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Nomenclatural changes and two new species in the leafhopper genus *Usanus* DeLong (Hemiptera: Cicadellidae) with notes on conservation status

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Abstract

The Mexican leafhopper genus and species *Devolana hemicycla* DeLong, 1967 **syn. nov.**, is recognized as a junior synonym of *Usanus stonei* DeLong, 1947. Three previously described species, *U. tuxcacuensis* (Pinedo-Escatel & Aguilar-Pérez, 2019) **comb. nov.**, *U. youajla* (Pinedo-Escatel, 2019) **comb. nov.**, and *U. xajxayakamej* (Pinedo-Escatel, 2019) **comb. nov.** are transferred to *Usanus*. Two new species, *U. xochipalensis* **sp. nov.** and *U. igualaensis* **sp. nov.** from Guerrero, are described and illustrated. An updated key to all known species of *Usanus* is provided.

Key words: Mexico, Auchenorrhyncha, Deltocephalinae, taxonomy, native species, Athysanini, *Devolana*

Resumen

La chicharrita mexicana del género y especie *Devolana hemicycla* DeLong, 1967 **syn. nov.** es reconocida como una júnior sinonimia de *Usanus stonei* DeLong, 1947. Tres especies previamente descritas, *U. tuxcacuensis* (Pinedo-Escatel & Aguilar-Pérez, 2019) **comb. nov.**, *U. youajla* (Pinedo-Escatel, 2019) **comb. nov.**, y *U. xajxayakamej* (Pinedo-Escatel, 2019) **comb. nov.**, son transferidas a *Usanus*. Dos nuevas especies, *U. xochipalensis* **sp. nov.** y *U. igualaensis* **sp. nov.** de Guerrero, son descritas e ilustradas. Se provee una clave actualizada para todas las especies conocidas del género *Usanus*.

Palabras clave: México, Auchenorrhyncha, Deltocephalinae, taxonomía, especies nativas, Athysanini, *Devolana*

Introduction

The poorly defined deltocephaline leafhopper tribe Athysanini (Deltocephalinae) is the largest and most widespread tribe within the insect family Cicadellidae (Hemiptera: Auchenorrhyncha). It comprises >1,123 described species worldwide currently placed in 262 genera, of which 126 occur in the New World (Zahniser & Dietrich 2013, Oman *et al*. 1990). Many genera currently placed in Athysanini appear to be endemic to southern Mexico and most of these were described by D. M. DeLong and his students in various publications based on collections made in the 1930s and 40s.

Usanus was described by DeLong (1947) based on *U. stonei* from three localities in Mexico: Iguala (Guerrero), Mexico City and "Acapulco Road". The precise locations of DeLong's collections, particularly the latter two, are unknown. Mexico City is a very large metropolitan area and the road from Mexico City to Acapulco extends ~407 km. Instead, *Devolana* DeLong (1967) was described based on type species *D. hemicycla* DeLong, 1967 from two localities in Guerrero state, Iguala and Zincauro. Subsequently, three species were added to *Devolana*: *D. tuxcacuensis* Pinedo-Escatel & Aguilar-Pérez, 2019 from Jalisco, *D. youajla* Pinedo-Escatel, 2019 and *D. xajxayakamej* Pinedo-Escatel, 2019 from Guerrero. Based on DeLong's collections, Iguala was the most species-rich region of

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Mexico for endemic leafhoppers in the mid–20th century, yielding more than 20 apparently endemic Athysanini genera. However, this region of Mexico remains poorly sampled.

Study of DeLong's type material at Ohio State University revealed that *Devolana* is a junior synonym of *Usanus* and that the type series of *Usanus stonei* comprises an additional new species. Study of additional specimens collected more recently revealed another new species of *Usanus*. Below, these two new species are described and illustrated. Some additional nomenclatural changes are also proposed.

Material and methods

Descriptive terminology herein mainly follows Dietrich (2005), Rakitov (1998) and Kramer (1950). Abdomens of male specimens were cleared with hot 10% KOH, rinsed with water three times then mixed with alcohol at different concentrations and stored in glycerine. Digital images of body and genitalia were obtained using a Big Kahuna Imaging system and QImaging Micropublisher 3.3 digital camera, respectively. Series of photographs were stacked using Zerene Stacker® and Combine ZP software, drawings were vectorized using GIMP®. Exact label data are cited for the type material by a single slash bar (/) which separates different labels.

