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***Cardiocondyla obscurior*, a new alien ant in Crete (Hymenoptera, Formicidae)**

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SUMMARY

We report for the first time the occurrence of the alien ant *Cardiocondyla obscurior* Wheeler, 1929 on the Greek island of Crete. *Cardiocondyla obscurior* is one of many congeneric taxa with worldwide success as tramp species, having attained a cosmopolitan distribution while having Indomalayan origins. It was first detected in Europe in 1999, and since 2015 it has started to be found outdoors in Southern European countries. Our record is the first in Europe in which the species is observed to be established outdoors in an agricultural area. Introduced *Cardiocondyla* ants are generally thought to have little ecological impact, although targeted studies have been lacking. *Cardiocondyla obscurior* is the third species of its genus to be found on the island of Crete, which is characterized by a remarkable ant diversity.

INTRODUCTION

The ant genus *Cardiocondyla* (Formicidae, Myrmicinae) counts at least 85 species currently classified into 17 species groups based on morphological evidence, while a comprehensive phylogeny is still missing (Seifert 2023a; Bolton 2023). *Cardiocondyla* belongs to the tribe Crematogastrini and the *Catalaucus* genus-

group, which probably has an Afrotropical origin (Ward et al. 2015; Blaimer et al. 2018). *Cardiocondyla* ants are present worldwide, however, their presence in the New World is the effect of anthropogenic introductions (Seifert 2023a). A notable number of species of *Cardiocondyla* have become successful tramp species across the world, with at least four

introduced species established outdoors in the Mediterranean: *C. minutior* Forel, 1899 (*minutior* species group), *C. emeryi* Forel, 1881 (*emeryi* species group), *C. obscurior* Wheeler, 1929, and *C. wroughtonii* (Forel, 1890) (both in the *wroughtonii* species group). *Cardiocondyla mauritanica* Forel, 1890 (*nuda* species group) is also present but appears to be native at least in parts of the region (Guénard et al. 2017; Schifani 2019; Seifert 2023b).

Cardiocondyla ants are sometimes deemed to have a lesser ecological role compared to other ant genera, and introduced species are not reported to cause ecological or economic problems (Seifert 2023a). Workers forage solitarily and are minute in size, but they are often equipped with effective repellent substances that allow them to co-exist with dominant aggressive ants (Seifert 2018). Colonies are small-sized, even if tramp species are typically polygynous (Seifert 2018). A notable biological characteristic of these ants is male polymorphism, with both alate dispersing males (absent in some species) and wingless ergatoid males that fight each other to mate with the queens: this peculiar system has been the subject of several sociobiological studies (Heinze & Hölldobler 1993; Heinze 2017).

Cardiocondyla obscurior is a species of Indomalayan origin that established alien populations in Africa, Europe, Central, Northern and Southern America, and Oceania (Seifert 2003; Wetterer 2015; Guénard et al. 2017). In the West-Palaearctic it was first collected in Palestine/Israel in 1930 and 1945, and in Germany and in the Canary Islands in 1999 (Seifert 2003) (Figure 1a). In recent years, many new records testified a rapid expansion to other countries in the region (Figure 1a): it was found in France in 2009 (Blatrix et al. 2018), in Cyprus in 2012 (Demetriou et al. 2023a), in mainland Spain in 2015, 2016, and 2018 (Sánchez-García

& Espadaler 2015, Trigos Peral & Reyes López 2016, Espadaler & Ortiz de Zugasti 2019), in the Netherlands in 2017 (Boer et al. 2018), and in Greece (Rhodes) in 2022 (Demetriou et al. 2023b). Here we report for the first time the presence of *C. obscurior* from the Greek island of Crete, where it becomes the eleventh alien species to establish (Salata et al. 2020; Demetriou et al. 2023b).

MATERIALS AND METHODS

Cardiocondyla obscurior workers and queens were collected from trees in an agricultural area mostly dominated by olive orchards near Knossos (35.290041, 25.163924, error range 10 m), in the Heraklion province of Crete (15.X.2023) (Figure 1). The collected specimens were examined under a stereoscopic microscope with up to 180x magnification, while morphometric characters were recorded using the software ImageJ and photos taken using Canon MP-E 65mm f/2.8 1–5x macro lens (Schneider et al. 2012) (Figure 2). On the same plant, we also collected the native ant species *Camponotus lateralis* (Olivier, 1792) and *Crematogaster schmidtii* (Mayr, 1853).

Identification was performed using the keys of Seifert (2003; 2023b), with morphometric data recorded on a colony sample of three workers. *Cardiocondyla obscurior* is easily distinguishable from most other *Cardiocondyla* species occurring in the region but can be confused *C. wroughtonii* (Forel, 1890) (Seifert 2023b). Its distinction from *C. wroughtonii* is possible based on the dark pigmentation of all tergites, but the use of discriminant functions is advisable; discriminant functions published in Seifert (2003) and Seifert (2023b), yielded the same results in the case of our samples, in both cases identifying them as *C. obscurior*.

