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Conservation

An updated checklist of the Mexican species of *Dalbergia* (Leguminosae) to aid in its conservation efforts

Un listado actualizado de las especies mexicanas de Dalbergia *(Leguminosae) para ayudar en los esfuerzos para su conservación*

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Abstract

The Mexican populations of the genus *Dalbergia* are severely diminished as a result of overexploitation and illegal traffic, as well as deforestation and fragmentation of their natural habitats. Here we present an updated list of the 20 species of the genus that are distributed in Mexico, 5 of which are endemic, along with an identification key. For each taxon we provide information on synonymy, life form, maximum height, distribution, altitude, vegetation types, common names, and conservation status. This checklist will contribute to the regulation and management of these species and constitute the foundation of *Dalbergia* conservation efforts in Mexico.

Keywords: Papilionoideae; Rosewood; Palisandre; Artificial key; Illegal traffic; Overexploitation; Endangered species

Resumen

Actualmente, las poblaciones mexicanas del género *Dalbergia* están siendo diezmadas tanto por la sobreexplotación y el tráfico ilegal, como por la deforestación y fragmentación de sus hábitats. En este trabajo, presentamos un listado actualizado de las especies del género que se distribuyen en México, de las cuales 5 son endémicas, junto con una clave de identificación. Para cada taxón se proporciona información sobre sinonimia, forma de vida, altura máxima, distribución, altitud, tipos de vegetación, nombres comunes y estado de conservación. Se espera que este estudio facilite la gestión y el manejo de estas especies y que sea la base de los esfuerzos de conservación de *Dalbergia* en México.

Palabras clave: Papilionoideae; Palo de rosa; Palisandro; Clave artificial; Tráfico ilegal; Sobreexplotación; Especies en riesgo

Introduction

The genus *Dalbergia* has a pantropical distribution and comprises ca. 250 species (Vatanparast et al., 2013), 27 of which are distributed in the Mesoamerican region (Linares & Sousa, 2007; Ricker et al., 2013; Sousa et al., 2001; Standley & Steyermark, 1946). Timber obtained from some species of the genus is known as rosewood,

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which has a high economic value for its beauty, durability and excellent mechanic and acoustic properties (Richter et al., 1996). According to Traffic (Jenkins et al., 2012) about 20 species of *Dalbergia* around the world are traded internationally for tonewood (for guitars, marimbas and xylophones, among other musical instruments), luxury furniture and luxury consumer items. In addition, the heartwood of some species has been used in traditional medicine, as they have antibacterial, antifungal, antioxidant and cytotoxic properties (Hamburger et al., 1988; Lianhe et al., 2011; Pérez-Gutiérrez & García-Báez, 2013; Rutiaga-Quiñones et al., 1995). Moreover, the pigments obtained from the heartwood of *Dalbergia congestiflora* Pittier have potential for food and cosmetics industry as colorants (Barragán-Huerta et al., 2004).

In Mexico, several species of *Dalbergia* have been traditionally used to make furniture, musical instruments, knife handles, and art crafts among other objects (Díaz-Gómez & Huerta-Crespo, 1986; Guridi & García-López, 1996). However, from 2010 onwards, the demand for *Dalbergia* as a source of timber increased worldwide driven mainly by the expansion of the Chinese market (Basik, 2015). As a consequence, enormous amounts of wood have been illegally extracted from the wild, seriously impacting natural populations. According to the Convention on National Trade in Endangered Species of Wild Fauna and Flora (CITES), between 2007 and 2012, China imported a total of 10,662 m^3 of rosewood from Mexico (CITES, 2013). Since then, the Mexican Environmental Protection Agency (Procuraduría Federal de Protección al Ambiente-Profepa) has detected several illegal shipments of *Dalbergia* wood to third countries. In addition to the problems of overexploitation and illegal trade, *Dalbergia* species in Mexico are distributed in highly endangered ecosystems such as tropical deciduous forests, tropical subdeciduous forests, tropical evergreen forests and cloud forests, among others. These 4 types of vegetation have been particularly affected by deforestation, mainly to establish agricultural and ranching fields (Dirzo & García, 1992; Gual-Díaz & Rendón-Correa, 2014; Hughes et al., 2000; Miles et al., 2006).

While important taxonomic contributions have enriched our knowledge on the genus *Dalbergia* such as the pioneering works of Pittier (1922) and Standley (1922), some national checklists (Ricker et al., 2013; Sousa et al., 2001, 2003), regional floras such as Flora of Guatemala (Standley & Steyermark, 1946) and Flora Novo-Galiciana (McVaugh, 1987) as well as the publication of new species in different regions of the country (Linares & Sousa, 2007; Rzedowski & Guridi-Gómez, 1988), the lack of an updated checklist of the *Dalbergia* species in Mexico has stalled the regulation and management of these species, especially of those subject to exploitation. This work compiles, to date, the taxonomic and conservation information for all species within a country rich in *Dalbergia* species; it provides an annotated checklist and an identification key for the Mexican species of *Dalbergia*, and makes available the information about their life form, distribution, types of vegetation in which they are found, common names, current risk status under the Mexican legislation (NOM-059-Semarnat-2010; Semarnat, 2010), the IUCN Red List, as well as the species listed in the CITES Appendices.

