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Description of *Femuros minimum* n. sp. (Hymenoptera: Cynipidae) collected on *Quercus glaucoides* Mart. & Gal. (Fagaceae) in Puebla, Mexico

Descripción de *Femuros minimum* n. sp. (Hymenoptera Cynipidae) colectado *Quercus glaucoides* Mart. & Gal. (Fagaceae) en Puebla (México)

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RESUMEN

Se describe una nueva especie en México de avispa agalladora de los encinos con base a su generación asexual, *Femuros mínimum* Bravo-Cuautle, Cuesta-Porta & Pujade-Villar n. sp., que induce pequeñas agallas en las yemas apicales de *Quercus glaucoides* Mart. & Gal. (Sección *Quercus*). Se comenta su distribución, datos biológicos y se ilustran los caracteres morfológicos distintivos. Finalmente, se exponen los caracteres diagnósticos para diferenciarlos de las especies cercanas.

PALABRAS CLAVE: nueva especie, avispa agalladora, Cynipini, Fagaceae, taxonomía, morfología, distribución, biología.

ABSTRACT

A new species of oak gall wasp from Mexico is described based on its asexual generation: *Femuros minimun* Bravo-Cuautle, Cuesta-Porta & Pujade-Villar n. sp., which induces small galls on the apical buds of *Quercus glaucoides* (section *Quercus*). The distribution and biological data of the new species are discussed, and its distinctive morphological characters are illustrated. Finally, the characters that differentiate it from closely related species are presented.

KEY WORDS: new species, oak gallwasp, Cynipini, Fagaceae, taxonomy, morphology, distribution, biology.

Mexico is one of the main centers of oak diversification and endemism, hosting approximately 250 described species (Romero-Rangel *et al*. 2015), 86 of which are endemic (Valencia 2004). The family Cynipidae (Hymenoptera) is notable for including phytophagous wasps that induce galls, belonging to the tribe Cynipini, which primarily attack Fagaceae, especially the genus *Quercus*. Due to the close relationship between oaks and cynipids, and the high number of species of *Quercus* in Mexico, it is believed that diversity of these gall wasps in the country is also high. Until 2022, 205 cynipid species had been recorded in Mexico (Martínez-Romero *et al*. 2022).

The genus *Femuros* was described by Kinsey (1937a) to include two Mexican species that exhibited a posterior femur widened on the ventral margin near the distal area and constricted toward the tibia (*F. repandae* Kinsey, 1937, and *F. ruidum* Kinsey, 1937). Later, Kinsey (1937b) described five additional Mexican species: *F. lusum* Kinsey, 1937*, F. perfectum* Kinsey, 1937*, F. geniale* Kinsey, 1937, *F. integrum* Kinsey, 1937, and *F. ocri* Kinsey, 1937. Melika & Abrahamson (2002) synonymized *Femuros* under *Andricus*. However, Pujade-Villar & Ferrer-Suay (2015) reinstated the genus, adding another distinguishing characteristic—the presence of an internal carina on the hind tibia. Finally, Cuesta-Porta *et al*. (2025) reviewed *Femuros* and transferred four of Kinsey's species to the genus *Andricus* (*A. lusum, A. perfectum, A. geniale*, and *A. integrum*), while including a new combination under *Femuros, F. bracteatus* Weld, 1944.

Since the latest revision (*Cuesta-Porta et al.* 2025), *Femuros* has been characterized by a nearly smooth or smooth lower head, no radiating carina from the clypeus (or a very short one), absence of a malar groove, a visible occipital carina behind the ocelli, a transcutal articulation, a posterior femur widened on the ventral margin near the distal end, and an internal carina on the hind tibia.

Currently, four species are known, all of them from their asexual form: three species described from Mexico (*F. repandae, F. ocri,* and *F. ruidum*) and one from the United States (*F. bracteatus*). The galls of this genus are round, partially covered by small bracts, with parenchymatous tissue connecting to the larval chamber, and have a lignified outer layer. There is some variation in gall size among species, making it difficult to distinguish them without

the emergence of the adult wasp. Despite these advances, the diversity of *Femuros* in Mexico remains insufficiently known, and additional undescribed species are likely to occur.

