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# Seven new species of *Allorhogas* (Hymenoptera: Braconidae: Doryctinae) from Mexico

## Siete especies nuevas de *Allorhogas* (Hymenoptera: Braconidae: Doryctinae) de México

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**Abstract.** Seven new Mexican species of the gall associated doryctine genus *Allorhogas* are described, illustrated and molecularly characterized: *A. amuzgo* sp. nov., *A. coccolobae* sp. nov., *A. crassifemur* sp. nov., *A. jaliscoensis* sp. nov., *A. marshi* sp. nov., *A. parvus* sp. nov., and *A. scotti* sp. nov. These new species were collected in tropical dry forests situated along the Pacific coast of Mexico in the states of Jalisco, Oaxaca and Guerrero. *Allorhogas coccolobae* was reared from leaf galls probably induced by an unidentified cecidomyiid (Diptera) on *Coccoloba barbadensis* Jacq., representing the first record of this genus on Polygonaceae galls. A key to the described Mexican species of *Allorhogas* is provided.

Key words: galls, Insecta, Mexico, taxonomy.

**Resumen.** Se describen, ilustran y caracterizan molecularmente 7 especies nuevas del género gallícola *Allorhogas* (Braconidae: Doryctinae): *A. amuzgo* sp. nov., *A. coccolobae* sp. nov., *A. crassifemur* sp. nov., *A. jaliscoensis* sp. nov., *A. marshi* sp. nov., *A. parvus* sp. nov. y *A. scotti* sp. nov. Estas especies fueron recolectadas en bosques tropicales caducifolios de la costa del Pacífico mexicano en Jalisco, Oaxaca y Guerrero. *Allorhogas coccolobae* fue criada de agallas foliares en *Coccoloba barbadensis* Jacq., inducidas probablemente por un cecidómido (Diptera) no identificado, representando el primer registro de este género en agallas de Polygonaceae. Se presenta una clave para las especies de *Allorhogas* descritas para México.

Palabras clave: agallas, Insecta, México, taxonomía.

### Introduction

*Allorhogas* is a moderately diverse doryctine wasp genus with 35 currently described and a large number of undescribed species (Marsh, 2002; Yu et al., 2005; Martínez et al., 2008, 2011; Penteado-Dias and Carvalho, 2008; Chavarría et al., 2009; Centrella and Shaw, 2010). Members of this group are mainly distributed in the Neotropical region, though 3 species were described from North America and a fourth one, *A. semitemporalis* Fischer, 1960, was described from Iraq. All *Allorhogas* species for which biological information is available are associated with plant galls. Some species are known to induce galls, mainly in seed tissues of representatives of the plant families Fabaceae and Melastomataceae (Macedo et al., 1998; Chavarría et al., 2009; Centrella and Shaw, 2010), whereas others have been obtained from galls induced by other insects, although their interaction with these inducers is essentially unknown (Gahan, 1912; Penteado-Dias and Carvalho, 2008).

To date, no Mexican specimens of *Allorhogas* have been identified at species level. All available information for this country only consists of scattered records of unidentified specimens assigned to *Allorhogas* from 9 different states: Guanajuato, Guerrero, Nuevo León, Oaxaca, Puebla, Quintana Roo, Sinaloa, Yucatan and Tamaulipas (Delfín-González and León, 1997; Sánchez-García and López-Martínez, 2000; González-Hernández et al., 2003; Coronado-Blanco, 2011). Recent collecting trips conducted in tropical dry forests in the states of Guerrero, Jalisco and Oaxaca allowed us to obtain a number of specimens of *Allorhogas*, all of which belong to undescribed species.

Our aim is to describe 7 of these new species, which we also characterize molecularly with the mitochondrial DNA sequence fragment belonging to the barcoding locus. We also provide a key to these first described species of *Allorhogas* from Mexico and give information about the

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biology of one of these species, which was reared from leaf galls of a Polygonaceae plant species.

## Materials and methods

All our studied specimens were collected during the past 3 years and are housed at the Colección Nacional de Insectos, Instituto de Biología, Universidad Nacional Autónoma de México, Mexico (CNIN), and the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina (MACN).

Photographs were taken and edited using a Leica® Z16 APO-A stereoscopic microscope, a Leica® DFC295/ DFC290 HD camera, and the Leica Application Suite® program. General morphological terminology follows Sharkey and Wharton (1997), except for the use of the term "precoxal sulcus", which replaces "sternaulus" according to Wharton (2006). Surface sculpture terminology follows Harris (1979), and wing veins are described according to Mason (1986). Abbreviations used in the descriptions are: POL (posterior ocellar line, the minimum distance between lateral ocelli), OD (ocellar diameter, the maximum diameter of lateral ocellus), OOL (ocular-ocellar line, the distance between the compound eye and the lateral ocellus). The term "metasomal tergite" refers to the median metasomal tergites, no laterotergites are described since they bear no relevant features for the diagnoses. The areas of propodeum and first metasomal tergite used in the descriptions are indicated in Figures 1, 2.

We also characterized molecularly the species described in this work. For this, we generated DNA sequences of the barcoding region (658 bp of the cytochrome oxidase I mitochondrial gene; Hebert et al., 2003) for most of the type material belonging to our 7 described species, as well as for specimens of other 6 Mexican species of *Allorhogas* that were not described here since they were only represented by singletons. Most of the DNA extraction, amplification and DNA sequencing were carried out at the University of Guelph following the same laboratory protocols employed in Smith et al. (2009). DNA extraction and amplification of the barcoding region for the wasps reared from leaf galls (see below) were carried out at the Instituto de Biología, UNAM, following the same protocols employed by Ceccarelli et al. (2012). Non-purified PCR products of these samples were sent to the High-Throughput Genomics Unit at the University of Washington (http://www.htseq.org/index.html) for DNA sequencing. All sequences are deposited in GenBank (see below), and most of them are also deposited in the project file "Parasitoid wasps from the Chamela-Cuixmala Biosphere Reserve" (ASDOR project), available in the projects section of the Barcode of Life Data System (www.boldsystem.org).

Corrected genetic distances among the sequenced specimens and a neighbor joining (NJ) phenogram were obtained using the K2P distance model (Kimura, 1980) with MEGA version 5 (Tamura et al., 2011). We included in these analyses previously published COI sequences of 2 species of *Allorhogas* from Argentina (*A. joergenseni* Martínez and Zaldívar-Riverón, 2008; GenBank accession number EU871763) and Costa Rica (*Allorhogas* sp. DQ498959).

## Descriptions

*Allorhogas* Gahan

*Allorhogas* Gahan, 1912: 3 (type species: *A. gallicola* Gahan, 1912).

*Catolestes* Brèthes 1922: 136 (synoymized by Marsh, 1993; type species: *C. argentinus* Brèthes, 1922).

*Diagnosis*. Small sized doryctines (1-4 mm), head distinctly to slightly transverse, frons excavated, usually with well defined lateral edges, vertex coriaceous, sometimes almost smooth, never striate; occipital carina present and complete, meeting hypostomal carina; pronotal collar very short, usually not visible in dorsal view; mesoscutum declivous anteriorly; notauli present, rarely obscured by sculpture, median lobe of mesoscutum ocassionally with a median longitudinal sulcus; propodeum with 2 basal semicircular or subtriangular areas, otherwise rugose areolate, rarely with more or less defined areola; hindcoxa with distinct basoventral tooth or tubercule; hindfemur in many cases sexually dimorphic, swollen in males; forewing with first submarginal cell closed by vein r-m; first subdiscal cell open apically; m-cu from slightly antefurcal, to instertitial or postfurcal, thus vein (2RS+M)b present or absent; hindwing with vein M+CU subequal to 1M or slightly shorter; cu-a present but sometimes spectral; m-cu straight or often slightly curved towards wing apex; males without a stigma-like swelling on hindwing veins; metasoma not petiolate, basal sternal plate about one fourth the length of first metasomal tergite; first tergite generally with basal smooth area delimited by a transverse carina, often with dorsal median area defined by 2 longitudinal carinae; ovipositor from barely exerted to longer than metasoma.

Key to known Mexican species of *Allorhogas*

1. First flagellomere distinctly long, 6.0-6.5 times longer than wide and 1.4 times longer than second flagellomere (Fig. 29); dark brown to black species; ovipositor sheaths short, 0.3-0.4 times as long as metasoma (Fig. 26); hindfemur

sexually dimorphic, distinctly swollen and darker in males (Fig. 33).....*Allorhogas crassifemur* sp. nov.

-. First flagellomere not distinctly long, subequal to second flagellomere, at most 5.0 times longer than wide and 1.1 times longer than second flagellomere; brown, orange brown or honey yellow species; ovipositor sheaths usually longer, 0.5-1.4 times as long as metasoma; hindfemur not distinctly swollen in males.....2

2. Mediodorsal area on first metasomal tergite long and narrow, at least 3 times longer than wide (Figs. 18, 50, 66).....3

-. Mediodorsal area on first metasomal tergite comparatively shorter, trapezoidal, at most twice longer than wide (Figs. 8, 41, 58).....5

3. First metasomal tergite with few striations, largely coriaceous (Fig. 18), forewing veins 3RSa, 3RSb, 3M and most of 2M unpigmented (Fig. 21).....*A. coccolobae* sp. nov.

-. First metasomal tergite uniformly striate on its entire dorsal surface (Figs. 50, 66), forewing veins3RSa, 3RSb, 2M and 3M pigmented (Figs. 51, 67).....4

4. Second metasomal tergite and basal half of third tergite coarsely striate with coriaceous microsculpture (Fig. 50), brown to dark brown species, with the apical metasomal tergites contrastingly lighter, yellowish (Figs. 44, 50).....*Allorhogas marshi* sp. nov.

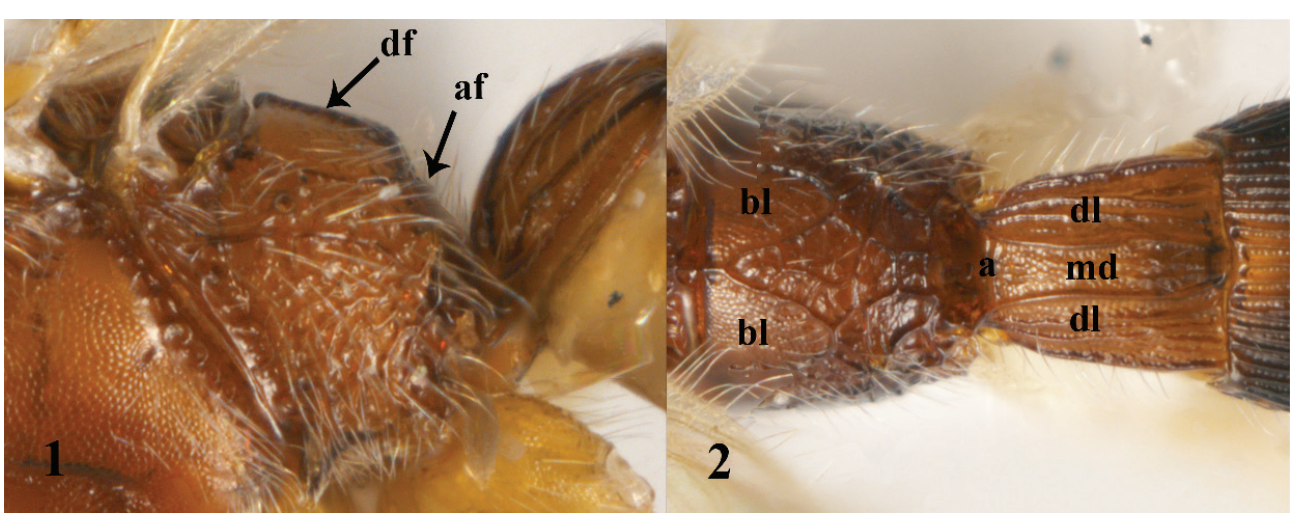
-. Second metasomal tergite finely striate; third tergite barely striate basally, almost entirely smooth and polished (Fig. 66); light brown to honey yellow species, sometimes with second and third metasomal tergites darker (Fig. 61), never with apical tergites contrastingly lighter.....*Allorhogas scotti* sp. nov.

