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64. JUGLANDACEAE

Family description and key to genera by D.E. Stone.

Trees or rarely large shrubs, deciduous or evergreen; buttresses absent or present; bark light or dark, smooth or rough, tight or exfoliating. Pith solid or chambered. Terminal buds enlarged and protected by scales, or undeveloped and naked. Leaves compound, alternate, opposite (decussate), or occasionally whorled, odd- or even-pinnate; petioles and rachises short to long, glabrous or pubescent and peltate scales sparse or abundant; leaflets [1] 5-32, sessile or petiolulate, blades ovate-lanceolate, rounded to truncate and flat or revolute and with or without auricles at base, margins entire or serrate, upper surfaces glabrous to lightly pubescent, lower surfaces glabrous or pubescent, peltate scales sparse to dense. Plants monoecious; flowers unisexual and highly reduced; wind pollinated. Inflorescences with staminate and pistillate flowers separate or together, erect or pendent; staminate catkins single or in clusters of 3 [-10+], often lateral on old wood or clustered at the base of new wood (growth); pistillate catkins terminal, erect [or pendent]. Staminate flowers numerous; bract of floral envelope 1- or 3-lobed; bracteoles 2 [or absent]; receptacles round or elongate; sepals 0-4, flat or hooded; stamens (3-) 4-100+ in one to several series. Pollen small, 14-16 μm , medium, 17-26 μm , or large, 28-60+ μm ; pores 3-many, distribution equatorial, subequatorial or heteropolar. Pistillate flowers few to numerous; bract of floral cup, with or without pedicel, unlobed or 3-lobed, fused to two bracteoles, or bracteoles absent; sepals 0-4, fused below with ovary, free above; inferior ovary of 2 carpels, glabrous or pubescent; ovule with single integument, erect, located at apex of incomplete partition; style 1, obsolete to long, bifurcate with shallow to deep clefts; stigmas short or long, 2-4 parted, carinal (stylar arms orthogonal to primary partition) or commissural (stylar arms parallel to primary partition). Fruit a drupaceous nut or [2-] 3-winged nutlet with small or large wings, spheroid to ellipsoid, incompletely [2-] 4- or 8-chambered; husks absent or present, glabrous or pubescent, smooth, rough or corrugated, remaining attached or separating from the nut; shell thin (c 1 mm) or thick (c 4 mm); seed solitary, germination hypogeal [or epigeal]. Seedlings

with first aerial leaves alternate or opposite, and simple or compound. 8-9 gen., aprox. 60 sp. North America, Mesoamerica, South America, Caribbean, Asia.

Concentradas en las regiones templadas de Asia y Norteamérica, pero unos pocos taxones se extienden hacia el sur por las zonas montañas del sureste de Asia, las Antillas, Centro y Sur América; 3 géneros y 9 especies nativas se encuentran en Mesoamérica.

Bibliografía: Manning, W.E. *Fl. Guat.* 24(3): 352-359 (1952); *Fl. Pan.* 47: 90-92 (1960a); *Amer. J. Bot.* 25: 407-419 (1938); 27: 839-852 (1940); 35: 606-621 (1948); *Ann. Missouri Bot. Gard.* 65: 1058-1087 (1978). Manos, P.S. y Stone, D.E. *Ann. Missouri Bot. Gard.* 88: 231-269 (2001). Manos, P.S., Soltis, P.S., Soltis, D.E. Manchester, S.R., Oh, S-H, Bell, C.D., Dilcher, D.L. y Stone, D.E. *Syst. Biol.* 56: 412-430 (2007). Stone, D.E. *Fieldiana, Bot.* 40: 28-53 (1977). Stone, D.E. *Novon* 20: 215-224 (2010). Stone, D.E. y Broome, C.R. *World Pollen and Spore Flora.* 4: 1-35 (1975).

1. Terminal buds enlarged and covered with protective scales; leaves alternate, odd-pinnate, or rarely even-pinnate; nuts [2-] 4-chambered.
2. Shoots with solid pith; staminate catkins in clusters of 3 at base of new growth; fruit dehiscent, husk readily splitting into 4 valves. **2. Carya**
2. Shoots of last year's growth usually with chambered pith; staminate catkins solitary on old wood; fruit indehiscent, husk not splitting when ripe (except cultivated *J. regia*). **3. Juglans**
1. Terminal buds undeveloped, without scales (naked); leaves mainly opposite, sometimes whorled, or occasionally alternate in sucker shoots, even-pinnate; nuts and nutlets 8-chambered.
3. Fruit an indehiscent nut. **1. Alfaroa**
3. Fruit a 3-winged nutlet. **4. Oreomunnea**

1. Alfaroa Standl.

By D.E. Stone.

Trees or rarely large shrubs, evergreen; buttresses absent to moderately large; bark dark, rough with congested lenticels, tight or with small, exfoliating chips. Pith solid. Terminal buds undeveloped, naked. Leaves opposite, occasionally whorled, or infrequently alternate, even-pinnate; petioles and rachises short to long, glabrous or pubescent, peltate scales sparse

to abundant; leaflets 6-24 (-32), even-pinnate, sessile or petiolulate, blades truncate to obtuse at base, flat or revolute on one or both margins, without auricles, margins entire or serrate, upper surfaces glabrous, lower surfaces glabrous or pubescent, peltate scales sparse to dense. Inflorescences borne terminally on main axis with pink flushes of new growth, or sometimes terminal on axillary shoots of old wood; staminate and pistillate catkins either separate and terminal, or combined in an androgynous panicle, with a cluster of pendent staminate catkins subtending the terminal, erect pistillate catkin. Staminate flowers with bracts 3-lobed; receptacles round or elongate; sepals 4-7, flat or hooded; stamens 6-12 in one series. Pollen medium size, triplicate, equatorial. Pistillate flowers numerous; abaxial bract forming 3-lobed floral cup, with or without stalk, 2 bracteoles forming adaxial rim; sepals 4, arched to house the stigmas and style; ovary glabrous or pubescent; styles obsolete to long, bifurcate with shallow to deep clefts; stigmas short, weakly 4-parted, horseshoe shaped, carinal. Fruit a drupaceous nut, medium to large, ellipsoidal to spheroidal; incompletely 8-chambered; husks present, glabrous or pubescent, sometimes glaucous, smooth, rough, or corrugated, remaining tightly attached to the nut; shell thin or thick. Seedlings with first aerial leaves opposite, simple or compound, entire or serrate. 5 spp., 5 spp. in Mesoamerica, 2 in Mexico, and 1 in Colombia.

Bibliografía: Manning, W.E. *Bull. Torrey Bot. Club* 76: 196-209 (1949a); 86: 190-198 (1959). *Ann. Missouri Bot. Gard.* 47: 90-92 (1960b); Stone, D.E. *Sida* 3: 352-355 (1969); *Fieldiana, Bot.* 40: 28-53 (1977); *Novon* 20: 215-224 (2010).