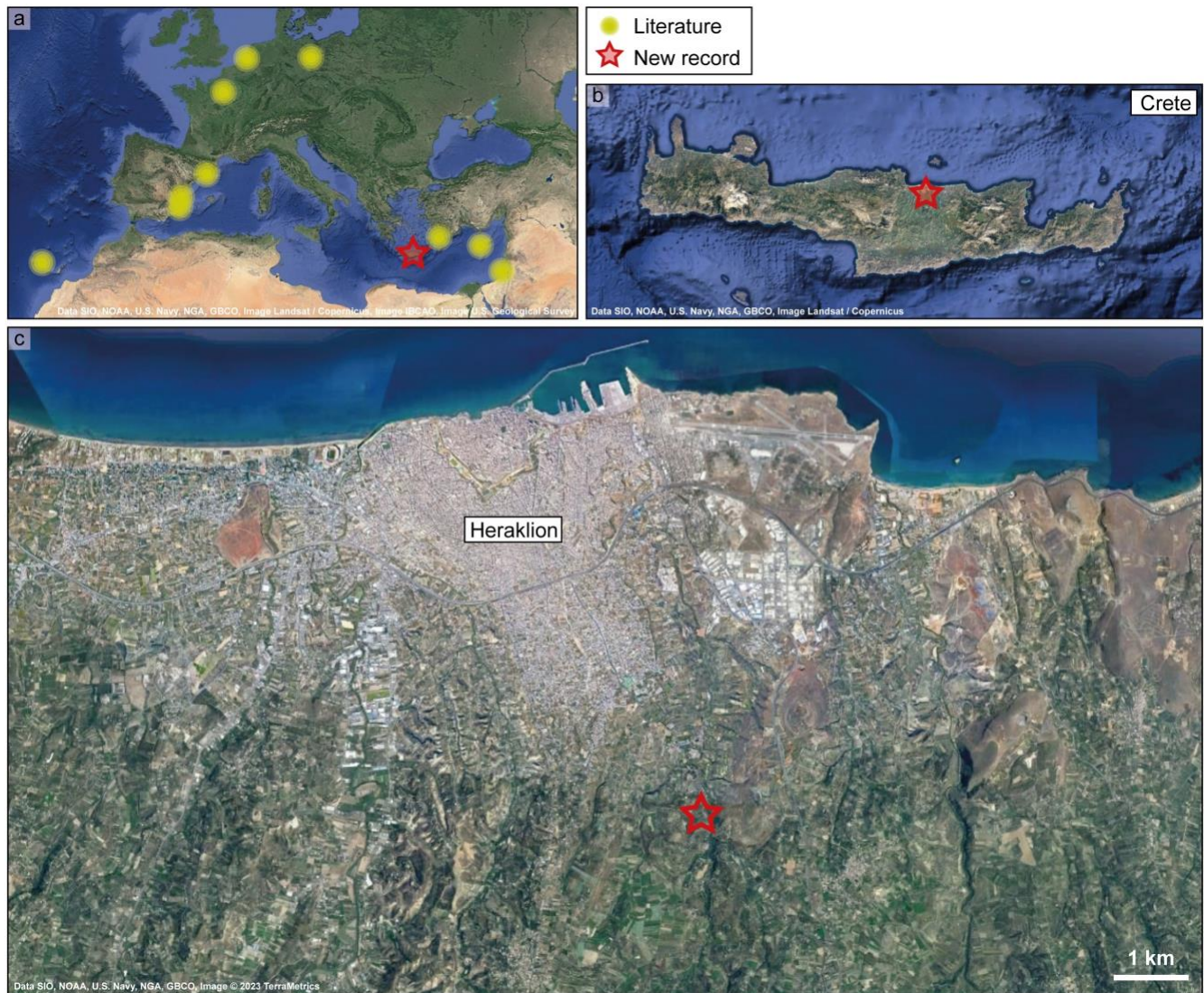


Figure 1. Map of the published records of *Cardiocondyla obscurior* in the West-Palaearctic (yellow circles) and location of the new record in Heraklion, Crete (red star).

DISCUSSION

About 40 alien ant species are currently estimated to occur as established in Europe, a number that seems to be constantly increasing (Schifani 2019; Menchetti et al. 2022; 2023; Blight et al. 2023). Of these, at least 15 species occur in Greece (Demetriou et al. 2023b). Most alien species in Greece and in the rest of Europe are restricted to urban or heavily disturbed habitats (Schifani 2019; Demetriou et al. 2023b). So far, *C. obscurior* in Europe was found indoors in central and northern countries (Seifert 2003; Blatrix et al. 2018; Boer et al. 2018) and

outdoors but still inside urban areas in southern countries (Sánchez-García & Espadaler 2015; Espadaler & Ortiz de Zugasti 2019; Demetriou et al. 2023a, b), with a single record from outside an urban area in Tenerife (Schrader 2015). Our record differs from all the previous ones, including the recent Greek record from the island of Rhodes in the Dodecanese archipelago (Demetriou et al. 2023b), due to the species being established outdoors in the middle of an agricultural area, suggesting that it has a greater ability to spread than previously thought. As it often happens, this new record is the fruit of casual collecting efforts rather than focused

monitoring projects (Schifani 2019; Menchetti et al. 2022; 2023; Blight et al. 2023), and given the habitat in which it was found, the species could be easily already widespread on a much larger scale (Menchetti et al. 2024).

