



**UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO**

**POSGRADO EN CIENCIAS BIOLÓGICAS**

**INSTITUTO DE BIOLOGÍA**

**SISTEMÁTICA**

**SISTEMÁTICA DEL GÉNERO *CENOPHENGUS* LECONTE, 1881 (COLEOPTERA:**

**PHENGODIDAE: MASTINOCERINAE)**

**TESIS**

**QUE PARA OPTAR POR EL GRADO DE:**

**DOCTORA EN CIENCIAS**

**PRESENTA:**

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CIUDAD UNIVERSITARIA, CD. MX., ABRIL, 2021



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COORDINACIÓN DEL POSGRADO EN CIENCIAS BIOLÓGICAS  
INSTITUTO DE BIOLOGÍA  
OFICIO CPCB/336/2021  
ASUNTO: Oficio de Jurado

**M. en C. Ivonne Ramírez Wence**  
**Directora General de Administración Escolar, UNAM**  
**Presente**

Me permito informar a usted que en la reunión ordinaria del Subcomité de Biología Experimental y Biomedicina del Posgrado en Ciencias Biológicas, celebrada el día **1° de marzo de 2021** se aprobó el siguiente jurado para el examen de grado de **DOCTORA EN CIENCIAS** de la estudiante **VEGA BADILLO VIRIDIANA** con número de cuenta **515015469** con la tesis titulada **“Sistemática del género *Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae: Mastinocerinae)”**, realizada bajo la dirección del **DR. SANTIAGO ZARAGOZA CABALLERO**, quedando integrado de la siguiente manera:

Presidente: DR. JULIAN BUENO VILLEGAS  
Vocal: DR. FRANCISCO ARMENDARIZ TOLEDANO  
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Vocal: DRA IVONNE JANETH GARZÓN ORDUÑA  
Secretario: DR. JUAN JOSÉ MORRONE LUPI

Sin otro particular, me es grato enviarle un cordial saludo.

**ATENTAMENTE**  
**“POR MI RAZA HABLARÁ EL ESPÍRITU”**  
Cd. Universitaria, Cd. Mx., a 22 de abril de 2021

**COORDINADOR DEL PROGRAMA**



**DR. ADOLFO GERARDO NAVARRO SIGÜENZA**



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## **AGRADECIMIENTOS**

Al posgrado en Ciencias Biológicas de la UNAM, por las facilitaciones académicas y administrativas para mi formación académica.

Al CONACyT por la beca de manutención otorgada durante mis estudios de doctorado.

A la Universidad Nacional Autónoma de México, por el apoyo recibido a través de Programa de Apoyos a Estudios de Posgrado (PAEP).

A mi tutor principal Dr. Santiago Zaragoza Caballero por el apoyo y confianza durante mi doctorado.

A los miembros de mi comité tutor:

A los Dres. Helga Ochoterena Booth y Juan José Morrone Lupi por su guía y por sus valiosas observaciones al desarrollo de este proyecto.

## **AGRADECIMIENTOS A TÍTULO PERSONAL**

A la Universidad Nacional Autónoma de México, por permitirme crecer.

Al Dr. Santiago Zaragoza Caballero, por el apoyo brindado para la realización de este trabajo, por sus comentarios tan valiosos y porque siempre se muestra con ese entusiasmo que es tan característico del él.

A los miembros del Jurado: Dr. Julian Bueno Villegas, Dr. Fernando Álvarez Padilla, Dra. Ivonne Janeth Garzón Orduña, Dr. Francisco Armendariz Toledano y al Juan José Morrone Lupi por la revisión y sus valiosos comentarios que ayudaron a mejorar este trabajo.

A la Dra. Paulina Cifuentes Ruiz y Dr. Martín Leonel Zurita García por sus valiosos comentarios que mejoraron este trabajo.

A la M. en C. Cristina Mayorga por las facilidades otorgadas en la Colección Nacional de Insectos.

A la Biól. Susana Guzmán Gómez responsable del Laboratorio de Microscopía y Fotografía de la Biodiversidad (II) por su asesoría en la obtención de las fotografías.

A la M. en C. Berenit Mendoza por su asistencia en el Laboratorio de Microscopía electrónica, IBUNAM.

Al Posgrado en Ciencias Biológicas de la UNAM, en particular a Rocío González auxiliar de posgrado en el Instituto de Biología y al Dr. Armando Rodríguez

Gracias a Mireya, Paulina, Edwin, Martín, Sara y Geovanni, que siempre me han apoyado, de todo corazón les agradezco su amistad.

Gracias a mis viejos Rodolfo, Maggi y Yess por estar presentes, los quiero.

## **Dedicatoria**

A mis padres por todo su amor, paciencia y apoyo en cada uno de mis pasos.

A mis hermanos por su amor y confianza en todo momento.

A Uriel, mi compañero de vida.



Los cronopios vinieron furtivamente, esos objetos verdes y húmedos.

Rodeaban al fama y lo compadecían, diciéndole así:

—Cronopio cronopio cronopio.

Y el fama comprendía, y su soledad era menos amarga.

Julio Cortázar

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## RESUMEN

Dentro de la familia Phengodidae se encuentra el género *Cenophengus*, propuesto por LeConte en 1881, a partir de entonces se le han asignado 23 especies. LeConte tomó en cuenta caracteres como la forma de los palpos maxilares, el tamaño de las antenas y la forma de los segmentos abdominales (vii y viii), consideró también la forma del protórax, distinguido por ser un poco más largo que ancho. Posteriormente, Wittmer (1976) añadió algunos caracteres a la descripción de *Cenophengus* (mandíbulas simples, palpos maxilares con cuatro palpómeros, palpos labiales con dos palpómeros, dos fosas tentoriales claramente separadas y gula con dos suturas) para poder ser claramente diferenciado del resto de los géneros. Los análisis filogenéticos de la familia Phengodidae han colocado al género *Cenophengus* dentro sus topologías en diferentes posiciones: como grupo hermano de Mastinocerinae y Phengodinae o dentro de la subfamilia Mastinocerinae. Sin embargo, en dichos análisis se han incluido pocas especies de *Cenophengus*, por lo que la variación morfológica interespecífica del género no ha sido analizada bajo un contexto filogenético. El objetivo de este estudio es inferir las relaciones filogenéticas de las especies del género *Cenophengus*, poniendo a prueba la monofilia del género, lo que permitirá proponer una hipótesis filogenética que permita integrar un contexto filogenético actualizado en la taxonomía de las especies de este género. En este trabajo se presenta un análisis filogenético que incluye una muestra representativa de *Cenophengus*, en el cual se analizaron 26 de las 27 especies previamente descritas, así como dos posibles nuevas especies. Como resultado del análisis filogenético realizado en el presente estudio, la composición actual de *Cenophengus* corresponde a un grupo monofilético. Las especies analizadas se agrupan en un clado soportado por las siguientes sinapomorfías: la forma sinuosa de la sutura gular, la distancia entre las suturas gulares en la parte media ampliamente separadas y la forma de los lóbulos laterales. Consistente con la filogenia

obtenida, se realizó un tratamiento taxonómico que incluyó todas las especies, dando como entre otros resultados el primer registro de *Cenophengus* en Belice y en Honduras. Asimismo se proponen cuatro especies nuevas (*C. gardunoi*, *C. saasil*, *C. tsiik* y *C. zuritai*) y una nueva sinonimia (*C. guerrerensis*, Zaragoza-Caballero, 1991= *C. major* Wittmer, 1976) dentro de *Cenophengus*, quedando 30 especies válidas en el género.

## ABSTRACT

The genus *Cenophengus* proposed by LeConte in 1881, belongs to the family Phengodidae, and 23 species have been assigned to it. LeConte took into account characters such as the shape of the maxillary palps, the size of the antennae and the shape of the abdominal segments (vii and viii), he also considered the shape of the prothorax, distinguished by being slightly longer than wide. Later Wittmer in 1976 added some characters to the description of *Cenophengus* (simple mandibles, maxillary palps with four palpomeres, labial palps with two palpomeres, two clearly separated tentorial pits and gula with two sutures) in order to be clearly differentiated from the rest of the genera. Phylogenetic analyses of the family Phengodidae have placed the genus *Cenophengus* within their topologies in different positions: as sister group to Mastinocerinae and Phengodinae or within the subfamily Mastinocerinae. However, few *Cenophengus* species have been included in such analyses, so that interspecific morphological variation in the genus has not been analyzed under a phylogenetic context. The aim of this study is to infer the phylogenetic relationships of the species of the genus *Cenophengus*, testing the monophyly of the genus, which will allow us to propose a phylogenetic hypothesis that will allow the integration of an updated phylogenetic context in the taxonomy of the species of this genus. In this work we present a phylogenetic analysis that includes a representative sample of *Cenophengus*, in which 26 of the 27 previously described species were analyzed, as well as two possible new species. As a result of the phylogenetic analysis made in the present study, the current composition of *Cenophengus* corresponds to a monophyletic group. The analyzed species are grouped into a clade supported by the following synapomorphies: the sinuous shape of the gular suture, the distance between the gular sutures in the widely separated middle part and the shape of the lateral lobes. Consistent with the phylogeny obtained, a taxonomic treatment was performed that included all species, resulting in the first

record of *Cenophengus* in Belize and Honduras. Four new species (*C. gardunoi*, *C. saasil*, *C. tsiik* and *C. zuritai*) and a new synonymy (*C. guerrerensis*, Zaragoza-Caballero, 1991= *C. major* Wittmer, 1976) were proposed within *Cenophengus*, leaving 30 valid species in the genus.

## 1.- INTRODUCCIÓN GENERAL

### 1.1 Historia taxonómica

La familia Phengodidae LeConte, 1861 comprende 38 géneros y 290 especies distribuidas en el continente Americano, desde el sur de Canadá hasta el norte de Chile-Argentina (Costa y Zaragoza-Caballero, 2010), que tradicionalmente se ha clasificado en tres subfamilias: Phengodinae LeConte, 1861; Mastinocerinae LeConte, 1881; y Penicillophorinae Paulus, 1975 (Constantin, 2014, 2016; Roza et al., 2017, 2018, 2019; Vega-Badillo y Zaragoza-Caballero, 2019; Roza y Mermudes, 2020; Vega-Badillo et al., 2020). Recientemente Kundrata et al. (2019), mediante un análisis filogenético, consideran que Cydistinae Paulus, 1972, forma parte de la subfamilia Phengodidae. Cydistinae consta de dos géneros distribuidos en Asia Menor: *Cydistus* Bourgeois, 1908, que incluye seis especies, y *Microcydistus* (Kundrata et al., 2019), con una especie. Los escarabajos de esta familia son depredadores; las larvas y las hembras son vermiformes, algunas especies viven entre la hojarasca, debajo de cortezas o en el humus, las hembras son neoténicas, es decir, permanecen con apariencia de larva en su etapa reproductiva. Los machos adultos son alados, en general tienen ojos grandes y antenas muy ornamentadas, frecuentemente plumosas y tienen un periodo de vida muy corto (Zaragoza-Caballero y Pérez- Hernández, 2014).

Dentro de Mastinocerinae se encuentra el género *Cenophengus*, propuesto por LeConte en 1881 con base en la descripción de dos ejemplares encontrados en California, Estados Unidos. A partir de entonces se han asignado 23 especies para este taxón.

Las especies de este género se distinguen por tener un cuerpo aplanado dorso-ventralmente; cabeza corta, frente normalmente vertical; antenas con 12 antenómeros, con ramas antenales de longitud y forma variable que se originan en la base del cuarto hasta el decimoprimer antenómero; mandíbulas falcadas, simples y sin dientes; palpos maxilares de

cuatro palpómeros, el apical más ancho y largo que el precedente; palpos labiales de dos palpómeros (Fig.1); tentorio con dos fosas ampliamente separadas; gula con dos suturas; élitros de longitud variable; alas membranosas con la vena radial y la mediana posterior siempre presentes (Fig. 2), célula radial de ordinario cerrada, y el resto de la venación variable; tarsos y uñas simples, sin dientes; abdomen con ocho segmentos; edeago alargado, con los lóbulos laterales anchos, cubriendo casi totalmente al lóbulo medio de forma casi cilíndrica y con la parte ventral excavada para alojar al saco interno, que presenta forma de cinta, éste se origina en el ápice del lóbulo medio y alcanza dos veces la longitud del mismo (Fig. 3). Las hembras de las especies del género *Cenophengus* no han sido descritas debido a que no han sido recolectadas. Su distribución abarca desde el sur de Estados Unidos hasta el norte de Argentina. En México se han citado 16 especies (Cuadro 1) (Zaragoza-Caballero, 2008).

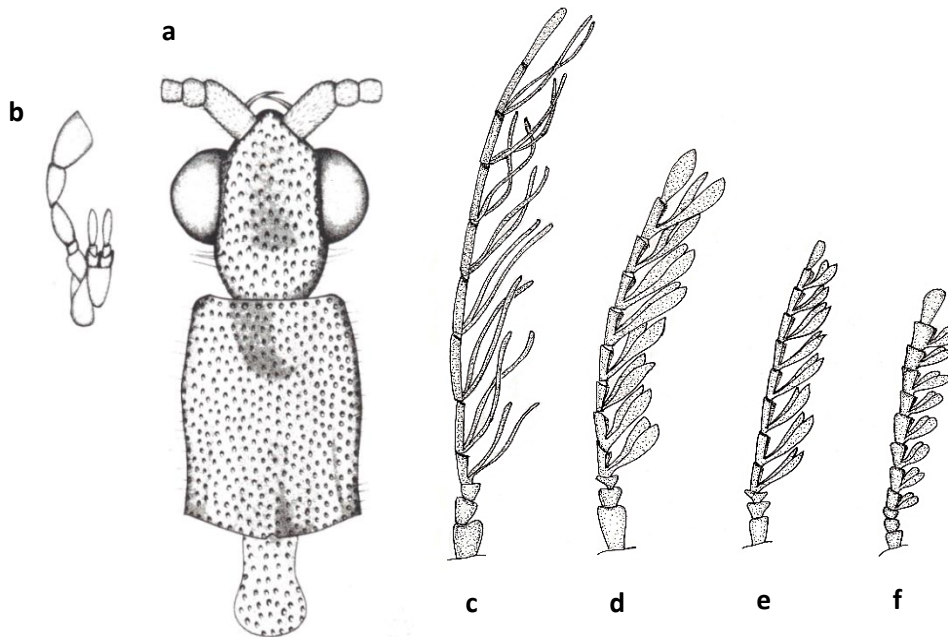


Figura 1. Cabeza y antenas de *Cenophengus*. a) Vista dorsal de la cabeza y del tórax de *Cenophengus villae* Zaragoza-Caballero, 1984; b) Vista ventral de los palpos maxilares y labiales de *Cenophengus villae* Zaragoza-Caballero, 1984; c) Vista dorsal de la antena izquierda de *C. munizi*; d) *C. sonoraensis*; e) *C. cuicatlaensis*; f) *C. huatulcoensis* (Zaragoza-Caballero, 1984, 2008).



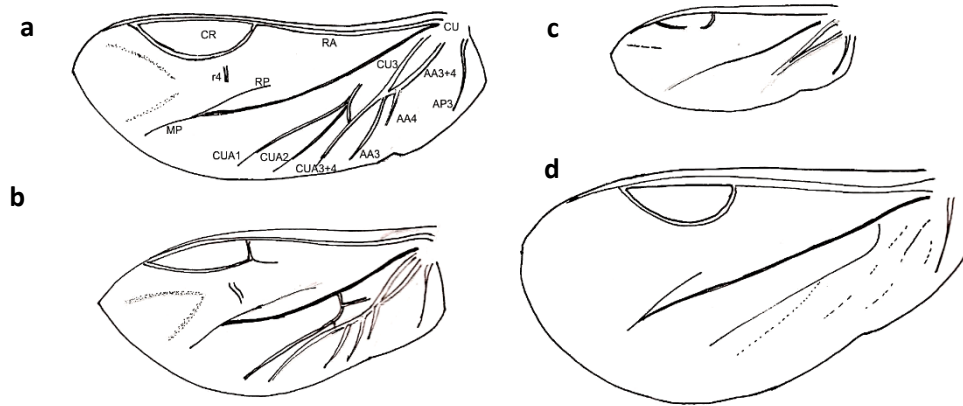


Figura 2. Vista dorsal del ala membranosa de cuatro especies de *Cenophengus*. a) *Cenophengus sonoraensis* Zaragoza-Caballero, 2008, b) *C. cuicatlaensis* Zaragoza-Caballero, 2008, c) *C. huatulcoensis* Zaragoza-Caballero, 2008 y d) *C. minizi* Zaragoza-Caballero, 2008. Venación: RA = Radial; CR = Célula Radial; r4 = radial 4; RP = Radial posterior; MP = Mediana posterior; CuA = Cubitales; AA y AP = Anal anterior y posterior (Zaragoza-Caballero, 2008).

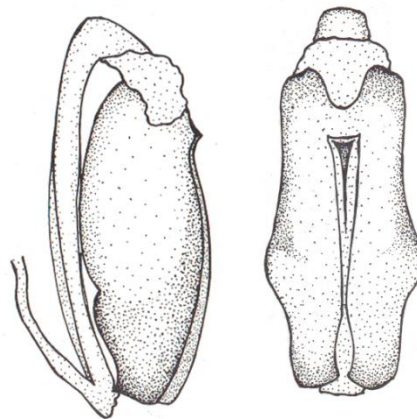


Figura 3. Vista lateral y dorsal del aparato reproductor masculino de *Cenophengus howdeni* Zaragoza-Caballero, 1986 (Zaragoza-Caballero, 1986).

Las especies de *Cenophengus* han sido descritas por tres autores de la siguiente manera: una especie de Estados Unidos por Schaeffer (1904); nueve de Colombia, México, Costa Rica

y Estados Unidos, descritas por Wittmer (1948, 1976, 1981, 1986) y 12 de México por Zaragoza-Caballero (1975, 1984, 1986, 1988, 1991, 2003 y 2008) (Cuadro 1).

Cuadro 1: Listado de las especies de <i>Cenophengus</i>			
<b>Especie</b>	<b>País</b>	<b>Localidad</b>	<b>Holotipo</b>
<i>Cenophengus baios</i> Zaragoza, 2003: 159	México	Chamela, Jalisco	CNIN
<i>Cenophengus brunneus</i> Wittmer, 1976:453	México	Córdoba, Veracruz	NMNH
<i>Cenophengus ciceroi</i> Wittmer, 1981: 106	Estados Unidos	Arizona	NMNH
<i>Cenophengus cuicatlaensis</i> Zaragoza, 2008: 153	México	Cuicatlán, Oaxaca	CNIN
<i>Cenophengus debilis</i> LeConte, 1881:41	Estados Unidos	California	MCZC
<i>Cenophengus guerrerensis</i> Zaragoza, 1991:109	México	Guerrero	CNIN
<i>Cenophengus gorhami</i> Zaragoza, 1986: 934	México	Yucatán	NMNH
<i>Cenophengus howdeni</i> Zaragoza, 1986: 933	México	El palmito, Sinaloa	CNIN
<i>Cenophengus hautulcoensis</i> Zaragoza, 2008: 154	México	Huatulco, Oaxaca	CNIN
<i>Cenophengus longicollis</i> Wittmer, 1976: 451	Estados Unidos, México	Texas	BMNH
<i>Cenophengus magnus</i> Zaragoza, 1988: 651	México	Nuevo León	
<i>Cenophengus major</i> Wittmer, 1976: 450	México	Tepic, Nayarit; Hidalgo	NHMB
<i>Cenophengus marmoratus</i> Wittmer, 1976: 453	México	Córdoba, Veracruz; Tamazunchale; San Luis Potosí	NMNH
<i>Cenophengus munizi</i> Zaragoza, 2008: 155	México	Tlanchinol, Hidalgo	CNIN
<i>Cenophengus niger</i> Wittmer, 1986: 160	Costa Rica	Monte Verde	NHMB
<i>Cenophengus pallidus</i> Schaeffer, 1904: 213	Estados Unidos		BMNH
<i>Cenophengus pedregalensis</i> Zaragoza, 1975: 69	México	Jardín Botánico UNAM, CDMX	CNIN
<i>Cenophengus puntatisimus</i> Wittmer, 1976: 452	México	Tamazunchale, San Luis Potosí	NMNH
<i>Cenophengus sonorensis</i> Zaragoza, 2008: 155	México	Tecoripa, Sonora	CNIN
<i>Cenophengus villae</i> Zaragoza, 1984: 198	México	Metlac, Veracruz	CNIN
<i>Cenophengus wittmeri</i> Zaragoza, 1984: 196	México	Xicotepec, Puebla; Ixtlahuaco, Hidalgo	CNIN

## 1.2 Relaciones filogenéticas

Los estudios enfocados en resolver las relaciones filogenéticas de Phengodidae han sido escasos. Zaragoza-Caballero y Zurita-García (2015) realizaron un análisis filogenético con base en evidencia morfológica tomando en cuenta un muestreo taxonómico en el que se incluyeron 36 terminales y 60 caracteres, en dicho estudio el género *Cenophengus* se recuperó como el grupo hermano de las Mastinocerinae y Phengodinae, esto sustentado por cinco sinapomorfias (tubérculos antenales ausentes, 12 antenómeros; tercer antenómero más ancho que largo, galea desarrollada y edeago con un flagelo visible) (Fig. 4). No obstante, este análisis solo considera a la especie *C. magnus* como representante del género.

Otro estudio de este tipo fue realizado por Souza-Quintino (2017), el cual consistió en un análisis filogenético en el que se puso a prueba la monofilia de la subfamilia Mastinocerinae. En él se llevó a cabo un análisis con pesos iguales donde se incluyeron tres especies de *Cenophengus* con las siguientes relaciones: (((*C. pallidus*) (*C. pedregalensis*)) ((*Acladocera hispaniolae*) (*C. debilis*))) (Fig. 5a). También, en este mismo trabajo se realizó un análisis de pesos implicados donde se recuperó la monofilia de *Cenophengus* con las siguientes relaciones: (*C. debilis*, (*C. pallidus* *C. pedregalensis*)): este clado se recuperó definido por cuatro sinapomorfias (anténomos serrados/ subserrados, anténomos con proyecciones en el margen interno, pronoto con ángulos anteriores rectos y pronoto con división media en el disco pronotal) (Fig.5b).

No obstante, la representatividad del género en este tipo de estudios ha sido escasa, tomando en cuenta que presenta una alta variación en caracteres morfológicos, como el diámetro de los ojos, la longitud y forma de las antenas y la longitud elitral (Zaragoza-Caballero y Zurita-García, 2015); por lo que es necesario incluir un mayor número de especies con la finalidad de tener un muestreo taxonómico más amplio, que permita poner a prueba la

monofilia del género. El presente análisis filogenético es el primero en analizar las relaciones de parentesco entre las especies del género *Cenophengus*.

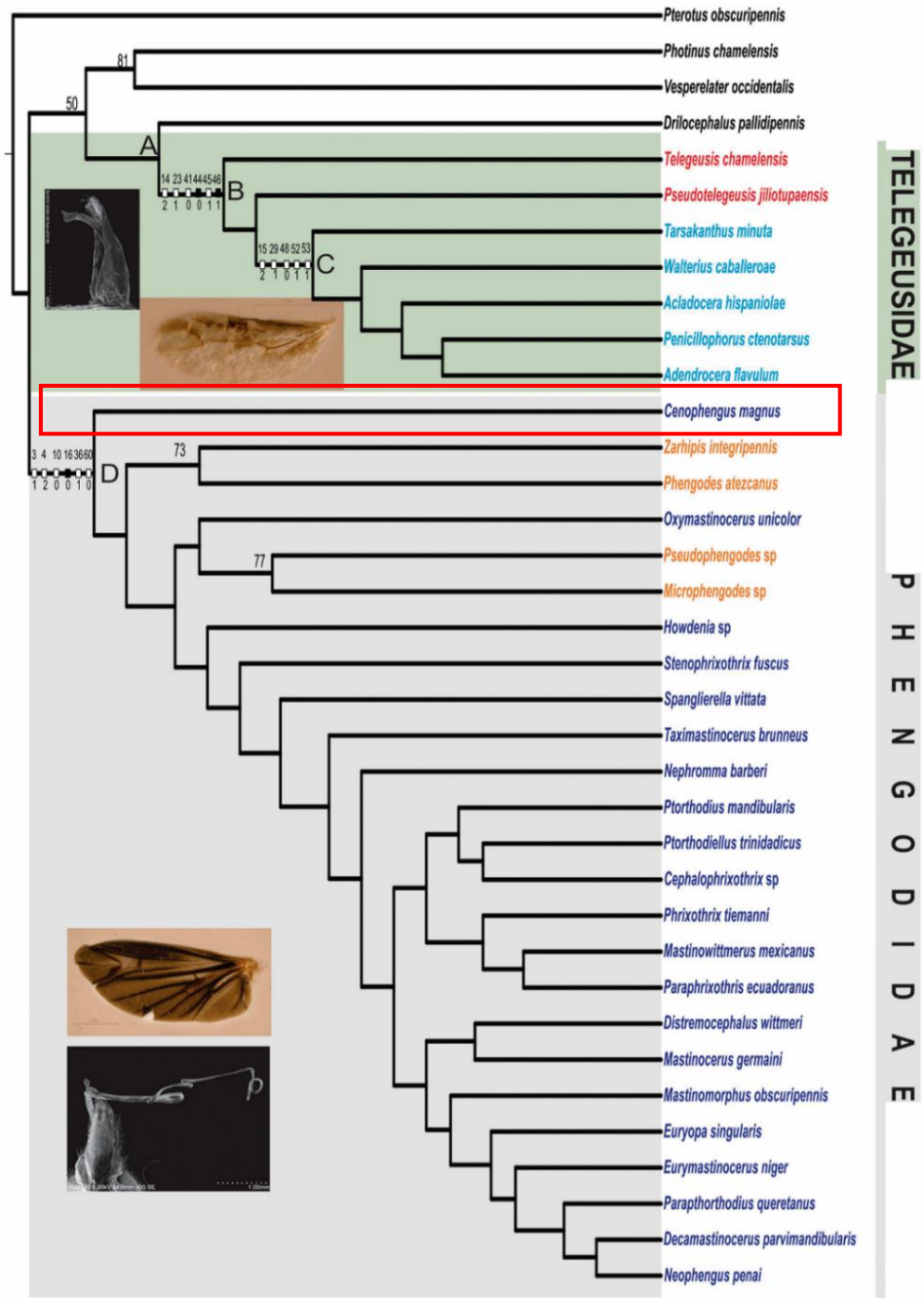


Figura 4. Filogenia de la familia Phengodidae basada en caracteres morfológicos (Zaragoza-Caballero y Zurita-García, 2015).

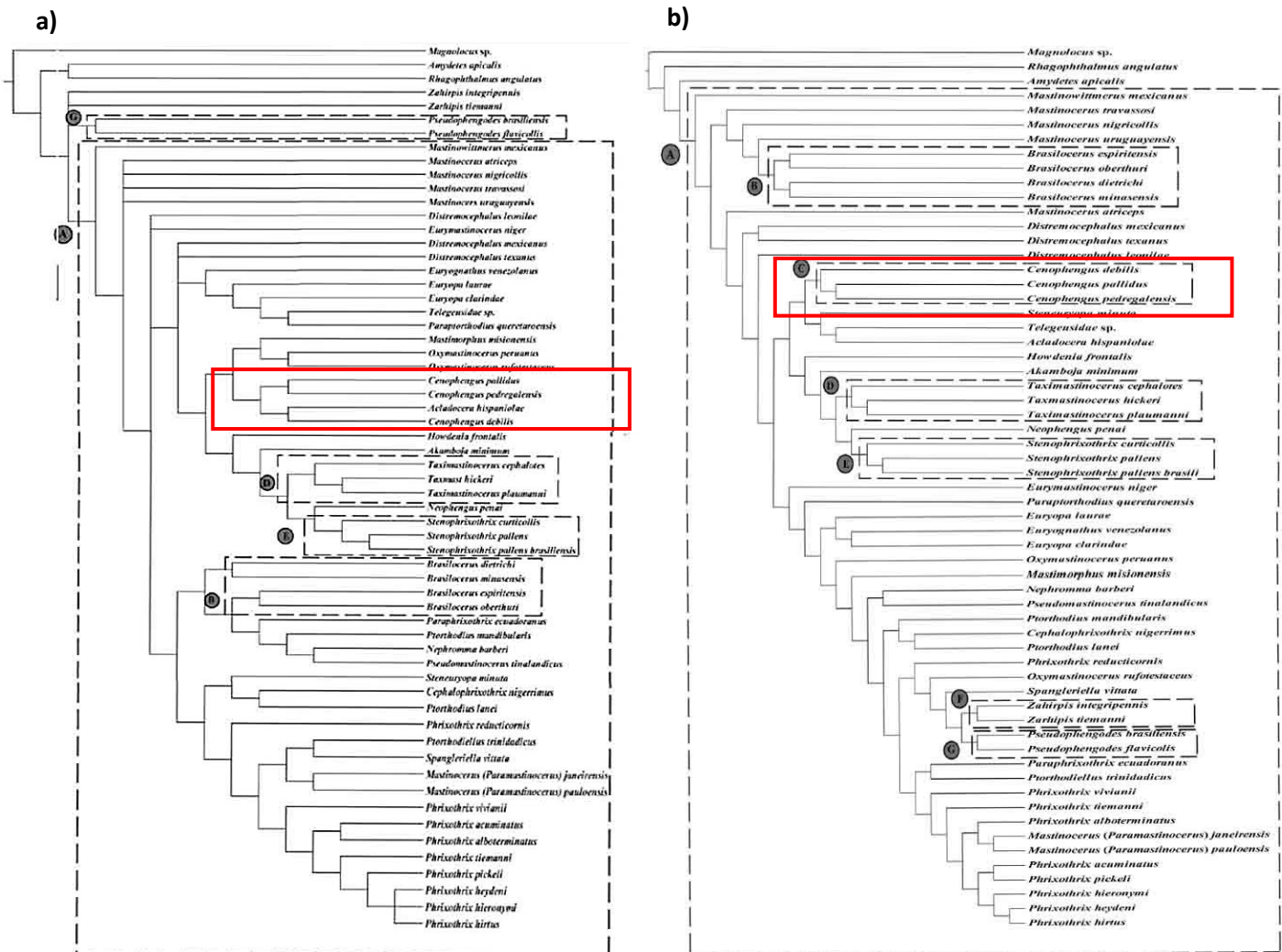


Figura 5. Filogenia de la de la subfamilia Mastinocerinae (Souza-Quintino, 2017). a) Análisis filogenético con pesos iguales y, b) análisis filogenético con pesos implicados.

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## 2.- JUSTIFICACIÓN

Debido a la escasa representatividad taxonómica, y a la consecuente exclusión de la variación morfológica del género *Cenophengus* en los análisis filogenéticos previos (Zaragoza-Caballero y Zurita-García, 2015; Souza-Quintino, 2017) no se tiene una idea clara de las relaciones de parentesco entre sus especies, ni de su consistencia como grupo monofilético, por lo que el presente estudio analiza las relaciones de parentesco entre un mayor número de especies, con la finalidad de mejorar el muestreo taxonómico del género y poner a prueba la monofilia del mismo.

A partir del análisis de la morfología de las especies de *Cenophengus*, se presentará una clave de identificación de las especies del género, que permita facilitar el desarrollo de estudios taxonómicos futuros.



### **3.- OBJETIVOS**

#### **3.1.- Objetivo general**

Analizar las relaciones filogenéticas de las especies del género *Cenophengus*.

#### **3.2.- Objetivos particulares**

- Poner a prueba la monofilia del género *Cenophengus*.
- Proponer una hipótesis de las relaciones filogenéticas entre las especies del género *Cenophengus*.
- Realizar una revisión taxonómica del género *Cenophengus*.

#### 4. - MÉTODO GENERAL

El método general para obtener el estudio sistemático del género *Cenophengus* incluye dos ejes principales: 1) Revisión bibliográfica y de colecciones científicas; 2) Análisis filogenético.

##### 1) Revisión bibliográfica y colecciones científicas

El estudio bibliográfico incluyó la consulta de literatura especializada, y la revisión de estudios en los que se realizaron las descripciones originales de cada una de las especies pertenecientes al género *Cenophengus*. Por otra parte, se revisaron morfológicamente alrededor de 200 ejemplares depositados en distintas colecciones científicas (CNIN, Colección Nacional de Insectos, Instituto de Biología, UNAM, Ciudad de México; BRI, Biosystematics Research Institute, Ottawa, Canada; CCo, Robert Constantin's collection, Francia; NMNH, Smithsonian Institution, Washington, DC, U.S.A.; FSCA, Florida State Collection of Arthropods; FMNH, Field Museum of Natural History, Chicago, U.S.A. ; MEL, Museo Entomológico de León, Nicaragua), además de las imágenes del ejemplar tipo de *Cenophengus debilis* que fueron consultadas en línea (MCZ, Museum of Comparative Zoology Collection. Harvard University, Cambridge, U.S.A.).

##### 2) Análisis filogenético

Un total de 197 ejemplares fueron examinados con un microscopio estereoscópico Zeiss Discovery V8 equipado con un micrómetro ocular para la caracterización morfométrica de las especies analizadas. En el análisis cladístico se incluyeron 55 especies, de las cuales 28 especies de *Cenophengus* conformaron el grupo interno. Para seleccionar el grupo externo, se tomó en cuenta los análisis filogenéticos previos de la familia Phengodidae (Zaragoza-Caballero y Zurita-García, 2015; Souza-Quintino, 2017). Para enraizar el cladograma se utilizó

*Telegeusis moroni*. Adicionalmente, para probar la monofilia de *Cenophengus* se muestrearon 25 especies de 17 géneros de Phengodidae (representando a Phengodinae, Mastinocerinae y Penicillophorinae). La nomenclatura utilizada sigue a Lawrence et al. (2011), y la codificación de las alas se basa en Kukalova-Peck y Lawrence (1993). Finalmente se tuvieron en cuenta los caracteres utilizados en estudios filogenéticos anteriores (Zaragoza-Caballero y Zurita-García, 2015; Souza-Quintino, 2017). Se codificaron un total de 39 caracteres binarios y 44 multiestatales. En el caso de los caracteres continuos se utilizó la siguiente fórmula para designar los estados del carácter:  $dmm = \frac{\text{max} - \text{min}}{3}$ , donde dmm es la diferencia entre el mínimo y el máximo, dividida por el número de estados del carácter. Los estados de los caracteres se asignaron de la siguiente manera 0= min+dmm; 2= max-dmm; 1= intervalos entre 0 y 2. En los caracteres que presentaban una mayor variabilidad, se realizaron gráficos de caja para identificar el número de estados del carácter, lo que permitió modificar la fórmula de tres estados del carácter a los que muestra el diagrama.

## 5. - CAPÍTULO I:

**New species of the genus *Cenophengus* LeConte 1881 (Coleoptera; Phengodidae) from Mexico and Guatemala**

Viridiana Vega-Badillo, Santiago Zaragoza-Caballero & Jessica Jazmín Ríos Ibarra

**Aceptado en Zootaxa**

## **New species of the genus *Cenophengus* LeConte 1881 (Coleoptera; Phengodidae) from Mexico and Guatemala**

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### **Abstract**

Six new species of the genus *Cenophengus* LeConte, 1881 are described. Five of these new species were collected in Mexico, in the states of Hidalgo (*Cenophengus mboi* sp. nov. and *Cenophengus hnogamui* sp. nov.), Coahuila (*Cenophengus kikapu* sp. nov.) and San Luis Potosí (*Cenophengus tupae* sp. nov., *Cenophengus mumui* sp. nov.); also one was collected in Puerta Parada, Guatemala (*Cenophengus xiinbali* sp. nov.). The new taxa described in the present study increase to 27 the number of species assigned to *Cenophengus*.

**Key words:** Diversity, Taxonomy, Neotropical Region, Malacodermes

### **Introduction**

The genus *Cenophengus* was proposed by LeConte in 1881 until now 21 species distributed from the southern United States to northern Argentina have been described (Zaragoza-Caballero, 2008). Species in this genus are characterized by simple mandibles, maxillary palps with 4 palpomeres, labial palps

with 2 palpomeres, two distinctly separated tentorial pits, two gular sutures and aedeagus trilobed (Zaragoza-Caballero, 2008) with parallel lateral lobes bearing apical teeth.

Morphologically, *Cenophengus* is similar to *Distremocephalus* Wittmer, *Mastinowittmerus* Zaragoza and *Cleicosta* Vega-Badillo *et al.* (2020), based on the presence of separated tentorial pits. The genera *Distremocephalus*, and *Mastinowittmerus* are similar in that they share 3-segmented labial palpi and the presence of a ventral ‘comb’ of bristle-like setae on first tarsomeres of the pro- and/or mesothoracic legs (Zaragoza-Caballero & Pérez-Hernández, 2014). *Cenophengus* is similar to *Cleicosta* in that they possess 2-segmented labial palpi and simple tarsomeres (Vega-Badillo *et al.*, 2020). In addition to this, *Distremocephalus*, *Mastinowittmerus* and *Cleicosta*, possess lateral lobes of aedeagus that are narrowed medially to toothless apex, a pattern different than that exhibited by *Cenophengus*, with lateral lobes parallel, with apical teeth.

As part of an extensive study focused on reconstructing the phylogenetic relationships of the genus *Cenophengus* and to expand the known diversity of this highly endemic genus, we herein describe six new species, five from Mexico and one from Guatemala.

## **Material and Methods**

Sixteen specimens initially identified to the family level and deposited in entomological collections were subsequently examined by the authors and identified as belonging to the genus *Cenophengus* (two collected in Guatemala and 14 in Mexico). Fourteen of these specimens were collected in Mexico from the states of Hidalgo, Coahuila and San Luis Potosí. These specimens were ultimately deposited in the national insect collection housed in Instituto de Biología, UNAM (CNIN-IBUNAM). The two specimens collected from Guatemala, collected in the Puerta Parada, were deposited in the Colección de Coleoptera del Centro de Investigaciones Biológicas, UAEH (CC-UAEH). The various trapping methods employed include light trapping, Malaise trapping, and hand collection. Specimens were

mounted on standard entomological pins. For this study we adopted concept of morphological species (Regan, 1926). We obtained a total of 38 specimens on loan from the following collections (acronyms follow the Insect and Spider Collections of the World website [Evenhuis, 2020]): CNIN, Colección Nacional de Insectos, Instituto de Biología, UNAM, Mexico City (Santiago Zaragoza Caballero); BRI, Biosystematics Research Institute, Ottawa, Canada (Patrice Bouchard); NMNH, Smithsonian Institution, Washington, DC, U.S.A. (Floyd Shockley); FMNH, Field Museum of Natural History, Chicago, U.S.A. (Crystal A. Maier). For morphological verification and study, we examined holotypes (16) and paratypes belonging to *Cenophengus baios* |CNIN, *C. brunneus* |NMNH, *C. ciceroi* |NMNH, *C. cuicatlaensis* |CNIN, *C. guerrerensis* |CNIN, *C. gorhami* |NMNH, *C. howdeni*, *C. hautulcoensis* |CNIN, *C. longicollis* |FMNH, *C. munizi* |CNIN, *C. marmoratus* |NMNH, *C. pedregalensis* |CNIN, *C. punctatissimus* |NMNH, *C. sonorensis* |CNIN, *C. villae* |CNIN and *C. wittmeri* |CNIN, as well as specimens identified as *C. debilis* (10) |BRI, *C. magnus* (2) |CNIN and *C. palludus* (2) |FMNH. As no specimens of *C. niquer* and *C. major* were available for study the original descriptions of these species were consulted.

Studies of morphological characters were conducted using a Zeiss Discovery V8 stereoscopic microscope equipped with a 1× lens and 1.6× eyepieces. The following measurements were taken: body length, interantennal and interocular distance, length and width of head, pronotum, elytra, scape, antennomeres, antennal rami, maxillary and labial palps, and tarsomeres, these measurements are expressed in millimeters. In order to describe the aedeagi morphology of the new species, ten specimens were dissected. Once separated, the aedeagi were mounted in cardboard points and placed on the mounting pins of the corresponding specimens. For identification of specimens to genus we used the identification key included in Zaragoza-Caballero & Pérez- Hernández (2014). We followed the wing venation nomenclature of Kukalova-Peck & Lawrence (1993). Photographs were taken with a Zeiss Axio Zoom V16 with a Plan NeoFluar Z lens, 1x10.25 FWD 56 in Laboratorio de Microscopía y

Fotografía de la Biodiversidad, Instituto de Biología, UNAM. Labels of the type specimens are arranged in sequence from top to bottom, where the data for each label are within double quotes (“ ”), and slash (/) separates the rows.

## Results

### *Cenophengus hnogamui* sp. nov. (Figs. 1-5)

**Etymology.** The term *hñoga'mui* means happy or quiet life in the Hñähñu (Otomí) language, which is spoken in the valley of Mezquital, Hidalgo, Mexico. The name of this species is assigned with the firm wish that happiness and peace prevail in the life of indigenous people.

**Diagnosis.** *Cenophengus hnogamui* is similar in appearance to *Cenophengus munizi* Zaragoza-Caballero 2018, but can be recognized by the following characters: the length of the antennae, which are shorter in *C. munizi* than in *C. hnogamui*; the antennal rami are twice as long as respective antennomere in *C. munizi*, whereas in *C. hnogamui* these are 1.5 times as long as respective antennomere. *C. munizi* can also be distinguished on the basis of the terminal maxillary palpomere, which is smaller than the sum of the previous three, on the other hand it is as long as the preceding three combined in *C. hnogamui*. Finally, elytral length is longer in *C. hnogamui* than in *C. munizi*, with *C. hnogamui* also bearing a whitish tip at the distal apex of each elytra which is not present in *C. munizi*.

**Description, male.** Total body length 4.6 mm; total body width 0.61 mm. Dark brown body, except for the first three antennomeres and the posterior part of the elytra which are amber in color (Figs. 1, 2).

**Head.** Surface concave, wider (0.59 mm) than long (0.55 mm), measured dorsally to exterior margins almost as wide (0.59 mm) as pronotum (0.61 mm), integument smooth, coarsely punctate, each puncture bearing an amber seta; interantennal distance longer than half length of 1<sup>st</sup> antennomere (0.11



mm); small eyes, hemispherical, prominent, finely faceted, longer (0.26 mm) than wide (0.16 mm); interocular distance greater than the length of the eyes (0.34 mm); long antennae (2.35 mm) reaching pronotal posterior margin; 1<sup>st</sup> antennomere as long (0.15mm) as the next two combined, 3<sup>rd</sup> antennomere cup-shaped, 4<sup>th</sup> in length (0.1 mm), 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.23 mm), 12<sup>th</sup> (terminal) lanceolate (0.3 mm), antennal rami lanceolate, one and a half times longer than respective antennomere; anterior border of the frons concave; clypeus bilobed; terminal maxillary palpomere securiform, as long as the preceding three combined (0.2 mm); terminal labial palpomere spindle-shaped, three times longer than the preceding (0.06 mm).

**Thorax.** Pronotum longer (0.57 mm) than wide (0.35 mm); tegument smooth, coarsely punctate; each puncture bearing an amber seta, convex disc with one longitudinal excavation on each side of the midline, anterior border concave, posterior border almost straight without a middle notch, lateral margins almost parallel, anterior and posterior angles rounded; scutellum almost quadrangular, posterior border bilobed, shiny integument, thickly dotted, each puncture with an amber colored seta; elytra almost six times as long (2.25 mm) as wide (0.37 mm), convex; hindwings with radial cell close, r3 vein presented, r4 vein developed, the posterior radial vein (RP) reduced (length less than half the size of the vein MP1+2), medial field containing five main veins: MP3, MP4, CuA1, CuA2 and CuA3+4; AA well marked and cubitoanal cell open, AP3+4 long; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs about equal in length.

**Abdomen.** Integument shiny, punctured, densely setose, penultimate sternite with posterior margin sinuate, last sternite cleft. Aedeagus: with three teeth at the apex of paramere (Figs. 3-5).

**Immatures and females.** Unknown

**Distribution:** Hidalgo, Mexico (Fig. 6).

**Type material. Holotype (male)** (COL-TIP-03591): “Mexico: Hidalgo, Huasca de/ Ocampo, Rancho Santa Elena,/ Presa San Carlos, 2430 msnm/20°08′04.5″ N 98°30′49.9″ W./ 05/IX-03/X/2005.

Trampa/ Malaise. Col. A. Contreras/ Meléndez y Reynoso”.

**Paratypes:** three males, same data. Deposited at CNIN (COL-TIP-03592; COL-TIP-03593) and at CC-UAEH (PHE-002-CC-UAEH).

***Cenophengus kikapu* sp. nov.** (Figs. 7-11)

**Etymology.** The term *kikapu* alludes to the Kikapu tribe that lives in Coahuila, Mexico.

**Diagnosis.** *Cenophengus kikapu* is similar in appearance to *Cenophengus sonorensis* Zaragoza 2008, but can be recognized by the following characters. In *Cenophengus sonorensis* the head is almost as wide as the pronotum, whereas in *C. kikapu* the head is wider than the pronotum. In addition the terminal maxillary palpomere is as long as the preceding three combined in *C. sonorensis*, whereas in *C. kikapu* it is longer than the preceding three combined.

