




SCIENTIFIC PAPER

Synergus pedroi n. sp. FROM COLOMBIA (HYMENOPTERA:
CYNIPIDAE: SYNERGINI)

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Folia Entomológica Mexicana (nueva serie), 3(3): 106–113, 2017.

Recibido: 5 de julio 2017

Aceptado: 7 de noviembre 2017

Publicado en línea: 31 de diciembre 2017

***Synergus pedroi* n. sp. FROM COLOMBIA (HYMENOPTERA: CYNIPIDAE: SYNERGINI)**

***Synergus pedroi* n. sp. de Colombia (Hymenoptera: Cynipidae: Synergini)**

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ABSTRACT. A new species of *Synergus* Hartig, 1840 is described from Colombia, being the second species of this genus known from this country. It is the first *Synergus* species with the radial cell open known from South America and the first inquiline related to galls induced by *Zapatella* Pujade-Villar & Melika (Hymenoptera: Cynipidae: Cynipini). The main morphological characters of this new species are described and illustrated. The few known *Synergus* species with the radial cell open are mentioned. The DNA barcode region COI of *S. pedroi* n. sp. is given.

Key words: Hymenoptera, Cynipidae, Synergini, *Synergus*, new species, Colombia.

RESUMEN. Se describe de Colombia una nueva especie de *Synergus* Hartig, 1840, siendo la segunda especie del género conocida en este país. Es la primera especie de *Synergus* con la celda radial abierta para Sur América y la primera especie inquilina obtenida a partir de agallas de *Zapatella* Pujade-Villar & Melika (Hymenoptera: Cynipidae: Cynipini). Se exponen e ilustran las principales características morfológicas de esta nueva especie. Se mencionan especies del género que presentan la celda radial abierta. Se proporciona el código de barras de ADN COI de *S. pedroi* n. sp.

Palabras clave: Hymenoptera, Cynipidae, Synergini, *Synergus*, nueva especie, Colombia.

INTRODUCTION

The most part of oak gall wasps (Cynipidae) are true gall makers (Ronquist, 1999); however, about 180 species, classified into ten genera, develop as inquilines inside galls of other cynipids (Pujade-Villar *et al.*, 2003; Nieves-Aldrey and Medianero, 2010; Péntzes *et al.*, 2012; Bozsó *et al.*, 2014, 2015; Schwéger *et al.*, 2015a, b; Ronquist *et al.*, 2015). Unlike true gall wasps, which can induce the formation of complex galls in different plants, inquilines are not capable to induce galls by themselves and develop as guests inside galls of other cynipids, except for one species described by Abe *et al.* (2011) from Japan, *Synergus itoensis* Abe, Ide & Wachi, and for *Saphonecrus hupingshanensis* Liu, Yang & Zhu, which was inferred to be a gall maker because no gall maker was reared from the galls it emerged from in *Castanopsis carlesii* (Hemsl.) Hayata (Fagaceae), according to Liu *et al.* (2012). Inquilinism is a

form of cleptoparasitism, usually considered to represent a unilateral advantageous relationship that benefits only the inquilines (Askew, 1984; Ronquist, 1994, 1999).

Until recently, all inquilines were included in the Synergini tribe. However, Ronquist *et al.* (2015) internally restructured the Cynipidae family, separating the inquilines in three tribes: Synergini s. str., Ceroptresini and Diastrophini. Currently, the Synergini tribe only includes genera whose first metasomal segment is ring-shaped and usually carinated, and it includes several genera related to galls that develop on Fagaceae (except for *Rhoophilus loewi* Mayr, 1881), mainly on *Quercus* spp.

The genus *Synergus* includes 117 species (Péntzes *et al.*, 2012; Schwéger *et al.*, 2015a; Pujade-Villar and Lobato-Vila, 2016a, b; Pujade-Villar *et al.*, 2016), but only 14 of them are present in the Neotropical region. Neotropical species have been studied by Ritchie and Shorthouse (1987),

Díaz and Gallardo (1998), Nieves-Aldrey (2005) and Nieves-Aldrey and Medianero (2011). In Colombia, just a single species of inquiline is mentioned: *Synergus colombianus* Nieves-Aldrey, 2005. The species described here is the first with the radial cell open known from South America and the second in the Neotropical area that shows this morphological trait (Pujade-Villar *et al.*, 2015).