This study describes a new *Femuros* species from Mexico that induces small galls on the apical parts of the branches of an endemic Mexican oak species, *Quercus glaucoides* Mart. & Gal.

MATERIAL AND METHODS

Asexual females were obtained from galls collected on *Q. glaucoides* (section *Quercus*), located in the Botanical Garden of Puebla, Mexico. The galls were preserved in emergence vials, and the adults were stored in 70% ethanol until morphological analysis.

The terminology used to describe morphological structures follows the works of Liljeblad *et al*. (2008), Melika (2006), and Melika *et al*. (2010). Wing venation abbreviations follow Ronquist & Nordlander (1989), and cuticular surface terminology follows Harris (1979).

The measurements and abbreviations used here include: F1–F12, referring to the first and subsequent flagellomeres; POL (postocellar distance), the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance), the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye; LOL (lateral-frontal ocelli distance), the distance between the lateral and frontal ocelli. The width of the radial cell of the forewing was measured from the wing margin to the Rs vein.

SEM images were taken by the first author using an environmental scanning electron microscope (FEI Quanta 200 ESEM) without any coating (gold or carbon). Gall images were taken by the first author using a Canon PowerShot SX510 HS digital camera directly through a binocular magnifier. Adult images were captured by the first author using a digital camera mounted on a Carl Zeiss III microscope.

The type material is deposited in the University of Barcelona (UB, J. Pujade-Villar collection).

RESULTS

Femuros minimum Bravo-Cuautle, Cuesta-Porta & Pujade-Villar, **sp. nov.**

(Figs 1-3)

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Type material. HOLOTYPE asexual female deposited in the JP-V (UB) collection, with the following labels: MEX, Jardín Botánico de Puebla, *Q. glaucoides*, (28.x.2024) 1.i.2025 (white label); Holotype *Femuros minimun* Bravo-Cuautle, Cuesta-Porta & Pujade-Villar n. sp., desig. JP-V 2025 (red label). PARATYPES 5♂ with the same labels as holotype except for the dates of collection and they were manually extracted (ext.): (28.x.2024) ext. 1.iii.2025: 1♂; (28.i.2025) extr. 1.iii.2025: 4♂.

Additional material. MEX Jardín Botánico de Puebla, *Q. glaucoides*, (28.i.2025) extr. 1.iii.2025: 1♂ dissected for SEM.

Etymology. The name *minimum* refers to the small size of the galls.

Diagnosis. *Femuros minimum* n. sp. differs from other species of *Femuros* by the number of flagellomeres (12 in the new species, 11 with a very inconspicuous suture in the other species) and by the length of the malar space (3.0x in the new species, around 2.1x in the others). The new species is morphologically closely related to *F. ocri*, but it differs in the following characters: ventral spine of hypopygium 5.0x as long as broad in ventral view (3.5-4.0x in *F. ocri*), body color dark brown (reddish-brown in *F. ocri*); anterior parallel lines and parapsidal lines black (without black marks in *F. ocri*); and ventral margin of clypeus straight (rounded in *F. ocri*). The new species also differs from all *Femuros* species by the small size of its gall, around 4.0 mm in diameter (averaging 8.0–15 mm in the other species).

Description. **Asexual female**. Body length 2.6–3.1 mm (n=6).

Color (Fig. 3e). Head, mesosoma, and metasoma chestnut brown with some darker areas on anterior parallel lines and parapsidal lines; mesopleura and scutellar foveae black, antennae with darker flagellomeres, legs chestnut brown, coxae lighter, third femur and tibia black. Wing hyaline, veins brown.

