

A REVISION OF *DILODENDRON* (SAPINDACEAE)¹

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ABSTRACT

Dilodendron of Brazil and adjacent regions and *Dipterodendron* of Central America and northern South America are congeneric. Here we discuss their relationships, present a key to the three species that we recognize in the combined genus, and make the appropriate new combinations for *Dilodendron costaricense* (Radlk.) Gentry & Steyermark and *D. elegans* (Radlk.) Gentry & Steyermark.

Dilodendron Radlk., a monotypic genus of the dry areas of subequatorial South America, is closely related to *Cupania* L. and *Matayba* Aubl., from both of which it differs strikingly in having bipinnate leaves. According to Radlkofer (1892–1900, 1895) the other main differentiating features of subtribe Cupanineae are that the petals of *Cupania* and *Matayba* (as well as closely related monotypic *Vouarana* Aubl.) have two squamae, whereas those of *Dilodendron* lack squamae. Two other monotypic genera, Brazilian *Scyphonychium* Radlk. and Guianan *Pentascyphus* Radlk., have an intermediate bifid or emarginate petal scale. The final genus of subtribe Cupanineae, *Tripterodendron* Radlk., likewise monotypic and restricted to Brazil, is unique in having tripinnate leaves and the small subcupular calyx and bisquamate petals of *Matayba*. Generic limits in subtribe Cupanineae are generally not clearly defined, and *Cupania* and *Matayba*, the only significant genera (indeed the only nonmonotypic genera) recognized by Radlkofer (1892–1900), are notoriously difficult to tell apart.

When Radlkofer (1892–1900) published his *Flora Brasiliensis* treatment, *Dilodendron* was known from Brazil and Bolivia, and from a single sterile collection from Costa Rica. *Dilodendron bipinnatum* has also since been collected in Paraguay and disjunct in the dry part of the Río Urubamba Valley in Convención Province of Cuzco Department, Peru (Macbride, 1956), but the Costa Rican collection was subsequently determined not to be congeneric.

Dipterodendron Radlk. is a small genus of three described species previously reported from Costa Rica, Panama, and northwestern Venezuela (Radlkofer, 1933; Steyermark, 1952; Croat, 1976). *Dipterodendron* was described by Radl-

kofer (1914) on the basis of three Costa Rican collections. He recognized two species separated by rather tenuous differences: leaflets smooth and drying bright green in *D. costaricense* Radlk. vs. leaflets dark green and papillose and appressed puberulous below in *D. elegans* (Radlk.) Radlk. The sterile Oersted collection now recognized as *D. elegans* had originally been described as a variety of *Dilodendron bipinnatum* in the *Flora Brasiliensis* by Radlkofer.

A third species, *D. venezuelense* Steyermark, was described in 1952 from Merida State in northwestern Venezuela, representing the first report of *Dipterodendron* for South America. Like that of *D. elegans* before it, the type of *D. venezuelense* was sterile. The Venezuelan plant was distinguished from *D. elegans* by larger, more coarsely toothed leaflets 2.3–4.5 cm long and 0.6–1.5 cm wide, and because of its geographic disjunction. However, recent collections from Costa Rica also have leaflets reaching 4 cm long and 1.5 cm wide. Some Costa Rican collections have leaflets with coarse teeth and others with fine teeth. Coarse teeth appear to reflect juvenile state rather than a consistent specific difference. Moreover, we have recently closed the geographic gap by collecting *Dipterodendron* in northern Colombia. Thus, we regard *D. venezuelense* as conspecific with *D. elegans*. Croat (1976) has already suggested that all three *Dipterodendron* species might prove conspecific, pointing out that *D. venezuelense* seems intermediate between *D. costaricense* and *D. elegans*. While the vegetative differences—mainly a more strongly appressed-puberulous leaflet undersurface in *D. elegans*—might be inadequate to justify maintaining *D. costaricense* as a species separate from *D. elegans*, there are also previously unreported fruit

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differences. Thus, we refer all Central American and northern South American material of *Dipterodendron* to two rather than three very closely related species, both of which range from Costa Rica to northern Venezuela.

