



Flora of Panama. Part VI. Family 101. Anacardiaceae

Robert E. Woodson, Jr.; Robert W. Schery; Will H. Blackwell, Jr.; Calaway H. Dodson

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FLORA OF PANAMA

BY ROBERT E. WOODSON, JR. AND ROBERT W. SCHERY
AND COLLABORATORS

Part VI

FAMILY 101. ANACARDIACEAE¹

BY WILL H. BLACKWELL, JR. AND CALAWAY H. DODSON
Missouri Botanical Garden, St. Louis, Missouri and
University of Miami, Coral Gables, Florida

Trees or shrubs with resinous bark. *Leaves* alternate, estipulate, imparipinately compound, less frequently trifoliolate or simple. *Inflorescences* paniculate, terminal or axillary, often with numerous flowers. *Flowers* small, actinomorphic, ♂ or ♂ ♀ by reduction; sepals usually 4-5, free or variously connate; petals distinct, typically 4-5, infrequently absent; stamens 5-10(-12), all fertile or occasionally some or most reduced and sterile, the introrse anthers 2-celled and longitudinally dehiscent; disc or nectariferous cushions usually present and intrastaminal, rarely extrastaminal or absent; pistil 1, the ovary superior, (1-)3(-5)-carpellate, 1-locular (rarely 2-5-locular), the ovule solitary (the ovary occasionally with 3 ovules only one of which is functional) and anatropous, the placenta apical, basal or less frequently lateral, the styles 1-5, terminal or excentric, the stigmas typically as many as the carpels. *Fruit* drupaceous or less frequently nut-like, most often dry but occasionally with a fleshy mesocarp; seed solitary, the embryo curved, the endosperm sparse or absent.

A family of 73 genera and about 600 species, chiefly tropical but extending into southern Europe and temperate Asia and America. Ten genera are known to occur in Panama²; eight are native and two are introduced and probably naturalized.

Several members of the family have considerable economic value; a number produce poisonous effluvia responsible for dermatitis in persons allergic to these secretions.

- a. Leaves simple, entire.
- b. Disc extrastaminal; stamens 5; leaf-blades usually acuminate or acute at the apex1. *Mangifera*
- bb. Disc intrastaminal or absent; stamens 7-12; leaf-blades obtuse to rounded or emarginate at the apex.

¹ Assisted by National Science Foundation Grant No. GB-5674 (Principal Investigator, Walter H. Lewis).

² Standley (Contr. U. S. Nat. Herb. **27**: 241, 1928) reported that trees of *Semecarpus anacardium* L. f. were planted at Ancon. The genus *Semecarpus* is not included in this treatment as there is no evidence of its spread in Panama, either by naturalization or cultivation.

- c. Inflorescences paniculate; flowers 5-merous; stamens basally connate; disc lacking; ovule lateral; fruit a reniform nut borne on an accrescent, fleshy pedicel (the hypocarp)2. *Anacardium*
- cc. Inflorescences virtually spicate; flowers 4-merous in Panamanian representatives; stamens free; intrastaminal disc present; ovule apical; fruit an ovoid drupe, the subtending pedicel not accrescent3. *Camposperma*
- aa. Leaves compound (rarely with simple and compound leaves on the same plant).
- d. Stamens 10, twice the number of petals.
- e. Styles 4-5 (if 3, then the flowers red and the inflorescences arising laterally on old wood).
- f. Ovary and styles pubescent; ovary 1-locular; well-developed stamens and pistil not present in the same flower; petals not uncinatate at the tip; leaflets opposite or subopposite4. *Tapirira*
- ff. Ovary and styles glabrous; ovary 3 to 5-locular; well-developed stamens and pistil occurring in the same flower; petals uncinatate at the tip; leaflets frequently both opposite and alternate (often on the same leaf)5. *Spondias*
- ee. Styles 3 or single with a 3-lobed stigma.
- g. Drupes oblique and strongly compressed, the exocarp and mesocarp not separating; calyx cupular, the lobes shallow; petals acute or subacuminatate; stamens and pistil well-developed in the same flower; leaflets petiolulate6. *Mauria*
- gg. Drupes neither oblique nor appreciably compressed, the exocarp deciduous; sepals free or connate only at the base; petals obtuse, rounded or truncate; stamens and pistil not well-developed in the same flower; leaflets sessile or subsessile (rarely with petiolules to 1 mm long)7. *Schinus*
- dd. Stamens 5, equal in number to the petals.
- h. Ovule subapical; the 3 styles separate to the ovary; calyx-lobes strikingly accrescent in fruit; fruit 3-5 times longer than broad; flowers pedicillate; a pistillode not present in ♂ flowers8. *Astronium*
- hh. Ovule basal or affixed laterally near the base; style single or 3-parted only at the apex; calyx-lobes not accrescent in fruit; fruit not more than 1½ times longer than broad; flowers pedicillate or sessile, ♀ or functionally ♂ flowers with a pistillode.
- i. Flowers sessile, each subtended by 3 persistent deltoid bracts; ovule attached laterally near the base; drupes red, the exocarp and mesocarp not separating; inflorescences not densely flowered; seed occupying a relatively small portion of the drupe lumen9. *Mosquitoxylum*
- ii. Flowers with pedicels 1-4.5 mm long, not subtended by 3 persistent deltoid bracts; ovule basal; drupes white, the exocarp deciduous, the mesocarp waxy and with conspicuous dark streaks; inflorescences densely flowered; seed occupying the entire drupe lumen10. *Toxicodendron*

1. MANGIFERA

Mangifera L., Sp. Pl. 200, 1753; Gen. Pl. ed. 5, 93, 1754.

Trees, often attaining great size. *Leaves* petiolate, the blades simple and entire. *Panicles* terminal, large, the bracts deciduous. *Flowers* ♀, the pedicels articulated; calyx-lobes 4-5, imbricate, deciduous; petals 4-5, free or adnate to the disc, imbricate, the nerves often ridged ventrally; stamens usually 5 (rarely 10-12), with 1 fertile and much larger than the rest (rarely with 2, 3 or all 5 fertile);

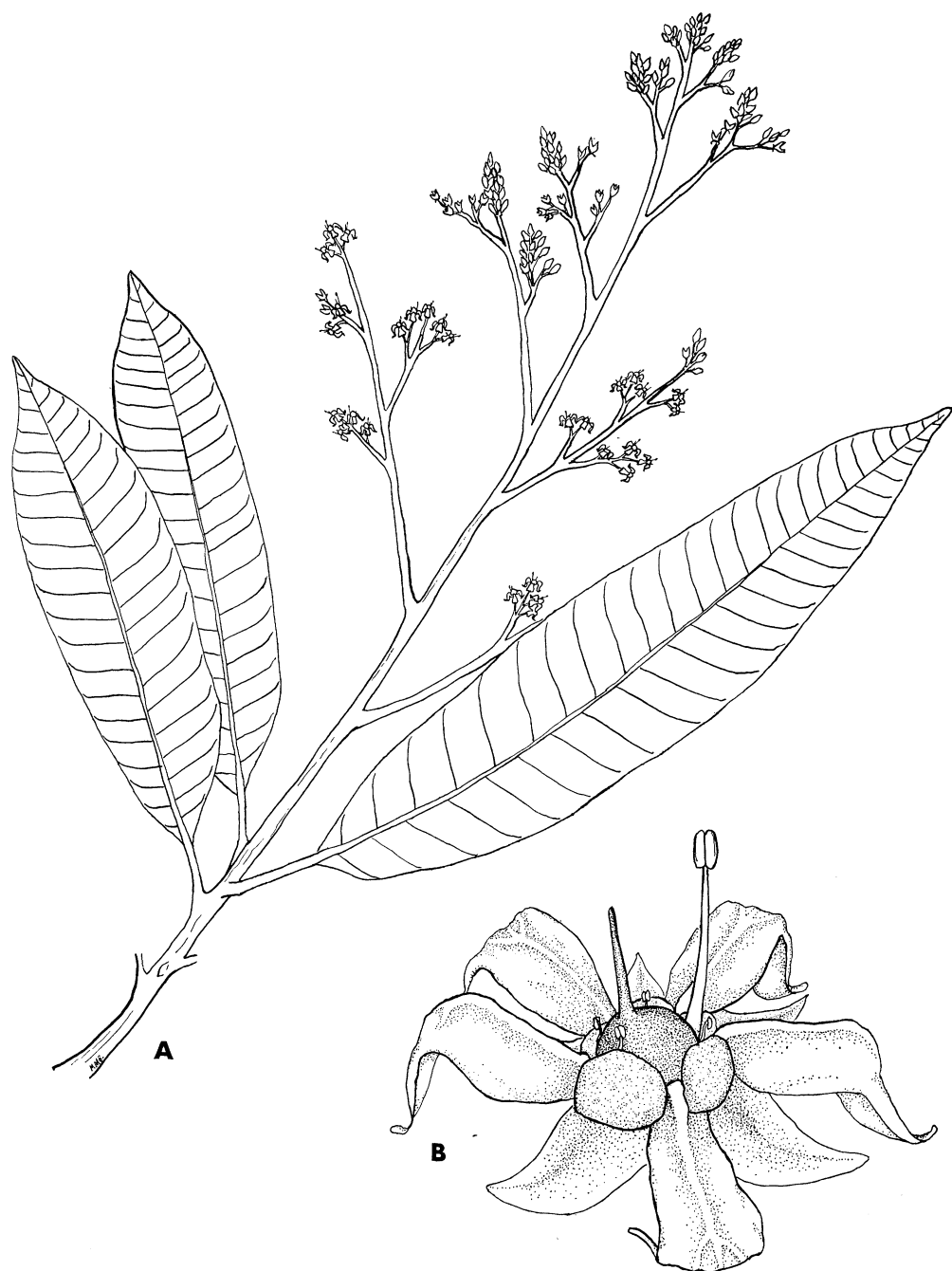


Fig. 1. *Mangifera indica* L.: A, habit ($\times\frac{1}{2}$); B, flower (ca $\times 10$). A after White 282 (MO); B after Lewis et al. 696 (MO).

disc extrastaminal, 4-5-lobed, tumid or less frequently much reduced; ovary 1-carpellate, 1-locular, the solitary ovule affixed just above the base of the locule, the style excentric. *Fruit* a fleshy drupe with a large, compressed seed.

A genus of about 53 species indigenous to tropical and subtropical Asia; one species is cultivated throughout the tropics of the Old and New World (including Panama) for its edible fruit.

Useful reference:

Mukherji, S., A monograph on the genus *Mangifera* L. *Lloydia* **12**: 73-136, 1949.

1. ***Mangifera indica*** L., Sp. Pl. 200, 1753.—Fig 1.

