



A new species of *Quercus*, section *Lobatae* (Fagaceae) from the Sierra Madre Oriental, Mexico

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Abstract

Quercus meavei is described and illustrated as a new species of section *Lobatae* in the Sierra Madre Oriental. It is compared to *Q. albocincta*, *Q. acutifolia*, *Q. furfuracea*, *Q. grahamii*, *Q. skinneri*, *Q. uxoris* and *Q. xalapensis* in the *Acutifoliae* group, which present a biennial pattern of maturation of fruits. *Quercus meavei* differs from these species in having ovoid to subspherical and glabrate acorns, leaves with a greater number of secondary veins [(12)14–19] impressed adaxially, a crispate leaf margin, long-ovoid buds with golden trichomes towards the apical scales and branchlets usually fulvo-tomentose.

Key words: *Acutifoliae*, *Quercus sartorii*, rainforest, red oaks

Introduction

The genus *Quercus* Linnaeus (1753: 994) comprises approximately 500 species of woody plants, with the greatest diversity in Mexico and southeastern Asia (Nixon 1993a; Govaerts & Frodin 1998; Valencia-A 2004). The oaks are one of the most important elements of the temperate forests in the northern hemisphere (Aldrich & Cavender-Bares 2011; Valencia-A. & Gual-Díaz 2014). According to Manos *et al.* (1999) and Manos & Stanford (2001) the species of this genus are grouped in two subgenera: *Quercus* and *Cyclobalanopsis* (Oersted 1866: 77; Schneider 1904: 210), and four sections: *Cerris* (Loudon 1830: 385), *Quercus* (white oaks), *Lobatae* (Loudon 1830: 385) (red oaks) and *Protobalanus* (Standley 1922: 176) (intermediate oaks or golden cup oaks). The subgenus *Cyclobalanopsis* is restricted to eastern Asian and Malaysia (Nixon 1993b), while the subgenus *Quercus*, with four well-recognized sections, has a wider distribution: the section *Quercus* occurs in America and Eurasia, *Cerris* in Eurasia and *Protobalanus* and *Lobatae* are endemic to the Americas.

A group of species of the section *Lobatae* characterized by glabrous or glabrate leaves, with dentate-aristate margin, belongs to *Acutifoliae* Trelease (1924). This group was originally delimited by Trelease (1924) as a series, although it was considered later on as a section by Camus (1938), while Muller (1942) regarded it as a natural group. It was studied as a complex by Romero (2006), who acknowledged ten species within it. During the taxonomic treatment of the species of the genus *Quercus* in the states of Hidalgo and San Luis Potosí, a new species of the group *Acutifoliae* was found in the Herbaria MEXU, FCME, HUAP and XAL, incorrectly determined as *Quercus xalapensis* Bonpland (1809: 24).

It should be noted that this study is based upon the proposal of Valencia-A. (2004) who recognizes *Quercus xalapensis* as a different species from *Q. sartorii* Liebmann (1854: 177), mainly due to the difference in the pattern of the fruit maturity (annual for *Q. sartorii* and biennial for *Q. xalapensis*). Although the original descriptions of *Q. sartorii* and *Q. xalapensis* could cause some confusion, the critical revision of the types at the website <http://plants.jstor.org>, the images of the protologues (Bonpland 1809 and Liebmann 1854), the revision of herbarium specimens and the work of other authors such as Muller (1942) and Breedlove (2001), prove that these are two separate species with differences in the shape of the leaf, size of the petiole and the pattern of fruit maturity. Furthermore, Martínez-Cabrera *et al.* (2011)

have highlighted anatomic and morphological differences among them, and other authors such as Valencia-A. (2004), González *et al.* (2011), Sabás-Rosales (2011) and Valencia-A. & Gual-Díaz (2014) have recognized both species.

Quercus meavei Valencia-A., Sabás & Soto *sp. nov.* (Fig. 1).

Type:—MEXICO, Hidalgo, San Bartolo Tutotepec: 3 km al N de El Fresno, 98° 11' N 20° 26' W, elev. 1754 m, 25-ago-2012 (fr), *Valencia & Flores 5286b* (Holotype: FCME; Isotypes: HUMO, HGOM, HUAP).

