

New *Atrusca* gallwasp species from Baja California, Mexico (Hymenoptera: Cynipidae: Cynipini)

Especie nueva de *Atrusca*, avispa formadora de agallas de Baja California, México (Hymenoptera: Cynipidae: Cynipini)

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ABSTRACT

A new species of oak gallwasp, *Atrusca dumosae* Melika & Pujade-Villar is described from Baja California Norte, Mexico, known to induce galls on *Quercus dumosa*. Only asexual females are known. Data on the diagnosis, distribution and biology of the new species is given. Diagnosis for the *bella* species complex and a key to the closely related species is given.

Key words: Cynipidae, oak gallwasp, *Atrusca*, taxonomy, morphology, distribution, biology.

RESUMEN

Se describe una nueva especie de cinípido, *Atrusca dumosae* Melika & Pujade-Villar, de Baja California Norte (México), colectadas en *Quercus dumosa*. Sólo la generación asexual es conocida. Se exponen los caracteres diagnósticos, la distribución y biología de la especie nueva. Se menciona la diagnosis del complejo de especies *bella* y se expone una clave para las especies estrechamente relacionadas.

Palabras clave: Cynipidae, agallas, *Atrusca*, taxonomía, morfología, distribución, biología



INTRODUCTION

The oak gallwasps (Cynipini) are by far the most species-rich group of gallwasps, with c. 1000 species in 25 genera worldwide (Csóka *et al.*, 2005; Abe *et al.*, 2007). The known fauna is the richest in the Nearctic region, with c. 700 species in 22 genera (Melika & Abrahamson, 2002), which from c. 154 species are known from Mexico and Central America and trophically associate with more than 30 oak species (Kinsey, 1936, 1937a, b, 1938; Pujade-Villar, 2008; Pujade-Villar *et al.*, 2009a, b), while approximately 150 *Quercus* species are known from Mexico (Govaerts & Frodin, 1998) which from 86 are considered endemic (Nixon, 1998; Zavala, 1998).

The majority of the species known from Mexico belongs to the complex named by Kinsey (1936) as the *Cynips*, with 70 species which from the majority were described from Mexico and all known to associate with white oaks. Later, his *Cynips* complex was divided into 6 genera: *Cynips* Linnaeus, *Antron* Kinsey, *Atrusca* Kinsey, *Besbicus* Kinsey, *Acraspis* Mayr and *Philonix* Fitch (Weld, 1952). The new species herein described belongs to the genus *Atrusca*, which from Kinsey (1936) distinguished 47 species in 5 species complexes. Positioning of our species within Kinsey's *Atrusca* complex is discussed below, in the comments.

Only two species of oak gallwasps are known from Baja California Norte, region of Mexico (Pujade-Villar *et al.*, 2009b); both belong to the genus *Callirhytis* (Dailey & Sprenger, 1977).

The Sierra de Juárez is the more extensive wooded zone of the state, with a forest surface of 342,113 ha, where 94.3% corresponds to species of pines, and 5.7% to oaks. Dominant species of the mountain forests are pines (*Pinus jeffreyi*, *P. monophylla* and *P. quadrifolia*), which occupy considerable areas in the zone of the Rumorosa, Southwest of Juárez Mountain range, where *Quercus agrifolia* and *Quercus dumosa* generally coexisting with pines. In this region of Mexico, 48 species of oaks are known (17 species of *Erythobalanus* section of oaks, 28 of *Lepidobalanus* and 3 of *Protobalanus*), which from many species are endemic to Baja California (Zavala-Chávez, 1998).

MATERIALS AND METHODS

We follow the current terminology of morphological structures (Liljeblad & Ronquist, 1989; Melika, 2006). Abbreviations for fore wing venation follow Ronquist & Nordlander (1998); cuticular surface terminology follows that of Harris (1979). Measurements and abbreviations used here include: F1–F12, 1st and subsequent flagellomeres; POL (post-ocellar distance) is the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance) is the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye; LOL, the distance between lateral and frontal ocelli. The width of the forewing radial cell is measured from the margin of the wing to the Rs vein.

