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Flower of the heart, *Magnolia yajlachhi* (subsect. *Talauma*, Magnoliaceae), a new species of ceremonial, medicinal, conservation and nurse tree relevance in the Zapotec culture, Sierra Norte de Oaxaca, Mexico

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Abstract

A new species of *Magnolia* from Sierra de Juárez, Oaxaca, Mexico, is described and illustrated. *Magnolia yajlachhi* belongs to sect. *Talauma* subsect. *Talauma*, locally known as *yajlachhi* ("flower of the heart" in Zapotec). It shares with *M. lacandonica* a subglobose mature fruit and entirely white petals, but differs in having fewer carpels and stamens, more lateral leaf veins per side, and orange seeds (vs. scarlet). It shares with *M. zoquepopolucae* a subglobose fruit but differs in having fewer carpels and stamens, entirely white petals (vs. purplish in the apical ¾), more lateral leaf-veins per side, and orange seeds (vs. scarlet). It shares with *M. mexicana* a similar number of carpels and stamens but differs in having subglobose fruits to widely ovoid-depressed (vs. widely ellipsoid), more leaf-veins per side, entirely white petals (vs. adaxially purplish in the apical ¾), and orange seeds (vs. scarlet). A key to Mexican species of sect. *Talauma* subsection *Talauma* is provided. This species was assessed as critically endangered (CR). The species has a ceremonial, medicinal, conservation and nurse-tree relevance in the Zapotecan culture.

Key words: medicinal use, nurse tree, Sierra de Juárez, *Talauma*. Zapotec

Resumen

Se describe e ilustra una nueva especie de *Magnolia* de Sierra de Juárez, Oaxaca, México. *Magnolia yajlachhi* pertenece a la sección *Talauma*, subsección *Talauma*, comúnmente conocida como *yajlachhi* (flor del corazón en zapoteco). Esta especie comparte con *M. lacandonica* el fruto maduro subgloboso y los pétalos enteramente blancos, pero difiere de esta última en tener menor número de carpelos y estambres; más venas foliares laterales por lado; y semillas de color naranja vs. escarlata. Similarmente, comparte con *M. zoquepopolucae* el fruto maduro subgloboso, pero difiere de esta última en que tiene menor número de carpelos y estambres; pétalos enteramente blancos vs. violáceos en la parte apical (¾); mayor número de venas foliares laterales por lado; y semillas de color naranja vs. escarlata. Comparte con *M. mexicana* una cantidad similar de carpelos y estambres, pero difiere de esta última en tener frutos subglobosos a ampliamente ovoides-deprimidos vs. ampliamente elipsoides; mayor número de venas foliares por lado; pétalos completamente blancos vs. adaxialmente purpúreos en la parte apical (¾); y semillas de color naranja vs. escarlata. Se provee una clave actualizada para las especies mexicanas de la sect. *Talauma* subsect. *Talauma* en México. Esta especie fue evaluada y clasificada como en peligro crítico (CR). La especie tiene importancia ceremonial, medicinal, como nodriza y en conservación *in situ* y *ex situ* en la cultura zapoteca.

Introduction

New World Magnoliaceae Jussieu (1789: 280) constitute nearly half of the species world-wide diversity in the family, with nearly half of these species (80 spp.) concentrated in Mexico (36 spp.), Central America (31 spp.) and the Caribbean (13 spp.), with almost no overlap of species distributions between regions; the other half occur in South America, from northern Colombia to southeastern Brazil. Only 4% of New World species are found in southeastern USA, with only one of these reaching Canada (Howard 1948, Lozano 1994, Vázquez-García 1994, Vázquez-García *et al*. 2016a; Meyer 1997, Palmarola *et al*. 2016).

The taxonomy of Neotropical Magnoliaceae, except for Colombia, has been poorly studied until recently,

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particularly that of *Magnolia* Linnaeus (1753: 535) section *Talauma* Jussieu (1789: 281), which now includes nearly 130 species in four subsections: 1) subsect. *Cubenses* Imkhanitskaya (1991: 60) consists of ten species all from the Caribbean islands; 2) subsect. *Chocotalauma* Vázquez, Pérez & Arroyo in Pérez *et al*. (2016: 270) includes six species, all from the biogeographical Chocó of Colombia-Ecuador; 3) subsect. *Dugandiodendron* (Lozano 1975: 33) Figlar & Noteboom (2004: 90) with 24 species, the great majority of them from the Colombian Andes and a few from northern Peru, the Andean tepuis of Ecuador and the Venezuelan tepuis of the Guyana Shield; and 4) subsect. *Talauma*, the largest, including 96 species ranging from western Mexico in the northwestern portion of the Sierra Madre del Sur in Jalisco to southeastern Brazil in the *Mata Atlantica* of Santa Catarina (Vázquez-García 2016a).

