

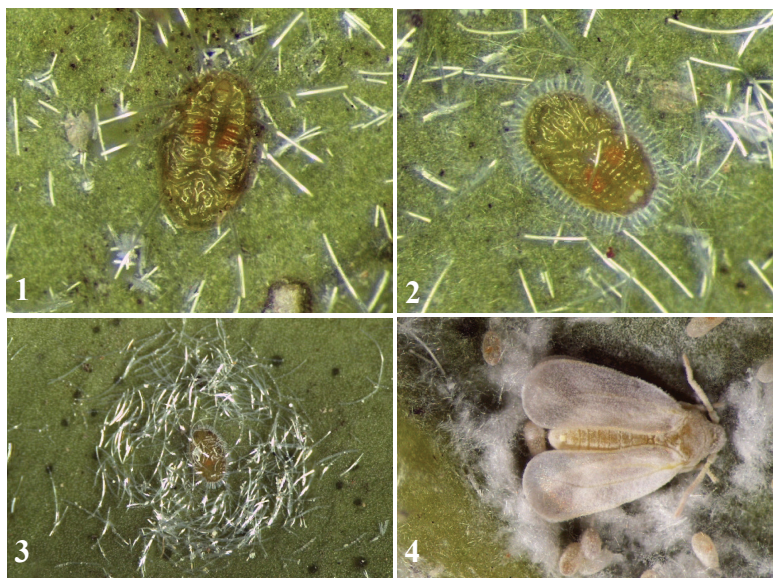
First record of the nesting whitefly, *Paraleyrodes minei* Iaccarino, 1990 (Hemiptera, Aleyrodidae) in Malta

Chris MALUMPHY¹ & David MIFSUD²

Whiteflies are plant-parasitic insects comprising a single family, the Aleyrodidae, with more than 1,550 described species worldwide (MARTIN & MOUND, 2007). Several species are important economic pests of crops and ornamental plants. They damage plants in three main ways: by feeding on plant sap; by contamination of fruit and foliage with honeydew eliminated by the larvae, which serves as a medium for the growth of black sooty moulds; and by the adults acting as vectors of plant-pathogenic viruses. Whiteflies are one of the most frequently transported groups of insects in international plant trade (MALUMPHY *et al.*, 2010) and many species are successful colonisers (MIFSUD *et al.*, 2010). The whiteflies of the Maltese Archipelago were comprehensively reviewed by MALUMPHY & MIFSUD (2012), who recorded 17 species, 40% of which were of non-European origin. The nesting whitefly, *Paraleyrodes minei* Iaccarino, 1990 is the latest exotic whitefly species to be found breeding in Malta, although its arrival had been anticipated since it was spreading rapidly in Sicily (Italy), an island only 50 nautical miles to the North (LONGO & RAPISARDA, 2014).

Paraleyrodes minei Iaccarino, 1990

(Figs 1-4)



Figures 1–4: *Paraleyrodes minei*. 1: Pupa. 2: Teneral 4th instar larva. 3: Larva in waxy ‘nest’. 4: Adult female and eggs.

¹Fera Science Ltd., Sand Hutton, York, YO41 1LZ, United Kingdom. E-mail: chris.malumphy@fera.co.uk

²Institute of Earth Systems, Division of Rural Sciences and Food Systems, University of Malta, Msida MSD 2080, Malta. E-mail: david.a.mifsud@um.edu.mt

Material examined: Malta, Msida (near Wied Ghollieqa), 6.vii.2016, numerous larvae and adults on the leaf undersides of young (3-4 years old) lemon trees (*Citrus limon*), leg. D. Mifsud; Iklin, 16.vii.2016, numerous larvae and adults on *Citrus* sp. leg. D. Mifsud; same data but Zabbar, 17.vii.2016; same data but Zejtun, 20.vii.2016.

Paraleyrodes minei was originally described from specimens collected from *Citrus* crops in Syria by IACCARIO (1990). It is the only member of the subfamily Aleurodicinae that has been found in Malta, all the other species belong to the subfamily Aleyrodinae.

Paraleyrodes minei may be distinguished from all other whitefly species found in Malta by the characteristic ‘nests’ of long wax filaments and fluffy wax that form around the ovipositing females (Fig. 4), and long wax rods that form around the fourth larval instar, known as the ‘puparium’ or ‘pupal case’ after adult emergence; hence the common name of ‘nesting whitefly’. The adults are yellow to pale orange (Fig. 4), about 1.2 mm in length, with two pairs of wings covered in a mealy wax, held relatively flattish over the body. The eggs are elongate oval and have a long pedicel (Fig. 4). The puparium (Fig. 1) is oval, cream, yellow or orange in colour, and about 0.9 mm long and 0.6 mm wide. The puparia occur in dense colonies and may become covered in wax rods exuded by adjacent puparia.

