Occurrence of *Centrouropoda almerodai* and *Uroobovella marginata* (Acari: Uropodina) phoretic on the Red Palm Weevil in Malta

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ABSTRACT. The unwanted introduction of the Red Palm Weevil (RPW) coincides with the spread in Malta of two species of Uropodid mites associated with this weevil. Usually, adult RPW carry phoretic forms of *C. almerodai* which are attached to the underside of elytrae, and *U. marginata* that prefers exposed surfaces of sternum, pygidium, head and legs. These mites use adult RPW to abandon dead palms and to colonize newly infested host-plants. Their role as plant pests is however negligible. Even the plant pathogen conidia, *Curvularia* which are carried by the mites, seem unable to germinate in palms under laboratory conditions. Both *Centrouropoda almerodai* and *Uroobovella marginata* are established in the Maltese Islands.

KEY WORDS. mite biology, ethology, distribution, Mediterranean.

INTRODUCTION

Several species of mites have a stable or occasional symbiotic relationship with insects from various orders. The Red Palm Weevil, *Rhynchophorus ferrugineus* (Olivier, 1790), a recently introduced pest of palms in the Mediterranean Region is no exception, and the following species have been reported to be associated with this weevil, namely: *Hypoaspis* sp. (Peter, 1989; Gomaa, 2006); *Rhynchopolipus rhynchophori* (Ewing, 1924) (Husband & Flechtmann, 1972; Ochoa *et al*., 1995); *Rhynchopolipus swiftae* Husband & O'Connor, 1999 (Husband & O'Connor, 1999); *Urobovella krantzi* (Zaher & Afifi) and *Eutogenes punctata* (Zaher & Soliman, 1966) (Gomaa, 2006); *Uroobovella marginata* Koch, 1839 (Ragusa *et al.*, 2009a) and *Centrouropoda almerodai* Hiramatsu & Hirschmann, 1992 (Longo & Ragusa, 2006; Ragusa *et al*., 2009a, 2009b) and *Uropoda orbicularis* (Müller, 1776) (Atakan *et al*., 2009). None of the above mentioned species seem to have a possible role in RPW control. The phoretic mite *C. almerodai* has managed to colonise the same habitat colonised by *R. ferrugineus* in Europe. This phoretic mite might cause a higher stimulus to the adult weevils to abandon the palm trees and search for new ones, favouring the distribution of both the mite and the beetle. Most probably the phoretic relationship between the two of them ends when the beetle reaches a new palm on which the mite would complete its life-cycle (Longo & Ragusa, 2006).

In the present work, the presence of *Centrouropoda almerodai* and *Uroobovella marginata* is reported as new for Malta and the biology of these species is discussed.