Diagnosis:—*Species ramulis fulvis tomentosis; foliis lanceolatis, oblongo-lanceolatis, raro ellipticis; venis utrinque 14–19, subtus prominentibus; 11–16 dentibus longiaristatis margine a latera; gemmae longae-ovoidea, squamulis superiores aureis vel fulvis pilosus. Fructibus biennis, cupula hemispherica, squamis adpressis; glande ovoidea vel subspherica, quasi glabra vel glabra.*

Description:—Trees of 20–30 m tall, branchlets 2.2–2.5 (–3) mm diameter, slightly sulcate, glabrate or more frequently fulvo-tomentose, with shortly stipitate, fascicled trichomes towards the apex of branchlets and the base of petioles; lenticels slightly evident, pale; buds strong and long-ovoid with acute apex, (4.5) 5.6–8.5 (10) × 2.1–3.5 mm, the scales ovate, grey-yellowish, glabrate and shiny, with the margin shortly and irregularly ciliate, the superior scales golden and pilose; stipules linear to narrowly linear or oblanceolate, 6.5–8(–10) mm long, puberulent, deciduous before the leaves reach maturity, sometimes persisting at the apex of the branchlets. Mature leaves with brownish petioles, (10–) 23–36 (–50) mm long, glabrescent or more frequently fulvo-tomentose towards the base; blades coriaceous or semicoriaceous when younger, lanceolate, oblong-lanceolate or oblanceolate, rarely elliptic, 13–18 × 4.5–7.5 cm, 2.4–3.5 times longer than wider, base obtuse to cuneate, sometimes slightly asymmetric, margin slightly thickened and cartilaginous, not revolute, crispate, with 11–16 long-aristate teeth, distributed above the base, each tooth (1.73–) 2.7–5 (–8.8) mm long, apex acute, sometimes apiculate, aristate, secondary veins 14–17 (19) on each side of the midvein, parallel, ascending, almost straight and continuing towards the arista, it is of 4.2–6.3 mm long, adaxially dull, glabrate or with some stellate trichomes towards the base of the midvein, primary and secondary veins impressed, veinlets smooth, abaxially glabrate, with tufts of fascicled stipitate trichomes in the axils of the secondary veins, the epidermis slightly papillose, with prominent primary and secondary veins, pale yellow. Male aments 70–80 mm long, rachis 60–70 mm long, slightly pilose, male flowers sparsely distributed, perianth cyathiform, ca. 1 mm long, with 5 lobules and ciliate margin, free for ½–⅓ of the total length of the perianth, stamens 6, 2.8–3 mm long, anthers exerted, 0.8–1.2 mm long; female flowers in groups of 2 on a short peduncle up to 2–4 mm long, stigmas 3. Fruits biennial, 1–2 at the end of a glabrate peduncle 6–13 mm long; cupules hemispheric, margin erect, (13–)18–23 mm diameter × (8.5–) 9.5–16.5 mm long, the scales lanceolate, sericeous, smooth and completely adpressed, the apex obtuse; acorns ovoid, glabrate, 12–16.5 × 11–16 mm, included for about ½–1/3 of their total length in the cupule.

Distribution and ecology:—A species endemic to Mexico where it is found in the Sierra Madre Oriental, in the states of Hidalgo, Puebla, San Luis Potosí and Veracruz. It can be found in temperate rainforests and oak-forests, in areas of high humidity or on river banks, associated with *Liquidambar styraciflua* Linnaeus (1753: 999), *Clethra* Linnaeus (1753: 396), *Quercus corrugata* Hooker (1842: 403–404), *Q. sartorii*, *Q. delgadoana* S.Valencia, Nixon & L.M.Kelly (2011: 275), *Carpinus caroliniana* Walter (1788: 236) and *Fagus grandifolia* subsp. *mexicana* (Martínez 1940: 85) Murray (1983: 6). Elevation 1630–2250 m. It flowers in March and its fruits reach maturity from September to November.

Etymology:—The specific epithet is dedicated to Dr. Jorge Arturo Meave del Castillo, who has carried out numerous studies of the flora and vegetation of the cloud forest and tropical regions in Mexico.

