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ON *CINNAMOMUM* (LAURACEAE) IN MEXICO[1]

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ABSTRACT

An overview of the species of *Cinnamomum* (Lauraceae) in Mexico is presented, and five new species (*Cinnamomum bractefoliaceum*, *C. glossophyllum*, *C. leptophyllum*, *C. velveti*, and *C. zapatae*) from this country are described and illustrated; comments on their distribution and possible relationships to other species of the genus are advanced. Additionally, two new names (*Cinnamomum concinnum* and *C. grisebachii*) are proposed. A key to the Mexican species of the genus is provided.

RESUMEN

Se da una visión general de la presencia de *Cinnamomum* (Lauraceae) en México y se describen e ilustran cinco especies nuevas del género (*Cinnamomum bractefoliaceum*, *C. glossophyllum*, *C. leptophyllum*, *C. velveti* y *C. zapatae*) para este país; se comentan además aspectos de su distribución y posibles relaciones con otras especies del género. Se proponen aquí también dos nuevos nombres (*Cinnamomum concinnum* y *C. grisebachii*). Al final se presenta una clave para las especies mexicanas de este género.

INTRODUCTION

With the report sent by J. Dombey in May 1780 from Peru to Minister José de Gálvez, dealing with affairs related to Spanish possesions in America, the expectations of Spain to find a plant in that region yielding good quality cinnamon vanished definitively: the American cinnamon (known as Quixos cinnamon) was a different species from that exploited by the Dutch in Ceylon, and of too low quality to get profit from it (González & Navarro, 1989; Steele, 1964). Dombey was part of the botanical expedition lead by Hipólito Ruiz, sent by King Charles III to the American kingdoms of Peru and Chile with the purpose of collecting first hand information for several plant species of potential economic use; among them was the American cinnamon.

Dombey's report cut off the debate on the economic grounds, but it did not do so for the Botanical Science. Ruiz & Pavón's work on the Peruvian Flora treated twenty-nine

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species in the genus *Laurus*, which included then most of the species known in the family Lauraceae. Nees (1836) set in the early 19th century the basis for the classification of the Lauraceae; any of the former *Laurus* species listed by Ruiz & Pavón in their work was considered by Nees in the genus *Cinnamomum* (to which cinnamon belongs). After Nees' work, no American species of this genus was accepted as living wild in the western hemisphere for more than 120 years (Meissner, 1864; Bentham, 1880; Mez, 1889; Pax, 1889; Allen, 1945). By the middle of the present century, however, Kostermans (1952, 1957) posed again the question that made Ruiz & Pavón set sail to Peru and Chile in 1777: are there "cinnamons" in America or not?

Following a general review assessing the presence of some morphological characters, Kostermans (1961, 1988) decided to move all the American species then included in *Phoebe* to *Cinnamomum*. Kostermans' point of view, however, was not acepted by most botanical systematists.

A recent systematic revision (Lorea, 1996) has shown that Kostermans idea was right to some extent. Not all the American species of *Phoebe*, but several indeed, are best placed in *Cinnamomum*. Thus, there are some "cinnamons" in America after all.

Cinnamomum in Mexico

At present forty-six *Cinnamomum* species have been recognized in America (Lorea, 1996), out of about 200 species total in the genus. Distribution of the genus in America is mainly within the tropics, just a few species extend beyond North and South of these geographical lines. In Mexico there are nineteen species (including the five new ones described here), slightly concentrated in the southern part of the country (Table 1).

Table 1. Distribution of *Cinnamomum* species by State in Mexico.

Cinnamomum amplexicaule (Schltdl. & Cham.) Kosterm.	Guerrero, Oaxaca, Veracruz
Cinnamomum areolatum (Lundell) Kosterm.	Chiapas, Oaxaca
Cinnamomum bractefoliaceum Lorea-Hernández[2]	Querétaro, San Luis Potosí
Cinnamomum breedlovei (Lundell) Kosterm.	Chiapas, Oaxaca
Cinnamomum chiapense (Lundell) Kosterm.	Chiapas
Cinnamomum concinnum Lorea-Hernández, nom. nov.[3]	Guerrero, Oaxaca
Cinnamomum effusum (Meissn.) Kosterm.	Hidalgo, Puebla, Querétaro, San Luis Potosí, Veracruz
Cinnamomum glossophyllum Lorea-Hernández[2]	Nayarit
Cinnamomum grisebachii Lorea-Hernández, nom. nov.[4]	Oaxaca, Tabasco
Cinnamomum hartmanii (I. M. Johnst.) Kosterm.	Chihuahua, Durango, Jalisco, Nayarit, Sonora
Cinnamomum kruseanum Téllez-Valdés & Villaseñor	Guerrero
Cinnamomum leptophyllum Lorea-Hernández[2]	Veracruz
Cinnamomum longipes (I. M. Johnston) Kosterm.	Hidalgo

Table 1. Continuation.

Cinnamomum pachypodum (Nees) Kosterm.	Guanajuato, Hidalgo, México, Michoacán, Puebla, Querétaro, San Luis Potosí
Cinnamomum padiforme (Standl. & Steyerm) Kosterm.	Guerrero, Jalisco
Cinnamomum salicifolium (Nees) Kosterm.	Hidalgo, Querétaro
Cinnamomum triplinerve (Ruiz & Pavón) Kosterm.	Chiapas, Oaxaca, Veracruz
Cinnamomum velveti Lorea-Hernández[2]	Guerrero
Cinnamomum zapatae Lorea-Hernández[2]	Chiapas, Guerrero, Oaxaca

[2] Species described in this paper.

[3] Basionym *Phoebe elegans* van der Werff, Ann. Missouri Bot. Gard. 75: 415. 1988; the combination *Cinnamomum elegans* Reinecke, Bot. Jahrb. Syst. 25: 633. 1898, prevents the use of the specific epithet.

[4] Basionym *Phoebe triplinervis* Grisebach, Pl. wright. Pars 1: 187. 1860; non *Phoebe triplinervis* (Ruiz & Pavón) Mez. The combination *Cinnamomum triplinerve* (Ruiz & Pavón) Kostermans, Reinwardtia 4: 24. 1961, prevents the use of the specific epithet.

Mexican *Cinnamomum* species are generally medium size or tall trees growing primarily on mountains covered with oak-pine mixed forest, from 750 to 2000 m altitude. Some species, however, spread naturally below the 500 m altitude level (*C. effusum*, *C. grisebachii*, and *C. hartmanii*). Occasionally, individuals of some species (*C. hartmanii*, *C. pachypodum*) are referred as living in typical lowland tropical forest; this certainly happens in deep gullies where contact between different types of vegetation is frequent.

Species with wide distribution ranges and well represented in herbaria are rather few (*C. effusum*, *C. hartmanii*, *C. pachypodum*, and *C. zapatae*), while several are known from small areas and by a handful of samples or even single collections (*C. amplexicaule*, *C. chiapense*, *C. concinnum*, *C. glossophyllum*, *C. kruseanum*, *C. leptophyllum*, *C. longipes*, and *C. velveti*). To establish, however, if this is the result of very local evolution or contraction from previous wider ranges of distribution it is necessary to carry out more collecting work in the area.

Three species have disjunct distributions: *C. amplexicaule*, *C. grisebachii*, and *C. padiforme*. The first one has a small population on the eastern slopes of the Sierra Madre Oriental in central Veracruz, and a wider distribution on the Sierra Madre del Sur in Guerrero and Oaxaca; *C. grisebachii* has populations in the Greater Antilles and the lowlands of Oaxaca and Tabasco in Mexico; and *C. padiforme* is not known from southern Guerrero to Chiapas, between its scattered populations in Jalisco and those in Guatemala, Honduras, and Nicaragua.