Tree 5-40 m high, the branches glabrous. *Leaves* with petioles 0.8-6.2 cm long; blades oblong-lanceolate to oblong or narrowly elliptic-lanceolate, apically acuminate or acute (rarely obtuse), basally cuneate to narrowly obtuse, 9-36 cm long, 2-7 cm broad, subcoriaceous or coriaceous, marginally straight or subundulate, glabrous on both surfaces, often glossy above and with prominulous or prominent reticulation. *Panicles* 15-50 cm long, densely flowered, pyramidal, the branches irregularly pilosulous and often spreading. *Flowers* 5-merous, the pedicels 0.5-4(-6) mm long; calyx-segments ovate-lanceolate, concave, 1.5-3 mm long, externally pubescent, spreading but arcuate and the distal portion ascending; petals oblanceolate or obovate to oblong, acute to obtuse or rounded, plicate toward the base, each producing a ventro-basal flap of tissue extending between the lobes of the disc, yellow or cream or pink (the ventral ridges often dark-red or rose-colored and imparting a streaked appearance to the corolla), 3-5 mm long, spreading or somewhat ascending, strongly recurved at the tip; disc consisting of 5 separate (sometimes apically coalescent) tumid cushions in a whorl between the stamens and petals and alternate with the petals; stamens 5, 1 large and fertile, the rest reduced to staminodes; ovary obliquely subglobose or ovoid, the style slender, often subequal in length to the fertile stamen. *Drupes* large (from 6 cm), often oblong or subreniform, frequently yellow externally (varying from yellow to green or apricot), the mesocarp thick and juicy, often orange or yellow in color.

Although a native of the Indian Peninsula, the mango is cultivated throughout Latin America (also in southern Florida and southern California) as well as the tropics of the Old World. In many regions (as in Panama) it has become a significant naturalized element of the flora.

CANAL ZONE: Gatun, *Hayes* 4 (US); in Government forest along Las Cruces Trail, *Hunter & Allen* 686 (MO), 758 (MO); Barro Colorado I, *Shattuck* 96 (F, MO), *Wetmore & Abbe* 94 (F); along the old Las Cruces Trail, betw Fort Clayton & Corozal, *Standley* 29171 (US); Obispo, *Standley* 31757 (US); vic of Miraflores Lake, Cocoli I, *White* 282 (MO, US), 283 (MO), 284 (MO), 285 (MO), 286 (MO), 287 (MO), 288 (MO), 291 (MO), 292 (MO, US), 293 (MO); s. loc., *Epplesheimer s.n.* (F), *White* 253 (MO), 349 (MO), 350 (MO), 351 (MO, US), 352 (MO). CHIRIQUÍ: 12.4 mi N of David, *Lewis et al.* 696 (MO). LOS SANTOS: Bahia Honda, *Elmore* H13 (F, US). PANAMA: Taboga I, *Allen* 132 (MO).

Although several different parts of the mango are utilized in various regions of the world (young leaves, seeds, bark, flowers, etc.), it is the edible fruit which is most sought after. The mango fruit ranks among the leading fruit crops of the world as a whole, furnishing fruit to about $\frac{1}{5}$ of the earth's inhabitants (Barkley, Missouri Bot. Gard. Bull. **24**: 218, 1936). The fruit is eaten raw and used in the preparation of preserves, jellies, tarts, sauces, and chutneys. Good varieties are scarce in many parts of Latin America as little selection is practiced.

2. ANACARDIUM

Anacardium L., Sp. Pl. 383, 1753; Gen. Pl. ed. 5, 180, 1754.

Rhinocarpus Bertero & Balbis ex H.B.K., Nov. Gen. Sp. Pl. **7**: 5, 1824.

Trees or shrubs, evergreen. *Leaves* short-petiolate; blades simple, entire, coriaceous. *Panicles* large, terminal. *Flowers* small, ♂, bracteate, the pedicels accrescent in fruit; calyx 5-parted, the segments imbricate in bud; petals 5, recurved, imbricate in bud; stamens (7-)10(-12), unequal, all or a few or only 1 fertile, the filaments basally connate and adnate to the torus; disc or nectariferous outgrowths lacking; ovary subglobose to turbinate or obovate, somewhat gibbous, 1-celled, 1-ovulate, the ovule lateral, ascending on a very short funicle, the style compressed-conic, excentric, as long or slightly longer than the ovary. *Nut* rather large, reniform, laterally compressed, virtually filled by the solitary reniform seed, borne at the apex of a fleshy hypocarp (the accrescent pedicel).

A genus of eight or nine species native to tropical America; only two species occur in Central America, including Panama.

- a. Tree 20-37 m high; leaf-blades 14-31 cm long; panicles with brown pubescence; 4 stamens much longer than the rest; staminal filaments pubescent (except the extreme distal portion); hypocarp 2-3 mm broad when ripe1. *A. excelsum*
- aa. Tree seldom reaching 10 m in height; leaf-blades 6-15.5 cm long; panicles with gray pubescence; 1 stamen much longer than the rest; staminal filaments entirely glabrous; hypocarp much broader than 3 mm when ripe2. *A. occidentale*

1. **Anacardium excelsum** (Bertero & Balbis) Skeels, U.S. Bur. Pl. Ind. Bull. **242**: 36, 1912.

Rhinocarpus excelsa Bertero & Balbis ex H.B.K., Nov. Gen. Sp. Pl. **7**: 6, t. 601, 1824 (incl. *Anacardium ? rhinocarpus* DC., Prodr. **2**: 62, 1825).

Tree 20-37 m high. *Leaves* aggregated toward the branch-tips, the petioles 7-21 mm long; blades usually obovate or broadly oblanceolate, less frequently oblong or \pm elliptic, apically obtuse to rounded or slightly emarginate, basally cuneate and symmetric or asymmetric, glabrous or essentially so, 14-31 cm long, 5-12 cm broad, with prominulous to prominent reticulation on both surfaces. *Panicles* 15-35 cm long, with a brown or rufescent pubescence, the bracts reduced, 1-2.5 mm long. *Flowers* with pedicels 1-6 mm long; calyx-segments ovate, 1-3 mm long, crassulate except at the margins; petals linear-oblong, 3-6 mm long, 1-1.75 mm broad, cream or green, \pm adnate to the stamen-tube; stamens (7-)10(-12),

4 much longer than the rest and extending well beyond the point at which the petals become recurved, the filaments subulate, rather conspicuously pubescent except on the extreme distal portion; ovary 0.2-0.5 mm long. *Hypocarp* 5-20 mm long, thickening to a breadth of 2-3 mm, twisted or sigmoid. *Nut* 2.5-3.5 cm long when ripe, 1-2 cm broad.

Costa Rica, Panama and northern South America.

BOCAS DEL TORO: s. loc., *Cox* 18823 (US). CANAL ZONE: Barro Colorado I, *Aviles* 986 (F), *Brown* 70 (F), *Carpenter* 2 (F), *Frost* 118 (F), *Kenoyer* 651 (US), *Knight* 10 (F), *Shattuck* 802 (F, MO, US), *Wetmore & Abbe* 194 (F), 199 (F), *Wilson* 5 (F), *Woodworth & Vestal* 337 (F); Albrook, U.S. Army Tropic Test Center Site, *Dwyer & Robyns* 50 (MO); nr Santiago, *Harvey* 5270 (F); river bank nr Gatun, *Pease* 22880 (US); Corozal, *Piper* 5297 (US); around Bohio, *Pittier* 3419 (US); nr Fort Randolph, *Standley* 28704 (US); vic of Fort Sherman, *Standley* 30929 (US); Obispo, *Standley* 31740 (US); Curundu on rd past Survival School, *Tyson* 3476 (MO). CHIRIQUÍ: Progreso, *Cooper & Slater* 206 (F). COCLÉ: Penonomé & vic, *Williams* 291 (US). DARIEN: trail betw Pinogana & Yavisa, *Allen* 297 (MO, US); vic of Pinogana, *Allen* 4286 (MO); Pico Piriaque, *Duke* 8146 (MO). HERRERA: vic of Ocú, *Allen* 4075 (MO). PANAMA: Río Las Lajas, *Allen* 1605 (F, MO, US); vic of Bejuco, *Allen* 4296 (MO); Río Indio drainage, ca 9 mi E of Trans-Isthmian Hwy, *Barbour* 1057 (F); San José I, Red Hill Grade, *Johnston* 649 (MO, US); Bella Vista, *Macbride* 2729 (F, MO, US); Sabanas, *Bro. Paul* 301 (US); nr the big swamp E of Río Tocumen, *Standley* 26576 (US); Río Tocumen, *Standley* 26743 (US), 26746 (US); Río Tapia, *Standley* 28270 (US). VERAGUAS: vic of Santa Fé, Río Santa María, *Allen* 4424 (MO).

This species, known as *espavé* or *espavel*, is a large forest tree of rather common occurrence in Panama. The wood is reportedly used in making trays and canoes and the bark for poisoning fish. The hypocarp is edible but the tree is not cultivated and has not been appreciably exploited economically.

2. *Anacardium occidentale* L., Sp. Pl. 383, 1753.—Fig. 2.

Tree to 8(-10) m. *Leaves* \pm aggregated toward the apex of the branchlets, the petioles 5-20 mm long; blades broadly oblong-ovate to somewhat obovate, obtuse to rounded or slightly emarginate at the apex, cuneate to obtuse or rounded at the base, glabrous, 6-15.5 cm long, 3.5-9 cm broad, with prominulous reticulation on both surfaces. *Panicles* 7-16.5 cm long, with gray pubescence; bracts usually at least sparsely puberulent, those subtending the lower primary branches of the panicle oblanceolate or oblong and foliaceous (though much reduced in size), those subtending the distal branches and flowers or flower-groups ovate and resembling the calyx-lobes. *Flowers* with pedicels 0.5-7 mm long; calyx-segments lanceolate to lance-ovate, 2.5-5 mm long, 1-2.3 mm broad, moderately grayish-appressed-puberulent dorsally; petals linear to linear-lanceolate or narrowly linear-elliptic, 6-13 mm long, 1-2 mm broad, greenish-yellow with red streaks at anthesis, turning dark red with age; stamens 10, 1 much longer than the others and extending well beyond the point at which the petals become recurved, the filaments glabrous; ovary 0.2-0.5 mm long. *Hypocarp* red or yellow at maturity, to 10 cm long and 5 cm broad, \pm obovate. *Nut* gray, 2-3.2 cm long, 1-2 cm broad.

Present and often common by introduction and cultivation throughout the tropics of the New and Old World, becoming naturalized in many places; probably native from Costa Rica to Brazil and Ecuador.

