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A nomenclatural revision of *Quercus acutifolia*, *Q. conspersa* and *Q. grahamii* (*Lobatae*, Fagaceae)

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Abstract

A nomenclatural conflict between *Quercus acutifolia* and *Q. conspersa* is solved based on the thorough revision of herbarium specimens, type specimens, original descriptions and field observations. *Q. conspersa* is proposed as a synonym of *Q. acutifolia*, as are the names *Q. acutifolia* ζ *conspersa*, *Q. acutifolia* β *bonplandi*, *Q. acutifolia* γ *angustifolia*, *Q. acutifolia* ε *longifolia* and *Q. candolleana.* In addition, *Q. grahamii* is recognized as the correct name for the taxon identified as *Q. acutifolia*. *Q. conspersa* is lectotypified and *Q. conspersa* f. *caudata* is neotypified here. Information on the distribution of *Q. acutifolia* and *Q. grahamii* and the main features used to distinguish them is also provided.

Key words: *Quercus*, Mexico, taxonomy, red oaks, type specimens

Introduction

During the revision of type specimens of the genus *Quercus* Linnaeus (1753: 994) at the Real Jardín Botánico Herbarium in Madrid, Spain, (MA) collected by Née in 1791, upon which were based the descriptions of 16 new species of oaks in America (Née 1801), an important conflict was found between the identity of the type material in the herbarium and the current application of the names *Quercus acutifolia* Née (1801: 267) and *Q. conspersa* Bentham (1842: 91).

Quercus acutifolia is a name traditionally assigned to a red oak species, native to America. However, the type specimen corresponds instead to what has been treated in recent works as *Q. conspersa*, while the type specimen of *Q. grahamii* Bentham (1840: 57) corresponds to what has been treated as *Q. acutifolia* (Muller 1942, Muller and McVaugh 1972, McVaugh 1974, González 1986, Valencia 1995, Valencia *et al.*, 2002, Valencia-A. 2004; Valencia and Flores 2006 and Romero 2006). This creates important nomenclatural problems that make difficult the communication among botanists regarding to the genus. Therefore, we have revised the nomenclature of *Q. acutifolia* and *Q. grahamii* and here provide a solution to the nomenclatural conflicts, as well as highlighting the distinctive features of both taxa.

Material and methods

The type specimens of *Quercus acutifolia* collected by Née in 1791 and deposited in the Real Jardín Botánico Herbarium in Madrid, Spain (MA), were revised, as were the digital images of the types of *Q. conspersa* and *Q. grahamii* at http://plants.jstor.org, and photos of the type specimens in the work of Trelease (1924), including their proposed synonyms. In addition, a thorough revision of the original descriptions and associated synonymy of the taxa was carried out.

The type material of *Quercus acutifolia* was collected in the current state of Guerrero (México), from where much material of this taxon has been collected for the taxonomic treatments made for the genus in this state (Valencia 1995, Valencia *et al*., 2002). There is also abundant material of *Q. grahamii* collected in the states of Guerrero and Oaxaca, thus the morphological variation of these species both in the wild and in herbarium specimens is well known. The material of these species deposited in Mexican herbaria MEXU, FCME and ENCB was also revised.

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Nomenclatural proposals

Quercus acutifolia was described by Née in 1801, based on the specimens MA152482, MA232909, MA25953, MA25954 and MA25955 of the Real Jardín Botánico Herbarium in Madrid, Spain (MA). The specimens were collected by Née in the state of Guerrero, México, in 1791. The original description points out that: "[…Sus hojas sostenidas por un peciolo …, que es larga y aguda: los bordes forman senos obtusos poco profundos, terminados en dientes aleznados cerdosos, la superficie superior es verde, venosa y lustrosa; la inferior ro[x]iza, y en ella resalta el nervio longitudinal y los alternos que de este nacen: vense en los ángulos que estos forman copitos de borra... Los frutos son pequeños, apenas como guisantes; las bellotitas quedan casi ocultas en el cáliz, cuyo borde superior se dobla hácia adentro..." (Née 1801: 267–268).

