

First Record of *Aleurothrixus floccosus* (Mask.) (Homoptera: Aleyrodidae) in Greece and Some Observations on its Phenology¹

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ABSTRACT

Aleurothrixus floccosus was first found in Greece on citrus trees in several urban areas of East Attica, in May 1991. During the following summer and autumn, all preimaginal instars of the insect were found on sample leaves. Adults were captured on yellow sticky traps throughout this period, until mid-December. During the winter (Dec., Jan.) the majority of the population consisted of third and fourth preimaginal instars. For control of *A. floccosus*, the parasitoid *Cales noacki* (Hymenoptera: Aphelinidae) was imported into Greece from Spain in late 1991. The introduced populations were successfully multiplied in the insectary.

Introduction

Whiteflies (Homoptera: Aleyrodidae), are serious pests of citrus almost all over the world. Until 1991, only two species of this family - *Dialeurodes citri* (Ashmead) and *Parabemisia myricae* (Kuwana) - had been noticed infesting citrus in Greece (Pappas 1981; Michalopoulos 1989; Michelakis and Alexandrakis 1989). In 1989, samples of citrus leaves seriously infested with whiteflies, collected from different regions in the Peloponnesus (Argolis, Achaia, Ilia, Lakonia, Messinia) as well as from different areas of Attica, Euboea and Western Crete, were examined in the laboratory. In all cases, only *P. myricae* was identified.

In May 1991, *Aleurothrixus floccosus* (Maskell) was first found in Attica, on citrus in several suburban neighborhoods of East Athens. Its identification was confirmed by the taxonomist Dr Bink Moenen.

A. floccosus seems to originate from Central and South America (Mound and Halsey 1978).

Around the Mediterranean basin, the insect has been reported in Spain (Moreno Vasquez 1973; Carrero 1975; Garrido *et al.* 1976), France (Onillon 1969), Morocco (Abbassi and Onillon 1973), Portugal (Magalhaes Silva 1979) and Italy (Genduso and Liotta, 1980).

A. floccosus is commonly called the wooly whitefly, because of the wool-like wax filaments that cover its third and fourth instar nymphal and pupae (Gill 1990) (Fig. 1). The eggs are

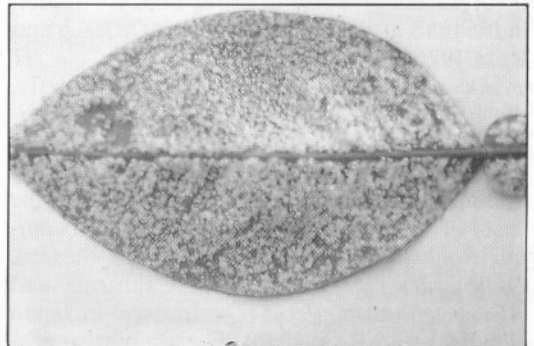


FIG. 1. Sour orange leaf heavily infested with *Aleurothrixus floccosus*.

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brownish in colour and long curved oval in shape. They are usually laid in circles as the female revolves with her inserted rostrum acting as a pivot during deposition (Fig. 2). The first nymphal stage is light green in colour. The wooly covering appears during the second nymphal stage and greatly increases in size during the third and fourth preimaginal instars. The adults are pale yellowish. They seldom fly and, even when they do, they fly rather short distances. The insect lives and oviposits on the under surfaces of leaves.



FIG. 2. Eggs of *Aleurothrixus floccosus* laid in circles.

On citrus, *A. floccosus* is reported as developing 6-7 overlapping generations per year in Spain (Vulic and Beltran, 1977), 4-6 per year in France (Onillon 1973, 1990) and 4-5 generations per year in Sardinia, Italy (Ortu and Ibba 1985). With a fecundity of 53 ± 9 eggs and an average adult lifespan of 36 ± 14 days (Paulson and Beardsley 1986), *A. floccosus* may threaten citrus seriously, since a single mated female can theoretically give rise to more than six million individuals after four generations (De Bach and Rose 1976).

In considering control of this exotic whitefly, the adverse effects of applying chemical insecticides within urban areas were considered, as well as previous failures of whitefly eradication attempts with chemical means, such as in the cases of *A. floccosus* in California, *Aleurocanthus woglumi* Ashmead in Cuba and Mexico, *Dialeurodes citri* Ashmead in California and *Aleurocanthus spiniferus* (Quaintance) in Japan (De Bach and Rose 1976). The alternative possibility of using classical biological control against this new pest of citrus in Greece was

examined. A number of hymenopterous parasites of different families are reported around the world as natural enemies of *A. floccosus*. These include: Aphelinidae (*Cales noacki* Howard, *Encarsia basicincta* Gahan, *Encarsia cubensis* Gahan, *Encarsia haitiensis* Dozier, *Encarsia portoricensis* Howard, *Eretmocerus californicus* Howard, *Eretmocerus haldemani* Howard, *Eretmocerus paulistus* Hempel, *Eretmocerus portoricensis* Dozier, *Prospaltella bella* Gahan, *Prospaltella brasiliensis* Hempel), Encyrtidae [*Plagiomerus cyaneus* (Ashmead)], Eulophidae (*Euderomphale aleurothrixi* Dozier), Signiphoridae (*Signiphora xanthographa* Blanchard) and Platygasteridae [*Amitus spinifer* (Brethes)] (Mound and Halsey, 1978). *C. noacki* has been most widely and successfully used in Mediterranean countries such as Spain (Vulic and Beltran 1977) Portugal (Magalhaes Silva 1979), France (Onillon 1973, 1975) and Italy (Liotta and Magnolia 1983).