Additional specimens examined (paratypes):—MEXICO, Hidalgo, Calnali: 16 km de la desviación a Calnali, 1234 m, 20°53'22"N, 98°37'30"W, 14 June 2013, *Monroy & Valencia 122* (FCME). San Bartolo Tutotepec: 2 km al N de El Fresno, 1754 m, 20°26'N, 98°11'W, 25 August 2012, *Valencia & Flores 5285b, 5287b* (FCME); aproximadamente 2.5 km al N de El Fresno, 1627 m, 20°26'N, 98°11'W, 25 August 2012, *Valencia & Flores 5293* (FCME); aproximadamente 3 km al NE de El Fresno, 1620 m, 20°26'N, 98°10'W, 25 August 2012, *Valencia & Flores 5294b, 5296* (FCME); aproximadamente 3 km al sur de Tutotepec, 1912 m, 20°24'N, 98°20'W, 26 August 2012 *Valencia & Flores 5311* (FCME). Tenango de Doria: Tenango de Doria, *Hernández 3325* (XAL); El Damo, aproximadamente 2 km al SE de Tenango de Doria, desviación a San Nicolás, *Luna et al. 845* (FCME, MEXU); El Potrero, aprox. 4 km al SO de Tenango de Doria, 2200 m, 20°18'9"N, 98°13'8"W, 2 September 1993, *Luna et al. 1346* (FCME); Agua Fría, aproximadamente 500 m al E del Damo, 1620 m, 20°19'27"N, 98°12'44"W, 4 September 1993, *Luna et al. 1455* (FCME); 6 km al NE de Agua Zarca, *Valencia 3721* (FCME, HUAP); km 23 de la carr. Tenango de Doria-Agua Zarca, *Valencia 5283* (FCME); East slope of Cerro del Estribo, above Tenango de Doria along road from Metepec, *Breedlove 69425, 69426, 69427, 69449* (MEXU); 8–11 km southwest of Tenango de Doria, *Breedlove 59561* (MEXU); 4.8 km E

