by its paniculate-cymose inflorescences and the erect indument on the lower leaf surface. This pubescence is inconspicuous, not discernable to the touch and is most clearly seen along the major veins. The stamens are also densely papillose. The collection from San Salvador has slightly obovate leaves, while the other collections have (broadly) elliptic leaves. A collection from Mexico (Martinez 1487, MO, from Veracruz) resembles *O. rhytidotricha*, but has the pubescence on the lower leaf surface sparser, has shorter hairs and smaller flowers. It is included in *O. rhytidotricha* with hesitation.

76. *Ocotea rivularis* Standley & L.O. Williams, *Ceiba* 1: 238 (1951). Isotype: Costa Rica, *Allen 5590* (MO!).

Trees, to 15 m. Twigs angular, solid, finely appressed pubescent, soon glabrescent, terminal buds densely appressed pubescent. Leaves (27-)30-50 × 15-25 cm, alternate, chartaceous, obovate, pinnately veined, gradually narrowed towards the base, at the base inrolled or reflexed, the apex rounded or shortly acuminate, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface, at maturity glabrous on both surfaces, domatia lacking; lateral veins 10-15; petioles to 1 cm, often poorly defined due to decurrent leaf bases, glabrous. Inflorescences 15-30 cm, paniculate-cymose, in the axils of leaves, moderately to densely puberulous, the hairs ascending to erect. Flowers greenish, 3.5 mm in diameter, perfect. Tepals 1.3 mm, elliptic, (sparsely) pubescent on both surfaces, the surface readily visible, more or less spreading at anthesis; outer 6 stamens 1 mm, glabrous, the filament free, half as long as the anther, the cells arranged in 2 pairs and opening introrse, a sterile tip lacking; inner 3 stamens 1.2 mm, with a few minute hairs at the junction of anther and filament, otherwise glabrous, the cells arranged in 2 pairs, the upper pair smaller than the lower pair, opening extrorse, glands present at the base of the filaments of the inner stamens, staminodia not seen; pistil glabrous, 1.5-2 mm, the ovary as long as the style, receptacle cup-shaped, glabrous inside. Fruits ellipsoid, 15 × 7 mm, cupule shallowly cup-shaped, 7 mm in diameter, tepals initially persistent on the cupule, but ultimately falling off, cupule with a simple margin. *Lowland rain forests*. CR (*Chavarria 514*, MO). 50-300 m. (Endemic.)

Ocotea rivularis is readily recognized by its large, obovate leaves. It can be confused with *O. endresiana*, due to the frequently reflexed leaf bases, but the latter species has smaller leaves, glabrous inflorescences and flowers and lacks the persistent tepals on the margin of the cupule. *Ocotea rivularis* is only known from the Osa Peninsula and is related to the variable *O. insularis*. A population of the latter species on the Osa Peninsula can be separated by its leaves to 25 cm and domatia in the form of tufts of hairs in the axils of the lateral veins. Included here are several collections matching *O. rivularis* vegetatively, but with 2-celled stamens (for instance, *Herrera 3974*, MO). I am

reluctant to describe these specimens as a new species of *Aiouea* and prefer for the time being their inclusion in *O. rivularis*.

??. *Ocotea rovirosae* Lorea-Hern. & van der Werff. *Brittonia* 54: 150-153, f. 3 (2002). Isotype: Mexico, Veracruz, Santiago Sinaca Colin 1023 (MO!).

Trees, to 35 m, already flowering at 8 m. Twigs terete, ridged, solid, densely puberulous, the hairs very short, erect, covering young twigs almost completely, becoming flabrous with age; terminal buds completely covered by short, erect to ascending hairs. Leaves 14-35 × 5-16 cm, elliptic, alternate, chartaceous, pinnately veined, base and apex acute or the apex shortly acuminate, the margin plane, midrib and lateral veins immersed, tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface, the laminae drying often yellowish green and the venation lighter in color than the laminae; upper surface glabrous except for the somewhat pubescent base of midrib, lower surface with scattered, erect, short hairs along the tertiary veins, not discernable to the touch, the indument denser and more conspicuous along the lateral veins and midrib; domatia present as axillary tufts of hairs; lateral veins 7-10; petioles 1.2-3.4 cm, with a similar indument as the twigs, round and ridged. Inflorescences 7-17 cm, paniculate-cymose, many-flowered, moderately to densely puberulous, the hairs erect or ascending, the surface partially visible. Flowers 2.5-3.3 mm in diameter, green or yellow, perfect. Tepals 1.4-1.7 mm, ovate-oblong, moderately pubescent on the outer surface, glabrous or nearly so on the inner surface, erect or slightly spreading at anthesis; stamens 9, all 4-celled, 1.3-1.5 mm, the filaments sparsely pubescent, about as long as the glabrous anthers, free, the outer 6 with the cells arranged in two pairs, opening introrse, a sterile tip lacking, the inner 3 with the cells opening lateral-extrorse and with 2 globose glands near the base of the filaments, staminodia not seen, pistil glabrous, 1.5 mm, the style a little shorter than the ovary, receptacle cup-shaped, glabrous. Fruits ellipsoid, 3 × 1.7 cm, the cupule flat, plate-like, with a single margin, the tepals not persistent, 1.5 cm in diameter, the pedicel thickened, warty. *Lowland rain forest*. 10-200 m. (Mexico [Oaxaca, Veracruz], to be expected in Chiapas and Tabasco.)

Ocotea rovirosae has only been collected in the Isthmus of Tehuantepec at low altitudes (up to 200 m). It can be readily recognized by the following combination of characters: the short, erect indument on twigs and leaves, the branched, many-flowered inflorescences and the rather large leaves. The yellowish-green color of the dried leaves and light color of the venation, often lighter than the surrounding laminae, indicate a relationship with *O. meziana* and allies. Of these, it approaches the variable *O. laetevirens* in leaf size and shape, but differs from it in the short, erect indument and *O. contrerasii* in indument, from which it differs in its paniculate-cymose, manyflowered (not racemose, few-flowered) inflorescences and its larger leaves (to 14 cm in *O. contrerasii*, more than 14 cm in *O. rovirosae*). Vegetatively, *O. rovirosae* resembles *Nectandra lundellii*, which is also known from the Isthmus of Tehuantepec, in its large leaves, drying yellowish green and with raised reticulation. The flowers of *N. lundellii* differ in having spreading tepals which are densely papillose on the inner surface and papillose stamens; its fruits are seated on much smaller cupules which are not warty and swollen pedicels are lacking.

77. *Ocotea rubriflora* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 279 (1889).

Type: Mexico, Tabasco, *Linden s.n.* (G!).

Nectandra rubriflora (Mez) C.K. Allen; *Ocotea perseifolia* Mez & J.D. Smith.

Trees, to 20 m. Twigs angular, solid, densely and minutely brown pubescent, the surface completely covered, individual hairs scarcely recognizable; terminal buds densely and minutely pubescent, the surface completely covered. Leaves 10-30 × 7-13 cm, ovate-elliptic to elliptic, alternate, chartaceous, pinnately veined, the base rounded to obtuse, the margin flat, the apex acute, the upper surface glabrous except for some appressed hairs on the major veins, the lower surface sparsely to moderately pubescent, the hairs short and appressed, midrib, lateral veins and tertiary venation slightly raised on the upper surface, raised or weakly raised on the lower surface, domatia absent, lateral veins 7-13; petioles 2-4 cm, ridged, with a similar dense indument as the twigs. Inflorescences 5-15 cm, paniculate-cymose, densely and minutely pubescent, the surface covered or nearly so, in the axils of leaves or bracts near the tip of the twigs. Flowers 6-7 mm in diameter, red, rarely white or yellowish, perfect. Tepals 3 mm, ovate, sparsely to

moderately appressed pubescent outside, papillose inside, spreading at anthesis; outer stamens 1.2 mm, densely papillose, the filament free, short, 0.2 mm, anther cells arranged in 2 pairs, opening introrse and filling the entire anther, inner 3 stamens 1.8 mm, densely papillose, the filament as wide as the anther, 0.4 mm, anther cells in 2 pairs, opening extrorse and filling the entire anther, glands present but rather small and inconspicuous, staminodia not seen; pistil 1.5 mm, glabrous, the ovary gradually narrowed into the short style, receptacle deeply cup-shaped, pubescent inside. Fruit ellipsoid, 28 × 10 mm, cupule funnel-shaped, 10 mm in diameter, margin simple, tepals usually not persistent and the pedicel thickened. *Lowland rain forest*. Ch (*Shilom Ton 7452*, MO); T (*Rico 746*, MO); B (*Schipp 1164*, MO); G (*Contreras 10044*, MO); CR (*Hammel 16929*, MO); P (*Sytsma 1323*, MO). 100-350 m. (Mexico, Mesoamerica).

The distinguishing character for *Ocotea rubriflora* is the dense and minute indument on the twigs and inflorescences, which covers the surface completely. This indument is also present on the major veins and to a lesser degree on the lower leaf surface. The flower color of most collections is described as red, a few collections placed here have white or yellowish flowers. Although tepals are absent from the rim of mature cupules, one collection, *Contreras 10288* (MO), has immature cupules with persistent tepals. A few fruiting collections from Panama (*McPerson 12128*, *Mori & Kallunki 4928* and *Nee 11285*, all MO) are included here, but differ in having shallower cupules, smaller leaves and large (35 × 20 mm) fruits. All three show the distinctive indument. Vegetatively, *O. rubriflora* resembles *O. macrantha* from the Osa Peninsula in Costa Rica, but the latter species differs in its larger flowers (10-12 mm vs 6-7 mm in diameter).

78. *Ocotea rubrinervis* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 351. (1889).
 Syntype: Peru, *Spruce 4580* (B!).

Shrub or small tree to 10 m. Twigs terete, sparsely to densely pubescent, the hairs more or less appressed or ascending, solid; terminal buds densely pubescent, the hairs ascending or appressed. Leaves 6-12 × 2.5-6 cm, (broadly) elliptic, chartaceous, alternate, pinnately veined, the base obtuse or acute, the margin flat, the apex obtuse, acute or shortly acuminate, the upper surface glabrous except for some hairs on the

proximal part of the midrib, the lower surface with some minute, erect hairs on the major veins, axillary tufts of hairs present, otherwise glabrous; midrib and lateral veins immersed, tertiary venation slightly raised and forming a small reticulum on the upper surface, gland dots usually readily visible on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; lateral veins 4-6; petioles 4-6 mm, with a similar indument as the twigs. Inflorescences to 6 cm, paniculate-cymose, moderately pubescent, the hairs ascending, axillary. Flowers c. 3 mm in diameter, white or creamy, unisexual. Tepals c. 1.8 mm, broadly elliptic, moderately appressed pubescent outside, rather sparsely appressed pubescent inside, erect to somewhat spreading at anthesis. Male flowers: stamens 9, 4-celled, the cells arranged in 2 pairs, a sterile tip lacking, outer 6 stamens c. 1.5 mm, glabrous or nearly so, the filament free, slightly shorter than the anther; inner 3 stamens with the anther cells opening extrorse, with 2 globose glands near the base, otherwise like the outer 6, staminodia stipitiform, very small, c. 0.2 mm, pistillode stipitiform, 1.4 mm glabrous, receptacle shallow, pubescent inside; female flowers: staminodia 9, c. 0.5 mm, glabrous, glands present at the base of the inner 3 staminodes, pistil 1.5 mm, glabrous, the style as long as the ovary, receptacle shallow, pubescent inside. Fruit ellipsoid, 10 × 8 mm, the pedicel widened into the shallow, platelike cupule, 8 mm in diameter, the margin simple, tepals persisting in the fruiting stage. *Lowland evergreen forest near the coast or along streams. P (Tyson & Loftin 5057, MO). 0-50 m. Distribution outside Panama uncertain due to confusion with *Ocotea bofo*.*

Ocotea rubrinervis is characterized by its unisexual flowers, the readily visible gland dots on the upper leaf surface, and the shallow cupule with persistent tepals. The Panamanian collections all come from Pacific islands (San Jose island, Coiba island) or the Pacific coast. If and how this species differs from *Ocotea bofo* Kunth is not clear and therefore the distribution of *O. rubrinervis* cannot be given at this moment.

79. *Ocotea rufescens* van der Werff, *Novon* 6: 479 (1996). Isotype: Costa Rica, Aguilar & Schmidt 1077 (MO). Illustr.: van der Werff, *Novon* 6: 480, t. 2 (1996).

Trees, to 25 m. Twigs terete or ridged, densely rusty brown tomentellous, the surface completely covered by the indument, solid; terminal buds densely brown

tomentellous. Leaves 9-16 × 3.5-6 cm, elliptic or ovate-elliptic, firmly chartaceous, alternate, pinnately veined, the base acute or obtuse, sometimes inequilateral, the margin plane, the apex acute or slightly acuminate; the upper surface glabrous, shiny, except for some curled hairs along the midrib and lateral veins, the lower surface completely covered by a reddish brown, tomentellous indument, this discernable to the touch; midrib, lateral veins and tertiary venation slightly raised on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation scarcely visible on the lower surface; domatia lacking; lateral veins 4-6; petioles 1-2 cm, densely tomentellous. Inflorescences 5-11 cm, in the axils of cataphylls or leaves, paniculately cymose, densely reddish brown tomentellous. Flowers c. 6 mm in diameter, white, perfect. Tepals 2-2.5 mm, elliptic, half-erect, the outside pubescent near the base, becoming glabrous near the tip, the inside papillose; outer 6 stamens c. 1 mm, glabrous, the filaments 0.1 mm, the anthers rectangular to roundish, with a narrow sterile margin near the tip, the cells arranged in 2 rows, introrse, a sterile tip lacking, inner 3 stamens c. 1 mm, the cells lateral-extrorse, the filaments with 2 glands near the base. staminodia present, very small; pistil glabrous, receptacle deep, glabrous inside. Fruits 2-2.5 cm, ellipsoid, cupule shallowly bowl-shaped, c. 8 mm in diameter, with a single margin and the tepals deciduous; pedicels swollen. *Montane forests*. CR (*Herrera 5279*, MO). 450-1500 m. (Endemic.)

Ocotea rufescens is only known from the Caribbean slopes of Costa Rica near the Panamanian border and is to be expected in adjacent Bocas del Toro. It is best recognized by the dense, reddish-brown pubescence on the lower leaf surface and is the only species in Costa Rica or Panama with such an indument. In general appearance it seems close to *O. pharomachrosorum*, but that species has a dense grey-brown pubescence and has tongue-shaped outer stamens with a sterile tip.

80. *Ocotea salvadorensis* (Lundell) van der Werff, *Novon* 6: 481 (1996).
Nectandra salvadorensis Lundell, *Wrightia* 4: 105-106 (1969). Isotype: El Salvador, Allen 7173 (GH!).

Phoebe salvadorensis (Lundell) Lundell

Trees, to 25 m. Twigs angular, densely and minutely brown-tomentellous, the surface not visible, the indument wearing off with age; solid; terminal buds densely tomentellous. Leaves 7-10 × 2.5-3.5 cm, (narrowly) elliptic, firmly chartaceous, alternate, pinnately veined; base and apex acute, the margin plane; the upper surface glabrous, the lower surface completely covered with a dense, greybrown, tomentellous indument, this discernable to the touch; midrib and lateral veins immersed or slightly impressed. tertiary venation slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation scarcely visible on the lower surface; domatia absent; lateral veins 4-6; petioles 1-1.5 cm, ridged or slightly sulcate, with a similar indument as the twigs. Inflorescences to 7 cm, paniculate-cymose, densely appressed puberulous, in the axils of cataphylls. Flowers c. 6 mm in diameter, whitish, perfect. Tepals 2-2.5 mm, sparsely appressed pubescent outside, moderately papillose with some appressed hairs near the base inside, more or less spreading; outer 6 stamens c. 1.5 mm, the filaments very short, the anther rectangular, without a sterile tip, glabrous, the cells in 2 pairs, introrse; inner 3 stamens c. 1.8 mm, the filaments with 2 glands at the base, the cells lateral extrorse, staminodia c. 1 mm, clubshaped, with a few hairs near the base; pistil c. 2.8 mm, glabrous, receptacle appressed pubescent inside. Fruit and cupule unknown. *Cloud forest*. ES (Allen 7173, GH). 2500 m (Endemic.)

Ocotea salvadorensis is only known from the type collection. Only two species shares the distinctive grey-brown tomentellous indument on the lower leaf surface with *O. salvadorensis* and of those, one, *O. pharomachrosorum*, has tongue-shaped stamens with a sterile tip, as well as larger, wider leaves often with an inequilateral base; the other, *O. iridescens*, has domatia on the lower leaf surface and smaller flowers. Provisionally included in *O. salvadorensis* are two collections from Honduras, *Dario 407* and *Liesner 26530* (both MO). Both collections come from tall (30-35 m) trees in cloud forest and differ from *O. salvadorensis* in their reddish brown indument on leaves and twigs and in the rather dense pubescence on the inner surface of the tepals. Possibly these collection represent an undescribed species, but more collections are needed for a better understanding of the variation in indument characters.

81. *Ocotea salvinii* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 264 (1889). Type: Guatemala, *Salvin s.n.* (K).

Cinnamomum salvinii (Mez) Kostermans, *Phoebe salvinii* (Mez) Lundell.

Trees, to 20 m. Twigs angular, densely ferruginous tomentellous, the surface not visible, the indument becoming sparser with age, solid; terminal buds densely ferruginous tomentellous. Leaves 8-12 × 4-7 cm, elliptic, coriaceous, alternate, pinnately veined, the base obtuse to acute, inrolled, the margin towards the base recurved, the apex acute or obtuse; the upper surface glabrous, often shiny, or, when very young, sparsely tomentellous; the lower surface densely ferruginous tomentellous, completely covered by the indument, this discernable to the touch; midrib, lateral veins and tertiary venation immersed or nearly so on the upper surface, midrib and lateral veins raised, tertiary venation not visible on the lower surface; domatia lacking; lateral veins 8-10; petioles 1.3-2.5 cm, with a similar indument as the twigs, longitudinally ridged. Inflorescences 5-14 cm, paniculate-cymose, densely ferruginous tomentellous, but the flowers and buds less densely pubescent than the inflorescence axes; in the axils of normal leaves or, less commonly, in the axils of cataphylls. Flowers c. 8 mm in diameter, green or yellow, perfect. Tepals c. 3 mm, elliptic, spreading, the outside sparsely to moderately pubescent, the inside with a tomentellous apex, otherwise glabrous or with a few hairs; outer 6 stamens c. 1.5 mm, the filaments free, c. 0.5 mm, glabrous or with a few hairs, anthers glabrous, the cells introrse arranged in 2 pairs, a sterile tip lacking; inner 3 stamens glabrous, c. 1.5 mm, the filaments about as long as the anthers, anther cells extrorse-lateral, 2 glands present at the base of the filaments; staminodia c. 1 mm, stipitiform to club-shaped, glabrous, pistil c. 2 mm, glabrous, the style c. 0.7 mm; receptacle urceolate, glabrous or with a few hairs inside. Fruits to 3 × 2 cm, ellipsoid, cupule shallowly bowl-shaped, becoming platelike, 1.2 cm in diameter, weakly double-margined, the inner margin erect, the outer spreading, the outer margin c. 1 mm, the inner c. 0.5 mm; tepals deciduous. *Cloud forest*. Ch (*Breedlove 46290*, MO); G (*Standley 80191*, F). 2400-3000 m. (Endemic.)

Characteristic for *Ocotea salvinii* is the combination of densely ferruginous tomentellous leaves with an inrolled base and the perfect flowers. It can only be confused with *O. rufescens*, which has perfect flowers and a similar indument, but this species

lacks inrolled leaf bases. *Ocotea salvinii* seems to be an isolated species without close relatives; the large staminodia and the indument of the tepals (tomentellous-papillose near the apex on the inner surface) points to the *O. helicterifolia* group, but double-margined cupules have not been reported from that group.

Ocotea sinuata (Mez) Rohwer, *Bot. Jahrb. Syst.* 112: 373 (1991). *Nectandra sinuata* Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 402 (1889). Type: Guatemala, *Bernoulli & Cario 2581* (B).

Trees to 30 m. Twigs terete or ridged, densely brownish-tomentose, solid; terminal buds densely tomentose. Leaves 9-21 × 5-11 cm, (broadly) obovate or elliptic, chartaceous, alternate, pinnately veined, the base rounded, obtuse or acute, the margin plane, the apex shortly acuminate, acute or obtuse, the upper surface moderately to sparsely pubescent, the hairs erect, the lower surface moderately to densely pubescent, the hairs erect, discernable to the touch, the surface visible between the hairs; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral clearly raised, tertiary venation raised on the lower surface; domatia absent; lateral veins 8-11; petioles 1.5-2.5(-3) cm, with a similar indument as the twigs, canaliculate above. Inflorescences 10-30 cm, densely pubescent, in the axils of leaves or less frequently of cataphylls. Flowers 13-16 mm in diameter, white or pink, perfect. Tepals 5 × 3.5 mm, spreading at anthesis, densely pubescent outside, densely papillose inside, outer 6 stamens 2.5-3 mm, (densely) papillose, sessile, the anther cells arranged in two rows, sterile tip 0.6-0.8 mm, inner 3 stamens 2.5 mm, papillose, with a short (0.3 mm) filament, this with 2 glands at the base, the anther cells lateral in 2 pairs, staminodia not seen; pistil c. 2.5 mm, densely pubescent; receptacle glabrous inside. Fruit 2.5 × 1.5 cm, ellipsoid, pubescent when young, becoming glabrous with age; cupule (shallowly) cup-shaped, 1.5 cm in diameter, with a single margin and the tepals deciduous. *Lowland and montane rainforests*. Ch (*Breedlove 23720*, MO); G (*Standley 64949*, F); ES (*Martinez ISF00129*, MO); CR (*Herrera 467*, MO); P (*Roubik 464*, MO). 200-1500 m. (Mexico [Oaxaca], Mesoamerica.)

