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Biology and postembryonic development of *Ommatissus binotatus* Fieber, a pest of the Dwarf Palm in Sicily

(Insecta, Homoptera, Auchenorrhyncha, Tropiduchidae)

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The five immature stages of *Ommatissus binotatus* Fieber are described and illustrated. The main characters that allow us to easily distinguish the various stages are emphasized. Moreover, data are given on the biology of this species and on the phytopathological aspects resulting from the activity of this tropiduchid on the host plant.

O. binotatus, in Sicily, is a monophagous species on *Chamaerops humilis* L. It is univoltine and overwinters in the egg stage.

The distinctive characters between the fifth instar nymphs of *Ommatissus lofouensis* Muir and *Ommatissus binotatus* Fieber are also made evident.

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Introduction

Chamaerops humilis L., commonly called "dwarf palm" because of its reduced size, is the only palm native to Europe. This species, found in the western stenomediterranean region, is typical of the mediterranean woodland and prefers dry, sandy and rocky biotopes. In Italy, it characterizes, together with other essences such as *Olea europea* var. *sylvestris* Brot., *Ceratonia siliqua* L. and *Myrtus* sp., the vegetation belt defined as "thermomediterranean".

From an economic point of view, the market of *C. humilis*, in Italy, seems to be thriving, even though, unfortunately, precise data are missing both on the number of plants sold and on the business connected to this plant. However, it is in high demand not only as an ornamental plant particularly suitable for embellishing gardens and parks, but also as foliage, used mostly in floral decorations. In the past century, the leaves were used even to make brooms and mats, or as "vegetable hair" to stuff sofas and armchairs. Today it is no longer used for this purpose but there has been emphasis on the sale of leaves for ornamental reasons, directed mostly toward Central and Northern Europe.

Two species of Auchenorrhyncha, both belonging to the family Tropiduchidae and the genus *Ommatissus* Fieber (*O. binotatus* Fieber and *O. magribus* Asche & Wilson) are associated with the dwarf palm.

The genus *Ommatissus* includes 12 species widespread in the Oriental, Afrotropical and Palearctic Regions. Among these, four are known from the Oriental Region: *Ommatissus binaculatus* Muir from northern India and Pakistan; *Ommatissus chinsanensis* Muir from China and Hong Kong; *Ommatissus lofouensis* Muir from southern China, Japan and Korea, and *Ommatissus vietnamicus* Asche & Wilson

Figs 1-3. *Ommatissus binotatus* Fieber. **1.** Egg at SEM (× 124). **2-3.** Eggs in *Chamaerops humilis* L. leaf.

from Vietnam. Five species are widespread in the Afrotropical Region: *Ommatissus alpinus* Linnavuori and *Ommatissus tumidulus* Linnavuori from Sudan; *Ommatissus bourgoini* Asche from Zaire; *Ommatissus kamerunus* Asche & Wilson from Cameroon; *Ommatissus natalensis* Asche & Wilson from South Africa. Three species are known from the Palearctic Region: *Ommatissus binotatus* Fieber from Italy (Sicily) and Iberian Peninsula; *Ommatissus lybicus* Bergevin from the Middle East; *Ommatissus magribus* Asche & Wilson from Morocco.

Little is known about the biology of these species, except for *Ommatissus lybicus* Bergevin which is considered the most serious pest of date palms in the Middle East (Alfieri 1934; Hussain 1963, 1974; Gharib 1966; Klein & Venezian 1985); as for the other species, only the host plant is known for some of them (*Ommatissus binotatus* and *Ommatissus magribus* live on *Chamaerops humilis* L. and *Ommatissus tumidulus* on *Poenix* sp.); knowledge on the others is inexistent. The study of the biology of the Auchenorrhyncha associated with palms can be important, because some species of these Homoptera are implicated in the transmission to palms of plant disease pathogens (for instance the Palm Lethal Yellowing) (Wilson 1987).

This paper contributes to the knowledge of the biology and postembryonic development of *Ommatissus binotatus* Fieber, the only species of the *Ommatissus* genus living in Italy.

Materials and Methods

The observations on the postembryonic development of *Ommatissus binotatus* were mainly made in a full field in the province of Siracusa (Sicily, Italy). In the three-year period 1994-96, the natural groupings of *Chamaerops humilis* L., in the Vendicari Natural Reserve, were periodically examined. During some trips, immature stages and adults were collected and later reared in laboratory for the purpose of obtaining plentiful material for the morphological descriptions and biological observations.