1. Leaflet margins entire on most adult leaves, serrations always present on seedlings, saplings and sucker shoots, lower surfaces glabrous or hirsute, peltate scales scarce to medium density; fruit sessile, ellipsoid to ovoid, small to medium, 2-3 x 1.5-2 cm, husks smooth to roughened by faint longitudinal ridges, without conspicuous lenticels, glabrous or pubescent, sometimes glaucous, husk + shell 1-2 mm, cartilaginous; seedlings with first aerial leaves compound.

2. Petioles short, 0.5-1 (-2) cm, densely or lightly hirsute; rachises densely or lightly hirsute; leaflets (8-) 12-18 (-32), sessile or petiolule to 3 mm, bases truncate, rounded or tapered, lower surfaces pubescent or glabrous, peltate scales sparse to moderate; basal leaflets greatly reduced, often less than one-third the length of the longest leaflets; female flowers densely or lightly hispid; fruit hispid or glabrous.

3. Leaflets on lower surfaces of mature trees pubescent, sucker shoots and saplings often glabrous; petioles and rachises densely hirsute; petiolules 0-1 mm; leaflet bases truncate or rounded; female flowers densely hispid; fruit densely hirsute, becoming glabrous on weathering (Costa Rica, Panama).

1a. *costaricensis* subsp. *costaricensis*

3. Leaflets on lower surfaces glabrous at all stages, petioles and rachises lightly hirsute, petiolules 0-3 mm, leaflet bases tapered to rounded; female flowers lightly hispid; fruit glabrous; (Mexico, Guatemala).

1b. *A. costaricensis* subsp. *septentrionalis*

2. Petioles long, (1.5-) 2-5 (-7) cm, usually glabrous; rachises usually glabrous; leaflets (6-) 8-12 (-16), sessile to short-petiolule, 0-2 (-3) mm, bases tapering to rounded, lower surfaces glabrous, peltate scales dense, thinning on weathering; basal leaflets slightly reduced, though never less than one-third the length of the longest leaflets; female flowers glabrous; fruit glabrous.

4. Staminate flowers with receptacles elongate; stamens 6-11; sepals (floral segments) 4-7. (Nicaragua)

5a. *A. williamsii* subsp. *williamsii*

4. Staminate flowers with receptacles round to oblong; stamens (6-) 8 (-9); sepals (floral segments) mainly 4. (Costa Rica, Panama?)

5b. *A. williamsii* subsp. *tapantiensis*

1. Leaflet margins entire in all stages of growth, lower surfaces mainly glabrous, peltate scales dense, thinning out on weathering; fruit pedicellate, oblong, ellipsoid to spheroid, medium to large, 3-6 x 2-4 cm, husks with faint to pronounced longitudinal ridges and with or without conspicuous lenticels, glabrous, not glaucous, husk + shell 2-4 mm, hard; seedlings with first aerial leaves simple or compound.

5. Leaflets revolute at base on one or both margins, enfolding a dense cluster of hairs; husks with faint longitudinal ridges, without conspicuous lenticels (Guatemala, Mexico)

4. *A. mexicana*

5. Leaflets flat at base, glabrous; husks with low to high longitudinal ridges, with or without conspicuous lenticels.
6. Small to medium size fruits, 4-3 x 2-1.5 cm; husks variable, with low to high pronounced longitudinal ridges (corrugated) (Costa Rica). **3. A. manningii**
6. Large fruits, 5 x 4 cm; husks with conspicuous lenticels (pockmarked) that mainly obscure the faint longitudinal ridges (Guatemala, Honduras) **2. A. guatemalensis**

1. *Alfaroa costaricensis* Standl., *J. Wash. Acad. Sci.* 17: 78 (1927a). Holotipo: Costa Rica, *Standley 33620* (US!). Ilustr.: Stone, *Fieldiana, Bot.* 40: 31, t. 6a-d (1977).

Trees or large shrubs to 23 m tall and 90 cm dbh; buttresses small or absent; bark tight, warty. Leaves opposite, occasionally whorled, or infrequently alternate; petioles 0.5-1.5 (-2) cm, hirsute; rachises 10-15 (-30) cm, hirsute; leaflets (8-) 12-24 (-32), lower most ones conspicuously reduced over the longest ones, less than one-third the length of the longest, and the tiny basal pair often obscured or lost, sessile to petiolules 1-3 mm, blades at base truncate, rounded, or tapered, flat or sometimes broadly revolute, margins on mature trees entire or sometimes serrate, but coarsely serrate on sucker shoots, seedlings, and saplings (*Mori 6776*, DUKE), upper surfaces glabrous, lower surfaces pubescent with unicellular hairs, or a mixture of unicellular and multicellular hairs, or glabrous on mature trees, sometimes glaucous, peltate scales sparse or medium density, saplings and seedlings glabrous. Staminate flowers with pedicels and receptacles elongate; sepals 4-7, flat and reflexed at maturity to expose stamens; stamens 6-11. Pollen 24-26 μm . Pistillate flowers hirsute, peltate scales dense, styles elongate, bifurcate, shallow to deep clefts. Fruit sessile, ellipsoid to ovoid, 3 x 2-2.5 cm; husks glabrous or hirsute, becoming glabrous on weathering, sometimes glaucous, husk + shell 1-2 mm, cartilaginous. Seedlings with first aerial leaves opposite, compound. *Selvas altas perennifolias*. Ch-G, CR-P. 1100-3200 m. (Endemic.)

1a. *Alfaroa costaricensis* subsp. *costaricensis* N.v.: Gaulín.

Petioles and rachises densely hirsute; leaflets (8-)12-24 (-32), margins on mature trees mainly entire, bases truncate or rounded, sometimes broadly revolute, petiolules 0 to 1 mm, lower surfaces pubescent, hairs mainly limited to veins, peltate scales light density. Staminate flowers with pedicels elongate [1-2 (8) mm]. Pistillate flowers densely hispid. Fruit densely hispid, but often becoming nearly glabrous on weathering. Seedlings densely

hispid on stems, petioles, and rachises. Flowering Jan.-Mar., May-Aug., Nov.; Fruiting throughout year. $2n = 32$. *Selvas altas perennifolias*. CR (Stone 2352, DUKE); P (Hammel et al. 11366, DUKE). 1100-2300 m. (Endemic.)

1b. *Alfaroa costaricensis* subsp. *septentrionalis* D.E. Stone, *Novon* 20: 215 (2010).
Holotipo: Guatemala, Stone 2210 (DUKE!).

Petioles and rachises lightly hirsute; leaflets 14-26, margins on mature trees entire to irregularly serrate, bases tapered, flat, petiolules 0-3 mm, lower surfaces glabrous, or sometimes only midribs and secondary veins pubescent; leaflet margins of saplings and sucker shoots finely serrate, upper and lower surfaces glabrous, light density of peltate scales. Mature staminate flowers unknown. Pistillate flowers lightly hirsute. Fruit glabrous, or rarely with a few hairs at base (Sousa 3619, DUKE). Seedlings lightly hispid on stems, petioles, and rachises. Flowering Jan., Nov.; Fruiting Mar., May, Sep., 1200-1700 m. $n = 16$. *Selvas altas perennifolias*. Ch (Breedlove 52670, DUKE); G (Stone 2210, DUKE). (Endemic.)

