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NOTES ON GEOGRAPHIC DISTRIBUTION

New geographic distribution records of *Liometopum apiculatum* Mayr, 1870 (Hymenoptera, Formicidae) in central northern Mexico

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Abstract. The geographic distribution of *Liometopum apiculatum* Mayr, 1870 is expanded and updated, based on specimens collected in the regions of the Mexican Plateau, Sierra Madre Oriental, and Sierra Madre Occidental. Ten new records include the first municipal occurrences for the states of Zacatecas (Guadalupe, Sombrerete, Valparaíso, and Zacatecas) and San Luis Potosí (Mexquitic de Carmona), and additional locality records for Nuevo León (Galeana and Iturbide) and Coahuila (Saltillo).

Key words. Dolichoderinae, edible insect, escamolera ant, geographic range update, Nearctic region, Tapinomini, taxonomy

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Introduction

The genus *Liometopum* Mayr, 1861 belongs to the tribe Tapinomini and comprises 21 extinct and seven extant species. Of the living species, four have a Holarctic distribution (Del Toro et al. 2009; Ward et al. 2010; Hoey-Chamberlain et al. 2013; Bolton 2025), while three are restricted to the Nearctic region: *Liometopum luctuosum* Wheeler, 1905, *Liometopum occidentale* Emery, 1895 and the widest distributed, *Liometopum apiculatum* Mayr, 1870 (Del Toro et al. 2009). *Liometopum apiculatum* is distributed in Arizona, Arkansas, California Colorado, New Mexico, and Texas, USA (Emery 1895; Wheeler 1905; Wheeler 1917; Wheeler and Bailey 1920; Smith 1936; Cole 1937; Browne and Gregg 1969; Hunt and Snelling 1975;Van Pelt 1983; Cokendolpher and Francke 1990; MacKay 1993; Andersen 1997; O'Keefe et al. 2000; Reddell and Cokendolpher 2001; MacKay and Mackay 2002; Del Toro et al. 2009; Guénard et al. 2017). According to Guénard et al. (2017), the specific identification of a record from Fresno, California needs to be reviewed, but a record from Los Angeles makes the presence of the species in that region plausible. In Mexico it is distributed across 25 states, from the north from Baja California and Tamaulipas to Quintana Roo (Wheeler 1905; Wheeler 1917; Navarrete et al. 2007; Ramos-Elorduy et al. 2007; Del Toro et al. 2009; Alatorre-Bracamontes and Vásquez-Bolaños 2010; Vásquez-Bolaños 2011; Dubovikoff et al. 2012; Cruz-Labana et al. 2014; Escalante-Jiménez and Vásquez-Bolaños 2015; Vásquez-Bolaños 2015; Lara-Juárez et al. 2016; Dubovikoff et al. 2017; Guénard et al. 2017; Dattilo et al. 2020; Berumen-Jiménez et al. 2021). Furthermore, *L. apiculatum* distribution extends to Central America, specifically in Guatemala (Guénard et al. 2017). The economic importance of this ant as an edible insect in central Mexico has been reported with the larvae of the reproductive caste being the stage of the life cycle traditionally consumed as food (Ramos-Elorduy et al. 2006; Lara-Juárez et al. 2015; Figueroa-Sandoval et al. 2018; Ángeles-Tovar et al. 2021; Berumen-Jiménez et al. 2021).

The species interacts with different types of organisms. It builds nests at the base of various plant species, such as oaks, pines, agaves, cacti, and other tree species. It also feeds on the waste of other ants, including *Pogonomyrmex barbatus* Smith, 1858, *Camponotus sayi* Emery, 1893, and *Solenopsis xyloni*

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McCook, 1879. However, its main source of energy is the honeydew exuded by various species of the Hemiptera group, such as *Saissetia oleae* (Olivier, 1791), *Anoecia cornicola* (Walsh, 1863), *Dysmicoccus brevipes* (Cockerell, 1893), *Crassicoccus* sp., and *Eriococcus* sp. (Velasco 2007; Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015; Berumen-Jimenez et al. 2021). *Liometopum apiculatum* inhabits a wide range of climates, soils, and altitudes (30–2900 m), from tropical and temperate forests to semi-desert environments, which explains its broad distribution and ecological plasticity across diverse habitats (Schowalter 2022).

