POLSKA AKADEMIA NAUK
INSTYTUT ZOOLOGII

ANNALES ZOOLOGICI

Tom 33 Warszawa, 25 XI 1975 Nr 9

Halina KOMOSIŃSKA

Studies on the biology of *Mytilaspis conchiformis* forma *conchiformis* (GMELIN) (*Homoptera, Coccoidea, Diaspididae*) in Poland

[With 6 Tables and 5 Text-figures]

In this paper the following problems are discussed: host plants, distribution, injury, life cycle in Poland, fecundity and some factors determining it. The studies of the development are supplemented by phyto- and zoophenological observations. Also the qualitative and quantitative studies were carried out on chalcids (*Chalcidoidea*) reared from the form *conchiformis*.

INTRODUCTION

This paper is a continuation of the study on *Mytilaspis conchiformis* f. *conchiformis* (GMELIN) in Poland (KOMOSIŃSKA 1969, 1974). This is the only form of this species occurring in Poland, being rather common. It was found on 339 trees and bushes, mostly on limes (*Tilia* sp.) growing along avenues in the towns. Particularly heavy infestation of limes was observed in Głogów in 1969. Dense populations of this insect were also observed on birch (*Betula* sp.) located within the border parts of the forests in the province of Zielona Góra (Przełazy, Sława).

More extensive studies on the biology of this species in California, where it occurs in two forms [*conchiformis* (GMELIN) and *minima* NEWSTEAD], were carried out by STAFFORD and BARNES (1948). As in Europe there are only fragmentary data on the biology of the form *conchiformis* (THIEM 1931, SCHMUTTERER 1952, 1959, KOMOSIŃSKA 1969), a more detailed study of this subject has been undertaken.

SYNONYMS

Coccus conchiformis Gmelin, 1789, p. 2221.
Aspidiotus saliceti Bouché, 1851, p. 111.
Mytilaspis ficus Signoret, 1870, p. 94.
Lepidosaphes rubri Thiem, 1931, p. 557.
Lepidosaphes conchyformis forma *conchyformis* [sic!]: Balachowsky, 1954, p. 65.

DISTRIBUTION AND HOST PLANTS

Nearctic Region. Western North American Province: California — *Ficus carica* (Ferris 1958, Stafford and Barnes 1948, McKenzie 1956).

Palaearctic Region. Mediterranean Province: Portugal — *Ficus carica* (Seabra 1918); Spain — *Ficus carica* and *Ulmus campestris* (Gómez-Menor 1937, 1955–1956); Italy — *Ficus* sp. and *Ulmus* sp. (Leonardi 1920); Yugoslavia — *Ficus carica*, *Phillyrea media*, *Celtis australis* and *Ulmus* sp. (Bachmann 1953, Schmidt 1956); Greece — *Ficus carica*, *Celtis australis*, *Pistacia terebinthus* and *Ulmus campestris* (Koronéos 1934); Crimea — *Ficus* sp. (Umnov 1940); Georgia, Armenia, Azerbaijan, West Kopet-Dagh and North Caucasus — *Ficus* sp., *Carpinus* sp., *Celtis* sp., *Ceratonia* sp., *Cistus* sp., *Crataegus* sp., *Fagus* sp., *Magnolia* sp., *Malus* sp. *Prunus* sp. *Syringa* sp. and *Juglans regia* (Borchsenius 1949, 1950, Gogiberidze 1938, Buščik 1960); Turkey — *Ulmus campestris* and *Rhamnus* sp. (Bodenheimer 1953); Palestine — *Ficus carica*, *Ceratonia siliqua* and *Styrax officinale* (Bodenheimer 1924); Egypt (Ezzat 1958). European-West Siberian Province: France — *Ficus carica* (Signoret 1870); German Democratic Republic and Federal Republic of Germany — *Acer pseudoplatanus*, *Betula verrucosa*, *Carpinus betulus*, *Corylus avellana*, *Fraxinus excelsior*, *Syringa vulgaris*, *Syringa emodi*, *Tilia platyphyllos* and *Ulmus campestris* (Thiem 1931, Schmutterer 1952, 1959). Poland — *Carpinus betulus*, *Tilia platyphyllos*, *Tilia cordata*, *Tilia euchlora*, *Fraxinus excelsior*, *Syringa vulgaris* and *Betula* sp. (Komosińska 1969); Ukraine — *Castanea sativa*, *Carpinus betulus*, *Fagus silvatica* and *Syringa vulgaris* (Tereznikova 1963, 1966); Hungary — *Ulmus carpinifolia*, *Ulmus glabra* and *Syringa vulgaris* (Kosztarab 1959). Central Asian Province: China (Hoffmann 1927). Sino-Japanese Province: Japan — *Pirus* sp., *Malus* sp. and *Diospyros kaki* (Takahashi 1955).

LOCATION ON THE HOST PLANT

It is generally reported that the form of the species under study inhabits woody parts, such as trunks, branches, small branches and shoots (Borchsenius 1950, 1963, Danzig 1964, Ferris 1958, Tereznikova 1966 and others). Thiem (1931) suggests that its development is poorer on small branches than on big ones. Stafford and Barnes (1948) report that the females that overwintered on more wooded shoots and trunks begin oviposition earlier than those occupying young shoots. It has been found in the present study that primarily trunks are attacked and then thicker branches. In the case of heavily infested trees, the scales of adults insects have also been found on small branches about 2 cm in girth, but at the minimum density. The author has not observed them on the youngest shoots or petioles. Kosztarab (1959) in Hungary and Umnov (1940) in Crimea have found this form also on leaves.