MATERIALS AND METHOD

Adults of the new species were obtained from different galls related to *Zapatella* Pujade-Villar & Melika (Hymenoptera: Cynipidae: Cynipini) developed on *Quercus*, *Lobatae* section.

For morphological descriptions, it has been used the current terminology of morphological structures as given in the following studies: Liljeblad and Ronquist (1998) and Melika (2006) for adult morphological structures, Ronquist and Nordlander (1989) for forewing venation and Harris (1979) for patterns of cuticular sculpture. The following are measurements and abbreviations used in this paper: F1-F12, the first and the following flagellomeres; POL (post-ocellar distance), the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance), the distance from the outer margin of the lateral ocellus to the inner margin of the compound eye; LOL (lateral-ocular distance), the 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 of adults were taken using a Scanning Electron Microscope (FEI Quanta 200 ESEM) at Universitat de Barcelona (Catalonia). Finally, optical images were taken with an Olympus SC30 digital microscope camera coupled with an Olympus U-CMAD3 adapter to a binocular microscope Olympus SZX10.

Type material of the species is deposited in the following institutions: **IAvH**. Instituto Alexander von Humboldt, Villa de Leyva, Colombia (Andrés M. Cuervo). **UB**. Universitat de Barcelona, Catalonia (col. Juli Pujade-Villar). **ICA-Tibaitata**

Instituto Colombiano Agropecuario, Mosquera, Colombia (Pedro A. Rodríguez).

DESCRIPTION

Synergus pedroi n. sp.

Pujade-Villar, Lobato-Vila & Fernández-Garzón (Figs. 1-3).

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Diagnosis. Female. (length 1.7-2.8 mm; n = 8).

This species is morphologically closely related to *Synergus mexicanus* Gillette, 1896, both having the radial cell open, but distinguishable by the following morphological characters: tarsal claws with a strong basal tooth (tarsal claws simple, without a basal tooth in *S. mexicanus*); head in dorsal view 1.7 times wider than long (2.1 times in *S. mexicanus*); F1/F2 ratio in females sub-equal (F1 1.6 times longer than F2 in females of *S. mexicanus*); mesosoma about as long as high in lateral view (1.4 times as long as high in *S. mexicanus*); metasoma strongly dorso-distally incised (not incised and pointed in *S. mexicanus*).

Color. (Fig. 1). Head reddish yellow in dorsal view and light yellow below toruli; mandibles apically black, frons and vertex medially with a black band that doesn't reach the eye margin, occiput black; antennae testaceous, sometimes darker in F9-F12; mesosoma laterally black, excepting the sides of pronotum and scutellum, and lateral margins of mesoscutum, which are reddish yellow to reddish brown; tegulae and mesopleural triangle yellow; mesoscutum black between notauli, with dark brown stripes between notauli and mesoscutum lateral margins; scutellum reddish yellow with a median dark spot near the anterior margin; metasoma black dorsally, antero-laterally reddish; legs yellow, excepting all tarsi, which are slightly darker; forewings hyaline, yellow veins.

Head. (Figs. 2b-c), in frontal view quadrangular with genae convergent, 1.2 times wider than high, genae not expanded behind compound eyes. Face slightly pubescent, lower face and genae with striae irradiating from clypeus and reaching basal margin of compound eye and basal margin of