Alfaroa costaricensis subsp. *septentrionalis* has been collected infrequently in Mexico (Chiapas, Veracruz) and Guatemala (Quetzaltenango). Specimens from saplings and adult trees are reminiscent of juvenile foliage of subsp. *costaricensis* in that they both have narrow leaflets, and conspicuous serrations. However, in *A. costaricensis* subsp. *septentrionalis* the majority of the leaflets have oblique or attenuate bases (vs. truncate or rounded), generally longer petiolules (0-3 vs 0-1 mm), the lower leaflet surface is glabrous (vs. pubescent), and the fruit is glabrous (vs. pubescent). When Manning (1952) examined the sterile specimens collected by Standley (86967 [A], 86985 [US]) on the road between Finca Pirineos and Patzulín he noted that “it is to be expected that the Guatemalan tree represents a distinct species...” even though “it has been impossible to suggest any definite character by which two species can be distinguished...” because the “foliage of Costa Rican trees is highly variable in pubescence, serrations, and other details” (Manning, 1952: p. 354). While his comments are correct and the differences noted above may seem slight, the northern subspecies, as noted above, looks dramatically different from the archetypal subsp. *costaricensis* (Standley 33620, US) on which the genus is based (Standley, 1927a).

A few specimens from Costa Rica do not fit the archetypal description of *Alfaroa costaricensis* subsp. *costaricensis* (Manning, 1959). Most of these specimens are sterile, coming from stump sprouts or saplings, but one with excellent staminate flowering material

(*Skutch 4685*, US) is the type of *A. costaricensis* var. *elongata* Manning (1949a). This Varablanca (Heredia) specimen differs principally in its longer petioles (2-3.5 cm) and glabrous petioles and rachises. In these respects this variety tends toward *A. williamsii*, which had not been named when Manning published *A. costaricensis* var. *elongata*. And again in *Morales 6990* (INB) from the headwaters of the Río Damitas (Pacífico Central de Puntarenas) there are plants with long petioles (5-6 cm) typical of *A. williamsii*, but they are clothed with a reddish hirsuteness characteristic of *A. costaricensis*. Some collections from the vicinity of the Río Navarro (Cartago) (*Stone 3379* DUKE; *Utley y Utley 2195*, DUKE) and Tapantí (Cartago) (*Stone 2344, 3358*, DUKE) also have the overall appearance of *A. williamsii*, with certain characteristics tending toward *A. costaricensis* subsp. *septentrionalis* (e.g., pubescence, somewhat shorter petioles, smaller size of the lowermost leaflets). Since several of these specimens occurred in the vicinity of the putative parents, they are provisionally categorized as hybrids between *A. williamsii* and *A. costaricensis*.

2. *Alfaroa guatemalensis* (Standl.) L.O. Williams et Ant. Molina, *Fieldiana, Bot.* 32: 208 (1970). *Engelhardia guatemalensis* Standl., *Field Mus. Nat. Hist., Bot. Ser.* 22: 12 (1940). Holotipo: Guatemala, *Standley 70477* (F). Ilustr.: Manning, *Bull. Torrey Bot. Club* 86: 196, t. 1 (1959).

Alfaroa hondurensis L.O. Williams, *Bull. Torrey Bot. Club* 86: 194 (1959).

Trees to 30 m tall and 100 cm dbh; buttresses absent to small; bark tight, warty (*Stone 2769*, DUKE). Leaves opposite; petioles 3.5-7 cm, glabrous; rachises 7-12 (-15) cm, glabrous; leaflets (6-) 8-12 (-14), lower ones only slightly reduced over the longest ones, petiolules 3-8 (-10) mm, blades cuneate to obtuse at base, slightly decurrent on petiolule, flat, margins entire from seedling stage to adult, glabrous, not glaucous, peltate scales dense, becoming sparse on weathering. Staminate flowers with pedicels obsolete, receptacles round; sepals 4, curved inward at tips to enfold triplets of stamens in protective hoods; stamens 12 (-14) (*Stone 2769*, DUKE). Pollen 14-15 μm (*Stone 3527, 3532*, DUKE). Pistillate flowers with glabrous ovaries; styles short to obsolete, clefts very shallow (*Stone 2769*, DUKE). Fruit pedicellate, oblong to spheroid, compressed laterally, large 4.5-6.1 x 3-3.5 cm; husk surface roughened with congested lenticels, glabrous; husk + shell to 5 mm (*Stone 2999, 4362*, DUKE). Seedlings with first aerial leaves opposite, simple (?) or compound (?). Flowering Jan., Jun.-Jul.; fruiting Feb.-Mar., May, Sep. *Selvas altas perennifolias*. G (*Stone*

2999, DUKE); H (*Allen y Chable 6573*, DUKE); ES (Paulson & Linares, 2011:720). 1200-12200 m. (Endemic.)

Based on fruit characteristics, *Alfaroa guatemalensis* and *A. mexicana* are reasonably distinct in their own right from *A. manningii* of Costa Rica, although sterile material is difficult to distinguish. It does seem however that the adult trees of the two northern species can be told apart by differences in the leaflet bases: the lower surfaces of *A. guatemalensis* are glabrous and the margins are essentially flat, whereas *A. mexicana* has hairs clustered between the midribs and the revolute margins. The roughened (lenticellate) surface texture of *A. guatemalensis* fruits is not found in any of the other entire-leaflet species. The nomenclature of *A. guatemalensis* has a tortured history. The type specimen from Guatemala, which is sterile, was originally thought to be a member of the genus *Engelhardia* (= *Oreomunnea* Oerst.), but when fruits that lacked wings (*Williams et al 40963*) were later collected in the same area, Williams and Molina (1970) recognized it as a new member of the genus *Alfaroa*. While they acknowledged it was “related to” *A. hondurensis*, no formal effort was made, until now, to reduce this taxon to synonymy, based on the similarities in both vegetative and fruit characteristics.

3. *Alfaroa manningii* J. León, *Ceiba* 4: 44 (1953). Holotipo: Costa Rica, *León 3649* (CATIE). Ilustr: Stone, *Fieldiana, Bot.* 40: 33, t. h-j (1977). N.v. Gavilán colorado, CR.

Alfaroa guanacastensis D.E. Stone.