Head (Figs. 1a–c**).** Transversally ovate, broadest part below toruli, broader than high and narrower than mesosoma in frontal view, with short dense white setae; 1.4x as broad as high in anterior view and head 2.1x as broad as broad as long in dorsal view. Gena alutaceous to smooth, slightly broadened behind eye, as broad as cross diameter of eye, measured in lateral view along transfacial line. Malar space weakly alutaceous to smooth, without striae radiating from clypeus, malar sulcus absent; eye 3.0x as high as length of malar space. Inner margins of eyes parallel. POL 3.0x as long as OOL, OOL shorter than the diameter of the lateral ocellus and shorter than LOL, all ocelli rounded and of same size. Transfacial distance equal to height of eye; toruli located above mid height of head, frons shorter than height of lower face, diameter of antennal torulus 1.7x as long as the distance between them, distance between torulus and eye slightly longer than the diameter of torulus. Lower face almost smooth, raised, central part below the toruli alutaceous, slightly pubescent. Clypeus impressed, smooth, straight ventrally, medially not incised, anterior tentorial pits distinct; epistomal sulcus and clypeo-pleurostomal line present. Frons uniformly alutaceous, without striae, with few setae and no piliferous points; interocellar area alutaceous. Vertex and occiput alutaceous to coriaceous.

Antenna (Fig. 1d**).** Longer than head + mesosoma but shorter than body, with 12 flagellomeres; pedicel around 1.3x longer than broad; pedicel slightly longer than broad, flagellomeres not broadening apically; F1 1.2x as long as F2 and 1.2x as long as scape + pedicel; F3 1.1x as long as

F4, F5 slightly longer than F6, F7=F8, F9=F10=F11, F12 1.6x as long as F11. Placodeal sensilla present on F4–F12, inconspicuous.

Mesosoma (Fig. 2 a–c) 1.25x as long as high, concave in lateral view, pubescent. Sides of pronotum alutaceous to coriaceous, with white setae and weak, without carinae on upper latero-posterior part, anterolateral rim of pronotum visible. Mesoscutum. 1.1x as broad as long in dorsal view; weakly coriaceous, without rugae, pubescent, with piliferous points more visible in the posterior half between notauli. Notaulus complete, deep, converging posteriorly, at posterior end, distance between notauli shorter than distance between notaulus and mesoscutal side; median mesoscutal line absent; parapsidal and anterior parallel lines distinct, smooth, darker than the rest of mesosoma. Mesoscutellum as long as broad, rugose centrally with more prominent rugae on lateral and posterior margins; interspaces weakly coriaceous; overhanging metanotum, with sparse long setae. Mesoscutellar foveae oval, delimited posteriorly by a weak carina, deep, with weakly alutaceous to smooth bottom, separated by a median triangular area. Circumscutellar carina absent. Mesopleuron smooth, with some piliferous points and sparse setae, speculum smooth and shining; mesopleural triangle alutaceous, with dense white setae; axillar carinae present, axillar area smooth and axillula strongly pubescent, subaxillular bar triangular to rectangular, not projected dorsally; metapleural sulcus reaching mesopleuron at mid-height. Metascutellum subrectangular, coriaceous with some weak longitudinal carina, convex ventrally; metanotal trough alutaceous, with dense setae; ventral bar of metanotal trough weakly sculptured; central propodeal area nearly smooth and glabrous; lateral propodeal carinae parallel, slightly converging near nucha, medial propodeal area smooth and shining; lateral propodeal areas uniformly alutaceous, densely pubescent. Nucha almost smooth and shining dorsally, with parallel lateral sulci.

Legs. Hind coxa broad, hind femur strongly broadened, with apical lobe; hind tibia with a weak ventral carina on the ventral part extending to half the length of the tibia; base of tarsal claws with strong tooth.

Forewing. (Fig. 3a). Hyaline 1.2x as long as body, pubescent, with marginal cilia; radial cell open, around 3.4x as long as broad; areolet present. Rs+M vein poorly defined, directed toward middle of the basal vein.