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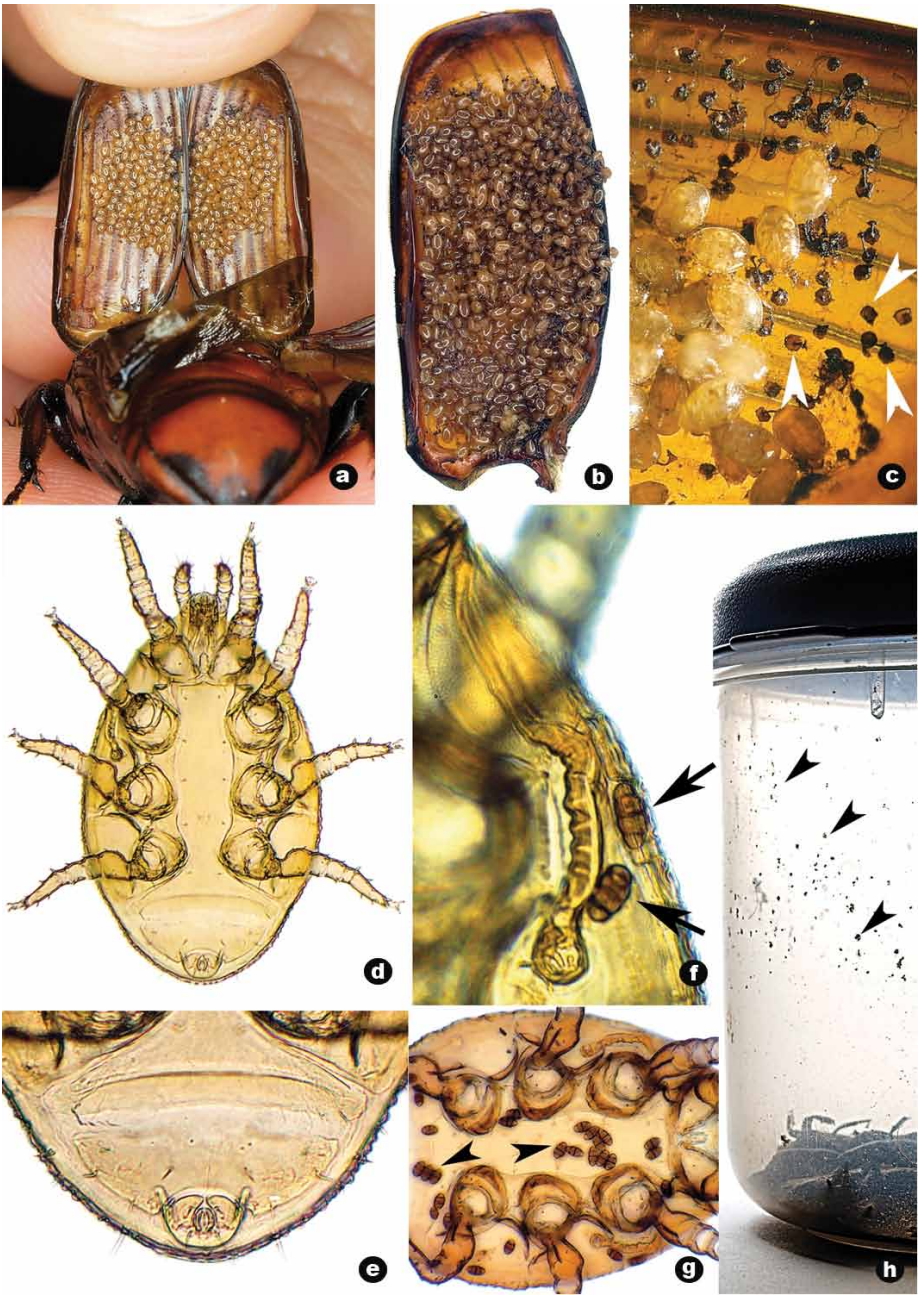

Figure 1: *Centrouropoda almerodai.* **a**, lifted elytrae of adult RPW to show aggregation of mites; **b**, underside of a single elytra bearing more than one hundred phoretic forms of *C. almerodai*; **c**, phoretic mites and their stalks – white arrows; **d**, slide-mounted *C. almerodai* deutonyph and **e**, detail of its anal area; **f**, right stigma with two *Curvularia* sp. conidia - black arrows; **g**, more conidia on deutonymph body; **h**, breeding box where *C. almerodai* adults (black arrows) were reared.

