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NOTES ON GEOGRAPHIC DISTRIBUTION

New records for *Conotrachelus lobatus* Champion, 1904 and *C. scoparius* Champion, 1904 (Coleoptera, Curculionidae) inhabiting leaf litter in oak forests in central Mexico

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Abstract. *Conotrachelus* Dejean 1835, is a highly diverse genus with a poorly studied taxonomy, making species differentiation difficult. Additionally, there is limited information on its geographical distribution, particularly for species that inhabit leaf litter. This study reports 46 new records of *Conotrachelus lobatus* Champion, 1904 and *C. scoparius* Champion, 1904 collected in oak forests in central Mexico. Regular biodiversity monitoring and reporting on new records are essential for creating effective conservation strategies.

Key words. Geographic range, oak acorns, weevils

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INTRODUCTION

With more than 1200 species described and many more species still awaiting description, *Conotrachelus* Dejean, 1835 is a hyperdiverse genus within the family Curculionidae (Pinzón-Navarro et al. 2010a; Chamorro and Barclay 2018; Anderson 2021). Limited to the New World, this genus is distributed in both North to South America but has its greatest diversity in tropical regions (Pinzón-Navarro et al. 2010a). Members of the genus are associated with more than 10 families of host plants, feeding on seeds or fruits, or forming galls on the stems (Schoof 1942; Florentine et al. 2002; Pinzón-Navarro et al. 2010b; Chamorro and Barclay 2018).

Some species of *Conotrachelus* are of economic interest because they attack important agricultural crops, such as apple, pear, guava, and avocado, among others (Mancera-Silva et al. 2018). A small species group belonging to the *Conotrachelus posticatus* complex are associated with oak acorns (Chamorro and Barclay 2018). The larvae feed on the inside of the acorn, which affects the viability of the seed and the generation of new plants, thus reducing the rate of forest regeneration; additionally, the feeding larvae damage the quality of the food resources of the animal species that depend on acorns (Galford et al. 1991; Williams and Hawkins 2020). According to Schoof (1942), *C. posticatus* Boheman, 1837 is associated with at least nine species of oaks in North America and seriously affects the viability of the acorns (Williams and Hawkins 2020). It has been speculated that *C. lobatus* Champion, 1904, *C. scoparius* Champion, 1904, and *C. squamifrons* Champion, 1904 are also associated with oak acorns because they are collected in oak forest. However, the identity of the host plants is generally unknown (Chamorro and Barclay 2018).

In the genus *Conotrachelus*, the *posticatus* species complex consists of four morphologically very similar species: *C. posticatus*, is distributed in Canada, USA, Mexico, Guatemala, and Panama (Chamorro and Barclay 2018); *C. squamifrons* is reported from Guatemala and Panama (Chamorro and Barclay 2018); and *C. lobatus* and *C. scoparius* limited to Mexico (Chamorro and Barclay 2018). Except for *C. posticatus*, these species have been little studied since Champion (1904), so there are very few records of their distribution. Chamorro and Barclay (2018) provided new distributional and taxonomic data for the *posticatus* species complex, Muñiz (1998) recorded distributional data for the two species restricted to Mexico collected in necrotraps in the state of Morelos, and Salas-Araiza et al. (2001) recorded a single individual of *C. lobatus* collected in light trap in the state of Guanajuato. Recently, Jones et al. (2022) recorded *C. scoparius* in the state of Querétaro where it was associated with leaf litter in oak forests; however, they did not provide more information about its local distribution.

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Although the species of *Conotrachelus* have been reviewed several times (Champion 1904; Fielder 1940, 1944, 1952; Schoof 1942), in addition to the contributions of Chamorro and Barclay (2018) for the *posticatus* complex, the separation of species is very complicated, especially for those species from Mexico and Central America. This is because the interspecific taxonomic distinction of *Conotrachelus* is based on the organization of informal species groups, which are supported by small morphological differences which are very subjective (Pinzón-Navarro et al. 2010a; Anderson 2021). This lack of taxonomic knowledge, both in hyperdiverse groups such as *Conotrachelus* and in other groups of Neotropical arthropods, hinders the recording of species' distribution at different spatial scales, which prevents an adequate understanding of biodiversity patterns and obstructs decision-making for the conservation of vulnerable species, natural resource management, or sanitary actions of economically important species (Dunn 2005; Novotny et al. 2007; Tänzler et al. 2012; Boieiro et al. 2024). For this reason, we document new distributional data for *C. lobatus* and *C. scoparius* collected in leaf litter in oak forests in central Mexico.