5. Mesosoma distinctly compact in lateral view, 1.3-1.4 times longer than high (Fig. 56); propodeum almost entirely vertical or oblique, with the dorsal face very short (Fig. 56), small species, 1.6-1.7 mm long.....*Allorhogas parvus* sp. nov.

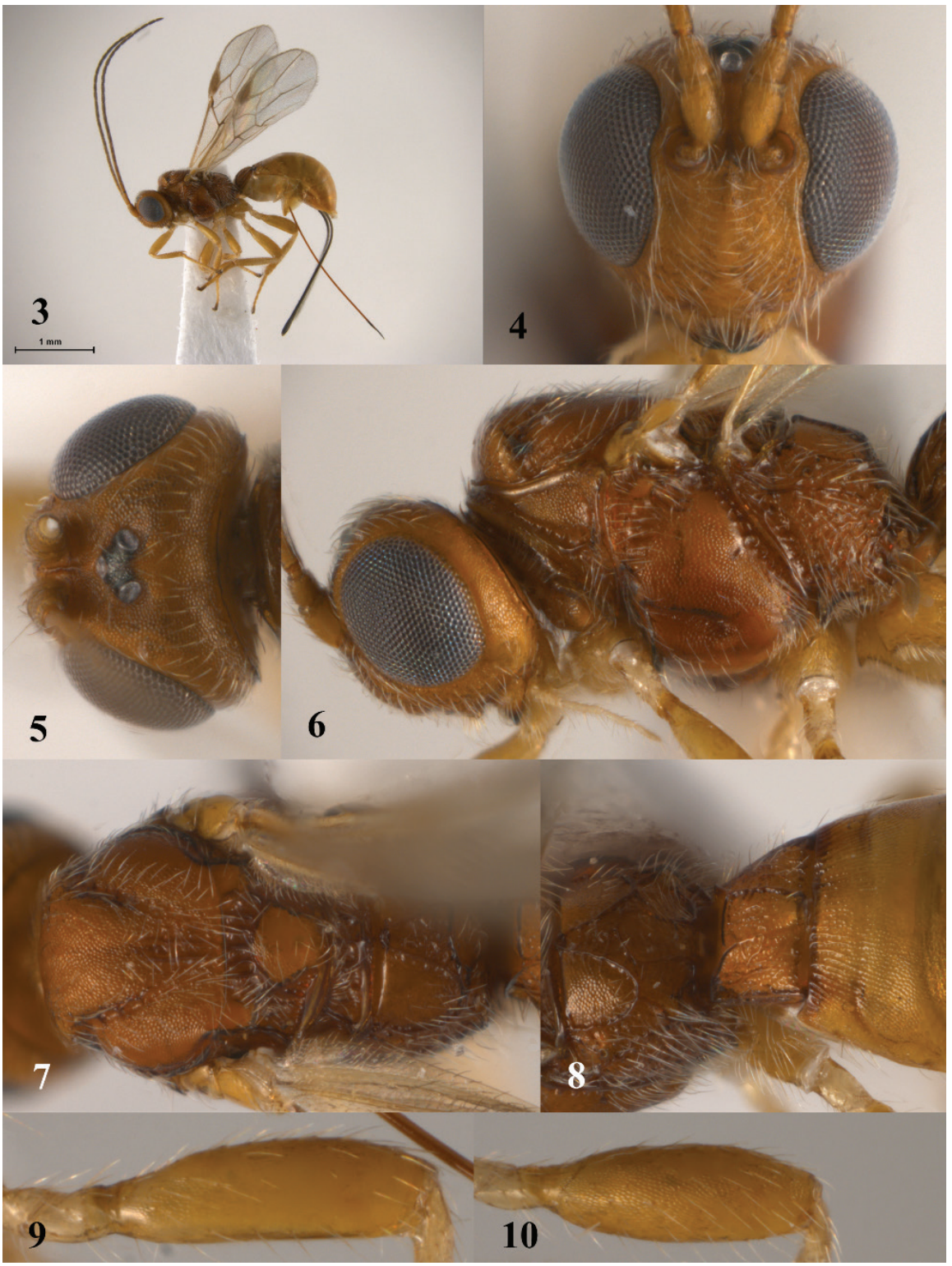
-. Mesosoma relatively slender in lateral view, 1.4-1.7 times longer than high in lateral view (Figs. 6, 39); propodeum with a distinct horizontal dorsal face subequal in length to the apical face (Figs. 6, 39); bigger species, 1.9-2.7 mm long.....6

6. Inner orbits distinctly emarginated near toruli (Fig. 4); ovipositor sheaths 1.4 times longer than mesosoma (Fig. 3); body uniformly orange brown to honey yellow.....*Allorhogas amuzgo* sp. nov.

-. Inner orbits slightly divergent, barely emarginated near toruli (Fig. 37); ovipositor 1.1-1.2 times longer than metasoma (Fig. 39); body brown with dark brown markings on mesoscutum and lower and upper areas of mesopleuron.....*Allorhogas jaliscoensis* sp. nov.



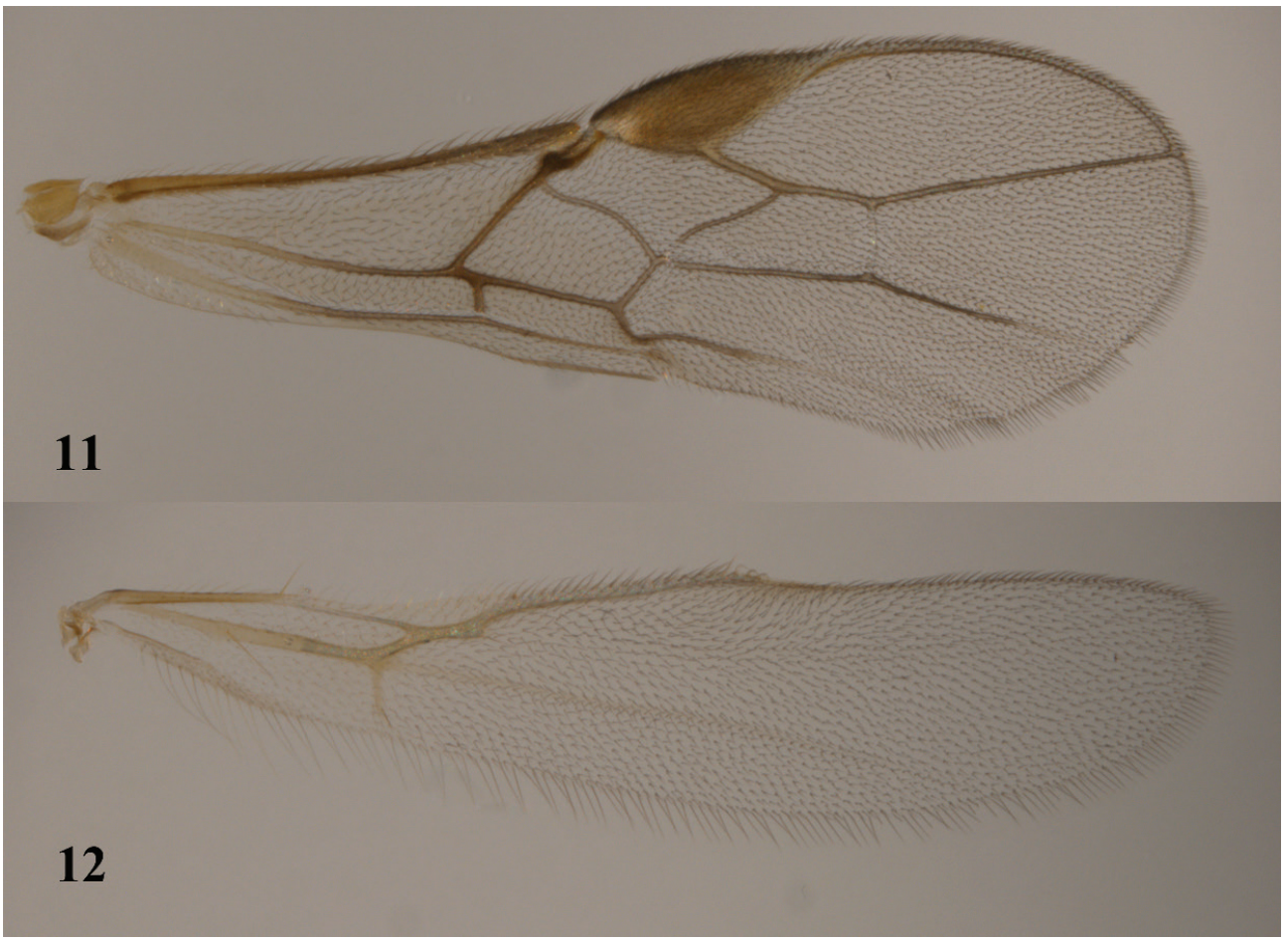

**Figures 1-2.** Morphological terms used in the descriptions of *Allorhogas* species. 1, propodeum of *A. amuzgo*, lateral view; 2, propodeum and first metasomal tergum of *A. marshi*, dorsal view. Abreviations: a, anterior area of first metasomal tergite; af, apical face of propodeum; df, dorsal face of propodeum; dl, dorsolateral areas of first metasomal tergite; bl, basolateral areas of propodeum; md, mediodorsal area of first metasomal tergite.




**Figures 3-10.** *Allorhogas amuzgo*. 3, habitus of female, lateral view; 4, head, anterior view; 5, head, dorsal view; 6, head and mesosoma, lateral view; 7, mesosoma, dorsal view; 8, propodeum and first metasomal tergite, dorsolateral view; 9, hindfemur of female; 10, hindfemur of male.