The recent revision of *Cinnamomum* (Lorea, 1996) has defined more precisely the characters useful in separating the species. Leaf venation pattern, presence and distribution of domatia along midvein and secondaries, pubescence type on lower leaf surface, inflorescence structure, pubescence of floral parts, and hypanthium development as well as persistence of tepals in fruit, are some of the helpful features for taxonomic purposes in the group. Here, species are recognized on the basis of correlation among these characters, more precisely their condition (states). The assumption of independent genetic control for these

characters is made, expecting that morphological entities correspond to biological species. With the same idea, all the specimens coming from different populations, but with similar syndrome of characters, are taken as belonging to the same species in the present study.

Based on these character correlations, several new taxa have been recognized in America. The following five were identified in Mexico.

Cinnamomum bractefoliaceum Lorea-Hernández, sp. nov. TYPE: Mexico. Querétaro: mpio. Jalpan, aprox. 4-5 km W to La Parada, 1400 m, tree 4-6 m. 23 April 1990 (fl) *B. Servín 141* (holotype, IEB; isotype, MO). Fig. 1.

Arbores vel frutices. Folia ovata vel lanceolata, apice acutato ad longe acuminato, triplinervia aut subtriplinervia, infra plus minusve pubescentia trichomatibus undulatis, adpressis; domatiis praesentibus ad axillas nonnullas venarum secundariarum et tertiariarum, pagina foliari utrinque ad domatia subplana. Inflorescentia ex cymis in paniculam aggregatis constans, plerumque bracteas foliaceas satis persistentes gerens. Flos tepalis extus sicut pedicello glabris vel sparsium pubescentibus, hypanthio intus saltem pro dimidio inferno glabrato; tepalis integris in fructu persistentibus.

Trees 4-6(10) m, or shrubs 2-3 m tall; twigs tomentose or velutinous, hairs 0.15-0.25 mm long, wavy or curly, appressed, sometimes erect and up to 0.8 mm long; petiole (5)7.5-12(16.5) mm long, tomentose; leaf blade (2)5.5-10.5 (15) cm long, and (1.2)2.5-4(5.5) cm wide, ovate to lanceolate, few times elliptic, apex acute to long acuminate, base rounded to acute, often oblique, upper surface sparsely tomentose to glabrous with aging, lower surface tomentose to glabrescent, hairs wavy to curly, appressed; venation triplinerved or subtriplinerved, with 3-5(7) pairs of secondary veins, slightly marked on upper surface, raised on lower surface, tomentose to glabrescent on lower surface; domatia present in all axils of secondary veins, domatia usually present in several axils of tertiary veins; inflorescence (3.5)5-9.5(11.5) cm long, axillary to leaves, sometimes clustered on the tips of twigs, very often with foliose bracts rather persistent, cymose-paniculate, villous to sparsely tomentose, flower pedicel 4-6.5(8.5) mm long, tomentose or glabrous; flowers ca. 2.5 mm long, narrowly campanulate to urceolate, greenish yellow, tepals 1.7-2.1 mm long, and 1.5-2 mm wide, ovate to widely ovate, glabrous or sparsely tomentose outside, sericeous inside, stamens of whorls I & II 1.3-1.8 mm long, their filaments pubescent ad and abaxially, anthers glabrous, stamens of whorl III 1.3-1.8 mm long, their filaments densely sericeous to glabrescent abaxially, glabrous adaxially, anthers glabrous, sporangia four in all stamens, glands ca. 0.5 mm long, rounded to elliptic, staminodes 0.9-1.1 mm long, filaments glabrous or sericeous apically on adaxial face, sericeous abaxially mainly on the margins, apex totally glabrous or pilose on the base abaxially, hypanthium 0.3-0.5 mm deep, sparsely tomentose or glabrous outside, glabrous or very sparsely pubescent inside, ovary and style glabrous; fruit 11.5-15.5 mm long, and 9-11.5 mm wide, ellipsoid, seated on the persistent tepals, pedicel turbinate, reddish.

This species grows mainly in oak and pine forest, but it has been found also in deciduous mixed forest, between 1000-1800 m, in a small area of northeastern Mexico. Flowers are produced during April and May (July), and fruits mature from July through September.

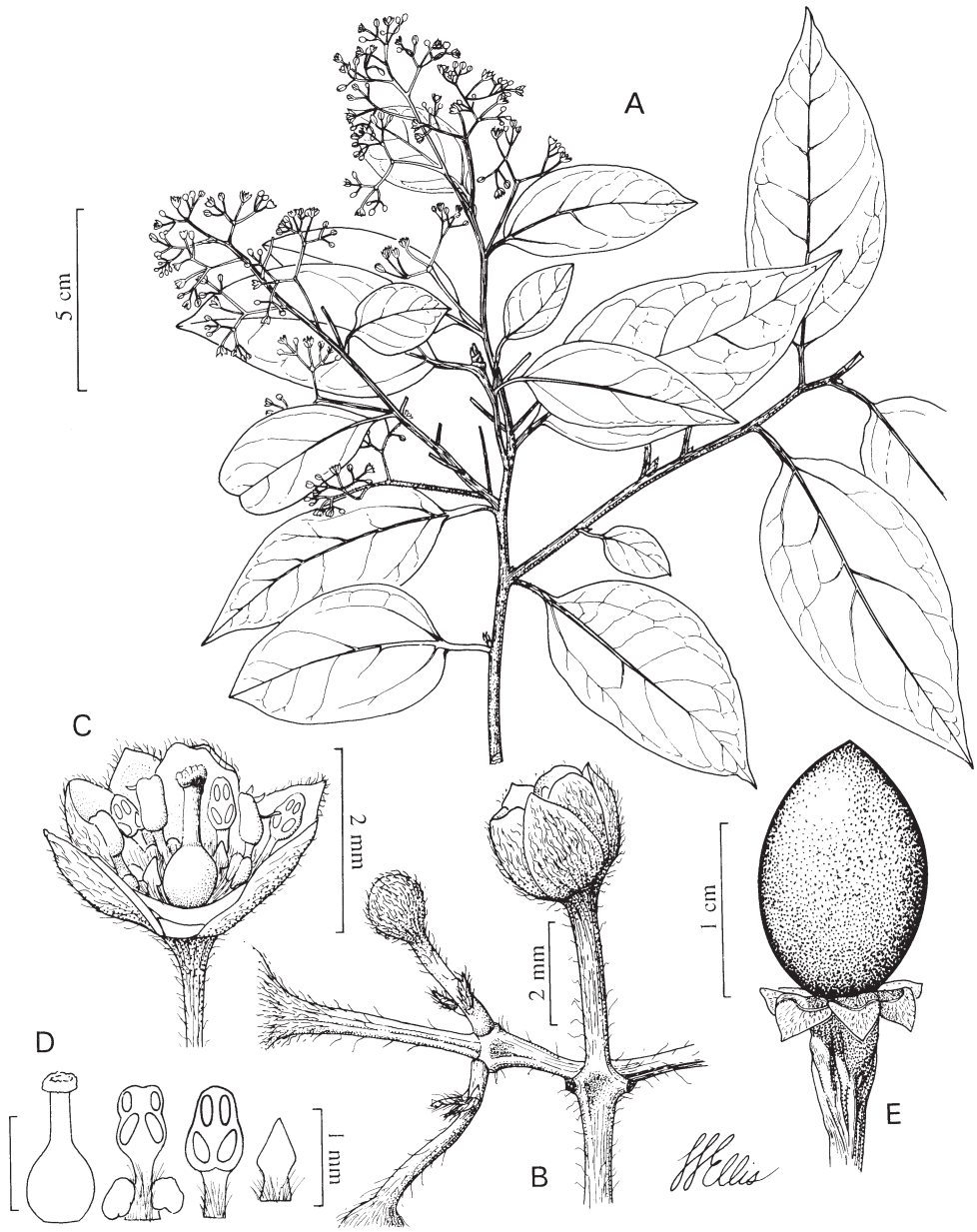

Fig. 1. *Cinnamomum bractefoliaceum* Lorea-Hernández. A. Branchlet with inflorescences; B. Terminal division of the inflorescence; C. Inner view of a flower; D. View (from left to right) of the ovary, whorl I stamen, whorl III stamen, and staminode; E. Fruit. Illustrated by Linda Ellis.