Laboratory studies mostly concerned the morphology of immature stages. Drawings and measurements were made on specimens preserved in 70 % alcohol and acetic acid. The following dimensions were taken from the juvenile stages: total body length, from the tip of the vertex to the distal apex of the abdomen; maximum thoracic width; thoracic length, from the anterior margin of the pronotum to the posterior margin of the metanotum. The measurements regarding body length of the various stages were taken on specimens which showed all the extended abdominal segments.

For the SEM observations, the eggs and immature instars were immersed in Karnovsky's fixative (Karnovsky 1965) for 2 h. After washing in 0.1 M (pH 7.2) cacodylate buffer, they were postfixed in 1 % osmium tetroxide for 1 h, rinsed in the same buffer and dehydrated in a graded ethanol series. This material was then dried by the critical-point method, using liquid CO_2 in a Balzers CPD 020 apparatus and gold-coated in a MED 010 Sputter Coater (Balzers Union) and observed under a Jeol JSM 5200 scanning electron microscope operating at 15 kV.

As regards the description of the immature stages, a detailed description of the first instar specimens is provided. Only the changes that differentiate them from the previous instar are highlighted for the later stages.

Description of eggs and immature stages

Eggs (Figs 1-3)

Dimensions. Length 0.72-0.80 mm; width 0.28-0.32 mm.

The egg is ellipsoidal with the anterior pole sharp and the posterior one rounded; the ventral surface is somewhat concave while the dorsal one is convex. Anteriorly, it has a large, subcircular respiratory area with the operculum and a short respiratory horn. At oviposition, the *O. binotatus* Fieber egg is milky white, but during embryonal development its colour can change to yellowish white.

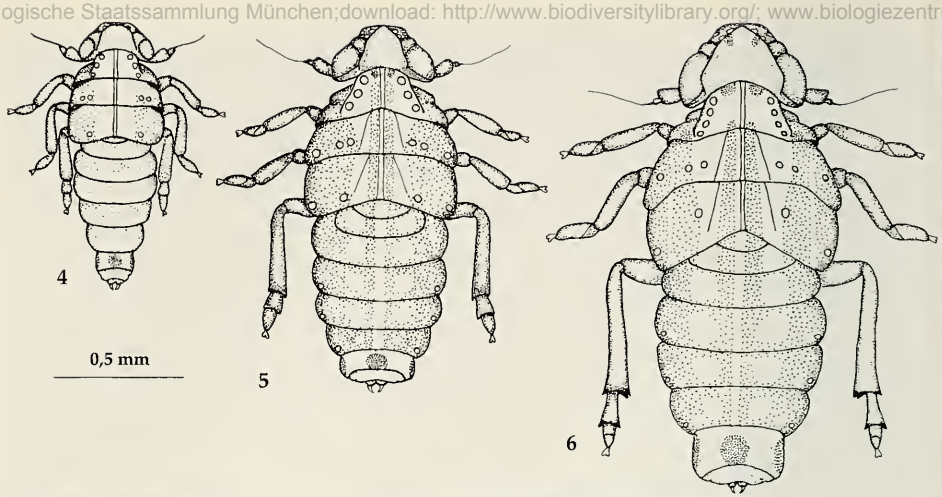
The female of *O. binotatus* Fieber inserts its eggs in the mesophyll of the leaf lamina in correspondence with the dehiscent lines of the *Chamaerops humilis* L. leaf. The eggs are laid only on the lower leaf surface and arranged in a linear sequence (Fig. 2). Each egg is entirely thrust into the leaf tissue, leaving only the operculum and respiratory horn exposed (Fig. 3).

First instar (Figs 4, 7)

Dimensions. Body length 1.02-1.42 mm; thoracic length 0.34-0.42 mm; thoracic width 0.40-0.46 mm.

Vertex pentagonal, wider than long; its surface slightly concave and has medially a longitudinal groove, just visible. The anterior margin forms an obtuse angle, posterior margin weakly concave. Frons, a bit wider than long, with a median carina, two lateral internal carinae and two lateral external carinae. All the carinae originate from the anterior margin of the frons and extend up to the frontoclypeal sutura. Surface between the median carina and each lateral internal carina large and flat. Area between each lateral internal carina and the corresponding lateral external one narrow and concave, with ten sensory pits. Clypeus convex, shows a subconical postclypeus and a subcylindrical anteclypeus. Antennae with anular and short scape; pedicel subcylindrical, long more than twice as long as scape; flagellum with bulbous basal portion, a little shorter than pedicel. The compound eyes are big and red.