The similarities between *Dipterodendron* of northern South America and monotypic *Dilodendron* of subequatorial South American dry forests suggest that even more merging is in order. This study was initiated when one of us recently collected a bipinnate-leaved Sapindaceae tree as a tree plot voucher at the Tambopata Nature Reserve in geographically intermediate Amazonian Peru. The Peruvian plant was recognized in the field as a species of *Dipterodendron*, representing a very large range extension of the genus. However, the equally striking vegetative similarity between the Peruvian plant and *Dilodendron* was subsequently discovered in the herbarium when an attempt was made to identify it to species. This led to an examination of the taxonomy of the entire complex, which has never been monographed except for a recopying of Radlkofer's earlier descriptions and commentary in his posthumous (1933) *Pflanzenreich* treatment. It turns out that *Dipterodendron* was never adequately differentiated from *Dilodendron* in the first place. Radlkofer (1914), who had seen no flowers, suggested that *Dipterodendron* is intermediate between *Dilodendron* and *Tripterodendron* but differentiated it only from the latter (which has tripinnate leaves and a thick oily aril, and lacks saponiferous cells in the embryo) rather than from the former even though he had earlier referred the first *Dipterodendron* collection to *Dilodendron*. Later (1933) he emphasized slight differences in radicle position. Aristeguieta (1973) questioned the validity of separating *Dipterodendron* from *Dilodendron*, noting that according to the literature *Dipterodendron* usually lacks petals and has the radicle on the margin of the cotyledon, while *Dilodendron* has 3–5 petals and the radicle descending down the middle of the dorsal side of the cotyledons. He ultimately assigned the Venezuelan material to *Dipterodendron* essentially on geographic grounds. Later, Steyermark (in herb.) identified sterile collections from Bolívar State in eastern Venezuela as *Dilodendron bipinnatum*, which would virtually eliminate the geographic discontinuity.

Although *Dipterodendron* might be retained as distinct on the basis of its apetalous flowers, vestigial petals are sometimes present. Moreover, in *Dilodendron* the very small petals are variable in

number, mostly 3–4 but sometimes making up a full complement of 5, and sometimes vestigial (Radlkofer, 1892–1900). In fact, male flowers can lack petals altogether, just as in *Dipterodendron*. Since number of petals and even their presence or absence is variable in the single species *D. bipinnatum*, there seems no compelling reason to separate *Dipterodendron* from *Dilodendron* on this basis. There is ample precedent for including in the same genus otherwise similar species that differ in presence or absence of petals, e.g., in *Swartzia*, *Licania*, or *Combretum*; moreover, other Sapindaceae genera like *Alectryon* and *Mischocarpus* have both petaliferous and apetalous species. Although interpretation of floral sexuality in Sapindaceae from herbarium specimens is very tricky, in the case of *Dipterodendron* loss of petals (only in male flowers?) might reflect a shift to full dioecy. We conclude that *Dipterodendron* should be united with *Dilodendron* to reflect best their extreme similarity. Indeed we are suspicious that monotypic *Tripterodendron*, of which we have examined only sterile material, might also be congeneric with *Dilodendron*. At any rate, some collections of *Dilodendron* have incompletely tripinnate leaves or squamellate petals, and the other distinguishing characters of disk margin, aril consistency, and lack of saponiferous cells in the embryo seem weak.

***Dilodendron* Radlk.**, Sitzungsber. Math.-Phys. Cl. Konigl. Bayer. Akad. Wiss. München 8: 355. 1878. TYPE: *D. bipinnatum*.

Dipterodendron Radlk., Smithsonian Misc. Collect. 61(24): 5. 1914. TYPE: *D. costaricense*.

Medium to large dioecious trees. Leaves alternate, bipinnate (rarely in part tripinnate), multifoliolate, the leaflets sessile or subsessile, serrate or dentate. Inflorescence a narrow (often almost subspiciform) panicle, usually borne clustered near the end of a branch and flowering precociously or with the newly expanding leaves. Flowers tiny, the sepals 5, the petals smaller than sepals, sometimes absent, when present variable in number and often in part vestigial, the stamens typically 8 but often fewer, the short anthers inflexed in bud, conspicuously exerted on slender filaments at anthesis, the ovary puberulous, trigonal-ovoid, (2–)3-locular, the style terminating in minute 2–3-lobed stigma. Capsule 2–3-lobed, loculicidally (2–)3-valved, the valves woody or subwoody, the 1–2(–3?) seeds ellipsoid, with a thin, shiny, dark brown testa, scarious aril (fide

Radlkofer), and basal hilum. Embryo (fide Radlkofer) subcircinately curved, the thick car-nose cotyledons saponiferous, the radicle dorsal.

