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Characteristics of Infestation of Olive Trees by *Prociphilus oleae* (Leach ex Risso) (Homoptera: Pemphigidae)¹

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ABSTRACT

A widespread infestation of olive trees in and near the city of Thessaloniki by *Prociphilus oleae* (Leach ex Risso) (Homoptera: Pemphigidae) was observed in 1988. Colonies including immatures and young alate adults were observed as late as early June. Infested trees were abundant along the streets of the Kalamaria section of the city. Infestations were also recorded 12 Km to the south and 75 Km to the southeast of the city, as well as on the island of Thassos, 200 Km to the east. Most infested trees had broad leaves and dense foliage, as well as scars, fissures, or other cavities on the trunk and limbs, and were shaded during part of the day by other trees or neighboring buildings. Compact colonies of the aphid occupied usually the basal part of 2 to 3-year old shoots at various heights in the trees up to 4 m, and mostly 1.5 to 2.5 from the ground. Usually there was one colony per shoot, and exceptionally up to 5.

Introduction

Prociphilus oleae (Leach ex Risso, 1826) (Homoptera: Pemphigidae) is the only species of aphid known to infest olive trees. It has been reported from a number of countries bordering the northern coast of the Mediterranean, namely Greece (Koroneos 1939), France, Turkey (Tuatay and Remaudière 1964), and mainland Italy (Roberti and Monaco 1987). Barbagallo and Stroyan (1980), with reservations, identified as *P. oleae* two adult apterous virginogeniae and immatures collected in Sicily on roots of a plant considered to be grapevine by the person who provided the sample. Information about the insect's life history is limited and is given only by Koroneos (1939) and Roberti and Monaco (1987). Koroneos found it in several locations of central and southern Greece on olive, *Olea europaea*, and on another oleaceous host, *Phillyrea media*. He

states that on olive the fundatrices occur in the fissures near the base of the trunk, while the fundatrigeniae almost exclusively infest the "wild shoots" at the base of the trunk, and seldom occur higher on the trunk. On *P. media* they occur on "stems and branches" towards their base. The fundatrigeniae are winged and migrate at the end of April and early May from these oleaceous primary hosts to the roots of an unknown secondary host or hosts. Alatae sexuparae fly to the primary hosts in November - December and the fundatrix occurs in March. Roberti and Monaco found it on the campus of the University of Bari on olive, during the first 10 days of May. It occurred on suckers, mostly towards the base of the trunk, where due to low vegetation there is shade. Infested trees were on uncultivated land. The colonies consisted of approximately 50 individuals, including fundatrices, alatae fundatrigeniae and immatures. The alatae fundatrigeniae abandoned the olive in mid May to go to the secondary host to lay the young virginogeniae.

In the spring and summer of 1988, many col-

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onies of the insect were seen in and near the city of Thessaloniki (northern Greece) on olive trees and on a few *Phillyrea media* shrubs. Observations made during that period are given below, to supplement our knowledge of the life history and habits of this insect.

Results and Discussion

The period of infestation

The presence of *P. oleae* infested olive trees in the city of Thessaloniki was brought to our attention by one of our students, on the 16th of May 1988. On 21.V.1988 we found many infested trees along the streets of the Kalamaria section of the city. Live infestations included immatures of various instars, with predominantly last-instar larvae, and alate adults. The immatures had their body covered with dense wax, giving the colonies their typical appearance (Fig. 1A). In addition to the colonies of live insects, groups of exuvia of last-instar immatures were detectable in certain trees (Fig. 1B), indicating that in early colonies the adults had already emerged and abandoned the olive trees. On 23.V.1988 dense white colonies were still abundant, while on 7.VI.1988 there were still many but fewer, and were limited to the trees of fewer city blocks than a week earlier. On 24.VI.1988 no live insects were found in the whole city section under survey.

The above observations show that, in Thessaloniki in 1988, certain colonies of immatures persisted on olive trees approximately one month later than recorded by Koroneos (1939) in central and southern Greece, and less than a month later than observed by Roberti and Monaco (1987) in Puglia, Italy.