Many Mexican and Central American species of *Magnolia* subsection *Talauma*, including the new species described here, until recently have been erroneously included in *Magnolia mexicana* De Candolle (1817: 451) [=*Talauma mexicana* (DC.) Don (1831: 85)], a species confined to just Central Mexico. This is largely because of incomplete and poor specimens obtained from remote tropical mountain forest relicts where these species occur as scattered individuals. Now we know that *Magnolia sect. Talauma*, subsect. *Talauma* in Mexico and Central America includes 30 species distributed in six countries: Mexico (12 spp.), Costa Rica (9), Panama (4), Guatemala (2), Honduras (3), Nicaragua (1), with only one species, *M. morii*, shared between two countries: Costa Rica and Panama (Zuccarini 1837; Pittier 1910; 1918; Standley 1940; Lozano 1994; Vázquez-García *et al.* 2012a, 2012b, 2012c, 2013a, 2013b, 2013c, 2013d).

Here we describe and illustrate, a new species of *M.* subsection *Talauma* (Magnoliaceae) and the third record of this group in the state of Oaxaca, Mexico, where it is a species of ancient cultural and medicinal relevance. The newly proposed taxon was first noticed flowering in July 2010 by Reyna Domínguez, in her garden, at San Juan Juquila Vijanos, Oaxaca, where her parents Bernardo Domínguez-Yescas and Ma. Luisa Pascual-Yescas, transplanted two seedlings over a decade ago (Figs. 3 A–F). Biologist Reyna kept wondering why a large tree with large fragrant flowers (Fig. 4 A–J) did not produced any seeds (Fig. 5 A). In mid-2013, noting the stipular scar covering the entire length of the petiole, the tree was determined as belonging to *Magnolia* sect. *Talauma* subsect. *Talauma*, but with some differences with respect to other morphologically similar species, i.e., *M. lacandonica* Vázquez, Pérez-Farrera & Martínez-Camilo in Vázquez-García *et al.* (2013a: 1), *M. mexicana* and *M. zoquepopolucae* Vázquez in Vázquez-García *et al*. (2012: 52). Later, in November 2013, the first fruiting material was obtained (Fig. 5 B–D), and the two-stem tree in the ravine had flowers damaged by at least by two kinds of beetles (Figs. 5 E–F, 6 A–I). Recently, this year, Reyna observed in one of her social network photographs of flowering branches similar to those of the trees in Juquila Vijanos, and she was impressed by the hundreds of flower buds in use during the Good Friday ceremony at Yatzona (Fig. 7 A–D, F). We obtained fruiting material from Yatzona to confirm its identity and determined its population size (ca. 60 trees), large enough to sustain a Holy Friday ceremony demanding nearly a thousand flowers. However, it was not until September 2018 that we gained sufficient understanding of fruit variability among various locations together with revision of specimens from pertinent herbaria (CHAPA, ENCB, IBUG, MEXU, MO, NY, OAX, SERO, US, WIS and XAL) that we were able to contrast the proposed species with the other species most similar morphologically (Table 1, Fig. 8). Morphological description and illustrations were based on fresh and herbarium material. Leaf description and general shapes of reproductive structures follow Lozano (1994) and Vázquez-García *et al*. (2016a). The herbarium acronyms follows Thiers (2018). For accepted names we used *Plants of the World Online* (POWO 2018). Names of plants follow in the *International Plant Name Index* (IPNI 2018). Conservation status was assessed based on IUCN (2012). We consulted the electronic database of the *Global Biodiversity Information Facility* (GBIF) for locations of species of *M*. sect. *Talauma* in Oaxaca (Fig. 1). Many references were located using *Tropicos* (http://www.tropicos.org/) in connection with the *Biodiversity Heritage Library* (http://biodiversitylibrary.org).

Key to Mexican species of *Magnolia* (section *Talauma* subsection *Talauma*) Magnoliaceae

1. Flower buds 3.5–4.0 cm long; occurring only in Hidalgotitlán, Veracruz ..... *Magnolia wendtii* Vázquez in Vázquez-García *et al*. (2013b: 482).
- Flower buds 8.0–12.0 cm long; not present in Hidalgotitlán,Veracruz 2
2. Abaxial portions of carpels detaching from fruit axis and falling mostly in large irregular many-carpellate (> 15) masses; Chiapas (Ocozocuautla) ..... *Magnolia perezfarrerae* Vázquez & Gómez-Donínguez in Vázquez-García *et al*. (2013a: 417).
- Abaxial portions of carpels detaching from fruit axis and falling mostly singly, occasionally in few-carpellate (< 8) masses; not in Ocozocuautla, Chiapas ..... 3.
3. Leaves mostly lanceolate to broadly lanceolate ..... 4.
- Leaves mostly elliptic to obovoid ..... 5.
4. Carpels 20–28, 1.8–3.75 × 1.7–2.1 cm, lateral walls of carpels curved outward, resembling wings ..... *Magnolia sinacacolinii* Vázquez in Vázquez-García *et al*. (2012b: 120).