Images of wasp anatomy were produced by G. Melika, with a digital Nikon Coolpix 4500 camera attached to a Leica DMLB compound microscope, followed by processing in CombineZP (Alan Hadley) and Adobe Photoshop 6.0. Gall images were taken by J. Pujade-Villar with a Canon camera PowerShot SX210 15 followed by processing with Adobe Photoshop CS3 program.

The type material is deposited in the next institutions: **UB**, University of Barcelona, Spain (J. Pujade-Villar); **PDL**, Pest Diagnostic Laboratory (the former Systematic Parasitoid Laboratory, SPL), Tanakajd, Hungary (G. Melika); **CP**, Collection of the "Instituto de Fitosanidad, Colegio de Postgraduados", Montecillo, Texcoco, Estado de México (A. Equihua-Martínez).

RESULTS

Atrusca dumosae Melika & Pujade-Villar, new species (Figs 1-14)

Diagnosis. According to the diagnostic characters and keys given by Kinsey (1936), *Atrusca dumosae*, new species belongs to the *bella*-complex of *Atrusca* species. In *Atrusca bella* (Basset, 1881), inner margins of compound eyes are parallel on the level of the transfacial line; the frons is slightly higher and interocellar area stronger elevated (Fig. 15), while in *A. dumosae* inner margins of compound eyes are slightly concave on the level of the transfacial line, the frons is shorter and the interocellar area less elevated (Fig. 1). In *Atrusca bella*, *A. vanescens* (Kinsey, 1936) and *A. congesta* (Kinsey, 1936), anterior parallel lines are distinctly smooth and shiny, while in *A. dumosae*, new species, *A. aspera* (Kinsey, 1936) and *A. pomifera* (Kinsey, 1936), anterior parallel lines are punctuate, hardly traceable in the surface sculpture of the mesoscutum. In *A. dumosae*, new species, the prominent part of the ventral spine of the hypopygium 2.5-2.7 times as long as broad from the ventral view (Fig. 12) like in *A. bella* (Fig. 17), while in *A. aspera* and *A. pomifera*, the prominent part of the ventral spine of the hypopygium is much shorter, never more than 1.6-1.8 times as long as broad from the ventral view (measured on Kinsey's paratypes) (Fig. 19). Also the darker spotty (cloudy) pattern on the forewing on the mentioned three allied *Atrusca* species (Figs 16, 18, 20) differ from that in *A. dumosae* (Fig. 13).

Description: Asexual female (Figs 1-13).

Body length 3.2-3.4 mm (n=11).

Colour. Head: gena, vertex, lower face aside median elevated part, frons aside, malar space dark brown; head posteriorly (including occiput, postocciput and postgena), interocellar area, frons medially, under frontal ocellus, median elevated part of lower face, clypeus very dark brown to black; maxillar and labial palps brown, mandibles dark brown with black tips; antenna uniformly dark brown. Pronotum dark brown, propleura black; mesoscutum dark brown, with black stripes along broad parascutal lines; area between notauli black, only very posterior part brown. Dorsal half of mesopleuron black, while ventral half dark brown; mesopleural triangle black; scutellar foveae black, while rest of mesoscutellum dark brown; metapleuron, propodeum, nucha black. Legs uniformly dark brown. 2nd metasomal tergite, especially dorsally and dorsolaterally black; subsequent tergites and ventral spine of hypopygium dark brown.