Trees to 30 m tall and 90 cm dbh; buttresses small to large, extending to 1-2 m up trunk; bark tight, warty with lenticels (*Stone 2150, 2716* DUKE), or rarely with small chips sloughing off (*Stone 3256*). Leaves opposite, or alternate on saplings (*Stone 1983, 2177C*, DUKE); petioles (1.5-) 2-9 (-11) cm, glabrous; rachises 4-28 (-40) cm, glabrous; leaflets (4-) 8-14 (-18), lower ones only slightly to moderately reduced over the longest ones, petioles (1-) 2-5 (-10) mm, blades cuneate to obtuse at base, slightly decurrent on petiolule, flat, or sometimes slightly revolute, margins entire from seedling stage to adulthood, glabrous, peltate scales dense, becoming sparse on weathering, not glaucous. Staminate flowers with pedicels obsolete, or essentially so, receptacles round (*Stone 2220*, DUKE) or slightly oblong (*Stone 3629*, DUKE); sepals 4, curved inward at tips to enfold triplets of stamens in protective hoods; stamens 12. Pollen 20-23 μm (*León 3331*, BUPL; *Stone 2167, 2211*, DUKE). Pistillate flowers glabrous, short to obsolete styles, very shallow clefts, ovary

glabrous. Fruit pedicellate, oblong or ellipsoid, not compressed laterally, medium, 2-4 x 1.7-3 cm, husk with low to very pronounced longitudinal ridges, glabrous; husk + shell 2-4 mm. Seedlings with first aerial leaves alternate or opposite, simple or compound. Flowering Feb.-Jul.; Fruiting Jan.-Nov. *Selvas altas perennifolias*. CR (Stone 2170, DUKE). 300-1300 m. (Endemic.)

The collection number (3469) of the type in the publication is a typographical error; IICA in publication = CATIE

This species is quite variable in leaf and fruit size and shape, so much so in fact that I described *Alfaroa guanacastensis* as a segregate with relatively shorter petioles, thinner husks, less pronounced ribs on the mature fruit, and a distinct geographic range: Pacific watershed for *A. guanacastensis* versus the Caribbean for *A. manningii*. Subsequent collections of these two taxa, as well as a more comprehensive overview of *Alfaroa* throughout Latin America, makes untenable a clear distinction between these taxa. It appears now like we are dealing with a series of disjunct populations that are characterized by intergrading differences in the sculpture pattern of the fruit husks.

4. *Alfaroa mexicana* D.E. Stone, *Amer. J. Bot.* 55: 477 (1968). Holotipo: Mexico, Veracruz, Stone 2134 (DUKE!). Ilustr.: Stone, *Amer. J. Bot.* 55: 479, t. 1-3 (1968).

Trees to 35 m tall and 1 m dbh; buttresses absent to moderate; bark tight, warty with lenticels (Stone 2211, DUKE). Leaves opposite, or alternate in seedlings (Stone 2135, DUKE); petioles (2.5-) 3-4 (-10) cm, glabrous; rachises (6-) 8-12 (-19) cm, glabrous; leaflets (6-) 10-12 (-22), lower ones only slightly reduced over the longest ones, petiolules (2-) 5-8 (-10) mm, blades cuneate to rounded at base, revolute on one or both margins, margins entire from seedling stage to adult, glabrous, or in adults with dense cluster of hairs at base on lower surface between midribs and revolute margins, not glaucous. Staminate flowers with pedicels obsolete or essentially so, receptacles round; sepals 4, curved inward at tips to enfold pairs or triplets of stamens in protective hoods; stamens 8-12. Pollen 25-26 μm (Stone 2136, DUKE). Pistillate flowers with glabrous ovaries; styles short to obsolete, very shallow clefts. Fruit pedicellate, obloid to ellipsoid, compressed laterally, large, 2-3.5 x 3-5.5 cm, surfaces roughened with faint to low longitudinal ridges, glabrous; husk walls 1-3 (-7) mm, ; shell walls 1-4 mm, hard. Seedlings with first leaves simple. Flowering Feb.-Mar., Nov.;

Fruiting Feb.-May, Sep., Nov.-Dec. *Selvas altas perennifolias*. Ch (Ton 4701, MEXU); G (Stone 2211, DUKE). 731-1700 m. (Mexico [Oaxaca, Veracruz], Mesoamerica.)

This species was previously reported from Veracruz, Mexico based on flowering and fruiting specimens (Stone, 1968; Narave, 1983). However, many of the sterile collections of *Alfaroa* from both Mexico and Guatemala were not identified to species or else were routinely assigned to *Engelhardia guatemalensis*. Collections from Guatemala are reported here for the first time from the western departments of Quetzaltenango (Stone 2211, DUKE) and San Marcos (Stone 2218, DUKE) that have leaves and fruits matching the Veracruz material.

5. *Alfaroa williamsii* Ant. Molina, *Fieldiana, Bot.* 31: 358 (1968). Holotipo: Nicaragua, Williams, Molina y Williams 23717 (F). Ilustr.: Stone, *Fieldiana, Bot.* 40: 31, t. e-i (1977).

Alfaroa colombiana Lozano et al., *A. costaricensis* Standl. var. *elongata* Manning.

Trees to 30 m tall and 90 cm dbh; buttresses absent to moderate; bark tight, smooth to warty. Leaves opposite or occasionally alternate; petioles (1.5-) 2-5 (-7) cm, glabrous or rarely pubescent; rachises (3-) 5-12 (-23) cm, glabrous; leaflets (6-) 8-12 (-16), lower ones only moderately reduced, though never less than one-third the length of the longest ones, petiolules 1-3 mm, blades tapered at base, rounded or even truncate, flat, often asymmetric with basiscopic side decurrent on petiolule, margins mainly entire on mature trees, occasionally with a few small teeth on the apical end, coarsely serrate on sucker shoots, seedlings and saplings, lower surfaces always glabrous, sometimes glaucous, peltate scales dense. Staminate flowers with pedicels obsolete or essentially so, receptacles irregular and elongate or well-defined and oblong; sepals 4, slightly curved at tips to enfold stamens; stamens (6-) 8 (-9). Pollen 23-26 μm (Skutch 4685, A; Stone 3119, DUKE). Pistillate flowers glabrous, peltate scales dense; styles elongate, shallow to deep clefts. Fruit sessile, ellipsoid to ovoid, 2 x 1.5 cm, glabrous, husk + shell < 1 mm, cartilaginous. Seedlings with first aerial leaves opposite, compound. Flowering Feb.-Jun. Fruiting Jan.-May, Aug., Oct.-Dec. *Selvas altas perennifolias*. N-P. 1100-1900(-2300) m. (Mesoamerica, Colombia.)

5a. *Alfaroa williamsii* subsp. ***williamsii***.

Staminate flowers with elongate receptacles; stamens 6-11; sepals + bracteoles 4-7, flat, tips not enfolding the stamens. *Selvas altas perennifolias*. N (Stone 2182, DUKE). 1100-1900(-2300) m. (Endemic.)

5b. *Alfaroa williamsii* subsp. *tapantiensis* D.E. Stone. *Fieldiana, Bot.* 40: 44 (1977). Holotipo: Costa Rica, Stone 3119 (DUKE).

Staminate flowers with oblong receptacles; stamens (6-) 8 (-9); sepals 4 (-5), with the tips slightly enfolding pairs of stamens *Selvas altas perennifolias*. CR (Stone 3624, DUKE); P (McPherson 11826, DUKE). 1100-1900(-2300) m. (Endemic.)

