SCIENTIFIC PAPER

A NEW SPECIES OF *Zapatella* (HYMENOPTERA: CYNIPIDAE) FROM MEXICO, INDUCING GALLS ON BUDS OF *Quercus crassifolia* (FAGACEAE)

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A NEW SPECIES OF *Zapatella* (HYMENOPTERA: CYNIPIDAE) FROM MEXICO, INDUCING GALLS ON BUDS OF *Quercus crassifolia* (FAGACEAE)

Nueva especie del género *Zapatella* (Zapatella (Hymenoptera: Cynipidae) de México que induce agalla en brotes de *Quercus crassifolia* (Fagaceae)

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ABSTRACT. The gall wasp genus *Zapatella* Pujade-Villar & Melika 2012 induces galls in oak species of the *Lobatae* section and it is found in the Nearctic and Neotropical regions. This study describes a new species of *Zapatella* found in *Q, crassifolia* Bonpl*,* from Mexico inducing galls on buds. Diagnosis data, distribution and biology of the new species are provided. The principal morphological characters of these new species are described and illustrated.

Palabras clave: Gall wasp, Cynipini, Oaxaca, *Zapatella gabrielae*.

RESUMEN. *Zapatella* Pujade-Villar &Melika 2012 es un género distribuido en las regiones neártica y el neotropical que induce agallas en encinos de la sección *Lobatae*. Este estudio describe una nueva especie de *Zapatella* para México que induce agallas en yemas de *Quercus crassifolia* Bonpl. Se proporciona la diagnosis, distribución y biología de la nueva especie. Los principales caracteres morfológicos de la nueva especie se describen e ilustran.

Keywords: avispa, agallas, encino, Oaxaca, *Zapatella gabrielae*.

INTRODUCTION

Zapatella Pujade-Villar & Melika 2012 is an American genus of oak gall wasp (Hymenoptera: Cynipidae) known from the Nearctic and Neotropical regions. Its species induce galls on mainly on twigs and stems, but also on acorns and buds, of several species of red oaks (*Quercus* of the *Lobatae* section). Gall wasps usually mean no harm to their host plants. However, four *Zapatella* species have been reported as dangerous: *Z. quercusmedullae* Ashmead, 1885 in North America (Burks, 1979) on *Quercus incana* Bartman, *Q. marilandica* (L.) Münchh. and *Q. myrtifolia* Willd.; *Z. davisae* Bufington & Melika, 2016 also in North América (Buffington *et al.*, 2016) on *Q. velutina* Lam.; *Z. petiolata* Pujade-Villar & Caicedo, 2017 in Colombia (Pujade-Villar *et al.*, 2017) on *Q. humboldtii* Bonpl.; and *Z. polytriposa* Pujade-Villar & Fernández-Garzón, 2020 in Mexico (Pujade-Villar *et al.*, 2020) on *Q. crassipes* Bonpl.

Since *Zapatella* was erected from five misplaced *Callirhytis* species by Pujade-Villar *et al.* (2012), numerous species have been newly described (Buffington *et al*., 2016; Fernandez-Garzón *et al*., 2017b; Pujade-Villar *et al*., 2012, 2015, 2017).

The genus is characterized by: the absence of malar sulcus; metasoma as long as broad and strongly arched in lateral view; pronotum and mesoscutum delicately reticulate laterally; metascutellum rugose-reticulate; dorsoposterior surface of hind coxa with dense white setae; tarsal claws simple, without basal lobe; 2nd metasomal tergite with a dense ring of white setae, interrupted dorsally and few setae scattered on lateral surface of tergite; forewing venation pale yellow, indistinct, R1 inconspicuous, hardly traceable; and a prominent ventral spine of the hypopygium, 4.5-13 times longer than broad, with very few short white setae in two rows, directed ventrally.