Despite its ecological, nutritional and economic importance (Dubovikoff et al. 2012; Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015; Berumen-Jiménez et al. 2021), knowledge about the species remains limited, particularly regarding its distribution. Ecological niche models (Berumen-Jiménez et al. 2021) suggest that central northern Mexico is a promising area to investigate, as it encompasses temperate regions of the Sierra Madre Occidental and Oriental as well as semi-desert zones of the Mexican Plateau, all within recognized biogeographic provinces (Morrone 2019). Therefore, to help fill this knowledge gap, we document new municipal records for *L. apiculatum* in the states of San Luis Potosí and Zacatecas, as well as new locality records for Coahuila and Nuevo León; the new records are situated within the biogeographic regions of the Sierra Madre Oriental, Sierra Madre Occidental, and the Mexican Plateau.

Methods

During 2022 and 2023 we manually collected ant specimens from vegetation preferred as nesting sites by *Liometopum apiculatum* (Berumen-Jiménez et al. 2021). Specifically, this vegetation includes species of the genera *Quercus* L., *Agave* L., *Pinus* L., *Yucca* L., *Prosopis* L., and *Cylindropuntia* (Engelm.) F.M. Knuth.

We sampled once per locality, with each session lasting 4 h and preferably done before midday (08:00–12:00 A.M.) when *L. apiculatum* exhibits its highest foraging activity (Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015). At each locality, we sampled a single exploratory transect (approximately 300 m to 1 km long) in regions without previous records. The transect's width was approximately 1 m, with occasional deviations toward potential nesting or foraging areas detected along the route. Our searches focused on vegetation (mainly tree trunks and the bases of cacti) where the species was nesting, encompassing both open and closed vegetation areas. From each locality, 10 worker specimens were manually collected and preserved in 80% ethanol. The absence of a sting in the ant facilitated hand collection, which is more selective and less invasive. Although only female workers ♀ (W) were sampled, they allowed reliable species identification and were the only caste encountered during the study period.

Specimen identification was performed using identification keys and redescriptions of the species (Mackay and Mackay 2002; Fernández 2003; Del Toro et al. 2009) and confirmed through the original species description (Mayr 1870) and comparison with type specimens photographs available in the AntWeb.org (2025) (type: CASENT0915550 and syntype: CASENT09089). Voucher specimens were deposited in the Entomological Collection of the Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional, Instituto Politécnico Nacional, Unidad Durango, Mexico. A single collection code (CECD-HYM: Colección Entomológica CIIDIR Durango, Hymenoptera) was assigned to all specimens for each locality.

Our specimens were dry-mounted and examined directly under a stereomicroscope (Luxeo 4D digital microscope LM-4145000) at 1.5× and 2× magnification, using a reference scale for calibration. Photographs were taken for documentation and figure preparation. Morphological measurements were taken using LABOMED Pixel Pro v. 2.8 software, and figures were prepared using Adobe Illustrator v. 26.3.1. Final photographs have a resolution of 300 dpi. The geographic distribution of *L. apiculatum* was updated using occurrence records from research reports, published articles (Emery 1895; Wheeler 1905; Wheeler 1917; Wheeler and Bailey 1920; Smith 1936; Cole 1937; Browne and Gregg 1969; Hunt and Snelling 1975; Van Pelt 1983; Cokendolpher and Francke 1990; MacKay 1993; Andersen 1997; O'Keefe et al. 2000; Reddell and Cokendolpher 2001; MacKay and MacKay 2002; Navarrete et al. 2007; Ramos-Elorduy et al. 2007; Del Toro et al. 2009; Alatorre-Bracamontes and Vásquez-Bolaños 2010; Vásquez-Bolaños 2011; Dubovikoff et al. 2012; Cruz-Labana et al. 2014; Escalante-Jiménez and Vásquez-Bolaños 2015; Vásquez-Bolaños 2015; Lara-Juárez et al. 2016; Dubovikoff et al. 2017; Guénard et al. 2017; Dáttilo et al. 2020; Berumen-Jiménez et al. 2021), and the databases GABI (The Global Ant Biodiversity Informatics) (Guénard et al. 2017), AntWeb (2024), and GBIF (Global Biodiversity Information Facility) (2024). For GBIF and AntWeb, only records supported by collection numbers and verifiable specimens were retained. For GABI, reliance was placed on the curation and reliability of the

database, which is widely used and maintained by experts, although direct verification of vouchers was not always possible. The compiled data, together with newly obtained records, were used to generate geographic distribution maps in ESRI ArcGIS Desktop v. 10.8.2 (ESRI 2011).