The following abbreviations are used for the institutions cited here:

INHS	Illinois Natural History Survey, Champaign, Illinois, US
CAJAPE	Colección de Auchenorrhyncha de J. Adilson Pinedo Escatel, Mexico
OSUC	C. A. Triplehorn Insect Collection, Columbus, Ohio, US
TAMU	Texas A&M University, College Station, Texas, US

Taxomony

Family Cicadellidae Latreille, 1825

Subfamily Deltocephalinae Dallas, 1870

Tribe Athysanini Van Duzee, 1892

Genus *Usanus* DeLong

Usanus DeLong, 1947: 110
Devolana DeLong, 1967: 22, **syn. nov.**

Morphology (modified from Aguilar-Pérez *et al*. 2019). Moderately robust leafhoppers. Dorsal color yellowish with symmetrical black spots on crown and two large, round submedial spots on pronotum. Crown short and rounded in dorsal view. Transition from crown to face poorly delimited, rounded, shagreen. Ocellocular area parallel and wide. Ocelli slightly below anterior margin of head, distance to adjacent eye approximately 2x ocellar diameter. Frontoclypeus wide, lateral frontal sutures reaching ocelli, fine seta present laterad of frontal suture. Anteclypeus widened apically, apex curved slightly surpassing natural curve of gena. Lorum width subequal to that of anteclypeus near base. Gena incised laterad. Pronotum weakly produced with lateral margin carinate. Scutellum broad. Forewing macropterous, translucent with veins dark brown, yellowish opaque pigmentation sometimes present near base of clavus, appendix restricted to anal margin, apex rounded, apical and anteapical cells large, claval veins free and without crossveins (fused for short distance in *D. tuxcacuensis*). Front femur AM1 near mid-height of apex, long; IC with long and thin setae; row AV with small setae. Front tibia dorsal macrosetal formula (AD+PD) 1 + 4, PV with small stout setae. Hind femur macrosetal formula 2 + 2 + 1. Pygofer broad, short, square or pointed, without processes, mixed long and short stout macrosetae near posterior margin, basolateral cleft present. Tenth segment small, broad, well sclerotized laterally with weak dorsal sclerotized band. Valve and subgenital plates free, articulated with pygofer. Valve rounded and slightly produced. Subgenital plate triangular, uniseriate laterad with

robust and fine setae. Connective Y -shaped, stem short, arms curved mesad and usually nearly touching each other anteriorly. Style slender, basal and preapical lobe weakly developed with setae on posterad margin, apophysis short and curved mesad, apex truncate. Aedeagus curved dorsad, shaft with one, two or three pairs of apical processes, with or without lateral flanges; base without processes; dorsal apodeme well developed; gonoduct sclerotized or not with gonopore subapical on ventral surface.

Distribution. Endemic to Mexico, (Fig. 1): Jalisco (Sierra de Tuxcacuesco) and Guerrero (Iguala de la Independencia, Zincauro and Xochipala)

Notes. Examination of the holotypes of the type species of *Usanus* and *Devolana* revealed these two taxa to be nearly identical in external structure, coloration and male genitalia. The holotype of *U. stonei* has the apical lobes of the aedeagal flanges produced and slightly more pointed than in the holotype of *D. hemicycla* but we consider these taxa to be conspecific. Thus, *Devolana* is here recognized as a junior synonynm of *Usanus* and all species previously placed in *Devolana* are here transferred to *Usanus* as indicated below.