Crete harbors a remarkable diversity of ants, being the second most species-rich Mediterranean island, despite ranking only fourth in size, while hosting a high proportion of endemics (Salata et al. 2020). Two *Cardiocondyla* species were hitherto known on Crete, namely *C. mauritanica* and *C. elegans*

Emery, 1869, both considered as alien species by Salata et al. (2020). The identity of the populations attributed to *C. elegans* should be checked in the future as Crete falls much closer to the native range of *C. dalmatica* Soudek, 1925, a recently recognized cryptic sister species (Seifert 2023b). In comparison to these species, *C. obscurior* differs in its arboreal habits, and despite not having been reported as an ecological threat anywhere so far, its interactions with native ants and other organisms should be monitored.

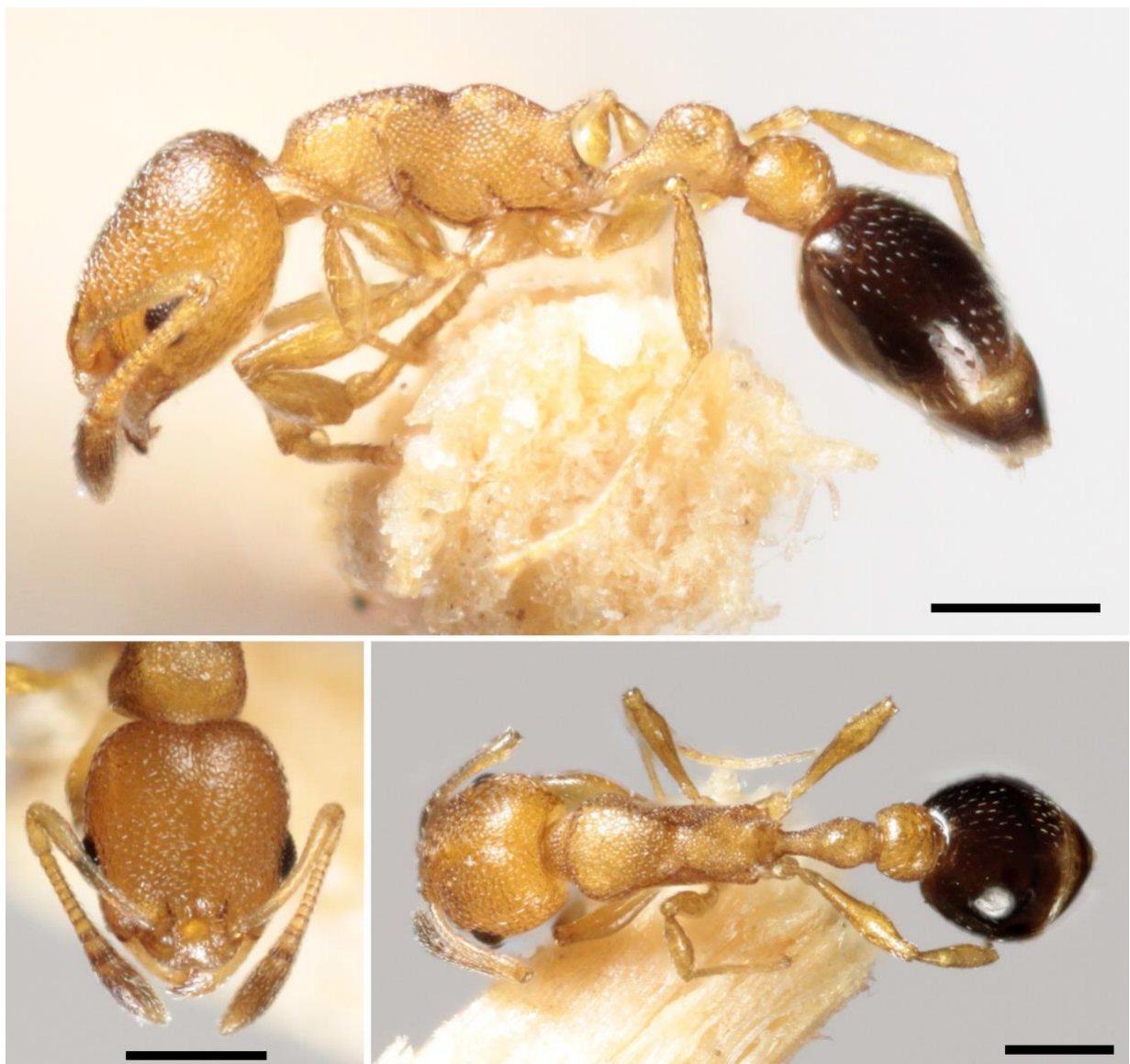


Figure 2. *Cardiocondyla obscurior* Wheeler, 1929 worker collected in Crete. Scale bar: 0.25 mm.

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