Thorax wider than long, divided into three pairs of plates by a longitudinal median groove. Pronotum with rounded anterior margin and slightly arcuate posterior margin, longest medially. Each pronotal plate with a sinuous-shaped carina which originates anteromedially and extends posterolaterally, not reaching the posterior margin of the pronotum. Each pronotal plate with a row of three sensory pits near the inner side of the carina. Mesonotum about as long as pronotum, with weakly convex anterior margin and posterior margin slightly sinuous mostly in the lateral portions; even mesonotum longest medially. Each mesonotal plate with three sensory pits arranged parallel to the



Figs 4-6. *Ommatissus binotatus* Fieber. **4.** First instar. **5.** Second instar. **6.** Third instar.

posterior margin, two of which in dorsomedial position and one in lateral position. Metanotum a little longer than mesonotum, with slightly convex anterior margin and concave posterior margin. Each metanotal plate with two sensory pits near posterior margin, one of which in dorsomedial position, one in lateral position.

Pro- and mesocoxae elongated and subcylindrical; metacoxae quadrangular and fused with metasternum. Trochanters of all legs developed, particularly the posterior ones, which bear some cuticular sclerified folds medially (Fig. 7). Femora of all legs elongated and cylindrical; hind femora longest and most robust. Tibiae well developed and progressively expanded distally; hind tibiae, larger than pro- and mesotibiae, with a crown of four spines at distal tip of ventral surface. Pro- and mesotarsi consist of one segment, elongated and tapered distally, with two small apical claws; metatarsi two-segmented: proximal segment subcylindrical with four spines at distal tip of ventral surface; distal segment ovoidal, slightly curved and with two small claws at distal tip.

Abdomen slightly narrower than thorax, nine-segmented; last two segments often telescopically invaginated and therefore not always visible; IX segment surrounds the anus. IV, V and VI segments with one sensory pit lateroventrally; VII segment without sensory pit; VIII segment with one sensory pit lateroventrally, IX segment with as two sensory pits, one ventrally, the other dorsally. On each side of the membranous area of the VII and VIII segments there are wax-producing plates that secern long and fine waxy filaments.

All first instar specimens are white with areas mostly pigmented and, for the most part, weakly defined contours. On head, the clypeus is soft brown; thorax with two wide grey-brown bands laterally on each tergite, tarsi of all the legs soft brown; abdomen grey-brown with transversal bands on the I-VI tergites, lateral and lateroventral portions of IX segment with brown pigmentation. In this stage, furthermore, the specimens have black spots, characteristic for their number, position and extension: one very large spot occupies the basal half of the frons reaching to the frontoclypeal suture; three large spots, one circular and in dorsomedial position, two elongated and lateral, characterize the VII abdominal tergite.

Second instar (Fig. 5)

Dimensions. Body length 1.30-1.70 mm; thoracic length 0.50-0.54 mm; thoracic width 0-54-0.58 mm.

In this stage, the head has eleven sensory pits on the frons. On the whole, it is rather similar to the first instar.

Thorax similar to that of first instar specimens, even regarding number and arrangement of the sensory pits. Differences are in the medial carinae of the pronotum which are more distinct, and in the appearance of a carina on each plate of meso- and metanotum; it is barely evident and originates near

the anteromedial angle, extends obliquely towards the posterior margin and ends just beyond the halfway point of the length of each segment. Anterior and median legs with two-segmented tarsi: the proximal segment shorter than the distal. Posterior legs with five spines at the distal tip of the tibiae; the two tarsal segments are more developed than those of the first instar, the proximal segment bears a crown of four spines on the distal margin.

The most significant differences regarding the abdomen concern the number of sensory pits. In the second instar, in fact, the IV-VI tergites have two sensory pits on each side, the VII tergite has one sensory pit in the lateral position; the VIII has two sensory pits lateroventrally and the IX tergite has two sensory pits, as in the first instar.

In the second instar specimens, coloration is different from that of the first instar ones. They bear two black spots at the apex of the frons; the black spot on the basal half of the frons is slightly reduced; the dorsal grey pigmentation on thorax and abdomen has more defined contours. Two dark suffused spots are on the anteromedial margin of the pronotum, from which two less pigmented median longitudinal bands originate, extending to the distal tip of the VI segment. The lateral portions of the thorax keep the soft greyish coloration already found in the first instar; on the abdominal tergites, the pigmentation is concentrated mostly on the sides of the midline, forming the above-mentioned longitudinal bands, and at the sides of each tergite; grey transversal streaks connect the lateral portions to the median bands.