However, there are specimens that have been incorrectly determined as *Quercus acutifolia*, for these do not match its description and types, but they do correspond to *Q. grahamii*, a species published by Bentham (1840) and based on the collection of *Graham 326* without locality. Muller and McVaugh (1972) mentioned that *Quercus acutifolia* and *Q. conspersa* are rather similar, but they differ in the texture and shape of the leave, and the infolded margin of the cup. Muller and McVaugh were correct when considering them as two well defined species, although they did not recognize either the synonymy of *Q. conspersa* under the name of *Q. acutifolia*, or the name of *Q. grahamii* for one of these taxa.

McVaugh (1974) discussed the difficulty of distinguishing sterile specimens of *Q. acutifolia* from those of *Q. conspersa*. Even though he detected some of the diagnostic features of *Q. acutifolia* in the original specimens of Née ("ovate-lanceolate, long-attenuate and conspicuously glandular leaves, broadly rounded at base, with no more than 5–7 coarse lobe-like teeth on each side" (1974: 17)), he highlighted that "the character of the infolded cup-margin in *Q. conspersa* is a very distinctive one…" (1974: 17). In consequence, it is clear that his concept of *Q. acutifolia* and *Q. conspersa* was not clear, as all these features belong to the same taxon.

Thus the revision of the type specimens and original descriptions of *Q. acutifolia* and *Q. conspersa* (the types of the latter are duplicates of the collection of *Hartweg 641* and are deposited at the herbarium K with the registration numbers K000512983, K000512982, K000512984) confirms they are the same taxon. Considering the principle of priority of the International Code of Nomenclature for algae, fungi and plants (McNeill *et al*. 2011), *Q. acutifolia* is the name that must be applied to what has been treated as *Q. conspersa,* and the latter is a synonym of the former. It is also noteworthy that the three specimens at K are registered as holotypes of *Q. conspersa*. Trelease (1924) mentioned that he revised the type specimen at the herbarium Dahlem in Berlin, which should have been the lectotype. Unfortunately, the material in Dahlem was destroyed during the Second World War, and it is now necessary to choose a lectotype from the rest of the material of *Hartweg 617*. The three specimens at K are complete and representative of the taxon, even though the specimen K000512984 clearly shows aristate, dentate leaves, while the other two have entire leaves. Then, considering the greater frequency of dentate leaves in this species, it is herein lectotypyfied based on the specimen K000512984.

Another synonym for *Q. acutifolia* is *Quercus nitida,* described by Martens et Galottii (1843: 210) based on the collection *Galeottii 121*, but this name had been previously assigned to another oak species described by Rafinesque (1838: 20), so Trelease (1924) named it *Q. uruapanensis* (Trelease 1924: 210). Later, McVaugh (1974: 27) proposed both the names of *Q. nitida* Martens & Galeottii and *Q. uruapanensis* to be synonyms of *Q. conspersa*. The revision of the digital images at http://plants.jstor.org of the holotype and isotype (BR6912444 and BR6912116, respectively) of these names, which are deposited in the National Botanic Garden of Belgium (BR), confirm that they are the same taxon described by Née and both names are therefore synonyms of *Q. acutifolia*.

De Candolle (1864) described five varieties for *Q. acutifolia*: *Q. acutifolia* δ *conspersa* (1864: 66) based on the same type of *Q. conspersa*, thus it is not recognized as a different species from *Q. acutifolia*; *Q. acutifolia* ζ *microcarpa* A. DC. (1864:67) later treated as *Q. correpta* by Trelease (1924). These two names were proposed by Muller (1942) and Romero (2006) as synonyms of *Q. conspersa,* and after revising the digital images of the type specimens and original descriptions it is concluded that they correspond to *Q. acutifolia,* so these names are proposed as synonyms of the latter. In the case of *Q. acutifólia* β *bonplandii* (1864: 66), through the revision based on the original description and the digital image of a fragment of the type specimen in the herbarium UCSB (UCSB000165), we propose that this name as a synonym of *Q. acutifolia*. The fourth variety is *Q. acutifolia* γ *angustifolia* (1864: 66), the revision of the original description and the photograph of the lectotype in Trelease (1924: plate 391b), confirms that it is the same taxon described by Née as *Q. acutifolia*. The fifth variety *Q. acutifolia* ε *longifolia* (1864: 67) was based on two specimens corresponding to two different taxa, the first one (*Warscewics 48*) supporting the original description of *Q.*