We created an updated distribution map of *L. apiculatum* using the World Imagerybasemap (ESRI 2024), displaying country boundaries and new records. Both maps are vector-based, with the graphic scale presented in kilometers, and the final figures were exported at 300 dpi resolution.

All occurrence and specimen data supporting this study are deposited in the Global Biodiversity Information Facility (https://doi.org/10.15468/gcykms).

Results

***Liometopum apiculatum* Mayr, 1870**

New records. MÉXICO — **Coahuila** • Saltillo, Rancho Miguel Velásquez; 25.1553, –100.5826; 2268 m alt.; 16.IX.2023; M. Berumen-Jiménez, N. Acuña-Quiñones, D. Ochoa-Vázquez; hand collected; 10 ♀(W), CECD-HYM-1525-1534, dry preserved — **Nuevo León** • Galeana, Carretera Matehuala-Linares; 24.6760, –100.1510; 2117 m alt.; 27.IX.2024; M. Berumen-Jiménez and N. Acuña-Quiñones; hand collected; 10 ♀(W), CECD-HYM-1535-1544, dry preserved • Iturbide, Carretera Matehuala-Linares; 24.7500, –99.9550; 1173 m alt.; 26.IX.2024; M. Berumen-Jiménez and N. Acuña-Quiñones; hand collected; 10 ♀(W), CECD-HYM-1545-1554, dry preserved — **San Luis Potosí** • Mexquitic de Carmona, Milpillas; 22.2544, –101.1286; 2042 m alt.; 09.XI.2024; R. Rosas-Valdez; hand collected; 10 ♀(W), CECD-HYM-1555-1564, dry preserved — **Zacatecas** • Zacatecas, Cerro de la Bufa; 22.4632, –102.3246; 2600 m alt.; 01.II.2023; M. Berumen-Jiménez; hand collected; 10 ♀(W), CECD-HYM-1565-1574, dry preserved