**Description, male.** Total body length 6.4 mm; total body width 0.8 mm. Dark brown body, except for the pronotum, legs and the last two abdominal segments that are amber colored (Figs. 7, 8).

**Head.** Surface concave, wider (0.86 mm) than long (0.52 mm), measured dorsally to exterior margins almost as wide (0.86 mm) as pronotum (0.8 mm), integument chagrined, coarsely punctuate, each puncture bearing an amber seta; interantennal distance (0.09 mm), half of the length of 1<sup>st</sup> antennomere; large eyes, hemispherical, prominent, finely faceted, longer (0.45 mm) than wide (0.36 mm); interocular distance equal to length of eyes; short antennae (1.58 mm) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.15 mm) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> in length 0.12, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15 mm), 12<sup>th</sup> (terminal) lanceolate (0.2 mm), antennal rami lanceolate, two times longer than respective antennomere; anterior border of frons concave;

clypeus bilobed; terminal maxillary palpomere robust securiform, as long as preceding three combined (0.3 mm); terminal labial palpomere spindle-shaped, five times longer than preceding (0.1 mm).

**Thorax.** Pronotum longer (1.07 mm) than wide (0.8 mm); tegument chagrined, coarsely punctate; each puncture bearing an amber seta, convex disc, one longitudinal excavation on each side of midline, anterior border concave, posterior almost straight with a middle notch, lateral margins almost parallel, anterior and posterior angles rounded; scutellum almost quadrangular, posterior border truncated, shiny integument, thickly dotted, each puncture with a yellowish seta; elytra almost three and a half times as long (1.95 mm) as wide (0.53 mm), convex; hindwings with radial cell closed, r3 vein (r3) absent, r4 vein (r4) developed, the posterior radial vein (RP) reduced (length less than half the size of the vein MP1+2), medial field containing six main veins: MP3, MP4, CuA1, CuA2, CuA3+4, and AA 3+4; CuA and AA well marked and cubitoanal cell closed, AP3+4 long.; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs about equal in length.

**Abdomen.** Integument shiny, dotted and silky, penultimate sternite sinuate, last sternite cleft.

Aedeagus: with three teeth at the apex of paramere (Figs. 9-11).

**Immatures and females.** Unknown.

**Distribution:** Coahuila, Mexico (Fig. 6).

**Type material. Holotype (male)** (COL-TIP-03587): “Mexico: El Cañón, Cuatro/ Ciénegas, Coahuila, Col. MTO/y UOGV/ 21-feb-2012 col./ nocturna luz blanca”. **Paratypes** (COL-TIP-03588, COL-TIP-03589): two males, same data. Deposited at CNIN.

***Cenophengus mboi* sp. nov.** (Figs. 12-16)

**Etymology.** The term *mboi* means black in the Hñähñu (Otomí) language, which is spoken in the valley of Mezquital, Hidalgo, Mexico. This term refers to the color of the body in this new species.

**Diagnosis.** *Cenophengus mboi* is similar in appearance to *Cenophengus pedregalensis* Zaragoza 1975, but can be distinguished by the color of the body and terminal maxillary palpomere. In *C. mboi* the body is dark brown, whereas in *C. pedregalensis* it is dark brown and the pronotum yellow-orange. Terminal maxillary palpomere is as long as the preceding three combined in *C. mboi*, in *C. pedregalensis* it is longer than the preceding three combined. The first tarsomere of the middle and hind legs are clearly longer than the second. In *C. pedregalensis* the two longitudinal excavations are near the center of the pronotum and the first and second tarsomeres of the middle and hind legs are of similar length.

**Description, male.** Total body length 9.6 mm; total body width 1 mm. Dark body (Figs. 12, 13).

**Head.** Surface concave, as wide (0.8 mm) as long (0.8 mm) measured dorsally to exterior margins almost as wide (0.8 mm) as pronotum (1 mm), integument chagrined, coarsely punctuate, each puncture bearing a black seta; interantennal distance (0.1 mm), half of the length of 1<sup>st</sup> antennomere; small eyes, hemispherical, finely faceted, longer (0.32 mm) than wide (0.14 mm); interocular distance greater than to the length of the eyes; long antennae (2.80 mm) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.25 mm) longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.23 mm), 12<sup>th</sup> (terminal) lanceolate (0.27 mm), antennal rami lanceolate, two times longer than respective antennomere; anterior border of frons concave; clypeus bilobed; terminal maxillary palpomere robust and securiform, as long as the preceding three combined (0.35 mm); terminal labial palpomere spindle-shaped (0.15), three times longer than the preceding.

**Thorax.** Pronotum longer (1.3 mm) than wide (1 mm); integument chagrined, coarsely punctuate; each puncture bearing a black seta, convex disc, with one longitudinal excavation on each side of the midline, anterior border concave, the posterior almost straight with a middle notch, lateral margins almost parallel, anterior and posterior angles rounded; scutellum almost quadrangular, posterior border

truncated; elytra almost four times as long (2.6 mm) as wide (0.62 mm), convex; shiny integument, thickly dotted, each puncture with a black seta; hindwings with radial cell closed, r3 vein present, r4 vein developed, the posterior radial vein (RP) developed (length equal to or longer than half the size of the vein MP1+2), medial field containing six main veins: MP3, MP4, CuA1, CuA2, CuA3+4, and AA 3+4; CuA and AA well marked and cubitoanal cell closed, AP3+4 long.; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of prothoracic legs about equal in length, 1st tarsomere of meso- and metathoracic legs longer than 2nd.

**Abdomen.** Integument shiny, punctured, densely setose, penultimate sternite with posterior margin sinuate, last sternite cleft. Aedeagus: with three teeth at the apex of paramere (Figs. 14-16).

**Immatures and females.** Unknown.

**Distribution:** Hidalgo, Mexico (Fig. 17).

**Type material. Holotype (male):** “Mexico Santiago de Anaya/ Hgo.20°24′0761″N/ 98°53′1797″O, 28-29 agosto/ 2017 Col. A. Ibarra Vázquez”. Deposited at CNIN (COL-TIP-03590). **Paratype (male):** “Mexico, Atotonilco/ El Grande, 3km NE de Montecillos./ Bosque Juniperus-Quercus. N 20°/ 18′9″, 98° 36′17″ W. Trampa de Intercepción de/ vuelo 12 al 19/ VII/ 2010. /J. Márquez y J. Asiain”. Deposited in CC-UAEH (PHE-001-CC-UAEH).

***Cenophengus mumui* sp. nov.** (Figs. 18-22)

**Etymology.** The term *Mumui* means sand in the Pame language (Xi'úi) which is spoken in Tamosopo, San Luis Potosí, Mexico. This term refers to the sandy color of the body in the new species.

**Diagnosis.** *Cenophengus mumui* is similar in appearance to *Cenophengus munizi* Zaragoza-Caballero 2008. These two species can be differentiated by the shape and color of the head, which is square and brown in the new species, while *C. munizi* exhibits a rectangular shaped head, which is amber colored like the rest of the body. Additionally, in *C. mumui* the antennal rami are 1.5 times as long as respective antennomere, whereas in *C. munizi* they are twice as long as respective antennomere.

**Description, male.** Total length 3.5 mm; total width 0.58 mm. Yellow body, except for the head which is brown colored (Figs. 18, 19).

**Head.** Surface concave, wider (0.61 mm) than long (0.49 mm), measured dorsally to exterior margins almost wider (0.61 mm) than the pronotum (0.58 mm), integument smooth, coarsely punctate, each puncture bearing an amber seta; interantennal distance longer than half of 1<sup>st</sup> antennomere length, (0.1 mm); small eyes, hemispherical, prominent, finely faceted, longer (0.2 mm) than wide (0.15 mm); interocular distance greater than the eyes length (0.36 mm); antennae (1.8 mm) extending beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.15 mm) as long as next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> in length (0.12 mm), 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.17 mm), 12<sup>th</sup> (terminal) lanceolate (0.25 mm), antennal rami lanceolate, one and a half times longer than respective antennomere; anterior border of frons concave; clypeus bilobed; terminal maxillary palpomere robust and securiform, as long as the preceding three combined (0.16 mm); terminal labial palpomere cylindrical (0.05 mm) and two times longer than the preceding.

**Thorax.** Pronotum as long (0.58 mm) as wide (0.56 mm); tegument smooth, coarsely punctate; each puncture bearing an amber seta, convex disc, with one longitudinal excavation on each side of the midline, anterior border concave, posterior almost straight with a middle notch, lateral margins almost parallel, anterior and posterior angles rounded; scutellum almost quadrangular, posterior border truncated, shiny integument, thickly dotted, each puncture with an amber seta; elytra almost four times as long (1.62 mm) as wide (0.37 mm), convex; hindwings with radial cell closed and slightly defined, r3 and r4 veins absent, the posterior radial vein (RP) reduced (length less than half the size of the vein MP1+2), those of the anterior anal and posterior anal sectors, absent, only AA well marked, AP3+4 short.; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs about equal in length.

**Abdomen.** Integument shiny, punctured, densely setose, penultimate sternite with posterior margin sinuate, last sternite cleft. Aedeagus: with three teeth at the apex of paramere (Figs. 20-22).

**Immatures and females.** Unknown

**Distribution:** San Luis Potosí, Mexico (Fig. 17).

**Type material. Holotype (male)** (COL-TIP-03596): Mexico, San Luis Potosí, / Tamasopo. Cerro al noroeste/ del cafetal, 01-06-15, N 21°55.47' / W 99°24.95' Col./ Jessica Ríos. Deposited at CNIN.

*Cenophengus tupae* sp. nov. (Figs. 23-27.)

**Etymology.** The term *Tu-pae* means mud in the Pame language (Xi'úi), which is spoken in Tamosopo, San Luis Potosí, Mexico. This term refers to the color of the body in the new species.

**Diagnosis.** *Cenophengus tupae* is similar in appearance to *Cenophengus wittmeri* Zaragoza, 1984, but can be distinguished by its shorter size, interocular distance and the terminal maxillary palpomere. In *C. tupae* interocular distance is 2.5 times longer than eye width, whereas in *C. wittmeri* it is twice longer than eye width. The terminal maxillary palpomere is shorter than the preceding three combined in *C. tuape*, whereas in *C. longicollis* it is as long as the preceding three combined. Additionally in *C. tupae* the antennal rami is three times as long as respective antennomere, whereas in *C. wittmeri* it is twice longer than the respective antennomere.

**Description, male.** Total body length 5.2 mm; total body width 0.6 mm. Brown body, except for the antennae and a stripe on the pronotum that are amber colored (Figs. 23, 24).

**Head.** Surface concave, wider (0.6 mm) than long (0.4 mm), measured dorsally to exterior margins almost as wide (0.6 mm) as the pronotum (0.62 mm), integument chagrined, coarsely punctuate, each puncture bearing an amber seta; interantennal distance a third of 1<sup>st</sup> antennomere length (0.05 mm); medium sized eyes, hemispherical prominent, finely faceted, longer (0.3 mm) than wide (0.25 mm); interocular distance greater than the eyes length (0.4 mm); long antennae (1.6 mm) extending beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.16 mm) longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> in length (0.12 mm), 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15 mm), 12<sup>th</sup> (terminal) lanceolate

(0.15 mm); antennal rami lanceolate, three times longer than respective antennomere; anterior border of frons concave; clypeus bilobed; terminal maxillary palpomere securiform, as long as the preceding two combined (0.25 mm); terminal labial palpomere spindle-shaped, three times longer than the preceding.

**Thorax.** Pronotum longer (0.72 mm) than wide (0.6 mm); tegument chagrined, coarsely punctuate; each puncture bearing an amber seta, convex disc, with two longitudinal excavations one on each side of the midline, anterior border concave, the posterior almost straight with a middle notch, lateral margins almost parallel, anterior angles rounded and posterior angles acute; scutellum almost quadrangular, posterior border truncated, shiny integument, thickly dotted, each puncture with an amber colored seta; elytra almost four times as long (1.9 mm) as wide (0.46 mm), convex; hindwings with radial cell closed, r3 vein present, r4 vein developed, the posterior radial vein (RP) reduced (length less than half the size of the vein MP1+2), medial field containing six main veins: MP3, MP4, CuA1, CuA2, CuA3+4, and AA 3+4 ; CuA and AA well marked and cubitoanal cell closed, AP3+4 long; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of prothoracic legs about equal in length, 1st tarsomere of meso- and metathoracic legs longer than 2nd.

**Abdomen.** Integument shiny, punctured, densely setose, penultimate sternite with posterior margin sinuate, last sternite cleft. Aedeagus: with one tooth at the apex of paramere (Figs. 25-27).

**Immatures and females.** Unknown.

**Distribution:** San Luis Potosí, Mexico (Fig. 17).

**Type material. Holotype (male)** (COL-TIP-03594): Mexico, San Luis Potosí, / Tamasopo. Cerro al noroeste/ del cafetal, 01-06-15, N 21°55.47' / W 99°24.95' Col./ Jessica Ríos. **Paratype** (COL-TIP-03595): male, same data. Deposited at CNIN.

***Cenophengus xiinbali* sp. nov.** (Figs. 28-32)



**Etymology.** The term “Aj xiinbal” means traveler in the Maya language. This species is named in honor of the South American migrant people who have gone missing or perished in the pursuit of a better life.

**Diagnosis.** *Cenophengus xiinbali* is similar in appearance to *Cenophengus longicollis* Wittmeri 1976, but can be distinguished by the interocular distance and terminal maxillary palpomere. In *C. xiinbali* the interocular distance is 3.5 times longer than eye width, whereas in *C. longicollis* it is three times longer. The terminal maxillary palpomere is as long as the preceding three combined in *C. xiinbali*, whereas in *C. longicollis* it is longer than the preceding three combined.

**Description, male.** Total body length 8.3 mm; total body width 0.93 mm. Brown body, except for the pronotum, legs and last two abdominal segments, which are orange colored (Figs. 28, 29).

**Head.** Surface concave, longer (0.8 mm) than wide (0.73 mm), measured dorsally to exterior margins thinner (0.73 mm) than pronotum (0.93 mm), integument chagrined, coarsely punctuate, each puncture bearing an amber seta; interantennal distance half-length of 1<sup>st</sup> antennomere (0.12 mm); small sized eyes, hemispherical, finely faceted, almost as long (0.33 mm) as wide (0.12 mm); interocular distance greater than eyes length (0.6 mm); antennae (2.4 mm) extending beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.21 mm) as long as next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> in length (0.1 mm), 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.21 mm), 12<sup>th</sup> (terminal) lanceolate (0.26 mm), antennal rami lanceolate, ramus two times longer than respective antennomere; anterior border of frons concave; clypeus bilobed; terminal maxillary palpomere securiform, as long as the preceding three combined (0.3 mm); terminal labial palpomere spindle-shaped, three times longer than the preceding (0.06 mm).

**Thorax.** Pronotum longer (1.14 mm) than wide (0.93 mm); tegument chagrined, coarsely punctuate; each puncture bearing an amber seta, convex disc, with one longitudinal excavation on each side of the midline, anterior border concave, posterior border almost straight with a middle notch, lateral margins almost parallel, anterior angles rounded and posterior angles acute; scutellum almost quadrangular,

posterior border truncated, shiny integument, thickly dotted, each puncture with a black seta; elytra almost four and a half times as long (2.68 mm) as wide (0.64 mm), convex; hindwings with radial cell closed, r3 vein absent, r4 vein reduced, the posterior radial vein (RP) reduced (length less than half the size of the vein MP1+2), medial field containing six main veins: MP3, MP4, CuA1, CuA2, CuA3+4, and AA 3+4 ; CuA and AA well marked and cubitoanal cell closed, AP3+4 long.; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of prothoracic legs about equal in length, 1st tarsomere of meso- and metathoracic legs longer than 2nd.

**Abdomen.** Integument shiny, punctured, densely setose, penultimate sternite with posterior margin sinuate, last sternite cleft. Aedeagus: with three teeth at the apex of paramere (Figs. 30-32).

**Immatures and females.** Unknown

**Distribution:** Puerta Parada, Guatemala (Fig. 17).

**Type material. Holotype (male)** (COL-TIP-03597): “Guatemala: Guatemala Dept./ Puerta Parada Km 14.5 carr. a/ El Salvador 1840 m alt./ 8-15/VI/2013 Col. J.C Schster”. **Paratype** (COL-TIP-03598): male, same data. Deposited at CNIN.

## Discussion

While characters associated with hindwing venation are not commonly assessed in studies documenting closely related species of coleoptera, we found that for the species within the genus *Cenophengus*, certain venation characters can be of limited use for distinguishing between species. In the six new species described here, we found different combinations in the hindwings venation, for example the veins r3 and r4 may or may not be present, as well as the posterior radial vein (RP) may be developed or reduced, in some cases exemplary as in *C. mimui* and *C. munizi* the veins of the anterior and posterior anal sector are not present, so these can generally delineate between these species. Other veins, such as the Median Posterior Vein (MP) and the Radial Closed Cell (CR) are present and

invariable across all members of this genus. This evidence the potential utility of hindwing venation in the recognition of species within the genus *Cenophengus* and raises the possibility of a wider application of this character suite within the family Phengodidae.

The wings play an important role in the dispersal capacity of the beetles (Hájek *et al.*, 2011). In the particular case of Phengodidae it was maybe an important organ highly associated to ecological processes that led to diversification, because phengodids are soft-bodied, poor-flying small beetles, thus finely sensitive to temperature and humidity, and subject to wind forces. Therefore, most species are restricted to warm, moist, generally forested and relatively well-conserved mesic areas, free of heavy wind forces and bearing narrow temperature ranges (Viviani & Bechara 1997; Costa & Zaragoza-Caballero 2010; Roza *et al.*, 2017), for *Cenophengus* species are restricted to specific, mostly mountainous areas, such as the Sierra Madre Oriental province (10 species) (Figs. 7, 20). This fact, as well as the few local records and their low vagility due to the loss of flight in neotenic females reduces the capabilities to disperse and colonize new habitats (Bocak *et al.*, 2008), suggests that these species may show high levels of endemism. Consequently, the small ranges of species, especially in the mountains, may constitute a considerable risk to survival in the event of rapid environmental change. So it is necessary to implement adequate sampling in order to explore the distribution patterns of *Cenophengus* species and detect the existence of possible areas of endemism.

This pattern of endemism, as well as the scarce records in environmentally related regions (Sierra Madre Occidental province, Sierra Madre del Sur province, Chiapas-Guatemala Highlands province, Honduras-Nicaragua Highlands province, Costa Rica-Panamá Highlands province), makes it likely that a greater number of species in this genus will be discovered in the future. This situation has been documented in other coleoptera exhibiting low vagility. Gutiérrez-Velázquez *et al.*, (2013) found that beetles in the family Passalidae exhibited distributions that were restricted to the mountains across the provinces of Sierra Madre Sur, Sierra Madre Oriental and Mexican Transition Zone, and exhibited

a high level of endemism. This is logical assuming that each mountain range serves as an island, with stable climatic conditions and altitudinal belts that provide specific biomes for each species (González-Elizondo *et al.*, 2012). This scenario could allow for the identification of distribution patterns maintained through the time. Conducting taxonomic studies of little-studied groups, such as Phengodidae, can help identify distribution patterns of species, which in turn, could facilitate the identification of important areas and habitats for conservation.

### **Acknowledgments**

We would like to thank Juan Marquez Luna (Universidad Autónoma del Estado de Hidalgo) for the loan of specimens. To Paulina Cifuentes Ruiz and Edgar Uriel Garduño Montes de Oca for their review and comments that enriched this work.

To Susana Guzmán Gómez for her technical assistance in taking the photographs, and to Atilano Contreras Meléndez for the donation of specimens.

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## Figures

Figures 1-5. *Cenophengus hnogamui* sp. nov.; Figs.1, 2 dorsal, and ventral view; Figs. 3, 4, 5 dorsal, lateral and ventral view of the aedeagus.

Figure 6. Distribution of *Cenophengus*.

Figures 7- 11. *Cenophengus kikapu* sp. nov.; Figs. 7, 8, dorsal and ventral view;

Figs. 9, 10, 11 dorsal, lateral and ventral view of the aedeagus.

Figures 12-16. *Cenophengus mboi* sp. nov.; Figs. 12, 13 dorsal and ventral view; Figs. 14, 15, 16 dorsal, lateral and ventral view of the aedeagus.

Figure 17. Distribution of *Cenophengus* (Continued)

Figures 18-22. *Cenophengus mumui* sp. nov.; Figs.18, 19 dorsal and ventral view; Figs. 20, 21, 22 dorsal, lateral and ventral view of the aedeagus.

Figures 23-27. *Cenophengus tupae* sp. nov.; Figs.23, 24 dorsal and ventral view; Figs. 25, 26, 27 dorsal, lateral and ventral view of the aedeagus.

Figures 28-32. *Cenophengus xiinbali* sp. nov.; Figs.28, 29 dorsal and ventral view; 30, 31, 32 dorsal, lateral and ventral view of the aedeagus.

## Figures



Figures 1-5. *Cenophengus hnogamui* sp. nov.; Figs.1, 2 dorsal, and ventral view; Figs. 3, 4, 5 dorsal, lateral and ventral view of the aedeagus.



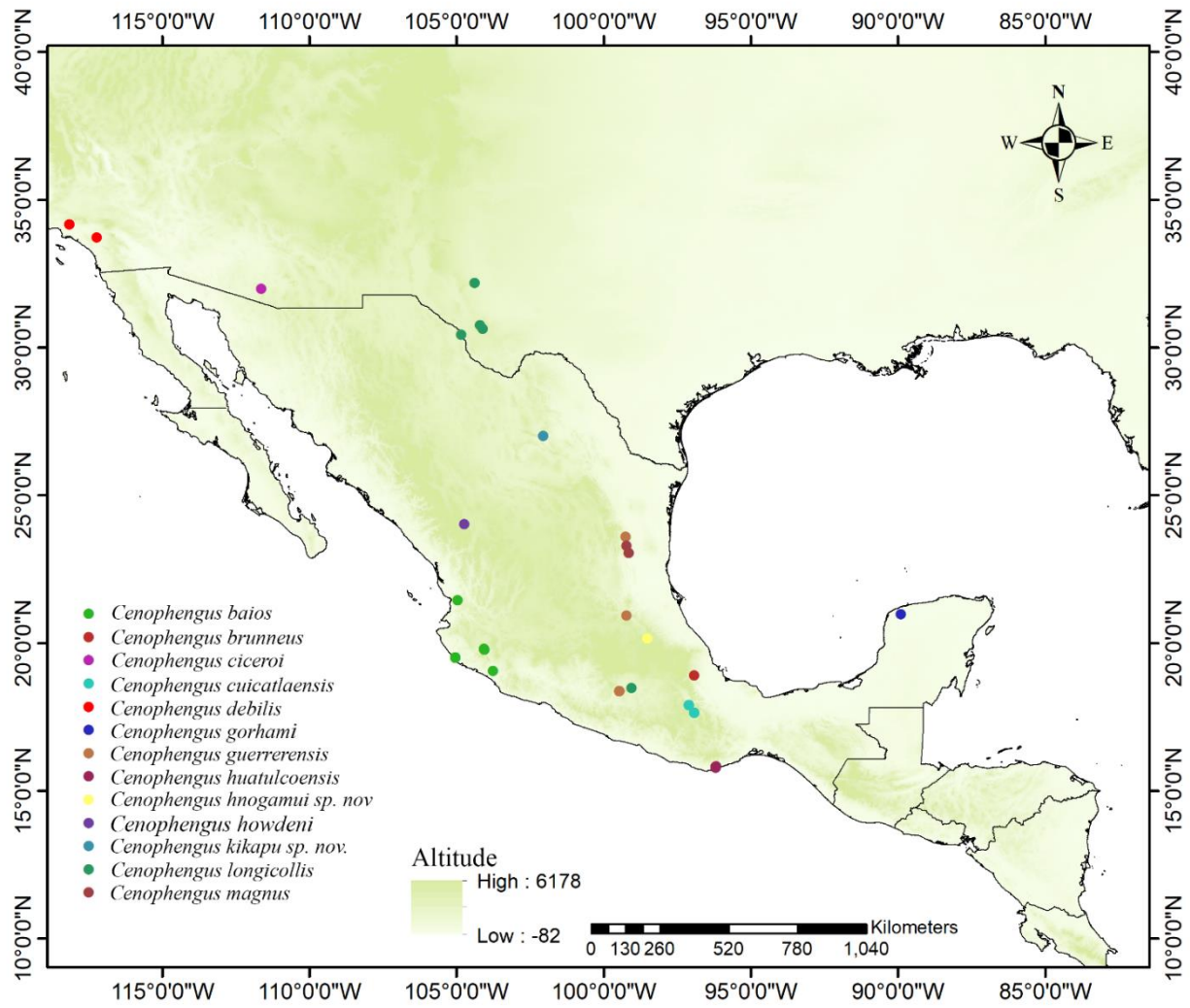
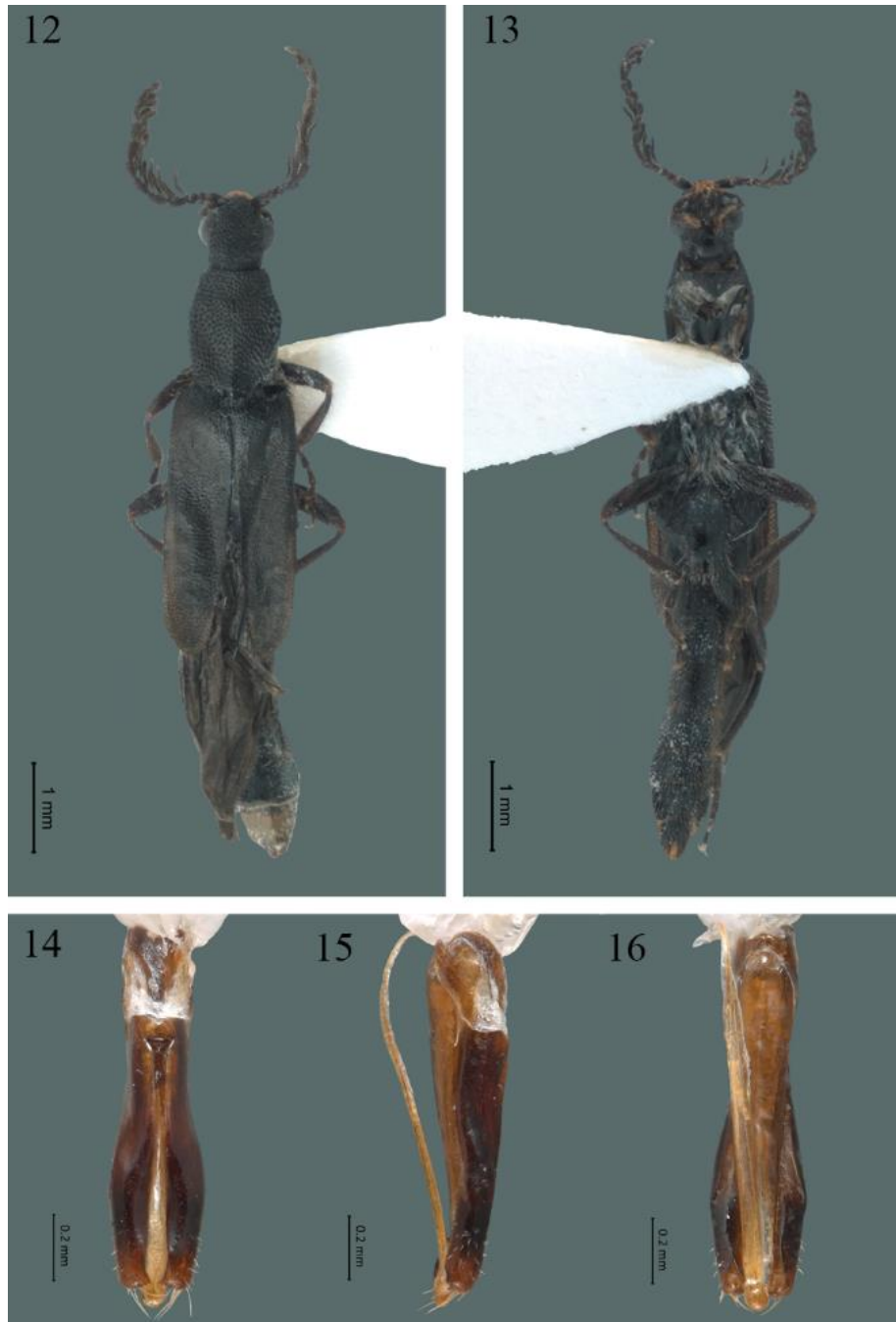


Figure 6. Distribution of *Cenophengus*.



Figures 7- 13. *Cenophengus kikapu* sp. nov.; Figs. 8, 9, 10 dorsal, lateral and ventral view; Figs. 11, 12, 13 dorsal, lateral and ventral view of the aedeagus.



Figures 12-16. *Cenophengus mboi* sp. nov.; Figs. 12, 13 dorsal and ventral view; Figs. 14, 15, 16 dorsal, lateral and ventral view of the aedeagus.

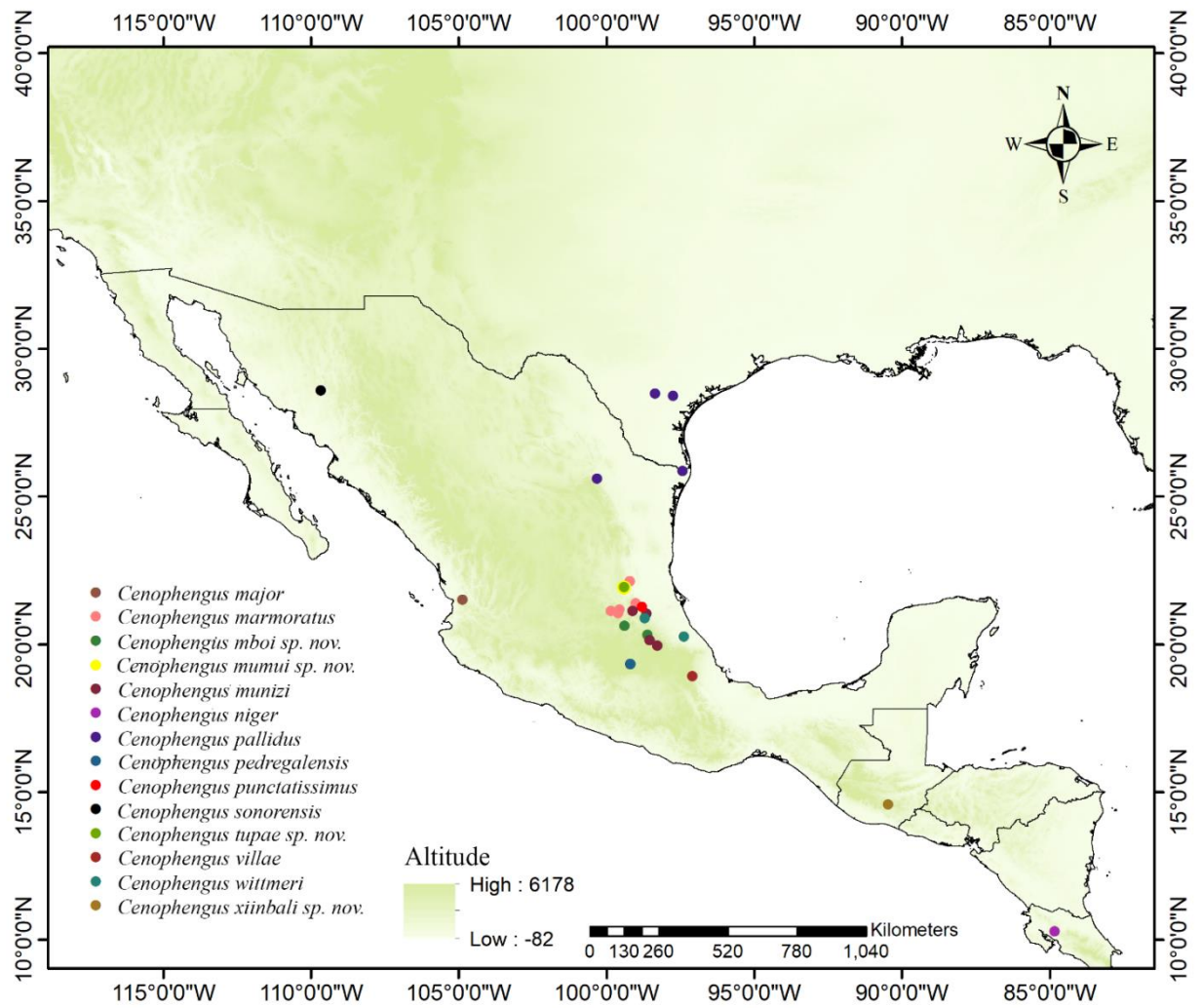
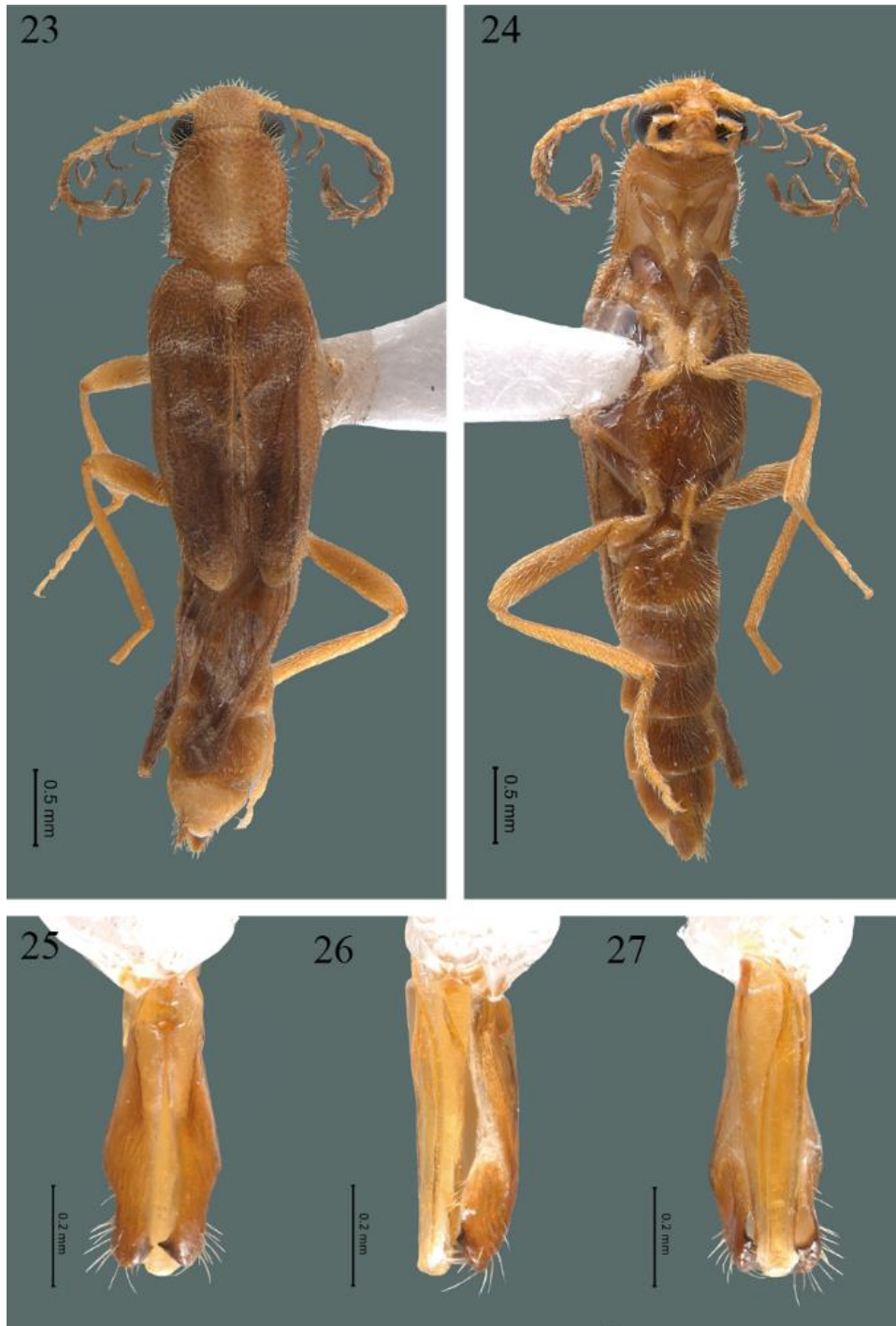


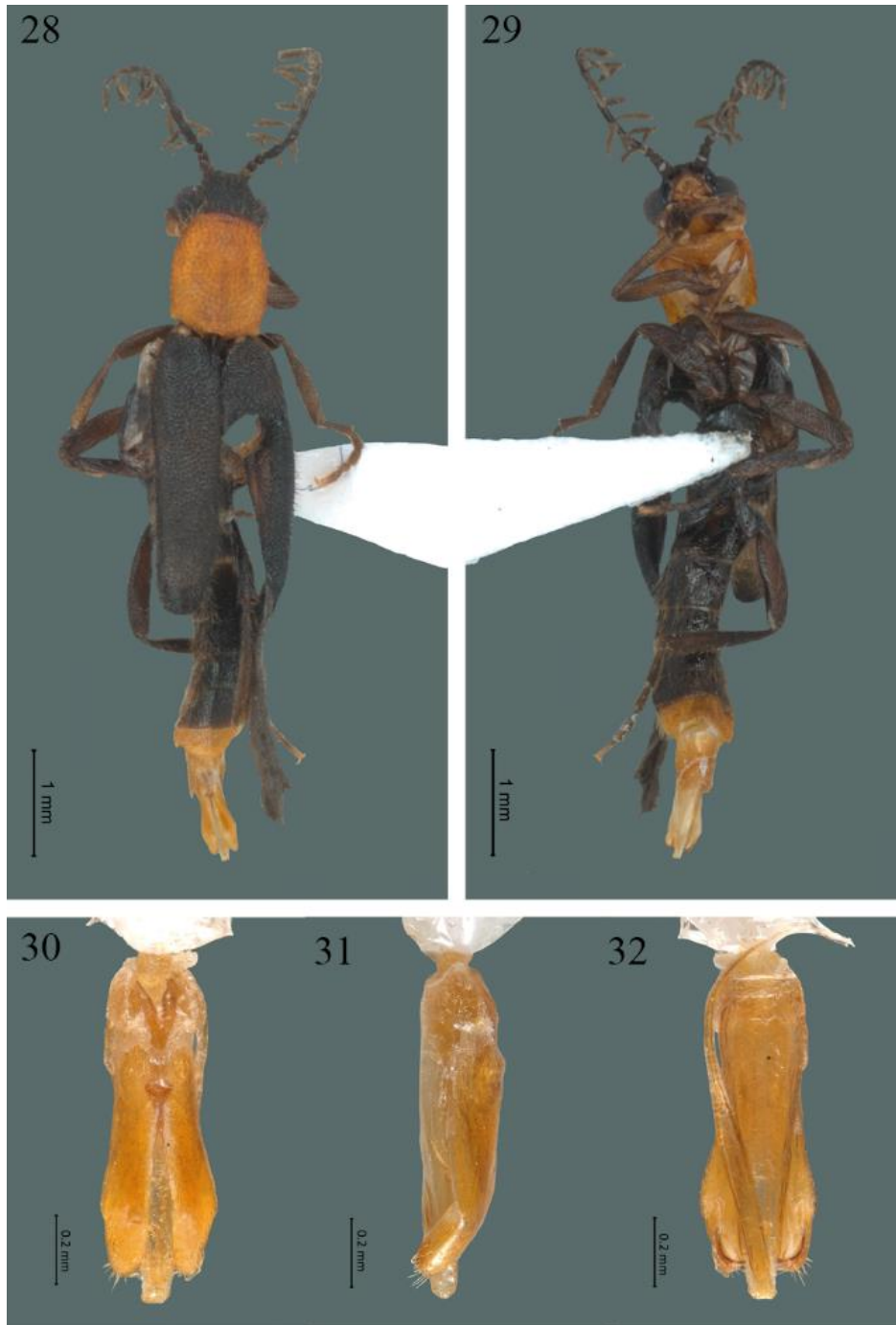
Figure 17. Distribution of *Cenophengus* (Continued)



Figures 18-22. *Cenophengus mumui* sp. nov.; Figs.18, 19 dorsal and ventral view; Figs. 20, 21, 22 dorsal, lateral and ventral view of the aedeagus.



Figures 23-27. *Cenophengus tupae* sp. nov.; Figs. 23, 24 dorsal and ventral view; Figs. 25, 26, 27 dorsal, lateral and ventral view of the aedeagus.



Figures 28-32. *Cenophengus xiinbali* sp. nov.; Figs.28, 29 dorsal and ventral view; 30, 31, 32 dorsal, lateral and ventral view of the aedeagus.

## **6.- CAPÍTULO II:**

**Phylogenetic analysis and evolutionary morphology of wings in the genus  
*Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae: Mastinocerinae) based on  
morphological characters**

Viridiana Vega-Badillo, Santiago Zaragoza-Caballero, Helga Ochoterena & Juan J. Morrone

**Enviado a Zoologischer Anzeiger**



**Phylogenetic analysis and evolutionary morphology of wings in the genus *Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae: Mastinocerinae) based on morphological characters**

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**Abstract**

The genus *Cenophengus* LeConte (1881) includes 27 described species, distributed from southern United States to northern Costa Rica. In order to test the monophyly of *Cenophengus*, a cladistic analysis based on 83 morphological characters, 26 ingroup species and 26 outgroup species was conducted. A clade supported by three synapomorphies corresponds to *Cenophengus* as a monophyletic group according to the relationships obtained (equal weights and implied weights). The systematic relevance of the coding of the characters from the wing is discussed and the sequence of the character state transformations for the veins (radial twenty [r3], posterior radial twenty [RP] size, and anterior cubital veins [CuA]) is optimized, in the cladogram obtained under implicit weights. *Cenophengus* species are distributed in the Nearctic and Neotropical regions, and particularly in the Mexican Transition Zone, where their greatest diversity is found.

**Key words:** Cladistics, external morphology, monophyly, systematics, Neotropical region, Mexican Transition Zone

## 1. Introduction

The genus *Cenophengus* was proposed by LeConte (1881), based on the description of two specimens from California, United States. It is distributed from southern United States to northern Colombia (Zaragoza-Caballero, 2008). The taxonomic history of *Cenophengus* is not complex, the 27 species currently described have been proposed by only five authors: Schaeffer (1904), Wittmer (1976, 1981, 1986), Zaragoza-Caballero (1975, 1984, 1986, 1988, 1991, 2003, 2008) and Vega-Badillo et al. (2020). Until now there have been no controversies concerning to species assigned to *Cenophengus*. The genus is characterized by two main characters: the widely separated distance from clearly separated tentorial pits and the simple tarsomeres (Zaragoza-Caballero, 2008).

Studies focused on resolving the phylogenetic relationships of Phengodidae are scarce. Zaragoza-Caballero and Zurita-García (2015) undertook a phylogenetic analysis based on morphological evidence, where *Cenophengus* was recovered as the sister group of Mastinocerinae and Phengodinae, supported by one synapomorph, the aedeagus with a visible flagellum. In this analysis, the traditional classification of Phengodidae into the subfamilies Phengodinae, Mastinocerinae and Penicillophorinae was challenged, and only the two former were found to be monophyletic. Souza-Quintino (2017) carried out a phylogenetic analysis to test the monophyly of Mastinocerinae, arriving to the same conclusions, as this subfamily was not found to be monophyletic, but the resulting topology was different, because the genus *Mastinowittmerus* was recovered as the sister group of Mastinocerinae plus Phengodinae. In this analysis, only three species of *Cenophengus* were included, and differences were found when using equal and implied weights.

Due to the low taxonomic representativeness, with the consequent exclusion of the morphological variation of the genus *Cenophengus* in previous phylogenetic analyses (Zaragoza-

Caballero & Zurita-García, 2015; Souza-Quintino, 2017), it is not clear whether *Cenophengus* is a monophyletic group. We analyze the relationships of a greater number of species, improving the taxonomic sampling of the genus to test its monophyly more adequately.

## 2. Material and methods

### 2.1

Fifty-five species were included in the cladistic analysis (Table 1). The ingroup consisted of 26 species of *Cenophengus*, and two new species. To select the outgroup, previous phylogenetic analyses of the family Phengodidae were taken into account (Zaragoza-Caballero & Zurita-García, 2015; Souza-Quintino, 2017). *Telegeusis moroni* Zaragoza-Caballero, 2015 was used to root the cladogram. Additionally, in order to test the monophyly of *Cenophengus* we sampled 25 species of 17 genera of Phengodidae (representing Phengodinae, Mastinocerinae and Penicillophorinae).

