N O T E

Four New Occurrences of Fungus-Growing Ants (Hymenoptera: Formicidae) in Agroecosystems of Tamaulipas State in Northeastern Mexico[1]

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Ants (Hymenoptera: Formicidae) play crucial roles in plant pollination, soil bioturbation, and pest control as biological control agents in agroecosystems (Diamé et al. 2017, Sustainability 10: 23). Moreover, ecological complexity in such habitats contributes to the availability of resources such as food or shelter for diverse species (De La Mora et al. 2015, Agr. Ecosyst. Environ. 201: 83–91). Specifically, Attine ants (e.g., fungus-growing ants) may aid in nutrient cycling in ecosystems by provisioning plant material, insect frass, and arthropod remains (Ronque et al. 2019, Insectes Sociaux 66: 1–13).

Attine agricultural activities are classified into five systems: lower agriculture, coral-fungus agriculture, yeast agriculture, higher agriculture, and leaf-cutting agriculture (Schultz et al. 2015, Amer. Nat. 185: 693–703). Currently, about 245 species of fungus-growing ants are described from the United States to Argentina (Fernández and Sendoya 2004, Biota Colomb. 5: 3–93), of which 51 species are reported in Mexico and with 11 of those species from Tamaulipas state (Coronado Blanco et al. 2013, CienciaUAT 7: 12–17; Vásquez-Bolaños 2015, Métodos en Ecología y Sistemática 10: 1–53). Herein, we report previously unreported occurrences of four fungus-growing ant species associated with agroecosystems in northeastern Mexico.

Ant specimens were obtained by sampling in a mixed orchard of mango and an agroforestry crop of the palm *Chamaedorea radicalis* Mart during October and November 2018 at the end of the rainy season in the municipality of Gómez Farías Tamaulipas, Mexico (Sánchez-Santillán 2018, Cuad. Geogr. Rev. Colomb. Geogr. 27:146–163). Sampling methods included hand collection, Winkler sacks for leaf

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litter collection, and pitfall traps. Ant species were identified using the taxonomic keys of Lattke (1997, Arq. Zool. [São Paulo] 34: 121–221), Mayhé-Nunes and Brandão (2002, Sociobiology 40: 667–698), Rabeling et al. (2007, Zootaxa 1664: 1–53), Snelling and Longino (1992, Revisionary notes on the fungus-growing ants of the genus *Cyphomyrmex*, *rimosus* group (Hymenoptera: Formicidae: Attini), Oxford Univ. Press, Oxford, 692 pp.), and Sosa-Calvo et al. (2019, Syst. Entomol. 44: 139–162), and data on the geographical distribution of the identified species were based on AntWeb (2019, https: //www.antweb.org.; 10 June 2019), Guénard et al. (2017, Myrmecol. News 24: 83–89), Ríos-Casanova (2013, Rev. Mex. Biodivers. Supl. 85: S392–S398), and Vásquez-Bolaños (2015, Métodos en Ecología y Sistemática 10: 1–53). Representative specimens were deposited in the entomological collection of the Instituto de Ecología Aplicada of the Universidad Autónoma de Tamaulipas.

The described sampling and identification of ant specimens yielded four species of Attine ants that had not been previously reported from Tamaulipas state in northeastern Mexico.

Apterostigma mexicanum Lattke, 1997

MEXICO, Tamaulipas, Gómez Farías. N 23°04′42′′, W 99°09′41′′, 298 m above sea level (masl), 11 Octob, 2018, mixed orchard of mango and citrus surrounded by native tropical vegetation, two workers collected by hand using forceps. M. Médina and M. Rosas. This species is only known from Mexico in the states of San Luis Potosí, Veracruz, and Queretaro (Guénard et al. 2017; Vásquez-Bolaños 2015). This finding represents the first occurrence in Tamaulipas state and the most northern report of its distribution (Lattke 1997, Arq. Zool. 34: 121–221).

Cyphomyrmex minutus Mayr, 1862

MEXICO, Tamaulipas, Gómez Farías. N 23°4′42′′, W 99°9′41′′, 297 masl, 11 October 2018, agroforestry crop of *Chamaedorea radicalis* surrounded by native tropical vegetation, four workers obtained from leaf litter using Winkler sacks. M. Médina and M. Rosas. This species is documented from Brazil, Bolivia, Peru, Venezuela, Colombia, Panama, Costa Rica, Honduras, Guatemala, Mexico, and the United States (AntWeb 2019). In Mexico, *C. minutus* was reported from Quintana Roo, Campeche, and Veracruz (Vásquez-Bolaños 2015); thus, this record expands its distribution further north.

Myrmicocrypta dilacerata (Forel, 1885)

MEXICO, Tamaulipas, Gómez Farías. N 23°1′6′′, W 99°9′23′′, 248 masl, November 29, 2018, agroforestry crop of *C. radicalis* surrounded by native tropical vegetation, three workers collected from leaf litter using Winkler sacks. M. Médina and M. Rosas. This species is known from Panama, Costa Rica, Nicaragua, Honduras, and Belize. In Mexico, it is reported from the states of Hidalgo, Tabasco, and Veracruz (Guénard et al. 2017). This report from Tamaulipas represents the most northern record in the Neotropics (Vásquez-Bolaños 2015).

Trachymyrmex opulentus (Mann, 1922)

MEXICO, Tamaulipas, Gómez Farías. N 23°04′42′′, W 99°09′41′′, 298 masl, October 11, 2018, a mixed orchard of mango and citrus surrounded by native tropical vegetation, two workers were collected using a pitfall trap. M. Médina and M. Rosas. It is recorded from Venezuela, Colombia, Panama, Costa Rica, Honduras, and Guatemala. In Mexico, it is reported from the states of Chiapas, Oaxaca, and Veracruz (AntWeb 2019; Vásquez-Bolaños 2015). This collection is the most northern report in the Neotropics.

Conclusion. This study reports four of five fungus-farming ant agriculture: lower fungus farmers (*Myrmicocrypta*), coral fungus farmers (*Apterostigma*), yeast farmers, and higher fungus farmers (*Trachymyrmex*) (Schultz et al. 2015). Attine ants may exhibit a seasonal variation regarding the selected biological material for fungus-growing (Ronque et al. 2019). Such seasonality is provided by arthropod diversity, phenological stages of plants, and fruit availability in the agroecosystems. This study contributes to the knowledge of Neotropical distribution of fungus-growing ant species as well as providing data of associated agroecosystems in northeastern Mexico.