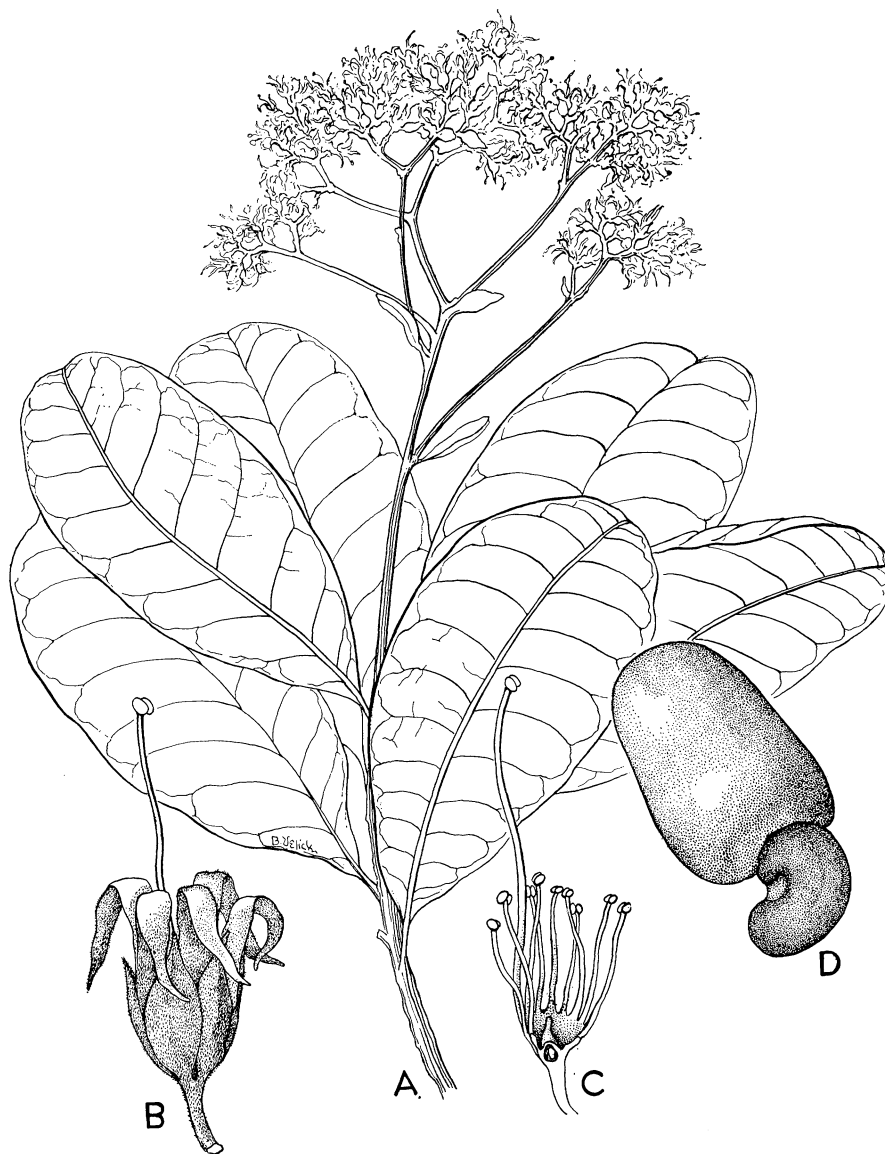


Fig. 2. *Anacardium occidentale* L.: A, habit ($\times\frac{1}{2}$); B, flower ($\times 4$); C, id., calyx and corolla removed ($\times 4$); D, nut and hypocarp ($\times\frac{2}{3}$). A, leaves after Allen 1079 (MO), inflorescence after Macbride 2728 (MO); B-C after Macbride 2728 (MO); D after Blum 2224 (MO).

CANAL ZONE: s. loc., *Blum* 2224 (MO); [Las Sabanas?], *Bro. Celestine* 105 (US); betw Mt Hope & Santa Rita Trail, *Cowell* 92 (US); Barro Colorado I, *Epplesheimer* 2 (F), *Wilson* 82 (F), *Woodworth & Vestal* 711 (F); s. loc., *Epplesheimer s.n.* (F); Chagres, *Fendler* 308 (MO, US); Gatun, *Hayes* 9 (MO, US); nr Fort Randolph, *Maxon & Harvey* 6522 (US); [Sabanas?], *Bro. Paul* 209 (US); betw Corozal & Ancon, *Pittier* 2633 (US); Balboa, *Standley* 25510 (US), 27127 (US); Curundu, *Tyson* 3574 (MO); Ancon Hill *Williams* 36 (US). CHIRIQUÍ: 25 mi E of David, *Harvey* 2568 (F); 12.4 mi N of David, *Lewis et. al.* 719 (MO). COCLÉ: Aguadulce, *Pittier* 4845 (US). COLÓN: betw France Field, Canal Zone & Catival, *Standley* 30324 (US). DARIEN: vic of El Real, Río Tuirá, *Stern et al.* 791 (MO, US). HERRERA: vic of Ocu, *Allen* 4063 (MO). PANAMA: Taboga I, *Allen* 130 (F, MO), *Hjerting & Rahn* 615 (US); 1 mi E of Tocumen airport on side rd off Inter-Amer Hwy, *Blum & Tyson* 1964 (MO); along rd betw Panama & Chepo, *Dodge et al.* 16706 (MO); Capira, *Duke* 6031 (MO); Cermeño, *Dwyer & Robyns* 109 (MO); on sabanas, rd to Chepo, *Hunter & Steyermark s.n.* (MO); Chorrera, *Killip* 3404 (US); Bellavista, *Macbride* 2728 (F, MO, US); nr Tapia River, Juan Díaz region, *Maxon & Harvey* 6720 (US); Tumba Muerto Rd, nr Panama, *Standley* 29829 (US). VERAGUAS: vic of Santiago, *Allen* 1079 (MO); rd betw San Francisco & Santa Fé, *Stern et al.* 1918 (MO).

This species is commonly known as *marañón* and *jocote marañón* in Central America. It produces the commercially important cashew nut. The cashew nut must be roasted before the seed, the "cashew nut" of commerce can be eaten. Cashew nuts are not produced on a large economic scale in tropical America (the native home of the cashew) but are largely exported from India where the cashew is extensively cultivated. The ripe, red or yellow hypocarp (the swollen pedicel subtending the nut) has a juicy, spongy, yellowish flesh and is used as a fruit in tropical America. The hypocarp is often mistaken for the true fruit and is sometimes referred to as the "cashew apple." Care should be exerted to avoid the nut when eating the hypocarp as the unroasted pericarp contains a volatile, irritating oil which may blister the skin.

3. CAMPNOSPERMA

Campnosperma Thwaites, Hook. Jour. Bot. Kew Gard. Misc. **6**: 65, 1854, nom. gen. conserv.

Cyrtospermum Benthams, loc. cit. **4**: 13, 1852, non *Cyrtosperma* Griffith (Notul. Pl. Asiat. **3**: 149, 1851).

Drepanospermum Benthams in Benthams & Hooker f., Gen. Pl. **1**: 425, 1862.

Trees. *Leaves* petiolate or sessile, clustered toward the branch-tips; blades simple, entire, coriaceous. *Inflorescences* paniculate, large, axillary but arising from the distal nodes of a branch. *Flowers* polygamo-dioecious, 3-5-merous; calyx persistent, the lobes imbricate in bud; petals erect or spreading, imbricate at anthesis; stamens 6-10, free, inserted at the base of the disc, subequal or slightly unequal, incurved, the filaments flattened, slightly narrowed toward the apex; intrastaminal disc fleshy, annular, entire or crenate-sulcate; ovary 1-2-locular, the style short, the stigma lobate-discoid, the ovule apical or basal. *Drupes* ovoid, erect, fleshy, 1-locular or 2-locular (one empty).

The genus is primarily East Indian. Two species occur in the New World tropics, one being native to Panama.

1. ***Camposperma panamensis*** Standley, Jour. Arnold Arb. **2**: 111, 1920.—Fig. 3.

Tree of large to medium size, the thick branches often with rugose and scaly bark, the young parts stellate-puberulent. *Leaves* short-petiolate or subsessile, ascending; blades oblong-obovate, rounded to emarginate at the apex, basally equilateral and cuneate to attenuate, stellate-pubescent beneath and also lepidote with minute brown scales, glabrous above and with scattered scales, somewhat lustrous above, 14-35 cm long, 5.5-15 cm broad, the midvein conspicuously raised beneath, the 32-52 \pm parallel secondaries pinnate, the reticulation prominulous below and prominent above. *Panicles* to 40 cm long, spicate, often with several primary branches arising from the main axis, with a brown stellate pubescence, occasionally with small ovate or lance-ovate bracts subtending the branches. *Flowers* with pedicels 0-2 mm long; calyx-lobes 4, broadly ovate, ca 0.5 mm long, stellate-pubescent; petals 4, ovate, broadly acute to rounded, 1.2-2 mm long, concave, glabrous, yellow; stamens 8, equal to or slightly shorter than the petals; disc tumid and conspicuous, crenate; ovary lepidote, latissimus-ovate, 1-locular, the ovule apical. *Drupes* triangular-ovoid, 1-1.5 cm long.

Costa Rica and Panama, infrequent.

BOCAS DEL TORO: Chiriquicito Lagoon, *Little s.n.* (holotype A; isotype US); swamp nr Almirante, *Rowlee & Stork 1001* (US); Laguna de Chiriquí, *Stern & Chambers 107* (A, F, MO, US). PROVINCE UNKNOWN: *s. loc.*, *Cooper & Slater 154* (F, GH, US).

Commonly known as *orey*.

4. TAPIRIRA

Tapirira Aublet, Hist. Pl. Gui. Fr. 470, 1775.

Trees or shrubs, erect or scandent, glabrous or pubescent. *Leaves* imparipinnate, the leaflets entire or serrate. *Panicles* axillary or terminal. *Flowers* polygamodioecious, small, frequently greenish-yellow and fragrant; calyx-segments 5, imbricate, persistent; petals 5, spreading, imbricate in bud; stamens 10, inserted below the disc, the anthers ovate to \pm globose; disc intrastaminal, 5-10-lobed; ovary ovoid, 1-locular, the ovule apical, the styles 4-5, short, conic, the stigmas simple. *Drupes* \pm oblique-oblong, fleshy, the stone rugulose-crustaceous; seed solitary, oblong, the testa thinly membranaceous.

The genus *Tapirira* is much in need of monographic attention. The exact number of valid species is undetermined but probably does not exceed 15. Asian, African and Tropical American representatives are known; two species occur in Panama. This genus is easily confused with *Protium* in the *Burseraceae*, particularly when specimens lack flowers. *Tapirira chagensis* Pittier (type from Chagres River above Alhajuela, Province of Panama, US) is *Protium sessiliflorum* (Rose) Standley.

- a. Inflorescences paniculate, often possessing secondary and tertiary branches, densely-flowered; flowers often appearing clustered, the pedicels 1-3 mm long; drupes 0.5-1.5 cm long1. *T. guianensis*
 aa. Inflorescences paniculate-spicate, simple or the rachis with only primary branches, rather sparsely flowered; flowers never clustered, the pedicels less than 0.5 mm long; drupes 1.7-2.7 cm long2. *T. breneisii*



Fig. 3. *Camptosperma panamensis* Standley: A, habit ($\times\frac{1}{3}$); B, flower ($\times 7$); C, id., longitudinal section ($\times 7$). After Stern & Chambers 107 (MO).