A total of 197 specimens analyzed were obtained on loan from the following collections (acronyms follow the Insect and Spider Collections of the World website [Evenhuis, 2018]): CNIN, Colección Nacional de Insectos, Instituto de Biología, UNAM, Mexico City (Santiago Zaragoza Caballero); BRI, Biosystematics Research Institute, Ottawa, Canada (Patrice Bouchard); CCo, Robert Constantin's collection, France (Robert Constantin); NMNH, Smithsonian Institution, Washington, DC, U.S.A. (Floyd Schokley); FSCA, Florida State Collection of Arthropods (Paul Skelley); FMNH, Field Museum of Natural History, Chicago, U.S.A. (Crystal A. Maier); and MEL, Museo Entomológico de León, Nicaragua (Jean-Michel Maes).

Specimens were examined with a Zeiss Discovery V8 stereomicroscope equipped with an ocular micrometer for length measurements. Characters used in previous phylogenetic studies were taken into account (Zaragoza-Caballero & Zurita-García, 2015; Souza-Quintino, 2017). New character hypotheses are indicated by a '\*' in the character list. The nomenclature used follows Lawrence et al. (2011), and wing's coding is based on Kukalova-Peck and Lawrence (1993). In order to obtain images

of the pronotum microstructure, scanning electron microscopy technique (SEM) was implemented using Hitachi SU1015 microscopes, in the Laboratorio de Microscopía y Fotografía de la Biodiversidad, Instituto de Biología, UNAM.

In order to designate the character states of characters 43 (Pronotum shape) and 74 (Lateral lobes shape), we performed a geometric morphometric analysis based on one picture per species, all with the same position and scale. Photographs were taken using a Zeiss Axio Zoom V16 microscope equipped with an Axiocam MRC5 digital camera and with Lens Plan NeoFluar Z, 1x10.25 FWD 56 (Laboratorio de Microscopía y Fotografía de la Biodiversidad, Instituto de Biología, UNAM). In each digital photograph we registered (x, y) cartesian coordinates from landmark (LM) and semi-landmark (SLM) points using tpsDig2 version 2.3 (Rohlf, 2017). As landmarks, we chose in the pronotum the four corners of the outline (4 LMs and 21 SLMs), this configuration of points will allow us to know the limits of both length and width. On the other hand, we chose three landmarks in the aedeagus, one in the inner part of the lateral lobe and two on the outer margin. The inner landmark was located where lateral lobe joins to the basal piece while the outer landmarks were located one on the apex of the lateral lobe and one at the inner landmark level (3 LMs and 21 SLMs). We registered all outlines with semi-landmarks positioned on segments of "fans" (1 pronotum) and "combs" (4 pronotum and 3 aedeagus) drawn with MakeFan8 software (Sheets, 2002). The lines were used as references to consistently register equivalent points along outlines from image to image using the tool tpsUtil version 1.69 (Rohlf, 2017). In order to recognize groups with greater similarity in the shape of these structures (character states), after the digitization of LM and SLM in the pronotum and aedeagus, we perform a cluster analysis for each structure on the basis of Euclidean distance matrix of the adjusted coordinates. The resulting difference matrix were plotted in a phenogram used as reference for the character state assignment (Figs. 1, 2), all cluster analysis were made in Past3 software.

A total of 39 binary and 44 multistate characters were coded. In the case of continuous characters we used the following formula to designate the character states:  $dmm = \max - \min / 3$ , where  $dmm$  is the difference between the minimum and maximum, divided by the number of character states. The character states were assigned as follows: 0 =  $\min + dmm$ ; 2 =  $\max - dmm$ ; 1 = intervals between 0 and 2. In the characters that exhibited a greater variability, box plots were made to identify the number of character states, which allowed to modify the formula of three character states to those shown by the diagram. Individual consistency and retention indices ( $ci$ ,  $ri$ ) are provided for all characters.

#### Character list

0. Average body length: less than 5.7 mm = 0; 5.8 mm to 8.4 mm = 1; 8.5 mm to 11.2 mm = 2; 11.3 mm to 14.16 mm = 3; 14.7 mm to 17 mm = 4; more than 17.1 mm = 5 ( $ci=0.29$ ;  $ri=0.42$ )

#### Head

1. Head shape: wider than long = 0; wide as long = 1; longer than wide = 2 ( $ci=0.22$ ;  $ri=0.63$ )

2. Interantennal distance: less than 0.33 mm = 0; from 0.34 mm to 0.62 mm = 1; 0.63 mm to 0.91 mm = 2; more than 0.92 mm = 3 ( $ci=0.37$ ;  $ri=0.37$ )

3. Eyes length: less than 0.29 mm = 0; 0.3 mm to 0.46 mm = 1; 0.46 mm to 0.63 mm = 2; more than 0.64 mm = 3 ( $ci=0.21$ ;  $ri=0.62$ )

4. Eyes width: less than 0.2 mm = 0; 0.21 mm to 0.34 mm = 1; more than 0.35 mm = 2 ( $ci=0.15$ ;  $ri=0.38$ )

5. Eyes shape: rounded = 0; oval = 1 ( $ci=0.09$ ;  $ri=0.44$ )

6. Relationship between head length and eyes length: less than 1.3 = 0; 1.4 to 2 = 1; more than 2.1 = 2 ( $ci=0.12$ ;  $ri=0.30$ )

7. Interocular distance: less than 0.6 mm = 0; 0.7 mm to 1.4 mm = 1; more than 1.5 mm = 2 ( $ci=0.16$ ;  $ri=0.41$ )

8. Relationship between interocular distance and eye width in dorsal view: less than 3.3 = 0; 3.4 to 4.9 = 1; more than 5 = 2 (ci=0.13; ri=0.13)
9. Relationship between interocular distance and eye width in ventral view: less than 1.6 = 0; 1.7 to 3 = 1; more than 3.1 = 2 (ci=0.12; ri=0.17)
10. Antennae shape: serrate = 0; semiserrated = 1; filiform = 2 (ci=0.15; ri=0.52)
11. Number of antennomeres: 12 = 0; 11 = 1 (ci=1; ri=1)
12. Antennae length: short (barely reaching the posterior border of pronotum) = 0; intermediate (extending slightly beyond posterior border of pronotum) = 1; long (extending beyond half of body) = 2 (ci=0.25; ri=0.62)
13. Antennal rami: absent = 0; present = 1 (ci=1; ri=1)
14. First antennomere shape: cylindrical = 0; cylindrical and hollow at base = 1; cup-shaped = 2 (ci=0.18; ri=0.50)
15. First antennomere length: less than 0.25 = 0; 0.26 to 0.43 = 1; more than 0.44 = 2 (ci=0.40; ri=0.66)
16. Relationship between interantennal distance and first antennomere length: less than 1.3 = 0; 1.4 to 2.2 = 1; more than 2.3 = 2 (ci=0.20; ri=0.57)
17. Second antennomere shape: cylindrical = 0; cup-shaped = 1 (ci=0.09; ri=0.28)
18. Second antennomere length: less than 0.09 mm = 0; 0.1 mm to 0.14 mm = 1; more than 0.15 mm = 2 (ci=0.18; ri=0.47)
19. Third antennomere length: less than 0.08 mm = 0; 0.09 mm to 0.13 mm = 1; more than 0.14 mm = 2 (ci=0.40; ri=0.57)
20. Relationship between first and third antennomere length: less than 0.67 = 0; 0.68 to 1 = 1; 1.1 to 1.35 = 2; more than 1.36 = 3 (ci=0.16; ri=0.31)
21. Apical antennomere shape: claviform = 0; lanceolate = 1; securiform = 2; filiform = 3 (ci=0.37; ri=0.72)

22. Twelfth antennomere length: less 2 mm = 0; 2.1mm to 3.9 mm = 1; more than 4 mm = 2 (ci=0.20; ri=0.68)
23. Relationship between twelfth and eleventh antennomere length: less than 1.7 = 0; 1.8 to 2.9 = 1; 3 to 4.2 = 2; more than 4.3 = 3 (ci=0.30; ri=0.30)
24. Antennal rami shape: lanceolate = 0; filiform = 1 (ci=0.12; ri=0.61)
25. Relationship between the antennal rami length and their respective antennomere length: less 2.3 = 0; 2.4 to 3.4 = 1; 3.5 to 4.5 = 2; 4.6 to 5.6 = 3; 5.7 to 6.7 = 4; 6.8 to 7.8 = 5; more than 7.9 = 6 (ci=0.40; ri=0.35)
26. Antennal protuberances: absent = 0; present = 1 (ci=0.20; ri=0.55)
27. Position of forehead in dorsal view: vertical = 0; horizontal = 1 (ci=1; ri=1)
28. Clypeus shape: bilobed = 0; lobed = 1 (ci=0.14; ri=0.50)
29. Sclerosed clypeus: partially sclerosed = 0; totally sclerosed = 1 (ci=50; ri=96)
30. Prementum shape: longer than wide = 0; wider than long = 1 (ci=0.50; ri=0.94)
31. Apical maxillary palpomere shape: cylindrical = 0; securiform = 1; spindle-shaped = 2; dorso-ventrally flattened = 3 (ci=0.60; ri=0.50)
32. Relationship between the fourth and third maxillary palpomeres length: less than 1.8 = 0; 1.9 to 2.5 = 1; more than 2.6 = 2 (ci=0.10; ri=0.33)
33. Number of labial pals: 1= 0; 2= 1; 3=2 (ci=0.40; ri=0.75)
34. Apical labial palpomere shape: cylindrical = 0; 0; securiform = 1; spindle-shaped = 2; dorso-ventrally flattened = 3 (ci=0.20; ri=0.33)
35. Tentorial pits: widely separated = 0; nearby = 1; merged = 2 (ci=0.66; ri=0.95)
36. Gular suture shape: straight = 0; sinuous = 1 (ci=1; ri=1)
37. Distance between gular suture in middle part: merged = 0; widely separated = 1; nearby = 2 (ci=1; ri=1)

38. Head punctuation type: simple = 0; umbilical = 1; composite = 2 (ci=0.33; ri=0.84)
39. Head punctuation size: small (less than 0.009 mm) = 0; medium (0.01 to 0.019 mm) = 1; large (more than 0,2 mm) = 2 (ci=0.15; ri=0.42)
40. Distance between punctuations on head (chose a score from the center and from it measured the distance to three other scores): less than 0.025 mm =0; 0.026 mm to 0.04 mm = 1; 0.041 mm to 0.055 mm = 2; more than 0.056 mm = 3 (ci=0.16; ri=0.16)
41. Surface shape of tegument between punctuations on the head: chagrined = 0; 1 smooth = 1 (ci=0.33; ri=0.90)
42. Apical shape of cervical sclerites: rounded = 0; truncated = 1 (ci=0.20; ri=0.33)
- Prothorax
43. Pronotum shape: square = 0; semicircular = 1; rectangular = 2 (ci=0.22; ri=0.74) (Fig. 1)
44. Pronotun anterior border shape: straight = 0; blunt = 1 (ci=0.16; ri=28)
45. Pronotum lateral border shape: almost straight = 0; curved = = 1 (ci=0.11; ri=0.61)
46. Pronotum anterior angles shape: blunt = 0; acute = 1 (ci=0.33; ri=0.50)
47. Pronotum posterior angles shape: blunt = 0; acute = 1 (ci=0.08; ri=0.57)
48. Surface shape of the tegument between punctuations in pronotum: chagrined = 0; smooth = 1 (ci=0.50; ri=0.94)
49. Punctuation size in pronotum disc: small (less than 0.018 mm) = 0; medium (0.019 mm to 0.033 mm) = 1; big (more than 0.033) = 2 (ci=0.50; ri=0.81)
50. Distance between pronotum disc punctuation (chose a score from the center and from it measured the distance to three other scores): less than 0.028 mm = 0; 0.029 mm to 0.047 mm = 1; more than 0.048 mm = 2 (ci=0.11; ri=0.28)
51. Prosternum: developed = 0; shortened= 1 (ci=0.20; ri=0.83)
52. Prosternum anterior border shape: sinuous = 0; straight = 1; concave = 2 (ci=0.28; ri=0.70)



53. Prosternum posterior border shape: acute = 0; blunt = 1; truncated = 2 (ci=0.16; ri=0.52)

54. Sternum posterior border shape: acute = 0; straight = 1 (ci=0.14; ri=0.45)

55. Sternum lateral border shape: curved = 0; straight = 1 (ci=0.20; ri=0.63)

56. Sternum suture: complete = 0; incomplete = 1 (ci=0.06; ri=0.34)

57. Scutellum shape: quadrangular = 0; spatula-shape = 1 (ci=0.14; ri=0.33)

58. Scutellum apex: blunted = 0; cleft = 1 (ci=0.07; ri=0.38)

#### Elytra

59. Elytra length: less than 2.1 mm = 0; 2.2 mm to 3.3 mm = 1; 3.4 mm to 4.5 mm = 2; 4.6 mm to 5.8 mm = 3; more than 5.9 mm = 4 (ci=0.23; ri=0.35)

60. Relationship between elytra length and elytra width: less than 2.9 = 0; 3 to 4 = 1; 4.1 to 5 = 2; 5.1 to 6.2 = 3; more than 6.3 = 4 (ci=0.17; ri=0.29)

61. Elytral apex shape: blunt = 0; acute = 1 (ci=0.07; ri=0.45)

#### Membranous wings

62. \*Radial cell: absent = 0; present = 1 (ci=0.50; ri=0.50)

63. \*Radial cell shape: closed = 0; open = 1 (ci=0.20; ri=0.63)

64. \*Radial vein (r3): absent= 0; present= 1 (ci=0.10; ri=0.50)

65. Posterior radial vein (RP): absent = 0; present = 1 (ci=0.33; ri=0.33)

66. \*Posterior radial vein (RP) size: reduced (less than half the size of MP1+2) = 0; developed (more than half the size of MP1+2) = 1 (ci=0.12; ri=0.58)

67. \*Posterior medial vein (MP 1+2): absent 0; present = 1 (ci=0.50; ri=0)

68. Anterior cubital veins (CuA: anterior anal (AA)): absent = 0; present = 1 (ci=0.25; ri=0.40)

69. Combs in first tarsomere: absent= 0; present = 1 (ci=0.20; ri=0.69)

#### Abdomen

70. Posterior border shape of penultimate sternite: concave = 0; sinuate = 1; cleft = 2 (ci=0.16; ri=0.41)

71. Posterior border shape of last sternite: straight = 0; blunt = 1; concave = 2; cleft = 3 (ci=0.18; ri=0.31)

72 Apex shape of lobes of last sternite (cleft sternite): blunt = 0; acute = 1 (ci=0.50; ri=0)

#### Aedeagus

73. Aedeagus: narrow = 0; robust = 1 (ci=0.20; ri=0.60)

74. \*Lateral lobes shape: (Fig. 2) (ci=0.71; ri=0.90)

75. \*Apex of lateral lobes: toothed = 0; toothless = 1 (ci=0.20; ri=0.60)

76.\*Number of teeth in apex of lateral lobes: 1= 0; 2= 1; 3= 2 (ci=0.40; ri=0.75)

77. \*Middle lobe size: smaller than lateral lobes = 0; the same as lateral lobes = 1; a little greater than lateral lobes = 2; twice greater than lateral lobes = 3 (ci=0.33; ri=0.73)

78. \*Middle lobe shape: grooved = 0; tubular = 1 (ci=0.20; ri=0.55)

79. \*Apex shape of middle lobe: rounded = 0; acute = 1; concave = 2; globular = 3 (ci=0.30; ri=0.66)

80. \*Insertion of flagellum in middle lobe: apical = 0; not apical = 1 (ci=0.50; ri=0.96)

81. \*Flagellum length: one and a half times longer than aedeagus length = 0; twice longer than aedeagus length = 1; three times longer than aedeagus length = 2. (ci=0.16; ri=0.52)

82. \*Seta size in apex in lateral lobes: big = 0; small = 1 (ci=0.12; ri=0.69)

## 2.2 Phylogenetic analysis

The data matrix was compiled using Winclada 1.00.08 (Nixon, 2002). Character polarity was determined by rooting with the outgroup comparison method (Nixon & Carpenter, 1993). Multistate characters were considered as non-additive. The code “?” was used to represent unobserved data and, “-” to represent inapplicable character states. Parsimony analyses were carried out in TNT 1.5 (Goloboff & Catalano, 2016) under equal weights, using the heuristic method of new search strategies (Ratchet), with the following parameters: 20 random seeds, find minimum length 10 times and 5000 iterations. Most parsimonious trees were summarized using a strict consensus tree constructed in

Winclada 1.00.08 (Nixon, 2002). To explore the effect of homoplasy on the results of the first analysis, a second analysis was performed under implied weights (IW) (Goloboff, 1993), with constants of concavity (k) set to different integer values of 3, 4, 6 and 11, where 1 is the most severely weighted against homoplastic characters. The TNT setk script, developed by Salvador Arias, was used to identify the most appropriate K value through the formula proposed by Goloboff et al. (2008). A value of 9.2188 was returned and subsequently used in the implied weighting scheme, using the heuristic method, of new search strategies were implemented (Ratchet), with the following parameters: 20 random seeds, find minimum length 10 times and 5000 iterations. To evaluate the statistical branch support, a Jackknife analysis was conducted with NONA (Goloboff, 1999) through WinClada 1.00.08 (Nixon, 2002), with 1,000 replicates conducted using 100 initial trees holding 10 trees and expanding the memory up to 1,000 trees (mult\*100 hold/10 max\*100).

### 2.3 Ancestral state reconstruction of the wing veins configuration

In an effort to understand the evolution of the wing veins configuration in *Cenophegus*, three characters related to the wing venation (64, 66 and 68) were optimized in TNT on the weighted cladogram. TNT shows our characters under Fitch optimization, because we considered them as ‘nonadditive’.

### 2.4 Distribution

Google Earth Pro 7.3.2.5776 was used to complete specimen locality georeferences. Only specimens examined by the authors were considered to determine distributional areas. A taxon-area cladogram was constructed by replacing the terminal species by the biogeographic areas recognized by Morrone et al. (2017).

## 3. Results

### 3.1

The data matrix had 4,565 cells, with 52 cells coded as missing (?) and 60 as inapplicable (–) (Appendix A).

### 3.2 Parsimony analysis using equal weights

The parsimony analysis with equal weights (EW) yielded 34 most parsimonious trees with 704 steps (length = L), a consistency index (CI) of 0.21, and a retention index (RI) of 0.58. The strict consensus tree (L=798; CI=0.19; RI=0.51) is presented in Figure 3. The consensus tree was not fully resolved; however, *Cenophengus* was recovered as monophyletic by synapomorphies 36:1, 37:1 and 74:2 (gular suture shape: sinuous; distance between gular suture in middle part: widely separated; lateral lobes shape: character state 2) (Fig. 2).

#### 3.2.1 Parsimony analysis using implied weights

The analyses under IW with different concavities  $k = 3, 4, 6, 11$  (Appendix B) and 9.2188 recovered *Cenophengus* as monophyletic. The cladogram with  $k = 9.2188$  (L: 714; Ci= 0.21; Ri= 0.58) was selected for comparison with the trees from other analyses, as it presents the majority of the clades obtained for all concavities (Fig. 4) (Goloboff et al. 2008), it was 10 steps longer than the most parsimonious trees under EW.

The phylogenetic hypothesis obtained groups the species into five main clades. Clade A, *Adendrocera* recovered as the sister group of all Phengodidae. Clade B, supported by synapomorphies 13:1 and 28:0 (antennal rami: present; clypeus shape: bilobed), includes the rest of the Phengodidae. Clade C, supported by synapomorphy 37:2 (distance between gular suture in middle part: nearby) and homoplasies 39:1; 65: 0 and 79:0 (head punctuation size: small; posterior radial vein: absent; apex shape of middle lobe; rounded) is made up only of *Cleicosta brevipumata* and *C. monaguensis*. Clade D is supported by synapomorphies 32:1 and 63:0 (relationship between the fourth and third maxillary palpomeres length: 1.9 to 2.5) and homoplasies 5:0; 21:1; 61:1 and 81:0 (eyes shape: oval; apical antennomere shape: securiform; elytral apex shape: acute; flagellum length: one and a half times longer than aedeagus length). Clade E is supported by synapomorphies 1:1 and 76:1 (head shape: longer than wide; number of teeth in apex of lateral lobes: 0). Clade F, supported by synapomorphies 36:1, 37:1

and 74:2 (gular suture shape: sinuous; distance between gular suture in middle part: widely separated; lateral lobes shape: character state 3 (Fig. 2) and homoplasies 45:1 (pronotum lateral border shape: curved), groups the rest of the species of *Cenophengus*.

### 3.3 Ancestral state reconstruction of the wing veins configuration

The particular distribution of three characters referring to the wing configuration in phylogenetic analyses (64: Radial vein [r3] [Fig. 5]; 66: Posterior radial vein [RP] size [Fig. 6r3]; and 68: Anterior cubital veins [CuA] [Fig. 7]) suggests that the ancestral state of this structure may have consisted of a developed wing configuration, and that throughout its evolution it has had several transformations. In the case of *Cenophengus* something similar occurs, finding *C. debilis* with a developed wing configuration (64:1) (66:0) (68:1), which contrasts with species like *C. huatulcoensis*, *C. munizi*, *C. mumui* and *C. baios* whose wing configuration is poorly developed, due to the absence of the r3 vein (64:0), a reduced size of the radial vein (66:0) and the absence of the ulnar vein branches (68:0). Finally, in the rest of the species, which seem to be recently diverged, the presence of a developed wing configuration is observed, similar to that present in *C. debilis*. Nevertheless, these species are distinguished from each other by the presence or absence of the radial vein (66:0.1) and posterior radial vein size (66:0.1), among other characteristics.

### 3.4 Distribution

*Cenophengus* species are distributed in the Nearctic and Neotropical regions, as well as in the Mexican Transition Zone (sensu Morrone et al. 2017), where its highest diversity is found. In the results of this study three main clades can be identified: the first is distributed in the Sierra Madre Oriental and the Sierra Madre del Sur. The second is found towards the Mexican Pacific coast, including the Sierra Madre Occidental, the Sierra del Sur, as well as the Chihuahuan Desert. Finally, the third clade is widely represented in central Mexico, within the Mexican Transition Zone, to which the Chihuahuan

Desert and the Tamaulipas provinces are added, and southward in the Chiapas Highlands province (Fig. 8).

#### 4. Discussion

##### 4.1 Systematics of Phengodidae

In the present analysis the genus *Adendrocera* both with EW and IW changes its position: it is recovered as the earliest divergent taxon of all Phengodidae (k: 4, 6, 8.5935 and 11) or as part of a large clade including *Mastinocerus*, *Distremocephalus* and *Cenophengus* (k: 3). This genus is part of the subfamily Penicillophorinae, one of its main characteristics is the absence of antennal rami. Zaragoza-Caballero & Zurita-García (2015) proposed that the subfamily Penicillophorinae could be transferred to the family Telegeusidae; however, the aedeagus of these species has a visible flagellum, very similar to the rest of the Phengodidae. Recently, Kundrata et al. (2019) considered Cydistinae Paulus, 1972 as part of the subfamily Phengodidae based on a phylogenetic analysis. The morphological characteristics that could support this hypothesis, is the presence of short and simple antennomeres II and III, and the simple and maxillary palpomers usually long, are present in *Adendrocera*. We think that this genus is part of Phengodidae, so it is necessary to reassess the genera belonging to this family in the future.

The subfamily Phengodinae is recovered as a monophyletic group in both analyses (EW, IW), which is supported by two synapomorphies (15: 2 first antennomere length: more than 0.44; 79: 2 apex shape of the middle lobe: globular), in the IW analysis Phengodinae is nested within Mastinocerinae in clade E. Thus, its classification as a subfamily is not congruent with the phylogenetic hypothesis, as in the previous analyses (Zaragoza-Caballero & Zurita García, 2015; Souza-Quintino, 2017; Kundrata et al., 2019). The consistency of these results is remarkable, because several morphological characteristics have been analyzed, particularly, the aedeagus has been explored in a superficial way, considering a single character for this structure (Zaragoza-Caballero & Zurita-García, 2015). A more rigorous test including a bigger sample of Phengodinae species could corroborate these results.

## 4.2 Systematics of *Cenophengus*

With respect to the relationships of *Cenophengus* species, their current composition corresponds to a monophyletic group according to the relationships obtained in the present study (EW, IW). The species analyzed are grouped in clade F (Fig. 4) in both analyses (EW, IW), which is supported by the following synapomorphies: the sinuous shape of the gular suture, the distance between the gular sutures in the middle part widely separated and lateral lobes shape. This analysis included 26 of the 27 previously described species and two new species, the only missing species in this analysis is *C. major* described for Mexico, deposited in the American Museum of Natural History.

The relationships between the species are not very clear; however, we may distinguish *C. debilis* as the earliest divergent species, and on the other hand a clear group supported by a synapomorphy (48:0 Surface shape of the tegument between punctuations in pronotum: chagrined) was recovered. Because the characters that support some relationships between *Cenophengus* species could be thought to be ambiguous, for example the head punctuation size (39) and seta size in apex in lateral lobes (82), the use of molecular and morphometric data from other structures such as the head, may help clarify a clear relationship between *Cenophengus* species. It is important to recognize and generate information on their geographical distribution, which would allow to explore the existence of distribution patterns, which in turn would help identify the evolutionary processes that may have influenced the diversification of the group.

## 4.3 Ancestral state reconstruction of the wing veins configuration

One of the characteristics that stands out in the morphology of the *Cenophengus* species is the configuration of the wing veins, because this is unique enough to allow to distinguish the species. The wing configuration evolution has generated several transformations in *Cenophengus* species, such as CuA = cubital, anterior anal (AA) veins, which presence or absence is very evident.

This wing composition may be important in knowing the relationships present among different groups, for example Kundera et al. (2019) consider as important characters the AP3 + 4 bifurcated vein in *Cenophengus guerresensis* because it supports the relationship of Phengodidae with *Cydistus*; however, this AP3 vein is present in all species reviewed here, and it is not found bifurcated not even in *C. guerresensis*. Therefore, it is proposed to carefully review the wing configuration of a larger number of species and genera in future studies with the aim of investigating the phylogenetic context and evolutionary significance of this structure in Phengodidae.

#### 4.4 Morphological remarks

The diagnosis used to recognize the genus *Cenophengus* apparently has homoplastic characters, such as the position of the forehead in dorsal view; tentorial pits widely separated; and first tarsomere simple, without teeth. This combination of characters could include one species that does not correspond to this genus. However, the presence of a very well characterized aedeagus allow to distinguish the species of this genus.

#### **Acknowledgements**

We thank Susana Guzmán Gómez and Berenit Mendoza Garfias for technical assistance in taking the photographs. The first author thanks the Posgrado en Ciencias Biológicas, UNAM. This work was supported by a doctoral fellowship from the Consejo Nacional de Ciencia y Tecnología (CONACyT) to the first author.

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## Figure legends

**Fig. 1.** Phenogram obtained by digitizing the register of pronotum contour (landmarks), showing three character states (square = 0; semicircular = 1; rectangular = 2), using Euclidean distance. Photograph of character 43, with the digitization of the pronotum landmarks (geometric morphometrics).

**Fig. 2.** Phenogram obtained by digitizing the register of aedeagus contour (landmarks), showing six character states, using Euclidean distance. Photograph of character 74, with the digitization of the aedeagus landmarks (geometric morphometrics).

**Fig. 3.** Strict consensus tree of 34 most parsimonious trees (L: 798;  $C_i= 0.19$ ;  $R_i= 0.51$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations. The number depicted above each rectangle represents the character, and the number below the rectangle represents the character state. The big number below the branches corresponds to Jackknife values. In the cladogram, three important synapomorphies for *Cenophengus* are shown: (36:1) gular suture shape: sinuous; (37:1) distance between the gular suture in the middle part: widely separated; (74:2) lateral lobes shape: character state 2. A group of *Cenophengus* species is supported by a synapomorphy: surface shape of the tegument between punctuations in pronotum: chagrined (48:0).

**Fig. 4** Single cladogram obtained under implied weighting with  $k =9.2188$  (L: 714;  $C_i= 0.21$ ;  $R_i= 0.58$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations. The number depicted above each rectangle represents the character, and the number below the rectangle represents the character state. The big number below the branches corresponds to Jackknife values. In the cladogram, three important synapomorphies for F clade are shown: (36:1) gular suture shape: sinuous; (37:1) distance

between the gular suture in the middle part: widely separated; (74:2) lateral lobes shape: character state 2. A group of *Cenophengus* species is supported by a synapomorphy: surface shape of the tegument between punctuations in pronotum: chagrined (48:0).

**Fig. 5** Ancestral state reconstruction of the radial vein (r3) in the membrane wing. Venation: CR = Radial Cell; r4 = radial 4; r3 = radial 3; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

**Fig. 6** Ancestral state reconstruction of the posterior radial vein (RP) size in the membrane wing. Venation: CR = Radial Cell; r4 = radial 4; r3 = radial 3; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

**Fig.7** Ancestral state reconstruction anterior cubital veins (CuA: anterior anal (AA)) in the membrane wing. Venation: CR = Radial Cell; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

**Fig. 8** Area cladogram and maps showing the distribution of the species and main clades of *Cenophengus*.

#### **Supplementary data**

**Appendix A:** Data matrix used in the phylogenetic analysis.

**Appendix B:** Parsimony analysis using implied weights

## Tables

Table 1. Taxon sampling.

Family	Genus	Species	Country
Phengodidae			
	<i>Adendrocera</i>	<i>Adendrocera</i> sp.	Guatemala
	<i>Brasilocerus</i>	<i>B. wygodzinskyi</i> Wittmer, 1976	French Guiana
	<i>Cenophengus</i>	<i>C. baios</i> Zaragoza-Caballero, 2003	Mexico
		<i>C. brunneus</i> Wittmer, 1976	Mexico
		<i>C. ciceroi</i> Wittmer, 1981	United States
		<i>C. cuicatlaensis</i> Zaragoza-Caballero, 2008	Mexico
		<i>C. debilis</i> LeConte 1881	United States
		<i>C. guerrerensis</i> Zaragoza-Caballero, 1991	Mexico
		<i>C. gorhami</i> Zaragoza-Caballero, 1986	Mexico
		<i>C. hnogamui</i> Vega-Badillo et al.	Mexico
		<i>C. howdeni</i> Zaragoza-Caballero, 1986	Mexico
		<i>C. huatulcoensis</i> Zaragoza-Caballero, 2008	Mexico
		<i>C. kikapu</i> Vega-Badillo et al.	Mexico
		<i>C. longicollis</i> Wittmer, 1976	United States, Mexico
		<i>C. magnus</i> Zaragoza-Caballero, 1988	Mexico
		<i>C. marmoratus</i> Wittmer, 1976	Mexico
		<i>C. mboi</i> Vega-Badillo et al.	Mexico
		<i>C. mumui</i> Vega-Badillo et al.	Mexico
		<i>C. munizi</i> Zaragoza-Caballero, 2008	Mexico
		<i>C. niquer</i> Wittmer, 1986	Costa Rica
		<i>C. pallidus</i> Schaeffer, 1904	United States
		<i>C. pedregalensis</i> Zaragoza-Caballero, 1975	Mexico
	<i>C. puntatisimus</i> Wittmer, 1976	Mexico	
	<i>C. sonorensis</i> Zaragoza-Caballero, 2008	Mexico	

	<i>C. tupae</i> Vega-Badillo et al.	Mexico
	<i>C. villae</i> Zaragoza-Caballero, 1984	Mexico
	<i>C. wittmeri</i> Zaragoza-Caballero, 1984	Mexico
	<i>C. xiinbali</i> Vega-Badillo et al.	Guatemala
	<i>Cenophengus</i> sp1	Honduras
	<i>Cenophengus</i> sp2	Mexico
<i>Cephalophrixothrix</i>	<i>Cephalophrixothrix</i> sp.	Ecuador
<i>Cleicosta</i>	<i>C. brevipumata</i> Wittmer, 1976	Colombia
	<i>C. monaguensis</i> Vega-Badillo et al. 2020	Venezuela
<i>Distremocephalus</i>	<i>D. leionilae</i> Zaragoza-Caballero, 1986	Mexico
	<i>D. opaculus</i> (Horn, 1895)	United States
	<i>D. wittmeri</i> Zaragoza-Caballero, 1986	Mexico
<i>Eurymastinocerus</i>	<i>E. guyanensis</i> Constantin, 2014	French Guiana
	<i>E. niger</i> (Gorham, 1881)	Nicaragua
<i>Euryopa</i>	<i>E. opacipennis</i> (Pic, 1926)	Argentina
	<i>E. singularis</i> Gorham, 1881	Mexico
<i>Howdenia</i>	<i>H. robusta</i> Wittmer, 1988	French Guiana
<i>Mastinocerus</i>	<i>M. germaini</i> (Pic, 1930)	Chile
	<i>M. touroulti</i> Constantin, 2014	French Guiana
<i>Neophengus</i>	<i>N. penai</i> Wittmer, 1963	Chile
<i>Oxymastinocerus</i>	<i>O. nigripennis</i> Wittmer, 1988	French Guiana
<i>Paraptorthodius</i>	<i>P. queretaroensis</i> Zaragoza-Caballero, 1999	Mexico
	<i>P. schaefferi</i> Zaragoza-Caballero, 1989	Mexico
<i>Phengodes</i>	<i>Phengodes aztecus</i> Zaragoza-Caballero, 1981	Mexico
	<i>P. brailovskyi</i> Zaragoza-Caballero & Wittmer, 1986	Mexico
	<i>P. tuxtlaensis</i> Zaragoza-Caballero, 1989	Mexico
<i>Phrixothrix</i>	<i>P. gibbosus</i> Wittmer, 1976	French Guiana
<i>Pseudophengodes</i>	<i>Pseudophengodes</i> sp.	Costa Rica
<i>Stenophrixothrix</i>	<i>S. fuscus</i> (Gorham, 1881)	French Guiana

<i>Taximastinocerus</i>	<i>T. parallelus</i> Wittmer, 1976	French Guiana
	<i>Phengodidae</i> sp.	Venezuela

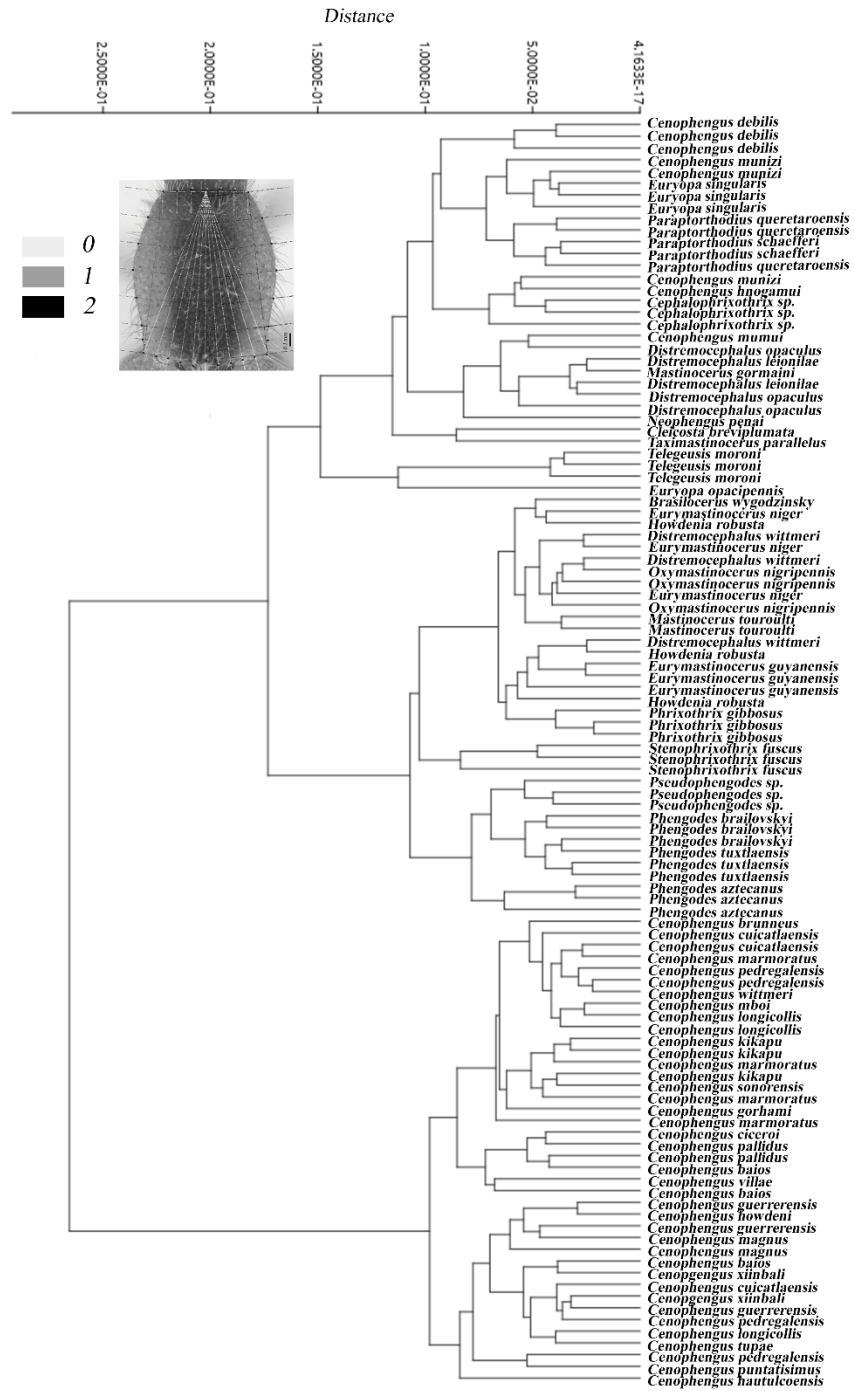
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Telegeusidae

<i>Telegeusis</i>	<i>T. moroni</i> Zaragoza-Caballero, 2015	Mexico
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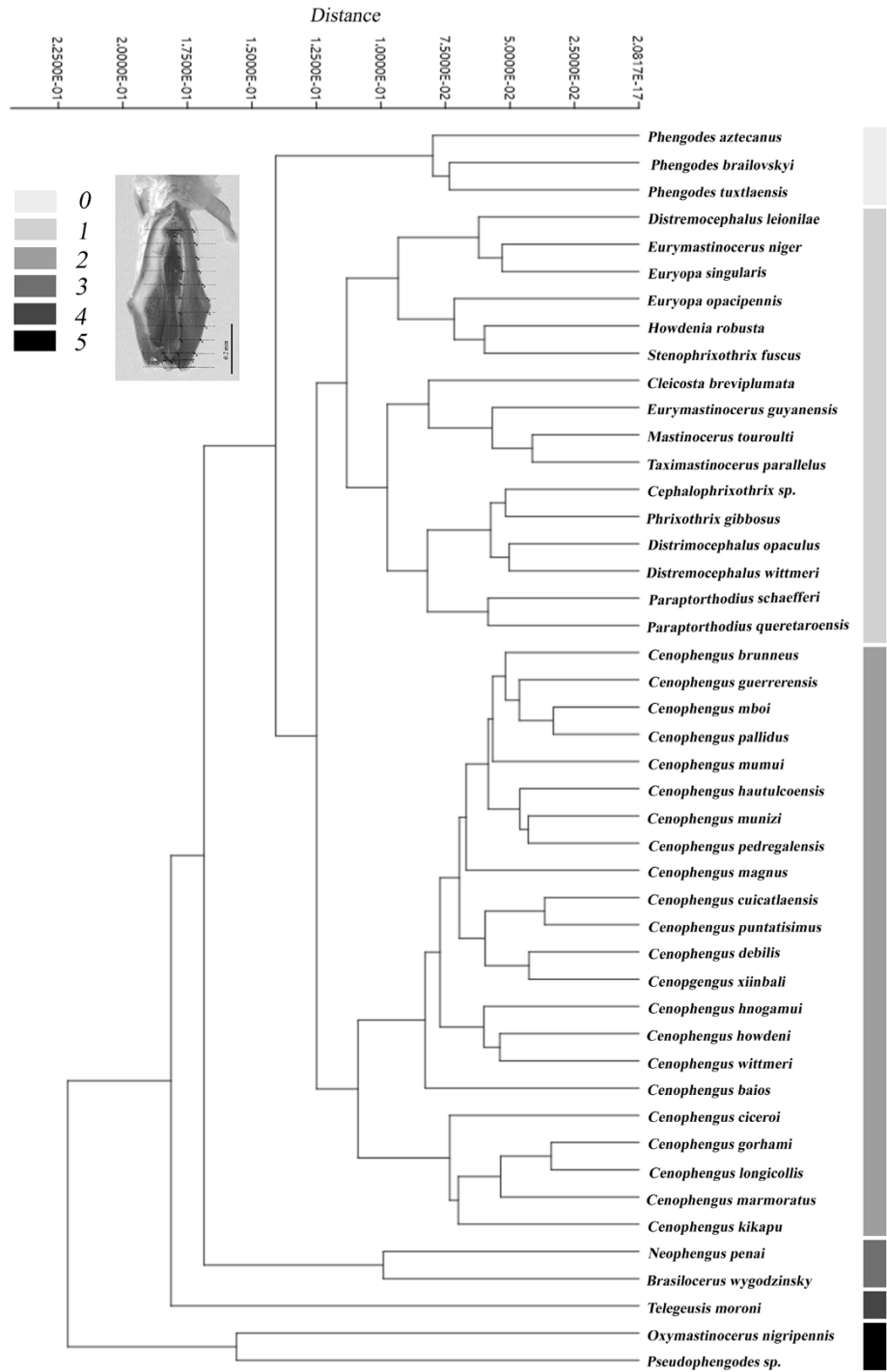
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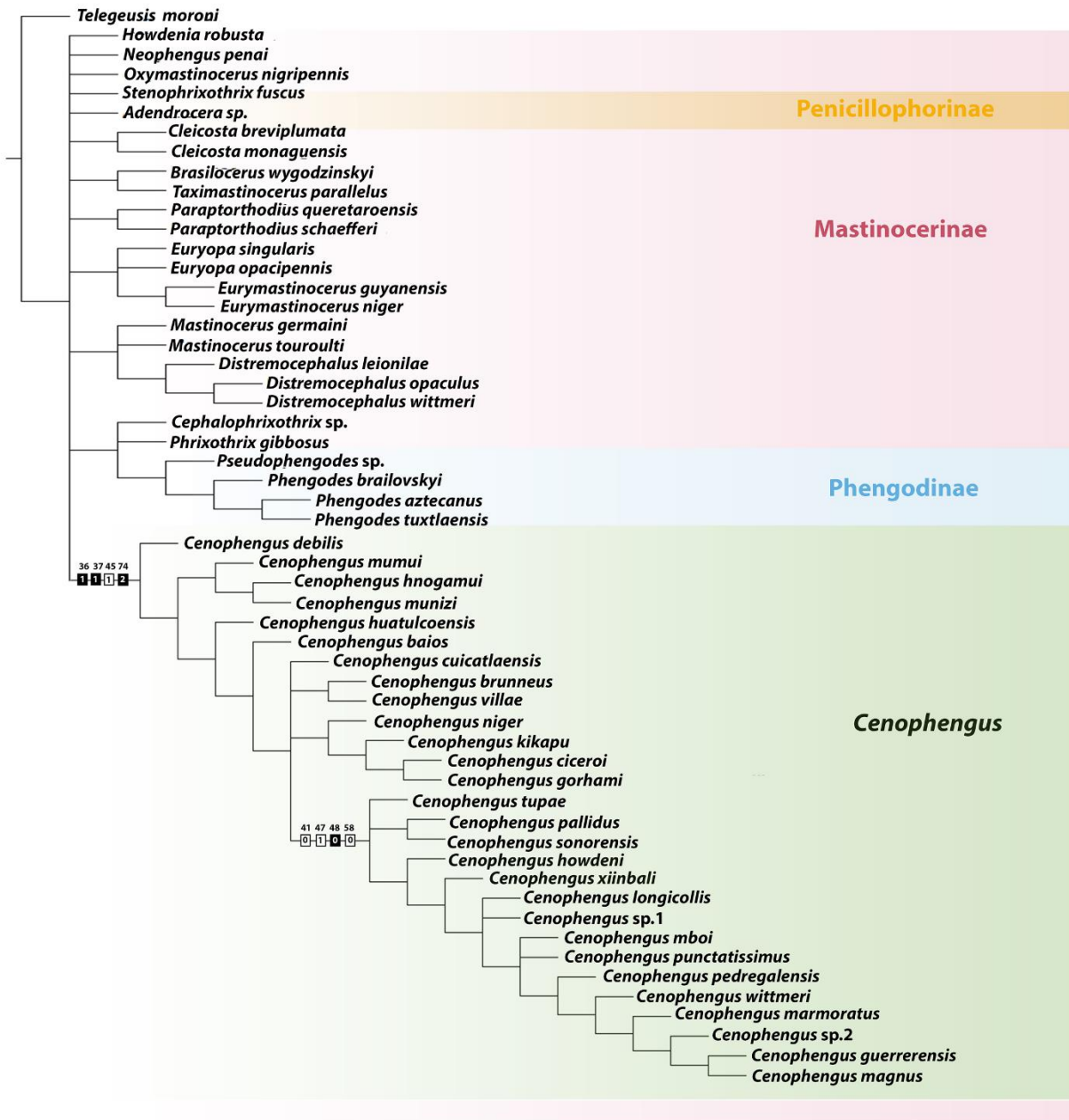


**Fig. 1.** Phenogram obtained by digitizing the register of pronotum contour (landmarks), showing three character states (square = 0; semicircular = 1; rectangular = 2), using Euclidean distance.