INJURY

The injury caused by this form is reported by the following authors: Borchsenius (1963) and Kosztarab (1959) for elm (*Ulmus* sp.), Komosińska (1969) for lime (*Tilia* sp.) — the ruptures of bark in the places of mass infestation; Umnov (1940) for olive-tree (*Olea* sp.) — the withering of fine branches and shoots. Schmutterer (1959) reports that any more serious damages have been noted in Central Europe because mass appearances have not occurred frequently. In California, however, this species is a dangerous pest of fig-tree (*Ficus carica*), as reported by Stafford and Barnes (1948). Two complete generations develop there annually. These are winter and summer generations. They differ from each other significantly in their morphology and biology, being two dimorphic forms called by Balachowsky (1954) the form *conchiformis* and *minima*, respectively. Ahmad and Ghani (1971) report that this is a harmful species in Pakistan. *Citrus acida*, *Melia azedarach* and *Ricinus communis* were seriously damaged there; their leaves died prematurely and the quality of the infested citrus fruit was lowered. The data from Pakistan, however, refer to an intermediate form between the forms *conchiformis* and *minima*.

DEVELOPMENT

Method. The study of the development was carried out in 1969 and 1970. The materials were collected in Warsaw, Głogów and Przełazy. The samples were collected in the form of flat cuttings of the bark taken from trunks with a scalpel. The surface of the cuttings varied from 2 to 8 cm², on the average 4 cm². Usually the samples were taken every 10 days. Only when the appearance of the next stage was expected, the samples composed of two or three cuttings each were taken every three days or even more often. They were taken at random, usually at the same time from two or sometimes several stands. The stand has been defined as a group of infested trees along one avenue or in the forest. If this term is used in relation to one tree, it is marked in the text. The average number of individuals in the samples taken every 10 days to determine the changes in the age structure and domination of successive developmental stages was 225, ranging from 66 to 385 individuals per sample.

Life cycle

There is only one generation of this species per year in Poland, like in German Democratic Republic, Federal Republic of Germany (Schmutterer 1959) and Turkey (Bodenheimer 1953). Two generations occur in Palestine (Bodenheimer 1924). Two generations, and partly the third, develop in California (Stafford and Barnes 1948). The fertilized females overwinter. The following developmental stages can be distinguished in the life cycle: egg, 1st instar larva, 2nd instar larva (male and female), pronymph and nymph. The last two stages are met only in males. The model of the annual life cycle, representing the time of duration of particular stages from the beginning of the appearance of one stage to the beginning of the appearance of the next one in 1969 and 1970, is shown in Fig. 1.

Table I. The dates of the beginning of appearance of successive developmental stages

Year	Location and host plant	Eggs	1st instar larvae	2nd instar larvae	Pro-nymphs and nymphs	Females	Males
1969	Warsaw, *Tilia platyphyllos*	28.IV	16. V	21. VI	9. VII	14. VII	24. VII
1970	Warsaw, *Tilia platyphyllos*	5.V	27. V	22. VI	19. VII	22. VII	1. VIII

Basing on the data from Table I, the time of duration of particular preimaginal stages and the sum of days required till the beginning of the appearance of females and males was calculated. The results are shown in Table II.

As it can be seen in Table II, the differences in the duration of the development of particular stages in 1969 and 1970 varied from 2 days (for pronymphs and nymphs) to 10 days (for 1st instar larvae). But because of the differences in temperature (Fig. 2), some stages developed longer and others shorter in a given year, and as a result the sum days needed for the appearance of imagines was similar in both the years. The females appeared after 77 days in 1969 and after 78 days in 1970. The males appeared after 87 and 88 days, respectively. But a 7-day delay in oviposition in 1970 resulted in an 8-day delay in the appearance of imagines (Tab. I). In sum, the differences in the course of temperatu-

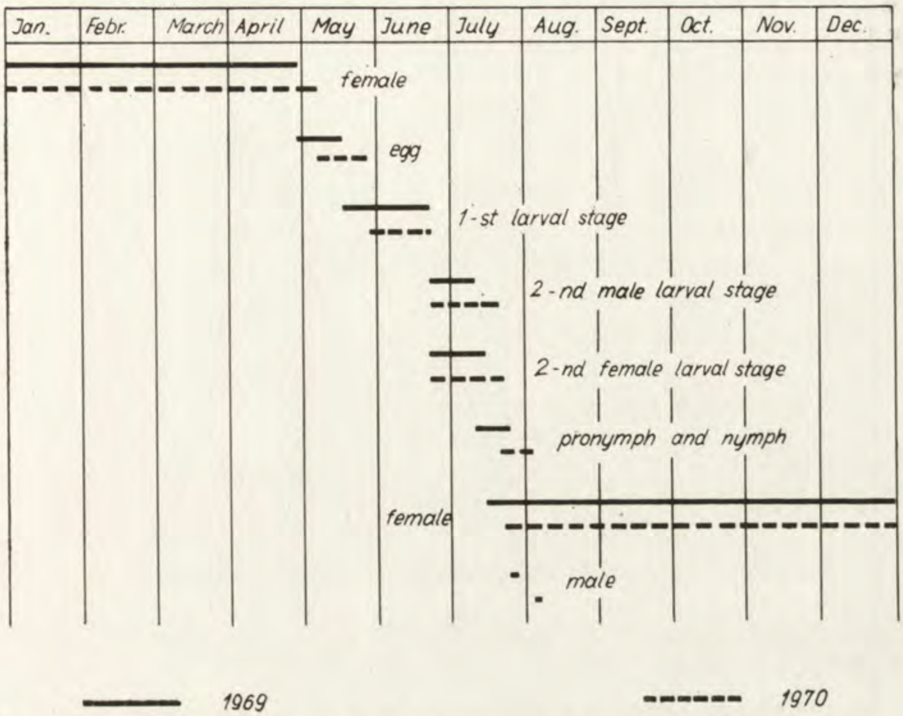

Fig. 1. Scheme of the annual cycle of development indicating the duration of successive stages from the beginning of appearance of one stage to the beginning of appearance of the next one in 1969 and 1970.

res between 1969 and 1970 influenced the disappearance of differences in the duration of development of particular preimaginal stages, so that the sum of days required for the appearance of imagines was very similar in these years. However, the differences in the dates of oviposition accounted for the differences in the date of imago appearance (Tab. I).