Materials and methods

We performed a bibliographic review for all *Dalbergia* species described for Mexico as well as in areas with phytogeographic affinity and revised all floristic contributions and taxonomic treatments published to date as well as the protologues for all species distributed in Mexico. We also reviewed ca. 4,000 herbarium specimens deposited in the National Herbarium of Mexico (MEXU) as well as duplicates of Mexican species deposited in the California Academy of Sciences (CAS), Dudley Herbarium, Stanford University (DS), Field Museum of Natural History (F), Escuela Agrícola Panamericana (EAP), Missouri Botanical Garden (MO), New York Botanical Garden (NY) and University of California (US) herbaria. We also revised herbarium material from Central America and northern South America. With this information, we compiled a list of the native Mexican species of *Dalbergia* (Appendix 1). Throughout the paper, we discuss the relevant taxonomic opinions that differ from those in published literature and databases. Our checklist includes the scientific name, its authority, as well as the protologue. We revised the type material for each Mexican species, as well as their associated literature, in order to better circumscribe species with their related names, considering morphological, phenological, and ecological aspects. We include all previously published synonyms for Mexican species, except those names which are in conflict with the species we recognize for the country (e.g., *Dalbergia cubilquizensis* (Donn. Sm.) Pittier as a synonym of *D. tucurensis* Donn. Sm. - TROPICOS). Information about life form, maximum height, vegetation types, altitude, and common names come from literature and herbarium specimens, whereas distribution is exclusively based on herbarium specimens. We only use curated specimens as the base for distribution as some of the information reported on the literature cannot be verified; on the other hand, herbarium specimens constitute primary information sources. We also provide distribution maps for each species based on ca. 1,000 herbarium specimens of MEXU; localities without coordinates were geo-referenced.

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Additionally, we include current risk of extinction status for each Mexican *Dalbergia* species according to the NOM-059-Semarnat-2010, the IUCN Red List, and the species regulated under CITES. Finally, we indicate if the species is endemic to Mexico.

Results

In Mexico, there are 20 species of *Dalbergia*, 5 of which (20%) are endemic. Most species are trees reaching 5 meters or more; 4 species are shrubs or lianas (*D. brownei* (Jacq.) Schinz, *D. ecastaphyllum* (L.) Taub., *D. monetaria* L. f. and *D. tabascana* Pittier); *D. glabra* (Mill.) Standl. is the only species that can be a liana, shrub or tree lower than 5 m high and with scandent branches. Below, we provide a key for the identification of the *Dalbergia* species distributed in Mexico, as well as a checklist of the *Dalbergia* species of Mexico (Appendix 1) and their corresponding distribution maps (Appendix 2).

Key to the Mexican species of *Dalbergia*.

1. Lianas and scandent shrubs or if trees less than 5 m high and with scandent branches 2
1. Erect trees 5 m high or more, never with scandent branches 6
2. Leaflets less than 4 cm long, mostly less than 2 cm long 3
2. Leaflets more than 4 cm long, most of them more than 5 cm long 4
3. Flowers 5-6 mm long; dense inflorescences, mostly axillary, pedicels 1-2 (-2.5) mm long; fruits linear-oblong or oblong, 4-10.5 × 0.9-1.2 (-1.4) cm, attenuate in the apex, reticulate veined, thin and flexible; terminal leaflet oblong; inhabiting open or rocky places, never in swamps or flooded places ..... *Dalbergia glabra*
3. Flowers (7-) 8-9 (-11) mm long; sparse inflorescences, mostly terminal, pedicels 3-5 mm long; fruits falcate or obliquely oblong, (1.4-) 1.5-4.6 × (0.7) 0.9-1.1 cm, normally truncate at the apex, not reticulate veined, thickened and somehow woody around the seeds; terminal leaflet mostly obovate; inhabiting permanent or seasonally flooded places ..... *Dalbergia tabascana*
4. Leaflet 1, densely strigose, discolorous; ovary villose or sericeous; fruit sparsely strigulose when mature ..... *Dalbergia ecastaphyllum*
4. Leaflets 1-7, sparsely strigulose, normally concoloured; ovary glabrous or ciliate in the upper margin; fruit glabrous, shining when mature 5
5. Leaflets 1-3, commonly subcordate or truncate at the base; flowers 8-10 mm long, petals not unguiculate, calyx with unequal lobes, the lowest linear, narrowly triangular or subulate, 1-1.5 × 0.5 mm long; fruits oblong or falcate, 1.5-4.5 × 0.8-1.3 cm, more than 1 seed ..... *Dalbergia brownei*
5. Leaflets 1-7, commonly attenuate or obtuse at the base; flowers 5-7 mm long, petals conspicuously unguiculate, calyx with equal or subequal lobes, 0.5 × 1.0 mm long; fruits orbicular to suborbicular or sub-square, rarely oblong, 2.2-5 × 2.1-4 cm, commonly 1 seeded ..... *Dalbergia monetaria*
6. Flowers (9.5-) 14-20 mm long, ovary glabrous or sometimes ciliate at the margins 7
6. Flowers of less of 10 mm long, ovary puberulent to variously pubescent 8
7. Calyx 7-9 mm long, hypanthium conspicuous, ribbed; inflorescences racemose; leaflets 5-7 (-9) mm long, ovate, glabrous when mature, shining, dark brown to chestnut when dry; drying fruits brown to mahogany, lustrous, never black ..... *Dalbergia calycina*
7. Calyx 4-7 mm long, hypanthium inconspicuous, smooth or scarsely ribbed; inflorescences paniculate; leaflets 9-21 mm long, ovate, elliptic, suborbicular or oblong, densely or sparsely strigose or glabrescent when mature, opaque, dark brown to blackish when dry; drying fruits olive to dark brown or black ..... *Dalbergia granadillo*
8. Inflorescences congested, peduncle and rachis not visible; fruits dense and congested with peduncles less than 1.5 cm long ..... *Dalbergia congestiflora*
8. Inflorescences not congested or if congested with peduncle clearly visible; fruits not congested with peduncles of more than 2 cm long 9
9. Leaflets 5; inflorescences open panicles, peduncles shorter than the inflorescences, branches of the inflorescences not thyrsoid; flowers mostly unilateral (or opening unilaterally); fruits glandular (black spots) ..... *Dalbergia stevensonii*
9. Leaflets more than 5 or at least some leaves with more than 5 leaflets; inflorescences racemes, peduncles longer than the inflorescences, branches of the inflorescences thyrsoid; flowers not unilateral (or opening in spiral); fruits eglandular 10
10. Leaflets 5-7 (-8), some leaves with 3 leaflets 11