1. **Tapirira guianensis** Aublet, Hist. Pl. Gui. Fr. 470, t. 188, 1775.—Fig. 4.

T. myriantha Triana & Planchon, Ann. Sci. Nat., Bot., sér. 5, **14**: 295, 1872.

Tree 3-40 m high; branches developing gray bark, the young portions dotted with lenticels. *Leaves* clustered toward the branch-tips, with (1-)2-5(-7) pairs of leaflets, the rachis 5-35 cm long and minutely ferruginous-puberulent or glabrous, the leaflets opposite, with petiolules 2-11 mm long (not including the petiolule of the terminal leaflet which is often longer); lamina of leaflets oblong or oblong-lanceolate to somewhat obovate or ovate, slightly oblique, acuminate or subacuminate apically (the acumen rounded or emarginate), rarely rounded or emarginate at the apex, basally cuneate to broadly obtuse and often somewhat assymmetric, 5-20 cm long, 1.5-8 cm broad, glabrous or sparsely puberulent beneath (rarely above) along the main veins, membranous or slightly coriaceous, entire, paler beneath, often lustrous above, the secondary veins brochidodrome. *Panicles* axillary but arising from the distal nodes of a branch, densely-flowered, 8-37 cm long, the branches at least sparsely ferruginous-puberulent (the trichomes ascending or appressed). *Flowers* functionally ♂ ♀ (one sex well developed morphologically and the other ± vestigial), occasionally ♂, the pedicels 1-3 mm long, 0.2-0.5 mm broad (in flower), rather conspicuously hirtellous with ascending to appressed trichomes (rarely glabrate); calyx-segments deltoid to rotund-ovate, apically acute to rounded, sparsely appressed-hirtellous externally, 0.5-0.75 mm long; petals elliptic or oblong-elliptic to ovate-lanceolate or subovate, acute to obtuse or rounded, occasionally slightly erose-dentate apically, 1.5-2.5 mm long, ascending to spreading or reflexed, yellowish-white or greenish-white; stamens 10, 1.5-2.5 mm long (hypoplastic in functionally ♀ flowers), the filaments rather slender, the anthers ovate, basally cordate or auriculate, 0.3-0.5 mm long; disc 10-crenulate occasionally tumid and subentire; ovary 1-1.5 mm long and oblong-ovoid to ovoid or slightly obovoid in functionally ♀ flowers, rather sparsely puberulent, greatly reduced and concealed by the disc in functionally ♂ flowers, the styles 5 (rarely 4 in functionally ♂ flowers), free and well spaced in functionally ♀ flowers, connivent and free or lightly coalescent basally in functionally ♂ flowers, stubby, 0.1-0.5 mm long, conspicuously pubescent, each surmounted by a slightly enlarged disciform stigma. *Drupes* ovoid to oblong or obovoid, 0.5-1.5 cm long, often showing remnants of the styles; seed pendulous from the locule apex or virtually so.

Panama to Peru, Brazil and Paraguay.

COLÓN: Loma de la Gloria, nr Fató (Nombre de Dios), *Pittier 4101* (F, US).

Collections of *T. myriantha* and *T. guianensis* from northern South America (deposited in MO) were compared and were found to be morphologically similar.

2. **Tapirira brenesii** Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. **18**: 628, 1937.

Tree 8-20 m high; branches brown or gray, subterete, lenticellous, often strigulose, glabrous or sparsely appressed-puberulent. *Leaves* with 2-5 pairs of opposite leaflets, the rachis 5-27 cm long and often striolate, the leaflets with petiolules 2-10 mm

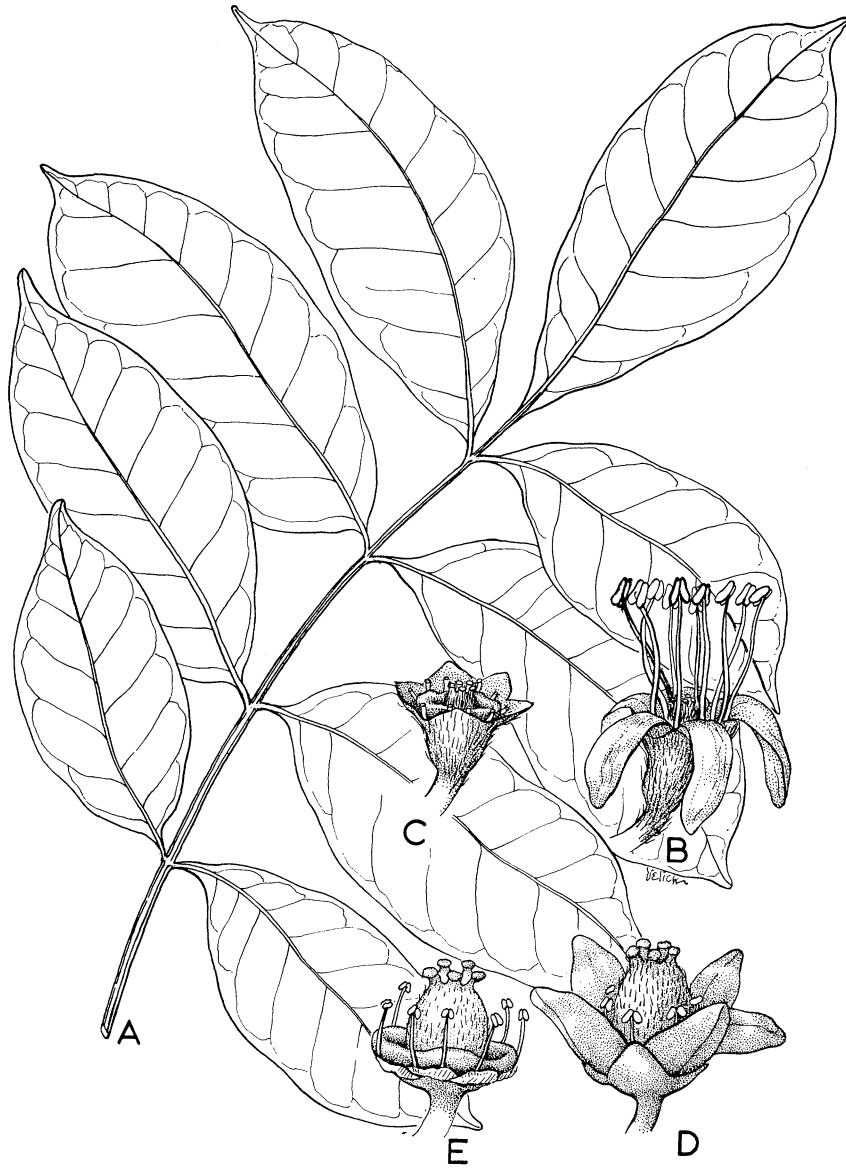


Fig. 4. *Tapirira guianensis* Aublet: A, compound leaf ($\times\frac{2}{3}$); B, functionally δ flower ($\times 10\frac{1}{2}$); C, id., petals and stamens removed ($\times 10\frac{1}{2}$); D, functionally f flower ($\times 9\frac{1}{2}$); E, id., calyx and corolla removed ($\times 9\frac{1}{2}$). A after Hassler 7771 (MO), Paraguay; B-C after De La Cruz 4604 (MO), British Guiana; D-E after De La Cruz 4436 (MO), British Guiana.

long; lamina of leaflets oblong-lanceolate to ovate-lanceolate or elliptic, apically acuminate or subacuminate (the acumen obtuse to rounded or emarginate), obliquely cuneate to obtuse at the base, 5.5-13.5 cm long, 2-5 cm broad, entire, coriaceous or subcoriaceous, glabrous or lightly appressed-pilose on the main veins beneath, the reticulation prominulous. *Panicles* axillary to the upper leaves, rather sparsely flowered, 4-16.5 cm long, appressed-hirtellous with ferruginous trichomes, spicate, with primary branches or simple. *Flowers* functionally ♂ ♀, sessile or with pedicels less than 0.5 mm long; calyx-segments sparsely appressed-hirtellous or glabrate, rotund-ovate, ca 1 mm long; petals white, oblong or slightly obovate, 1.8-3.5 mm long, often spreading or reflexed; stamens 1-2 mm long, reduced to staminodes in ♀ flowers; disc 10-crenulate; ovary oblong, ca 1.5 mm long in ♀ flowers, rather sparsely appressed-hirtellous, reduced to a pubescent pistillode in ♂ flowers, the styles ca 0.2 mm long, each surmounted by a slightly expanded stigmatic region. *Drupes* ovoid to oblong, reddish-purple, 1.7-2.7 cm long, carnosae. Nicaragua, Costa Rica and Panama.

CHIRIQUÍ: Boquete Distr, *Davidson 850* (F, US).

It is difficult to separate specimens of this species which do not have mature flower from *Protium sessiliflorum* (Rose) Standley of the *Burseraceae*.

5. SPONDIAS

Spondias L., Sp. Pl. 371, 1753; Gen. Pl. ed. 5, 174, 1754.

Warmingia Engler in Martius, Fl. Bras. **12**(2): 281, 1874.

Shrubs to large trees. *Leaves* odd-pinnate, often crowded toward the branch apex, deciduous, the leaflets alternate or opposite, membranous or subcoriaceous, petiolulate or rarely subsessile. *Inflorescences* paniculate to racemose or subcapitate, terminal or lateral, large or small. *Flowers* small, ♂ or less often ♂ ♀, pedicellate or sessile; calyx-segment (4)5, small, deciduous, slightly imbricate; petals (4)5, erect to spreading or reflexed, subvalvate in bud; disc intrastaminal, cupular, crenate; stamens (4-)8-10, inserted below the disc; ovary 3-5-locular, the styles 3-5, connivent above but free (rarely united by their stigmas), a distinct stigmatic region apparent or not, the ovules solitary in each locule, apical. *Fruit* a fleshy drupe, 1-5-locular; seeds with a membranous testa.

A genus of about eight species, the majority of Asian distribution; two species occur in Central America including Panama.

- a. Shrub or small tree; lamina of leaflets usually less than 6 cm in length; inflorescences lateral on older (leafless) branches, racemose-paniculate to subcapitate, 0.5-8 cm long; petals erect or ascending strictly, red; styles (3)4, each constricted strongly at the junction with its capitate stigma; mature fruits red or purple1. *S. purpurea*
- aa. Small to large tree; lamina of leaflets usually 6 cm or more in length; inflorescences terminal on leafy branches of the season, paniculate, 15-40 cm long; petals spreading or reflexed, white or yellow; styles 5, not appreciably constricted at the beginning of the stigmatic portion; mature fruits yellow2. *S. mombin*

1. *Spondias purpurea* L., Sp. Pl. ed. 2, 613, 1762.—Fig. 5(E).