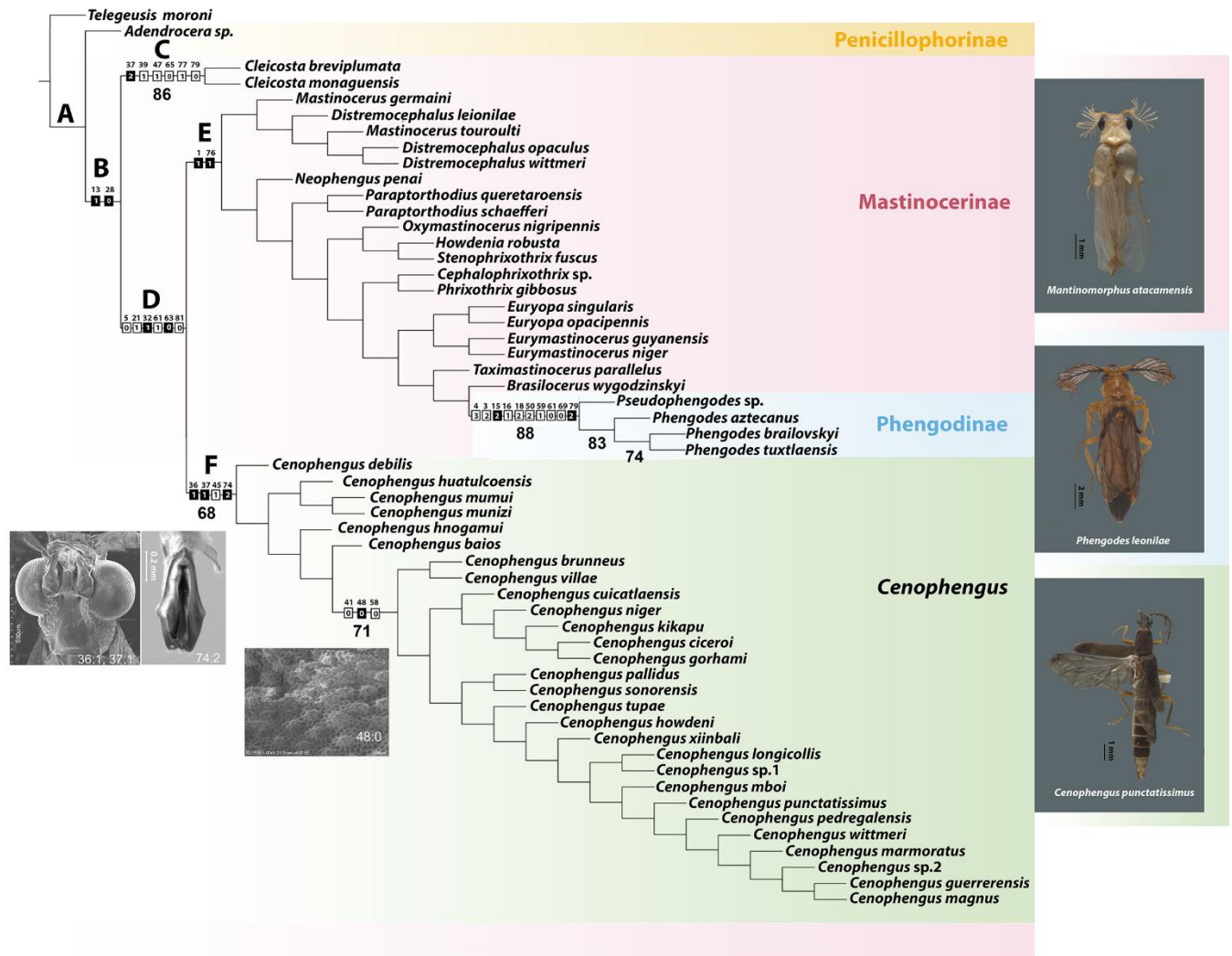
Photograph of character 43, with the digitization of the pronotum landmarks (geometric morphometrics).



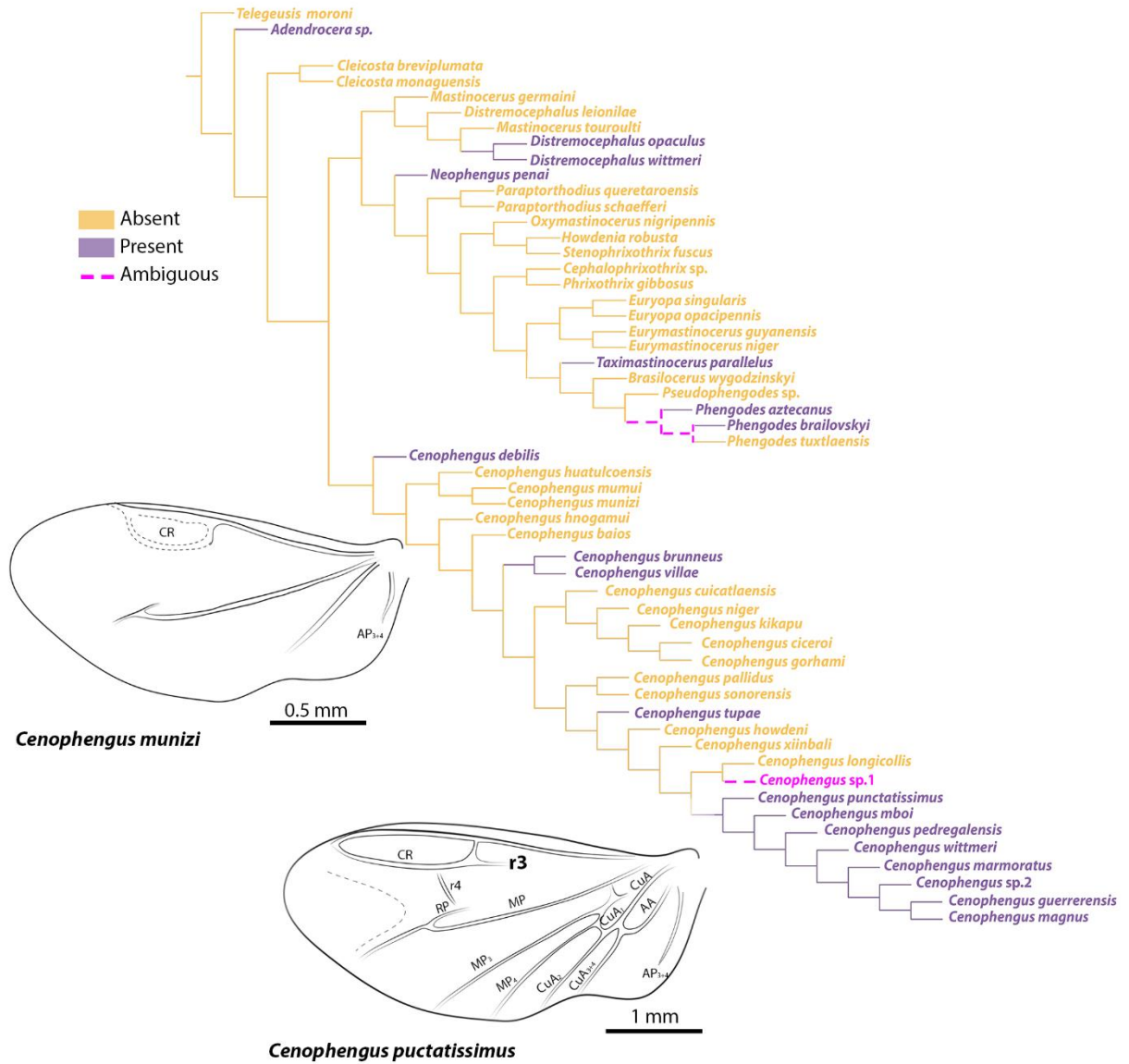
**Fig. 2.** Phenogram obtained by digitizing the register of aedeagus contour (landmarks), showing six character states, using Euclidean distance. Photograph of character 74, with the digitization of the aedeagus landmarks (geometric morphometrics).



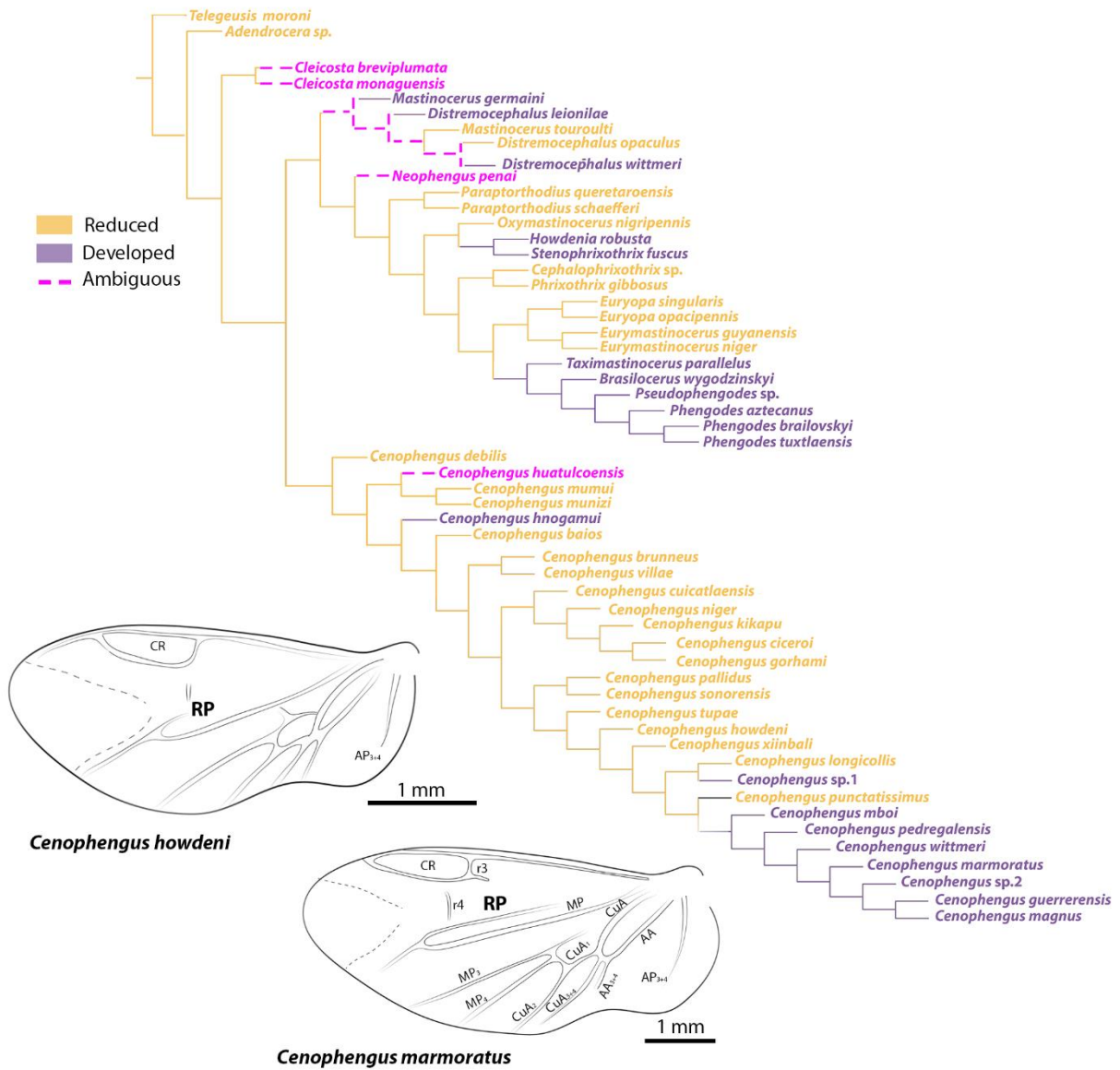
**Fig. 3.** Strict consensus tree of 34 most parsimonious trees (L: 798; Ci= 0.19; Ri= 0.51). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations. The number depicted above each rectangle represents the character, and the number below the rectangle represents the character state. The big number below the branches corresponds to Jackknife values. In the cladogram, three important synapomorphies for *Cenophengus* are shown: (36:1) gular suture shape: sinuous; (37:1) distance between the gular suture in the middle part: widely separated; (74:2) lateral lobes shape: character state 2. A group of *Cenophengus* species is supported by a synapomorphy: surface shape of the tegument between punctuations in pronotum: chagrined (48:0).



**Fig. 4** Single cladogram obtained under implied weighting with  $k = 9.2188$  (L: 714;  $Ci = 0.21$ ;  $Ri = 0.58$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations. The number depicted above each rectangle represents the character, and the number below the rectangle represents the character state. The big number below the branches corresponds to Jackknife values. In the cladogram, three important synapomorphies for F clade are shown: (36:1) gular suture shape: sinuous; (37:1) distance between the gular suture in the middle part: widely separated; (74:2) lateral lobes shape: character state 2. A group of *Cenophengus* species is supported by a synapomorphy: surface shape of the tegument between punctuations in pronotum: chagrined (48:0).

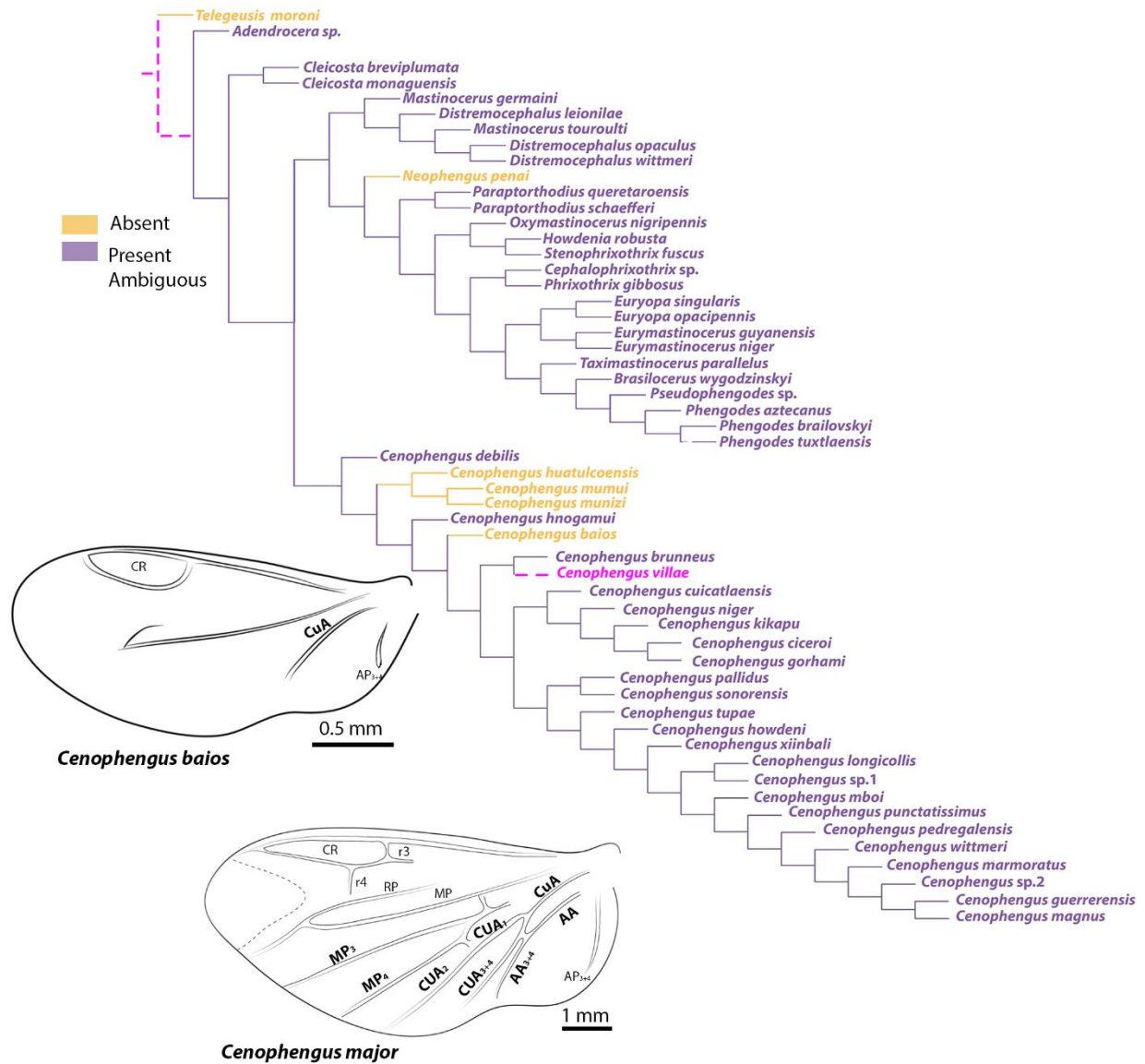


**Fig. 5** Ancestral state reconstruction of the radial vein (r3) in the membrane wing. Venation: CR = Radial Cell; r4 = radial 4; r3 = radial 3; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

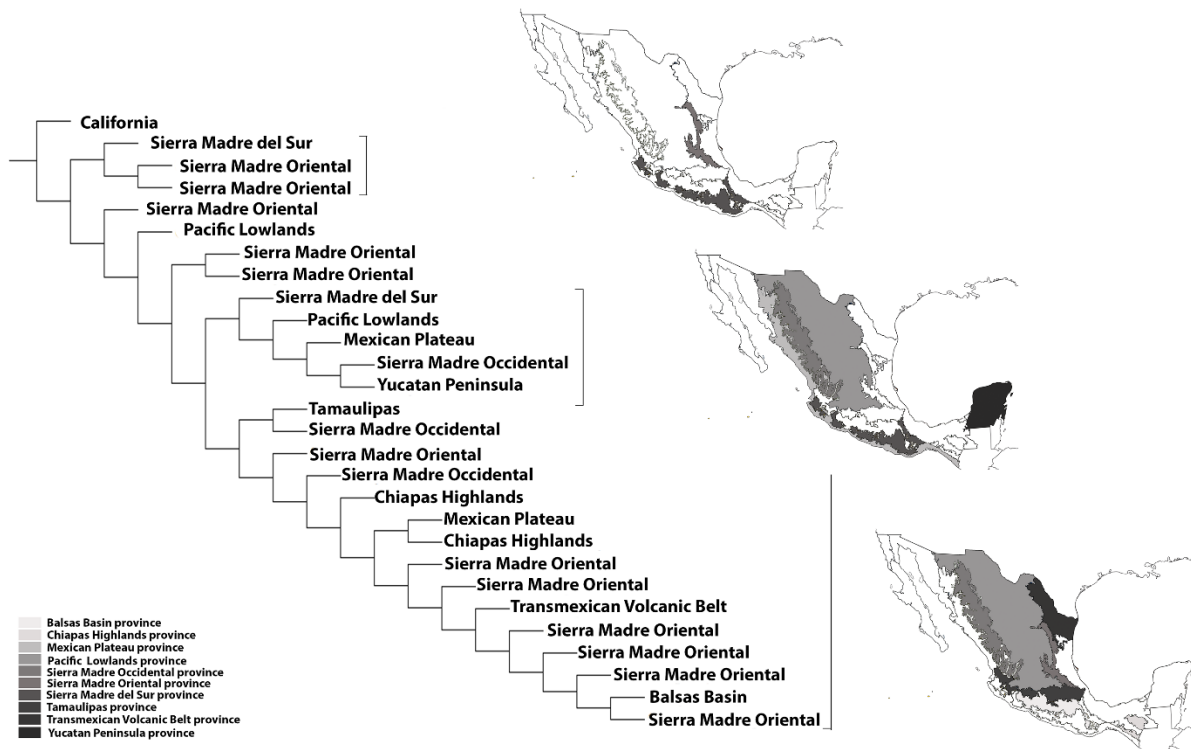


**Fig. 6** Ancestral state reconstruction of the posterior radial vein (RP) size in the membrane wing.

Venation: CR = Radial Cell; r<sub>4</sub> = radial 4; r<sub>3</sub> = radial 3; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.



**Fig.7** Ancestral state reconstruction anterior cubital veins (CuA: anterior anal (AA)) in the membrane wing. Venation: CR = Radial Cell; r3= radial 3; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.



**Fig. 8** Area cladogram and maps showing the distribution of the species and main clades of *Cenophengus*.

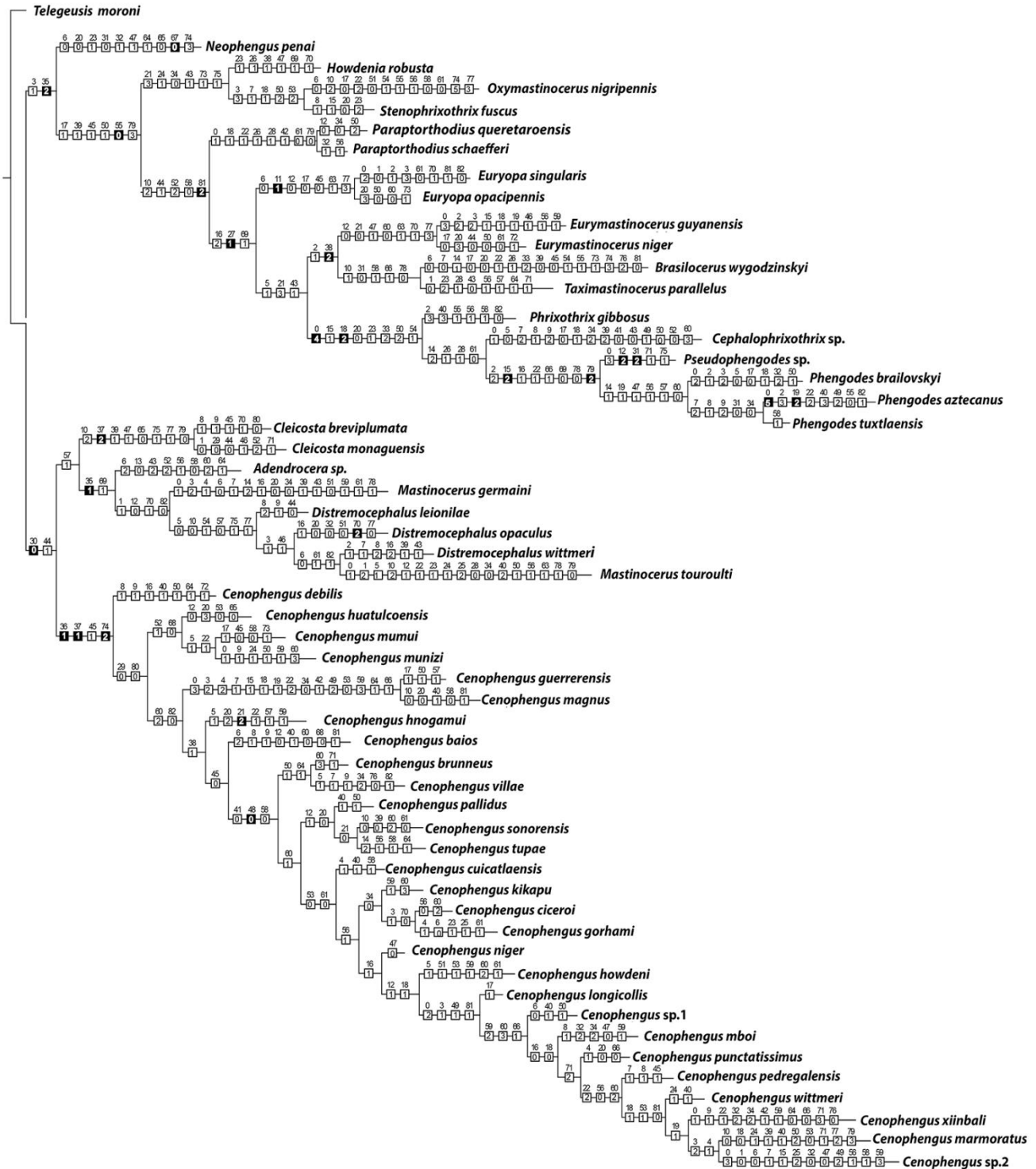




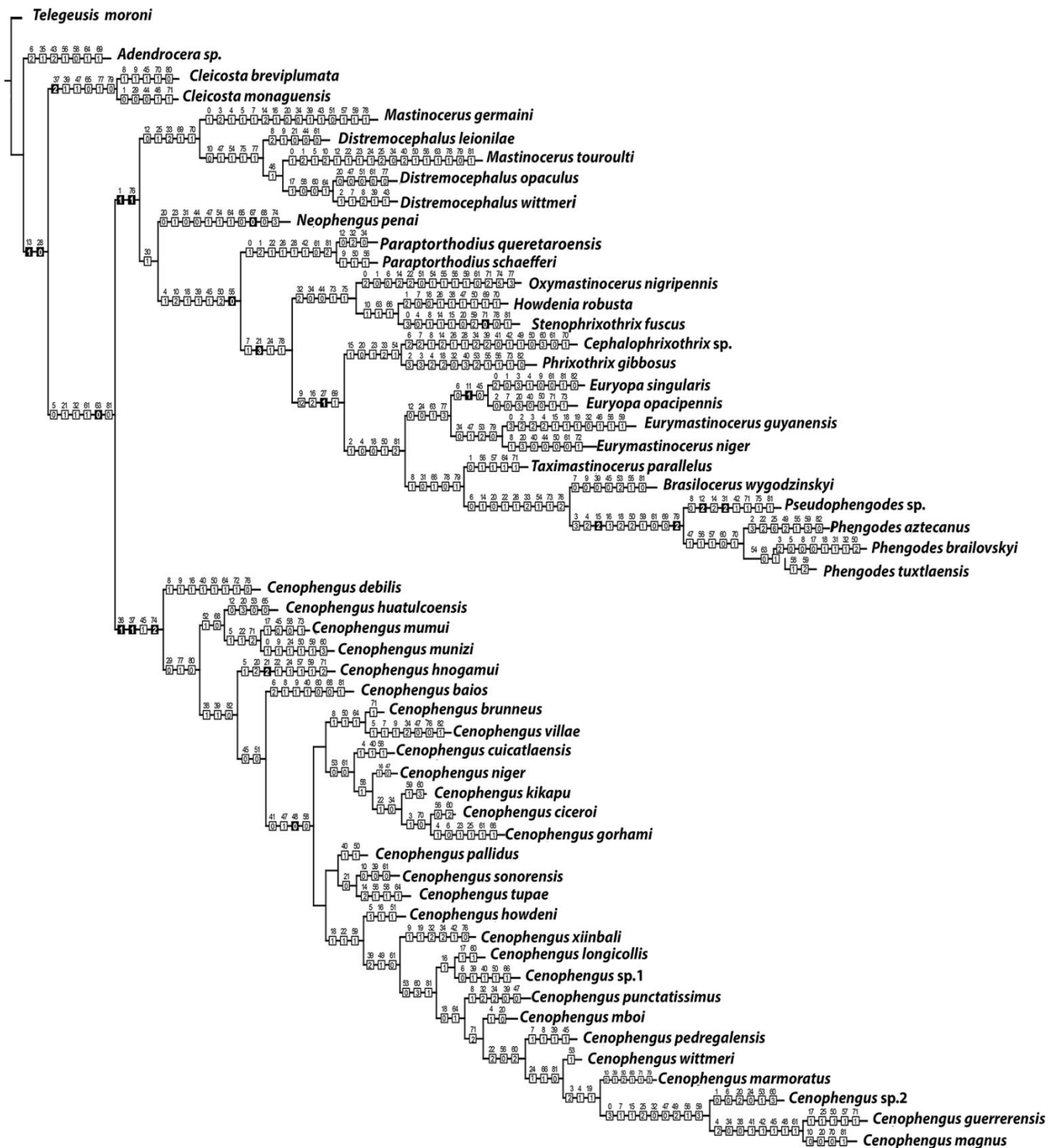


	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	
<i>Stenophrixothrix fuscus</i>	3	1	0	3	0	0	1	1	1	0	1	0	1	1	1	0	1	1
<i>Taximastinocerus parallelus</i>	0	0	1	1	0	1	1	1	2	1	0	1	1	0	0	1	1	1

Appendix B: Parsimony analysis using implied weights.



Single cladogram obtained under implied weighting with  $k = 3$  (L: 736;  $C_i = 0.21$ ;  $R_i = 0.56$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations.



Single cladogram obtained under implied weighting with  $k=6$  (L: 716;  $C_i=0.21$ ;  $R_i=0.57$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations.



Single cladogram obtained under implied weighting with  $k = 11$  (L: 708;  $C_i = 0.21$ ;  $R_i = 0.58$ ). Black rectangles represent single, non-homoplastic character state transformations, and white rectangles represent multiple, homoplastic character state transformations.

## 7.- CAPITULO III

### Revision of the genus *Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae)

Viridiana Vega-Badillo, Juan J. Morrone, Santiago Zaragoza-Caballero

Preparado para Zookeys

## Revision of the genus *Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae)

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### Abstract

A taxonomic revision of the genus *Cenophengus* LeConte, 1881 (Coleoptera: Phengodidae) is provided, including new data on geographic ranges. This is the first time this genus is registered in Belize and in Honduras. Four new species (*C. gardunoi*, *C. saasil*, *C. tsiik* and *C. zuritai*) and one new synonymy (*C. guerrerensis*, Zaragoza-Caballero, 1991 = *C. major* Wittmer, 1976) are proposed within *Cenophengus*, leaving 30 valid species in the genus. The study includes a key to all species, diagnoses, descriptions, habitat, photographs, and distribution maps.

**Key works:** Taxonomy, Diversity, New species, New synonymy



## Introduction

*Cenophengus* was described by LeConte (1881) based on *C. debilis*, a species from California, United States. LeConte took into account characters such as the shape of the maxillary palpi, the size of the antennae, and the shape of the seventh and eighth abdominal segments. He also considered the shape of the prothorax to be a little longer than wide, with the distinct lateral border, only behind the middle, and the anterior angle of the pronotum acute. Schaeffer (1904) described *C. pallidus*, from Texas, but stressing that it did not agree completely with LeConte's description of the genus. Wittmer (1963) transferred three species to this genus, *C. mirabilis* Schaeffer 1904 (from *Paraptorthodius*) and *C. nanus* Wittmer 1948 and *C. unicolor* (from *Phrixothix*), and described a new species (*C. penai*). Wittmer (1976) added some characters to the description of *Cenophengus* (mandibles simple, maxillary palpi with four palpomeres, labial palpi with two palpomeres, two clearly separated tentorial pits, and gula with two sutures), and described one species from Colombia and five more from Mexico. He also relocated *C. unicolor* in *Oxymastinocerus*; and transferred *C. penai* and *C. nanus* to a new genus (*Neophengus*) with reserves in *C. nanus*. Finally, he described one species of *Cenophengus* from Costa Rica and another from the United States (Wittmer 1981, 1986).

Zaragoza-Caballero (1975, 1984, 1986, 1988, 1991, 2003, 2008) described 12 Mexican species, being his descriptions more complete compared to those from the previous authors. Vega Badillo et al. (2020) designated *C. brevipilumatus* as the type species of a new genus (*Cleicosta*) characterized by the elytra short, last seven tergites exposed, gular sutures parallel anteriorly, and lateral lobes of aedeagus narrowed medially to toothless apex, differing from *Cenophengus* in that the latter has lateral lobes of aedeagus parallel, with apical teeth (Fig.1). Finally, Vega

Badillo et al. (2021) described one species from Guatemala and five more for Mexico.

*Cenophengus* currently consists of 27 species.

The aim of this study is to revise the species of *Cenophengus*, based on available type material and other specimens.

## **Material and methods**

A total of 85 specimens analyzed were obtained on loan from the following collections (acronyms follow the Insect and Spider Collections of the World website [Evenhuis, 2018]): CNIN, Colección Nacional de Insectos, Instituto de Biología, UNAM, Mexico City (Santiago Zaragoza Caballero); BRI, Biosystematics Research Institute, Ottawa, Canada (Patrice Bouchard); NMNH, Smithsonian Institution, Washington, DC, U.S.A. (Floyd Schokley); FSCA, Florida State Collection of Arthropods (Paul Skelley); FMNH, Field Museum of Natural History, Chicago, U.S.A. (Crystal A. Maier); and AMNH, American Museum of Natural History, New York, U.S.A. (Lee Herman); and MCZ, Museum of Comparative Zoology Collection, Harvard University, Boston, U.S.A.

Two holotypes were not available for this study (*C. pallidus* and *C. magnus*), however, in the case of *C. pallidus*, the literature was consulted (Schaeffer 1904) and specimens identified were examined. For *C. magnus*, in addition to the literature (Zaragoza-Caballero 1988), specimens identified by Zaragoza-Caballero were examined.

The entomological material was determined by means of existing taxonomic keys, the specific level assignment was made from the original descriptions and the reference material. The following measurements were taken with a Zeiss Discovery V8 stereoscopic microscope equipped with a 1× lens and a 1.6× eyepiece: body length, interantennal and interocular distance, length and width of head, pronotum, elytra, scape, antennomeres, antennal rami, maxillary and labial

palpi, and tarsomeres. Measurements are expressed in mm. The taxonomic treatment includes information on the type species and the material examined. A key is provided to identify the species of *Cenophengus*. General terminology follows Lawrence et al. (2011), except for membranous wing veins that was taken from Kukalova-Peck & Lawrence (1993). Photographs were taken with the Zeiss Axio Zoom V16 with a Plan NeoFluar Z lens, 1x10.25 FWD 56 in Laboratorio de Microscopía y Fotografía de la Biodiversidad, Instituto de Biología, UNAM. Studied material is cited in the following format: labels of the specimens are arranged in sequence from top to bottom, where the data for each label are within double quotes (“ ”), a slash (/) separates the rows, and information between square brackets ([ ]) provide the correct information for label mistakes. (#) | DEPOSITORY. The number between parentheses refers to the number of specimens in lot.

## Results

### Key to the species of *Cenophengus*

1 Pronotum as long as wide; integument smooth .....	2
1' Pronotum longer than wide; integument chagrined or smooth .....	5
2 Branches of the anterior cubital veins (CuA) of the membranous wing developed.....	
.....	<i>C. hnogamui</i>
2' Branches of the anterior cubital veins (CuA) of the membranous wing undeveloped (absent)...	
.....	3
3 Body length not exceeding 3 mm; rounded eyes; posterior radial vein (RP) absent in the membranous wing .....	<i>C. huatulcoensis</i>
3' Body length longer than 3 mm; oval eyes; posterior radial vein (RP) present in the membranous wing .....	4

4	Interocular distance is twice longer than eye width; terminal maxillary palpomere is smaller than preceding three combined.....	<i>C. munizi</i>
4'	Interocular distance 2.5 times longer than eye width; terminal maxillary palpomere as long as preceding three combined.....	<i>C. mumui</i>
5	Integument smooth.....	6
5'	Integument chagrined.....	9
6	Body length not exceeding 5 mm.....	7
6'	Body length longer than 10 mm.....	8
7	Body light brown; pronotum monochrome; branching of anterior cubital veins (CuA) absent in membranous wing.....	<i>C. baios</i>
7'	Body brown; pronotum bicolored; branching of anterior cubital veins (CuA) present on membranous wing.....	<i>C. debilis</i>
8	Elytra almost three times as long as wide; r3 vein absent .....	<i>C. magnus</i>
8'	Elytra almost 4.5 times as long as wide; r3 vein present .....	<i>C. major</i>
9	Radial vein (r3) absent in membranous wing.....	10
9'	Radial vein (r3) present in membranous wing .....	22
10	Antennae short (barely reaching pronotal posterior margin).....	11
10'	Antennae long (extending slightly beyond pronotal posterior margin).....	16
11	Vein r4 developed.....	12
11'	Vein r4 reduced.....	14
12	Pronotum disc with longitudinal carina that extends in the center of the base; interocular distance 1.2 times longer than eye width .....	<i>C. kikapu</i>
12'	Pronotum disc convex, without longitudinal carina; interocular distance twice or more twice the width of eye.....	13

13 Body color brown, except for head dark brown; 4th (terminal) maxillary palpomere longer than the preceding three combined.....	<i>C. cuicatlaensis</i>
13' Body color dark brown, except for the antennae and legs are light brown to yellow; 4th (terminal) maxillary palpomere smaller than the preceding three combined .....	<i>C. tsiik</i> sp. nov.
14 Body black; 1 <sup>st</sup> antennomere equal to length of next two combined .....	<i>C. niger</i>
14' Body light brown; 1 <sup>st</sup> antennomere longer than next two combined.....	15
15 Pronotum disc with longitudinal little groove in the middle part; terminal maxillary palpomere as long as the preceding three combined.....	<i>C. ciceroi</i>
15' Pronotum disc with central longitudinal elevation; terminal maxillary palpomere smaller than preceding three combined .....	<i>C. gorhami</i>
16 Interocular distance twice or less than the width of eye.....	17
16' Interocular distance more than twice the width of eye.....	19
17 Body length longer than 9 mm .....	<i>C. saasil</i> sp. nov.
17' Body length not exceeding 5 mm .....	18
18 Body yellow; interocular distance 1.5 times longer than eye width.....	<i>C. pallidus</i>
18' Body light brown; interocular distance twice longer than eye width.....	<i>C. sonorensis</i>
19 1 <sup>st</sup> antennomere smaller than next two combined.....	<i>C. howdeni</i>
19' 1 <sup>st</sup> antennomere longer than next two combined.....	20
20 Vein r4 developed, terminal maxillary palpomere longer than the preceding three combined .....	<i>C. longicollis</i>
20' Vein r4 reduced; terminal maxillary palpomere equal or smaller than the preceding three combined.....	21
21 Interocular distance 3.5 times longer than eye width; terminal maxillary palpomere as long as the preceding three combined.....	<i>C. xiinbali</i>

21' Interocular distance three times longer than eye width; terminal maxillary palpomere smaller than the preceding three combined.....	<i>C. zuritai</i> sp. nov.
22 Body length not exceeding 6 mm .....	23
22' Body length longer than 9 mm .....	25
23 Antennae long (extending slightly beyond pronotal posterior margin); interocular distance 2.5 than the width of eye .....	<i>C. tupae</i>
23' Antennae short (barely reaching pronotal posterior margin); Interocular distance more three times than the width of eye .....	24
24 Pronotum disc convex, with two concavities barely marked to the sides.....	<i>C. brunneus</i>
24' Pronotum disk present a longitudinal carina that extends in the center of the base to a little more than half.....	<i>C. villae</i>
25 Rear radial vein RP reduced (length less than half the size of the vein MP1+2).....	<i>C. punctatissimus</i>
25' Rear radial vein RP developed (length equal to or longer than half the size of the vein MP1+2) .....	26
26 Interocular distance twice or less than the width of eye.....	27
26' Interocular distance more than twice the width of eye .....	29
27 Terminal maxillary palpomere twice as small as the preceding three combined.....	<i>C. gardunoi</i> sp. nov.
27' Terminal maxillary palpomere equal or 1.5 times small as the preceding three combined...	28
28 Body brown, except for the middle part of pronotum dark brown; posterior radial vein barely reaching half the length of medial radial vein.....	<i>C. wittmeri</i>

- 28' Body yellow or light brown, pronotum partially interrupted by darker brown spots; posterior radial vein extending beyond half the length of medial radial vein.....*C. marmoratus*
- 29 Body black; terminal maxillary palpomere as long as preceding three combined.....*C. mboi*
- 29' Body dark brown and pronotum yellow-orange; terminal maxillary palpomere longer than preceding three combined..... *C. pedregalensis*

## Redescriptions

### *Cenophengus debilis* LeConte, 1881 (Fig. 2A, 3A, 4A)

*Cenophengus debilis* LeConte, 1881: 41.

**Type locality.** California, U.S.A.

**Type material examined.** Holotype ♂: “Type /2813” “*Cenophengus/ debilis* Lec.” “Cal.” | MCZ, url: <http://insects.oeb.harvard.edu>.

**Remarks.** This species is closely related to *C. baios* but can be distinguished by the branching of the membranous wing and interantennal distance. In *C. debilis* the branching of the anterior cubital veins (CuA) is present on the membranous wing, whereas in *C. baios* it is absent. The interantennal distance is wider than length of first antennomere in *C. debilis*, in *C. baios* it is narrower than length of 1<sup>st</sup> antennomere. Additionally in *C. debilis* the antennal rami are 1.5 times as long as respective antennomere, whereas in *C. baios* they is as long as the respective antennomere.

**Diagnosis.** This species can be distinguished by the integument smooth and pronotum bicolored (amber and dark brown).

**Description.** Male. Body length 4; maximum body width 0.69 (pronotum). Body brown, except for the head, posterior part of the pronotum, scutellum and elytra are dark brown. **Head.** Surface concave, wider (0.66) than long (0.44) (Fig. 2A), at eye level, almost as wide (0.66) as the

pronotum (0.69), integument smooth densely and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.15) wider than the length of the first antennomere (0.1); eyes large, hemispherical, finely faceted, prominent, longer (0.25) than wide (0.11); interocular distance (0.3) three times longer than eye width; short antennae (1.05), barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.13) longer than the next two combined (0.1), 3<sup>rd</sup> cup-shaped, the 4<sup>th</sup> (0.11) shorter than following antennomeres; 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.13), 12<sup>th</sup> (terminal) lanceolate (0.16), antennal rami lanceolate, 1.5 times as long as respective antennomere; clypeus bilobed and totally sclerosed; terminal maxillary palpomere robust, securiform (0.17), is smaller than the preceding three combined (0.25); terminal labial palpomere spindle-shaped (0.11), 5.5 times as long as preceding one (0.02). **Thorax.** Pronotum longer (0.77) than wide (0.67) (Fig. 3A); integument smooth, densely and coarsely punctured, each puncture bearing an amber seta, convex disc, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin truncated, integument densely and coarsely punctured, each puncture bearing an amber seta; elytra almost 1.5 times as long (1.74) as wide (0.47), convex, without longitudinal costae, elytral apex almost acute; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein present, r4 vein reduced, those of the anterior anal and posterior anal sectors, evident (Fig. 4A); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with one tooth at the apex of paramere.

**Immatures and females.** Unknown.

**Distribution.** U.S.A.: California (Fig. 5).



**Additional material examined.** “U.S.A. CA: 10 mi. NE of /Trimmer/ 24.VI. 93. / Lot 2 BF&JL/ Carr.” “J. & B. Carr Coll. / Bequest to CNC/ August, 2000” (3) |BRI; “Sun City, Calif. / Riverside Co./ VIII. 28.1968/ D. E. Bright” “*Cenophengus /dedilis / det. W. Wittmer*” (1) |BRI; “3 mi. N Refugio/ Beach, Calif. / Sta. Barb. Co. / July 4, 1965 “” J.S. Bucket/ Collector” (1) |CNIN; “Pasadena/ 13 – 15/ VI.1917 Cal. / A. Fenyés” “Electric light” “*Cenophengus/ debilis* Lec. / det. D. Linsdale 1960” (1) |CNIN.

***Cenophengus baios* Zaragoza-Caballero, 2003 (Fig. 2B, 3B, 4B)**

*Cenophengus baios* Zaragoza-Caballero, 2003: 159.

**Type locality.** Jalisco, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Jalisco/ Est. Biol. Chamela 7/ Cuenca 1 TM. / 3-8- VIII-1992/ Trampa Malaise 237/ Col. A. Rodríguez” |CNIN. Paratype ♂: “MEXICO: Jalisco/ San Buenaventura/ 3-8-VI-1992 Alt. 720 m/ 19°47.6' N 104°03.32' O/ Trampa Malaise 4” “Cols. V.H. Toledo/ M.E. Guardado, A. Soria/ S. Zaragoza, L.F. Novelo/ E. Ramírez, M.A. Sarmiento” |CNIN; Paratype ♂:” MEXICO: Jalisco/ Estación Biológica Chamela/ 13-XI-1987 en hojarasca/ R. Terron” |CNIN.

**Remarks.** This species is closely related to *C. hualcoensis* but can be distinguished by the interantennal and interocular distances. In *C. baios* the interantennal distance is less wide than the length of the 1<sup>st</sup> antennomere, whereas in *C. huatulcoensis* it is equal. The interocular distance is 3.5 times longer than eye width in *C. baios*, and in *C. huatulcoensis* it is three times longer. Additionally, in *C. baios* the antennal rami are as long as the respective antennomere, whereas in *C. huatulcoensis* they are twice as long as respective antennomere.

**Diagnosis.** This species can be distinguished by integument smooth, short antennae, antennal rami as long as the respective antennomere, pronotum as long as wide, elytra almost three times

as long as wide, and branching of the anterior cubital veins (CuA) absent in the membranous wing.