10. Leaflets usually 7-15 or more, some leaves with 5 leaflets 12
11. Leaves 9-14 cm long, leaflets 3-7; inflorescences of less than 4 cm long; ovary villose; mature fruits velutinous, ferrugineous or yellowish ..... *Dalbergia calderonii*
11. Leaves 18-23 cm long, leaflets 7 (-8); inflorescences more than 4 cm long; ovary pubescent; mature fruits strigulose or glabrescent; straw-colored or yellow ..... *Dalbergia longepedunculata*
12. Leaves less than 14 cm long, leaflets less than 1.9 cm wide; inflorescences often longer than the underlying leaves ..... *Dalbergia luteola*
12. Leaves 14 cm long or at least some leaves more than 14 cm long; leaflets more than 1.9 cm wide; inflorescences always longer than the underlying leaves 13
13. Floral branchlets and underside of mature leaflets tomentose to densely tomentose, pubescence easy to feel by touch 14
13. Floral branchlets and underside of mature leaflets pubescent, densely strigose, strigulose or glabrescent, pubescence difficult to detect by touch 15
14. Leaflets (10-) 11 (-12); flowers 4-4.5 mm long; stigma ciliate ..... *Dalbergia modesta*
14. Leaflets 13-15; flowers 4.5-6 mm long; stigma glabrous ..... *Dalbergia cubilquitzensis*
15. Lateral leaflets commonly more than 3 cm wide; terminal leaflet 6-8 × 3-4 cm, obovate ..... *Dalbergia rhachiflexa*
15. Lateral leaflets commonly less than 3 cm wide; terminal leaflet 3-7 × 1.2-3 (-3.4) cm, oblong or elliptic, rarely obovate 16
16. Leaflets (15-) 19-21 ..... *Dalbergia ruddae*
16. Leaflets 9-13 17
17. Leaflets usually oblong, membranous or chartaceous, pubescence appressed or strigose; ovary glabrous, or scarcely ciliate at the margins; fruit membranous in the wings ..... *Dalbergia glomerata*
17. Leaflets usually ovate, sometimes oblong-elliptic, chartaceous to sub-coriaceous, with sparse trichomes, crispate, or sub-appressed; ovary villous or pubescent; fruit coriaceous in the wings 18
18. Leaflets 9-11, mostly elliptic, 2.1-5 × 1.1-2.2 cm, secondary nerves 9-12 pairs, tertiary and quaternary veins inconspicuous; inflorescences 3-4.5 cm long; mature fruits with ampulose, woody seminal chamber, with rigid wings ..... *Dalbergia melanocardium*
18. Leaflets (11-) 13-19, mostly oblong to ovate, 4-9 × 1.8-3.5 cm, secondary nerves more than 12, tertiary and quaternary veins conspicuous, at least near the midvein; inflorescences 3.5-9 cm long; mature fruits with seminal chamber not woody nor ampulose, wings not rigid 19
19. Leaflets usually ovate, membranous, tertiary and quarterly veins conspicuous only near the midvein, leaflets underside almost glabrous or sparsely strigulose ..... *Dalbergia palo-escrito*
19. Leaflets usually oblong or oblong-ovate, coriaceous or sub-coriaceous, tertiary and quarterly veins conspicuous along the entire lamina, leaflets underside densely pubescent with yellow or brown-yellowish trichomes ..... *Dalbergia tucurensis*

