Russian Entomol. J. 28(2): 169–179

First record of the genus *Lamachus* Förster, 1869 (Hymenoptera: Ctenopelmatinae) from Mexico, with description of two new species

Первая находка рода *Lamachus* Förster, 1869 (Hymenoptera: Ctenopelmatinae) из Мексики с описанием двух новых видов

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KEY WORDS: Mesoleiini, Diprionidae, *Neodiprion*, Nearctic region, North America, fauna, new species, taxonomy, host, parasitoids.

КЛЮЧЕВЫЕ СЛОВА: Mesoleiini, Diprionidae, *Neodiprion*, Неарктика, Северная Америка, фауна, новый вид, систематика, хозяин, паразитоиды.

PALABRAS CLAVE. Mesoleiini, Diprionidae, *Neodiprion*, Región Neártica, Norteamérica, fauna, nuevas especies, taxonomía, hospederos, parasitoides.

ABSTRACT. Two new species of the genus *Lamachus* Förster, 1869, *L. cushmani* Khalaim et Ruíz-Cancino, **sp.n.** and *L. toluca* Khalaim et Ruíz-Cancino, **sp.n.**, are described from Central Mexico. The genus *Lamachus*, as well as the tribe Mesoleiini, is recorded from Mexico for the first time, representing a southern most record of the genus in the New World. A checklist of eleven North American species of *Lamachus*, including eight native and three introduced species, is provided. An identification keys to species of *Lamachus* occurring in Mexico is given. *Neodiprion omosus* Smith (Diprionidae) is reported as a host of *Lamachus* species for the first time.

РЕЗЮМЕ. Два новых вида рода *Lamachus* Förster, 1869, *L. cushmani* Khalaim et Ruíz-Cancino, **sp.n.** и *L. toluca* Khalaim et Ruíz-Cancino, **sp.n.**, описаны из центральной Мексики. Род *Lamachus* и триба Mesoleiini указаны для Мексики впервые, что также является самой южной находкой рода в Новом Свете. Составлен список одиннадцати североамериканских видов *Lamachus*, включающий восемь аборигенных и три интродуцированных вида. Дан определительный ключ видов *Lamachus*, обитающих в Мексике. *Neodiprion omosus* Smith (Diprionidae) впервые указан в качестве хозяина для рода *Lamachus*.

RESUMEN. Se describen dos especies nuevas del género *Lamachus* Förster de la zona centro de México, *L. cushmani* Khalaim et Ruíz-Cancino, **sp.n.** y *L. toluca* Khalaim et Ruíz-Cancino, **sp.n.** El género *Lamachus* así como la tribu Mesoleiini son reportados para México por primera vez, representando los registros más sureños del género en el Nuevo Mundo. Se elaboró una lista comentada de las especies norteamericanas de *Lamachus*, incluyendo ocho especies nativas y tres introducidas. Se proporciona una clave para la identificación de las especies de *Lamachus* que ocurren en México. Se reporta *Neodiprion omosus* Smith (Diprionidae) como hospedero de especies de *Lamachus* por primera vez.

Introduction

The genus *Lamachus* Förster, 1869 (Ctenopelmatinae) is almost exclusively Holarctic, with 20 species in

How to cite this article: Khalaim A.I., Ruíz-Cancino E., Coronado-Blanco J.M., Castañeda-Vildózola Á. 2019. First record of the genus *Lamachus* Förster, 1869 (Hymenoptera: Ctenopelmatinae) from Mexico, with description of two new species // Russian Entomol. J. Vol.28. No.2. P.169 –179. doi: 10.15298/rusentj.28.2.09

the Palaearctic and Oriental regions, and six native species in the Nearctic region [Yu et al., 2016]. It is one of 25 currently recognized genera of the tribe Mesoleiini, which is also almost exclusively Holarctic in distribution [Gauld, 1997; Yu et al., 2016]. Seventeen mesoleiine genera have native representation in North America [Carlson, 1979; Gauld, 1997], but only one, *Alexeter* Förster, 1869 occurs in Central America, being represented by two species described from Costa Rica [Gauld, 1997], and none genus of Mesoleiini was recorded hitherto from Mexico [Yu et al., 2016].

Species of *Lamachus* are common parasitoids of sawflies of the family Diprionidae, primarily the genera *Diprion* Schrank, 1802, *Gilpinia* Benson, 1939 and *Neodiprion* Rohwer, 1918, whose larvae develop on coniferous plants [Oehlke, 1966; Townes, 1970; Yu et al., 2016].

In addition to six native species of *Lamachus* occurring in North America, in the 1930s and 1940s several species were shipped from Europe (e.g. *L. coalitorius* (Thunberg, 1822) and *L. eques* (Hartig, 1838)), and Japan (*L. albopictus* Cushman, 1937), and released in Eastern Canada and Northeastern USA [Finlayson, Reeks, 1936; Finlayson, Finlayson, 1958; Carlson, 1979] for the control of the European spruce sawfly *Gilpinia hercyniae* (Hartig) and the European pine sawfly *Neodiprion sertifer* (Geoffroy), but none of these species was established there [Finlayson, Finlayson, 1958; Carlson, 1979].

The aims of this study are to describe new species of *Lamachus* reared from a new diprionid host from Mexico and provide a checklist of Nearctic species with detailed data on their distribution and hosts.

Material and Methods

This work is based on the material of *Lamachus* reared from *Neodiprion omosus* Smith, 1988 (Figs 1–5) whose larvae feed on *Pinus patula* Schiede and *P. hartwegii* Lindley (Pinaceae) at mountainous regions in Central Mexico. Late instar larvae of *N. omosus* were collected by Dr. Á. Castañeda-Vildózola from 30 trees of *P. patula* and 10 trees of *P. hartwegii* at the Experimental Field Station of the Universidad Autónoma de Estado de Morelos situated north of Toluca (19°24′33″ N, 99°41′21″ W) at elevation of about 2600 m. The sawfly species *N. omosus* was identified by Á. Castañeda-Vildózola using the guide on the family Diprionidae of Mexico [González-Gaona, Sánchez-Martínez, 2018].