Metasoma. (Fig. 2d–e). Shorter than head + mesosoma, longer than high. 2nd metasomal tergum occupying 3/4 of metasoma, with anterolateral patches of sparse white setae, without micropunctures, remaining terga uniformly smooth and glabrous. Prominent part of ventral spine of hypopygium needle-like, about 5.0x as long as broad, with sparse lateral setae, without apical tuft.

Gall. (Fig. 3c –3d). Spherical, unilocular, sessile, located on the main branches, solitary or sometimes in pairs, up to 4.0 mm in diameter, parenchymal tissue is narrow because the larval chamber occupies most of the gall, surface covered with short bracts, brown when mature.

Biology. The new species induces galls on *Q. glaucoides* Mart & Gal. (section *Quercus*), and only the asexual form is known. Galls were collected between October and January and the adults emerged in the second half of January. After cutting the galls in March, live adults were observed inside, suggesting that emergence likely occurs from January to March. Galls detach easily and probably fall to the ground to complete development.

Distribution. Mexico, know only from Puebla State.

DISCUSSION

According to Cuesta-Porta *et al*. (2025), all species included in the genus *Femuros* produce unilocular and spherical galls, as also occurs in the species described here. The gall of the new species is the smallest among all *Femuros* species: *F. ruidum* has the largest galls (up to 23 mm in diameter), followed by *F. repandae* (17 mm), *F. ocri* (12 mm), *F. bracteatus* (8.4 mm), and *F. minimum* (4.0 mm). The main structural difference in the gall of *F. minimum* is the reduction of the parenchymal tissue, although it is still present as in the rest of *Femuros* galls. Consequently, the adult body size of *F. minimum* falls within the range of the other *Femuros* species *F. ruidum* (3.0–4.3 mm), *F. repandae* (3.2–4.0 mm), *F. ocri* (3.0–4.5 mm), *F. bracteatus* (2.1–3.5 mm), and *F. minimum* (2.6–3.6 mm). The new species falls into couplet 8 of the identification key to Feron species published in Cuesta-Porta *et al.* (2025) along with *F. ruidum* and *F. ocri*. We propose the following update to the identification key:

8. Mesopleuron densely pubescent with visible punctures and deep piliferous points, speculum mostly pubescent except for a small central glabrous smooth area (Fig. 22a); propodeal carinae bent outwards (Fig. 22c) ….... *F. ruidum*
- Mesopleuron sparsely pubescent, mostly smooth with scattered delicate shallow piliferous points; speculum smooth and glabrous at least on median 1/2 length of speculum (Fig. 16c); propodeal carinae parallel (Fig. 17c) …. 9
9. Antenna with 11 flagellomeres, F11 sometimes with a faint incomplete suture; ventral spine of hypopygium 3.5–4.0x, reddish-brown body coloration; without black marks along anterior parallel lines and parapsidal lines; and ventral margin of clypeus rounded …..... *F. ocri*
- Antenna with 12 flagellomeres, F12 not partially divided; ventral spine of hypopygium 5.0x as long as broad in ventral view; dark brown body color; anterior parallel lines and parapsidal lines black; and ventral margin of clypeus straight .....… *F. minimum* **sp. nov.**

Following this study, the genus *Femuros* is now represented by four species in Mexico, while *F. bracteradus* is the only species known in the United States (Arizona). The adults of the new species differ from other *Femuros* species by the number of flagellomeres (see Diagnosis) and is morphologically most similar to *F. ocri* (see Diagnosis).

Both species mentioned have smaller galls compared with other *Femuros*, but the galls of the new species are clearly smaller tha those of *F. ocri*.