S. cytherea Sonn., Voy. Ind. Or. Chin., t. 123, 1782.

Warmingia pauciflora Engler in Martius, Fl. Bras. 12(2): 281, t. 57, 1874.

Spondias purpurea var. *venulosa* Engler in Martius, loc. cit. 373, 1876.

S. macrocarpa Engler in Martius, loc. cit. 375, t. 78.

S. purpurea var. *munita* Johnston, Sargentia 8: 182, 1949.

Shrub or small tree to 10(-15) m high with smooth gray bark, the branches stout. *Leaves* with (3-)5-12 pairs of leaflets, the rachis 5-25 cm long (often sulcate or bisulcate above and with pilose trichomes bordering the grooves), the leaflets alternate or opposite, with petiolules 0.5-3 mm long and frequently pilose; lamina of leaflets obliquely elliptic to obovate or less often ovate, apically acute or subacuminate to rounded or emarginate and often cuspidate, basally typically acute but varying from subattenuate to obtuse, assymmetric at the base, entire or serrate (the teeth sometimes with a cilium at the tip), 1.5-6 cm long, 0.7-3 cm broad, membranous, pilose along the midvein (and sometimes on the secondaries) above and/or below or else glabrous, with a rather distinct submarginal collecting vein. *Inflorescences* racemose-paniculate or subcapitate, laterally disposed on older denuded branches, red or reddish-purple, 0.5-8 cm long, pilosulous or glabrate. *Flowers* ♂, red, the distally articulated pedicels 0.5-4 mm long; calyx-segments 5, rotund-ovate, ca 1 mm long; petals 5, lanceolate to oblong- or ovate-lanceolate apically strongly uncinata (hooked inward), 2.5-3.5 mm long, erect or strongly ascending; stamens 10, subequal or unequal, slightly exceeded by the petals, the filaments flattened, tapering toward the apex; disc strongly crenate to subentire; styles (3-)4, 1 mm long or slightly less, ovate or ampulliform, glabrous, conspicuously constricted at the beginning of the capitate stigmatic portion. *Drupes* red or purple, 1.5-3.5 cm long, 1-2.5 cm broad, ovoid or oblong.

Southern Mexico, Central America and the West Indies to Brazil and Peru; cultivated in southern Florida.

BOCAS DEL TORO: region of Almirante, *Cooper* 355 (F, US). CANAL ZONE: Chiva-Chiva Trail, Red Tank to Pueblo Nuevo, *Piper* 5772 (US); hospital grounds at Ancon, *Pittier* 2729 (US); Sosa Hill, Balboa, *Standley* 26485 (US); along the old Las Cruces Trail, betw Fort Clayton & Corozal, *Standley* 29122 (US); vic of Miraflores Locks, Madden Dam, Trans-Isthmian Hwy, *Stern et al.* 350 (MO, US); nr mouth of Cocoli River, *White* 98 (MO). CHIRIQUÍ: Progreso, *Cooper & Slater* 202 (US); Boquete Distr, *Davidson* 763 (F); Río San Cristobal, 2 mi W of David, *Tyson* 914 (MO). COCLÉ: Penonomé, *Williams* 380 (US). DARIEN: vic of El Real, Río Tuira, *Stern et al.* 795 (MO, US). PANAMA: along Chiva-Chiva Trail to Search Light Station beyond Chiva-Chiva, *Allen* 954 (MO); San José I, *Johnston* 573 (holotype of var. *munita* GH; isotype US), *Johnston* 1410 (MO); Bellavista, *Macbride* 2760 (F, US), *Standley* 25388 (US); Savana de Alhajueta, Chargres Valley, *Pittier* 3486 (US); banks of Mamoni River, below Chepo, *Pittier* 4692 (US); Tumba Muerto Rd, nr Panama, *Standley* 29779 (US); betw Matías Hernández & Juan Díaz, *Standley* 31940 (US); Taboga I, *Woodson et al.* 1511 (MO). PROVINCE UNKNOWN: "Western Panama," *Stork* 27 (US).

Spondias purpurea var. *munita* is not recognized as a distinct taxon in this treatment. In examining specimens assigned to this proposed segregate (including type specimens), no character was found which provides absolute separation from other specimens of *S. purpurea*. A feature considered by Johnston (loc. cit. 183) to be among those distinguishing var. *munita* is the rather striking serration of the

leaflets. However, the leaflets of many other specimens of *S. purpurea* show a greater or lesser amount of serration. The woody spines, reportedly characteristic of older branches of specimens of var. *munita*, were not present on the material available for study. Characters of the inflorescence, flower and fruit mentioned by Johnston do not serve to distinguish var. *munita*.

The plum-like fruits of the "red mombin" or "hog plum" are extensively eaten in tropical America, reportedly having a sweet-acid flavor.

2. *Spondias mombin* L., Sp. Pl. 371, 1753.—Fig. 5(A-D).

S. lutea L., Sp. Pl. ed. 2, 613, 1762.

S. lutea var. *maxima* Engler in Martius, Fl. Bras. **12**(2): 374, 1876.

S. lutea var. *glabra* Engler in Martius, loc. cit.

S. radlkoferi J. D. Sm., Bot. Gaz. **16**: 194, 1891.

S. nigrescens Pittier, Contr. U.S. Nat. Herb. **18**: 75, 1914.

Tree 6-27 m high with smooth or furrowed bark, the trunk straight. Leaves with 3-15 pairs of leaflets, the proximal leaflets alternate and the distal \pm opposite, the rachis 7-35 cm long; lamina of leaflets oblong to somewhat ovate or obovate, apically acuminate or less frequently acute, basally acute to broadly obtuse, oblique and assymmetric at the base, 5.5-14 cm long, 2-6.5 cm broad, membranous or subcoriaceous, glabrous or short-pilose on the nerves and along the margins; petiolules 2-7(-12) mm long (not including the petiolule of the terminal leaflet which is often longer). Panicles terminal, 15-40 cm long, minutely hirsutulous. Flowers ∞ , \varnothing , 5-merous, the articulated pedicels 1.5-5 mm long; calyx-segments scale-like, ca 0.5 mm long, deltoid or deltoid-ovate; petals oblong-lanceolate or elliptic-lanceolate, apically uncinata, 2-3.5 mm long, spreading to reflexed, white or yellow; stamens 10, subequal, slightly shorter than the petals, the anthers ca 1 mm long, slightly curved, oblong-quadrate, relatively massive; disc strongly crenate (annular but virtually divided into 10 separate cushions); styles 5, \pm linear, virtually uncontracted at the beginning of the stigmatic portion, glabrous, ca 1 mm long. Drupes ovoid to obovoid or oblong, 1.5-4 cm long, 1-2.5 cm broad, yellow.

Southern Mexico, Central America, the West Indies and tropical South America; introduced and naturalized in tropical Africa.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 504 (F), *Cooper & Slater* 101 (US); Chiriquí Lagoon region, Chiriquicito, vic of Guarumo River, *Seibert* 1555 (US). CANAL ZONE: Victoria Fill, nr Miraflores Locks, *Allen* 1762 (F, MO, US); Barro Colorado I, *Carpenter* 52 (F), *Dwyer* 1458 (MO), *Kenoyer* 420 (US), *Shattuck* 82 (F, MO), *Starry* 107 (F), *Wilson* 113 (F), *Zetek* 3414 (F), 3584 (F), 3611 (F, MO), 3645 (F, US), 3854 (MO); New Frijoles, *Christopherson* 135 (US); U.S. Army Tropic Test Center, Miraflores Bridge, *Dwyer & Robyns* 3 (MO); Albrook, U.S. Army Tropic Test Center Site, *Dwyer & Robyns* 61 (MO); Chagres, *Fendler* 141 (F, MO, US); around Bohio, *Pittier* 3423 (US); Summit, *Standley* 26969 (US); along the Las Cruces Trail, betw Fort Clayton & Corozal, *Standley* 29140 (US); Obispo, *Standley* 31792 (US); Balboa, *Standley* 32102 (US); vic of Miraflores Locks, edge of lake below spillway of Miraflores Dam, *Stern et al.* 1 (MO); Miraflores Lake nr water plant, *Tyson* 3553 (MO); Curundu Survival School Area, *Tyson & Dwyer* 4457 (MO). CHIRIQUÍ: Progreso, *Cooper & Slater* 207 (F, US). COCLÉ: betw Aguadulce & Antón, *Woodson et al.* 1206 (F, MO). COLÓN: betw France Field, Canal Zone & Catival, *Standley* 30401 (US). DARIEN: trail betw Pinogana & Yavisa, *Allen* 272 (F, MO). PANAMA: Pedro Gonzalez I, *Allen* 2598 (MO); San José I, *Erlanson* 286 (US), 596 (US), *Johnston* 746 (US); nr Chepo, *Kluge* 34 (US); Trapiche I, *Miller* 1877 (US), 1903 (US); Juan Díaz, *Standley* 30464 (US); El Cermeño, *Zetek* Z-4998 (F).