The following acronyms have been used for insect collections:

ANSP — Academy of Natural Sciences of Philadelphia, Pennsylvania, USA;

BMNH — Natural History Museum, London, United Kingdom;

TAMU — Texas A&M University, College Station, Texas, USA;

UAT — Universidad Autónoma de Tamaulipas, Cd. Victoria, Tamaulipas, Mexico;

UNAM — Instituto de Biología, Universidad Nacional Autónoma de México, D.F., Mexico;

USNM — National Museum of Natural History, Washington D.C., USA;

UUZM — Uppsala University, Uppsala, Sweden;

ZISP — Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia.

Six previously known Nearctic species of *Lamachus* are known to us only from their descriptions and identification keys (see literature and remarks to the genus and species), but all clearly differ from undescribed Mexican species in their predominantly black colouration of the body, and are also well isolated geographically.

Morphological terminology generally follows that of Gauld [1991]. Photographs of insects in nature (Figs 1–7) were taken by Á. Castañeda-Vildózola. Detailed photographs of new species (Figs 819) were taken in ZISP with a Canon EOS 70D digital camera attached to an Olympus SZX10 stereomicroscope; images were combined using Helicon Focus 6.7.1 Pro software.

Results

Subfamily Ctenopelmatinae
Tribe Mesoleiini

Genus *Lamachus* Förster, 1869

= *Adexioma* Förster, 1869 [Townes, 1945: 519].

= *Bathyglyptus* Schmiedeknecht, 1913 [Townes et al., 1965: 258].

= *Torocampus* Schmiedeknecht, 1913 [Townes, 1945: 519].

= *Zaphthora* Förster, 1869 [Townes et al., 1965: 258].

Type species: *Tryphon lophyrum* Hartig, 1838 (= *Tryphon frutetorum* Hartig, 1838), included as "*lophyrorum*" (lapsus) by Thomson [1892: 1877], designated by Viereck [1914: 81] (see also Perkins, 1962: 434).

REFERENCES. Rohwer, 1915: 217–218 (two new species: *Lagarotis diprioni*, *L. virginianus*); Cushman, 1939: 400–402 (review of 6 North American species, including two new species: *Lamachus tsugae*, *L. oregon*); Townes, 1945: 519–520 (catalogue; 6 species in America north of Mexico); Townes and Townes, 1951: 334–335 (catalogue; 6 species in America north of Mexico); Burks, 1952: 81 (key to Nearctic genera of Mesoleiini), 85 (description of *Lamachus*);Townes, 1970: 118 (catalogue of genera; description of *Lamachus*); Carlson, 1979: 596–597 (catalogue; 9 species in America north of Mexico, including 3 introduced species).

Six native species of *Lamachus* occur in America north of Mexico: all are known from the USA and four from Canada. In the United States, two species (*L. angularius*, *L. tsugae*) occur in the Northwest, three species (*L. contortionis*, *L. lophyri*, *L. ruficoxalis*) in the Northeast, and one (*L. virginianus*) in the East extending southwards to Florida.

All known Nearctic species have head and mesosoma predominantly black in colour, and metasoma reddish brown to black with white and/or black markings. Below we describe two new species of *Lamachus* from Central Mexico. In one discovered species, *L. cushmani* **sp.n.**, female has a rather remarkable colouration, i.e. almost entirely orange-brown body with scarse yellow and black markings (Fig. 6). This is the first record of *Lamachus*, as

well as the tribe Mesoleiini, from Mexico, and a southern most record of the genus in the New World.

Also we report a new host species, *Neodiprion omosus* Smith, 1988, which was not previously recorded for this genus. This diprionid sawfly was described from the states of México, Michoacán and Morelos in Central Mexico, and probably also occurs in Guatemala; larvae of *N. omosus* were reported feeding on *Pinus patula* Schiede, *P. lawsonii* Roezl, *P. leiophylla* Schiede and *P. ayacahuite* Ehrenb. in Mexico, and probably on *P. maximinoi* Moore (= *tenuifolia* Benth.) in Guatemala [Smith, 1988: 231–232]. Later, Cibrián-Tovar et al. [1995: 180] provided description of *N. omosus*, its biology, host plants and distribution in the states of

Figs 1–5. *Neodiprion omosus* in nature: 1–2 — feeding larvae; 3 — cocoons; 4–5 — adult sawfly.
Рис. 1–5. *Neodiprion omosus* в природе: 1–2 — питающиеся личинки; 3 — коконы; 4–5 — взрослые пилильщики.

Hidalgo, Michoacán, Morelos, Puebla, State of Mexico and Distrito Federal in Central Mexico, and noted that this species requires control in Christmas tree plantations, watershed protection plantations and in urban areas, thought in natural forests infestation of young trees can occur without causing serious damage.

Lamachus albopictus Cushman, 1937

Lamachus albopictus Cushman, 1937: 37 [holotype female (USNM), Japan, Kagoshima-Ken, Toso, reared from *Diprion nipponicum* by R.W. Burrell; no. 52118, U.S.N.M.].

REFERENCES. Finlayson and Finlayson, 1958: 561 (shipped from Japan, released in Eastern Canada); Carlson, 1979: 596 (catalogue; introduced in Canada, New Brunswick).

DISTRIBUTION. Japan; introduced to Eastern Canada, not established.

BIOLOGY. Parasitoid of *Diprion nipponicus* Rohwer, 1910 (Diprionidae) in Japan [Cushman 1937]. Introduced to Eastern Canada for the control of the European spruce sawfly *Gilpinia hercyniae* (Hartig, 1837) [Finlayson, Finlayson, 1958].

1. *Lamachus angularius* (Davis, 1897)

Adexioma angularia Davis, 1897: 284 [holotype female (ANSP), USA, Washington].