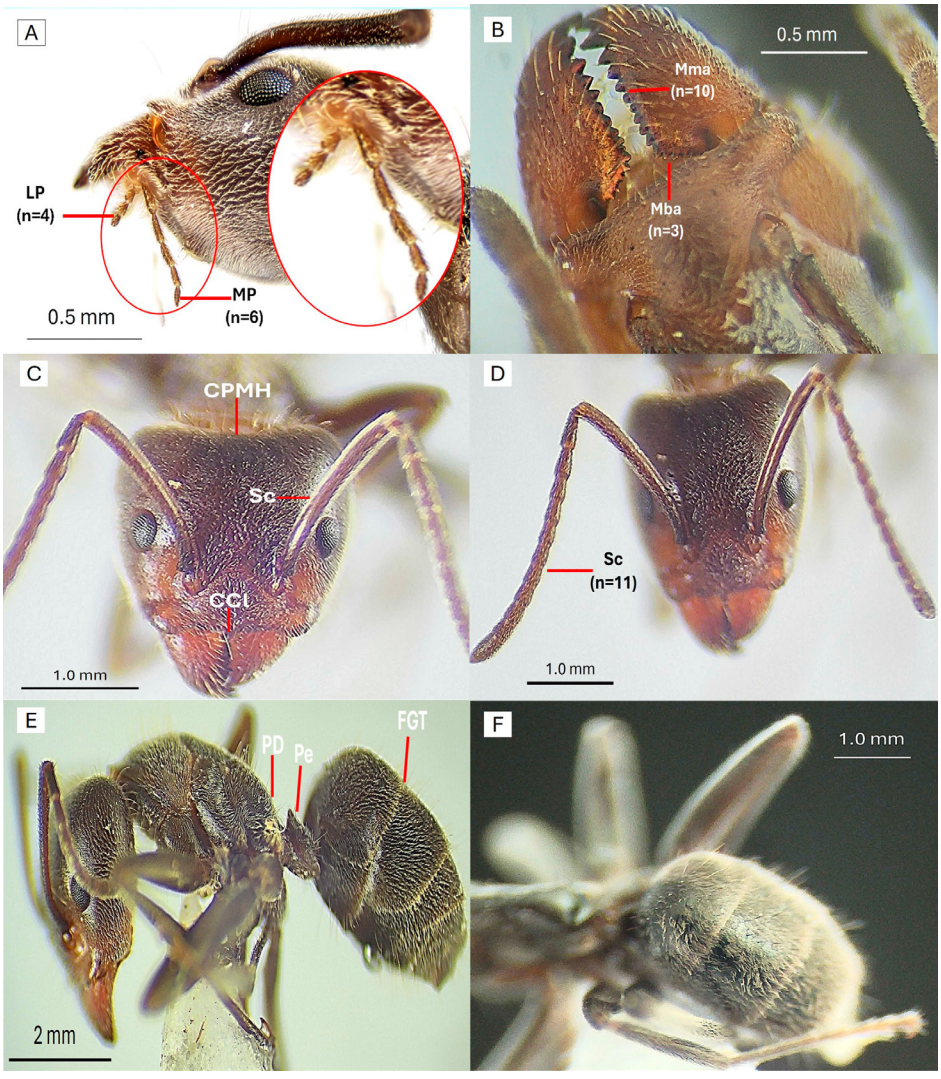

Figure 1. Worker of *Liometopum apiculatum* (CECD-HYM-1565; CECD--HYM-1605; CECD-HYM-1621; CECD--HYM-1585) collected at Cerro de la Bufa, Sombrerete, Valparaiso and Panzacola, Zacatecas, Mexico. **A.** Part of head in lateral view (maxillary palp) (*n* =10 and *n* =3 number of palp segments). **B.** Mandible in anterior view (*n* =10 and *n* =3 teeth). **C.** Full face view. **D.** Antenna (*n* =11 segments). **E.** Body lateral view. **F.** Gaster. CPHM: Concavity at the posterior margin of the head. CCl: Concavity at anterior clypeal. Sc: Scape. Mma: Masticatory margin. Mba: Basal margin. LP: Labial palp, MP: Maxillary palp. PD: Propodeal decline. Pe: Petiole. FGT: First gastral tergite. Photograph (E) by Daniel Ochoa-Vásquez.

• Zacatecas, Cerro de la Virgen; 22.4409, –102.3342; 2690 m alt.; 04.II.2023; M. Berumen-Jiménez and R. Rosas-Valdez; hand collected; 10 ♀(W), CECD-HYM-1575-1584, dry preserved • Zacatecas, Panzacola; 22.3960, –102.2650; 2280 m alt.; 10.III.2023; M. Berumen-Jiménez and Daniel Ochoa-Vázquez; hand collected; 10 ♀(W), CECD-HYM-1585-1594, dry preserved • Zacatecas, Ecoparque Centenario; 22.7769, –102.5461; 2420 m alt.; 07.X.2023; M. Berumen-Jiménez; hand collected; 10 ♀(W), CECD-HYM-1595-1604, dry preserved • Zacatecas, Sombrerete, Carretera Zacatecas-Durango; 23.7408, –103.7925; 2348 m alt.; 10.IV.2023; M. Berumen-Jiménez and Daniel Ochoa-Vázquez; hand collected; 10 ♀(W), CECD-HYM-1605-1614, dry preserved • Valparaiso, La Campana; 23.0115, –103.3128; 2272 m alt.; 19.II.2023; M. Berumen-Jiménez and Daniel Ochoa-Vázquez; hand collected; 10 ♀(W), CECD-HYM-1615-1624, dry preserved.

Identification. All the diagnostic and differential features among Nearctic species of *Liometopum* are according to Mackay and Mackay (2002), Fernández (2003) and Del Toro et al. (2009). The specimens were identified as *Liometopum* based on the following characteristics, illustrated in Figure 1: coloration dark brown. Maxillary palp with six segments, and labial palp with four segments (Figure 1A), 7–10 teeth at the masticatory margin of the mandible and 3–5 teeth at the basal margin (Figure 1B). Slight