KEY TO THE SPECIES OF *DILODENDRON*

- 1a. Outer margin of leaflet teeth convex, the leaflet margin noticeably ciliate, the lower midrib and lateral nerves with spreading hairs; flowers usually with small well-developed petals; calyx lobes apically rounded; leaves with 5–10, often opposite pinnae; Brazil to southern Peru 1. *D. bipinnatum*
- 1b. Outer margin of leaflet teeth straight, the leaflets not ciliate-margined, the lower midrib and lateral nerves glabrous or strigillose with a few appressed hairs on midrib nerves; flowers apetalous; calyx lobes acute; leaves with 8–16, usually alternate pinnae; Costa Rica to Venezuela and Peru.
- 2a. Fruit trigonal-globose, at dehiscence the valves not splitting to the base nor reflexed; inside of valves densely pilose, the outer surface dull, puberulous, and lenticellate; leaflets glabrous beneath, the tertiary venation visibly reticulate 2. *D. costaricense*
- 2b. Fruit laterally compressed, at dehiscence the valves splitting to the base and reflexing; inside of valves glabrous or sparsely pilose, the outer surface elenticellate, drying black and shiny, the scattered minute trichomes hardly visible on the verruculose surface; leaflets densely strigillose beneath, the tertiary venation usually not evident 3. *D. elegans*

1. ***Dilodendron bipinnatum*** Radlk., Sitzungsber. Math.-Phys. Cl. Konigl. Bayer. Akad. Wiss. München. 8: 355. 1878. SYNTYPES: Brazil. Minas Gerais: *St. Hilaire 1586, Martius s.n., Riedel 1090, Warming s.n.* (US).

Tree 8–20 m tall, to 40 cm dbh, the branchlets usually somewhat angled and/or longitudinally ridged, puberulous with both long and short (in part gland-tipped) hairs when young, becoming glabrescent, lenticels absent or minute and inconspicuous. Leaves bipinnate with 5–10 subopposite or alternate pinnae, rarely the basal leaflets of the lower pinnae completely divided and the leaf subtripinnate, the rachis puberulous with crisped trichomes, flattened adaxially toward base, usually ending in a naked tip extended beyond base of uppermost pinna, the pinnae 3–16-foliolate, the usually alternate leaflets narrowly ovate or oblong-ovate, obtuse to narrowly acute, 1.5–9 cm long, 0.5–3 cm wide, smaller at base and apex of each pinna, the margin rather ciliate and deeply toothed, the outer tooth margin

strongly convex, sometimes with 1 or 2 marginal notches (= doubly toothed), puberulous with erect or suberect (sometimes in part gland-tipped) trichomes, above glabrescent except the main veins, below \pm persistently pubescent over surface but concentrated on main veins, the tertiary venation somewhat prominulous below, the petiole 6–12 cm long. Inflorescence a terminal fascicle of narrow panicles, usually borne in the axils of fallen leaves at apex of a leafless branchlet, 3–36 cm long, tannish puberulous with trichomes of different lengths, the flowers sessile or subsessile, borne singly or in widely spaced, few-flowered clusters along and at tips of the lower branches (only at apex of the much-reduced upper lateral branches), subtended by bracteoles. Flowers greenish to cream or yellowish, 2–3 (male) to 5 (female, fide Radlkofer) mm long; sepals 5, ovate, unequal, sparsely appressed-puberulous and lepidote, the margins \pm ciliate; petals reduced, shorter than sepals, 3–4(–5), sometimes completely lacking in male flowers, broadly obovate, contracted to basal claw, puberulous at least on 2 tiny lateral projections (= scales) near apex of basal stalk; disk glabrous except for tuft of hairs between filament bases; stamens exerted, (6–) 8(–9, fide Radlkofer), radiating from center of disk, the filaments ca. 3 mm long, much narrower at apex, the anthers 1–1.5 mm long, reddish; the female flowers (not seen, fide Radlkofer) with puberulous disk, short thick style, and obtuse 3-lobed stigma. Capsule trigonal-obovoid, 1.5–2 cm long, splitting open somewhat unequally to near base, 3-valved, the valves woody, 3–4 mm thick, pubescent inside, glabrous or glabrate outside, drying black, the surface rugulose.