**Description.** Male. Body length 3.8, maximum body width 0.52 (pronotum). Body light brown, except for head is dark brown. **Head.** Surface concave, wider (0.53) than long (0.4) (Fig. 2B), at eye level, as wide (0.53) as the pronotum (0.52), integument smooth, densely and coarsely punctuate, each puncture bearing an amber seta; interantennal distance (0.07) less wide than the length of the 1<sup>st</sup> antennomere length (0.13); eyes larger, hemispherical, finely faceted, longer (0.16) than wide (0.09); interocular distance (0.35) 3.5 times longer than eye width, slightly excavated; short antennae (1.2) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.13) as long as the next two combined, 3<sup>th</sup> cup-shaped, from 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.1), 12<sup>th</sup> (terminal) lanceolate (0.15), antennal rami lanceolate, as long as the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere securiform (0.15), as long as the preceding three combined (0.16); terminal labial palpomere spindle-shaped (0.06), three times as long as preceding one (0.02). **Thorax.** Pronotum as long (0.52) as wide (0.53) (Fig. 3B); integument smooth, distinctly and coarsely punctured, each puncture bearing an amber seta, disc with two convexities and a light carine in the middle part, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost three times as long (0.95) as wide (0.34), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 and r4 veins absent, those of the anterior anal and posterior anal sectors, absent (Fig. 4B); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin

sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Jalisco, Colima (Fig. 5).

**Additional material examined.** “MEXICO. Jalisco, San Buenaventura/ 19° 47'.614" N 104° /03'.324" O. Alt. 720 m/ TL3 09-02-1997/ Cols. F. A. Noguera, S. / Zaragoza, E. Ramírez y /E. González” (1) |CNIN; “MÉXICO: Jalisco, San Buenaventura/ 19° 46'61" N 104°/ 03'32" O Alt 620 m/ TL2 09-II-97” “Cols. F. A. Noguera, / S. Zaragoza, E. Ramírez, / E. González” “*Cenophengus baios*/ det. S. Zaragoza” (5) |CNIN; “MÉXICO: Jalisco, San Buenaventura/ 19° 46'61"N 104°/ 03'32" O Alt 620 m/ TL2 09-II-97/ Col S. Zaragoza” “*Cenophengus baios* /det. S. Zaragoza” (1) |CNIN; “MÉXICO: Colima, 0.5 km /S Jiliotupa Alt.330m Tl 4/ 19° 03' 05.6" N/ 103° 45' 28.8"O/28-IV-2006” “Cols. S. Zaragoza, F. A. Noguera/ E. Ramírez, E. González/ L. Salas” (1) |CNIN.

***Cenophengus brunneus* Wittmer, 1976 (Fig.2C, 3C, 4C)**

*Cenophengus brunneus* Wittmer, 1976: 453.

**Type locality.** Veracruz, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Veracruz/ Córdoba / Dr. A. Fenyés” “*Cenophengus/ brunneus* det. W. Wittmer” “HOLOTYPUS” “Type No. / 73887/ USNM” | NMNH.

**Remarks.** This species is closely related to *C. villae* but can be distinguished by the interocular distance: in *C. brunneus* it is 3.5 times longer than eye width, whereas in *C. villae* it is four times longer. Additionally, in *C. brunneus* the pronotum disc is convex, with two concavities barely

marked to the sides, whereas in *C. villae* the disk presents a longitudinal carina that extends from the center of the base to a little more than half.

**Diagnosis.** This species can be distinguished by the body brown, integument chagrined, short antennae, antennal rami 1.5 times longer than the respective antennomere, and elytra almost five times as long as wide.

**Description.** Male. Body length 4.3, maximum body width 0.47 (pronotum). Body brown, legs slightly lighter. **Head.** Surface concave, wider (0.5) than long (0.4) (Fig. 2C), at eye level, a little wider (0.5) than the pronotum (0.47), integument chagrined, diffuse and slightly punctured, each puncture bearing an amber seta; interantennal distance (0.04) less wide than the length of the 1<sup>st</sup> antennomere length (0.12); eyes small, hemispherical, finely faceted, longer (0.21) than wide (0.09); interocular distance (0.32) 3.5 times longer than eye width; short antennae (1.59) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.12) as long as the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.13) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.14), 12<sup>th</sup> (terminal) lanceolate (0.20), antennal rami lanceolate, 1.5 times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.17), as long as the preceding three combined (0.18); terminal labial palpomere spindle-shaped (0.07), three times as long as preceding one (0.02). **Thorax.** Pronotum longer (0.64) than wide (0.47) (Fig.3C); integument chagrined, moderately punctured, each puncture bearing an amber seta; convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, densely punctured, each puncture bearing an amber seta; elytra almost five times as long (1.64) as wide (0.32), convex, without longitudinal costae, elytral apex blunted; posterior wings with the

posterior radial vein (RP) reduced, radial cell close, r3 and r4 vein present, those of the anterior anal and posterior anal sectors, evident (Fig. 4C); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>.

**Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Veracruz (Fig, 5).

***Cenophengus ciceroi* Wittmer, 1981 (Fig. 2D, 3D,4D)**

*Cenophengus ciceroi* Wittmer, 1981: 106.

**Type locality.** U.S.A.

**Type material examined.** Holotype ♂: U.S.A: “Az. Pima Co. Tucson Mts. / Saguaro Nat. Mon./ 5-APR-80/ Cicero” “Red Hills / visitor center” “Note Luminescent spots/ vaguely indicated as/ two white patches on/ last tergite” “*Cenophengus / ciceroi* det. W. Wittmer” “HOLOTYPUS” “Type No./ 100336 / USMN” | NMNH.

**Remarks.** This species is closely related to *C. gorhami* but can be distinguished by the interocular distance and the terminal maxillary palpomere. In *C. ciceroi* the interocular distance is 1.5 times longer than eye width, whereas in *C. gorhami* it is twice longer. The terminal maxillary palpomere is as long as the preceding three combined in *C. ciceroi*; in *C. gorhami* it is smaller than the preceding three combined. Additionally, in *C. ciceroi* the antennal rami are twice as long as the respective antennomere, whereas in *C. gorhami* they are 1.5 times as long as respective antennomere.

**Diagnosis.** This species can be distinguished by integument chagrined, antennae short, antennal rami twice longer than the respective antennomere, pronotum longer than wide, and elytra almost four times as long as wide.

**Description.** Male. Body length 4.2, maximum body width 0.6 (pronotum). Head dark brown to black, rest of the body, antennae and legs included, yellow to light brown. **Head.** Surface concave, wider (0.75) than long (0.42), at eye level, wider (0.75) than the pronotum (0.64) (Fig. 2D), integument chagrined, distinctly and moderately punctured, each puncture bearing an amber seta; interantennal distance (0.04) less wide than the length of the 1<sup>st</sup> antennomere length (0.16); eyes long, hemispherical, finely faceted, longer (0.37) than wide (0.17); interocular distance (0.25) 1.5 times longer than eye width; antennae short (1.51) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.16) longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.1) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.20), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.23), as long as the preceding three combined (0.24); terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum longer (0.89) than wide (0.64) (Fig. 3D); integument chagrined, distinctly and moderately punctured, each puncture bearing an amber seta; disc with a longitudinal little grooved in the middle part, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (1.88) as wide (0.56), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and

posterior anal sectors, absent (Fig. 4D); 1<sup>st</sup> tarsomere of pro-, meso- and meathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** U.S.A (Fig. 5)

***Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008 (Fig. 2E, 3E, 4E)**

*Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008: 153.

**Type locality.** Oaxaca, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Oaxaca/ 23.5 km SSE Cuicatlán/ 17°37.582' N, 96°55.121' O/ 25-V-1998. Alt. 940 m/ trampa de Luz 2/ Cols. S. Zaragoza, A. Soria/ V. H. Toledo, E. Ramírez/ M.A. Morales” “*Cenophengus cuicatlaensis*/ S. Zaragoza-Caballero” | CNIN. Paratype ♂: “MÉXICO: Oaxaca / Dominguillo / 17°38'907” N, 96°54' / 703" O, Alt. 760 m. / TL3 P475 m./ 26/01/1998 / Col. S. Zaragoza” (3) | CNIN.

**Remarks.** This species is closely related to *C. kikapu* but can be distinguished by the interocular distance and the terminal maxillary palpomere. In *C. cuicatlaensis* the interocular distance is twice longer than eye width, whereas in *C. kikapu* it is 1.2 times longer. The terminal maxillary palpomere is longer than the preceding three combined in *C. cuicatlaensis*, in *C. kikapi* it is as long as preceding three combined. Additionally, in *C. cuicatlaensis* the pronotum disc is convex, one longitudinal excavation on each side of midline, whereas in *C.kikapu* it has a longitudinal carine that extends in the center of the base to a little more than half.

**Diagnosis.** This species can be distinguished by the integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, pronotum longer than wide, and elytra almost four times as long as wide.

**Description.** Male. Body length 4.5, maximum body width 0.60 (pronotum). Body brown, except for head dark brown; buccal parts and the two last sternites are yellowish colored. **Head.** Surface concave, wider (0.64) than long (0.53) (Fig. 2E), at eye level, a wider (0.64) than the pronotum (0.60), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.06) less wide than the length of the 1<sup>st</sup> antennomere length (0.11); eyes long, hemispherical, finely faceted, longer (0.26) than wide (0.17); interocular distance (0.35) twice longer than eye width; antennae long (1.37) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.11) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.12), 12<sup>th</sup> (terminal) lanceolate (0.17), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.26), longer than the preceding three combined (0.10); terminal labial palpomere spindle-shaped (0.07), twice as long as preceding one (0.03). **Thorax.** Pronotum longer (0.68) than wide (0.62) (Fig. 3E); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with a longitudinal carina that extends in the center of the base to a little more than half, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument distinctly and coarsely punctured, each puncture bearing an amber seta; elytra almost four times as long (1.32) as wide (0.34), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and



posterior anal sectors, evident (Fig. 4E); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Oaxaca (Fig. 5)

***Cenophengus gardunoi* sp. nov. (Fig. 2F, 3F, 4F)**

**Type locality.** San Luis Potosí, Mexico.

**Type material.** Holotype ♂: “MEXICO: S.L.P., Mun. / Xilitla 15 mi. SW. / Xilitla, 1500m., 20-III-1988/ R. E. Jones P. W. / Kovarik, Colls” “From the Michael / Ivie Collection” (TIP-COL) |CNIN.

**Remarks.** This species is closely related to *C. major* but can be distinguished by the integument, in *C. gardunoi* it is chagrined whereas in *C. major* it is smooth.

**Diagnosis.** This species can be distinguished by the integument chagrined, antennae long, antennal rami three times longer than the respective antennomere, and elytra almost 4.5 times as long as wide, with two longitudinal costae.

**Description.** Male. Body length 16, maximum body width 2.0 (pronotum). Body orange, except for the antennae, maxillary palpi, labial palpi, abdomen, posterior wings and legs dark brown.

**Head.** Surface concave, wider (1.5) than long (0.6) (Fig. 2F), at eye level, less wide (1.5) than the pronotum (2), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.15) less wide than the length of the 1<sup>st</sup> antennomere length (0.45); eyes long, hemispherical, finely faceted, prominent, longer (0.60) than wide (0.45);

interocular distance (0.8) 1.7 times longer than eye width; antennae long (4.5) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.45) longer than next two combined (0.3), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.3) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.45), 12<sup>th</sup> (terminal) lanceolate (0.5), antennal rami lanceolate, three times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.4), smaller than the preceding three combined (0.82); terminal labial palpomere spindle-shaped (0.2), twice as long as preceding one (0.1). **Thorax.** Pronotum longer (2.5) than wide (2.0) (Fig. 3F); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, with small notch on posterior margin, integument distinctly and coarsely punctured, each puncture bearing an amber seta; elytra almost 4.5 times as long (7.5) as wide (1.7), convex, with two longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 4F); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin concave, last sternite with margin blunted; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: San Luis Potosí (Fig. 5).

**Etymology.** Species dedicated by the first author to Edgar Uriel Garduño Montes de Oca, her beloved life partner.

***Cenophengus gorhami* Zaragoza, 1986 (Fig. 2G, 3G, 4G)**

*Cenophengus gorhami* Zaragoza, 1986: 934.

**Type locality.** Yucatan, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Yucatán/ Mérida/ VII-39-30-1964/ Paul J. Spangler” “S. Zaragoza C. det. / *Cenophengus gorhami* / Zaragoza” “BLNO/ 004121” | NMNH.

**Remarks.** This species is closely related to *C. ciceroi* but can be distinguished by the interocular distance and the terminal maxillary palpomere. In *C. gorhami* the interocular distance is twice longer than eye width, whereas in *C. ciceroi* it is 1.5 times longer. The terminal maxillary palpomere is smaller than the preceding three combined in *C. gorhami*, in *C. ciceroi* it is as long as the preceding three combined. Additionally, in *C. gorhami* the pronotum disc with central longitudinal elevation, whereas in *C. ciceroi* it has a longitudinal little grooved in the middle part.

**Diagnosis.** This species can be distinguished by the integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, and elytra short, barely reaching the middle of the metasternum, almost three times as long as wide.

**Description.** Male. Body length 5.68, maximum body width 0.71 (pronotum). Body yellow to light brown, head a little darker, tip of mandibles almost black, elytra brown with yellowish apical part. **Head.** Surface concave, wider (0.98) than long (0.55) (Fig. 2G), at eye level, a wider (0.98) than the pronotum (0.71), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.08) less wide than the length of the 1<sup>st</sup> antennomere length (0.15); eyes long, hemispherical, finely faceted, prominent, longer (0.45) than wide (0.25); interocular distance (0.47) twice longer than eye width; antennae long (1.73) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.16), 12<sup>th</sup> (terminal) lanceolate (0.26), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed

and partially sclerosed; terminal maxillary palpomere robust, securiform (0.30), smaller than the preceding three combined (0.35); terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum longer (1.03) than wide (0.71) (Fig. 3G); integument chagrined, slightly punctured, each puncture bearing an amber seta, disc with central longitudinal elevation, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument slightly punctured, each puncture bearing an amber seta; elytra short, barely reaching the middle of the metasternum, almost three times as long (1.52) as wide (0.48), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior anal sectors, absent (Fig. 4G); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>.

**Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Yucatan, Quintana Roo (Fig. 5).

**Additional material examined.** “MEXICO: Quintana Roo/ 19 km N Carrillo Puerto/ 18-VI-1990 blacklight trap/ coll. M.C. Thomas” “*Cenophengus gorhami*/ Det. V. Vega-Badillo 2019” (1) | FSCA.

***Cenophengus hnogamui* Vega-Badillo et al. 2021 (Fig. 2H, 3H 4H).**

*Cenophengus hnogamui* Vega-Badillo et al. 2021: xxxx.

**Type locality.** Hidalgo, Mexico.

**Type material examined.** Holotype ♂: "MEXICO: Hidalgo, Huasca de/ Ocampo, Rancho Santa Elena, / Presa San Carlos, 2430 msnm/ 20°08'04.5" N 98°30' 49.9" W. / 05/IX-03/X/2005.

Trampa /Malaise. Col. A. Contreras / Meléndez y Reynoso" | CNIN. Paratypes ♂: same data | CNIN (2); CC-UAEH (1).

**Remarks.** This species is closely related to *C. munizi* but can be distinguished by the length of the antennae, which are shorter in *C. munizi*; the proportion of the antennal rami length /corresponding antennomere length ratios longer in *C. hnogamui* than *C. munizi*. Additionally, in *C. munizi* the terminal maxillary palpomere is smaller than the preceding three combined, whereas in *C. hnogamui* it is as long as the preceding three combined.

**Diagnosis.** This species can be distinguished by the integument smooth, long antennae, antennal rami one and a half times longer than respective antennomere, and elytra almost six times as long as wide with the whitish coloration at the apex.

**Description. Male.** Body length 4.6, maximum body width 0.61 (pronotum). Body dark brown, except for first three antennomeres and posterior part of the elytra amber colored. **Head.** Surface concave, wider (0.59) than long (0.45) (Fig. 2H), at eye level, almost as wide (0.65) as the pronotum (0.58), integument smooth, coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.11) less wide than the length of the first antennomere; eyes small, hemispherical, finely faceted, prominent, longer (0.26) than wide (0.16); interocular distance (0.34) twice longer than eye width; long antennae (2.35), extending beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) as long as the next two combined, 3<sup>rd</sup> cup-shaped, the 4<sup>th</sup> (0.1) shorter than following antennomeres; 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.23), 12<sup>th</sup> (terminal) lanceolate (0.3), antennal rami lanceolate, one and a half times longer than respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust,

securiform (0.21), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.06), three times as long as preceding one (0.02). **Thorax.** Pronotum longer (0.57) than wide (0.35) (Fig. 3H); integument smooth, coarsely punctured, with an amber colored seta in each puncture; convex disc, anterior margin rounded, the posterior almost straight without a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument slightly punctured, each puncture bearing an amber seta; elytra almost six times as long (2.25) as wide (0.37), convex, without longitudinal costae, elytral apex almost acute; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein presented, r4 vein developed, those of the anterior anal and posterior anal sectors (Fig. 4H), evident; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs with a similar length. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Immatures and females.** Unknown.

**Distribution.** Mexico: Hidalgo (Fig. 5).

***Cenophengus howdeni* Zaragoza-Caballero, 1986 (Fig. 2I, 3I, 4I).**

*Cenophengus howdeni* Zaragoza-Caballero, 1986: 933.

**Type locality.** Durango, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Durango /24 ml. W. La Ciudad/ Dgo. MEX. VII. 11. 64/ H.F, Howden” | CNIN.

**Remarks.** This species is closely related to *C. niger* but can be distinguished by the length of the 1<sup>st</sup> antennomere and the pronotum disc. In *C. howdeni* the 1<sup>st</sup> antennomere smaller than next two

combined, whereas in *C. niger* it is equal to the length of the next two combined. The pronotum disc with a longitudinal little grooved in the middle part in *C. howdeni*, in *C. niger* it has a longitudinal carine that extends in the center of the base to a little more than half.

**Diagnosis.** This species can be distinguished by integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, elytra almost 2.5 times as long as wide.

**Description.** Male. Body length 5.2, maximum body width 0.6 (pronotum). Body brown, yellowish mandibles with darker tips. **Head.** Surface concave, wider (0.67) than long (0.36) (Fig. 2I), at eye level, a wider (0.67) than the pronotum (0.6), integument chagrined, distinctly, densely and coarsely punctured, each puncture bearing a brown seta; interantennal distance (0.15) wider than the length of the 1<sup>st</sup> antennomere length (0.1); eyes long, hemispherical, finely faceted, prominent, longer (0.45) than wide (0.16); interocular distance (0.45) three times longer than eye width; antennae long (1.64) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.1) smaller than next two combined (0.17), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.12) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.25), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.25), as long as the preceding three combined (0.24); terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum as long (0.74) as wide (0.7) ((Fig. 3I); integument chagrined, distinctly, densely and coarsely punctured, each puncture bearing a brown seta, disc with a longitudinal little grooved in the middle part, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing a brown seta; elytra almost 2.5 times as long (2.1) as wide (0.8), convex,

without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior anal sectors (Fig. 4I); tarsomeres of the holotype lost. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Durango (Fig. 5).

*Cenophengus huatulcoensis* Zaragoza-Caballero, 2008 (Fig. 6A, 7A, 8A).

*Cenophengus huatulcoensis* Zaragoza-Caballero, 2008: 154.

**Type locality.** Oaxaca, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Oaxaca/ Parque Nal. Huatulco/ Estación el Sabanal/ 15° 48' 10" N, 98° 11' / 39.4"O. Atl. 109 m. / TL-1. 30/05/2005/ Col. S. Zaragoza” | CNIN. Paratype ♂: “MEXICO: Oaxaca/ Parque Nal. Huatulco/ Estación el Sabanal/ 15° 48' 10" N, 98° 11' / 39.4"O. Atl. 109 m. / TL-1. 30/05/2005/ Col. S. Zaragoza” (3) | CNIN; “MEXICO: Oaxaca-Parque Nal. Huatulco/ 1 km N Estación el Sabanal / TL-4. 15° 46' 10" N / 98° 11'40.6"O. 05-09-2005” “S. Zaragoza, F.A. Noguera/ E. Ramírez, E. González/ y V. Jiménez” (2) | CNIN.

**Remarks.** This species is closely related to *C. baios* but can be distinguished by its shorter size, interantennal and interocular distances. In *C. hualcoensis* the interantennal distance is equal than the length of the 1<sup>st</sup> antennomere, whereas in *C. baios* it is smaller. The interocular distance is three times longer than eye width in *C. hualcoensis*, in *C. baios* it is 3.5 times longer.

Additionally, in *C. hualcoensis* the antennal rami is twice as long as respective antennomere, whereas in *C. baios* it is as long as the respective antennomere.



**Diagnosis.** This species can be distinguished by integument smooth, short antennae, antennal rami lanceolate, twice as long as respective antennomere, pronotum as long as wide, and elytra almost three times as long as wide (0.33).

**Description.** Male. Body length 2.84; maximum body width 0.44 (pronotum). Body dark amber, except for anterior part of head, anterior half of pronotum, legs and seventh abdominal segment yellow. **Head.** Surface concave, wider (0.51) than long (0.3) (Fig. 6A), at eye level, wider (0.51) than the pronotum (0.44), integument smooth and shiny, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.07) equal to the length of the first antennomere (0.07); eyes large, hemispherical, finely faceted, prominent, longer (0.17) than wide (0.1); interocular distance (0.3) three times longer than eye width; short antennae (0.82), barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.07) smaller than the next two combined (0.11), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.07), 12<sup>th</sup> (terminal) lanceolate (0.1), antennal rami lanceolate, twice as long as respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.12), is smaller than the preceding three combined (0.17); terminal labial palpomere spindle-shaped (0.05), 2.5 times as long as preceding one (0.02).

**Thorax.** Pronotum as long (0.46) as wide (0.45) (Fig. 7A); smooth and shiny, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with a longitudinal carina that extends in the center of the base to a little more than half, anterior margin rounded, the posterior curved, lateral margins curved, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, with small notch on posterior margin, integument coarsely punctured, each puncture bearing an amber seta; elytra almost three times as long (0.9) as wide (0.33), convex, without longitudinal costae, elytral apex almost acute; posterior wings with the posterior radial vein (RP) absent, radial cell close and slightly

defined, r3 and r4 vein absent, those of the anterior anal and posterior anal sectors, evident (Fig. 8A); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with one teeth at the apex of paramere.

**Immatures and females.** Unknown.

**Distribution.** Mexico: Oaxaca (Fig. 5).

***Cenophengus kikapu* Vega-Badillo et al. 2021 (Fig. 6B, 7B, 8B).**

*Cenophengus kikapu* Vega-Badillo et al. 2021: xxxx.

**Type locality.** Coahuila, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: El Cañón, Cuatro/ Ciénegas, Coahuila, Col. MTO/ y UOGV 21/feb/2012 Col. / nocturna luz blanca” |CNIN. Paratypes ♂: same data |CNIN (2).

**Remarks.** This species is closely related to *C. sonorensis* but can be distinguished by the antennal ramus length /corresponding antennomere length ratio, which is smaller in *C. kikapu* than in *C. sonorensis*. Additionally, in *C. sonorensis*, the head is wider than the pronotum, whereas in *C. kikapu* is almost as wide as the pronotum.

**Diagnosis.** This species can be distinguished by head almost as wide as pronotum, integument chagrined, short antennae, antennal rami twice longer than respective antennomere, terminal maxillary palpomere as long as preceding three combined, elytra almost 3.5 times as long as wide.

**Description.** Male. Body length 6.4, maximum body width 0.8 (pronotum). Body dark brown, except for pronotum, legs and two last abdominal segments amber. **Head.** Surface concave, wider

(0.86) than long (0.52) (Fig. 6B), at eye level, almost as wide (0.86) as pronotum (0.8), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.09) less wide than the length of the 1<sup>st</sup> antennomere length (0.15); eyes long, hemispherical, finely faceted, prominent, longer (0.45) than wide (0.36); interocular distance (0.45) 1.2 times longer than eye width; antennae short (1.58) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) is longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.12) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.2), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.3), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.5), three times as long as preceding one (0.1). **Thorax.** Pronotum longer (1.07) than wide (0.8) (Fig. 7B); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, disk with one longitudinal excavation on each side of midline, anterior margin rounded, the posterior almost straight with a middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 3.5 times as long (1.95) as wide (0.53), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8B); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs with a similar length. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Coahuila (Fig. 5).

***Cenophengus longicollis* Wittmer, 1976 (Fig. 6C, 7C, 8C).**

*Cenophengus longicollis* Wittmer, 1976: 451.

**Type locality.** Texas, U.S.A.

**Type material examined.** Holotype ♂: “U.S.A: 3 mi. NE. of / Porvenir/ Presidio Co. /Tex. 26.IX.46. / B. Patterson, / J. M. Schmid” “California Academy / of Sciences /Type No. 12986”. |FMNH. Paratype ♂: “Texas: Jeff Davis Co. /Ft. Davis, Limpia Cayon/ 16.VII.1964 St. Pla” “At light/ W. Suter leg.” (1) |FMNH. “New Mexico: White’s City/ Eddy Co. 8.IX. 1952” “C.N.H.M 1960/ Borys Malkin/ Coleoptera Colln.” (1) |FMNH.

**Remarks.** This species is closely related to *C. xiinbali* but can be distinguished by the interocular distance and the terminal maxillary palpomere. In *C. longicollis* the interocular distance is three times longer than eye width, whereas in *C. xiinbali* it is 2.5 times longer. The terminal maxillary palpomere is longer than the preceding three combined in *C. longicollis*, whereas in *C. xiinbali* it is as long as the preceding three combined.

**Diagnosis.** This species can be distinguished by the integument chagrined, antennae short, antennal rami twice longer than the respective antennomere, and elytra almost 3.5 times as long as wide.

**Description.** Male. Body length 8.6, maximum body width 0.7 (pronotum). Head black; antennae black to brown, pronotum and scutellum yellow-orange; wingtips black to brown, sometimes only at the base poorly lit, legs and lower yellow to yellow-orange. **Head.** Surface concave, wider (0.78) than long (0.55) (Fig. 6C), at eye level, a little wider (0.78) than the pronotum (0.7), integument chagrined, distinctly and coarsely punctured, each puncture bearing a brown seta;

interantennal distance (0.17) wider than the length of the 1<sup>st</sup> antennomere length (0.12); eyes long, hemispherical, finely faceted, prominent, longer (0.39) than wide (0.17); interocular distance (0.47) three times longer than eye width; antennae short (2) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.12) a little longer than next two combined (0.14), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.17) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.2), 12<sup>th</sup> (terminal) lanceolate (0.24), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.25), is longer than the preceding three combined (0.20); terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum longer (1.01) than wide (0.7) (Fig. 7C); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 3.5 times as long (1.9) as wide (0.54), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8C); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed (Figs.) with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** U.S.A: Texas (Fig. 5)

**Additional material examined.** “U.S.A: Texas J. Davis/ Limpia Cyn./ July 26 197/ J. E. Wappes” (1) |FMNH.

*Cenophengus magnus*, Zaragoza-Caballero, 1988 (Fig. 6D, 7D, 8D).

*Cenophengus magnus*, Zaragoza-Caballero, 1988: 651.

**Type locality.** Nuevo Leon, Mexico.

**Type material.** Holotype ♂: “Nuevo Leon, Mexico (92°44'N; 99°56'W), 16 de Julio de 1979, 1800m, Col. D.C. Darling” | CUIC.

**Remarks.** This species is closely related to *C. major* but can be distinguished by the elytral length and r3 vein. In *C. magnus* elytra are almost three times as long as wide, whereas in *C. major* they are almost 4.5 times as long as wide; the r3 vein is absent in *C. magnus*, whereas in *C. major* it is present.

**Diagnosis.** This species can be distinguished by the integument smooth, antennae long, antennal rami three times longer than the respective antennomere, scutellum almost quadrangular, with small notch on posterior margin, and elytra almost three times as long as wide, with one longitudinal costa.

**Description.** Male. Body length 12, maximum body width 1.5 (pronotum). Body brown, except for head, pronotum and scutellum yellow-orange; antennae and buccal parts dark brown. **Head.** Surface concave, wider (1.2) than long (0.8) (Fig. 6D), at eye level, a wider (1.2) than the pronotum (1.5), integument smooth, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.16) less wide than the length of the 1<sup>st</sup> antennomere length (0.34); eyes long, hemispherical, finely faceted, prominent, longer (0.55) than wide (0.35); interocular distance (0.65) 1.8 times longer than eye width; antennae long (3.58) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.34) longer than next two combined,

3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.26) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.33), 12<sup>th</sup> (terminal) lanceolate (0.5), antennal rami lanceolate, three times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.3), smaller than the preceding three combined (0.7); terminal labial palpomere spindle-shaped (0.15), three times as long as preceding one (0.05). **Thorax.** Pronotum longer (1.6) than wide (1.5) (Fig. 7D); integument smooth, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, with small notch on posterior margin, integument densely punctured, each puncture bearing an amber seta; elytra almost three times as long (4.75) as wide (1.52), convex, with one longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8D); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin concave, last sternite with margin blunted; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Nuevo Leon, Tamaulipas (Fig. 5).

**Additional material examined.** “Mexico: Tamaulipas/ Gómez Farias km 7 a Julilo/ 13-IV-2003 /I. Pacheco L. Cervantes” “Cenophengus /magnus /S. Zaragoza C. det.” (2) | CNIN.

***Cenophengus major* Wittmer, 1976 (Fig. 6E, 7E, 8E).**

*Cenophengus major* Wittmer, 1976: 450

*Cenophengus guerrerensis*, Zaragoza-Caballero, 1991: 109, **syn. nov.**

**Type locality.** Nayarit, Mexico.

**Type material examined.** Holotype ♂: Mexico: “Tepic, Nayarit, / Mex. VII-28-53” “D. Rockefeller/ Mex. Exp. 1953/ C. & P. Vaurie” “*Cenophengus major* Wittmer” “Holotypus”.  
|AMNH.

**Remarks.** We synonymize *C. guerrerensis* with *C. major* based on one clearly identified specimen of the former.

**Diagnosis.** This species can be distinguished by the integument smooth, antennae long, antennal rami lanceolate, three times longer than the respective antennomere, and elytra almost 4.5 times as long as wide.

**Description.** Male. Body length 13, maximum body width 1.33 (pronotum). Body brown, except for head, pronotum and scutellum yellow-orange; antennae and buccal parts dark brown. **Head.** Surface concave, wider (1.13) than long (0.70) (Fig. 6E), at eye level, a wider (1.13) than the pronotum (1.33), integument smooth, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.11) less wide than the length of the 1<sup>st</sup> antennomere length (0.35); eyes long, hemispherical, finely faceted, prominent, longer (0.55) than wide (0.35); interocular distance (0.66) 1.8 times longer than eye width; antennae long (3.8) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.35) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.25) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.35), 12<sup>th</sup> (terminal) lanceolate (0.5), antennal rami lanceolate, three times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.45), smaller than the preceding three combined (0.55); terminal labial palpomere spindle-shaped (0.2), twice as long as preceding one (0.1). **Thorax.** Pronotum longer



(1.65) than wide (1.33) (Fig. 7E); integument smooth, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 4.5 times as long (4.5) as wide (1), convex, with one longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8E); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin blunted; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Nayarit, Guerrero, Hidalgo (Fig. 5).

**Additional material examined.** Holotype ♂: MEXICO: “Guerrero, Cerro Tuxpan/ Iguala, 12-VII-88. 8-2 pm. Col. R. Sánchez 11617” “*Cenophengus/ guerrerensis /Zaragoza*” | CNIN.

Paratypes ♂ (3): “Cerro Tuxpan/ Iguala, Gro. /1700 m. / 25-VI-87 /Col. R. Sánchez” | CNIN.

“MEXICO: Hidalgo: PN Los Mármoles/ Minas Viejas, Bosque de encino/ 1892m. N 20° 55' W 99° 12' 41.1”/ Trampa de luz 18-VIII-2007/ J. Márquez, J. Asiain y S. Sierra cols.” | CNIN.

***Cenophengus marmoratus* Wittmer, 1976 (Fig. 6F, 7F, 8F).**

*Cenophengus marmoratus* Wittmer, 1976: 453.

**Type locality.** Veracruz, Mexico.

**Type material examined.** Holotype ♂: Mexico: “Cordoba/ Mex. Ver. / Dr. A. Fenyes”

“*Cenophengus/ marmoratus/ Wittmer*” “Type No./ 73886/ USMN” | NMNH.

**Remarks.** This species is closely related to *C. wittmeri* but can be distinguished by the color of the body and the terminal maxillary palpomere. In *C. marmoratus* the body is yellow or light brown, the pronotum is partially interrupted by darker brown spots, whereas in *C. wittmeri* they are brown, except for the middle part of the pronotum that is dark brown. The terminal maxillary palpomere is smaller than the preceding three combined in *C. marmoratus*, in *C. wittmeri* it is as long as the preceding three combined. Additionally, in *C. marmoratus* the posterior radial vein is extending beyond half the length of the medial radial vein, whereas in *C. wittmeri* it is barely reaching half the length of the medial radial vein.

**Diagnosis.** This species can be distinguished by head almost as wide as the pronotum, integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, and elytra almost four times as long as wide.

**Description.** Male. Body length 10.3, maximum body width 1.2 (pronotum). Body yellow or light brown; antennal rami somewhat darker than respective antennomere, pronotum partially interrupted by darker brown spots. **Head.** Surface concave, wider (1.1) than long (0.75) (Fig. 6F), at eye level, almost as wider (1.1) as the pronotum (1.1), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.1) less wide than the length of the 1<sup>st</sup> antennomere length (0.3); eyes long, hemispherical, finely faceted, prominent, longer (0.55) than wide (0.27); interocular distance (0.6) twice longer than eye width; antennae long (3.36) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.3) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.25) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.3), 12<sup>th</sup> (terminal) lanceolate (0.4), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially

sclerosed; terminal maxillary palpomere robust, securiform (0.3), smaller than the preceding three combined (0.45); terminal labial palpomere spindle-shaped (0.2), twice as long as preceding one (0.1). **Thorax.** Pronotum longer (1.3) than wide (0.85) (Fig. 7F); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (3.75) as wide (0.95), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8F); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Veracruz, Hidalgo, San Luis Potosi, Querétaro (Fig. 5).

**Additional material examined.** “Mexico: Hidalgo/: km 14 Carr. Huejutla- /Atlepexco 13-05-1999/ H. Brailovsky y E. Barrera” (1) |CNIN“MEXICO: Hidalgo, Cuautepec /Tezoncualpan “El Caminero”/ Bosque de encino. / N 19° 56' 53.8" W 98° 16' 27.9". /Trampa intercepción de vuelo, / 22 a 29- VIII-2009, M. Torres col.” (1) | CNIN; “San Luis Potosí: /Rio Micos /9-IV-78 / Col S.Z.C.” (2) | CNIN; “MEXICO: San Luis Potosí /Xilitla, Los Pozos/ 21 22 45 N 99 00 15 O/ 780 msnm. 03-VII-2006/ L. Cervantes, D. Brzoska” (1) | CNIN; “Mexico: Querétaro: / Misión de

Bucareli, / N 21° 02' 280"/ O 99° 36' 885"/ 1150msnm. 1. III.1998 / G. Ortega, E. Barrera” (1) | CNIN.

***Cenophengus mboi* Vega-Badillo et al. 2021 (Fig. 6G, 7G, 8G,).**

*Cenophengus mboi* Vega-Badillo et al. 2021: xxxx.

**Type locality.** Hidalgo, Mexico.

**Type material examined.** Holotype ♂: “Mexico: Santiago de Anaya/ Hgo.20°24'0761"N/ 98°53'1797"O, 28-29 agosto /2017 Col. A. Ibarra Vázquez” |CNIN. Paratype ♂: “Mexico, Atotonilco El / Grande, 3 km NE Montecillos/ Bosque Juniperus-Quercus. 20° /18' 9" N, 98° 36'17" W. Trampa de / Intercepción de vuelo 12 al 19-VII-/2010. J. Márquez y J. Asiain” | CC-UAEH.

**Remarks.** This species is closely related to *C. predregalensis* but can be distinguished by the color of the body and terminal maxillary palpomere. In *C. mboi* the body is dark brown, whereas in *C. predregalensis* it is dark brown and the pronotum yellow-orange. Terminal maxillary palpomere is as long as the preceding three combined in *C. mboi*, in *C. predregalensis* it is longer than the preceding three combined.

**Diagnosis.** This species can be distinguished by body black, integument chagrined, antennae long, antennal rami twice longer than respective antennomere, terminal maxillary palpomere is as long as the preceding three combined and elytra almost four times as long as wide.

**Description. Male.** Body length 9.6; maximum body width 1 (pronotum). Body black. **Head.** Surface concave, as wider (0.8) as long (0.8) (Fig. 6G), almost as wide (0.8) as pronotum (1), integument chagrined, distinctly and coarsely punctured, each puncture bearing a black seta; interantennal distance (0.1) less wide than the length of the 1<sup>st</sup> antennomere length (0.25); eyes long, hemispherical, finely faceted, prominent, longer (0.32) than wide (0.14); interocular

distance (0.48) 3.5 times longer than eye width; antennae long (2.73) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.25) longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.23) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.25), 12<sup>th</sup> (terminal) lanceolate (0.27), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.35), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.15), three times as long as preceding one (0.05). **Thorax.** Pronotum longer (1.3) than wide (1) (Fig. 7G); integument chagrined, distinctly and coarsely punctured, each puncture bearing a black seta, convex disc, with one longitudinal excavation on each side of the midline, anterior margin rounded, the posterior almost straight with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing a black seta; elytra almost four times as long (2.6) as wide (0.6), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 8G); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of prothoracic legs about equal in length, 1<sup>st</sup> tarsomere of meso- and metathoracic legs longer than 2<sup>nd</sup>.

**Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Hidalgo (Fig. 9).

*Cenophengus mumui* Vega-Badillo et al. 2021 (Fig. 6H, 7H, 8H).

*Cenophengus mumui* Vega-Badillo et al. 2021: xxxx

**Type locality.** San Luis Potosi, Mexico.

**Type material examined.** Holotype ♂: “Mexico, San Luis Potosí, / Tamasopo. Cerro al noroeste/ del cafetal, 01-06-15, / N 21°55.47' W 99°24.95' Col. / Jessica Ríos” |CNIN.

**Remarks.** This species is closely related to *C. munizi* but can be distinguished by the shape and color of the head and interocular distance. In *C. mumui* head is square and brown, whereas in *C. munizi* it is rectangular shaped. The interocular distance is 2.5 times longer than eye width in *C. mumui*, in *C. munizi* it is twice longer than eye width. Additionally, in *C. mumui* the antennal rami are 1.5 times as long as respective antennomere, whereas in *C. munizi* they are twice as long as respective antennomere.

**Diagnosis.** This species can be distinguished by body yellow, except for head brown, integument smooth, long antennae, antennal rami one and a half times longer than respective antennomere, pronotum as long as wide and elytra almost four times as long as wide.

**Description. Male.** Body length 3.5; maximum body width 0.58 (pronotum). Body yellow, except for head brown. **Head.** Surface concave, wider (0.61) than long (0.49) (Fig. 6H), at eye level, almost as wide (0.61) as the pronotum (0.58), integument smooth, slightly punctured, each puncture bearing an amber seta; interantennal distance (0.1) less wide than the length of the 1<sup>st</sup> antennomere; eyes small, hemispherical, finely faceted, prominent, longer (0.2) than wide (0.15); interocular distance (0.36) twice longer than eye width; long antennae (1.8), extending beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) as long as the next two combined, 3<sup>rd</sup> cup-shaped, the 4<sup>th</sup> (0.12) shorter than following antennomeres; 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.17), 12<sup>th</sup> (terminal) lanceolate (0.25), antennal rami lanceolate, 1.5 times as long as respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.16), as long as the preceding three combined; terminal labial palpomere spindle-

shaped (0.05), twice as long as preceding one (0.02). **Thorax.** Pronotum as long (0.58) as wide (0.56) (Fig. 7H); integument smooth, slightly punctured, with an amber colored seta in each puncture; convex disc, with one longitudinal excavation on each side of the midline, anterior margin rounded, the posterior almost straight with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument slightly punctured, each puncture bearing an amber seta; elytra almost four times as long (1.62) as wide (0.37), convex, without longitudinal costae, elytral apex almost acute; posterior wings with the posterior radial vein (RP) reduced, radial cell close and slightly defined, r3 and r4 veins absent, those of the anterior anal and posterior anal sectors, absent (Fig. 8H) 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs with a similar length. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with one teeth at the apex of paramere.

**Immatures and females.** Unknown.

**Distribution.** Mexico: San Luis Postosi, Tamaulipas (Fig. 9).

**Additional material examined.** “MEXICO: Tamps. Mun./ Gomez Farias, Al/ Cimas, 1000 m. 22- / III-1987 P. Kovarik/ R. Jones; UV light” “From the Michael / Ivie Collection” (1) |CNIN

***Cenophengus munizi* Zaragoza-Caballero, 2008 (Fig. 6I, 7I, 8I).**

*Cenophengus munizi* Zaragoza-Caballero, 2008: 155.

**Type locality.** Hidalgo, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Hidalgo, Tlanchinol, La/ Cabaña. Bosque Mesófilo de montaña/ 1478m. N 21° 01.3343', W 98° 38.600' / Trampa de intercepción de vuelo 1. /13-20 -mayo- 2006. C. Ortiz y M.C. / Pedraza.”

**Remarks.** This species is closely related to *C. mumui* but can be distinguished by the shape and color of the head and the interocular distance. *Cenophengus munizi* exhibits a rectangular shaped head, which is amber colored like the rest of the body, whereas in *C. mumui* it is square and brown. The interocular distance is twice longer than eye width in *C. munizi*, in *C. mumui* it is 2.5 times longer than eye width. Additionally, in *C. munizi* the antennal rami are twice as long as respective antennomere, whereas in *C. mumui* they are 1.5 times as long as respective antennomere.

**Diagnosis.** This species can be distinguished by integument smooth, head almost as wide as the pronotum, long antennae, antennal rami twice as long as respective antennomere, elytra almost six times as long as wide.

**Description.** Male. Body length 6.2; maximum body width 0.58 (pronotum). Body yellow, elytra yellow with whitish apical part. **Head.** Surface concave, wider (0.65) than long (0.45) (Fig. 6I), at eye level, almost as wide (0.65) as the pronotum (0.58), integument smooth, slightly punctured, each puncture bearing an amber seta; interantennal distance (0.12) equal to the length of the first antennomere; eyes small, hemispherical, finely faceted, prominent, longer (0.2) than wide (0.14); interocular distance (0.36) twice longer than eye width; long antennae (2), extending beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.12) as long as the next two combined, 3<sup>rd</sup> cup-shaped, the 4<sup>th</sup> (0.15) shorter than following antennomeres; 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.2), 12<sup>th</sup> (terminal) lanceolate (0.3), antennal rami lanceolate, twice as long as respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.19), smaller than the preceding three combined (0.26); terminal labial palpomere spindle-shaped (0.05), five times as long as preceding one (0.01). **Thorax.** Pronotum as long (0.6) as wide (0.58) (Fig. 7I); integument smooth, slightly punctured, with an amber colored seta



in each puncture; convex disc, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument slightly punctured, each puncture bearing an amber seta; elytra almost six times as long (2.16) as wide (0.36), convex, without longitudinal costae, elytral apex almost acute; posterior wings with the posterior radial vein (RP) absent, radial cell close and slightly defined, r3 and r4 veins absent, those of the anterior anal and posterior anal sectors, absent (Fig. 8I); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs with a similar length. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with one teeth at the apex of paramere.

**Immatures and females.** Unknown.

**Distribution.** Mexico: Hidalgo (Fig. 9).

**Additional material examined.** “MEXICO: Hidalgo, Cuauhtepic /Tezoncualpan “El Caminero”/ Bosque de encino./ 19° 56' 53.8" N; 98° 16' 27.9" W. /Trampa intercepción de vuelo, / 22 a 29-VIII-2009, M. Torres col.” (1) | CNIN; “MEXICO, Hidalgo, La Misión, Lomas / del Pericón, Bosque Mesofilo de mon- /taña perturbado. 1377m. N 21° 06' 46.0"/ W 99° 06' 15.6". Trampa de intercepción / de vuelo. Del 8 al 16-III-2008/ J. Márquez y J. Asiain cols.” (1) | CNIN; “MEXICO, Hidalgo, La Misión, Lomas/ del Pericón, Bosque Mesofilo de mon- /taña perturbado. 1377m. N 21° 06' 46.0" /W 99° 06' 15.6".NTP-80 (Calamar). Del 8 / al 16-III-2008. J. Márquez y J. Asiain cols.” (1) | CNIN. “MEXICO: Hidalgo, Tlanchinol/ J. Márquez y J. Asiain cols.” (2) | CC-UAEH.

***Cenophengus niger* Wittmer 1986 (Fig. 10A, 11A, 12A).**

*Cenophengus niger* Wittmer 1986: 160.

**Type locality.** Monteverde, Costa Rica.

**Type material examined.** Holotype ♂: “COSTA RICA: Punt. / Monteverde. 1400m/ 23 May 1979/ H & A Howden” “*Cenophengus/ niger* Wittmer” “PHENGODIDAE/ PHENG00000347” | NHMB.