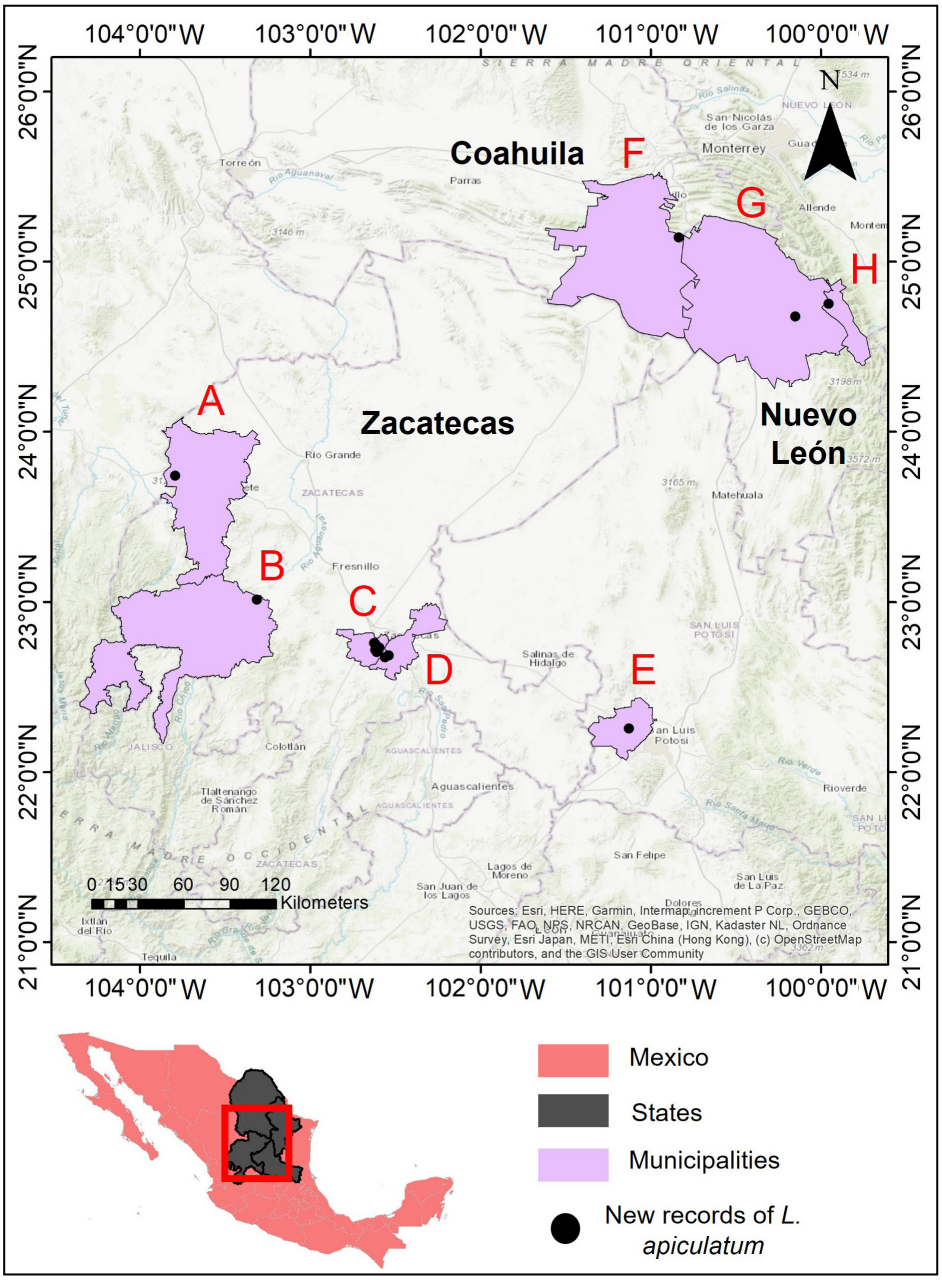

Figure 2. New records of *L. apiculatum* in the states of Coahuila, Nuevo León and Zacatecas. Municipalities, **A.** Sombrerete. **B.** Valparaíso. **C.** Zacatecas. **D.** Guadalupe (Zacatecas). **E.** Mexquitic de Carmona (San Luis Potosí). F: Saltillo (Coahuila). **G.** Galena. **H.** Iturbide (Nuevo León).

concavity at the anterior clypeal edge without teeth (Figure 1C). Scape extends beyond the posterior margin of the head, and antenna 11-segmented (Figure 1D). Concavity at the posterior margin of the head (Figure 1C). Mesosome convex. Metanotal groove reduced to a suture. Legs with a spur present on each tibia. Petiole as scale without a subpetiolar process; first gastral tergite the largest (Figure 1E). Gaster covered with grayish pubescence (Figure 1F) dorsal setae erect and of variable length (short and long), some of the setae nearly as long as those on the pronotum.

Liometopum apiculatum is distinguished from the other two species (*L. occidentale* and *L. luctuosum*) in North America by the following characteristics: (a) antennal scape surpassing posterior margin of head by at least twice the maximum thickness of scape (Figure 1D), and (b) petiole coming to sharp angular apex from dorsal view, the metapleural angle is straight and posterior propodeal face is erect in lateral view (Figure 1E). In addition, *L. apiculatum* has the entire gastral surface covered in pilosity, and these are very uneven in length that differentiates it from *L. luctuosum.*

Distribution and habitat associations. In the 10 localities, the six sampled areas within the state of Zacatecas, along with one in San Luis Potosí, represent the first records for the municipalities of Guadalupe, Sombrerete, Valparaiso, Zacatecas, and Mexquitic de Carmona. For Nuevo León and Coahuila, our sampled sites represent only new records for the species within the corresponding municipalities (Figure 2).