Additional specimens examined. BRAZIL. BAHIA: 10 km W of Barreiras, 500 m, (fr), *Irwin et al. 31317* (F, NY, US). DISTRITO FEDERAL: Bacia do Rio São Bartolomeu, Brasilia, (fl), *Heringer et al. 4530* (MO, NY), (fr), *Heringer et al. 5224* (NY), (fl), *Heringer et al. 7011* (MO). GOIAS: 15 km N of Veadeiros, (fl), *Prance & Silva 58264* (MO, NY, US); Zona do calcareo, correngo Maranhão, (fl), *Pires et al. 9472* (F). MATO GROSSO: Campinapolis, (st), *Haridasan 72* (F); 270 km N of Xavantina, 8 km E of base camp, (fl), *Ratter et al. 1874* (NY). MINAS GERAIS: Ituiutaba, (fl), *Macedo 761* (MO, US); 15 km de Grão Mogol, estr. Montes Claros-Grão Mogol, (fl), *Pirani et al. s.n.* (CFCR 880) (NY); Lagoa Santa, (st), *Warming s.n.* (US).

PARAGUAY: prope Concepción, (fl), *Hassler 7393* (MO).

BOLIVIA. BENI: Lake Rogagua, 300 m, *Rusby 1686* (NY). SANTA CRUZ: Río Yapacani, (fl), *Kuntze s.n.* of June 1892 (NY, US); Velasco, (fl), *Kuntze s.n.* of July 1892 (NY, US); Provincia del Sara, Montes de Dolores, Cantón Buena Vista, 450 m, (fl), *Steinbach 2515* (NY);