Remarks

Although *Dalbergia retusa* Hemsl. has been reported in publications and databases as being present in Mexico [Berendsohn et al., 2009; Croat, 1978; Dwyer, 1965; Sousa et al., 2001, 2003; Zamora, 2010; TROPICOS of the Missouri Botanical Garden (http://www.tropicos.org/) and the International Legume Database and Information Service-ILDIS (https://www.ildis.org)], a revision of the voucher specimens of the cited herbaria confirms that no wild specimens of this species have ever been collected in Mexico. We also checked carefully all publications citing Mexican *Dalbergia retusa* and even though they cite this species as known to Mexico, none of them provides vouchers that support this distribution. Even among the specimens cited in TROPICOS as *D. retusa*, there is not a single specimen from Mexico. Moreover, in the National Herbarium of Mexico (MEXU) we found only 1 voucher labeled as *D. retusa* from Quintana Roo with an annotation stating it comes from a cultivated individual introduced from Costa Rica (Sousa 12356 et al.-MEXU). It is highly probable that all comments in the aforementioned publications and international databases which identify *D. retusa* as native from Mexico derive from this misunderstanding.

Furthermore, *Dalbergia tilarana* N. Zamora was originally described for Nicaragua, Costa Rica and Panama (Zamora, 2000), and later recorded from Oaxaca, Mexico (García-Mendoza & Meave, 2011) and cited in TROPICOS as such. However, MEXU´s voucher sub *D. tilarana* (Calzada 16905-MEXU) cited by García-Mendoza

and Meave (2011), from which the registry of TROPICOS derives, was curated in 2014 by Linares and determined as *D. glomerata* Hemsl. Therefore, the record of this species in Oaxaca is also the result of a misidentification.

Dalbergia glomerata has been confirmed as an endemic species of Mexico as was previously stated by Sousa et al. (2001, 2003) and Ricker et al. (2013). This species is distributed in Oaxaca, Veracruz, Tabasco and Chiapas in tropical rain forests, tropical oak forests and secondary vegetation. Herbarium specimens determined as *D. glomerata* from other states were examined and they correspond to *Dalbergia congestiflora* Pittier (e.g., Soto & Boom 2036; Soto & Aureoles 8780-Guerrero-MEXU; Soto 147; Soto 521 & Andrade; Soto 2699 & Torres-Michoacán-MEXU; Halbinger s/n-Morelos-MEXU). Thus, *D. glomerata* is only distributed in the humid slope of the Gulf of Mexico. *Dalbergia glomerata* has also been reported as native of Costa Rica (Zamora, 2010), however the species is not distributed in that country, and it has probably been confused with *D. tilarana* N. Zamora, because of its vegetative resemblance. However, they can be distinguished by their inflorescences and fruits: *D. glomerata* has congested panicles 3-7 cm long while *D. tilarana* has open panicles 10-14 cm long; the fruits in *D. glomerata* are 3-5 × 0.5-1.6 cm, while in *D. tilarana* are 5.5-7.5 × 1.5-1.7 cm.

Dalbergia tabascana Pittier was originally described on the basis of the position of the standard, number of stamens, and shape of the style and leaflets (Pittier, 1922). Later the species was treated as a synonym of *Dalbergia glabra* (Mill.) Standl. by Standley and Steyermark (1946), albeit with a question mark. Novelo & Ramos (2005) included *D. tabascana* as an accepted taxon for the aquatic flora of Tabasco. However, TROPICOS and ILDIS still uses *D. tabascana* as a synonym of *D. glabra*. According to our revision, these 2 species differ on a variety of characters. For instance, *D. tabascana* has larger flowers of (7-) 8-9 (11) mm long, versus 5-6 mm long in *D. glabra*; *D. tabascana* has sub-cymose inflorescences, mostly terminal, few flowered while *D. glabra* has small panicles or corymbs, mostly axillary, densely flowered; *in D. tabascana*, fruits are falcate, while in *D. glabra* these are linear-oblong or oblong. Thus, we agreed with the taxonomic opinion of Pittier (1922) and Novelo & Ramos (2005), in considering *D. tabascana* and *D. glabra* as 2 different taxa.

According to the protologue of *Dalbergia palo-escrito* (Rzed. & Guridi-Gómez, 1988), this species inhabits the cloud forest of the Sierra Madre Oriental in the states of Hidalgo, San Luis Potosí and Querétaro, but we detected some disjunct populations from Morelos, Guerrero and Oaxaca that could be morphologically associated with *D. palo-escrito*. It is probable that in the past, *D. palo-escrito* might have had a broader range, and we are currently observing fragments of the original distribution. Further studies are needed to confirm this observation.

Discussion

The checklist provided here represents the baseline for any conservation efforts of the *Dalbergia* species in the country, according with the first target of the Global Strategy for Plant Conservation (GSPC) and the Mexican Strategy for Plant Conservation (EMCV), that calls for the "provision of a working list of known species". Checklists facilitate the accessibility and the use of accurate botanical names, as well as information for research, conservation and sustainable use, and provide data to respond to the necessities of policy makers (Patton et al., 2008), as well as enforcing authorities in the case of legally protected species, as is the case of those species within *Dalbergia*.

