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Mesostigmata) as predators of the Japanese bayberry
whitefly, *Parabemisia myricae* Kuwana (Hom.,
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NOTE

Mites of the family *Phytoseiidae* (Acarina, *Mesostigmata*) as predators of the Japanese bayberry whitefly, *Parabemisia myricae* Kuwana (*Hom.*, *Aleyrodidae*) ⁽¹⁾

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SUMMARY

The Japanese bayberry whitefly, *Parabemisia myricae* (Kuwana) (*Hom.*, *Aleyrodidae*), a newly introduced pest of avocado and citrus in Israel, is attacked by two predacious mites, *Euseius rubini* Swirski & Amitai, and *Amblyseius swirskii* Athias-Henriot (*Mesostigmata* : *Phytoseiidae*). Adults of *E. rubini* preyed on all stages of this whitefly ; larvae attained adulthood when fed on eggs and larvae of *P. myricae*, but reached only nymphal stages when fed on 2nd and 3rd instars. The adults of *A. swirskii* fed on eggs and larvae and on 2nd and 3rd instars, and continued to lay eggs. The young stages of *A. swirskii* attained adulthood only when fed on eggs and larvae of *P. myricae* ; when fed on 2nd and 3rd instars they died in the nymphal stage. A survey was made of *E. rubini* in association with *P. myricae* in avocado orchards.

Additional key words : *Euseius rubini*, *Amblyseius swirskii*, *predation*, *avocado*, *citrus*.

RÉSUMÉ

Acariens de la famille des Phytoseiidae (Acarina, *Mesostigmata*), *prédateurs de l'aleurode du laurier-cerise*, *Parabemisia myricae* Kuwana (*Hom.*, *Aleyrodidae*).

L'aleurode du laurier-cerise japonais, *Parabemisia myricae* (Kuwana) (*Hom.* *Aleyrodidae*), ravageur nouvellement introduit en Israël sur avocats et citrons, est attaqué par deux acariens prédateurs, *Euseius rubini* Swirski & Amitai, et *Amblyseius swirskii* Athias-Henriot (*Mesostigmata*, *Phytoseiidae*). Les adultes d'*E. rubini* se nourrissent aux dépens de tous les stades de l'aleurode ; les larves ne parviennent au stade adulte que si elles s'alimentent aux dépens des œufs et des larves mobiles du 1^{er} stade de *P. myricae* ; nourries sur les larves des 2^e et 3^e stades, elles ne parviennent qu'au stade nymphal. Les adultes d'*A. swirskii* s'alimentent aux dépens des œufs et des larves mobiles puis des larves du 2^e et 3^e stade et continuent à pondre les œufs. Les jeunes stades d'*A. swirskii* atteignent l'âge adulte uniquement lorsqu'elles se nourrissent aux dépens des œufs et des larves mobiles de *P. myricae* ; alimentées avec des larves du 2^e et 3^e stades, ils meurent au stade nymphal. Un examen de l'association *E. rubini*-*P. myricae* a été réalisé en vergers d'avocats.

Mots clés additionnels : *Euseius rubini*, *Amblyseius swirskii*, *prédation*, *avocat*, *citrus*.

I. INTRODUCTION

The Japanese bayberry whitefly, *Parabemisia myricae* (Kuwana), a newly introduced pest in Israel (STERNLICHT, 1979), causes serious damage to citrus and somewhat less damage to avocado plantations (SWIRSKI *et al.*, 1980a ; 1980b). The pest occurs also on other plants (SWIRSKI *et al.*, 1980a). At the same time the pest was reported as new in

California (Anon., 1978 ; ROSE *et al.*, 1981). In Japan (KUWANA, 1927), its country of origin, the pest is successfully controlled by the parasitic wasp *Encarsia* (= *Prospaltella*) *bemisiae* (Ishii) (*Hymenoptera*, *Aphelinidae*) (ISHII, 1938 ; YASUMATSU & WATANABE, 1965). In Israel some natural enemies imported from other countries were released in the field : e.g. *Eretmocerus* sp. (*Hymenoptera*, *Aphelinidae*) sent by M. ROSE and P. DEBACH from California ; *Delphastus pusillus* (Leconte) and *Nephaspis amnicola* Win. (*Coleoptera*, *Coccinellidae*) sent by PO-YUNG LAI from Hawaii ; *Cybocephalus binotatus* Grouvelle (*Coleoptera*, *Cybocephalidae*) from laboratory culture of D.