The differences between these two subspecies are subtle at best, relying on the staminate flowers. *Alfaroa williamsii* subsp. *tapantiensis* has less variable flowers with 4 sepals subtending 8 stamens, whereas the staminate flowers of subsp. *williamsii* often have extra floral segments in addition to the 4 sepals, as well as a higher and more variable number of stamens. It has not been possible to assign the Panamanian collections to subspecies because staminate flowering material is lacking. The *Alfaroa* with immature fruit collected by Killip and Smith (19285, GH) in Colombia in 1927 was tentatively identified by Manning (1959) as *A. manningii*, but at the same time he opined that it might represent a new species. Subsequently Molina (1968) described *A. williamsii* from Nicaragua that matches the Killip and Smith collection. Even more recently Lozano et al. (1981) described *A. colombiana* Lozano-C, Hernández-C, Espinal-T, S from Antioquia, Colombia This material also fits the description of *A. williamsii*, though it is clear that the authors were unaware of the Molina article. It is my opinion, therefore, that *A. colombiana* should be reduced to synonymy under *A. williamsii*.

2. *Carya* Nutt. N.v.: nuez

By D.E. Stone.

Trees or occasionally large shrubs, deciduous; buttresses absent; bark ridged and tight with appressed scales or exfoliating with small platelike scales. Pith solid. Terminal buds with psuedovalvate [imbricate or naked] bud scales. Leaves alternate; petioles and rachises long, leaflets 9-13 [3-21], odd-pinnate, sessile or petiolulate, blades sometimes falcate, ovate-lanceolate to cunneate at base, flat, without auricles, margins serrate, upper surfaces

glabrous, lower surfaces glabrous or lightly pubescent [tomentose], peltate scales sparse [abundant]. Inflorescences borne separately with flushes of new growth; staminate catkins in fascicles of 3 [5-8], pendent, at bases of new growth or sometimes on reduced shoots arising on branches of previous year's growth; pistillate catkins terminal, erect. Staminate flowers with bracts 1-lobed (2 bracteoles, posterior); receptacles round; sepals 0 (or rarely 1-2), flat; stamens (3-) 4 (-15) in one series. Pollen [small to] large, 3-pores, subequatorial. Pistillate flowers few, 2-10, without pedicels; bract unlobed, fused to two bracteoles to form involucre around ovary; sepals per se lacking; styles modified into stigmatic disc (with sepal tissue); stigmas short, 2 parted, commissural. Fruit a drupaceous nut, medium to large, ellipsoid [to spheroid], 2-4 chambered at base, wall thin [or thick], husks glabrous, separating from nut into 4-6 valves and typically becoming free from nut at maturity; shell thin [to thick]. Seedlings with first aerial leaves alternate and compound. $2n = 32$ [$2n = 64$]. Approximately 18 species, 1 cultivated in Mesoamerica. Canada, eastern US to southern Mexico, SE Asia.

Bibliografía: W.E. Manning. *J. Arnold Arbor.* 30: 425-432 (1949b). Narave F., H.V. *Fl. Veracruz* 31: 1-30 (1983). Stone, D.E. *Fl. N. Amer.* 3: 417-425 (1997).

1. *Carya illinoensis* (Wangenh.) K. Koch, *Dendrologie* 1: 593 (1869). *Juglans illinoensis* Wangenh., *Beytr. Teut. Forstwiss.* 54 (1787). Type: Wangenh., *Beytr. Teut. Forstwiss.* t. 18, f. 43 (1787). Ilustr.: Elias, *Complete Trees N. Ame.* 280 (1980).

Trees to 44 m tall and 1+ m dbh. Petioles 4-8 cm, glabrous to scurfy with short single hairs or scattered fascicles; leaflets (7-) 9-13 (-17); petiolules 0-7 mm, lower surfaces glabrous to scurfy with short single hairs or scattered fascicles. Pollen large (38-)46-48(-56) μm (Stone 429, 875, DUKE). Fruit 2.5- 6 x 1.5-3 cm; husks thick 3-4 mm, exterior rough, sutures winged; shell thin. Flowering Apr.; mature fruit Apr., Sep.-Oct.. $2n = 32$. *Selvas altas caducifolias*. CR (Gomez s.n, DUKE). (0-)1200-1500 m. (United States, N. Mexico.)

The pecan (nogal) is the single most important native fruit crop in the U.S., and it has been cultivated extensively throughout the world, including Mexico where it is probably native and where plantations are common and prolific nut producers. The extent to which it is grown in Mesoamerica is not known; however, this species has been collected in Mexico as far south as Cerro de San Felipe in Oaxaca, and an isolated stand of trees was discovered in a light gap in a "pristine," oak-dominated forest in southern Costa Rica at 1200-1500 m (Puntarenas, Finca Las Alturas: Gomez s.n., DUKE).

Seed from Illinois was received by William Prince on Long Island in 1762 (Rehder, 1941). An accurate illustration of the leaf based on a plant growing in his nursery appears in Wangenheim, 1787, pl. 18, t. 43 as *Juglans illinoensis*, and this is the type of the species.

3. *Juglans* L. N.v.: Nogál

By D.E. Stone.

Trees [occasionally large shrubs], deciduous; buttresses absent; bark light to dark, smooth to fissured, or deeply furrowed. Pith usually chambered. Terminal buds with pseudovalvate bud scales. Leaves alternate; petioles long, glabrous or pubescent; rachises long, glabrous or pubescent, peltate scales sparse to abundant; leaflets (3-) 5-18 (-21), odd-pinnate, sessile or petiolulate; blades tapered, rounded or truncate [ovate-lanceolate] at bases, flat, without auricles, margins serrate or entire, upper surfaces glabrous or slightly pubescent, lower surfaces glabrous or pubescent. Inflorescences borne separately; staminate catkins single, axillary on old wood, pendent; pistillate catkins erect on new growth. Staminate flowers with dorsal bract 1-lobed, subtending 2 lateral bracteoles; receptacles round or elongate; sepals 4, flat; stamens 10-100+ in one to several series. Pollen medium to large, pores many, heteropolar. Pistillate flowers few 2-5 [-38]; bract unlobed, fused to 2 bracteoles and sepals to form involucre around ovary; sepals 4; styles with 2 elongate recurved branches; stigmas long, 2-parted, carinal. Fruit a drupaceous nut, [small to] large, spheroid, subglobose to pyriform, 4- [2-] chambered at base, glabrous; husk indehiscent or irregularly dehiscent, walls thick; shell thin or thick. Seedlings with first aerial leaves alternate and compound. Approximately 20 spp. SE. Canada, SW. and E. United States, N. Mexico, Mesoamerica, south to northern Argentina, SE. Asia, 2 spp. native and 2 cultivated in Mesoamerica

Bibliografía: Manning, W.E. *J. Arnold Arbor.* 38: 121-150 (1957); *Brittonia* 9:131 (1957b); *Brittonia* 12: 1-26 (1960a). Narave F., H.V. *Flora de Veracruz* 31: 1-30 (1983). Stone, D.E., Oh, S.-H., Tripp, E.A., Ríos G, L.E., y Manos, P.S. *J. Torrey Bot. Soc.* 136: 1-25 (2009).

