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Taxonomy and systematics

New records of exotic species of Oniscidea (Crustacea: Isopoda) from northern Mexico

Nuevos registros de especies exóticas de Oniscidea (Crustacea: Isopoda) del norte de México

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Abstract

To date 86 species of 33 genera and 16 families of Oniscidea have been recorded in Mexico. Collections of 4 academic institutions and recent field materials were revised. From 1,820 specimens, 1,417 (77.6%) were determined to belong to 6 exotic forms. A taxonomic account and a species identification key with SEM plates of these exotic entities are presented. For morphological analysis we used light and SEM microscopy. The molecular identity of 5 of the 6 forms was examined through cytochrome oxidase 1 gene (mtDNA) analyses. The exotic species determined are: Armadillidae, *Cubaris murina*; Armadillidiidae, *Armadillidium vulgare*; Porcellionidae, *Agabiformius lentus*, *Porcellio laevis*, *P. scaber,* and *Porcellionides pruinosus*. The exotic oniscideans were recorded from urban, rural and natural (riparian) zones in 15 states of northern Mexico, including the first formal records in Aguascalientes, Chihuahua, Durango, and Zacatecas. *Armadillidium vulgare*, *P. laevis*, and *P. pruinosus* often co-occurred and are the most widely distributed species in this region. Although most of the material examined was recorded from urban zones (> 50% of studied sites), *A. vulgare* and *P. laevis* were also found in riparian areas (natural zones), yet *P. pruinosus* was recorded mainly from riparian areas (60% of 45 lots examined).

Keywords: Armadillidae; Armadillidiidae; Porcellionidae; Systematics; Taxonomy; CO1

Resumen

A la fecha se han registrado en México 86 especies de 33 géneros y 16 familias de Oniscidea. Se revisaron colecciones de 4 instituciones académicas del norte de México y material recién recolectado en campo. De 1,820 especímenes, 1,417 (77.6%) pertenecen a 6 especies exóticas. Se presenta una relación taxonómica y una clave de identificación con láminas MEB. Se examinó la identidad molecular de 5 de las 6 formas exóticas a través del análisis

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del gen citocromo oxidasa 1 (ADNmt). Las especies determinadas son: Armadillidae, *Cubaris murina*; Armadillidiidae, *Armadillidium vulgare*; Porcellionidae, *Agabiformius lentus*, *Porcellio laevis*, *P. scaber* y *Porcellionides pruinosus*. Los oniscideos exóticos se registraron de zonas urbanas, rurales y naturales (áreas riparias) en 15 estados del norte de México, incluyendo los primeros registros formales en Aguascalientes, Chihuahua, Durango y Zacatecas. *A. vulgare*, *P. laevis* y *P. pruinosus* cohabitaron frecuentemente y son las especies más ampliamente distribuidas en esta región. A pesar de que la mayoría del material se registró de zonas urbanas (> 50% de sitios), *A. vulgare* y *P. laevis* se encontraron también en áreas riparias, y más aun, *P. pruinosus* se registró principalmente en zonas naturales (60% de 45 lotes examinados).

Palabras clave: Armadillidae; Armadillidiidae; Porcellionidae; Sistemática; Taxonomía; CO1

Introduction

The Oniscidea (woodlice) constitute the most diverse suborder of the crustacean order Isopoda (Ahyong et al., 2011; Leistikow & Wagele, 1999). They are mostly terrestrial organisms living in a wide range of ecosystems, from temperate and tropical regions to arid zones; they prefer humid habitats but some can be adapted to aquatic environments (Schmidt, 2008). The onisciddeans are considered important decomposers of organic material by feeding on vegetation detritus and associated microorganisms (Cochard et al., 2010). They often form populations of a high number of individuals constituting a relevant part of the soil fauna, being eventually preyed upon by other soil arthropods (Davis, 1984; Hatch, 1947; Schmidt, 2008).

The greatest threats to biodiversity are habitat destruction (degradation or loss) and introduction of exotic (alien, nonnative) species (Wilcove et al., 1998). Exotic oniscideans have been recorded long ago in many countries around the world, and several of these isopods are now considered as synanthropically cosmopolitans and as very successful silent invaders (Cochard et al., 2010; Schmalfuss, 2003; Schmalfuss & Wolf-Schwenninger, 2002; Souza-Kuri, 2000). The number of studies on diversity and abundance of exotic and native oniscideans in urban, rural and natural areas has risen in the last decades (Giurginca et al., 2017; Magura et al., 2008; Vilisics et al., 2007, 2012). Given the increment of the worldwide trade in ornamental plants, it is expected for the countries involved to experience an increase in the number of exotic species which are hidden in the roots and soil during plant transportation (Cochard et al., 2010).

The first 3 oniscideans reported from Mexico 160 years ago by De Saussure (1857, 1858) resulted to be exotic species (Budde-Lund, 1885; Mulaik, 1960). Up to now, 86 species of 33 genera and 16 families of Oniscidea have been recorded in this country (Jass & Klausmeier, 2004). Of these, 10 species are considered as exotic forms (Garthwaite & Sassaman, 1985; Garthwaite et al., 1995; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Souza-Kury, 2000; Treviño-Flores & Rodríguez-Almaraz, 2012). Although, most of these alien species in Mexico are also widely distributed and recorded in the USA (Jass & Klausmeier, 2000; Leistikow & Wagele, 1999), their presence has not been well documented (Garthwaite et al., 1995; Jass & Klausmeier, 2004). As of today the few available state records are as follows: Armadillidae, *Cubaris murina* Brandt, 1833 recorded from Estado de México, Guanajuato, and Quintana Roo (Armas & Juarrero, 1997; De Borre, 1886; Mulaik, 1960; Souza-Kury, 2000; Van Name, 1936); Armadillidiidae, *Armadillidium vulgare* (Latreille, 1804) from Baja California, Baja California Sur, Ciudad de Mexico, Michoacán, Nuevo León and Sonora (Gandara, 1926; Garthwaite et al., 1995; Hatch, 1947; Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Souza-Kury, 2000; Van Name, 1936); Cylisticidae, *Cylisticus convexus* (De Geer, 1778) from Ciudad de México and Guerrero (Jass & Klausmeier, 2004; Mulaik, 1960; Van Name, 1942); Oniscidae, *Oniscus asellus* Linnaeus, 1758 from Ciudad de México, Colima and Guerrero (Jass & Klausmeier, 2004; Mulaik, 1960; Van Name, 1942); Porcellionidae, *Agabiformius lentus* (Budde-Lund, 1885) from Coahuila, Hidalgo, Nuevo León, and San Luis Potosí (Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Schultz, 1965; Van Name, 1942), *Porcellio laevis* Latrielle, 1804 from Baja California, Ciudad de México, Coahuila, Estado de México, Guanajuato, Guerrero, Nuevo León, Puebla, Tamaulipas, and Yucatán (Creaser, 1936, 1938; Dollfus, 1896; Gandara, 1926; Herrera, 1892; Hatch, 1947; Jass & Klausmeier, 2004; Reddell, 1981; Richardson, 1905; Rodríguez-Almaraz et al., 2014; Souza-Kuri, 2000; Treviño-Flores & Rodríguez-Almaraz, 2012; Van Name, 1936), *Porcellio scaber* Latrielle, 1804 from Michoacán, Nuevo León, Puebla, and Veracruz (Budde-Lund, 1885; Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Treviño-Flores & Rodríguez-Almaraz, 2012), *Porcellionides floria* Garthwaite & Sassaman, 1985 from Baja California, Baja California Sur, Sonora and Yucatán (Garthwaite & Sassaman, 1985; Jass & Klausmeier, 2004), *Porcellionides pruinosus* (Brandt, 1833) from Ciudad de

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México, Nuevo León, and Yucatán (Jass & Klausmeier, 2004; Rodríguez-Almaraz et al., 2014), and Trichoniscidae, *Haplophthalmus danicus* Budde-Lund, 1880 from Ciudad de México (Mulaik, 1960).

We revised scientific isopod collections of 4 academic institutions located in northern Mexico. Recent field collections in this region obtained by our team were also included in the revision. Up to date, we have studied 1,820 specimens of which 77.6% were determined to belong to 6 exotic forms. In this paper we present a taxonomic account with new records and a species key of these exotic entities. The specimens were morphologically examined using light and SEM microscopy and taxonomically determined according to literature. Additionally, the molecular identity of 5 of the 6 exotic forms was explored by studying representative specimens through the analysis of fragments of the mitochondrial gene Cytochrome oxidase 1 (CO1).

Material and methods

The material examined came from 15 states: Aguascalientes, Baja California, Baja California Sur, Chihuahua, Coahuila, Durango, Guanajuato, Jalisco, Nayarit, Nuevo León, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, and Zacatecas. The isopod collection lots revised are in the following institutions: Centro de Investigaciones Biológicas del Noroeste, S.C. (CIB) located in the state of Baja California Sur; Departamento de Biología, Universidad Autónoma de Aguascalientes (UAA); Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León (UANL), and Facultad de Ciencias Biológicas, Universidad Juárez del Estado de Durango (UJED).

Additional material examined came from field collections. During the years 2016 to 2018 we made a survey for oniscideans in the states of Baja California Sur and Durango. At the time of sampling the geographic position of the sites was determined with a GPS unit. The specimens were fixed in 100% ethanol and deposited in the crustacean collection at CIB.

For the revision of each collection lot we carried out the following activities: *1)* separation of morphotypes according to the general shape of cephalothorax, second antennae, pereon, pleon, uropods and pleotelson; *2)* the specimens of each morphotype were differentiated in males and females according to sexual dimorphism (Schmidt, 2002). Only adult specimens were taxonomically determined; *3)* each adult specimen was examined in a stereomicroscope, the number of ommatidia (ocelli) was registered, and using a digital caliper (Mitutoyo 700-113, Kawasaki, Japan) the measurements of total length, and maximum body width were obtained. The meristic and morphometric data base is deposited in CIB collection; *4)* representative specimens of the species determined were prepared for SEM analysis. Male and female specimens were dissected and dehydrated individually in 100% ethanol for 24 h and critical-point dried (Samdri-PVT-3B, Tousimis, Rockville, MD, USA), sputter coated with gold (desk II, Denton Vacuum, Moorestown, NJ, USA), and analyzed with scanning electron microscopes S-300N Hitachi at CIB, and JEOL at Universidad Autónoma de Aguascalientes. The material examined was determined following morphological descriptions of Budde-Lund (1885), Richardson (1902, 1905), Barnard (1932), Van Name (1936), Mulaik (1960), Green (1961), Schultz (1984, 2018), Karasawa (2012), and Treviño-Flores and Rodríguez-Almaraz (2012).

Genomic DNA was isolated from pereopods of selected individuals of 5 exotic species using the Gentra Puregene kit (Qiagen). A fragment of CO1 was amplified with primers 22F and HCO2198 by adopting the cycling conditions of Tizol-Correa et al. (2009). We used the forward primer (22F) to obtain CO1 sequences, edited them with DNA Baser 4.5 (www.dnabaser.com) and aligned them using Clustal X software to generate multiple alignments under default settings (Thompson et al., 1997). The genetic identity of the individuals was determined by utilizing haplotype determination (DnaSP 5.10, Librado & Rozas, 2009). Using the program MEGA 7 (Kumar et al., 2016), uncorrected pairwise genetic distances (*p*-distance) were determined between the haplotypes obtained by us and conspecific GenBank haplotypes from other countries including sequences of *Porcellionides myrmecophilus* (Stein, 1859). We confirmed the species identity through a phylogenetic analysis by including all sequences used for the genetic distance analysis in the program MrBayes v3.2 (Ronquist et al., 2012) with a best nucleotide substitution model selected under Bayesian information criterion from the jModeltest (Darriba et al., 2012). MrBayes analysis was run for 10 million generations and a consensus tree was generated after burning 0.25 fraction of the trees generated during the analysis. The consensus tree was viewed using the program FigTree v1.4.3. Sequences of 2 species of *Periclimenes* were used as out-group.

The classification and order of the families follows Ahyong et al. (2011). The place of the species to their respective genus and family is after Schmidt and Leistikow (2004) and Schmalfuss (2003). The systematic account includes: name, author, and year of description of the family, genus, and species, species synonymy (restricted to Mexican material), diagnosis, type locality, remarks (on the material examined), haplotypic identity, distribution in Mexico, general distribution, and material examined and locations. The diagnoses of the species are mainly based on publications of several authors, which are indicated in the correspondent species account. These morphological diagnoses are not an extensive morphological description, but rather a condensed statement of distinctive characters of the species (Blackwelder, 1967). The anatomical terminology used is mainly according to Schmidt (2002, 2003). The section of examined material is organized by political state, name of the site, geographical coordinates (if available), habitat type, collection date, collector's name, catalog code, number of males and females examined (with TL range between brackets). Most of the collection lots revised had no information about the habitat where the material was collected. For each lot we indicate the habitat type according to their geographic location as urban zone (highly artificial habitat and artificial ecosystem like urban parks and houses), rural zone (semi-natural habitats and agriculture areas), and natural zone (natural habitats, mostly riparian areas).

Descriptions

Order Isopoda Latreille, 1817
Suborder Oniscidea Latreille, 1802
Armadillidae Brandt, 1831
Cubaris Brandt, 1833
Cubaris murina Brandt, 1833
(Fig. 1A-O)
Cubaris murina Brandt, 1833: 190 (original description).
Armadillo murinus Brandt: De Borre (1886: CXIII).
Cubaris murina Brandt, 1833: Van Name (1936: 387); Souza-Kury (2000: 244); Jass and Klausmeier (2004: 4, 8).
Armadillo murinus (Brandt), 1833: Mulaik (1960: 214).
Cubaris murina (Brandt, 1833): Armas & Juarrero (1997: 24).
Venezillo osorioi (Mulaik, 1960): Rodríguez-Almaraz et al. (2014: 281).

Diagnosis. Habitus type endoantennal conglobator. Body ovate strongly convex, more than twice as long as wide. Dorsal surface of pereon-tergites (pereon-segments) 1-7 with confluent tubercles on lateral regions (Fig. 1A). Color varying from light or dark gray to brownish or brown mottled with yellowish color on tubercles and uropod sympodites. Cephalothorax 3 times as wide as long, lamina frontalis straight and curved dorsally (Fig. 1C), vertex convex in the middle, frontal shield trapezoid in frontal view. Compound eyes situated at the sides of cephalothorax, halfway between the frontal and caudal margins, each with about 20 ommatidia in 4 rows (Fig. 1D). Lamina frontalis with proximal lateral antennal lobes for holding the proximal portion of the second antenna during conglobation (Fig. 1E, I). First antenna 3-jointed with about 10-12 aesthetascs on distal article. Basal article longest and broadest (Fig. 1F). Second antennae with first article short, second about 3 times as long as first, third and fourth subequal and each a little shorter than second, fifth about 1.5 times longer than fourth (Fig. 1E, G). Flagellum 2-jointed, second article larger, about 2 or 3 times longer than first (Fig. 1H). First maxilla with outer endite bearing about 10 tooth-like setae at the apex, inner endite with 2 penicils. Maxilliped palp with 3 articles. Mandibles without palp. Pereon-tergite 1 about 1.5 longer than the rest, which are subequal in size (Fig. 1A). No epimera are separated off on any of the pereon-tergites from above. Epimera of the first 2 pereon-tergites not cleft on their posterior angles. Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax up to the base of compound eyes at linea lateralis (Fig. 1D), and with a semicircular lobe on ventral surface (Fig. 1I-J). Pereon-tergite 2 with a quadrangular lobe on ventral surface (Fig. 1J). Posterolateral margins of tergite epimera junctions 1-6 produced posteriorly (Fig. 1A), in epimera junction 7, straight or shallowly curved. Male pereopods 1-3 each with a brush of long setae on ventral side of carpus and merus (Fig. 1K). Pleon-tergites (pleon-segments) 1-2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7. Pleon-tergites 3, 4 and 5 broadly expanded laterally, lateral margins forming a continuous line with the lateral margins of pereon-tergites. Male copulative appendages of pleopods 1 with tips slightly divergent (Fig. 1M). Pleotelson (pleon-tergite 6 = terminal abdominal segment) wide at the base, becoming constricted about the middle, and then expanding to a truncate caudal margin, dorsal surface not keeled (Fig. 1O). Uropod sympodites (uropod protopodites) enlarged and flattened about twice as wide as long, filling the space between the caudal side of pleon-tergites 5 and lateral side of pleotelson; exopodites small, inserted on the medial margin of sympodites, about halfway between frontal and caudal margins (Fig. 1O); endopodites not visible from dorsal side, underneath on ventral side, they are elongated, extending only half the length of the pleotelson (Fig. 1L). Total length 10-12 mm. Sources: Budde-Lund (1885), Richardson (1905), Barnard (1932), Van Name (1936) and Karasawa (2012).