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BLUMBERG, originally from Pakistan. The establishment of these natural enemies in Israel is not yet known. Several local natural enemies were observed to prey on this pest: coccinellids, chrysopids (*Chrysopa carnea* Stephens), and a heteropterous predator from the family *Anthocoridae* (SWIRSKI *et al.*, 1982). Predatory mites from the family *Phytoseiidae* were found in considerable numbers associated with this pest, particularly *Euseius rubini* (Swirski & Amitai) and *Amblyseius swirskii* Athias-Henriot (SWIRSKI *et al.*, 1982); the former is more abundant in avocado orchards, and the latter in citrus plantations (WYSOKI & SWIRSKI, 1971). In a Bet Dagan orchard, as many as 50 predatory mites of *E. rubini* were observed on one avocado leaf infested with *P. myricae*.

Laboratory trials were conducted to clarify the predatory habit of these mites on *P. myricae*.

II. MATERIALS AND METHODS

The laboratory culture of *E. rubini* was started from mites collected in avocado orchards at Bet Dagan heavily infested with *P. myricae*. The *A. swirskii* used in those experiments were from a laboratory culture of 9 years on *Carpobrotus edulis* N. Bal. pollen, so they were well adapted to this food. This strain is even less effective as a predator (RAGUSA & SWIRSKI, 1977). The mites were bred according to SWIRSKI *et al.* (1967) and all stages of *P. myricae* collected from the field were supplied as food. The experiments were done on small plates (3 cm diameter), with a base plate on which a sponge and filter paper were placed to ensure moisture for the avocado leaf used as substrate. A plastic cover with a 3 cm opening was placed on the leaf and fixed in place by 2 metal clips. A barrier consisting of Canada balsam and castor bean oil (1:1) surrounded the plate to prevent the mites from escaping. The experiments were conducted in incubators at a constant temperature of $27 \pm 1^\circ\text{C}$, 70% R.H., and 16 h light/8 h dark regime.

III. RESULTS

A. Field records

In many avocado orchards of Israel *E. rubini* was found in association with *P. myricae*, and was observed to prey on the pest. The records are as follows (coll. with E. SWIRSKI and det. with E. SWIRSKI & S. AMITAI): Rosh Haniqra 19.XI.81, Matzuba 6.II.79, 20.III.81, 19.XI.81, Eylon 6.II.79, Cabri 6.II.79, 20.III.79 (abundant), Yehiam 5.IX.79, Regba 6.II.79, 19.XI.81 (Western Galilee); Daphna (abundant), Mulata, Sade Eliezer (abundant), Yesod Hamaala, Gadot, Shefer, 24.IX.81, (Upper Galilee and Hula Valley); Arbel 8.XII.81 (Lower Galilee); En HaShofet 8.XII.81 (Mt. Carmel); Bet She'arim, Kibbutz Sarid, Megiddo 8.XII.81 (Yizre'el Valley); Ramat Yohanan 23.VII.79, 'En Shemer (abundant), 'En HaHoresh, Nahshonim, Ramat HaKovesh 31.VIII.81, Ga'ash 21.IX.79; 31.VIII.81 (abundant), Bet Dagan V.81 (abundant) (Coastal Plain); Tequma 25.II.82 (Negev).