longifolia Liebmann (1854:185) (which was later renamed as *Q. acatenangensis* Trelease (1924: 163) and different from these aristate species) and the second one (*Ghiesbreght 124*, collected in Huatusco [Veracruz]) is a syntype of the previously published homonym *Q. longifolia* Rafinesque (1838: 21) (identified by Breedlove as *Q. conspersa* on the specimen and confirmed by the authors as *Q. acutifolia*). Based on the specimen *Ghiesbreght 124*, Trelease (1924) transferred *Q. acutifolia* ε *lonfigolia* to the species category, and as the name *Q. longifolia* had been previously used, he renamed it as *Q. candolleana* Trelease (1924: 191). Later, Govaerts and Frodin (1998: 214) reduced this name to a synonym of *Q. acatenangensis*, and Govaerts *et al.* (2011) of *Q. ocoteifolia* Liebmann (1854: 176). Detailed examination of the specimen of *Ghiesbreght 124* showed that it corresponds to *Q. acutifolia.* Therefore, *Q. acutifolia* ε *longifolia* and *Q. candolleana* are here proposed as synonyms of *Q. acutifolia*.

In addition to this convoluted taxonomy, Trelease (1924) described several taxa that are related with names evaluated here, such as *Quercus conspersa* f. *ovatifolia* (1924: 192)*, Q. conspersa* f. *caudata* (1924: 192), *Q. grahamii* var. *coyulana* (1924: 190), and *Q. grahamii* var. *nelsoni* (1924: 190). All these taxa were treated by Muller (1942) as synonyms of *Q. conspersa,* and after confirming these names, we now regard them as synonyms of *Q. acutifolia*.

The names *Quercus tonaguiae* Trelease (1924: 190) and *Q. vexans* Trelease (1924: 190) are rejected as synonyms of *Q. conspersa* (here regarded as *Q. acutifolia*) (Valencia-A. 2004; Valencia and Flores 2006), as the images of the types in Trelease (1924) show blades with a truncate to rounded base, fusiform buds, long petioles and parallel veins from the base, which are characteristics of *Q. xalapensis* Bonpland (1809: 25), not of *Q. acutifolia.*

Quercus grahamii Bentham was regarded as a synonym of *Q. acutifolia* by Govaerts and Frodin (1998), Govaerts *et al.*, (2011) and Romero (2006), while Valencia-A. (2004) considered it as a distinct species. We regard this as a different taxon as stated before and this synonymy is not accepted here.

Romero (2006) proposed *Q. anglohondurensis* C. H. Muller (1942: 76), *Q. monserratensis* C. H. Muller (1942: 71) and *Q. tenuiaristata* Trelease (1938: 358) as synonyms of what was at the time considered to be *Q. acutifolia* (here regarded as *Q. grahamii*). However, our observations do not support this, for example, the first species has annual fruits and the second one has leaves with more secondary veins (10–11 on each side of the midrib) and deep teeth, and the cups are wider (20–22 mm) than in *Q. grahamii*. *Q. tenuiaristata* has coriaceous leaves with primary veins printed on the surface, glabrescent tomentose branchlets and more secondary veins (12–16 on each side of the midrib), while *Q. grahamii* has biennual fruits, 6–10 secondary veins and an equal number of short teeth, cups 6–12 mm wide, subcoriaceous leaves with primary veins at the surface and at the same level and glabrous branchlets.