Currently, the Nearctic and Neotropical regions include 14 species of *Zapatella* (Buffington *et al*., 2016; Fernández-Garzón, *et al*., 2017a, 2017b;

Pujade-Villar, 2017; Pujade-Villar *et al.*, 2012, 2015, 2020): six from America North of Mexico *Z. davisae* Bufington & Melika, 2016; *Z. herberti* Weld, 1926; *Z. quercusmedullae* Ashmead, 1885; *Z. quercusphellos* Osten Sacken, 1961; *Z. oblata* Weld, 1952), one from Mexico (*Z. polytriposa* Pujade-Villar & Fernández-Garzón, 2020), one present in Costa Rica and Colombia (*Z. grahami* Pujade-Villar & Melika, 2012), and six exclusively from Colombia (*Z. cupulae* Fernández-Garzón, Caicedo, Rodríguez & Pujade-Villar, 2017; *Z. inflata* Pujade-Villar & Rodríguez, 2015; *Z. migueli* Pujade-Villar & Fernández-Garzón, 2017; *Z. nievesaldreyi* Melika & Pujade-Villar, 2012; *Z. petiolata* Pujade-Villar & Caicedo, 2017; *Z. tuberosa* Pujade-Villar & Caicedo, 2015). In this study, a new species of *Zapatella* from Mexico is described. The new species galls on buds of *Q. crassifolia* Bonpl.

Material and Method

Adults of the new species were obtained collecting galls on *Q. crassifolia* (Lobatae section). Insects emerged from galls preserved in breeding boxes under laboratory conditions.

The terminology used to describe gall wasp morphology follows other recent cynipid studies (Liljeblad *et al.*, 2008; Melika *et al.*, 2010). Abbreviations for forewing venation follow Ronquist & Nordlander (1989), and cuticular surface terminology follows Harris (1979).

The following are measurements and abbreviations used in this paper: F1-Fn, the first and following flagellomeres; POL (post-ocellar distance), distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance), distance from the outer margin of the lateral ocellus to the inner margin of the compound eye; LOL (lateral-ocular distance), distance between lateral and frontal ocellus; transfacial line, distance between inner margins of compound eyes measured across toruli; width of radial cell, measured as the distance between the upper margin of the forewing and the Rs vein.

Electron microscope images were taken using a Scanning Electron Microscope (FEI Quanta 200 ESEM) at Universitat de Barcelona (Catalonia), at high voltage (10 kV) with gold coating. Stereomicroscope pictures of the adult were taken via an Olympus SC30® camera, coupled to Olympus U-CMAD3®, adapted to stereomicroscope Olympus SZX10®. The definitive images were obtained combining multiple photographs stacking and processing with the software Helicon Focus 6.2.2.

Results

Zapatella gabrielae Cuesta-Porta & Pujade-Villar, n. sp.

LSID: urn:lsid:zoobank.org:act:E65BFF45-CA43-48AD-9069-98DD4A299CCD

Type material. HOLOTYPE ♀ (deposited in UB) with the following labels: "MEXICO, Santa Catarina Lachatao, Oaxaca, Mexico, 96° 29' 12.2' 'N, 17° 15' 34.4" W, 2154 m, (xi.2016) 25-30.vi.2017, *Ex Quercus crassifolia*, leg. R. Clark" (white label), "Holotype *Zapatella gabrielae* Cuesta-Porta & JP-V n. sp., desig. Cuesta-Porta, 2020" (red label).

Paratypes: 3 ♀ with the same data as the holotype, one of them dissected and mounted for SEM photographing; 4 ♀ with the following labels: "La Resinera, Santa Catarina Ixtepeji, Oaxaca, Mexico, 17° 8' 2.08" N and 96° 37' 2.46" W, (15.i.2020) 25.ii-30.iii.2020: 3 ♀, Ex *Q. crassifolia*, leg. R. Clark" (3♀ at UB and 1♀ in M. Serrano collection).