Third instar (Fig. 6)

Dimensions. Body length 2.12-2.28 mm; thoracic length 0.60-0.72 mm; thoracic width 0.72-0.80 mm.

Head less turgid than in the previous instars. Face more elongated, with more distinct carinae. Frons with eleven sensory pits. Antennae with more developed scape, it is a little less than half as long as the pedicel; the bulbous portion of the flagellum approximately ⅓ of the length of the pedicel.

In this instar, the pronotum is the shortest tergite of the thorax and bears four sensory pits at the inner side of each medial carina. The mesonotum has more evident and longer median carinae than in the second instar; they do not reach the posterior margin; laterally, the mesonotum differentiates two short wingpads that cover the anterolateral margins of the metanotum. Metanotum as long as mesonotum or a little shorter , the medial carinae are more marked but shorter than the mesonotal ones; the wingpads differentiate themselves even on the metanotum and are broadly expanded lateroposteriorly to make the posterior margin seem strongly arcuate; besides, due to better development of the metanotal plates, each dorsal sensory pit takes on a central position, almost leaning against the outer side of the medial carina. Regarding the legs, the major differences are found in the hind legs: the tibiae bear distally a crown of six spines, the median pair of which has a more proximal insertion, and laterally a spine-shaped pad; metatarsi three-segmented: the proximal segment distally with a crown of five spines, the medial one is shorter than the previous segment and differentiates distally two rudimentary spines, the distal segment is of intermediate length and does not bear spines.

The IV, V and VI abdominal tergites show one pit without sensory hair situated medially with respect to the two sensory pits already observed in the previous instar; the VIII segment shows three sensory pits; the VII and IX segments have, as in the second instar specimens, one and two sensory pits, respectively.

Significant differences in coloration can be noticed. On the head, the black spot, situated in the basal half of the frons, is slightly reduced; on the anteromedial margins of the vertex two dark subtriangular spots are differentiated. On pronotum, the spots delineated in the second instar on the anteromedial margin are darker and more extensive; besides, near posterior margin two dark spots near the outer side of each medial carina are differentiated. The grey dorsal coloration of thorax and abdomen is better defined, and is represented by two medial longitudinal bands, which originate near posterior margin of pronotum and reach, as in the second instar, the posterior margin of the VI abdominal tergite. On abdomen, the pigmentation between each median band and the corresponding lateral portion of each segment is reduced progressively.

Fourth instar (Fig. 8)

Dimensions. Body length 2.60-2.80 mm; thoracic length 0.84-0.88 mm; thoracic width 1.00-1.04 mm.

Number and arrangement of the sensory pits on head, thorax and abdomen are the same as those of the third instar.

Fig. 7. *Ommatissus binotatus* Fieber.Cuticular folds on the metathoracic trochanters of the first instar (× 1900).

The head is generally more developed; the face is more elongated and the vertex shows a marked longitudinal median groove.

The mesonotum is the longest segment of the thorax. It has strongly lobate wingpads that cover each lateral portion of the metanotum for more than half of its length. Wingpads of metanotum are developed and extend posteriorly to the II or III abdominal segment. Other significant changes are on posterior legs: tibiae with a spine-like pad and a robust spine on lateral margin; at distal tip with a crown of six spines. First tarsal segment with five spines distally; second segment shorter than first, with two spines at distal tip.

Abdomen without any particular morphological differences compared to the third instar.

Coloration. Frons with a more and more reduced black spot on basal half; on the contrary, the two black spots located on apex which emerged in the second instar, are more extensive. The two subtriangular spots outlined on vertex in the third instar larger and black, just like the two pairs of spots on the pronotum. Even the grey dorsal coloration shows further modifications. Besides the two median longitudinal bands (which are, moreover, well outlined), the pigmentation on each side of meso- and metanotum results in two longitudinal streaks, while on each side of abdomen it forms a longitudinal band from the well defined contours.

Fifth instar (Fig. 9)