**Remarks.** This species is closely related to *C. howdeni* but can be distinguished by the length of the 1<sup>st</sup> antennomere and the pronotum disc. In *C. niger* the 1<sup>st</sup> antennomere is equal to the length of the next two combined, whereas in *C. howdeni* it is smaller than next two combined. The pronotum disc has a longitudinal carina that extends from the center of the base to a little more than half in *C. niger*, in *C. howdeni* it has a longitudinal little groove in the middle part.

**Diagnosis.** This species can be distinguished by integument chagrined, head less wide than pronotum, antennae short, antennal rami twice longer than the respective antennomere, and elytra almost 3.5 times as long as wide.

**Description.** Male. Body length 6, maximum body width 0.76 (pronotum). Body dark brown, only mouthparts, three first antennomere, two last abdominal segments, all legs with trochanter and coxae yellowish. **Head.** Surface concave, wider (0.80) than long (0.55) (Fig. 10A), at eye level less wide (0.80) than the pronotum (0.85), integument chagrined, distinctly and coarsely punctured; interantennal distance (0.1) less wide than the length of the 1<sup>st</sup> antennomere length (0.15); eyes long, hemispherical, finely faceted, prominent, longer (0.26) than wide (0.12); interocular distance (0.4) three times longer than eye width; antennae short (2.3) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) equal to the length of the next two combined (0.14), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.14) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.16), 12<sup>th</sup> (terminal) lanceolate (0.21), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere

robust, securiform (0.27), as long as the preceding three combined (0.26); terminal labial palpomere spindle-shaped (0.06), three times as long as preceding one (0.02). **Thorax.** Pronotum longer (0.95) than wide (0.85) (Fig. 11A); integument chagrined, distinctly and coarsely punctured, disk with a longitudinal carina that extends in the center of the base to a little more than half, anterior margin rounded, the posterior curved, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 3.5 times as long (1.62) as wide (0.46), convex, without longitudinal costae, elytral apex blunted posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior anal sectors, evident (Fig. 12A); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three tooth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Costa Rica: Monteverde, Heredia, Puntarenas (Fig. 9).

**Additional material examined.** “COSTA RICA: Heredia/ La Selva, 75m / 10°26'N, 84°01'W /Sept 1992 / P. Hansen, Malaise” "From the Michael/ Ivie Collection" (2) | MTEC ; “COSTA RICA:Puntarenas/ 3 km SW Rincón /8.683°N, 83.483° W July 1991. 10m /P. Hanson. Malaise” "From the Michael/ Ivie Collection" (1) | MTEC.

***Cenophengus pallidus* Schaeffer, 1904 (Fig. 10B, 11B, 12B).**

*Cenophengus pallidus* Schaeffer, 1904: 213.

**Type locality.** Texas, U.S.A.

**Type material.** Holotype ♂: U.S.A. “Texas. Brownsvell, 21.V. 1904, H.S. Barber col.” | BMNH

**Remarks.** This species is closely related to *C. sonorensis* but can be distinguished by the color of the body and the interocular distance. In *C. pallidus* body is yellow, whereas in *C. sonorensis* it is light brown. The interocular distance is 1.5 times longer than eye width in *C. pallidus*, in *C. sonorensis* it is two longer than eye width. Additionally, in *C. pallidus* the disk has a longitudinal carina that extends from the center of the base to a little more than half, whereas in *C. sonorensis* it has two concavities barely marked to the sides.

**Diagnosis.** This species can be distinguished by the integument chagrined, head wider than the pronotum, antennae short, antennal rami twice longer than the respective antennomere, and elytra almost 3.5 times as long as wide.

**Description.** Male. Body length 3.84, maximum body width 0.53 (pronotum). Body yellow.

**Head.** Surface concave, wider (0.63) than long (0.34) (Fig. 10B), at eye level, wider (0.63) than the pronotum (0.53), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.05) less wide than the length of the 1<sup>st</sup> antennomere length (0.15); eyes long, hemispherical, finely faceted, prominent, longer (0.3) than wide (0.17); interocular distance (0.27) 1.5 times longer than eye width; antennae short (1.27) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) is longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.08) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.11), 12<sup>th</sup> (terminal) lanceolate (0.16), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.23), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum longer (0.69) than wide (0.53) (Fig. 11B); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with a longitudinal carina that extends in the center of the

base to a little more than half, anterior margin rounded, the posterior curved, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument slightly punctured, each puncture bearing an amber seta; elytra almost 3.5 times as long (1.4) as wide (0.4), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein absent, those of the anterior anal and posterior anal sectors, evident (Fig. 12B); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** U.S.A: Texas; Mexico: Nuevo León (Fig. 9).

**Additional material examined.** U.S.A: “Texas, Cameron Co. / Sabal Palm Grove/ Audobon Reserve/ 26-28 May 1979/ N. M. Downie” (1) |FMNH. “Texas, Bee Co. / 5 m N. Beeville/ on US181/1 June 1979/ N. M. Downie” “*Cenophengus/ pallidus* /Schaeffer” “N.M. Downie Colln. / 1992 Acc. Z-18,343/ FIELD MUSEUM” (1) |FMNH; “Esprza Rch/ Brownsville, Tex.” (1) | CNIN; “Mexico: 5 mi. S. Monterrey/ N.L. Mex. VII.22.1963/ H. Howden” “*Cenophengus/ pallidus* Schaeffer/ det. W. Wittmer” (1) |FMNH. “Tx. Cameron Co. / Sabal Palm Grove/ June 9-10 1978/ J.E. Wappes” “*C. pallidus*” (2)| FSCA.

***Cenophengus pedregalensis* Zaragoza-Caballero, 1975 (Fig. 10C, 11C, 12C).**

*Cenophengus pedregalensis* Zaragoza-Caballero, 1975: 452.

**Type locality.** Mexico City, Mexico.

**Type material examined.** Holotype ♂: MEXICO: “Pedregal San Ángel/ 11-VIII-69/ S. Zaragoza” | CNIN. Paratype ♂: MEXICO: “Jardín Botánico, C.U. / D.F. 2.VIII.69. /S. Zaragoza-Caballero” (6) | CNIN.

**Remarks.** This species is closely related to *C. mboi* but can be distinguished by the color of the body and the terminal maxillary palpomere. In *C. predregalensis* body is dark brown and pronotum yellow-orange, whereas in *C. mboi* it is dark. Terminal maxillary palpomere is longer than the preceding three combined in *C. predregalensis*, in *C. mboi* it is as long as the preceding three combined.

**Diagnosis.** This species can be distinguished by the body dark brown with pronotum yellow-orange, integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, terminal maxillary palpomere is longer than the preceding three combined, and elytra almost 4.5 times as long as wide.

**Description.** Male. Body length 11, maximum body width 1.08 (pronotum). Body dark brown, antennae black to brown, pronotum yellow-orange. **Head.** Surface concave, wider (0.99) than long (0.7) (Fig. 10C), at eye level less wide (0.99) than the pronotum (1.08), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.11) less wide than the length of the 1<sup>st</sup> antennomere length (0.22); eyes long, hemispherical, finely faceted, prominent, longer (0.3) than wide (0.15); interocular distance (0.65) four times longer than eye width; antennae long (2.8) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.22) as long as the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.2) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.26), 12<sup>th</sup> (terminal) lanceolate (0.4), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.38), longer than the preceding three combined (0.22); terminal labial palpomere

spindle-shaped (0.15), four times as long as preceding one (0.04). **Thorax.** Pronotum longer (1.4) than wide (1.08) (Fig. 11C); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 4.5 times as long (3.52) as wide (0.8), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 12C); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>.

**Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Mexico City (Fig. 9).

**Additional material examined.** “MEXICO: Ciudad de Mexico/Jardín Botánico, /19°19'10" N 99° 11'37.25"/ W, 2321 msnm. 19-X-2017/ V. Vega-Badillo y S. Zaragoza-Caballero” (2) | CNIN; MEXICO: Ciudad de Mexico/ Jardín Botánico, /19°19'10" N 99° 11'37.25" /W, 2321 msnm. 25-VIII-2017/ V. Vega-Badillo y S. Zaragoza-Caballero (1) | CNIN; MEXICO: Ciudad de Mexico/ Jardín Botánico/ 19°19'10" N 99° 11'37.25" /W, 2321 msnm. 27-VIII-2017/ V. Vega-Badillo y S. Zaragoza-Caballero (1) | CNIN.

***Cenophengus punctatissimus* Wittmer, 1976 (Fig. 10D, 11D, 12D).**

*Cenophengus punctatissimus* Wittmer, 1976: 452.

**Type locality.** San Luis Potosí, Mexico.

**Type material examined.** Holotype ♂: MEXICO: “2 km S Tamazunchale, / San Luis Potosí (R. 1 km 363) / 31-V-1948, 700 ft / tropical canyon-jungle” “at light/ F, Werner/ W. Nutting” “Type No. / 73888/ USNM” | NMNH.

**Remarks.** This species is closely related to *C. mboi* but can be distinguished by the interocular distance. In *C. punctatissimu* interocular distance is 2.5 times longer than eye width, whereas in *C. mboi* it is three times longer than eye width. Additionally, in *C. punctatissimu* the posterior radial vein is less than half the length of the medial radial vein, whereas in *C. pedregalensis* it extends beyond half the length of the medial radial vein.

**Diagnosis.** This species can be distinguished by the body dark brown, integument chagrined, head less wide than the pronotum, antennae long, antennal rami twice longer than the respective antennomere, and elytra almost 5.5 times as long as wide.

**Description.** Male. Body length 10.5, maximum body width 1 (pronotum). Body dark brown, except for buccal parts, coxa, trochanter, femur and two last sternites yellowish colored. **Head.** Surface concave, wider (0.91) than long (0.8) (Fig. 10D), at eye level less wide (0.91) than the pronotum (1), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.1) less wide than the length of the 1<sup>st</sup> antennomere length (0.2); eyes small, hemispherical, finely faceted, prominent, longer (0.35) than wide (0.21); interocular distance (0.52) 2.5 times longer than eye width; antennae long (2.42) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.2) as long as the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.2) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.25), 12<sup>th</sup> (terminal) lanceolate (0.3), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.4), as long as the preceding three combined (0.4); terminal labial palpomere



spindle-shaped (0.15), three times as long as preceding one (0.05). **Thorax.** Pronotum longer (1.4) than wide (1) (Fig. 11D); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with a longitudinal carina that extends in the center of the base to a little more than half, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost 5.5 times as long (3.48) as wide (0.64), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 12D); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.**

Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin concave; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: San Luis Potosí (Fig. 9).

***Cenophegus saasil* sp. nov. (Fig. 10E, 11E, 12E).**

**Type locality.** Honduras

**Type material.** Holotype ♂: HONDURAS: “HND: CR; Cusuco National Park; / Cantiles 15.5077° N 88.2336° W/ 2028m 19-25 Jun. 2014 Michelle/ D’Souza” ”Barcode of Life DNA/ Voucher specimen/ Sample ID/ BIOUG19147-G03 /ProcessID/ GMHKB847-15” |...

**Remarks.** This species is closely related to *C. wittmer* but can be distinguished by the posterior radial vein (RP) and r3 vein. In *C. saasil* the posterior radial vein (RP) is reduced, whereas in *C. wittmer* it is well-developed; the r3 vein is present in *C. wittmer* and absent in *C. saasil*.

**Diagnosis.** This species can be distinguished by the body light yellow, integument chagrined, head as wide as the pronotum, antennae long, antennal rami twice longer than the respective antennomere, and elytra almost 4.5 times as long as wide.

**Description.** Male. Body length 9.5, maximum body width 0.9 (pronotum). Body light yellow, except for the antennae and stripe on pronotum brown. **Head.** Surface concave, wider (0.90) than long (0.65) (Fig. 10E), at eye level, as wide (0.9) as the pronotum (0.9), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.06) less wide than the length of the 1<sup>st</sup> antennomere length (0.24); eyes long, hemispherical, finely faceted, prominent, longer (0.41) than wide (0.21); interocular distance (0.42) twice longer than eye width; antennae long (3.1) extending slightly beyond pronotal posterior margin; 1<sup>st</sup> antennomere (0.24) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.3), 12<sup>th</sup> (terminal) lanceolate (0.33), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; maxillary palpomeres of the holotype lost; 1<sup>st</sup> labial palpomere (0.03). **Thorax.** Pronotum longer (1.1) than wide (0.90) (Fig. 11E); integument chagrined, slightly punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin almost straight; sternal suture incomplete; scutellum of the holotype lost; elytra almost 4.5 times as long (3.4) as wide (0.74), convex, with longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior

anal sectors, present (Fig. 12E); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.**

Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Honduras (Fig. 9).

**Etymology.** The term *sáasil* means light in the Maya language, which is spoken in Honduras.

***Cenophengus sonorensis* Zaragoza - Caballero, 2008 (Fig. 10F, 11F, 12F).**

*Cenophengus sonorensis* Zaragoza – Caballero 2008: 155.

**Type locality.** Sonora, Mexico.

**Type material examined.** Holotype ♂: “MEXICO: Sonora, 36.6 / km SE Tecoripa, La / Barranca, 28°34'40.1"N, / 109° 39' 40.1"O. Atl. 562m. / TL 1 16-08-2004 / Col. S. Zaragoza” | CNIN.

**Remarks.** This species is closely related to *C. pallidus* but can be distinguished by the color of the body and the interocular distance. In *C. sonorensis* is light brown body, whereas in *C. pallidus* it is yellow. The interocular distance twice longer than eye width in *C. sonorensis*, in *C. pallidus* it is 1.5 longer than eye width. Additionally, in *C. sonorensis* disk with two concavities barely marked to the sides, whereas in *C. pallidus* it has a longitudinal carina that extends in the center of the base to a little more than half.

**Diagnosis.** This species can be distinguished by the body light brown, integument chagrined, head wider than the pronotum, antennae short, antennal rami twice longer than the respective antennomere, and elytra almost four times as long as wide.

**Description.** Male. Body length 4.2, maximum body width 0.55 (pronotum). Body light brown, except for head dark brown. **Head.** Surface concave, wider (0.69) than long (0.34) (Fig. 10F), at eye level, wider (0.69) than the pronotum (0.55), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.07) less wide than the length of the 1<sup>st</sup> antennomere length (0.15); eyes long, hemispherical, finely faceted, prominent, longer (0.3) than wide (0.2); interocular distance (0.38) twice longer than eye width; antennae short (1.2) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.15) is longer than the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.1) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.11), 12<sup>th</sup> (terminal) lanceolate (0.12), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.25), as long as the preceding three combined (0.25); terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03).

**Thorax.** Pronotum longer (1.4) than wide (1) (Fig. 11F); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with two concavities barely marked to the sides, anterior margin rounded, the posterior rounded, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (1.4) as wide (0.34), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 12F); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus of the holotype lost.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Sonora (Fig. 9).

***Cenophengus tsiik* sp. nov. (Fig. 10G, 11G, 12G).**

**Type locality.** Belize

**Type material.** Holotype ♂: “BELIZE: Orange Walk Dist/ Ro Bravo Conserv. Area/18. IV. 1995; PKKovarik &/ JShuey colrs; light trap” “From the Michael Ivie Collection” |...

**Remarks.** This species is closely related to *C. cuicatlaensis* but can be distinguished by the interocular distance and the terminal maxillary palpomere. In *C. tsiik* interocular distance is three times longer than eye width, whereas in *C. cuicatlaensis* it is twice longer than eye width.

Terminal maxillary palpomere is smaller than the preceding three combined in *C. tsiik*, in *C. cuicatlaensis* palpomere is longer than the preceding three combined.

**Diagnosis.** This species can be distinguished by the integument chagrined. head almost as wide as the pronotum, antennae short, antennal rami 1.5 times longer than the respective and antennomere, elytra almost three times as long as wide.

**Description.** Male. Body length 5.50, maximum body width 0.65 (pronotum). Body dark brown, except for the antennae buccal parts, legs and the two last sternites are light brown to yellow.

**Head.** Surface concave, wider (0.68) than long (0.55) (Fig. 10G), at eye level, almost as wide (0.68) as the pronotum (0.65), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.09) less wide than the length of the 1<sup>st</sup> antennomere length (0.18); eyes long, hemispherical, finely faceted, prominent, longer (0.30) than wide (0.13); interocular distance (0.4) three times longer than eye width; antennae short (1.58) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.18) is longer than the next two combined (0.1), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.1) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup>

about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.17), antennal rami lanceolate, 1.5 times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.25), smaller than the preceding three combined; terminal labial palpomere spindle-shaped (0.09), three times as long as preceding one (0.03).

**Thorax.** Pronotum longer (0.8) than wide (0.65) (Fig. 11G); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, disk with a longitudinal carina, and with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument distinctly and coarsely punctured, each puncture bearing an amber seta; elytra almost three times as long (1.12) as wide (0.40), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein developed, those of the anterior anal and posterior anal sectors, slightly evident (Fig. 12G); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>.

**Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Belize (Fig.9).

**Etymology.** The term tsiik means honor in the Maya language, which is spoken in some regions of Belize.

***Cenophengus tupae* Vega-Badillo et al. 2021 (Fig. 10H, 11H, 12H).**

*Cenophengus tupae* Vega-Badillo et al. 2021: xxxx

**Type locality.** San Luis Potosí, Mexico

**Type material examined.** Holotype ♂: “Mexico, San Luis Potosí, / Tamasopo. Cerro al noroeste/ del cafetal, 01-06-15, / N 21°55.47' W 99°24.95' Col. / Jessica Ríos” | CNIN. Paratype ♂: same data | CNIN.

**Remarks.** This species is closely related to *C. wittmeri* but can be distinguished by its shorter size, interocular distance and the terminal maxillary palpomere. In *C. tupae* interocular distance is 2.5 times longer than eye width, whereas in *C. wittmeri* it is twice longer than eye width. The terminal maxillary palpomere is shorter than the preceding three combined in *C. tuape*, whereas in *C. longicollis* it is as long as the preceding three combined. Additionally in *C. tupae* the antennal rami is three times as long as respective antennomere, whereas in *C. wittmeri* it is twice longer than the respective antennomere.

**Diagnosis.** This species can be distinguished by the body brown except for antennae amber, integument chagrined, antennae long, antennal rami three times as long as the respective antennomere, head almost as wider as the pronotum, and elytra almost four times as long as wide.

**Description.** Male. Body length 5.2, maximum body width 0.62 (pronotum). Body brown, except for antennae and stripe on pronotum amber. **Head.** Surface concave, wider (0.6) than long (0.4) (Fig. 10H), at eye level, almost as wider (0.6) as the pronotum (0.62), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.05) less wide than the length of the 1<sup>st</sup> antennomere length (0.16); eyes long, hemispherical, finely faceted, prominent, longer (0.3) than wide (0.23); interocular distance (0.4) twice longer than eye width; antennae long (1.6) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.16) longer than next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.12) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.15),

antennal rami lanceolate, three times as long as the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.16), smaller than the preceding three combined; terminal labial palpomere spindle-shaped (0.1), three times as long as preceding one (0.03). **Thorax.** Pronotum longer (0.72) than wide (0.6) (Fig. 11H); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior almost straight with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (1.9) as wide (0.46), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 12H); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: San Luis Potosí (Fig. 9).

***Cenophengus villae* Zaragoza-Caballero, 1984 (10I, 11I, 12I).**

*Cenophengus villae* Zaragoza-Caballero, 1984: 198.

**Type locality.** Veracruz, Mexico.



**Type material examined.** Holotype ♂: MEXICO: “Veracruz, Metlac, / VI. 76 /900 msnm. / S. Zaragoza / Col. Noc.” | CNIN.

**Remarks.** This species is closely related to *C. brunneus* but can be distinguished by the interocular distance: in *C. villae* it is four times longer than eye width, whereas in *C. brunneus* it is 3.5 times longer. Additionally, in *C. villae* the pronotum disc present a longitudinal carine that extends in the center of the base to a little more than half, whereas in *C. brunneus* disc is convex, with two concavities barely marked on the sides.

**Diagnosis.** This species can be distinguished by the body dark brown, integument chagrined, antennae short, antennal rami 1.5 times longer than the respective antennomere, and elytra almost 4.5 times as long as wide.

**Description.** Male. Body length 4.2, maximum body width 0.51 (pronotum). Body dark brown, except for legs yellowish. **Head.** Surface concave, wider (0.65) than long (0.5) (Fig. 10I), at eye level, less wide (0.65) than the pronotum (0.51), integument chagrined, distinctly and coarsely punctured, each puncture bearing a brown seta; interantennal distance (0.05) less wide than the length of the 1<sup>st</sup> antennomere length (0.13); small long, hemispherical, finely faceted, prominent, longer (0.28) than wide (0.15); interocular distance (0.7) four times longer than eye width; antennae short (1.6) barely reaching pronotal posterior margin; 1<sup>st</sup> antennomere (0.13) as long as the next two combined, 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.11) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.15), 12<sup>th</sup> (terminal) lanceolate (0.2), antennal rami lanceolate, 1.5 times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.4), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.06), three times as long as preceding one (0.02). **Thorax.** Pronotum longer (0.67) than wide (0.51) (Fig. 11I); integument chagrined, distinctly and coarsely punctured, each puncture bearing a brown seta, disk with a longitudinal carina that extends in the

center of the base to a little more than half, anterior margin rounded, the posterior curved, lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument, distinctly and coarsely punctured, each puncture bearing a brown seta; elytra almost 4.5 times as long (1.64) as wide (0.38), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 12I); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro- and mesothoracic legs with a similar length, 1<sup>st</sup> tarsomere of metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus of the holotype lost.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Veracruz (Fig, 9).

***Cenophengus wittmeri* Zaragoza-Caballero, 1984 (13A, 14A, 15A).**

*Cenophengus wittmeri* Zaragoza-Caballero, 1984: 196.

**Type locality.** Puebla, Mexico.

**Type material examined.** Holotype ♂: MEXICO: “Puebla, Plata, / VII-75 / 960 msnm. / J. Bueno / Col. Noc.” |CNIN. Paratype ♂: “Mexico: Hidalgo, Ixtlahuaco / Alt. 1550 m. 17- 07- 1983 / Luz incandescente amarilla / colecta nocturna, Bosque / Mesófilo de montaña. / Col. R. Terrón” (1) | CNIN.

**Remarks.** This species is closely related to *C. marmoratus* but can be distinguished by the color of the body and the terminal maxillary palpomere. In *C. wittmeri* is brown body, except for the middle part of the pronotum that is dark brown, whereas in *C. marmoratus* it is yellow or light

brown, the pronotum partially interrupted by darker brown spots. The terminal maxillary palpomere is as long as the preceding three combined in *C. wittmeri*, in *C. marmoratus* it is smaller than the preceding three combined. Additionally, in *C. wittmeri* the posterior radial vein barely reaches half the length of the medial radial vein, whereas in *C. marmoratus* it extends beyond half the length of the medial radial vein.

**Diagnosis.** This species can be distinguished by the body brown, except for middle part of pronotum, integument chagrined, head almost as wider as the pronotum, antennae long, antennal rami twice longer than the respective antennomere, and elytra almost four times as long as wide.

**Description.** Male. Body length 9.2, maximum body width 1.04 (pronotum). Body brown, except for middle part of pronotum and last two sternites dark brown, elytral apex whitish. **Head.**

Surface concave, wider (0.9) than long (0.8) (Fig. 13A), at eye level, almost as wider (0.9) as the pronotum (0.95), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.09) less wide than the length of the 1<sup>st</sup> antennomere length (0.28); eyes long, hemispherical, finely faceted, prominent, longer (0.4) than wide (0.24); interocular distance (0.5) twice longer than eye width; antennae long (2.9) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.28) longer than next two combined (0.1), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.25) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.27), 12<sup>th</sup> (terminal) lanceolate (0.3), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.3), smaller than the preceding three combined (0.45); terminal labial palpomere spindle-shaped (0.15), three times as long as preceding one (0.05). **Thorax.** Pronotum longer (1.3) than wide (0.95) (Fig. 14A); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior curved with a small middle notch, lateral

margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture incomplete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (3.75) as wide (1), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) developed, radial cell close, r3 vein present, r4 vein developed, those of the anterior anal and posterior anal sectors, evident (Fig. 14A); 1<sup>st</sup> tarsomere of pro-, meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Mexico: Puebla, Hidalgo, Veracruz (Fig. 9).

**Additional material examined.** “MEXICO: Hidalgo, Tlanchinol/TiV-1, 1 a 22 - X -2011/ Cols. J. Márquez y J. Asiain” (1) | CNIN; “MEXICO: Veracruz, Hwy. /131, Altotonga /7000’20 Aug. 1982 C & / L.O’ Brien & G. Wibmer “(1) | FSCA.

***Cenophengus xiinbali* Vega-Badillo et al. 2021 (Fig. 13B, 14B, 15B).**

*Cenophengus xiinbali* Vega-Badillo et al. 2021: xxxx

**Type locality.** Puerta Parada, Guatemala.

**Type material examined.** Holotype ♂: “Guatemala: Guatemala Dept. / Puerta Parada km 14.5 carr. a / El Salvador 1840 m alt./ 8-15/VI/2013 Col. J.C Schuster” | CNIN. Paratype ♂: same data | CNIN.

**Remarks.** This species is closely related to *C. longicollis* but can be distinguished by the interocular distance and terminal maxillary palpomere. In *C. xiinbali* the interocular distance is 3.5 times longer than eye width, whereas in *C. longicollis* it is three times longer. The terminal

maxillary palpomere is as long as the preceding three combined in *C. xiinbali*, whereas in *C. longicollis* it is longer than the preceding three combined.

**Diagnosis.** This species can be distinguished by integument chagrined, antennae long, antennal rami twice longer than the respective antennomere, terminal maxillary palpomere as long as the preceding three combined and elytra almost four times as long as wide.

**Description.** Male. Body length 8.3, maximum body width 0.93 (pronotum). Body brown, except for pronotum, legs and two last abdominal segments orange. **Head.** Surface concave, wider (0.8) than long (0.73) (Fig. 13B), at eye level, less wide (0.8) than the pronotum (0.93), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.12) wider than the length of the 1<sup>st</sup> antennomere length (0.21); eyes long, hemispherical, finely faceted, prominent, longer (0.33) than wide (0.15); interocular distance (0.55) 3.5 times longer than eye width; antennae long (2.4) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.21) longer than the next two combined (0.16), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> (0.14) shorter than following antennomeres, 5<sup>th</sup> to 11<sup>th</sup> about equal in length (0.21), 12<sup>th</sup> (terminal) lanceolate (0.26), antennal rami lanceolate, twice longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.3), as long as the preceding three combined; terminal labial palpomere spindle-shaped (0.06), three times as long as preceding one (0.02). **Thorax.** Pronotum longer (1.14) than wide (0.93) (Fig. 14B); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior almost straight with a small middle notch, lateral margins almost straight, anterior angles rounded and posterior angles acute; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument densely punctured, each puncture bearing an amber seta; elytra almost four times as long (2.68)

as wide (0.64), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior anal sectors, evident (Fig. 14B); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of the prothoracic legs with a similar length and 1<sup>st</sup> tarsomeres of meso- and metathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctured, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with three teeth at the apex of paramere (Fig. 32F–H).

**Female and immatures.** Unknown.

**Distribution.** Guatemala: Puerta Parada (Fig. 9).

***Cenophengus zuritai* sp. nov. (Fig. 13C, 14C, 15C).**

**Type locality.** Cartago, Costa Rica

**Type material examined.** Holotype ♂: “COSTA RICA: Cartago/ 4 km NE Canon Genesis II/9.761° N, 83.916°W/ FEB-MAR 1993, 2350m/S.& P. Friedman. Malaise” “From the Michael Ivie Collection” |. Paratype ♂: “COSTA RICA: Cartago / 4 km NE Canon Genesis II/ 9.761° N, 83.916°W/ FEB-MAR 1993, 2350m/ S.& P. Friedman. Malaise” “From the Michael Ivie Collection” (2) |...

**Remarks.** This species is closely related to *C. xiinbali* but can be distinguished by the interocular distance and terminal maxillary palpomere. In *C. zuritai* the interocular distance is three times longer than eye width, whereas in *C. xiinbali* it is 2.5 times longer. The terminal maxillary palpomere is smaller than the preceding three combined in *C. zuritai*, whereas in *C. xiinbali* it is as long as the preceding three combined.

**Diagnosis.** This species can be distinguished by the head orange-brown, pronotum orange, integument chagrined, head a little wider than the pronotum, antennae long antennal rami 1.5

times longer than the respective antennomere, terminal maxillary palpomere smaller than the preceding three combined, and elytra almost twice as long as wide.

**Description.** Male. Body length 8.5, maximum body width 0.86 (pronotum). Head orange-brown; antennae black to brown, pronotum orange; legs yellow to brown and two last sternites yellowish colored. **Head.** Surface concave, wider (0.9) than long (0.65) (Fig. 13C), at eye level, a little wider (0.9) than the pronotum (0.86), integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta; interantennal distance (0.09) wider than the length of the 1<sup>st</sup> antennomere length (0.2); eyes long, hemispherical, finely faceted, prominent, longer (0.35) than wide (0.2); interocular distance (0.6) three times longer than eye width; antennae long (2.4) extending slightly beyond the pronotal posterior margin; 1<sup>st</sup> antennomere (0.2) longer than next two combined (0.17), 3<sup>rd</sup> cup-shaped, 4<sup>th</sup> to 11<sup>th</sup> about equal in length (0.22), 12<sup>th</sup> (terminal) lanceolate (0.27), antennal rami lanceolate, 1.5 times longer than the respective antennomere; clypeus bilobed and partially sclerosed; terminal maxillary palpomere robust, securiform (0.3), smaller than the preceding three combined (0.37); terminal labial palpomere spindle-shaped (0.1), twice as long as preceding one (0.05). **Thorax.** Pronotum longer (1.1) than wide (0.86) (Fig. 14C); integument chagrined, distinctly and coarsely punctured, each puncture bearing an amber seta, convex disc, with two concavities barely marked to the sides, anterior margin rounded, the posterior and lateral margins almost straight, anterior and posterior angles rounded; prosternal anterior margin sinuous; sternal suture complete; scutellum almost quadrangular, posterior margin blunted, integument distinctly and coarsely punctured, each puncture bearing an amber seta; elytra almost twice as long (2.8) as wide (1.5), convex, without longitudinal costae, elytral apex blunted; posterior wings with the posterior radial vein (RP) reduced, radial cell close, r3 vein absent, r4 vein reduced, those of the anterior anal and posterior anal sectors, evident (Fig. 15C); 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro- and mesothoracic legs with a

similar length, 1<sup>st</sup> tarsomere of meathoracic legs is longer than 2<sup>nd</sup>. **Abdomen.** Integument shiny, punctuate, with silky appearance due to dense setosity, penultimate sternite with margin sinuate, last sternite with margin notched; aedeagus trilobed with one tooth at the apex of paramere.

**Female and immatures.** Unknown.

**Distribution.** Costa Rica: Cartago (Fig. 9).

**Etymology.** Species dedicated to our dear friend and colleague Dr. Martín Leonel Zurita García, entomologist who dedicated his life to the study of beetles.

### **Acknowledgments**

We would like to thank Paulina Cifuentes Ruiz and Edgar Uriel Garduño Montes de Oca for their review and comments that enriched this work. Caleb Califre Martins for his help in the elaboration of the edeagus schemes. Susana Guzmán Gómez for her technical assistance in taking the photographs. This work was supported by a doctoral fellowship from the Consejo Nacional de Ciencia y Tecnología (CONACyT) to the first author.

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## Figures

**Figure 1.** Morphological structures in the male reproductive apparatus of *Cenophengus gardunoi* (A) dorsal; (B) lateral; (C) ventral.

**Figure 2.** Head dorsal (A) *Cenophengus debilis* LeConte, 1881; (B) *Cenophengus baios* Zaragoza-Caballero, 2003; (C) *Cenophengus brunneus* Wittmer, 1976; (D) *Cenophengus ciceroi* Wittmer, 1981; (E) *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; (F) *Cenophengus gardunoi* sp. nov.; (G) *Cenophengus gorhami* Zaragoza, 1986; (H) *Cenophengus hnogamui* Vega-Badillo et al. 2021; (I) *Cenophengus howdeni* Zaragoza-Caballero, 1986.

**Figure 3.** Pronotum dorsal (A) *Cenophengus debilis* LeConte, 1881; (B) *Cenophengus baios* Zaragoza-Caballero, 2003; (C) *Cenophengus brunneus* Wittmer, 1976; (D) *Cenophengus ciceroi* Wittmer, 1981; (E) *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; (F) *Cenophengus gardunoi* sp. nov.; (G) *Cenophengus gorhami* Zaragoza, 1986; (H) *Cenophengus hnogamui* Vega-Badillo et al. 2021; (I) *Cenophengus howdeni* Zaragoza-Caballero, 1986.

**Figure 4.** Posterior wings (A) *Cenophengus debilis* LeConte, 1881; (B) *Cenophengus baios* Zaragoza-Caballero, 2003; (C) *Cenophengus brunneus* Wittmer, 1976; (D) *Cenophengus ciceroi* Wittmer, 1981; (E) *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; (F) *Cenophengus gardunoi* sp. nov.; (G) *Cenophengus gorhami* Zaragoza, 1986; (H) *Cenophengus hnogamui* Vega-Badillo et al. 2021; (I) *Cenophengus howdeni* Zaragoza-Caballero, 1986. Venation: CR = Radial Cell; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

**Figure 5.** Distribution of *Cenophengus*.

**Figure 6.** Head dorsal. (A) *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; (B) *Cenophengus kikapu* Vega-Badillo et al. 202; (C) *Cenophengus longicollis* Wittmer, 1976; (D) *Cenophengus magnus* Zaragoza-Caballero, 1988; (E) *Cenophengus major* Wittmer, 1976; (F) *Cenophengus marmoratus* Wittmer, 1976; (G) *Cenophengus mboi* Vega-Badillo et al. 2021; (H) *Cenophengus mumui* Vega-Badillo et al. 2021; (I) *Cenophengus munizi* Zaragoza-Caballero, 2008.

**Figure 7.** Pronotum dorsal. (A) *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; (B) *Cenophengus kikapu* Vega-Badillo et al. 202; (C) *Cenophengus longicollis* Wittmer, 1976; (D) *Cenophengus magnus* Zaragoza-Caballero, 1988; (E) *Cenophengus major* Wittmer, 1976; (F) *Cenophengus marmoratus* Wittmer, 1976; (G) *Cenophengus mboi* Vega-Badillo et al. 2021; (H)

*Cenophengus mumui* Vega-Badillo et al. 2021; **(I)** *Cenophengus munizi* Zaragoza-Caballero, 2008.

**Figure 8.** Posterior wings. **(A)** *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; **(B)** *Cenophengus kikapu* Vega-Badillo et al. 202; **(C)** *Cenophengus longicollis* Wittmer, 1976; **(D)** *Cenophengus magnus* Zaragoza-Caballero, 1988; **(E)** *Cenophengus major* Wittmer, 1976; **(F)** *Cenophengus marmoratus* Wittmer, 1976; **(G)** *Cenophengus mboi* Vega-Badillo et al. 2021; **(H)** *Cenophengus mumui* Vega-Badillo et al. 2021; **(I)** *Cenophengus munizi* Zaragoza-Caballero, 2008. Venation: CR = Radial Cell; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AP = Posterior Anal.

**Figure 9.** Distribution of *Cenophengus*. (Continued)

**Figure 10.** Head dorsal. **(A)** *Cenophengus niger* Wittmer, 1986; **(B)** *Cenophengus pallidus* Schaeffer, 1904; **(C)** *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; **(D)** *Cenophengus punctatissimus* Wittmer, 1976; **(E)** *Cenophengus saasil* sp.nov.; **(F)** *Cenophengus sonorensis* Zaragoza-Caballero, 2008; **(G)** *Cenophengus tsiik* sp.nov.; **(H)** *Cenophengus tupae* Vega-Badillo et al. 2021; **(I)** *Cenophengus villae* Zaragoza-Caballero, 1984.

**Figure 11.** Pronotum dorsal. **(A)** *Cenophengus niger* Wittmer, 1986; **(B)** *Cenophengus pallidus* Schaeffer, 1904; **(C)** *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; **(D)** *Cenophengus punctatissimus* Wittmer, 1976; **(E)** *Cenophengus saasil* sp.nov.; **(F)** *Cenophengus sonorensis* Zaragoza-Caballero, 2008; **(G)** *Cenophengus tsiik* sp.nov.; **(H)** *Cenophengus tupae* Vega-Badillo et al. 2021; **(I)** *Cenophengus villae* Zaragoza-Caballero, 1984.

**Figure 12.** Posterior wings. **(A)** *Cenophengus niger* Wittmer, 1986; **(B)** *Cenophengus pallidus* Schaeffer, 1904; **(C)** *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; **(D)** *Cenophengus punctatissimus* Wittmer, 1976; **(E)** *Cenophengus saasil* sp.nov.; **(F)** *Cenophengus sonorensis* Zaragoza-Caballero, 2008; **(G)** *Cenophengus tsiik* sp.nov.; **(H)** *Cenophengus tupae* Vega-Badillo

et al. 2021; **(I)** *Cenophengus villae* Zaragoza-Caballero, 1984. Venation: CR = Radial Cell; r3 = radial 3; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

**Figure 13.** Head dorsal. **(A)** *Cenophengus wittmeri* Zaragoza-Caballero, 1984; **(B)** *Cenophengus xiinbali* Vega-Badillo et al. 2021; **(C)** *Cenophengus zuritai* sp. nov.

**Figure 14.** Pronotum dorsal. **(A)** *Cenophengus wittmeri* Zaragoza-Caballero, 1984; **(B)** *Cenophengus xiinbali* Vega-Badillo et al. 2021; **(C)** *Cenophengus zuritai* sp. nov.

**Figure 15.** Posterior wings. **(A)** *Cenophengus wittmeri* Zaragoza-Caballero, 1984; **(B)** *Cenophengus xiinbali* Vega-Badillo et al. 2021; **(C)** *Cenophengus zuritai* sp. nov. Venation: CR = Radial Cell; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal. Aedeagus: **(F)** dorsal; **(G)** lateral; **(H)** ventral.

## Table

Table 1: Species of the genus <i>Cenophengus</i>			
Species	Author	Country	Holotype
<i>C. baios</i>	Zaragoza-Caballero, 2003	Mexico	CNIN
<i>C. brunneus</i>	Wittmer, 1976	Mexico	NMNH
<i>C. ciceroi</i>	Wittmer, 1981	U.S.A.	NMNH
<i>C. cuicatlaensis</i>	Zaragoza-Caballero, 2008	Mexico	CNIN
<i>C. debilis</i>	LeConte 1881	U.S.A.	MCZ
<i>C. gardunoi</i>		Mexico	CNIN
<i>C. gorhami</i>	Zaragoza-Caballero, 1986	Mexico	NMNH
<i>C. hnogamui</i>	Vega-Badillo et al. 2021	Mexico	CNIN
<i>C. howdeni</i>	Zaragoza-Caballero, 1986	Mexico	CNIN

<i>C. hautulcoensis</i>	Zaragoza-Caballero, 2008	Mexico	CNIN
<i>C. kikapu</i>	Vega-Badillo et al. 2021	Mexico	CNIN
<i>C. longicollis</i>	Wittmer, 1976	U.S.A. and Mexico	FMNH
<i>C. magnus</i>	Zaragoza-Caballero, 1988	Mexico	CUIC
<i>C. major</i>	Wittmer, 1976	Mexico	AMNH
<i>C. marmoratus</i>	Wittmer, 1976	Mexico	NMNH
<i>C. mboi</i>	Vega-Badillo et al. 2021	Mexico	CNIN
<i>C. mumui</i>	Vega-Badillo et al. 2021	Mexico	CNIN
<i>C. munizi</i>	Zaragoza-Caballero, 2008	Mexico	CNIN
<i>C. niger</i>	Wittmer, 1986	Costa Rica	NHMB
<i>C. pallidus</i>	Schaeffer, 1904	U.S.A.	NHMUK
<i>C. pedregalensis</i>	Zaragoza-Caballero, 1975	Mexico	CNIN
<i>C. punctatissimus</i>	Wittmer, 1976	Mexico	NMNH
<i>C. saasil</i>		Honduras	
<i>C. sonorensis</i>	Zaragoza-Caballero, 2008	Mexico	CNIN
<i>C. tsiik</i>		Belize	
<i>C. tupae</i>	Vega-Badillo et al. 2021	Mexico	CNIN
<i>C. villae</i>	Zaragoza-Caballero, 1984	Mexico	CNIN
<i>C. wittmeri</i>	Zaragoza-Caballero, 1984	Mexico	CNIN
<i>C. xiinbali</i>	Vega-Badillo et al. 2021	Guatemala	CNIN
<i>C. zuritai</i>		Costa Rica	

Figures

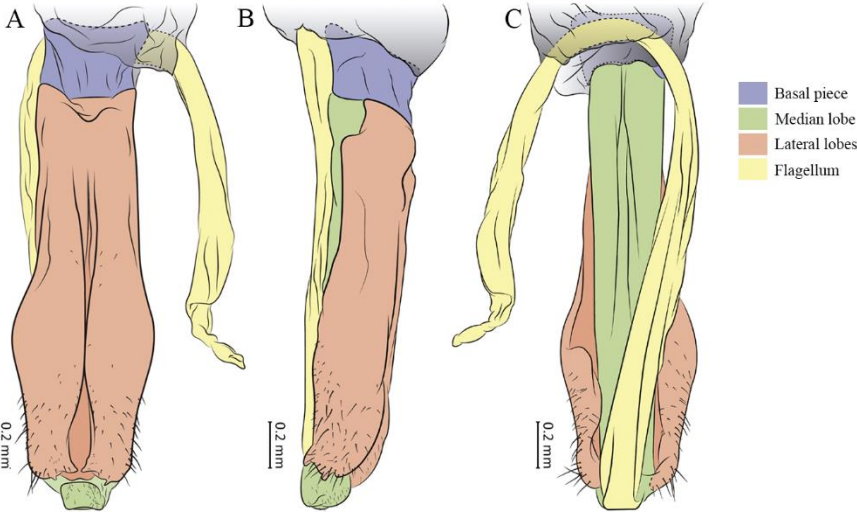
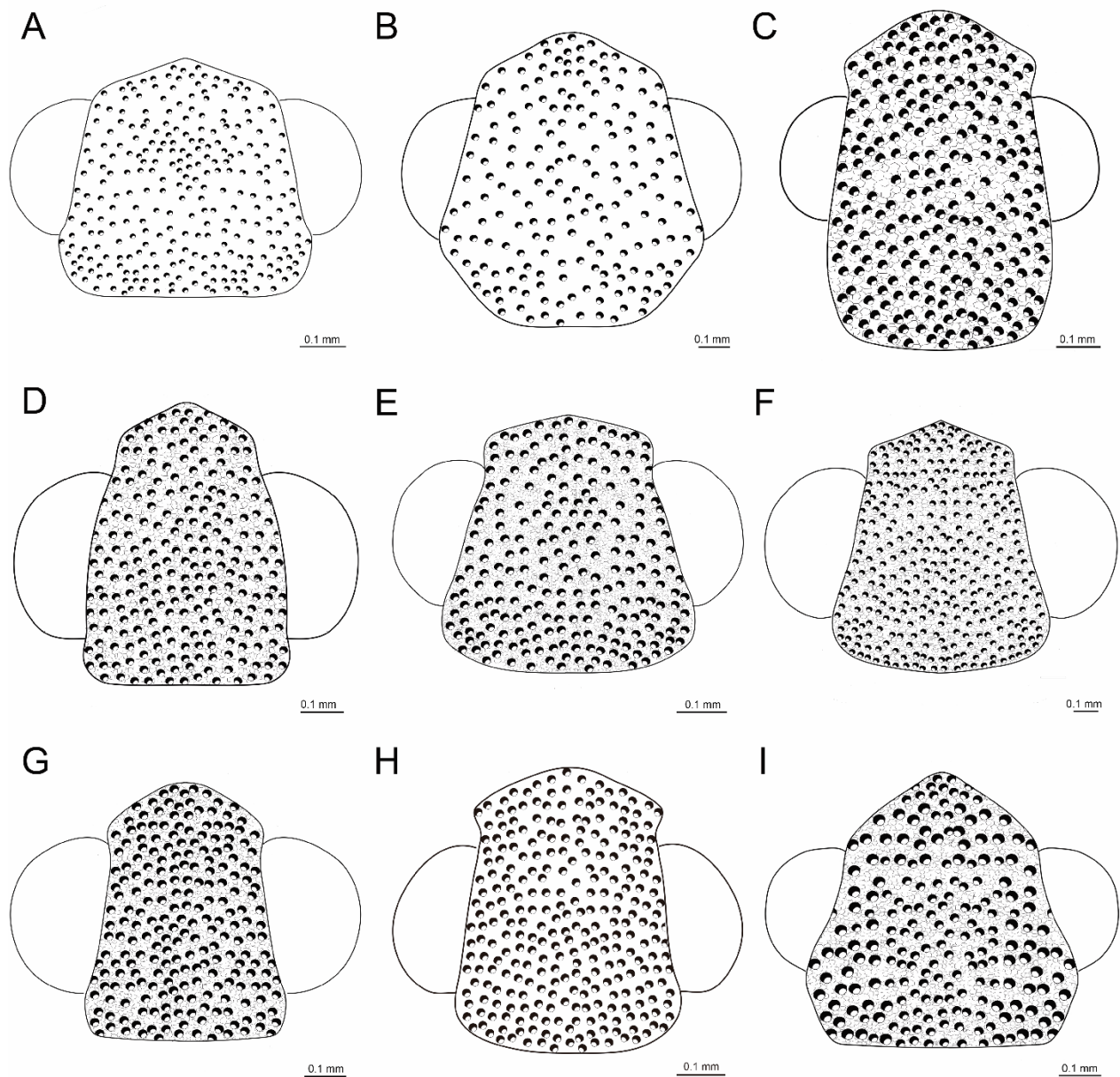
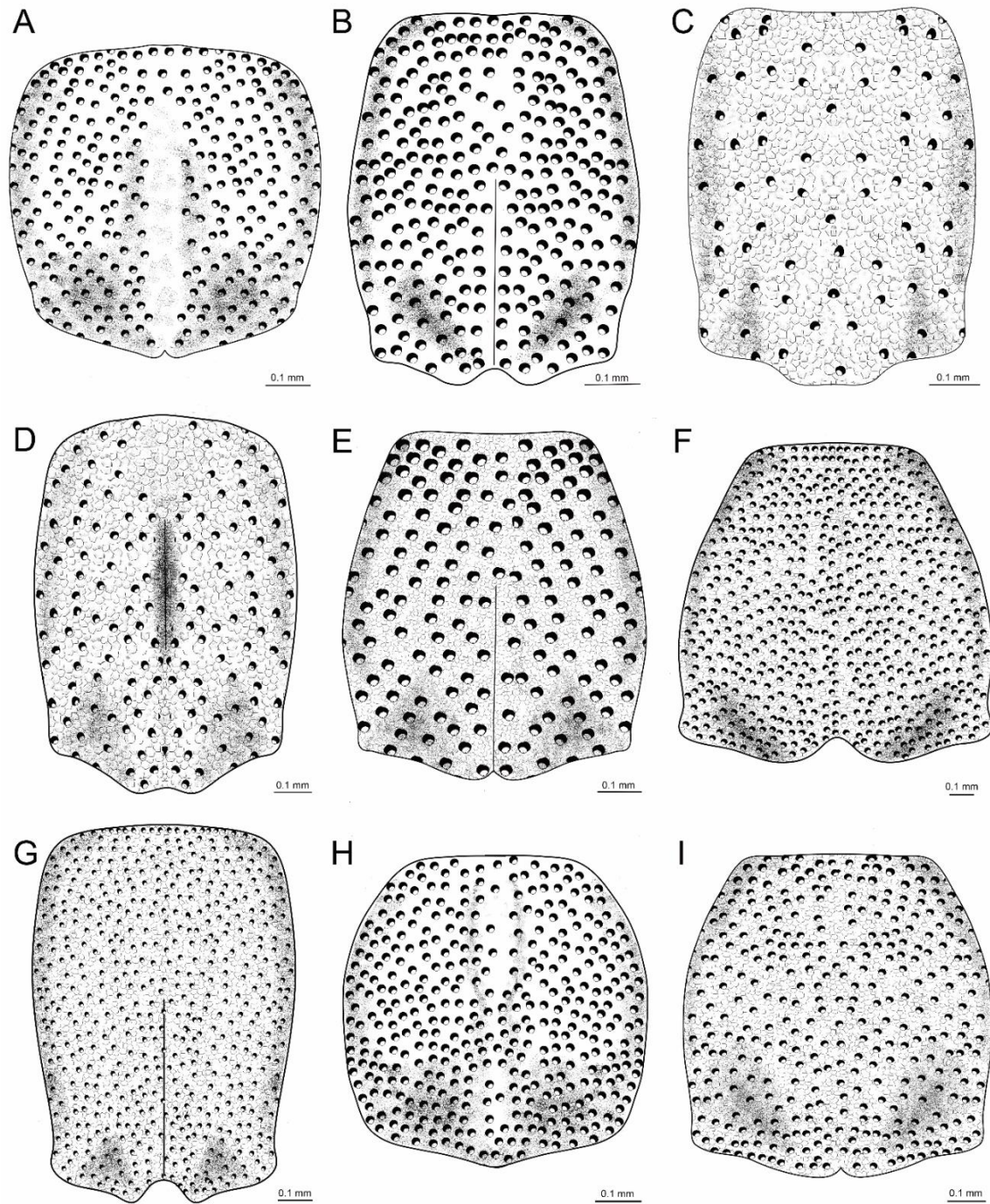


Figure 1. Morphological structures in the male reproductive apparatus of *Cenophengus gardunoi* (A) dorsal; (B) lateral; (C) ventral.

