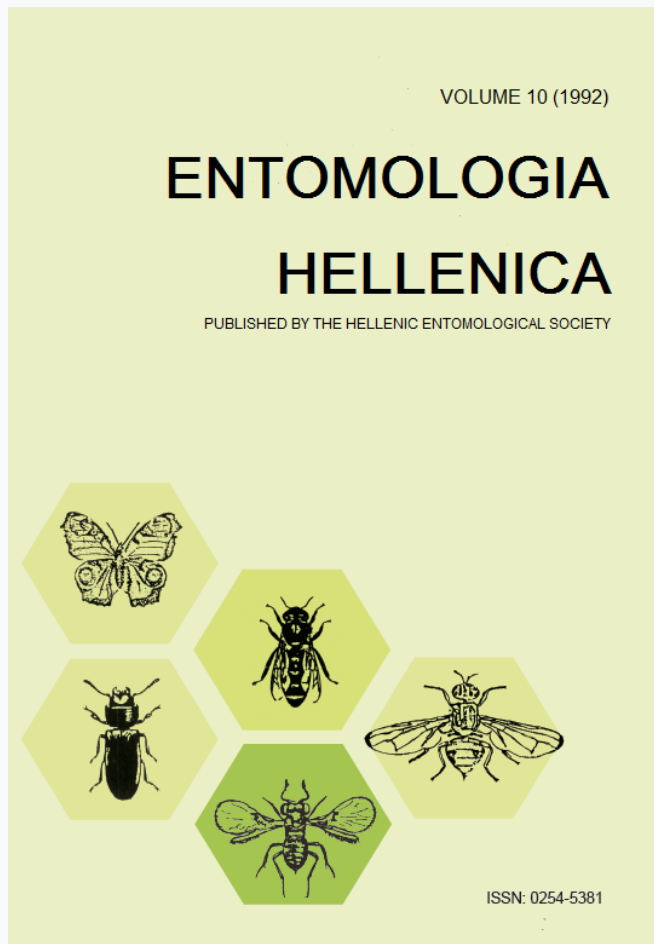


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Flight of White Peach Scale, *Pseudaulacaspis pentagona*, Males and Time of Crawler Appearance in Northern Greece¹

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ABSTRACT

The seasonal flight of white peach scale (WPS), *Pseudaulacaspis pentagona* Targioni-Tozzetti, males was studied during 1989, 1990 and 1991 in a peach orchard of Central Macedonia in Northern Greece by sex pheromone trapping. Three periods of male flight activity (mid-May to late June, mid-July to late August and early September to early November) were recorded annually. These flights correlated with three periods of crawler emergence (late June to early August, second ten days of August to third ten days of September, and mid-April to early May – late May to early June of the next year). The first two periods of crawler activity came approximately 33 and 27 days after the beginning of the two first periods of male flight, respectively, while the crawlers corresponding to the third male flight emerged approximately 15 days after the deposition of the first spring eggs.

Introduction

The white peach scale (WPS), *Pseudaulacaspis pentagona* Targioni-Tozzetti (Homoptera: Diaspididae), is a key pest in peach orchards of Northern Greece. It was first recorded in Central Greece in 1960 and it has been found in many locations throughout the country ever since (Paloukis and Mentzelos 1971, Paloukis 1979). The phenology of the scale has been studied in peach orchards of Central Macedonia, using sampling methods (Paloukis and Mentzelos 1971, Paloukis 1983). The identification and synthesis of the WPS sex pheromone (Heath et al. 1979, Heath et al. 1980, Einhorn et al. 1983) offered the possibility of developing pheromone trapping techniques for male WPS. Pheromone traps have been used to monitor male adult flight activity (Bénassy et al. 1983, Cravedi and Molinari 1988, Nicolas and Bonet 1992). Male flight has been used to forecast

emergence of crawlers and their control by determining timely applications (Bénassy et al. 1983).

The objective of the present work was to study the flight activity of WPS males by sex pheromone trapping, to monitor seasonal crawler activity by a sampling method, and to examine the possible relationship between male appearance and crawler emergence in a peach orchard of Central Macedonia in Northern Greece.

Material and Methods

Male flight activity and crawler appearance were studied for three years (1989-1991) and during the spring of 1992 in an untreated 0.8 ha peach orchard, in Krya Vryssi, Central Macedonia.