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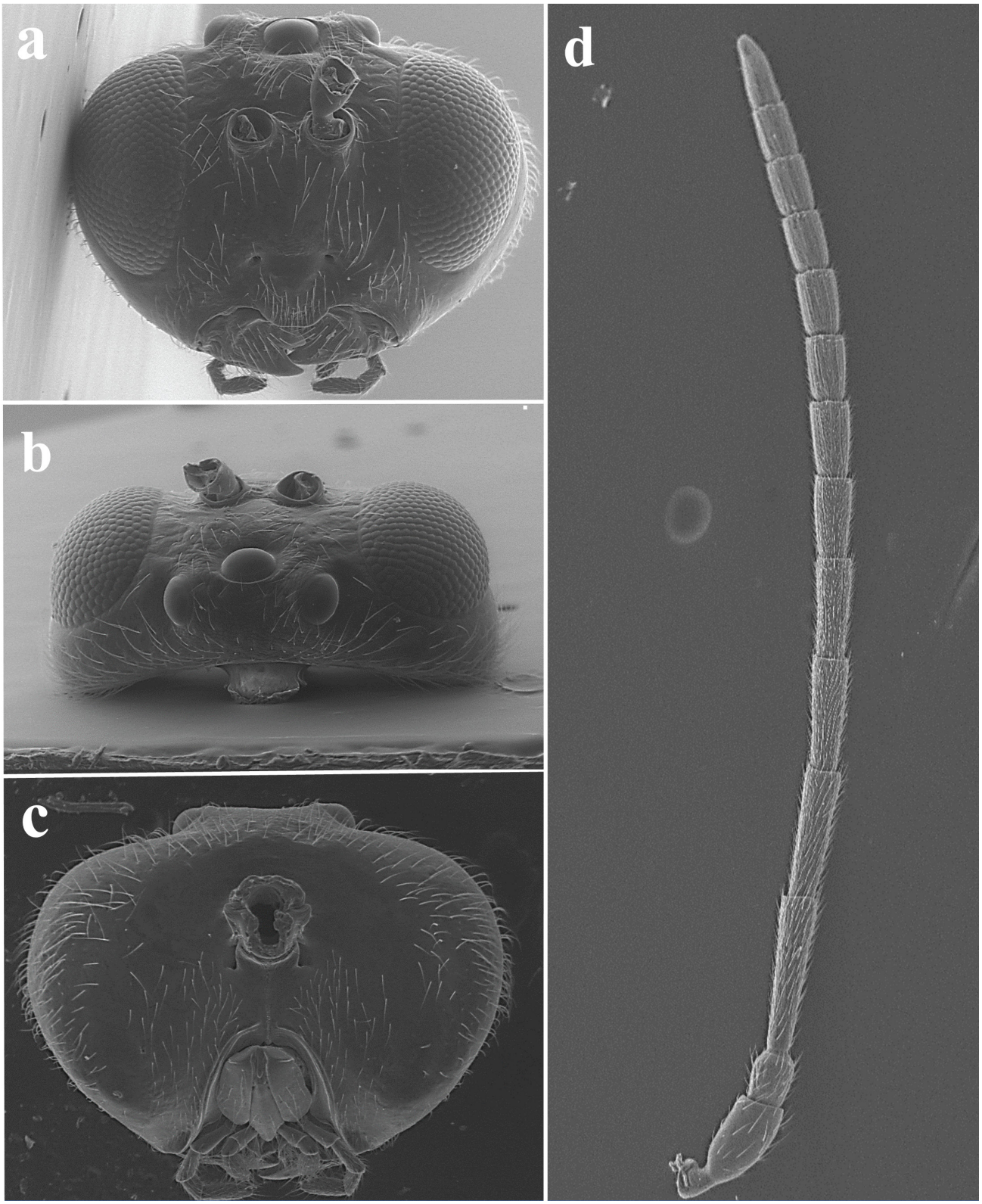

Figure 1. *Femuros minimum* sp. nov.: (a) head in frontal view, (b) head in dorsal view, (c) head in posterior view, (d) antenna.