Table II. The duration of the development of particular preimaginal stages (in days) and the sum of days required for the appearance of imagines.

Year	Eggs	1st instar larvae	2nd instar male larvae	2nd instar female larvae	Pronymphs and nymphs	Sum of days till the beginning of appearance of	
						females	males
1969	18	36	18	23	15	77	87
1970	22	26	27	30	13	78	88
Average	20	31	22.5	26.5	14	77.5	87.5

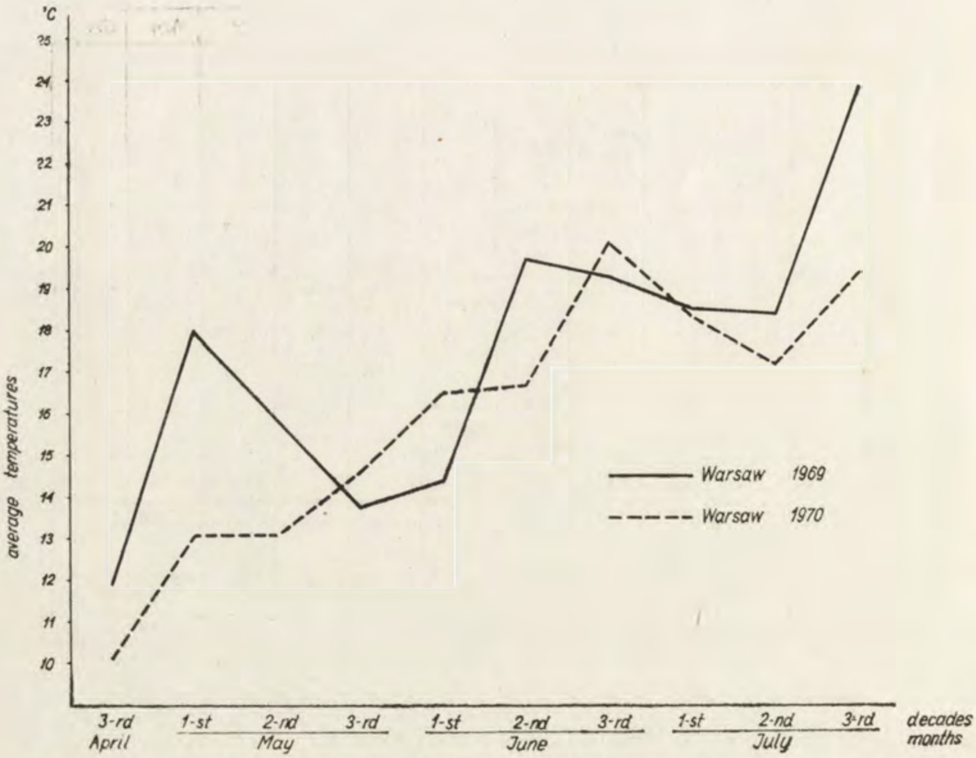

Fig. 2. Average temperatures in Warsaw for 10-day periods in 1969 and 1970.

Period of the occurrence of eggs under scales

The duration of the occurrence of eggs under the scales of females was studied, and the changes in the number of eggs under the scales were observed every ten days. This study was conducted in Warsaw on the large-leaved lime (*Tilia platyphyllos*) in 1969. The main period of the occurrence of eggs under the scales lasted two months, from the last decade (ten days) of April to the last decade of June (Fig. 3). This period is characterized by a steep curve of the increase in the number of eggs which lasted till the beginning of hatching, i.e., till the 2nd decade of May. During the third decade of May the number of eggs increased very slowly and then, considerably decreased. During the last decade of June the average number of eggs per scale decreased to one. In July a period of sporadic occurrence of eggs can be distinguished. Only 5 % of females had eggs under their scales at that time, the number of eggs being 2–10 per scale and the average number of eggs per female being 0.3. These late eggs can hatch, which is supported by the sporadic observations of crawlers at that time.