= *Lamachus oregon* Cushman, 1939: 401 [holotype female (USNM), USA, Oregon, Sweet Home, ex cocoon of *Neodiprion tsugae*, coll. R.L. Furniss; no. 53349, U.S.N.M.].

REFERENCES. Cresson, 1928: 12 (type in ANSP); Cushman, 1939: 402 (*L. oregon* (description); host); Furniss and Dowden, 1941: 49 (host); Townes, 1945: 519 (*Lamachus* (comb.); *L. oregon* (syn.); catalogue); Townes and Townes, 1951: 334 (catalogue); Carlson, 1979: 596 (catalogue; host).

REMARKS. According to its original description [Davis, 1897], the species was described on the basis of a single female which is named in the text as "type". But in the catalogue Taxapad [Yu et al., 2016], authors list for this species a lectotype referring to the catalogue of types deposited in the ANSP by Cresson [1928]. Actually, Cresson [1928: 12] only listed the species "*Adexioma angularia*" in his catalogue, but neither designated nor mentioned lectotype for this species.

DISTRIBUTION. Northwest USA (Idaho, Oregon, Washington).

BIOLOGY. Reared from cocoons of *Neodiprion tsugae* Middleton (Diprionidae) in Oregon, USA [Cushman, 1939; Furniss & Dowden, 1941]. Reported as parasitoid of *N. scutellatus* Rohwer [Carlson, 1979].

Lamachus coalitorius (Thunberg, 1822)

Ichneumon coalitorius Thunberg, 1822: 278 [lectotype male (UUZM), Sweden; designated by Horstmann, 2004: 57].

= *Mesoleius marginatus* Brischke, 1871.

= *Mesoleius spectabilis* Holmgren, 1876.

REFERENCES. Finlayson and Finlayson, 1958: 561 (*L. marginatus*, *L. spectabilis*; shipped from Europe, released in Eastern Canada); Dowden, 1962: 14 (*L. marginatus*; released in USA, Massachusetts, New Hampshire, Vermont); Carlson, 1979: 596 (catalogue; introduced in Canada and USA); Horstmann, 2004: 57 (description; lectotype male (des.)).

DISTRIBUTION. Europe; introduced to Eastern Canada and Northeastern USA, not established.

BIOLOGY. Parasitoid of various Diprionidae in Europe [see Yu et al., 2016]. Introduced to Eastern Canada and Northeastern USA for the control of the European spruce sawfly *Gilpinia hercyniae* (Hartig) [Finlayson, Finlayson, 1958; Dowden, 1962].

2. *Lamachus contortionis* Davis, 1897

Lamachus (?) *contortionis* Davis, 1897: 284 [holotype female (ANSP), USA, District of Columbia].

= *Lagarotis diprioni* Rohwer, 1915: 217 [holotype female (USNM), USA, Virginia, Falls Church, collected and reared from *Diprion lecontei* by W. Middleton and S.A. Rohwer; no. 18521, U.S.N.M.].

REFERENCES. Rohwer, 1915: 217 (*Lagarotis diprioni*; description; host); Cresson, 1928: 14 (type in ANSP); Cushman, 1939: 400 (*Lagarotis diprioni* (syn.)); Brown, 1941: 5 (host; Canada); Townes, 1945: 519 (catalogue); Townes and Townes, 1951: 335 (catalogue); Carlson, 1979: 596 (catalogue; host).

Figs 6–7. *Lamachus cushmani* **sp.n.** in nature: 6 — female; 7 — male.

Рис. 6–7. *Lamachus cushmani* **sp.n.** в природе: 6 — самка; 7 — самец.

REMARKS. Townes [1945] in his catalogue of Nearctic Ichneumonidae reported, after Brown [1941], this species as parasitoid of *Diprion* [*Gilpinia*] *hercyniae* and *Neodiprion abietis*. Actually, Brown [1941] records *L. contortionis* as parasitoid of *Gilpinia polytoma* (sic!) and *N. abietis*, without *D.* [*Gilpinia*] *hercyniae*.

Carlson [1979] in his catalogue mentioned distribution of this species in USA from Maine south to north Florida, and west to Wisconsin and Arkansas, but with no details.

DISTRIBUTION. Canada, Northeast USA (Pennsylvania, DC, Virginia).

BIOLOGY. Parasitoid of *Diprion lecontei* (Fitch) [Rohwer, 1915], *Neodiprion abietis* (Harris) and *Gilpinia polytoma* (Hartig) in Canada [Brown, 1941]. Also reported as parasitoid of *Gilpinia hercyniae* (Hartig) [Townes, 1945; Carlson, 1979], *N. nanulus* Schedl and *N. pratti banksianae* Rohwer [Carlson, 1979].

3. *Lamachus cushmani* Khalaim et Ruíz-Cancino, **sp.n.** Figs 6–13.

MATERIAL EXAMINED. Holotype: ♀ (UAT), Mexico, Estado de Mexico (EMex), N of Toluca, El Cerrillo, Piedras Blancas, 19°24′40″ N, 99°42′02″ W, 2614 m, ex *Neodiprion omosus* on *Pinus patula*, 18–23.II.2017, coll. Á. Castañeda-Vildózola.

Paratypes. Mexico, Estado de Mexico (EMex), N of Toluca, El Cerrillo, Piedras Blancas, 19°24′40″ N, 99°42′02″ W, 2614 m, ex *N. omosus* on *P. patula*, 18–23.II.2017, coll. Á. Castañeda-Vildózola, 2 ♀♀ (UNAM, ZISP). Same data, but 11.II.2017, 1 male (UAT). Same data, but reared ex *N. omosus* on *P. patula* and *P. hartwegii*, 1.I–28.II.2018, 35 ♀♀, 35 ♂♂ (5 ♀♀, 5 ♂♂ in BMNH; 5 ♀♀, 5 ♂♂ in TAMU; 15 ♀♀, 15 ♂♂ in UAT; 5 ♀♀, 5 ♂♂ in UNAM; 5 ♀♀, 5 ♂♂ in ZISP). N of Toluca, El Cerrillo, Piedras Blancas, 19°24′32″ N, 99°41′21″ W, 2612 m, ex *N. omosus* on *P. patula*, 6–13.IX.2017, 10 ♀♀, 3 ♂♂ (8 ♀♀, 2 ♂♂ in UAT; 2 ♀♀, 1 ♂♂ in UNAM). Same data, but 27.IX.2017, 1 ♀, 1 ♂ (UAT).