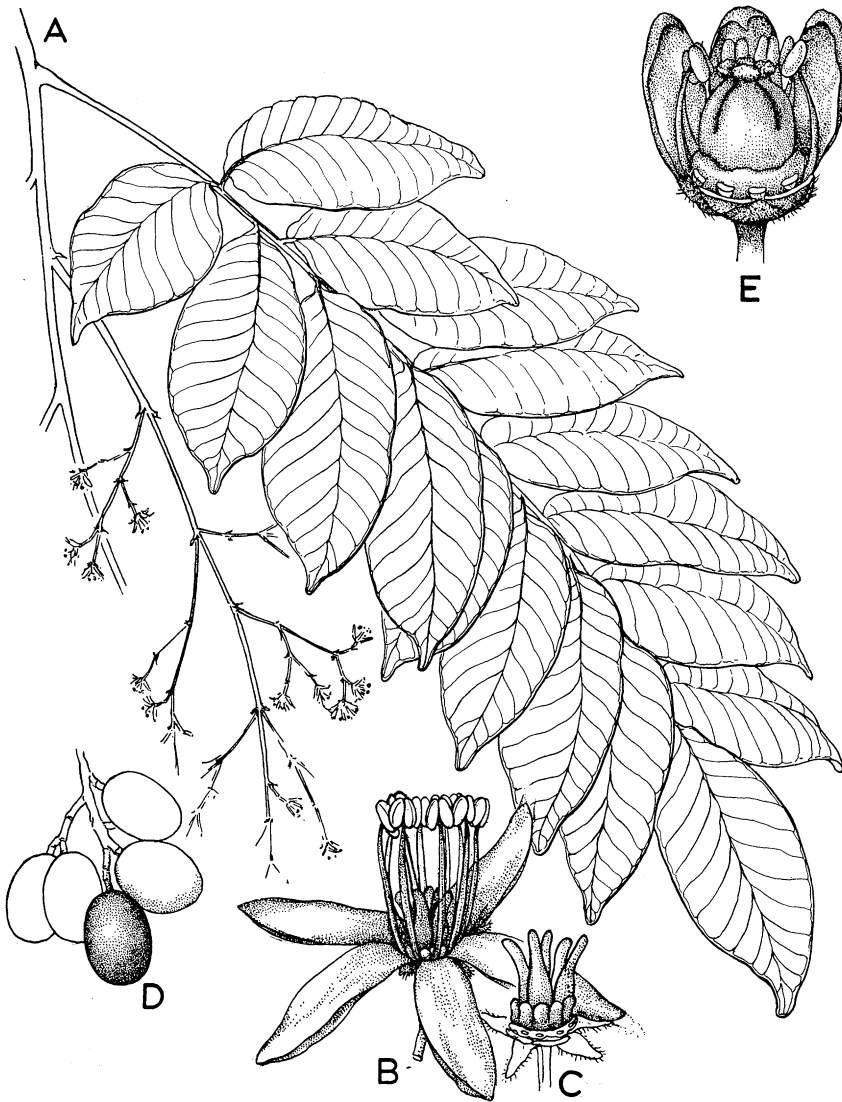


Fig. 5. *Spondias mombin* L.: A, habit ($\times\frac{2}{3}$); B, flower ($\times 6$); C, id., petals and stamens removed ($\times 9$); D, drupes ($\times\frac{1}{2}$). A-C after Woodson *et al.* 1206 (MO); D after Allen 2598 (MO). *Spondias purpurea* L.: E, flower, two petals and four stamens removed ($\times 6$). After Johnston 1410 (MO).

Spondias mombin is regarded in this treatment as a polymorphic species. Examination of collections of *S. nigrescens* and *S. radlkoferi*, deposited at three major herbaria (F, MO, US), as well as the types of these species, indicated that they are forms of the highly variable *S. mombin*.

The fruit of this species is edible but is of inferior quality and is eaten less frequently than that of *S. purpurea*. The trees are sometimes used as living fence-posts.

6. MAURIA

Mauria Kunth, Ann. Sci. Nat., Bot., sér. 1, **2**: 338, 1824.

Shrubs to small trees. *Leaves* odd-pinnate to simple, the leaflets petiolulate. *Inflorescences* terminal or axillary panicles, often large. *Flowers* ♂ or less frequently polygamo-dioecious, short-pedicellate or sessile; calyx short-cupulate, distally with 4-5 shallow, broad teeth; petals 4-5, valvate or subvalvate; stamens 8-10, the filaments subulate, the anthers dorsifixed; disc intrastaminal; ovary 1-locular, the solitary ovule subapical, the style short, persistent, terminating in a 3-lobed stigma. *Fruit* drupaceous, compressed, the endocarp chartaceous; seed virtually filling the lumen of the drupe.

A genus of possibly 10-15 species much in need of monographic revision. Most of the species have been described on the basis of differences in leaf form and pubescence, characters which may be quite variable on an individual plant. The distribution of the genus is from Honduras to Peru and southern Brazil; one species is known to occur in Panama.

Mauria is closely related to the genus *Sorindeia* Dupetit-Thouars (Gen. Nov. Madag. 23, 1808) of tropical Africa. Marchand (Rév. Anacard. 167, 1869) treated *Mauria* as a section of *Sorindeia* and transferred the species of *Mauria* known at that time to *Sorindeia*. However, the majority of authors, both before and since Marchand, have recognized these two entities as separate genera. The latter view is adopted in this treatment as adequate discontinuity between them has been found. The virtually apical attachment of the ovule in the genus *Mauria* as well as the stamens always twice as many as the petals in the typically polygamous flowers would seem to merit generic distinction. That *Mauria* and *Sorindeia* are closely related genera, however, cannot be denied.

1. *Mauria heterophylla* H.B.K., Nov. Gen. Sp. Pl. **7**: 13, t. 606, 1824.—Fig. 6.

M. suaveolens Poeppig in Poeppig & Endl., Nov. Gen. Sp. Pl. **3**: 77, 1845.

M. puberula Tulasne, Ann. Sci. Nat., Bot., sér. 3, **6**: 363, 1846.

M. biringo Tulasne, loc. cit. 365.

Sorindeia glaberrima Engler in Martius, Fl. Bras. **12**(2): 392, 1876.

S. venulosa (Marchand) Engler in Martius, loc. cit.

Mauria heterophylla var. *puberula* (Tulasne) Engler in A. & C. DC., Monogr. Phan. **4**: 328, 1883.

M. biringo var. *granatensis* Engler in A. & C. DC., loc. cit. 329.

M. glauca J. D. Sm., Bot. Gaz. **23**: 5, 1897.

Shrub or tree to 20 m high. *Leaves* with 1-4 pairs of petiolulate leaflets, rarely simple on the same plant, the rachis 2-20 cm long; lamina of leaflets variable in



Fig. 6. *Mauria heterophylla* H.B.K.: A, habit ($\times\frac{2}{3}$); B, flower ($\times 7\frac{1}{2}$); C, drupes ($\times\frac{2}{3}$). A-B after White 33 (MO); C after Allen 3466 (MO).

shape (ovate, elliptic, oblong, lanceolate, obovate), apically acute or acuminate, less frequently obtuse or rounded at the apex, basally cuneate to rounded, usually asymmetric at the base, membranous or coriaceous, entire, 4-15 cm long, 1.5-7 cm broad, glabrous or else pubescent along the main nerves below (when pubescent beneath often barbate in the axils of the secondary veins), the secondaries often \pm equally dichotomizing toward the margin, the reticulation usually prominent on both surfaces. *Panicles* terminal and axillary (from the upper nodes), 6-32 cm long, many-flowered. *Flowers* σ , the pedicels 1-3 mm long; calyx cupular, 1-2 mm long, persistent, the 5 shallow lobes broadly deltoid; petals 5, white or yellow, erect or ascending, ovate-lanceolate or oblong-lanceolate, acute or subacuminate, 2-4 mm long; stamens 10, shorter than the petals; disc rather broad, 10-crenulate; ovary ovoid, 1-1.5 mm long, the style short, fleshy, glabrous, the stigmatic region minutely papillose, the ovule strongly compressed. *Drupes* obliquely ellipsoid or ovoid, 5-13 mm long.

Costa Rica, Panama and northern South America to Peru and Bolivia.

CHIRIQUÍ: llanos on slopes of Volcán de Chiriquí Viejo & along Río Chiriquí Viejo, *Allen* 993 (US); Llano del Volcán, *Allen* 3466 (F, MO, US); vic of El Boquete, *Maxon* 5017 (F, US), 5149 (F, US); pastures around El Boquete, *Pittier* 2897 (F, US); vic of Boquete, Llanos area just S of town, *Stern et al.* 1944 (MO); Río Chiriquí Viejo valley, *White* 33 (MO), 55 (MO), 71 (F, MO), 234 (MO), *White & White* 99 (MO). DARIEN: vic of Campamento Buena Vista, Río Chucunaque above confluence with Río Tuquesa, *Stern et al.* 936 (MO, US).

Examination of specimens of *Mauria biringo*, *M. glauca* and *M. suaveolens*, from Costa Rica, Panama and South America, deposited in MO, revealed no consistent morphological characters separating them from specimens of *M. heterophylla*. These species were based on leaf form and pubescence, characters which are often quite variable within a species and even on a single plant. The specific rank of these proposed segregates seems gravely in doubt and they have consequently been placed in the synonymy of *M. heterophylla*.

7. SCHINUS

Schinus L., Sp. Pl. 388, 1753; Gen. Pl. ed. 5, 184, 1754.

Trees or shrubs. *Leaves* simple or compound (the rachis often winged), the leaflets typically sessile or subsessile. *Inflorescences* paniculate, terminal or axillary, ∞ -flowered. *Flowers* small, usually σ φ (at least functionally), the pedicels articulated; sepals 4-5, often ciliate marginally; petals 4-5, imbricate at anthesis, usually glabrous; stamens 8-10, those alternate with the petals almost as long as the petals in σ flowers, those opposite the petals ca $\frac{1}{2}$ as long, all greatly reduced in φ flowers; disc cupular, not tumid, 8-10 crenulate; ovary unilocular, the solitary ovule suspended variously from near the middle to near the apex of the locule, the styles terminal, 3 or occasionally single, the stigmas 3. *Fruit* a small drupe as broad as long, the exocarp thin, lustrous, usually lavender or red, deciduous, the endocarp bony; seed compressed.

A genus of about 27 species native to South America; one species, possibly native, extends through Central America into Mexico. Several species are cultivated as ornamentals in tropic and warm-temperate regions of the New and Old World.

Useful reference:

Barkley F. A., *Schinus* L. *Brittonia* 5: 160-198, 1944.

- a. Leaves with 1-6 pairs of opposite leaflets; lamina of leaflets various but not narrowly lanceolate, with a length/width ratio of 1.3/1 to 3/1; style 1, the stigmas 3; ovule subapical1. *S. terebinthifolius*
 aa. Leaves with 7-20 pairs of leaflets (often some of the leaflets alternate); lamina of leaflets rather narrowly lanceolate to linear-lanceolate, having a length/width ratio of 4/1 to 16/1; styles 3, free or confluent only at the base; ovule attached laterally to the ovary wall just above the middle of the locule2. *S. molle*

1. ***Schinus terebinthifolius*** Raddi, Mem. Mod. 18, fig. 399, 1820.—Fig. 7.

Shrub or tree to 7 m high, the branches glabrous or pubescent on young portions. *Leaves* imparipinnate, with 1-6 pairs of opposite leaflets, the rachis 3-14 cm long and often winged, the leaflets sessile or with petiolules to 1 mm long; lamina of leaflets obovate or elliptic to oblong or oblong-lanceolate, apically acute to rounded or rarely emarginate, occasionally mucronulate at the apex, basally cuneate, 1.5-7.5 cm long, 0.7-3.2 cm broad, having a length/width ratio of 1.3/1 to 3/1, entire or serrate, glabrous to conspicuously pilose, darker and often lustrous above, thickly membranous or subcoriaceous, the secondaries apparent, the reticulation obscure or subobscure. *Inflorescences* paniculate to subracemose, axillary, 1-11.5 cm long, conspicuously hirsute to glabrate. *Flowers* ♂ ♀ (a pistillode present in ♂ flowers, staminodes present in ♀ flowers), the pedicels 0.5-3 mm long; calyx-segments 5, deltoid, ca 0.75 mm long, often ciliate marginally; petals 5, ascending, oblong to ovate, apically rounded or subtruncate, white, 1.2-2.5 mm long, often curled outward at the tip; stamens 10, the anthers ovate and 0.5-0.8 mm long in ♂ flowers, the filaments compressed-subulate; disc 10-crenulate; ovary subglobose, ca 1 mm long, the ovule subapical, the style apparently single (the 3 styles confluent), 0.2-0.3 mm long, the stigmas 3, flattened, capitate. *Drupe*s red, 4-6.5 mm long and broad.