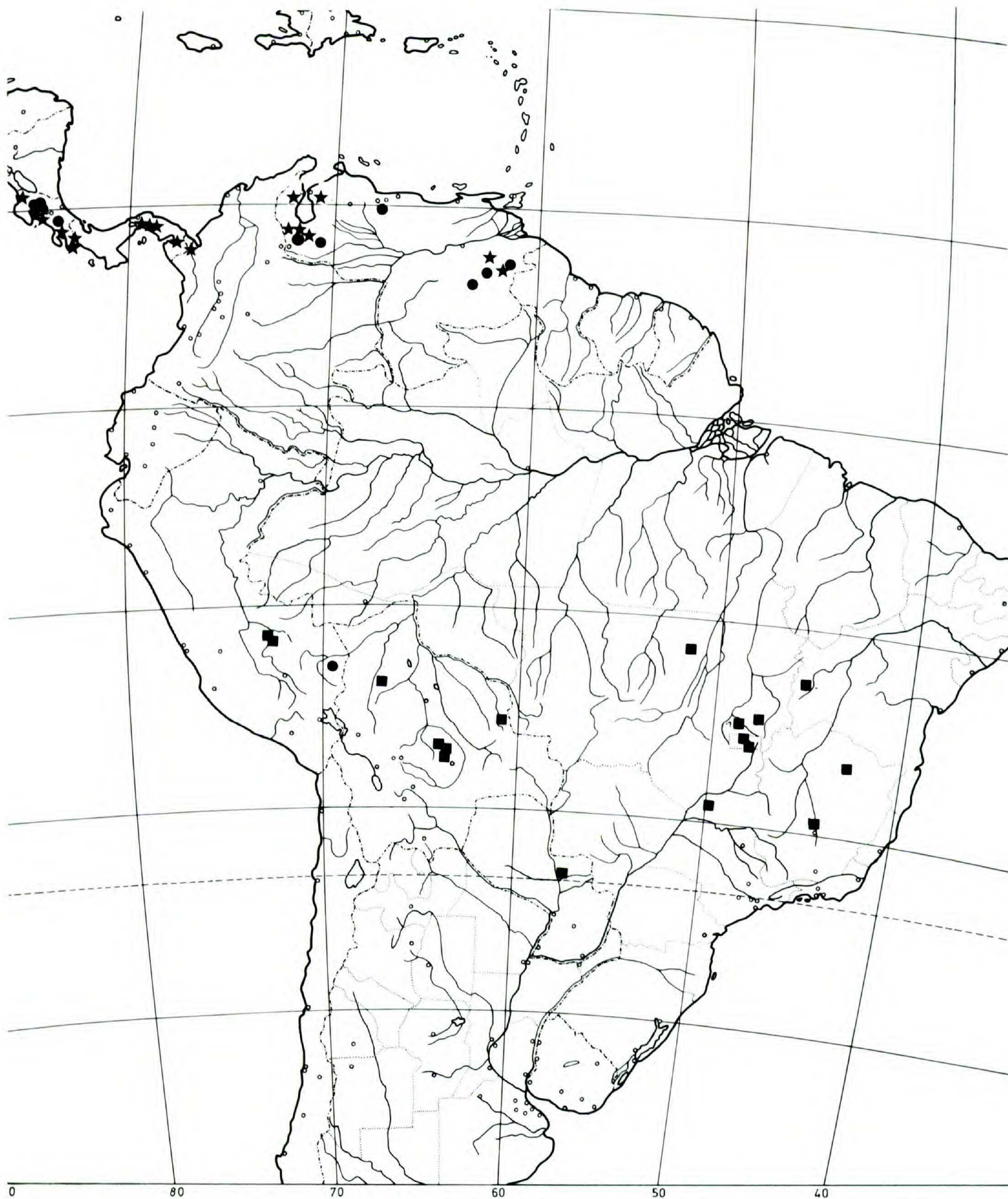


FIGURE 1. Distribution of *Dilodendron*. Squares = *D. bipinnatum*, stars = *D. costaricense*, circles = *D. elegans*.

Buenavista, Prov. Sara, 450 m, (fl), *Steinbach 6479* (F, MO, NY).

PERU. CUZCO: Santa Ana, 900 m, (fl), *Cook & Gilbert 1468* (US), *1617* (US); Potrero, Prov. Convención, 1,500 m, (fl), *Vargas 8228* (US); Santa Ana, Prov. Convención, (fl), *Weberbauer 5020* (F), (fr), *Weberbauer 5020* (F).

Vernacular names. Brazil: *Maria pobre*, *ma-*

moniha, *pão pobre*, *farinha secca*. Bolivia: *cuta*. Peru: *sumbaylo hembra*, *sumbaillo*.

2. ***Dilodendron costaricense*** (Radlk.) A. Gentry & Steyerl., comb. nov. *Dipterodendron costaricense* Radlk., *Smithsonian Misc. Collect.* 61(24): 7. 1914. TYPE: Costa Rica. Alajuela:

La Balsa de Río Grande, *Pittier 3645* (holotype, US; isotype, US).

Tree 14–35 m tall, to 45 cm dbh, with buttresses and flat spreading crown, the branchlets glabrescently finely puberulous, minutely and inconspicuously lenticellate. Leaves bipinnate with 8–14 alternate or subopposite pinnae, the rachis puberulous with crisped trichomes, slightly flattened adaxially, often subwinged when young, the pinnae 5–32-foliolate (or the leaflets of the uppermost incompletely differentiated), the alternate leaflets elliptic to oblong-elliptic, obtuse to acutish when mature, often subacuminate when young, 1–4.5 cm long, 0.3–1.5 cm wide, slightly smaller at base and extreme apex of each pinna (or the terminal leaflets incompletely differentiated when young), the margin not ciliate, serrate with relatively even teeth (occasionally almost entire and typically more deeply dentate when young), the outer tooth margin nearly straight, above glandular-punctate, puberulous on midvein, below glabrous or with very few inconspicuous trichomes near base, the tertiary venation visible and often \pm prominulous below; petiole 2–9 cm long. Inflorescences several per branch, 5–15 cm long, each a few-branched, narrow panicle arising from axil of fallen leaf, borne below leaves near branch apex in fruit (presumably as in *D. elegans* when in flower), puberulous with crisped and subappressed trichomes. Flowers unknown, presumably 8-staminate from the vestiges at base of young fruits (fide Radlkofer). Capsule trigonal-globose (even when only 2 fertile seeds), 2–3.4 cm long and diam., splitting open only partially, 3-valved, the valves woody, 2–4 mm thick, densely pilose inside, puberulous and minutely raised lenticellate outside, drying dull brownish with tannish lenticels, the seeds bean-shaped, 1.8–2 cm long with a shiny brown testa and a basal hilum.