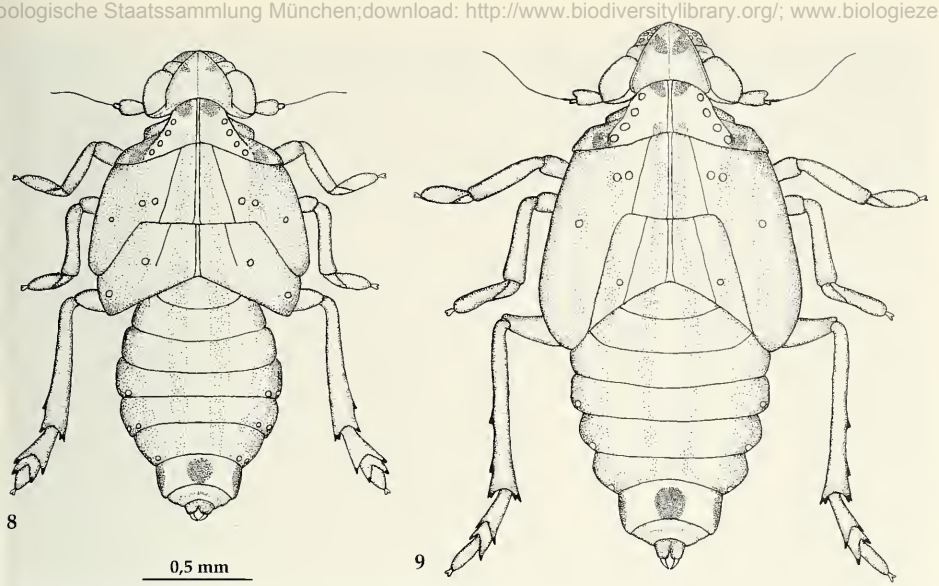
Dimensions. Body length 3.00-3.16 mm; thoracic length 1.00-1.08 mm; thoracic width 1.32-1.40 mm.

The most significant differences which allow to distinguish the fifth instar specimens from those of the fourth instar concern thorax and coloration.

On thorax, the mesonotal wingpads are much more developed and extend to the apex of the metanotal wingpads. Each metanotal plate has the median carina reaching posterior margin; each plate bears only one sensory pit in dorsomedial position.

Posterior tibiae with two robust spines on lateral margin and six/seven spines at distal tip; first tarsal segment with six spines distally, second segment with two.

Regarding the modifications of the black spots on head and thorax, the following can be observed: 1. further reduction of the spot located in basal half of frons; 2. greater extension of the spots located on vertex and those on posterior margin of pronotum; 3. reduction and different shape, from circular



Figs 8-9. *Ommatissus binotatus* Fieber. **8.** Fourth instar. **9.** Fifth instar.

to subtriangular, of the spots on anterior margin of pronotum. Further differences can be seen even in dorsal coloration. The two medial longitudinal bands are narrower and the pigmentation on the sides of meso- and metanotum forms three fine longitudinal streaks, instead of two as in fourth instar.

Biological data

The data regarding the annual cycle of *O. binotatus* Fieber are outlined in Tab. 1. In Sicily the species is univoltine and overwintering at the egg stage. The eggs hatch at the end of the second decade of April and continue scalarly until about the first decade of June. The first and second instar specimens move very little and they live on the lower leaf surface of the leaf lamina near the hatching site. The behaviour of the specimens in the later stages is different; they are more active as they develop and even move around, by jumping from one leaf to another or from one plant to another, if nearby.

Moulting occurs when the cuticle breaks according to two preformed lines of weakness; one, transversal, which extends on each side from the anterior margin of the vertex to near the anteromedial angle of the eye, following the outer side of the external lateral carinae; the other starts from the apex of the vertex and continues along the medial longitudinal grooves on vertex and thorax, reaching the posterior margin of the metanotum.

Since the hatching of the eggs is scalar, the specimens of all juvenile stages can be observed on vegetation during the first decade of June.

Tab. 1. Life history of *Ommatissus binotatus* Fieber in Sicily. Symbols: • = egg; o = nymphs; + = adult

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
•••	•••	•••	•••	•••	•						
			oo	ooo	ooo	ooo					
					+	+++	+++	+++	++		
						•	•••	•••	•••	•••	•••