COMPARISON. The new species may easily be distinguished from another Mexican species, *L. toluca* **sp.n.**, by the colour pattern of the body, yellow maxillary and labial palps, darker pterostigma, lacking ventrally epicnemial carina, smaller areolet in the fore wing, intercepted above middle nervellus (cu1&cu-a), and shorter first metasomal segment (in both sexes). *Lamachus cushmani* **sp.n.** differs from six other Nearctic species by colour pattern of female, i.e. orange-brown body with scarse yellow and black markings (Figs 6, 8–12), while in other species head and mesosoma are extensively black, metasoma black or reddish brown with white and/or black markings. The new species is also characterized by its almost entirely brownish yellow antennal flagellum (Fig. 8), propodeum with only lateral longitudinal carina more or less developed, and hind wing with nervellus (cu1&cu-a) intercepted somewhat above its middle.

DESCRIPTION. **Female** (holotype). Body length 9.3 mm. Fore wing length 8.0 mm.

Head strongly rounded behind eyes in dorsal view. Inner eye orbits slightly concave at level of bases of antennae (Fig. 9). Face and frons granulate, dull, with moderately dense very fine punctures. Vertex and gena shallowly granulate, dull to weakly shining, with very fine punctures. Flagellum distinctly tapered towards apex, with approximately 36 flagellomeres (Fig. 8). Face 2.2 times as broad (minimum distance between eyes) as long (measured from antennal insertions to supraclypeal furrow). Clypeus (Fig. 9) about 2.6 times as broad as long, clearly separated from face, convex in upper 2/3 and transverselly impressed in lower 1/3, with lower margin centrally weakly concave; clypeus smooth, with fine sparse setiferous punctures. Malar space 0.3–0.4 times as long as basal mandibular width. Mandible robust, weakly tapered, with fine but sharp punctures on very finely granulate background in basal half, longitudinally striate in apical half; teeth polished, upper tooth somewhat longer than the lower. Occipital carina fine, complete, mediodorsally weakly arcuate. Hypostomal carina complete, joining occipital carina above the base of the mandible at distance equal to approximately half basal mandibular width.

Mesosoma predominantly shallowly granulate, dull to weakly shining, with fine to moderately strong (on mesopleuron) punctures; upper posterior part of mesopleuron (below speculum) with weak oblique wrinkles; propodeum in posterior half virtually impunctate, granulate, partly with very weak irregular wrinkles. Pronotum without epomia. Notaulus rather sharp, not especially deep, with anterior end well above lateral margin of mesoscutum. Scutellum with lateral longitudinal carinae present only at its extreme base. Epicnemial carina present laterally and completely absent ventrally, its upper ends extending somewhat above the level of the lower corner of pronotum, not reaching front margin of mesopleuron. Speculum smooth. Submetapleural carina complete, strong. Propodeum without carinae except for lateral longitudinal carinae which are more or less developed from posterior end of propodeum to level of propodeal spiracle. Pleural carina present, distinct. Propodeal spiracle round, separated from pleural carina by 0.5–1.0 times diameter of spiracle. Tarsal claws simple. Fore wing with areolet oblique, subtriangular, stalked above, receiving vein 2m-cu slightly before its distal corner. Hind wing with nervellus (cu1&cu-a) intercepted somewhat above its middle.

Metasomal tergites shallowly granulate, weakly polished, with very fine punctures. First tergite in dorsal view 1.6 times as long as posteriorly broad, with spiracles near its centre; lateromedian longitudinal carinae present only at extreme base of tergite; lateral longitudinal carinae present as sharp ridges at posterior end of tergite; glymmae superficial. Ovipositor short, projecting beyond subgenital plate, shorter than apical depth of metasoma (Fig. 10).