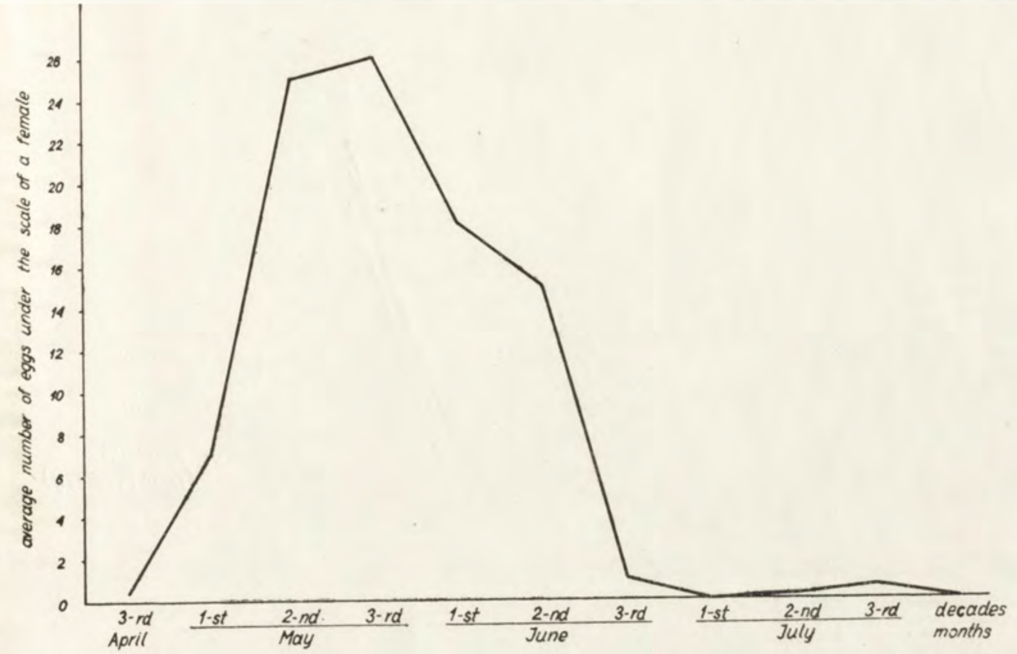

Fig. 3. Period of the occurrence of eggs under the scales of females in Warsaw in 1969.

Beginning of hatching in different localities and biotopes

The beginning of hatching is defined as a period of time when the number of egg shells does not exceed 10 % of the total number of eggs.

The data summarized in Table III indicate that in 1969 the differences in the dates of the beginning of hatching between different localities varied from two weeks (Warsaw–Głogów) to one month (Warsaw–Przełazy). These differences were probably due to the differences in temperatures which is shown

Table III. The comparison of the dates of the beginning of hatching in different localities and biotopes

Date of beginning of hatching	Locality	Biotope	Host plants	Percentage of egg shells	Number of females
16. V. 1969	Warsaw	avenues	*Tilia* sp.	6	30
30. V. 1969	Głogów	avenues	*Tilia* sp.	7	50
30. V. 1969	Głogów	lawn at streets	*Syringa* sp.	6	98
16. VI. 1969	Przełazy	mixed, shaded forest about 50 m to Lake Niesłysz, about 4 km to buildings	*Betula* sp.	7	90

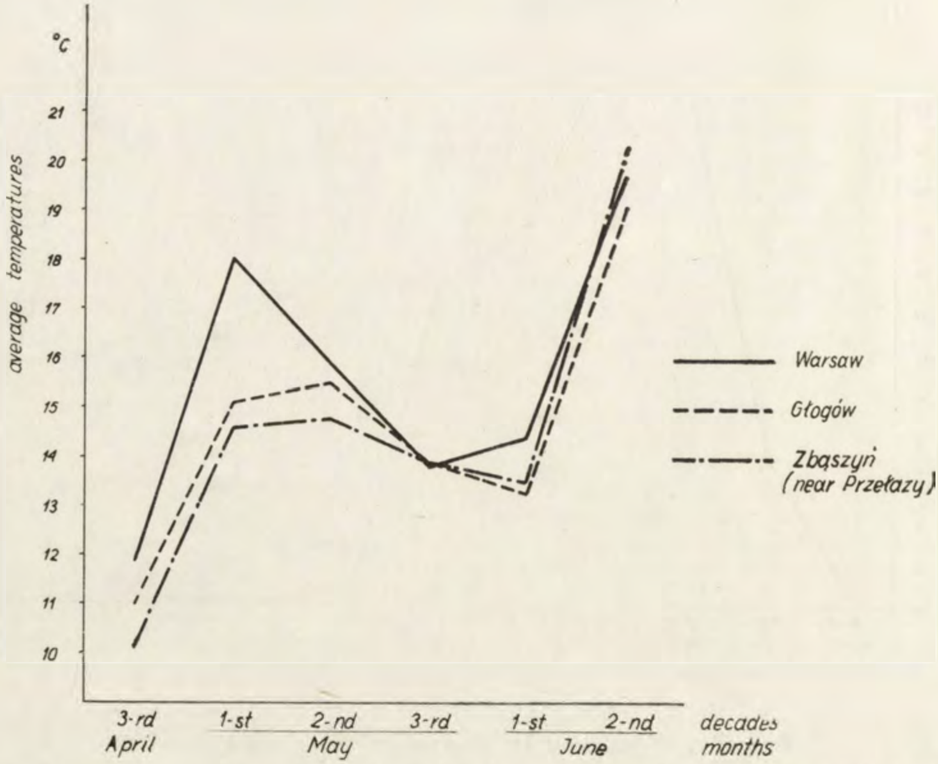

Fig. 4. Average temperatures in Warsaw, Głogów and Zbąszyń for 10-day periods in 1969.

in Figure 4. Because the data on temperature in Przełazy were not available, in Fig. 4 the temperatures from Zbąszyń are cited, which is situated about 37 km from Przełazy but is also located on the shore of a lake. It should be remembered, however, that because of the character of biotop, the temperature at Przełazy was lower than in the urban agglomeration of Zbąszyń.

Age structure and domination of developmental stages

When hatching begins the females still continue oviposition. The average number of eggs present in the body of a female at the beginning of hatching was 4–11 % of the total number of eggs (Tab. IV). Due to this fact different developmental stages can be simultaneously observed in the population. The changes in the age structure and domination of successive stages are shown in Fig. 5. These data are based on the materials collected from two stands of the large-leaved lime in Warsaw in 1969.