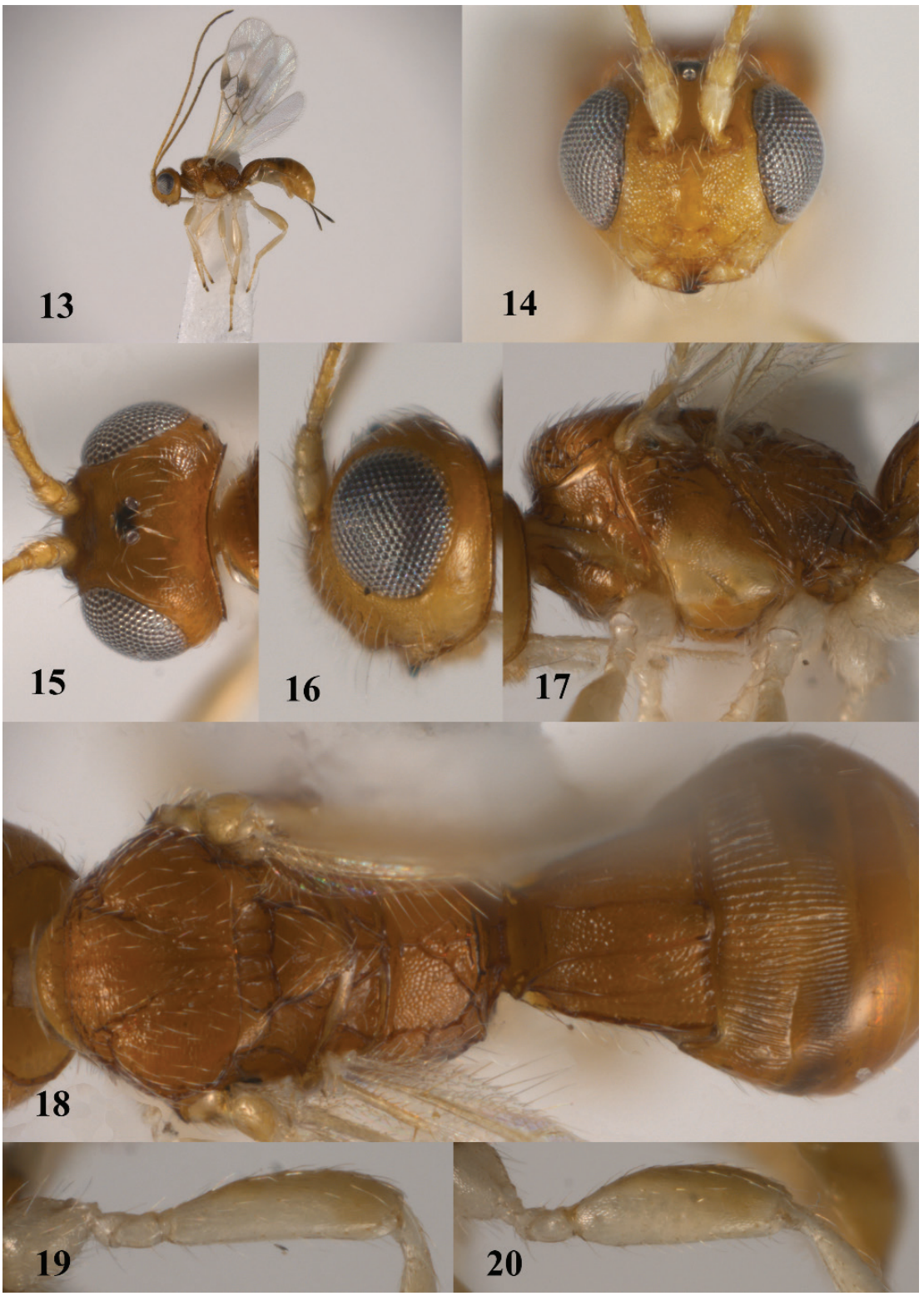
***Allorhogas amuzgo*** sp. nov.
(Figs. 3-12)
*Diagnosis.* Morphologically similar to *A. jaliscoensis* sp. nov., from which can be distinguished by its uniformly orange brown to honey yellow mesosoma and its longer ovipositor sheaths. It is also similar to the Costa Rican *A. ingavera* Marsh, 2002, but differs from it by the longer forewing vein r, which is 0.8 times as long as 3RSa (at most 0.3 times as long in *A. ingavera*).
*Female.* Body size 2.4-2.7 mm (Fig. 3), forewing 2.1-2.2 mm. *Head:* transverse in dorsal view, 1.8-2.0 times wider than its median length, and 1.1-1.3 times wider than high (Fig. 4); occipital carina complete and reaching hypostomal carina; POL as long as OD, 0.5 times OOL; frons, vertex, gena and face coriaceous, frons excavation distinct but narrow; eye 1.1-1.2 times longer than wide; eye width 2.7-3.0 times longer than temple in dorsal view (Fig. 5); malar space 0.2-0.3 times eye height and 0.8-0.9 times the width of hypoclypeal depression; mandibles 3-dentate; antenna with 24-25 antennomeres, first flagellar segment 3.8-4.0 times longer than wide, 1.0-1.1 times longer than second segment. *Mesosoma:* 1.6-1.7 times longer tan high (Fig. 6) and 1.6-1.7 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum distinctly transverse in dorsal view, its median length 0.8 times its width; notauli present and complete (Fig. 7); scutellum coriaceous, prescutellar sulcus with 5 carinae; propodeum with dorsal and apical faces subequal in length (Fig. 7), basolateral areas coriaceous and distinctly delimited by carinae, remaining areas rugose-areolate, sometimes with a poorly defined areola (Fig. 8); precoxal sulcus coriaceous to weakly scrobiculate, 0.7 times as long as mesopleuron (Fig. 7). *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 3.2 times longer than wide (Fig. 9). *Wings:* forewing (Fig. 11) 2.6-2.7 times longer than wide. Pterostigma 2.7-2.9 times as long as wide and 0.6 times as long as R. Vein r 0.8-1.0 times as long as 3RSa, 0.2-0.3 times as long as 3RSb, and as long as r-m. Vein 2RS meeting RS+M posterior to m-cu, vein RS+Mb short but always distinguishable. Hindwing (Fig. 12) vein M+CU 0.8-0.9 times as long as 1 M, m-cu from slightly and evenly curved towards wing apex. *Metasoma:* first tergite 0.9-1.1 times as long as its apical width, rugose-striate over most of its dorsal surface, median dorsal area separated from dorsolateral areas by carinae; anterior area smooth and delimited by a transverse carina (Fig. 8). Second tergite striate, separated from third tergite by a distinct and slightly sinuate furrow. Third tergite striate basally, gradually turning coriaceous to apex. Remaining tergites coriaceous basally, turning smooth apically. Ovipositor sheaths about 1.4-1.5 times as long as metasoma. *Color:* head, mesosoma and first metasomal terigte orange brown to honey yellow; remaining metasomal tergites and legs honey yellow, except telotarsi which are brown; antenna honey yellow basally, turning orange brown apically, ovipositor sheaths dark brown; wings hyaline, veins brown to light brown.
*Male.* Similar to female, with hindfemur not distinctly swollen, 2.8 times longer than wide (Fig. 10).
*Taxonomic summary*
*Biology.* Unknown.
*Etymology.* The specific epithet refers to the Amuzgo people, from the states of Oaxaca and Guerrero.
*Material examined.* Holotype female: **Mexico:** Oaxaca, Base Cerro Huatulco, 15.85093N -96.3646O, 238m, 20.vi.2010, red, Ceccarelli, De Jesús col., selva mediana. *Paratypes:* 1 female, Oaxaca, P. Nac. Lag. de Chacahua, 16.0154N -97.7666O, 20m, 24.vi.2010, Ceccarelli, De Jesús col., selva baja. (DNA voucher no. CNIN748; GenBank accession no. JX462512); 1 female, Oaxaca, Pinotepa Nacional, 16.33082N -98.01401O, 58m, 25.vi.2010, red, Ceccarelli-De Jesús col., selva baja perturbada; 1 male, Guerrero, Tierra Blanca, 16.1526N-98.32206W, 261m, 26.vi.2010, red, Ceccarelli, De Jesús, selva baja.

***Allorhogas coccolobae*** sp. nov.
(Figs. 13-22)
*Diagnosis.* Morphologically similar to *A. scotti*, from which it differs by the coarser sculpture on the second and third metasomal tergites and the less striate first metasomal tergite. Following the key to *Allorhogas* species from Costa Rica (Marsh, 2002), it runs to *A. shawi,* Marsh 2002, but it differs from the latter by its longer second submarginal cell.
*Female.* Body size 1.8-2.0 mm (Fig. 13), forewing 1.7-1.8 mm. *Head:* distinctly transverse in dorsal view, 1.6-1.7 times wider than its median length and 1.1-1.2 times wider than high (Fig. 14); occipital carina complete and reaching hypostomal carina; POL 1.2-1.3 times OD, 0.4 times OOL; frons, vertex, gena and face coriaceous, frons excavation shallow, without sharp edges; eye 1.1 times longer than wide; eye width 2.7-3.0 times longer than temple in dorsal view (Fig. 15); malar space 0.3 times eye height (Fig. 16) and 0.9-1.0 times the width of hypoclypeal depression; mandibles bidentate; antenna with 19-20 antennomeres, first flagellar segment 5.0 times longer than wide and as long as second segment. *Mesosoma:* 1.5-1.6 times longer tan high (Fig. 17) and 1.4-1.5 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum transverse in dorsal view, its median length 0.7-0.8 times its width; notauli present and complete (Fig.




**Figures 11-12.** *Allorhogas amuzgo*. 11, forewing; 12, hindwing.

18) meeting in a rugose striate median area; scutellum weakly coriaceous, prescutellar furrow with 3-4 carinae; propodeum not distinctly angled in lateral view, its dorsal surface subequal to slightly longer than apical face; dorsolateral areas distinctly delimited by carinae and coriaceous; remaining areas irregularly carinated but delimiting a fairly distinguishable pentagonal areola; precoxal sulcus coriaceous to weakly scrobiculate, 0.5-0.6 times as long as mesopleuron. *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 3.5-3.7 times longer than wide (Fig. 19). *Wings:* forewing (Fig. 21) 2.8-2.9 times longer than wide. Pterostigma 3.3 times as long as wide and 0.7-0.8 times as long as R. Vein r 0.4-0.5 times as long as 3RSa, 0.2 times as long as 3RSb, and 0.7 times as long as r-m. Vein 2RS meeting RS+M anterio to m-cu, sometimes almost interstitial, vein RS+Mb absent. Hindwing (Fig. 22) vein M + CU 0.6-0.8 times as long as 1 M, m-cu from almost straight to slightly and evenly curved towards wing apex. *Metasoma:* first tergite 0.9-1.0 times as long as its apical width, median dorsal area coriaceous, delimited by a pair of dorsolateral carinae (Fig. 18), lateral areas largely coriaceous with a few longitudinal striations, anterior area not distinctly delimited by a transverse carina. Second tergite striate. Third tergite striate basally and smooth and polished apically. Remaining tergites smooth and polished. Ovipositor sheats about 0.5 times as long as metasoma. *Color:* head, mesosoma and metasoma light brown to honey yellow; sometimes propodeum, metapleuron and second and third metasomal tergites darker, brownish; antenna honey yellow, turning orange brown apically, ovipositor sheaths dark brown; coxae, trochaters, trochantelli and basoventral areas of femora pale, whitish, apico-dorsal areas of femora, tibiae and tarsi pale brown; wings hyaline, veins and pterostigma brown, except veins M+CU and 1-1A, which are lighter, and veins 3RSa, 3RSb, 3M, r-m, and apical two thirds of 2M, which are entirely unpigmented.




**Figures 13-20.** *Allorhogas coccolobae*. 13, habitus of female, lateral view; 14, head, anterior view; 15, head, dorsal view; 16, head, lateral view; 17, mesosoma, lateral view; 18, mesosoma and metasoma, dorsal view; 19, hindfemur of female; 20, hindfemur of male.

*Male.* Similar to female, sometimes darker; with hindfemur not distinctly swollen, 3.1 times longer than wide (Fig. 20).

*Taxonomic summmary*

*Biology.* We collected leaves of a tree belonging to *Coccoloba barbadensis* Jacq. (Fig. 23), each one infested with several galls, on May 5, 2011. These galls consist of a conical abnormal growth that projects from the adaxial surface of the leave (Fig. 24), whereas on the abaxial surface they are blunt (Fig. 25). Approximately 1-2 weeks after collecting these leaves, a large number of individuals of an unidentified species of Cecidomyiidae (Diptera) came out from the abaxial surface of these galls, leaving their characteristic exuviae attached outside their emergence hole. Two-three weeks after this, around 25 specimens assigned to *A. coccolobae* emerged from the galls together with specimens of at least 5 different species belonging to other parasitoid wasp families (Eulophidae, Torymidae Eurytomidae). This suggests that the gall midge species is the one that induces these galls. We also observed at least 2 other kind of galls in leaves collected during different times of the year, but rearing was not successful.

*Etymology.* The specific epithet refers to the known biology of this species, associated with galls on *Coccoloba*.