Distribution of infested olive trees

In 1988, there was a widespread infestation on olive trees in the Kalamaria section of the city of Thessaloniki. Kalamaria is a residential section occupying the southern part of the city proper and reaching the coast of the Thermaikos gulf. Most streets have shade trees, including olives, along the sidewalks. Shade, ornamental and fruit trees and shrubs are also found in many front and back yards. Several hundreds of infested olive trees occurred along

the streets of Kalamaria in 1988. Along certain streets there was no infestation, while along others as many as half the trees were infested. In some streets 3 or 4 trees in a line were infested, while in others an infested tree was followed by a few to several uninfested ones. On the University of Thessaloniki Farm in Micra, another low-elevation area, 12 Km to the south of the city of Thessaloniki, in a grove of 60 olive trees, 13 were found infested by the aphid. On the same farm, infestation was noticed also on a few *Phillyrea media* shrubs.

During a two-day search along coastal Halikidiki, 80 to 120 Km southeast of Thessaloniki, groups of last instar exuvia were noticed on only 2 olive trees, which were within 100 m from summer houses. On Thassos, an island of the northern Aegean Sea, 200 Km to the east of Thessaloniki, live infestation or exuvia were noticed in 7 trees of the cultivar *Thurmbolia* of a small grove near summer houses.

Characteristics of infested trees

A high percentage of the infested olive trees in the city of Thessaloniki and in coastal Halikidiki, in 1988, had some or all of the following characteristics: deep scars, fissures, or other cavities on the trunk or on the main limbs. Those cavities were caused by the removal of limbs, shoots, or suckers in the past, or by large wounds of the bark. Some trees had knobs or galls at the base of the trunk, at or near the soil line or up to half a meter from it. The cavities seem to offer suitable sites for the sexuales to lay the winter eggs. In some infested trees, exuvia were seen in such protected sites, and in many trees active apterous colonies in late May and early June occurred within a few centimeters to less than a meter from such protected sites.

Olive cultivars with broad leaves and dense foliage, such as the Kalamon, were infested to a greater extent than narrow-leaved varieties with less dense foliage. Along the streets of the city, most infested and uninfested trees were shaded during part of the day by neighboring buildings and by such trees as pines, poplars and acacias. Most of those trees had little exposed soil surface around their bases, the rest of the sidewalk being paved. Many trees were watered during late spring and summer. Presumably they were not receiving insecticide

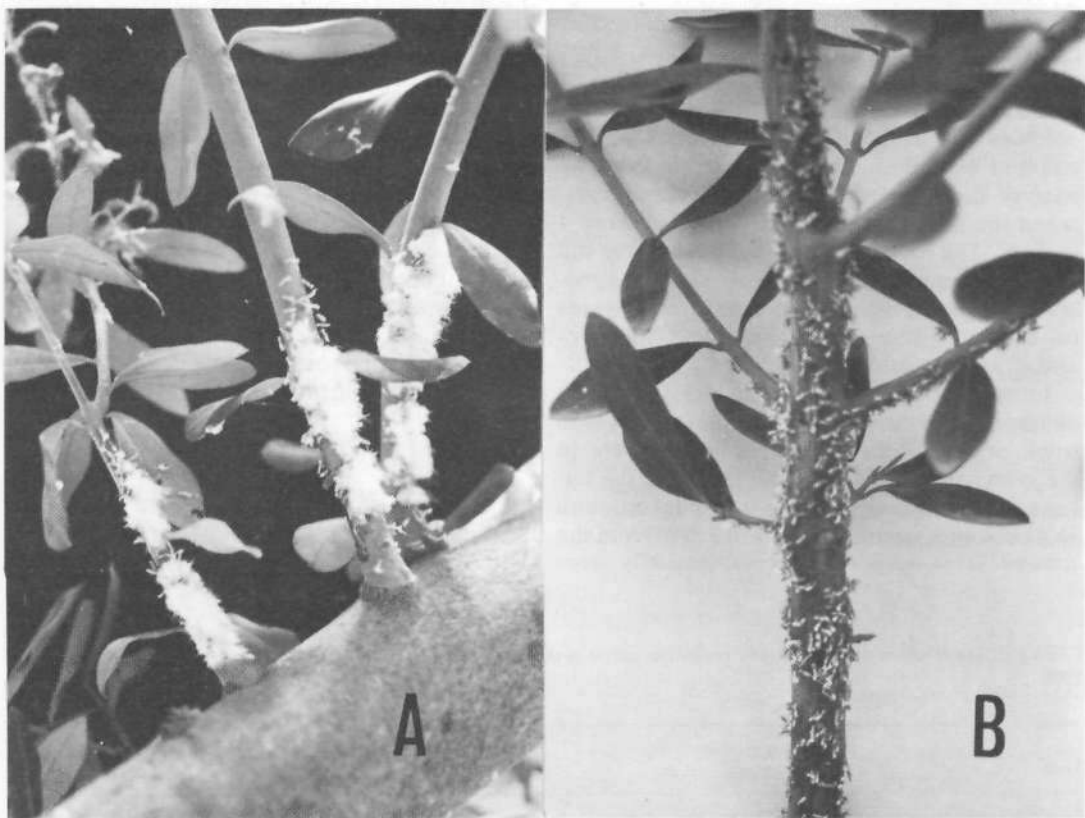


Fig. 1. A: Colonies of immatures of *Prociphilus oleae* on three adjacent olive shoots, in late May 1988. B: Groups of exuvia of last-instar immatures, showing where recent colony was.