Ocotea sinuata is characterized by its large, branched inflorescences, and pubescent twigs, leaves and pistil. Vegetatively it is difficult to separate from *O.*

botrantha; however, the latter has, at least in Mexico, a whitish (not brownish) indument on the twigs, has longer petioles and tends to occur at higher altitudes.

83. *Ocotea standleyi* Allen, *J. Arnold Arbor.* 26: 343 (1945). Holotype: Guatemala, *Standley 70009* (F).

Phoebe macrophylla Standley & Steyermark non Blume.

Trees, to 15 m, rarely taller. Twigs roundish or angular and ridged, glabrous, solid; terminal buds glabrous. Leaves (12-)15-35 cm, broadly elliptic, coriaceous or firmly chartaceous, alternate, pinnately veined; the apex obtuse to somewhat acute, the base rounded, subcordate or obtuse, the margin flat, glabrous on both surfaces, midrib, lateral veins and tertiary venation slightly raised on the upper surface, raised on the lower surface; domatia lacking; lateral veins 8-13; petioles 1.5-2 cm, glabrous, weakly canaliculate or flat above. Inflorescences to 15 cm, paniculate-cymose, sparsely pubescent, the hairs very short and erect, in the axils of leaves or near the tips of the twigs. Flowers c. 4 mm in diameter, perfect. Tepals 1.5 mm, broadly ovate or roundish, the outer surface sparsely pubescent, the inner surface glabrous or with a few hairs near the base, more or less erect at anthesis; stamens 9, all 4-celled, the outer 6 stamens glabrous, 1.3 mm, the anther free, slightly longer than the narrow filament, the cells arranged in 2 pairs, opening introrse, a sterile tip lacking; inner 3 stamens the same size, glabrous, the lower cells extrorse, upper cells lateral and sometimes smaller; globose glands present at the base of the filaments of the inner stamens; staminodia stipitate, 0.4 mm, glabrous; pistil glabrous, 1.5 mm, the ovary twice as long as the style, receptacle cup-shaped, glabrous inside. Fruits broadly ellipsoid, 2.5 × 2 cm, cupule shallowly cup-shaped, 1.5 cm in diameter, often lenticellate, rather gradually narrowed into the pedicel, the margin simple, tepals deciduous. *Montane rainforests*. Ch (*Breedlove & Almeda* 58139, MO); G (*Williams et al.* 40600, F). 800-2500 m, mostly above 1500 m. (Endemic.)

Ocotea standleyi is a distinct species, readily recognized by its large, almost coriaceous leaves with an rounded to subcordate base and glabrous terminal buds and leaves. It is a morphologically isolated species without close relatives. A *Licaria* species occurring in Chiapas, probably *L. alata* Miranda, resembles *O. standleyi* vegetatively and

has been confused with it. When fertile, the *Licaria* can be identified by its flowers with only 3, 2-celled stamens and its deeply cup-shaped cupule with a weakly developed double margin. The *Licaria* species occurs in Chiapas generally below 1000 m.

84. *Ocotea stenoneura* Mez & Pittier, *Bull. Herb. Boissier, ser. 2, 3: 233 (1903).*
Isotype: Costa Rica, *Tonduz 13377 (US!)*.

Trees, to 25 m. Twigs angular and ridged, solid, densely rufous-tomentellous or tomentose, terminal buds densely rufous-tomentellous or tomentose. Leaves 12-22 × 6-11 cm, elliptic, subcoriaceous, alternate, pinnately veined; the apex obtuse to shortly acuminate, the margin recurved towards the base, the base decurrent on the petiole and revolute, sometimes auriculate, the upper surface mostly glabrous, but tomentellous on the base of the midrib, the lower surface densely or moderately pilose, the surface visible between the hairs, the indument discernable to the touch; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface, with the intersecondary veins forming a ladder-like pattern; domatia lacking; lateral veins 8-12; petioles with similar indument as the twigs and poorly differentiated due to the decurrent leaf bases, to 2 cm, flat above. Inflorescences c. 15 cm, densely rufous-tomentellous, paniculate-cymose, in the axils of leaves. Flowers 4-5 mm in diameter, whitish, perfect. Tepals 2-2.5 mm, broadly ovate, densely pubescent on both surfaces, more or less erect at anthesis; stamens 9, 4-celled, the outer 1-1.5 mm, the filament free, pubescent and about half as long as the anther, the cells introrse, a sterile tip lacking, the inner 3 about as long, the filament dorsally densely pubescent, glands present at the base of the inner stamens, staminodia not seen, pistil c. 2 mm, glabrous, the style half as long as the ovary, receptacle cup-shaped, densely pubescent inside. Fruits roundish, 1.2 × 1.4 cm, the cupule flat, platelike, 8-10 mm in diameter, with a single margin; tepals persistent on young cupules but ultimately falling off. *Montane forests. CR (Aguilar & Schmidt 1176, MO); P (Gentry & Mori 14126, MO).* (Mesoamerica, possibly Colombia and Ecuador.)

Ocotea stenoneura can be recognized by its decurrent, revolute leafbases, the erect, rather dense indument on the lower leaf surface and by the prominently raised venation (including tertiary venation) on the lower leaf surface. It is rarely collected and the few specimens assigned to this species, vary somewhat in vegetative characters. One

collection, *Skutch 3014*, has a glaucous lower leaf surface, a character not visible in the other collections; the description of the flowers is based on this collection. Provisionally included are two collections from the San Vito region in Costa Rica; these specimens differ in having cup-shaped cupules, a softer indument on the leaves and longer petioles with the leaf bases decurrent and inrolled, but not recurved-auriculate. A few other collections included with hesitation in *O. stenoneura* have a denser, more ascending or spreading indument on the lower leaf surface (*Morales 4353, Rivera 1983*). Describing these collections as different species would increase the number of poorly known and weakly defined species and it seems better to wait until more collections become available. Collections from Colombia and Ecuador have shorter petioles, inrolled but not recurved leaf bases and cup-shaped cupules. They may well represent a different species.

85. *Ocotea strigosa* van der Werff, *Ann. Missouri Bot. Gard.* 75: 723 (1988).

Holotype: Nicaragua, *Stevens 22181* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 75: 724 (1988).

Shrubs or small trees, to 10 m. Twigs terete, solid, glabrous at maturity, but near the tips with varying amounts of brown, appressed hairs; terminal buds densely appressed pubescent. Leaves 6-9 × 2-3.5 cm, ovate or narrowly ovate, firmly chartaceous, alternate, pinnately veined, the base obtuse or acute, the margin plane, the apex gradually narrowed into a slender tip, when young, strigose on both surfaces, becoming glabrous with age, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation slightly raised on the lower surface, domatia absent or rarely a few erect hairs present in the axils of the lateral veins; lateral veins 3-6 pairs; petioles 6-10 mm, sparsely appressed pubescent or subglabrous, flat above. Inflorescences to 6 cm, paniculate-cymose, sparsely to moderately pressed pubescent, in the axils of leaves or cataphylls. Flowers 3-4 mm in diameter, white, perfect. Tepals 1.5 mm, narrowly elliptic, initially erect, but spreading in old flowers, the outer surface sparsely pubescent, the inner surface glabrous and the tips of the outer tepals papillose; stamens 9, all 4-celled, glabrous, the outer 6 with introrse cells, these arranged on 2 rows, c. 1 mm, the anther as long as the free filament, a sterile tip lacking, inner 3 with the cells extrorse-lateral, c. 1.5 mm, the filament about as long as the anther, glands present at the

base of the filaments of the inner 3 stamens, staminodia present, 0.7 mm, with a small, triangular apex; pistil 1.5 mm, glabrous, the ovary as long as the style, receptacle shallow, sparsely pubescent inside, with a ring of hairs on the upper rim. Fruit 12×7 mm, ellipsoid, the cupule 1 cm in diameter, shallowly cup-shaped, with a single margin, the tepals not persistent. *Cloud forest*. N (*Moreno 20201*, MO). 1000-1600 m. (Endemic.)

Ocotea strigosa is an inconspicuous species, best recognized by its ovate leaves and few-flowered inflorescences. It is very similar to *O. parvula*, a cloud forest species from Chiapas, which differs in having domatia and glabrous tepals. These differences are not very strong and if intermediate specimens should be collected in Guatemala or Honduras, it might be best to consider *O. strigosa* a synonym of *O. parvula*. *Ocotea iridescens* is another close relative of *O. strigosa* and *O. parvula*, but it differs in the dense indument on the lower leaf surface.

86. *Ocotea subalata* Lundell, *Lloydia* 4: 48 (1941). Isotype: Mexico, Chiapas, *Matuda 2957* (F!)

Trees, to 10 m. Twigs strongly angular to winged, densely pubescent, the hairs erect and largely covering the surface, soon becoming glabrous, solid; terminal buds completely covered by whitish, appressed or ascending hairs. Leaves $9-19 \times 3-6.5$ cm, narrowly elliptic to narrowly obovate, pinnately veined, the base obtuse or acute, the margin flat, the apex obtuse or acute; the upper surface glabrous or with a few appressed hairs near the base, the lower surface sparsely appressed pubescent, the indument denser and partially ascending along the major veins; midrib, lateral veins and tertiary venation slightly raised on the upper surface, more prominently so on the lower surface; domatia lacking; lateral veins 9-12; petioles 10-15 mm, with a similar indument as the twigs, strongly canaliculate. Inflorescences to 20 cm, paniculate-cymose, moderately to sparsely pubescent, the hairs erect, in the axils of leaves. Flowers 3 mm in diameter, perfect. Tepals 1.5 mm, broadly ovate, moderately to densely pubescent on the both surfaces, erect at anthesis; stamens 9, 4-celled, c. 1.5 mm, a sterile tip lacking, the filaments free, pubescent and about as long as the anthers, inner 3 stamens with 2 large glands near the base and the base of the anther densely pubescent; staminodia not seen; pistil 1.8 mm, the ovary 1.3 mm, glabrous, the style sparsely pubescent; receptacle shallow, glabrous inside.

Fruits 2×1 cm, ellipsoid; cupule flat, 1.1 cm in diameter, the margin simple, tepals not persistent, the pedicel swollen in fruit. *Montane forest*. Ch (*Matuda 5376*, MO). 2100-2500 m. (Endemic.)

Ocotea subalata is only known from 2 collections, both made in Chiapas. Useful characters for identification of this species are the long inflorescences, and the sharply angled or winged and densely pubescent young twigs. Its relationships are not well known. The cupule shape and thickened fruiting pedicels suggest the *O. tenera* group, but the indument on twigs and inflorescences do not.

87. *Ocotea tenera* Mez & J.D. Smith, *Bull. Herb. Boissier*, ser. 2, 3: 234 (1903).
Syntype: Costa Rica, *Pittier 13396* (US!).

Ocotea effusoides Lundell; *O. eucymosa* Lundell.

Shrubs or small trees, to 12 m. Twigs terete, solid, glabrous; terminal buds glabrous. Leaves $5-18 \times 2-7$ cm, papyraceous, alternate, elliptic or ovate-elliptic, drying dark, pinnately veined, the base acute, the apex acute or acuminate, the acumen to 1.5 cm, the margin plane, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface, gland dots visible as small pinpricks on the upper surface, small pit domatia present in the axils of the basal lateral veins or along those veins; lateral veins 4-7, arching upwards near the margin and sometimes loopconnected; petioles 6-12 mm, flat or canaliculate, glabrous. Inflorescences 4-12 cm, paniculate-cymose, slender, laxly flowered, glabrous, in the axils of leaves. Flowers 2.5-3 mm in diameter, pale yellow, perfect (but see discussion). Tepals 1.3-1.5 mm, glabrous on both surfaces, erect at anthesis, outer 6 stamens c. 1.3 mm, glabrous, the anther about as long as the free filament, the cells arranged in 2 superposed pairs, opening introrse, a sterile tip lacking, inner 3 stamens c. 1.5 mm, glabrous, glands present at the base of the filaments, anther 0.6 mm, the cells extrorse and arranged in 2 pairs, cells occupying the entire anther in all stamens; staminodia 0.4 mm, linear, glabrous, pistil 1.5 mm, glabrous, the style 0.6 mm, receptacle bowl-shaped, glabrous inside. Fruits 3×1.5 cm, ellipsoid or narrowly ellipsoid; cupule 1 cm in diameter, disc-shaped, with a single margin and the tepals deciduous; the pedicel gradually thickened

towards the cupule. *Lowland and montane rainforests*. G (Lundell & Contreras 19174, MO); CR (Grayum & Sleeper 3875, MO). 100-1600 m. (Endemic.)

Ocotea tenera is easily recognized by its small size, its thin, darkdrying leaves with gland dots on the upper surface, glabrous terminal buds and small, glabrous flowers with erect tepals. It is related to a few other species with glabrous, darkdrying leaves, pitdomatia and glabrous flowers with erect tepals from Mexico and Guatemala. Of these, *O. vanderwerffii* has tripliveined leaves, *O. bernouilliana* has large (20 cm) inflorescences and deeply cup-shaped cupules and *O. euvenosa* has large (to 27 × 15 cm) leaves. Also related is an undescribed species from Costa Rica and Panama, which differs in having coriaceous leaves with an obtuse apex, large domatia, larger, cup-shaped cupules and a pubescent terminal bud.

The flowers of *O. tenera* have here been described as perfect. Detailed field studies have shown that some trees of this species never set fruit and that others consistently do so. Careful observations on liquid preserved flowers have indicated that three floral types can be distinguished, one associated with trees that never set fruit, one with trees that rarely set fruit and one with trees that frequently set fruit. The authors of this study (Gibson & Diggle, 1997) conclude that *O. tenera* is gynodioecious. While I accept their conclusion, I still describe this species as having perfect flowers because the differences between the floral types are so small that a casual observer would almost certainly judge the flowers to be perfect.

The type of *O. eucymosa* has lighter colored leaves than typical *O. tenera*, but other collections of *O. eucymosa* from the same area have leaves as dark as typical *O. tenera*. Because no other differences could be found between *O. tenera*, *O. effusoides* and *O. eucymosa*, I place the latter two species in the synonymy of *O. tenera*.

88. *Ocotea tonduzii* Standley, *Field Mus. Publ. Bot.* 18: 456 (1937). Syntype: Costa Rica, *Tonduz 2142* (BR!)

Ocotea cuneata Mez non (Grisebach) Gomez.

Trees, to 15 m. Twigs (sharply) angular, glabrous, solid, terminal buds glabrous or finally appressed pubescent in the distal half. Leaves 11-22 × 4.5-11 cm, alternate, stiffly chartaceous or coriaceous, (broadly) obovate, rarely elliptic, pinnately veined, the

base cuneate, with the margin inrolled, the apex obtuse; midrib, lateral veins and tertiary venation slightly raised or immersed on the upper surface, slightly to moderately raised on the lower surface, upper surface glabrous, lower surface glabrous or with a few appressed hairs, tufts of brownish, erect hairs frequently present along the midrib on the lower surface and these not confined to the axils of the main lateral veins; lateral veins 7-9; petioles very short, 1-2 mm long and the leaves appearing sessile. Inflorescences mostly in the axils of leaves, 7-19 cm, paniculate-cymose, mostly glabrous, but towards the flowers with increasing amounts of reddish indument. Flowers 5 mm in diameter, bronze-colored, perfect, densely pubescent outside, the indument covering the surface completely. Tepals c. 2.5 mm, appressed pubescent on the inner surface, half erect at anthesis; stamens 9, 4-celled, the outer 6 c. 1mm, glabrous, the anther as long as the free filament, the cells opening introrse, a sterile tip lacking, inner 3 stamens c. 1.5 mm, glabrous, the upper 2 cells lateral, the lower 2 extrorse, glands present at the base of the filaments, staminodia 3, c. 0.7 mm, stipitate; pistil 2.5 mm, glabrous, the ovary gradually narrowed into the style, receptacle cup-shaped to deeply cup-shaped, glabrous inside. Fruits (probably immature) ellipsoid, 9 × 6 mm; cupule shallowly cup-shaped, with entire, simple margin. *Montane forests. CR (Morales 1716, MO). 1500-2400 m.* (Endemic.)

Ocotea tonduzii is easily recognized by the dense, reddish indument on the flowers, the large, glabrous (or partially appressed pubescent) terminal buds, the raised tertiary venation on the lower leaf surface and the glabrous, nearly sessile leaves with an inrolled base. *Ocotea endresiana* has a similar appearance, but lacks the reddish indument of the flowers.

89. *Ocotea tonii* (Lundell) van der Werff, *Novon* 9: 579 (1999). *Nectandra tonii* Lundell. Isotype: Mexico, Chiapas, *Ton 2014* (NY!). Illustr.: van der Werff, *Novon* 9: 580 (1999).

Trees, to 15 m. Twigs terete, densely yellowish-brown tomentose, the indument turning darker on older growth, covering the young twigs completely, solid; terminal buds densely tomentose. Leaves 13-25 × 3-6 cm, firmly chartaceous, clustered, narrowly elliptic to narrowly elliptic-obovate, pinnately veined, gradually narrowed towards the

base, rounded at the base, the margin plane, the apex acute, gradually narrowed into a slender tip; midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface, the upper surface moderately pubescent, the hairs erect and discernable to the touch, the lower surface moderately to densely pubescent, the hairs erect and soft to the touch, domatia absent; lateral veins 10-15; petioles to 6 mm, densely pubescent. Inflorescences 6-15 cm, densely tomentose, paniculate-cymose, mostly in the axils of cataphylls. Flowers 8-10 mm in diameter, white, perfect, the outside of the receptacle densely, of the tepals sparsely pubescent. Tepals 3.5 mm, elliptic, spreading at anthesis, the inner surface pubescent near the base, papillose distally; stamens 9, 4-celled, the outer 6 1.8 mm, slightly papillose, filaments lacking, sterile tip c. 0.3 mm, inner 3 stamens c. 1.5 mm, sessile or nearly so, the cells lateral, glands present at the base of the inner stamens, staminodia not seen, pistil glabrous, 2 mm, the style 0.6 mm, receptacle cup-shaped, glabrous inside. Fruits 3 × 1.8 cm, ellipsoid, the cupule initially cup-shaped, at maturity shallowly bowl-shaped, 1.3 cm in diameter, with a single margin and the tepals deciduous, the pedicel thickened. *Montane forests*. Ch (*Shilom Ton 5264*, MO). 1000-1500 m. (Endemic.)

Ocotea tonii is easily recognized by its clustered leaves with short petioles, yellow-brown indument, paniculate-cymose inflorescences and pubescent flowers. Most of these characters also occur in *O. congregata* but that species differs in its longer petioles (10 mm or more vs. less than 6 mm), the impressed midrib and lateral veins on the upper leaf surface, the relatively broader leaves (2-2.5 times as long as broad vs. 3-4 times as long as broad in *O. tonii*) and the darker indument of the twigs.

90. *Ocotea truncata* Lundell, *Phytologia* 12: 244 (1965). Isotype: Guatemala, *Contreras 4731* (US!).

Shrubs or small trees, to 13 m, but usually smaller. Twigs terete, solid, sparsely to rather densely appressed pubescent; terminal buds densely appressed pubescent, the hairs white. Leaves 6-12 × 1.8-4 cm, thinly chartaceous to papyraceous, elliptic to broadly elliptic, alternate, drying dark green, pinnately veined; the base acute or cuneate, the margin plane, the apex shortly acuminate to acute, acumen to 1 cm; glabrous on both surfaces or the lower surface with a few appressed hairs; midrib, lateral veins and tertiary

venation immersed or slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface, midrib and lateral veins often lighter in color than the leaf tissue; small gland dots commonly present on the lower surface; domatia present as axillary tufts of hairs, often in a small depression, visible to the unaided eye; lateral veins 4-6; petioles 4-9 mm, with a similar indument as the twigs, flat above. Inflorescences to 7 cm, paniculate-cymose, few-flowered, sparsely appressed pubescent to almost glabrous, in the axils of leaves or bracts. Flowers c. 2.5 mm in diameter, white, perfect. Tepals 1.5 mm, glabrous or nearly so on both surfaces, erect at anthesis; stamens 9, 4-celled, the outer 6 1 mm, glabrous or with a few hairs on the free filaments, the anther slightly longer than the filament, the cells arranged in 2 pairs, introrse, a sterile tip lacking; inner 3 stamens 1.3 mm, with a patch of hairs dorsally at the base of the anther, the filaments with 2 large glands at the base and about as long as the anther; pistil 1.8 mm, glabrous, the ovary gradually narrowed into the style; receptacle shallow, glabrous inside. Fruits 30×12 mm, narrowly ellipsoid, cupule shallowly bowl-shaped, to 7 mm in diameter, but cup-shaped in immature fruits; cupule with a single margin; tepals not persistent in fruit; pedicel not or scarcely thickened in fruit. *Montane rain forest*. Ch (*Breedlove 56243*, CAS); G (*Williams et al. 42057*, F). 700-1200 m. (Endemic.)

Ocotea truncata can be recognized by its thin, dark green drying leaves with rather conspicuous domatia, its few-flowered inflorescences with glabrous flowers and its slender fruits. The presence of many small gland dots on the lower leaf surface and the light-colored veins in the dark green leaves are also useful characters. The type specimen has narrower leaves than the other collections. This species is possibly related to *Ocotea tenera*, but the cupule is smaller and the pedicel is not or scarcely enlarged in fruit. The truncate apex of the young fruits is less pronounced in more mature fruits and does not help the identification very much.

91. *Ocotea uxpanapana* Wendt & van der Werff, *Ann. Missouri Bot. Gard.* 74: 413 (1987). Isotype: Mexico, Veracruz, *Wendt et al. 2869* (MO!). Illustr.: Wendt & van der Werff, *Ann. Missouri Bot. Gard.* 74: 414 (1987).