Additional specimens examined. COSTA RICA. ALAJUELA: La Balsa de Río Grande, (fr), *Pittier 3645* (US); El Coyolar, near San Mateo, 100 m, (fr), *Pittier 3681* (coll. *Werckle*) (US); El Coyolar, 240 m, (st), *Standley 40056* (US); vic. of Capulín, Río Grande de Tarcoles, 80 m, (st), *Standley 40159* (US). GUANACASTE: Santa Rosa National Park, 200–300 m, 10°51'N, 85°37'W, (st), *Janzen 10683* (MO), *Liesner 4236* (MO). PUNTARENAS: Palmar Norte de Osa, 0 m, (fr), *Allen 5738* (US).

PANAMA. CHIRIQUI: Progreso, (st), *Cooper & Slater 280* (NY, US); W of San Bartolo Limite, (st), *Croat 22159A* (MO). DARIEN: Cerro Coasí, Río Coasí, (seed), *Duke 15629* (MO); Yaviza, (fr), *Pittier 6589* (US). PANAMA: El Llano, (fr), *Duke 5818* (MO); Río Tapía, (st),

Standley 28087 (US), 28282 (US); Juan Díaz, (st), *Standley 30574* (US); Río Tapía, (st), *Standley 41186* (US).

COLOMBIA. BOLIVAR: San Juan Nepomuceno, 200 m, 9°58'N, 75°10'W, (fr), *Cuadros & Gentry 3617* (MO). CHOCO: Municipio de Riosucio, Peyé, 60 m, (st), *Forero 1781* (COL, MO).

VENEZUELA. BOLIVAR: 48 km NE del caserío Los Rosos, 17 km de Upata, (st), *Blanco 334* (MO, NY, VEN); Altiplanicie de Nuria, ESE of Villa Lola, 315 m, (st), *Steyermark 86364* (NY, VEN). MERIDA: El Vigía-Panamericana, 100–120 m, (st), *Bernardi 2093* (NY). ZULIA: Dto. Colón, 14–25 km NO de Pto. Chama, (fr), *Bunting & Drummond 6324* (VEN); El Toro, 8 km SSO de El Consejo, (fr), *Bunting & Alfonzo 7054* (VEN); Misión de Tucuco, 105–250 m, (fr), *Ijjasz 88* (NY); La Cocha, Mun. Uribarri, (fr), *Trujillo 12211* (F).

Vernacular names. Costa Rica: *lupinsacca*. Panama: *guavino*. Venezuela: *tamarindo de monte*, *machirio tamarindo*.

The seeds are said to be edible (*Bernardi 2093*).

3. *Dilodendron elegans* (Radlk.) A. Gentry & Steyermark, comb. nov. *D. bipinnatum* var. *elegans* Radlk., in *Mart. Fl. Bras.* 13(3): 597. 1900. *Dipterodendron elegans* (Radlk.) Radlk., *Smithsonian Misc. Collect.* 61(24): 7. 1914. SYNTYPES: Costa Rica. Alajuela: prope Alajuela, *Oersted 4, 5* (C, not seen).

Dipterodendron venezuelense Steyermark, *Fieldiana, Bot.* 28: 346. 1952. TYPE: Venezuela. Merida: between San Isidro Alto and Santa Cruz de Mora, 760–1,800 m, *Steyermark 56569* (holotype, F; isotype, VEN).

Tree 8–25 m tall, the branchlets longitudinally striate-ridged or slightly angled, minutely puberulous with erect or subappressed trichomes, glabrescent, the lenticels small, inconspicuous and scattered or essentially lacking. Leaves bipinnate with 10–16 frequently opposite or subopposite pinnae, the rachis puberulous with crisped trichomes, grooved above; pinnae (5–)9–23-foliolate, the alternate to subopposite leaflets oblong-elliptic, obtuse to acute, 1–6(–7) cm long, 0.3–2 cm wide, smaller at apex and base of each pinna (or the terminal leaflets incompletely differentiated), the margin not ciliate, serrate with relatively even teeth, the outer tooth margin nearly straight, the upper surface rather glandular and shiny, drying dark, the midrib puberulous, the lower surface drying olive, \pm conspicuously strigillose with appressed trichomes, the tertiary venation usually not evident; petiole 3–17 cm long. Inflorescences few-branched, very narrow, subspiciform panicles, typically arising in clusters at the end of a leafless branch from the axils