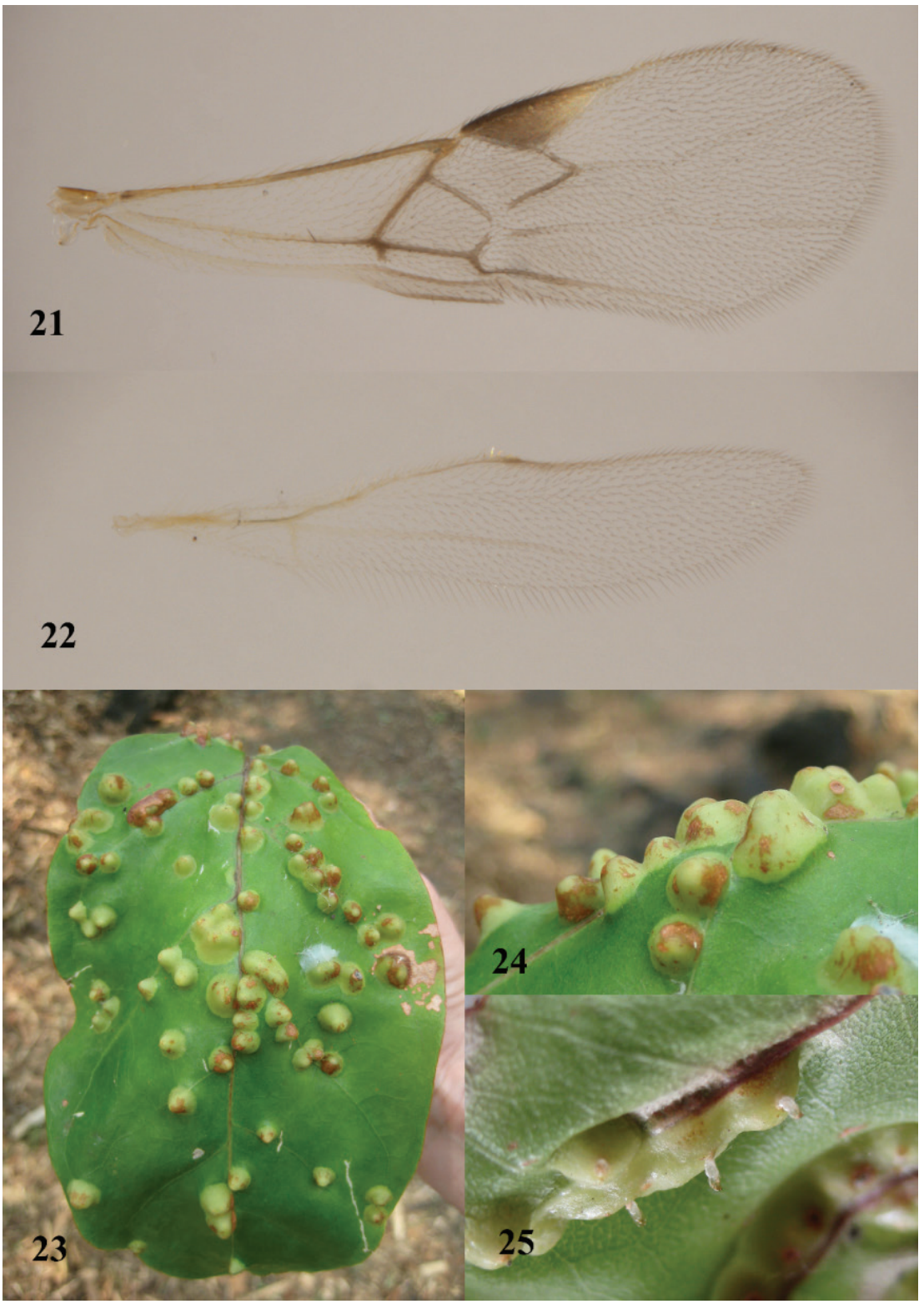
*Material examined.* Holotype female: **Mexico:** Jalisco, Chamela Biostation, 19.49590N-105.04202O, 113m, 5.v.2011, tropical dry forest, Zaldívar, Zaragoza, Ibarra colls. (DNA voucher no. CNIN777; GenBank accession no. JX462509 ). *Paratypes:* 10 females and 7 males, same data as holotype (2 females with DNA voucher nos CNIN778, 779; GenBank accession nos JX462510-11); 1 male, Jalisco, Chamela Biostation, camino Calandria, 19.4950485N-105.043786W, 45m, 28.iii.2010, sweep, selva baja-mediana, Zaldívar, Salinas-Ramos colls. (DNA voucher no. BOLD-ASDOR764; GenBank accession number HQ200974); 3 females, Jalisco, Chamela Biostation, camino Chachalaca, 19.4997N-105.03851W, 51m, 21.ii.2010, sweep, tropical dry forest, Zaldívar coll. (DNA voucher nos BOLD-ASDOR 517-19; GenBank accession nos HQ200980-82); 1 female, Jalisco, Estación Chamela, camino Buho-Chachalaca 19.49913N/19.49786N-105.04217W/105.0444W, 68-106m, 20.ii.2010, sweep, tropical dry forest, Zaldívar, Zaragoza, Ibarra colls. (DNA voucher no. BOLD-ASDOR472; GenBank accession no. HQ200961).

***Allorhogas crassifemur*** sp. nov.

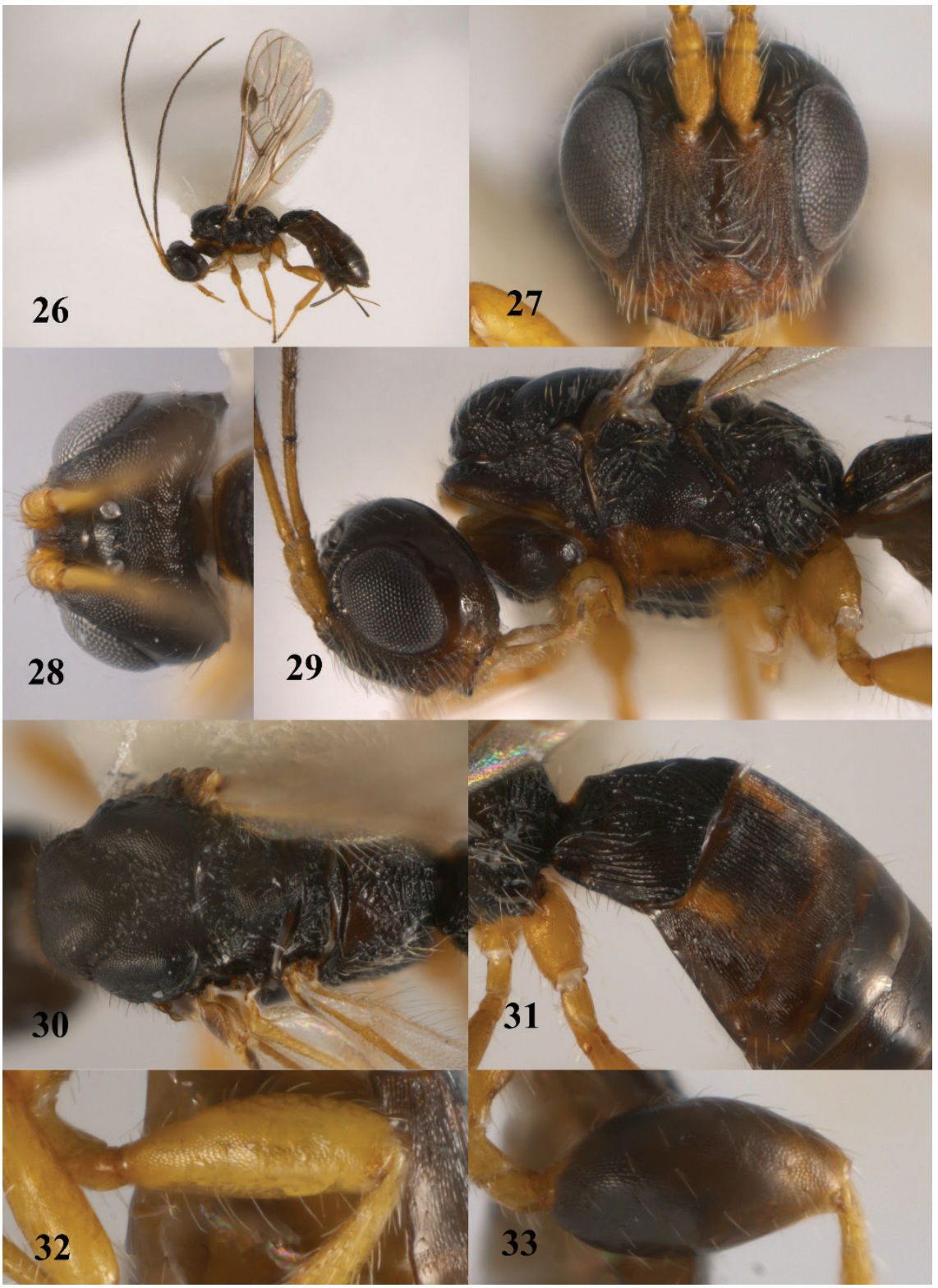
(Figs. 26-35)

*Diagnosis.* Easily distinguished from all other species of the genus with vein 2RS meeting RS+M anterior to m-cu by the distinctly long first flagellomere, short ovipositor sheaths and convergent striations on apical area of first metasomal tergite.

*Female.* Body size 2.8-2.9 mm (Fig. 26), forewing 2.2-2.3 mm. *Head:* transverse in dorsal view, 1.7-1.8 times wider than its median length, and 1.1 times wider than high (Fig. 27); occipital carina complete and reaching hypostomal carina; POL 1.8-2.0 times OD, 0.8 times OOL (Fig. 28); frons, vertex, gena and face coriaceous, frons excavation distinct and narrow, defined by sharp edges; eye 1.8-1.9 times longer than wide; eye width 1.5-1.6 times longer than temple in dorsal view; malar space 0.3 times eye height and 0.8-0.9 times the width of hypoclypeal depression; mandibles bidentate; antenna with 27-28 antennomeres, first flagellar segment very long 6.0-6.5 times longer than wide, 1.4 times longer than second segment (Fig. 29). *Mesosoma:* 1.7 times longer tan high (Fig. 29) and 1.7-1.8 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum transverse in dorsal view, its median length 0.7-0.8 times its width; notauli present and complete (Fig. 30), obscured in a posterior rugose median area, scutellum weakly coriaceous, prescutellar furrow with 4-5 carinae; propodeum evenly rounded in lateral view (Fig. 29), dorsal and apical faces not easily distinguishable, dorsolateral areas distinctly delimited by carinae, remaining areas of propodeum coarsely rugose-areolate (Figs. 29, 30, 31); precoxal sulcus coriaceous, 0.6-08 times as long as mesopleuron. *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 2.6 times longer than wide (Fig. 32). *Wings:* forewing (Fig. 34) 2.8-2.9 times longer than wide. Pterostigma 2.7 times longer than wide and 0.8 times as long as R. Vein r 0.5-0.6 times as long as 3RSa, 0.2-0.3 times as long as 3RSb, and 0.7-0.8 times as long as r-m. Vein 2RS meeting RS+M distinctly anterior to m-cu, thus vein RS+Mb absent. Hindwing (Fig. 35) Vein M + CU 0.6-0.7 times as long as 1 M, m-cu usually straight, directed to wing apex. *Metasoma:* first tergite 0.9-1.0 times as long as apically wide, striate over most of its dorsal surface, anterior area delimited by a V-shaped transverse carina, dorsal surface, entirely striate, striation convergent apically (Fig. 31). Second tergite striate. Third tergite striate basally and smooth and polished apically. Remaining tergites, weakly sculptured, coriaceous basally and smooth apically. Ovipositor sheats about 0.3-0.4 times as long as metasoma. *Color:* most of body dark brown; except lower face, genae, clypeous, mouth parts and lower area of mesopleuron which are lighter, basal antennomeres honey yellow to light brown, legs honey yellow; wings hyaline, veins brown.




**Figures 21-25.** 21, forewing and 22, hindwing of *A. coccolobae.*; 23, leave of *Coccoloba barbadensis* Jacq. with galls; 24, detail of the adaxial surface of a leaf infested with galls; 25, detail of the abaxial surface of a leaf infested with galls and showing cecidomyiids exuviae.




**Figures 26-33.** *Allorhogas crassifemur*. 26, habitus of female, lateral view; 27, head, anterior view; 28, head, dorsal view; 29, head and mesosoma, lateral view; 30, mesosoma, dorsal view; 31, first 3 metasomal terga, dorsolateral view; 32, hindfemur of female; 33, hindfemur of male.

*Male.* Similar to female, with the hindfemur distinctly swollen and much darker, 1.8 times longer than wide (Fig. 33).

*Taxonomic summary*

*Biology.* Unknown.

*Etymology.* The specific epithet derives from the Latin words *crassus* (thick, fat) and *femur*, in reference to the distinctly swollen hindfemur of the males of this species.

*Material examined.* Holotype female: **Mexico:** Jalisco, Estación Chamela, cerca del laboratorio, 19.49814N -105.0444O, 95m, 23-24.vi.2009, trampa de luz, selva baja caducifolia, Cham006A, Clebsch-Zaldívar-Polaszek col. (DNA voucher no. BOLD-ASDOR043; GenBank accession no. JF912208). *Paratypes*: 1 female, same data as holotype; 1 male, same data as holotype except date, 24-25.vi.2009 (DNA voucher no. BOLD-ASDOR042; GenBank accession no. JF912207).