Slide-mounted puparia of *P. minei* may be identified using the key to the whiteflies of Europe and the Mediterranean Basin by MARTIN *et al.* (2000). The key to the whiteflies of the Maltese Archipelago (MALUMPHY & MIFSUD, 2012), can also be used with the addition of the following couplet at the start of the key:

1a. Subdorsal compound pores present; lingula large, tongue-shaped, with four stout setae; each leg with an apical claw *Paraleyrodes minei*
 - Subdorsal compound pores absent; lingula with two setae or none visible; legs without claws 1

The following suite of characters can be used to confirm the diagnosis: dorsum with 1 cephalothoracic and 6 abdominal pairs of compound pores, the latter ones located as follows: 2 smaller pairs (15–20 µm diameter) on the 3rd and 4th abdominal segments, and 4 larger pairs (30–40 µm diameter) on the 5th to 8th abdominal segments; lingula spatulate-globose, extending beyond the posterior margin of the vasiform orifice; and submargin with 14 pairs of long setae. The compound pores exude long wax rods (Fig. 3) which break off around the puparium and form the ‘nest-like’ structures (Fig. 3). The adult males can be identified by the complex shape of the aedeagus, whose apex bears three dorsal and one ventral horn, and a pair of long ventral spines (see MARTIN, 1996; LONGO & RAPISARDA, 2014 for illustrations).

In the Mediterranean Region, other whitefly species which are often found with *P. minei* on citrus include the woolly whitefly, *Aleurothrixus floccosus* and the citrus whitefly *Dialeurodes citri*. The puparia of *P. minei* can be distinguished from the puparia of the other two whitefly species by the presence of long wax rods which the other species do not produce, although *A. floccosus* puparia produce a flocculent mass of short curly wax filaments that forms a dense white mat over the colony.

Paraleyrodes minei is native to the Neotropical Region and has been spread widely by anthropogenic activities in tropical and subtropical areas of the Afrotropical, Nearctic, Austro-Oriental, Pacific and Palaearctic regions (CABI/EPPO, 2015). In the Palaearctic it has been recorded from the Azores, Canary Islands, Cyprus, Iran, Israel, Italy, Lebanon, Madeira, Morocco, Portugal, Spain, Syria and

Turkey (CABI/EPPO, 2015; Evans, 2008; LONGO & RAPISARDA, 2014). It has only recently been found in Sicily, where it is reported to have spread very rapidly in both urban environments and commercial orchards (LONGO & RAPISARDA, 2014). Since the first accidental findings of this whitefly in Msida, its presence was found in all subsequent localities visited and most likely it is already widespread and established all over Malta.

Paraleyrodes minei is polyphagous, feeding on mostly woody plants assigned to 19 families: Annonaceae, Apocynaceae, Araceae, Arecaceae, Asteraceae, Ericaceae, Euphorbiaceae, Lauraceae, Malvaceae, Moraceae, Musaceae, Myrtaceae, Piperaceae, Poaceae, Polygonaceae, Rhizophoraceae, Rubiaceae, Rutaceae and Solanaceae. The significance of records on grasses and other herbaceous plants is unclear. It is most frequently recorded on *Citrus*, including lime (*C. aurantifolia*), sour orange (*C. aurantium*), lemon (*C. limon*) and orange (*C. sinensis*). It is a moderate pest of Japanese persimmon or kaki (*Diospyros kaki*) (BONO & FEDERICO, 2015) and a moderate to severe pest of citrus (GARCIA GARCIA *et al.*, 1992).

There are several other whitefly species known from Italy that could be introduced to Malta with plant trade (MALUMPHY & MIFSUD, 2012). The species that could have the biggest impact in Malta is the orange spiny whitefly *Aleurocanthus spiniferus* (Quaintance) because it is a significant economic pest of citrus. It is native to Asia but has recently become established in southern Italy (PORCELLI, 2008; CIOFFI *et al.*, 2013) and has also been found in Croatia and Montenegro (RADONJIC *et al.*, 2014). It is regulated in the European Union and therefore the risk of introduction is at least partially mitigated.

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