Paratypes. MEXICO. Querétaro: mpio. Jalpan, 4 -5 km S of La Parada, 1350 m, tree 6-8 m (fl) *B. Servín 168* (IEB, MO); mpio. Jalpan, 3-4 km NE of El Saucito, 1150 m, tree 6-8 m (fr) *B. Servín 220* (IEB, MO); mpio. Jalpan, cerro Los Fresnos, 2 km N of trail to El Carrizal, 1500 m, tree 5 m (fr) *C. Guzmán 125* (IEB, MO); mpio. Jalpan, 3-4 km N of La Parada, 1300 m, shrub 2-3 m (fr) *B. Servín 366* (IEB, MO); mpio. Jalpan, cerro El Pilón, S of La Parada, 1200 m, shrub 2 m (fr) *C. Guzmán 58* (IEB). San Luis Potosí. mpio. Rayón, 82 km W of Ciudad Valles on highway to Rio Verde, 1400 m, tree 4 m (fr) *P. Fryxell 3783* (ENCB, F, MO, NY); mpio. Ciudad del Maíz, 16-18 km NE of Ciudad del Maíz, 1400-1600 m, tree (fl) *R. McVaugh 10443* (NY). Tamaulipas. mpio. Gómez Farías, Rancho del Cielo, 1000 m, shrub 4 m (fl) *A Gómez-Pompa 2039* (MEXU); mpio. Gómez Farías, Rancho del Cielo, near El Limón, (fr) *A. Sharp et al. 52035* (MEXU); mpio. Gómez Farías, El Paraíso, 7 km W of Rancho del Cielo, 1800 m, *F. G. Medrano et al. 7497* (MEXU, MO).

Morphological affinity of *C. bractefoliaceum* is with *C. effusum* by the presence of domatia at the axils of tertiary veins and persistent tepals in the fruit. However, the indument on the lower leaf surface is very different in the two species; absent or made of straight and appressed trichomes in *C. effusum*, whereas always present and made of wavy to curly appressed hairs more or less persistent in *C. bractefoliaceum*. The presence of foliaceous rather persistent bracts in the inflorescence is also distinctive for *C. bractefoliaceum*, and the name of the species is derived from that feature. Foliaceous bracts in *C. effusum* are rarely present, and then are poorly developed and soon deciduous.

Cinnamomum glossophyllum Lorea-Hernández, sp. nov. TYPE: Mexico. Nayarit: mpio. Nayar, 12 km N of Linda Vista on the road to Santa Teresa, 2250 m, 3 August 1990, (fl), *G. Flores 2198* (holotype, MEXU; isotypes, FCME, MO). Fig. 2.

Arbores parvae (?). Folia longa anguste elliptica aut lanceolata, apice acuminato vel obtusato, subtriplinervia aut triplinervia, infra villosa-tomentosa trichomatibus undulatis vel crispis, patulis; domatiis praesentibus ad axillas nonnullas venarum secundariarum et tertiariarum, pagina foliari utrinque ad domatia subplana. Inflorescentia ex cymis in paniculam aggregatis constans, bracteis foliaceis carens. Flos tepalis extus sicut pedicello dense tomentosis, hypanthio intus pubescente; tepalis integris (?) in fructu persistentibus.

Small trees (?); twigs densely villous-tomentose, stem surface hardly seen through the hairs, hairs 0.6-0.8(1.2) mm, some wavy and more or less appressed, matted, others rather erect, more or less straight, persistent; petiole (11)15-20(23) mm long, 1.2-1.6 mm wide, densely villous-tomentose, hairs as on stems; leaf blades (6)13.5-23 cm long, (2.5)3.5-5(6) cm wide, narrowly elliptic to lanceolate, apex acuminate or (usually) bluntly obtuse by arrest of apical meristem, base cuneate, villous-tomentose above and below, surfaces not concealed, hairs wavy to curly, long persistent, but finally glabrous above, subtriplinerved to triplinerved, midvein (rather) flat above, densely villous-tomentose, strongly raised below, densely villous-tomentose, hairs long persistent, secondary veins 5-7 pairs, flat above, raised below, densely villous-tomentose above and below, finally glabrous above, tertiary veins flat above, slightly raised below, domatia present at the axils of several secondaries, sometimes inconspicuous, domatia usually present at the base