Furthermore, after reviewing the isotype of *Q. grahamii* var. *brevipes* Trelease (1924: 190) in herbarium C and its original description, we confirme that it is a synonym of *Q. grahamii* as Valencia and Flores (2006) proposed.

Nomenclatural summary

Quercus acutifolia Née. Anales Ci. Nat. 3:267. 1801. Type:—MÉXICO. Guerrero: más allá del Río Mezcala, de Acapulco a México. *Née s.n.,* 1791 (lectotype MA25953!, designated by Breedlove on the specimen; isolectotypes: MA152482!, MA232909!, MA25953!, MA25954! y MA25955!).

= *Q. conspersa* Benth. Pl. Hartw. 91. 1842. Type:—GUATEMALA, *Hartweg 617* (lectotype designated here: K000512984 [photo!]; isolectotypes: K000512982 [photo!]; K000512983 [photo!]; BM000583230 [photo!]. *Q. acutifolia* δ *conspersa* (Benth.) A. DC. Prodr. 16(2):66. 1864.

= *Q. nitida* M. Martens et Galeotti, Bull. Acad. Roy. Sci. Bruxelles. 10(1): 210. 1843. Type:—MÉXICO. Michoacán: Taretan and Uruapan, *Galeotti 121*, oct-1840 (holotype: BR0000006912444 [photo!]; isolectotypes: BR0000006912116 [photo!]; K000512925 [photo!]). *Q. uruapanensis* Trel., Mem. Natl. Acad Sci. 20: 143, pl. 276, 277. 1924.

= *Q. acutifolia* β *bonplandii* A. DC., Prodr. 16(2): 66. 1864. Type:—MÉXICO, *Bonpland 3917* (fragment of the type: UCSB000165 [photo!]).

= *Q. acutifolia* ζ *microcarpa* A. DC., Prodr. 16(2): 67. 1864. Type:—GUATEMALA, *Warscewicz 25* (lectotype designated by Trelease (1924) G-BOIS; isolectotypes: UCSB000070 [photo!], S-R-5408 [photo!]). *Q. correpta* Trel., Mem. Natl. Acad. Sci. 20: 153, pl. 300. 1924.

= *Q. acutifolia* γ *angustifólia* A. DC., Prodr. 16(2): 66. 1864. Lectotype designated by Trelease (1924)—MÉXICO, Thibaud 3 (G-DC [photo in Trelease, 1924: plate 391!]).

= *Q. acutifolia* ε *longifolia* A. DC., Prodr. 16(2): 67. 1864 (*pro part.*). Type:—MÉXICO. Province d´Oaxaca: Huatusco, *Ghiesbreght A., 124*, 1842; (lectotype designated by Trelease (1924) G-DC; isolectotypes: P00744195 [photo!], P00744196 [photo!]). *Q. candolleana* Trel., Mem. Natl. Acad. Sci. 20: 191, pl. 387. 1924.

= *Q. conspersa* f. *ovatifolia* Trel., Mem. Natl. Acad. Sci. 20: 192, pl. 389. 1924. Type:—GUATEMALA. *Wascewicz 28* (holotype: G-BOIS; fragmente of the type in UCSB000068 [photo!]).

= *Q. conspersa* f. *caudata* Trel., Mem. Natl. Acad. Sci. 20: 192, pl. 389. 1924. Type:—GUATEMALA. Guatemala City to Cobán, *Lehmann 1320* (holotype: B†; neotype designated here:—GUATEMALA. San Antonio Mt., *W. A. Kellerman 5028*, 11-jun-1906. (MEXU).

= *Q. grahamii* var. *coyulana* Trel., Mem. Natl. Acad. Sci. 20: 190, pl. 384. 1924. Type:—MÉXICO. Oaxaca: El Portello, Coyula, *Conzatti 3553* (holotype: US00089536!).

= *Q. grahamii* var. *nelsoni* Trel., Mem. Natl. Acad. Sci. 20: 190, pl. 384. 1924. Type:—MÉXICO. Oaxaca: San Miguel Albarrados, *Nelson 533* (isotype: US00566420!; US00089535!).