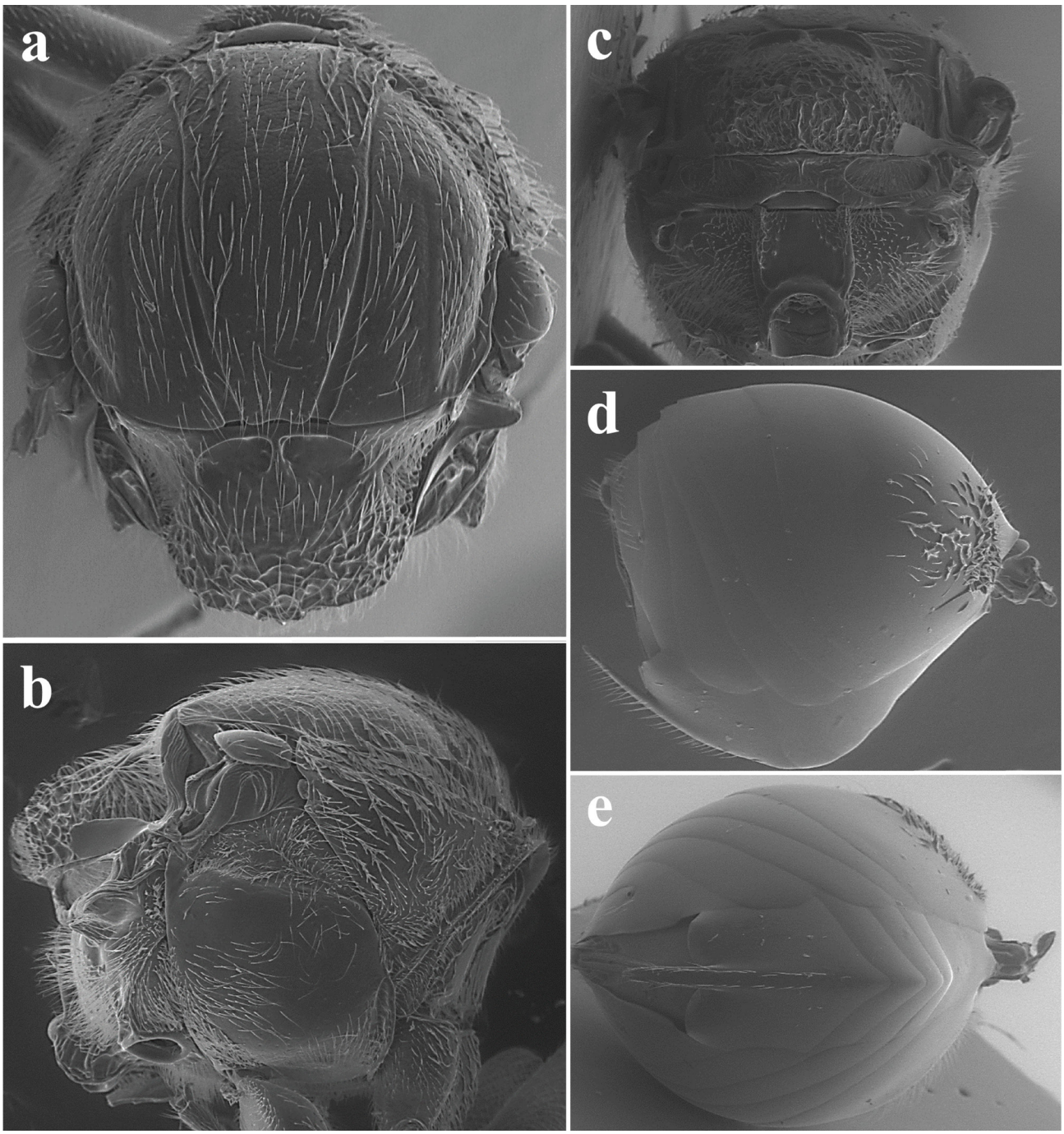

Figure 2. *Femuros minimum* sp. nov.: (a) mesosoma in dorsal view, (b) mesosoma in lateral view, (c) propodeum, (d) metasoma in lateral view, e) metasoma in ventral view.