Taxonomic summary

Type locality. Brazil (Brandt, 1833).

Distribution in Mexico. Cubaris murina has been recorded from Estado de México, Guanajuato, and Quintana Roo (Armas & Juarrero, 1997; De Borre, 1886; Mulaik, 1960; Souza-Kury, 2000; Van Name, 1936). The new state records for this species are Baja California Sur, Nuevo León and Tamaulipas (Fig. 7).

General distribution. Anthropophilous cosmopolitically distributed (Leistikow & Wagele, 1999), pantropical (Schmalfuss, 2003).

Material examined. Baja California Sur: Colonia La Perla, La Paz (24°08′32″ N, 110°18′39″ W), urban zone, 14.12.2018, I. Segura, CIB-110B, 3 ♂♂ (4.7-8.0 mm), 5 ♀♀ (3.0-7.0 mm). Nuevo León: Balcones de San Miguel, Guadalupe (25°43′05.68″ N, 100°11′03.73″ W), urban zone, 21.09.2008, B. E. Chávez, UANL-C509-7694, 1 ♂ (10.0 mm), 2 ♀♀ (9.1-10.4 mm); Colonia Escobedo, Escobedo (25°48′33.20″ N, 100°19′28.20″ W), urban zone, 11.09.2010, UANL-C509-7695, 3 ♀♀ (9.3-9.7 mm); Rincón de los Encinos, Escobedo (25°48′26.00″ N, 100°18′31.68″ W), urban zone, 14.09.2010, D. Moreno, UANL-C509-7703, 4 ♂♂ (6.8-9.0 mm), 1 ♀ (8.0 mm); Fraccionamiento Las Hadas, Escobedo (25°47′04.00″ N, 100°17′52.80″ W), urban zone, 14.10.2014, M. Estrada, UANL-C509-7705, 1 ♂ (7.6 mm), 2 ♀♀ (8.3-9.4 mm); Plaza de las Naciones, San Nicolás de los Garza (25°43′35.00″ N, 100°17′48.99″ W), urban zone, 13.10.2010, D. Moreno, UANL-C509-7696, 2 ♂♂ (4.7-5.2 mm), 2 ♀♀ (5.7-6.4 mm); Lázaro Cárdenas and San Telmo, San Nicolás de los Garza (25°45′47.99″ N, 100°21′46.00″ W), urban zone, 20.09.2010, A. P. Ramírez, UANL-C509-7707, 2 ♂♂ (9.0-9.2 mm); Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León, San Nicolás de los Garza (25°43′26.41″ N, 100°18′57.90″ W), urban zone, 09.03.2011, C. Salazar, UANL-C509-7711, 8 ♂♂ (8.0-10.6 mm), 4 ♀♀ (7.5-10.5 mm); Carlos Fuentes, Santa Catarina (25°40′58.70″ N, 100°29′17.60″ W), urban zone, 12.10.2010, O. M. Juárez, UANL-C509-7697, 1 ♀ (13.5 mm); Cruillas, Santa Catarina (25°39′30.70″ N, 100°27′08.30″ W), urban zone, 16.09.2010, A. Cantú, UANL-C509-7700, 1 ♂ (6.9 mm), 3 ♀♀ (9.6-10.3 mm); La Huasteca, Santa Catarina (25°38′57.40″ N, 100°27′31.00″ W), rural zone, 18.10.2010, A. P. Ramírez, UANL-C509-7704, 1 ♂ (7.2 mm); Monterrey-Saltillo highway, Santa Catarina (25°40′15.60″ N, 100°29′45.71″ W), rural zone, 21.10.2010, A. P. Ramírez, UANL-C509-7706, 1 ♀ (10.8 mm); Cerro, Santa Catarina (25°40′42.90″ N, 100°29′38.10″ W), rural zone, 16.10.2010, A. Cantú, UANL-C509-7708, 1 ♂ (9.9 mm); Cuesta Corona, Santa Catarina, (25°39′57.66″ N, 100°28′03.38″ W), rural zone, 15.10.2010, A. P. Ramírez, UANL-C509-7709, 1 ♂ (7.6 mm), 2 ♀♀ (7.8-8.4 mm); Río Amazonas street, Apodaca (25°44′38.36″ N, 100°10′21.76″ W), urban zone, 23.10.2010, C. Rosales, UANL-C509-7698, 1 ♂ (5.6 mm), 2 ♀♀ (8.7-9.7 mm); Mercurio-Málaga, Apodaca (25°47′06.05″ N, 100°15′43.86″ W), urban zone, 10.09.2010, J. L. Brandy, UANL-C509-7701, 1 ♂ (6.3 mm), 1 ♀ (7.7 mm); Del Níspero, Apodaca (25°46′00.85″ N, 100°14′54.83″ W), urban zone, 10.09.2010, J. L. Brandy, UANL-C509-7702, 1 ♂ (7.3 mm), 1 ♀ (5.4 mm); Ruperto Martínez, Monterrey (25°40′38.28″ N, 100°18′09.09″ W), urban zone, 09.10.2010, J. L. Brandy, UANL-C509-7699, 3 ♂♂ (4.7-7.2 mm), 3 ♀♀ (5.7-8.4 mm). Tamaulipas: La Morita, Llera de Canales (23°05′23.1″ N, 99°06′40.1″ W), rural zone, 29.07.2005, A. Maeda, CIB-03B, 6 ♂♂ (7.0-10.0 mm), 13 ♀♀ (7.4-9.5 mm); La Bocatoma, Gómez Farías (22°59′14.20″ N, 099°08′52.22″ W), natural zone, 08.05.2006, A. Maeda, CIB-06B, 1 ♀ (9.5 mm); Río Purificación (24°04′41.8″ N, 99°07′18.5″ W), natural zone, 07.05.2006, A. Maeda, CIB-07B, 5 ♂♂ (7.8-14.5 mm), 5 ♀♀ (8.2-13 mm); Rancho San Carlos, Xicoténcatl (23°00′50.7″ N, 098°55′22.64″ W), rural zone, 30.07.2006, A. Maeda, CIB-22B, 4 ♂♂ (6.1-10.4 mm), 4 ♀♀ (7.6-10.1 mm); 01.06.2018, A. Obregón, CIB-111B, 29 ♂♂ (5.8-7.6 mm), 23 ♀♀ (6.3-9.4 mm); Rancho Santa Martha, Aldama (22°55′05.49″ N, 98°04′13.48″ W), rural zone, 14.04.2010, A. Leija, UANL-C509-7712, 2 ♀♀ (4.0-8.9 mm); Colonia Tamaulipas, Jiménez (25°50′40.4″ N, 97°37′41.01″ W), urban zone, 14.08.2010, A. Leija, UANL-C509-7713, 2 ♂♂ (7.5-8.7 mm), 1 ♀ (8.3 mm).

Remarks

Total length of males ranged 4.0-14.5 mm, and females 3.0-13.5 mm, compound eyes with 20-23 ommatidia. A photograph of the habitus in dorsal view of a specimen of *C. murina* (cited as *Venezillo osorioi*) from Nuevo León, Mexico was published by Rodríguez-Almaraz et al. (2014).

Haplotypic identity. Sequences of CO1 gene fragments of *C. murina* were obtained from 1 male and 1 female, both from Rancho San Carlos, Xicoténcatl, Tamaulipas. The 2 sequences are identical and represent a single haplotype. The sequences are deposited in GenBank under accession numbers MN689289 and MN689290. The genetic distance between this haplotype (579 bp) and the 5 sequences deposited in the GenBank as *C. murina* from Okinawa, Japan (AB861525, AB861527, AB861528, LC218701, LC218702), ranges from 0.69 to 0.86% (Table 1).

Armadillidiidae Brandt, 1833
Armadillidium Brandt in Brandt & Ratzeburg, 1833
Armadillidium vulgare (Latreille, 1804)
(Fig. 2A-O)
Armadillo vulgaris Latreille, 1804: 48 (original description).
Armadillidium vulgare Latreille, 1804: Gandara (1926: 291).
Armadillidium vulgare (Latreille, 1804): Van Name (1936: 278); Hatch (1947: 204); Mulaik (1960: 178); Souza-Kury (2000: 245); Jass & Klausmeier (2004: 7, 19-20); Rodríguez-Almaraz et al. (2014: 280).

Diagnosis. Habitus type endoantennal conglobator. Body ovate rather convex, about twice as long as wide. Color of dorsal side variable, uniformly dark grey or nearly black, or with lighter patches generally arranged in 3 longitudinal rows, 1 median and 2 lateral, between them, on each segment with a group of more or less distinct stripes. Cephalothorax about 3 times as wide as long (Fig. 2B). Vertex convex in the middle. Lamina frontalis triangular in frontal view and projects beyond linea frontalis, with lateral lobes for holding second antenna during conglobation (Fig. 2B). Compound eyes situated at proximal lateral sides of cephalothorax, each with about 18-30 ommatidia, normally in 3 rows (Fig. 2D). First antenna 3-jointed with about 15-20 aesthetascs on distal article. Basal article longest and broadest (Fig. 2F). Second antennae extend to the posterior margin of the first thoracic segment; first article short, second about 4 times longer the first, third about 0.5 as long as the second, fourth 1.5 times longer than third, fifth 2 times as long as fourth (Fig. 2G). Flagellum 2-jointed with nearly equal articles, the first article may be shorter than second article (Fig. 2H). Maxilliped palp with 3 articles. Mandible palp wanting. Pereon tergites subequal in length. Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax up to the base of compound eyes (Fig. 2A). Epimera are not distinctly separated from the segments. The pleon is not narrower than the pereon (Fig. 2N). Pleon-tergites 1 and 2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7 (Fig. 2N). Pleon-tergites 3, 4 and 5 broadly expanded laterally, lateral margins forming a continuous line with the lateral margins of pereon-tergites. Male copulative appendages of pleopods 1 with tips divergent (Fig. 2L). Pleotelson triangular wider at the base than its posterior truncated margin (Fig. 2O). Uropod sympodites not visible in dorsal view; exopodite broad and fills the space between caudal side of pleon-tergite 5 and pleotelson lateral side, its caudal margin continuous with margins of pleon-tergite 5 and pleotelson (Fig. 2N); endopodite narrow and elongate, not extended beyond caudal margin of pleotelson (Fig. 2M). Total length 14-20 mm. Sources: Budde-Lund (1885), Richardson (1905), Barnard (1932), Van Name (1936), Green (1961) and Schultz (2018).

Taxonomic summary

Type locality. Latreille (1804) did not mention a specific site, but it is generally accepted to be a European species (Budde-Lund, 1885; Leistikow & Wagele, 1999), autochthonous of the Mediterranean region (Schmalfuss, 2003).

Distribution in Mexico. Armadillidium vulgare has been recorded from Baja California, Baja California Sur, Ciudad de Mexico, Michoacán, Nuevo León and Sonora (Gandara, 1926; Garthwaite et al., 1995; Hatch, 1947; Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Souza-Kury, 2000; Van Name, 1936). The new state records are Aguascalientes, Chihuahua, Coahuila, Durango, Guanajuato, Jalisco, Nayarit, San Luis Potosí, Sinaloa, and Tamaulipas (Fig. 7).

General distribution. Native to the Mediterranean region, *Armadillidium vulgare* has been introduced around the world (Schmalfuss, 2003).