Trees, to 30. Twigs angular, finely appressed pubescent, soon glabrescent, solid; terminal buds slender, densely appressed pubescent. Leaves 10-25 × 2.5-8 cm, narrowly elliptic to elliptic-obovate, chartaceous, alternate, pinnately veined, the base acute to cuneate, the margin flat or slightly recurved, the apex acute or acuminate, the upper surface glabrous, lower surface sparsely appressed pubescent or glabrous, midrib, lateral veins and tertiary venation weakly raised on the upper surface, more prominently so on the lower surface, domatia present as axillary tufts of hairs surrounding a shallow depression, lateral veins 7-14, petioles 1-2.3 cm, with a similar indument as the twigs, shallowly canaliculate above. Inflorescences 5-20 cm, rather densely puberulous, the hairs ascending, mostly in the axils of cataphylls near the tips of the twigs, infrequently in the axils of leaves, paniculate-cymose. Flowers 4-6 mm in diameter, pale yellowish or greenish, perfect. Tepals 2-2.5 mm, broadly ovate, the outer surface densely pubescent with short, grey hairs, inner surface less densely so; more or less spreading at anthesis; stamens 9, 4-celled, the outer 6 1.2 mm, the pubescent, free filament half as long as the anther, cells arranged in 2 pairs, opening introrsely, sterile tip lacking; inner 3 1.5 mm, the pubescent filament as long as the anther, glands present at the base of the filaments, staminodia not seen; pistil 2 mm, glabrous, the style as long as the ovary, receptacle cup-shaped, glabrous inside. Fruits 2.2 × 1.9 cm, ellipsoid, the cupule shallowly bowl-shaped, 1 cm in diameter, with 6 strongly developed lobes, the margin simple, tepals not persistent. Surface of the fruits finely wrinkled, except for the smooth tip. *Lowland rain forest*. 100-300 m. (Mexico [Veracruz], to be expected in Chiapas.)

Ocotea uxpanapana is currently only known from the Uxpanapa region in Veracruz, where it is a rather common riparian tree. It resembles *O. eucuneata* and *O. nigrita*, but differs from these in its rather large, mostly elliptic leaves and the slightly larger flowers. The strongly lobed cupules are a unique feature of this species, but fruits and cupules of *O. eucuneata* and *O. nigrita* are not yet known.

92. *Ocotea valeriana* (Standley) Burger, *Fieldiana Botany n.s.* 23: 96 (1990).
Phoebe valeriana Standley, *Publ. Field Mus. Nat. Hist., Bot. Ser.* 18: 460 (1937).
 Holotype: Costa Rica, *Tonduz 11746* (F).

Nectandra austinii Allen; *Phoebe smithii* Allen.

Tree, to 15 m (rarely 20 m). Twigs terete or somewhat angular, densely tomentellous, the surface almost completely covered, the indument grey- or yellowish brown, solid; terminal buds densely tomentellous. Leaves 8-25 × 4-14 cm, alternate, (stiffly) chartaceous, elliptic, oblong or obovate, pinnately veined, the base acute, obtuse or rounded, the margin plane, the apex acuminate or rounded, the acumen to 1 cm, the upper surface sparsely pubescent with mostly erect hairs, soon becoming glabrous, the hairs denser along midrib and lateral veins, lower surface moderately to sparsely pubescent with erect hairs, these denser along the major veins and discernable to the touch; midrib, lateral veins and tertiary venation immersed or nearly so on the upper surface, midrib rather prominently raised, lateral veins and tertiary venation raised on the lower surface, domatia lacking, lateral veins 8-12; petioles 4-15 mm, flat above, with a similar indument as the twigs. Inflorescences 8-30 cm, paniculate-cymose, sparsely to moderately pubescent, the hairs erect, in the axils of leaves or cataphylls. Flowers 6-9 mm in diameter, glabrous, white or yellowish, fragrant at night, perfect. Tepals 3-4 mm, the inner surface glabrous, with a few hairs near the base or papillose, spreading at anthesis, stamens 9, 4-celled, the outer 6 1.5-2 mm, the cells arranged in 2 pairs, introrse, the anthers sessile or with a free filament 1/3 the length of the stamen, a sterile tip lacking, inner 3 stamens 1.7 mm, the cells lateral-extrorse, in 2 rows, glands present at the base of the filaments, staminodia 3, present, glabrous, to 0.7 mm, pistil 2-2.5 mm, glabrous, the style c. 1 mm, receptacle rather deeply cup-shaped, glabrous inside. Fruits 3 × 1.8 cm, ellipsoid, cupule cup-shaped, 2 cm in diameter, 1.5 cm high, with a single margin, tepals persistent on young fruits, but deciduous at maturity. *Montane forests*. CR (Haber & Atwood 9155, MO); P (McPherson 9259, MO). 800-2200 m. (Endemic.)

Ocotea valeriana is similar to *O. helicterifolia* from which it differs in the indument of the twigs, consisting of shorter, matted hairs with longer, erect ones in *O. valeriana* and only long, erect hairs in *O. helicterifolia*; the shorter matted hairs in *O. valeriana* tend to completely cover the surface of the young twigs, while this surface is at least partly visible in *O. helicterifolia*. Other differences are the deeper cupules and presence at greater altitudes of *O. valeriana*. Two other species with pubescent, obovate leaves occur in Costa Rica, but these, *O. lentii* and *O. valeroides*, have the inner surface of the receptacles densely pubescent and have larger leaves. *Ocotea valeriana*, as

accepted here, is a variable species. Specimens with short petioles, obovate leaves and short inflorescences have been described as *Phoebe smithii*. However, these characters vary independently and I consider *Phoebe smithii* as an extreme of a continuum, which should not be given taxonomic recognition.

93. *Ocotea valerioides* Burger, *Fieldiana Botany n.s.* 23: 97 (1990). Isotype: Costa Rica, *Hartshorn 1530* (MO!). Illustr.: van der Werff, *Novon* 9: 580 (1999).

Trees, to 20 m, but frequently less than 10 m. Twigs ridged, densely tomentellous, the hairs yellowish- to grey-brown, completely covering the young branches, solid; terminal buds densely tomentellous. Leaves 13-40 × 10-22 cm, alternate, firmly chartaceous, obovate to oblong-obovate, pinnately veined, gradually narrowed towards the base and the base obtuse or rounded, the margin plane, the apex rounded or shortly acuminate, the upper surface with some erect hairs when young, the lamina becoming glabrous, but the major veins remaining brown-tomentellous, the lower surface moderately to sparsely pubescent, the hairs erect and discernable to the touch, the major veins tomentellous-tomentose; midrib and lateral veins immersed or slightly raised, tertiary venation immersed on the upper surface, midrib prominently raised, lateral veins and tertiary venation raised on the lower surface; domatia absent; lateral veins 8-12; petioles 5-12 mm, sulcate above, with a similar indument as the twigs. Inflorescences 10-30 cm, paniculate-cymose, densely tomentellous, the surface entirely or largely covered, in the axils of cataphylls, rarely in axils of leaves. Flowers 8-9 mm in diameter, white, perfect, sparsely pubescent on the outside. Tepals 3-4 mm, elliptic, spreading at anthesis, the inner surface with some hairs near the base, distally papillose, stamens 9, 4-celled, the outer 6 1 mm, sessile or nearly so, glabrous, the cells arranged in 2 rows, introrse, a sterile tip lacking, inner 3 1.2 mm, filament very short, pubescent, the upper 2 cells extrorse, the lower 2 cells lateral, glands present at the base of the filaments, staminodia not seen, pistil 2 mm, glabrous, the style slender, as long as the ovary, receptacle shallowly cup-shaped, appressed pubescent inside. Fruit ellipsoid, 3 × 2 cm, cupule shallowly bowl-shaped, 1.7 cm wide, with a single margin, the tepals not persistent, the pedicel thickened in fruit. *Lowland rain forest*. CR (*Grayum 3519*, MO); P (*Kirkbride & Duke 486*, MO). 50-500 m. (Endemic.)

Ocotea valerioides can be readily recognized by its large, obovate leaves and the dense, tomentellous indument on the twigs and inflorescences. It can be confused with *O. lentii*, which differs in its pilose, not tomentellous indument, with the surface of twigs and inflorescences visible; the hairs of *O. lentii* are also stiffer and coarser. Most, but not all collections of *O. lentii* come from higher altitude (above 700 m). *Ocotea helicterifolia*, which can also have rather large, obovate leaves, lacks the tomentellous indument on twigs and inflorescences and has glabrous flowers and the inside of the receptacle is also glabrous. Likewise, *O. valerioana* has a glabrous receptacle and glabrous flowers, although its twigs are densely pubescent, much like *O. valerioides*.

94. *Ocotea vanderwerffii* (Kostermans) van der Werff, *Novon* 11: 511 (2001). *Phoebe glabra* van der Werff, *Ann. Missouri Bot. Gard.* 74: 406, f. 3 (1987). Holotype: Mexico, Oaxaca, *Wendt et al. 4813* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 74: 407, fig. 3 (1987).

Cinnamomum vanderwerffii Kostermans.

Trees to 20 m. Twigs finely ridged, glabrous, solid; terminal buds glabrous. Leaves 8-16 × 2.5-6 cm, chartaceous, alternate, elliptic, tripliveined, the base acute to obtuse, the apex acute to acuminate, acumen to 1 cm, the margin plane, glabrous on both surfaces, drying dark green, midrib, lateral veins and tertiary venation immersed or tertiary venation raised on the upper surface, midrib, lateral veins and tertiary venation slightly raised on the lower surface, gland dots not conspicuous on the upper surface, lateral veins 3-5 pairs, the basal pair stronger developed than the others and leaves tripliveined, pit domatia present in the axils of the lowermost pair of lateral veins, these usually visible as protuberances on the upper leaf surface, petioles 8-15 mm, canaliculate, glabrous. Inflorescences 5-10 cm, paniculate-cymose, glabrous, in the axils of leaves. Flowers 3 mm in diameter, greenish, perfect. Tepals 1.5 mm, glabrous on both surfaces or with a few hairs on the inner surface, erect at anthesis, outer 6 stamens 1.2 mm, the filament free, somewhat shorter than the anther, with a few hairs near the base, the cells introrse and arranged in 2 rows, a sterile tip lacking, the inner 3 stamens c. 1 mm, the filament pubescent on the side facing the pistil, anther 0.6 mm, the cells lateral extrorse and in 2 pairs, glands present at the base of the inner stamens, staminodia 0.5 mm,

pubescent; pistil 2 mm, glabrous, the style distinct, 0.5 mm, receptacle cup-shaped, glabrous inside. Fruits 2.5×1.5 cm, ellipsoid, cupule platelike or shallowly bowl-shaped, with a single margin, frequently but not always with the tepals persisting as small teeth, the pedicel gradually thickened towards the cupule. *Lowland and montane rain forest*. Ch (*Breedlove 50853*, MO). 150-1200 m. (Mexico [Veracruz, Oaxaca], Mesoamerica.)

Ocotea vanderwerffii is best recognized by its dark-drying, tripliveined leaves with large pitdomatia in the axils of the basal lateral veins and the glabrous flowers with erect tepals. It resembles *O. tenera* from Costa Rica, but the latter species has pinnately veined leaves and small pitdomatia which are not visible on the upper leaf surface. For differences with *O. bernoulliana* see the discussion under the latter species.

95. *Ocotea veraguensis* (Meissner) Mez, *Jahrb. Koenigl. Bot. Gart. Berlin* 5: 240 (1889). *Sassafridium veraguense* Meissner, *Prodr.* 15: 171 (1864). Syntypes: Costa Rica, *Bridges s.n.* (K), *Oersted*, *Laur.* 10 (B), *Warszewicz 1* (G).

Ocotea bakeri Blake, *O. escuintlensis* Lundell, *O. paradoxa* Mez.

Small to medium-sized trees, rarely to 30 m. Twigs terete or angular, finely appressed pubescent, soon glabrescent, solid; terminal buds densely pubescent. Leaves $6-14 \times 2-5$ cm, elliptic, firmly chartaceous, alternate, pinnately veined, the base and apex acute to obtuse, the margin plane, glabrous on both surfaces or the lower surface with some appressed hairs; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation immersed or nearly so on the lower surface; domatia lacking; lateral veins 5-8; petioles 5-12 mm, shallowly sulcate above, glabrous or sparsely appressed pubescent. Inflorescences 5-16 cm, paniculate-cymose, in the axils of cataphylls, occasionally in the axils of normal leaves, sparsely to moderately pubescent. Flowers 7-10 mm in diameter, white, perfect. Tepals 3-4 mm, elliptic, spreading at anthesis, sparsely to moderately appressed pubescent outside, papillose inside except for the pubescent base; stamens 1.7-2.1 mm, papillose, tongue-shaped, sessile or nearly so, with a sterile apical tip, this c. 0.5 mm, sometimes stamens of whorl 2 with 2 glands at the base, inner 3 stamens with 2 glands at the base; staminodia, when visible, c. 0.5 mm, stipitiform, pubescent; pistil c. 1.5 mm, glabrous; receptacle urceolate, glabrous inside. Fruits c. 1.8×0.9 cm, ellipsoid, cupule shallowly

cup-shaped, with a double margin, the inner margin erect, the outer margin spreading, c. 1 mm, tepals deciduous. *Lowland rain or seasonally dry forest, occasionally in montane forest.* Ch (Ventura 4311, MO); QR (Cabrera 4410, MO); B (Brewer 438, MO); G (Johnston 1550, F); H (Saunders 154, MO); ES (Sermeno AS014, MO); N (Stevens 6476, MO); CR (Godfrey 67078, MO); P (Schmalzel 1333, MO). 10-2000 m. (Mexico, Mesoamerica, Colombia, Ecuador.)

Ocotea veraguensis is a widespread and fairly frequently collected species. It is rather variable in vegetative characters and especially specimens from higher altitude show a denser indument than most lowland collections. Also its flowers vary more than usual; for instance, glands can be present at the base of stamens of the 2nd whorl, sometimes anthers have only 3 cells instead of 4 and one collection (Lundell 19447, MO) has flowers with the parts in whorls of 4 instead of 3. Nevertheless, the combination of flowers with tongue-shaped, papillose stamens with a sterile tip, solid stems, (nearly) glabrous leaves and cupules with a double margin is distinctive. Its closest relative is *O. dendrodaphne*, which differs in having larger leaves, hollow twigs, a pubescent inside of the receptacle and cupules which appear single-margined and which do not have a spreading outer margin. Both species typically have greyish twigs which contrast with the dark petioles, an unusual character among *Ocotea* species. Provisionally placed in *O. veraguensis* are 2 Matuda collections (4368, 5157, F) from Siltepec, Chiapas, which differ in their short, compact inflorescences and Thomsen 1269 (MO) from the Osa Peninsula in Costa Rica, which differs in its lax, fewflowered inflorescences, flowers with reflexed tepals and its thin, acuminate leaves.

96. *Ocotea verapazensis* Standley & Steyermark, *Field Mus. Publ. Bot.* 23: 114 (1944). Holotype: Guatemala, *Standley 71421* (F!).

Trees, to 10 m. Twigs ridged to angular, glabrous, solid; terminal buds glabrous. Leaves 12-20 × 4.5-8 cm, elliptic or elliptic-obovate, pinnately veined, the base acute to rounded, the margin plane, the apex obtuse to acute, firmly chartaceous, alternate, glabrous on both surfaces, midrib, lateral veins and tertiary venation weakly raised on the upper surface, raised on the lower surface, pitdomatia sometimes present in the axils of the lateral veins, lateral veins 6-9, petioles 1.2-1.8 cm, flat above, the leaf base often

decurent as narrow wings along the petiole. Inflorescences 5-14 cm, glabrous, paniculate-cymose, in the axils of leaves. Flowers c. 3 mm in diameter, green, perfect. Tepals 1.6 mm, ovate, glabrous, erect at anthesis; stamens 9, all 4-celled, a sterile tip lacking, the outer 6 1.7 mm, glabrous, the anther as long as the free filament; the inner 3 the same length, but the filament pubescent in the distal part and the base of the filament with 2 globose glands; staminodia c. 1 mm, stipitiform, pubescent; pistil c. 2 mm, glabrous, the style much shorter than the ovary; receptacle rather shallow, glabrous inside. Fruits 2.5×1.7 cm, ellipsoid, seated in a shallow cupule, 1.5 cm in diameter, this gradually narrowed into the pedicel; margin simple; tepals deciduous. *Montane rain forest*. G (Standley 71421, F). 1500-2000 m. (Endemic.)

Ocotea verapazensis is a poorly known species, best recognized by its glabrous terminal buds, twigs and leaves, and its slightly winged petioles. In older leaves the main veins are lighter in color than the lamina; this, the shallow cupules and flowers with erect tepals indicate a relationship with *O. meiziana* and allies. Vegetatively this species resembles *O. subalata* Lundell, but the latter species has densely pubescent terminal buds and pubescent inflorescences and flowers. However, *Steyermark 37752* (F) stands in between these two species; its twigs, inflorescences and flowers are sparsely pubescent. Pit domatia are only present on older leaves; *Standley 71163* (F) has only young leaves without any trace of domatia.

97. *Ocotea verticillata* Rohwer, *Bot. Jahrb. Syst.* 112(3): 369 (1991). Holotype: Mexico, Veracruz, *Ibarra 2328* (MO!). Illustr.: Rohwer, *Bot. Jahrb. Syst.* 112(3): 371, t.1 (1991).

Trees, to 15 m. Twigs roundish, densely yellowish or brownish pubescent, the indument completely covering the surface, solid; terminal buds densely pubescent. Leaves 14-26 \times 5-15 cm, obovate, pinnately veined, gradually narrowed towards the base and at the base abruptly rounded, firmly chartaceous, whorled, the base rounded, the margin plane, the apex shortly acuminate; upper surface glabrous except for the pubescent midrib and margin, lower surface moderately densely pubescent, the hairs erect, discernable to the touch and denser along the midrib and main veins, midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins

prominently raised on the lower surface, tertiary venation less so; domatia lacking; lateral veins 7-12; petioles 3-8 mm, with a similar indument as the twigs, sulcate above. Inflorescences 5-10 cm, densely pubescent, racemose or with a few 3-flowered cymes near the base. Flowers 7-10 mm in diameter, white, perfect. Tepals 3-4 mm, elliptic, spreading at anthesis, the outer 3 pubescent on the outer surface, the inner 3 with a large, triangular pubescent patch near the base, otherwise glabrous; all tepals with a triangular pubescent patch near the base, otherwise glabrous on the inner surface; stamens 2-3 mm, the outer 6 dorsally near the base pubescent, otherwise sparsely papillose, tongue-shaped, sessile, the anther cells arranged in 2 pairs, the sterile tip c. 0.5 mm; inner 3 stamens with a short filament, the anther cells lateral, glands present at the base of the filaments, staminodia not seen. Pistil 2.5-3 mm, glabrous, receptacle glabrous inside. Fruits ellipsoid, 3x1.5 cm, cupule shallowly cup-shaped, c. 1.5 cm in diameter, with a single margin; tepals deciduous. *Lowland and montane rain forests*. 100-1000 m. (Mexico [Veracruz, Oaxaca], to be expected in Chiapas).

Ocotea verticillata is easily recognized by its whorled leaves, gradually narrowed towards the base and at the base abruptly rounded, and its tongue-shaped stamens with a sterile tip. Together with *O. botrantha* and *O. sinuata* it forms a distinct group and its relationships with other *Ocotea* species are not clear.

98. *Ocotea viridiflora* Lundell, *Wrightia* 5: 36 (1974). Isotype: Panama, *Proctor 31916* (MO!)

Shrubs to trees 18 m. Twigs ridged or terete, glabrous, solid; terminal buds glabrous. Leaves 5-12 × 1.5-3 cm, narrowly elliptic, chartaceous, alternate, pinnately veined, the base acute, margin plane, the apex finely acute to acuminate, acumen to 1 cm, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper surface, raised on the lower surface; pitdomatia present in the axils of several lateral veins, small, infrequently also present along the lateral veins; lateral veins 4-7; petioles 5-12 mm, glabrous, canaliculate or shallowly canaliculate. Inflorescences 3-5 cm, glabrous, paniculate-cymose or rarely racemose, in the axils of distal leaves or bracts. Flowers 5 mm in diameter, pale green, perfect. Tepals 2 mm, broadly elliptic, glabrous on both surfaces, half erect to spreading at anthesis; stamens all 4-celled, the

cells arranged in 2 pairs, a sterile tip lacking, outer 6 stamens 1, 5 mm, glabrous or with a few hairs on the filament, the anthers slightly longer than the free filaments, the cells opening introrse; inner 3 stamens 1.5 mm, the anthers pubescent on the introrse side, anthers about as long as the filaments, the filaments with 2 large glands at the base, the cells lateral; staminodia stipitate, 0.5 mm, sparsely pubescent; pistil 2 mm, glabrous, the style as long as the ovary; receptacle shallow, glabrous inside. Fruits 2.5×1.2 cm, ellipsoid, the cupule shallowly bowl-shaped, 1 cm in diameter, with a single margin, the tepals usually persisting as short lobes on the cupule, the pedicel thickened in fruit.

Montane forests. CR (*Haber 6383*, MO); P (*Mori & Kallunki 5787*, MO). 1300-1800 m. (Endemic.)

Ocotea viridiflora is similar to *O. meiziana*, but differs from it in its glabrous terminal buds, sharply acute leaves and its shorter inflorescences with slightly larger flowers. It shares with *O. meiziana* its elliptic leaves with raised tertiary venation on the lower surface, the greenish gray color of the dried leaves, and the small pit domatia in the axils of the lateral veins. The collections from Costa Rica do not have persistent tepals on the cupules.

99. *Ocotea whitei* Woodson, *Ann. Missouri Bot. Gard.* 24: 188 (1937). Holotype: Panama, *Seibert 307* (MO!)

Nectandra whitei (Woodson) C.K. Allen, *Ocotea eusericea* Lundell, *O. skutchii* C.K. Allen.