of fallen leaves and often accompanying a cluster of unexpanded new leaves, in fruit \pm clustered at the base of the now fully expanded leaves, 3–26 cm long, tannish puberulous with \pm appressed trichomes, the flowers mostly in subsessile or short-stalked clusters along it. Flowers reddish, apetalous, the sepals 5, ovate, less than 1 mm long, puberulous; disk flat, densely puberulous; stamens exerted at anthesis, 6–7(–8?), the expanded filaments ca. 2.5 mm long, the short, thick anthers ca. 1 mm long; female flowers similar to immature male flowers, with the 1 mm long densely puberulous ovary tapering into a long, narrow style and surrounded by ca. 6–8 subsessile sterile stamens, the stigma minutely 2-lobed. Capsule compressed-obovoid, 1–1.8 cm long, 1–2 cm wide, splitting to base at dehiscence with the valves reflexed, 2-valved, the valves subwoody, ca. 2 mm thick, sparsely pilose or \pm glabrate inside, outside with sparse and inconspicuous scattered trichomes, drying black (red when fresh) with a minutely wrinkled-verrucose surface, elenticellate; seeds mostly 1 per fruit, flattened ovoid, 1 cm long, with shiny dark brown testa and a tan basal hilum.

Additional specimens examined. COSTA RICA. ALAJUELA: Camino de San Ramón, (st), *Brenes 4351a* (NY); La Palma (San Miguel) de San Ramón, 900–1,000 m, (fl), *Brenes 5351* (F, NY); San Pedro de San Ramón, (fl), *Brenes 15041* (F, NY); El Rodeo, (fl), *Lankester 1300* (F); El Rodeo, 900 m, (st), *Pittier 1578* (US); San Pedro, pres San Ramón, 1,300–1,400 m, (fr), *Tonduz 17667* (US). SAN JOSÉ: Basin of El General, 675–900 m, (fl), *Skutch 4850* (F, MO, NY), (fr), *4876* (MO, NY, US).

VENEZUELA. BARINAS: Barinitas, (st), *Bernardi 3337* (VEN). BOLIVAR: between Tumeremo and El Dorado, 29 km N of El Dorado, 220 m, (st), *Steyermark 86570* (NY, VEN); savanna de los Chacharros, 4 km upstream from Raudal Cotua, Río Asa, (st), *Steyermark 86773* (NY, VEN); 2 km SE of Los Patos, 30 km S of El Manteco, 365 m, (st), *Steyermark 86957* (NY, US, VEN). CARABOBO: carretera Maracay–Magdaleno–Guigüe, Cuesta de Yuma, 450 m, (fr), *Bunting 4349* (NY). TRUJILLO: Cerro Gordo, sandstone soil on ridge, 9°45'N, 70°15'W, 1,000 m, (fr), *Steyermark & Carreno 111646* (MO, NY, US). ZULIA: Dto. Colón, carretera Machiques–La Fria entre La Redoma y Placita, (fl), *Bunting & Alfonzo 6930* (VEN).

PERU. MADRE DE DIOS: Tambopata, 12°49'S, 69°18'W, 280 m, (st), *Gentry et al. 46217* (AMAZ, MO, USM).

Vernacular names. Costa Rica: *lorito*, *gallinazo*. Venezuela: *caro montañero*.

As thus constituted, *Dilodendron* is a small genus of three species with one species (*D. bi-*

pinnatum) mostly in the subequatorial dry areas of the Brazilian shield and adjacent regions, a second (*D. costaricense*) in northern South America extending northward into southern Central America, and a third (*D. elegans*) widespread from Costa Rica to Venezuela and Amazonian Peru. *Dilodendron elegans* and *D. costaricense* are apparently ecologically separated. In Central America *D. elegans* occurs in wet forest, whereas *D. costaricense* occurs in moist forest with a strong dry season and exclusively on the Pacific slope; similarly, in Colombia and Venezuela, *D. costaricense* occurs mostly in drier forests and *D. elegans* in wetter ones.

Dilodendron provides an excellent example of the importance of sterile collections. Not only was the original Peruvian collection that led to this entire revision sterile, but so are most of the other collections of the former *Dipterodendron*. Of the 22 collection numbers of *D. costaricense*, all but six are sterile and six of the ten state records from which it is known, including the only report from Colombia, are based only on sterile collections; the flowers are still unknown. Described from a sterile collection, *D. elegans* is now known from 17 collection numbers from eight different states in three countries; however, only nine of the collections are fertile and the only records for several states as well as for the country of Peru are based on sterile material. Large tropical forest trees like *Dilodendron* will never be understood until more collectors (and collecting institutions) get over their prejudice against sterile collections.

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