Additional material. One pupa with same data as the type material except for (13.iii.2019) extracted 13.iii.2019 and deposited in M. Serrano collection; "La Resinera, Santa Catarina Ixtepeji, Oaxaca, Mexico, 17° 8' 2.08" N and 96° 37' 2.46" W, *Q. crassifolia*, (12.xi.2011-i.2012) only galls (V. Rodríguez leg); same data, (10.xi.2019) 25.iii.2020: 2 ♀ (Clark leg).

Etymology. In honour to Anna Gabriel Sabaté, a Catalan politics currently forced to live in Switzerland.

Diagnosis. This species is characterized by big triangular scutellar foveae with rugate bottom; lateral propodeal carinae subparallel slightly converging anteriorly, median propodeal area finely rugate; F11 partially divided and twice as long as F10.

This species morphologically resembles to, *Z. nievesaldreyi*, and *Z. quercusmedullae* for its uniform

coloration, incomplete notauli extending to 1/2 of length of mesonotum, median sulcus present but short, POL subequal to OOL, F1 subequal to F2, F11 twice as long as F10, ventral spine of hypopygium 6-8 times as long as broad; but can be differentiated by the triangular and sculptured scutellar foveae divided by a reticulate area, never by a thin carina (smooth and round foveae divided by a wide bar in *Z. nievesaldreyi* and *Z. quercusmedullae*) the subparallel and strong propodeal carinae (subparallel but bent outwards in posterior 1/3 in *Z. nievesaldreyi*), the delicately rugose median propodeal area (smooth in *Z. nievesaldreyi* and *Z. quercusmedullae*), F11 partially segmented (not segmented in the rest).

The galls of this species are unique in the genus by being a rather big bud gall, subglobular with a strong nipple at apex, smooth surface with longitudinal ridges (twig galls in *Z. nievesaldreyi*, and stem swelling galls in *Z. quercusmedullae*).

Other species have bud galls (*Z. cryptica*, and *Z. oblata*), but the galls are remarkably morphologically different (acorn-like) and smaller, and the adults are easily differentiable from the new species for their median sulcus reaching more than 1/3 of mesoscutum.

The host of this species is also different from the rest of species of *Zapatella*, inducing galls on *Q. crassifolia* (*Lobatae* section), while the rest of species induce galls on other *Quercus* species of the *Lobatae* section.

DESCRIPTION

Female. Body length: 3.4-4.0 mm (N = 4).

Colour (Fig. 3A)**.** Head, antennae, mesosoma, legs and metasoma reddish brown; metasomal tergites darkened at posterior margin to dark brown or sometimes black.

Head (Figs. 1A-B) ellipsoidal in anterior view, upper face delicately reticulated, almost glabrous, 2.0-2.3 times as broad as long from dorsal view, 1.3 times as broad as high in anterior view and slightly narrower than mesosoma; lower face with irradiating carinae emanating from the clypeus except a faintly reticulate to almost smooth area between clypeus and toruli, uniformly sparsely pubescent with white setae. Gena reticulated, slightly broadened behind eye, visible behind eyes in anterior view, 1.3 times as broad as cross diameter of eye on lateral view; malar space 0.6 times as long as height of compound eye, malar sulci absent.

POL 1.2-1.3 times OOL; diameter of lateral ocellus subequal to LOL; ocelli round. Transfacial distance 1.3 times as broad as height of eye; diameter of antennal torulus 5-6 times longer than distance between toruli; distance between torulus and inner margin of eye subequal to diameter of torulus.

Clypeus rectangular, smooth, ventrally slightly emarginated, without median incision; anterior tentorial pits deep, covered by irradiating carinae; epistomal sulcus and clypeo-pleurostomal lines obscured, slightly discernible. Frons, vertex, interocellar area and occiput delicately reticulate. Occiput rounded. Labial palpus three-segmented, maxillary palpus five-segmented.