Head. Delicately coriaceous to reticulate, with white setae,

more denser on lower face, clypeus and posterior part of head, 2.3 times as broad as long from above, 1.3 times as broad as high and slightly broader than mesosoma in front view. Gena delicately coriaceous to reticulate, broadened behind eye, visible in front view behind eye, narrower than cross diameter of eye; malar space very delicately coriaceous, with short delicate striae extending from clypeus to half length of malar space, height of compound eye 2.5 times as high as height of malar space. POL 1.7 times as broad as OOL; OOL 2.4 times as long as length of lateral ocellus and slightly longer than LOL; ocelli ovate. Transfacial distance 1.4 times as broad as height of eye; diameter of antennal torulus 1.5 times as long as distance between toruli, distance between torulus and inner margin of eye 1.2 times as long as diameter of torulus; lower face delicately coriaceous, without striae, with elevated coriaceous median area. Clypeus quadrangular, delicately coriaceous, with small elevated central area, laterally and ventrally widely emarginate, without median incision; anterior tentorial pits elongated, deep, epistomal sulcus and clypeo-pleurostomal line distinct, widely and deeply impressed. Frons reticulate, vertex and occiput uniformly delicately coriaceous; interocellar area coriaceous, slightly elevated. Postocciput coriaceous, with longitudinal subparallel fragmented striae; postgena smooth, impressed around occipital foramen; posterior tentorial pits large, deep, area around them strongly impressed; height of occipital foramen nearly equal to height of postgenal bridge; hypostomal carina emarginate, not going around oral foramen, continuing into postgenal sulcus. Labial palpus 3-segmented, maxillary palpus 5-segmented. Antenna with 12 flagellomeres; slightly longer than mesosoma; scape+pedicel slightly shorter than F1, pedicel subglobose, slightly longer than broad; F1 1.2 times as long as F2, F2 1.2 times as long as F3; F3 1.2 times as long as F4, subsequent flagellomeres shorter, F12 only slightly longer than F11; placodeal sensilla on F5-F12, absent on F1-F4.

Mesosoma. Slightly longer than high. Pronotum smooth dorsally, delicately coriaceous laterally, without striae anterolaterally; propleuron brown, coriaceous, shiny, concave in mediocentral part. Mesoscutum in dense white setae, delicately coriaceous to reticulate, especially in between notauli; subequal, slightly longer than broad in dorsal view (largest width measured across mesoscutum on the level of the base of tegulae). Notauli complete, deep and broad, with smooth bottom, distinctly impressed, slightly converging posteriorly; anterior parallel lines invisible, hidden in reticulate surface sculpture; parapsidal lines distinct, smooth, shiny and broad, start away from posterior margin and extending at least to 2/3 length of mesoscutum; median mesoscutal line absent; parascutal carina distinct, anteriorly reach notauli. Mesoscutellum slightly longer than broad, uniformly coriaceous, with nearly parallel sides, overhanging metanotum; scutellar foveae quadrangular, nearly as long as broad, with smooth bottom, with distinct elevated broad coriaceous median carina. Mesopleuron and speculum uniformly delicately coriaceous, with very dense white setae; mesopleural triangle rugose; dorsal axillar area smooth; lateral axillar area with wrinkles; axillula coriaceous, with few white setae; subaxillular bar smooth, shiny, triangularly shaped, highest posteriorly, its height nearly equal to height of metanotal trough; postalar process long, with parallel striae; metapleural sulcus reaching mesopleuron slightly above middle height. Metascutellum uniformly coriaceous, metanotal

trough smooth, shiny, with dense white setae; ventral impressed area smooth, shorter than height of metascutellum; central propodeal area smooth, shiny, lateral propodeal carinae lyre-shaped, bented outwards in the middle; lateral propodeal area with irregular wrinkles and dense white setae; nucha smooth, with some delicate irregular wrinkles.

Legs. Hind coxa with dense long white setae anteroposteriorly; all tarsal claws with distinct but short basal lobe.

Wings. Forewing longer than body, hyaline, with short dense cilia on margin, radial cell 1.8-2.0 times as long as broad; R1 and Rs nearly reaching wing margin; areolet large, triangular, closed and distinct; projection of M reaching basalis in its 1/2. The pattern of cloudy dark spots on forewing on Fig. 13.

Metasoma longer than head+mesosoma, higher than long in lateral view; 2nd metasomal tergite dorsally occupying 2/3 of metasoma length, smooth, shiny, with large patch of dense white setae laterally; subsequent tergites uniformly smooth, shiny, without setae. Ventral spine of hypopygium short, prominent part 2.5 times as long as broad in ventral view, with long white dense apical and subapical setae, extending far beyond apex of spine and forming a tuft.