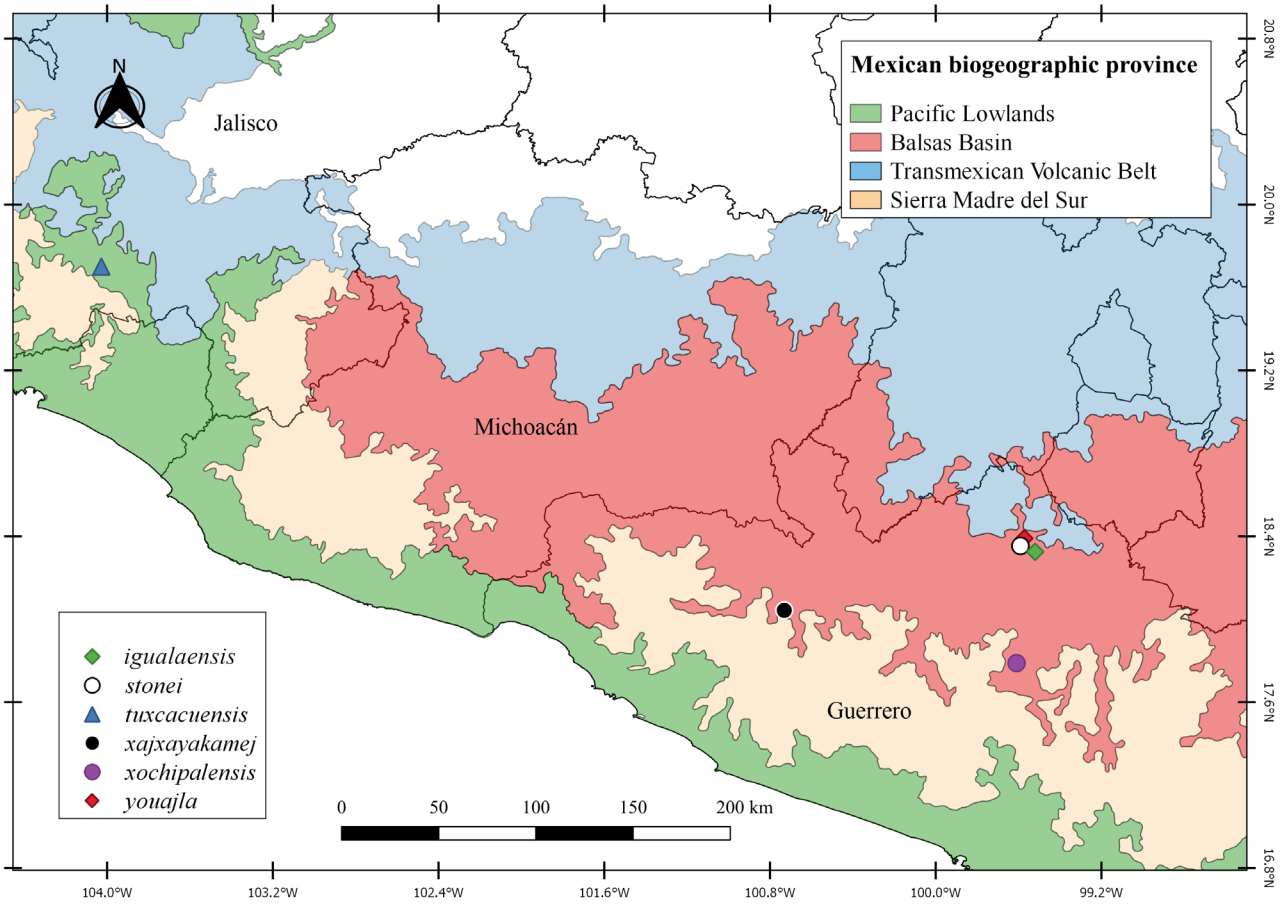


FIGURE 1. Distribution of the endemic Athysanini leafhopper genus *Usanus* DeLong in Mexico.

Species of the leafhopper genus *Usanus*

Usanus stonei DeLong, 1947: 110
Usanus tuxcacuensis (Pinedo-Escatel & Aguilar-Pérez, 2019): 2042, **comb. nov.**
Usanus youajla (Pinedo-Escatel, 2019): 2046, **comb. nov.**
Usanus xajxayakamej (Pinedo-Escatel, 2019): 2050, **comb. nov.**
Usanus igualaensis **sp. nov.**
Usanus xochipalensis **sp. nov.**

Key to species of the leafhopper genus *Usanus*

1	Aedeagus with one pair of long processes arising near midlength; apex dorsally serrated	***xochipalensis* sp. nov.**
-	Aedeagus with 2-3 pairs of processes arising at or near apex; apex smooth	2
2(1)	Aedeagus with two pairs of apical processes	3
-	Aedeagus with three pairs of apical processes	5
3(2)	Forewing with yellowish opaque pigment on clavus, claval veins confluent for short distance; aedeagus without lateral flanges, apical processes directed anterodorsad	***tuxcacuensis***
-	Forewing uniformly translucent, claval veins separate; aedeagus with lateral flanges, apical processes directed dorsad and anteromesad	4
4(3)	Apical pair of aedeagal processes extended distad from base of rounded preapical flanges; preapical pair sinuate	***igualaensis* sp. nov.**
-	Apical pair of aedeagal processes curved anteromesad from flange apices; preapical pair straight	***youajla***
5(2)	Aedeagal flanges broadened apically in ventral view	***hemicycla***
-	Aedeagal flanges tapered apically in ventral view	***xajxayakamej***

***Usanus igualaensis* sp. nov.**
(Figs. 2, 4, 6, 8, 11, 13–15, 18, 22–24)

Type material. Holotype ♂: MEXICO: Guerrero, Iguala, X–25–1941 / D. M. DeLong Collection / D. M. DeLong Coll. / (OSUC 356668).

Description. Overall color light brown with symmetrical black spots dorsally. Crown mostly brown-yellowish with pair of triangular black spots submedially on anterior margin (Figs. 2 and 4) and pair of small black spots next to eyes, ecdysial line black and slender, width less than ocelli diameter. Ocellocular area black basad. Frontoclypeus mostly black with some arcuate transverse lines and midline yellowish. Anteclypeus upper half yellowish with lower half black. Gena light yellowish with small black spots below eyes. Lorum yellowish medially black laterally (Fig. 6). Pronotum light–brown with some irregular gold spots on anterior margin and large pair of black spots centrally. Forewing translucent with brown veins (Fig. 2). Exposed part of mesonotum orange (Fig. 2). Venter and legs with black and brown patches (Fig. 4).