- Carpels 30–35, 3.4–5.0 × 1.7–2.1 cm, lateral walls of carpels not curved outward..... ..... *Magnolia lopezobradorii* Vázquez in Vázquez-García *et al*. (2012b: 110),
5. Leaves obovate; known only from San Pedro Ixcatlán, Oaxaca..... ..... *Magnolia decastroi* Vázquez & Muñiz-Castro in Vázquez-García *et al*. (2013b: 463).
- Leaves mostly elliptic, not present in San Pedro Ixcatlán, Oaxaca.....6.
6. Petals adaxially purplish in the apical ¾ .....7.
- Petals adaxially white throughout .....8.
7. Fruit oblongoid; Zongolica y Córdoba, Veracruz.....*Magnolia mexicana*
- Fruit spheroidal; Volcán Santa Martha, Veracruz.....*Magnolia zoquepopolucae*
8. Fruit ovoid to obovoid or ellipsoid.....9.
- Fruit globose to subglobose or widely ovoid .....11.
9. Flowers 20–22 cm in diameter, fruit ellipsoid, basal carpels decurrent to a length of 0.4–0.6 cm long; Sierra de Manantlán, Jalisco/Colima .....*Magnolia jaliscana* Vázquez & Guzmán in Vázquez-García *et al*. (2012b: 108).
- Flowers 13–17 cm in diameter; fruit pear-shaped to ovoid; basal carpels decurrent to a length of 1.0–2.0 cm long; not in the Sierra de Manantlán, Jalisco/Colima .....10.
10. Leaves 35–45 × 23–29 cm, flower diameter 13–14 cm, split of the carpel apex (1/3–1/2); occurring only in Talpa de Allende, Jalisco ..... *Magnolia ofeliae* Vázquez & Cuevas in Vázquez-García *et al*. (2013b: 470).
- Leaves 18–38 × 8–23 cm; flower diameter 16–17 cm; split of the carpel apex (2/3–3/3), present in southern, Oaxaca ....*Magnolia macrocarpa* (Zuccarini 1836: 369) Vázquez-García *et al*. (2013: 466).
11. Carpels 61–70, inconspicuously marked; seeds scarlet; Selva Lacandona, Chiapas ..... *Magnolia lacandonica*
- Carpels 36–41, conspicuously marked; seeds orange to pale red; northern Oaxaca.....*Magnolia yajlachhi*, here described.

TABLE 1. Differences between *Magnolia yajlachhi, M. lacandonica*, *M. zoquepopolucae* and *M. mexicana*.

Characters	*M. yajlachhi*	*M. lacandonica*	*M. zoquepopolucae*	*M. mexicana*
Tree size	15.0–20.0 × 0.2–0.4	28.0–35.0 × 0.5–0.7	30–45 × 0.5–0.8	28.0–32.0
Leaf blades				
Size	12.3–20.2 × 6–9.1	18.0–22.5 × 7.0–11.0	12.50–23.0 × 6.00–11.0	12.0–22.4 × 7.1–10.4
Veins per side	13–14	10–11	10–12	10–12
Flower				
Hypsophylls	2–3	2	1–3	2
Sepal size (cm)	7.5–7.7 × 5.5–5.6	3.4–5.8 × 3.7–5.0	7.0–8.5 × 4.0–5.5	9–10 × 6
Petals Size (cm) Color	7.5–7.7 × 5.5–5.6 Entirely white	6–6.2 × 2.7–3.2 Entirely white	6.9–8.3 × 4.0–5.5 Adaxially purplish (upper ¾).	9–10 × 6 Adaxially purplish (upper ¾).
Stamens	166–175	198–248	200	120–178
Carpels	36–41	61–80	46–56	38–40
Fruit				
Shape	Widely ovoid depressed to subglobose	Subglobose	Subglobose	Broadly ellipsoid
Size (cm)	5.4–10.0 × 4.6–5.8	11.5 × 9.5	8.5–9.0 × 7.5–8.5	10.0–15.0 × 7.0–8.0
Distribution	Sierra Norte, Oaxaca.	Usumacinta-Lacandonia region	Los Tuxtlas, southern Veracruz	Zongolica, Córdoba (Central Veracruz)
Habitat	Coffee plantations	Tropical rainforest	Tropical rainforest	Subdeciduous forest
Frequent species	*Hedyosmum mexicanum*, *Mikania pyramidata*, *Morus celtidifolia*, *Brunellia mexicana*, *Vismia camparaguey*, *Pinus chiapensis* and *Liquidambar styraciflua*.	*Terminalia amazonica, Nectandra ambigens, Lycania platypus, Dialium guianense, Brosimum alicastrum, Castilla elastica, Oreopanax capitatus, Calophyllum brasiliensis, Swietenia macrophylla,* and *Rheedia macrantha*	*Olmeca recta*, *Dialium guianense*, *Pterocarpus rohrii, Pouteria rhynchocarpa*, *Cedrela odorata*, *Guatteria anomala*, *Hirtella triandra* and *Poulsenia armata*.	*Cordia alliodora, Persea schiedeana, Chamaedorea tepejilote, Heliocarpus donnellsmithii, Ficus aurea, Cupania* sp., and *Inga vera,*
Elevation (m)	1269–1520	150–1200	420–1300	450–1500