Material examined. Aguascalientes: Aguascalientes (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 31.03.2016, J. Estrada, UAA-BIN-C02, 1 ♂ (9.5 mm); 25.05.2016, M. A. Ramírez, UAA-BIN-C03, 5 ♀♀ (7.3-15.8 mm); 05.06.ND, P. Balestra, UAA-BIN-C05, 3 ♀♀ (10.6-15.8 mm); 02.06.1979, A. Velázquez, UAA-C-76, 6 ♀♀ (9.0-13.1 mm); 18.08.1979, R. Ramírez, UAA-C-79, 1 ♀ (12.5 mm); 10.11.1989, A. Mendiola, UAA-C-208, 3 ♀♀ (8.8-12.5 mm); 01.03.1996, J. Estrada, UAA-C-285, 3 ♂♂ (9.3-11.8 mm); 01.04.1996, I. Torres, UAA-C-301, 1 ♂ (12.5 mm), 1 ♀ (9.7 mm), 06.03.1996, M. S. Ramírez, UAA-C-308, 11 ♂♂ (6.6-10.8 mm), 4 ♀♀ (9.5-11.2 mm); 01.05.1996, J. Estrada, UAA-C-312, 2 ♂♂ (7.00-11.0 mm), 2 ♀♀ (9.0-12.5 mm); 14.06.1996, Ibeth, UAA-C-361, 5 ♂♂ (8.6-10.5 mm), 4 ♀♀ (8.7-10.5 mm); 10.10.1998, J. G. Macías, UAA-C-380, 3 ♂♂ (5.5-8.0 mm), 10 ♀♀ (5.0-9.5 mm); 20.06.1999, L. A. Rodríguez, UAA-C-412, 2 ♀♀ (10.1-14.5 mm); 20.06.1999, E. Castañeda, UAA-C-415, 4 ♂♂ (5.9-7.9 mm), 8 ♀♀ (5.1-7.5 mm); 22.06.1999, L. F de Alba, UAA-C-418, 7 ♂♂ (5.9-8.3 mm), 7 ♀♀ (6.3-8.6 mm); 25.06.1999, J. Estrada, UAA-C-419, 3 ♂♂ (8.6-11.6 mm); 06.06.2000, J. O. Cárdenas, UAA-C-508, 1 ♀ (13.0 mm); 08.06.2003, D. Rosales, UAA-C-657, 2 ♂♂ (10.1-12.5 mm), 3 ♀♀ (10.1-11.7 mm); 14.05.2005, B. Torres, UAA-C-718, 13 ♂♂ (7.6-13.3 mm), 2 ♀♀ (7.2-9.1 mm); 20.07.2006, H. Obregón, CIB-24B, 4 ♀♀ (10.5-12.4 mm); Los Arquitos (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 21.03.1990, O. Ponce, UAA-C-213, 4 ♂♂ (8.2-10.1 mm), 7 ♀♀ (7.5-14.6 mm); 21.03.1996, O. Ponce, UAA-C-289, 1 ♀ (10.9 mm); 21.03.1996, L. Salas, UAA-C-290, 2 ♂♂ (9.0-11.5 mm); Universidad Autónoma de Aguascalientes, Aguascalientes (21°54′50.99″ N, 102°18′58.77″ W), urban zone, UAA-BIN-CO4, 1 ♀ (7.3 mm); 27.06.1982, F. Bañuelos, UAA-C-103, 1 ♀ (13.1 mm); 01.06.2002, J. V. Rodríguez, UAA-C-553, 12 ♂♂ (5.6-9.4 mm), 4 ♀♀ (5.3-10.0 mm); Alisos, Calvillo (21°28′11.87″ N, 102°27′55.29″ W), rural zone, 13.08.82, B. Cortez, UAA-C-105(18), 1 ♀ (ND); Malpaso, Calvillo (21°51′37.79″ N, 102°39′51″ W), rural zone, 14.08.1989, J. Solorio, UAA-C-205, 3 ♂♂ (10.4-14.5 mm); 14.08.1989, J. Moreno, UAA-C-206, 4 ♂♂ (4.7-9.5 mm), 3 ♀♀ (6.7-14.4 mm); 14.08.1989, C. Soto, UAA-C-207, 3 ♀♀ (6.5-7.6 mm). Baja California: Centro de Bachillerato Tecnológico Agropecuario 198, Maneadero (31°42′02.47″ N, 116°33′24.49″ W), urban zone, 01.03.2004, H. García, CIB-01B, 5 ♂♂ (9.4-12.3 mm), 5 ♀♀ (9.0-9.6 mm); 05.05.2011, H. García, CIB-72B, 4 ♂♂ (9.5-13.8 mm), 3 ♀♀ (10.7-12.5 mm). Baja California Sur: Centro de Investigaciones Biológicas del Noroeste, El Comitán, La Paz (24°08′19.39″ N, 110°24′27.19″ W), urban zone, 01.05.2004, A. Maeda, CIB-16B, 3 ♂♂ (11.1-13.5 mm), 5 ♀♀ (8.4-13.0 mm). Chihuahua: San Francisco de Conchos, Camargo (27°35′35.05″ N, 105°20′06.89″ W), natural zone, 09.11.2018, CIB-112B, D. Espino, 4 ♂♂ (7.8-10.5 mm), 3 ♀♀ (6.4-8.0 mm); CIB-1123, D. Espino, 5 ♂♂ (10.1-11.8 mm), 5 ♀♀ (7.8-11.1 mm); Río Conchos, Camargo (27°34′08.60″ N, 105°25′23.33″ W), natural zone, 09.11.2018, CIB-114B, G. Murugan, 3 ♂♂ (8.0-9.1 mm), 4 ♀♀ (10.1-10.2 mm); Ojo de Agua, Camargo (27°33′33.27″ N, 105°25′01.82″ W), natural zone, 09.11.2018, CIB-115B, G. Murugan, 5 ♂♂ (7.5-10.3 mm), 5 ♀♀ (8.2-10.8 mm). Coahuila: Justo Sierra, Sabinas (25°51′78″ N, 101°06′33.30″ W), rural zone, 17.12.1984, M. L. Flores, UANL-C510-7683, 5 ♂♂ (6.7-9.0 mm), 4 ♀♀ (7.0-10.7 mm); Cerro de La Gloria, Monclova (26°54′10.59″ N, 101°23′38.33″ W), rural zone, 09.10.1984, J. E. Jiménez, UANL-C510-7684, 3 ♂♂ (8.5-10.4 mm), 3 ♀♀ (7.7-9.2 mm); Piedras Negras (28°41′24.82″ N, 100°31′50.20″ W), urban zone, 21.07.1981, F. M. Rodríguez, UANL-C510-7686, 1 ♂ (10.9 mm), 5 ♀♀ (10.8-12.5 mm); Reforma, Saltillo (23°49′14″ N, 101°00′25.25″ W), urban zone, 30.10.1979, J. G. Rodríguez, UANL-C510-7687, 4 ♂♂ (8.5-10.4 mm), 2 ♀♀ (7.7-7.8 mm); Unión, Saltillo (25°24′52.73″ N, 101°00′22.12″ W), urban zone, 06.03.1983, Y. Blanco, UANL-C510-7688, 4 ♂♂ (8.9-12.6 mm), 4 ♀♀ (9.5-14.7 mm); Emilio Carranza, Saltillo (25°27′17.76″ N, 101°00′49.18″ W), urban zone, 31.12.1986, M. E. Aguirre, UANL-C510-7689, 2 ♂♂ (11.4-12.7 mm); Villas de la Aurora, Saltillo (25°25′40.82″ N, 100°56′40.61″ W), urban zone, 10.08.2009, R. A. Chaires, UANL-C510-7690, 2 ♂♂ (10.8-10.9 mm); Conquián, Arteaga (25°27′11.41″ N, 100°51′19.16″ W), rural zone, 11.11.1984, M. G. Valencia, UANL-C510-7685, 4 ♂♂ (9.5-12.1 mm), 4 ♀♀ (9.2-11.3 mm); Centenario, Arteaga (25°26′53.44″ N, 100°50′59.33″ W), rural zone, 19.07.2009, L. E. Arizpe, UANL-C510-7691, 1 ♂ (10.1 mm). Durango: Mezquital (23°23′23.42″ N, 104°01′8.55″ W), rural zone, 19.06.2017, J. Lumar, UJED-56, 4 ♂♂ (4.8-12.7 mm), 4 ♀♀ (6.5-11.7 mm); Río Nombre de Dios (23°51′16.2″ N, 104°15′01.09″ W), natural zone, 10.05.2006, A. Maeda, CIB-26B, 4 ♂♂ (10.1-16.3 mm), 4 ♀♀ (11.3-13.2 mm); Manantial La Concha (24°43′53.76″ N, 104°05′19.22″ W), natural zone, 26.12.2006, A. Maeda, CIB-116B, 4 ♂♂ (5.8-14.2 mm), 4 ♀♀ (8.8-13.6 mm); Río Peñón Blanco, Peñón Blanco (24°47′19.10″ N, 104°01′56.83″ W), natural zone, 20.11.2017, I. Segura, CIB-123B, 26 ♂♂ (11.1-17.4 mm), 21 ♀♀ (11.3-20.5 mm); 04.05.2014, A. Maeda, CIB-124B, 2 ♂♂ (12.6-12.9 mm); Río Peñón Blanco, El Ranchito (24°55′17.6″ N, 104°04′57.8″ W), natural zone, 04.05.2006, A. Maeda, CIB-31B, 4 ♂♂ (10.7-14.4 mm), 2 ♀♀ (14.2-14.3 mm); 04.05.2006, A. Maeda, CIB-34B, 1 ♀ (16.4 mm); Ciudad Juárez, Lerdo (25°29′15.45″ N, 103°34′56.39″ W), urban zone, 21.02.2009, C. Martínez, UJED-03, 1 ♀ (8.4 mm); 11.02.2009, I. López, UJED-10, 1 ♂ (9.4 mm); Universidad Juárez del Estado de Durango, Núcleo Universitario, Gómez Palacio, Durango (25°35′13.02″ N, 103°30′07.87″ W), urban zone, 28.03.2009, C. Quezada, UJED-01, 1 ♂ (7.6 mm); 22.03.2009, A. López, UJED-02, 1 ♂ (10.1 mm); 27.03.2009, M. Elena, UJED-06, 1 ♀ (8.0 mm); 30.04.2013, C. Garza, UJED-11, 1 ♂ (9.0 mm); Gómez Palacio (25°35′20.93″ N, 103°29′9.10″ W), urban zone, 14.04.2008, I. Mejía, UJED-05, 1 ♂ (9.6 mm); 23.03.2009, D. Carrillo, UJED-07, 1 ♂ (8.7 mm); 22.06.2010, A. Jesús, UJED-08, 1 ♂ (9.7 mm); 02.05.2013, L. Mendoza, UJED-12, 1 ♂ (9.6 mm); Secretaría de Salud y Asistencia, Gómez Palacio (25°35′20.93″ N, 103°29′9.10″ W), urban zone, 14.02.2017, J. Segura, UJED-60, 8 ♂♂ (5.9-10 mm), 3 ♀♀ (6.8-9.0 mm). Guanajuato: Comanjilla, León (21°03′51.80″ N, 101°28′22.65″ W), rural zone, 15.07.2007, E. Obregón, CIB-125B, 3 ♀♀ (10.3-13.3 mm). Jalisco: Encarnación de Díaz (21°31′34.65″ N, 102°14′25.14″ W), urban zone, 10.09.1988, M. L. Escobedo, UAA-C-187, 2 ♂♂ (5.6-14.0 mm), 6 ♀♀ (7.5-11.7 mm); 21.02.2005, K. Torres, UAA-C-709, 1 ♀ (10.0 mm). Nayarit: Hotel Bugambilias, Tepic (21°31′15.51″ N, 104°55′31.04″ W), urban zone, 16.07.2006, A. Maeda, CIB-23B, 5 ♂♂ (10.4-13.3 mm), 5 ♀♀ (6.8-10.0 mm). Nuevo León: Parque Mitras Centro, Escuela Ignacio Zaragoza (25°40′48.3″ N, 100°20′48″ W), urban zone, 27.07.2005, A. Maeda, CIB-29B, 5 ♂♂ (9.5-11.8 mm); Colonia Burócratas del Estado, Monterrey (25°42′37.03″ N, 100°22′02.39″ W), urban zone, 01.07.2011, A. Maeda, CIB-35B, 2 ♂♂ (7.8-10.4 mm); Parque Chipinque, Km 2, Monterrey (25°36′38.1″ N, 100°21′20.8″ W), rural zone, 06.05.2006, A. Maeda, CIB-30B, 4 ♂♂ (11.4-12.4 mm), 4 ♀♀ (11.4-14.6 mm). San Luis Potosí: Las Rusias, federal highway No. 70, Rio Verde-San Luis Potosí (22°03′42.2″ N, 100°33′14.1″ W), rural zone, 10.05.2006, A. Maeda, CIB-25B, 3 ♂♂ (7.8-8.4 mm), 1 ♀ (9.50 mm). Sinaloa: Camino de Jitzamuri (26°11′57.6″ N, 109°04′50.8″ W), rural zone, 20.05.2006, A. Maeda, CIB-27B, 1 ♀. Tamaulipas: La Pesca (23°47′11.28″ N, 97°46′47.70″ W), rural zone, 17.10.2009, A. M. Soriano, UANL-C510-7692, 1 ♀ (7.7 mm).

Remarks

Total length of males ranged 4.7-14.5 mm, and females 5.0-20.5 mm, compound eyes with 20-28 ommatidia. A photograph of the habitus in dorsal view of an *Armadillidium vulgare* specimen from Nuevo León, Mexico was published by Rodríguez-Almaraz et al. (2014).

Haplotypic identity. Sequences of CO1 gene fragments of *Armadillidium vulgare* were obtained from a male from the city of Aguascalientes, a female from Parque Mitras Centro, Nuevo León, and a female from Camino de Jitzamuri, Sinaloa. The 3 sequences (579 bp), deposited in GenBank under accession numbers MN689271-MN689273 represent 3 haplotypes with genetic distance among them from 1.04 to 4.66%. Genetic distance among the 3 Mexican sequences and 4 sequences deposited in the GenBank as *A. vulgare* from Australia (KR424608), Brazil (KJ814231), France (MF187614), and Japan (LC424986) ranges from 0 to 4.84% (Table 1).

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Figure 1. SEM micrographs of adult specimens of *Cubaris murina* from Tamaulipas. Specimen A is from Colonia Tamaulipas, Jiménez. Specimens B-I, L, M, and O are from La Morita, Llera de Canales. Specimens J, K, and N are from Río Purificación. A, Left anterior part of female in lateral dorsal view (bar = 3 mm); B, cephalothorax and pereon-tergites 1 and 2 of female in right anterolateral view (bar = 200 µm); C, cephalothorax of female in anterior view (bar = 500 µm); D, right compound eye of male in anterolateral view (bar = 100 µm); E, cephalothorax of female in anteroventral view (bar = 1 mm); F, right first antenna of female (bar = 50 µm); G, right second antenna of male in anteroventral view (bar = 200 µm); H, flagellum of right second antenna of male in anteroventral view (bar = 100 µm); I, cephalothorax and first pairs of pereopods of female in anteroventral view (bar = 1 mm); J, ventral surface of pereon-tergite 1 of male with a semicircular lobe and pereon-tergite 2 with a quadrangular lobe (bar = 500 µm); K, right first pereopod of male in medial view (bar = 1 mm); L, posterior part of body showing pleon-tergites 3-5, pleotelson, uropod sympodites with endopodites, and pleopods 1-5 of male in ventral view (bar = 500 µm); M, copulative appendages of first pair of pleopoda of male (bar = 100 µm); N, posterior part of body showing pleon-tergites 3-5, pleotelson, and uropod sympodites with exopodites of male in dorsal posterior view (bar = 1 mm); O, pleotelson, and uropod sympodites with exopodites of female in dorsal posterior view (bar = 500 µm).

Table 1

Species, GenBank number, origin, and percentage of uncorrected cytochrome oxidase subunit 1 (579 bp) genetic distances among isopod species and outgroup used in the molecular analyses.

	Species GenBank number / origin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	*Porcellionides pruinosus* KR424606 / Australia																												
2	*P. pruinosus* Hap1 / Baja California Sur	0																											
3	*P. pruinosus* EU364627 / Australia	0.17	0.17																										
4	*P. pruinosus* Hap2 / Baja California Sur	0.17	0.17	0.35																									
5	*Porcellio laevis* FN824122 / Italy	15.54	15.54	15.72	15.72																								
6	*P. laevis* FN824121 / Italy	15.37	15.37	15.54	15.54	0.17																							
7	*P. laevis* FN824119 / Italy	15.54	15.54	15.72	15.72	0.35	0.17																						
8	*P. laevis* Hap1 / Durango	15.03	15.03	15.20	14.85	12.95	12.78	12.61																					
9	*P. laevis* KJ814239 / Brazil	15.03	15.03	15.20	14.85	12.95	12.78	12.61	0																				
10	*P. laevis* Hap2 / Aguascalientes	15.03	15.03	15.20	14.85	12.78	12.61	12.78	3.45	3.45																			
11	*Porcellionides myrmecophilus* FN824131 / Italy	16.93	16.93	17.10	16.75	17.96	17.79	17.96	17.10	17.10	17.27																		
12	*P. myrmecophilus* FN824129 / Italy	16.75	16.75	16.93	16.58	17.79	17.62	17.79	16.93	16.93	17.10	0.17																	
13	*Agabiformius lentus / Durango*	19.34	19.34	19.52	19.52	20.03	19.86	20.03	19.86	19.86	19.86	20.38	20.55																

Table 1.
Continued

	Species GenBank number / origin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
14	*Armadillidium vulgare* KR424608 / Australia	19.17	19.17	19.34	19.34	19.17	19.00	19.00	19.17	19.17	18.65	20.38	20.21	19.17															
15	*A. vulgare* KJ814231 / Brazil	19.17	19.17	19.34	19.34	19.17	19.00	19.00	19.17	19.17	18.65	20.38	20.21	19.17	0														
16	*A. vulgare* Hap1 / Aguascalientes	19.17	19.17	19.34	19.34	19.17	19.00	19.00	19.17	19.17	18.65	20.38	20.21	19.17	0	0													
17	*A. vulgare* Hap2 / Sinaloa	19.00	19.00	19.17	19.17	18.83	18.65	18.65	19.17	19.17	18.65	20.03	19.86	18.83	1.04	1.04	1.04												
18	*A. vulgare* Hap3 / Nuevo León	19.34	19.34	19.52	19.52	17.62	17.44	17.44	18.65	18.65	18.48	19.69	19.52	19.52	4.66	4.66	4.66	4.84											
19	*A. vulgare* MF187614 / France	19.34	19.34	19.52	19.52	17.62	17.44	17.44	18.65	18.65	18.48	19.69	19.52	19.52	4.66	4.66	4.66	4.84	0										
20	*A. vulgare* LC424986 / Japan	19.34	19.34	19.52	19.52	17.62	17.44	17.44	18.65	18.65	18.48	19.69	19.52	19.52	4.66	4.66	4.66	4.84	0	0									
21	*Cubaris murina* / Tamaulipas	24.35	24.35	24.53	24.18	26.25	26.08	26.08	24.35	24.35	25.22	24.70	24.53	25.73	23.32	23.32	23.32	22.80	23.49	23.49	23.49								
22	*C. murina* AB861525 / Japan	24.53	24.53	24.70	24.35	26.42	26.25	26.25	24.18	24.18	25.04	24.87	24.70	26.25	23.83	23.83	23.83	23.32	23.66	23.66	23.66	0.69							
23	*C. murina* LC218702 / Japan	24.70	24.70	24.87	24.53	26.60	26.42	26.42	24.35	24.35	25.22	25.04	24.87	26.42	24.01	24.01	24.01	23.49	23.83	23.83	23.83	0.86	0.17						
24	*C. murina* AB861527 / Japan	24.70	24.70	24.87	24.53	26.60	26.42	26.42	24.35	24.35	25.22	25.04	24.87	26.42	24.01	24.01	24.01	23.49	23.83	23.83	23.83	0.86	0.17	0					
25	*C. murina* LC218701 / Japan	24.70	24.70	24.87	24.53	26.60	26.42	26.42	24.35	24.35	25.22	25.04	24.87	26.42	24.01	24.01	24.01	23.49	23.83	23.83	23.83	0.86	0.17	0.35	0.35				
26	*C. murina* AB861528 / Japan	24.70	24.70	24.87	24.53	26.60	26.42	26.42	24.35	24.35	25.22	25.04	24.87	26.42	24.01	24.01	24.01	23.49	23.83	23.83	23.83	0.86	0.17	0.35	0.35	0			
27	*Periclimenes imperator* GQ415636 / ND	22.28	22.28	22.11	22.11	20.38	20.55	20.55	20.73	20.73	19.34	20.90	20.73	22.45	20.03	20.03	20.03	20.03	19.69	19.69	19.69	24.87	24.87	25.04	25.04	25.04	25.04		
28	*P. rathbunae* KX090114 / Curacao	21.79	21.79	21.62	21.97	21.97	22.14	22.32	21.09	21.09	18.98	20.91	20.74	24.96	22.32	22.32	22.32	22.85	20.56	20.56	20.56	27.42	27.77	27.94	27.94	27.94	27.94	15.29	

Figure 2. SEM micrographs of a male adult specimen of *Armadillidium vulgare* from the city of Aguascalientes, Aguascalientes. A, Cephalothorax, pereon-tergites 1 and 2, and left second antenna in left lateral view (bar = 2 mm); B, cephalothorax in dorsal view showing the compound eyes situated at proximal lateral sides, the triangular lamina frontalis, the right lateral lobe for holding the second antenna during conglobation, and the first and second articles of left second antennae (bar = 1 mm); C, cephalothorax in anteroventral view showing the labrum, the first, second and third articles of left second antenna, the right lateral lobe for holding the second antenna during conglobation, and the triangular lamina frontalis (bar = 1 mm); D, right compound eye in anterolateral view (bar = 200 µm); E, right first antenna in anterior view (bar = 100 µm); F, distal article of first antenna with aesthetascs (bar = 50 µm); G, left second antennae in left lateral view (bar = 1 mm); H, flagellum with 2 articles (bar = 500 µm); I, left first pereopod in medial view (bar = 1 mm); J, pereopod 7 in medial view (bar = 1 mm); K, posterior part of body showing pleon-tergites 3-5, pleotelson, uropod sympodites with exopodites and endopodites, and pleopods 1-5 in ventral view (bar = 2 mm); L, copulative appendages of first pair of pleopoda with tips divergent in ventral view (bar = 1 mm); M, uropod sympodites with exopodites and endopodites in ventral view (bar = 500 µm); N, posterior part of body showing pereon-tergites 6 and 7, pleon-tergites 1-5, pleotelson, and exopodites of uropod sympodites in dorsal posterior view (bar = 3 mm); O, pleon-tergites 4 and 5, and triangular pleotelson with exopodites of uropod sympodites in dorsal posterior view (bar = 1 mm).