Trees, to 30 m. Twigs ridged or angular, solid, (sparsely) appressed pubescent, soon becoming glabrous, terminal buds densely appressed pubescent. Leaves $5-15 \times 2-5$ cm, alternate, (narrowly) elliptic to obovate, alternate, firmly chartaceous to coriaceous, pinnately veined, the base inrolled and frequently but not always decurrent on the petiole, the apex acute, less frequently obtuse, the upper surface glabrous, the lower surface (sparsely) appressed pubescent, the surface always visible, midrib, lateral veins and tertiary venation immersed or slightly raised on the upper surface, somewhat more raised on the lower surface, domatia present or absent, lateral veins 6-12, petioles 5-20 mm, often poorly defined due to the decurrent leaf blades, with a similar indument as the twigs. Inflorescences 6-20 cm, paniculate-cymose, in the axils of normal leaves,

moderately to sparsely appressed pubescent. Flowers 3-4 mm in diameter, white or green, perfect. Tepals 2 mm, ovate, sparsely to densely pubescent outside, sparsely to moderately pubescent inside, half erect at anthesis, outer 6 stamens 1.2 mm, the filament free, 0.4 mm, dorsally with some hairs, the cells arranged in 2 rows, opening introrse, a sterile tip lacking, the inner 3 stamens 1.4 mm, the filaments half as long as the anthers, dorsally pubescent, the cells in rows, opening extrorse, glands present at the base of the filaments of the inner 3 stamens, staminodia not seen, pistil 1.5 mm, glabrous, the receptacle glabrous inside, cup-shaped. Tepals usually falling as a unit in old flowers. Fruits 4 × 2 cm, ellipsoid, cupule initially cup-shaped, at maturity platelike, 1.3 cm in diameter, with a simple margin, the tepals usually deciduous, rarely persisting on the margin of the cupule. *Lowland and montane forests*. N (*Nee 28059*, MO); CR (*Rivera 1303*, MO); P (*Quiroz 447*, MO). 100-2500 m. (Mesoamerica, Venezuela.)

As here accepted, *Ocotea whitei* is a variable species, best recognized by the dorsally pubescent filaments of the inner 3 stamens and the rather narrow (up to 5 cm wide), frequently oblanceolate or obovate-elliptic leaves with the base decurrent on the petiole and sometimes inrolled as well. *Ocotea skutchii* has been recognized by other authors as a distinct species, based on the presence or absence of domatia or the orientation of the indument on the lower leaf surface, but I find that these characters vary greatly. For instance, some collections from Barro Colorado Island have domatia, while others don't; the same applies to collections from Chiriqui in Panama. *Ocotea insularis* is closely related to *O. whitei*, but differs in having wider leaves which have frequently an obtuse apex. Also included here (albeit with some hesitation) are the specimens placed in Burger & van der Werff (1990) under *Ocotea aff. bijuga* (Rottb.) Bernardi. These specimens, all from the La Selva Biological Station in Costa Rica, resemble *O. whitei* very closely vegetatively and in flower structure. They differ from typical *O. whitei* in having a roundish fruit seated on a small, plate-like cupule. The inflorescences of the specimens from La Selva show the flattened lateral brachlets and the stamens of whorl III have a patch of hairs near the top of the filaments and the base of the anthers; both characters are typical for the *O. insularis* group to which *O. whitei* belongs. I cannot explain the unusual fruits and cupules, but do not want to describe a new species based on fruits and cupule shape only. Bernardi, who saw the type of *O. bijuga*, regarded *O.*

neesiana (Miq.) Kostermans as a synonym of it, thus making it a species occurring in Venezuelan Guayana, the Guyanas, adjacent Brazil and Amazonian Colombia. Following Bernardi's concept, I consider *O. bijuga* a species with unisexual flowers, definitely different from the La Selva specimens.

Imperfectly known species.

100. *Ocotea* sp. A.

Tree, 8 m. Twigs angular, solid, densely and minutely appressed pubescent, the surface completely covered on young twigs. Leaves 10-15 × 4-5 cm, alternate, elliptic, chartaceous, pinnately veined, the base obtuse to acute, the margin flat, the apex acute to acuminate, the acumen to 1.5 cm, upper leaf surface initially sparsely appressed pubescent, soon becoming glabrous except for some persistent hairs on midrib and lateral veins; lower surface with some appressed hairs, these denser along the major veins, midrib and lateral veins immersed, tertiary venation immersed or slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; domatia lacking; lateral veins 4-5; petioles 13-20 mm, flat above, with a similar indument as the twigs. Inflorescences 5-12 cm, moderately densely appressed pubescent, paniculate-cymose, in the axils of leaves or bracts. Flowers 6 mm in diameter, white, perfect. Tepals 2.3 mm, glabrous or with a few appressed hairs outside, sparsely papillose and with a few hairs near the base inside, stamens 1 mm, papillose, with short filaments, those of the outer 6 partially fused with the tepals, glands present at the base of the inner stamens, staminodia present, about as long as the glands; pistil glabrous, 2 mm, the style about as long as the ovary, receptacle cup-shaped, glabrous inside. Fruit and cupule unknown.

The only known collection, *Carvajal 328* from Costa Rica (MO), probably represents an undescribed species. I agree with Rohwer (1991) that it is better to wait with a description until more collections are available. It resembles *Ocotea brenesii*, but differs from that species in its paniculate inflorescence (racemose in *O. brenesii*) and in the glabrous inner surface of the receptacle.

14. *Persea* Miller

By. H. van der Werff.

Trees and shrubs. Leaves alternate, evenly distributed along the twigs or clustered, pinnately veined, axillary tufts of hairs or domatia lacking. Inflorescences in the axils of leaves or cataphylls, paniculate-cymose, lateral flowers of a cyme always strictly opposite. Flowers bisexual; tepals 6, equal or unequal; if unequal, outer 3 tepals smaller than the inner 3; tepals deciduous in fruit or persistent; if persistent, usually remaining entire, rarely with the tips of the inner tepals breaking off; stamens 9 or 6; if 6, stamens of whorl III staminodial; anthers usually 4-celled, rarely 2-celled; inner 3 stamens with 2 glands at the base; staminodia of whorl IV present, with a sagittate or triangular apex. Fruit with or without persistent tepals at the base, but never with a cupule. 80-90 species in the Neotropics, 1 species on the Canary Islands.

Persea is a variable genus and includes in Mesoamerica three quite distinct species groups. These are the subgenus *Persea*, characterized by flowers with equal tepals which are deciduous in fruit, subgenus *Eriodaphne*, characterized by flowers with unequal tepals which are persistent in fruit, and a group characterized by flowers with equal, persistent tepals. Related species outside Mesoamerica possess yet other combinations of characters. A survey of the entire group, including Asian species placed in *Machilus*, *Alseodaphne*, *Dehaasia* and *Phoebe* is necessary for a re-evaluation of the generic boundaries in the group. In Mesoamerica, *Persea* species can be recognized in many instances by the unequal tepals, by the tepals persisting in fruit without the formation of a cupule, by the lack of domatia, by the well-developed staminodia of whorl IV or by the stamens with filaments longer than the anthers (in case of species with equal tepals). Many species have relatively long petioles. Species with deciduous tepals can be confused with *Beilschmiedia* when in fruit. *Persea americana*, the type species of the genus, is widely cultivated for its edible fruits; its long history of cultivation has resulted in much variation of fruit and vegetative characters which is reflected in a very complicated synonymy.

1. Tepals equal or nearly so.

2. Pistil pubescent; pedicels 5-15 mm.

3. Pedicels 5-8 mm; bracts surrounding terminal buds uniformly pubescent; pistil sparsely to densely pubescent.

3. P.

americana

3. Pedicels 8-15 mm; bracts surrounding the terminal buds with a scarious margin; pistil densely pubescent.

17. P. schiedeana

2. Pistil glabrous; pedicels to 5 mm.

4. Lower leaf surfaces glaucous; tepals to 2 mm.

5. Leaves 15-30 cm; petioles 15-40 mm.

2. P. albiramea

5. Leaves to 15 cm , petioles to 16 mm.

6. Bark of twigs whitish; midrib impressed and reticulation raised on the upper leaf surface; terminal buds sparsely to moderately appressed pubescent.

12. P. perglauca

6. Bark of twigs dark brown; midrib and reticulation immersed on the upper leaf surface; terminal buds densely white pubescent.

9. P. laevifolia

4. Lower leaf surfaces not glaucous; tepals 3 mm or longer.

7. Leaves evenly distributed; tips of branches not swollen, without multiple branches.

1. P. albida

7. Leaves whorled, clustered near the tips of the branches; branches with thickened nodes from which multiple branches emerge.

8. Inflorescences and flowers densely white pubescent, the surface of the flowers completely covered.

15. P. rigens

8. Inflorescences and flowers sparsely pubescent or if densely pubescent, the indument brown.

9. Petioles to 8 mm; tertiary venation raised on the upper leaf surface, forming a coarse reticulum; flowers sparsely pubescent to subglabrous.

5. P. brevipetiolata

9. Petioles 8-25 mm; tertiary venation immersed or raised on the upper leaf surface; if raised, forming a fine reticulum; flowers moderately to sparsely pubescent.

10. Leaves 3-6 cm wide, the base slightly decurrent on the petiole; flowers moderately pubescent, the hairs ascending to erect.

16. P. rufescens

10. Leaves 7-12 cm wide, the base not decurrent on the petiole; flowers sparsely or moderately pubescent; the hairs appressed.

19. P. silvatica

1. Tepals unequal, the outer 3 clearly shorter (not more than 2/3 the length of) the inner tepals.

11. Flowers with 9 2-celled stamens.

7. *P. cuneata*

11. Flowers with 6 or 9 4-celled stamens.

12. Flowers with 6 4-celled stamens.

14. *P. pseudofasciculata*

12. Flowers with 9 4-celled stamens.

13). Outer tepals glabrous or nearly so on the outer surface; inner tepals moderately to densely pubescent on the outer surface, the difference in indument between inner and outer surface readily visible.

13. *P. povedae*

13. Indument, if any, on inner and outer tepals similar.

14. Leaves sessile, the base cordate or rounded.

18. *Persea sessilis*

14. Leaves petiolate, the base never cordate.

15. Twigs densely tomentose, the surface completely covered; lower leaf surface moderately to densely tomentose, the indument discernable to the touch.

8. *Persea donnell-smithii*

15. Twigs glabrous or variously pubescent, but not densely tomentose; lower leaf surface usually glabrous or appressed pubescent; if hairs ascending, then straight, not curly or crisped.

16. Lower leaf surface covered by a short, dense, felt-like indument, this sometimes difficult to discern; individual hairs not or scarcely visible.

22. *Persea vesticula*

16. Lower leaf surface glabrous or with appressed or ascending hairs; if pubescent, indument not felt-like and individual hairs visible.

17. Leaves, twigs and terminal buds glabrous; leaves longer than 10 cm.

20. *P. standleyi*

17. Plants vegetatively with some indument (occasionally specimens of *P. vesticula* may be glabrous, but this species has leaves generally less than 10 cm).

18. Leaves and twigs initially pubescent, the hairs erect or ascending, but soon becoming glabrous; leaves coriaceous, rarely exceeding 10 cm.

11. *P. obtusifolia*

18. Indument of twigs and leaves when present, strictly appressed; leaves coriaceous or chartaceous, usually exceeding 10 cm (check *P. brenesii*).

19. Leaves elliptic, to 10×3.5 cm, petioles 1-1.5 cm; indument on twigs and lower leaf surface dense, consisting of coarse, appressed hairs. **4. P. brenesii**

19. Leaves elliptic to broadly elliptic or ovate, generally longer and/or broader than 10×3.5 cm; indument variable; if dense, then hairs fine.

20. Inner tepals 3-4 longer than the outer tepals; flowers with a distinct, slender pedicel; distal part of the inner tepals breaking off in fruit, thus fruit seemingly subtended by 6 equal tepals. **6. P. caerulea**

20 Inner tepals twice as long as the outer ones; fruit sessile or nearly so, without slender pedicel; distal part of inner tepals not breaking off in fruit, thus fruit subtended by 6 unequal tepals.

21. Inflorescences clustered at the base of seasonal growth or near the tip of the twigs, in the axils of bracts or leaves, about as long as the leaves. **21. P. veraguasensis**

21. Inflorescences more or less evenly distributed along the seasonal growth, mostly in the axils of leaves, rarely more than half as long as the subtending leaves.

10. P. liebmannii

1. Persea albida Kostermans, *Reinwardtia* 7: 51 (1969). Isotype: Costa Rica, Valle de Coto, Pittier 11111 (, G!).

Persea guatemalensis Lundell, *P. pallida* Mez & Pittier non (Nees) Oliver.

Trees, to 25 m. Twigs angular, sparsely to moderately appressed pubescent, glabrescent, branches not clustered, without conspicuous clusters of bract scars, although some scattered scars present; terminal buds densely white, appressed pubescent; terminal buds not surrounded by bracts. Leaves $9-22 \times 3.5-9$ cm, elliptic, chartaceous, alternate, more or less evenly distributed along the branches, the base and apex acute, the upper surface glabrous, the lower surface often glaucous, very sparsely appressed pubescent, the hairs denser along the major veins; midrib immersed, lateral veins and tertiary veins slightly raised and tertiary venation forming a fine reticulum on the upper surface, midrib and lateral veins (slightly) raised, tertiary venation immersed or slightly raised on the lower surface; lateral veins 6-9 pairs; petioles 2-4.5 cm, ridged and slightly canaliculate, with a similar indument as the twigs. Inflorescences 6-15 cm, the unbranched peduncle about $2/3$ of the length of the inflorescence; the peduncle sparsely appressed pubescent,

the upper, branched part of the inflorescence moderately to densely appressed pubescent or slightly tomentellous; mostly in the axils of upper leaves, rarely in the axils of bracts. Flowers 4 mm in diameter, greenish yellow, the tepals erect at anthesis, pedicels 1-2 mm. Tepals 4-4.5 mm, thick, ovate, equal or the inner 3 slightly longer, densely pubescent on both surfaces; stamens 9, all 4-celled, the outer 6 2.3 mm, the anther slightly longer than the filament, the cells arranged in 2 overlapping pairs, introrse, the filaments and the base of the anther abaxially pubescent, adaxially glabrous, the filaments rather broad and gradually widened into the anther; inner 3 as long as the outer 6, the anther glabrous, the lower pairs of cells extrorse, the upper pair lateral, the filament as wide as the anther and not differentiated from it, pubescent abaxially, with two globose glands near the base; staminodia 0.8-1 mm, broadly triangular, abaxially pubescent; pistil 3 mm, glabrous, the style longer than the ovary; receptacle shallow, glabrous inside. Fruits roundish, 1.5-2 cm in diameter, glabrous, the tepals persistent and indurate at the base of the fruits. *Montane forests*. G (*Contreras 10943*, MO); H (*House 1057*, MO); CR (*Burger 12182*, MO). 1200-2100 m. (Endemic.)

Persea albida is an uncommon cloud forest species and is best recognized by its densely pubescent flowers with equal, persistent tepals and evenly distributed, often glaucous leaves. It can be confused with *P. rigens* and *P. silvatica*, but these two species have the leaves distinctly clustered. Included here with hesitation is a fruiting collection from Chiapas (*Breedlove 31306*, CAS), which differs in its indument on the lower leaf surface (erect, curly hairs, these clearly denser along the major veins instead of straight, appressed hairs). Such indument occurs in *P. cinerascens* Blake, known from Veracruz only, but the specimens I have seen of *P. cinerascens* have a much denser indument on the leaves and twigs. Flowering material from Chiapas is needed for a more accurate identification.

2. *Persea albiramea* van der Werff. *Novon* 12: 578-580, f. 1 (2002). Holotype: Costa Rica, *Marin* 128 (MO!)

Trees, to 30 m. Twigs thick, ridged or angular, with pale grey bark, glabrous or with a few appressed hairs near the apex, prouped towards the tip of leafless shoots, clusters of bract scars lacking; terminal buds densely pubescent, the hairs brownish,

ascending, completely covering the surface, not protected by bracts. Leaves 15-30 × 5-10 cm, elliptic, chartaceous, grouped along the distal parts of seasonal shoots, the base and apex acute, the margin thickened, glabrous on both surfaces, or minutely puberulous along the major veins on the lower surface, the lower surface glaucous, midrib immersed or slightly raised, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface; lateral veins 10-16; petioles 1.5-4 cm, ridged, glabrous, dark brown and contrasting in color with the light-colored twigs. Inflorescences 7-15 cm, sparsely puberulous, in the axils of bracts immediately below the tip of seasonal flushes. Flowers 2.5-3 mm in diameter, white, pedicels slightly longer than the flowers. Tepals c. 2 mm, the outer 3 slightly shorter than ($2/3$ to $4/5$ the length of) the inner 3, erect at anthesis, sparsely puberulous or glabrous on the outer surface, puberulous on the inner surface; stamens 9, 4-celled, c. 1.5 mm, the filaments pubescent, about as long as the anthers, slightly narrower than the anthers; outer 6 anthers with the cells introrse, inner 3 with the cells extrorse, filaments of the inner 3 stamens with 2 globose glands at the base; staminodia 0.8 mm, broadly triangular, with a cordate base, abaxially pubescent, adaxially pubescent near the base only; pistil 1.5 mm, glabrous, the style distinct and about as long as the ovary; receptacle cup-shaped, densely pubescent inside. Fruits 1.4 × 1.9 cm, wider than long, tepals persisting at the base of the fruits, reflexed, not enlarged or thickened; pedicel thickened towards the fruit, at the base 4 mm in diameter, near the tip 8 mm in diameter. *Lowland rain forest*. CR (Herrera 4980, MO); P (Croat 27170, MO). 200-600 m. (Endemic.)

Persea albiramea is a very distinctive species and is easily recognized by the combination of large, glaucous leaves grouped near the tips of the branches, the thick, pale twigs and the long petioles. As *P. laevifolia*, it does not fit well in any of the proposed infrageneric taxa of *Persea* due to its small flowers with subequal tepals and the persistent, but not enlarged tepals in fruit. It strongly resembles Asiatic species placed in *Alseodaphne* or *Dehaasia* and is likely closely related to these species. An unusual feature, shared with *P. laevifolia*, is the impressed tertiary venation on the upper leaf surface. Most *Persea* species have the tertiary venation raised and forming a fine reticulum.

The Panamanian specimen included here differs from the Costa Rican specimens in its glabrous flower buds; vegetatively, it is a good match with the Costa Rican specimens.

3. *Persea americana* Miller, *Gard. Dict. ed.* 8, (1768). Lectotype (designated by van der Werff, 2002): Sloane, *Voy. Jamaica* 2: t. 222, f. 2 (1725) (BM-SL). N.v.: Aguacate, Avocado, Palta.

Laurus persea L., *Persea americana* var. *angustifolia* Miranda, *P. americana* var. *drymifolia* (Schlecht. & Cham.) Blake, *P. americana* var. *nubigena* (L.O. Williams) Kopp, *P. drymifolia* Schlecht. & Cham., *P. edulis* Raf., *P. floccosa* Mez, *P. gigantea* L.O. Williams, *P. gratissima* Gaertn., *P. gratissima* var. *drymifolia* (Schlecht. & Cham.) Mez, *P. gratissima* var. *macrophylla* Meissner, *P. gratissima* var. *oblonga* Meissner, *P. gratissima* var. *praecox* Nees, *P. gratissima* var. *vulgaris* Meissner, *P. leiogyna* Blake, *P. nubigena* L.O. Williams, *P. paucitriplinervia* Lundell, *P. steyermarkii* Allen.

Trees, to 40 m. Twigs angular, initially moderately pubescent, the hairs mostly erect, soon becoming glabrous, branches not clustered, scars of bracts frequently present at the base of seasonal flushes; terminal buds densely pubescent, rarely glabrous; bracts surrounding terminal buds densely pubescent. Leaves 6-25 × 3-11 cm, narrowly to broadly elliptic, chartaceous, alternate or somewhat clustered near the tips of the branches, the base acute to obtuse, apex acute, glabrous above, lower surface sparsely to rather densely pubescent, rarely glabrous, the hairs erect, glaucous or not; midrib and lateral veins immersed, or midrib impressed, tertiary venation slightly raised, forming a dense reticulum, on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised on the lower surface; lateral veins 5-9; petioles 1-6 cm, terete or flattened above; glabrous or puberulous. Inflorescences 5-15 cm, sparsely to moderately puberulous, usually in the axils of bracts at the base of seasonal growth, sometimes leafless when flowering or with very immature leaves. Flowers c. 1 cm in diameter when tepals spreading, greenish-yellow, pedicels to 8 mm long. Tepals 4-6 mm, narrowly elliptic, equal, densely pubescent on both surfaces, stamens 9, all 4-celled, outer 6 3.5 mm, the anther 1.5 mm, glabrous, upper pair of anther cells introrse, lower pair lateral, filaments rather densely pubescent; inner 3 stamens 4 mm, the glabrous anther 1.5 mm,

the lower pair of anther cells extrorse, the upper pair lateral, glands present at the base of the inner stamens, these 5 mm; staminodia present, 1.5 mm, the filament and abaxial side of the triangular apex pubescent; pistil 4 mm, sparsely to densely pubescent, the ovary 1.5 mm; receptacle shallow, pubescent inside. Fruit 5-15 cm, pearshaped to round, glabrous, the skin smooth or warty, green or black; tepals sometimes persisting at the base of young fruits, but eventually falling off individually. *Evergreen forest*. Ch (Breedlove 55612, MO); Y (Gaumer 402, MO); C (Lundell 1292, MO); QR (Tellez 1629, MO); B (Balick 2458, MO); G (Lundell 1292, MO); H (Garcia 37, MO); ES (Sandoval 887, MO); N (Stevens 22514, MO); CR (Haber 9841, MO); P (Busey 564, MO). 0-3000 m. (Mesoamerica. **add general distribution**)

Widely cultivated in tropical and subtropical countries for its edible fruits. *Persea americana* is morphologically a variable species and is closely related to *P. schiedeana*. It can be separated from this species by its shorter pedicels (to 8 mm), the uniformly pubescent bracts protecting the terminal buds and its narrower leaves. It is widely cultivated for its edible fruit. Smith (1966) reported that *Persea americana* cotyledons were found in cave deposits approximately 10,000 years old and the species has thus been cultivated for a long period. Much of the variation in fruit shape and size as well as variation in indument and leaf shape can be attributed to the process of cultivation. A classification based on these characters (for instance, the one proposed by L.O. Williams in 1977) will only lead to the recognition of cultivars; I prefer to accept *Persea americana* in a wide sense and ignore the cultivated races of this species. It seems likely that *P. americana* originated in the highlands of Mesoamerica. However, I would not know how to recognize the "wild" *P. americana* and include all specimens matching the description given above in *P. americana*, regardless if they come from obviously cultivated or seemingly native trees.