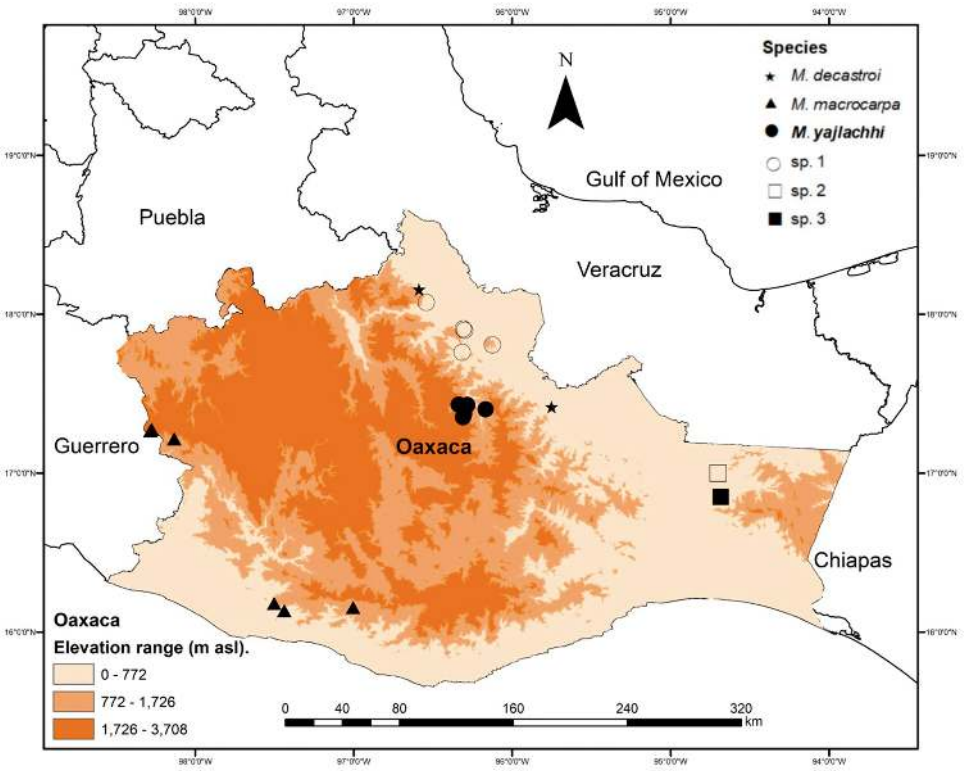


FIGURE 1. Distribution of *Magnolia* sect. *Talauma* subsect. *Talauma* in Oaxaca, Mexico.