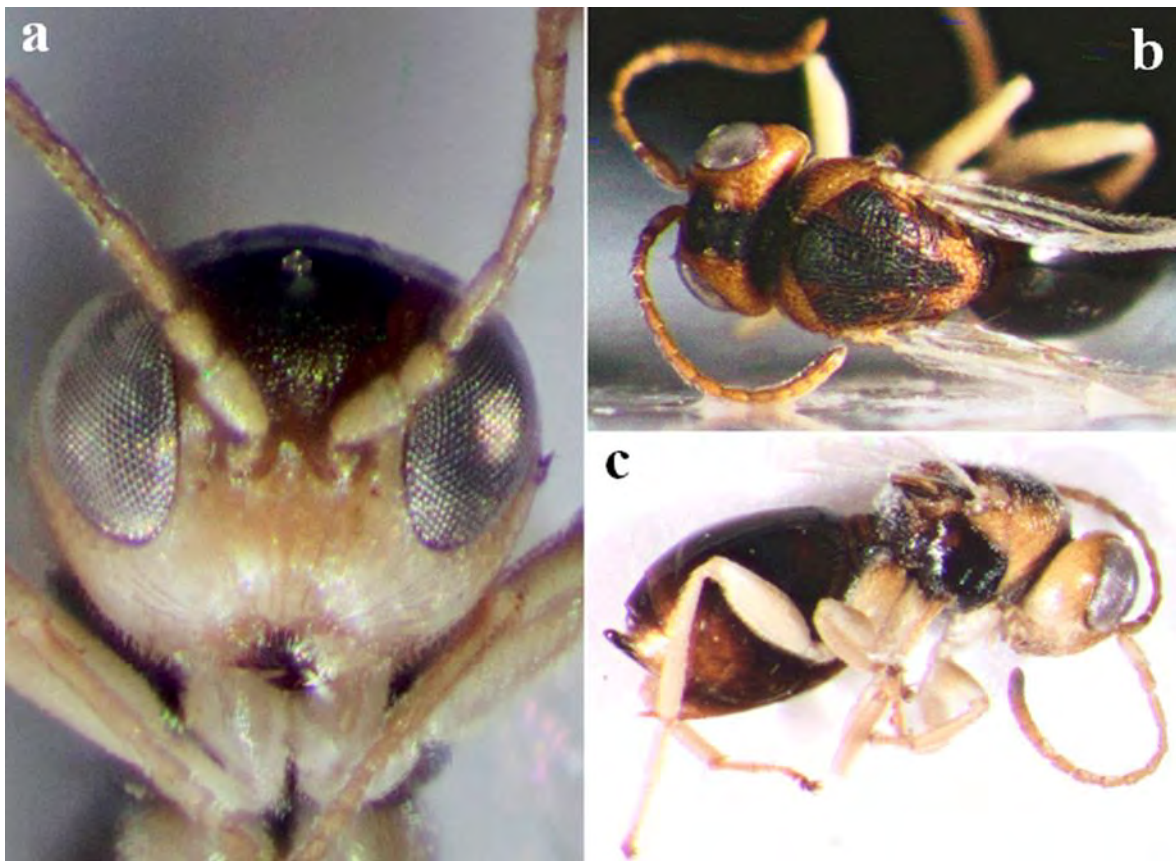


Figure 1. Female of *Synergus pedroi* n. sp.: (a) head in anterior view, (b) dorsal view of head and mesosoma, (c) habitus.

antennal toruli; medial carina absent. Clypeus indistinct, ventral margin straight. Malar space about 0.4 times as long as height of compound eye (4:10). Anterior tentorial pits visible at 1/4 of the distance between clypeus and the basal margin of antennal toruli; pleurostomal and epistomal sulcus absent. Transfacial line 0.9 times as long as height of compound eye. Toruli situated mid-height of compound eye; distance between torulus and compound eye shorter than diameter of toruli; distance between toruli 0.6 times as long as the diameter of torulus. Frons coriaceous with a few and scattered punctures; frontal carinae visible, branched and not reaching the lateral ocelli, or very weak impressed near ocelli. Head in dorsal view 1.7 times wider than long. Vertex coriaceous with piliferous punctures. POL:OOL:LOL = 5:3.4:3; POL 1.5 times as long as OOL; OOL 1.7 times longer than the diameter of lateral ocellus. Occiput coriaceous with scattered piliferous punctures.