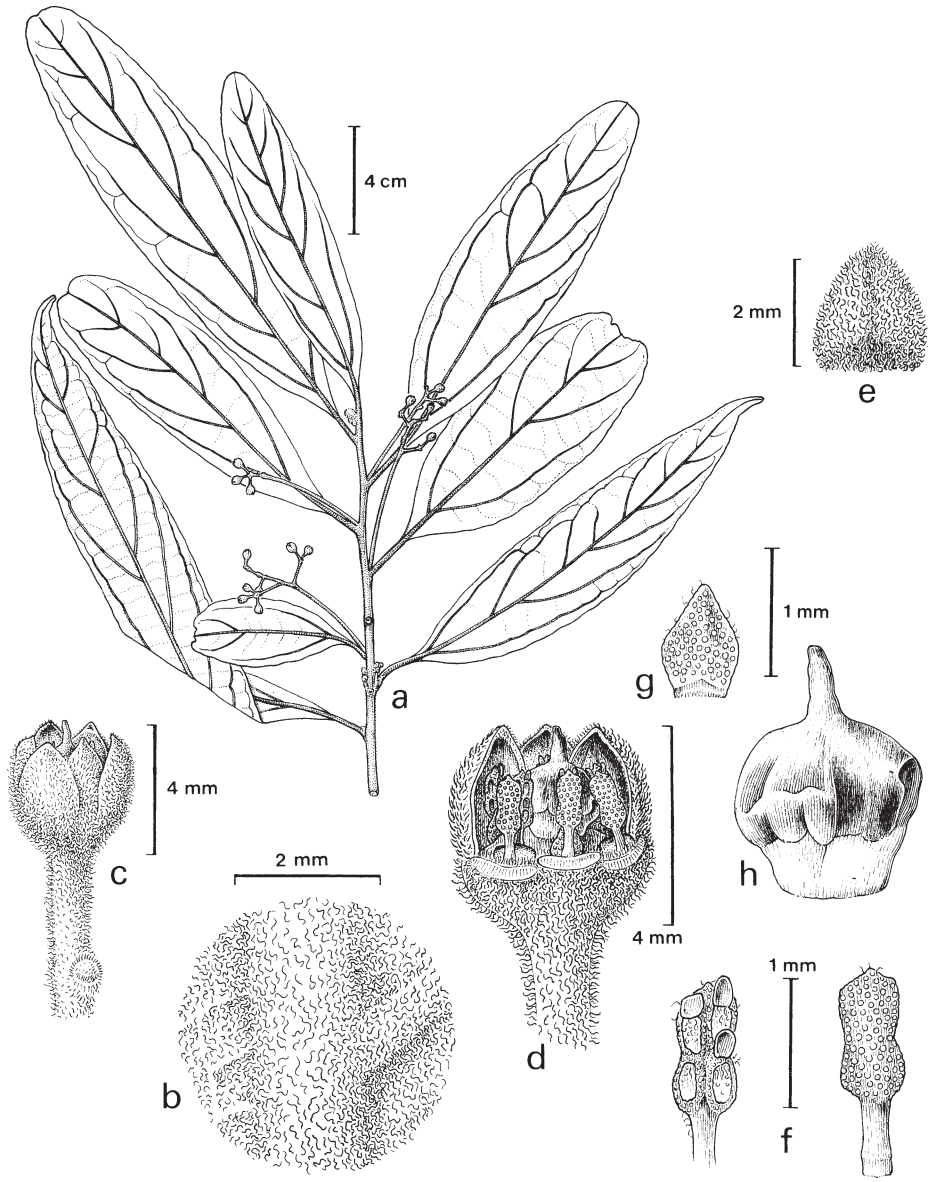

Fig. 2. *Cinnamomum glossophylum*. a. Branchlet of the plant; b. Close up of pubescence on underleaf surface; c. Single flower; d. Inner view of a flower; e. External view of a tepal; f. View of a whorl I stamen, adaxial (left), abaxial (right); g. Staminode; h. Young fruit (scale as in g). Illustrated by E. Saavedra.

of several tertiaries; inflorescences 4-11 cm long, axillary to leaves, cymose-paniculate, peduncle 2.5-7 cm long, villous-tomentose, rachis villous-tomentose, flower pedicels 2.5-3.5 mm long, densely tomentose; flower urceolate, tepals 2.4-2.8 mm long, 1.8-2.2 mm wide, ovate or wide ovate, densely tomentose outside, densely sericeous inside, stamens of whorls I & II ca. 1.5 mm long, filaments glabrous adaxially, glabrous abaxially or sparsely sericeous, anthers ca. 1 mm long, glabrous ad and abaxially, sporangia four, in two pairs, introrse, stamens of whorl III ca. 1.5 mm long, filaments apparently glabrous ad and abaxially, anthers ca. 0.9 mm long, glabrous ad and abaxially, sporangia four, in two pairs, upper ones latrorse, lower ones latrorse-extrorse, glands 0.5 mm long, at filament base, ovate, sparsely sericeous at point of attachment adaxially, glabrous abaxially, staminodes 0.8-0.9 mm long, pedicel glabrous adaxially, sparsely sericeous abaxially, head 0.6 mm long, ovate-acuminate in outline, glabrous ad and abaxially, hypanthium 0.4-0.3 mm deep, densely tomentose outside, (sparsely) sericeous inside, some red hairs present, glabrous outside and inside, pistil glabrous; ripe fruit not known.

The single collection of this species has old flowers and very young fruits. Thus, it seems that flowers should be present by June-July, and fruits should mature by the end of the year. Pine-oak forest is the habitat where this species grows, at an altitude of 2250 m.

In general, vegetative morphological characters of *C. glossophyllum* are reminiscent in a way of some specimens of *C. hartmanii*. But leaves in *C. glossophyllum* are densely covered on upper and lower surfaces by rather persistent wavy to curly hairs, and tepals in young fruits do not show any sign of having an abscission line, indicating that they are persistent. Besides, tepals are conspicuously pubescent on their external surface in *C. glossophyllum*, but glabrous in *C. hartmanii*. Thus, although only one collection was at hand, there is no doubt that it represents a distinct entity. Leaves in the new species resemble tongues, therefore the name.

Cinnamomum leptophyllum Lorea-Hernández, sp. nov. TYPE: Mexico. Veracruz: mpio. Atzalan, ranchito El Caballo, 1000 m, (fl, fr), 7 May 1976, *F. Ventura 12740* (holotype, ENCB; isotypes, FCME, MO). Fig. 3.

Frutices vel arbusculae. Folia elliptica, apice caudato, subtriplinervia aut triplinervia (vel pinnatinervia), infra glabra; domatiis plerumque praesentibus, ad axillas venarum secundariarum paris basalis tantum, pagina foliari ad domatia infra concava, supra subplana vel leviter prominens. Inflorescentia ex cyma solitaria constans, bracteis foliaceis carens. Flos tepalis extus glabratis, pedicello glabro; hypanthio intus pubescente; tepalis integris in fructu persistentibus.

Shrubs or small trees (?) up to 5 m tall; twigs glabrous or sparsely pubescent close to terminal bud, hairs 0.15 mm long, straight, appressed; petiole (3.5)4.5-7 mm long, 0.4-0.8 mm wide, glabrous; leaf blades (3.5)5-7(8.5) cm long, (1.3)2-3(3.5) cm wide, elliptic, apex caudate, base acute, glabrous above and below, subtriplinerved, triplinerved or penninerved, midvein slightly marked above, slightly raised below, glabrous, secondary veins 4-5(6) pairs, flat above, slightly raised below, particularly lowest pair, tertiary veins rather