Currently, only 3 species distributed in Mexico have been assessed by the IUCN Red List: *Dalbergia calycina* Benth. (LC, Least concern), *Dalbergia monetaria* L. f. (LC, Least concern), and *D. glomerata* (Vu, Vulnerable), the later affected by the extraction of timber and habitat loss due to agricultural practices (Groom, 2012). Moreover, only 2 species, *D. congestiflora* and *D. granadillo*, are included in the Mexican Red List (NOM-059-Semarnat-2010), the only list that has legal standing in the country. Moreover, until 2016, only *D. granadillo* and *D. stevensonii*, both distributed in Mexico, were included in the appendices of the Convention on National Trade in Endangered Species of Wild Fauna and Flora data (CITES) (Table 1). Thus, this lack of information and regulation has favored in recent times the overexploitation of these very vulnerable species.

This checklist was used as the baseline to assess the risk of extinction of the timber species of Mexican *Dalbergia* in 2015 during a workshop organized by the National Commission for the Knowledge and Use of Biodiversity (Conabio), together with the Mexican Environmental Protection Agency (Profepa). Those species which life form are lianas were not considered in the assessment. During the workshop, a group of experts assessed the distribution, habitat, intrinsic biological vulnerability and anthropogenic impact using the Risk Evaluation Method (MER) of the Mexican Norm 059 (NOM-059-Semarnat-2010), and they concluded that all Mexican native timber species of *Dalbergia* qualify under some risk category (Table 1). As a direct result of assessment of the Mexican timber species of *Dalbergia,* in 2016, the Mexican Scientific Authority of CITES submitted a proposal to list 13 timber species of *Dalbergia* native to Mexico under the

Table 1

Dalbergia species included in Red Lists and CITES appendices. A (threatened), Ap. II (Appendix II), LC (least concern), P (endangered), Pr (special protection), Vu (vulnerable); * (not listed).

Mexican species	Current NOM-059-Semarnat-2010	Proposed categories for timber species NOM-059-Semarnat-2010	IUCN	CITES
Dalbergia brownei	*	*	*	*
Dalbergia calderonii	*	P	*	Ap. II
Dalbergia calycina	*	A	LC	Ap. II
Dalbergia congestiflora	P	*	*	Ap. II
Dalbergia cubilquitzensis	*	P	*	Ap. II
Dalbergia ecastaphyllum	*	*	*	*
Dalbergia glabra	*	*	*	*
Dalbergia glomerata	*	Pr	Vu	Ap. II
Dalbergia granadillo	P	*	*	Ap. II
Dalbergia longepedunculata	*	P	*	Ap. II
Dalbergia luteola	*	P	*	Ap. II
Dalbergia melanocardium	*	P	*	Ap. II
Dalbergia modesta	*	*	*	Ap. II
Dalbergia monetaria	*	*	LC	*
Dalbergia palo-escrito	*	A	*	Ap. II
Dalbergia rhachiflexa	*	A	*	Ap. II
Dalbergia ruddae	*	P	*	Ap. II
Dalbergia stevensonii	*	P	*	Ap. II
Dalbergia tabascana	*	*	*	*
Dalbergia tucurensis	*	P	*	Ap. II

Appendix II of CITES (*D. granadillo* and *D. stevensonii* were previously listed) (CITES, 2016). This proposal was approved during the 17th Conference of the Parties in Johannesburg in 2016 and the new CITES rosewood listings came into force on January 2, 2017 (Table 1). Thus, the 15 timber species of *Dalbergia* native to Mexico are now protected by this binding international Convention.

Although the species included in this checklist represent the current state of knowledge of the native species of Mexican *Dalbergia*, it is expected that as part of the dynamic process of taxonomy, there may be adjustments in the light of new observations and registries, as well as with the incorporation of new evidence coming from molecular studies that will help to elucidate limits among species, phylogenetic affinities, and the general patterns of diversification of the Mexican *Dalbergia* species.

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Appendix 1. Checklist of the native Mexican species of *Dalbergia. For each species we provide data of the protologue, synonyms, life form, maximum height, distribution in Mexico with representative specimens by state, types of vegetation, altitude, and vernacular names, as well as their conservation status.**

1. *Dalbergia brownei* (Jacq.) Schinz, Bull. Herb. Boissier 6(9): 731. 1898.
Amerimnon brownei Jacq., Enum. Syst. Pl. 27. 1760.
Dalbergia amerimnum Benth., J. Linn. Soc., Bot. 4 (Suppl.): 36. 1860.
T, S, L; 10 m; Tamaulipas (Pringle 6809-MEXU), Veracruz (Calzada 11660-MEXU), Tabasco (Novelo et al. 4125-MEXU), Campeche (Moreno-Casasola et al. 537-MEXU), Quintana Roo (Cabrera & Cabrera 13583-MEXU), Chiapas (Martínez 17852-MEXU); tropical evergreen forest, floodplain forest, tropical semi-deciduous forest, mangrove forests, riparian vegetation, coastal dunes, secondary vegetation; 0-120 m. Muco, mucal, bejuco de estribo.