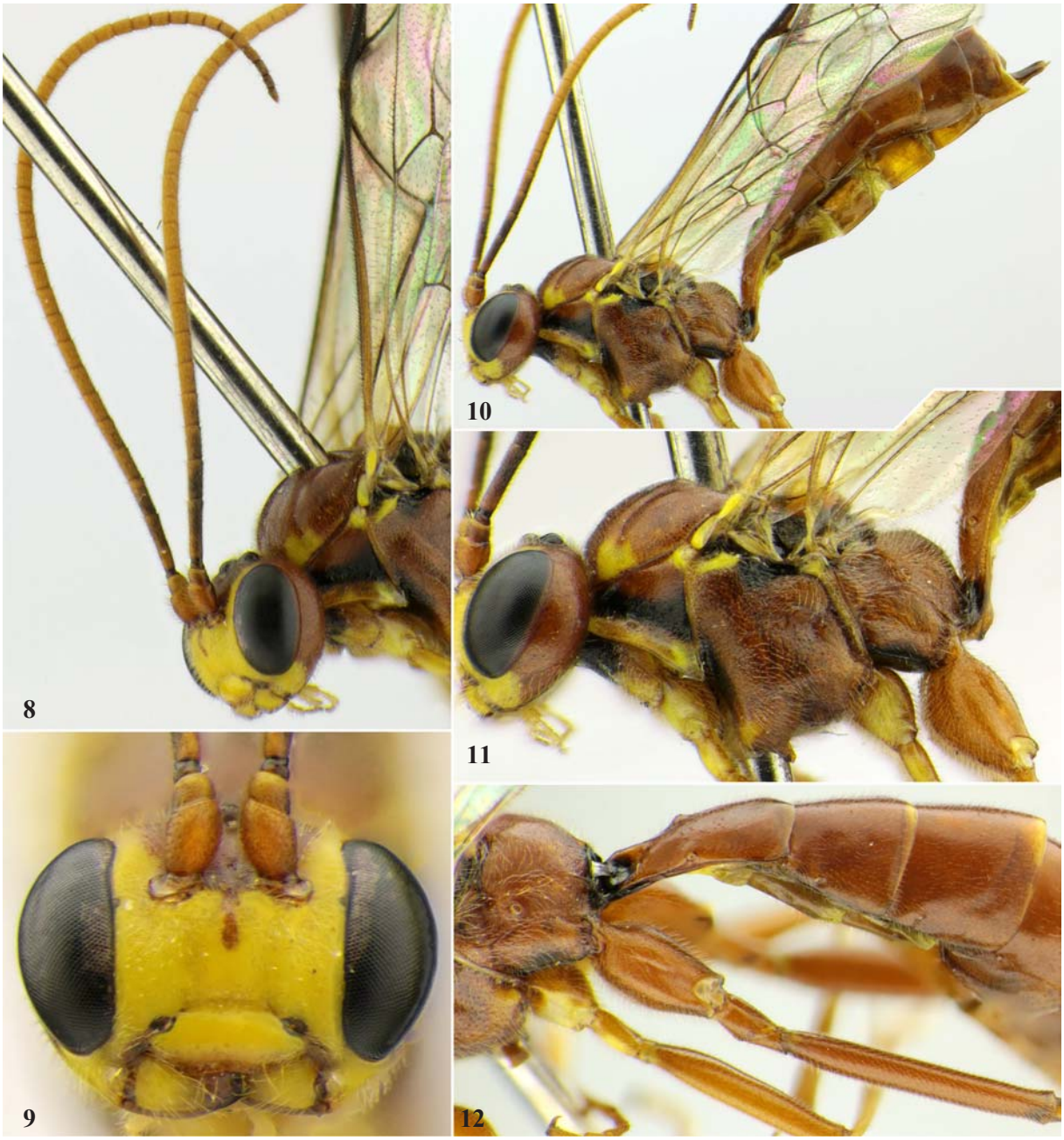
Colour pattern. Head predominantly orange-brown; clypeus, face, frontal orbits and lower part of gena yellow; face with median longitudinal brown stripe in upper part (Fig. 9). Mandible yellow with blackish teeth. Maxillary and labial palps yellow. Antenna with scape yellow-brown, yellowish ventrally; pedicel yellow-brown with fuscous markings; flagellum brownish yellow with two basal flagellomeres black or extensively marked with dark brown or black (sometimes flagellomere 3 also darkened dorsally), and 2 to 7 distal flagellomeres darkened with brown.

Mesosoma orange-brown with black and yellow markings. Prosternum (in ventral view, clearly discernible between propleuron and fore coxae) black; propleuron yellow in lower 0.8 and black in upper 0.2; pronotum with broad yellow band on front margin, broad black band centrally (parallel to front margin), and orange-brown in upper posterior part; with faint yellow mark on dorsolateral margin and posterior corner yellow. Mesoscutum orange-brown, with a pair of large yellow marks anterolaterally; prescutellar concavity blackish. Scutellum and postscutellum yellow on median concavities, laterally orange-brown. Mesopleuron orange-brown with subtegular ridge and ventro-lateral mark (on path of epicnemial carina) yellow, and with slight yellowish marks in front upper part and near posterior lower end; mesepimeron pale yellow; impression in upper part of mesopleuron between subtegular ridge and upper end of mesepimeron (and also narrowly above subtegular ridge) black (Fig. 11). Metapleuron orange-brown, black-marked in lower part. Propodeum almost entirely orange-brown, with extreme hind margin black.

Wings almost hyaline, very weakly infumate. Pterostigma brownish black to black. Fore and mid legs with coxae and trochanters yellow, sometimes reddish basally and/or dorsally; femora, tibiae and tarsi reddish yellow, femora and tibiae more or less yellowish on front and/or dorsal sides, tibiae sometimes also yellowish basally. Hind leg with coxa, trochanters and femur reddish brown, femur darkened at extreme apical end; tibia yellow in basal 0.5–0.6 and black in apical 0.4–0.5, sometimes also darkened at extreme base; tarsus black basally to dark reddish brown apically.

Metasoma orange-brown, ventrally paler; first tergite black at base; tergites 3 and 4 (and less distinctly tergites 2, 5 and 6) mediodorsally narrowly yellow-marked on hind margin. Ovipositor sheath black, brownish at extreme apex.

Male. Morphologically similar to female; flagellum without tyloids; first tergite in dorsal view about 1.9 times as long as posteriorly broad. Colour pattern generally resembles that of female but with orange-brown colour of body and legs replaced by black (Fig. 13); hind tibia with narrow black band at base; metasoma with first tergite dark reddish brown to black, following tergites predominantly reddish brown, and distal end of metasoma blackish. Antenna black, sometimes scape and pedicel yellow ventrally.



Figs 8–12. *Lamachus cushmani* **sp.n.**, female: 8 — head with antennae, lateral view; 9 — head, front view; 10 — body, lateral view; 11 — head, mesosoma and base of metasoma, lateral view; 12 — propodeum and base of metasoma, dorsolateral view.

Рис. 8–12. *Lamachus cushmani* **sp.n.**, самка: 8 — голова с антеннами, сбоку; 9 — голова, спереди; 10 — тело, сбоку; 11 — голова, мезосома и основание метасомы, сбоку; 12 — проподеум и основание метасомы, сверху и сбоку.

Fig. 13. *Lamachus cushmani* **sp.n.**, male, habitus, lateral view.
Рис. 13. *Lamachus cushmani* **sp.n.**, самец, габитус, сбоку.

REMARKS. Colouration of alive females in nature (Fig. 6) differs from those of dry specimens, mounted after their preservation in alcohol (Fig. 10), i.e. dry females have body darker and more orange-brown rather than red.