Male genitalia. Pygofer lobe rounded with macrosetae scattered over distal third, 1.4x longer than wide (Fig. 11). Segment X well–sclerotized laterad, conical, base wider than apex (Fig. 13). Valve weakly projected posterad with rounded margin, 2x wider than long. Plate extended to pygofer apex, without macrosetae, digitate (Fig. 14). Style very broad basally with preapical lobe weakly developed, apophysis short, straight, not expanded, apex rounded and blunt (Fig. 18). Connective, stem apex truncate, arms only slightly separated anteriorly. Aedeagus slender, curved dorsad, with two pairs of apical processes, apical pair directed dorsad with apices curved anterad, preapical pair sinuous directed basad; lateral flanges directed anterodorsad with apices rounded (Figs. 15, 22–24).

Female genitalia. Unknown.

Immature stages. Unknown.

Type locality. Iguala de la independencia, Guerrero (Mexico), Figs. 1 and 8.

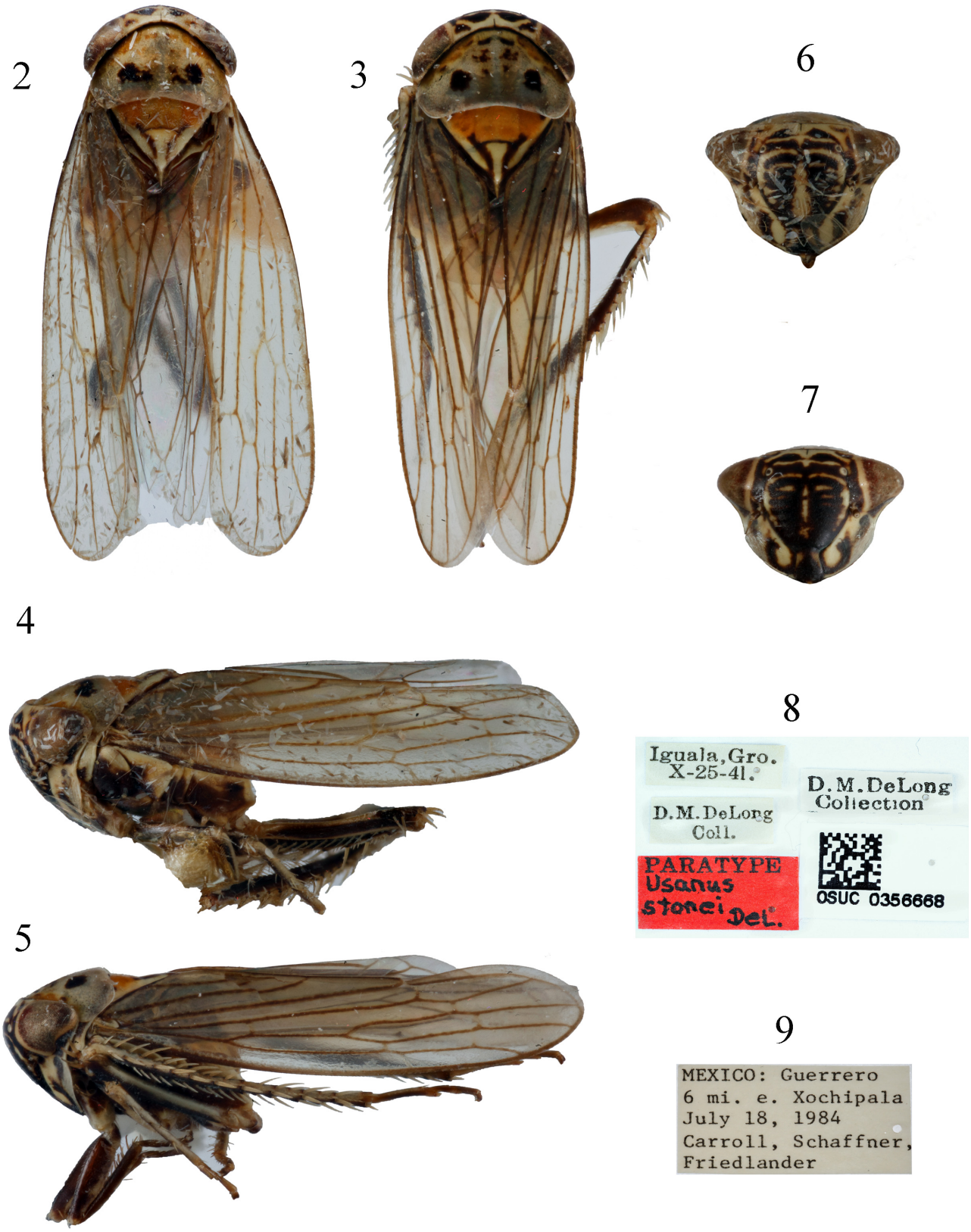
Seasonality. Adults of this species are present in October.