***Allorhogas jaliscoensis*** sp. nov.

(Figs. 36-43)

*Diagnosis.* Morphologically similar to *A. amuzgo*, from which it differs by the dark markings on mesoscutum and shorter ovipositor sheaths, which are about 1.1 times longer than metasoma.

*Female.* Body size 1.9-2.0 mm (Fig. 36), forewing 1.8 mm. *Head:* transverse in dorsal view, 1.7-1.9 times wider than its median length, and 1.3-1.4 times wider than high (Fig. 37); occipital carina complete and reaching hypostomal carina; POL 1.3-1.5 times OD, 0.6-0.8 times OOL (Fig. 38); frons, vertex, gena and face coriaceous, frons excavation shallow; eye 1.1 times longer than wide; eye width about 3 times longer than temple in dorsal view; malar space 0.3 times eye height (Fig. 37) and as long as width of hypoclypeal depression; mandibles bidentate; antenna with 22-23 antennomeres, first flagellar segment 4.2-4.6 times longer than wide, 1.1 times longer than second segment. *Mesosoma:* about 1.4 times longer tan high (Fig. 39) and 1.4-1.6 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum distinctly transverse in dorsal view, its median length 0.6-0.8 times its width; notauli present and complete (Fig. 40), obscured in a striate-rugose median area; scutellum coriaceous, prescutellar furrow with 3 transeverse carinae; propodeum with dorsal and apical faces subequal in length, basal areas rugose-areolate and distinctly delimited by carinae, remaining areas rugose-areolate (Figs. 40, 41); precoxal sulcus weakly scrobiculate, 0.5-0.6 times as long as mesopleuron. *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 3 times longer than wide. *Wings:* forewing (Fig. 42) 3.5 times longer than wide. Pterostigma 2.7 times as long as wide and 0.8 times as long as R. Vein r 0.8-0.9 times as long as 3RSa, 0.2-0.3 times as long as 3RSb, and 1.1-1.2 times as long as r-m. Vein 2RS meeting RS+M slightly anterior to m-cu to almost interstitial, vein RS+Mb not distinguishable. Hindwing (Fig. 43) vein M + CU 0.8-0.9 times as long as 1 M, m-cu slightly and evenly curved towards wing apex. *Metasoma:* first tergite distinctly wider than long, 0.8 times as long as its apical width, irregularly striate over most of its dorsal surface, anterior area smooth and delimited by a transverse carina, mediodorsal area trapezoidal, about twice longer than wide, defined by a pair of dorsolateral carinae (Fig. 39). Second tergite striate. Third tergite striate basally gradually turning coriaceous apically. Remaining tergites, largely coriaceous, apical tergites smooth apically. Ovipositor sheats about 1.1-1.2 times longer than metasoma. *Color:* most of mesosoma and second and third metasomal tergites brown, most of mesoscutum except rugose median area, upper areas of mesopleuron darker; head, most of metasomal tergites and legs light brown to honey yellow; antenna honey yellow basally turning brown apically; ovipositor sheaths brown; wings hyaline, veins brown.

*Male.* Unknown.

*Taxonomic summary*

*Biology.* Unknown.

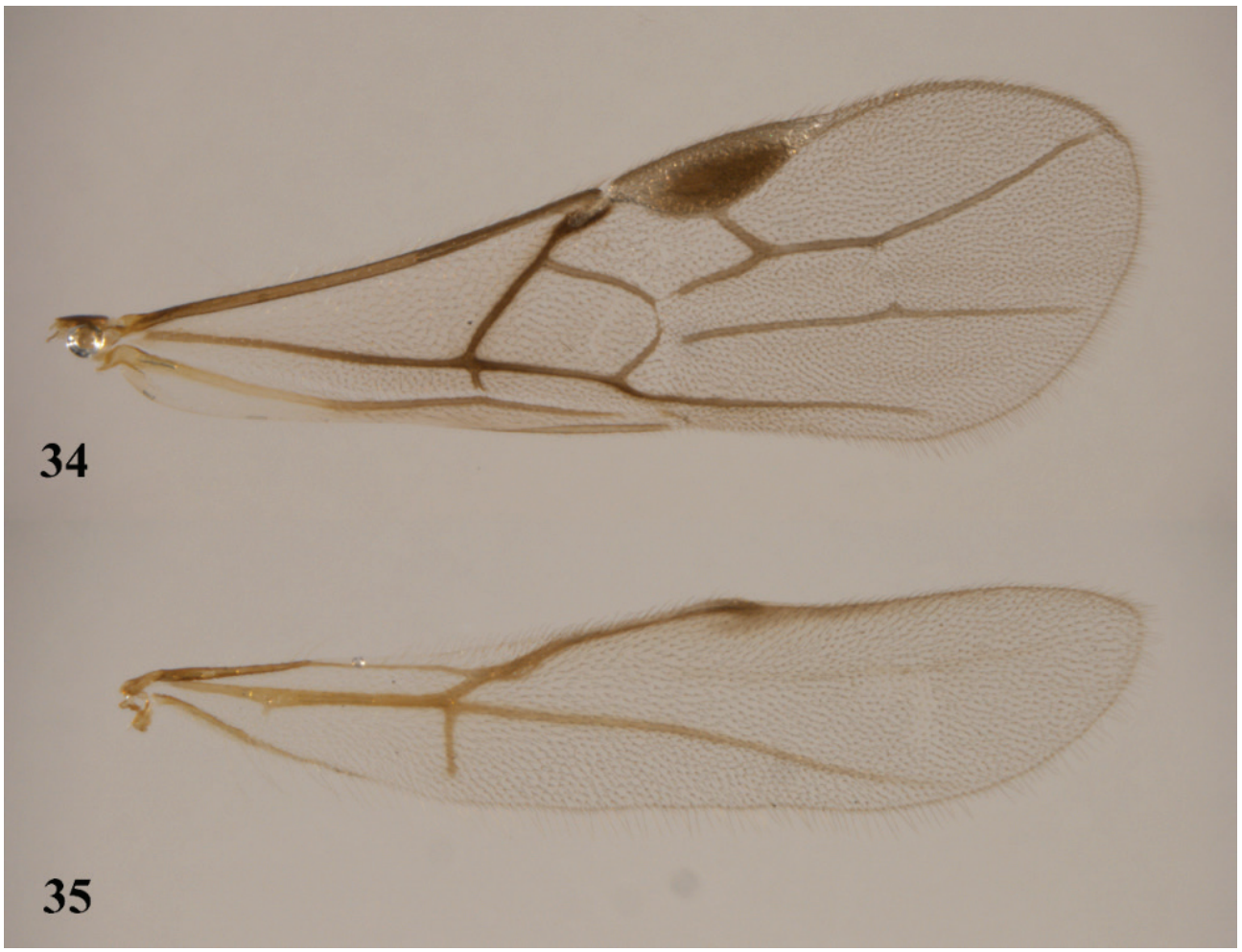
*Etymology.* The specific epithet of this species refers to the type locality in Jalisco, Mexico.

*Material examined.* Holotype female: **Mexico:** Jalisco, Estación Chamela, camino Ardilla, 20-XI-2009, red de barrido, selva baja caducifolia, Cham032, Zaldívar col. (DNA voucher no. BOLD-ASDOR457; GenBank accession no. HQ200993). *Paratypes*: *1* female, same data as holotype (DNA voucher no. BOLD-ASDOR456; GenBank accession no. HM434542); 1 female, Jalisco, Estación Chamela, cerca del laboratorio, 19.49814N-105.0444W, 95m, 23-24-VI-2009, Trampa de luz, Selva baja caducifolia, Cham006A, Clebsch, Zaldívar, Polaszek coll. (DNA voucher no. BOLD-ASDOR081; GenBank accession no. HM434331); 1 female, Jalisco, Estación Chamela, camino Calandria, 19.50496N-105.0377, 52 m, 3-IX-2009, red barrido, selva baja-mediana, Cham-0018, Clebsch, Zaldívar coll. (DNA voucher no. BOLD-ASDOR350; GenBank accession no. HM434506).

***Allorhogas marshi*** sp. nov.

(Figs. 44-52)

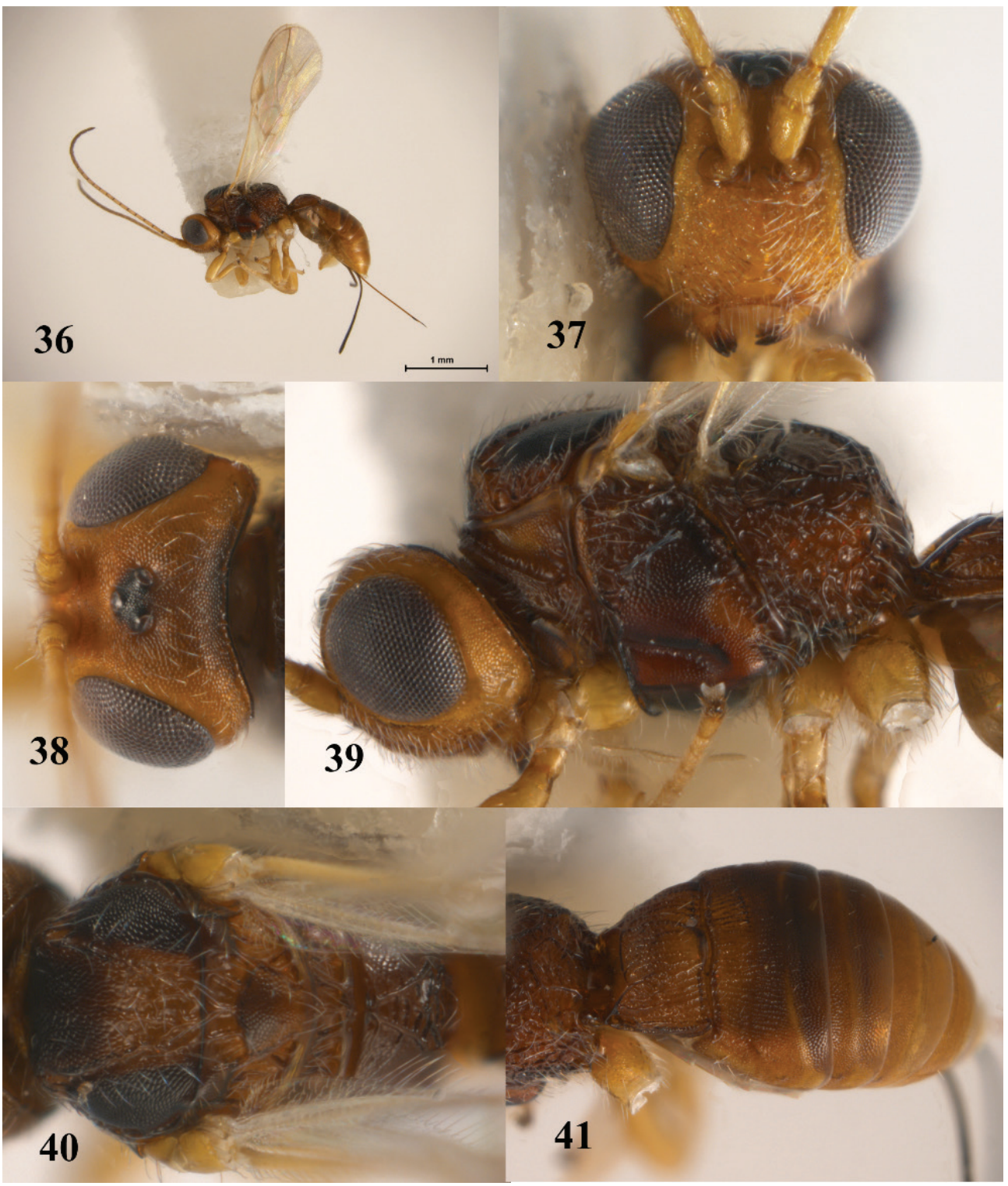
*Diagnosis.* Among the Mexican species, similar to *A. scotti* sp. nov., from which it differs by the color pattern of metasomal terga and the coarser sculpture on second and third metasomal tergites. Following the key to




**Figures 34-35.** *Allorhogas crassifemur*. 34, forewing; 35, hindwing.

Costa Rican species (Marsh 2002), this species runs to *A. shawi* Marsh, from which it can be distinguished by its relatively longer second submarginal cell and by its apical metasomal tergites contrastingly lighter.