The species is characterized by the considerable sexual dimorphism (see Figs 6–7). Females are with body almost entirely orange-brown, while in males head and mesosoma are predominantly black with yellow markings, and colouration of the metasoma varying from reddish brown to almost black, with ventral part yellowish or pale brown.

ETYMOLOGY. The species name is dedicated to Robert Asa Cushman (1880–1957), an American entomologist, expert in Hymenoptera, in recognition of his contribution to the study of North American Ichneumonidae.

DISTRIBUTION. Central Mexico (EMex).

BIOLOGY. The adult parasitoids (Figs 6–7) were reared from cocoons of *Neodiprion omosus* Smith (Fig. 3) whose larvae develop on *Pinus patula* Schiede and *P. hartwegii* Lindley (Pinaceae) (Figs 1–2) in Central Mexico.

Lamachus eques (Hartig, 1838)

Tryphon eques Hartig, 1838: 272 (type lost [Horstmann, 1986: 331]).

REFERENCES. Finlayson and Reeks, 1936: 164 (*Torocampus*; shipped from Europe, released in Canada (Quebec)); Finlayson and Finlayson, 1958: 561 (shipped from Europe, released in Eastern Canada); Dowden, 1962: 14 (released in USA, Vermont), 28 (released in USA, New Jersey); Carlson, 1979: 597 (catalogue; introduced in Canada and USA).

DISTRIBUTION. Europe; introduced to Canada and Northeastern USA, not established.

BIOLOGY. Parasitoid of various Diprionidae in Europe [see Yu et al., 2016]. Introduced to Eastern Canada and Northeastern USA for the control of the European spruce sawfly *Gilpinia hercyniae* (Hartig) [Finlayson, Finlayson, 1958; Dowden, 1962] and *Neodiprion sertifer* (Geoffroy) [Dowden, 1962].

4. *Lamachus lophyri* (Ashmead, 1898)

Neoeryma lophyri Ashmead, 1898: 169 [♂♀ (USNM), USA, New Hampshire, Canobie Lake, "Bred from saw-fly larva, *Lophyrus* sp."].

REFERENCES. Dimmock, 1898: 153 (host); Cushman, 1939: 400 (*Lamachus*, comb.); Brown, 1941: 5 (host; Canada); Townes, 1945: 520 (catalogue); Townes and Townes, 1951: 335 (catalogue); Coppel, 1954 (Canada, Ontario; host); Underwood, 1967 (Canada, New Brunswick; host); Price and Tripp, 1972 (Canada, Quebec; host); Carlson, 1979: 597 (catalogue).

REMARKS. Carlson [1979] in his catalogue also mentioned distribution of this species in Maine, Massachusetts and Wisconsin (USA), but with no details.

DISTRIBUTION. East Canada (New Brunswick, Ontario, Quebec), Northeast USA (New Hampshire).

BIOLOGY. Parasitoid of *Neodiprion abbottii* (Leach) [Dimmock, 1898], *N. abietis* (Harris) [Brown, 1941], *N. nanulus* Schedl [Coppel, 1954; Underwood, 1967] and *N. swainei* Middleton [Price, Tripp, 1972]. Also mentioned as parasitoid of several *Neodiprion* species in the catalogue by Carlson [1979], but with no details.

5. *Lamachus ruficoxalis* (Cushman, 1919)

Labrossyta ruficoxalis Cushman, 1919: 118 (holotype female (USNM), Canada, Manitoba, Aweme, reared from spruce sawfly, 31 May or 1 June 1915, coll. N. Criddle; no. 22202, U.S.N.M.).

REFERENCES. Cushman, 1939: 520 (*Lamachus*, comb.; *L. ruficornis*, sic!); Brown, 1941: 5 (host; Canada); Townes, 1945: 520 (catalogue); Townes and Townes, 1951: 335 (catalogue); Carlson, 1979: 597 (catalogue).

DISTRIBUTION. Canada (Manitoba, Ontario), Northeast USA (Maine).

BIOLOGY. Parasitoid of *Neodiprion abietis* (Harris) in Canada [Brown, 1941].