Quercus acutifolia grows in pine-oak forest, tropical semidecidous forest, pine forest and oak forest, associated with other oaks such as *Q. castanea*, *Q. glaucoides*, *Q. magnoliifolia* and *Q. elliptica*, or associated with *Pinus oocarpa*. This species develops at elev. 750–2450 m, in temperate and semi-humid zones, on north and east facing slopes, and in red soils derived from limestones. Its distribution in Mexico includes Chiapas, Guerrero, Jalisco, México, Michoacán, Oaxaca and Veracruz, and extends into Guatemala and Honduras. It flowers from April to May; the mature fruits are found from July to August.

Quercus grahamii Benth., Pl. Hartweg., 57. 1840. Type:—MÉXICO. *Graham 326*, 1830. (holotype: K000512981!).

= *Q. grahamii* f. *brevipes* Trel., Mem. Natl. Acad. Sci. 20: 190, pl. 384. Type:—MÉXICO. [Veracruz]: Puente Colorado, *Liebmann 3437,* may-1842 (isotypes: P754098 [photo!]; C10012490!).

Q. grahamii grows in oak forest, associated with *Q. crassifolia, Q. castanea, Q. splendens* and *Q. candicans*; in the ecotone of oak forest and tropical deciduous forest it is associated with *Q. magnoliifolia* and *Brahea dulcis;* in pine oak forest, with *Pinus strobus* var. *chiapensis*, *P. michoacana* and *Arbutus* sp. *Q. grahamii* grows at elev. 1540–2480 m in temperate regions and in shallow soils with leaf litter, usually derived from limestones of the Morelos formation. It is known only from Mexico and its distribution includes Colima, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Puebla, Oaxaca, Tlaxcala and Veracruz. It flowers in March. The mature fruits are found from July to November.

Distinguishing features

Both *Quercus grahamii* and *Q. acutifolia* belong to section *Lobatae* (Nixon 1993) better known as red oaks, and have been placed by several authors in the supraspecific group *Acutifoliae* (Trelease 1924, Muller 1942, Muller & McVaugh 1972). The morphology of both species can be confusing, as they can both have lanceolate leaves, which are glabrous or glabrescent, with an aristate margin and of similar size. Nonetheless, theys can be distinguished based on vegetative and cup characteristics. On the one hand, *Q. acutifolia* is distinguished by its brown-reddish branchlets, coriaceous, lanceolate leaves with round base, the underside with abundant glandular trichomes that give a yellowish to red color, the margin is usually aristate and dentate, although the same tree can have entire leaves, and the margin of the cup is usually infolded (most of these features were mentioned by Née in the protologue description cited above). On the other hand, *Q. grahamii* has brown-yellowish to greyish branchlets, semicoriaceous, oblong to lanceolate leaves with an oblique to cuneate base, the underside without glandular trichomes and the margin of the cup is never infolded (Table 1; Figure 1).

TABLE 1. Comparison between features of *Q. acutifolia* and *Q. grahamii*.

Q. acutifolia	*Q. grahamii*
Coriaceous leaves	Subcoriaceous leaves
Lanceolate leaves with rounded base	Oblong, lanceolate leaves with oblique base
Leaf margin aristate-dentate or entire	Leaf margin always aristate
Underside with amber glandular trichomes	Underside without glandular trichomes
Cup margin infolded, rarely erect	Cup margin never infolded

