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Myrmecological fauna (Hymenoptera: Formicidae) collected with Multilure-type traps in a Neotropical transitional region from northeastern Mexico

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Ants represent the highest diversity of eusocial insects and account for between 15 and 20% of total animal biomass in contemporary terrestrial ecosystems (Fittkau & Klinge 1973; Lach & Hooper-Bùi 2010). In Mexico terrestrial ecosystems, such as tropical deciduous forests, are reservoirs for the greatest diversity of species (Jaramillo et al. 2010). Such tropical ecosystems find their Neotropical limit in northeastern Mexico, particularly in the state of Tamaulipas, which is located in the transition zone between the Neotropical and Nearctic regions in the Americas (Morrone 2014). This transitional zone is located over the Sierra Madre Oriental in the biosphere reserve "El Cielo," characterized by the presence of tropical areas and mountain ecosystems along an altitudinal gradient (Valiente-Banuet et al. 1995).

Multilure traps are used for monitoring fruit fly (Diptera: Tephritidae) populations. These traps consist of 2 removable invaginated cylindrical containers that allow them to be serviced and baited (FAO/IAEA 2003). Ants often comprise a large portion of fly collections as non-targets (Herrera et al. 2015; García-Martínez et al. 2018), which suggests they may be used in diversity surveys for this taxa. The myrmecofauna diversity associated with these traps is unknown in northeastern Mexico. In central Veracruz, Mexico, García-Martínez et al. (2018) demonstrated the effectiveness of this trap baited with Cera Trap® (Bioibérica, Barcelona, Spain), a food attractant for fruit flies, when sampling the diversity of foraging ants in the forest canopy. The study concluded that the incorporation of Cera Trap bait with Multilure traps was an effective method for sampling ants inhabiting the canopy of agroecosystems. We report here on our study regarding the arboreal myrmecofauna associated with Multilure traps baited with a product similar to Cera Trap in a tropical deciduous forest of northeastern Mexico.

The study area was located in the biosphere reserve "El Cielo" in the municipality of Gomez Farias, Tamaulipas, Mexico, between 23.0407°N, 99.0923°W, and 23.0122°N, 99.0859°W, at an altitude range between 250 and 300 masl. The predominant vegetation is medium evergreen forest, characterized by *Bursera simaruba* (L.) Sarg. (Burseraceae), *Brosimum alicastrum* Sw. (Moraceae), *Enterolobium cyclocarpum* (Jacq.) Griseb. (Fabaceae), *Mirandaceltis monica* (Hemsl.) Sharp. (Ulmaceae), *Cedrela odorata* L. (Meliaceae), *Leucaena pulverulenta* (Schltdl.) Benth. (Fabaceae), *Phoebe tampicensis* (Meisn.) Mez. (Lauraceae), *Savia sessiliflora* (Sw.) Willd. (Phyllanthaceae), *Achatocarpus nigricans* Triana (Achatocarpaceae) among others (Valiente-Banuet et al. 1995). The mean temperature in the region is 23 °C with an annual rainfall of approximately 1,600 mm.

Eight Multilure® fruit fly traps (Better World Manufacturing, Inc., Fresno, California, USA) baited with 250 to 300 mL of Strepha Trap® (Productos Biológicos S. A., Barcelona, Spain) were deployed and checked every 7 d from Nov 2016 to Jun 2017 (Fig. 1). Strepha Trap is a food attractant, similar to Cera Trap, used for monitoring *Anastrepha* and *Ceratitis* (Diptera: Tephritidae) fruit flies and that consists of enzymatically hydrolyzed proteins of animal origin (Lasa & Cruz 2014). Traps were placed on trees at least 2 m above the ground. Ant specimens were removed from the mixture and preserved in 70% alcohol, and transported to the Zoology Laboratory of the Instituto de Ecología Aplicada of the Universidad Autónoma de Tamaulipas at Ciudad Victoria, Tamaulipas, Mexico. Specimens were identified using the taxonomic keys of Hölldobler and Wilson (1990), Mackay (1995), Fernández (2002), Fisher and Cover (2007), and Longino and Cox (2009).

A total of 34 ants from 7 species were identified. The subfamily Formicinae was represented by 4 species, followed by Myrmicinae with 2, and Dolichoderinae with only 1 species. Following is a list of ants from species that were recorded.



Fig. 1. Multilure trap baited with 300 mL of Strepha Trap® on a tree in the biosphere reserve "El Cielo."

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AZTECA SCHIMPERI EMERY

Azteca schimperi Emery (Hymenoptera: Formicidae: Dolichoderinae) is reported for the first time in the state of Tamaulipas, Mexico. A total of 4 workers and a queen were collected. Nests of this species are difficult to detect because of its arboreal habit, as documented by Longino (2007), who reported 3 nests of *A. schimperi* on *Cecropia* (Urticaceae) after several yr of sampling in Costa Rica. It forms large nests constructed from gnawed plant material and is reported elsewhere nesting in trees of the genus *Cecropia* (Benson 1985). Visual searches near the location of the traps indicated that their foraging territories were not limited to the host tree, but extended into the surrounding undergrowth. Additional searching detected *A. schimperi* nesting in cavities of broken or rotten branches of mango trees (*Mangifera indica* L.; Anacardiaceae), which are common components of the tropical forest in the region. Workers possess a middle and posterior tibia without an apical spur, mandible with typical thickness at base, concave masticatory edge curved towards an enlarged apical tooth, apical tooth much larger than penultimate tooth, medial clypeal lobe strongly convex and protruding, extending far beyond the lateral clypeal lobes, head with convex sides, and strongly cordate posterior margin (Longino 2007).