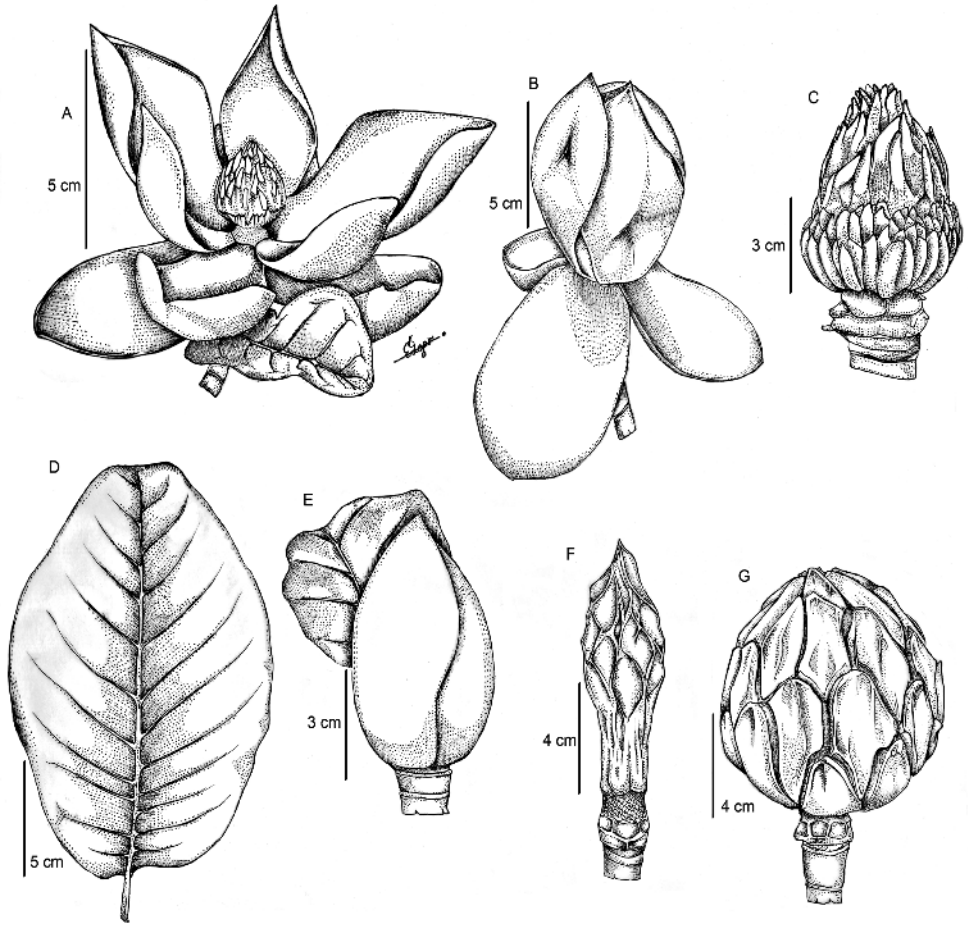


FIGURE 2. *Magnolia yajlachhi*. A. Flowering branch. B. Flower with reflexed sepals. C. Receptive gynoecium (female phase), still retaining the stamens. D. Leaf venation. E. Flower bud without spathaceous bract. F. Fruit axis. G. Fruit. (By Edgar Esau Vázquez Verdejo).



FIGURE 3. *Magnolia yajlachhi* at San Juan Juquila Vijanos, Oaxaca. A–B. Bernardo Domínguez Yescas and his wife, Ma. Luisa Pascual-Yescas, the family that transplanted and cared for seedlings for over a decade, until the trees flowered and turned out to be a new species. C. First documented (2010) open flower at male phase for this species. D. Flower bud *flower of the heart*, ready to be harvested for decoration, each tree producing up to 200 flower buds. E. Female phase (1:30 pm), with ca. perpendicular sepals, partially opened for beetle entrance, closing latter at night. F. Male phase (8:01 am) fully open flower, after pollen shedding (Photographs: A, D–F by J.A. Vázquez-García; B–C by R. Domínguez-Yescas).



FIGURE 4. *Magnolia yajlachhi*. A. Leaves from a young shoot, found under shade. B. Leave exposed to direct sunlight. C. Spathaceous bract protecting the young flower bud. D. Heart shaped flower bud fully grown. E. Flowers at female phase, with sepals at an angle of ca. 30 degrees from the axis, barely opening for beetle entrance. F. Flower at female phase with perpendicular sepals, starting to close, usually with insects inside. G. Flower with reflexed sepals at an angle of ca. 80 degrees. H. Receptive gynoecium, female phase, with stamens. I. Receptive gynoecium (female phase, with stamens removed. J. Stamens. (Photographs: A, E and H–I by J. A. Vázquez-García; B–D, F–G and J by R. Domínguez-Yescas; G and H).



FIGURE 5. *Magnolia yajlachhi.* A. Sterile fruits of a cultivated tree at Juquila Vijanos, Oaxaca, B–D. Fruit, and fruit axis with seeds at Llano de Piedra, E–F. Flowers of a tree within a coffee plantation in Llano de Piedra, Juquila, showing rusty spots due to visiting beetles (Photographs: A–F by R. Domínguez-Yescas).

Magnolia yajlachhi A.Vázquez & Domínguez-Yescas, *sp. nov.* (Figs. 2–7, 8 A–C)

Type:—MEXICO. Oaxaca: Mpio. San Juan Juquila Vijanos, Lachi-Luguiaj or Llano de Piedra, rare in coffee plantations that used to be cloud forest habitat in secondary *Liquidambar-Pinus* forest, property of Procoro Pascual, 17°21'10.2"N, 96°18'39.30"W, 1269 m, 2 Sep 2018 (fr.), *Pascual Domínguez 1* (holotype: IBUG!; isotypes: CORU!, ENCB!, HUAP!, MEXU!, OAX!, SERO!, XAL!).