Antenna (Figs. 1C-D) with 11 flagellomeres; slightly longer than mesosoma and head together; scape 1.6 times as long as pedicel; pedicel subglobose, slightly longer than broad; F1 slightly longer than scape and slightly shorter than F2; F2 slightly longer than F3; F3 slightly longer than F4, subsequent flagellomeres shorter, F11 twice as long as F10; F11 twice as long as F10, placodeal sensilla visible on F5–F11, absent on F1-F4. Antennal formula: 8: 5 x 4: 9.5: 10: 9: 8: 7: 7: 6.5: 6: 6: 6: 13 (5 + 8).

Mesosoma (Figs. 1E-G). Only slightly longer than high in lateral view, with few setae. Pronotum, delicately reticulate laterally, with smooth or faintly reticulated dorsally. Mesoscutum concave, strongly arched, with sparse setae, with transverse delicate interrupted striae which are connected with longitudinally orientated weak striae forming an irregular network of striae, together forming an irregular reticulate surface sculpture; round, as long as broad in dorsal view (largest width measured across mesoscutum on the level of tegulae base).

Notauli incomplete, deep and broad on posterior end and narrowing anteriorly until lost at half-length of mesoscutum, bottom smooth; anterior parallel lines visible, depressed, extending to almost half of mesoscutum; parapsidal lines hardly