Porcellionidae Brandt, 1831
Agabiformius Verhoeff, 1908
Agabiformius lentus (Budde-Lund, 1885)
(Fig. 3A-O)
Lyprobius lentus Budde-Lund, 1885: 230 (original description).
Porcellio gertschi Van Name, 1942: 309: Mulaik (1960: 171); Schultz (1965: 103); Jass & Klausmeier (2004: 18-20).
Metoponorthus hidalguensis Mulaik, 1960: 175: Jass & Klausmeier (2004: 18-20).
Agabiformius lentus (Budde-Lund, 1885): Leistikow & Wagele (1999: 33); Jass & Klausmeier (2004: 18-20); Rodríguez-Almaraz et al. (2014: 281).

Diagnosis. Habitus type clinger not conglobator. Body ovate rather convex, about twice as long as wide, dorsal side roughly and minutely granulated (Fig. 3A-C). Color variable sometimes light reddish or yellowish brown, with markings of dark brown in patches on pereon tergites. Cephalothorax about 2 times as wide as long, posterior margin (linea frontalis) of lamina frontalis produced in a prominent rounded median lobe and 2 rounded concave lateral lobes (Fig. 3F). Compound eyes situated at proximal lateral sides of cephalothorax, close to the rounded lateral lobes, each with about 10 to 12 ommatidia, normally in 3 rows (Fig. 3D). Vertex convex in the middle. First antenna 3-jointed with 10-12 aesthetascs on distal article. Basal article longest and broadest (Fig. 3G). Second antennae short, not reaching the caudal margin of pereon-tergite 1, with first article short, second about 2.5 times as long as first, third about 0.5 as long as second, fourth as long as third, fifth about 2 times as long as fourth (Fig. 3H). Flagellum 2-jointed, second article 2-3 times longer than first (Fig. 3I). Maxilliped palp with 3 articles. Mandibles without palp. Pereon-tergites subequal in length, lateral parts broadly expanded. Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax up to the base of rounded concave lateral lobes (Fig. 3A-C). Epimera not distinctly separated from the segments. The pleon is not narrower than the pereon (Fig. 3L, O). Pleon-tergites 1 and 2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7 (Fig. 3O). Pleon-tergites 3-5 broadly expanded laterally, posterolateral margins strongly produced and curved backwards, lateral margins forming a continuous line with lateral margins of pereon-tergites. Male copulative appendages of pleopods 1 with tips slightly divergent (Fig. 3M). Pleopod 1 with endopodite stout and tapering to rounded tip, exopodite triangular, with posterior margin sharply truncated to leave a straight, but undulating, edge (Fig. 3M). Pleopod 2 with endopodite narrow, curved along its entire length, with a constriction near the mid-point and then tapered to a very fine point. The exopodite triangular, bearing a few spines on the outer margin (Fig. 3M). Pleotelson triangular with rounded tip extends half its length beyond the lateral caudal parts of pleon-tergites 5 (Fig. 3O). Uropod sympodites visible in dorsal view and attain half the length of pleotelson (Fig. 3N); exopodite as long as uropod sympodite, half of its length extends beyond the caudal margin of pleotelson (Fig. 3O); endopodite slender, cylindrical, reaching the caudal margin of pleotelson (Fig. 3N). Total length about 5 mm. Sources: Budde-Lund (1885), Mulaik (1960) and Schultz (1984).

Taxonomic summary

Type locality. M´sila in Algeria (Budde-Lund, 1885).

Distribution in Mexico. Agabiformius lentus has been recorded from Coahuila, Hidalgo, Nuevo León and San Luis Potosí (Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Schultz, 1965; Van Name, 1942). The new state record is Durango (Fig. 7).

General distribution. Native to the Mediterranean coasts, *Agabiformius lentus* has been introduced around the world (Schmalfuss, 2003).

Material examined. Durango: Universidad Juárez del Estado de Durango, Núcleo Universitario, Gómez Palacio, Durango (25°35′13.02″ N, 103°30′07.87″ W), urban zone, 08.01.2016, I. Segura, UJED-34, 6 ♂♂ (3.5-4.9 mm), 5 ♀♀ (3.1-3.8 mm). Nuevo León: laguna de Sánchez, Santiago (25°20′41.38″ N, 100°16′51.82″ W), rural zone, 15.08.2008, J. A. Treviño, UANL-C517-7403, 1 ♂ (4.3 mm); La Pastora, Guadalupe (25°40′03.76″ N, 100°19′58.92″ W), urban zone, 01.04.2012, UANL-C517-7404, 1 ♀ (6.0 mm); Colonia Don Lalo, Apodaca (25°48′27.74″ N, 100°19′58.92″ W), urban zone, 20.03.2012, J. A. Treviño, UANL-C517-7405, 1 ♂ (5.5 mm), 1 ♀ (5.3 mm).

Remarks

Total length of males ranged 3.5-5.5 mm, and females 3.1-6.0 mm, compound eyes with 13-14 ommatidia. A photograph of the habitus in dorsal view of an *Agabiformius lentus* specimen from Nuevo León was published by Rodríguez-Almaraz et al. (2014).

Haplotypic identity. One sequence of CO1 gene fragment (629 bp) of *Agabiformius lentus* was obtained from a male from the city of Gómez Palacio, Durango. The sequence was deposited in GenBank under accession number MN689274, and represents the first CO1 sequence for the species.

Porcellio laevis Latreille, 1804
(Fig. 4A-O)
Porcellio laevis Latreille, 1804: 46 (original description).
Porcellio aztecus De Saussure, 1857: 307: De Saussure (1858: 65); Stuxberg (1875: 62); Miers (1877: 669); Dollfus (1896: 46).

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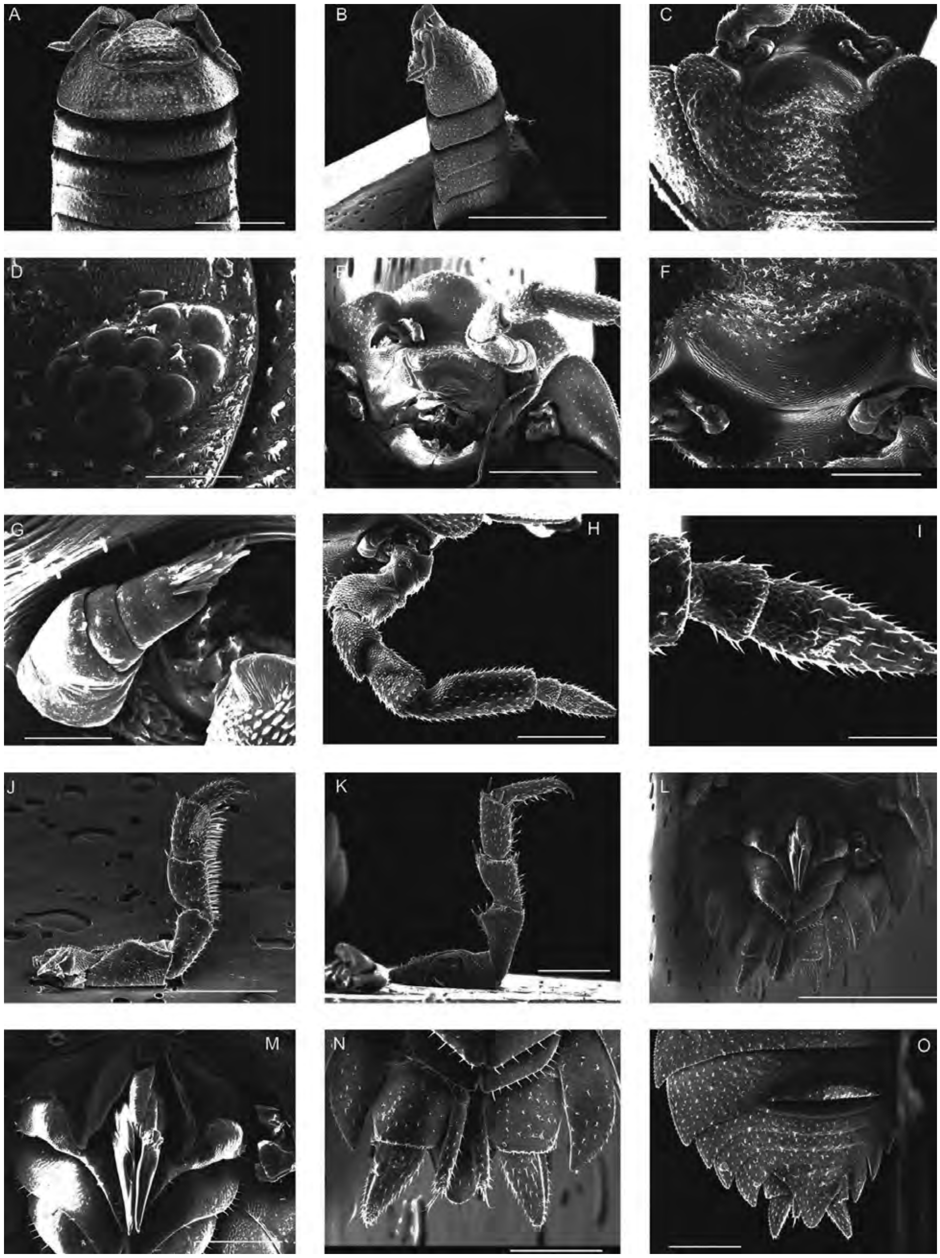

Figure 3. SEM micrographs of a male adult specimens of *Agabiformius lentus* from Gómez Palacio, Durango. A, B, K and L correspond to a male of 6.0 mm of total length, and C-J, M, N, and O to a male of 5.0 mm of total length. A, Cephalothorax, second antennae, and pereon-tergites 1-5 in dorsal view (bar = 1 mm); B, cephalothorax, second antennae, and pereon-tergites 1-5 in lateral view (bar = 2 mm); C, cephalothorax in dorsal view showing the lamina frontalis produced in a prominent rounded median lobe and at the sides in a large rounded lateral lobes limited by linea frontalis (bar = 500 µm); D, compound eye at proximal lateral side of cephalothorax (bar = 100 µm); E, cephalothorax in anteroventral view showing the labrum, 1-5 articles of left second antenna, the lamina frontalis produced in a prominent rounded median lobe and 2 rounded concave lateral lobes (bar = 500 µm); F, lamina frontalis produced in a prominent rounded median lobe, and the first antennae in anterior view (bar = 200 µm); G, left first antenna with aesthetascs in anterior view (bar = 50 µm); H, left second antennae in dorsal view (bar = 300 µm); I, flagellum with 2 articles (bar = 100 µm); J, left pereopod 1 in medial view (bar = 500 µm); K, pereopod 7 in medial view (bar = 500 µm); L, pleon-tergites 3-5, pleotelson, uropod sympodites with exopodites and endopodites, and pleopods 1-5 in ventral view (bar = 1 mm); M, copulative appendages of first pair of pleopoda with tips divergent in ventral view (bar = 300 µm); N, uropod sympodites with exopodites and endopodites in ventral view (bar = 300 µm); O, posterior part of body showing pereon-tergites 6 and 7, pleon-tergites 1-5, triangular pleotelson, and uropod sympodites with exopodites in dorsal view (bar = 500 µm).

Porcellio mexicanus De Saussure, 1857: 307: De Saussure (1858: 64); Herrera (1892: 220); Dollfus (1896: 46).
Porcellio laevis Latr.: De Borre (1886: CXIII); Dollfus (1896: 46).
Porcellio laevis Latreille, 1804: Richardson (1905: 615); Gandara (1926: 285); Creaser (1936: 120); Van Name (1936: 229); Hatch (1947: 196); Reddell (1981: 93); Souza-Kuri (2000: 245); Jass & Klausmeier (2004: 5); Treviño-Flores & Rodríguez-Almaraz (2012: 15); Rodríguez-Almaraz et al. (2014: 282).

Diagnosis. Habitus type runner-clinger not conglobator. Body ovate rather convex, about twice as long as wide, dorsal side roughly and minutely granulated. Color variable often dark gray with 2 longitudinal bands of a lighter color in wavy stripes, one on either side of the median line. Cephalothorax about 1.5 times as wide as long (Fig. 4C). Lamina frontalis with posterior margin (linea frontalis) produced in a small triangular median lobe and 2 large rounded concaved lateral lobes (Fig. 4E). Compound eyes situated at proximal lateral sides of cephalothorax, close to the large rounded lateral lobes, each with 22-26 ommatidia, normally in 4 rows (Fig. 4D). Vertex convex in the middle. First antenna 3-jointed with about 10-20 aesthetascs on distal article. Basal article longest and broadest (Fig. 4H). Second antennae extending to the pereon tergite 3, with first article short, second about 1.5 longer than first, third as long as second, fourth about 2 times as long as third, fifth about 1.5 times as long as fourth (Fig. 4I). Flagellum 2-jointed, first article subequal in length to second one (Fig. 4J). Maxilliped palp with 3 articles. Mandibles without a palp. Pereon-tergites subequal in length, lateral parts broadly expanded (Fig. 4A). Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax up to the base of the large rounded concave lateral lobes (Fig. 4B). Epimera are not distinctly separated from the segments. Male pereopod 1 with brush of long setae on ventral side of carpus and merus (Fig. 4K). The pleon is not narrower than the pereon. Pleon-tergites 1-2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7. Pleon-tergites 3-5 broadly expanded laterally, lateral margins forming a continuous line with the lateral margins of pereonites. Male copulative appendages of pleopods 1 with tips slightly divergent (Fig. 4M). Pleotelson triangular with a shallow groove extending the length of the produced apex, rounded tip extends half its length beyond the lateral caudal parts of the pleon-tergites 5. Uropod sympodites visible in dorsal view, extending almost full length of pleotelson (Fig. 4O) and to the tip of posterior lateral angles of pleon-tergites 5; exopodite lanceolate, 1.5 longer than uropod sympodite, its total length almost extends beyond the caudal margin of pleotelson (Fig. 4O); endopodite slender, cylindrical, extending beyond caudal margin of pleotelson and up to half length of exopodite (Fig. 4N). Total length 10-15 mm. Sources: Budde-Lund (1885), Richardson (1905), Barnard (1932), Van Name (1936) and Schultz (2018).

Taxonomic summary

Type locality. Latreille (1804) did not mention a specific site. *Porcellio laevis* is considered to be autochthonous to southern Europe and northern Africa (Leistikow & Wagele, 1999; Schmalfuss, 2003).

Distribution in Mexico. Porcellio laevis has been recorded from Baja California, Ciudad de México, Coahuila, Estado de México, Guanajuato, Guerrero, Nuevo León, Puebla, Tamaulipas and Yucatán (Creaser, 1936, 1938; Dollfus, 1896; Gandara, 1926; Herrera, 1892; Hatch, 1947; Jass & Klausmeier, 2004; Reddell, 1981; Richardson, 1905; Rodríguez-Almaraz et al., 2014; Souza-Kuri, 2000; Treviño-Flores & Rodríguez-Almaraz, 2012; Van Name, 1936). The new state records are Aguascalientes, Baja California Sur, Chihuahua, Durango, Sinaloa, Sonora and Zacatecas (Fig. 7).