1. Leaflet margins entire; staminate flowers with elongate receptacles; fruit husk dehiscent.

Native of Central Asia, cultivated throughout the world.

3. *J. regia*

1. Leaflet margins serrate; staminate flowers with round receptacles; fruit husk indehiscent.

2. Leaflets stalked (petiolulate); petioles, rachises, and blades glabrous: Mexico,

Guatemala, Honduras, Nicaragua, commonly cultivated in Mesoamerica.

2. J. olanchana

2. Leaflets very short-stalked or sessile; petioles, rachises, and blades pubescent.
3. Leaflets sessile to short-stalked; petioles and rachises with reddish fuzz of minute glandular trichomes (0.04-0.08 mm); upper surface of blade essentially glabrous, with a scattering of minute glandular trichomes on the midrib; lower surface of blade with minute glandular trichomes and non-glandular fascicles of trichomes on the veins, and single and double non-glandular trichomes concentrated in the vein axils and scattered on the surfaces. Native of Bolivia, Peru, cultivated in Costa Rica.

1. J. boliviana

3. Leaflets sessile; petioles and rachises with reddish coating of capitate-stalked glandular trichomes (0.4 mm) and relatively inconspicuous whitish fascicles of non-glandular trichomes intermixed; upper surface of blade with conspicuous glandular trichomes and fascicles on midrib and secondary veins; lower surface of blade with conspicuous glandular trichomes, fascicles and single and double non-glandular trichomes on the veins and inter-vein surfaces: Guatemala.

4. J. steyermarkii

1. Juglans boliviana (C. DC.) Dode, *Bull. Soc. Dendrol. France* 1909: 211 (1909).

Juglans nigra L. var. *boliviana* C. DC., *Ann. Sci. Nat., Bot.*, sér. 4, 18: 33 (1863). Holotipo: Peru, *Robb* 1894 (K!). Ilustr.: Manning, *Brittonia* 12: 9, t. 5-11 (1960a).

Juglans peruviana Dode.

Trees to 35 m tall and 30+ cm dbh, bark brown with flat scaly ridges and shallow furrows. Petioles c 7 cm, minutely glandular puberulent; rachises c 44 (-60+) cm, minutely glandular-puberulent; leaflets 14-18 (-30), petiolules absent to 3 mm, blades tapered to rounded at bases, margins finely serrate, upper surfaces essentially glabrous, with a scattering of minute glandular trichomes on the midribs, lower surfaces pubescent with minute glandular trichomes and non-glandular fascicles of trichomes on the veins, and single and double non-glandular trichomes concentrated in the vein axils and scattered on the surfaces. Staminate flowers with receptacle round; stamens 50-105 in one to several series. Pollen 30-36 μm (*Knowles s.n.*, BUPL; *Stone 2152*, DUKE), pores 10-13. Fruit to 5 cm, subglobose, husks indehiscent, walls thick; shell thick. Flowering Apr.; fruiting Jan., Mar.–Apr. $2n = 32$.

Selvas altas caducifolias. CR (Stone 4116, DUKE). 500-1800 m. (Mesoamerica, Peru, Bolivia.)

This South American species cultivated in Costa Rica was introduced by the USDA. at Turrialba in 1948 (Manning, 1957b). The seed which came from the Upper Perene valley of Peru, Dept. Junín was first thought to be the more widespread *Juglans neotropica* Diels (Colombia, Ecuador, Peru). Manning's examination of specimens from Turrialba (IICA = CATIE) determined that they were *J. boliviana*. Subsequently seed was made available to interested parties in Costa Rica for testing. The trees at the Wilson Botanical Garden near San Vito de Java (1200 m) are doing well and producing clear, straight boles and abundant fruit during the dry season in Feb.-Mar.

2. *Juglans olanchana* Standl. et L.O. Williams, *Ceiba* 1: 76 (1950). Holotipo: Honduras, Standley 18159 (F). Ilustr.: Stone et al., *J. Torrey Bot. Soc.* 136: 1-25, t. ? (2009)

Juglans guatemalensis Manning.

Trees to 30 (-55) m tall and 1 m dbh; bark dark, tight but deeply furrowed. Petioles (4-)6-7 (-10) cm, glabrous; rachises (14-)16-28(-46) cm, glabrous; leaflets (12-)15-17(-23), petiolules 1-6 mm, blades truncate or broadly rounded above, strongly tapered on lower side, margins serrate, upper and lower surfaces glabrous. Staminate flowers with receptacles round; stamens 60-100+ in one to several series. Pollen c 41 μm (Stone et al. 4363, DUKE), pores 8-14. Fruit 5-6 x 4-5 (-5.5) cm; shell thick, subglobose to pyriform; husks indehiscent, walls thick (0.6-0.9 cm). Flowering Jan.-Mar.; fruiting Mar., Aug.-Oct. *Selvas altas caducifolias*. G (Williams et al. 40700, CAS); H (Standley 18159, F); ES (Renderos s.n., MO); N (Stevens 19731, MO). 100-1400 m. (Mexico, Guatemala, Honduras, El Salvador,

Manning described *Juglans guatemalensis* in 1952, but later determined it was indistinguishable from *J. olanchana*, which had priority, and consequently reduced it to synonymy in 1957. *Juglans olanchana* was an exceedingly common tree in the Alta and Baja Verapaz regions of Guatemala (Williams y Molina, 1970) before coffee fincas expanded to their present state (Loening y Sautter, 2005). Manning (1957a) believed that all walnuts in El Salvador and Nicaragua were planted, and this is certainly close to the situation today in Guatemala. More recent collections, however, would suggest that *J. olanchana* can still be found in the wild as far south as Nicaragua (Stone, 2001). A 1998 collection from El Salvador (Renderos s.n., MO) was made on the summit of Los Mangones (950 m; La

Libertad), and in Matagalpa, Nicaragua this species has been collected along a river in a “subtropical wet forest” (*Neill 2352*, MO) and in “cloud forest remnants” (*Stevens 21663* MO). Neither Costa Rica nor Panama are known to have native walnuts. Although this species has been collected in Monteverde, Costa Rica near “farms and forest patches” (*Haber 11044*, INB), the collector notes that he has “never seen it growing outside of cultivation here, yet” (pers. com.). Black walnuts are native to South America as well, extending from Colombia to northern Argentina (Manning, 1960a; Stone, D.E. et al., 2009). Not far north of the Flora Mesoamericana boundaries, in the states of Colima and Jalisco in the Sierra Madre Occidental, Manning (1957a) identified specimens that he described as *J. olanchana* var. *standleyi* (*Mexia 1438*, NY!). This variety differs in having conspicuously hairy twigs, rachises, and leaflets, and the leaflets are either sessile or have a short petiolule. His statement that “this taxon may prove, upon further study, to be a distinct species” is as valid today as it was over 50 years ago.

