

First record in the Balearic Islands of *Oobius rudnevi* (Nowicki, 1928) (Hymenoptera: Encyrtidae), egg parasitoid of the great capricorn beetle, *Cerambyx cerdo* Linnaeus, 1758

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The micro-wasp *Oobius rudnevi* (Nowicki, 1928) (Hymenoptera: Encyrtidae) is reported for the first time in the Balearic Islands (Spain). This egg parasitoid was detected in July 2023 in a holm oak forest located in Biniamar (Selva), Mallorca, using sentinel eggs of the great capricorn beetle, *Cerambyx cerdo* Linnaeus, 1758 (Coleoptera: Cerambycidae), the only known host species on the island. The presence of *O. rudnevi* in Mallorca is of phytosanitary significance considering the pest status of *C. cerdo* in its holm oak forests.

Keywords: *Oobius rudnevi*, egg parasitoid, biocontrol agent, sentinel eggs, *Cerambyx cerdo*, holm oak forests, *Quercus ilex*, Mallorca, Balearic Islands.

PRIMER REGISTRE A LES ILLES BALEARS D'*Oobius rudnevi* (NOWICKI, 1928) (HYMENOPTERA: ENCYRTIDAE), PARASITOIDE D'OUS DEL BANYARRIQUER, *Cerambyx cerdo* LINNAEUS, 1758. La microvespa *Oobius rudnevi* (Nowicki, 1928) (Hymenoptera: Encyrtidae) es registra per primera vegada a les Illes Balears. Aquest parasitoide d'ous es va detectar el juliol de 2023 en un alzinar situat a Biniamar (Selva, Mallorca), utilitzant ous sentinella del banyarriquer, *Cerambyx cerdo* Linnaeus, 1758 (Coleoptera: Cerambycidae), l'única espècie hoste coneguda a l'illa. La presència d'*O. rudnevi* a Mallorca és d'importància fitosanitària tenint en compte l'estatus de plaga de *C. cerdo* als seus alzinars.

Paraules clau: *Oobius rudnevi*, parasitoide d'ous, agent de biocontrol, ous sentinella, *Cerambyx cerdo*, alzinars, *Quercus ilex*, Mallorca, Illes Balears.

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Introduction

The genus *Oobius* Trjapitzin, 1963 (Hymenoptera: Encyrtidae) currently includes almost 50 species distributed worldwide. Some of these species are important biocontrol agents of insect pests in forest ecosystems, particularly wood-boring Coleoptera in the families Cerambycidae and Buprestidae (Noyes, 2019; Torres-Vila and Fusu, 2020). Our target species, *Oobius rudnevi* (Nowicki, 1928), was originally described as an egg parasitoid of the great capricorn beetle, *Cerambyx cerdo* Linnaeus, 1758. The description was based on specimens from Ukraine supplied by D.F. Rudnev, to whom the species was dedicated (Nowicki, 1928). More recently, *O. rudnevi* has been reported to also parasitise eggs of two other congeneric species, *Cerambyx welensii* (Küster, 1845) (Torres-Vila and Fusu, 2020) and *Cerambyx miles* Bonelli, 1812 (Torres-Vila *et al.*, 2022). Field and laboratory tests have also shown that *Cerambyx* (*Microcerambyx*) *scopolii* Fuessly, 1775, and *Prinobius myardi* Mulsant, 1842 (= *Macrotoma germari* Chevrolat, 1859) are not recognised as hosts by the wasp (Torres-Vila *et al.*, 2022). *O. rudnevi* is a gregarious egg parasitoid that flies from about mid-May to early August, a period coinciding with the presence of its adult hosts (and their eggs) in the wild. The wasp is mostly a monovoltine species, although the presence of bivoltine phenotypes/lineages has also been documented (Torres-Vila and Fusu, 2020; Torres-Vila *et al.*, 2021). *O. rudnevi* is known from Ukraine, Georgia (including Abkhazia), Russia, Morocco and mainland Spain (Noyes, 2019; Torres-Vila and Fusu, 2020 and references therein). Other records from “western Europe”, Poland and Croatia are

imprecise or doubtful and need confirmation (Trjapitzin and Volkovitch, 2011). The striking discrepancy between the relatively limited known range of *O. rudnevi* and the widespread distribution of their hosts across the western Palaearctic has been tentatively attributed to an incomplete knowledge of the wasp's biogeography rather than to its rarity (Torres-Vila and Fusu, 2020). In the described scenario, we conducted a study to investigate the presence of *O. rudnevi* in Mallorca due to its potential parasitic impact on *C. cerdo*, as this longhorn is a major pest threatening holm oak forests on the island (González *et al.*, 2010, 2013; Alomar and Núñez, 2018, 2022; Mascaró *et al.*, 2022). In this paper, we report the occurrence of *O. rudnevi* in Mallorca.