General distribution. Native to Europe and North Africa, *Porcellio laevis* has been introduced around the world (Schmalfuss, 2003).

Material examined. Aguascalientes: Aguascalientes (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 10.11.1989, C. Soto, UAA-C-209, 1 ♂ (8.7 mm); 10.11.1989, A. Mendiola, UAA-C-210, 2 ♀♀ (11.0-14.0 mm); 10.11.1989, J. Moreno, UAA-C-211, 3 ♂♂ (7.7-9.8 mm), 4 ♀♀ (8.5-11.0 mm); 08.06.2003, I. Torres, UAA-C-300, 2 ♂♂ (15.5-18.0 mm); 10.10.1998, J. G. Macías, UAA-C-380, 1 ♂ (10.3 mm), 1 ♀ (13.5 mm); 10.06.2003, K. de Luna, UAA-C-659, 1 ♂ (14.0 mm); 14.05.2005, B. Torres, UAA-C-718, 2 ♂♂ (17.0-17.8 mm), 1 ♀ (13.5 mm); Colonia Héroes, Aguascalientes (21°52′29.45″ N, 102°14′54.66″ W), urban zone, H. Obregón, 20.07.2006, CIB-129B, 5 ♂♂ (8.1-15.3 mm), 5 ♀♀ (10.6-11.4 mm); Los Arquitos (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 21.03.1990, O. Ponce, UAA-C-213, 3 ♂♂ (9.5-14.6 mm), 5 ♀♀ (9.0-11.5 mm); 01.06.2003, C. Quiñones, UAA-C-647, 1 ♂ (13.9 mm); 01.06.2003, E. Guillén, UAA-C-649, 1 ♂ (17.0 mm); Universidad Autónoma de Aguascalientes, Aguascalientes (21°54′50.99″ N, 102°18′58.77″ W), urban zone, 26.03.2016, K. Rosales, UAA-BIN-C04, 1 ♂ (19.2 mm); 01.07.2002, V. Rodríguez, UAA-C-553, 4 ♂♂ (9.4-10.0 mm), 9 ♀♀ (7.8-10.3 mm); 11.05.2003, R. Luna, UAA-C-571, 1 ♂ (14.2 mm), 1 ♀ (15.2 mm); 01.06.2003, R. Sánchez, UAA-C-638, 1 ♀ (9.5 mm); 01.06.2003, C. Quiñonez, UAA-C-646, 1 ♂ (12.2 mm); 03.06.2003, R. Víctor, UAA-C-650, 3 ♂♂ (11.0-15.5 mm), 2 ♀♀ (10.0-12.4 mm); Alisos, Calvillo (21°28′11.87″ N, 102°27′55.29″ W), rural zone, 13.08.1982, B. Cortez, UAA-C-105, 1 ♀ (11.8 mm). Baja California: Centro de Bachillerato Tecnológico Agropecuario 198, Maneadero

(31°42′02.47″ N, 116°33′24.49″ W), urban zone, 31.03.2004, H. García, CIB-126B, 5 ♂♂ (10.5-16.0 mm), 5 ♀♀ (12.2-14.8 mm); 17.11.2010, I. Martínez, CIB-05B, 5 ♀♀ (11.0-12.8 mm); Manantial Km 39.5, Guerrero Negro-Chapala (28°43′22.22″ N, 114°05′41.17″ W), natural zone, 01.16.2006, A. Maeda, CIB-40B, 2 ♂♂ (8.8-12.2 mm), 3 ♀♀ (6.8-17.5 mm). Baja California Sur: Oasis Estero San José, San José del Cabo (23°02′59.93″ N, 109°41′18.70″ W), natural zone, 16.01.2006, A. Maeda, CIB-11B, 1 ♂ (13.5 mm), 4 ♀♀ (13.3-16.2 mm); Oasis San Pedrito (23°23′21.05″ N, 110°12′34.41″ W), natural zone, 12.09.2006, A. Maeda, CIB-10B, 4 ♂♂ (14.2-16.4 mm), 2 ♀♀ (11.0-15.5 mm); Arroyo La Junta, Sierra La Laguna (23°39′20.82″ N, 110°09′03.79″ W), natural zone, 20.05.2013, A. Maeda, CIB-43B, 4 ♂♂ (9.2-12.8 mm), 4 ♀♀ (6.6-14.4 mm); Centro de Investigaciones Biológicas del Noroeste, El Comitán, La Paz (24°08′19.39″ N, 110°24′27.19″ W), urban zone, 01.03.2006, A. Maeda, CIB-15B, 3 ♂♂ (12.6-17.5 mm), 3 ♀♀ (12.8-14.5 mm); 02.05.2005, A. Maeda, CIB-127B, 3 ♂♂ (11.1-13.5 mm), 5 ♀♀ (8.4-13.1); 29.01.2004, A. Maeda, CIB-17B, 2 ♂♂ (10.4-14.1 mm), 4 ♀♀ (8.8-12.7 mm); 12.05.2011, A. Maeda, CIB-58B, 1 ♀♀ (19.2 mm); 15.06.2011, A. Maeda, CIB-84B, 4 ♂♂ (10.2-13.1 mm); 02.04.2012, A. Maeda, CIB-128B, 4 ♂♂ (10.5-20.5 mm), 3 ♀♀ (11.4-17.1 mm); El Sauzal, San Ignacio, Mulegé (27°10′26.9″ N, 112°52′06.2″ W), natural zone, 10.08.2017, C. Palacios, CIB-55A, 4 ♀♀ (10.5-16.4 mm); 13.07.2017, C. Palacios, CIB-56A, 4 ♀♀ (10.3-13.7 mm); 13.07.2017, C. Palacios, CIB-57A, 6 ♀♀ (9.3-14.5 mm); 12.07.2017, C. Palacios, CIB-59A, 5 ♀♀ (11.6-17.6 mm). Chihuahua: San Francisco de Conchos, Camargo (27°35′35.05″ N, 105°20′06.89″ W), natural zone, 09.11.2018, D. Espino, CIB-141B, 5 ♂♂ (13.0-14.7 mm), 4 ♀♀ (11.8-13.7 mm); 09.11.2018, D. Espino, CIB-142B, 2 ♂♂ (12.5-15.0 mm); 09.11.2018, D. Espino, CIB-143B, 4 ♂♂ (9.2-19.8 mm), 5 ♀♀ (8.5-15.3 mm); Ojo de Agua, Camargo (27°33′33.27″ N, 105°25′01.82″ W), natural zone, 09.11.2018, G. Murugan, CIB-144B, 5 ♂♂ (7.4-11.3 mm), 5 ♀♀ (6.0-9.9 mm). Coahuila: Colonia Torreón Jardín (25°31′46.60″ N, 103°25′25.41″ W), urban zone, 24.03.2007, S. Guajardo, UJED-15, 2 ♂♂ (10.1-14.6 mm), 1 ♀ (9.2 mm); 18.04.2004, S. Favela, UJED-26, 1 ♀ (14.8 mm). Durango: Río Nombre de Dios (23°51′16.2″ N, 104°15′01.09″ W), natural zone, 20.11.2016, A. Maeda, CIB-130B, 5 ♀♀ (12.5-15.1 mm); Manantial La Concha (24°43′53.76″ N, 104°05′19.22″ W), natural zone, 14.03.2016. A. Maeda, CIB-131B, 5 ♂♂ (12.7-18.0 mm), 6 ♀♀ (11.8-15.8 mm); Río Peñón Blanco, Peñón Blanco (24°47′19.10″ N, 104°01′56.83″ W), natural zone, 23.12.2010, A. Maeda, CIB-133B, 1 ♂ (13.0 mm), 4 ♀♀ (6.0-13.7 mm); 20.11.2016, I. Segura, UJED-48, 21 ♂♂ (9.8-15.8 mm), 13 ♀♀ (9.4-14.0 mm); Río Peñón Blanco-1 (24°55′17.4″ N, 104°04′57.8″ W), natural zone, 04.05.2006, A. Maeda, CIB-132B, 4 ♂♂ (15.0-16.8 mm), 3 ♀♀ (13.2-13.3 mm); Río Peñón Blanco-2 (24°55′26.5″ N, 104°04′40.60″ W), natural zone, 04.05.2006, A. Maeda, CIB-32B, 5 ♂♂ (10.5-16.5 mm), 5 ♀♀ (12.5-15.2 mm); Río Peñón Blanco, El Ranchito (24°55′34.2″ N, 104°04′36.3″ W), natural zone, 04.05.2006, A. Maeda, CIB-33B, 10 ♂♂ (8.7-16.5 mm), 10 ♀♀ (11.5-15.2 mm); Cañón de Fernández, Lerdo (25°19′13.01″ N, 103°45′7.52″ W), natural zone, 28.03.2009, A. Rodríguez, UJED-27, 1 ♀ (14.0 mm); Ciudad Juárez, Lerdo (25°29′15.45″ N, 103°34′56.39″ W), urban zone, 11.02.09, I. López, UJED-17, 1 ♀ (12.8 mm); 28.03.2009, N. Hernández, UJED-30, 1 ♀ (13.3 mm); Universidad Juárez del Estado de Durango, Núcleo Universitario, Gómez Palacio, Durango (25°35′13.02″ N, 103°30′07.87″ W), urban zone, 28.03.2009, A. González, UJED-13, 1 ♂, 1 ♀ (13.5 mm); 26.11.2013, N. Gutiérrez, UJED-14, 1 ♀ (10.2 mm); 27.03.2009, M. del Río; UJED-20, 6 ♂♂ (9.8-15.6 mm); Gómez Palacio (25°35′20.93″ N, 103°29′9.10″ W), urban zone, 13.03.2007, R. Huijich, UJED-19, 2 ♀♀ (13.1-13.4 mm); 20.02.2007, M. A., UJED-28, 1 ♀ (13.3 mm); Ejido 6 de Octubre (25°48′46.31″ N, 103°34′34.40″ W), rural zone, J. Ana, 29.03.2007, UJED-29, 1 ♀ (12.9 mm). Guanajuato: Comanjilla, León (21°03′51.80″ N, 101°28′22.65″ W), rural zone, 15.07.2007, E. Obregón, CIB-145B, 1 ♀ (9.0 mm). Nuevo León: Bolívar street, Galeana (24°49′31.73″ N, 100°04′24.74″ W), rural zone, 21.09.1977, J. G. Salinas, UANL-C517-7189, 4 ♀♀ (9.2-10.2 mm); Doctor Mier street, Allende (25°16′47.54″ N, 100°01′59.10″ W), rural zone, 27.03.1982, A. Martínez, UANL-C517-7198, 5 ♀♀ (13.3-16.6 mm); Juan Zuazua, Monterrey (25°39′59.60″ N, 100°18′36.38″ W), urban zone, 20.11.1984, H. Ruíz, UANL-C517-7185, 1 ♀ (9.8 mm); Río de la Silla, Monterrey (25°38′21.54″ N, 100°14′11.99″ W), natural zone, 19.06.1983, A. Barrón, UANL-C517-7192, 1 ♀ (9.3 mm); Río Santa Catarina, Monterrey (25°40′15.03″ N, 100°20′58.66″ W), natural zone, 16.06.1981, F. Sireno, UANL-C517-7198, 1 ♂ (16.6 mm); Cerro Las Mitras, Santa Catarina (25°43′00.79″ N, 100°23′31.72″ W), urban zone, 30.12.1984, J. Rodríguez, UANL-C517-7200, 6 ♂♂ (14.4-18.7 mm), 17 ♀♀ (9.2-16.8 mm); Granada street, San Pedro Garza García (25°38′50.29″ N, 100°24′01.45″ W), urban zone, 03.07.1984, A. Ramírez, UANL-C517-7190, 4 ♂♂ (11.3-15.4 mm), 1 ♀ (13.0 mm); Pablo Livas street, Guadalupe (25°39′55.07″ N, 100°12′43.82″ W), urban zone, 06.12.1987, E. Hernández, UANL-C517-7187, 1 ♀ (8.0 mm); Eloy Cavazos street, Guadalupe (25°39′25.78″ N, 100°13′02.91″ W), urban zone, 22.08.1981, A. Correa, UANL-C517-7193, 7 ♂♂ (13.8-16.6 mm), 18 ♀♀ (11.0-16.3 mm); Colonia Cumbres, Monterrey (25°41′56.21″ N, 100°21′47.66″ W), urban zone, 26.11.1980, UANL-C517-7195, 1 ♀ (12.6 mm); Colonia La Fe, San Nicolás (25°42′57.77″ N, 100°13′10.4″ W), urban zone, 02.11.1977, H. R. Alemán, UANL-C527-7188, 1 ♀ (9.8

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mm); San Nicolás, Colonia del Bosque, San Nicolás (25°43′54.50″ N, 100°18′36.38″ W), urban zone, 21.03.1992, M. González, UANL-C517-7186, 3 ♂♂ (10.0 mm), 1 ♀ (8.0 mm); Sierra Morena street, San Nicolás (25°44′52.58″ N, 100°16′17.85″ W), urban zone, 09.07.1984, D. M. Guajardo, UANL-C517-7199, 3 ♂♂ (9.2-15.2 mm), 1 ♀ (11.2 mm); Santo Domingo street, San Nicolás (24°45′16.87″ N, 100°16′48.64″ W), urban zone, 16.10.1989, J. Rodríguez, UANL-C517-7202, 1 ♀ (17.3 mm); Granada street, San Pedro Garza García (25°38′50.29″ N, 100°24′01.45″ W), urban zone, 03.07.1984, A. Ramírez, UANL-C517-7190, 4 ♂♂ (11.3-15.4 mm), 1 ♀ (13.0 mm); Cartagena street, Apodaca (25°46′15.31″ N, 100°15′02.73″ W), urban zone, 09.07.1979, J. Rodríguez, UANL-C517-7204, 3 ♂♂ (10.5-17.5 mm), 2 ♀♀ (13.5-17.0 mm); Séptima Zona Militar, Apodaca (25°39′49.18″ N, 100°17′37.75″ W), urban zone, 07.06.1999, J. Rodríguez, UANL-C517-7203, 2 ♀♀ (12.3-13.5 mm), Agustín de Iturbide, Mina (25°59′52.92.79″ N, 100°31′46.90″ W), urban zone, 30.12.1985, J. Rodríguez, UANL-C517-7201, 1 ♀ (15.7 mm). Sinaloa: Río Sinaloa, Guasave (25°35′21.91″ N, 108°27′34.71″ W), natural zone, 20.05.2006, A. Maeda, CIB-73B, 4 ♂♂ (8.3-15.5 mm), 3 ♀♀ (11.2-14.3 mm). Canal de Riego XIII, Nuevo San Miguel (25°57′12.5″ N, 109°05′33.3″ W), rural zone, 01.05.2006, A. Maeda, CIB-20B, 2 ♂♂ (13.7-14.1 mm), 5 ♀♀ (12.0-20.0 mm); Camino de Jitzamuri (26°11′57.6″ N, 109°04′50.8″ W), rural zone, 20.05.2006, A. Maeda, CIB-27B, 1 ♀ (14.4 mm). Sonora: Hotel Armida, Guaymas (27°55′30.64″ N, 110°54′27.38″ W), urban zone, 19.04.2011, A. Maeda, CIB-76B, 5 ♂♂ (12.0-18.3 mm), 4 ♀♀ (11.0-14.0 mm); 19.04.2011, A. Maeda, CIB-77B, 4 ♂♂ (11.3-11.8 mm); Entronque Huatabampo-Navojoa (26°50′16.7″ N, 109°29′51.5″ W), rural zone, 01.05.2006, A. Maeda, CIB-28B, 5 ♂♂ (11.3-15.7 mm), 4 ♀♀ (9.9-13.0 mm). Zacatecas: Cerro del Padre, Zacatecas (22°45′22.75″ N, 102°35′31.5″ W), rural zone, 31.05.2003, C. Barron, UAA-C-635 (17), 3 ♀♀ (10.9 mm).

Remarks

Total length of males ranged 7.4-20.5 mm, and females 6.0-20.1 mm, compound eyes with 18-31 ommatidia. A photograph of the habitus in dorsal view of a *Porcellio laevis* specimen from Nuevo León was published by Rodríguez-Almaraz et al. (2014).