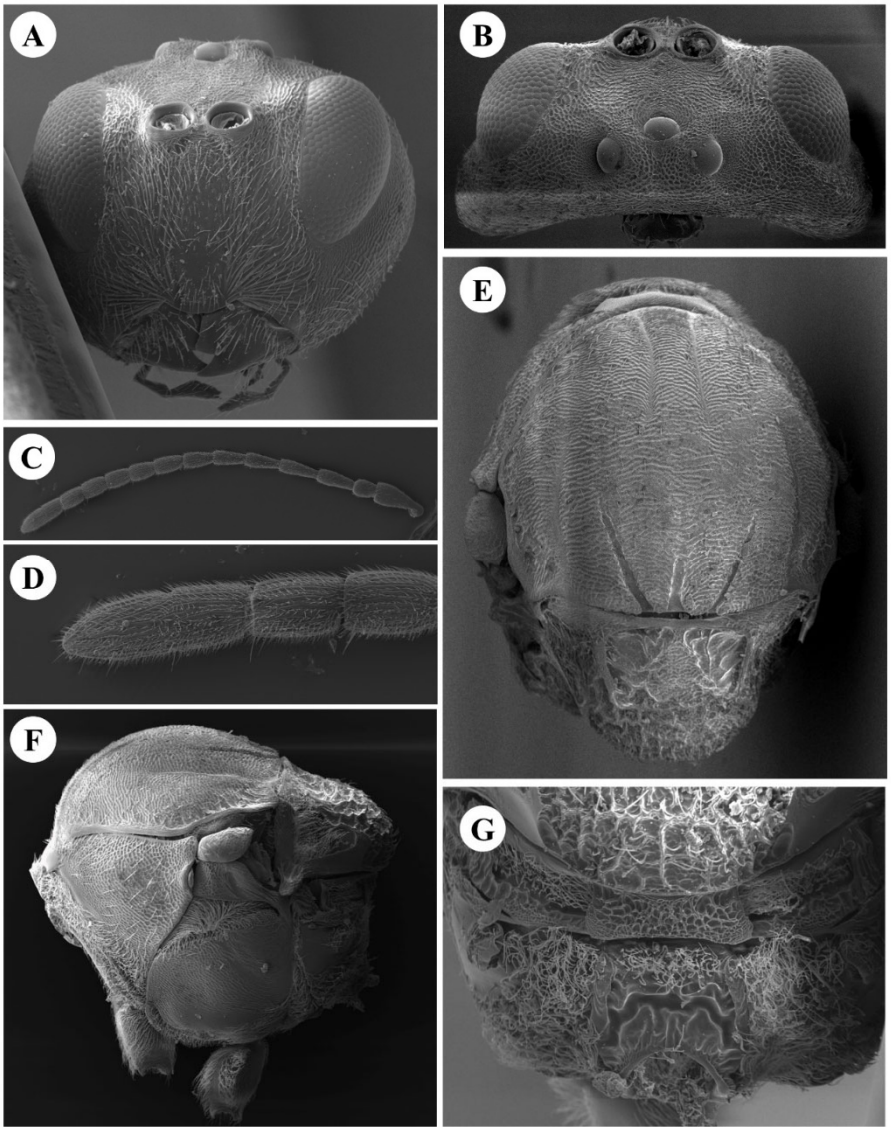

Figure 1. *Zapatella gabrielae* n. sp.: (A) head in frontal view; (B) head in dorsal view; (C) antenna; (D) detail of last flagellomeres, F10 and F11 signaled; (E) mesosoma in dorsal view; (F) mesosoma in lateral view; (G) propodeum.

visible, extending to half-length of mesoscutum, slightly depressed; median mesoscutal sulcus short, only visible on posterior 1/5 of mesoscutum; parascutal carina short, slightly surpassing the level of tegula. Mesoscutellum 0.4-0.5 times as long as mesoscutum, slightly longer than broad, delicately reticulate on anterior half transitioning to coarsely dull rugose posteriorly, round, overhanging metanotum; scutellar foveae triangular, rather deep, only margined by a carina laterally, conspicuously divided anteriorly by a narrow elevated bar, reticulate median area as broad as median sulcus of mesoscutum, faintly rugate bottom with dull interspaces, rugae almost absent on lateral margins, shiny smooth near lateral margins, foveae inconspicuously margined posteriorly, fusing with rugate sculpture; lateral sides of foveae with a conspicuous narrow carina, separating them from dorsoaxillar area.

Mesopleuron uniformly delicately reticulate, almost glabrous. Mesopleural triangle densely pubescent; dorsal axillar area delicately reticulate; lateral axillar area almost smooth with some faint carinae; axillula smooth, densely pubescent of white setae; subaxillular bar smooth, shiny, with parallel sides, its height less than height of metanotal trough, most posterior part extending to half height of mesoscutellum; postalar process long

with delicate reticulations; metapleural sulcus inconspicuous. Metascutellum uniformly faintly rugate-reticulate, metanotal trough faintly shiny rugate, with dense white setae; ventral impressed area rugose, slightly shorter than height of metascutellum. Propodeum anterolaterally smooth and glabrous, densely pubescent on the rest on lateral view; central propodeal area faintly rugate, shiny, with a small patch of dense pubescence; lateral propodeal carinae visible, strong, subparallel, slightly converging anteriorly; nucha short, surrounded by faint irregular wrinkles.