Gall (Fig. 14). Galls are nearly spherical, slightly tapering at the base, monolocular, located usually on the underside of leaves, attached by a single fine point to the main vein. Young galls are greenish to yellowish; mature galls brownish tan or dark reddish brown, unspotted or heavily mottled with brownish purple. The surface of the gall smooth, only microscopically roughened, shiny, thin-walled, with radiating fine filaments, supporting the central larval chamber. Galls are 18-25 cm in diameter.

Type material. Holotype asexual female: MEXICO, Agua Amarilla, San Pedro Mártir, Baja California Norte, (31.X.2008) XI.2008; ex *Quercus dumosa*, N 32°08'28'' and E 115°56'08'', 1729 m a.s.l. Ten paratype females with the same label as the holotype.

Deposited material. UB (Holotype and 4 asexual female paratypes), PDL (4 asexual female paratypes), and CP (2 asexual female paratypes).

Biology. The asexual generation is only known, inducing galls on *Quercus dumosa* Nutt. (section *Quercus* of *Quercus*, white oaks), which is distributed only in California (USA) and Baja California Norte, Mexico (Govaerts & Frodin 1998). Galls were collected in late October and beginning of November. Adults emerged right after galls were collected.

Etymology. The species is named after the host oak, *Q. dumosa* Nutt., it was found on.

Distribution. Currently known from the type locality only: Mexico, Agua Amarilla, San Pedro Mártir, Baja California Norte [N 32°08'28'' and E 115°56'08'], 1729 m a.s.l. This is the first species from the genus *Atrusca* known from Baja California, Mexico.

DISCUSSION AND CONCLUSIONS

Kinsey (1936) divided his *Cynips* subgenus *Atrusca* into 5 species complexes: *dugesi* (28 species, which from 23 species known from Mexico only, the rest from north of Mexico), *bulboides* (5, all from Mexico), *aggregata* (5, which from 4 species known from Mexico only and 1 from north of Mexico), *bella* (5, which from 3 species known from Mexico and 2 from north of Mexico), and *centricola* (4 species, all known from north

of Mexico). It is hard to distinguish the *bella* complex species from some species of the *dugesi* complex which was divided by Kinsey (1936) into 7 species complexes based on: (i) the length of wings; (ii) the length of the ventral spine of the hypopygium, and (iii) geographic distribution. Moreover, the majority of the species of *Atrusca* which belong to the *dugesi* and *bella* complexes induce galls which are impossible to distinguish -- they all are spherical, with mottled smooth surface, monolocular, attached to the underside of leaves, nearly of the same size. Kinsey's (1936) *Cynips* species concept entirely was based on the geographic distribution and possible geographic isolation.

Species of Kinsey's (1936) *bella* complex hard to distinguish from some species he put into his *dugesi* complex, however, in *bella* species complex the prominent part of the ventral spine of the hypopygium never more than 1.6-2.7 times as long as broad from the ventral view, while in species from the *dugesi* complex which possess with relatively short ventral spine compared with other *Atrusca* complexes, nevertheless, its prominent part always at least 3.0 times as long as broad from the ventral view in the *dugesi* complex. We strongly doubt Kinsey's species complexes in *Atrusca* as a real natural entities, especially the limits established for them by Kinsey (1936), particularly between *dugesi* and *bella* complexes. In our opinion, all Kinsey's species complexes are overlapping because the Kinsey system was entirely built onto geographic isolation what is probably not true in most cases. Kinsey (1936) mentioned in his work that there are might be somebody who will treat his numerous species as one; so he might be right and, no doubts, many species of *Atrusca* described by him from Mexico, are synonymic and a detail revision of this oak gallwasp group is in urgent need.