Magnolia yajlachhi shares with *M. lacandonica* the mature subglobose fruit and entirely white petals, but differs from the latter in having carpels less numerous (36–41 vs. 61–80) and marked vs. inconspicuously marked; stamens less numerous (166–175 vs. 198–248), leaf-veins per side more numerous (13–14 vs. 10–11); and seeds orange vs. scarlet. *Magnolia yajlachhi* shares with *M. zoquepopolucae* the subglobose fruit but differs from the latter in having carpels less numerous (36–41 vs. 46–56); stamens less numerous (166–175 vs. 200), petals entirely white vs. purplish in the apical portion (¾); lateral leaf-veins per side more numerous (13–14 vs. 10–11); and seeds orange vs. scarlet. *Magnolia yajlachhi* shares with *M. mexicana* a similar number of carpels and stamens but it differs from the latter in having shorter petals (7.5–7.7 vs. 9.0–10.0 cm) and entirely white vs. adaxially purplish in the apical portion (¾); fruits smaller (5.4–10.0 vs. 10.0–15.0 cm) and widely ovoid-depressed to subglobose vs. widely ellipsoid; leaf-veins per side more numerous (13–14 vs. 10–12); and seeds orange vs. scarlet (Table 1, Fig. 8).



FIGURE 6. *Magnolia yajlachhi* at Llano de Piedra. A–B Two kinds of visiting beetles. C–D, F–H. Piercing the flower by beetles (possibly *Cyclocephala*). E. Two-stem tree (Photographs: A–H by R. Domínguez-Yescas).

Evergreen trees, 15–20 m, 0.2–0.4 m diameter at breast height; bark grey, smooth; sapwood white; twig internodes 1.5–2.2 × 0.6–0.9 cm spotted with whitish lenticels, glabrous, dark brown; petioles 4.0 × 7.0 × 0.2–0.4 cm, adaxially flat with cracks on the petiolar scar, abaxially convex with longitudinal wrinkles, thickened and darkened at the base, finely verrucose, glabrous; stipules, stipular scar as long as the petiole; leaf blades 12.3–20.2 × 6–9.1 cm, elliptic, obtuse-subobtuse or rarely acute at the base, not evidently decurrent on the petiole, obtuse-subobtuse or rarely acute at the apex, margin undulate, with 13–14 secondary veins per side, glabrous or glabrescent; flowers white; pedunculate, spathaceous bract 1, 4.5–6.8 × 3.8–6.5 cm, pubescent, a single structure opens to the middle with 2–3 peduncular scars; sepals 3, 7.5–7.7 × 5.5–5.6 cm, cochleate, tablet-like when dried; petals 6, in two whorls; outer petals 7.5–7.7 × 5.5–5.6 cm, obovate; inner petals 5.5–7.0 × 1.9–4.2 cm, 1.7–2.0 cm wide at the base, obovate; stamens 166–175, yellow stamens with base and tip of dark brown, 1.6 × 0.3 cm, the connective obtuse to rounded; gynoecium ovoid 3.6–4 × 2.6–2.8 cm, with 36–41 carpels; styles tongue-like, 1.1 cm long, white, discrete; fruit broadly ovoid, depressed, to subglobose, 5.4–9.0 × 4.6–10.0 cm, the fruit axis 8.1–9.0 × 3.0 cm, narrowly lanceolate, acute at the apex, cuneate at the base, the cells 1.5–2.3 × 0.7–1.0 cm, 0.5–0.7 cm deep; carpels striate at the base, dorsally rugose, with an arched but non-humped dorsal wall, occasionally with an ascending apex; seeds 1–2 per carpel, 0.9 × 1.3 cm, sub-orbicular, flattened, seeds paired, some appearing prismatic with a flat side, with a bright orange sarcotesta.

Distribution and ecology:—Endemic, so far, to the Sierra Norte de Oaxaca (Fig. 1), known from the River Cajonos, a tributary in the upper Papaloapan watershed (the Cajonos River joins the Manso River, and both form the Tesechoacán River before reaching Tlacotalpan Veracruz, where the Tesechoacán River joins the Papaloapan River), which flows into the Gulf of Mexico, inhabiting an ecotone between tropical and cloud-forest elements, often as a nurse tree in coffee plantations that used to be cloud forest habitat in the Sierra Norte of Oaxaca. On shallow, sandy loam soils, 1269–1520 m, 1200–2000 mm of mean annual rainfall, with *Brunellia mexicana* Standley (1927: 166; Brunelliaceae), *Hedyosmum mexicanum* Cordemoy (1863: 307; Chloranthaceae), *Mikania pyramidata* Donnell Smith (1888: 188; Asteraceae), *Morus celtidifolia* Kunth (1817: 33; Moraceae), *Pinus chiapensis* (Martínez 1940: 81; Pinaceae) Andresen (1964: 417), *Liquidambar styraciflua* Linnaeus (1753: 999; Altingiaceae), *Trema micrantha* (Linnaeus 1759: 937; Cannabaceae) Blume (1856: 58) and *Vismia camparaguey* Sprague & Riley (1924: 13; Hypericaceae). Trees have been planted at several houses in San Juan Juquila Vijanos. Flowering occurs throughout the year, with a peak in spring, the female phase starting about at noon, whereas the male phase occurs early the next day. The flowers are visited by ants and beetles of the genus *Cyclocephala* Latr. in Dejean (1821: 57; Dynastinae) (Figs. 6 A–C). Isolated trees outside their natural habitat produce clean, white flowers since they are not visited by *Cyclocephala* beetles, whereas those growing naturally have plenty of this beetle destroying petals and stamens. Fruiting throughout the year, many fruits fall without producing seeds.