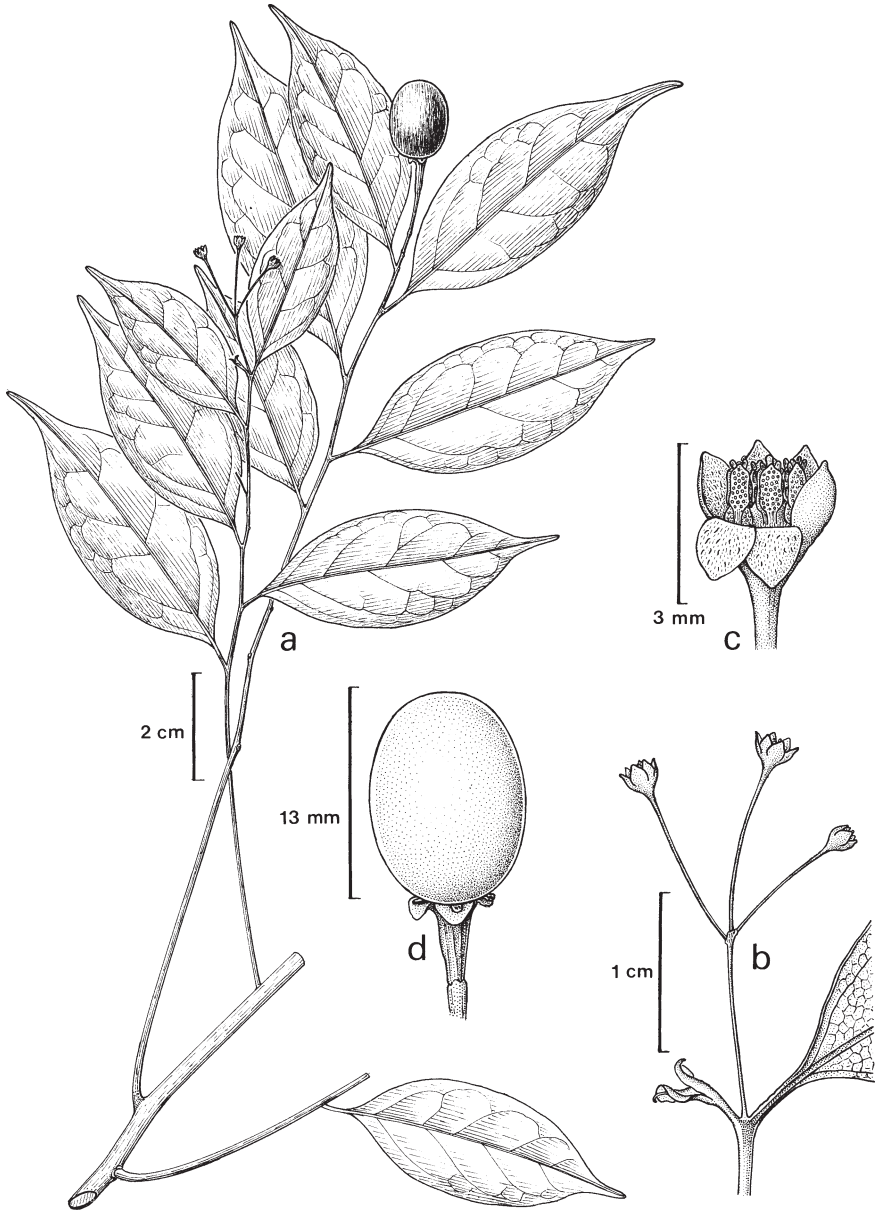

Fig. 3. *Cinnamomum leptophyllum*. a. Branchlet of the plant; b. Inflorescence; c. Inner view of a flower; d. Fruit. Illustrated by E. Saavedra.

inconspicuous, flat above, almost flat below, domatia along midvein, usually present only the lowest pair, sometimes absent, concave below, flat or sometimes slightly raised above, domatia along secondary veins absent; inflorescence 2-4 cm long, axillary to leaves or to tiny deciduous bracts, a single 3-flowered cyme, peduncle 1-2.5 cm long, glabrous, flower pedicel 8-12.5 mm long, glabrous; flowers urceolate, yellowish, tepals 1.3-1.5 mm long, 1.3-1.7 mm wide, widely ovate or ovate, glabrous outside, sericeous inside, outer ones sometimes sparsely so, some scattered red hairs present, stamens of whorls I & II ca. 1 mm long, filaments sparsely sericeous at the very base ad and abaxially, anthers 0.7 mm long, glabrous ad and abaxially, sporangia four, in two pairs, introrse, stamens of whorl III 1.1 mm long, filaments sparsely sericeous ad and abaxially at the very base, anthers 0.6-0.7 mm long, glabrous ad and abaxially, sporangia four, in two pairs, upper ones latrorse, lower ones extrorse-latrorse, glands 0.3-0.4 mm long, at about the middle part of the filament, rather abaxial on filament, rounded, sparsely sericeous adaxially at point of attachment, glabrous abaxially, staminodes 0.8 mm long, pedicels sericeous ad and abaxially, head 0.5-0.6 mm long, narrow cordate-triangular in outline, glabrous adaxially, sparsely (long) sericeous abaxially, hypanthium 0.5 mm deep, glabrous outside, sericeous inside, some red hairs present, pistil 1.7-1.9 mm long, glabrous, ovary 0.7-0.9 mm long, 0.6-0.7 mm wide; fruit 12-15 mm long, 0.8-0.9 mm wide, ellipsoid, cupule 7-13 mm long, 2.7-3.8 mm wide, pedicel 4-6 mm long, 0.5-0.6 mm wide, tepals persistent.

Flowers and ripe fruits in May. Growing in oak forest, at altitudes of 800-1000 m. Collected in wet gullies. *C. leptophyllum* is known just from a small area in the eastern Sierra Madre, Mexico.

Paratype. MEXICO. Veracruz: mpio. Atzalan, Arroyo Colorado, 800 m, (fr), *F. Ventura 12572* (ENCB, FCME).

The combination of caudate, glabrous and rather thin leaves (from which the name is derived), and domatia hairs dense and erect to parallel to leaf surface, makes this species distinct from others in the area. Morphologically the closest species to *C. leptophyllum* is *C. areolatum*, which has thicker leaves with pubescent lower surface, and domatia with sparse hairs mainly parallel to leaf surface.

Cinnamomum velveti Lorea-Hernández, sp. nov. TYPE: Mexico. Guerrero: mpio. Mochitlán, Cerro de la Vaca, aprox. 2.5 km W of Agua de Obispo, 1000-1500 m, 6 May 1987, (fl, fr), *L. Rodríguez 59* (holotype, FCME; isotype, MO). Fig. 4.

Frutices. Folia plerumque lanceolata, apice acutato vel longe acuminato, lamina pinnatinervia vel (raro) triplinervia, infra dense tomentosa trichomatibus undulatis, patulis, particulis ceraceis etiam abundantibus; domatiis praesentibus ad axillas nonnullas venarum secundariarum, saepe indistinctis, pagina foliari utrinque ad domatia subplana, aut supra leviter prominens. Inflorescentia ex cymis in paniculam aggregatis constans, plerumque bracteas foliaceas satis persistentes gerens. Flos tepalis extus sicut pedicello tomentosis, hypanthio intus glabro praeter verticem disperse pubescente; tepalis integris in fructu persistentibus.

Shrubs up to 3 m tall; twigs densely villous-tomentose, surface concealed by the indument, hairs 0.4-0.6 mm long, spreading to more or less erect, wavy, pale yellow, persistent; petioles (3)4-6.5(7) mm long, 1-1.6 mm wide, densely villous-tomentose, hairs as on twigs; leaf blades (3)5-8.5(11) cm long, (1)1.5-2.5(3.5) cm wide, lanceolate, rarely ovate or elliptic, apex acute to long acuminate, base obtuse to acute, sometimes oblique, tomentose above when young, indument pale yellow, with red hairs intermixed, glabrescent with age, densely tomentose below, surface covered by an almost continuous layer of white waxy particles, indument persistent, pinnate to subtriplinerved, rarely triplinerved, midvein slightly marked to flat above, tomentose, red hairs present, conspicuous, indument rather persistent, strongly raised below, densely tomentose, secondary veins (6)7-9(10) pairs, flat to slightly raised above, glabrescent, raised below, particularly the lowest pair, tomentose, tertiary veins flat or slightly raised above, glabrous, slightly raised below, tomentose, domatia along midvein apparently present but not distinct, domatia along secondary veins absent; inflorescence (4.5)6-9.5(10.5) cm long, axillary to leaves, cymose-paniculate, foliose bracts often present at main branchings, peduncle (3)4-6.5 cm long, tomentose, rachis tomentose, flower pedicel 2.5-4.5(6) mm long, tomentose; flower urceolate, tepals 1.8-2.1 mm long, 1.3-1.8 mm wide, ovate to wide ovate, tomentose outside, red hairs present, sericeous inside, red hairs present, stamens of whorls I & II 1.2-1.4 mm long, filaments sparsely sericeous ad and abaxially along the median section, anthers 0.7-0.9 mm long, glabrous adaxially, glabrous abaxially or sparsely sericeous at the very base, thecae four, in two pairs, introrse, stamens of whorl III 1.2-1.4 mm long, filaments (long) sericeous on the margins adaxially, sparsely sericeous along the median section abaxially, anthers 0.6-0.8 mm long, sericeous adaxially, except along the connective, glabrous abaxially, sporangia four, in two pairs, the upper ones latrorse, the lower ones extrorse (latrorse), glands 0.4-0.5 mm long, at the base of filament, ovate, sericeous adaxially at median section, glabrous elsewhere, staminodes 0.7-0.9 mm long, pedicel glabrous or sparsely sericeous at base adaxially, long sericeous abaxially, head 0.5 mm long, triangular in outline, glabrous adaxially, long sericeous abaxially, mainly on lower two thirds, hypanthium 0.4 mm deep, tomentose outside, glabrous inside except for big patches of sericeous hairs between the base of third stamens and staminodes, pistil 1.6-1.9 mm long, glabrous, ovary 1-1.2 mm long, 0.9-1.2 mm wide; fruit (still immature) 8-8.6 mm long, 5.2-5.8 mm wide, ellipsoid, cupule 5-5.3 mm long, 3.2 to 1.4 mm wide, no pedicel; tepals persistent.