Antennae (Fig. 2b), 14-segmented (12: 8: 12: 11: 11.5: 10.5: 10: 9: 8: 7.5: 6.5: 6.5: 6: 13);

filiform, not broadened apically; pubescence dense and short; placodeal sensilla visible only on flagellar segments F6-F12. Pedicel 1.8 times longer than wide; F1 and F2 subequal (1.1), F2 as long as F3. Last flagellar segment two times longer than wide and about two times longer than F11.

Mesosoma. (Figs. 3a-c), about as long as high in lateral view (including nucha), with short and not dense pubescence. Ratio of length of pronotum medially/laterally: 0.25. Pronotal plate absent or reduced; ad-median pronotal depressions oval, transverse, small, shallow, open laterally, widely separated medially by a distance 2.3 times the width of an adventitious depression. Lateral pronotum sculpture regularly rugose, densely pubescent, its dorsal part with weak pubescence to glabrous; lateral margins of pronotum rounded, without lateral carina. Mesoescutum 1.2 times wider than long, with a few weak and sometimes interrupted transverse rugae; anterior grooves weakly impressed, occupying almost 1/3 of mesoescutum length. Notauli complete, wider and

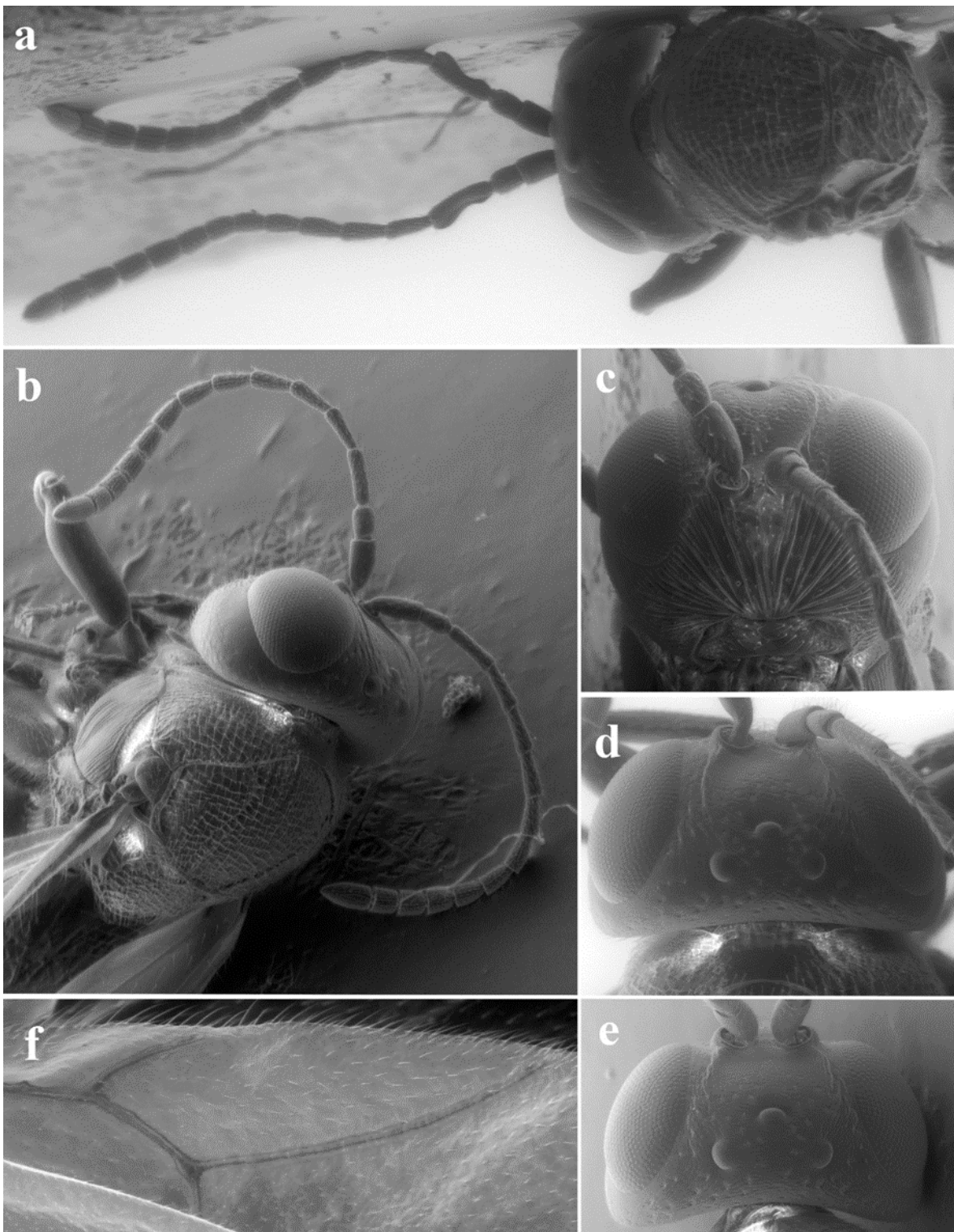


Figure 2. *Synergus pedroi* n. sp.: (a) male antennae, (b) female antennae, (c) female head in anterior view, (d) female head in dorsal view, (e) male head in dorsal view, (f) radial cell of forewing (with detail of the radial cell open).

converging posteriorly. Median groove absent. Parapsidal grooves inconspicuous. Scutellum rounded, almost as long as wide, rugose, densely pubescent, circumscutellar carina weak but visible; scutellar foveae superficial, shallowly impressed,

smooth, more or less oval-triangular-shaped, posterior margins almost indistinct and separated from each other by a narrow septum. Mesopleuron shiny, transversely striated, speculum striated; interspaces smooth, pubescent basally. Metapleural sulcus well