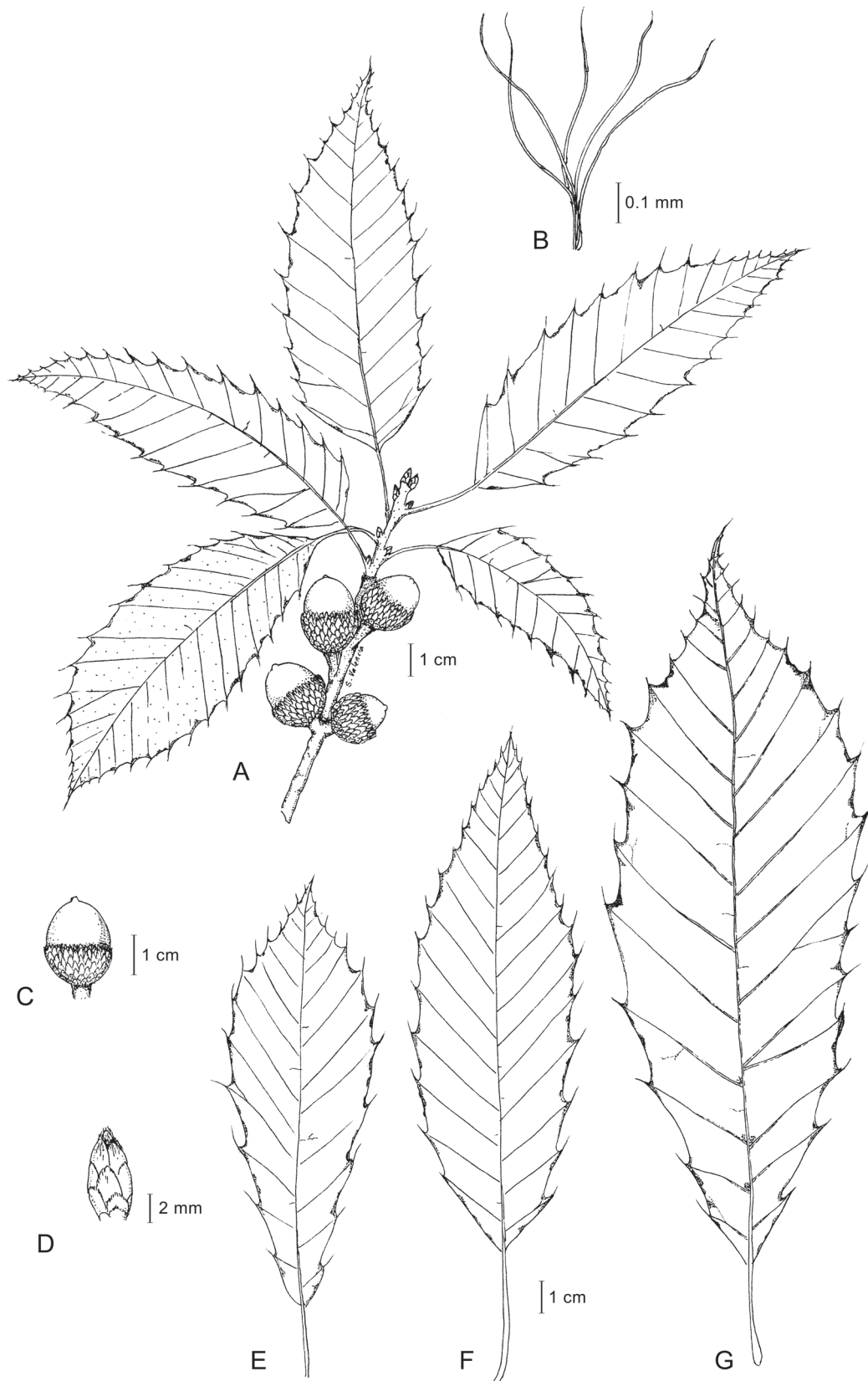


FIGURE 1. A–G. *Quercus meavei*. **A.** Branchlet with leaves and fruits; **B.** Fasciculate trichome from one of the secondary vein axils; **C.** Fruit; **D.** Bud; **E–G.** Variants of leaves.