Eponymy and ethnobotany:—The specific epithet "yajlachhi" derives from its common name: "yajlachhi" (*Pascual Domínguez 01*), meaning "flower of the heart" in Zapotec of San Juan Juquila Vijanos, pers. comm. by Bernardo Domínguez-Yescas (Fig. 3 A–B), perhaps related to the heart shape of flower buds and fruits. The Zapotec culture call themselves *Ben `Zaa*, meaning "the cloud people". They have endured over 2.5 millennia and overcome colonization by Aztecs and Spaniards and impacts of modern globalization. Currently one million Zapotecans continue to live their culture; Zapotec is considered a macrolanguage with nearly 62 variants and includes an ancient writing system (Urcid 2005). Additional common names or variants for this species include: *yë lhachhi* and *yödzö Gua* in Zapotec of San Juan Yatzona (Leoncio Jiménez Hernández), *yiaj lhachhi* in Zapotec of San Juan Yaee (Gisella Judith Hernández Pérez). In the social network in the group "Fotografías de la Sierra Juárez Oaxaca" this species it is also recognized in Zapotec as: *yëo la'chhi* (Eduardo Vargas), *guij lachi* (Alvaro Chávez Flores), *yaj lachhhe* (Ms Mariscal), *iulatghi* (Jonas Gutiérrez), *yaj lache* (Armando Méndez), *yaj lachhi* (Mey Pérez), *yaj laxhe´e* (Mell Luna), *yuzun buluzzu* (Angel Junior Cabrera), *guij lachi* (Álvaro Chávez Flores) and *yio lashh* (Aurelio Ciprés).

Magnolia yajlachhi has traditional ceremonial use for church decoration during Easter holidays including the Holy Friday procession. Harvesting of the heart-shaped flower buds is by a group of young volunteer men, who collect nearly a thousand flowers buds and transport them well protected by their leaves, since they are fragile and may immediately become discolored if improperly manipulated. A second group of experienced men are designated to build and decorate the andas (floats; Fig. 7 C–D, F), and nearly 40% of flower buds are used to decorate four cylindrical wooden columns nearly 2 m high, with nearly 80 flower buds nicely arranged and packed together with few leaves each. Church decoration during Easter holidays involves a third designated group led by the sacristan, and ca. 15% of flower buds are reserved for this activity. At the Yatzona church, these men carefully prune the branches and unnecessary leaves to arrange a dozen flower vases filled each with 10 to 12 heart-shaped white flower buds and their dark green leaves (Figs. 7 A–B). These flower vases are then placed on the altar together with flower vases of magenta-flowered bromeliads (*Tillandsia* sp.). The altar eventually receives the impressive decorated columnar andas.

In the Good Friday procession, women mostly dressed white lead the procession, carrying the little virgin sculpture while men mostly dressed in blue trousers form a second line carrying the impressive, heavy andas, including a large sculpture of Jesus. Behind these, lines of mostly boys and men carry one or two beautiful flower buds of *M. yajlachhi*, as if they are holding in their hands a heart to sacrifice to God as a sign of recognition or obedience. Approximately 25% of the heart-shaped flower buds are used for this activity. A similar ceremonial use is reported from Puebla (San Andrés Chalchicomula) with flowers obtained from La Magdalena, Veracruz (Sánchez-Cuahua 2016); however, they use a different species, *M. mexicana* (*yoloxóchitl* in Náhuatl, "flower of the heart"), for a different ceremony, Sunday of the Santísimo Sacramento) at a different season (summer), usually the third Sunday of June when *M. mexicana* is flowering (Sánchez-Cuahua 2016). The species is occasionally used in Juquila Vijanos as an offering in the tombs of the cemetery, the only native species among many exotic ones: goldenrods, lilies, geranium and hydrangea (Fig. 7 E), as an offering and sign of gratitude and farewell to deceased beloved ones.



FIGURE 7. A. *Flower bud bouquet*. B. Procession of Good Friday in San Juan Yatzona, using flower buds. C. Sculpture of Jesus on a donkey decorated with flower buds. D. Men of San Ju*an Yatzo*na decorating with Magnolia flower buds. E. Altar at San Juan Yatzona´s church decorated with flower buds and bromel*iads. F.* Tomb in cem*e*tery adorned with Magnolia flower buds (Photographs: A by J. Bautista-Vargas, B by D. Sánchez-Luna, C–D and E by S. A. Hernández-Merlín, F by J. A. Vázquez-García).