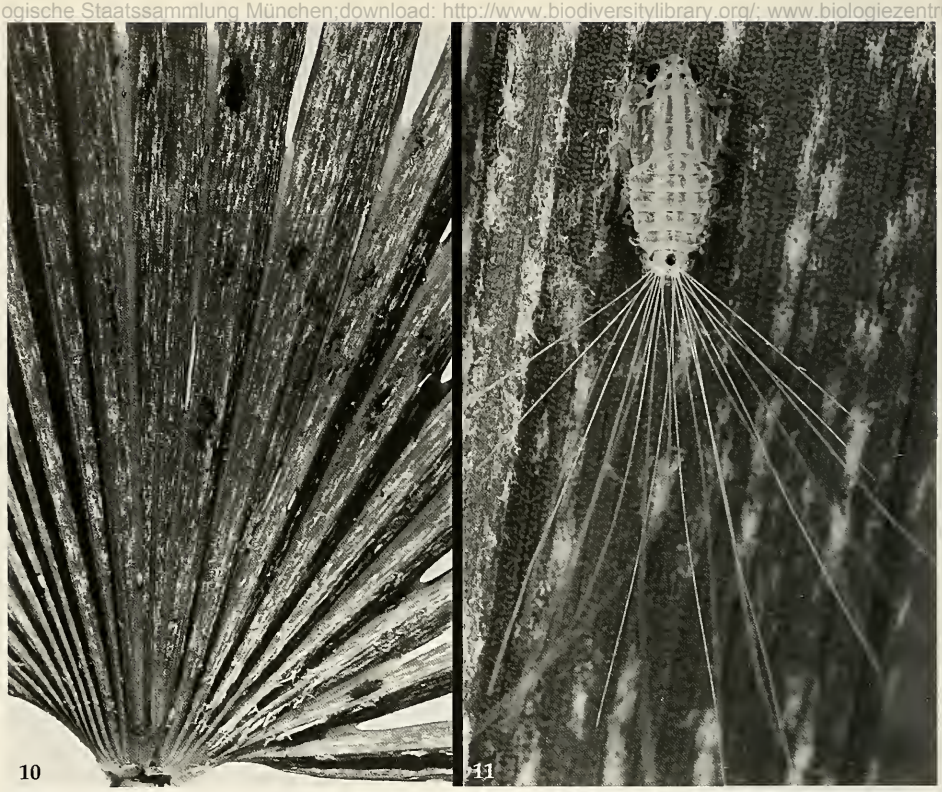


Fig. 10. Development of sooty mold on honeydew of *Ommatissus binotatus* Fieber on *Chamaerops humilis* L. leaf.
Fig. 11. Fourth instar nymph showing long waxy filaments posteriorly.

In all the immature stages there is an abundant production of honeydew.

The postembryonic development lasts about two months. The adults emerge in the last decade of June and the ovipositions begin in the third decade of July. The adults are present until the second decade of October with the last ovipositing females.

In Sicily, natural enemies were not observed preying upon or parasitizing the eggs or immature stages of *O. binotatus*.

Phytopathological aspects

The action of the insect on the plant comes about in various ways and with different effects. The feeding punctures, usually inflicted from the lower surface of the leaf, are to be considered negligible from a phytopathological point of view, since the areas concerned do not show alterations nor necrotic processes. From this point of view, the oviposition punctures are more important. The female digs a deep hole with her ovipositor in the thickness of the leaf lamina, in which she inserts the egg; the plant tissues concerned go into necrosis after a short time.

Another significant phytopathological aspect is the large quantity of honeydew produced in the immature stages. The production of honeydew is often followed by the development of sooty molds (Fig. 10). They cause damage to the plant indirectly; the development, in fact, of the mycelium forms a black papery layer that obstacles the photosynthetic activity and the gaseous exchanges in that area of the leaf.

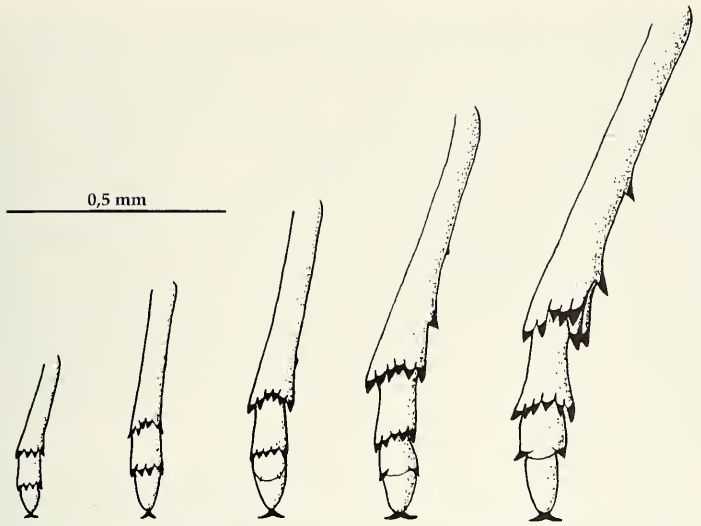


Fig. 12. Development of hind legs and arrangement of relative spines in the juvenile stages of *Ommatissus binotatus* Fieber.

As a consequence of the presence of honeydew and sooty molds, it is possible to observe various insects eating sugar solutions, especially bees, wasps and ants of the *Camponotus* genus, and Psocids on *Chamaerops* plants in Sicily.