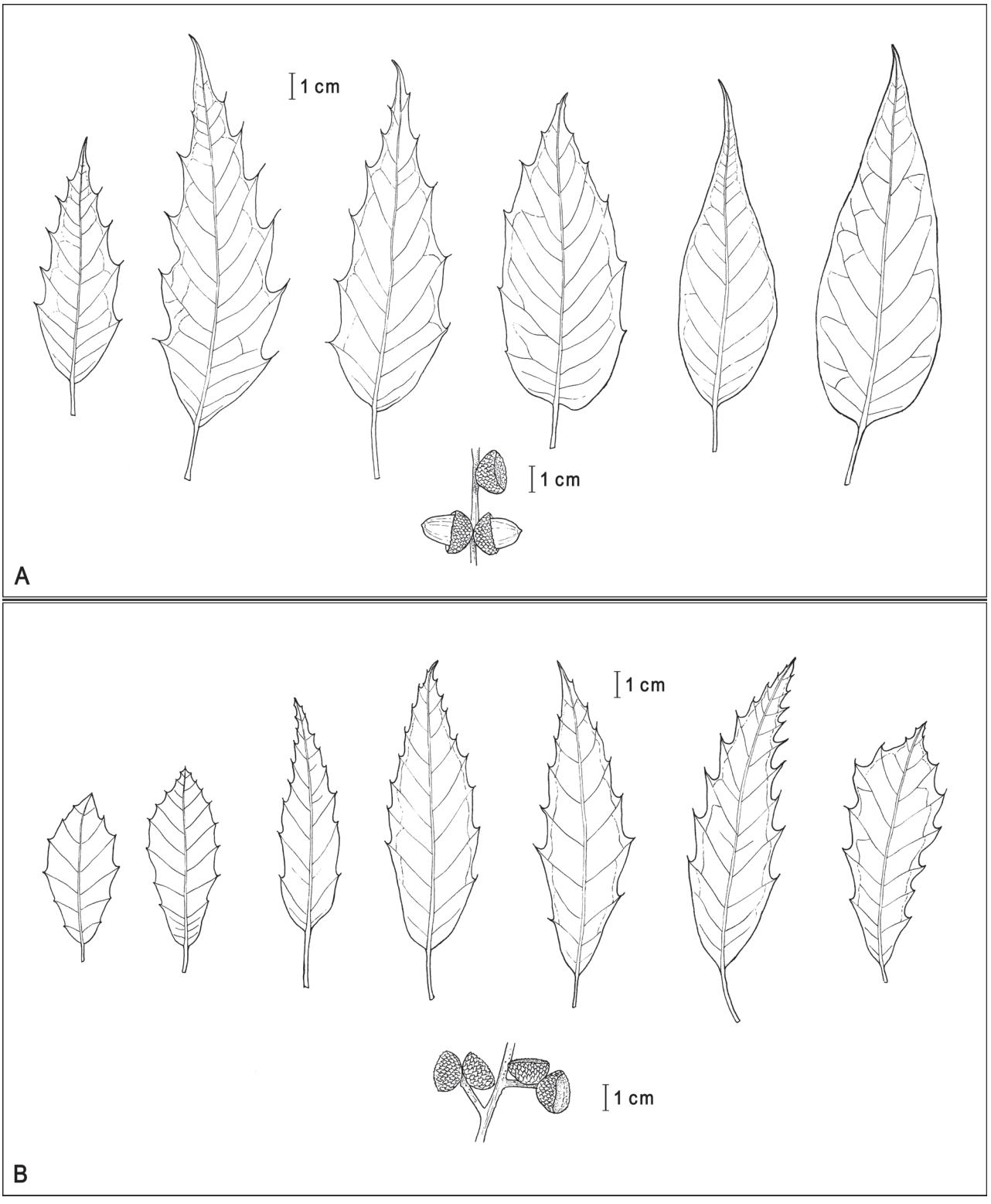

FIGURE 1. Variation in the shape of leaves and cup of the acorn of A. *Q. acutifolia* and B. *Q. grahamii*.

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References

Bentham, G. (1839–1857) *Plantas Hartwegianas imprimis Mexicanas*. E. Societate Linnaeana Londinensi, London, 393 pp.

Bonpland, A.J.A. (1809) *Voyage de Humboldt et Bonpland*. *In:* Humboldt, A. von, Bonpland, A., Poiteau, A., Schoell, F. & Turpin, P.J.F. *Plantes Équinoxiales.* 2. F. Schoell, Paris.

De Candolle, A. (1864) Systematis universalis Regni vegetabilis. *Prodromus* 16 (2): 1–69.