3. *Juglans regia* L., *Sp. Pl.* 997 (1753). Lectotype (designated by Nasir, 1972): 1 (LINN-1129.1). N.v.: Persian walnut, English walnut.

Trees to 30+ m tall and 128 cm dbh; bark gray, smooth initially, becoming fissured and rough. Petioles 5-7 cm, glabrous; rachises 20-25 cm, glabrous; leaflets (3-) 5-9, petiolules absent to 2 mm, blades at base symmetrical or broadly rounded on upper edges and tapered on lower edges, margins entire, or sometimes finely serrate on saplings, upper and lower surfaces glabrous, except for tufts of hairs in vein axils. Staminate flowers with elongate receptacles; stamens 6-30 (-40). Pollen 43-49 μm , pores 7-18. Fruit 4-6 cm, subglobose; husks thick, irregularly dehiscent into 4 valves, easily separating from the nut; shells relatively thin. $2n = 32$. Cultivated. G (*de Milián 11*, BIGU). (Native to Eurasia; widely cultivated elsewhere in temperate areas.)

The Persian or English Walnut is a native of the Old World, ranging from Central Asia (Hemery, 1998) to southeastern Europe. It is cultivated widely throughout the world in mild climates from sea level to 3300 m. This distinctive walnut with entire leaflets may well be cultivated in any number of mid elevation sites in Mesoamerica.

Bibliografía: Lu, A, Stone, D.E. y Grauke, L.J., in Wu, Z. y Raven, P.H., *Fl. China* (1999). Hemery, G. E. *Quart. J. Forestry* 92: 153-157 (1998).

4. *Juglans steyermarkii* Manning, *Fieldiana, Bot.* 24: 358 (1952). Holotipo: Guatemala, *Steyermark 51140* (F). Ilustr.: Stone et al., *J. Torrey Bot. Soc.* 136: 1-25, t. ? (2009).

Trees to 18 m and trunk to 135 cm dbh; bark grayish-brown, furrowed, older trees exfoliating narrow strips. Petioles (3-)6-8(-14) cm, pubescent with mixture of reddish capitate-glandular trichomes and whitish single and fasciculate non-glandular trichomes; rachises to 50 cm, pubescence similar to petioles; leaflets (11-)13-18(-21), petiolules essentially absent, blades asymmetrical at base, truncate to broadly rounded, lower margin extending to rachis, upper margin set back 1-5 mm, margins finely serrate, density of pubescence variable from population to population, upper surfaces with capitate-glandular, single and fasciculate trichomes on midrib and secondary veins, lower surfaces with single and fasciculate trichomes on blade and secondary veins, and mixture of fasciculate trichomes and short capitate-glandular trichomes near base of midrib. Staminate flowers with receptacle rounded; stamens 54-76 in one series. Pollen c 39 μm (Stone et al. 4339, DUKE), pores 8-14. Fruit globose to pear-shaped to 5+ cm; husk thick to 1.25 cm; nut subglobose, globose to ovoid, 3.5-4 long, 3.6-3.8 cm wide along the primary partition and wide 3.4-3.5 cm along secondary partition; shell to 5 mm thick, longitudinally furrowed with shallow to moderately deep grooves giving a smooth but bumpy feeling. Flowering Mar.-Apr.; fruiting Oct.-Nov. *Selvas altas caducifolias*. G (Stone et al. 4330-4334, 4338, 4339, DUKE). 1100-1800 m. (Endemic.)

Juglans steyermarkii was known until recently only from the type collection made by Steyermark in 1942. Trees in the vicinity of the type locality near La Libertad were relocated in November 2005, and the range was extended about 20 km northwest to the Guatemalan-Mexican border and 150 km to the southeast along the Cordillera Volcánica del Pacífico (Stone et al., 2009). It is quite likely that this species occurs across the border in southeastern Chiapas. *Juglans steyermarkii* is distinct from *J. olanchana* in a number of ways: the leaflet bases are sessile versus petiolulate and truncate or rounded versus tapering; pubescence on the petiole, rachis and lower leaflet surface versus essentially glabrous; and leaf fall appears to be several weeks later in *J. steyermarkii* than *J. olanchana*. The leaves of *J. steyermarkii* are, however, remarkably similar to *J. boliviana*, *J. hirsuta* Manning that is a narrow endemic of northeastern Mexico (Nuevo León), and *J. olanchana* var. *standleyi* from Colima and Jalisco of western Mexico.

4. *Oreomunnea* Oerst.: N.v.: Gavilán

By D.E. Stone.

Trees or rarely large shrubs, evergreen; buttresses moderately to well developed; bark light or dark, slightly rough, tight or exfoliating in platelets and long strips. Pith solid. Terminal buds undeveloped, naked. Leaves opposite, alternate in saplings (*Stone 1016C*, DUKE); petioles and rachises short to long, glabrous or minutely pubescent; leaflets 4-12, even-pinnate, sessile or petiolate, blades obtuse at base, flat or revolute on one or both basal margins, with or without auricles, margins entire or serrate, upper surfaces glabrous, lower surfaces glabrous or slightly pubescent. Inflorescences borne terminally with pink flushes of new growth, or sometimes terminal on axillary shoots of the old wood; staminate and pistillate catkins either separate and terminal, or combined in an androgynous panicle with a cluster of pendent staminate catkins subtending the terminal, erect pistillate catkins. Staminate flowers with pedicels obsolete, bracts 3-lobed; receptacles round or elongate; sepals 4-6, flat or hooded; stamens 8-12 in one to two series, or 16-19 in two series. Pollen medium size, 3 pores, equatorial. Pistillate flowers numerous, with or without pedicels; abaxial bract forming a 3-lobed floral cup, bracteoles forming an adaxial rim; sepals 4, arched to house the stigmas and styles, or reflexed at pollination; ovaries glabrous; styles short or elongate, bifurcate with shallow to deep clefts; stigmas short, weakly 4-parted, horseshoe shaped, carinal. Fruit 3-winged, wings small or large, nutlet small or large, enveloped by a frontal lobe (prophyllum), spheroid, incompletely 8-chambered; husks absent; shell very thin. Seedlings with first aerial leaves opposite and simple or compound. 3 spp. Mesoamerica and South America.

Bibliografía: Lozano-C.G., et al. *Anales Jard. Bot. Madrid* 52: 13-19 (1994).
Manning, W.E. *Bull. Torrey Bot. Club* 86: 190-198 (1959). Stone, D.E. *Ann. Missouri Bot. Gard.* 59: 297-331 (1972).

1. Bark exfoliating; petioles short (1.3-3.3 cm), base glabrous; leaflets 4-12; petiolules short (0-3 mm); receptacles of male flowers compact, bearing 8-12 stamens; female flowers with short, nearly obsolete style and shallow cleft separating stylar halves; fruits small, lateral wing span to 5 cm; seedlings with first aerial leaves compound.

2. Staminate flowers with rather irregular, elongate receptacles; stamens 6-11; sepals 4-7, opened flat to expose stamens. (Nicaragua.) **1a. *O. mexicana* subsp. *mexicana***

2. Staminate flowers with well-defined, oblong receptacles; stamens (6-) 8 (-9); sepals 4-5, curved at tips to enfold stamens in a partial hood. (Costa Rica, Panama?.)