METHODS

The collections were based on random exploratory sampling by the second and third authors in oak-associated habitats from 2001 to 2024 in the Mexican states of Querétaro, Guanajuato, and Estado de México, and a systematic sampling of different levels of forest disturbance in the state of Querétaro (Jones et al. 2015, 2022). The collection of specimens was done by leaf-litter sifting following Anderson and Ashe (2000) and Jones et al. (2022). The specimens were examined under a Carl Zeiss Stemi SV6 stereomicroscope. Multiple images of the habitus were taken with a Canon Rebel T6 camera at different focal lengths, then combined and processed with Adobe Photoshop 2025. The species were identified following taxonomic information in the descriptions by Champion (1904) and Chamorro and Barclay (2018). Voucher specimens are deposited in the Insect Collection of the Universidad Autónoma de Querétaro, Mexico (UAQ-E). Distribution maps were generated using the R packages sf (Pebesma and Biband 2023), ggplot2 (Wickham 2016), and ggspatial (Dunnington 2023) through R v. 4.4.2 (R Core Team 2024).

RESULTS

***Conotrachelus lobatus* Champion, 1904**
Figures 1, 2A

New records. MEXICO — Guanajuato • San Luis de la Paz; 12 km E of San Luis Paz; 21°18′14″N, 100°14′47″W; 2080 m elev.; 25.IX.2011; R. Jones leg., leaf litter Berlese, 1 ♂, UAQE-30657 • Xichú, 3 km W El Cantón; 21°12′30″N, 099°53′26″W; 2040 m elev.; 4.VIII.2011; R.W. Jones leg., leaf litter Berlese, 2 ♂, UAQE-31204, 31208.

Identification. This species falls into couplet f[5] in Champion's (1904) key. According to this key *C. lobatus* is distinguished by following combination of characters: head foveate between eyes; rostrum cylindrical, a little longer than the head and prothorax, with feebly 5 carinate; antennae in the male inserted close to the

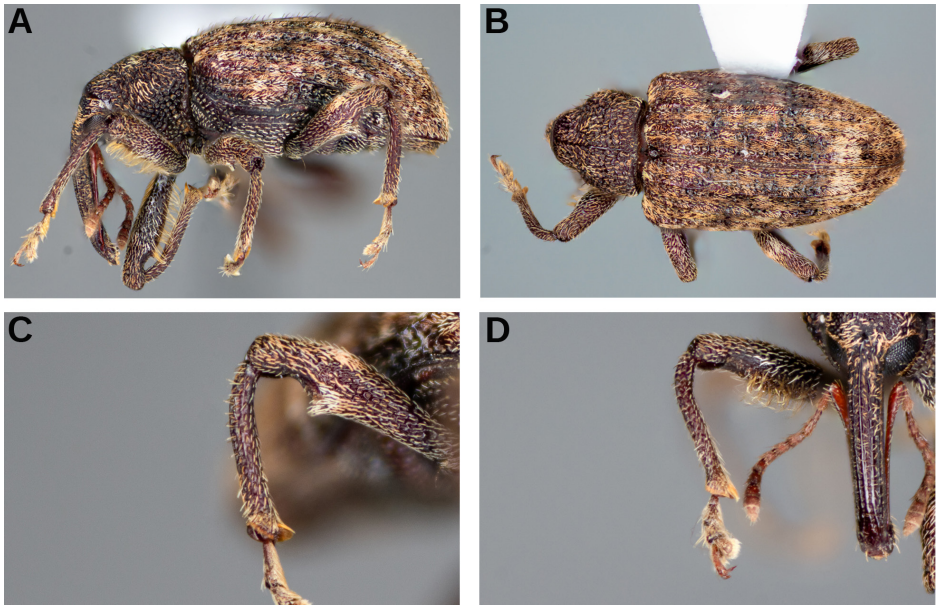

Figure 1. *Conotrachelus lobatus* male. **A.** Lateral view. **B.** Dorsal view. **C.** Hind tibia. **D.** Front femur showing the dense ventral cilia.