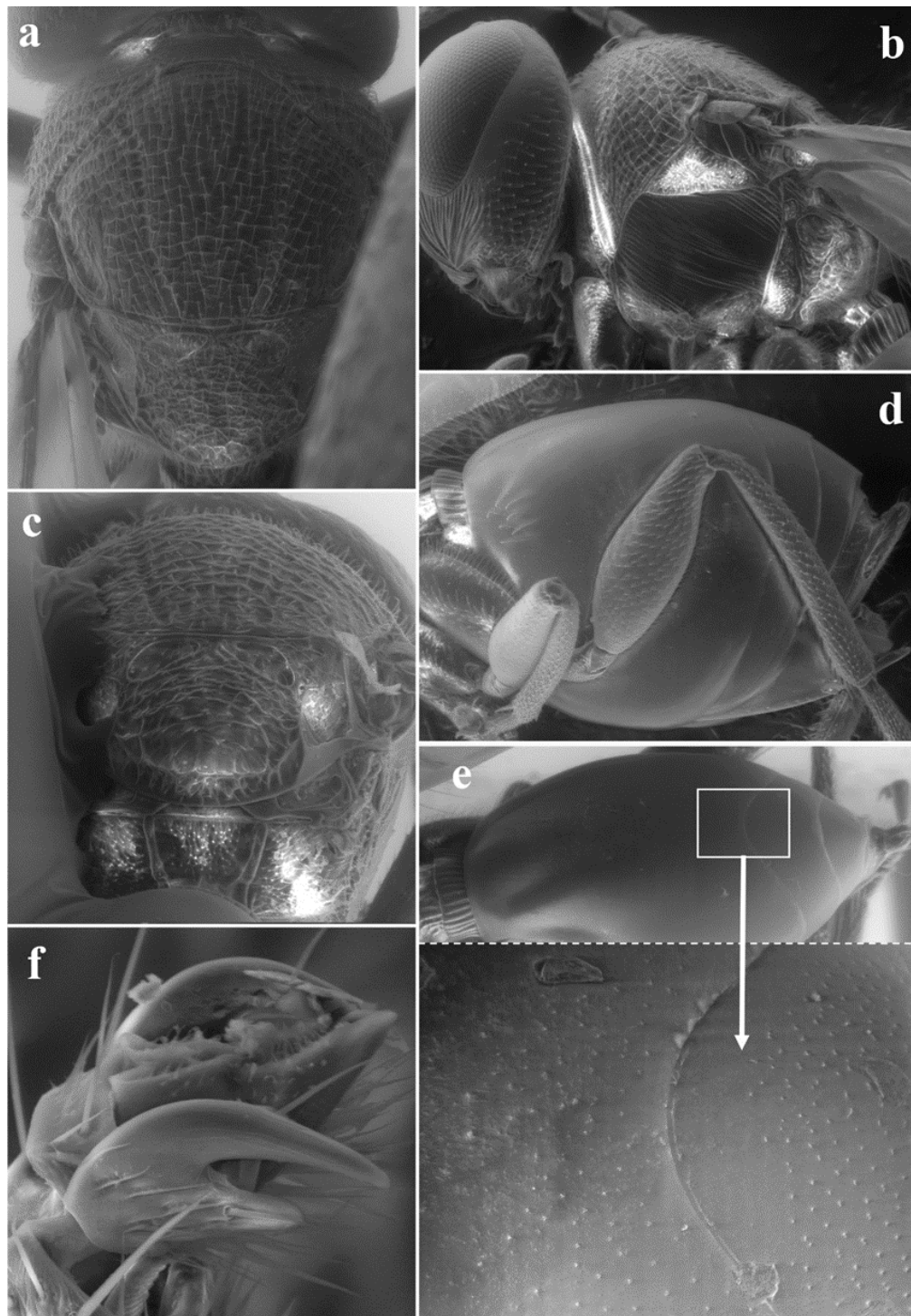


Figure 3. *Synergus pedroi* n. sp.: (a) mesosoma in dorsal view, (b) mesosoma in lateral view, (c) propodeum, (d) metasoma in lateral view, (e) metasoma in dorsal view (with detail of the micropunctures), (f) tarsal claws.

defined, reaching almost 2/3 parts of mesopleuron height. Propodeum pubescent and weakly sculptured, alutaceous with some rugae; propodeal carinae straight and convergent, central area alutaceous and pubescent. Nucha sulcated dorsally and laterally.

Legs. (Fig. 3f). Tarsal claws with a strong basal lobe or tooth.

Wings. Forewings pubescent with marginal setae, longer than mesosoma plus metasoma. Radial cell open and 3.5 times longer than wide (Fig. 2f); areolet indistinct. Rs+M vein not visible. Basal cell weakly pubescent.

Metasoma. (Figs. 3d-e), slightly shorter than head plus mesosoma length, 1.2 times longer than

high in lateral view. First metasomal segment sulcated dorsally and laterally. Syntergite smooth, anterolateral pubescence composed of a group of 6-7 setae; strongly dorso-distally incised, with a short postero-dorsal patch of micropunctures (Fig. 3e); following segments micropunctured. Hypopygial spine 1.8 times longer than wide and with a few lateral setae; apical setae projected beyond the tip of the spine.