In Fig. 5 the percentage of females from preceding year is shown. Under their scales the following materials were found: eggs (a), eggs and egg shells, which indicates a partial hatching (b), and only egg shells indicating that hatching was complete (c). In Fig. 5 is also shown the percentage of preimaginal

Table IV. The fecundity of females in relation to host plants

No of stand and host plants	Date of sampling	Number of females	Fecundity calculated, from			Average fecundity per female and range of variation (number of eggs)
			egg shells (%)	eggs laid (%)	eggs in body (%)	
1. Warsaw *Tilia* sp.	16. V. 1969	30	6	84	10	38 (15–71)
2. Głogów *Tilia* sp.	30. V. 1969	50	7	82	11	51 (39–74)
3. Głogów *Syringa* sp.	30. V. 1969	98	6	90	4	40 (13–56)
4. Przełazy *Betula* sp.	16. VI. 1969	90	7	83	10	34 (10–50)

stages (1st instar larva, 2nd instar larva, pronymph and nymph) and adults of the current year. This makes it possible to follow the age structure and the changes in the domination of successive stages from the last decade of April to the last decade of August. It can be seen that from the beginning of the observation period to the 2nd decade of June only column "a", "b" and "c" are present

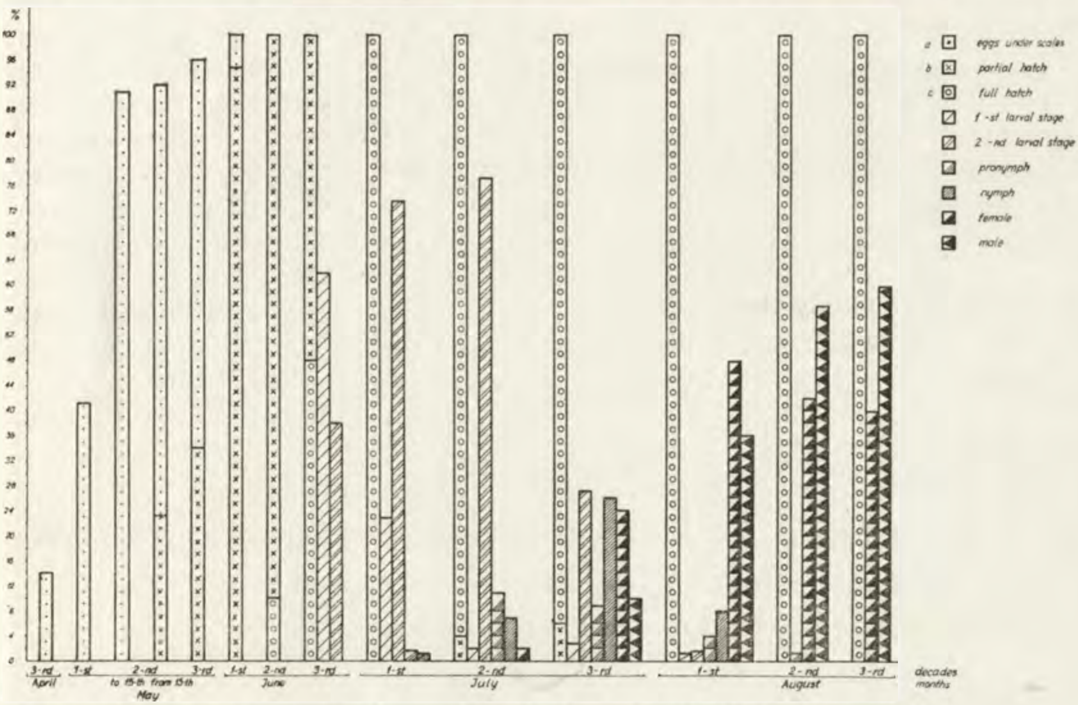

Fig. 5. Changes in the age structure and domination of particular developmental stages in Warsaw in 1969.

in the diagram. Only in the 3rd decade of June it was possible to find the percentage of the 1st and 2nd instar larvae. The larvae of the 1st instar predominated (63 %) over those of the 2nd instar (39 %). In the 1st and 2nd decades of July the 2nd instar larvae predominated (73 and 77 %, respectively). At that period also pronymphs and nymphs appeared, and in the 2nd decade of July — young females. In the 3rd decade of July the diagram has a characteristic shape. There is no any significantly dominating stage, the 2nd instar larvae slightly pradominate, all preimaginal stages are present and also adult males and females of the current year. This period can be regarded as a kind of a bridge joining this part of development in which preimaginal stages dominate with that in which imaginal stages begin to dominate as in the 1st decade of August females predominate and in the 2nd and 3rd decades of August the empty scales of males. This was a result of the greater percentage contribution of males than females in the populations under study.

WAY OF REPRODUCTION AND SOME DATA ON THE BIOLOGY OF MALES

Method. The experiment was carried out on the trunks of *Tilia platyphyllos*, 7 years old, in 1970. During the period of hatching the cuttings of the bark from infested trees were attached to these limes. The parts of trunks with attached cuttings were isolated with white cloth throughout the experiment. When the larvae, which moved on the trunk, reached the 2nd stage and their sex could be recognized with a hand-glass, all male larvae were removed with a needle, each trunk being controlled many times. It has been found that there is no parthenogenesis. On 7 trees from which all male larvae were removed not any of 69 females laid eggs. On one tree with 9 females and 2 empty scales of males (overlooked during the period of control) all the females had eggs and larvae under their scales. This indicates that one male can fertilize more than one female.

It was found that males could survive two days in a test-tube. In the populations under study there were more males than females. Fig. 5 indicates that there were 60 % of males and 40 % of females in the 3rd decade of August. Schmutterer (1952) has found that the sex ratio approximates to 1:1.

FECUNDITY

The effect of host plant, density, stand and exposition (N–S) on fecundity was studied.

Effect of host plants on fecundity

Method. Because oviposition is continued also during hatching, fecundity was estimated at the beginning of hatching as the sum of the number of egg shells, eggs present under the scales and eggs in the body of the females. The beginning of hatching was defined as the period when the number of egg shells did not exceed 10% of fecundity. This method of fecundity calculation was checked by comparing the fecundity of females in the samples collected at the beginning of hatching with the fecundity of those collected at the beginning of hatching with the fecundity of those collected later when the number of egg shells contributed to 55% of fecundity. The results were similar in both cases. The samples were taken at random. The females that did not lay eggs till the beginning of hatching were not considered.