4. *Persea brenesii* Standley, *Publ. Field Mus. Nat. Hist., Bot. Ser.* 18: 458 (1937). Holotype: Costa Rica, *Brenes 4451* (F!).

Mutisiopersea brenesii (Standley) Kostermans.

Small trees, to 8 m. Twigs angular, solid, moderately to densely appressed pubescent, a few bract scars present at the base of seasonal growth, branching not

clustered; terminal buds densely appressed pubescent, not protected by bracts. Leaves 5-10 × 1-3.5 cm, elliptic or narrowly elliptic, coriaceous, alternate and evenly distributed along the twigs; the base and apex acute, the margin plane to slightly revolute near the base; the upper surface glabrous except for the midrib with appressed pubescence near the base, lower surface moderately to densely appressed pubescent, the hairs coarse; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface; lateral veins 5-7; petioles 1-1.5 cm, appressed pubescent, flat above. Inflorescences 7-11 cm, moderately to densely pubescent throughout, in the axils of leaves. Flowers 5 mm in diameter, pedicels 2 mm, much shorter than the flowers. Tepals unequal, outer 3 2 mm, inner 3 4-5 mm, densely pubescent on the outside, inner surface of the outer tepals glabrous, of the inner tepals pubescent; tepals erect to somewhat spreading at anthesis; stamens 9, all 4-celled, stamens c. 3 mm, the pubescent filament as long as or shorter than the glabrous anther; outer stamens with introrse cells, inner stamens with extrorse cells and 2 glands at the base of the filaments; staminodia c. 1.5 mm, pubescent; pistil c. 4 mm, glabrous, the ovary c. 1.5 mm; receptacle shallow, pubescent inside. Fruits roundish, c. 1 cm in diameter, subtended by the persistent tepals, these remaining entire, clasping or spreading; pedicel slightly thickened. *Montane forests. CR (Primack et al. 254, F). 900-1200 m. (Endemic.)*

Persea brenesii is a poorly known species. The type has a striking indument on the leaves and twigs, which it not present on the other collections included here. Without the striking, coarse hairs, *P. brenesii* differs from *P. obtusifolia* only in its appressed indument and from *P. veraguasensis* in its shorter leaves and petioles. The description of the flowers is taken from *Primack et al. 254*, which has a sparser indument than the fruiting type. Three recent collections from Rincon de la Vieja are a good match for the *Primack* collection and are tentatively included in *P. brenesii* because of their leaf size and length of petioles. Without more collections which match the type, *P. brenesii* will continue to be an unsatisfactorily delimited species.

5. *Persea brevipetiolata* van der Werff. *Novon*. Holotype: Mexico, Veracruz, *Wendt et al. 4794 (MO!)*.

Small trees, to 8 m. Twigs smooth, terete, solid, glabrous, thickened at nodes, from which multiple branches may emerge, a few bracts or bract scars present at the base of seasonal growth; terminal buds small, glabrous, protected by a few bracts. Leaves 10-16 × 2.5-5 cm, elliptic, clustered at nodes, coriaceous; the base acute or somewhat decurrent on the petiole, apex gradually acute, glabrous on both surfaces, midrib, lateral veins and tertiary venation weakly raised on the upper surface, raised on the lower surface; lateral veins 7-10 pairs; petioles 5-8 mm, glabrous, flat above, with the same color as the twigs. Inflorescences 10-15 cm, glabrous or nearly so, often with a few bracts or bract scars at the very base, in the axils of leaves or bracts at the nodes. Flowers 4 mm in diameter, greenish yellow, pedicels 5 mm. Tepals equal or subequal, with the outer tepals slightly shorter, 2.5 mm, broadly elliptic, erect or weakly spreading at anthesis, the outer surface glabrous or very sparsely and minutely pubescent, the inner surface glabrous or nearly so, stamens 9, 4-celled, c. 2 mm, the anthers as long as the filaments, anthers glabrous, filaments pubescent, filaments half as wide as the anthers; outer 6 stamens with introrse cells, inner 3 with extrose-lateral cells, filaments of the inner stamens with 2 globose glands near the base; staminodia present, 1.3 mm, broadly triangular, abaxially pubescent; pistil 2 mm, glabrous, the ovary 1.2 mm, distinct from the narrow style; receptacle shallowly cup-shaped, glabrous inside. Fruits globose, c. 2 cm in diameter, tepals persistent in fruit, but not enlarged, spreading, the pedicel a little thickened and warty. *Lowland forests*. 200-300 m. (Mexico [Veracruz], but to be expected in Chiapas or Tabasco.

Persea brevipetiolata is only known from 2 collections from lowland forests on the Isthmus of Tehuantepec. It is closely related to *P. rufescens*, which occurs in montane forests between 1500 and 2500 m and it differs from this species in its glabrous (or nearly so) flowers and inflorescences, in the raised reticulation on the lower leaf surface and in its shorter (to 8 mm versus 15-25 mm in *P. rufescens*) petioles. *Persea brevipetiolata* is also close to the Costa Rican-Panamanian *P. rigens* and *P. silvatica*. The former can be recognized by its dense, white indument on flowers and inflorescences, the latter differs in its larger and wider leaves and longer inflorescences. All four species in this group are rarely collected and more collections are needed for a better understanding of this group.

6. *Persea caerulea* (Ruiz & Pavon) Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 171 (1889). Type: Peru, *Ruiz & Pavon s.n.* (MA).

Laurus caerulea Ruiz & Pavon, *Persea laevigata* Kunth, *P. petiolaris* Kunth, *P. skutchii* C.K. Allen.

Trees, to 25 m. Twigs angular or terete, solid, sparsely to densely pubescent, the hairs ascending or appressed, branching not whorled, no or few bract scars present at base of seasonal growth; terminal buds densely pubescent. Leaves 8-24 × 4-12 cm, chartaceous, elliptic, ovate-elliptic or ovate-oblong, alternate, evenly distributed along the twigs, the base acute, obtuse or rounded, the margin plane, the apex acute or less frequently obtuse; the upper surface glabrous, the lower surface sparsely appressed pubescent to glabrous; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface; lateral veins 8-12; petioles 1.5-6 cm, striate, glabrous to moderately pubescent. Inflorescences 4-15 cm, moderately to rather densely pubescent, in the axils of leaves. Flowers yellow green, 5-6 mm in diameter, the tepals initially erect, ultimately somewhat spreading; pedicels 2-4 mm, slender. Tepals unequal, the outer 3 1-2 mm, broadly ovate, inner 3 4.5-6 mm, oblong, moderately to densely pubescent on the outer surface, inner surface of the outer tepals glabrous, of the inner tepals densely pubescent; stamens 9, all 4-celled, 3.5-4 mm, the glabrous anthers 1 mm, the pubescent filaments 2.5-3 mm, filaments of the inner 3 stamens with 2 glands attached 1 mm above the base, anthers of the outer stamens with the cells introrse, those of the inner stamens with the cells lateral-extrorse; staminodia 2 mm, pubescent, with a large, sagittate apex; pistil glabrous, 3 mm, the ovary 1 mm, the style slender; receptacle shallow, pubescent inside. Fruits globose, 8-10 mm in diameter, blue, tepals persisting in fruit, but the distal half of the outer tepals breaking off and the fruit seemingly subtended by 6 equal tepals; pedicel scarcely thickened in fruit. *Montane forests*. H (*Williams 14056*, MO); N (*Moreno 24139*, MO); CR (*Fuentes 252*, MO); P (*Nee 10168*, MO). 500-1800 m. (Mesoamerica, Colombia, Venezuela, Ecuador, Peru, Bolivia.)

Persea caerulea is a frequently collected species, best recognized by its strongly unequal inner and outer tepals, its chartaceous leaves, and the partly deciduous inner tepals in the fruiting stage. The relatively long filaments (at least twice as long as the

anthers) are also a useful character. This species is not infrequently confused with *P. americana*, but that species has equal tepals, which are deciduous in the fruiting stage. *Persea caerulea* can persist quite well in disturbed vegetation and is often collected along roads or in pastures. Several collections from Honduras have been identified as *P. microbotrys* L. Williams, an unpublished name.

7. *Persea cuneata* Meissner, *Prodr.* 15: 46 (1864). Type: Colombia, *Jervise s.n.* (K).

Beilschmiedia cuneata (Meissner) Kostermans, *Mutisiopersea cuneata* (Meissner) Kostermans.

Shrubs or small trees, to 15 m. Twigs ridged or irregular angular, glabrous, solid or fistulose, the branching frequently whorled, bract scars present at the base of seasonal growth; terminal buds glabrous, rarely sparsely appressed pubescent, surrounded by bracts. Leaves 5-12 × 2.5-5 cm, elliptic to obovate, firmly chartaceous to coriaceous, grouped near the tips of seasonal flushes, the base cuneate, acute or obtuse, the apex obtuse or rounded, glabrous on both surfaces, midrib impressed, lateral veins and tertiary venation immersed or slightly raised, the tertiary venation forming a fine reticulum, on the upper surface, midrib and lateral veins raised, tertiary venation immersed or slightly raised on the lower surface, the lower surface finely gland-dotted; lateral veins 7-12; petioles 1-2 cm, glabrous, canaliculate. Inflorescences 7-14 cm, in the axils of leaves and about as long as the subtending leaves, glabrous. Flowers pale yellow, 3 mm in diameter, the tepals erect or slightly spreading, pedicels short, the flowers subsessile or pedicels to 5 mm, slightly longer than the flowers. Tepals unequal, the outer 3 2 mm, broadly ovate, glabrous or sparsely appressed pubescent on the outer surface, the inner surface glabrous; inner 3 tepals 3.5-4 mm, oblong, sparsely to densely coppery appressed pubescent on the outer surface, sparsely pubescent on the inner surface; stamens 9, all 2-celled, the filaments twice as long as the anthers, outer 6 stamens 2.5 mm, the cells introrse, the filaments almost as wide as the anther, glabrous or sparsely pubescent, inner 3 stamens as long as the outer 6, the cells lateral, the filaments pubescent, glands attached above the base of the filaments, staminodia present, 1.5 mm, with a triangular apex, abaxially pubescent; pistil 2.8 mm, glabrous, the ovary 1 mm, receptacle cup-shaped, pubescent

inside. Fruits globose to ellipsoid, 9×7 mm, the tepals persisting entirely and more or less clasping the fruit. *Montane forests*. CR (*Herrera 3378*, MO); P (*McPherson 13522*, MO). 1000-1900 m. (Mesoamerica, Colombia, Venezuela, Ecuador, Peru.)

Persea cuneata is the only *Persea* species in Mesoamerica with 2-celled stamens and can thus be easily identified. Even in fruit, some stamens usually remain attached to the tepals. Vegetatively, *P. cuneata* is very similar to *P. povedae*; the latter has somewhat larger leaves and fruits, but differs more importantly in having 9 4-celled stamens. Throughout its range *P. cuneata* is a variable species. The amount of indument on the tepals is variable, as is the length of the pedicels and one specimen from Colombia (*Giraldo-Gensini 584*, MO) has a dense, erect indument on the twigs and terminal buds as well as a sparse erect indument on the lower leaf surface. The difference in density of the indument on the inner and outer tepals is usually strong enough to be seen without magnification and this is an unusual character in *Persea*.

8. *Persea donnell-smithii* Mez, *Arbeiten Königl. Bot. Gart. Breslau* 1: 113 (1892). Syntype: Guatemala, *Donnell Smith 1718* (MO).

Mutisiopersea donnell-smithii (Mez) Kostermans.

Trees, to 15 m. Twigs angular to roundish, densely brown-tomentose, the surface completely covered by the indument, the indument wearing off with age, branching not clustered, a few scars present at the base of seasonal growth, terminal buds densely brown tomentose, with a few bracts. Leaves $10-24 \times 5-21$ cm, firmly chartaceous, elliptic, broadly elliptic to almost round, alternate, the base acute, obtuse or roundish, the margin flat, not thickened, the apex acute, obtuse to roundish; the upper surface sparsely tomentose when young, soon becoming glabrous, sometimes the major veins, especially the midrib, tomentose; lower surface densely to sparsely tomentose, the surface scarcely visible to almost completely exposed; midrib, lateral veins and tertiary venation immersed on the upper surface, tertiary venation forming a fine reticulum, midrib and lateral veins strongly raised, tertiary venation raised on the lower surface; lateral veins 6-9; petioles 2-6 cm, terete or slightly flattened above, with a similar indument as the twigs. Inflorescences 5-12 cm, paniculate cymose, densely tomentose, the surface completely covered, mostly in the axils of bracts along the lower part of seasonal growth, less

frequently in the axils of leaves. Flowers cream-colored, 4 mm in diameter, the tepals more or less erect, flowers sessile or nearly so. Tepals unequal, the outer 3 2-2.5 mm, broadly elliptic, the inner 3 c. 4 mm, elliptic to oblong, both densely pubescent on the outer surface, the outer 3 glabrous on the inner surface, the inner 3 pubescent on the inner surface; stamens 9, all 4-celled, outer 6 stamens c. 2.5 mm, the anther 2 mm, glabrous, the cells opening introrse, the filament c. 0.5 mm, densely pubescent; inner 3 stamens 3 mm, linear, the filament poorly differentiated from the anther, filament and base of the anther densely pubescent, cells opening extrorse, glands present at the base of the filaments; staminodia present, 1 mm, densely pubescent, the hairs c. 1 mm long and thus staminodia appearing 2 mm long; pistil 4 mm, glabrous or with a few hairs at the base of the style, ovary globose, 1.5 mm, clearly differentiated from the style, this 2.5 mm. Fruits 1.2 cm in diameter, globose, glabrous, the tepals persisting at the base of the fruits, the tips of the inner tepals not breaking off and the tepals remaining unequal in fruiting stage. *Montane forests*. Ch (*Breedlove 24731*, MO); G (*Lundell & Contreras 19196*, MO); H (*Williams 15988*, MO); N (*Pipoly 6036*, MO); CR (*Herrera 3710*, MO). 900-2400 m. (Endemic? see discussion).

Persea donnell-smithii can be readily recognized by the combination of its dense pubescence on twigs and lower leaf surfaces and the unequal tepals. In leaf size and density of the indument on the lower leaf surface, it is a variable species. The single collection from Costa Rica has narrower leaves (4-5 cm wide) than usual, but does not differ in other characters from more typical *P. donnell-smithii*. Several other collections from Costa Rica, mostly sterile, are provisionally placed here. These specimens have the erect indument of *P. donnell-smithii*, but it is much less dense and leaves much of the surface of twigs and leaves visible. This species is closely related to *P. chamissonis* Mez, known in Mexico from Oaxaca northwards. I have not seen good material of *P. chamissonis*, but suspect that *P. donnell-smithii* may be conspecific with *P. chamissonis*. One of the syntypes of *P. donnell-smithii* cited by Mez (*Liebmann 11*) came from Veracruz, Mexico. This specimen has not been seen by later botanists, who have accepted *P. donnell-smithii* as occurring from Chiapas southwards and *P. chamissonis* as occurring from Oaxaca northwards. The name *P. chamissonis* has priority over *P. donnell-smithii*.

9. *Persea laevifolia* van der Werff, *Novon* 12: 582, f. 4 (2002). Holotype: Costa Rica, *Hammel & Grayum 17334* (MO).

Trees, to 20 m. Twigs slightly ridged, glabrous or nearly so, dark brown, the branching not clustered, clusters of bract scars lacking; terminal buds densely white pubescent, not protected by bracts. Leaves 7-15 × 2-4 cm, chartaceous, elliptic to slightly obovate, alternate and clustered near the tips of the branches; base narrowly cuneate and somewhat decurrent on the petiole, the margin thickened, the apex acute or shortly acuminate, glabrous on both surfaces, midrib immersed or weakly raised, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins and tertiary venation immersed on the lower surface, lower surface glaucous; lateral veins 7-10, poorly visible; petioles 7-14 mm, glabrous, canaliculate. Inflorescences 4-12 cm, sparsely pubescent when immature, glabrous in young fruiting stage, near the base of seasonal flushes. Flowers unknown; description of floral parts based on remnants at the base of young fruits. Tepals 1.7 mm, broadly elliptic, equal, the outer surface sparsely to moderately, the inner surface moderately to densely pubescent; stamens 9, all 4-celled, but often only 2 or 3 cells opening, the inner 3 stamens sometimes with the upper 2 cells vestigial, the outer 6 1 mm, the anther clearly wider than the filament, the cells introrse, anther about as long as the basally pubescent filament; inner 3 stamens as long as the outer 6, anther slightly wider than the filament, filament as long as the anther, densely pubescent, with large glands near the base, staminodia 0.8 mm, broadly triangular, pubescent on both surfaces, pistil glabrous. Young fruits globose, the largest seen 6 mm in diameter, tepals in very young stage persisting, but ultimately dehiscing as a unit with the stamens attached or, less frequently, individually. *Lowland rain forest*. CR (*Hammel & Chacon 16055*, MO). 100-200 m. (Endemic.)

Persea laevifolia is an unusual *Persea* species because of its small flowers with equal tepals which are dehiscent in the fruiting stage. Thus, it does not fit well in the previously recognized infrageneric taxa of *Persea*. Most neotropical species of *Persea* have unequal or equal, persisting tepals or equal, deciduous tepals which are not basally united. Nearly all have clearly larger flowers. *Persea laevifolia* resembles *P. perglauca* from Guatemala, but differs in having dark brown (not very pale to whitish) twigs, a

densely pubescent (not sparsely pubescent) terminal bud, immersed (not raised or slightly raised) lateral and tertiary veins on both surfaces, the leaf bases slightly decurrent on the petioles and the midrib immersed (not impressed) on the upper leaf surface. These differences are slight, but consistent and I expect that when good flowering collections become available, floral differences will be found as well. Currently *P. laevifolia* is only known from 3 collections from the lower atlantic slope of Costa Rica.

10. *Persea liebmannii* Mez, *Jahrb. Königl. Bot. Gart. Berlin* 5: 166 (1889).

Syntype: Mexico, Oaxaca, *Liebmann 116*, (MO!).

Mutisiopersea liebmannii (Mez) Kostermans, *Persea flavifolia* Lundell, *P. petenensis* Lundell.

Small trees. Twigs angular, solid, densely appressed pubescent, the surface of young twigs completely covered, with some bract scars at the base of seasonal growth, branching not clustered; terminal buds densely appressed pubescent, completely covered by the indument. Leaves 9-16 × 3.5 × 8 cm, narrowly to broadly elliptic, firmly chartaceous to coriaceous, alternate, evenly distributed; the base acute to obtuse, the margin plane, the apex acute or obtuse; the upper surface glabrous, the lower surface densely to moderately pubescent; upper surface with midrib, lateral veins and tertiary venation immersed, midrib and lateral veins weakly raised, tertiary venation immersed on the lower surface; lateral veins 7-11; petioles 2-4 cm, striate, flat above, with a similar indument as the twigs. Inflorescences 4-7 cm, densely appressed pubescent, in the axils of leaves, occasionally in the axils of bracts. Flowers 3-4 mm in diameter, the tepals erect, flowers gradually narrowed into the short pedicel and flowers appearing subsessile. Tepals unequal, the outer 3 1.7-2.2 mm, ovate, the inner 3 3-4 mm, elliptic, densely pubescent on the outer surface, inner surface of the outer tepals glabrous, of the inner tepals densely pubescent; stamens 9, all 4-celled, the outer 6 2 mm, the pubescent filament slightly shorter than the glabrous anther, the cells opening introrse, the inner 3 2.5 mm, the glabrous anther as long as the pubescent filament, the cells extrorse-lateral, the filament with 2 globose glands near the base; staminodia 3, 1 mm, densely pubescent; pistil 3 mm, glabrous, the ovary 1 mm, style slender; receptacle shallow, pubescent inside. Fruits globose, 1 cm in diameter, the tepals persisting at the base of the fruit,

clasping or spreading, remaining entire; pedicel slightly thickened in fruit. *Montane forests*. Ch (*Purpus 7096*, MO); G (*Contreras 903*, MO). 2000-2500 m. (Mexico, Mesoamerica.)

Persea liebmannii, as accepted here, is best recognized by its appressed indument on twigs and leaves, the rather long petioles, short inflorescences and the inflorescences predominantly placed in the axils of leaves. This species resembles *P. veraguasensis* closely and the differences are discussed under the latter. The description presented here is based on specimens from Chiapas, including the type of *P. flavifolia*. Collections from other parts of Mexico vary somewhat and further research is needed to determine if *P. liebmannii* s.l. is a good species or if more than one species should be recognized in this complex. The single collection from Guatemala, *Contreras 903*, the type of *P. petenensis*, differs in having longer inflorescences (15-20 cm) and less densely pubescent twigs. More collections are needed to determine if *P. petenensis* should be recognized as a distinct species; I find the differences not strong enough to recognize *P. petenensis* based on a single collection.

11. *Persea obtusifolia* Kopp, *Mem. New York Bot. Gard.* 14: 81 (1966). Isotype: Panama, *Allen 4883* (MO!).

Shrub or small tree, to 6 m. Twigs angular, solid, moderately to densely pubescent when young, the hairs ascending or erect, soon becoming glabrous, with some bract scars present at the base of seasonal growth, branching not clustered; terminal buds densely pubescent, the hairs mostly erect, covering the entire surface, but terminal buds frequently covered by the leaves. Leaves 4-11 × 2-5.5 cm, coriaceous, ovate to obovate-elliptic, alternate, evenly distributed along the twigs, the base acute to obtuse-rounded, the margin plane, the apex obtuse to acute, the upper surface glabrous, but midrib sometimes tomentose when young, the lower surface densely or moderately pubescent when young, the hairs ascending, the indument wearing off with age but persisting along the midrib; midrib and lateral veins immersed or nearly so, tertiary venation immersed or weakly raised, forming a fine reticulum on the upper surface; midrib and lateral veins raised, tertiary venation immersed or weakly raised on the lower surface; lateral veins 4-6; petioles 5-12 mm, with a similar or denser indument than the twigs, striate.