1b. *O. mexicana* subsp. *costaricensis*

1. Bark tight; petioles long (3.5-6 cm), base pubescent; leaflets 6-8; petiolules long (5-15 mm); receptacles of male flowers elongate bearing 16-19 stamens; female flowers with elongate style and deep cleft separating stylar halves; fruits large, lateral wing span to 13 cm; seedlings with first aerial leaves simple.

2. *O. pterocarpa*

1. *Oreomunnea mexicana* (Standl.) J.-F. Leroy, *Bull. Mus. Hist. Nat. (Paris) sér. 2*, 23: 127 (1951). *Engelhardia mexicana* Standl., *Trop. Woods* 12: 15 (1927b). Holotipo: Mexico, Chiapas, *Rovirosa 1006* (PH!). Ilustr.: Stone, *Ann. Missouri Bot. Gard.* 59: 311 (1968).

Engelhardia nicaraguensis Ant. Molina, *Oreomunnea americana* Lundell.

Shrubs or trees to 40 m tall and 150 cm dbh; buttresses small to medium, occasionally extending to heights of 3 m; bark dark, smooth to sand-paper rough from lenticels, tight or exfoliating in platelets and long strips (*Stone 2141*, DUKE). Petioles short (1.5-) 2-3.5 (-4.5) cm, glabrous or occasionally minutely pubescent; rachises 2-15 cm, glabrous or occasionally minutely pubescent; leaflets (4-) 6-12 (-18), petiolules 0-3 (-6) mm, blades flat at base, auricles most often present on basal margins, margins usually entire on adult trees, serrate on seedlings, saplings, and stump sprouts, midribs sometimes minutely pubescent on upper and lower surfaces. Staminate flowers with pedicels obsolete, round receptacles; sepals 4, hooded; stamens 8-12 in one or two series. Pollen 20-23 μ m. Pistillate flowers with or without pedicels, sepals arching over the stigma at pollination, but later reflexed; styles short, with shallow cleft. Fruit with small lateral wing span, to 5 cm, central wing to 4 cm (tip to branch of laterals), prophyllum to 1.2 cm. Flowering Jan.-Jun., Aug.-Sep.; Fruiting Jan.-Sep., Nov.-Dec. Ch-G, N-P. 600-1900 m. (Mexico, Mesoamerica.)

1a. *Oreomunnea mexicana* subsp. *mexicana*

Female flowers and fruits with conspicuous pedicels 2- 3 mm; pistil oriented parallel to axis of the inflorescence, sepals incurved over the stigma; $2n = 32$. *Selvas altas perennifolias*.

Ch (*Rovirosa 1006*, PH); G (*Lundell y Contreras 19701*, DUKE); N (*Stone 2181*, DUKE), P (*McPherson 12490*, DUKE). 600-1900 m. (Mexico, Guatemala, Nicaragua, Panama.)

1b. *Oreomunnea mexicana* subsp. *costaricensis* D.E. Stone, *Ann. Missouri Bot. Gard.* 59: 320 (1972). Holotipo: Costa Rica, *Stone 2680* (DUKE!).

Female flowers and fruits essentially without pedicels; pistil oriented at 45° angle to axis of the inflorescence, sepals reflexed, stigma exposed. *Selvas altas perennifolias*. CR (*Stone 3632*, DUKE). (Endemic.)

The flower and fruit characteristics that distinguish these subspecies appear distinctive based on a limited number of suitable samples; only one in the case of Panamanian material. However, additional collections may prove these differences to be variable and of minor significance.

2. *Oreomunnea pterocarpa* Oerst., *Vidensk. Meddel. Dansk Nat. Foren. Kjøbenhavn* 3: 34 (1856). Holotipo: Costa Rica, *Ørsted 3778* (C!). Ilustr.: Stone, *Ann. Missouri Bot. Gard.* 59: 297-321, t. ? (1972).

Engelhardia pterocarpa (Oerst.) Standl.

Trees to 60 m tall and 80 cm dbh; buttresses well developed; bark light, tight, smooth to sand-paper rough from lenticels (*Stone 2222*, DUKE). Petioles long 3.5-8 (-13) cm, glabrous or hirsute at base in saplings and stump sprouts; rachises (2.5-) 4-10 (-22) cm, glabrous; leaflets 6-8 (12), petiolules (0-) 5-10 (-15) mm, essentially sessile in saplings and stump sprouts, with pulvinus at attachment point, blades revolute on one or both margins, without auricles, margins always entire from seedlings to adult and stump sprouts, lower surfaces glabrous. Staminate flowers with receptacle elongate; sepals 5-6, flat; stamens 16-19 in two series. Pollen 20-24 µm (*Stone 1346*, DUKE; *León 1819*, CATIE). Pistillate flowers without pedicels, sepals reflexed; style elongate, with deep cleft. Fruits with large lateral wing span to 13 cm, central wing to 11 cm (tip to branch with laterals), prophyllum to 3 cm. Flowering Mar., Oct.- Nov.; Fruiting Jan. -Apr., Jul. *Selvas altas perennifolias*. CR (*Stone 1346*, DUKE); P (*Dressler 6000*, DUKE). 200-1500 m. (Endemic.)

This large 3-wing fruited species is a canopy tree at mid-elevation sites in Costa Rica, such as the Río Peñas Blancas area, Alajuela (*Bello et al. 4529*, DUKE; *Stone 4118*, DUKE) where the annual rainfall approaches 7 m. It is reported now from 6 provinces in Costa Rica

(Alajuela, Cartago, Guanacaste, Heredia, Puntarenas, and San José) and Coclé, Panamá, but from none of the northern Mesoamerican countries. However, *O. munchiquensis* from the western cordillera of Colombia is morphologically very similar (Lozano-C., González y Ruiz-Rodgers, 1994). The principal differences noted between *O. pterocarpa* and *O. munchiquensis* are, respectively, petiole length (3.5-8 versus 6.3-10 cm), petiolule length (5-10 versus 0 mm), petiolule pulvinus (absent versus present), and leaflet base (revolute vs flat). The curious thing is that the distinctive features of *O. munchiquensis* are exactly those found in the juvenile foliage of *O. pterocarpa*. When I broached this subject with co-author Fabio González, he acknowledged “that the measurements...were taken in leaves from sucker sprouts. However, I took care of looking at falling and fallen leaflets from the very same tree (the type) and they look extremely similar in size and shape” (pers. com.). The differences between these two taxa could be spurious or perhaps due to timing in expression of character states. In any case, additional specimens need to be examined to determine the range of variability of *O. munchiquensis* and whether or not it is a valid species.

See also *Vidensk. Meddel. Dansk Nat. Foren. Kjøbenhavn*. 159-173 (1870a), 2 plates; *Vidensk. Meddel. Dansk Nat. Foren. Kjøbenhavn*. 1-3 (1870b) (legends to plates).

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