Etymology. The species epithet refers to the type locality.

Measurements. Body length, male 5.69 mm and female unknown; head width 1.86 mm; crown length 0.16 mm; crown width 1.01 mm; eye length 0.21 mm; eye width 0.64 mm; width between ocelli 0.66 mm; ocellocular area length 0.31 mm; ocellocular area width 0.14 mm; frontoclypeus length 0.82 mm; frontoclypeus median width 0.84 mm; frontoclypeus apex width 0.32 mm; anteclypeus length 0.29 mm; anteclypeus width 0.24 mm; lorum length 0.32 mm; lorum width 0.2 mm; pronotum length 0.73 mm; pronotum width 1.66 mm; scutellum length 0.91 mm; scutellum width 1.16 mm; forewing length 3.89 mm.

Note. The holotype was labeled as a paratype of *U. stonei* by DeLong but was not dissected (Fig. 8).

Remarks. This species is similar in external morphology to *U. youajla*, but *U. igualaensis* differs in having the aedeagus with slender distal processes arising at the base of a separate pair of rounded anterolateral flanges (Figs. 22 and 24).



FIGURES 2–9. Leafhopper aspect. (2, 4, 6, 8) *Usanus igualaensis* **sp. nov.**; (3, 5, 7, 9) *Usanus xochipalensis* **sp. nov.**; 2–3 dorsal view; 4–5 lateral view; 6–7 anterior view; 8–9 labels.

***Usanus xochipalensis* sp. nov.**
(Figs. 3, 5, 7, 9-10, 12, 16–17, 19–21, 25–26)

Type material. Holotype ♂: MEXICO: Guerrero, 6 mi. E. Xochipala, July–19–1941, Carroll, Schaffner, Friedlander Colls (TAMU)

Description. Dorsal color brownish with symmetrical black spots, venter mostly black (Figs. 3 and 5). Crown with broad pair of black spots near anterior margin and smaller pair near eyes, ecdysial line black and broad, wider than ocelli diameter. Ocellocular area black. Frontoclypeus black with thin yellowish arcuate lines next to lateral suture and midline. Anteclypeus black with yellowish spots near base. Gena dark yellowish with large black spots below eyes, stramineous distally. Lorum yellowish, suture black through length (Fig. 7). Pronotum dark–brown with gold spots on anterior margin below eyes, some irregular and regular large pair of black spots centrally. Exposed part of mesonotum orange (Fig. 3). Forewing translucent with intense dark brown veins (Fig. 3). Venter and legs mostly black (Fig. 5).

Male genitalia. Pygofer lobe triangular, strongly sclerotized dorsally, macrosetae scattered over distal third, 1.2x longer than wide (Fig. 10). Segment X well sclerotized laterally and dorsally (Fig. 12). Valve rounded and projected posterad, 1.3x wider than long. Plate slightly shorter than pygofer length, triangular with uniseriate macrosetae laterally. Style base relatively slender, preapical lobe reduced, apophysis short, curved, not expanded with apex rounded and blunt (Fig. 19). Connective, steam apex emarginate (Fig. 20). Aedeagus curved dorsad, with two pairs of processes, one at midlength of shaft directed basad, second broad and directed dorsad, lateral flanges relatively short and broadly rounded, apex serrate anteriorly in lateral view (Figs. 16–17, 21, and 25–26).

Female genitalia. Unknown.

Immature stages. Unknown.

Type locality. Xochipala, Guerrero (Mexico), Figs. 1 and 9.

Seasonality. This species occurs in July.

Etymology. The species epithet refers to the type locality.

Measurements. Body length, male 5.79 mm, female unknown; head width 1.87 mm; crown length 0.18 mm; crown width 1.04 mm; eye length 0.20 mm; eye width 0.64 mm; width between ocelli 0.65 mm; ocellocular area length 0.3 mm; ocellocular area width 0.13 mm; frontoclypeus length 0.83 mm; frontoclypeus median width 0.83 mm; frontoclypeus apex width 0.32 mm; anteclypeus length 0.29 mm; anteclypeus width 0.23 mm; lorum length 0.31 mm; lorum width 0.23 mm; pronotum length 0.78 mm; pronotum width 1.68 mm; scutellum length 0.92 mm; scutellum width 1.17 mm; forewing length 3.91 mm.