Below we provide a key to the species of *Atrusca* in the *bella* complex:

1. Anterior parallel lines smooth and shiny, well-visible on the surface sculpture of mesoscutum at least posteriorly; inner margins of compound eyes parallel on the level of transfacial line; frons slightly higher, interocellar area stronger elevated (Fig. 15) 2
- Anterior parallel lines reticulate or punctuate, hardly traceable on the surface sculpture of mesoscutum (Fig. 9); inner margins of compound eyes slightly concave on the level of transfacial line; frons shorter, interocellar area less elevated (Fig. 1) 4
2. Areolet of forewing large or very large, body with rich rufous on head and mesosoma 3
- Areolet smaller, body predominantly black with little rufous ... *vanescens*
3. Spots in cubital cell numerous, often fine (Fig. 16); spot in radial cell large, often complex, elongate or massive *bella*
- Spots in cubital cell less numerous, often fused, spot in radial cell single *congesta*
4. Prominent part of ventral spine of hypopygium 2.5-2.7 times as long as broad from ventral view (Fig. 12) *dumosae*, **new species**
- Prominent part of ventral spine of hypopygium shorter, never more than 1.6-1.8 times as long as broad from ventral view (Fig. 19) 5
5. Antenna dark brown to black; head and mesosoma dark or with

rich dark rufous colouration; cloudy spot pattern of forewing on Fig. 20. *pomifera*
 - Antenna rufous; head and mesosoma bright, with rich rufous; cloudy spot pattern of forewing on Fig. 18. *aspera*

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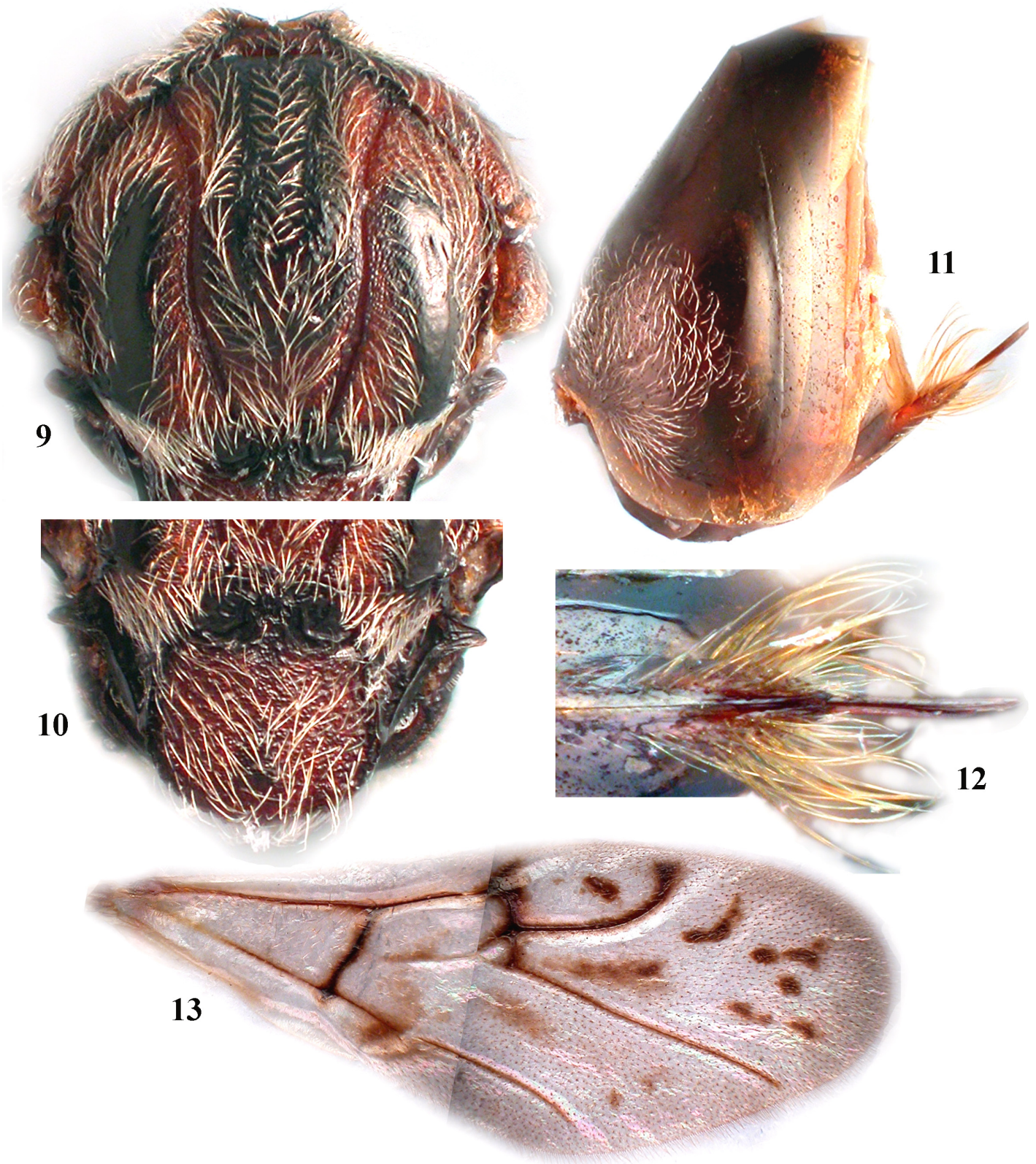
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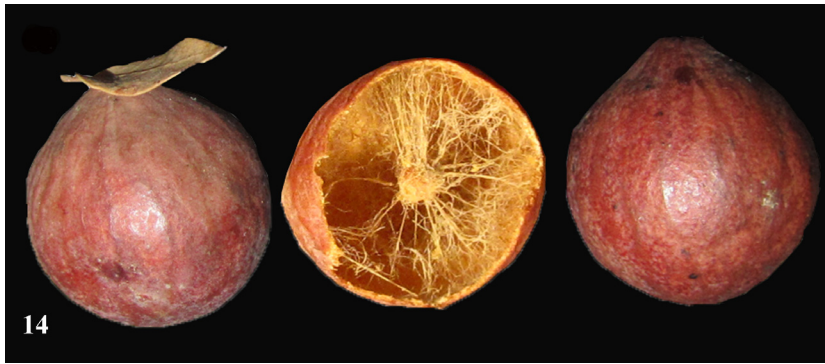
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Figures 1-8. *Atrusca dumosae*, new species, asexual female: 1, head (anterior view); 2, head (posterior view); 3, head (lateral view); 4, head (dorsal view); 5, antenna; 6, hind tarsal claw; 7, mesosoma (lateral view); 8, metascutellum and propodeum (posterodorsal view).