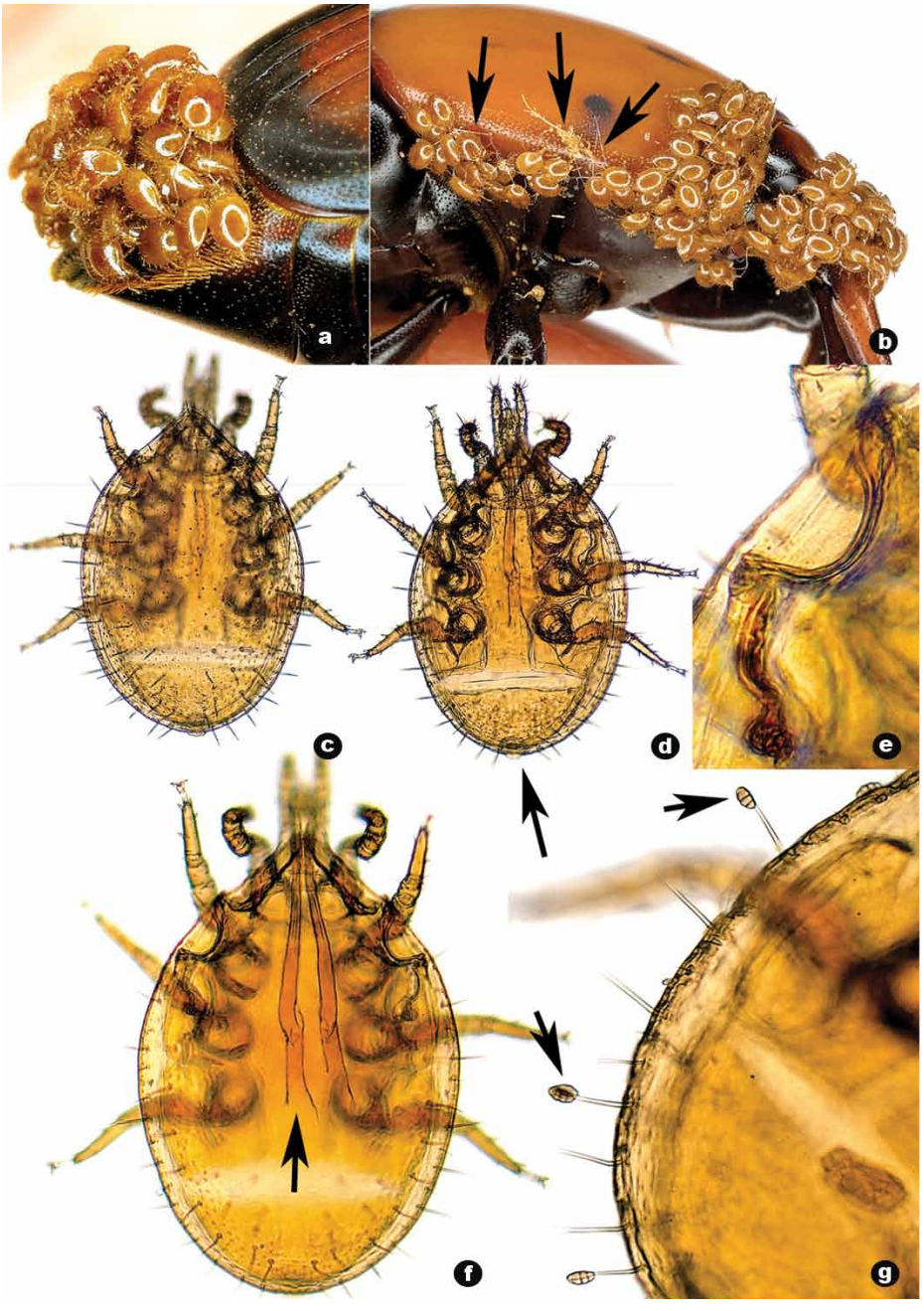

Figure 2: *Uroobovella marginata*. **a**, phoretic deutonymphs on pygidium; **b**, mites tethered (black arrows) on thorax and head; **c**, **d**, phoretic form from dorsum and venter, respectively, black arrow on terminal anus; **e**, left stigma; **f**, deutonymph: black arrow on left chelicera; **g**, conidia of *Curvularia* attached to shield seta of a deutonymph.

MATERIAL AND METHODS

Data presented in this paper was obtained both in the field, by direct observation and collection of mites on RPW, and by breeding mites in the laboratory. *R. ferrugineus* adults were collected between August 2008 and April 2009 from infested *Phoenix canariensis* from different localities in Malta including Floriana, Baħar iċ-Ċagħaq, Ħamrun, Kappara, Madliena, Msida, Mtarfa, Pietà, Salini, Santa Venera and Sliema. Furthermore, pheromone traps in which an aggregation pheromone available in the market was used were placed in 11 different localities from September 2008 until December 2008. The localities in which these were placed include Naxxar, Msida, Salini, Żejtun, Pietà, Rabat, Żurrieq, Mtarfa, Mġarr, Mrieħel and Qormi. Mites were removed from RPW and conserved in 75% ethanol.

Mites were cleared in lactophenol or Essig's fluid (Wilkey, 1990) by moderate warming and later studied in the same clearing fluid or mounted in PVA. Identifications were made on the basis of Wisniewski *et al*. (1992) for *C. almerodai*, and Ghilyarov & Bregetova (1977) for *U. marginata*. Pictures were taken by an Olympus macro digital camera and by Zeiss Photomicroscope III.