Haplotypic identity. Sequences of CO1 gene fragments of *Porcellio laevis* were obtained from a male from the city of Aguascalientes, a female from Carambuche, La Purísima, Baja California Sur, female from El Ranchito, Peñon Blanco, Durango, male and female from Río Nombre de Dios, Durango, male from Canal de Riego XIII, Nuevo San Miguel, Sinaloa, female from Camino de Jitzamuri, Sinaloa, and male and female from Entronque Huatabampo-Navojoa, Sonora. Of the 9 sequences, 8 were identical, thus resulting in 2 haplotypes. The sequences were deposited in GenBank under accession numbers MN689275-MN689283. The genetic distance between them is 3.45%. The genetic distance among the 2 sequences of Mexican specimens and 4 sequences deposited in the GenBank as *Porcellio laevis* from Italy (FN824119, FN824121, FN824122), and Brazil (KJ814239) ranges from 0 to 12.95% (Table 1).

Porcellio scaber Latrielle, 1804
(Fig. 5A-L)

Porcellio scaber Latreille, 1804: 45 (original description).
Porcellio montezumae De Saussure (1857: 307): De Saussure (1858: 64); Dollfus (1896: 46).
Porcellio scaber Latr.: Dollfus (1896: 46).
Porcellio scaber Latreille, 1804: Gandara (1926: 285); Souza-Kury (2000: 245); Jass & Klausmeier (2004: 5, 19-20); Treviño-Flores & Rodríguez-Almaraz (2012: 18); Rodríguez-Almaraz et al. (2014: 282).
Porcellio marginalis Mulaik, 1960: 168: Schmalfuss (2003: 229); Jass & Klausmeier (2004: 5).

Diagnosis. Habitus type runner-clinger not conglobator. Body ovate rather convex, about twice as long as wide. Dorsal side covered with small tubercles (Fig. 5A-D). Color dark gray, sometimes lighter with irregular dark spots, occasionally black with lateral areas light yellow. Cephalothorax about 1.5 times as wide as long, lamina frontalis with posterior margin (linea frontalis) produced in a triangular median lobe and 2 large rounded concave lateral lobes (Fig. 5C). Compound eyes situated at proximal lateral angles of cephalothorax, posterior and close to the rounded lateral lobes, each with 23-27 ommatidia, normally in 4 rows (Fig. 5D). Vertex convex in the middle. First antenna 3-jointed with 10-16 aesthetascs on distal article. Basal article longest and broadest (Fig. 5E). Second antennae extend to pereon-tergite 3, with first article short, second about 1.5 longer than first, third as long as second, fourth about 1.5 times as long as third, fifth about 1.5 to 2.0 times as long as fourth (Fig. 5F). Flagellum 2-jointed, second article up to 1.5 times as first one (Fig. 5G). Maxilliped palp with 3 articles. Mandibles without a palp. Pereon-tergites subequal in length, broadly expanded laterally. Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax up to the base of the large rounded concave lateral lobes (Fig. 5A). Epimera not distinctly separated from the segments. Male pereopod 1 each with brush of long setae on ventral side of carpus and merus (Fig. 5H). The pleon is not narrower than the pereon. Pleon-tergites 1-2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7. Pleon-tergites 3-5 broadly expanded laterally (Fig. 5K, L), lateral margins forming a continuous line with the lateral margins of pereon-tergites. Male copulative

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appendages of pleopods 1 with tips slightly divergent. Pleotelson triangular with rounded tip extending its length beyond the lateral caudal portion of the pleon-tergite 5 (Fig. 5L). Uropod sympodites visible in dorsal view extending about complete length of pleotelson (Fig. 5L) and to the tip of posterior angles of lateral surface of pleon-tergites 5; exopodite lanceolate about same length as uropod sympodite, its total length extends slightly beyond the caudal margin of pleotelson (Fig. 5J-L); endopodite slender cylindrical extends beyond caudal margin of pleotelson and up to half length of exopodite (Fig. 5J, K). Total length 5-10 mm. Sources: Budde-Lund (1885), Richardson (1905), Barnard (1932), Van Name (1936), Green (1961) and Schultz (2018).

Taxonomic summary

Type locality. Latreille (1804) did not mention a specific site, but generally accepted to be autochthonous from western Europe (Leistikow & Wagele, 1999; Schmalfuss, 2003).

Distribution in Mexico. Porcellio scaber has been recorded from Michoacán, Nuevo León, Puebla and Veracruz (Budde-Lund, 1885; Jass & Klausmeier, 2004; Mulaik, 1960; Rodríguez-Almaraz et al., 2014; Treviño-Flores & Rodríguez-Almaraz, 2012). The new state records are Aguascalientes and Coahuila (Fig. 7).

General distribution. Native to Europe, *Porcellio scaber* has been introduced around the world (Schmalfuss, 2003).

Material examined. Aguascalientes: Aguascalientes (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 10.11.1989. J. Moreno, UAA-C-211(12), 3 ♂♂ (7.7-9.8 mm), 3 ♀♀ (8.5-11.0 mm); Los Arquitos (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 01.06.2003, C. Quiñones, UAA-C-646(2), 1 ♂ (13.2 mm). Coahuila: Quinta Cumbres del Chorro, Arteaga (25°22′40.5″ N, 100°47′33.6″ W), rural zone, 11.12.2015, V. O. Vidales, UANL-C517-7872, 1 ♂ (12.9 mm). Nuevo León: Los Tanques, Guadalupe (25°38′53.7″ N, 100°13′10.1″ W), urban zone, 09.05.2009, M. G. Herrera, UANL-C517-7389, 3 ♂♂; Universidad Autónoma de Nuevo León, San Nicolás de los Garza (25°53′25″ N, 100°30′7″ W), urban zone, 19.10.2015. K. Ruiz, UANL-C517-7871, 2 ♂♂.

Remarks

Total length of males ranged 7.7-13.2 mm, and females 8.5-11 mm, compound eyes with 24 ommatidia. A photograph of the habitus in dorsal view of a *P. scaber* specimen from Nuevo León was published by Rodríguez-Almaraz et al. (2014).

Porcellionides pruinosus (Brandt, 1833)
(Fig. 6A-L)

Porcellio pruinosus Brandt, 1833: 19 (original description).
Porcellionides pruinosus (Brandt, 1833): Hatch (1947: 195); Souza-Kury (2000: 245); Jass & Klausmeier (2004: 5); Rodríguez-Almaraz et al. (2014: 283).
Metoponorthus pruinosus (Brandt, 1833): Creaser (1936: 120).
Metoponorthus pruinosus (Brandt, 1893): Mulaik (1960: 174).

Diagnosis. Habitus type runner, not conglobator. Body ovate rather convex, about twice as long as wide, slightly granulated. Color reddish brown with wavy lines of a light yellow on either side of the median line, other parts with lighter reddish-brown color. Cephalothorax about 1.5 times as wide as long (Fig. 6B). Lamina frontalis triangular in the central part with posterior margin (linea frontalis) produced in a slightly convex lobe (Fig. 6B, C) and 2 large rounded concaved lateral lobes. Compound eyes situated at proximal lateral angles of cephalothorax, posterior and close to the rounded lateral lobes, each with about 18 to 24 ommatidia, normally in 4 rows (Fig. 6D). Vertex convex in the middle. First antenna 3-jointed with about 10-14 aesthetascs on distal article. Basal article longest and broadest (Fig. 6E). Second antennae extend to the pereon-tergites 4-5 (Fig. 6A), with first article short, second about 2 times longer than first, third as long as second, fourth about 2 times as long as third, fifth about 1.5 times as long as fourth. Flagellum 2-jointed, first article about 2 times longer than second, complete flagellum about same length of fifth second antenna article (Fig. 6F). Maxilliped palp with 3 articles. Mandibles without a palp. Pereon-tergites subequal in length, lateral parts broadly expanded. Pereon-tergite 1 with proximal-lateral angles produced forward to surround the cephalothorax (Fig. 6A) up to the base of the large rounded concaved lateral lobes. Epimera are not distinctly separated from the segments. Male pereopod 1 each with brush of long setae on ventral side of carpus and merus (Fig. 6G). Pleon abruptly narrower than pereon (Fig. 6K). Pleon-tergites 1 and 2 with lateral parts undeveloped and covered at the sides by pereon-tergite 7. Pleon-tergites 3, 4 and 5 broadly expanded laterally (Fig. 6K). Male copulative appendages of pleopods 1 with tips slightly divergent (Fig. 6I). Pleotelson triangular with rounded tip extends its length beyond the lateral caudal parts of the preceding pleon-tergite 5 (Fig. 6L). Uropod sympodites visible in dorsal view and extend beyond the tip of posterior angles of lateral parts of pleon-tergites 5, and the complete length of pleotelson (Fig. 6L); exopodite lanceolate about 2 times longer as uropod sympodite, its total length almost extends beyond the caudal margin of pleotelson (Fig. 6J); endopodite cylindrical extends beyond caudal margin of pleotelson and up to 0.25 length of exopodites (Fig. 6L). Total length 5-10 mm. Sources: Budde-Lund (1885), Richardson (1905), Barnard (1932), Van Name (1936) and Schultz (2018).

Figure 4. SEM micrographs of adult specimens of *Porcellio laevis*. A, C, D, F, J, N, and O correspond to a male from Colonia Héroes, Aguascalientes. B, E, G, H, I, K, L, and M correspond to a male from Canal de Riego XIII, Nuevo San Miguel, Sinaloa. A, Cephalothorax and pereon-tergites 1-5 in right lateral view (bar = 3 mm); B, cephalothorax and pereon-tergites 1-4 in dorsal view (bar = 3 mm); C, cephalothorax and pereon-tergite 1 in dorsal view showing the lamina frontalis with posterior margin (linea frontalis) produced in a small triangular median lobe and 2 large rounded concaved lateral lobes, the compound eyes situated at proximal lateral sides on the posterior side of the lateral lobes, and 1-3 articles of left second antenna (bar = 1 mm); D, right compound eye in dorsolateral view (bar = 500 µm); E, cephalothorax in anterodorsal view showing the lamina frontalis with posterior margin (linea frontalis) produced in a small triangular median lobe and 2 large rounded concaved lateral lobes, the compound eyes situated at proximal lateral sides on the posterior side of the lateral lobes, and the first antennae (bar = 1 mm); F, cephalothorax in anteroventral view showing the labrum, the first antennae, the first, second and third articles of left second antenna, the linea frontalis and the right lateral lobe with a compound eye (bar = 1 mm); G, cephalothorax in ventral view showing the labrum, the first antennae, the first and second articles of left second antenna, linea frontalis produced in a small triangular median lobe and 2 large rounded concaved lateral lobes (bar = 1 mm); H, right first antenna in anterior view (bar = 200 µm); I, right second antenna with 5 articles and the 2-jointed flagellum in posterior view (bar = 1 mm); J, flagellum of second antenna with 2 joints (bar = 500 µm); K, right pereopod 1 in medial view (bar = 2 mm); L, posterior part of body showing the pleon-tergites 3-5, the uropod sympodites with exopodites and endopodites, and the pleopods 1-5 in ventral view (bar = 2 mm); M, copulative appendages of first pair of pleopoda with tips divergent in ventral view (bar = 1 mm); N, uropod sympodites with exopodites and endopodites in ventral view (bar = 500 µm); O, pleon-tergite 5, triangular pleotelson, and uropod sympodites with exopodites and endopodites in dorsal posterior view (bar = 1 mm).

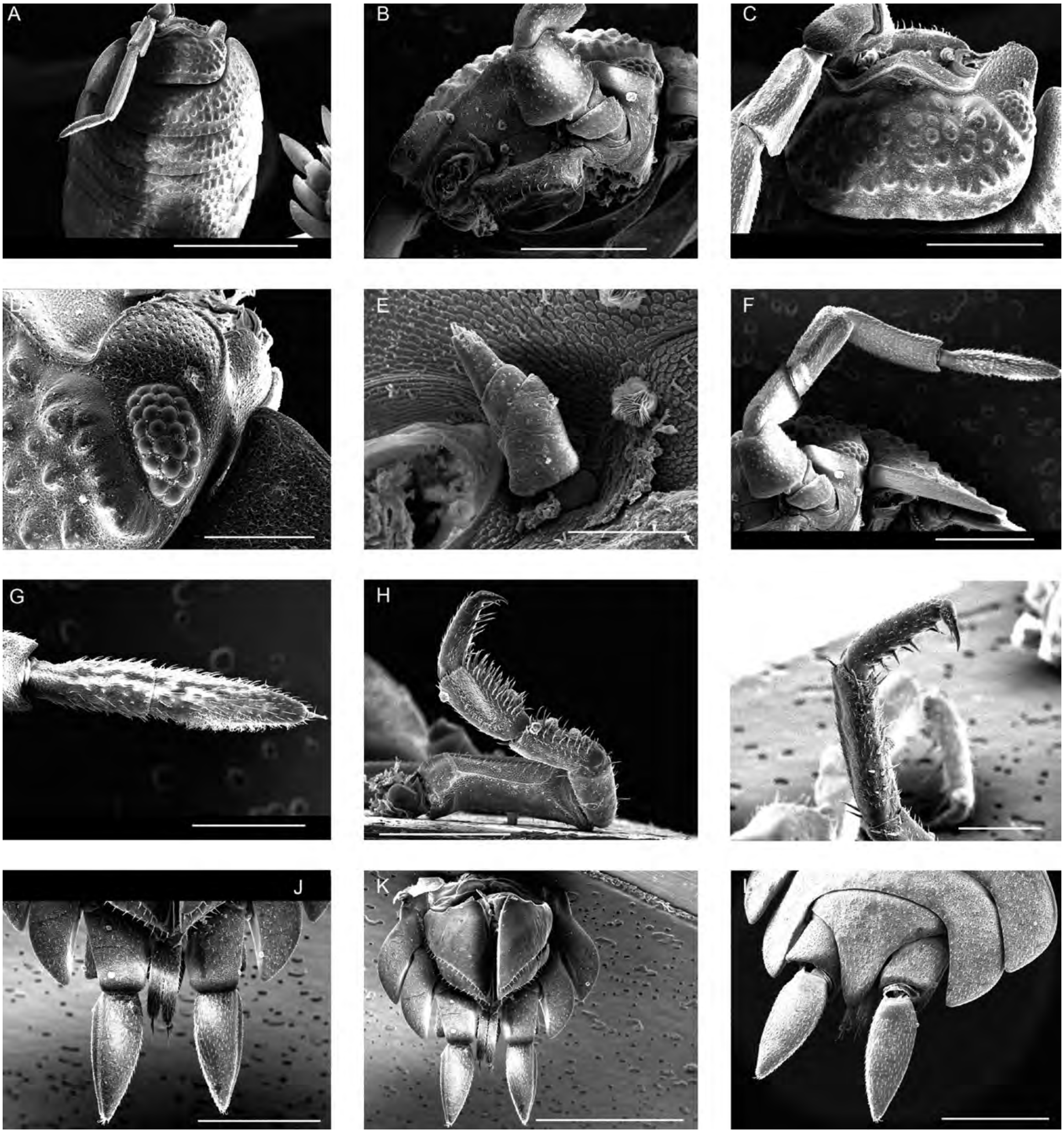

Figure 5. SEM micrographs of an adult male specimen of *Porcellio scaber* from Quinta Cumbres del Chorro, Arteaga, Coahuila, Mexico. A, Cephalothorax and pereon-tergites 1-6 covered with small tubercles in dorsal view (bar = 3 mm); B, cephalothorax in anteroventral view showing the labrum, the right first antenna, the first, second and third articles of left second antenna, the linea frontalis and the lateral lobes with left compound eye, and vertex covered with small tubercles (bar = 1 mm); C, cephalothorax in dorsal view showing the small tubercles, the lamina frontalis with posterior margin (linea frontalis) produced in a small triangular median lobe and 2 large rounded concaved lateral lobes, right compound eye situated at right proximal lateral side on the posterior side of right lateral lobe, and 1-4 articles of left second antenna (bar = 1 mm); D, right side of cephalothorax in dorsal view showing the small tubercles, and the right compound eye situated on the posterior side of right lateral lobe (bar = 500 µm); E, right first antenna in anterior view (bar = 200 µm); F, left second antenna with 5 articles and the 2-jointed flagellum in ventral view (bar = 1 mm); G, flagellum of second antenna with 2 joints (bar = 500 µm); H, right pereopod 1 in medial view (bar = 1 mm); I, right pereopod 7 in lateral view (bar = 500 µm); J, uropod sympodites with exopodites and endopodites in ventral view (bar = 1 mm); K, posterior part of body showing pleon-tergites 4-5, uropod sympodites with exopodites and endopodites, and pleopods 4-5 in ventral view (bar = 2 mm); L, pleon-tergites 4-5, triangular pleotelson, and uropod sympodites with exopodites in dorsal posterior view (bar = 1 mm).