Remarks. This species resembles other *Usanus* spp. in external morphology but differs in having a pair of processes arising at the midlength of the aedeagal shaft and in having the apex of the shaft serrate (Figs. 16 and 25).

***Usanus stonei* DeLong, 1947**

Usanus stonei DeLong, 1947: 110
Devolana hemicycla DeLong, 1967: 23, **comb.** et **syn. nov.**

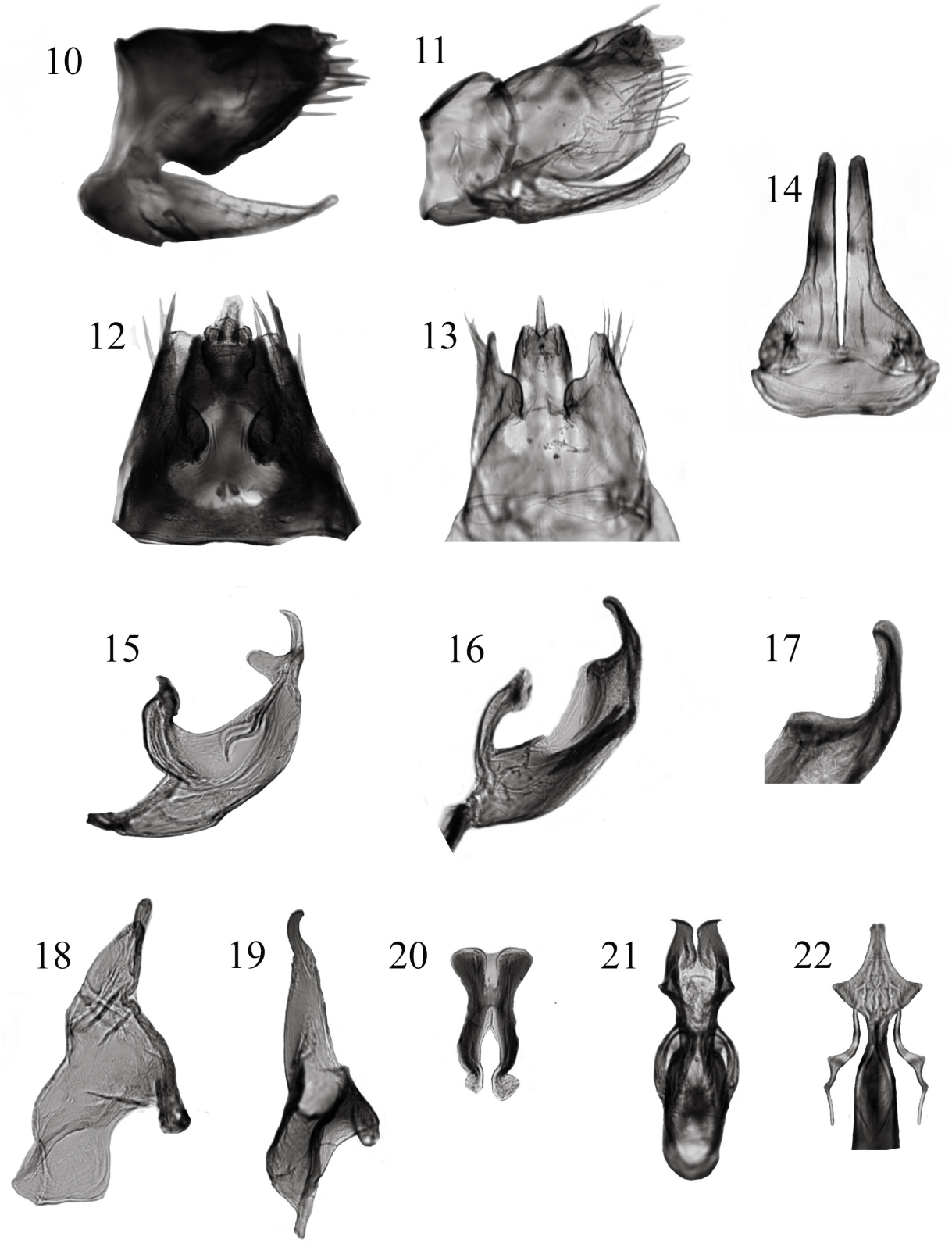
Type material examined. Holotype ♂: labeled as "*Devolana hemicycla*", MEXICO: Guerrero, Iguala, X–25–1941 / DeLong, Good, Caldwell and Plummer Colls. / E–103 / D. M. DeLong Collection / (OSUC 0209432); Holotype ♂: labeled as "*Usanus stonei*", MEXICO: Guerrero, Iguala, X–22–1941 / D. M. DeLong Collection, DeLong, Good, Caldwell and Plummer Colls. / (OSUC 169297); Paratype ♂: labeled as "*Usanus stonei*", MEXICO: Guerrero, Iguala, X–25–1941 / D. M. DeLong Collection / D. M. DeLong Coll. / (OSUC 356667).