The data in Table IV indicate that *Tilia* sp., *Syringa* sp. and *Betula* sp. are almost equivalent host plants as far as their effect on the fecundity of the form *conchiformis* is concerned. But the effect of the stand was pronounced as there were greater difference in the fecundity of females living on *Tilia* sp. between stand 1 and 2 (38 and 51 eggs, respectively) than between those living on *Tilia* sp. (38 eggs), *Syringa* sp. (40 eggs) and *Betula* sp. (34 eggs) on stands 1, 3, and 4, respectively.

Effect of density, stand and exposition (N–S) on fecundity

Method. The samples were taken from the trunks of two trees growing on different stands (stand I — Warsaw, Av. Żwirki i Wigury; stand II — Warsaw, Av. Wyzwolenia). Both these trees had trunks of similar thickness (about 45 cm in girth), they were in similar condition and infested to a similar degree with the form *conchiformis*. From the collected cuttings the females were selected. Those living under low density conditions were called "noncrowded" females, and those living under very high density conditions (usually they were smaller and had deformed scales) — were called "overcrowded" females. On both stands 74 "noncrowded females were obseved (35 exposed to the north, 39 to the south) and 76 "overcrowded" females (37 exposed to the north and 39 to the south). The females that did not lay eggs by the day of sampling were eliminated.

The results are summarized in Table V. There is a difference in the fecundity in relation to the density and stand, and a very slight difference in relation to the exposition. For this reason an average fecundity has been calculated

Table V. The comparison of fecundity in relation to density, stand and exposition

1	2	3	4	5	6	7	8
No of stand	Dates of sampling	Host plant	Exposition	Average fecundity per female			
				non-crowded	over-crowded	non-crowded	over-crowded
I	8. VI. 1970	*Tilia platyphyllos*	N	49	37	46	33
			S	43	29		
II	8. VI. 1970	*Tilia platyphyllos*	N	30	21	31	22
			S	32	23		

for both expositions, and these values (column 7 and 8) were used for further considerations.

(a) The fecundity of "overcrowded" females was 28 % lower than that of "noncrowded" females on stand I (33 and 46 eggs, respectively) and 29 % lower on the stand II (22 and 31 eggs, respectively).

(b) There appeared the differences in fecundity between the stands. So stand I was called a "better" one and stand II was called a "poorer" one. On the "poorer" stand the fecundity of "noncrowded" females was 33 % lower than on the "better" one (31 and 46 eggs, respectively); the fecundity of "over crowded" females on the "poorer" stand was also 33 % lower than on the "better" stand[1] (22 and 33 eggs, respectively).

When the differences in fecundity resulting from the differences in density (28 %, see point a) are compared with those resulting from the differences in the stands (33 % – point b), it may be concluded that under some conditions the effect of the stand on fecundity can be more pronounced than the effect of density.

Because of the relationship presented in points (a) and (b), the differences in fecundity between the "overcrowded" females on the "poorer" stand and "noncrowded" females on the "better" stand are still more pronounced. On the one hand, the unfavourable conditions overlapped (high density and poorer stand), and on the other, favourable conditions (low density and better stand). As a result the fecundity of the females exposed to overlapping unfavourable conditions was 52 % lower than under overlapping favourable conditions (22 and 46 eggs, respectively). When the fecundity of the females subjected partly to favourable and partly to unfavourable conditions, ie. "noncrowded" females on the poorer stand and "overcrowded" females on the better stand was compared, the difference was only 6 % (31 and 33 eggs, respectively). In this case the negative effect of the "poorer" stand was balanced by the positive effect of low density and, on the other hand, the negative effect of high density was neutralized by the positive effect of better stand. As the result, the difference in fecundity due to the differences in both density and stand were nearly eliminated.

The presented results do not provide the basis for general conclusions as the observations were made on small materials and many factors which could influence fecundity were not controlled. They may, however, be used for some suggestions concerned with the problem.

Information on the effect of density on the fecundity of a related species, *Lepidosaphes ulmi* (L.), can be found in the papers of Smirnov and Polejaeff (1934) and Schmutterer (1952). Smirnov and Polejaeff have found that an increase in density is not followed by a decrease in the number of eggs but

[1] The term "better" stand is used here to indicate better physiological condition of the tree or of the population of insects, or the interaction of both these factors.

by an increase in the number of sterile females. SCHMUTTERER, however, found the differences in fecundity with increasing density. The females kept under low density conditions laid on the average 41 (15–78) eggs, while those under high density conditions 26 (5–49) eggs. This negative effect of high density on fecundity is explained by him as a result of the shortage of food and space.

Below the data on the fecundity of the form *conchiformis* from our studies and literature are presented. Poland — *Tilia* sp., the average fecundity at different densities and on different stands: 22, 31, 33, 38, 46, and 51 eggs; *Betula* sp., 34; *Syringa* sp., 40 eggs. Germany — THIEM (1931), from 5 to 19 eggs, and SCHMUTTERER (1952), 26 eggs. California — STAFFORD and BARNES (1948) — *Ficus carica*, 30 eggs, and form *minima*, 12 eggs.

PHENOLOGICAL OBSERVATIONS

The beginning of appearance of some developmental stages of the form *conchiformis* (oviposition, hatching, 2nd instar larvae and females) were related to the appropriate phyto- and zoophenological phases.

Method. This study was carried out in the park at Komarow street in Warsaw in 1969 and 1970.