At each sampling site, we observed ants actively foraging on various plants and substrates. In Iturbide, Galena (Nuevo León), Saltillo (Coahuila), and Sombrerete (Zacatecas), the dominant vegetation was pine forest interspersed with elements of xerophilous scrub, the ants were collected from foraging trails on pine trees. In Valparaiso (Zacatecas), we collected individuals in a pine–oak forest, predominantly dominated by oaks. On Cerro de la Virgen (Zacatecas), the workers were found in an oak forest with grassland elements. In the Ecoparque Centenario (Zacatecas), a riparian vegetation area was present, and we collected the species from a willow tree. At Cerro de la Bufa (Zacatecas), the ant was found within an introduced eucalyptus forest, specifically foraging on one of the trees. Finally, at the sites in the Mexquitic of Carmona (San Luis Potosí) and Panzacola (Zacatecas), we found the species xerophilous scrub vegetation.

Updating the geographic distribution. A total of 1028 records of *L. apiculatum* were retrieved from the databases and literature. The geographical distribution ranges from the southern United States and extends south to Guatemala through Mexico. A total of 664 records are from Mexico and 364 from the United States. Lately, this species was reported from Guatemala, extending its distribution

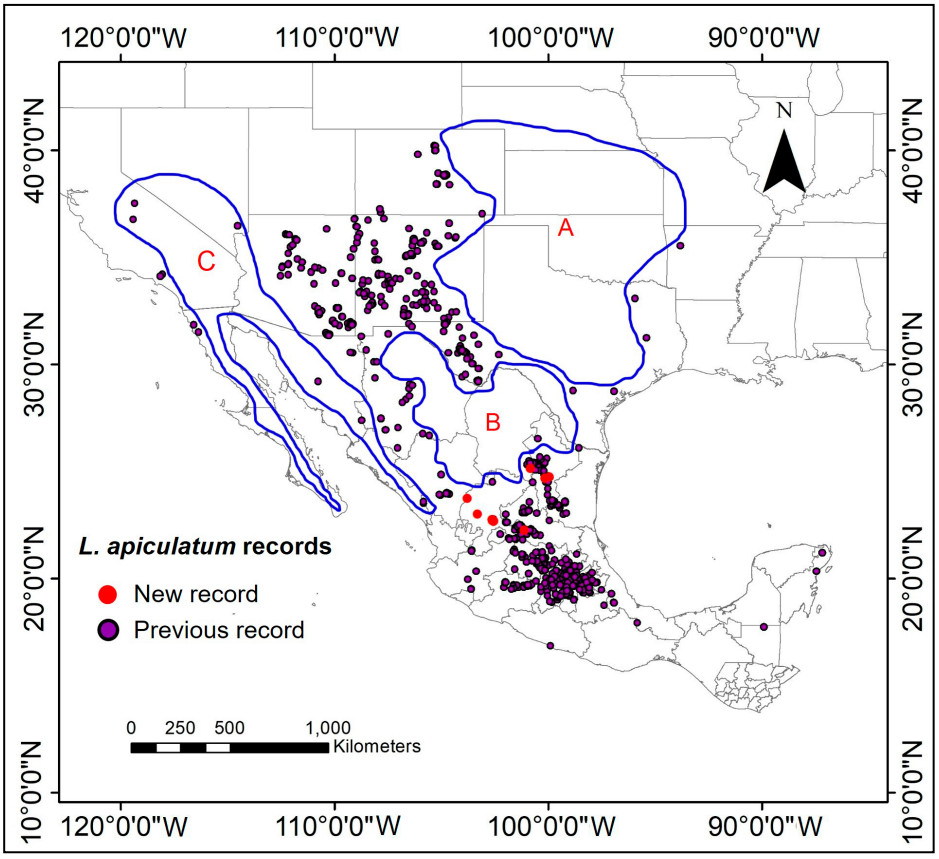

Figure 3. Updated distribution of *L. apiculatum*. Polygon A, B, and C (inside the blue line) areas with gaps about distribution information of this species.

to Central America (Guénard et al. 2017). In addition, this study contributed to 10 new distribution records (Figure 3).