***Usanus tuxcacuensis* (Pinedo-Escatel & Aguilar-Pérez, 2019), comb. nov.**

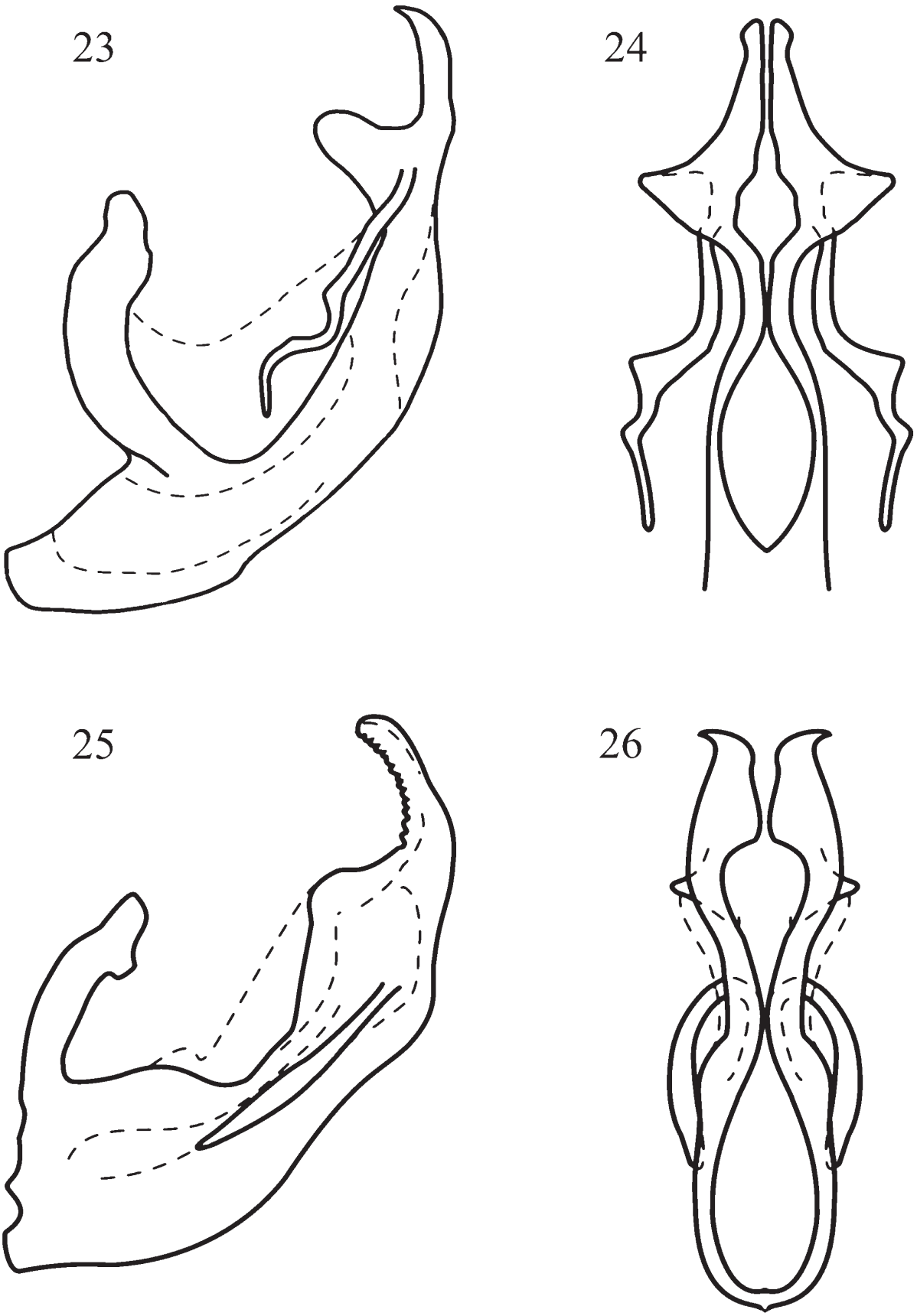
Devolana tuxcacuensis Pinedo-Escatel & Aguilar-Pérez, 2019: 2042

Type material examined. Holotype ♂: MEXICO: Jalisco, 13km ESE Tuxcacuesco 900 m, 19°40'6"N 104°1'53"W, 13–Oct–2001, S. H. McKamey *et al*. Colls., fogging 1 E–T (INHS); Paratype ♂: MEXICO: Jalisco, Región Si-

erra de Amula, Municipio Tuxcacuesco, Sierra de Tuxcacuesco a 5.5 km del pueblo Tuxcacuesco, 19°42’02.1”N 104°01’41.6” W, 864 m, 08 de septiembre de 2018, Vegetación BTC. J. A. Pinedo-Escatel Col. Trampa de Luz [MEXJAL88] (INHS).