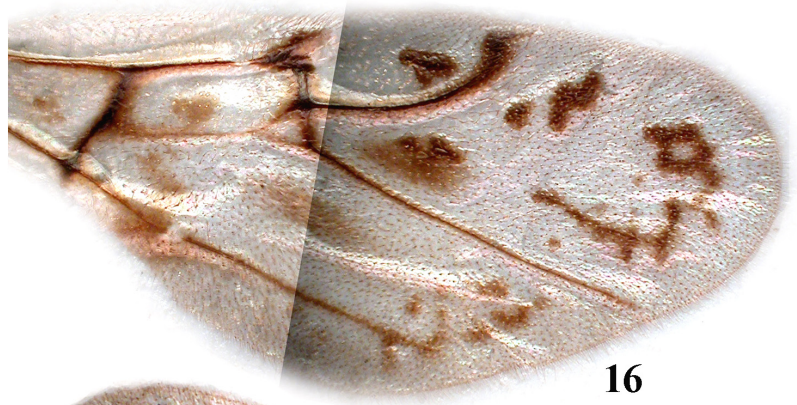
Figures 9-13. *Atrusca dumosae*, new species, asexual female: 9, mesoscutum (dorsal view); 10, mesoscutellum (dorsal view); 11, metasoma (lateral view); 12, ventral spine of hypopygium (ventral view); 13, forewing.



Figures 14. *Atrusca dumosae*, new species, galls (gall photos by J. Pujade-Villar).



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Figures 15-20. 15-17, *Atrusca bella*, asexual female: 15, head (anterior view); 16, forewing; 17, ventral spine of hypopygium (ventral view). 18-19, *Atrusca aspera*: 18, forewing; 19, ventral spine of hypopygium (ventral view). 20, *Atrusca pomifera*, asexual female, forewing.