Considering the above, it is easily understandable how the leaves concerned by the attack of this plant sucking insect are subject to significant alterations, even from an aesthetic point of view. Their presence cause, therefore, economic damage since the plants showing this damage can encounter difficulty in the commercialization process. However, it must be pointed out that the specimens of *O. binotatus* essentially carry out their biological cycle on not young leaves that the palm has already produced in the course of several months. Besides, it has been observed that the entity of the populations living on the natural groupings of *Chamaerops humilis* in Sicily is never excessively high and this allows the palm to tolerate the colonization of this insect without to many damages.

Conclusions

The five immature stages of *O. binotatus* Fieber differ among themselves not only for the dimensions but also the number of sensory pits, the presence and development of wingpads, the number of tarsal segments, the number of spines on the tibia and on the first and second tarsal segments of the hind legs, the presence and extension of black spots on the head, thorax and abdomen, and the general body coloration.

The main distinctive characters are outlined in Tab. 2; in this table the expression "2 + 1", referring to the number of pits present on the abdominal tergites helps to distinguish the two typical sensory pits from one pit without sensory hair. The development of the hind legs and the arrangement of its relative spines in the five stages is illustrated in Fig. 12.

The sensory pits (Fig. 13) are characteristic of the juvenile instars of the Fulgoromorpha; they are located on the frons, thoracic and abdominal tergites and show a deep depression, circular or elliptic, with a sensory hair arising from it, near its edge. The sensory pits, other than the sensory function, also seem to have a glandular function, with wax production, as observed in *Metcalfa pruinosa* (Say) (Lucchi & Santini 1993). Besides, in all the juvenile stages the specimens show long waxy filaments sunburst-arranged (Fig.11) at the distal tip of the abdomen. These filaments are produced in a waxy area (Fig. 4)

Tab. 2. Comparison of the postembryonic stages of *Ommatissus binotatus* Fieber. - = no spot; o = slightly visible or not very extensive spot; + = distinct and extensive spot; □ = distinct and very extensive spot. Other explanation in text.

	I° instar	II° instar	III° instar	IV° instar	V° instar
Spot on the basal half of the frons	□	□	+	+	o
Spots on the apex of the frons	–	□	□	□	□
Spots on the vertex	–	–	o	+	□
Spots on the anterior margin of the pronotum	–	o	+	□	□
Spots on the posterior margin of the pronotum	–	–	o	□	□
Spots on the VII° abdominal segment	□	□	□	□	□
Number of sensory pits on each side of the frons	10	11	11	11	11
Number of sensory pits on each side of the pronotum	3	3	4	4	4
Number of sensory pits on each side of the mesonotum	3	3	3	3	3
Number of sensory pits on each side of the metanotum	2	2	2	2	1
Number of spines on the lateral margin of the hind tibiae	–	–	–	1	2
Formula of the spines on the hind legs	4-4-0	5-4-0	6-5-0	6-5-2	6/7-6-2
Number of sensory pits on each side of the abdominal tergites:					
IV°	1	2	2 + 1	2 + 1	2 + 1
V°	1	2	2 + 1	2 + 1	2 + 1
VI°	1	2	2 + 1	2 + 1	2 + 1
VII°	–	1	1	1	1
VIII°	1	2	3	3	3
IX°	2	2	2	2	2