A native of Brazil (and probably Paraguay), *S. terebinthifolius* is cultivated in Central America (possibly naturalized in the Canal Zone), Florida, California and in various parts of the Old World.

CANAL ZONE: region of Balboa, *Johansen* 6 (US); Summit, *Mell* 10 (MO, US); Balboa, *Standley* 26897 (US).

The four Brazilian varieties of *S. terebinthifolius* recognized by Barkley are based on stem and leaf pubescence, leaflet number and angle of the leaflet apex. Brief examination of Brazilian specimens deposited in MO indicated that these taxa may represent nothing more than different points on a continuum of intergrading infraspecific variation in leaf and pubescence characters so often encountered in plant species. However, the authors do not assume the competence in the genus required to definitively evaluate the status of these varieties and for this reason they have not been placed in the synonymy of *S. terebinthifolius*.

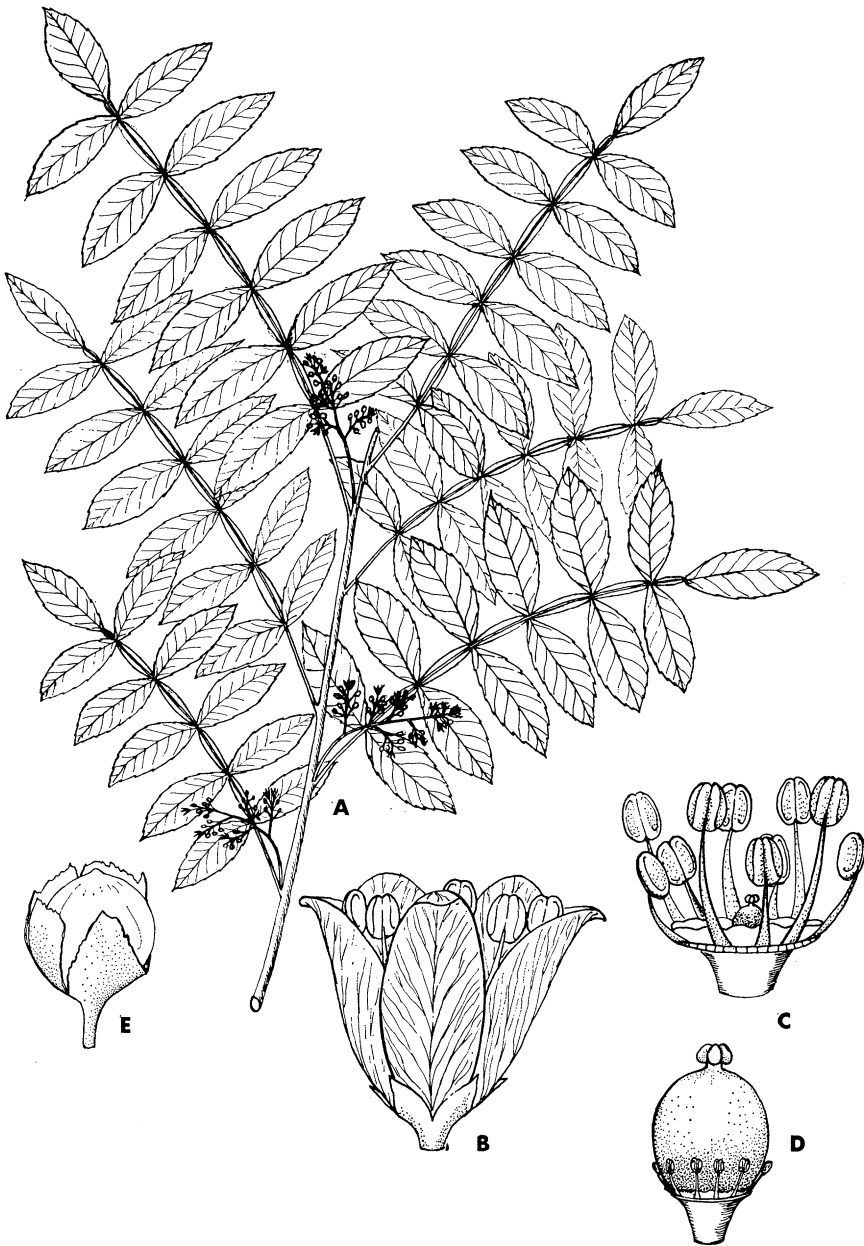


Fig. 7. *Schinus terebinthifolius* Raddi: A, habit ($\times\frac{1}{2}$); B, functionally male flower ($\times 12$); C, id., calyx and corolla removed ($\times 12$); D, functionally female flower, calyx and corolla removed ($\times 12$); E, fruit with exocarp peeling ($\times 3\frac{1}{2}$). A after *Dusén 14324* (MO), Brazil; B-C after *Macedo 3375* (MO), Brazil; D after *Bertoni 3467* (MO), Argentina; E after *Lindman A1437* (MO), Brazil.

2. *Schinus molle* L., Sp. Pl. 388, 1753.

Schinus molle, the pepper tree, is noted for its handsome panicles loaded with yellowish-white flowers and the subsequent clusters of shiny, red or lavender fruits. It is cultivated as an ornamental in Mexico and Central America and has doubtless escaped from cultivation in many places. It is uncertain whether it is truly native to Mexico and Central America or was originally introduced from South America. The authors are not aware of the existence of a Panamanian collection of *S. molle*, but its occurrence in Panama seems probable.

8. ASTRONIUM

Astronium Jacquin, Enum. Syst. Pl. Carib. 10, 1760.

Myracrodruon Freire Allemao, Braz. Comm. Sci. Expl. Trab. Sec. Bot. 3, t. 1 & 2, 1862.

Trees, large or less frequently small. *Leaves* odd-pinnate, the leaflets usually opposite, entire or less frequently crenate or serrate, short-petiolulate. *Inflorescences* terminal or axillary, ∞ -flowered. *Flowers* small, \varnothing or σ \varnothing ; calyx-segments 5, imbricate, persistent, accrescent and scarious in fruit; petals 5, imbricate in bud; disc 5-lobate, annular or the lobes \pm sepaarte; stamens 5, inserted at the base or margin of the disc; ovary unilocular, the solitary ovule subapical, the styles 3, terminal, separate, short. *Fruit* drupaceous, narrowly oblong to ovoid or subglobose, \pm terete, coriaceous, rostrate; seed oblong, the testa membranous.

About 12 species are known in tropical America; only one species is recognized in this treatment as occurring in Panama.

1. **Astronium graveolens** Jacquin, Enum. Syst. Pl. Carib. 33, 1760.—Fig. 8.

A. fraxinifolium Schott ex Sprengel in L., Syst. Veg. ed. 16, 4(2):404, 1827.

Tree to 35 m high. *Leaves* 2-7-jugate, the rachis 7-21 cm long (the petiole portion often elongate), the deciduous leaflets opposite (occasionally some alternate), with petiolules 1-6 mm long which are glabrous to pilosulous or villosulous; lamina of leaflets lance-oblong, less frequently ovate, acute or more often acuminate at the apex (the acumen obtuse to rounded or emarginate), basally obliquely acute to rounded or subtruncate, 4-14 cm long, 1.7-5 cm broad, membranous or subcoriaceous, entire or obscurely and irregularly crenate to serrate, glabrous to conspicuously pilosulous along the main veins below and often also above, occasionally generally pilosulous beneath, the secondaries often branching \pm equally near the margin (dichotomous), the reticulation faint to prominent. *Panicles* terminal, 7-25 cm long. *Flowers* σ \varnothing (staminodes are present in \varnothing flowers but a pistillode is absent in σ flowers), the pedicels 1-15 mm long, articulated; sepals orbicular or infrequently ovate, 1-1.5 mm long in flower, becoming 9-14 mm long and elliptic to obovate or oblanceolate as the fruit matures, scarious in fruit; petals 1.5-3 mm long, oblong-ovate to elliptic, acute or rounded, ascending to spreading or reflexed; stamens 2-3 mm long, the filaments compressed and subulate, the anthers 1-1.5 mm long; disc flattened (not tumid); ovary ovoid-oblong, 1.5-2 mm long, the styles 0.5-1 mm long, persistent or deciduous, the stigmas small and disciform. *Fruit* narrowly oblong, 10-15 mm long at maturity, 2-4.5 mm broad, subterete, the mature seed filling the lumen.

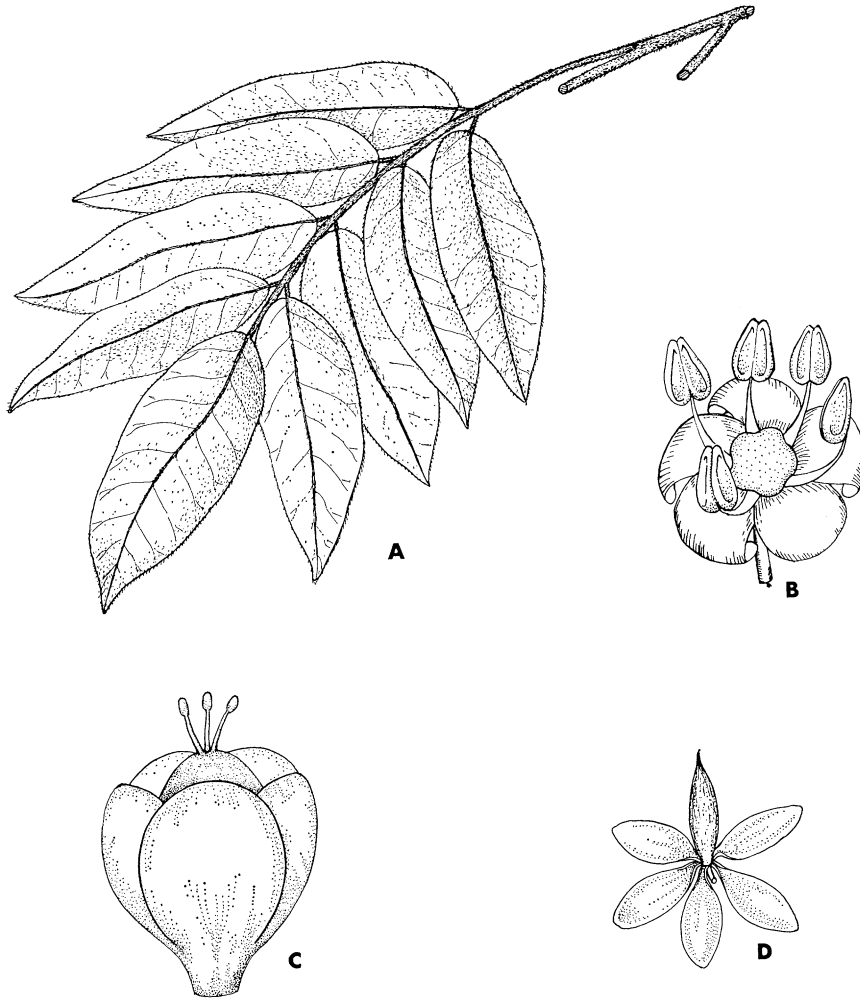


Fig. 8. *Astronium graveolens* Jacquin: A, compound leaf ($\times\frac{1}{2}$); B, male flower ($\times 7\frac{1}{2}$); C, functionally female flower ($\times 10$); D, fruit and persistent sepals ($\times 1$). A, D after Purpus 8761 (MO); Mexico; B after Hassler 7151 (MO), Paraguay; C after Hassler 91898a (MO), Paraguay.