Discussion

Liometopum apiculatum is the ant species with the widest geographic distribution in Mexico, with records from 25 states (Berumen-Jiménez et al. 2021). Despite this broad distribution, the range of environmental conditions occupied by the species remains insufficiently documented (Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015; Berumen-Jiménez et al. 2021). The new occurrences reported here come from north-central Mexico, a region previously identified by ecological niche models as environmentally suitable for the species (Berumen-Jiménez et al. 2021).

Our new records mainly correspond to the species' occurrence in vegetation characterized as Pine Forest and Xerophilous Scrub (Rzedowski and Huerta 1978). Here, we present the first records of *L. apiculatum* from the municipalities of Guadalupe, Sombrerete, Valparaiso, and Zacatecas (state of Zacatecas), from the municipality of Mexquitic de Carmona (San Luis Potosí), from the municipalities of Galena and Iturbide (Nuevo León), and Saltillo (Coahuila) (Figure 1).

One of the new records at Cerro de la Bufa, municipality of Zacatecas, includes vegetation disturbed by human activity, reforested with exotic *Eucalyptus* sp. The Cerro de la Bufa has been reforested with exotic trees for decades until recent years (CONABIO 2020). This record suggests that *L. apiculatum* can persist in recently disturbed environments. This finding highlights the species' ecological flexibility and its ability to tolerate habitat alteration, which may contribute to its broad distribution across heterogeneous ecosystems. Focusing sampling efforts on areas with distributional gaps, particularly regions with few or no occurrence records, is essential to achieve a more comprehensive understanding of the species' range. The geographic distribution of *L. apiculatum* spans both the Nearctic and Neotropical regions, with notable differences in sampling coverage.

In the United States of America, a further area of interest encompasses northwestern and central Texas, along with the states of Kansas and Oklahoma, which are in the Great Plains and Chihuahuan Desert provinces of the Nearctic region (Del Toro et al. 2009; Guénard et al. 2017; Morrone 2019; AntWeb 2024; GBIF 2024) (polygon B, Figure 3).

In northwestern Mexico, it is imperative to conduct further investigations on the Baja California Peninsula, particularly across the Baja California province; this region also extends northward into eastern California and western Arizona (AntWeb 2024) (polygon C, Figure 3). Additional surveys are also required in the states of Sonora and Sinaloa, belonging to the Sonoran and Pacific Lowlands provinces, respectively (Morrone 2019).

In northern Mexico, within the Nearctic and Transition zones (Morrone 2019, 2022), the geographic distribution data reveal an information deficit across portions of the Mexican Plateau and the Sierra Madre Occidental, particularly in the states of Chihuahua, Durango, and Zacatecas, which belong to the Chihuahuan Desert and Sierra Madre Occidental provinces (Morrone 2019). Additional gaps occur within the Sierra Madre Oriental, encompassing Coahuila, Nuevo León, and San Luis Potosí, which in part correspond to the Sierra Madre Oriental province (Del Toro et al. 2009; Guénard et al. 2017; Morrone 2019; AntWeb 2024; GBIF 2024) (polygon A, Figure 3).

These distributional gaps also include coastal plains along the coasts of Baja California Norte, as well as Guerrero and Quintana Roo. Although three known records of *L. apiculatum* below 50 m a.s.l. come from these regions (Guénard et al. 2017), they represent isolated occurrences, and extensive low-elevation areas within these coastal zones remain unsampled or lack confirmed records.

In contrast, within the Neotropical region, the southernmost distribution of *L. apiculatum* in Mexico is limited, with three records marking its range boundary in the states of Guerrero, Veracruz, and Quintana Roo (Del Toro et al. 2009; Guénard et al. 2017; AntWeb 2024; GBIF 2024), corresponding respectively to the Sierra Madre del Sur, Veracruzana, and Yucatán Peninsula provinces (Morrone 2022). Central America represents the species' southernmost known limit, with a record from El Mirador, Petén, Guatemala, located in the Petén province (Guénard et al. 2017). Although *Liometopum* is primarily a Nearctic genus, these Neotropical occurrences likely represent relict populations (Del Toro et al. 2009).

The new records presented here are all within the Nearctic region (Morrone 2019) and come from the municipalities of Guadalupe, Sombrerete, Valparaíso, and Zacatecas, located in the Zacatecan district of the Chihuahuan Desert province; they expand the species' known range in central Mexico. We propose to search for the species in surrounding municipalities, in northern Zacatecas, within the Nearctic region and the Transition zone. The predominant vegetation in these areas consists of tem-

perate forest, grassland, and scrubland (CONABIO 2020), habitats where *L. apiculatum* regularly nests (Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015; Berumen-Jiménez et al. 2021).