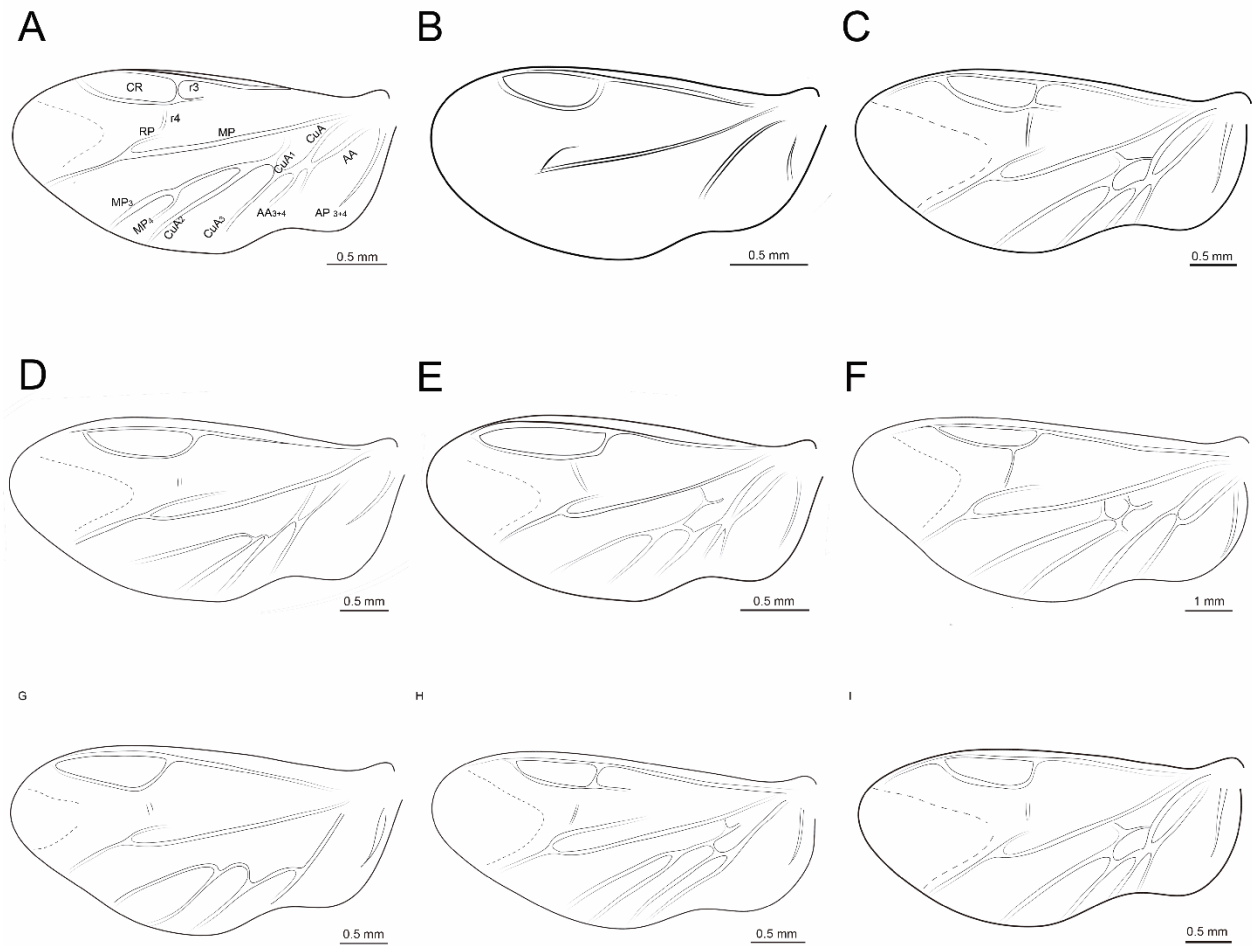


**Figure 2.** Head dorsal (A) *Cenophengus debilis* LeConte, 1881; (B) *Cenophengus baios* Zaragoza-Caballero, 2003; (C) *Cenophengus brunneus* Wittmer, 1976; (D) *Cenophengus ciceroi* Wittmer, 1981; (E) *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; (F) *Cenophengus gardunoi* sp. nov.; (G) *Cenophengus gorhami* Zaragoza, 1986; (H) *Cenophengus hnogamui* Vega-Badillo et al. 2021; (I) *Cenophengus howdeni* Zaragoza-Caballero, 1986.





**Figure 3.** Pronotum dorsal (A) *Cenophengus debilis* LeConte, 1881; (B) *Cenophengus baios* Zaragoza-Caballero, 2003; (C) *Cenophengus brunneus* Wittmer, 1976; (D) *Cenophengus ciceroi* Wittmer, 1981; (E) *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; (F) *Cenophengus gardunoi* sp. nov.; (G) *Cenophengus gorhami* Zaragoza, 1986; (H) *Cenophengus hnogamui* Vega-Badillo et al. 2021; (I) *Cenophengus howdeni* Zaragoza-Caballero, 1986.



**Figure 4.** Posterior wings **(A)** *Cenophengus debilis* LeConte, 1881; **(B)** *Cenophengus baios* Zaragoza-Caballero, 2003; **(C)** *Cenophengus brunneus* Wittmer, 1976; **(D)** *Cenophengus ciceroi* Wittmer, 1981; **(E)** *Cenophengus cuicatlaensis* Zaragoza-Caballero, 2008; **(F)** *Cenophengus gardunoi* sp. nov.; **(G)** *Cenophengus gorphami* Zaragoza, 1986; **(H)** *Cenophengus hnogamui* Vega-Badillo et al. 2021; **(I)** *Cenophengus howdeni* Zaragoza-Caballero, 1986. Venation: CR = Radial Cell; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

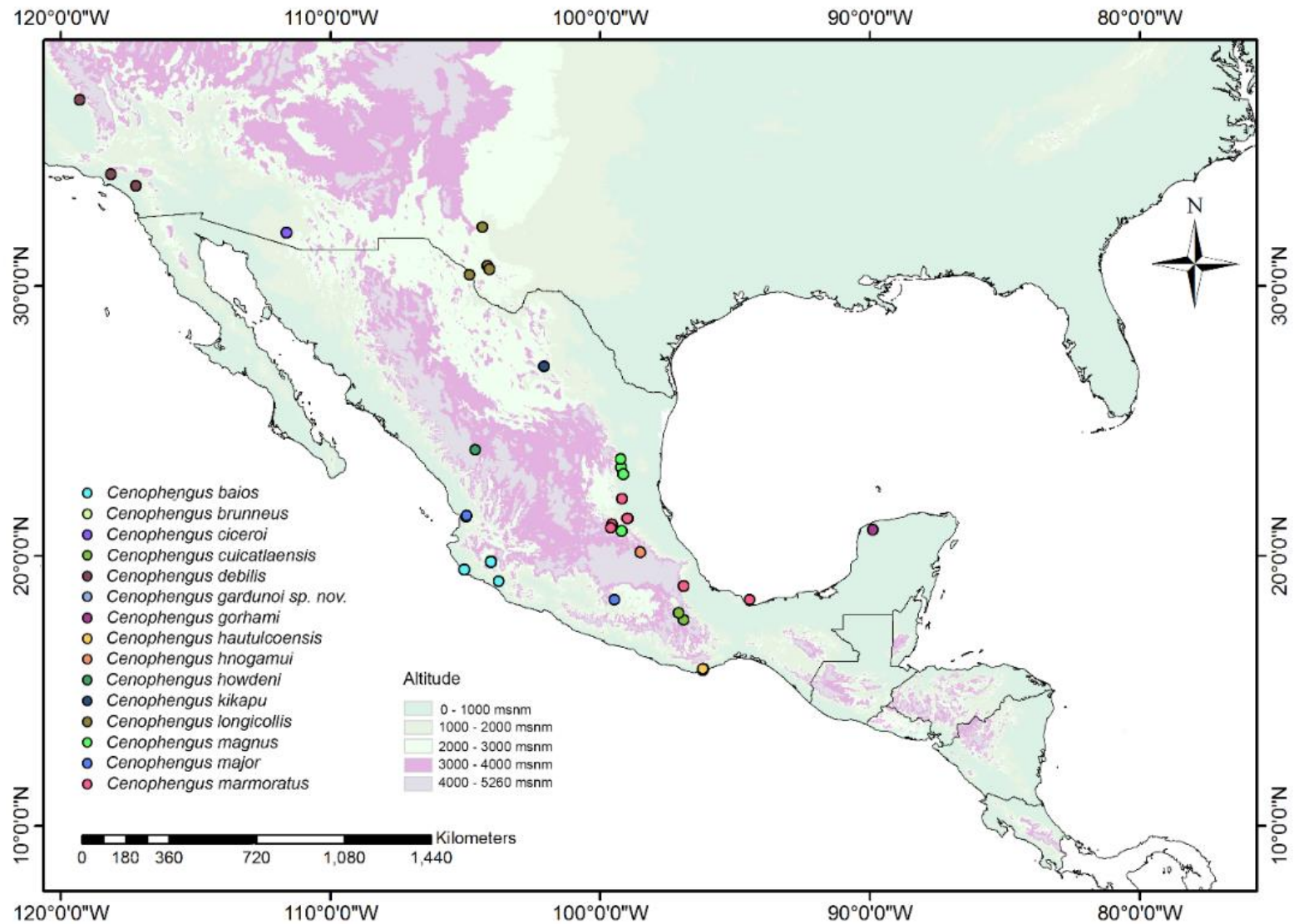
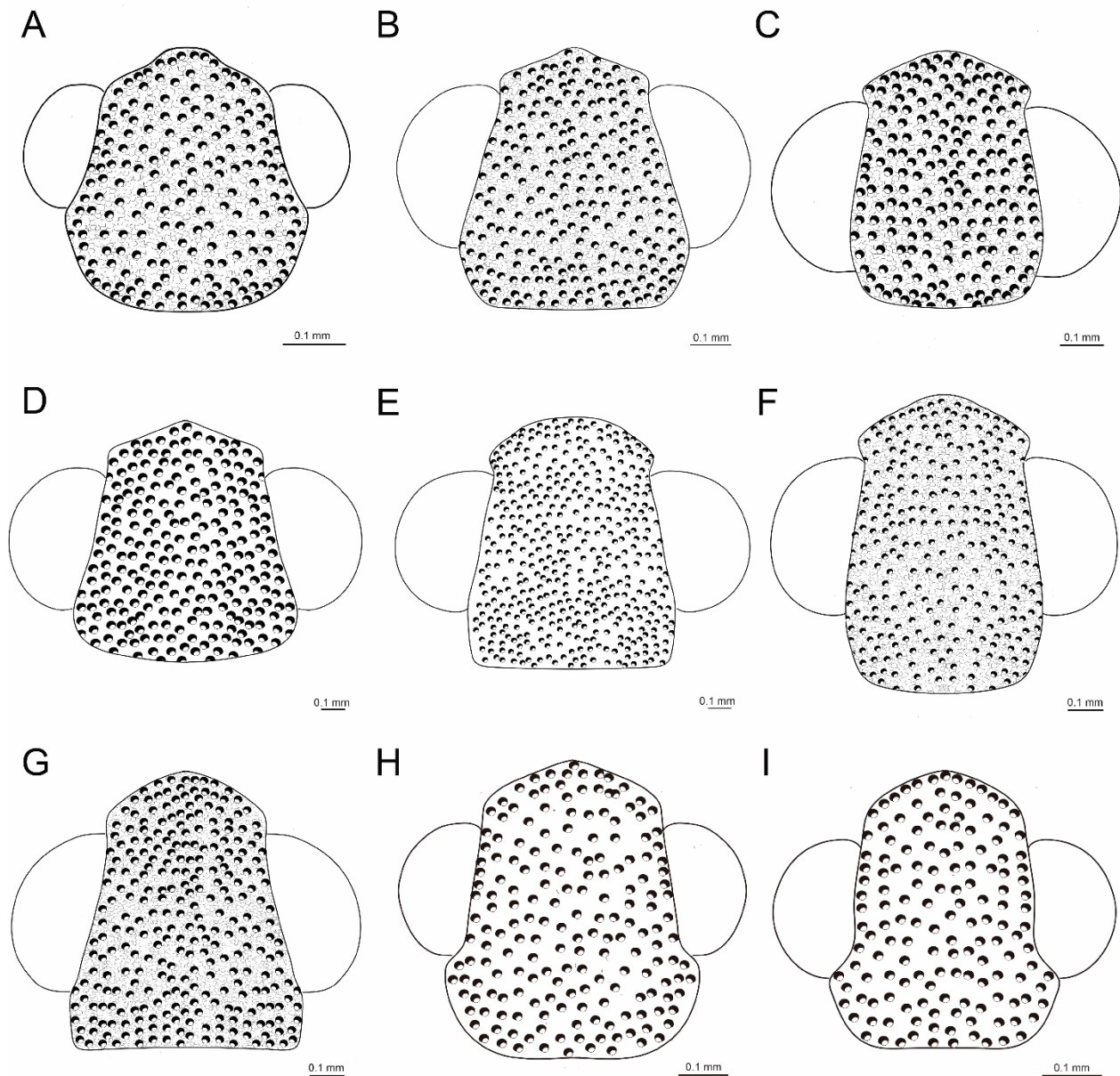
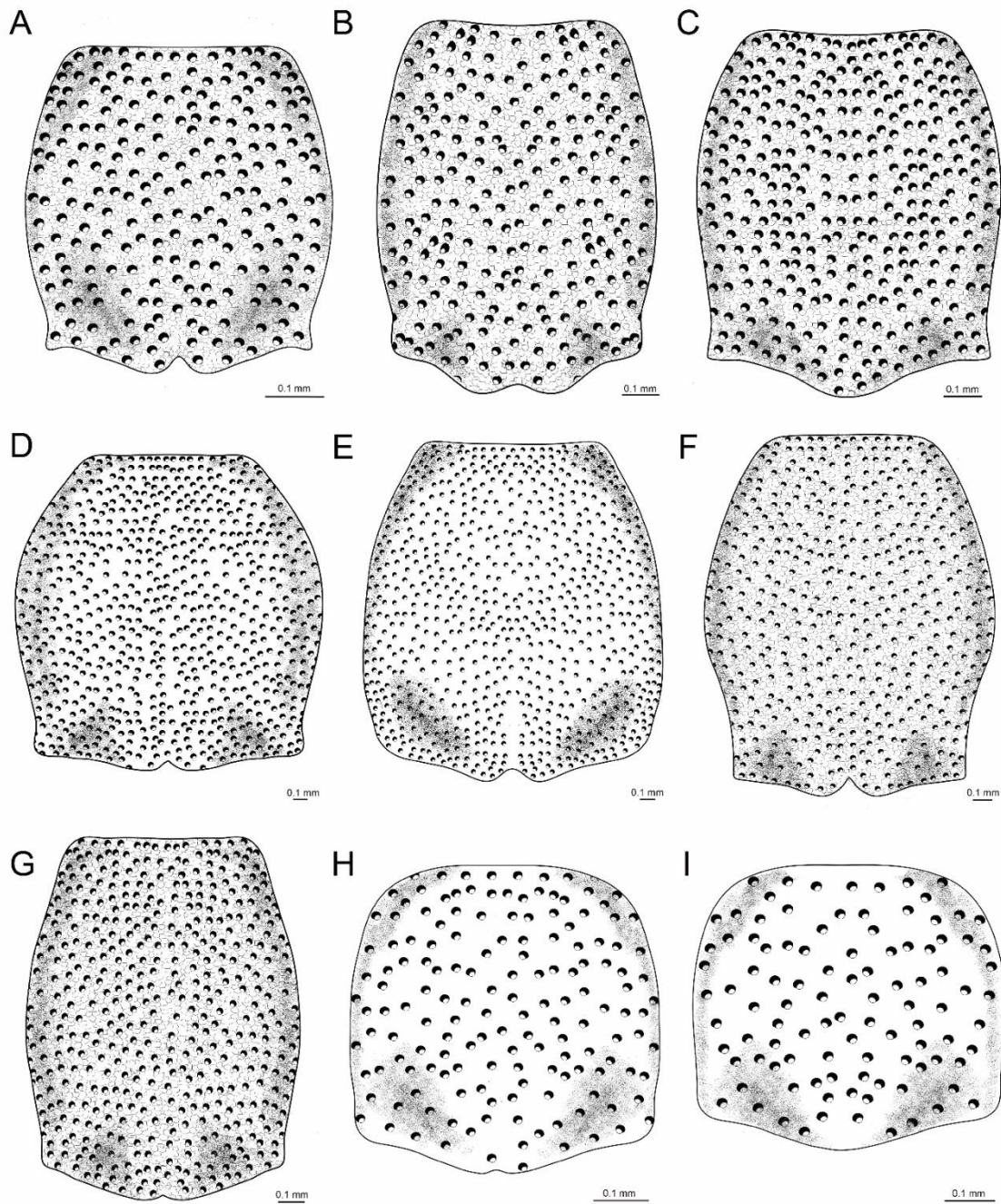


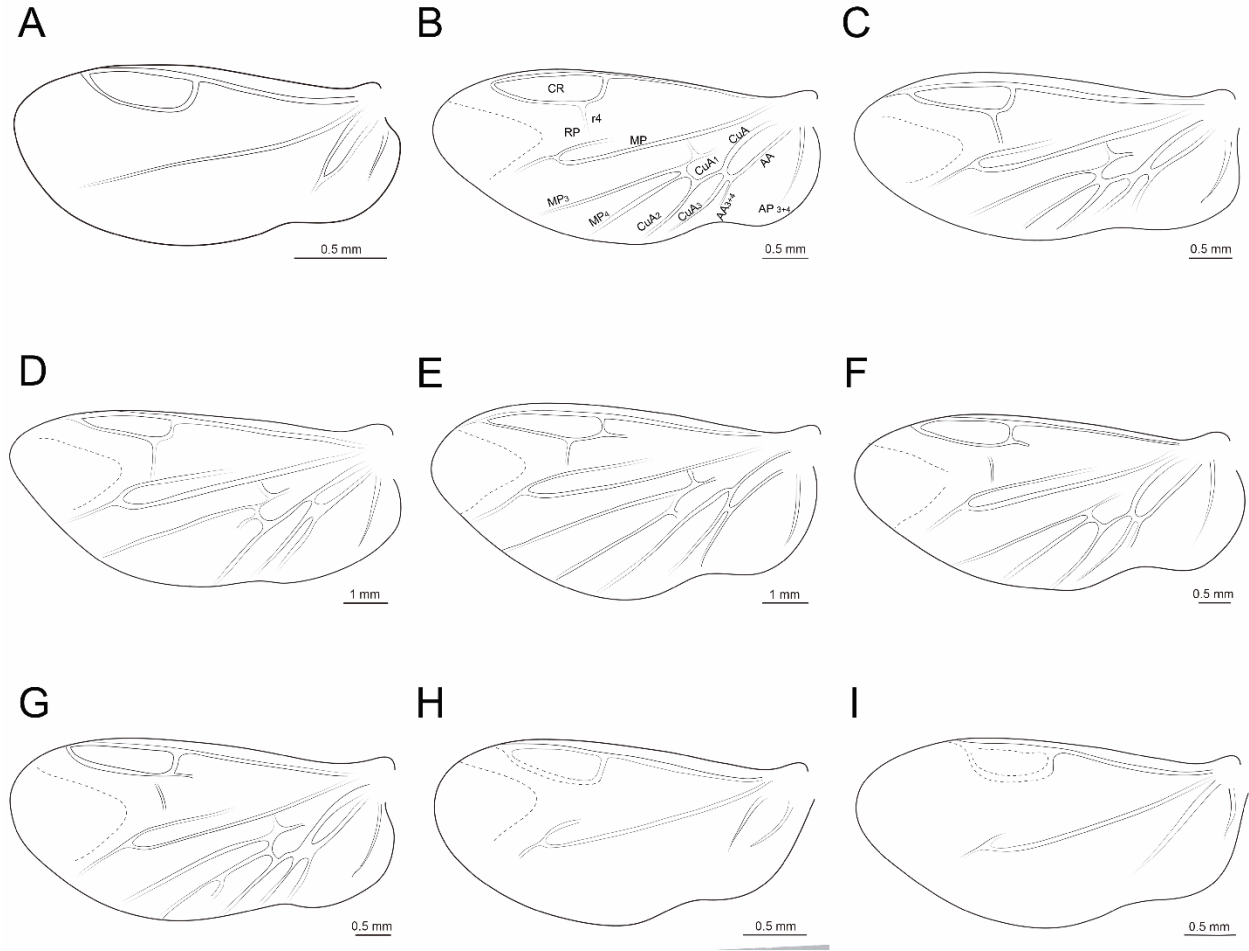
Figure 5. Distribution of *Cenophengus*



**Figure 6.** Head dorsal. **(A)** *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; **(B)** *Cenophengus kikapu* Vega-Badillo et al. 202; **(C)** *Cenophengus longicollis* Wittmer, 1976; **(D)** *Cenophengus magnus* Zaragoza-Caballero, 1988; **(E)** *Cenophengus major* Wittmer, 1976; **(F)** *Cenophengus marmoratus* Wittmer, 1976; **(G)** *Cenophengus mboi* Vega-Badillo et al. 2021; **(H)** *Cenophengus mumui* Vega-Badillo et al. 2021; **(I)** *Cenophengus munizi* Zaragoza-Caballero, 2008.



**Figure 7.** Pronotum dorsal. **(A)** *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; **(B)** *Cenophengus kikapu* Vega-Badillo et al. 202; **(C)** *Cenophengus longicollis* Wittmer, 1976; **(D)** *Cenophengus magnus* Zaragoza-Caballero, 1988; **(E)** *Cenophengus major* Wittmer, 1976; **(F)** *Cenophengus marmoratus* Wittmer, 1976; **(G)** *Cenophengus mboi* Vega-Badillo et al. 2021; **(H)** *Cenophengus mumui* Vega-Badillo et al. 2021; **(I)** *Cenophengus munizi* Zaragoza-Caballero, 2008.



**Figure 8.** Posterior wings. (A) *Cenophengus hautulcoensis* Zaragoza-Caballero, 2008; (B) *Cenophengus kikapu* Vega-Badillo et al. 202; (C) *Cenophengus longicollis* Wittmer, 1976; (D) *Cenophengus magnus* Zaragoza-Caballero, 1988; (E) *Cenophengus major* Wittmer, 1976; (F) *Cenophengus marmoratus* Wittmer, 1976; (G) *Cenophengus mboi* Vega-Badillo et al. 2021; (H) *Cenophengus mumui* Vega-Badillo et al. 2021; (I) *Cenophengus munizi* Zaragoza-Caballero, 2008. Venation: CR = Radial Cell; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AP = Posterior Anal.

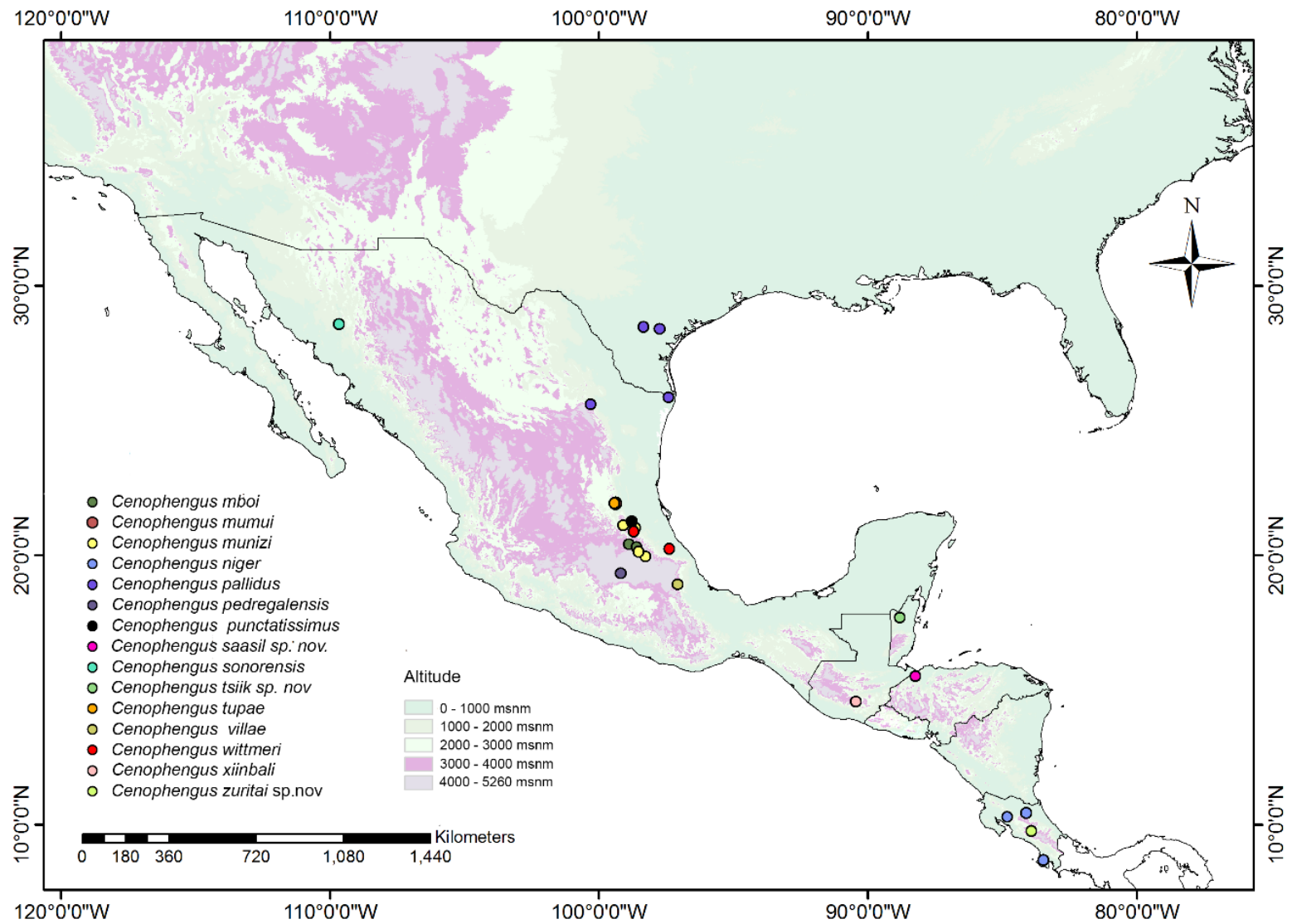
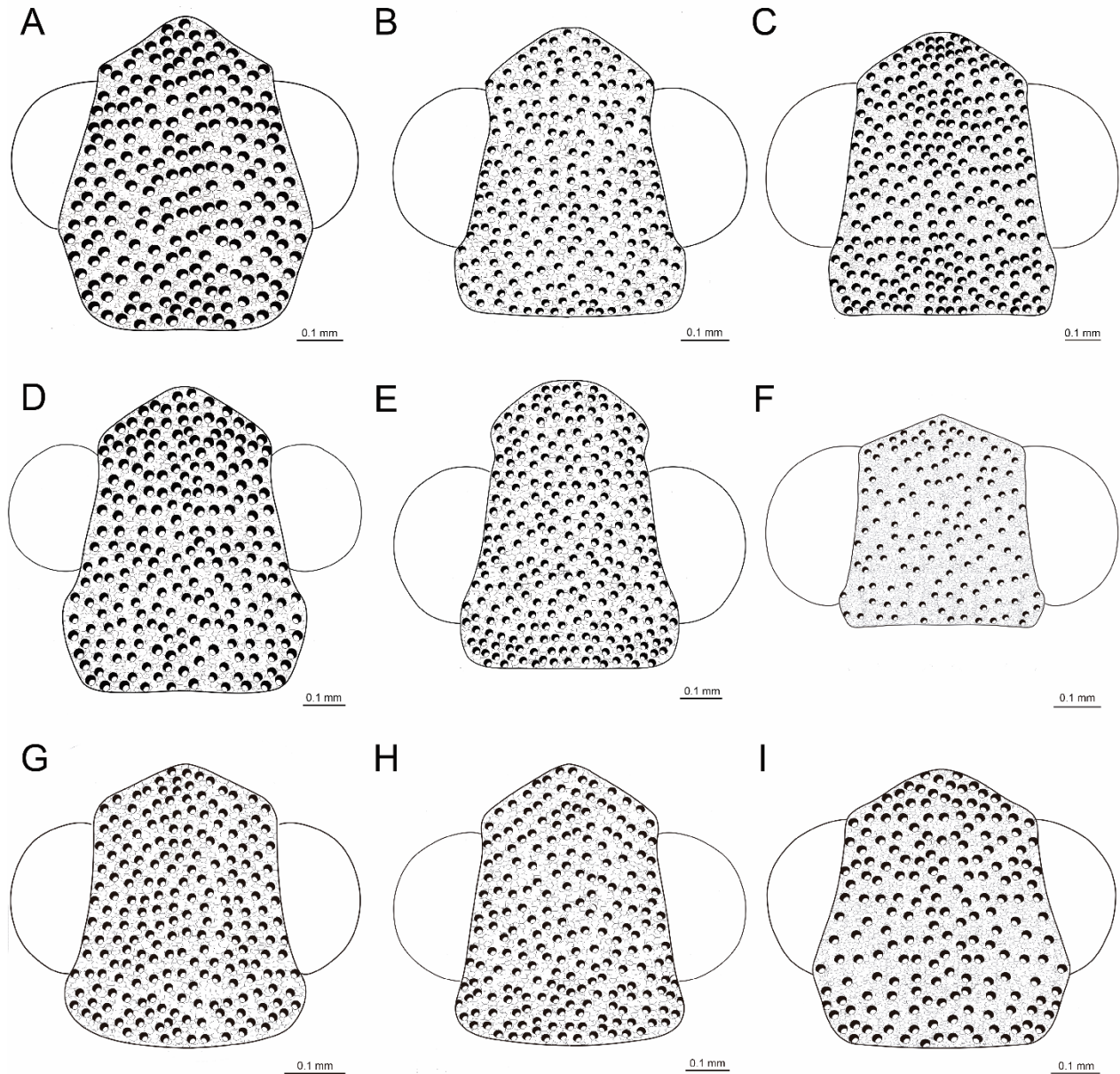
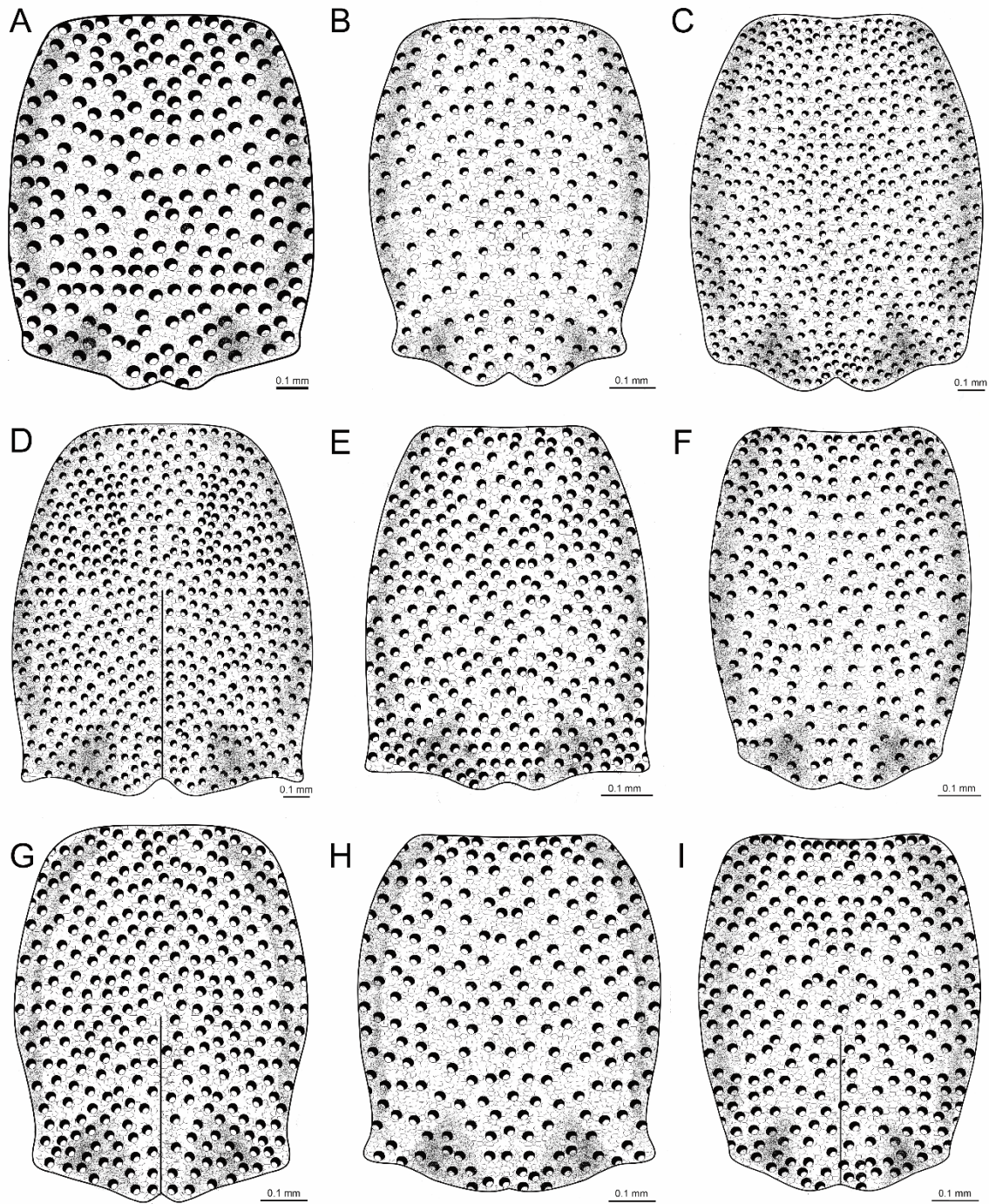


Figure 9. Distribution of *Cenophengus* (Continued).

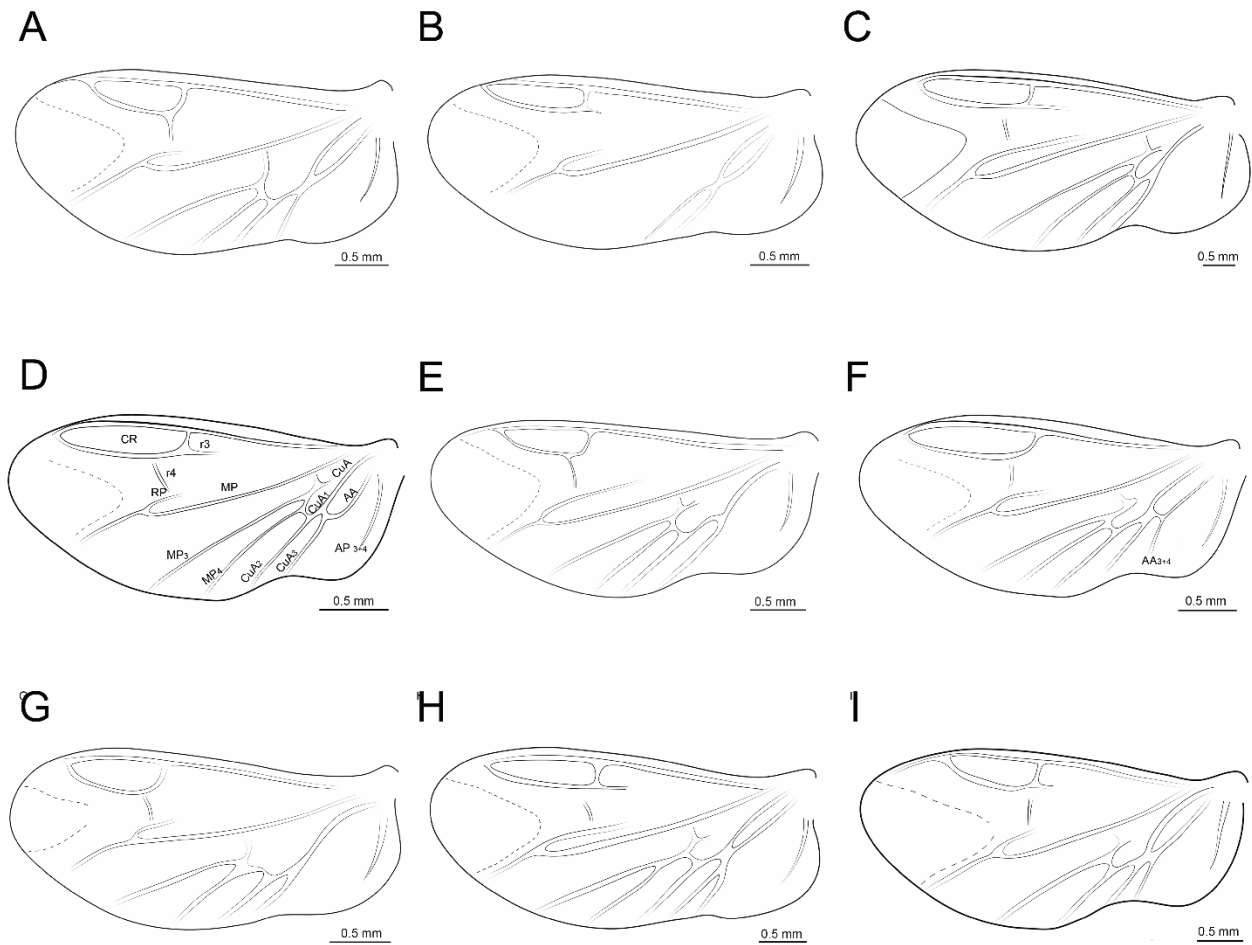


**Figure 10.** Head dorsal. (A) *Cenophengus niger* Wittmer, 1986; (B) *Cenophengus pallidus* Schaeffer, 1904; (C) *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; (D) *Cenophengus punctatissimus* Wittmer, 1976; (E) *Cenophengus saasil* sp.nov.; (F) *Cenophengus sonorensis* Zaragoza-Caballero, 2008; (G) *Cenophengus tsiik* sp.nov.; (H) *Cenophengus tupae* Vega-Badillo et al. 2021; (I) *Cenophengus villae* Zaragoza-Caballero, 1984.

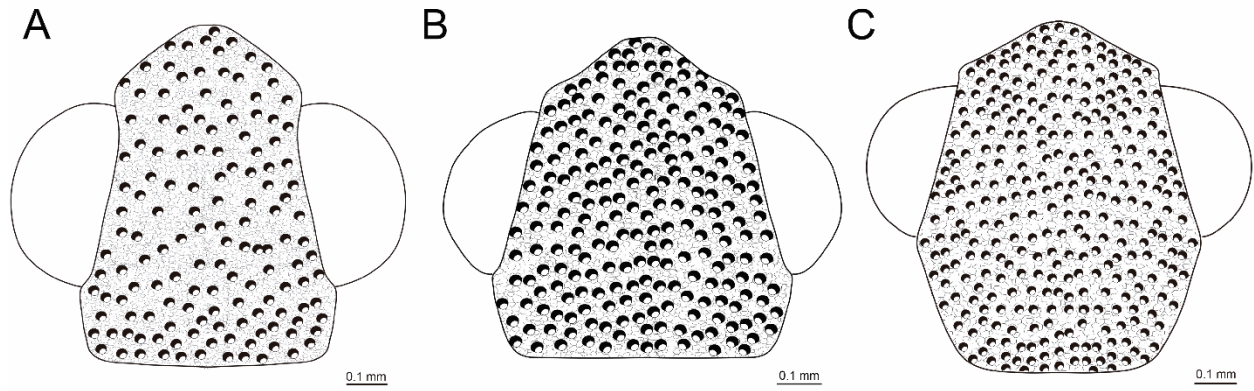




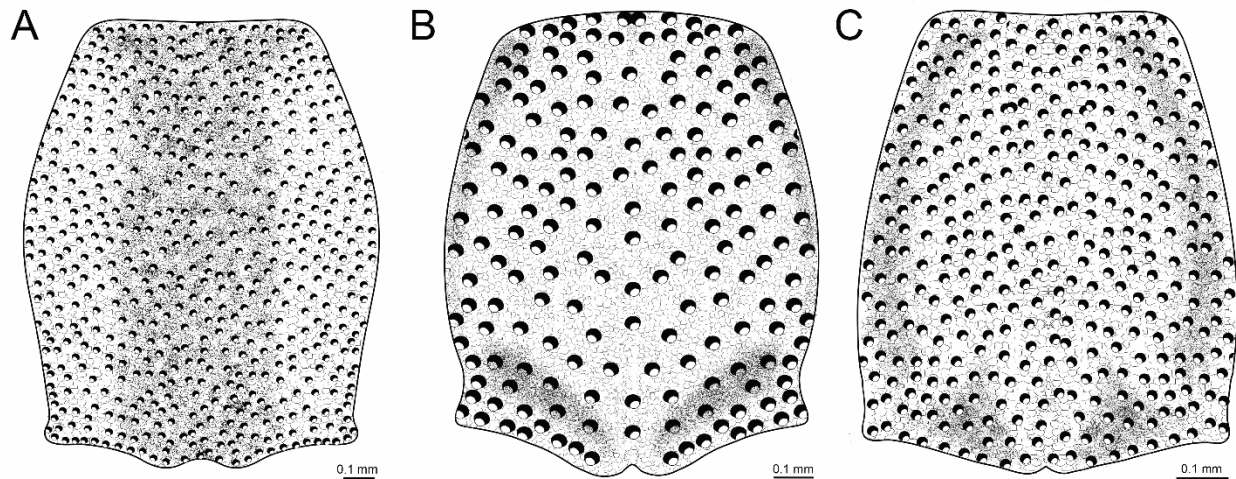
**Figure 11.** Pronotum dorsal. (A) *Cenophengus niger* Wittmer, 1986; (B) *Cenophengus pallidus* Schaeffer, 1904; (C) *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; (D) *Cenophengus punctatissimus* Wittmer, 1976; (E) *Cenophengus saasil* sp.nov.; (F) *Cenophengus sonorensis* Zaragoza-Caballero, 2008; (G) *Cenophengus tsiik* sp.nov.; (H) *Cenophengus tupae* Vega-Badillo et al. 2021; (I) *Cenophengus villae* Zaragoza-Caballero, 1984.