Flowers in May and June. Fruits ripe in November. In pine and oak-pine forest, at an altitude between 850-920 (1500?) m.

Paratypes. MEXICO. Guerrero: mpio. Chilpancingo, on the trail from Zoyatepec to Cerro de la Vaca, (fl), *L. Rodríguez 333* (FCME, MO); 3.5 km N of Zoyatepec, 920 m, (fr), *E. Martínez 2573* (MEXU); barranca de El Toro, aprox. 3 km WNW of El Ocotito, 850 m, (fl), *F. Lorea 5500* (FCME, MO).

The type of indument suggests a relationship with *C. kruseanum*, another species found in the area where *C. velveti* occurs, but the former species has ovate to ovate-lanceolate leaves with the apex acute to rounded, the leaf base cordate and amplexicaul, and 3 to 5 pairs of secondary veins that tend to be in the bottom third of the leaf blade.

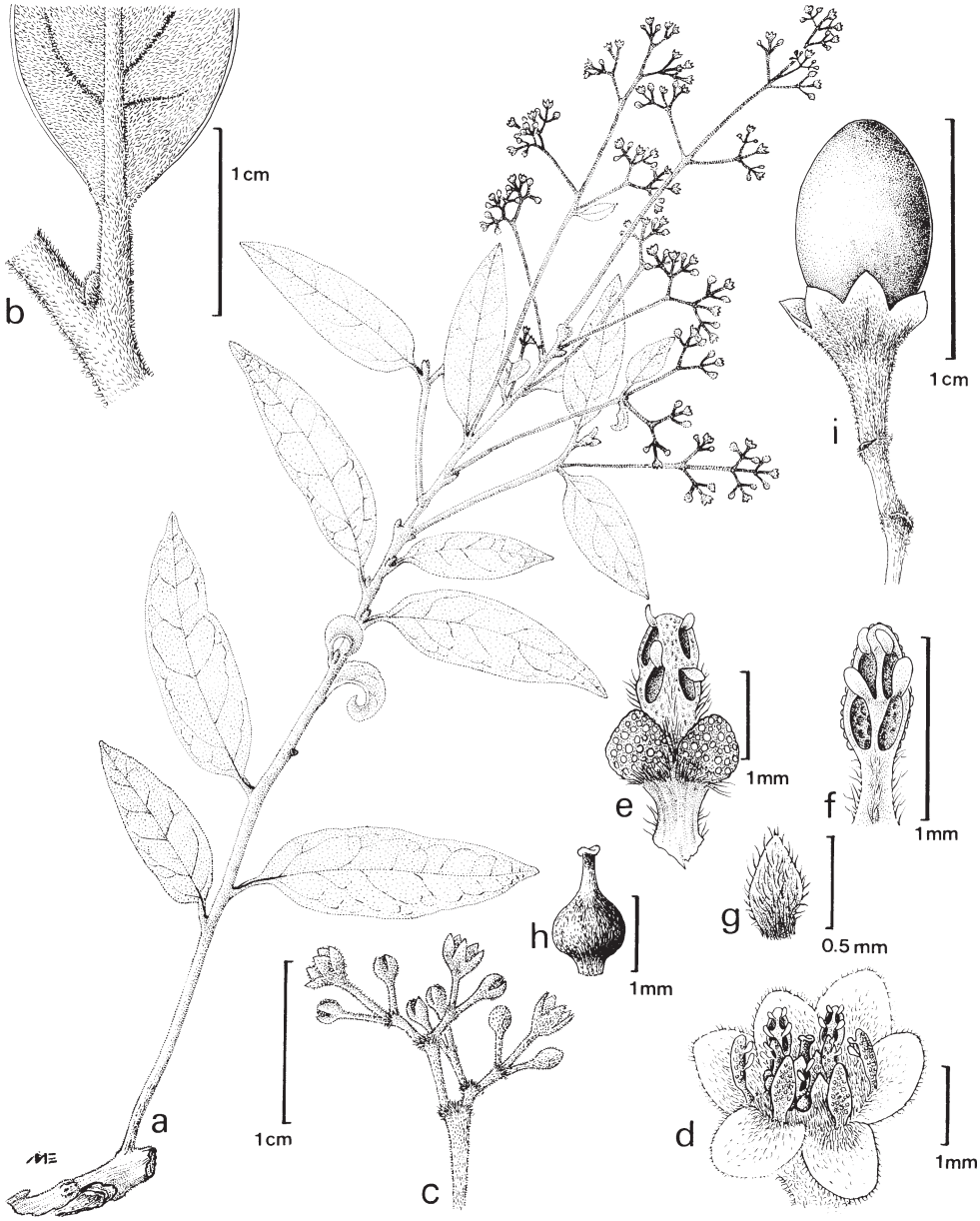

Fig. 4.*Cinnamomum velveti*. a. Branchlet of the plant; b. Detail of pubescence at the insertion of a leaf; c. Terminal branchings of the inflorescence; d. Inner view of a flower (tepals extended manually); e. Abaxial view of a whorl III stamen; g. Staminode; h. Ovary; i. Fruit. Illustrated by M. Escamilla.

Specimens of *Lorea 5500* show less pubescent thinner leaves and almost no evidence of waxy particles on the leaf surface. However, the differences are thought to derive from the fact that this collection was made from sprouts of a badly cut shrub. A reconsideration of this conclusion would be needed if more material with these characters is collected in the future.

The velvety surfaces of the plants is a conspicuous feature to identify the species, whence the specific epithet proposed. The name *C. velutinum* Ridley prevents the use of that epithet and so, in accordance with the rules, the genitive of "velvetum" was taken for the species name.

Cinnamomum zapatae Lorea-Hernández, sp. nov. TYPE: Mexico. Guerrero: mpio. Chichihualco (Leonardo Bravo), 3 km NE of Cruz de Ocote, between Filo de Caballos and Puerto El Gallo, 2250 m, (fl, young fr), 14 January 1988, *F. Lorea 4172* (holotype, FCME; isotypes, FCME, MO). Fig. 5.

Arbores. Folia plerumque ovata vel late ovata, apice acutato vel breviter acuminato, triplinervia aut subtriplinervia, infra dense pubescentia trichomatibus undulatis vel crispis, adpressis vel patulis; domatiis praesentibus ad axillas nonnullas venarum secundariarum et tertiariarum, pagina foliari utrinque ad domatia subplana. Inflorescentia ex cymis in paniculam aggregatis constans, bracteis foliaceis nonnunquam praesentibus, deciduis. Flos tepalis extus sicut pedicello pubescentibus, hypanthio intus dense pubescente; tepalis integris in fructu persistentibus.