2. *Dalbergia calderonii* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 4(8): 311. 1929.
Dalbergia funera Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 23(2): 55. 1944.
T; 15 m (25 m in Nicaragua); Oaxaca (Sánchez et al. 2626-MEXU), Chiapas (Breedlove 37536-MEXU); tropical deciduous forest, tropical semideciduous forest; 40-900 m. Palo de peine, funera, granadillo. CITES: Ap. II.

3. *Dalbergia calycina* Benth., J. Proc. Linn. Soc., Bot. 4 (Suppl.): 35. 1860.
Amerimnon calycinum (Benth.) Kuntze, Revis. Gen. Pl.1: 159. 1891. (5 Nov 1891).
Dalbergia intibucana Standl. & L.O. Williams, Ceiba 1(2): 81–82. 1950.
T; 25 m; Michoacán (Soto-Núñez et al. 9308-MEXU), México (Hinton 3971-MEXU), Oaxaca (Sousa et al. 10607-MEXU), Chiapas (Miranda 7805-MEXU); oak forest, pine-oak forest, 1400-1450 m. Sangualica, zopilote, cahuirica, granadillo negro. CITES: Ap. II.

4. *Dalbergia congestiflora* Pittier, J. Wash. Acad. Sci. 12(3): 57–58. 1922.
Amerimnon congestiflorum (Pittier) Standl., Contr. U.S. Natl. Herb. 23(5): 1666. 1926.
T, S; 10 m; Jalisco (Solís-Magallanes 957-MEXU), Colima (Leger s/n MEXU), Michoacán (Soto & Boom 2174-MEXU), Puebla (Guízar 1298-MEXU), Morelos (Castro 326-MEXU), Guerrero (Macqueen et al. 426-MEXU), Oaxaca (Anderson & Anderson 5577-MEXU), Chiapas (Hughes 577-MEXU); tropical deciduous forest, tropical semideciduous forest, riparian vegetation, secondary vegetation; 40-1400 m. Campinchirán (tarasco), cuero de vaca, camotillo. NOM-059-SEMARNAT-2010: En peligro de extinción (Endangered); CITES: Ap. II.

5. *Dalbergia cubilquitzensis* (Donn. Sm.) Pittier, J. Wash. Acad. Sci. 12(3): 56. 1922.
Dalbergia variabilis var. *cubilquitzensis* Donn. Sm., Bot. Gaz. 57(5): 417. 1914.
T; 15 m; Oaxaca (Torres & Campos 13891-MEXU), Chiapas (González 22-MEXU); tropical evergreen forest, tropical semideciduous forest, cloud forest, secondary vegetation; 150-700 m. Granadillo, hormiguillo, palo de cuero. CITES: Ap. II.

6. *Dalbergia ecastaphyllum* (L.) Taub., Nat. Pflanzenfam. 3(3): 335. 1894.
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Ecastaphyllum ecastophyllum Huth. Helios: Abhandlungen und monatliche Mittheilungen aus dem Gesammtgebiete der Naturwissenschaften 11(9): 134. 1893. *Nom. inval.*
Amerimnon ecastaphyllum (L.) Standl., J. Wash. Acad. Sci. 15(20): 459. 1925.
T, S, often scandent; 7 m; Veracruz (González-Quintero 268-MEXU), Tabasco (Ventura 20136-MEXU); Quintana Roo (Tapia & Carnevali 1412-MEXU); thickets along the seashore, riparian vegetation, coastal dunes, mangrove forests, forests associated to mangroves; 0-10 m.

7. *Dalbergia glabra* (Mill.) Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 8(1): 15. 1930.
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Amerimnon glabrum (Mill.) Standl., Contr. U.S. Natl. Herb. 23(2): 507. 1922.
Dalbergia cibix Pittier, J. Wash. Acad. Sci. 12(3): 59. 1922.
T, S, L; 10 m; Veracruz (Ventura 10694-MEXU), Guerrero (Torres et al. 1833-MEXU), Oaxaca (Sousa et al. 561-MEXU), Tabasco (Castillo 627-MEXU), Campeche (Álvarez & Jiménez 4474-MEXU), Yucatán (Reyes 297-MEXU), Quintana Roo (Álvarez &

Ramírez 10933-MEXU), Chiapas (Breedlove 51897-MEXU); riparian vegetation, gallery forest, tropical deciduous forest, tropical semideciduous forest; tropical evergreen forest, ecotone of oak forest and tropical evergreen forest, tropical semideciduous forest, oak forest, *Pinus oocarpa* forest, pine-oak forest, secondary vegetation; 12-820 m. Bejuco de estribo, ay-pach (mixe).

8. *Dalbergia glomerata* Hemsl., Diagn. Pl. Nov. Mexic. 1: 8. 1878.
Amerimnon glomeratum (Hemsl.) Standl., Contr. U.S. Natl. Herb. 23(2): 507–508. 1922.
T; 30 m; Veracruz (Ibarra & Sinaca 1749-MEXU), Tabasco (Guadarrama et al. 6303-MEXU), Oaxaca (Sousa et al. 9349-MEXU), Chiapas (Aguilar 983-MEXU); tropical evergreen forest, tropical oak forest, secondary vegetation; 200-1250 m. Hormiguillo, palo de marimba, gateado, bálsamo. CITES: Ap. II. Endemic.