Southern Mexico, Central America and South America from Colombia to Brazil, Bolivia and Paraguay.

CANAL ZONE: Barro Colorado I, *Shattuck* 632 (F), 866 (F); Río Pedro Miguel, nr East Paraiso, *Standley* 29951 (US). CHIRIQUÍ: Comarca del Barú, area W of Puerto Armuelles, *Stern & Chambers* 129 (F, MO, US); Finca Lérida to Boquete, *Woodson et al.* 1109 (F, MO). DARIEN: El Real de Sta. Maria, *Pittier* 6997 (US). PANAMA: dry, wooded hills around Alhajuela, *Pittier* 3730 (US); Río Tapia, *Standley* 26183 (US); nr Matías Hernández, *Standley* 28942 (US); Río Tocumen, *Standley* 29377 (US); Juan Díaz, *Standley* 30550 (US).

In both the Flora of Guatemala (Standley and Steyermark, *Fieldiana: Bot.* **24**(6): 180, 1949) and the Flora of Costa Rica (Standley, *Publ. Field Mus. Nat. Hist., Bot. Ser.* **18**: 624, 1937), *A. graveolens* and *A. fraxinifolium* are recognized as distinct species. In the Flora of Guatemala, however, a question is raised concerning the validity of separating specimens of *A. fraxinifolium* from Mexico and Petén from *A. graveolens*. The only character supposedly delimiting these species is the pubescence of the leaflets, being pilose in *A. fraxinifolium* and glabrous or essentially so in *A. graveolens*. After examination of Mexican, Central American and South American specimens of these taxa (deposited in F and MO), it appears that this distinction is arbitrary, as variation from completely glabrous to conspicuously pilose may be found in a very restricted geographic area. Specimens with an intermediate degree of pubescence are often encountered. Varietal status is the highest rank which could be accorded *A. fraxinifolium*. However, the authors have not recognized a variety *fraxinifolium* as they do not wish to apply formal names to extremes of a continuum of pubescence variation.

Wood of this species is of excellent grain and is used in furniture manufacture. It is also used for construction purposes but is apparently not insect resistant.

9. MOSQUITOXYLUM

Mosquitoxylum Krug & Urban, *Notizbl. K. Bot. Gart. Mus. Berlin* **1**: 78, 1895.

Trees. Leaves imparipinnate, \pm persistent, the leaflets opposite or subopposite; lamina of leaflets subcoriaceous, glabrate to soft-pubescent above and below, entire. *Panicles* arising from the upper leaf-axils, the branches spicate. *Flowers* small, mostly \varnothing ; sepals 5, free, persistent, imbricate; petals 5, imbricate in bud; stamens 5, inserted at the margin of the disc; ovary 1-locular, the ovule affixed laterally near the base of the locule, the style terminal, short, 3-branched near the apex, the stigmas 3. *Drupes* obliquely ovoid, compressed; seed latero-basal, small (occupying only a small portion of the fruit lumen).

A monotypic genus occurring in Mexico, Central America and the West Indies.

Mosquitoxylum jamaicense Krug & Urban, *Notizbl. K. Bot. Gart. Mus. Berlin* **1**: 79, 1895.—Fig. 9.

M. jamaicense var. *panamense* Barkley & Reed, *Amer. Midl. Nat.* **24**: 677, 1940.

Tree to 30 m high; branches with scurfy, gray or grayish-brown bark, the elliptical lenticels often prominent. *Leaves* clustered toward the branch-tips, with 5-14



Fig. 9. *Mosquitoxylum jamaicense* Krug & Urban: A, habit ($\times 1/2$); B, flower ($\times 7 1/2$); C, id., sepals and petals removed ($\times 9 1/2$). After Woodson *et al.* 1245 (MO).

pairs of leaflets, the rachis 10-30 cm long, the leaflets short-petiolulate; lamina of leaflets oblong to oblanceolate or obovate, apically rounded or emarginate or obtuse to acute or short-acuminate, basally cuneate and unequal, 2.5-8.5 cm long, 1.2-3 cm broad, marginally subrevolute, pilose above and below or glabrate. *Panicles* 7-27 cm long, the branches hirtellous. *Flowers* sessile, not clustered, each subtended by 3 persistent deltoid bracts ca 1 mm long; sepals ovate or rotund-ovate, ca 1 mm long, marginally minutely ciliate; petals ascending, ovate or elliptic, sparsely pubescent on the inner surface, 1.5-2 mm long; stamens ca 1 mm long; disc 5-lobate (each lobe secondarily lobed, the disc thus 10-crenulate), cupular; style persistent, the stigma \pm capitate. *Drupes* scarlet, lustrous, glabrous, 6-9 mm long, the mesocarp thin; seed somewhat compressed.

CANAL ZONE: Barro Colorado I, *Aviles 23b* (F), 955 (F), *Bangham 426* (F). COCLÉ: Loma del Tigre, region N of El Valle de Antón, *Allen 3805* (MO); betw Las Margaritas & El Valle, *Woodson et al. 1254* (F, MO). COLÓN: Loma de la Gloria, nr Fató (Nombre de Dios), *Pittier 4143* (holotype var. *panamense* B; isotypes GH, US). DARIEN: Puerta St. Dorothea, *Dwyer 2200* (MO), 2266 (MO, US).

The variety *panamense* proposed by Barkley and Reed is not recognized. With respect to the supposedly distinguishing characteristics of the varieties (leaflet number and pubescence), an isotype specimen (GH) of var. *panamense* has been found to conform more closely to var. *jamaicense* than to var. *panamense*. Examination of Central American specimens deposited in MO indicates that variation in leaflet number and pubescence is at random and completely intergrading within the species population. Two entities could not be said to exist in such a situation.

Mosquitoxylum jamaicense, known as mosquito wood, is valued for building purposes.

10. TOXICODENDRON

Toxicodendron P. Miller, Gard. Dict. Abr. ed. 4, 1754.

Rhus L., Sp. Pl. 265, 1753, pro parte.

Trees, shrubs or woody lianas with poisonous secretions. *Leaves* imparipinnate, deciduous, the leaflets membranous. *Inflorescences* paniculate, axillary, erect to nodding or pendant, the bracts lanceolate and deciduous. *Flowers* small, polygamodioecious; sepals 5, persistent; petals 5, ascending to spreading or reflexed, imbricate at anthesis; stamens 5, inserted below the disc; ovary 1-locular, sessile on the disc, the ovule basal, the style terminal, simple or apparently so, the stigmas 3. *Drupes* white, ca as long as broad, glabrous or sparingly pubescent with simple (eglandular) trichomes, slightly compressed, the exocarp deciduous, the mesocarp richly ceriferous; seed compressed.

Many authors (e.g., Engler in A. & C. DC., Monogr. Phan. 4: 393, 1883) have treated *Toxicodendron* as part of the genus *Rhus* L. However, Barkley (Ann. Missouri Bot. Gard. 24: 419, 1937) presents considerable evidence that *Toxicodendron* is a distinct genus. Five species are recognized by Barkley in the Western Hemisphere, one occurring in Panama. There are several Asian species. All members of the genus possess an irritant poison in the stem and leaves (and often in



Fig. 10. *Toxicodendron striatum* (Ruiz & Pavon) Kuntze: A, habit ($\times\frac{2}{3}$); B, bud of ♀ flower ($\times 17$); C, pistil and disc ($\times 14$); D, functionally ♂ flower ($\times 8$); E, drupe after epicarp has fallen away ($\times 1\frac{1}{3}$). A, B & E after Woodson & Schery 483 (MO); C after Purpus 7378 (MO), Mexico; D after Purpus 2019 (MO), Mexico.

the flowers) causing dermatoses in many individuals. Poison oak, *T. radicans* (L.) Kuntze, is a member of this genus. The sap of *Toxicodendron* species has the property of becoming black on exposure to air and drying into a durable varnish.

1. ***Toxicodendron striatum*** (Ruiz & Pavon) O. Ktze, Rev. Gen. Pl. **1**: 153, 1891.—Fig. 10.

Rhus striatum Ruiz & Pavon, Fl. Peruv. Chil. **3**: 29, pl. 252, 1802.

R. juglandifolia Willd. ex Roemer & Schultes in L., Syst. Veg. ed. 15, **6**: 649, 1820.

R. samo Tulasne, Ann. Sci. Nat., Bot., sér. 3, **6**: 367, 1846.

R. juglandifolia var. *samo* (Tulasne) Engler in A. & C. DC., Monogr. Phan. **4**: 401, 1883.

Tree or large shrub. *Leaves* 4-8 jugate, the rachis 10-30 cm long, the leaflets mostly opposite, with petiolules 2-6 mm long; lamina of leaflets oblong-lanceolate to oblong or occasionally ovate-lanceolate, apically acuminate, basally unequal and broadly cuneate to rounded, 5-11 cm long, 2.5-5 cm broad, entire and often sub-revolute, glabrous or puberulent beneath on the main veins. *Panicles* large, erect to \pm pendant, ∞ -flowered, the branches hirtellous. *Flowers* apparently σ (pistillode present) or φ (stamens somewhat reduced), the pedicels 1-4.5 mm long; sepals suborbicular to ovate-oblong, apically rounded or subtruncate, ca 1 mm long; petals ovate or oblong-ovate, 2-3 mm long; anthers 1.5-2 mm long in σ flowers, smaller in φ flowers, lanceolate or ovate-lanceolate, basally \pm cordate, the filaments compressed and subulate, 1.5-2 mm long in σ flowers; disc flattened, not tumid, obscurely 5-10 crenulate; ovary ovoid, ca 0.8 mm long, the style less than 0.5 mm long, persistent, the stigmas minutely papillose, capitate, flattened, sub-obscure. *Drupes* 5-9 mm long, white, the surface of the mesocarp with conspicuous dark, longitudinal streaks; seed filling the lumen of the drupe, 5-8 mm broad.

Vera Cruz, Mexico to Brazil and Peru.

CHIRIQUÍ: forests around El Boquete, *Pittier* 3029 (US); vic of Callejón Seco, Volcán de Chiriquí, *Woodson & Schery* 483 (MO, US).

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