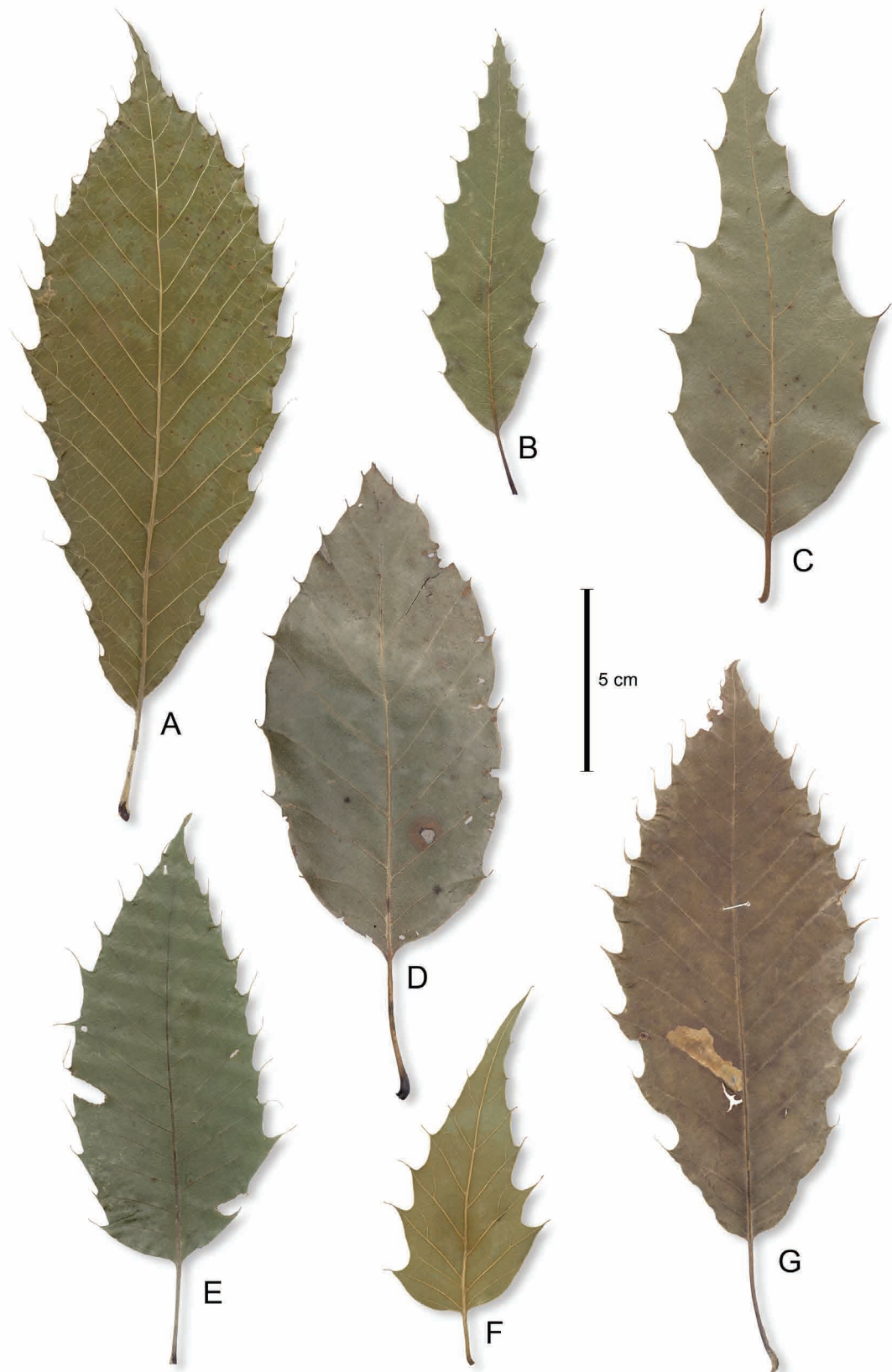


FIGURE 2. A–G. Some representative leaves of biennial species of *Acutifoliae* group. A. *Quercus meavei*; B. *Q. grahamii*; C. *Q. conspersa*; D. *Q. xalapensis*; E. *Q. skinneri*; F. *Q. albocincta*; G. *Q. uxoris*.

of Tenango de Doria along rd to San Nicolas, *McCauley 353 & Cortés* (MEXU); 9 km al SW de Tenango de Doria o 1 km al NE de El Potrero, 2153 m, 20°18'N, 98°13'W, 27 July 2013, *Flores 6533* (FCME); km 23 de la carr. Tenango de Doria-Agua Zarca, *Valencia 5283* (FCME). Zacualtipan: Paraje Cumbre de Tlahuelompa, 2 km al SW de Tlahuelompa, *López 328* (XAL); paraje La Laja, 1 km del poblado de Tlahuelompa, *Verdugo Z8* (XAL). **Puebla.** Huauchinango: 3 km al W de Huauchinango, *Valencia 1256* (FCME). **San Luis Potosí.** Xilitla: aproximadamente 2.3 km en línea recta al SSE de La Trinidad, 1823 m, 21°23'12"N, 99°3'37"W, 2 January 2010, *Sabás & Romo 388* (FCME). **Veracruz.** Huatusco, 1650 m, 19°11'28" N, 97°01'10" W, 27 September 2001, *CONEMEX 41* (FCME, HUAP). Huayacocotla: 1 km al E de Viborillas, *Nee & Taylor 29046* (MEXU); Xico: 1 km al NE de Oxtlapa, rumbo a Tonalco, faldas del Cofre de Perote, 2250 m, 19°25'50"N, 97°6'5"W, 12 September 2001, *Rincón 2606* (MEXU, XAL, FCME).