Material and Methods

Observations of *A. floccosus* were made on citrus trees in an urban area situated to the west of Mount Hymitos in Attica, Central Greece. Samples of leaves were taken and examined under the stereoscopic microscope. Adults were caught by yellow sticky traps (20 × 20 cm). Visual estimations of infestation rates on 21 sour orange trees (*Citrus aurantium* L.) were made quarterly (once/3 months). These estimations were classified and recorded according to a scale of eight infestation categories, ranging from trees having isolated leaves with waxy spots (the lightest infestation) to trees with half-to-all of the foliage covered with waxy cushions (the heaviest infestation).

Populations of *Cales noacki* Howard (Hymenoptera: Aphelinidae), parasitoid of *A. floccosus*, were introduced from Spain on 90 citrus leaves infested with *A. floccosus* parasitized by *C. noacki*.

Rearings of *A. floccosus* and of *C. noacki* in the laboratory were carried out under $25 \pm 1^\circ\text{C}$ temperature, $65 \pm 5\%$ relative humidity and natural day length, in cylindrical plexiglass cages (30 cm in diameter and 60 cm long).

Results and Discussion

A. floccosus was found infesting leaves of sour orange trees (*C. aurantium*) planted in rows along the streets, as well as lemon (*Citrus limon* Burn. f.), mandarin (*Citrus deliciosa* Ten.) and orange (*Citrus sinensis* Osbeck) trees planted in small house gardens at the neighborhoods of

Zographou, Ilissia, Papagou, Ampelokipi, Halandri, Holargos, Agia Paraskevi and Neo Psychiko, all located near the slopes of Mount Hymitos. *A. floccosus* was also found in one neighborhood in the center of Athens (Exarchea). Until now, the local distribution of *A. floccosus* seems to be limited to Attica. It was not found in 1991 samples taken from other parts of Greece (Argolis, Achaia, Corinthia, Ilia, Lakonia, Messinia, Arta, Preveza).

During summer and autumn 1991, all preimaginal instars were found on sample leaves examined. Parasitized nymphs were not noticed. During the winter (Dec., Jan.) of 1991-92, the *A. floccosus* population found on sample leaves was mostly of the third and fourth nymphal stages. Adults of *A. floccosus* were captured in high numbers (thousands) on yellow sticky traps during the summer and autumn. The flight of adults ceased from mid-December.

On marked trees used for visual estimation, all rates of infestation were found. Two quarterly visual estimations for the 1991 growing season were made, on August 8 and November 14. On most (61.9%) of the marked trees, the rate of infestation increased between these two dates, by one unit on the qualitative scale used. On 28.6% of the trees, there was no change; on 9.5% of the trees, the rate of infestation decreased by one unit.

As a promising natural enemy of *A. floccosus*, *C. noacki* was imported into Greece in three shipments (Oct. 17, Nov. 5 and Dec. 3, 1991) from Valencia, Spain. The introduced populations of *C. noacki* were successfully reared and have multiplied rapidly under laboratory conditions. Current insectary production of *C. noacki* will provide parasites for inoculative and inundative field releases in Attica, scheduled to be carried out during the 1992 growing season.

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KEY WORDS: *Aleurothrixus floccosus*, *Cales noacki*, citrus, Attica, Greece, phenology.

Πρώτη Διαπίστωση στην Ελλάδα και Μερικές Παρατηρήσεις επί της Φαινολογίας του *Aleurothrixus floccosus* (Mask.) (Homoptera: Aleyrodidae)

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ΠΕΡΙΛΗΨΗ

Το *Aleurothrixus floccosus* βρέθηκε για πρώτη φορά στην Ελλάδα επί εσπεριδοειδών σε διάφορες αστικές περιοχές της Ανατολικής Αττικής, το Μάιο του 1991. Κατά τη διάρκεια του θέρους και του φθινοπώρου που ακολούθησαν, πάνω σε δείγματα φύλλων, βρέθηκαν όλες οι ατελείς μορφές του εντόμου. Ακμαία συνελήφθησαν πάνω σε κίτρινες παγίδες κόλλας καθ' όλη τη διάρκεια της περιόδου αυτής και μέχρι τα μέσα Δεκεμβρίου. Κατά τη διάρκεια του χειμώνα (Δεκ., Ιαν.) στην πλειονότητά του ο πληθυσμός αποτελείτο από νύμφες τρίτου και τετάρτου σταδίου. Προς καταπολέμηση του *A. floccosus*, εισήχθη από την Ισπανία περί τα τέλη του 1991 το παρασιτοειδές *Cales noacki* (Hymenoptera: Aphelinidae) που πολλαπλασιάστηκε με επιτυχία στο εντομοτροφείο.