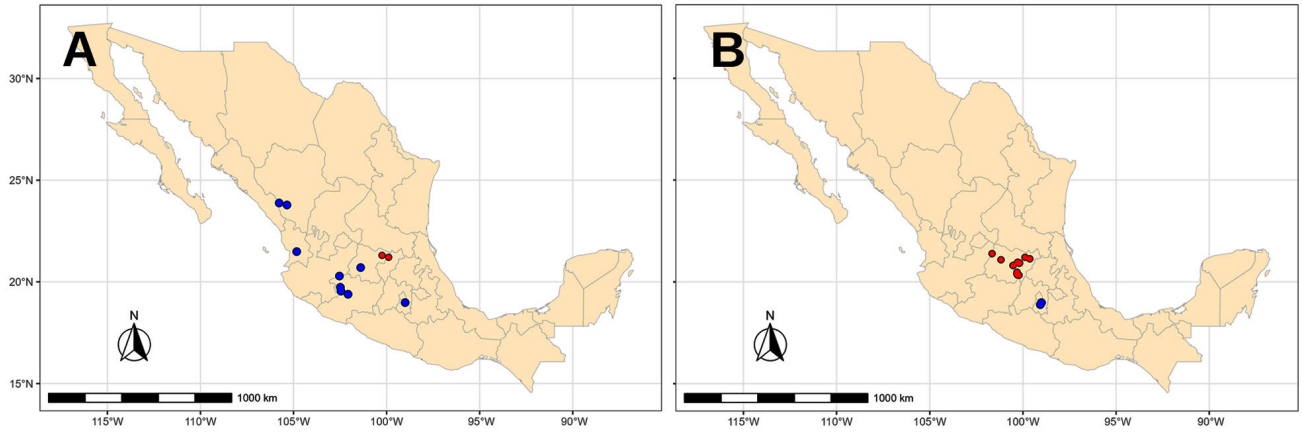

Figure 2. New records and the known distribution of *Conotrachelus* species in this study. New records are shown with red circles and old records with blue circles. **A.** *Conotrachelus lobatus*. **B.** *Conotrachelus scoparius*.

tip and in the female at about ⅓ from it, funicle with articles 1 and 2 subequal in length. Prothorax bisinuate at the base; disc longitudinally carinate; surface densely, rugulosely punctate. Elytral slightly constricted beneath the humeri and narrowing thence to the apex, elytral intervals 3, 5, 7, 9 uninterruptedly costate. Prosternum not tuberculate behind the anterior coxae. Mesosternum flat, protuberant and binodose in front; mesosternum, metasternum and ventral segments not pilose. Ventral segment nearly uniformly punctured. Femora moderately clavate, unidentate. Male with frontal femora densely ciliated ventrally along basal half, hind tibia with a spoon-shaped lobe at apex. Tarsal claws with a moderately long tooth.

***Conotrachelus scoparius* Champion, 1904**

Figures 2B, 3

New records. MEXICO — Guanajuato • Dolores Hidalgo; km 85, Carr. 110; 21°05′18.6″N 101°10′41.4″W; 2600 m elev.; 12.V.2006; R. Jones, M. Pérez leg.; leaf litter Berlese; 3 ♂; UAQE-30916, 30963, 30968 • León; Vergel; 21°23′20″N, 101°39′27″W; 2330 m elev.; 22.VII.2012; A. Obregón leg.; leaf litter Berlese; 1 ♂; UAQE-31262 • same locality as preceding; 23.X.2012; J. Vadillo leg.; leaf litter Berlese; 1 ♂; UAQE-31315 • San J. Iturbide; 1 km NE of El Peral; 20°57′58″N, 100°16′48″W; 2392 m elev.; 15.X.2012; A. Obregón leg.; leaf litter Berlese; 1 ♂; UAQE-31214; ibid R. Jones leg.; leaf litter Berlese; 2 ♂; UAQE-31215, 31231 • Tierra Blanca; 0.3 km SW of El Peral; 20°57′35″N, 100°17′21″W; 2535 m elev.; 11.III.2018; ND leg.; leaf litter Berlese; 4 ♂; UAQE-30599, 30600, 30601, 30869 • 0.4 km SW of El Peral; 20°57′33″N, 100°17′29″W; 2580 m elev.; 11.III.2018; [collectors unknown]; leaf litter Berlese; 3 ♂; UAQE-30597, 30865, 30867 • Cerro Zamorano; 20°56′01″N, 100°11′06″W; 3170 m elev.; 24.XI.2012; J. Vadillo leg.; leaf litter Berlese; 3 ♂; UAQE-31199, 31201, 31293 • Xichú; 3 km W of El Cantón; 21°12′30″N, 099°53′26″W; 2040 m elev.; 4.VIII.2011; R.W. Jones leg.; leaf litter Berlese; 5 ♂; UAQE-30849, 30852, 30854, 30958, 31211 — Querétaro •