Notes:—The new species can be confused with *Quercus xalapensis*, *Q. skinneri* Bentham (1841: 116) and *Q. uxoris* McVaugh (in Muller & McVaugh 1972: 513), especially when they lack fruits, as they all present glabrous or nearly glabrate leaves with a dentate-aristate margin, and all of them can be found in rainforests. *Quercus meavei* can be distinguished from *Q. xalapensis* by having leaves with a greater number of secondary pale-yellowish veins, usually adaxially impressed (14–19), a greater number of teeth (11–16), the presence of strong and long ovoid buds of greater size (4–10 mm) with the apical scales with golden to brown trichomes, a subsistent tomentum towards the apex of the branchlets (occasionally towards the nodes), base of the petioles and midvein, and the crispate leaf margin. On the other hand, *Q. xalapensis*, which is distributed from the center of Veracruz to Nicaragua, has leaves with fewer (8–12) secondary veins which are adaxially smooth or convex rarely impressed and slightly orange, fewer teeth (7–12), the buds are ovoid to elliptic-globose (2–4 mm), the scales with ciliate margins, glabrate petioles and branchlets, the margin of the blades is flat or widely crispate. *Q. uxoris* differs from *Q. meavei* in having subhemispheric to patelliform cupules, acorns which are ovoid to broadly ovoid, covered with a fine and slightly golden tomentum, as well as its distribution in the Sierra Madre del Sur. Likewise, it is different from *Q. skinneri* because the latter has larger fruits of which the cup can reach 22–50 mm diameter and 8–20 mm long, patelliform to slightly hemispheric, and the scales are quite keeled; the acorn measures 18–40 (50) mm both in diameter and length and is tomentose and broadly ovoid or depressed, with the pericarp strongly thickened.

The group *Acutifoliae* in which *Q. meavei* is placed is quite complicated. Every species within this group has glabrate or nearly glabrate leaves, with an aristate margin (Fig. 2); in addition, the great morphological variation among the leaves of some of the species living in sympatry makes it difficult (sometimes even impossible) to distinguish these species in the vegetative phase. An important feature that can be used to distinguish some of these species is the fruit and pattern of maturity, as the group includes both annual (*Q. paxtalensis* Muller (1942: 75), *Q. canbyi* Trelease (1924: 188) and *Q. sartorii*) and biennial species (*Q. albocincta* Trelease (1924: 193), *Q. xalapensis*, *Q. uxoris*, *Q. skinneri*, *Q. acutifolia* Née (1801: 267), *Q. grahamii* Bentham (1839–1857: 57), *Q. furfuracea* Liebmann (1854: 189) and the new species *Q. meavei*). An identification key to the biennial species of the *Acutifoliae* group, including *Q. meavei*, is provided below.

Key to the biennial species of *Acutifoliae* group

1. Branchlets and petioles glabrate or glabrous, secondary veins adaxially smooth.....2
1. Branchlets and petioles fulvo-tomentose, secondary veins adaxially impressed or flat6
2. Acorns 18–40 (50) mm diameter, tomentose, pericarp strongly thickened; cup scales strongly keeled..... *Q. skinneri*
2. Acorns 16–19 mm diameter, glabrate, pericarp thin; cup scales smooth3
3. Acorn cup with involute margin. The leaves abaxially with amber, glandular trichomes *Q. acutifolia*
3. Acorn cup with erect margin. The leaves abaxially without glandular trichomes4
4. Leaves elliptic, narrowly elliptic, lanceolate or oblanceolate, coriaceous-papiraceous *Q. grahamii*
4. Leaves narrow to broadly ovate, coriaceous, petioles up to 40 mm long5
5. Leaf teeth 4–5 mm long, acorns 5–10 mm diameter. Trees from northwestern Mexico..... *Q. albocincta*
5. Leaf teeth 0.5–2 mm long, acorns 11–16 mm diameter. Trees from eastern Mexico and Central America *Q. xalapensis*
6. Leaves 2.5–5 cm wide, with 6–9 secondary veins on each side of the midvein, the teeth of the blade margin ca. 1.4 mm long, margin flat or almost so *Q. furfuracea*
6. Leaves 4.5–10 cm wide, with 10–17 (19) secondary veins on each side of the midvein, the teeth of the blade margin (2) 4–8 mm long7
7. Acorns ovoid-depressed, tomentose at the apex, cups subhemispherical to patelliform, secondary veins 10–14 on each side of the midvein. Trees of the Sierra Madre del Sur (México)..... *Q. uxoris*
7. Acorns ovoid, glabrate, cups hemispherical, secondary veins 14–17(19) on each side of the midvein. Trees of the Sierra Madre Oriental (México)..... *Q. meavei*

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