Inflorescences 2.5-6 cm, moderately to densely pubescent, the indument usually covering the lateral axes completely; in the axils of leaves or reduced leaves. Flowers 4 mm in diameter, the tepals erect, green or pale yellow, pedicels c. 2 mm, shorter than the flowers. Tepals unequal, outer 3 c. 3.5 mm, inner 3 c. 5 mm, the outer surface densely pubescent, inner surface of the outer tepals glabrous, of the inner tepals densely pubescent; stamens 9, all 4-celled, outer 6 stamens 3 mm, the filaments densely pubescent, as long as the glabrous anthers, the cells opening introrse; inner 3 stamens about the same length, the filaments pubescent, with 2 globose glands at the base, cells opening extrorse; staminodia present, 1 mm, densely pubescent; pistil 3 mm, glabrous, the ovary 1 mm; receptacle shallow, pubescent inside. Fruits roundish, c. 1 cm in diameter, subtended by the persistent tepals, these spreading, their tips not breaking off. *Elfin forest* or *shrubby paramo*. CR (*van der Werff et al. 14040*, MO); P (*Hammel 5623*, MO). 2500-3300 m. (Endemic.)

Persea obtusifolia is a high-altitude shrub or low tree, best recognized by its coriaceous, rather small leaves and the erect or ascending indument on the twigs and leaves. Although this indument wears off with age, traces usually persist along the midrib on the lower leaf surface. *Persea brenesii*, another species from Costa Rica with rather small, coriaceous leaves, differs in its strictly appressed indument and occurs at lower altitudes. Most Costa Rican specimens here included in *P. obtusifolia* had been previously identified as *P. vesticula*, but this species as accepted here has a different indument on the leaves (minute, dense, with individual hairs scarcely visible) and does not occur in Costa Rica.

12. *Persea perglauca* Lundell, *Wrightia* 5: 147 (1975). Isotype: Guatemala, *Lundell & Contreras 19217* (MO!).

Trees, to 20 m. Twigs glabrous, ridged, the bark whitish, clusters of bract scars lacking, branching not clustered; terminal buds sparsely to moderately appressed pubescent, not protected by bracts. Leaves 5.5-12 × 2.2-4 cm, alternate, elliptic, grouped near the tips of the branches, firmly chartaceous, the base acute or rarely obtuse, the apex acute, the upper surface glabrous, lower surface glabrous or with some scattered appressed hairs when immature, glaucous; midrib impressed, lateral veins and tertiary

venation slightly raised, the tertiary venation forming a fine reticulum on the upper surface, midrib raised, lateral veins and tertiary venation weakly raised, on the lower surface, the tertiary venation forming a similar reticulum as on the upper surface; lateral veins 7-10; petioles 9-16 mm, striate, weakly canaliculate, glabrous. Inflorescences to 2.5 cm, the flowers grouped at the tip of the inflorescence, sparsely to moderately appressed pubescent, in the axils of bracts at the base of seasonal flushes. Flowers 3.5 mm in diameter, the tepals erect or slightly spreading, yellow-green, pedicels 2-3 mm. Tepals 2 mm, ovate, equal or nearly so, moderately appressed pubescent on both surfaces; stamens 9, 4-celled, but upper pair of anther cells not always developed; outer 6 stamens 1.3 mm, the anther about as long as the pubescent filament, the cells in 2 pairs, introrse; inner stamens the same length, the upper pair of cells lateral, the lower extrorse, the filament pubescent, as long as the anther; glands present at the base of the filaments; staminodia 0.8 mm, with a triangular apex, abaxially sparsely pubescent; pistil 2 mm, pubescent except for the lower half of the ovary, style about as long as the ovary; receptacle shallowly cup-shaped, glabrous inside. Fruits roundish to weakly pearshaped, 2.8 × 2.5 cm when dry, tepals persisting or deciduous in fruit, not enlarged and reflexed if persistent. Rain forest. G (*Lundell & Contreras 20910*, MO). Altitude not known. (Endemic.)

Persea perglauca is only known from a few collections made in the Departamento Baja Verapaz in Guatemala. It is readily recognized by the glaucous lower leaf surface, the pale bark of the twigs contrasting with the dark petioles and the impressed midrib on the upper leaf surface. It is similar to *P. laevifolia* from Costa Rica, which also has clustered, glaucous leaves of about the same size and shape, but that species differs in having dark twigs, an immersed midrib and tertiary venation (the latter not visible) on the upper leaf surface, a white pubescent terminal bud and leaf bases which are slightly decurrent on the petiole. *Persea perglauca* can also be confused with specimens identified as *P. steyermarkii* which are here included in *P. americana* s.l.; *P. perglauca* differs from these specimens in its much smaller flowers (tepals 2 mm vs. 4-6 mm). However, only the type of *P. perglauca* has flowers; all other collections are in fruit and very difficult to separate from specimens identified as *P. steyermarkii*.

Additional collections may well show that *P. perglauca* is nothing more than a small-flowered variety of the already variable *P. americana*.

13. *Persea povedae* Burger, *Fieldiana Botany, n.s.* 23: 105 (1990). Isotype: Costa Rica, *Poveda 740* (MO!).

Trees, to 30 m. Twigs ridged or irregularly angled, glabrous, fistulose, the branching sometimes whorled, bract scars present at the base of the seasonal growth; terminal buds glabrous, protected by bracts. Leaves 9-21 × 4-9 cm, firmly chartaceous, obovate or elliptic, grouped towards the tips of the branches or more or less evenly distributed, the base cuneate or obtuse, the apex, obtuse or rounded, glabrous on both surfaces, the lower surface finely gland dotted, the midrib impressed, lateral veins and tertiary venation immersed or slightly raised, the tertiary venation forming a fine reticulum, on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised on the lower surface; lateral veins 8-12 pairs; petioles 15-40 mm, glabrous, canaliculate. Inflorescences 8-15 cm, glabrous, only branched in the upper 1/3, in the axils of leaves. Flowers pale yellow, 5 mm in diameter, the tepals erect or slightly spreading at anthesis, pedicels 2-3 mm. Tepals unequal, the outer 3 2 mm, broadly ovate, glabrous on both surfaces or the outer surface sparsely appressed pubescent, the inner 3 5-6 mm, oblong, densely pubescent on both surfaces, stamens 9, all 4-celled, the outer 6 4.5 mm, the anthers glabrous, 1 mm, the filaments 3.5 mm, pubescent, the anther cells introrse; inner 3 stamens 4 mm, the anther glabrous, 1 mm, the cells extrorse-lateral, the filaments 3 mm, pubescent, glands present, attached 0.5 mm above the base of the filaments; staminodia present, 2.5 mm, the apex narrowly triangular, glabrous adaxially, otherwise staminodia pubescent; pistil 4,5 mm, glabrous, the ovary 1 mm, the style long, slender; receptacle shallow, densely pubescent inside. Fruits globose, to 17 mm in diameter, tepals initially persistent, ultimately falling off individually, not enlarged or thickened; distal part of the inner tepals not breaking off; fruiting pedicels thickened and often warty. *Montane forest*. CR (*Bello 856*, MO); P (*Galdames 4148*, MO). 700-1100 m. (Mesoamerica, Ecuador.)

Persea povedae is an infrequently collected species, best recognized by the combination of its 4-celled anthers, the inner tepals much more densely pubescent than

the small outer tepals and the glabrous twigs and obovate, glabrous leaves. It is quite similar to *P. cuneata*, but differs in its 4-celled (not 2-celled) anthers and larger leaves, flowers and fruits. However, vegetatively these two species are difficult to separate. Two fruiting collections from Venezuela, may belong to *P. povedae*, but lack of flowers prevents a more definite identification of these specimens.

14. *Persea pseudofasciculata* Kopp, *Mem. New York Bot. Gard.* 14: 85 (1966).

Isotype: Bolivia, *Krukoff 11283* (MO!).

Tree, 25 m. Twigs terete or slightly angular, glabrous or with a few appressed hairs, fistulose, branching unknown, bracts scars lacking on the twigs; terminal buds densely appressed pubescent, nor surrounded by bracts. Leaves 15-20 × 4.5-5.5, elliptic, firmly chartaceous, evenly distributed along the twigs, base and apex acute, the upper surface glabrous, the lower surface very sparsely to sparsely appressed pubescent, midrib impressed, lateral veins slightly impressed or immersed, tertiary venation weakly raised to immersed, forming a fine reticulum, on the upper surface, midrib and lateral veins raised, tertiary venation immersed on the lower surface; lateral veins 6-8 pairs; petioles 2-3 cm, ridged, glabrous or with a few appressed hairs. Inflorescences 2-6 cm, densely pubescent, the hairs ascending, branched from the very base, in the axils of leaves. Flowers yellowish green, 4 mm in diameter, the tepals erect or somewhat spreading, pedicels very short, c. 1 mm. Tepals unequal, the outer 3 1.5-2 mm, densely pubescent outside, glabrous inside, inner 3 5.5 mm, oblong, densely pubescent on both surfaces; fertile stamens 6, representing the outer 6, 4-celled, 4 mm, the anther 1.2 mm, glabrous, the much longer filament slender, pubescent; inner 3 stamens staminodial, 4.5 mm, the tip glabrous, otherwise pubescent, glands stalked, attached near the base; staminodia (whorl IV) present, 2 mm, the tip incurved, scarcely wider than the filament and adaxially glabrous, otherwise staminodia densely pubescent; pistil 4 mm, glabrous, the ovary 1 mm, the style slender, stigma conspicuous, receptacle shallow, pubescent inside. Fruits globose, 1-1.3 cm in diameter, tepals persisting, but not enlarging, spreading to reflexed, pedicels swollen in fruit. *Lowland rain forest. CR (Herrera 4799, MO). 500 m.* (Mesoamerica, Ecuador, Peru, Venezuela, Brazil, Bolivia.)

Persea pseudofasciculata is the only *Persea* species in Mesoamerica with whorl III staminodial and thus with only 6 fertile stamens. Additional useful characters are the densely pubescent, short, branched inflorescences and the nearly glabrous twigs. This species is known from 1 collection in Mesoamerica. Its distribution in South America is not certain; most collections identified as this species are sterile and the identifications are not much more than educated guesses. The floral size of the Costa Rican collection places it in the var. *pseudofasciculata*; the var. *parviflora* Kopp has flowers with the inner 3 tepals only 2 mm.

15. *Persea rigens* Allen, *J. Arnold Arbor.* 26: 297 (1945). Isolectotype (designated by ???, ???): Panama, *Little 6058* (MO!).

Trees, to 30 m. Twigs terete or slightly angled, glabrous, solid, branching whorled, the nodes swollen and knob-like; bract scars present at the base of seasonal growth; terminal buds glabrous, protected by glabrous bracts. Leaves 10-20 × 4-10 cm, stiffly chartaceous, elliptic, clustered near the tips of the branches; base obtuse to acute, apex acute, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed or slightly raised on the upper surface, midrib and lateral veins raised, tertiary venation slightly raised or immersed on the lower surface; lateral veins 6-8 pairs; petioles 1-1.5 cm, glabrous. Inflorescences (immature) to 8 cm, near the base moderately, the distal parts densely white pubescent, in the axils of bracts at the swollen tips of the branches or in the axils of leaves. Mature flowers not known, those farthest developed 3 mm in diameter, the pedicels as long as the flowers. Tepals (measurements from immature flowers) equal, 3 mm, ovate, densely white pubescent on both surfaces, stamens 9, 4-celled, c. 1.5 mm, the pubescent filaments as long as the glabrous anthers, slightly narrower than the anthers, outer anthers with introrse cells, inner anthers with extrorse-lateral cells, glands present at the base of the filaments of the inner stamens; staminodia present, c. 1 mm, broadly triangular, abaxially pubescent, adaxially glabrous and folded around the pistil; pistil 2.5 mm, glabrous, the style a little longer than the ovary, receptacle cup-shaped, glabrous inside. Fruits globose, 7-8 mm in diameter, tepals persistent at the base of the fruit, somewhat spreading to appressed; pedicel scarcely

thickened. *Montane forest*. CR (Herrera 4744, MO); P (Croat 26775, MO). 1400-1600 m. (Mesoamerica, probably Colombia.)

Persea rigens is a poorly known species. The type collection is largely in bud and the measurements for the floral parts may therefore not be accurate. Distinctive are the densely white pubescent inflorescences and flowers. It is closely related to *P. silvatica* and *P. rufescens*, with which it shares the whorled branching and swollen tips of the branches. Specimens identified as *P. rigens* from Venezuela differ in having longer petioles (to 3 cm) and fruits wider (2.8 cm) than long (1.8 cm) and it is likely that reports of *P. rigens* from Venezuela and Ecuador are based on closely related, but different species.

16. *Persea rufescens* Lundell, *Wrightia* 5: 38 (1974). Isotype: Mexico, Chiapas, *Matuda 5394* (MO!).

Trees, to 12 m. Twigs terete or ridged, glabrous, solid, the nodes thickened; few bract scars present at the base of seasonal flushed and inflorescences; terminal buds glabrous, surrounded by a few bracts. Leaves 13-20 × 3-6 cm, coriaceous, narrowly elliptic to narrowly oblong, clustered at the tips of the branches, the base acute or somewhat decurrent on the petiole, the apex acute, glabrous on both surfaces, midrib, lateral veins and tertiary venation immersed on the upper leaf surface, midrib raised, lateral slightly raised and tertiary venation immersed on the lower surface; lateral veins 7-11 pairs; petioles 1.5-2.5 cm, glabrous, flat above. Inflorescences 12-16 cm, very sparsely puberulous near the base, becoming densely puberulous distally, the hairs brown, very short and predominantly erect; in the axils of leaves or bracts near the tips of the branches. Flowers 5 mm in diameter, yellow, pedicels 4-5 mm, densely puberulous. Tepals equal, 2.5 mm, broadly ovate, the outer surface densely pubescent, the inner surface moderately so, stamens 9, 4-celled, the outer 6 1.5-2 mm, the anthers glabrous, slightly longer than the pubescent filaments, these almost as wide as the anthers; anther cells introrse; inner 3 stamens about as long, anthers glabrous, cells lateral-extrorse, the filaments a little shorter than the anthers, pubescent, glands present at the base of the filaments; staminodia present, 1.3 mm, abaxially pubescent, the apex broadly triangular-sagittate; pistil 2 mm, glabrous, style as long as the ovary, receptacle cup-shaped, largely

glabrous inside. Fruits 1.8 cm in diameter, globose, subtended by the persistent, not enlarged tepals, these clasping the fruit or spreading. *Montane forests*. Ch (*Matuda 5394*, MO). 1500-2500 m. (Mexico [Oaxaca], Mesoamerica).

Persea rufescens is easily recognized by the combination of the densely brown-pubescent flowers and distal parts of the inflorescences, the clustered leaves, swollen nodes and flowers with equal tepals and large staminodia. The description of the flowers is based on a collection from Oaxaca (*Cedillo & Lorence 2339*, MO) and not on the dried remnants at the base of the fruits. A related species is known from 2 collections in the lowlands near the Veracruz-Oaxaca boundary; it differs in having almost glabrous flowers, short petioles and a raised, tertiary venation on both leaf surfaces. *Persea rigens*, a species from Costa Rica and Panama, differs in having densely white-pubescent flowers and inflorescences.

17. *Persea schiedeana* Nees, *Syst. Laurin.* 130 (1836). Holotype: Mexico, Misantla, *Schiede 1141* (B).

Persea gratissima var. *schiedeana* (Nees) Meissner; *Persea pittieri* Mez

Trees, to 40 m. Twigs angular, densely brown-tomentose when young, the older parts becoming glabrous, conspicuous clusters of bract scars present at the base of this year's growth; branching not clustered; resting terminal buds covered by broadly elliptic bracts, these abaxially pubescent except for the glabrous margin, adaxially glabrous; active terminal buds densely brown-tomentose. Leaves 8-30 × 4-20 cm, (firmly) chartaceous, clustered near the tips of the branches, broadly elliptic, rarely elliptic, the base obtuse, rounded, rarely cordate or acute, the apex obtuse or rounded, rarely acute, the upper surface tomentose when young, glabrous at maturity, lower surface densely tomentose when young, the surface completely covered, at maturity becoming sparsely pubescent, the hairs erect and denser along the main veins, sometimes glaucous; midrib, lateral veins and tertiary venation immersed or slightly raised on the upper surface, raised on the lower surface; lateral veins 6-10 on each side; petioles 2-4 cm, with a similar indument as the twigs, rounded or flat on the upper surface. Inflorescences 4-10 cm, tomentose or tomentellous, the surface (nearly) completely covered, in the axils of bracts at the base of recent flushes. Flowers c. 1.2 cm in diameter when tepals spreading,

yellowish green, pedicels 10-25 mm. Tepals 6-8 mm, narrowly elliptic to lanceolate, densely pubescent on both surfaces, spreading in old flowers, equal; stamens 9, all 4-celled, the outer 6 5 mm, the anther 2 mm, pubescent near the base, otherwise glabrous, the upper pair of anther cells introrse, the lower pair lateral, filament 3 mm, densely pubescent, inner 3 stamens 5.5 mm, the anther 2 mm, pubescent near the base, the filament 3.5 mm, densely pubescent, the upper pair of anther cells extrorse, the lower pair lateral; glands present at the base of the inner stamens, shortly stalked; staminodia 2 mm, slender, the glabrous tip not or scarcely wider than the pubescent filament or with a distinct triangular apex; pistil 5 mm, densely pubescent, the ovary 3 mm, receptacle very shallow, pubescent inside. Fruit $4.5 \times 3-4$ cm, ellipsoid, obovoid or globose, densely pubescent when young, sparsely so at maturity, tepals initially persisting at the base of the fruit, eventually falling off individually. *Lowland to montane wet forest*. Ch (Breedlove 8852, CAS); G (Williams *et al.* 40462, F); H (Dario 163, MO); ES (Calderon 1497, US); CR (Gomez & Herrera 21130, MO); P (Lao 326, MO). 800-2500 m. (Mexico [Veracruz, Oaxaca], Mesoamerica.)

Persea schiedeana is closely related to *P. americana* and is best recognized by its long pedicels (10-25 mm vs. less than 8 mm), densely tomentose young twigs and the broad bracts with a scarious margin protecting the terminal buds. In contrast with *P. americana*, the fruits are generally pubescent, although this disappears in fully mature fruits. This species has sometimes been treated as a variety of *P. americana* and indeed, some specimens are difficult to place. Some specimens from the northern part of the range (for instance Ibarra M. 3047, MO), have leaves with shape and texture (elliptic, with an acute apex, tertiary venation less raised on the lower surface) of *P. americana* but bracts and pedicel length of *P. schiedeana*. Fruits are not frequently collected; most are slightly asymmetrical, often a sign of diseased fruits. Lao 326 from Panama has a large, symmetrical fruit, which is glabrous and resembles fruits of *P. americana*, but has the bracts of *P. schiedeana*. Kopp (1966) reported this species also from Colombia based on a collection I have not seen. In most cases flowers appear with a new flush of leaves and therefore most flowering specimens have very immature leaves.

18. *Persea sessilis* Standley & Steyermark, *Publ. Field Mus. Nat. Hist., Bot. Ser.* 23: 115 (1944). Holotype: Guatemala, *Steyermark 42487* (F!).

Shrub, 1.5 m. Twigs terete, glabrous, solid, branching not seen, terminal buds not seen. Leaves alternate, 8-20 × 3-7 cm, narrowly elliptic to obovate-elliptic, firmly chartaceous, the base cordate or rounded, the apex acute, glabrous on both surfaces, midrib immersed or slightly impressed, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins raised, tertiary venation weakly raised and forming a fine reticulum; lateral veins 10 (15 ex descr.); petioles absent and leaves sessile. Infructescences about as long as the leaves, axillary, sparsely strigose, the hairs ascending. Flowers not known. Remnants of tepals in fruit equal or subequal (inner ones slightly longer than outer ones), appressed pubescent, spreading in fruit. Immature fruit roundish, 1 cm in diameter. *Montane forest. G (Steyermark 42487, US). 2100-2400 m. (Endemic.)*

Persea sessilis is a very distinctive species by virtue of its sessile leaves with a cordate base, a combination unique among Mesoamerican Lauraceae. It is only known from the type collection, of which I have seen the holotype and the US isotype. This specimen is sterile and part of the description given above is taken from the original description. Although I have not seen flowers or fruits of this species, I accept it as a distinct species of *Persea*. In leaf shape *Persea sessilis* resembles *Persea pajonalis* van der Werff, a species known from a few collections from the mountains in central Peru. This species differs in having a sparse indument on the lower leaf surface, short, but visible petioles and fistulose twigs. The distribution also makes it unlikely that *P. pajonalis* is a synonym of *P. sessilis*.

19. *Persea silvatica* van der Werff, *Fieldiana Botany, n.s.* 23: 107 (1990). Holotype: Costa Rica, *Schatz & Young 964* (MO!). Illustr.: Burger & van der Werff, *Fieldiana Botany n.s.* 23: 34 (1990).