RESULTS

Centrouropoda almerodai Hiramatsu & Hirschmann, 1992

(Fig. 1)

Phoretic individuals of *C. almerodai* are mainly found on the underside of the elytrae of the RPW, rarely on wings and first abdominal terga of the RPW. Their number range from few individuals to more than a hundred (Fig. 1a, b). They are firmly attached to the elytra surface through a short and stout stalk that originates from the anal area at posterior end of their body and adheres to the elytral cuticle by an enlarged circular base. The stalks are persistent on the elytrae and remain in place as brown-black spots even once abandoned by the deutonymph (Fig. 1c - white arrows).

Often, these phoretic mites bring conidia of *Curvularia* sp. on their cuticle, preferably on sternum or dorsal shield (Fig. 1e, h: black arrows).

Uroobovella marginata Koch, 1839

(Fig. 2)

Phoretic deutonymphs of *U. marginata* are exposed on the weevil body (Fig. 2a, b), but tethered by a long, flexible stalk (Fig. 2b - black arrows) whose distal end is attached to a smooth cuticular surface. About sixty mites can be found on a single *R. ferrugineus* adult. These are mainly found on sternum, on pygidium, on thorax and on head and rarely on legs and tarsi.

Even *Urobovella* bears *Curvularia* conidia that are attached to dorsal shield setae (Fig. 2g).

Distinguishing features: It is possible to just distinguish living phoretic forms of the two species by a dissecting microscope mainly through stalk morphology and the spiny (Fig. 2a, c, d) aspect of *Urobovella* dorsal shield in comparison to the smoother dorsal shield of *Centrouropoda* (Fig. 1d). Also, the attachment site of the mite on the RPW is a good indication of the mite species in question. However, authoritative identification requires a compound microscope and a good slide mounting technique, proper references plus adequate skills. Once cleared and slide mounted, the

C. almerodai deutonyphs can be distinguished from those of *U. marginata* because of the shape of the stigma (Fig. 1e; Fig. 2e) and anal plate/terminal anus morphology (Fig. 1g; Fig. 2 c, d - black arrows). Also, longer chelicera can be seen through the deutonymph body (Fig. 2f - black arrow) in *U. marginata*.

CONCLUSIONS

The biology of *Centrouropoda almerodai*, is better known than that of *Uroobovella marginata* (Ragusa *et al.*, 2009b). Adults lay one egg at a time on the rotting fibres of the palm. Eggs have an elliptical shape, and are white and slightly milky. The behaviour of all the young stages is very similar; they move on the rotting parts of the palm, looking for food. As a matter of fact, it is possible to see the mites pulling out their chelicerae quickly towards the substratum to capture the various food residues they feed on. Small larvae enclose from the eggs, each with three pairs of legs; they move very slowly and in a few days become protonymphs. These are darker and more sclerotized. The next stage, the deutonymph, is the most interesting for the relationship it creates with the *Rhyncophorus*. It is during this stage that mites look for larvae of the RPW, especially of the last larval stage. The mites follow them while they excavate tunnels and feed on the palm fibres. Even when the mature larvae of the beetle become pupae, the mobile stages of the mite will remain on them, until they become adults. At this stage, deutonymphs will quickly abandon the pupal exuvia and will quickly move on the still soft body of the adult insect, positioning themselves often in large numbers under elytrae and on the membranous wings. At this point, in these places it is possible to observe mobile forms, which will soon change into non-moving forms, fix themselves on their host, through a peduncle protruding from their anus. In this way, when the RPW moves toward a new palm, mites are able to remain attached to the beetle, and hence transported to the new host-palm. Once the new palm is reached, the deutonymphs will abandon the peduncle, becoming mobile forms, and move onto the palm fibres will feed on them to accomplish their biological cycle and becoming adults. Presumably before the last moult, the deuto might eat dead *Rhyncophorus*, probably because its high proteinic value will accelerate their transformation into adults.

The possible role of phoretic acari in plant pathogen conidia dispersion (i.e. *Curvularia* sp.) must be investigated to understand the role of the fungus in palm damages.

Both *Uroobovella marginata* and *Centrouropoda almerodai* can be considered as acclimated and widely distributed in Malta.

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