Adult males were monitored from May to mid-November using standard WPS pheromone «Trap-test-S» traps (Gruppo Montedison, Farmoplant S.P.A. Piazza Repubblica 14/16, 2014 Milano, Italia). In early May three pheromone traps were placed 1.8-2.0 m above the ground in the north-east side of the trees. Trap catches were recorded two or three times per week and attractive caps were replaced every four weeks. WPS males were counted in

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the lab under a dissecting microscope where traps were transferred.

Seasonal crawler activity was determined by samplings (Bobb et al. 1973, Paloukis 1983) made once or twice per week from early April through September. On each observation date, scale-infested twigs, about 30 cm long, were collected and ca. 150 live scales examined in the laboratory. Data were recorded on the egg deposition and egg hatching timing.

To estimate the relationship between first appearance of the males in the first and second flight, and the corresponding first crawler emergence two techniques were used: pheromone traps and direct observation. Trap observations were taken daily from the installations of the traps to the first male catches. For this purpose in the experimental orchard three pheromone «Traptest-S» traps were placed. First crawler emergence was detected by careful visual observations starting 22-25 days after the onset of male flight and repeated at two or three day intervals in selected peach trees.

Results and Discussion

The seasonal WPS male flight is shown in Fig. 1A. Three almost discrete flights were recorded in each year. The first flight began in mid-May to early June and continued for 6 weeks. The second flight – lasting for 6 weeks – appeared in the middle of July, while the third one occurred in early September and continued until late October – early November. In 1989 and 1990 the 1st flight was followed by a 2-week period with no male activity, while in 1991 the 1st and 2nd flights overlapped. Furthermore, in all years the 2nd and 3rd flights partly overlapped and the

trap captures of both flights were progressively higher than those of the 1st one.

It is evident from the Fig. 1B that there were three distinct periods of crawler appearance, as was also reported by Paloukis (1983) under similar conditions. Emergence of crawlers, corresponding to the 1st male flight of the year, began approximately in the last part of June and continued for 4 weeks. Emergence of crawlers, corresponding to the second flight, started in the second ten days of August and continued until mid-to late September. The crawlers, corresponding to the third male flight, emerged from mid-April to early May of the following year. These last crawlers derive from eggs laid in the spring by females mated during the previous fall (Paloukis and Mentzelos 1971). Their activity lasts approximately 6 weeks known as the first generation of the year.

The first crawlers emerged approximately 33 to 27 days after the beginning of the first and second male flight, respectively (Table 1). Based on this information it is possible to forecast the appearance of crawlers by sex pheromone trapping of the males. This technique can not be used to forecast the emergence of the first generation crawler of the year (mid-April to early June), because these crawlers derive from eggs laid in the spring by females mated during the previous fall (3rd male flight). The above forecast may be possible to be based on the relationship between the deposition of the first spring eggs, as a biofix, and the first crawler emergence. This can be justified by our 4-year observa-

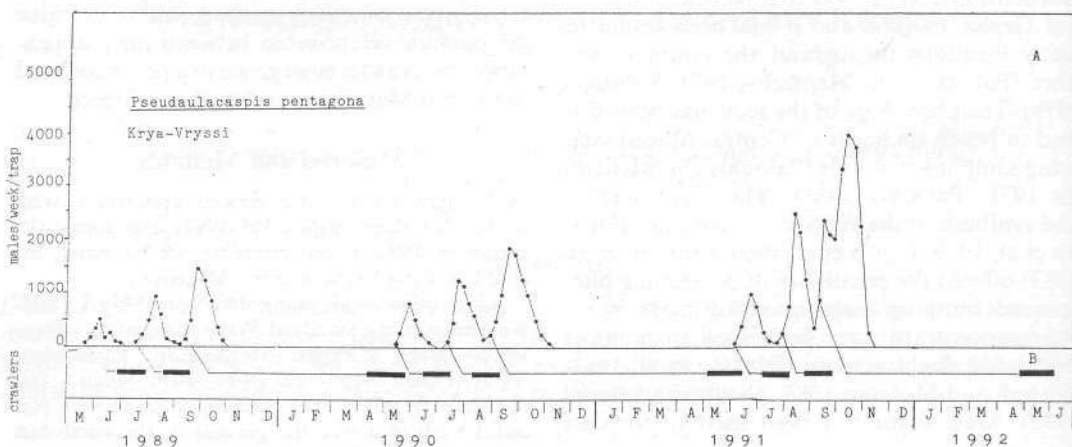


FIG. 1. 1989-1991 (A): White peach scale adult male flight activity, 1989-1991; 1B, white peach scale crawler appearance in 1989-1992 (B) in Krya Vryssi, Northern Greece.