9. *Dalbergia granadillo* Pittier, J. Wash. Acad. Sci. 12(3): 62–63. 1922.
Amerimnon granadillo Standl., Contr. U.S. Natl. Herb. 23(2): 507. 1922.
T; 25 m; Nayarit (Benítez 3246-MEXU), Jalisco (Pérez & Verduzco 3018bis-MEXU), Michoacán (Madrigal 3191-MEXU), Guerrero (Torres et al. 9944-MEXU), Oaxaca (Perret et al. 313-MEXU), Chiapas (Ventura & López 3558-MEXU); tropical deciduous forest, tropical semideciduous forest, tropical evergreen forest, oak forest, disturbed oak-pine forest; 80-1950 m. Granadillo. NOM-059-SEMARNAT-2010: En peligro de extinción (Endangered); CITES: Ap. II. Endemic.

10. *Dalbergia longepedunculata* J. Linares & M. Sousa, Ceiba 48(1–2): 63–64, f. 2. 2007 [2008].
T; 8 (-18) m; Oaxaca (Maya 1730-MEXU), Chiapas (Martínez & Aguilar 36800-MEXU); tropical subdeciduous forest, pine-oak forest, oak forest, secondary vegetation; 300-1100 m. CITES: Ap. II.

11. *Dalbergia luteola* J. Linares & M. Sousa, Ceiba 48(1–2): 64–654, f 3. 2007 [2008].
T; 8 m; Chiapas (Breedlove 42124-MEXU, MO, NY); tropical deciduous forest, riparian vegetation in pine-oak forest; 800-1100 m. CITES: Ap. II.

12. *Dalbergia melanocardium* Pittier, J. Wash. Acad. Sci. 12(3): 57. 1922.
Amerimnon melanocardium (Pittier) Standl., J. Wash. Acad. Sci. 13(20): 443. 1923.
T; 15 m; Chiapas (Miranda 7756-MEXU); tropical subdeciduous forest and derived vegetation; 1300-1600 m. Granadillo, ebano. CITES: Ap. II.

13. *Dalbergia modesta* J. Linares & M. Sousa, Ceiba 48(1–2): 65–66, f. 4. 2007 [2008].
T; 13 m; Oaxaca (Pascual 1497-MEXU), Chiapas (Calónico et al. 22886-MEXU); mixed forests, cloud forest, ecotone of cloud forest with tropical deciduous forest, tropical deciduous forest; 800-1500 m; CITES: Ap. II. Endemic.

14. *Dalbergia monetaria* L. f., Suppl. Pl. 317 1781 [1782].
Dalbergia volubilis Roxb., Pl. Coromandel 2: 48, pl. 191. 1798.
Ecastaphyllum monetaria Pers., Syn. Pl. 2(2): 277. 1807.
Ecastaphyllum benthamianum Miq., Linnaea 18: 575. 1844 [1845] (prob. Aug 1845).
Ecastaphyllum monetaria Baker, Fl. Trop. Afr. 2: 236. 1871.
Dalbergia volubilis (L.) Urb. Repert. Spec. Nov. Regni Veg. 16: 136. 1919.
T, S, L; 15 m; Veracruz (Menéndez 96-MEXU), Tabasco (Ventura 21.162-MEXU), Chiapas (Aguilar et al. 10698-MEXU); riparian vegetation, mangrove forests, tropical evergreen forest, tropical semideciduous forest; 0-350 m.

15. *Dalbergia palo-escrito* Rzed. & Guridi-Gómez, Acta Bot. Mex. 4: 2–8, f. 1–2. 1988.
T; 35 m; San Luis Potosí (Jiménez s/n MEXU), Querétaro (Carranza 3441-MEXU), Hidalgo (Torres & Hernández 3074-MEXU), Morelos (Carlson 3148-MEXU), Guerrero (García 372-MEXU), Oaxaca (Calzada 22250-MEXU); cloud forest, *Juniperus* and *Pinus* forest, *Liquidambar* and *Cupressus* forest, pine-oak forest, tropical deciduous forest, oak and *Lonchocarpus* forest; 900-1900 m. Escrito, palo escrito, tlanchinol, tlacuilo, tlajuilocuáhuitl (nahuatl), tzipil y tzipilín (huastec). CITES: Ap. II. Endemic.

16. *Dalbergia rhachiflexa* J. Linares & M. Sousa, Ceiba 48(1–2): 66–67, f. 5. 2007.
T; 15 m; Michoacán (Soto-Núñez & Cortés 2625-MEXU, CAS), Guerrero (Noriega 598-MEXU); tropical deciduous forest, disturbed vegetation derived of tropical semideciduous forest; 0-400 m. CITES: Ap. II. Endemic.

17. *Dalbergia ruddae* J. Linares & M. Sousa, Ceiba 48(1–2): 67–69. 2007.
T; 25 m; Chiapas (Téllez et al. 535-MEXU); tropical evergreen forest. 0-900 m. Corazón bonito, tepenahuastle; CITES: Ap. II.