treatments. Some trees infested by *P. oleae* in Kalamaria in late May 1988, had also colonies of immatures of the olive psylla, *Euphyllura phillyrae* Foerster. Many more olive trees, in Kalamaria, were infested by *E. phillyrae* than by *P. oleae* in that year.

Form and location of colonies in the tree

Thirty to more than 60 individuals congregate close to one another, forming compact colonies. The immatures are covered by abundant secreted cottony wax, giving the colony its typical cottony white appearance, as described by Koroneos (1939) and seen in Fig. 1A. Last-instar immatures have posterior wax filaments often as long as their body. In late May and early June 1988, in the city, the colonies were established on suckers near the base of the trunk or, more frequently, on shoots along the trunk and/or along main limbs. Infested shoots

had a base diameter of 0.8 to 3 cm. Most shoots were vigorous and vertical, while some were at various angles or even horizontal. Infested shoots within the crown of the trees were 2 to 3 years old and some still had leaves at their basal part where the insect's colonies mostly occurred. The colonies surrounded the shoots completely or partially over a length of 2 to 5 cm. Colonies having a length of 4 cm or more were considered as large and are referred to as such in Table 1.

In contrast to shoots in the tree crown, infested suckers growing from the basal part of the trunk were often one-year-old or less. On most shoots the colonies occupied the basal part of the shoot (Fig. 1A). No colonies were seen on the apical part of shoots or twigs bearing one-year-old or younger leaves. On certain shoots groups of exuvia, indicating an earlier colony, were seen near and distal to live colonies. As a rule, there was one colony per

shoot. On some shoots there were more than one colony, and in an exceptional case, 5 discrete colonies were found on a shoot. Three of them are seen in Fig. 1A. In the case of 5 colonies on a shoot the basal ends of the colonies were 0, 5, 11, 42, and 70 cm from the base of the infested shoot. The distances between the proximal 3 of those colonies were 1 to 3 cm. The base diameter of the shoot was 0.8 cm. The fecundity of the fundatrix and the possibility of it establishing more than one colonies on the same shoot or on adjacent shoots remains to be established.

In addition to colonies and individuals we observed at or near the base of the trunk or on trunk or root suckers, many colonies were in the crown of olive trees. The height of the latter colonies varied between 0.8 and 4 m, with most colonies occurring at 1.5 to 2.5 m from the ground. This height differs substantially from

that reported in the literature. Koroneos (1939) states that fundatrigeniae occur almost exclusively on suckers of the base of the trunk and seldom higher on the trunk, while Roberti and Monaco (1987) mention that the insect occurred also on suckers near the ground. The heights of colonies in some trees are given in Table 1.

On suckers along the basal part of the trunk, single immatures were also observed. In trees where most individuals had reached the adult stage and left the tree, a few single last-instar immatures were seen walking down the trunk. Their final destination is unknown to us.

The infrequent appearance on olive trees

P. oleae seems to be distributed along the northern coast of the Mediterranean (Tuatay and Remaudière 1964) yet, records outside

TABLE 1. Distribution of colonies of *Prociphilus oleae* in some olive trees in the city of Thessaloniki, in May and June 1988.

Tree	Number and size of colonies	Height from ground (m)	Diameter of shoot or limb (cm)
23 May 1988			
A	1 large	1.5	—
B	6 —	1.4-1.5	0.5-1.0
C	4 —	2.2-2.3	—
D	1 —	2.3	1.0
E	1 small	1.4	1.0
E	1 —	2.0	1.0
E	A few	2.5	—
F	6 large	2.5	0.8-1.2
F	3 large	—	0.8
F	2 —	—	0.8
G	1 —	—	1.2
H	Several	2.0	0.8-1.5
H	A few	0.3-0.5	—
I	A few	2.5	—
7 June 1988			
J	1 large	1.8	—
K	1 large	2.2	—
L	1 large	—	0.8
M	1 large	2.0	2
N	1 large	2.1	0.8
O	3 large	2.5	—
O	6 —	0.8-2.0	—
P	1 large	2.5	1.0
Q	1 large	0.0	Trunk
R	—	1.5	—
S	1 —	3.0	—
T	1 small	1.7	0.8
U	2 large	4.0	1.5