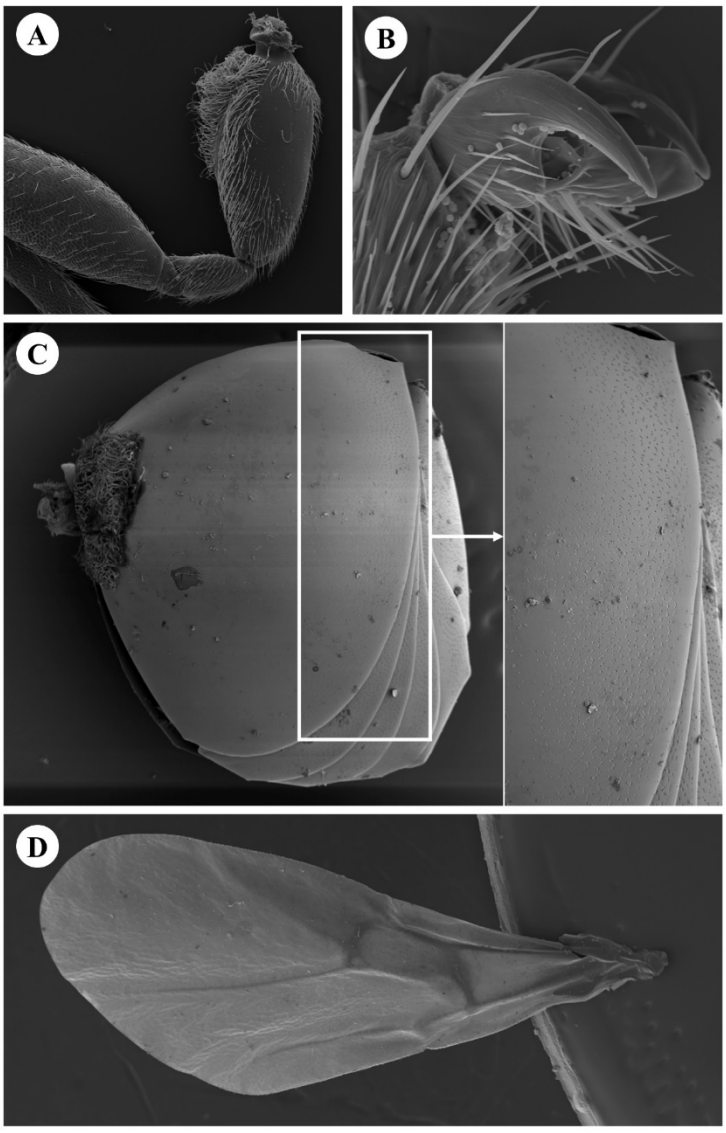

Figure 2. *Zapatella gabrielae* n. sp.: (A) hind coxa, dense patch of pubescence signaled (white arrow); (B) tarsal claw; (C) metasoma in lateral view, with detail of micropunctures; (D) forewing.

Legs (Figs 2A-B) with hind coxae smooth, glabrous on anterolateral side and with dense patch of white setae on posterior side; trochanters rather pubescent, femora and tarsi delicately reticulate and sparsely pubescent; tarsal claws simple.

Forewing (Fig. 2D) longer than body, slightly smoked almost hyaline; glabrous margin; veins faint light yellow, barely noticeable, except for the Sc+R, R+Rs, M+Cu veins conspicuously light brown; Rs vein almost inconspicuous; radial cell opened on margin, 3 times longer than broad; R1

nearly reaching wing margin; areolet small, visible, round, inconspicuously closed, some veins extremely faint; Rs+M not reaching basalis.

Metasoma (Fig. 2C) almost as long as head+mesosoma, ranging between 0.9–1.3 times longer than high in lateral view; 2nd metasomal tergite covering more than 2/3 of length of metasoma, smooth, with a dorsally truncated ring of dense setae on anterior 1/5 of T2; posterior 1/4 of T2 and subsequent tergites with dense micropunctures, grouping in short lines of 2-3 micropunctures forming the illusion of a discontinuous reticulate sculpture; posterior margin of tergites with a very narrow smooth band, without punctures. Ventral spine of hypopygium long, needle-like, usually covered by metasomal tergites, prominent part 7.5 times as long as broad ventrally, without white setae.

Gall (Figs 3B-D). A rather small subglobose unilocular oak bud gall (8–10 mm in diameter), sometimes shortened at base, pointy tip at apex. Solitary or forming groups of two, rarely of 3. The gall is reddish brown, with smooth and naked surface with some longitudinal ridges, usually the globular body of the gall is covered by a thin layer of detachable scales resembling the cupule of acorns, the scales remain in the base when mature.

The outer wall of the gall is thin; the lignified parenchyma is hard and spongious; central area ovate soft-walled larval chamber, with largest length of 3.0 mm.