Trees, to 10 m. Twigs terete or ridged, glabrous, solid or fistulose, swollen at the nodes from which multiple branches emerge; bract scars lacking; terminal buds glabrous, without or with very few bracts. Leaves 15-25 × 7-12 cm, elliptic, elliptic-oblong or slightly obovate, chartaceous, clustered at the tips of the branches; the base acute or

obtuse, the apex acute or obtuse, glabrous on both surfaces, midrib immersed, lateral veins and tertiary venation weakly raised on the upper surface, midrib, lateral veins and tertiary venation raised on the lower surface, the tertiary venation forming a fine reticulum; lateral veins 6-10; petioles 8-15 mm, glabrous, flat above or slightly sulcate. Inflorescences 10-20 cm, very sparsely puberulous near the base, becoming sparsely puberulous on the distal branchlets, in the axils of leaves at the tips of the branches. Flowers 3-4 mm in diameter, white, pedicels 4-5 mm. Tepals equal, 2.5-3 mm, broadly ovate, erect at anthesis, sparsely puberulent on both surfaces, stamens 9, 4-celled, the outer 6 c. 2.4 mm, the puberulent filaments 1.4 mm, the anther cells introrse, inner 3 stamens 2.1 mm, the pubescent filaments 1.3 mm, the anther cells extrorse, globose glands present at the base of the inner filaments; staminodia present, 1.3 mm, abaxially pubescent, the apex triangular-sagittate; pistil 2.2 mm, glabrous, the ovary c. 1.1 mm, the receptacle shallow, glabrous. Fruits 1.9×2.7 cm, wider than long, the tepals persisting, but not enlarged or hardened at the fruiting stage, spreading to reflexed, the pedicel warty and a little thickened. *Lowland rain forest*. CR (*Herrera & Solis 2430*, MO). 80-300 m. (Endemic.)

Persea silvatica is apparently restricted to the lowland atlantic slopes of Costa Rica and is known from five collections. It is closely related to *P. rigens*, from which it differs in the sparsely pubescent flowers and inflorescences and the longer pedicels. However, *P. rigens* is poorly known and additional collections may change the concepts of these two species. Vegetatively, these species and two related species from Chiapas/Oaxaca can be easily recognized by the equal tepals, clustered leaves, swollen nodes of the twigs and its branching, with multiple branches emerging from the nodes.

20. *Persea standleyi* Allen, *J. Arnold Arbor.* 26: 301 (1945). Holotype: Guatemala, *Steyermark 47130* (F).

Mutisiopersea standleyi (Allen) Kostermans.

Trees, to 20 m. Twigs terete or angular, glabrous, solid, glaucous, with a few scars at the base of seasonal growth; branching not clustered; terminal buds glabrous, protected by a few bracts. Leaves 9-20 \times 3-8 cm, narrowly oblong, oblong or elliptic, chartaceous, alternate and evenly distributed along the twigs, the base obtuse or acute,

the margin plane, the apex acute or obtuse; glabrous on both surfaces; midrib, lateral veins and tertiary venation immersed on the upper surface, the tertiary venation forming a fine reticulum; midrib and lateral veins raised, tertiary venation immersed on the lower surface; lower surface glaucous; lateral veins 7-10; petioles 1-4 cm, ridged.

Inflorescences 5-10 cm, the main axis glabrous, often glaucous, the secondary and further axis moderately densely appressed pubescent, in the axils of leaves. Flowers in bud only, 2.5 mm in diameter, cream-colored, pedicels c. 2 mm, as long as the buds. Tepals unequal, the outer 3 1.5-2 mm, broadly ovate, moderately to densely pubescent on the outer surface; inner 3 3 mm (but not fully grown), densely pubescent outside; stamens 9, 4-celled; staminodia 3, pistil glabrous, the style about as long as the ovary; measurements of floral parts not given, because the flowers are clearly immature. Fruits roundish, c. 1 cm in diameter, the tepals persistent, spreading, tips of the inner tepals not breaking off and tepals unequal in fruit. *Montane forests*. G (*Steyermark 31491*, F); H (*Molina & Molina 13919*, F). 1500-2100 m. (Endemic.)

Persea standleyi is a poorly known species of which I have seen 4 collections, none with flowers. Characteristic are the glabrous leaves, twigs and vegetative buds, with twigs and leaves often glaucous and the rather large (to 20 cm) leaves. Two of the collections have rather long and narrow leaves, but 2 other ones (*Molina & Molina 14042* and *Davidse & Zuñiga 34645*) have broader leaves. I attach more importance to the absence of indument on the vegetative parts than to the leaf shape. Two collections from Chiapas (*Lorea 5527*, *Heath & Long 935*, both MO) differ from typical *P. standleyi* in their smaller (8-10 cm), more coriaceous leaves. However, because of their oblong leaves and inflorescences with glabrous main axis and pubescent lateral axes, I include these specimens in *P. standleyi*. *Martinez S. 18545* (MO), also from Chiapas, is similar, but differs in its appressed pubescence on twigs and leaves. *Persea standleyi* seems closely related to *P. longipes* (Schlecht.) Meissner, which is known from Veracruz, Mexico. Both species are vegetatively glabrous and have long pedicels. The leaves of *P. longipes* are elliptic to broadly elliptic in shape and the few fruiting collections I have seen have persistent tepals, but with the tips of the tepals broken off. In order to determine if *P. longipes* and *P. standleyi* are synonyms, more and better collections are needed. One collection from Chiapas, *Miranda 6269* (US), could be identified as *P. longipes*. *Persea*

standleyi has been compared to *P. podadenia* from Mexico; the latter species differs in its pubescent vegetative buds, twigs and leaves.

21. *Persea veraguasensis* Seemann, *Bot. voy. Herald* 193 (1854). Type: Panama, Seemann 1578 (BM, photo MO!).

Mutisiopersea veraguasensis (Seemann) Kostermans.

Shrubs or small trees, to 12 m. Twigs ridged or angular, solid, densely or rarely moderately appressed pubescent, the surface largely or entirely covered, glabrescent with age, some bract scars present at the base of seasonal growth, branching more or less clustered; terminal buds densely appressed pubescent, protected by a few bracts. Leaves 6-15 × 2.5-6 cm, narrowly ovate, lanceolate to ovate-elliptic, coriaceous, alternate or clustered near the tips of seasonal growth; the base acute to rounded, the margin flat, the apex acute to obtuse; the upper surface glabrous, the lower surface sparsely to densely appressed pubescent; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib raised, lateral veins weakly raised and tertiary venation immersed on the lower surface; lateral veins 6-10; petioles 2-5 cm, ridged, flat above, with a similar indument as the twigs. Inflorescences 5-15 cm, densely appressed pubescent, mostly in the axils of bracts clustered at the base of seasonal growth. Flowers 3 mm in diameter, green or yellow, gradually narrowed at the base into the short, thick pedicel and flowers appearing sessile or nearly so. Tepals unequal, densely pubescent outside, the outer 3 2-2.5 mm, ovate, the inner 3 3.5-4.5 mm, elliptic-ovate, inner surface of the outer tepals glabrous, of the inner tepals densely pubescent; tepals erect at anthesis; stamens 9, all 4-celled, c. 2.5 mm, the mostly glabrous anther about as long or slightly longer than the pubescent filament; outer 6 stamens with introrse cells, inner 3 stamens with extrorse-lateral cells, filaments of the inner stamens with 2 glands near the base; staminodia 1 mm, pubescent; pistil glabrous, 3-3.5 mm, glabrous, the ovary 1 mm, receptacle shallow, pubescent inside. Fruits globose, c. 1 cm in diameter, subtended by the persistent, spreading tepals, inner tepals remaining intact and tepals in fruiting stage unequal; tepals in fruit thickened near the base. *Montane forest*. CR (*Bello* 2692, MO); P (*Lao* 337, MO). 1200-2000 m. (Endemic.)

Persea veraguasensis is very similar to *P. liebmannii*, but can be recognized by its rather large inflorescences (about as long as the leaves) which are clustered at the base of seasonal growth. In *P. liebmannii* the inflorescences are much shorter (not more than half as long as the leaves) and are found mostly in the axils of leaves and not clustered at the base of seasonal growth. The distribution of the two species is also quite different. *Persea caerulea* differs from *P. veraguasensis* in its relatively shorter outer tepals (1/3 to 1/4 as long as the inner ones), its distinct pedicels and long filaments (filaments 2 to 3 × as long as the anthers). In some collections, for instance *Bello 2692*, the open flowers have shorter stamens (1.5 mm instead of 2.5 mm); anther cells of these stamens appear only as thin slits and do not open with valves as is normally the case. The pistil is also longer than the stamens, whereas it is shorter than the stamens in flowers with fully developed stamens. Thus, these flowers appear pistillate, but unisexual flowers have not been reported from any species of *Persea*.

In the past, some authors have used the name *Persea veraguensis* for this species, which I consider an error for *P. veraguasensis*, the name Seemann published.

22. *Persea vesticula* Standley & Steyermark, *Publ. Field Mus. Nat. Hist., Bot. Ser.* 23: 116 (1944). Type: Guatemala, *Steyermark 36207* (F).

Mutisiopersea vesticula (Standley & Steyermark) Kostermans, *Persea chiapensis* Lundell, *P. popenoei* L.O. Williams.

Trees, to 30 m, but sometimes fertile as shrub of 2-3 m. Twigs angular, solid, initially minutely and densely fuscous puberulous, becoming glabrous with age, some bract scars present at the base of seasonal growth, branching not clustered; terminal buds densely and minutely puberulous, protected by a few bracts. Leaves 6-17 × 3-6 cm, elliptic, elliptic-oblong or broadly elliptic, coriaceous, alternate and evenly distributed along the twigs; the base acute or obtuse, the margin flat or slightly inrolled, the apex acute, rarely obtuse, the upper surface glabrous, the lower surface densely and minutely puberulous, the indument felt-like, individual hairs scarcely visible; midrib, lateral veins and tertiary venation immersed on the upper surface, midrib and lateral veins clearly raised, tertiary venation raised, scalariform or immersed; lateral veins 6-10; petioles 1-2.3 cm, with a similar indument as the twigs, flat or shallowly canaliculate above.

Inflorescences 5-15 cm, in the axils of leaves or bracts, densely and minutely puberulous. Flowers c. 7 mm in diameter, yellow-green, pedicels 2-3 mm. Tepals unequal, the outer 3 2 mm, broadly ovate or broadly triangular, inner 3 4 mm, elliptic; all tepals densely pubescent on the outer surface, outer 3 glabrous, inner 3 densely pubescent on the inner surface; stamens 9, all 4-celled, outer 3 stamens 3 mm, the anther as long as the filament, the filament pubescent, narrower than the anther; anther glabrous, the cells opening introrse; inner 3 stamens 3 mm, the pubescent filament 2 mm, as wide as the anther; anther glabrous, cells opening extrorse, 2 glands present at the base of the filament; staminodia 1.5 mm, with a triangular apex, abaxially pubescent; pistil 3.5 mm, glabrous, the ovary 2 mm, style slender; receptacle shallow, glabrous inside. Fruits roundish, 1.2 cm in diameter, tepals persisting under the fruit, spreading or clasping, the tips of the inner tepals not breaking off and tepals remaining unequal in fruit, somewhat thickened at their base. *Montane forests*. Ch (*Matuda 5526*, MO); G (*Contreras 5006*, MO); H (*Hawkins 918*, MO); ES (*Allen 7145*, F). 1800-2500 m (Endemic.)

Persea vesticula is best recognized by its distinctive indument on the lower leaf surface; several, but not all, specimens also had a scalariform tertiary venation on the lower leaf surface. In habit this species is very variable, ranging from 30 m trees to shrubs, 2-3 m tall. Burger & van der Werff (1990) included several collections from Costa Rica in *P. vesticula*; I consider these better placed in *P. obusifolia*, because they lack the distinctive indument of *P. vesticula*.

15. *Pleurothyrium* Nees

By H. van der Werff.

Trees. Leaves alternate or clustered, pinnately veined, venation camptodrome or brochidodrome; domatia lacking. Inflorescences usually in the axils of cataphylls, rarely in the axils of normal leaves, paniculate-cymose (rarely racemose), the lateral flowers of a cyme strictly opposite. Flowers bisexual; tepals equal, deciduous in fruiting stage. Stamens 9, 4-celled; anthers of the outer stamens bent inwards with 2 or all 4 locelli dorsal; glands of the inner 3 stamens usually strongly enlarged and forming a disc which

encloses the stamens; staminodia, when present, inconspicuous. Fruit seated in a (frequently large) cupule. 42 spp., Neotropics.

Characteristic are the strongly enlarged glands which frequently form a disc surrounding the stamens.

Bibliography: van der Werff, H. A revision of the genus *Pleurothyrium* (Lauraceae). *Ann. Missouri Bot. Gard.* 80: 39-119 (1993).

1. Lower leaf surface densely tomentellous, the surface completely covered by the indumenta. **6. P. palmanum**

1. Lower leaf surface glabrous or variously pubescent, the surface never completely covered by the indumenta.

2. Indument on the lower leaf surface consisting of erect hairs.

3. Leaf base acute or obtuse, apex acuminate; lateral veins 14-20. **7. P. pauciflorum**

3. Leaf base and apex obtuse or rounded (rarely acute in *P. racemosum*); lateral veins 6-9.

4. Leaves 15-25 × 7-13 cm, pilose on the lower surface, the indument not readily deciduous with age. **8. P. pilosum**

4. Leaves 6-14 × 2.5-4 cm, the lower leaf surface soon glabrescent, the indument persistent along midrib and lateral veins. **9. P. racemosum**

2. Lower leaf surface with appressed hairs or glabrous.

5. Tepals erect or half erect at anthesis; glands of stamens enlarged, free, not forming a disc surrounding the stamens; anthers held above the glands. **10. P. trianae**

5. Tepals spreading or reflexed at anthesis; glands enlarged, fused or free, forming a disc surrounding the stamens; stamens about as tall as the glandular disc.

6. Leaf bases obtuse, rounded to rounded-cordate; lateral veins strongly loop-connected in the distal 2/3 of the lamina; leaves 20-45 cm.

7. Leaves obovate; petioles c. 5 mm. **3. P. hexaglandulosum**

7. Leaves oblong to elliptic-oblong; petioles 15-25 mm. **5. P. oblongum**

6. Leaf bases angustate, acute or rarely obtuse; lateral veins not loop-connected or only loop-connected in the distal half of the lamina; leaves generally less than 20 cm.

8. Bracts of inflorescence present at anthesis; leaf bases obtuse. **1. P. golfodulcense**

8. Bracts of inflorescence absent at anthesis (sometimes present in *P. immersum*); leafbases acute, cuneate, attenuate to somewhat decurrent.

9. Inner surface of the tepals glabrous near the base, papillose towards the apex; leaves obovate or obovate-elliptic.

2. *P. guindonii*

9. Inner surface of the tepals uniformly pubescent; leaves elliptic.

10. Flowers c. 8 mm diameter; tepals spreading at anthesis; leaves 15-20 cm.

11. *P. westphalii*

10. Flowers c. 5 mm diameter; tepals spreading to reflexed at anthesis; leaves to 10 cm.

4. *P. immersum*

1. *Pleurothyrium golfodulcense* W.C. Burger & N. Zamora, *Fieldiana Bot., n.s.* 23: 115 (1990). Holotype: Costa Rica, *Sanchez et al. 1228* (CR). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 80: 77, t. 24 (1993).

Trees, to 15(-25) m. Twigs terete, grey, more or less appressed pubescent. Leaves 10-20 × 4-7 cm, elliptic to elliptic-obovate, chartaceous, alternate, the base obtuse or acute, the apex acuminate; upper surface glabrous (sometimes the midribs with some pubescence), lower surface glabrous or with minute appressed hairs, the midribs and lateral veins more or less appressed pubescent; lateral veins 6-10, loop-connected in the distal 1/2 of the lamina; venation immersed on the upper surface, the midrib and lateral veins raised and tertiary venation weakly raised or immersed on the lower surface; petioles 6-22 mm. Inflorescences to 10 cm, in the axils of cataphylls or (infrequently) in the axils of normal leaves, paniculate-cymose, brown-pubescent, bracts present at anthesis. Flowers 9-12 mm in diameter, white; the tepals, spreading, elliptic, 4-6 mm, pubescent outside, papillose inside; glands enlarged, not fully fused, together with the stamens forming a dome-shaped disc 2.5 × 1 mm, the anthers at the surface of the dome, the cells lateral; pistil c. 2.2 mm, the ovary pubescent, the style less so; the receptacle pubescent inside. Fruit 4 × 2 cm, ellipsoid; cupule 2 × 2 cm, with coarse warts outside. *Wet lowland forests. CR (Herrera 4870, MO). 100-600 m. (Endemic.)*

Characteristics are the obtuse leaf bases and the persistent bracts of the inflorescences.

2. *Pleurothyrium guindonii* van der Werff, *Novon* 6: 476 (1996). Holotype: Costa Rica, *Haber et al. 11089* (MO!). Illustr.: van der Werff, *Novon* 6: 477, t. 11 (1996).

Trees, to 25 m. Twigs angular, appressed pubescent, glabrescent with age. Leaves 5-11 × 2-4.5 cm, obovate or obovate-elliptic, chartaceous, alternate; the base attenuate or acute, the apex obtuse or very shortly acuminate, upper surface glabrous, lower surface glabrous or with some appressed hairs along the midrib; lateral veins 5-7, arching upwards near the margin, but not loop-connected, these and tertiary venation immersed on both surfaces; petioles 6-9 mm. Inflorescences 2.5-6 cm, in the axils of cataphylls, paniculate-cymose or racemose, grey or brown-pubescent; bracts not present at anthesis. Flowers 8-10 mm in diameter, greenish; the tepals 3-4 mm, spreading, puberulent outside, inside glabrous near the base, papillose towards the apex, glands almost completely fused, together with the stamens forming a dome-shaped disc, the anthers at the surface of the disc, the cells lateral; pistil, c. 3 mm, glabrous; receptacle (sparsely) pubescent inside. Fruit 3.5 × 1.7 cm, ellipsoid; cupule 1 × 1.5 cm, deeply cup-shaped, usually split in 3 parts, with a few coarse lenticels, dried glands and stamens frequently present at the rim of the cupule. *Wet lowland forests*. CR (*Guindon 48*, MO). 700 - 1500 m. (Endemic.)

This species can be confused with *Pleurothyrium immersum*, but the latter species differs in having elliptic leaves with rather conspicuous gland dots on the upper surface, and an acuminate apex, flowers c. 5 mm in diameter, and in having the inner surface of the tepals uniformly pubescent.

3. *Pleurothyrium hexaglandulosum* van der Werff, *Ann. Missouri Bot. Gard.* 75: 417 (1988). Holotype: Panama, *Hammel & Trainer 14781* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 80: 81, t. 27 (1993).

Trees, 6 m. Twigs terete, densely tomentulose. Leaves 30-45 × 10-15 cm, obovate, chartaceous, alternate, gradually narrowed towards the base, at the base abruptly rounded or cordate, the apex acuminate; upper surface glabrous, lower surface with some small, appressed hairs, especially along midrib and lateral veins; lateral veins 14-16, prominently loop-connected in the upper 2/3 of the lamina; midrib and lateral veins immersed on the upper surface, raised on the lower surface; petioles c. 5 mm, thick.

Inflorescences to 65 cm, in the axils of cataphylls, paniculate-cymose, brown pubescent; bracts lacking at anthesis. Flowers c. 10 mm in diameter, green, turning yellow with age; tepals c. 4 mm, elliptic, spreading, densely pubescent outside, glabrous inside except for the linear pubescent areas where the inner surface was not tightly pressed against the glands and stamens in bud; glands enlarged but not fused into a dome-shaped disc and not tightly enclosing the stamens; the anthers raised above the glands, the cells introrse-lateral; pistil 1.5 mm, puberulous; receptacle shallow, pubescent inside. Fruit and cupule unknown. *Wet lowland forests*. CR (*Croat & Grayum 59792*, MO); P (*Hammel & Trainer 14781*, MO). 50-250 m. (Endemic.)

Pleurothyrium hexaglandulosum is only known from the two cited collections. Characteristic are the large, obovate leaves, large inflorescences and the short, thick petioles. The collection from Costa Rica differs from the Panamanian type in having nearly glabrous twigs, in its shorter and less pubescent inflorescences and in a slightly different indument on the inner surface of the tepals. In other characters the two collections agree. Once more collections are available, it will be possible to determine if the plants from Costa Rica form a different taxon.

4. *Pleurothyrium immersum* van der Werff, *Ann. Missouri Bot. Gard.* 80: 118 (1993). Holotype: Costa Rica, *Herrera & Fallas 4638* (MO!).

Trees, to 20 m. Twigs terete, finely grey, appressed pubescent. Leaves 5-9 × 1.5-2.5 cm, elliptic, firmly chartaceous, alternate, the base acute, the apex acuminate or acute; upper surface glabrous; lower surface with scattered appressed hairs, these denser along midrib, or glabrous; lateral veins 5-6, not loop-connected; midrib slightly raised on both surfaces, otherwise the lateral veins and tertiary venation immersed and scarcely visible; petioles 4-9 mm, finely appressed pubescent. Inflorescences to 5 cm, in the axils of cataphylls or normal leaves, paniculate-cymose, appressed pubescent; bracts sometimes present at anthesis. Flowers c. 5 mm diameter, yellow-green, the tepals 2 mm, elliptic, pubescent on both surfaces; spreading or reflexed; glands strongly enlarged, forming a dome-shaped disc with the stamens, fused; anthers at the surface of the dome, the cells dorsal or dorsal-lateral; pistil c. 1.2 mm, the ovary more or less pubescent;

receptacle pubescent inside. Fruit and cupule unknown. *Wet lowland forests*. CR (Marin 313, MO). (Endemic.)

The only other *Pleurothyrium* species with similarly small leaves is *P. guindonii*, which see for a discussion of the differences. An additional character for *P. immersum* is the presence of rather conspicuous gland dots on the upper leaf surface. Such gland dots are present in all Lauraceae, but they are rarely as obvious as in this species. It is probably more closely related to *P. golfodulcense*, which has a similar flower structure (the glands do not press the outer stamens tightly against the inner ones and the outer stamens are on the outside of the glandular dome) and which also has bracts persistent at anthesis. However, these two clearly differ in leaf and flower size and leaf shape.

5. *Pleurothyrium oblongum* van der Werff, *Novon* 6: 476 (1996). Holotype: Costa Rica, *Estrada 445* (INB).