*Female.* Body size 2.2-2.6 mm (Fig. 44), forewing 1.8-2.2 mm. *Head:* transverse in dorsal view, 1.9 times wider than its median length, and 1.2-1.3 times wider than high (Fig. 45); occipital carina complete and reaching hypostomal carina; POL 1.3 times OD, 0.5-0.6 times OOL (Fig. 46); frons, vertex, gena and face coriaceous, frons excavation shallow, its edges not acute; eye 1.2 times longer than wide (Fig. 47); eye width 2.5-2.8 times longer than temple in dorsal view; malar space 0.3 times eye height and 0.9-1.0 times the width of hypoclypeal depression; mandibles bidentate; antenna with 24-25 antennomeres, first flagellar segment 4.3-4.5 times longer than wide, 1.1-1.2 times longer than second segment. *Mesosoma:* 1.8-1.9 times longer tan high (Fig. 48) and 1.7-1.9 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum transverse in dorsal view, its median length 0.8 times its width; notauli present and complete (Fig. 49); scutellum coriaceous,prescutellar furrow with 3 transverse carinae; propodeum with dorsal and apical faces subequal, basal areas coriaceous, delimited by carinae, remaining areas rugose areolate; precoxal sulcus coriaceous to weakly scrobiculate, 0.6 times as long as mesopleuron. *Wings:* forewing (Fig. 51) 2.9-3.1 times longer than wide. Pterostigma 2.9-3.2 times longer than wide and 0.6-0.7 times as long as R. Vein r 0.4-0.5 times as long as 3RSa, 0.2 times as long as 3RSb, and 1.1 times as long as r-m. Vein 2RS meeting RS+M slightly anterior to m-cu, almost interstitial, vein RS+Mb not distinguishable. Hindwing (Fig. 52) vein M + CU 1.5-1.7 times as long as 1 M, m-cu stright. *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur about 3 times longer than wide. *Metasoma:* first tergite 1.3-1.4 times longer than wide, striate with




**Figures 36-41.** *Allorhogas jaliscoensis*. 36, habitus of female, lateral view; 37, head, anterior view; 38, head, dorsal view; 39, head and mesosoma, lateral view; 40, mesosoma, dorsal view; 41, metasoma, dorsolateral view.

coriaceous microscultpure over most of its dorsal surface, anterior area smooth and delimited by a transverse carina, mediodorsal area long and narrow, delimited by a pair of dorsolateral carinae (Fig. 50). Second tergite striate with coriaceous microsculpture. Third tergite striate basally and smooth and polished apically. Remaining tergites entirely smooth and polished. Ovipositor sheaths about 0.8 times as long as metasoma. *Color:* mesosoma and first 4 metasomal terigtes dark brown, metanotum, propodeum and first metasomal tergite lighter; remaining visible metasomal tergites and legs contrastingly pale yellowish; head honey yellow; antenna honey yellow basally, turning brown apically, ovipositor sheaths dark brown; wings hyaline, veins brown.

*Male. Unknown*.

*Taxonomic summary*

*Biology.* Unknown.

*Etymology.* This species is named after Paul M. Marsh, for his valuable contribution to the knowledge of the doryctine wasps from the New World.

*Material examined.* Holotype female: **Mexico:** Jalisco, Estación Chamela, camino Buho-Chachalaca, 19.49913N/19.49786N-105.04217W/105.0444, 68-106 m, 25-ii-2010, red barrido, selva baja caducifolia, Cham54, Zaldívar coll. (DNA voucher no. BOLD-ASDOR777; GenBank accession no. HQ200969). *Paratypes*: 4 females same data as holotype (DNA voucher no. BOLD-ASDOR758, 759, 760, 776; GenBank accession nos HQ200978; HQ200984-5); 2 females, Estación Chamela, camino Zarco-Chachalaca, 19.49566N-105.03931W, 30 m, 28-iii-2010, red barrido, selva baja-mediana, Cham-58, Zaldívar-Salinas-Ramos coll. (DNA voucher no. BOLD-ASDOR762, 763; GenBank accession nos HQ200975-6).

***Allorhogas parvus*** sp. nov.

(Figs. 53-60)

*Diagnosis.* The small body size, distinctly compact mesosoma and an almost entirely vertical or oblique propodeum relates this species with *A. minimus* Centrella and Shaw, 2010, from Costa Rica, and *A. argentinus* (Brèthes, 1922), from Argentina; however, it can be distinguished from the latter 2 species by its distinct honey yellow body color.

*Female.* Body size 1.6-1.7 mm (Fig. 53), forewing 1.6 mm. *Head:* distinctly transverse in dorsal view, 2.3-2.4 times wider than its median length, and 1.1-1.2 times wider than high (Fig. 54); occipital carina complete and reaching hypostomal carina; POL 1.5-2.0 times OD, 0.5-0.6 times OOL (Fig. 55); frons, vertex, gena and face coriaceous, frons excavation narrow indicated by slightly acute edges; eye 1.2-1.4 times longer than wide; eye width 2.0-2.2 times longer than temple in dorsal view; malar space 0.4 times eye height (Fig. 54) and 1.2 times the width of hypoclypeal depression; mandibles bidentate; antenna with 19 antennomeres, first flagellar segment 4.2 times longer than wide, 1.1 times longer than second segment. *Mesosoma:* short and compact, 1.3-1.4 times longer than high (Fig. 56) and 1.3-1.4 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow smooth, not scrobiculate; mesoscutum distinctly transverse in dorsal view, its median length 0.5-0.6 times its width; notauli present and complete (Fig. 57); scutellum weakly scrobiculate, prescutellar furrow with 3-4 transverse carinae; propodeum almost entirely vertical or oblique, its dorsal surface very short (Fig. 57), basal areas coriaceous, small and semicircular, remaining areas rugose-areolate; precoxal sulcus coriaceous, 0.6 times as long as mesopleuron. *Wings:* forewing (Fig. 59) 2.3-2.4 times longer than wide. Pterostigma 2.7-3.0 times as long as wide and 0.8 times as long as R. Vein r 0.8 times as long as 3RSa, 0.2 times as long as 3RSb, and 0.9-1.0 times as long as r-m. Vein 2RS almost directly in line with m-cu, vein RS+Mb not distinguishable. Hindwing (Fig. 60) vein M + CU as long as 1 M, m-cu slightly curved towards wing apex. *Legs:* foretibia with a row of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 3.3 times longer than wide. *Metasoma:* first tergite wider than long, 0.7-0.8 times as long as its apical width, striate with coriaceous rugulose microsculpture over most of its dorsal surface, anterior area smooth and delimited by a transverse carina (Fig. 58). Second tergite striate with coriaceous microsculpture. Third tergite striate basally gradually turning coriaceous and smooth apically. Remaining tergites smooth. Ovipositor sheaths 0.9-1.1 times as long as metasoma. *Color:* almost uniformly honey yellow, with head and legs slightly lighter, antenna and ovipositor sheaths darker apically; wings hyaline, veins brown.

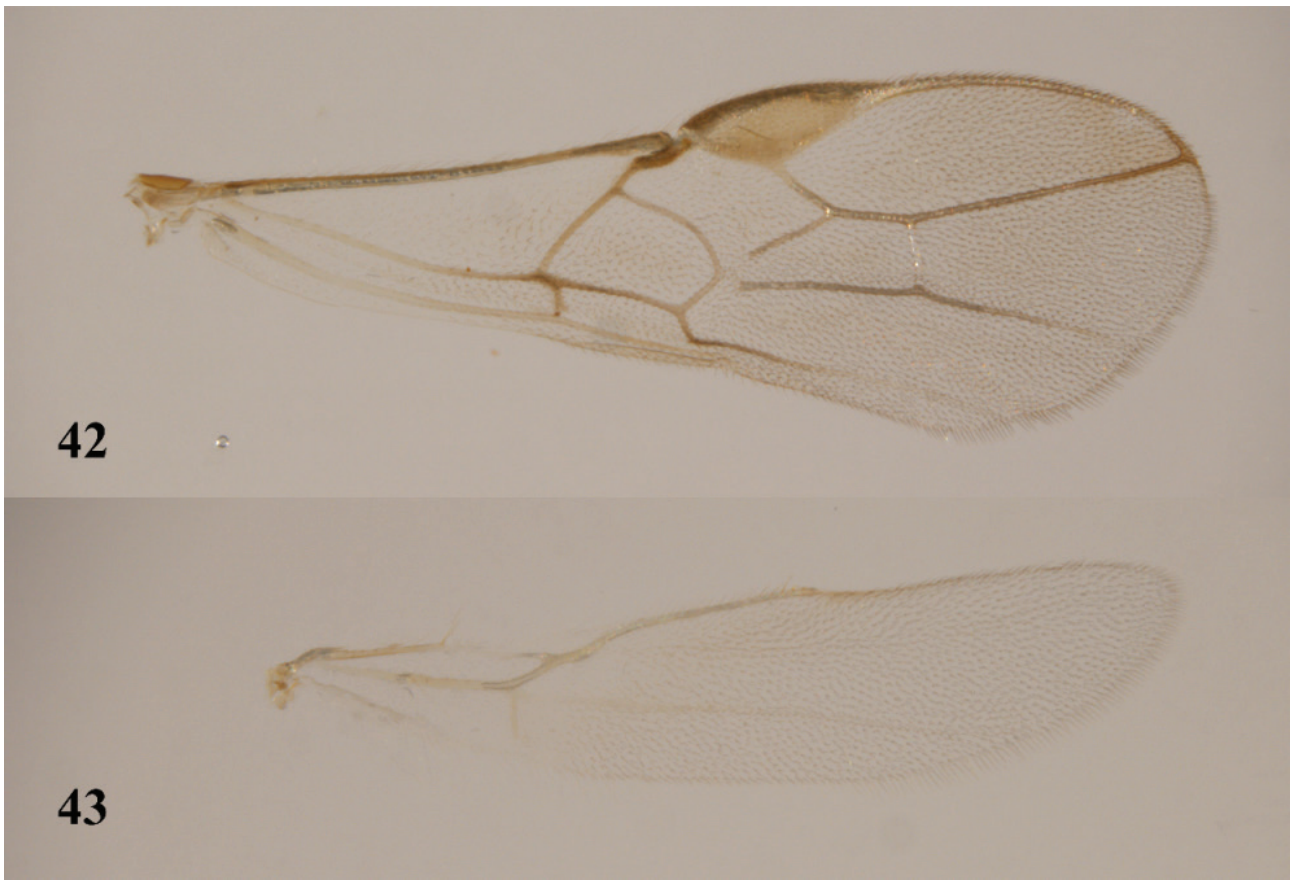
*Male.* Unknown.

*Taxonomic summary*

*Biology.* Unknown.

*Etymology.* The specific epithet derives from the Latin word *parvus* (small) in reference to the small body size of this species.