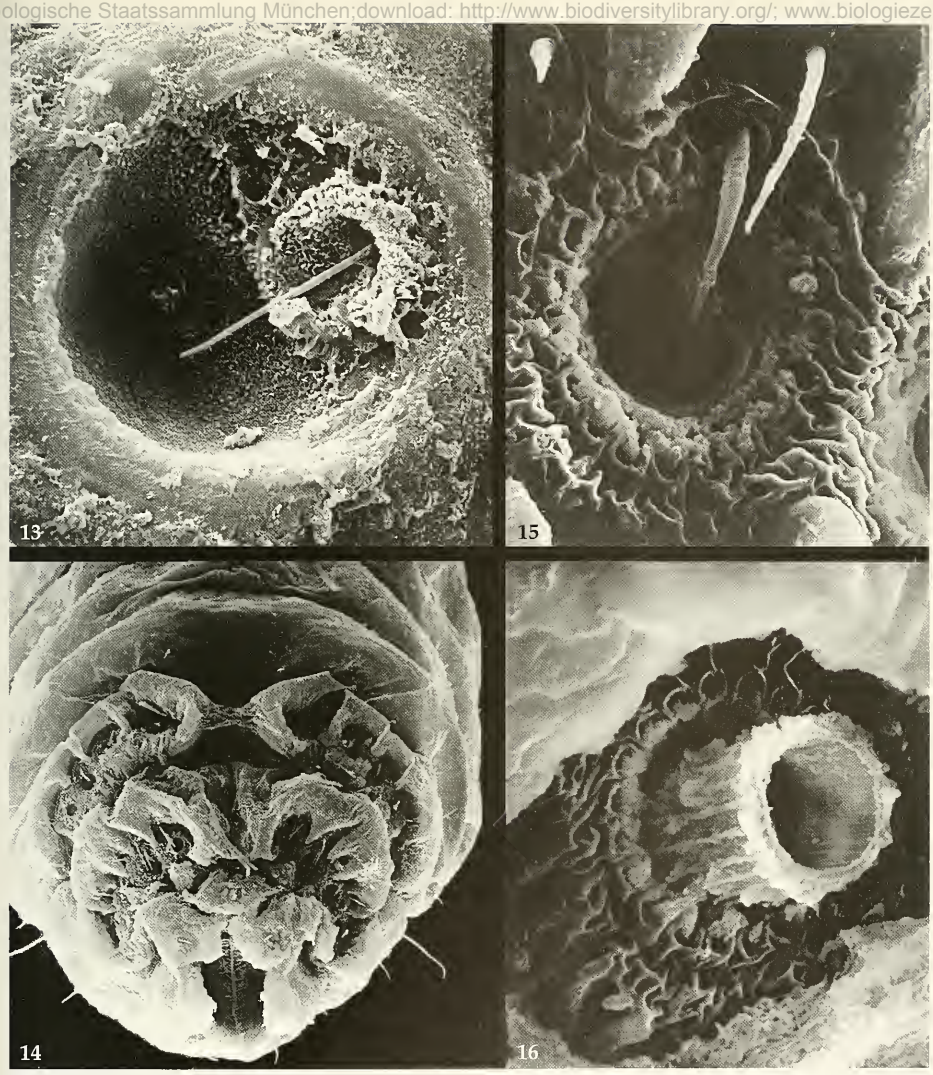
made up of six pits arranged on each side of the VII and VIII abdominal segments. Each pit represents a complex glandular structure since it is formed by a central canal, externally surrounded by a crown of small pores. On the superior margin there is a hair with a sensory function, whose distal tip reaches the central glandular cavity. It seems that the smaller pores produce ribbon-like wax (Fig. 15); the central glandular canal forms long waxy filaments which are entirely hollow (Fig. 16).

O. binotatus Fieber is a monophagous species on *Chamaerops humilis* L. In Italy, it has only been recorded in Sicily. Asche & Wilson (1989) reported it only from the western region ("above Trapani, Mount Erice"), but further investigations showed that this tropiduchid is widespread in the island.

The possibility of identifying the immature stages of the pest or those potentially so, is surely an important aspect in pest control programs. From a systematic point of view, the coloration, number and

Tab. 3. Comparison of the fifth instar of *Ommatissus binotatus* Fieber and *Ommatissus lofouensis* Muir.

V° instar	*O. binotatus*	*O. lofouensis*
Number of sensory pits on each side of the frons	11	11
Number of sensory pits on each side of the pronotum	4	5
Number of sensory pits on each side of the mesonotum	3	3
Number of sensory pits on each side of the metanotum	1	1
Number of spines on the lateral margin of the hind tibiae	2	2
Formula of the spines on the hind legs	6/7-6-2	6-6-2
Number of sensory pits on each side of the abdominal tergites:		
III°	–	2
IV°	2 + 1	3
V°	2 + 1	3
VI°	2 + 1	2
VII°	1	1
VIII°	3	3
IX°	2	3
Number of wax-pores on each side of the VII° abdominal segment	6	6
Number of wax-pores on each side of the VIII° abdominal segment	6	6



Figs 13-16. *Ommatissus binotatus* Fieber. **13.** Sensory pit on the abdomen of fifth instar nymph (× 1850). **14.** Posterior tip of the abdomen of fifth instar nymph showing wax-pores of the VII° and VIII° segments (× 310). **15.** Detail of secreting wax-pore (× 1800). **16.** Detail of wax-pore secreting a hollow filament (× 2600).

arrangement of the spines and sensory pits represent the most reliable characters for the identification of the Fulgoromorpha nymphs. Up to now, within the *Ommatissus* framework, the lack of studies allows us to specify some distinctive characters only in the fifth instar specimens of *O. lofouensis* Muir, described by Yang & Yang (1991), and *O. binotatus* Fieber. The main characters are summarized in Tab. 3; even in this table the typical sensory pits have been distinguished from those without sensory hair.

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