Greece are few. Only mention is made that it has been observed in France and Turkey (Tuatay and Remaudière 1964) and its presence on mainland Italy was observed for the first and only time in 1985 (Roberti and Monaco 1987), and there is some doubt about the identity of the specimens collected in Sicily (Barbagallo and Stroyan 1980). In Greece, Koroneos (1939) found it in the region of Pelion in 1931, 1932 and 1935, on the island of Euboea in 1935 and 1938, in Nafplion (southern Greece) in 1936, and in Glyphada (a suburb of Athens) in 1938. Koroneos (in litteris) did not encounter the aphid between 1938 and 1962 in any part of Greece, including Halkidiki. Santas (1983) includes *P. oleae* among the insects whose honeydew is fed upon incidentally by honeybees in Greece, without mentioning the year or location this was observed. We observed a few colonies on olive trees near Bralos, a hilly location in central Greece in May 1983, then came the widespread infestation reported in the present paper. We feel that if the aphid had infested the aerial part of olive trees frequently, its presence would have been recorded more often than so far.

It is worth noting that, in Italy, the aphid was observed on the campus of the University of Bari. In Thessaloniki we found the aphid either on our University Farm, or within the city. The few colonies outside the city were on trees near human habitations. All the sites where Koroneos observed the insect were also either within towns or villages, or not far from them. In inhabited areas people may have brought the aphid's secondary host(s) in sufficient proximity to the primary host(s) and/or in other ways may have created conditions favorable for the aphid's appearance in noticeable numbers.

Given the infrequent occurrence of noticeable colonies of the aphid on olive trees in recent years, we consider the 1988 infestation in Thessaloniki and suburbs as an outbreak. In the region in question, the spring of 1988 was unusually favorable for several other species of aphids infesting annual and perennial plants. Excessively dense populations of other aphids were observed for instance on poplars, causing premature leaf drop, in addition to other damage.

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KEY WORDS: Olive aphid, *Prociphilus oleae*, Pemphigidae, Olive insects

Χαρακτηριστικά της Προσβολής Ελαιοδένδρων από το *Prociphilus oleae* (Leach ex Risso) (Homoptera: Pemphigidae)

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ΠΕΡΙΛΗΨΗ

Το *Prociphilus oleae* (Leach ex Risso) είναι το μόνο είδος αφίδας που προσβάλλει τα ελαιόδενδρα. Οι γνώσεις μας για τον τρόπο ζωής του είναι περιορισμένες. Το 1988 παρατηρήθηκε μια εκτεταμένη προσβολή από την αφίδα αυτή σε ελαιόδενδρα μέσα και κοντά στη Θεσσαλονίκη. Αποικίες της αφίδας που αποτελούνταν από ανήλικα στάδια και νεαρά πτερωτά ενήλικα παρατηρήθηκαν πάνω στα δέντρα ως τις αρχές Ιουνίου. Κατά μήκος των οδών της περιοχής Καλαμαριά, τα προσβλημένα από το έντομο δέντρα ήταν πολλά. Επίσης, διαπιστώθηκαν προσβλημένα δέντρα 12 χιλιόμετρα νότια και 75 χιλιόμετρα νοτιοανατολικά της Θεσσαλονίκης, καθώς και στη Θάσο. Τα πλείστα των προσβλημένων δέντρων είχαν πλατιά φύλλα, πυκνό φύλλωμα, ουλές, ρωγμές, ή άλλες κοιλότητες στον κορμό και τους βραχίονες και σκιάζονταν κατά τη διάρκεια μέρους της ημέρας από άλλα δέντρα ή από γειτονικά κτίρια. Οι χαρακτηριστικές σαν βαμβάκι πυκνές αποικίες της αφίδας βρίσκονταν συνήθως στο βασικό τμήμα βλαστών ηλικίας 2 ως 3 ετών, σε διάφορα από το έδαφος ύψη, ως 4 μέτρα και οι πλείστες σε ύψος 1,5 - 2,5 μέτρα. Συνήθως υπήρχε μία αποικία ανά βλαστό και κατ' εξαίρεση περισσότερες, ως 5.