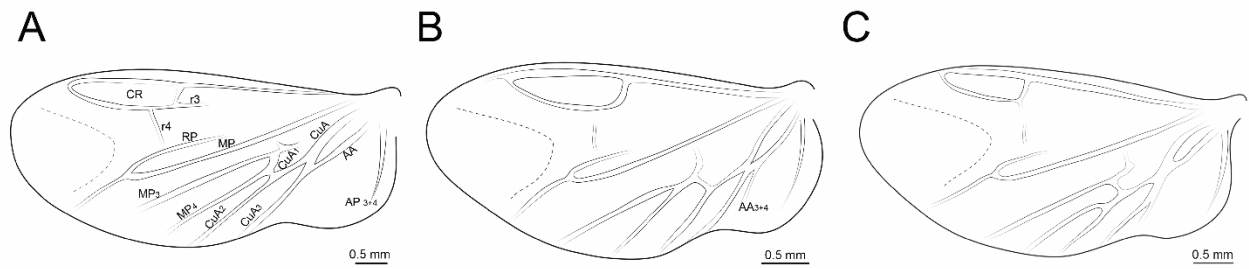
**Figure 12.** Posterior wings. **(A)** *Cenophengus niger* Wittmer, 1986; **(B)** *Cenophengus pallidus* Schaeffer, 1904; **(C)** *Cenophengus pedregalensis* Zaragoza-Caballero, 1975; **(D)** *Cenophengus punctatissimus* Wittmer, 1976; **(E)** *Cenophengus saasil* sp.nov.; **(F)** *Cenophengus sonorensis* Zaragoza-Caballero, 2008; **(G)** *Cenophengus tsiik* sp.nov.; **(H)** *Cenophengus tupae* Vega-Badillo et al. 2021; **(I)** *Cenophengus villae* Zaragoza-Caballero, 1984. Venation: CR = Radial Cell; r3 = radial 3; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.



**Figure 13.** Head dorsal. (A) *Cenophengus wittmeri* Zaragoza-Caballero, 1984; (B) *Cenophengus xiinbali* Vega-Badillo et al. 2021; (C) *Cenophengus zuritai* sp. nov.



**Figure 14.** Pronotum dorsal. (A) *Cenophengus wittmeri* Zaragoza-Caballero, 1984; (B) *Cenophengus xiinbali* Vega-Badillo et al. 2021; (C) *Cenophengus zuritai* sp. nov.



**Figure 15.** Posterior wings. **(A)** *Cenophengus wittmeri* Zaragoza-Caballero, 1984; **(B)** *Cenophengus xiinbali* Vega-Badillo et al. 2021; **(C)** *Cenophengus zuritai* sp. nov. Venation: CR = Radial Cell; r4 = radial 4; RP = Posterior Radial; MP = Posterior Median; CuA = Cubital; AA and AP = Anterior and Posterior Anal.

## **8.- CAPITULO IV**

### **A new genus of Phengodidae (Coleoptera) from the Neotropical region**

Viridiana Vega-Badillo; Santiago Zaragoza-Caballero & Michael A. Ivie

**Papéis Avulsos Zoologia (2020) v.60.special-issue: e202060(s.i.).06**

# A new genus of Phengodidae (Coleoptera) from the Neotropical Region

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**Abstract.** *Cleicosta*, a new genus of Phengodidae containing two new species, *C. equatoreana* sp. nov., and *C. monaguense* sp. nov., are described. Additionally, a new combination for *Cenophengus brevipilumatus* Wittmer, 1976 is included. *Cleicosta* gen. nov., is the thirty-eighth genus assigned to the beetle family Phengodidae in the new world and is also the most morphologically similar to *Cenophengus* LeConte, 1881. Both genera exhibit clearly separated tentorial pits, vertical frons and simple tarsomeres. In *Cleicosta* gen. nov., however, the antennal rami are 1.5 times longer than the corresponding antennomere, the pronotum is subquadrate and the elytra are short, reaching the first or second abdominal segment. In addition, it presents an aedeagus with lateral lobes slender, parallel exteriorly, narrowed medially to toothless apex.

**Key-Words.** Diversity; Taxonomy; *Cleicosta*; Elateroidea.

## INTRODUCTION

The coleopteran family Phengodidae LeConte, 1861 comprises 37 genera and 282 species in Americas. It has traditionally been classified into three subfamilies: Phengodinae LeConte, 1861; Mastinocerinae LeConte, 1881; and Penicillophorinae Paulus, 1975 (Constantin, 2014; Zaragoza-Caballero & Pérez-Hernández, 2014; Roza *et al.*, 2017, 2019; Vega-Badillo & Zaragoza-Caballero, 2019; Roza & Mermudes, 2019, 2020). These subfamilies are present in the New World, from southern Canada to the north of Chile and Argentina (Costa & Zaragoza-Caballero, 2010). Recently, Kundrata *et al.* (2019) by phylogenetic analysis, considered *Cydistinae* Paulus, 1972, to be part of the Phengodidae. *Cydistinae* consists of two genera distributed in Asia Minor: *Cydistus* Bourgeois, 1885 which includes six species, and *Microcydistus* Kundrata *et al.*, 2019 with one species. The collection records for this family are limited to local sites, and their low vagility suggests that its species present high levels of endemism (Roza *et al.*, 2017). Thus, several characteristics of the phengodid species could be related to their geographical boundaries (Viviani & Bechara, 1997). The aim of this study is to increase our knowledge of the family Phengodidae by describing a new genus based on two new species and transferring one previously described species into this genus.

## MATERIAL AND METHODS

We examined specimens deposited at MTEC (Montana Entomology Collection "From Ivie Michael Ivie Collection", Bozeman Montana, U.S.A.), plus the holotype of *Cenophengus brevipilumatus* Wittmer, 1976, deposited at NMNH (National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.) (Floyd Schockley, curator). All specimens are pinned. By means of a Zeiss Discovery V8 stereoscopic microscope equipped with a 1× lens and a 1.6× eyepiece, the following measurements were taken: body length, interantennal and interocular distance, length and width of head, pronotum, elytra, scape, antennomeres, antennal rami, maxillary and labial palps, and tarsomeres. Holotype measurements are expressed in millimeters. The aedeagus was extracted from six specimens, and a wing was detached from three; these were glued onto cardboard triangles and pinned under corresponding specimens. Photographs were taken with a Zeiss Axio Zoom V16 microscope equipped with a Plan NeoFluar Z 1×10.25 FWD 56 lens. Lastly, the aedeagi of the new species were examined by means of the Hitachi SU1015 SEM microscope at the Laboratorio de Microscopía y Fotografía de la Biodiversidad, Instituto de Biología, UNAM. General terminology follows Lawrence *et al.* (2011), except for membranous wing veins, that

Pap. Avulsos Zool., 2020; v.60.special-issue: e202060(s.i.).06

<http://doi.org/10.11606/1807-0205/2020.60.special-issue.06>

<http://www.revistas.usp.br/paz>

<http://www.scielo.br/paz>

Edited by: Sônia A. Casari / Gabriel Biffi

Received: 27/09/2019

Accepted: 14/01/2020

Published: 04/03/2020

<http://zoobank.org/1544DC3E-0933-469E-ACAE-4D587BABDB4E>

ISSN On-Line: 1807-0205

ISSN Printed: 0031-1049

ISSN: 0000-0004-0384-1825



was taken from Kukalová-Peck & Lawrence (1993). Labels of the type specimens are arranged in sequence from top to bottom, where the data for each label are within double quotes (" "), a slash (/) separates the rows, and information between brackets ([ ]) provide the correct information for label mistakes.

**Depositories:** The specimens are deposited in, National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A. (NMNH), the Colección Nacional de Insectos (CNIN) of the Universidad Nacional Autónoma de México (UNAM) and the Museo del Instituto de Zoología Agrícola Francisco Fernández Yépez (MIZA) of the Universidad Central de Venezuela (UCV).

## RESULTS

A key, only for the mastinocerine genera exhibiting distinctly separated tentorial pits, is provided, adapted from Zaragoza-Caballero & Pérez-Hernández (2014) with modifications in couplet 2'.

2. Labial palpi 2-segmented; tarsomeres simple ..... 3  
2'. Labial palpi 3-segmented; first tarsomeres of pro- and/or mesothoracic legs with ventral 'comb' of bristle-like setae ..... 4  
3. Elytra long; last 3 tergites exposed; gular sutures divergent anteriorly; lateral lobes of aedeagus parallel, with apical teeth .....  
..... *Cenophengus* LeConte  
3'. Elytra short, last 7 tergites exposed; gular sutures parallel anteriorly; lateral lobes of aedeagus narrowed medially to toothless apex .....  
..... *Cleicosta* gen. nov.  
4. Fifth and sixth sternites with apical crescent-shaped area containing transverse line of dense setae; first tarsomere of pro- and mesothoracic legs with complete 'comb' ..... *Distremocephalus* Wittmer  
4'. Fifth and sixth sternites without crescent-shaped area; first tarsomere of prothoracic legs with complete ventral 'comb' .....  
..... *Mastinowittmerus* Zaragoza

### *Cleicosta* gen. nov.

**Type species:** *Cenophengus breviplumatus* Wittmer, 1976.

**Diagnosis:** *Cleicosta* gen. nov., is morphologically similar to *Cenophengus* LeConte, 1881: both genera exhibit clearly separated tentorial pits, vertical frons and simple tarsomeres. *Cleicosta* gen. nov., differs from *Cenophengus* in the arrangement of the gular sutures: parallel anteriorly in the new genus and divergent anteriorly in *Cenophengus*. Additionally, in *Cleicosta* gen. nov., pronotum is subquadrate in shape and elytra are short (reaching only first or second abdominal segment). In *Cenophengus* the pronotum is rectangular, and elytra long, last 3 tergites exposed. Other important characteristics in *Cleicosta* gen. nov., are: aedeagus with lateral lobes parallel, elongate, narrowed medially to toothless apex; in *Cenophengus* with lateral lobes parallel, with apical teeth.

**Head:** Wider than long (Fig. 1A), fully exposed; integument smooth, glossy, coarsely punctate: antennae 12-articulated serrated, extending slightly beyond pronotal posterior margin; antennomeres 4<sup>th</sup> to 11<sup>th</sup> with lanceolate rami, 1.5 to twice times longer than respective antennomere; frons vertically produced; interantennal distance nearly equal to first antennomere length; eyes finely faceted, hemispherical, variable in length; labrum 3 times wider than long; mandibles simple, thin, falcate; maxillary palpi 4-segmented; terminal palpomere bullet-shaped with apex acute, longer than preceding 3; 3<sup>rd</sup> palpomere shorter than 2<sup>nd</sup>; labial palpi 2-segmented; terminal palpomere fusiform, 5 times longer than preceding one; tentorium with 2 distinctly separated pits; gular sutures parallel anteriorly (Fig. 1B).

**Thorax:** Pronotum subquadrate (Fig. 1C); anterior angles rounded, posterior angles acute, lateral margins rounded; integument smooth, glossy, densely punctured (Fig. 1D); prosternal anterior margin almost straight; sternal suture complete. Elytra short, reaching 1<sup>st</sup> or 2<sup>nd</sup> abdominal segment, 3 to 4 times longer than wide, subparallel, apex rounded. Posterior wings with posterior medium vein (MP 1 + 2) always present; posterior radial vein (RP) absent; radial cell open; venation otherwise variable. Length of legs gradually increasing from pro- to metathoracic legs; tarsi simple; in all pairs of legs, length of 4<sup>th</sup> tarsomere equal to half the length of 5<sup>th</sup>; claws simple.

**Abdomen:** Integument shiny, punctured, densely setose; penultimate sternite with posterior margin sinuate; last sternite deeply notched. Aedeagus with median lobe cylindrical, with apex rounded; lateral lobes elongate, parallel externally, narrowed medially to toothless apex (Figs. 1E-G).

**Etymology:** The new genus is named *Cleicosta* in recognition of the outstanding work of Dr. Cleide Costa, on her eightieth birthday. Her first name was abbreviated as "Cleï" in order to avoid homonymy with the elaterid genus *Cleidecosta* Johnson, 2002. Gender feminine.

### *Cleicosta breviplumata* (Wittmer, 1976) comb. nov. (Figs. 2A-D)

*Cenophengus breviplumatus* Wittmer, 1976: 450.

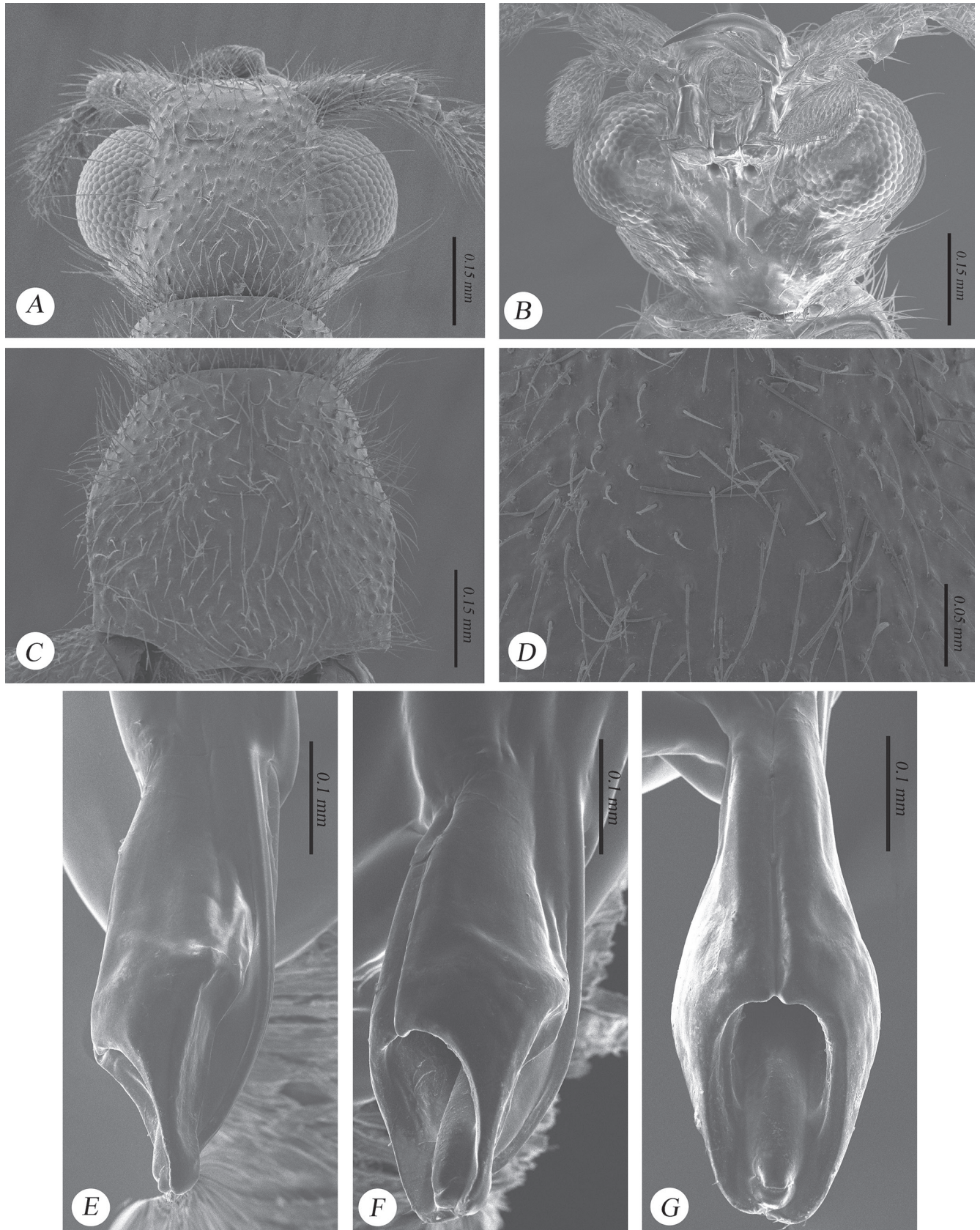
**Type material:** Holotype (♂ NMNH): "Monserrate/ Bogota/ Colombia/ 10,000/ ALT 03.V.46/ E.A.Chapin" "*Cenophengus breviplumatus*/ det. W. Wittmer" "Type No./ 73885/ USNM" "Loan from/ USNMNH/ 2081909".

**Diagnosis:** *Cleicosta breviplumata* comb. nov., is similar to *C. monaguense* sp. nov., but they differ in their interantennal and interocular distances. In *C. breviplumata* comb. nov., the interantennal distance equals the width of the antennal fossa, whereas in *C. monaguense* sp. nov., it is greater. The interocular distance is four times greater than eye width in *C. breviplumata* comb. nov.; in *C. mona-*

*guense* sp. nov., it is three times greater. Additionally, in *C. brevipumata* comb. nov., the first and second tarsomeres are equal in length in all three pairs of legs, whereas in *C. monaguense* sp. nov., the first tarsomere is shorter than the second in all legs.

**Redescription:** Holotype, male. Body length 4.0; maximum body width 0.46. Body color brown.

**Head:** Surface concave, wider (0.50) than long (0.44); at eye level, wider (0.50) than pronotum (0.46); integument

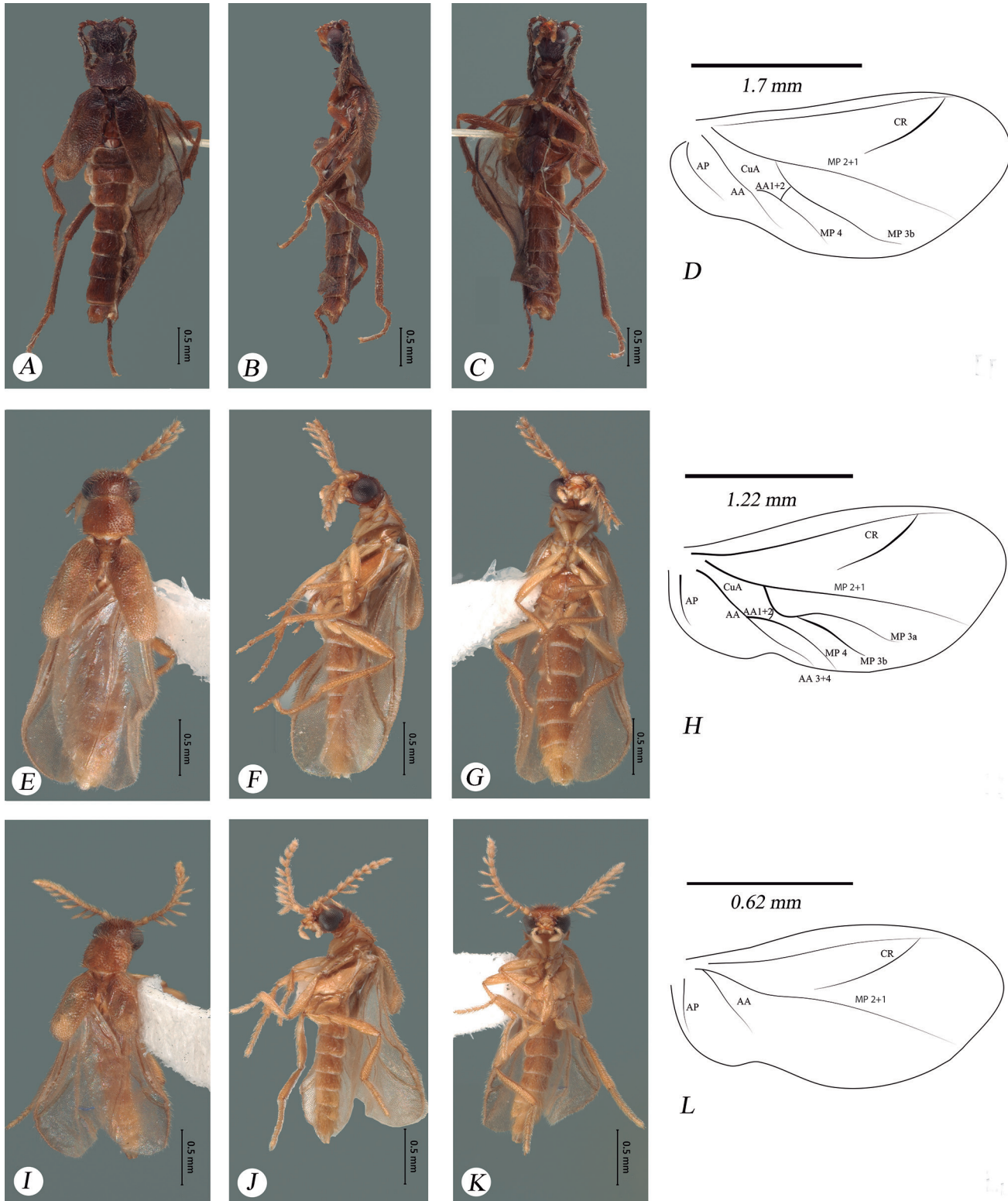


**Figure 1.** *Cleicosta monaguense* sp. nov., SEM images: (A) head dorsal; (B) head ventral; (C, D) pronotum. Aedeagus: (E) dorsal; (F) lateral; (G) ventral.



smooth, coarsely punctate, each puncture bearing a brown seta; interantennal distance (0.12) equal to antennal fossa width (0.11); eyes small, hemispherical, finely faceted, not prominent, longer (0.2) than wide (0.08); interocular distance (0.33) 4 times greater than eye width; antennae short (1.63), barely reaching pronotal posterior-

margin; 1<sup>st</sup> antennomere (0.15) as long as 2<sup>nd</sup> and 3<sup>rd</sup> combined; 3<sup>rd</sup> cup-shaped and short (0.05), 4<sup>th</sup> in length 0.12, 5<sup>th</sup> to 10<sup>th</sup> about equal in length (0.16); 11<sup>th</sup> 0.1 in length; 12<sup>th</sup> (terminal) bullet-shaped with apex acute (0.15); antennal rami lanceolate, 1.5 times longer than respective antennomere; labrum bilobed; terminal max-



**Figure 2.** *Cleicosta brevipumata* comb. nov., habitus: (A) dorsal; (B) lateral; (C) ventral; (D) posterior wings. *Cleicosta monaguense* sp. nov., habitus: (E) dorsal; (F) lateral; (G) ventral; (H) posterior wing. *Cleicosta equatoreana* sp. nov., habitus: (I) dorsal; (J) lateral; (K) ventral; (L) posterior wing. Venation: posterior medium vein (MP 1 + 2), posterior radial vein (RP), radial cell (CR); posterior anal vein (AP), anterior anal vein (AA) divided into AA 1 + 2 and AA 3 + 4, the cubital-anal vein (CuA) and MP 4, MP 3a, MP 3b posterior veins.

illary palpomere robust, spindle-shaped (0.12), longer than preceding 3 combined; terminal labial palpomere spindle-shaped (0.05), 5 times longer than preceding one.

**Thorax:** Pronotum wider (0.49) than long (0.45); integument smooth, coarsely punctate; each puncture bearing a brown seta; disc convex, anterior margin almost straight, anterior angles rounded, lateral margins convergent anteriorly, posterior margin rounded, posterior angles acute; scutellum spatulate, with small notch on posterior margin; integument shiny, densely punctured; each puncture bearing a brown seta; elytra short, 3.5 times longer (1.3) than wide (0.37); posterior wings (Fig. 2D) with posterior medium vein (MP 1 + 2) distinct, posterior radial vein (RP) absent, radial cell (CR) open; cubital-anal area of wings with posterior anal vein (AP) distinct, anterior anal vein (AA) incomplete and distinct, cubital-anal vein (CuA) distinct, mid-posterior veins MP 4 and MP 3b present; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of pro-, meso- and metathoracic legs about equal in length.

**Abdomen:** Integument shiny, punctured, with silky appearance due to dense setosity; penultimate sternite with posterior margin emarginate; last sternite with posterior margin deeply notched; pygidium with posterior margin emarginate; aedeagus slender.

**Females and immatures:** Unknown.

**Distribution:** Bogota, Colombia (Fig. 3).

### *Cleicosta monaguense* sp. nov. (Figs. 2E-H)

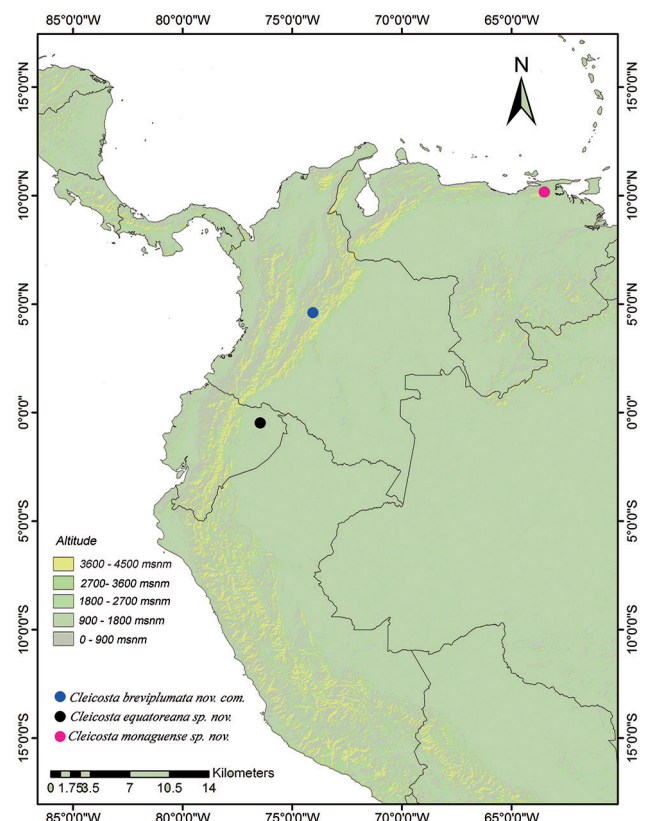
**Type material:** Holotype (♂ MIZA): "VENEZUELA: Monagus [Monagas], 700 m/ Caripe, Cueva #87-82/ Guacharo, 20-30 July 1987/ Forest over coffee/ S & J Peck, Malaise FIT""From the Michael Ivie Collection". Paratypes: "VENEZ: Monagus, 700 m/ Caripe, Cueva #87-82/ Guacharo, 20-30 July 87/ Forest over coffee/ S & J Peck, Malaise""Michael Ivie Collection" (3♂ CNIN, 3♂ MTEC).

**Diagnosis:** *Cleicosta monaguense* sp. nov., can be separated from the similar *C. brevipumata* comb. nov., by its greater interantennal distance which equals twice the antennal fossa width (interantennal distance equals antennal fossa width in *C. brevipumata* comb. nov.). The interocular distance is three times greater than eye width in *C. monaguense* sp. nov., and in *C. brevipumata* comb. nov., it is four times greater. Additionally, in *C. monaguense* sp. nov., the first tarsomere is shorter than the second in all legs, whereas in *C. brevipumata* comb. nov., the first and second tarsomeres are equal in length in all three pairs of legs.

**Description: Male:** Body length 3.50, maximum body width 0.46. Light brown body.

**Head:** Surface concave, wider (0.53) than long (0.41); at eye level, wider (0.53) than pronotum (0.46); integument smooth thick and roughly dotted densely and coarsely punctate, each puncture bearing a brown seta, interantennal distance (0.12) equal to twice antennal fossa width (0.07); eyes large, hemispherical, finely faceted, prominent, longer (0.22) than wide (0.01); interocular distance (0.31) 3 times greater than eye width; antennae short (1.17), barely reaching pronotal posterior margin, 1<sup>st</sup> antennomere (0.10) longer than next 2 combined, 3<sup>rd</sup> cup-shaped and short (0.03), 4<sup>th</sup> in length 0.10, 5<sup>th</sup> to 10<sup>th</sup> about equal in length (0.11), 11<sup>th</sup> measuring 0.09, 12<sup>th</sup> (terminal) bullet-shaped with apex acute (0.12); antennal rami lanceolate, 1.5 times as long as respective antennomere; labrum bilobed; terminal maxillary palpomere robust, spindle-shaped, as long as preceding 3 combined (0.15); terminal labial palpomere spindle-shaped (0.07), 6 times as long as preceding one.

**Thorax:** Pronotum wider (0.46) than long (0.42), integument smooth, densely and coarsely punctate; each puncture bearing a brown seta; disc convex, anterior margin almost straight, anterior angles rounded, lateral margins slightly curved, posterior margin curved, posterior angles acute; scutellum spatulate, with small notch on posterior margin, integument shiny, densely punctate, each puncture bearing a yellow seta; elytra short, 2.5 times longer (0.95) than wide (0.33); posterior wings (Fig. 2H) with posterior medium vein (MP 1 + 2) long and distinct, posterior radial vein (RP) absent, radial cell (CR) open; wing cubital-anal area with anterior anal vein (AA) (divided into AA 1 + 2 and AA 3 + 4) and posterior anal



**Figure 3.** Geographical distribution of *Cleicosta* gen. nov., species.

vein (AP) distinct, cubital-anal vein (CuA) divided into MP 4, MP 3a and MP 3b mid-posterior veins; 1<sup>st</sup> tarsomere of all legs shorter than 2<sup>nd</sup>.

**Abdomen:** Integument shiny, punctuate, with silky appearance due to dense setosity; penultimate sternite with posterior margin sinuate, last sternite with posterior margin notched; pygidial posterior margin straight.

**Female and immatures:** Unknown.

**Distribution:** Monagas, Venezuela (Fig. 3).

**Etymology:** Specific epithet alludes to the type locality.

***Cleicosta equatoreana* sp. nov.**  
(Figs. 2I-L)

**Type material:** Holotype (♂ NMNH): "ECUADOR: Sucumbios/ Sacha Lodge, 270 m/ 00.5°S, 76.5°W/ 04-14 May 1994/ P. Hibbs, Malaise""Michael Ivie Collection".

**Diagnosis:** *Cleicosta equatoreana* sp. nov., is similar to *C. monaguense* sp. nov., however they differ in their inter-antennal distance. In *C. equatoriana* sp. nov., it is equal to antennal fossa width; in *C. monaguense* sp. nov., interantennal distance is greater than fossa width. Additionally, in *C. equatoreana* sp. nov., the terminal maxillary palpomere is 1.5 times longer than the preceding three combined, whereas in *C. monaguense* sp. nov., the terminal palpomere is equal in length as the preceding three combined.

**Description: Male:** Body length 2.4, maximum width 0.38. Body color light brown.

**Head:** Surface concave; wider (0.42) than long (0.32); at eye level, wider (0.42) than pronotum; integument smooth, coarsely punctuate, each puncture bearing an amber seta; interantennal distance (0.06) equal to antennal fossa width (0.07); eyes large, hemispherical, finely faceted, prominent, longer (0.18) than wide (0.08); interocular distance (0.24) 3 times greater than eye width; antennae short (0.81), barely reaching pronotal posterior border; 1<sup>st</sup> antennomere longer (0.1) than next 2 combined, 3<sup>rd</sup> cup-shaped, small (0.03), 4<sup>th</sup> 0.07 in length, 5<sup>th</sup> to 10<sup>th</sup> about equal in length (0.08), 11<sup>th</sup> 0.06 in length, 12<sup>th</sup> (terminal) bullet-shaped with apex acute (0.06); antennal rami lanceolate, twice as long as respective antennomere; labrum bilobed; terminal maxillary palpomere robust, spindle-shaped (0.12), 1.5 times longer than preceding 3 combined; terminal labial palpomere spindle-shaped (0.04), 4 times longer than preceding one.

**Thorax:** Pronotum wider (0.38) than long (0.31); integument smooth, coarsely punctuate, each puncture bearing an amber seta; disc convex, anterior margin almost straight, posterior margin convex with small notch; scutellum spatulate, posterior margin with small notch

on posterior margin, integument shiny, densely punctuate, each puncture bearing an amber seta; elytra short, 3 times longer (1.02) than wide (0.32); posterior wings (Fig. 2L) with posterior medium vein (MP 1 + 2) distinct, posterior radial vein (RP) absent, radial cell (CR) open; cubital-anal wing area with undivided anterior anal vein (AA) and posterior anal vein (AP) visible; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of all legs about equal in length.

**Abdomen:** Integument shiny, punctuate, with silky appearance due to dense setosity; penultimate sternite with posterior margin emarginate.

**Female and immatures:** Unknown.

**Distribution:** Sucumbios, Ecuador (Fig. 3).

**Etymology:** Specific epithet alludes to the type locality.

**Key to species of *Cleicosta* gen. nov.**

1. Body length 2.4 mm; 4<sup>th</sup> (terminal) maxillary palpomere 1.5 times longer than preceding 3 combined; antennal rami lanceolate, twice as long as respective antennomere ..... *Cleicosta equatoreana* sp. nov.
- 1'. Body length greater than 3 mm; 4<sup>th</sup> (terminal) maxillary palpomere as long as preceding 3 combined; antennal rami lanceolate, 1.5 times longer than respective antennomere ..... 2
2. Body color light brown; interocular distance 3 times greater than eye width; 1<sup>st</sup> tarsomere of all legs shorter than respective 2<sup>nd</sup> tarsomere.. ..... *Cleicosta monaguense* sp. nov.
- 2'. Body color brown; interocular distance 4 times greater than eye width; 1<sup>st</sup> and 2<sup>nd</sup> tarsomeres of all legs about same length ..... *Cleicosta brevipilumata* comb. nov.

**ACKNOWLEDGMENTS**

We would like to thank to Edgar Uriel Garduño Montes de Oca and Martín Zurita García for their review and comments that enriched this work. We thank Susana Guzmán Gómez and Berenit Mendoza Garfias for technical assistance in taking the photographs. The first author thanks the Graduate program in Biological Sciences, UNAM.

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## 9.- DISCUSIÓN GENERAL

### 9.1 Diversidad del género *Cenophengus*

Aunque los caracteres asociados a la venación de las alas traseras no suelen evaluarse en los estudios que documentan especies de coleópteros estrechamente emparentadas, descubrimos que en el caso de las especies del género *Cenophengus*, ciertos caracteres presentes en la venación de las alas pueden ser útiles para distinguir entre especies. En las nuevas especies de *Cenophengus*, encontramos diferentes combinaciones en las venas de las alas traseras, por ejemplo las venas r3 y r4, que pueden o estar presentes o ausentes, también se observó variación en la vena radial posterior (RP), que puede estar desarrollada o reducida. Así mismo, en algunos casos ejemplares como en *Cenophengus mimui* y *Cenophengus Munizi*, las venas del sector anal anterior y posterior no están presentes. Otras venas, como la vena posterior mediana (MP) y la cerrada radial (CR), están presentes y son invariables en todos los miembros de este género. Estas observaciones evidencian la utilidad potencial de la venación de las alas traseras en el reconocimiento de especies dentro del género *Cenophengus* y plantea la posibilidad de una aplicación más amplia de este conjunto de caracteres dentro de la familia Phengodidae.

La importancia taxonómica observada tiene un contexto ecológico y evolutivo singular, ya que las alas desempeñan un papel importante en la capacidad de dispersión en los escarabajos (Hájek et al., 2011). En el caso particular de Phengodidae fue quizás un órgano importante, debido a que está altamente asociado a los procesos ecológicos que pudieron haber impulsado su diversificación, ya que los fengódidos son pequeños escarabajos de cuerpo blando y poco voladores, sensibles a la temperatura y la humedad, sujetos a las fuerzas del viento. Algo congruente con lo anterior es que la mayoría de las

especies están restringidas a zonas cálidas, húmedas, generalmente boscosas y relativamente bien conservadas, libres de las fuerzas del viento y con rangos de temperatura cortos (Viviani y Bechara, 1997; Costa y Zaragoza-Caballero, 2010; Roza, et al., 2017). Adicionalmente, las especies de *Cenophengus* se encuentran restringidas en áreas específicas, principalmente montañosas, como la provincia de la Sierra Madre Oriental (10 especies). Este hecho, así como los escasos registros locales y su baja vagilidad debido a que la pérdida de vuelo en las hembras neoténicas reduce las capacidades de dispersión y colonización de nuevos hábitats (Bocak, et al., 2008), sugiere que estas especies pueden mostrar altos niveles de endemismo. La realización de estudios taxonómicos de grupos poco estudiados, como los Phengodidae, puede ayudar a identificar patrones de distribución de las especies, lo que a su vez, podría facilitar la identificación de áreas y hábitats importantes para su conservación.

## 9.2 Sistemática de Phengodidae

A partir del presente análisis, el género *Adendrocera*, tanto con EW como con IW, cambia de posición: se recupera como el taxón divergente más temprano de todos los Phengodidae (k: 4, 6, 8,5935 y 11) o como parte de un gran clado que incluye a *Mastinocerus*, *Distremocephalus* y *Cenophengus* (k: 3). Este género forma parte de la subfamilia Penicillophorinae, siendo una de sus principales características la ausencia de ramos antenales. Zaragoza-Caballero y Zurita-García (2015) propusieron que la subfamilia Penicillophorinae podría ser transferida a la familia Telegeusidae; sin embargo, el edeago de estas especies tiene un flagelo visible, muy similar al del resto de los Phengodidae. Recientemente, Kundrata et al. (2019) consideraron a Cydistinae Paulus, 1972 como parte de la subfamilia Phengodidae basándose en un análisis filogenético.

Las características morfológicas que podrían apoyar esta hipótesis, son la presencia de antenómeros cortos y simples II y III, y los palpómeros simples y maxilares generalmente largos, presentes en *Adendrocera*. Creemos que este género forma parte de Phengodidae, por lo que es necesario volver a evaluar los géneros pertenecientes a esta familia en el futuro.

La subfamilia Phengodinae se recupera como un grupo monofilético en ambos análisis (EW, IW), lo que está apoyado por dos sinapomorfías (longitud del primer antenómero: más de 0,44; forma del ápice del lóbulo medio: globular), en el análisis IW Phengodinae se recupera anidado dentro de Mastinocerinae en el clado E. De este modo, su clasificación como subfamilia no es congruente con la hipótesis filogenética, lo que resulta congruente con los resultados obtenidos en análisis anteriores (Zaragoza-Caballero y Zurita García, 2015; Souza-Quintino, 2017; Kundrata, et al., 2019). La consistencia de estos resultados es notable, ya que se han analizado varios caracteres morfológicos, particularmente, hasta el presente estudio el edeago había sido explorado de manera superficial, considerando un solo carácter para esta estructura (Zaragoza-Caballero y Zurita-García, 2015). No obstante, un análisis más riguroso que incluya una muestra mayor de especies de Phengodinae podría corroborar estos resultados.

### 9.3 Sistemática de *Cenophengus*

En cuanto a las relaciones de las especies de *Cenophengus*, su composición actual corresponde a un grupo monofilético según las relaciones obtenidas en el presente estudio (EW, IW). Las especies analizadas se recuperan en un clado en ambos análisis (EW, IW), lo que se apoya en las siguientes sinapomorfías: la forma sinuosa de la sutura gular, la distancia entre las suturas gulares en la parte media ampliamente separadas y

la forma de los lóbulos laterales. Este análisis incluyó 26 de las 27 especies previamente descritas y dos nuevas especies, la única especie que falta en este análisis es *C. major* descrita para México, depositada en el Museo Americano de Historia Natural.

Las relaciones entre las especies no son muy claras; sin embargo, podemos distinguir a *C. debilis* como la especie divergente más basal, y por otro lado se recuperó un grupo claro apoyado por una sinapomorfía (Forma superficial del tegumento entre puntuaciones en el pronoto: chagrinado). Debido a que los caracteres que apoyan algunas relaciones entre las especies de *Cenophengus* podrían considerarse ambiguos, por ejemplo el tamaño de la puntuación de la cabeza y el tamaño de la seta en el ápice en los lóbulos laterales, el uso de datos moleculares y morfométricos de otras estructuras como la cabeza, puede ayudar a construir una hipótesis más clara de las relaciones filogenéticas entre las especies de *Cenophengus*.



## 10.- CONCLUSIONES GENERALES

-La sistemática es una disciplina de la biología que se encarga de descubrir, describir, nombrar, clasificar y entender la biodiversidad biológica, en este contexto en este estudio se abordaron estos objetivos. Al realizar estudios sistemáticos de grupos poco estudiados, como los fengódidos se abre la pauta para identificar tanto patrones evolutivos como geográficos y ecológicos, esenciales para el entendimiento de la biodiversidad y una parte crucial de la conservación de los ecosistemas.

-Una de las características que destaca en la morfología de las especies de *Cenophengus* es la configuración de las venas del ala, la cual presenta una particular variación inter específica que permite distinguir entre las especies del género, así mismo presenta venas que son constantes dentro de este género, como la Vena Posterior Media (MP) y la Célula Cerrada Radial (CR). En este sentido, las alas juegan un papel muy importante en la capacidad de dispersión de los escarabajos, en particular para las especies de *Cenophengus*, ya que esta capacidad de dispersión no es muy efectiva en comparación con otros grupos, manteniéndolos en áreas restringidas, principalmente en zonas montañosas.

-A partir del análisis filogénico, la subfamilia Phengodinae se recupera como un grupo monofilético, lo que está apoyado por dos sinapomorfías (longitud del primer antenómero: más de 0,44 y la forma del ápice del lóbulo medio: globular). En uno de los análisis la subfamilia Phengodinae se recuperó anidada dentro del clado de Mastinocerinae, por lo que su clasificación como subfamilia no es congruente con la hipótesis filogenética obtenida, este resultado es similar a los obtenidos en estudios anteriores.

- Aún no es clara la posición filogenética del género *Adendrocera*: se recupera como el taxón más tempranamente divergente de todos los Phengodidae o como parte de un gran

clado que incluye a *Mastinocerus*, *Distremocephalus* y *Cenophengus*. Este género forma parte de la subfamilia Penicillophorinae, siendo la ausencia de ramas antenales una de sus principales características. Zaragoza-Caballero y Zurita-García (2015) propusieron que la subfamilia Penicillophorinae podría ser transferida a la familia Telegeusidae, sin embargo, el edeago de estas especies tiene un flagelo visible, muy similar al del resto de los Phengodidae. Particularmente se sugiere que este género forma parte de Phengodidae, no obstante es necesario volver a evaluar los géneros pertenecientes a esta familia en el futuro.

-En cuanto a las relaciones de las especies de *Cenophengus*, su composición actual corresponde a un grupo monofilético apoyado por tres sinapomorfías (la forma sinuosa de la sutura gular, la distancia entre las suturas gulares en la parte media ampliamente separadas y la forma de los lóbulos laterales). Este análisis incluyó 26 de las 27 especies previamente descritas y dos nuevas especies, la única especie faltante en este análisis es *C. major* descrita para México.

-Las relaciones entre las especies de *Cenophengus* no son muy claras; sin embargo, podemos distinguir a *C. debilis* como la especie más tempranamente divergente. Debido a que los caracteres que apoyan algunas relaciones entre las especies de *Cenophengus* podrían considerarse ambiguos, el uso de datos moleculares y morfométricos podrían ser útiles para aclarar las relaciones entre las especies de *Cenophengus*.

-Consistentemente con la filogenia se realizó un tratamiento taxonómico que incluyó todas las especies, por lo que se registró por primera vez a *Cenophengus* en Belice y en Honduras, se proponen cuatro nuevas especies (*C. gardunoi*, *C. saasil*, *C. tsiik* y *C. zurita*) y una nueva sinonimia (*C. guerrerensis* Zaragoza-Caballero, 1991= *C. major* Wittmer, 1976) dentro de *Cenophengus*, quedando 30 especies válidas en el género.

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