*Material examined.* Holotype female: **Mexico:** Jalisco, Estación Chamela, camino Búho-Chachalaca, 19.49913N/19.49786N -105.0421O/105.0444O, 106m, 25.ii.2010, red de barrido, selva baja caducifolia, Cham 54, Zaldívar col., DNA voucher no. BOLD-ASDOR 778, GenBank accession no. HQ200968. *Paratypes*: 1 female, same data as holotype except date: 20.ii.2010, DNA voucher no. BOLD-ASDOR 470, GenBank accession no. HQ200963; 1 female, Jalisco, Estación Chamela, camino



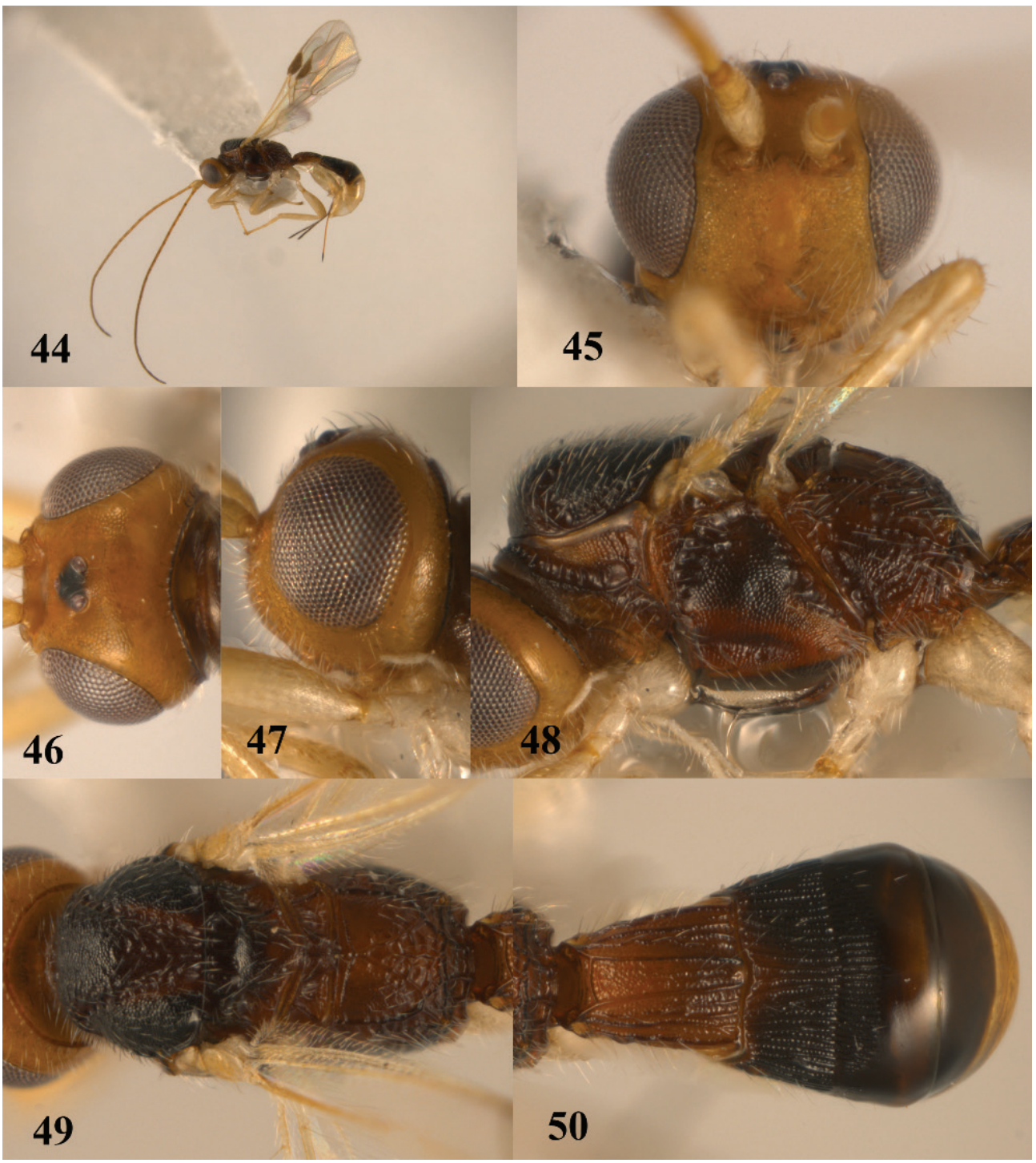

**Figures 42-43.** *Allorhogas jaliscoensis*. 42, forewing; 43, hindwing.

Chachalaca, 19.49934N -105.03833O, 56m, 1-21. xi.2009, trampa malaise, selva baja caducifolia, Cham 028, Zaldívar col. DNA voucher number no. BOLD-ASDOR 458; GenBank accession no. HQ200994.

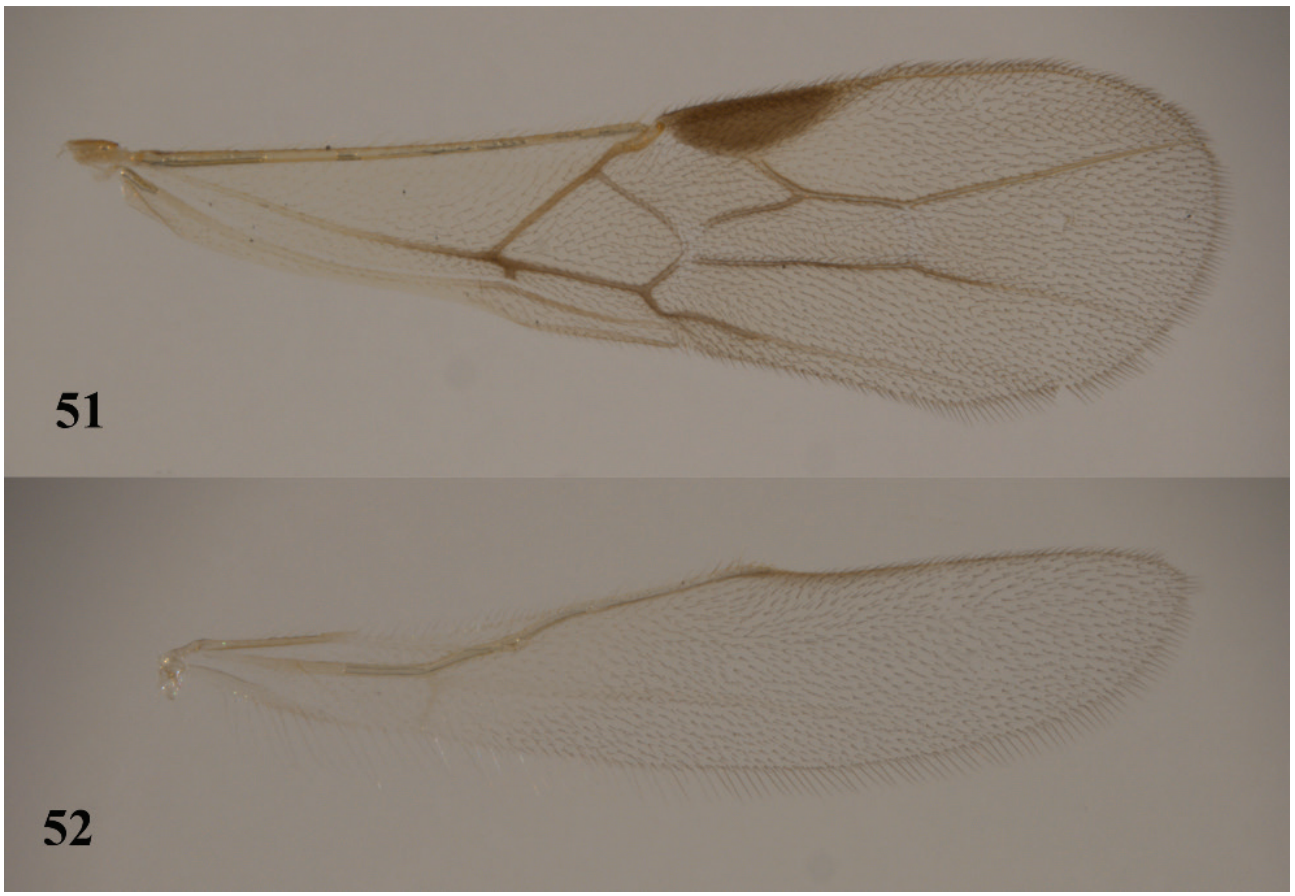
***Allorhogas scotti*** sp. nov.
(Figs. 61-68)

*Diagnosis.* Morphologically similar to *A. coccolobae*, from which it can be distinguished by its fine striations on second metasomal tergite and an almost smooth third metasomal tergite, with a few striations basally.

*Female.* Body size 2.0-2.2 mm (Fig. 61), forewing 1.9-2.0 mm. *Head:* transverse in dorsal view, 1.5-1.7 times wider than its median length, and 1.3-1.4 times wider than high (Fig. 62); occipital carina complete and reaching hypostomal carina; POL 1.7-1.8 times OD, 0.5 times OOL (Fig. 63); frons, vertex, gena and face coriaceous, frons excavation shallow without sharp edges; eye 1.1 times longer than wide; eye width 2.5-2.6 times longer than temple in dorsal view; malar space 0.3-0.4 times eye height and 0.9-1.0 times the width of hypoclypeal depression; mandibles bidentate; antenna with 21-22 antennomeres, first flagellar segment 5.0-5.4 times longer than wide, 1.0-1.1 times longer than second segment. *Mesosoma:* 1.6-2.0 times longer tan high (Fig. 64) and 1.7-2.0 times longer than wide; pronotal collar very short, not visible in dorsal view, pronotal furrow scrobiculate; mesoscutum slightly transverse in dorsal view, its median length 0.7-0.9 times its width; notauli present and complete, obscured in a striate median area (Fig. 65); scutellum coriaceous, prescutellar furrow with 4-5 transverse carinae; propodeum with dorsal face slightly longer than apical face (Fig. 64), basal areas coriaceous; irregularly carinated, with a more or less defined pentagonal areola; precoxal sulcus weakly scrobiculate, 0.5-0.6 times as long as mesopleuron. *Wings:* forewing (Fig. 67) 3.3-3.4 times longer than wide. Pterostigma 3.1-3.4 times longer than wide and 0.7-0.8 times as long as R. Vein r 0.4 times as long as 3RSa, 0.2 times as long as 3RSb, and 0.8 times as long as r-m. Vein 2RS meeting RS+M anterior to m-cu, sometimes almost interstitial, vein RS+Mb not distinguishable. Hindwing (Fig. 68) vein M + CU 0.7 times as long as 1 M, m-cu from slightly curved towards wing apex. *Legs:* Foretibia with a row




**Figures 44-50.** *Allorhogas marshi*. 44, habitus of female, lateral view; 45, head, anterior view; 46, head, dorsal view; 47, head, lateral view; 48, mesosoma, lateral view; 49, mesosoma, dorsal view; 50, metasoma, dorsal view.




**Figures 51-52.** *Allorhogas marshi*. 51, forewing; 52, hindwing.

of spines along anterior margin. Hindcoxa with distinct basoventral tooth. Hindfemur 3.2 times longer than wide. *Metasoma:* first tergite distinctly wider than long, 1.3-1.4 times longer than apically wide, striate over most of its dorsal surface, anterior area smooth and delimited by a transverse carina, mediodorsal area long and narrow, delimited by a pair of dorsolateral carinae (Fig. 66). Second tergite finely striate. Third tergite with a few weak strations basally, otherwise smooth (Fig. 66). Remaining tergites, smooth and polished. Ovipositor sheaths 0.8-0.9 times as long as metasoma. *Color:* mostly light brown to honey yellow, with some dark irregular areas on lower metapleuron and second and third metasomal tergites; coxae, trohanters and trochantelli pale, whitish; femora, tibiae and tarsi light yellow; wings hyaline, veins brown. *Male.* Essentially as in female, with hindfemur not distinctly swollen.