González, V.L.M. (1986) *Contribución al conocimiento del género Quercus (Fagaceae) en el estado de Jalisco*. Colección Flora de Jalisco, Instituto de Botánica, Universidad de Guadalajara, México, 240 pp.

Govaerts, R., Andrews, S., Coombes, A., Gilbert, M., Hunt, D., Nixon, K. & Thomas, M. (2011) *Quercus acatenangensis* Trel. World Checklist of Fagaceae, Facilitated by the Royal Botanic Gardens, Kew.

Govaerts, R. & Frodin, D.G. (1998) *World Checklist and Bibliography of Fagales (Betulaceae, Corylaceae, Fagaceae, and Ticodendraceae)*. Royal Botanical Gardens, Kew. 456 pp.

Liebmann, F.M. (1854) Om Egeslaegten i America. *In:* Johan, M.C. (Ed.) *Oversigt over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Midlemmers Arbeider*. Kjobenhavn, Copenhagen, pp. 159–189.

Linnaeus, C. von (1753) *Species Plantarum,* pag. 2. Impensis Laurentii Salvii, Holmiae, 994 pp.

Martens, M. & Galeotti, H. (1843) Enumeratio synoptica plantarum phanerogamicum ab Henrico Galeotii in regionibus mexicanis collectarum. *Bulletin de l´Academie Royale des Sciences et Belles-lettres de Bruxelles* 10 (1): 208–224.

McNeill, C.J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud´Homme Van Reine, W.F., Smith, G.F., Wiersema, J.H. & Turland, N.J. (2011) *International Code of Nomenclature for algae, fungi and plants (Melbourne Code)*. Eighteenth International Botanical Congress Melbourne. Available from: http://www.iapt-taxon.org/nomen/main.php?page=glo (accessed 22 June 2015)

McVaugh, R. (1974) Flora Novo-Galiciana. *Contributions of the University of Michigan Herbarium 12, I* 3: 1–93.

Muller, C.H. (1942) *The Central American species of Quercus*. U. S. Department of Agriculture, Washington, pp. 1–216.

Muller, C.H. & McVaugh, R. (1972) The oaks (Quercus) described by Née (1801), and by Humboldt et Bonpland (1809), with comments on related species. *Contributions from the University of Michigan Herbarium* 9 (7): 507–522.

Née, L. (1801) Descripciones de varias especies nuevas de encinos (*Quercus* de Linneo). *Annales de Ciencias Naturales* 3: 260–278.

Nixon, K.C. (1993) Infrageneric classification of *Quercus* (Fagaceae) and typification of sectional names. *Annales des Sciences Forestières* 50: 25–34.
http://dx.doi.org/10.1051/forest:19930701

Rafinesque, C.S. (1838) *Alsographia Americana or an American Grove of trees and shrubs*. Philadelphia, 76 pp.

Romero, R.S. (2006) Revisión taxonómica del complejo *Acutifoliae* de *Quercus* (Fagaceae) con énfasis en su representación en México. *Acta Botanica Mexicana* 76: 1–45.

Trelease, W. (1924) The American Oaks. *Memoirs of the National Academy of Sciences* 20: 1–255, 420 pl.

Valencia, A.S. (1995) *Contribución al Conocimiento del Género Quercus (Fagaceae) en el Estado de Guerrero, México*. Contribuciones del Herbario de la Facultad de Ciencias No. 1, Universidad Nacional Autónoma de México, México, 154 pp.

Valencia, A.S. (2004) Diversidad del género *Quercus* (Fagaceae) en México. *Boletín de la Sociedad Botánica de México* 75: 33–53.

Valencia, A.S. & Flores, F.G. (2006) *Catálogo de autoridad taxonómica del género Quercus, Fagaceae en México.* Universidad Nacional Autónoma de México.

Valencia, A.S., Gómez, C.M. & Becerra, L.F. (2002) *Catálogo de encinos del estado de Guerrero, México.* INIFAP-División Forestal, Libro Técnico No. 1, México, 180 pp.