FIGURES 10–22. Male genital capsule morphology. (10, 12, 16–17, 19–21) *Usanus xochipalensis* **sp. nov.**; (11, 13–15, 18, 22) *Usanus igualaensis* **sp. nov.**; 10–11 pygofer, lateral view; 12–13 pygofer, dorsal view; 14 valve and subgenital plates, ventral view; 15–16 anterior view; 17 apex of aedeagus, lateral view; 18–19, right style, ventral view; 20 connective, ventral view; 21–22 aedeagus, ventral view.



FIGURES 23–26. Aedeagal morphology. 23–24 *Usanus igualaensis* **sp. nov.**; 25–26 *Usanus xochipalensis* **sp. nov.**; 23, 25 lateral view; 24, 26 ventral view.

Usanus youajla (Pinedo-Escatel, 2019), comb. nov.

Devolana youajla Pinedo-Escatel, 2019: 2046

Type material examined. Holotype ♂: labeled as "*Devolana youajla*", MEXICO: Guerrero, Iguala, IX–11–1939 / D. M. DeLong Coll. / DeLong Collection / (OSUC 356605); Paratype 2 ♂: MEXICO: Guerrero, Iguala, IX–11–1939 / D. M. DeLong Coll. / DeLong Collection / (OSUC 356606 and OSUC 356607); Paratype 2 ♂: labeled as "*Usanus stonei*", MEXICO: Guerrero, Iguala, X–25–1941 / D. M. DeLong Collection / D. M. DeLong Coll / (OSUC 356669 and OSUC 356670).

Note. Two paratypes of *U. stonei*, misidentified by DeLong, are included in the type series of this species based on features of the male terminalia.

Usanus xajxayakamej (Pinedo-Escatel, 2019), comb. nov.

Devolana xajxayakamej Pinedo-Escatel, 2019: 2050

Type material examined. Holotype ♂: MEXICO: Guerrero, Zincauro, IX–2–1930 / J. Parra Coll. / D. M. DeLong Collection. / (OSUC 356604).

Conservation status

Species of *Usanus* inhabit the Pacific Lowland (1 spp.) and the Balsas Basin (5 spp.) biogeographic provinces of Mexico and despite extensive recent collecting are, so far, recorded from a very limited area. Because the extent of occurrence (EOO) and area of occupancy (AOO) appear to be limited and the known populations are small and considerably threatened by deforestation, intensive livestock grazing, agricultural expansion, and human settlements, these species should be further evaluated for possible inclusion on the IUCN Red List (IUCN 2012). The dry tropical forest habitats in which these species occur (Aguilar-Pérez *et al*. 2019) are among the most threatened habitats in the world (DryFlor 2016). Table 1 summarizes known locality data to complement the IUCN criteria and facilitate further evaluation of the conservation status of these species. Further study of these and other poorly studied and highly endemic insect taxa is needed to improve understanding of healthy forest and biodiversity hotspots and specific areas of endemism in the Mexican dry tropical forest. New data provided here may help inform decisionmaking for future conservation projects to protect leafhopper habitats currently threatened by modern human activities.

TABLE 1. Summary of IUCN criteria for *Usanus* species based on records from the 1940s to 2018

***Usanus* spp.**	**Localities**	**State**	**MBP**	**Status**	**EOO**	**AOO**	**Ind.**
stonei	Iguala	Guerrero	BB	EN	30.6 km^2	8.1 km^2	3
tuxcacuensis	Sierra de Tuxcacuesco	Jalisco	PL*	EN	23.2 km^2	9.4 km^2	2
youajla	Iguala	Guerrero	BB	EN	30.6 km^2	8.1 km^2	5
xajxayakamej	Zincauro	Guerrero	BB*	EN	7.5 km^2	3.1 km^2	1
igualaensis	Iguala	Guerrero	BB	EN	20.6 km^2	8.1 km^2	1
xochipalensis	Xochipala	Guerrero	BB*	EN	18 km^2	4.9 km^2	1

MBP—Mexican biogeographic province
BB—Balsas Basin
PL—Pacific Lowland
EN—endangered
EOO—extent of occurrence
AOO—area of occupancy
*—in transition to any other Mexican biogeographic province

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