Trees ca. 25 m tall; twigs densely pubescent, hairs 0.2-0.5 mm long, appressed to erect, mostly wavy or curly, long persistent; petioles (9.5)11-17(20) mm long, (0.8)1.3-2 mm wide, densely pubescent, hairs as on twigs; leaf blades (5)8-13(16) cm long, (2.5)4-6.5(9.5) cm wide, ovate to widely ovate, occasionally elliptic, apex acute to acuminate, base obtuse to rounded, sometimes oblique, pubescent when young above, soon glabrous, densely pubescent below, hairs as on twigs, rather persistent, sometimes deciduous in part of the leaf area, triplinerved or subtriplinerved, midvein slightly sunken above, glabrous, strongly raised below, densely pubescent, hairs wavy to curly, spreading to erect, secondary veins (3)4-5 pairs, rather flat above, strongly raised below, densely pubescent, hairs as on midvein, tertiary veins flat above, raised to strongly raised below, pubescent to sparsely pubescent, domatia along midvein present in most of secondaries axils, domatia on secondary veins present, mostly along basal pair of secondaries, domatia along tertiary veins occasionally present; inflorescence (3)6.5-11(13.5) cm long, axillary to leaves, solitary, or several in short racemes, cymose-paniculate, peduncle 0.5-3.5(5.5) cm long, or absent, densely pubescent, rachis densely pubescent, flower pedicel 2.5-5(7) mm long, pubescent; flowers urceolate, tepals 2.3-2.7 mm long, 1.6-2.3 mm wide, ovate or widely ovate, pubescent outside, sericeous inside, some red hairs present, stamens of whorls I & II 1.6-1.8 mm long, filaments glabrous adaxially, glabrous or sparsely sericeous abaxially, anthers 0.7-1.1 mm long, glabrous ad and abaxially, or sparsely sericeous on base abaxially, sporangia four, introrse, stamens of whorl III 1.7-2 mm long, filaments sericeo-tomentose adaxially, red hairs sometimes present, sparsely long sericeous abaxially, particularly on lower half, anthers 0.7-1 mm long, sparsely sericeo-tomentose adaxially on lower half, glabrous abaxially, sporangia four, upper ones latrorse, lower ones

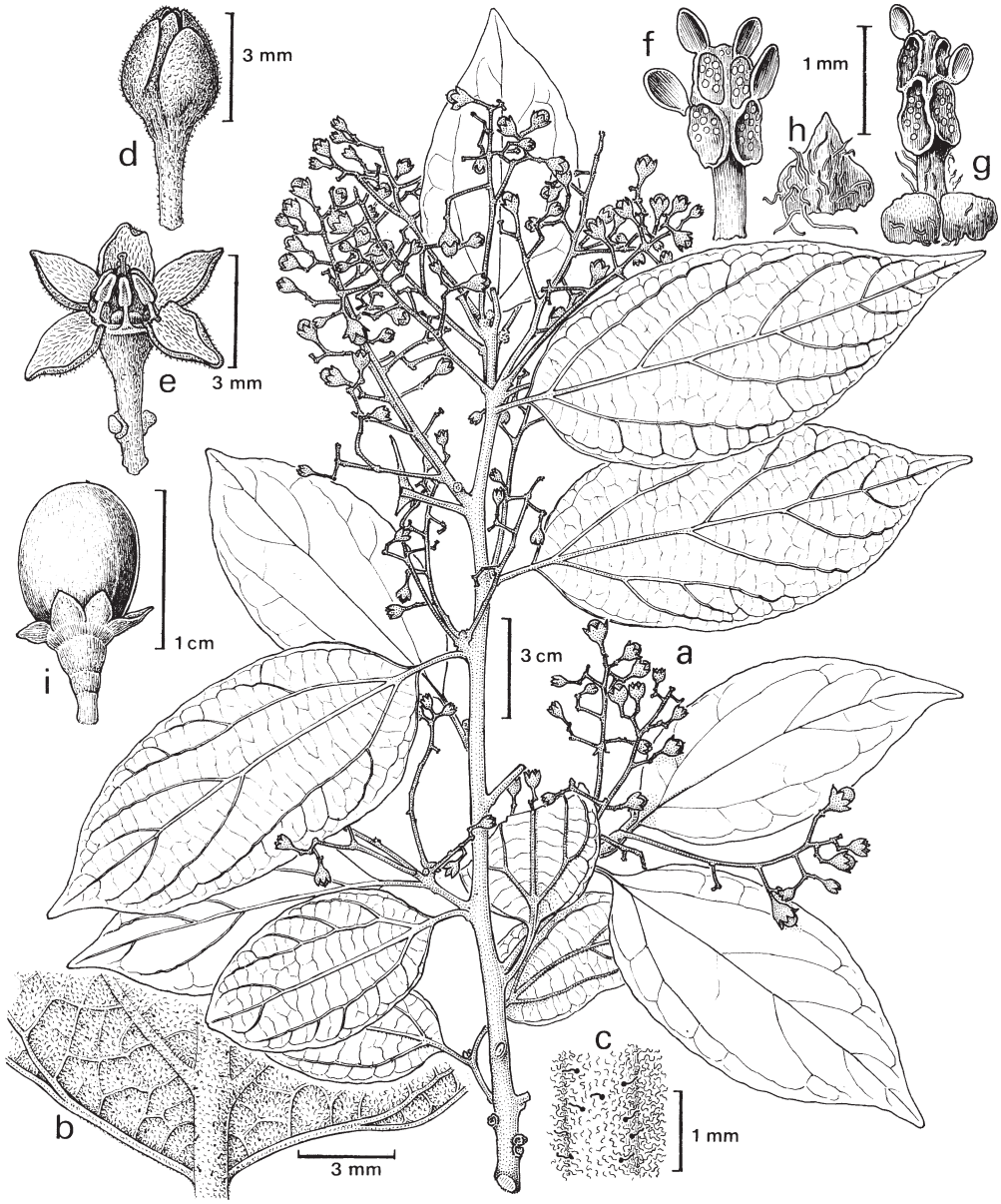

Fig. 5. *Cinnamomum zapatae*. a. Branchlet of the plant; b. Detail of leaf undersurface; c. Detail of pubescence on terminal branchlet; d. View of a single flower; e. Inner view of a flower (tepals extended manually); f. Adaxial view of a whorl I stamen; g. Abaxial view of a whorl III stamen; h. Staminode; i. Fruit. Illustrated by E. Saavedra.

extrorse, glands ca. 0.5 mm long, above filament base or higher, roundish, long sericeous adaxially, glabrous abaxially, staminodes 0.9-1.1 mm long, filaments (red) sericeo-tomentose adaxially, sericeous abaxially, head 0.5-0.7 mm long, wide cordate in outline, acuminate, glabrous adaxially, sparsely long sericeous on lower half abaxially, hypanthium 0.5 deep, pubescent outside, sericeous inside, red hairs abundant, pistil 2-2.3 mm long, glabrous, ovary 0.8-1.2 mm long, 0.9-1.2 mm wide; fruit 9-15.5 mm long, 6-10 mm wide, cupule 5-9.5 mm long, 5-8.5 mm wide, narrowing to a bottom 1.5-2.5 mm wide, pedicel not distinct, tepals persistent.

Flowers are present in January, April, and May. Fruits are ripe in December, January, and February. The habitats of this species are mainly the cloud forests and pine-oak forests that grow along the mountain ranges that run across southern Mexico and adyacent Guatemala, at altitudes of (1300)1600-2450(2750) m.