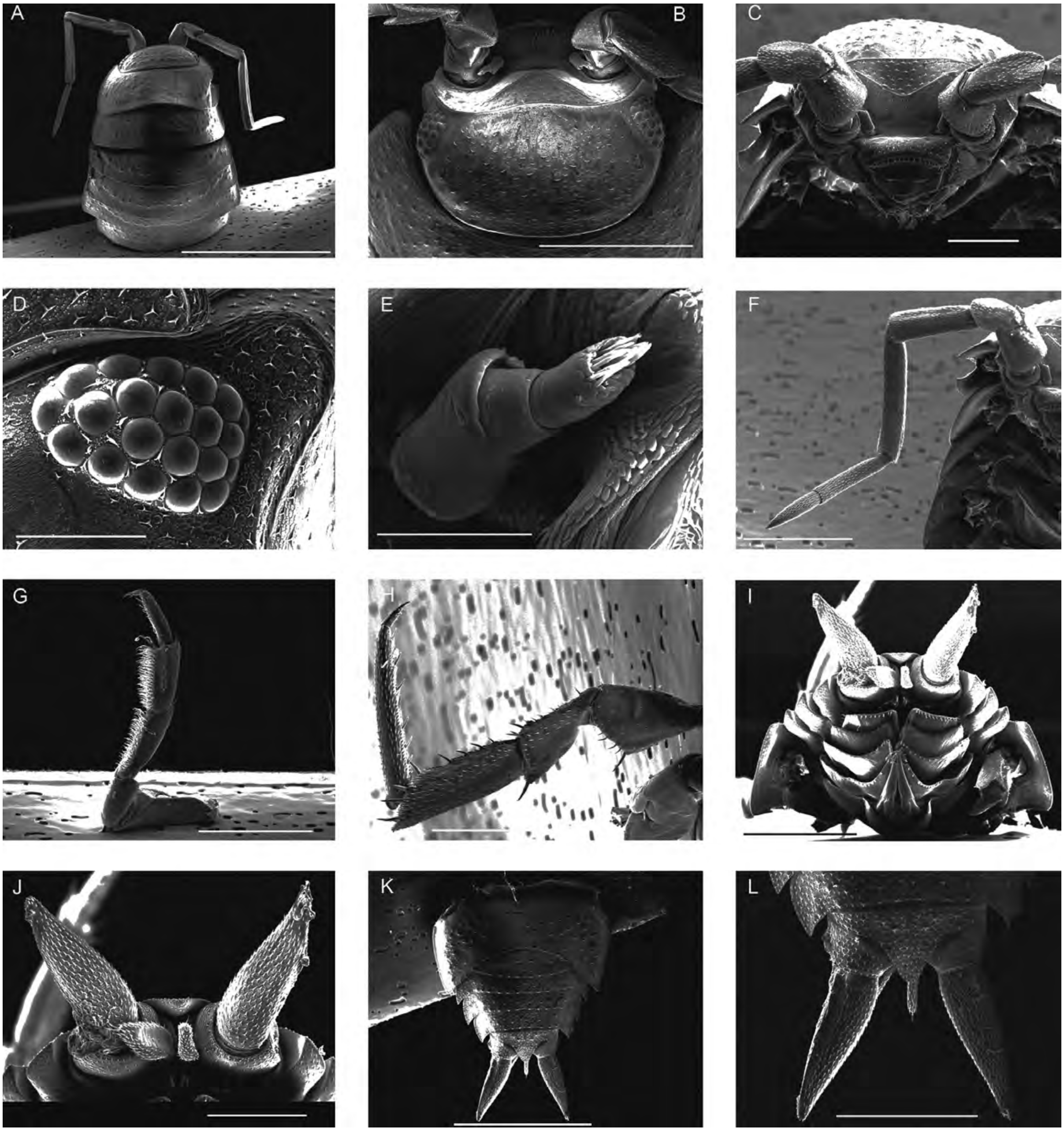

Figure 6. SEM micrographs of adult specimens of *Porcellionides pruinosus* from El Comitán, La Paz, Baja California Sur. A, Cephalothorax, second antennae, and pereon-tergites 1-5 in dorsal view (bar = 3 mm); B, cephalothorax in dorsal view showing the triangular lamina frontalis with posterior margin (linea frontalis) produced in a slightly convex lobe and 2 large rounded concaved lateral lobes, the compound eyes situated at proximal lateral sides of cephalothorax close to the rounded lateral lobes, the first antennae, and basal articles of second antennae (bar = 1 mm); C, cephalothorax in anteroventral view showing the labrum, the first antennae, the first, second and third articles of second antennae, and the triangular lamina frontalis (bar = 500 µm); D, left compound eye in dorsal view (bar = 200 µm); E, left first antenna (bar = 100 µm); F, right second antenna with 5 articles and the 2-jointed flagellum in ventral view (bar = 1 mm); G, right pereopod 1 in medial view (bar = 1 mm); H, right pereopod 7 in lateral view (bar = 1 mm); I, posterior part of body showing pereon-tergite 7, pleon-tergites 3-5, pleotelson, uropod sympodites with exopodites and endopodites, and pleopods 1-5 in ventral view (bar = 1 mm); J, uropod sympodites with exopodites and endopodites in posteroventral view (bar = 500 µm); K, posterior part of body showing pereon-tergite 7, pleon-tergites 1-5, pleotelson, and uropod sympodites with exopodites and one endopodite in dorsal view (bar = 2 mm); L, pleon-tergite 5, triangular pleotelson, and uropod sympodites with exopodites and one endopodite in dorsal view (bar = 1 mm).

Taxonomic summary

Type locality. Germany (Brandt, 1833).

Distribution in Mexico. Porcellionides pruinosus has been recorded from Ciudad de México, Nuevo León, and Yucatán (Jass & Klausmeier, 2004; Rodríguez-Almaraz et al., 2014). The new state records are: Aguascalientes, Baja California, Baja California Sur, Chihuahua, Durango, Jalisco, Sinaloa, Sonora and Tamaulipas (Fig. 7).

General distribution. Native to the Mediterranean region, *Porcellionides pruinosus* has been introduced by man to all parts of the world, thus, it is considered synanthropically cosmopolitan (Leistikow & Wagele, 1999; Schmalfuss, 2003).

Material examined. Aguascalientes: Aguascalientes (21°52′29.45″ N, 102°14′54.66″ W), urban zone, 14.05.2005, B. Torres, UAA-C-187, 2 ♀♀ (13.5-17.8 mm). Baja California: Manantial Km 39.5 carr. Guerrero Negro-Laguna Chapala (28°43′22.22″ N, 114°05′41.17″ W), natural zone, 01.12.2006, A. Maeda, CIB-148B, 1 ♀ (10.9 mm); Arroyo San Fernando (29°58′15.1″ N, 115°14′15.9″ W), natural zone, 12.06.2017, C. Palacios, CIB-113A, 2 ♂♂ (7.4-8.3 mm), 4 ♀♀ (8.7-9.9 mm); 12.06.2017, C. Palacios, CIB-112A, 2 ♂♂ (11.6-13.8 mm), 3 ♀♀ (15.4-17.6 mm); 12.06.2017, C. Palacios, CIB-153B, 1 ♂ (10.1 mm), 2 ♀♀ (9.7-10.0 mm). Baja California Sur: Arroyo La Junta, Sierra La Laguna (23°39′20.82″ N, 110°09′03.79″ W), natural zone, 20.05.2013, A. Maeda, CIB-149B, 5 ♂♂ (8.8-12.5 mm), 5 ♀♀ (10.1-11.8 mm); Centro de Investigaciones Biológicas del Noroeste, El Comitán, La Paz (24°08′19.39″ N, 110°24′27.19″ W), urban zone, 20.10.2012, J. Camacho, CIB-02B, 4 ♂♂ (7.6-10.1 mm), 2 ♀♀ (9.2 mm); 29.01.2004, A. Maeda, CIB-154B, 1 ♂ (8.8 mm), 1 ♀ (12.0 mm); 08.01.2013, A. Maeda, CIB-147B, 5 ♂♂ (10.2-12.4 mm); Las Pocitas-El Pilar (24°28′19″ N, 111°00′09″ W), natural zone, 24.11.2008, A. Maeda, CIB-02A, 1 ♂ (11.0 mm), 1 ♀ (10.8 mm); San Pedro de la Presa (24°50′17″ N, 110°59′41″ W), natural zone, 10.07.2008, C. Palacios, CIB-03A, 3 ♂♂ (6.6-10.1 mm), 5 ♀♀ (11.2-12.7 mm); 10.07.2008, C. Palacios, CIB-13A, 2 ♂♂ (7.4-11.1 mm), 4 ♀♀ (8.6-11.3 mm); Carambuche, La Purísima (26°12′58″ N, 112°01′12″ W), natural zone, 31.12.2006, A. Maeda, CIB-14B, 5 ♂♂ (5.9-8.0 mm), 5 ♀♀ (4.5-7.3 mm); La Purísima (26°11′7.57″ N, 112°04′33.39″ W), natural zone, 08.01.2013, A. Maeda, CIB-38B, 5 ♀♀ (8.3-11.2 mm); El Sauzal (27°10′26.9″ N, 112°52′06.2″ W), natural zone, 13.07.2017, C. Palacios, CIB-110A, 4 ♀♀ (10.0-12.6 mm); San Ignacio (27°17′49.9″ N, 112°52′50.4″ W), natural zone, 13.07.2017, C. Palacios, CIB-111A, 2 ♂♂ (9.8-11.6 mm), 1 ♀ (9.6 mm). Chihuahua: Río Conchos, Camargo (27°34′08.60″ N, 105°25′23.33″ W), natural zone, 09.12.2018, D. Espino, CIB-157B, 2 ♂♂ (8.6-12.0 mm), 6 ♀♀ (4.8-11.7 mm); 09.12.2018, G. Murugan, CIB-158B, 2 ♂♂ (7.9-13.2 mm). Durango: Río Peñón Blanco, Peñón Blanco (24°47′19.10″ N, 104°01′56.83″ W), natural zone, 20.11.2016, I. Segura, UJED-52, 4 ♂♂ (9.8-11.0 mm), 2 ♀♀ (9.6-11.9 mm); Manantial La Concha (24°43′53.76″ N, 104°05′19.22″ W), natural zone,26.12.2016, A. Maeda, CIB-159B, 2 ♂♂ (14.0-14.5 mm), 4 ♀♀ (10.1-11.2 mm); Río Peñón Blanco, El Ranchito (24°55′34.2″ N, 104°04′36.3″ W), natural zone, 04.05.2006, A. Maeda, CIB-146B, 5 ♂♂ (9.6-10.4 mm), 1 ♀ (12.5 mm); Secretaría de Salud y Asistencia, Gómez Palacio (25°35′20.93″ N, 103°29′9.10″ W), urban zone, 14.02.2017, J. Segura, UJED-35, 6 ♂♂ (8.9-10.2 mm), 16 ♀♀ (8.2-12.8 mm). Jalisco: Encarnación de Díaz (21°31′34.65″ N, 102°14′25.14″ W), urban zone, 10.10.1998, J. G. Macías, UAA-C-187, 2 ♀♀ (7.8-9.7 mm). Nuevo León: Laguna del Labrador, Galeana (24°48′54.14″ N, 100°07.8′31″ W), natural zone, 21.03.2011, G. de Jesús, UANL-C517-7401, 1 ♀ (11.6 mm); Carretera Nacional, Santiago (25°26′12.18″ N, 100°09′12.68″ W), urban zone, 22.10.2008, De Borre, UANL-C517-7395, 1 ♀; Guadalupe (25°39′34.10″ N, 100°12′52.84″ W), urban zone, 12.11.2012, G. Gámez, UANL-C517-7402, 1 ♀ (9.8 mm); Río Santa Catarina, Monterrey (25°39′50.55″ N, 100°18′56.21″ W), natural zone, 08.01.1991, R. Castillo, UANL-C517-7392, 2 ♂♂ (7.1-10.0 mm), 2 ♀♀ (10.4 mm); Panteón Las Escobas, Guadalupe (25°40′49.38″ N, 100°09′54.88″ W), urban zone, 09.10.2010, G. J. Montemayor, UANL-C517-7399, 1 ♂ (8.9 mm); Colonia La Fe, San Nicolás de los Garza (25°43′19.10″ N, 100°13′19.39″ W), urban zone, 04.11.1989, Cárdenas, UANL-C517-7391, 6 ♀♀ (8.1-10.00 mm); Lázaro Cárdenas, San Nicolás de los Garza (25°43′55.77″ N, 100°13′12.41″ W), urban zone, 03.06.1982, V. Salas, UANL-C517-7390, 7 ♀♀ (6.3-9.7 mm); Santo Domingo, San Nicolás de los Garza (25°45′10.32″ N, 100°15′12.07″ W), urban zone, 06.01.1991, A. Bertnaud, UANL-C517-7393, 1 ♀; Palmas, Santa Catarina (25°40′42.51″ N, 100°28′05.71″ W), urban zone, 14.03.2011, I. Sánchez, UANL-C517-7400, 1 ♂ (9.1 mm), 1 ♀ (7.7 mm); Del Abedul street, Apodaca (25°45′58.68″ N, 100°14′41.04″ W), urban zone, 20.05.2008, J. Montemayor, UANL-C517-7396, 1 ♀ (9.4 mm); Doctor González (25°51′36.84″ N, 99°56′43″ W), 21.06.1993, R. E. Morales, UANL-C517-7394, 1 ♂ (7.3 mm), 1 ♀ (9.4 mm). Sinaloa: Río Sinaloa, Guasave (25°35′21.91″ N, 108°27′34.71″ W), natural zone, 20.05.2006, A. Maeda, CIB-150B, 4 ♂♂ (10.6-13.1 mm), 4 ♀♀ (7.1-13.1 mm). Sonora: Hotel Armida, Guaymas (27°55′30.64″ N, 110°54′27.38″ W), urban zone, 19.04.2011, A. Maeda, CIB-151B, 4 ♂♂ (9.2-11.6 mm), 2 ♀♀; 19.01.2011, A. Maeda, CIB-152B, 2 ♀♀; Presa Adolfo Ruiz Cortínez (27°13′00.03″ N, 109°05′59.98″ W), natural zone, 21.04.2011, A. Maeda, CIB-79B, 4 ♂♂ (6.5-12.1 mm), 4 ♀♀ (6.5-8.5 mm); Entronque Huatabampo-Navojoa (26°50′16.7″ N, 109°29′51.5″

W), rural zone, 01.05.2006, A. Maeda, CIB-156B, 1 ♂ (15.7 mm). Tamaulipas: Rancho San Carlos, Xicoténcatl (23°00′50.7″ N, 098°55′22.64″ W), rural zone, 30.07.2006, A. Maeda, CIB-155B, 2 ♂♂ (8.0 mm), 1 ♀ (10.0 mm); Río Purificación (24°04′41.8″ N, 99°07′18.5″ W), natural zone, 07.05.2006, A. Maeda, CIB 07B, 1 ♂ (7.8 mm), 1 ♀ (8.2 mm).

Remarks

Total length of males ranged 5.9-15.7 mm, and females 4.5-17.8 mm, compound eyes with 16-27 ommatidia. A photograph of the habitus in dorsal view of a *Porcellionides pruinosus* specimen from Nuevo León was published by Rodríguez-Almaraz et al. (2014).

Haplotypic identity. CO1 sequences of *Porcellionides pruinosus* were obtained from a female from El Comitán, La Paz, Baja California Sur, male and female from Carambuche, La Purísima, Baja California Sur, male from Entronque Huatabampo-Navojoa, Sonora, and a female from Río Purificación, Tamaulipas. Of the 5 sequences 2 haplotypes were found and the sequences were deposited in the GenBank under accession numbers MN689284-MN689288. The genetic distance between them (579 bp) is 0.17%. Genetic distance among the 2 Mexican sequences and 2 sequences deposited in the GenBank as *P. pruinosus* from Australia (KR424606, EU364627) ranges from 0 to 0.35% (Table 1).