B. Laboratory experiments

The laboratory experiments and field observations show that the adults of *E. rubini* prey on all stages of *P. myricae*, even on newly emerged whiteflies that still do not have extended wings. The mites were observed copulating and laying eggs. Moreover, when the mite populations started from larvae, they attained adulthood and laid eggs when fed on the eggs and larvae of *P. myricae* (table 1). The same populations (from larvae of *E. rubini*) when started on 2nd and 3rd instars, were not successful and the mite reached only nymphal stages. Nymphs of *E. rubini* attacked the eggs and larvae and reach adulthood, but if they preyed on 2nd and 3rd instars they did not reach adulthood. Laboratory mass rearing of *P. myricae* was successful for 6 generations.

In preliminary experiments with *A. swirskii*, the mites preyed on *P. myricae*. The adults fed on eggs and larvae and continued to lay eggs (average of 0.35 egg/female/day), as they did when fed on 2nd and 3rd instars (0.28 egg/female/day). The young stages of this predator did

TABLE 1

Effects of Parabemisia myricae (Kuwana) as a prey on the development and fecundity of Euseius rubini (Swirski & Amitai). Relation entre le stade de la proie consommée (Parabemisia myricae Kuwana), le développement et la fécondité du prédateur (Euseius rubini Swirski & Amitai).

Stages of <i>P. myricae</i> as a food	Active stages	Initial population	<i>E. rubini</i>			6-day oviposition rate (eggs/female/day)
			Attaining adulthood			
			females	males	%	
Eggs and larvae	larvae	20	13	7	100	1.01
	nymphs	20	12	6	90	1.02
	adults	16				0.98
second and third instars	larvae	20	0	0	0 (*)	
	nymphs	20	0	0	0 (*)	
	adults	15				0.76
fourth instars (and pupae)	adults	12				0.50

(*) Did not develop beyond nymphal stages.

not develop on this prey to adulthood, except when fed on eggs and larvae. When larvae of *A. swirskii* bred on 2nd and 3rd instars they died in the nymphal stage. The *A. swirskii* used in those experiments was a strain which had been bred in the laboratory for 9 years and was well adapted to pollen of *C. edulis*. This strain is characterized by low fecundity, and thus, additional experiments should be carried out with field-collected mites.

IV. DISCUSSION, CONCLUSION

Mites of the family *Phytoseiidae* are known as predators of whiteflies. *A. swirskii* and *E. rubini* are effective predators of the tobacco whitefly, *Bemisia tabaci* (Gennadius) (TEICH, 1966; SWIRSKI *et al.*, 1967). The immature stages of *B. tabaci* were also attacked by 3 additional phytoseiids: *Typhlodromus medianicus* Elbadry, *T. sudanicus* Elbadry (ELBADRY, 1967) and *Amblyseius aleyrodus*

Elbadry 1967 (ELBADRY, 1967; GAMEEL, 1971). The last mentioned develops and reproduces, as well as or better, on pollen or mites than on *B. tabaci* (ELBADRY, 1968). *A. aleyrodus* attacks the immature stages of *B. tabaci* and reaches a very high oviposition rate: 1.8 progeny on whitefly nymphs and 1.07 on whitefly eggs, per female per day (ELBADRY, 1968); *E. rubini*, fed on the same food, had an average of 0.68 progeny (TEICH, 1966; SWIRSKI *et al.*, 1967). In addition to *E. rubini* and *A. swirskii*, 4 other species are found in avocado orchards of Israel: *Typhlodromus athiasae* Porath & Swirski (SWIRSKI *et al.*, 1981, 1982), *Seiulus amaliae* Ragusa & Swirski (SWIRSKI, 1980), *Amblyseius largoensis* Muma and *Iphiseius degenerans* Berlese, which was observed in one case to prey on *P. myricae* (SWIRSKI *et al.*, 1982). The predation of *P. myricae* by phytoseiid mites is one example of the adaptation of local natural enemies to a newly introduced pest.

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