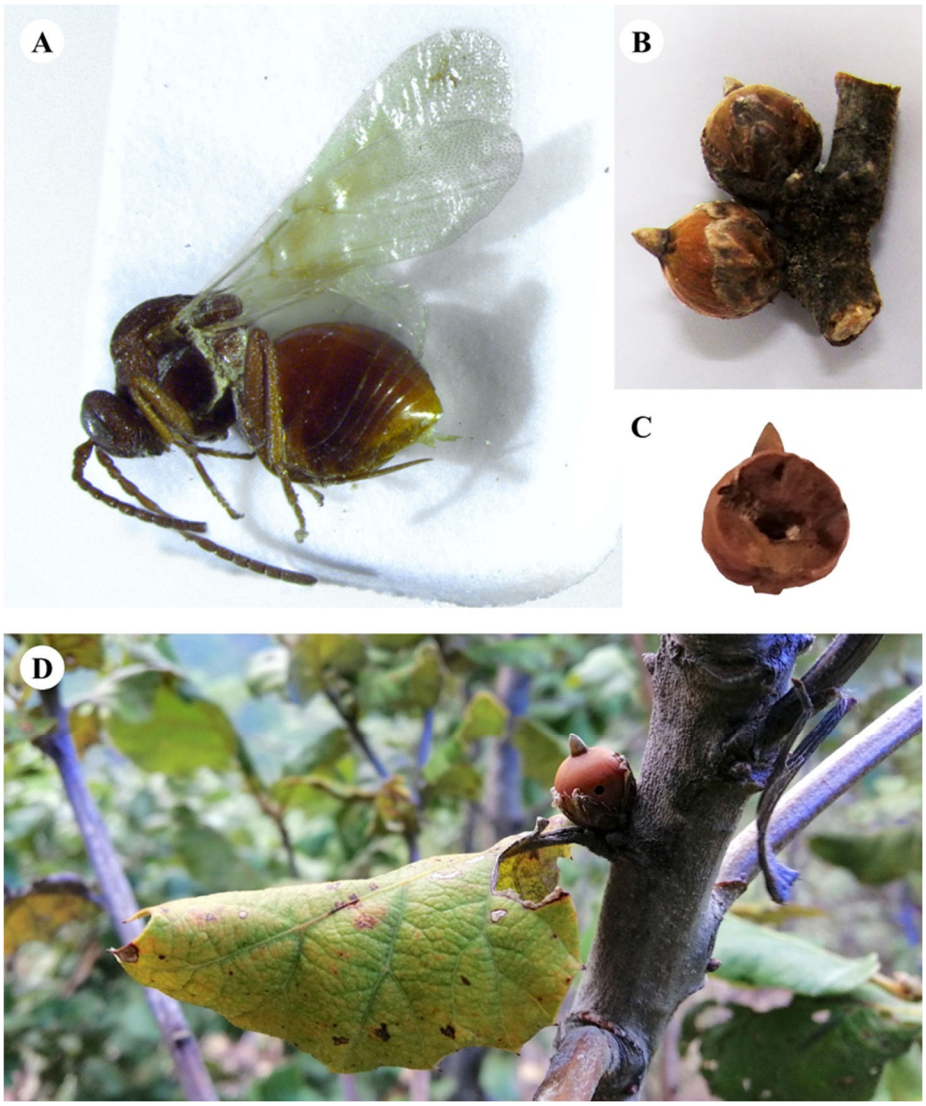

Figure 3. *Zapatella gabrielae* n. sp.: (A) habitus; (B) dry galls; (C) internal structure of gall; (D) mature gall on *Q. crassifolia*.

Host. *Q. crassifolia* Bonpl.

Biology. Species known only for its females. The mature galls were collected from October to January and the adults emerged between March and June.

Distribution. Mexico (Oaxaca State).

Comments. Some morphological variability has been observed among the type material: the POL:OOL ratio varies between 1 and 1.3; the shape and proportions of metasoma may vary depending on the specimen (0.87-1.1 times as long as high in lateral view) and the overlap of the tergites. The T2 ranges from covering the metasoma almost entirely in dorsal view to cover 2/3 the length of the metasoma. The subsequent tergites are always at least partially visible in lateral view.

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