Discussion

The presence of exotic oniscideans in Mexico is an old issue. Budde-Lund (1885) considered that the first records of terrestrial isopods for this country, published by De Saussure (1857, 1858) as new species, were the Old World forms *Porcellio laevis* and *P. scaber*. From 1885 to 2014, the number of exotic oniscideans reported from Mexico has increased to 10 species upon the records and revisions published by several authors (Mulaik, 1960; Garthwaite & Sassaman, 1985; Garthwaite et al., 1995; Souza-Kury, 2000; Rodríguez-Almaraz et al., 2014; Treviño-Flores & Rodríguez-Almaraz, 2012). The specimens examined in this study fit well the morphological descriptions and diagnoses of 6 species published by Budde-Lund (1885), Richardson (1902, 1905), Barnard (1932), Van Name (1936), Green (1961), Schultz (1984, 2018) and Karasawa (2012). Molecular identity of 5 of these exotic species found in northern Mexico was examined by studying CO1 from representative specimens. In the case of *P. scaber*, we had no suitable material for DNA analysis. Our *A. lentus* haplotype represents the first CO1 sequence for this species deposited in the GenBank, therefore we were not able to compare its molecular identity. Sequences of 4 species showed 0 to 5% genetic distances with conspecific GenBank sequences from other countries, with exceptions in *P. laevis* haplotypes. The *C. murina* haplotype of this study has a genetic distance less than 1% with haplotypes of the same species from Japan. The *A. vulgare* haplotypes show 1 to 5% distances with haplotypes of the same species from Australia, Brazil, France and Japan, and the *P. pruinosus* haplotypes have a distance from 0 to 0.35% with haplotypes of the same species from Australia. In *P. laevis* the 2 haplotypes from Mexico have 3.45% of genetic difference between them, and they show a distance of 0% with a conspecific sequence from Brazil, and up to 13% with haplotypes from Italy. These high distances suggest that the *P. laevis* sequences included in our analysis could represent more than one species; likely the European nominal *P. laevis* may represent a complex of sibling species. The founder effect of the conventional genetic theory states that founding populations would have lower genetic variability than the source populations (Stepien et al., 2005), and in the case of widespread invasive species, these can remain genetically invariant and very similar between distant populations (Hagenblad et al., 2015). The phylogenetic relationship of all sequences used for the genetic distance analysis with conspecific GenBank sequences (Table 1) was studied through a Bayesian analysis. As expected, the consensus tree generated is congruent with the obtained genetic distances, grouping our haplotypes with their conspecific GenBank haplotypes (Fig. 8). In agreement with recent molecular phylogenetic studies (Dimitriou et al., 2018; Lins et al., 2017; Michel-Salzata & Bouchona, 2000), the phylogenetic tree shows that the taxa belonging to the Porcellionidae (*A. lentus*, *P. laevis*, *P. scaber*, *P. myrmecophilus*, and *P. pruinosus*) form a defined clade, with a close relationship to the Armadillidiidae (*A. vulgare*), and the Armadillidae (*C. murina*) forming a separate clade (Fig. 8).

The publication of Mulaik (1960), considered the most complete revision of the Oniscidea of Mexico (Jass & Klausmeier, 2004; Souza-Kury, 2000), treated the morphological taxonomy of *A. vulgare*, *P. laevis*, *P. scaber* and *P. pruinosus*. Mulaik indicated that these species had a wide distribution in Mexico, mainly in agricultural districts. As Van Name (1936) had suggested, Mulaik (1960) also mentioned that these common Old World anthropophilous species have been established in Mexico since the time of the first arrival of Spanish colonists to this region. In this work, we document the presence of exotic oniscideans in 15 states of northern Mexico, including the first formal records for the states of Aguascalientes, Chihuahua, Durango, and Zacatecas (Fig. 7). From 258 collection lots examined, we determined 1,417 specimens distributed among the 6 exotic species. We confirm that

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A. vulgare, *P. laevis* and *P. pruinosus* are the 3 most widely distributed exotic species in Mexico, and that the northern state with more exotic forms is Nuevo León with the 6 species as reported by Rodríguez-Almaraz et al. (2014), following Aguascalientes, Baja California Sur, and Durango with four species each. *Cubaris murina* appears as a species in expansion, whilst *A. lentus* and *P. scaber* are a poorly known exotic species in northern Mexico (Treviño-Flores & Rodríguez-Almaraz, 2012; this study).

Porcellio laevis (a not conglobator species) is morphologically very similar to other alien species reported in Mexico, *Cylisticus convexus* (an exoantennal conglobator species), which can be differentiated by having the postero-lateral margins of the pereon-tergite 1 with broad posteriorly pointed angles, and pleopods 1-5 with lungs, whilst in *P. laevis* the same margins are bluntly rounded and the lungs are only in pleopods 1-2 (Schultz, 2018). We carried out an additional genetic distance analysis of the *P. laevis* sequences used in the study (2 from Mexico and 4 from GenBank), with 2 sequences of *C. convexus* (GenBank MF744625 and KR013002) and showed more than 19% variation. *Porcellionides floria* is considered an Old World species and an exotic form in the American continent (Garthwaite & Lawson, 1992). Garthwaite and Sassaman (1985) reported this species from southern USA, and from 4 Mexican states, 2 of which (Baja California and Yucatán) are geographically the extreme states of this country. These authors stated that *P. floria* and *P. pruinosus* were reproductively and distributionally distinct, however Garthwaite and Lawson (1992) wrote that "…it is impossible to assign individuals of these 2 taxa definitively to species without fresh specimens…". Schmalfuss (2003) in his catalog of terrestrial isopods remarked that *P. floria* is very probably a synonym of *P. pruinosus*. We suggest that this taxonomic controversy may be solved through the analysis of molecular markers of *P. floria* populations (including its type locality), and compare them with GenBank *P. pruinosus* sequences.

The co-occurrence of several species was registered in several sites. The 3-species assemblage of *A. vulgare*, *P. laevis*, and *P. pruinosus* was recorded in riparian zones of Peñón Blanco, Durango, and San Francisco de Conchos, Chihuahua; the 2-species assemblage *A. vulgare* and *P. laevis* in 8 sites in urban and riparian zones of Aguascalientes, Durango and Guanajuato; *A. vulgare* and *P. pruinosus* in 4 sites in Durango and Jalisco; *P. laevis* and *P. pruinosus* in 5 sites in Baja California, Chihuahua, Sinaloa, and Sonora; and the assemblage of *C. murina* and *P. pruinosus* in one site of Tamaulipas. Species assemblages involving *A. vulgare*, *P. laevis*, and *P. pruinosus* have been widely reported in the USA (Garthwaite & Lawson, 1992; Garthwaite et al., 1985). These species in particular have been reported to form crowd populations, occasionally attacking crops (Hatch, 1947). It is expected that these isopods are already well dispersed in all major cities of Mexico. The metropolitan areas involved in the present study, Aguascalientes, Gómez Palacio, La Paz and Monterrey were recorded with exotic oniscideans only, which may indicate the prevalence of a high degree of biotic homogenization (Vilisics & Hornung, 2009). The null presence of native forms in these Mexican urban areas is intriguing, and can be a sound indication of biodiversity loss of native terrestrial isopods. Degradation or loss of the habitats and competitive exclusion exerted by the exotic on the natives are plausible explanations (Wilcove et al., 1998). Studies on oniscidean assemblages in metropolitan areas of Hungary and Japan have demonstrated that urban environments provide suitable conditions (high diversity of habitat patches) for both native and exotic species, but the latter forms might be a threat to the natives (Nasu et al., 2018; Vilisics & Hornung, 2009). The present work documents the silent successful invasion and colonization of 6 synanthropic alien species in different habitat types in northern Mexico. Although most of the material examined was recorded from urban zones (> 50% of studied sites), the common species *A. vulgare* and *P. laevis* were also found in riparian areas (21% and 31% of sites, respectively), yet *Porcellionides pruinosus* was recorded mainly from riparian areas (60% of 45 lots examined). These findings are different from certain data from Europe, where alien isopods prosper in artificial habitats (e.g. greenhouses, urban parks and houses), but normally do not invade natural areas (Cochard et al., 2010). Besides the human-assisted transportation of these exotic crustaceans through movements of plants, soil and compost (Cochard et al., 2010), we advance the hypothesis that their presence in riparian zones may function as a biological source which promotes their passive (by water currents) and active (by walking on moist substrates) dispersion along the total drainage system of the basins involved, and so eventually the isopods invade new natural, rural and urban zones. Clearly under these conditions, the Mexican native oniscidean species are likely threatened by the invasive exotic species reported in this work.

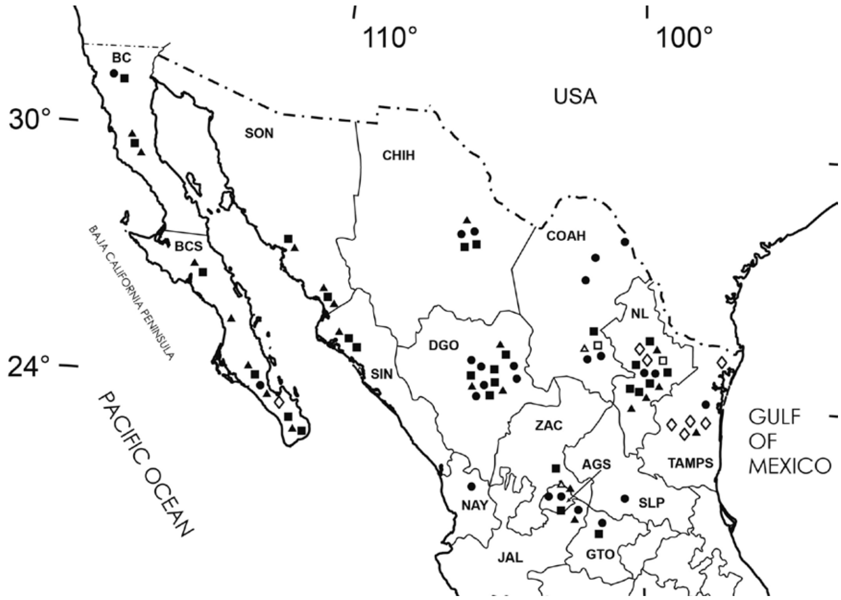

Figure 7. New geographical records of exotic species of Oniscidea in 15 states of northern Mexico: *Cubaris murina* (open rhombuses), *Armadillidium vulgare* (black dots), *Agabiformius lentus* (open squares), *Porcellio laevis* (closed squares), *Porcellio scaber* (open triangles), and *Porcellionides pruinosus* (closed triangles). AGS = Aguascalientes, BC = Baja California, BCS = Baja California Sur, CHIH = Chihuahua, COAH = Coahuila, DGO = Durango, GTO = Guanajuato, JAL = Jalisco, NAY = Nayarit, NL = Nuevo León, SLP = San Luis Potosí, SIN = Sinaloa, SON = Sonora, TAMPS = Tamaulipas, and ZAC = Zacatecas.

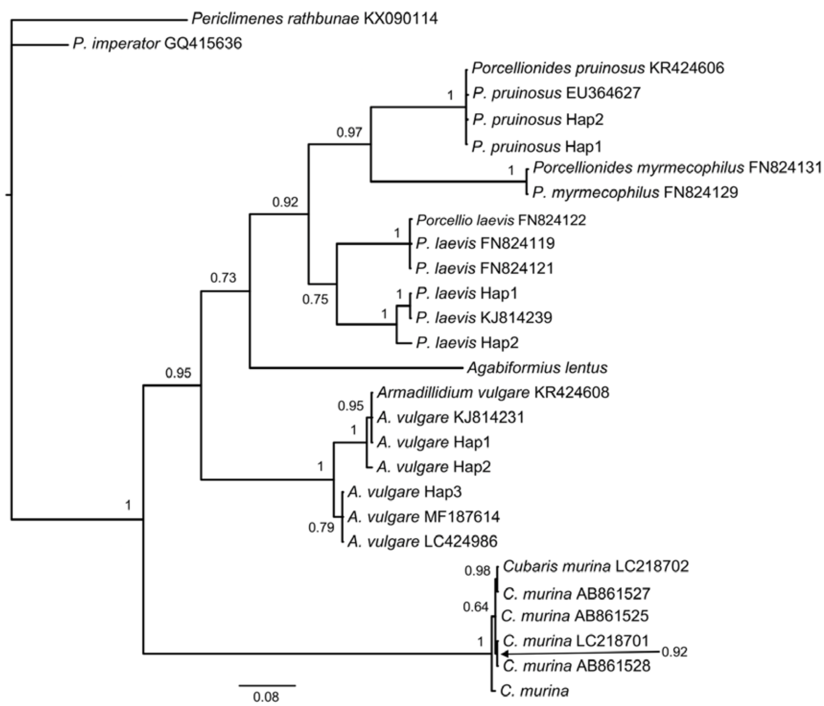

Figure 8. Phylogenetic relationships of exotic terrestrial isopods found in Mexico based on cytochrome oxidase subunit 1. Bayesian phylogenetic tree was generated using TPM1uf+I+G model by running the analysis for 10 million generations; values on the nodes represent posterior probabilities. *Armadillidium vulgare* Hap1: MN689271, *A. vulgare* Hap2: MN689273, *A. vulgare* Hap3: MN689272, *Porcellio laevis* Hap1: MN689276-MN689283, *P. laevis* Hap2: MN689275, *Porcellionides pruinosus* Hap1: MN689284, MN689287 and MN689288, *P. pruinosus* Hap2: MN689285 and MN689286.

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Key to exotic species of Oniscidea from northern Mexico, for adult specimens.

1. Pleotelson and uropods follow same outline margin of pleon-tergites 5 (Figs. 1N, 2N) 2

- Pleotelson and uropods do not follow same outline margin of pleon-tergites 5 (Figs. 3O, 4L, 5K, 6K) 3

2. Lamina frontalis triangular in frontal view. Compound eyes with 18-30 ommatidia. Pereon-tergites 1-2 without lobes on ventral surface. Pleotelson triangular, wider at the base than its posterior truncated margin. Uropod sympodites not visible in dorsal view, exopodites broad filling the space between caudal side of pleon-tergites 5 and lateral sides of pleotelson. Habitus type conglobator. (Armadillidiidae) . . . . *Armadillidium vulgare* (Latreille, 1804) (Fig. 2).

- Lamina frontalis straight and curved dorsally in frontal view. Compound eyes with about 20 ommatidia. Pereon-tergite 1 with a semicircular lobe on ventral surface. Pereon-tergite 2 with a quadrangular lobe on ventral surface. Pleotelson sand-clock shape, wide at the base, becoming constricted about the middle, and then expanding to a truncate caudal margin. Uropod sympodites visible in dorsal view filling the space between the caudal side of pleon-tergites 5 and lateral sides of pleotelson. Habitus type conglobator. (Armadillidae) . . . . *Cubaris murina* Brandt, 1833 (Fig. 1).

3. Compound eyes with 10-12 ommatidia. Second antenna with flagellum second article 2 or 3 times longer than first. The pleon is not narrower than the pereon. Pleotelson triangular with rounded tip extends half its length beyond the lateral caudal parts of pleon-tergites 5. Uropod sympodites visible in dorsal view and attain half the length of pleotelson. Habitus type not conglobator. (Porcellionidae) . . . . *Agabiformius lentus* (Budde-Lund, 1885) (Fig. 3).

- Compound eyes with more than 15 ommatidia 4

4. Pleon abruptly narrower than pereon (Fig. 6K). Flagellum of second antenna with first article about 2 times longer than second. Compound eyes with 18-24 ommatidia. Pleotelson triangular with rounded tip extends its length beyond the lateral caudal parts of pleon-tergites 5. Uropod sympodites visible in dorsal view and extend the complete length of pleotelson. Habitus type not conglobator. (Porcellionidae) . . . . *Porcellionides pruinosus* (Brandt, 1833) (Fig. 6).

- Pleon is not abruptly narrower than pereon (Figs 4L, 5K). Flagellum of second antenna with first article little longer or smaller than second article 5

5. Dorsal side of body minutely granulated. Flagellum of second antenna with first article little longer or same length as second article. Compound eyes with 23-27 ommatidia. Pleotelson triangular extends half its length beyond the lateral caudal parts of pleon-tergites 5. Uropod sympodites visible in dorsal view, extend to the tip of posterior angles of lateral parts of pleon-tergites 5. Habitus type not conglobator. (Porcellionidae) . . . . *Porcellio laevis* Latreille, 1804 (Fig. 4).

- Dorsal side of body covered with tubercles (Fig. 5A-C). Flagellum of second antenna with first article smaller than second article. Compound eyes with 23 to 27 ommatidia. Pleotelson triangular extends its length beyond the lateral caudal parts of the preceding pleon-tergites 5. Uropod sympodites visible in dorsal view extend to the tip of posterior angles of lateral parts of pleon-tergites 5. Habitus type not conglobator. (Porcellionidae) . . . . *Porcellio scaber* Latrielle, 1804 (Fig. 5).

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