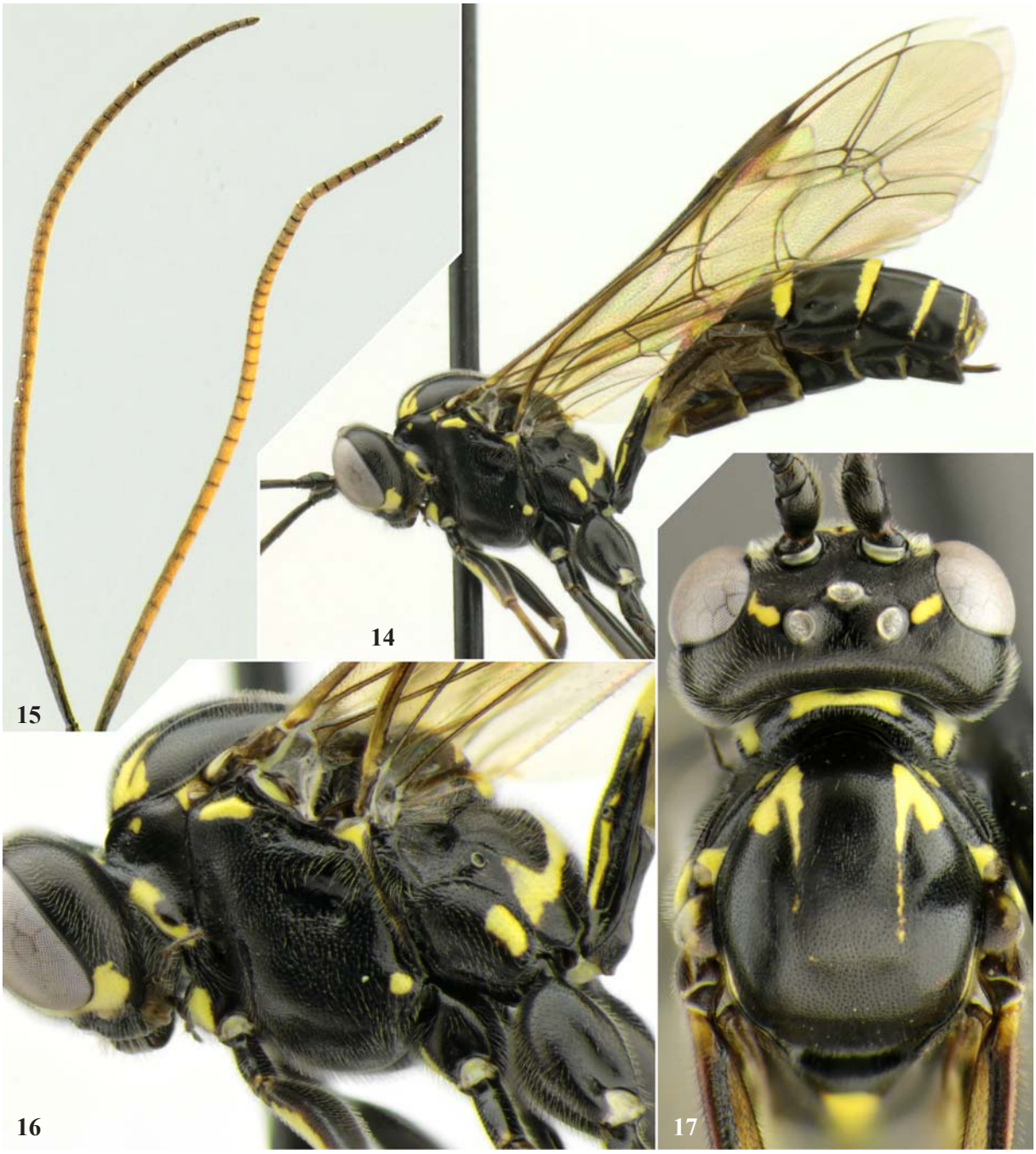
6. *Lamachus toluca* Khalaim et Ruíz-Cancino, **sp.n.**
Figs 14–19.

MATERIAL EXAMINED. Holotype: ♀ (UAT), Mexico, Estado de Mexico (EMex), N of Toluca, El Cerrillo, Piedras Blancas, 19°24′32″ N, 99°41′21″ W, 2612 m, ex *Neodiprion omosus* Smith on *Pinus patula*, 27.IX.2017, coll. Á. Castañeda-Vildózola.

Paratypes. Same data as holotype, 2 ♀♀, 3 ♂♂ (1 ♀, 1 ♂ in TAMU; 1 ♂ in UAT; 1 ♀, 1 ♂ in ZISP).

COMPARISON. *Lamachus toluca* **sp.n.** differs from another Mexican species, *L. cushmani* **sp.n.**, by its predominantly black body with some pale markings, black maxillary and labial palps, paler pterostigma, developed ventrally epicnemial carina, larger areolet in the fore wing, intercepted in posterior 0.45–0.5 nervellus (cu1&cu-a), and slender first metasomal segment (in both sexes). See also the key below.

DESCRIPTION. **Female** (holotype). Body length 9.3 mm. Fore wing length 8.6 mm.



Figs 14–17. *Lamachus toluca* **sp.n.**, female, holotype: 14 — body and wings, lateral view; 15 — antennae, lateral view; 16 — head and mesosoma, lateral view; 17 — head and mesoscutum, dorsal view.

Рис. 14–17. *Lamachus toluca* **sp.n.**, самка, голотип: 14 — тело и крылья, сбоку; 15 — антенны, сбоку; 16 — голова и мезосома, сбоку; 17 — голова и мезоскутум, сверху.

Head strongly rounded behind eyes in dorsal view (Fig. 17). Inner eye orbits slightly concave at level of bases of antennae (Fig. 18). Face and frons finely granulate, dull, with moderately dense, fine but distinct punctures. Vertex and gena shallowly granulate, dull to weakly shining, with very fine punctures. Flagellum distinctly tapered towards apex, with approximately 39 flagellomeres (Fig. 15). Face almost twice as broad (minimum distance between eyes) as long (measured from antennal insertions to supraclypeal furrow). Clypeus (Fig. 18) about 2.9 times as broad as long, separated from face by distinct furrow, convex in upper 2/3 and transversally impressed in lower 1/3, with lower margin centrally distinctly concave; clypeus smooth, with very small, inconspicuous punctures. Malar space 0.25–0.3 times as long as basal mandibular width. Mandible robust, weakly tapered, with fine but sharp punctures on very finely granulate background in basal half, longitudinally striate in apical half; teeth polished, upper tooth somewhat longer than the lower (Fig. 18). Occipital carina fine, complete. Hypostomal carina complete, joining occipital carina above the base of the mandible at distance equal to 0.6 basal mandibular width.

Mesosoma shallowly granulate, subpolished, dull to weakly shining, with fine and dense punctures; upper posterior part of mesopleuron (below speculum) sometimes with weak oblique wrinkles; punctures on propodeum mostly indistinct. Pronotum without epomia. Notaulus sharp, moderately deep, with anterior end well above lateral margin of mesoscutum. Scutellum with lateral longitudinal carinae present only at its extreme base. Epicnemial carina present laterally and ventrally, its upper ends extending somewhat above the level of the lower corner of pronotum, not reaching front margin of mesopleuron. Speculum smooth. Submetapleural carina complete, strong. Propodeum without carinae except for lateral longitudinal carinae which are represented by short strong ridges in posterior part of propodeum, and vestiges of lateral longitudinal carinae above spiracles. Pleural carina present. Propodeal spiracle round, separated from pleural carina by 0.6–1.0 times diameter of spiracle. Tarsal claws simple. Fore wing with areolet oblique, subtriangular, with short stalk above, receiving vein 2m-cu at its distal corner. Hind wing with nervellus (cu1&cu-a) intercepted in centre or somewhat below centre.