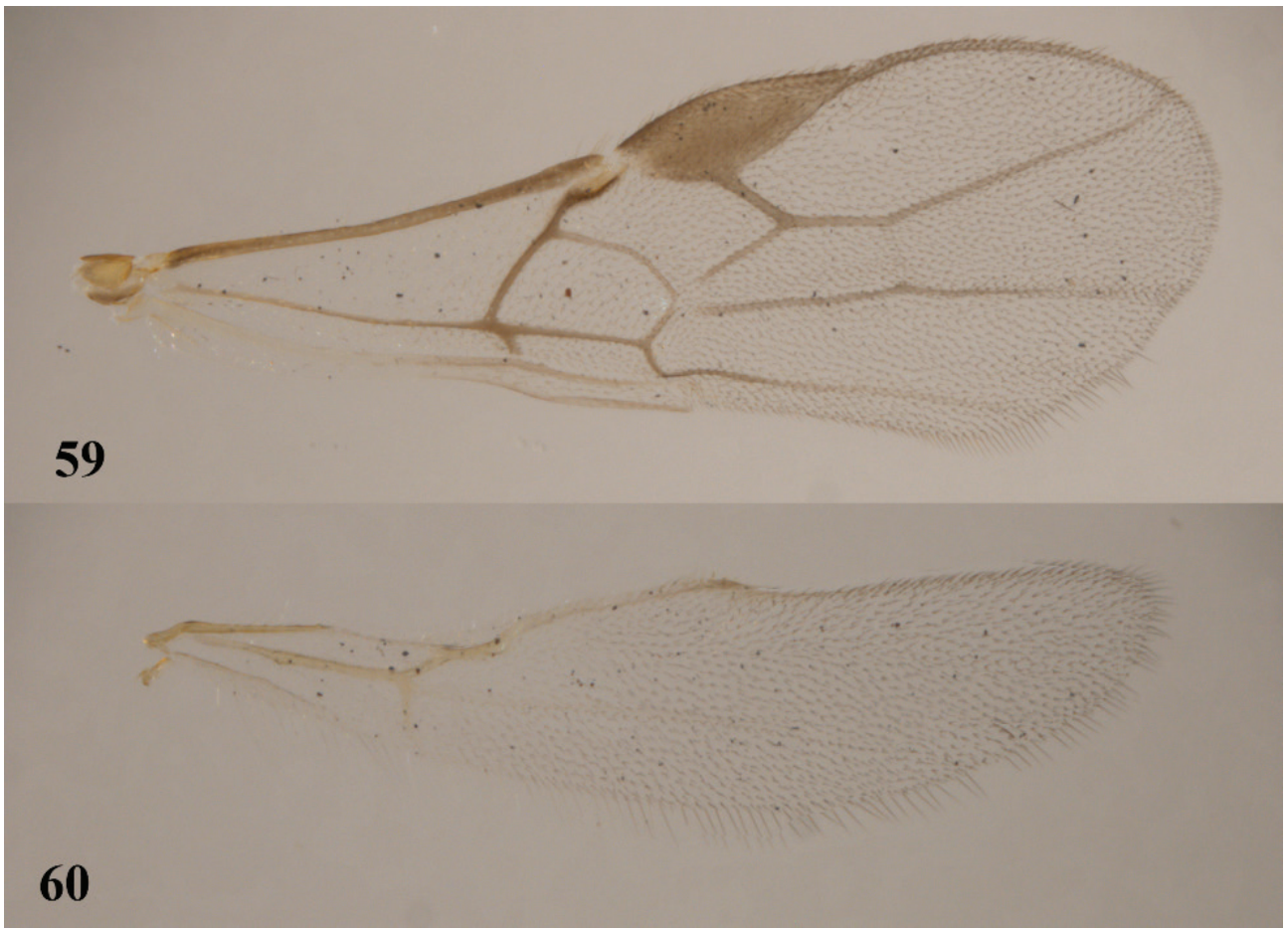
*Taxonomic summary*

*Biology.* Unknown.

*Etymology.* This species is named after our dear colleague Scott Shaw.

*Material examined.* Holotype female: **Mexico:** Jalisco, Chamela Biostation, camino Calandria, 19.4950485N-105.043786W, 45m, 28.iii.2010, sweep, selva baja-mediana, Zaldívar, Salinas-Ramos colls. (DNA voucher no. BOLD-ASDOR767; GenBank accession number HQ200972); *Paratypes*: 1 male, same data as holotype (DNA voucher no. BOLD-ASDOR768; GenBank accession number HQ200971); 1 female, Estación Chamela, camino Zarco-Chachalaca, 19.49566N-105.03931W, 30 m, 28-iii-2010, red barrido, selva baja-mediana, Cham-58, Zaldívar-Salinas-Ramos coll. (DNA voucher no. BOLD-ASDOR745; GenBank accession no. HQ200987); 1 female, Jalisco, Estación Chamela, camino a calandria, 19.50485/19.50369N -105.03786/105.03642W, 45-62m, 23-ii-2010, red barrido, selva baja caducifolia, Cham-50, Zaldívar (DNA voucher no. BOLD-ASDOR607; GenBank accession no. HQ200966); 1 female, Jalisco, Estación Chamela, camino Búho-Chachalaca, 19.49913/19.49786N -105.04217/105.0444W, 68-106m, 20-ii-2010, red de barrido, selva baja caducifolia, Cham-38, Zaldívar (DNA


**Figures 53-58.** *Allorhogas parvus*. 53, habitus of female, lateral view; 54, head, anterior view; 55, head, dorsal view; 56, head and mesosoma, lateral view; 57, mesosoma, dorsal view; 58, propodeum and metasoma, dorsolateral view.




**Figures 59-60.** *Allorhogas parvus*. 59, forewing; 60, hindwing.

voucher no. BOLD-ASDOR488; GenBank accession no. HQ200960); 1 female, Jalisco, Fundación Chamela-Cuixmala, Poza Jaguar, 19.42927N-104.97968W, 66m, 5-IX-2009, red barrido, selva baja caducifolia, Cham020, Clebsh, zaldívar coll. (DNA voucher no. BOLD-ASDOR321; GenBank accession no. HM434481).

*Molecular characterization.* A NJ phenogram showing the pairwise corrected distances for the barcoding locus among the specimens examined is given in Figure 69. Corrected genetic distances within our 7 described species of *Allorhogas* ranged from 0 to 0.4%, except for the variation found within *A. marshi*, which varied from 0 to 2.4%. We did not find any external morphological variation among the specimens assigned to the latter species and therefore decided to consider them as a single taxon until further morphological, molecular and biological studies help to clarify their taxonomic status. Genetic distances among the 15 included species of the genus on the other hand varied from 7.7 to 19.4%.

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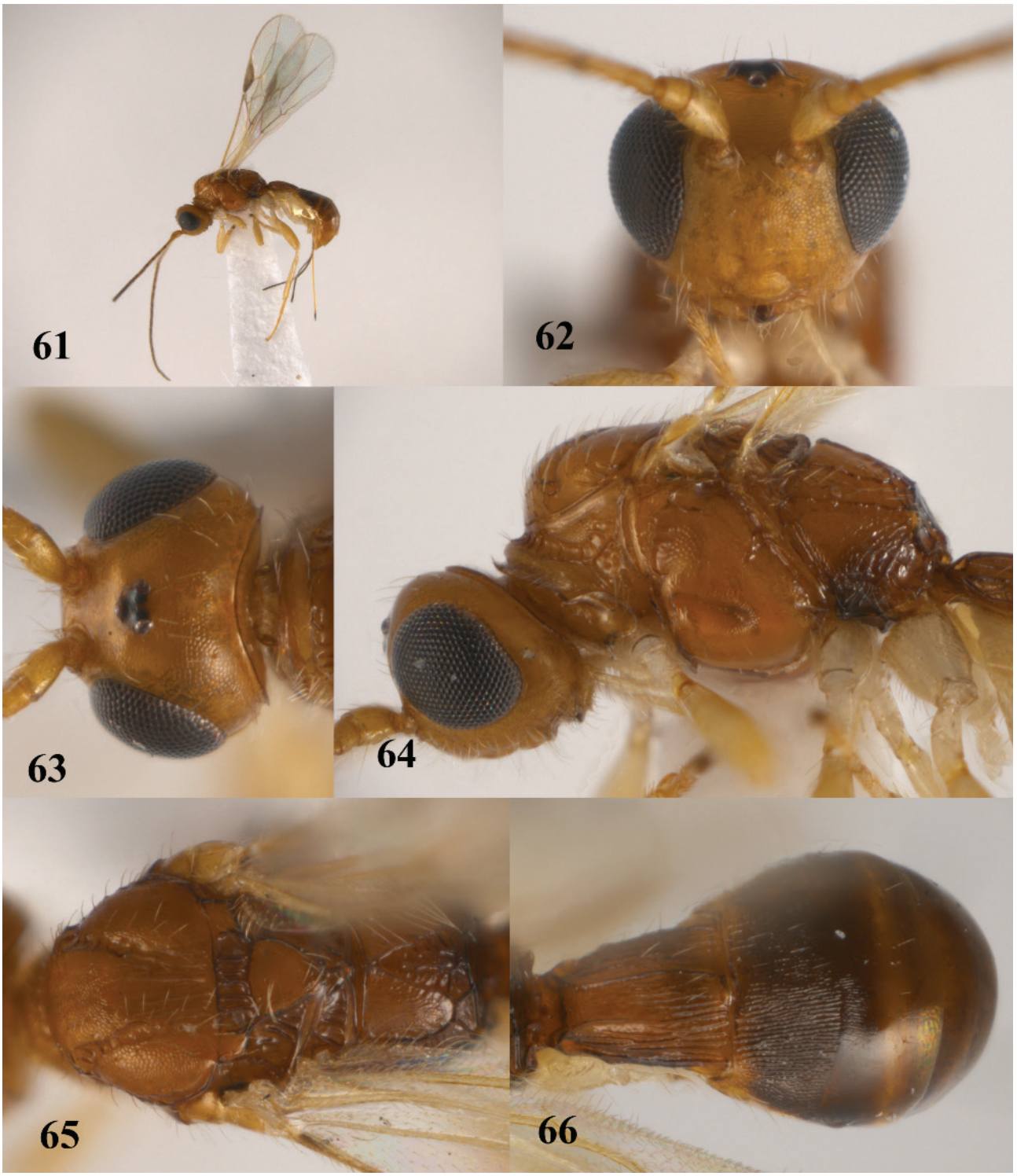


**Figures 61-66.** *Allorhogas scotti*. 61, habitus of female, lateral view; 62, head, anterior view; 63, head, dorsal view; 64, head and mesosoma, lateral view; 65, mesosoma, dorsal view; 66, metasoma, dorsal view.

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**Figures 67-68.** *Allorhogas scotti*. 67, forewing; 68, hindwing.

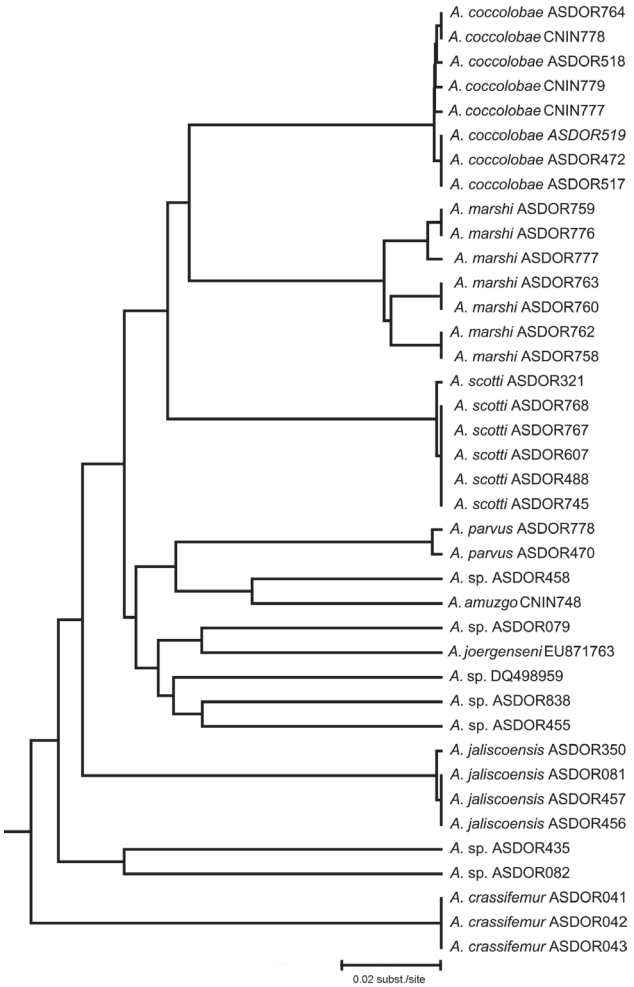


**Figure 69.** NJ phenogram illustrating the corrected genetic distances (DNA barcoding region) among specimens assigned to the 7 described and 6 undescribed Mexican species of *Allorhogas* and 2 species of the genus from other countries.

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