Five phases were distinguished to determine the advancement of a given phenomenon:

Phases	Abbreviation used in the text	Degree of advancement of phenomenon
1. Beginning of appearance of 1st degree	appearance 1	1–20 %
2. Beginning of appearance of 2nd degree	appearance 2	21–40 %
3. Full appearance	—	41–60 %
4. End of appearance of 1st degree	end 1	61–80 %
5. End of appearance of 2nd degree	end 2	81–100 %

If three phenological phases occurred simultaneously, for instance flower buds, flowers and shed flowers, the percentage of the last phenomenon to the last but one was determined. It was not possible to use here the method of determing the phases of phenological phenomena applied by PRZYBYLSKI (1958, 1962), because this author distinguished, as it is generally practiced, only three phases: the beginning of appearance when 10 % of the phenomenon is completed, full phase when 50 % is completed, and the end of appearance at 90 %. This method does not indicate the intermediate phases with which the appearance of some developmental stages of the form *conchiformis* is frequently correlated.

The beginning of oviposition in 1969 coincided with appearance 1 of the opening of leaf buds of *Tilia platyphyllos*, while in 1970 with appearance 1 of the development of leaves. There was no synchronization between the phenological phase of the host plant and a definite stage of the development of insects living on it. The same was observed by PRZYBYLSKI (1962) who suggested that this is due to the predominating effect of temperature on the development of insects in spring. In 1970 the beginning of oviposition coincided with appearance 1 of shedding blossoms by *Forsythia intermedia*, and with the exclusive occurrence of the eggs of *Lepidosaphes ulmi* (L.).

The beginning of the appearance of 1st instar larvae (= beginning of hatching) in both the years coincided with appearance 1 of shedding flowers by *Crataegus monogyna*, *Syringa vulgaris*, *Aesculus hippocastanum*, and with the beginning of the moulting of 1st instar larvae of *Lepidosaphes ulmi*.

The beginning of the appearance of 2nd instar larvae in both the years coincided with the full blossoming of *Philadelphus coronarius* and with appearance 2 of the moulting of 2nd instar larvae of *Lepidosaphes ulmi*.

The beginning of the appearance of females in 1969 and 1970 was synchronized with full colouring of the fruit of *Sorbus aucuparia* in yellow-orange, and with the end of the appearance of the males of *Lepidosaphes ulmi*.

PARASITES

The available literature (GÓMEZ-MENOR 1937, 1955–1956, BALACHOWSKY 1954 and SCHMUTTERER 1959) reports the following species of chalcids (*Chalcidoidea*): *Aphytis mytilaspidis* (Baron), *Azotus pinifoliae* MERC. (= *A. atomon* (WALKER), *Coccophagoides insidator* (Dalm.), *Pteroptrix dimidiata* WESTW., *Prospaltella leucaspidis* MERC. and *Apterencyrtus microphagus* MAYR.

Method. The matrials for rearing chalcids were collected in Warsaw, Zielona Góra, Głogów and Przełazy in 1970. Four stands in Warsaw were sampled every 10 days from 5 May to 28 September, and others were sampled sporadically.

On each stand the samples in the form of the flat cuttings of bark about 4 cm² in area were taken from one or several trees. In order to rear only the chalcids of *Mytilaspis conchiformis* form *conchiformis*, the cuttings were examined under the binocular-microscope. The other species of the armored scale insects and the scales of the form *conchiformis* from preceding years, under which the other species of host could be present, were removed. Then the cuttings were placed in short, wide tubes closed with cotton plugs moistened with water. The tubes were kept at room temperature in the laboratory.

In the reared materials 8 species of chalcids were found[1], 4 of which are new to the form *conchiformis* and 4 are new for *Coccoidea* of Poland.

Survey of the species

Hymenoptera
Chalcidoidea
Family *Aphelinidae*
1. *Aphytis mytilaspidis* (BARON)
2. *Aphytis proclia* (WALKER)[2]
3. *Azotus atomon* (WALKER)
4. *Coccophagoides similis* (MASI)[2,3]
5. *Pteroptrix dimidiata* WESTW.[2]
6. *Hispaniella lauri* (MERC.)[2,3]

Family *Encyrtidae*
7. *Apterencyrtus microphagus* MAYR

Family *Mymaridae*
8. *Anaphes gracilis* HOW.[2,3]

Aphytis mytilaspidis (BARON)

Warsaw – *Tilia* sp.: 64 ♂♂ and 199 ♀♀; Warsaw – *Syringa* sp.: 3 ♀♀; Głogów – *Tilia* sp.: 5 ♀♀; Głogów – *Syringa* sp.: 1 ♀; Zielona Góra – *Tilia* sp.: 7 ♀♀.

This species has been recorded in Poland by ŻAK-OGAZA (1958, 1961) as a parasite of *Lepidosaphes ulmi* (L.), *Carulaspis visci* (SCHRK.), *Chionaspis salicis* (L.) and *Quadraspidiotus ostreaeformis* (CURT.).
It is quoted by NIKOL'SKAJA and JASNOŠ (1966) as a parasite of several dozens of species of armored scale insects.

Distribution: Europe (Switzerland, France, Italy, Federal Republic of Germany, Yugoslavia, Czechoslovakia), Asia (Iraq, Iran, Ceylon, Japan), North Africa (Algeria), America (FERRIÈRE 1965, NIKOL'SKAJA and JASNOŠ, 1966).

Aphytis proclia (WALKER)

Warsaw – *Tilia* sp.: 9 ♂♂ and 14 ♀♀; Głogów – *Tilia* sp.: 1 ♀; Przełazy – *Betula* sp.: 14 ♂♂ and 27 ♀♀;

This species was recorded in Poland by ŻAK-OGAZA (1958, 1961) as a parasite of *Aulacaspis rosae* (BOUCHÉ), *Lepidosaphes ulmi* (L.) and *Chionaspis salicis* (L.). It is quoted by NIKOL'SKAJA and JASNOŠ (1966) as a parasite of several dozens of species of armored scale insects. NIKOL'SKAJA (1952) indicates that it is also a parasite of two species of *Aleurodoidea*.