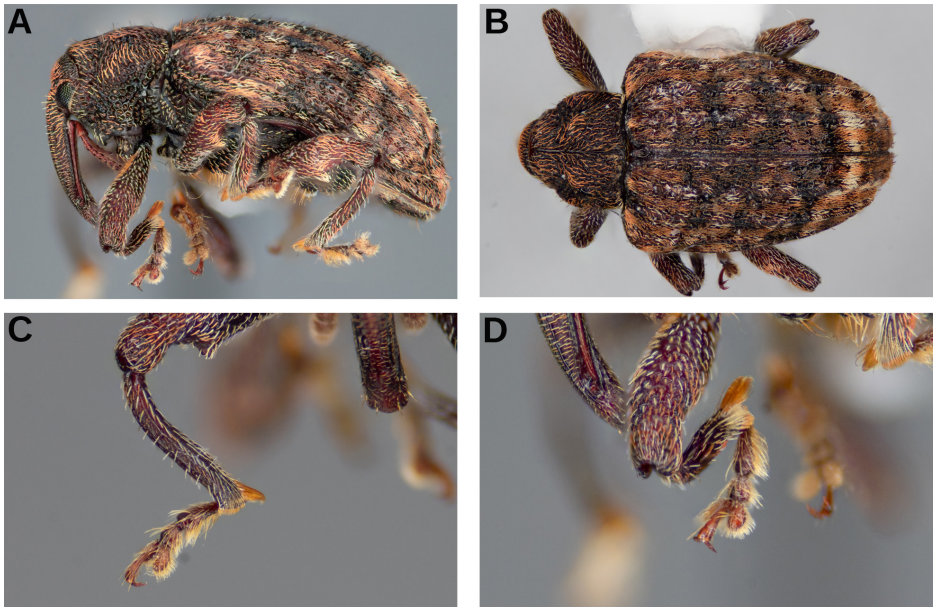

Figure 3. *Conotrachelus scoparius* male. **A.** Lateral view. **B.** Dorsal view. **C.** Front tibia showing the long setae at apex. **D.** Front tibia showing the long setae at apex, detail.

Amealco; Cañón Rio Galindo; 20°19′50″N, 100°12′54″W; 2373 m elev.; 27.VIII.2018; [collector unknown]; leaf litter Berlese; 1 ♂; UAQE-30603 • same locality as preceding; 20°19′51″N, 100°12′56″W; 2370 m elev.; 25.XI.2017; ND leg.; leaf litter Berlese; 1 ♂; UAQE-30943 • Colon; El Zamorano; 20°55′36″N, 100°10′45″W; 3202 m elev.; 24.VI.2012; J.A. Obregón leg.; leaf litter Berlese; 1 ♂; UAQE-30656; Loc. El Zamorano; 20°55′13″N, 100°10′52″W; 3085 m elev.; 24.VI.2012; J. A. Obregón leg.; leaf litter Berlese; 1 ♂; UAQE-30655; Colón; Cerro Zamorano; 20°54′57″N, 100°11′59″W; 2688 m elev.; 10.XI.2019; R.W. Jones leg.; leaf litter Berlese; 4 ♂; UAQE-30552, 30561, 30567, 30572 • Huimilpan; Cerro Cristo Dormido; 20°23′46″N, 100°19′41″W; 2440 m elev.; 18.XI.2017; ND leg.; leaf litter Berlese; 1 ♂; UAQE-30888; Parque Nacional Cimatario (Sur); 20°28′44″N, 100°18′58″W; 2230 m elev.; 26.X.2018; ND leg.; leaf litter Berlese; 1 ♂; UAQE-30999; 5 km SW of Humilpan; 20°20′32″N, 100°17′34″W; 2475 m elev.; 30.VIII.2018; Olga M. [surname unknown] leg.; leaf litter Berlese; 1 ♂; UAQE-30602 • Pinal de Amoles; Cruz de Palo; 21°08′02.6″N, 099°38′21.1″W; 2470 m elev.; 8.IV.2009; R. Jones, Y. Bizuet leg.; leaf litter Berlese; 1 ♂; UAQE-11895 • same locality as preceding; 21°07′55.4″N, 099°37′44.2″W; 2470 m elev.; 8.IV.2009; R. Jones Y., Bizuet leg.; leaf litter Berlese; 1 ♂; UAQE-11978 • Querétaro; 5.7 km SE of La Barreta; 20°48′23″N, 100°31′53″W; 2564 m elev.; 17.XI.2018; V. Martínez leg.; leaf litter Berlese; 1 ♂; UAQE-30596 • same locality as preceding; 20°48′25.8″N, 100°31′53.1″W; 2493 m elev.; 13.IX.2018; R. Jones leg.; leaf litter Berlese; 4 ♂; UAQE-30591, 30592, 30593, 30595 • same locality as preceding; 20°48′29″N, 100°31′49″W; 2456 m elev.; 25.V.2019; R. W. Jones leg.; leaf litter Berlese; 2 ♂; UAQE-30563 , 30566.