TABLE 1. Appearance dates and time elapsed from first male flight to first crawler emergence, Krya-Vryssi, 1989, 1990, 1991 and 1992.

Male flight	Appearance date		Period from 1st male to 1st crawler
	1st male	1st crawler	Days
First	21 May 1989	27 June 1989	37
	15 May 1990	20 June 1990	35
	6 June 1991	7 July 1991	30
	25 May 1992	25 June 1992	31
Average			33
Second	21 July 1989	19 August 1989	28
	14 July 1990	10 August 1990	26
	29 July 1991	24 August 1991	25
	21 July 1992	19 August 1992	28
Average			27

tions made in the experimental peach orchard showing that the crawler emergence occurs approximately 15 days after the deposition of the first spring eggs (Table 2).

The present study showed that pheromone traps can be used to accurately monitor flight activity of male WPS and to identify discrete generation of the scale under field conditions. Forecasting the emergence of the 2nd and 3rd generation crawlers of the year is essential in timing application of chemicals against the immature stages of scale, under conditions prevailing in Northern Greece.

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TABLE 2. Egg deposition, crawler emergence dates, and elapsed time from first egg deposition to first crawler emergence, Krya-Vryssi, 1989-1992.

Year	Dates ¹		Period from 1st egg to 1st crawler
	1st egg	1st crawler	Days
1989	31 March	14 April	14
1990	30 March	12 April	13
1991	15 April	4 May	18
1992	11 April	26 April	15
Average			15

¹ From mid-March 150 mated females were examined in the lab twice of three times every week.

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KEY WORDS: *Pseudaulacaspis pentagona*, Pheromone, Monitoring.

Πτήση των Αρσενικών και Εμφάνιση των Ερπουσών του *Pseudaulacaspis pentagona* στη Βόρεια Ελλάδα

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ΠΕΡΙΛΗΨΗ

Μελέτες που έγιναν την περίοδο 1989-1991 με φερομονικές παγίδες σε οπωρώνα ροδακινιάς στην περιοχή Κρύας Βρύσης - Γιαννιτσών (Κεντρική Μακεδονία) έδειξαν ότι υπάρχουν κάθε χρόνο τρεις περίοδοι πτήσης των αρσενικών του *Pseudaulacaspis pentagona* Targioni-Tozzetti. Τα αρσενικά της πρώτης πτήσης εμφανίζονται από τα μέσα του δευτέρου δεκαπενθήμερου του Μαΐου και συνεχίζουν την πτήση τους μέχρι το τέλος Ιουνίου. Η δεύτερη πτήση εμφανίζεται από το δεύτερο δεκαήμερο του Ιουλίου, ενώ μια τρίτη αρχίζει χωρίς το Σεπτέμβριο και τελειώνει στις αρχές Νοεμβρίου. Ο αριθμός αυτός των πτήσεων συσχετίζεται με την ύπαρξη τριών περιόδων (τέλος Ιουνίου - αρχές Αυγούστου, δεύτερο δεκαήμερο Αυγούστου - τέλη του β' 10ημέρου του Σεπτεμβρίου και δεύτερο δεκαπενθήμερο Απριλίου - αρχές Ιουνίου του επόμενου χρόνου) εμφάνισης των ερπουσών. Το χρονικό διάστημα που μεσολαβεί από την πρώτη σύλληψη των αρσενικών στις φερομονικές παγίδες μέχρι την παρουσία των πρώτων ερπουσών είναι κατά μ.ο. 33 και 27 ημέρες για τη δεύτερη και τρίτη περίοδο της εμφάνισής τους, αντίστοιχα, ενώ οι έρπουσες της πρώτης γενεάς εμφανίζονται 15 περίπου ημέρες μετά την εναπόθεση των πρώτων εαρινών αυγών. Τα στοιχεία αυτά μπορούν να χρησιμοποιηθούν για τον προσδιορισμό του κατάλληλου χρόνου εφαρμογής των χημικών επεμβάσεων εναντίον των ευπαθών σταδίων (κινητά, σταθεροποιημένα - 1ου σταδίου, άτομα) κάθε γενεάς του κοκκοειδούς.