Metasomal tergites shallowly granulate, weakly polished, with very fine punctures. First tergite in dorsal view 2.6 times as long as posteriorly broad, with spiracles near its centre; lateromedian longitudinal carinae present only at extreme base of tergite; lateral longitudinal carinae completely absent; glymmae superficial. Ovipositor short, projecting beyond subgenital plate, shorter than apical depth of metasoma (Fig. 19).

Colour pattern. Head black; lower part of gena and a pair of marks extending from top of eyes towards lateral ocelli (Fig. 17) yellow; face yellow-marked as in Fig. 18; clypeus yellow centrally and pale brown to blackish peripherally (Fig. 18). Mandible with basal half and teeth black, remaining brownish (Fig. 18). Maxillary and labial palps brownish black. Antenna with scape and pedicel black; flagellum fuscous dorsally and brownish ventrally, with base and distal apex more or less completely black (Fig. 15).

Mesosoma black with yellow markings on pronotum, mesoscutum, scutellum, postscutellum, mesopleuron, metapleuron and propodeum (Figs 16–17).

Wings almost hyaline, very weakly infumate. Pterostigma brown, sometimes peripherally blackish. Legs black; fore and mid coxae yellow-marked on front and ventral sides; fore and mid femora and tibiae yellow on front sides; hind tibia with broad yellow subbasal band (as in Fig. 13).

Metasoma black, with posterior transverse yellow band on each tergite (pale bands broader on basal tergites and thin on posterior tergites); first tergite also yellow-marked laterally (Fig. 19). Ovipositor sheath black, brownish at extreme apex.

Male. Similar to female in structure and colour pattern with slight differences. Flagellum without tyloids. First tergite, in dorsal view, almost 2.9 times as long as posteriorly broad. Distal part of metasoma not or weakly compressed laterally, more or less cylindrical. Face yellow, with one median (indistinct in one paratype) and a pair sublateral longitudinal stripes in upper half. Pale markings on the mesosoma are weaker than in female (possibly due to storage in alcohol). Otherwise similar to female.

REMARKS. Unlike *L. cushmani* **sp.n.** which is characterized by considerable sexual dimorphism, females and males of *L. toluca* **sp.n.** are very similar, with minor differences in structure and colouration.

ETYMOLOGY. The species is named after the type locality, volcan Toluca (noun).

DISTRIBUTION. Central Mexico (EMex).

BIOLOGY. The adult parasitoids were reared from cocoons of *Neodiprion omosus* Smith (Fig. 3) whose larvae develop on *Pinus patula* Schiede and *P. hartwegii* Lindley (Pinaceae) (Figs 1–2) in Central Mexico.

Figs 18–19. *Lamachus toluca* **sp.n.**, female, holotype: 18 — head, front view; 19 — propodeum and metasoma, lateral view.
Рис. 18–19. *Lamachus toluca* **sp.n.**, самка, голотип: 18 — голова, спереди; 19 — проподеум и метасома, сбоку.

7. *Lamachus tsugae* Cushman, 1939

Lamachus tsugae Cushman, 1939: 401 [holotype female (USNM), USA, Oregon, Sweet Home, ex cocoon of *Neodiprion tsugae*, coll. R.L. Furniss; no. 53348, U.S.N.M.].

REFERENCES. Furniss and Dowden, 1941: 49 (host); Townes, 1945: 520 (catalogue); Townes and Townes, 1951: 335 (catalogue); Carlson, 1979: 597 (catalogue).

DISTRIBUTION. Canada (Ontario, Quebec), Northwest USA (Oregon).

BIOLOGY. Reared from cocoons of *Neodiprion tsugae* Middleton in Oregon, USA [Cushman, 1939; Furniss, Dowden, 1941].

8. *Lamachus virginianus* (Rohwer, 1915)

Lagarotis virginianus Rohwer, 1915: 218 [holotype male (USNM), USA, Virginia, Falls Church, 16 May 1913, collected and reared from *Diprion lecontei* by S.A. Rohwer; no. 18522, U.S.N.M.].

REFERENCES. Cushman, 1939: 400 (*Lamachus*, comb.); Townes, 1945: 520 (catalogue); Townes and Townes, 1951: 335 (catalogue).

DISTRIBUTION. East USA (Georgia, Virginia).

BIOLOGY. Primary parasitoid of *Diprion lecontei* (Fitch) [Rohwer, 1915].

Key to species of *Lamachus* occurring in Mexico

1. Maxillary and labial palps yellow, sometimes distal palpomere infuscate. Pterostigma brownish black to black. Epicnemial carina present laterally and absent ventrally. First tergite in dorsal view 1.6–1.9 times as long as posteriorly broad. Metasomal tergites uniformly orange, reddish brown or black, without transverse pale bands. Female with body almost entirely orange-brown with scarse yellow and black markings (Figs 6, 8–11). Male with propodeum completely black .... *L. cushmani* **sp.n.**
— Maxillary and labial palps black. Pterostigma brown, sometimes peripherally blackish. Epicnemial carina present laterally and ventrally. First tergite slender, in dorsal view 2.6–2.8 times as long as posteriorly broad. Metasomal tergites black with posterior pale bands dorsally (Fig. 19). Female with body predominantly black with yellow markings (Figs 12–18). Male with propodeum extensively white-marked posteriorly (as in Fig. 16). ..... *L. toluca* **sp.n.**

ACKNOWLEDGEMENTS. We are thankful to Dmitri R. Kasparyan (ZISP) for his remarks on the taxonomy of the genus *Lamachus*. This work was supported by the PRODEP project "Taxonomical and biological studies of pests and natural enemies in Mexico". The work of the senior author was also supported by the Russian Foundation for Basic Research (project no. 19-04-00027) and performed in the framework of the Russian State Research Project no. 01201351189.

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