MALE. (length 1.8-2.6 mm; n=6). Similar to female, except for the following morphological characters: antennae (Fig. 2a) 15-segmented (9: 6: 15: 10: 9: 9: 7: 6: 6: 6: 7: 7: 7: 6: 9); F1 curved, medially excavated, more expanded distally than basally; F1/F2 ratio about 1.5; head in dorsal view more curved (Fig. 2e); radial cell about 4.2 times longer than wide; metasoma 1.3 times longer than high in lateral view.

Type material. HOLOTYPE ♀ deposited in IAvH with the following labels: “COL, Sitio CAR (Guayabal de Siquina, Cundinamarca, Colombia), 4° 50' 36" N, 74° 27' 43" W, 2083 m.” (white label); “ex. *Zapatella inflata* on *Quercus humboldti*, (04.i.2013) 20-29 i.2013” (leg. P. Rodriguez)” (white label); “*Synergus pedroi* Pujade-Villar, Lobato-Vila & Fernández-Garzón n. sp., desig. JP-V 2017” (red label). PARATYPES (10♂ & 10♀): same data as the Holotype: 8♂ & 5♀ (6♂ & 4♀ deposited in UB; 2♂ & 1♀ deposited in IAvH); Finca Rafael (Guabal de Siquina, Cundinamarca, Colombia), 4° 50' 36" N, 74° 28' 34" W, 1919 m, *Zapatella nievesaldreyi* on *Quercus humboldti*, (12.vii.2012) 22-27.vii.2012: 2♂ & 5♀ (leg. P. Rodriguez) (1♂ & 1♀ deposited in ICA-Tibaitata; 3♀ deposited in UB; 1♂ & 1♀ deposited in IAvH).