CAMPONOTUS STRIATUS (SMITH)

Two *Camponotus striatus* (Smith) (Hymenoptera: Formicidae: Formicinae) workers and 1 major were recorded in *Acacia sphaerocephala* Schltdl. & Cham. (Fabaceae) and *Coffea arabica* L. (Rubiaceae) (Wheeler 1934; Gillette et al. 2015). Workers possess a very depressed metanotal suture, a strong, dotted, and opaque sculpture on the sides of the head, and the sides of the pronotum are finely sculptured with smooth sections (Mackay & Mackay 2018).

CAMPONOTUS ATRICEPS (SMITH)

Four worker minors and 1 major of *Camponotus atriceps* (Smith) (Hymenoptera: Formicidae: Formicinae) were detected. This is a synanthropic species often observed nesting on trunks in coffee farms (De la Mora et al. 2015). It is a reddish-brown to black ant with lighter legs and coxae, abundant but distinctly flexible setae of anterior projection on its mesosomal dorsum, medium to large eyes with more than 6 facets, the propodeum and petiole node lack a pair of short teeth (Sarnat 2012).

COLOBOPSIS ETIOLATA (WHEELER)

Four *Colobopsis etiolata* (Wheeler) (Hymenoptera: Formicidae: Formicinae) workers and a major were recorded. This species was reported previously from nests on *Quercus virginiana* Mill. (Fagaceae). Soldiers of this species use their heads to occlude the entrance of the nest. Individuals are pale-colored and possess sharp edges along the truncated surface of the subcylindrical head. Frontal carinae are widely separated, clearly converging to the front, curved antennal scapes, thin at the base, increasing in width towards the tip. Uniformly profiled and gently arched top chest with rounded pronotum, barely wider than long (Bolton et al. 2007).

CAMPONOTUS MINA FOREL

A minor and major of *Camponotus mina* Forel (Hymenoptera: Formicidae: Formicinae) were recorded. This ant usually nests in mesquite bushes (*Prosopis glandulosa* Torr.; Fabaceae). It features abundant erect setae on most surfaces, almost all of them with blunt tips, some are almost spatulate, covering the head. An appressed pubescence is scarce, and the anterior edge of the clypeus is concave. This ant is black with reddish-brown mandibles, brown antennae, and tibiae (Mackay & Mackay 2002).

PHEIDOLE PUNCTATISSIMA MAYR

Six minors and 1 major of *Pheidole punctatissima* Mayr (Hymenoptera: Formicidae: Myrmicinae) were identified from traps. This species is found often in disturbed areas, nesting in rotten branches, and under the bark of trees (Longino & Cox 2009). It is a species relatively easy to identify; two-thirds of the head capsule in majors areyellowish-white in color, which contrasts sharply with the medium brown to dark brown color of the rest of the body. In the workers, all parts of the body except the second and successive segments of the gaster are foveolate and opaque (Wilson 2003).

MONOMORIUM EBENINUM FOREL

Six *Monomorium ebeninum* Forel (Hymenoptera: Formicidae: Myrmicinae) workers were collected. Large colonies of this species often nest on dead branches, under stones, and in the cavities of plants. Workers possess sloping and basal faces of the propodeum of approximately the same length. Also, the mesopleuron in workers is smooth and bright (DuBois 1986).

Based on the recorded species, Multilure traps baited with Strepha Trap attractant may represent a useful tool for ant sampling. This sampling method could have some future advantages for improving ant inventories in Mexico and the world. The lure seems to be attractive to *Azteca* ants with arboreal habits, which was reported for the first time in Tamaulipas. The number of species reported in this study contrasts with that reported by García-Martínez et al. (2018), who recorded 3,626 ant workers and 54 species by using fruit fly monitoring methods in different habitats. They highlighted the use of the lure Cera Trap as a highly effective alternative for ant sampling.

In summary, the limit of the Neotropical region in northeastern Mexico as a refuge for several species of Formicidae are currently unknown. As such, synthetic lures for monitoring tephritids result in an interesting approach to document the diversity of arboreal ants in a transitional zone between the Neotropical and Nearctic regions. Moreover, further research is suggested to assess the role of this zone for the conservation of ant diversity and the transitional ecological processes involving this insect group.

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Summary

We found Multilure traps baited with Strepha Trap® to be a useful method for sampling arboreal ants. A total of 7 ant species (Hymenoptera: Formicidae) were recorded from 8 Multilure traps associated with tree canopies in a Neotropical transition region in northeastern Mexico. The genus *Azteca* and the species *A. schimperi* Emery are reported for the first time in the state of Tamaulipas, Mexico. This finding represents the northernmost distribution of these species in the Americas.

Key Words: *Azteca*; ants; distribution; sampling; StephaTrap; Tamaulipas

Resumen

Las hormigas representan uno de los grupos de insectos eusociales mas diversos. Este estudio reporta siete especies de hormigas (Hymenoptera: Formicidae) asociadas al trampeo Multilure para moscas de la fruta en una región de transición neotropical en el noreste de México.

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El género *Azteca* Forel y la especie *A. schimperi* Emery se reportan por primera vez en el estado de Tamaulipas, México. Esto representa la distribución más septentrional de esta especie en el continente americano. Las trampas Multilure® cebadas con Strepha Trap® son un método útil para el muestreo de hormigas arbóreas.

Palabras Clave: *Azteca*; hormigas; distribución; muestreo; Stepha-Trap; Tamaulipas

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