Paratypes. MEXICO. Guerrero: mpio. Chichihualco (Leonardo Bravo), 3.5 km NE of Cruz de Ocote, 2100 m, (fr), *F. Lorea 5489* (FCME, MO); mpio. Chilpancingo, 2 km E of Omiltemi on the road to Chilpancingo, 2250 m, *J. Rzedowski 16071* (ENCB). Oaxaca: Rancho Grande, *F. Miranda 1097* (MEXU); mpio. Laxopa, 20 km E of Ixtlán along road to Talea de Castro, 2450 m, (fl), *G. Martin 514* (MEXU, MO); 25 km SSW of Talea de Castro, 3 km N to Yalina junction, 2750 m, (fl), *R. Cedillo & D. Lorence 2373* (MEXU); mpio. Ixtlán, on the road from Calpulalpan to Llano Verde, ca. 15 km N of Calpulalpan, 2400 m, (fl, fr), *R. Cedillo & D. Lorence 2368* (MEXU, MO). Chiapas: mpio. Tenejapa, Ojo del Río Yash Zanal, 1600 m, (fr), *A. Méndez 5332* (MEXU, MO); mpio. Angel Albino Corzo, Reserva El Triunfo, 1930 m, (fr), *L. Avila & S. Solórzano 30* (CHIP, FCME). GUATEMALA. Alta Verapaz: along Río Cobán, 4 km E of Cobán, 1300 m, (fr), *L. Williams et al. 43353* (F, NY).

The pubescence made of wavy to curly hairs, along with the strongly raised secondary and tertiary veins, domatia along secondary veins, and fruit pedicel turbinate from top to bottom distinguish this species from other morphologically related, like *C. bractefoliaceum*, *C. padiforme*, and *C. tonduzii*. *C. glossophylum*, which also has the same kind of pubescence, differs in leaf shape. Some collections from Oaxaca (e.g. *Martin 514* and *Cedillo & Lorence 2368*) present racemose inflorescences and because of this look very different, but other features link the specimens tightly to typical *C. zapatae*. In this case, I think that inflorescence architecture alone cannot support the separation of those specimens as a distinct species.

This species is named after Emiliano Zapata, a Mexican revolutionary that fought in southern Mexico (1911-1919) for the vindication of basic rights of peasants (indigenous people).

A key to distinguish the species of *Cinnamomum* found in Mexico is provided next.

1 Lower leaf surface concealed by dense pubescence of tight wavy to curly hairs. Leaf base cordate, amplexicaul ..... *C. kruseanum*
1 Lower leaf surface not concealed by pubescence; hairs absent or present, straight to curly, appressed or erect. If apparently leaf surface concealed (*C. velveti*), leaf base never cordate. Leaf base mostly obtuse.

2 Leaf surface of mature leaves entirely glabrous above and below (veins may have some hairs).
3 Domatia absent.
4 Leaves trinerved to (less frequent) triplinerved. Secondaries 3-4 pairs. Basal glands of third whorl stamens absent ..... *C. concinnum*
4 Leaves penninerved to (less frequent) subtriplinerved. Secondaries (5-)6-11 pairs. Basal glands of third whorl stamens present.
5 Leaf base round, obtuse to cordate, often amplexicaul, or truncate. Leaf apex acuminate to obtuse. Inflorescence cymose-paniculate, usually with more than 15 flowers ..... *C. amplexicaule*
5 Leaf base acute. Leaf apex long acuminate. Inflorescence with only 1-3 dichasia ..... *C. chiapense*
3 Domatia present, at least one in the axil of lowest pair of secondary veins in some leaves.
6 Floral hypanthium sericeous inside, at least patchily.
7 Domatia leaf surface area flat above and below.
8 Twigs winged; flower pedicel (10-)12-20(-24) mm long ..... *C. longipes*
8 Twigs terete or slightly ridged; flower pedicel not over 6 mm long .... *C. triplinerve*
7 Domatia leaf area usually concave below, flat or more or less ampullose above.
9 Inflorescences a single 3-flowered cyme; leaves caudate, thin-herbaceous ..... *C. leptophyllum*
9 Inflorescence cymose-paniculate; leaves acute to acuminate, rather chartaceous ..... *C. areolatum*
6 Floral hypanthium glabrous inside.
10 Primary domatia (along midvein) present in several pairs; secondary domatia (along secondaries) present, at least one or two in some leaves. Basal pair of secondaries not conspicuously distant from next pair, nor strongly ascending ..... *C. effusum*
10 Primary domatia present only at the base of lowermost pair of secondary veins. Secondary domatia absent. Lowermost pair of secondary veins strongly ascending ..... *C. grisebachii*
2 Leaf surface of mature leaves sparse to densely pubescent at least below (sometimes inconspicously puberulent).
11 Indument of lower leaf surface made only of straight appressed hairs, sometimes inconspicuous.
12 Leaf area of domatia concave below, ampullaceous above ..... *C. areolatum*
12 Leaf area of domatia flat above and below.
13 Secondary domatia (those along secondary veins) present, at least in some leaves.
14 Floral hypanthium glabrous outside and inside ..... *C. effusum*
14 Floral hypanthium mostly pubescent outside, sericeous inside ..... *C. triplinerve*
13 Secondary domatia absent.
15 Lower leaf surface with conspicuous irregular dark spots .... *C. salicifolium*

15 Lower leaf surface without dark spots ..... *C. triplinerve*

11 Indument of lower leaf surface made of wavy to curly hairs, more or less appressed to erect, if straight hairs present, these mainly spreading or erect.

16 Secondary domatia (those along secondary veins) absent.

17 Flower pedicel and outer surface of tepals conspicuously pubescent; fruit pedicel not distinct (turbinate from base to top) ..... *C. velveti*

17 Flower pedicel glabrous, tepals glabrous or sparsely pubescent outside; fruit pedicel partially distinct (turbinate distally).

18 Tepals without an abscission line, entirely persistent in fruit. Flower pedicel conspicuously pubescent ..... *C. pachypodum*

18 Tepals with an abscission line above their base, partially persistent in fruit. Flower pedicel glabrous ..... *C. hartmanii*

16 Secondary domatia present.

19 Twigs tips and lower leaf surface of young leaves with (conspicuous) glomerules of white wax ..... *C. breedlovei*

19 Twigs tips and lower surface of young leaves without glomerules of white wax.

20 Floral hypanthium entirely glabrous or with some hairs on upper half inside.

21 Hairs on lower leaf surface wavy, appressed; secondary domatia restricted to lowermost secondaries ..... *C. bractefoliaceum*

21 Hairs on lower surface straight to slightly wavy, erect to spreading; secondary domatia usually present along several pairs of secondaries ..... *C. padiforme*

20 Floral hypanthium conspicuous and evenly sericeous inside.

22 Leaf base obtuse to rounded; leaves mostly broadly ovate to ovate; upper leaf surface glabrous ..... *C. zapatae*

22 Leaf base cuneate; leaves narrowly elliptic to lanceolate; upper leaf surface tomentose ..... *C. glossophyllum*

FINAL COMMENT

At present most species of *Cinnamomum* in Mexico are morphologically well defined. Nevertheless there are still few problems to solve: one concerns the variability of *C. pachypodum* in the western extreme of its distribution; a second one has to do with the variability within some populations of *C. areolatum* that blurs the boundaries between this species and *C. triplinerve*; and thirdly, the apparent hybrid origin of some specimens from Veracruz involving *C. effusum* and *C. pachypodum*. All these cases will need more field work in order to gather, besides additional herbarium samples, collections of proper material for other kind of studies; like leaf tissue for DNA analysis.

It is likely that disjunct populations of *C. amplexicaule*, *C. grisebachii*, and *C. padiforme*, mentioned in the text, might be indeed distinct species. But again, in this case, it is necessary to obtain more information before advancing a different point of view.

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