Trees, 8 m. Twigs terete or slightly angular, glabrous or sparsely appressed pubescent. Leaves 20-45 × 8-16 cm, oblong or elliptic-oblong, chartaceous, alternate, both surfaces glabrous; the base rounded to obtuse, the apex acuminate, the acumen c. 1 cm; lateral veins 10-20, conspicuously loop-connected; venation immersed on the upper surface, the midrib and lateral veins raised on lower surface; tertiary venation immersed on upper surface, weakly raised on lower surface; petioles 15-25 mm, glabrous. Inflorescence (detached) 12 cm, laxly branched, paniculate-cymose, minutely puberulous, more densely so towards the flowers; tepals c. 3 mm, half-erect at anthesis, the outer 3 densely puberulous outside, the inner 3 with a densely triangular patch near the base, otherwise glabrous outside, glabrous or nearly so inside; glands strongly enlarged, but not fused; the outer 6 stamens with the anthers bent inwards, lying on the glands; anther cells lateral; pistil c. 1.5 mm, grey puberulous; receptacle glabrous inside. Fruits 2.5 × 1.5 cm, ellipsoid; cupule c. 1 × 1.5-2 cm, shallowly cup-shaped, with a few warty protuberances. *Wet lowland forests*. CR (*Estrada 445*, MO); P (*Proctor Cooper 539*, F). 200m. (Endemic.)

Pleurothyrium oblongum can be readily recognized by its large, oblong leaves with a strongly developed marginal vein. The single flowering collection has few flowers on a detached piece of the inflorescence, thus the position of the inflorescence and some

details of the flowers (rotate or not, diameter) are not yet known. However, there is no doubt about the generic determination, and the vegetative characters separate it clearly from all other *Pleurothyrium* species.

6. *Pleurothyrium palmanum* (Mez & J.D. Smith) Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 41 (1986). *Ocotea palmana* Mez & J.D. Smith, *Bot. Gaz.* 33: 259 (1902). Type: Costa Rica, *Tonduz 12652* (B!).

Trees, to 30 m. Twigs ridged or terete, tomentulose with brown or yellow-brown hairs. Leaves 10-28 × 7-15 cm, obovate or broadly obovate, firmly chartaceous, alternate, the base cuneate or acute, the apex rounded or with a very short acumen; upper surface glabrous except for the short, erect pubescence along the midrib, lower surface densely tomentulose with erect, yellow-brown to brown hairs; lateral veins 5-9, weakly loop-connected in the distal 1/2 of the lamina; venation immersed on the upper surface or the midrib slightly raised, the midrib and lateral veins raised on lower surface, the tertiary venation weakly raised; petioles 1-2 cm, with similar indument as the twigs. Inflorescences 4-10 cm, in the axils of cataphylls, paniculate-cymose, rarely depauperate and racemose, brown-tomentellous, bracts sometimes persisting at anthesis. Flowers 10-12 mm in diameter, greenish yellow; tepals c. 5 mm, elliptic, spreading, the outer three tomentellous outside, the inner three papillose outside, all tepals papillose inside; glands enlarged, but remaining free, not totally enclosing the outer stamens, the anthers raised above the glands, their cells lateral; ovary c. 1 mm, globose, glabrous; receptacle glabrous inside. Fruit 2 × 1.5 cm, broadly ellipsoid, cupule 1 × 1.8 cm, bowl-shaped, with some coarse warts outside. *Wet montane forests*. CR (*Bello 1277*, MO); P (*Stern et al. 1064*, MO). 1000-1600 m. (Endemic.)

This is the only *Pleurothyrium* species in Mesoamerica with the lower surface completely covered by the indument. Leaf size is variable; the type has leaves to 28 cm, whereas the only collection from Panama has leaves of about 10 cm.

7. *Pleurothyrium pauciflorum* van der Werff & Hammel, *Ann. Missouri Bot. Gard.* 80: 94 (1993). Holotype: Costa Rica, *Hammel et al. 17909* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 80: 95, t. 36 (1993).

Trees, to 35 m. Twigs terete, ferruginous tomentulose. Leaves 16-35 × 7-12 cm, oblong or elliptic, firmly chartaceous, alternate, somewhat grouped near the tips of the branches, the base acute or obtuse, the apex acuminate, the acumen to 2 cm, but the apex frequently damaged; upper surface glabrous or with traces of indument along the midrib; lower surface pubescent with more or less erect hairs, this indument denser along the major veins and midrib, but not completely covering the surface; lateral veins 14-20, loop-connected in the distal 1/2 of the lamina; venation immersed on the upper surface, the midrib and lateral veins raised on the lower surface, the tertiary venation less so; petioles 1.5-5 cm, with similar indument as the twigs. Inflorescences to 3 cm, with up to 7 flowers (usually 3 or 1), in the axils of cataphylls, racemose or paniculate-cymose, ferruginous-tomentulose; bracts sometimes present at anthesis. Flowers c. 8 mm in diameter, the tepals 4-5 mm, elliptic, half-erect, the outer three ferruginous tomentulose outside, the inner 3 papillose except for the tomentulose base, all tepals slightly papillose inside; glands strongly enlarged, fused, forming a dome-shaped disc with the stamens in the center, the anthers at the surface of the dome, the cells lateral-dorsal; pistil 3 mm, the pubescent ovary gradually narrowed into the glabrous style; receptacle deep, more or less pubescent inside. Fruits 3 × 1.5 cm, ellipsoid, cupule 2 × 3 cm, 1.5 cm deep, thick, warty, the tepals persistent on the cupule. *Wet lowland forests. CR (Herrera 4895, MO). 50-600 m. (Endemic.)*

This species is readily recognized by its short, few-flowered inflorescences and the ferruginous indument on young twigs, inflorescences and leaves.

8. *Pleurothyrium pilosum* van der Werff, *Ann. Missouri Bot. Gard.* 80: 96 (1993). Holotype: Panama, *de Nevers et al.* 7520 (MO!).

Tree, size unknown. Twigs angular or terete, reddish brown tomentose, with conspicuous scars of fallen leaves. Leaves 15-25 × 7-13 cm, obovate, chartaceous, clustered at the tips of the branches, the base obtuse to rounded, the apex rounded or very shortly acuminate; upper surface glabrous or with very few scattered reddish hairs, lower surface densely covered with erect, reddish hairs, but the surface visible between the hairs, becoming tomentose along midrib and lateral veins; lateral veins 6-9, strongly arching upward near the margin, but only the distal 2 or 3 loop-connected; venation on

the upper surface immersed, midrib and lateral veins conspicuously raised on the lower surface, the tertiary venation less so; petioles 1.5-3 cm, with similar indument as the twigs. Inflorescences to 15 cm, in the axils of cataphylls, paniculate-cymose, reddish brown tomentose. Flowers at anthesis not known, tepals (present on young fruits) 3 mm, elliptic, densely pubescent on both surfaces; glands strongly enlarged, enclosing the stamens, but not fused, the anther cells lateral; pistil glabrous; receptacle pubescent inside. Young fruits enclosed in the cupule, this 1.5 cm, with 6 longitudinal ribs. *Wet lowland forests*. P (*de Nevers et al.* 7520, MO). 30 m (Endemic.)

Pleurothyrium pilosum is only known from the type collection; it is best recognized by its large, obovate and pilose leaves, the ferruginous tomentose twigs and its leaves with an obtuse base and a rounded apex.

The type collection is in young fruiting stage, and the description of the flowers is therefore incomplete.

9. *Pleurothyrium racemosum* van der Werff, *Ann. Missouri Bot. Gard.* 80: 100 (1993). Holotype: Panama, *McPherson 12120* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 80: 101, t. 38 (1993).

Tree, to 7 m. Twigs terete, brown-tomentose, the indument turning gray in age. Leaves 6-14 × 2.5-4 cm, oblong or oblong-obovate, firmly chartaceous, clustered near the tips of the branches, the base truncate or acute, the apex obtuse or slightly acute; upper surface glabrous or with some brown hairs near the base of the midrib and lateral veins; lower surface sparsely pubescent with brown, curly hairs, the indument denser along the midrib, lateral veins and the margins, becoming tomentose at the base of the midrib; lateral veins 6-9, strongly arching upwards and becoming loop-connected in the distal 1/2 of the lamina; venation immersed on the upper surface, the midrib and lateral veins raised on the lower surface, the tertiary venation scarcely raised; petioles 9-12 mm, brown tomentose. Inflorescences 3-7 cm, in the axils of cataphylls, racemose, brown tomentose, bracts present at anthesis. Flowers 9 mm in diameter, creamy white inside; tepals 4.5 mm, elliptic, spreading, the outer 3 brown tomentose outside, the inner 3 with a triangular tomentose basal patch, otherwise glabrous, outer three with a triangular pubescent basal patch, otherwise glabrous inside, the inner 3 pubescent inside; glands enlarged,

surrounding the stamens, but not fused; the anthers slightly raised above the glands, the cells lateral; pistil 2 mm, glabrous; receptacle rather deep, pubescent inside. Fruits and cupules unknown. *Wet montane forest*. P (McPherson 12120, MO). 900 m. (Endemic.)

Pleurothyrium racemosum is only known from the type collection. Its closest relative is probably *P. pilosum*, from which it differs in its smaller leaves, and in its indument consisting of curly hairs.

10. *Pleurothyrium trianae* (Mez) Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 43 (1986). *Nectandra trianae* Mez, *Jahrb. Bot. Gart. Berlin* 5: 439 (1889). Holotype: Colombia, *Triana 1037* (P). Illustr.: Burger & van der Werff, *Fieldiana Bot., n.s.*, 23: 22, t. 9 (1990).

Trees, to 35 m. Twigs terete or angular, finely appressed pubescent, glabrescent with age. Leaves 8-20 × 3-7 cm, elliptic, (firmly) chartaceous, alternate, the base acute or decurrent on the petiole with the margin inrolled, the apex acute or shortly acuminate; upper surface glabrous, lower surface minutely papillose to puberulous with appressed hairs or glabrous; lateral veins 8-12, not loop-connected; venation immersed on the upper surface, the midrib and lateral veins raised, the tertiary venation immersed on the lower surface; petioles 10-15 mm, with similar indument as the twig. Inflorescences to 12 cm, in the axils of normal leaves or cataphylls, paniculate-cymose, finely appressed pubescent, bracts not persistent. Flowers c. 4 mm in diameter, white; tepals 3 mm, elliptic, erect or half-erect, finely pubescent outside, papillose inside; glands enlarged, free, not or scarcely enclosing the stamens, the anthers raised above the glands, erect, one pair of cells lateral, the other dorsal; pistil 1.5-2 mm, glabrous or slightly papillose on the upper part; receptacle deep, glabrous inside. Fruit 22 × 16 mm, ellipsoid, cupule 15 × 10 mm, warty. *Wet lowland forests*. H (*Soto 613*, MO); N (*Bunting 872*, F); CR (*Hammel et al. 18068*, MO). 0-250 m. (Mesoamerica, Colombia, Venezuela, Ecuador.)

Pleurothyrium trianae is a widespread and somewhat variable species. In its floral morphology (anthers erect, not bent inwards, glands completely free, not enclosing the stamens) it is less advanced than the other *Pleurothyrium* species. The specimens from the Osa Peninsula in Costa Rica are unusual in having the leaf base decurrent on the

petiole and the margin inrolled. In its other characters it fits well in *P. trianae*, and for this reason I prefer not to recognize it as a distinct taxon.

11. *Pleurothyrium westphalii* van der Werff, *Ann. Missouri Bot. Gard.* 74: 410 (1987). Holotype: Guatemala, *Kunkel 9* (BR!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 80: 114, t. 46 (1993).

Trees, to 20 m. Twigs angular, densely appressed pubescent, glabrescent with age. Leaves 15-20 × 4-7 cm, elliptic, membranous, alternate, the base acute, cuneate or somewhat decurrent on the petiole, the apex acute; upper surface glabrous or nearly so; lower surface with some scattered appressed hairs, more densely so along the midrib and lateral veins; lateral veins 5-8, not loop-connected; venation immersed or nearly so on both surfaces; petioles 1 cm, with similar indument as the twigs. Inflorescences 8 cm, in the axils of cataphylls, paniculate-cymose, densely gray-brown pubescent, bracts not present at anthesis. Flowers c. 8 mm in diameter; tepals 4 mm, spreading, tomentulose on both surfaces; glands strongly enlarged, completely surrounding the stamens, fused, the anthers at the surface of the glandular dome, the cells lateral; pistil c. 1.5 mm, glabrous; receptacle rather deep, glabrous inside. Fruit and cupule unknown. *Wet montane forests*. G (*Kunkel 17*, MO). 900-1100 m. (Endemic.)

This is the only *Pleurothyrium* species known from Guatemala and is best recognized by its thin leaves, lateral veins which are not loop-connected and the grey-brown indument of young twigs and inflorescences.

16. *Povedadaphne* W.C. Burger

By H. van der Werff.

Trees. Leaves alternate, pinnately veined, domatia present. Inflorescences axillary, paniculate-cymose, the lateral flowers of the cymes strictly opposite. Flowers bisexual. Tepals equal, free, deciduous in age. Stamens nine, all 4-celled, the outer 6 curving inwards with the locelli arranged in an arc at the tip of the anther, the inner 3 columnar with the locelli arranged in 2 rows on the flattened tip. Fruit subtended by a small, disc-shaped cupule, this with a single margin. 1 sp. Endemic to Costa Rica.

Characteristic for *Povadadaphne* are the stamens with the locelli arranged near or at the tip; thus, all locelli are visible when looking inside the flower. Vegetatively, the genus is indistinctive, the domatia are a useful indicator, but domatia are present in other genera as well.

Bibliography: Burger, W.C. A new genus of Lauraceae from Costa Rica, with comments on the problems of generic and specific delimitation within the family. *Brittonia* 40(3): 275-282 (1988).

1. *Povedadaphne quadriporata* W.C. Burger, *Brittonia* 40(3): 277 (1988).

Ocotea quadriporata (Burger) Kostermans, *Bot. Helv.* 100: 36 (1990). Holotype: Costa Rica, *Poveda & Castro 3561* (CR)

Trees, to 30 m. Twigs somewhat ridged, glabrous or slightly appressed pubescent; terminal buds appressed pubescent. Leaves 7-18 × 3.5-6.5 cm, elliptic, chartaceous, glabrous on both surfaces except for tufts of whitish hairs in the axils of the basal lateral veins on the lower surface, the midrib and secondary veins immersed on upper surface, raised on lower surface, the tertiary venation immersed or nearly so, the base acute or decurrent on the petiole, the margins not thickened, the apex acute or acuminate; domatia present as axillary tufts of hairs; petioles to 1 cm, canaliculate above, rounded below, glabrous. Inflorescences to 15 cm, glabrous or sparsely appressed pubescent. Flowers minutely appressed pubescent on the outside, creamy, tepals c. 1.2 mm, broadly elliptic, glabrous on the inner surface, filaments pubescent, inner stamens with 2 large glands at their base, staminodia absent, pistil c. 2 mm, glabrous. Fruits to 8 × 4 cm, ellipsoid, rough due to many elongated, warty protuberances, seated on a small, disk-like cupule, this c. 15 mm wide. *Wet lowland and montane forests. CR (Robles et al. 2064, MO) 100-1000 m. Endemic.*

17. *Rhodostemonodaphne* Rohwer & Kubitzki

By H. van der Werff.

Trees. Leaves alternate, pinnately veined, domatia absent. Inflorescences in axils of leaves, paniculate-cymose, the lateral flowers of a cyme strictly opposite. Flowers

unisexual. Tepals equal, usually persistent in fruit. Staminate flowers with 9 4-celled stamens, the locelli arranged in an arc or in a horizontal line, the inner 3 stamens with 2 glands at their base, staminodia absent, pistillodes present. Pistillate flowers with 9 staminodia and a well-developed pistil. Fruits seated in a (deeply) cup-shaped cupule with a single margin; remnants of tepals frequently present on the cupule. 36 spp. Costa Rica, Panama, South America.

Characteristic are the unisexual flowers and the stamens with the locelli arranged in a shallow arc or a straight line.

Bibliography: Madrinan, S. A taxonomic revision of the genus *Rhodostemonodaphne* Rohwer & Kubitzki (Lauraceae). Ph.D. thesis, Harvard University (1996).

1. *Rhodostemonodaphne kunthiana* (Nees) Rohwer, *Mitt. Inst. Allg. Bot. Hamburg* 20: 84 (1986). *Acrodiclidium kunthianum* Nees, *Syst. Laur.* 269 (1836).
Holotype: French Guyana, *Poiteau s.n.* (B)

Nectandra kunthiana (Nees) Kosterm. *Ocotea cooperi* C.K. Allen, *O. kunthiana* (Nees) Mez.

Trees, to 25 m. Twigs terete or angular, sparsely to densely brown-tomentellous; terminal buds densely tomentellous. Leaves 12-35 × 6-14 cm, elliptic to oblong, chartaceous, upper surface glabrous, the lower surface tomentellous to sparsely pubescent, the indument often denser along the midrib and lateral veins; midrib and lateral veins (9-14) immersed on the upper surface, the tertiary venation slightly raised, distinctly scalariform, the midrib, lateral veins and scalariform tertiary venation raised on the lower surface; base obtuse, apex acute or acuminate; petioles 10-35 mm, with similar indument as the twigs, canaliculate. Inflorescences 10-20 cm, tomentellous. Tepals 1.5 mm, broadly elliptic, densely pubescent outside, sparsely so inside; staminate flowers with stamens c. 1 mm, pubescent at the base, and a linear pistillode. Pistillate flowers with a well-developed pistil; stigma discoid; staminodes with locelli which remain closed. Fruits 2.5-4 × 1.5 cm, seated in a deeply cup-shaped cupule; tepals not persistent on the cupule. *Wet lowland and montane forests.* N (*Rueda 7527*, MO); CR (*Herrera*

4263, MO); P (*Cooper 489*, F). 50-1000 m. (Mesoamerica, Colombia, Venezuela, Guyanas, Ecuador, Peru, Bolivia, Brasil.)

18. *Williamodendron* Kubitzki & Richter

By H. van der Werff.

Trees. Leaves alternate, strongly clustered at the tips of the branches, pinnately veined; domatia absent. Inflorescences axillary, paniculate-cymose, the lateral flowers of the cymes strictly opposite, but frequently lateral flowers of a cyme lacking, thus part of the inflorescence appearing racemose. Flowers bisexual. Tepals equal or nearly so, free, persistent in the fruiting stage. Stamens 3, 4-celled, the cells apical-extrorse, arranged in 2 rows. Fruits without a cupule, only subtended by the small, persistent tepals. 3 sp., Costa Rica to southern Brazil.

This genus can be readily recognized by its 3, 4-celled stamens, the clustered leaves with long petioles and the lack of a cupule. It is closely related to *Mezilaurus* which has 3 2-celled stamens and a different wood and bark anatomy.

Bibliography: Kubitzki, K. & Richter, H.G. *Williamodendron* Kubitzki & Richter, a new genus of neotropical Lauraceae. *Bot. Jahrb. Syst.* 109: 49-58 (1987).

1. Lower leaf surface, petioles and young twigs with a minute, appressed indument; surface of petioles and young twigs visible.

1. *W. glaucophyllum*

1. Lower leaf surface with scattered, erect hairs; petioles and young twigs with a dense, erect indument, surface of petioles and young twigs completely covered by indumenta.

2. *W. sp. A*

1. *Williamodendron glaucophyllum* (van der Werff) Kubitzki & Richter, *Bot. Jahrb. Syst.* 109: 58 (1987). *Mezilaurus glaucophylla* van der Werff, *Ann. Missouri Bot. Gard.* 74: 164 (1987). Holotype: Costa Rica, *Zamora & Poveda 1014* (MO!). Illustr.: van der Werff, *Ann. Missouri Bot. Gard.* 74: 165 (1987).

Trees, 10-25 m. Twigs thick, terete, the young parts minutely appressed pubescent, scars of fallen leaves conspicuous; terminal buds densely and minutely

appressed pubescent. Leaves 14-30 × 7-15 cm, obovate to oblong-obovate, chartaceous, the upper surface glabrous, the lower surface minutely and rather sparsely appressed pubescent, glaucous, the upper surface with midrib and lateral veins immersed, the tertiary venation slightly raised, the lower surface with midrib and lateral veins raised, tertiary venation immersed; the base acute, often unequal, the apex obtuse to short-acuminate; petioles 3-8 cm, minutely and sparsely appressed pubescent, more or less terete. Inflorescences 6-20 cm, appressed pubescent. Flowers glabrous; tepals c. 0.6 mm, glabrous inside; stamens c. 1 mm; staminodia 3, 0.8 mm, pubescent, pistil c 1.2 mm, glabrous. Fruit 3 × 1.7 cm, ellipsoid, smooth; pedicels not thickened under the fruit. *Wet lowland forests. CR (Hammel et al. 17035, MO). 50-400 m. (Endemic).*

Diagnostic are the large, glaucous, obovate leaves clustered near the tips of the branches with long petioles.

2. *Williamodendron* sp. A

Tree, 15 m. Young twigs densely brown-pubescent, the indument short, erect, completely covering the surface; scars of fallen leaves conspicuous; terminal bud densely brown-pubescent. Leaves 30-45 × 12-18 cm, elliptic or elliptic-obovate, chartaceous, upper surface glabrous except for the pubescent midrib, lower surface with midrib and lateral veins brown-tomentellous, the lamina with a sparser, erect indument, the base acute, sometimes unequal, the margins tomentellous, the apex shortly acuminate; the venation on upper surface immersed or slightly raised, lower surface with midrib and lateral veins raised, tertiary venation slightly raised; petioles 5-9 cm, densely brown-tomentellous. Flowers and fruits unknown. *Wet lowland forests. P (de Nevers et al. 7522, MO). 30 m. (Endemic.)*

This species is only known from one sterile collection. It differs clearly from the other *Williamodendron* species in its indument. It may belong to *Mezilaurus*, but again, it differs from the known *Mezilaurus* species in its indument. Flowering material is needed for a complete description.