Material and methods

We used sentinel eggs of *C. cerdo* to detect the occurrence of *O. rudnevi* in the wild. Eggs were produced in the laboratory from field-derived *C. cerdo* adults (see Torres-Vila, 2017), which were caught in June-July 2023 with non-lethal feeding traps placed in holm oak forests at Caimari (Selva) and Menut (Escorca), the two sites in the Mallorca island. Cork oak wood disks (78 cm in diameter, 2 cm thick) were used as egg-laying substrate in the laboratory, and then as support for sentinel eggs in the field (Fig. 1). The cork layer was detached with a penknife, returned to its place and fixed with a rubber band. The narrow space between wood and cork is extremely attractive for ovipositing females of *C. cerdo* (Torres-Vila, 2017). Wood disks housing newly-laid eggs (<24 h old) were taken to the field in the morning and fixed with metal bolts to the holm oak trunk at a height of 1.401.50 m, oriented northwards to avoid excessive



Fig. 1. Cork oak wood disks housing sentinel eggs of *Cerambyx cerdo* placed in a holm oak stand at Biniamar (Selva), Mallorca, July 2023 (Photo: Marc Mascaró).

Fig. 1. Discs d'alzina surera que contenen ous sentinella de *Cerambyx cerdo* col·locats en un alzinar de Biniamar (Selva), Mallorca, juliol de 2023 (Foto: Marc Mascaró).

insolation (Fig. 1). A small drop of entomological glue was finally applied at the base of the bolts to prevent sentinel egg predation by ants (for more details, see Torres-Vila and Fusu, 2020; Torres-Vila *et al.*, 2021). Three wood disks were placed in a holm oak stand where *C. cerdo* was known to occur, located at Biniamar (Selva), Mallorca (WGS84 coordinates: 39.73955, 2.86619). Disks were set on July 6th, 2023, coinciding with the flight period of *C. cerdo*. They were kept in the field for one week and then taken to the laboratory to be inspected. Sentinel eggs were carefully detached from wood disks, counted and individually placed in plastic tubes to check for parasitisation by *O.*

rudnevi. The uncorrected parasitism rate was calculated as $P_U = 100P / (P + H + U)$, and the net parasitism rate as $P_N = 100P / (P + H)$, where P, H and U are the number of parasitised, hatched and unviable eggs, respectively (Torres-Vila and Fusu, 2020).

Results

Parasitised eggs were easily recognisable due to their characteristic light green colour. The numbers of parasitised, hatched and unviable eggs were $P = 21$, $H = 9$ and $U = 5$ (disks pooled). Thus, 21 out of 35 sentinel eggs were found to be parasitised by *O. rudnevi* (Fig. 2). The uncorrected parasitism rate was $P_U = 60.0\%$ (range 47.1–83.3%), and the net parasitism rate was $P_N = 70.0\%$ (range 57.1–100.0%). Most parasitoids are currently overwintering inside the host eggs to emerge in the late spring or early summer of the next year (2024). However, in a fraction of parasitised eggs (5 out of 21, 23.8%), *O. rudnevi* adults emerged during the same summer in which sentinel eggs were exposed in the wild (July 2023). The specimens of *O. rudnevi* from the Mallorca island closely resemble those from the Extremadura region in mainland Spain, in particular the colour pattern of the female antenna funicular segments (Torres-Vila and Fusu, 2020).

Discussion

We provide the first record of *O. rudnevi* in the Balearic Islands. Results strongly suggest that the parasitoid could be widespread in Mallorca, as we found medium-high parasitism rates, and we were able to detect the parasitoid using a reduced number of sentinel eggs placed in a single holm oak stand. Moreover, although *O. rudnevi* usually undergoes



Fig. 2. Lateral and dorsal views of *Oobius rudnevi* female. Body length: 1.2 mm (antennae excluded) (Photo: Rafael López-Calvo).

Fig. 2. Vista lateral i dorsal de la femella d'*Oobius rudnevi*. Longitud del cos: 1,2 mm (antenes excloses) (Foto: Rafael López-Calvo).

obligate diapause and thereby is a monovoltine species, we found that some wasp lineages from Mallorca exhibit facultative diapause and are bivoltine, similar to what has been reported in mainland Spain (Torres-Vila and Fusu, 2020). Additional studies will be conducted to investigate the distribution, ecology and parasitic potential of *O. rudnevi* as a native biocontrol agent of *C. cerdo* in Balearic holm oak woodlands.

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