Additional material. Cruce de San Miguel (Chiquinquirá, Boyacá, Colombia), 5° 37' 22" N, 73° 46' 11" W, 2578 m, ex. *Zapatella* sp. (agalla C bellota) on *Quercus humboldti*, 09.i.2012 (15-17.i.2012): 2♂ & 4♀ (leg. P. Rodriguez) (1♀ deposited in UB; 2♂ & 3♀ deposited in IAvH). Vereda Jabonera, carretera vía Escuela El Gaitán, Bosque del Acueducto, transición bosque-rastrero-carretera (El Peñón, Santander, Colombia), 6° 2' 64.4" N, 73° 47' 36.6" W, 2838 m, Trampa Malaise #Malaise2 (8 días), 13-

20.viii.2016: 1♀ (leg. M. A Gonzalez, E. A. Tenorio & H. Arenas) (deposited in IAvH).

Distribution. Colombia: Boyacá, Cundinamarca and Santander Departments.

Biology. Emerged from galls induced by species of the genera *Zapatella* on *Quercus humboldti*: *Z. inflata* Pujade-Villar and Rodríguez, 2015; *Z. nievesaldreyi* Melika and Pujade-Villar, 2012 and *Zapatella* sp. (undescribed species).

Etymology. Named in honor to our friend Pedro Rodriguez, collector of most of the specimens.

Barcoding. The DNA barcode of the specimen collected in Vereda Jabonera with Malaise trap mentioned in ‘additional material’ and deposited in IAvH is available at BOLD (<http://www.boldsystems.org>) under the sample ID code CBIHM001-17.

DISCUSSION

The morphological limits between *Synergus* and *Saphonecus* genera are imprecise. Very few *Synergus* species present the radial cell open but it occurs in all species of *Saphonecus*. These species are: *Synergus plagiotrochi* Nieves-Aldrey and Pujade-Villar, 1985 with a Circum-Mediterranean distribution in the Palearctic area; *S. castaneus* Pujade-Villar, Bernardo and Viggiani, 2013 and *Synergus kawakamii* Tang and Melika, 2015 in the Eastern Palearctic area; *S. mexicanus* Gillette, 1896 [= *S. dugesi* Ashmead 1899 = *S. brevis* (Weld, 1926) according to Pujade-Villar and Lobato-Vila, 2016a, b] in the Nearctic and the Neotropical area; and also, the new species described here in the Neotropical area.

In recent phylogenetic studies, *Saphonecus* appears as a polyphyletic genus (Pénzes *et al.*, 2012; Bozsó *et al.*, 2014, 2015; Schwéger *et al.*, 2015a). Until *Saphonecus* is not restructured, the traits that separate *Synergus* and 'Saphonecus complex', according to the key presented by Schwéger *et al.* (2015a), are: frontal carinae present and radial cell closed; if radial cell is open, then pronotal carinae are present, or frontal carinae are present, or female antennae have 14 segments. In accordance with this definition, there is no doubt that *Synergus pedroi* n. sp. belongs to the *Synergus* genus because, despite having no

pronotal carinae and the radial cell open, it has frontal carinae and 14-segmented antennae in females.

ACKNOWLEDGMENTS

Convenio especial de cooperación No. FP44842-109-2016 (IAvH 16-062) Colombia BIO for funding malaise trap sampling and DNA barcode. Eduardo Tovar and Paola Pulido-Santacruz (Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Colombia) for arranging and sending the data to BOLD. And also to the entomology group of the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Colombia for your support.

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