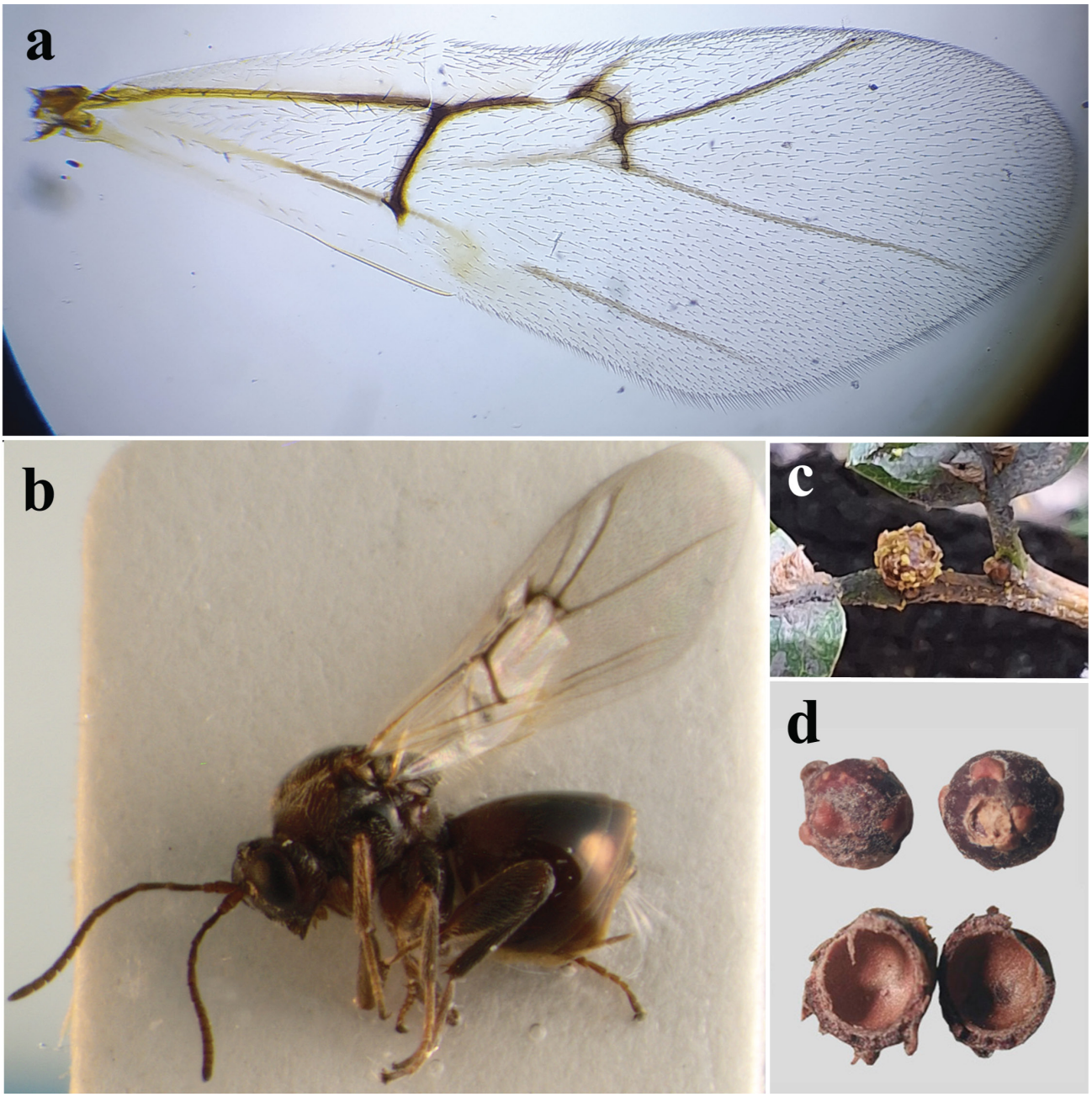

Figure 3. *Femuros minimum* sp. nov.: (a) fore wing, (b) habitus, (c) gall, (d) isolated galls and transverse cut of gall.