It is noted that the occurrence of this ant has been previously documented in Saltillo, Coahuila, and Galeana and Iturbide, Nuevo León (Guénard et al. 2017). However, the present study extends the distribution in the Sierra Madre Oriental. This highlights need for further fieldwork to better understand the distribution of the species.

We suggest exploring the eastern region of San Luis Potosí, especially the Sierra Madre Oriental area because there are records of *L. apiculatum* in the neighboring states to the north (Nuevo León and Tamaulipas) and to the south (Queretaro and Hidalgo), all within this physiographic region.

We make the following observations between previously reported records for this ant species (Guénard et al. 2017) and our new records: The previous records from Nuevo León (Galeana/Carretera Matehuala-Linares and Iturbide/Carretera Matehuala-Linares) are 14 km and 18 km, respectively, from the closest new record in the city of Galeana. The Saltillo record is 30 km from another in the same municipality. Sombrerete and Valparaíso, Zacatecas, are 91 km and 172 km, respectively, from the closest record in the municipality of Durango, Durango. Additionally, Valparaíso record is 190 km from a record in the municipality of Teúl de Gonzalez Ortega, Zacatecas. The Mexquitic de Carmona record is 27 km from the previously reported point in Soledad de Graciano Sánchez, San Luis Potosí. Finally, the records of Panzacola, Ecoparque Centenario, Cerro de la Bufa, and Cerro de la Virgen in Zacatecas are approximately 47 km and 60 km from the record reported in the municipality of Pánfilo Natera in the same state.

Evaluating the spatial distances among existing records helps distinguish areas where apparent absences likely reflect insufficient sampling rather than true distributional limits. This spatial understanding is crucial for identifying potential dispersal corridors, assessing population connectivity, and detecting ecological discontinuities (Schowalter 2022). These considerations become especially relevant when considering the dispersal capacity of ants. For instance, some ant species can fly 2–5 km during their nuptial flights. However, most winged ants typically limit their flights to shorter distances of 100–300 m, primarily due to energy constraints and the urgency of finding a suitable nesting site (Quirán and Molas 1998; Cortés-Peréz and León-Sicard 2003; Fernández 2003). The documentation of new records, in conjunction with molecular studies, could yield valuable insights into the dynamics of dispersal and the genetic variation observed within geographically dispersed ant populations.

Finally, *L. apiculatum* is not only ecologically significant but also has growing economic importance, which in some areas has led to threats to its colonies (Berumen-Jiménez et al. 2021). In central and northern Mexico, the immature stages of this species, known as "escamoles", are extracted from underground nests in specific localities of Hidalgo, the State of Mexico, Tlaxcala, Puebla, Querétaro, San Luis Potosí, and Zacatecas (Ramos-Elorduy et al. 2006; Esparza-Frausto et al. 2008; Miranda-Roman et al. 2011; Lara-Juarez et al. 2018; Ángeles-Tovar et al. 2021). These extractions occur mainly in semi-arid and scrubland areas, where the product is sold in local and tourist markets. Although this activity provides seasonal income to rural communities, the lack of regulation and sustainable management may pose a risk to natural populations (Ramos-Elorduy et al. 2006). This species can influence the dynamics of other organisms due to its foraging behavior and interactions with various plants and animals (Velasco 2007; Hoey-Chamberlain et al. 2013; Lara-Juárez et al. 2015; Berumen-Jiménez et al. 2021). The species' geographic distribution, spanning diverse ecosystems in northern Mexico, highlights the importance of identifying and protecting these habitats. A better understanding of its distribution will help prioritize areas that, due to their biodiversity, could be conserved along with this ant species.

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Additional information

Conflict of interest
The authors declare that no competing interests exist.

Ethical statement
No ethical statement is reported.

Author contributions
Conceptualization: MBJ, RRV. Data curation: MBJ. Investigation: MBJ, RRV. Methodology: MBJ. Writing-Original draft preparation: MBJ, RRV. Writing- Reviewing and Editing: EAMS, LATA.

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Data availability
All data supporting this study's findings are available in the main text. All occurrence and specimen data supporting this study are deposited in the Global Biodiversity Information Facility (https://doi.org/10.15468/gcykms).

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