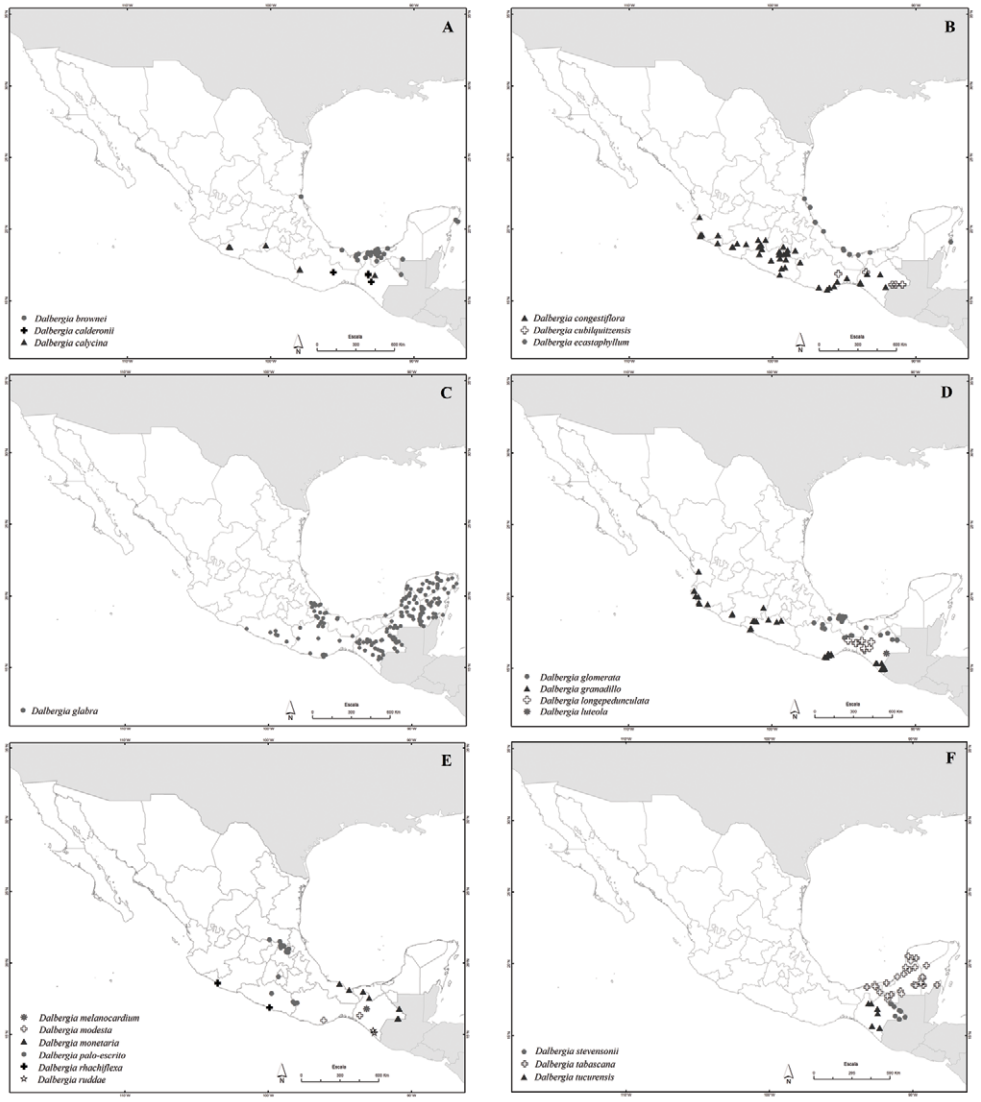
18. *Dalbergia stevensonii* Standl., Trop. Woods 12: 4–5. 1927.
T; 20 (-35) m; Chiapas (Martínez 18496-MEXU); tropical evergreen forest, tropical semideciduous forest, secondary vegetation; 0-350 m. Corazón azul, nogal, rosul; CITES: Ap. II.

19. *Dalbergia tabascana* Pittier, J. Wash. Acad. Sci. 12(3): 58–59. 1922.
S, L; 3 m; Tabasco (Hanan et al. 1028-MEXU), Chiapas (Ramamoorthy et al. 2531-MEXU), Campeche (Cabrera & Cabrera 14115-MEXU), Yucatán (Carnevali et al. 5566-MEXU), Quintana Roo (Álvarez et al. 9406-MEXU); swamps, mangrove forest, riparian and coastal vegetation, sabana, tropical deciduous forest, flood lowland forest, tropical evergreen forest, tropical semideciduous forest, coastal dunes; 0-50 m. Estribo, box-muc, muk.

20. *Dalbergia tucurensis* Donn. Sm., Bot. Gaz. 46(2): 111. 1908.
Dalbergia calderonii var. *molinae* Rudd, Novon 5(4): 368. 1995.
T; 20 (-30) m; Chiapas (Shilom 4168-MEXU); tropical deciduous forest, tropical evergreen forest, cloud forest, pine-oak forest, pine forest, secondary vegetation; 1700-2500 m. Granadillo, ya te' (tzeltal), hormiguillo; CITES: Ap. II.

*The letters refer to life form: trees (T), shrubs (S), and lianas (L).

Appendix 2. Distribution maps of the Mexican species of *Dalbergia.*



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