Identification. This species falls into couplet f[5] in Champion's (1904) key. This species is recognizable by the following combination of characters (Champion 1904): head feebly foveate and a little depressed between the eyes; rostrum cylindrical, a little longer than the head and prothorax, with 5 carinate almost to the tip; antennae inserted near to tip, funicle with articles 1 and 2 subequal in length. Prothorax bisinuate at the base; disc longitudinally carinate; surface coarsely, densely punctate. Elytral intervals 3, 5, 7, 9 uninterruptedly costate. Prosternum not tuberculate behind the anterior coxae. Metasternum broadly depressed, mesosternum, metasternum and first ventral segment pilose, sparser on ventrite 1. Ventral segment nearly uniformly punctured; ventrite 5 foveate at the apex. Femora clavate, unidentate. Tibiae with long setae at apex. Tarsus ventrally clothed with long hairs at the base; claws with a moderately long slender tooth.

DISCUSSION

The new data presented here and our previous work demonstrate *Conotrachelus lobatus* has a wide geographical distribution elevations of 1650–2080 m in the Sierra Madre Occidental, Sierra Madre Oriental, and the Trans-Mexican Volcanic Belt in the Mexican states of Durango, Jalisco, Michoacán, Nayarit, Morelos, and Guanajuato (Champion 1904; Muñiz 1998; Salas-Araiza et al. 2001; Chamorro and Barclay 2018). However, this species is not frequently sampled; only 17 individuals have been recorded in previous studies between 1955–1973 in random sampling in Durango, Jalisco, Michoacán and Nayarit (Chamorro and Barclay 2018); Muñiz (1998) recorded three specimens in three years of sampling, and Salas-Araiza et al. (2001) only one specimen. In this study, we recorded three specimens over more than 20 years of sampling. Currently, 27 individuals of this species have been recorded so far, of which 89% are males.

Conotrachelus scoparius is distributed at elevations of 1158–3100 m in the Sierra Madre Oriental, the Trans-Mexican Volcanic Belt, and the Central Mexican Plateau in the Mexican states of Morelos, Guanajuato, and Querétaro. For a considerable time, the only records of *C. scoparius* were based on two male individuals from Morelos: one from the type locality in Yautepec and another from San José de los Laureles (Champion 1904; Muñiz 1998; Chamorro and Barclay 2018). Here, we catalog the most individuals of *C. scoparius* to date. Female specimens are unknown.

The scarcity of records of *C. lobatus* and *C. scoparius* indicates that these species are rare despite being broadly distributed. They inhabit oak forests of central Mexico, habitats that are increasingly becoming deforested and fragmented (López-Mendoza et al. 2022; Latorre-Cárdenas et al. 2023; Mata-Guel et al. 2023) and highlighting the potential vulnerability of these species. Therefore, conservation strategies for leaf litter arthropods depend on forest conservation through various actions involving government agencies and institutions responsible for biodiversity studies, as well as the cooperation of specialized taxonomists. This is to strengthen biological inventories and generate ecological, biological, and systematic knowledge to enhance and facilitate understanding of the importance of soil fauna in the ecosystem.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: JLC. Data curation: NRH. Formal analysis: NRH, JLC. Funding acquisition: RWJ. Investigation: NRH, JLC. Methodology: RWJ, JLC. Resources: JLC. Writing – original draft: NRH, JLC. Writing – review and editing: NHC, OGM, RWJ, SZL.

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Data availability

All data that support the findings of this study are available in the main text.

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