FIGURE 8. *Magnolia yajlachhi* (left side). A. Open flower. C. Mature fruit before dehiscence. E. Fruit axis with seeds, after circumscissile dehiscence. *Magnolia mexicana* (right side) B. Open flower. D. Mature Fruit before dehiscence. F. Fruit axis with seeds, after circumscissile dehiscence. (Photographs: A, C and E by R. Domínguez Yescas; B, D and F by R. Sánchez Cuahua).

Magnolia yajlachhi is frequently used as a medicinal plant in the Zapotec culture. An infusion of petals is said to be good for strengthening the heart (Bernardo Domínguez Yescas (Fig. 7 A–B). Leaves are prepared as a fasting infusion to tone the blood and clarify the eyes (Almicar Barcas). In Yaee, Oaxaca, the strongly aromatic flowers are used to treat asthma (Gisella Judith Hernández Pérez). Similarly, several medicinal uses are reported for *M. mexicana* from Zongolica, Veracruz (Sánchez-Cuahua 2016).

Magnolia yajlachhi is also used as a nurse tree in coffee plantations at San Juan Juquila Vijanos (Fig. 6 F) and San Juan Yatzona, a traditional management practice also noted for *M. ofeliae* in Talpa de Allende, Jalisco (Vázquez-García *et al*. 2013b), *M. macrocarpa* in Coatlán, Oaxaca (Ciro Pérez, pers. comm.), *M. mexicana* in Zongolica,

Veracruz (Sánchez-Cuahua 2016) and *Magnolia cubensis* Urban (1899: 307) in Cuba. This management practice requires evaluation of its effectiveness in terms of conservation of genetic diversity in *Magnolia* because it may add value for coffee producers through this new concept ("*Magnolia*-nursed coffee") of conserving biodiversity by using endangered or threatened species of *Magnolia* as nurse trees in their coffee plantations.

Conservation status:—These trees are to some extent protected by people due to their ceremonial value in church decoration and use in medicinal and as nurse trees in coffee plantations. Several plants grown from seeds near the Church of San Juan Juquila Vijanos failed to survive, possibly because of water stress and insufficient nutrients because they were located on top of a hill, with greater exposure to sunlight, frequent wind and soil leaching. In Yatzona, Oaxaca, the trees are managed inside the coffee plantations or along roadsides, and when the people of the village locate a *Magnolia* seedling, they clean the herbs around them so that they grow better with less competition because they consider these trees as an inheritance from their ancestors. Major threats to this plant include flower harvesting for ceremonial and medicinal use, deforestation for agricultural and urban expansion and climate change. The category assigned to this species was critically endangered (CR). Conservation status of *Magnolia yajlachhi* was evaluated considering the following criteria [B1b (i, ii) and B2b (i, ii)] of the IUCN Red List Categories and Criteria (IUCN 2012).

Additional Specimens examined:—MEXICO: Oaxaca. Mpio. Municipio San Juan Juquila Vijanos, backyard of the Domínguez-Yescas home, 17°21'15.41"N, 96°18'13.47"W, 1520 m, 10 Jul 2010 (fl), *Domínguez-Yescas 78* (IBUG); same as previous location 30 Jul 2013 (fl), *Domínguez-Yescas 79* (IBUG); same as previous location, 15 Apr 2014 (fl), *Vázquez García 10112* (IBUG); Llano de Piedra (Lachi-Luguiaj in Zapotec), property of Procoro Pascual, 17°21'10.2"N, 96°18'39.30"W, 1269 m, 01 Ago 2013 (fl), *Domínguez-Yescas 80* (IBUG); same as previous location, 27 Nov 2013 (fr), *Domínguez-Yescas 81* (IBUG); same as previous location, 23 Sep 2018 (fr), *Pascual Domínguez 2* (IBUG, CIDIR); Mpio. Tanetze de Zaragoza, rare, planted on the right side of the Catholic church in the center of the town, 5 km from the Municipal Agency of San Isidro Reforma, coming from the community San Juan Juquila Vijanos, 17°22'29.14"N, 96°18'8.47"W, 1332 m. 15 Sep 2018 (fr.)*, Pérez Santiago 1,* (IBUG, CIDIR, MEXU); Municipal Agency Santa María Zoogochi, cultivated in front of the municipal agency, attached to the basketball court, property of Taurino Salvador Chávez, 17°25'52.53"N, 96°20'17.03"W, 1142 m. 19 Sep 2018 (fl)*, Bautista Pérez 1* (IBUG, CIDIR, MEXU); Mpio. San Juan Yaee, planted 50 m before arriving at the Catholic Church, 17°25'45.83"N, 96°16'58.87"W, 1436 m. 6 Oct 2018 (fr), *Hernández Pérez 1* (IBUG, CIDIR, MEXU); Mpio. San Juan Yatzona, 17°24'6.87"N, 96°10'3.37"W, 1280 m. 16 Sep 2018 (fr)*, Rodríguez Pérez 1* (IBUG, CIDIR, MEXU).

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