Distribution: Europe, North Africa, Iran, Hawaii, North America and Australia (NIKOL'SKAJA 1952).

---

[1] They were indentified by Mr. J. GŁOWACKI.

[2] Parasite new for *Mytilaspis conchiformis* f. *conchiformis*.

[3] Parasite new for *Coccoidea* in Poland.

Azotus atomon (Walker)

Warsaw — *Tilia* sp.: 22 ♂♂ and 50 ♀♀; Głogów — *Tilia* sp.: 28 ♂♂ and 7 ♀♀; Głogów — *Syringa* sp.: 2 ♂♂; Zielona Góra — *Tilia* sp.: 4 ♂♂ and 3 ♀♀; Przełazy — *Betula* sp.: 54 ♂♂ and 33 ♀♀.

This species was identified in Poland by Żak-Ogaza (1961) as *Azotus mokrzeckii* Now., a parasite of *Leucaspis* sp. and *Quadraspidiotus ostreaeformis* (Curtis). Balachowsky (1954) and Schmutterer (1959) identified it as *Azotus pinifoliae* Merc. as a parasite of *Mytilaspis conchiformis* forma *conchiformis*; Ferrière (1965) suggests that this is rather a superparasite of armored scale insects. Nikol'skaja and Jasnoš (1966) quoted it as a secondary parasite of a dozen of species of armored scale insects.

Distribution: Europe, Asia and North America (Nikol'skaja and Jasnoš 1966, Ferrière 1965).

Coccophagoides similis (Masi)

Warsaw — *Tilia* sp.: 303 ♂♂ and 642 ♀♀; Warsaw — *Syringa* sp.: 3 ♂♂ and 3 ♀♀; Głogów — *Tilia* sp.: 28 ♂♂ and 22 ♀♀; Głogów — *Syringa* sp.: 6 ♂♂ and 4 ♀♀; Zielona Góra — *Tilia* sp.: 11 ♂♂ and 4 ♀♀; Przełazy — *Betula* sp.: 15 ♂♂ and 17 ♀♀.

This species was not recorded in Poland before. Ferrière (1965, after Zinn 1962) indicates that the females of this species are endoparasites of the larvae and females of *Coccoidea* while the males are ectoparasites of the female larvae of its own species. Nikol'skaja and Jasnoš (1966) announce that this is a parasite of a dozen of species of *Coccoidea*, including *Quadraspidiotus ostreaeformis* (Curt.), *Quadraspidiotus gigas* (Thiem et Gern.), *Lepidosaphes ulmi* (L.) *and Leucaspis lowi* (Colv.).

Distribution: Europe, Asia (Ferrière 1965 and Nikol'skaja 1952).

Pteroptrix dimidiata Westw.

Warsaw — *Tilia* sp.: 50 ♂♂ and 23 ♀♀; Warsaw — *Syringa* sp.: 1 ♀; Głogów — *Tilia* sp.: 2 ♂♂ and 10 ♀♀; Głogów — *Syringa* sp.: 1 ♀; Zielona Góra — *Tilia* sp.: 49 ♀♀.

This species was not recorded in Poland earlier. Nikol'skaja (1952), Ferrière (1965) and Nikol'skaja and Jasnoš (1966) report that it is a parasite of *Quadraspidiotus ostreaeformis* (Curt.), *Quadraspidiotus zonatus* (Frauenf.), *Quadraspidiotus perniciosus* (Comst.), *Targionia vitis* Sign., *Aulacaspis rosae* (Bouché) and other species of armored scale insects.

Distribution: Europe, North Africa, America (Nikol'skaja 1952)

Hispaniella lauri (Mercet)

Warsaw — *Tilia* sp.: 5 ♂♂ and 19 ♀♀.

This is a new species for *Coccoidea* in Poland. Ferrière (1965), Nikol'skaja and Jasnoš (1966) report that it is a parasite of a dozen of species of armored scale insects, including *Quadraspidiotus ostreaeformis* (Curt.), *Quadraspidiotus gigas* (Thiem et Gern.), *Chionaspis salicis* (L.), *Parlatoria oleae* Colv., *Lepidosaphes ulmi* (L.) and *Aonidia lauri* Bché.

Distribution: Europe (Spain, Czechoslovakia, Yugoslavia, the Soviet Union), North Africa (Nikol'skaja 1952).

Apterencyrtus microphagus (Mayr)

Warsaw — *Tilia* sp.: 7 ♀♀.

This species has already been identified in Poland by Żak-Ogaza (1958, 1961) as a parasite of *Asterolecanium* sp., *Aulacaspis rosae* (Bché.) and *Lepidosaphes ulmi* (L.).

Distribution: European part of the Soviet Union, western Europe, North Africa, Java and North America (Nikol'skaja 1952).

Anaphes gracilis How.

Warsaw — *Tilia* sp.: 37 ♀♀.

This is a new species for *Coccoidea* of Poland. Nikol'skaja (1952) reports that it is a parasite of *Diaspidiotus perniciosus* (Comst.) and *Lepidosaphes ulmi* (L.).

Numbers of species

The numbers of a species has been expressed as a percentage of the specimens of one species in relation to the number of the specimens of all species.

A total of 1809 specimens of chalcids were identified. The numbers of these insects are presented in Table VI.

Table VI. The numbers of *Chalcidoidea* reared from *Mytilaspis conchiformis* f. conchiformis (Gmelin)

Species	Numbers (in %)
1. *Aphytis mytilaspidis* (Baron)	15.42
2. *Aphytis proclia* (Walker)	3.59
3. *Azotus atomon* (Walker)	11.22
4. *Coccophagoides* similis (Masi)	58.48
5. *Pteroptrix* dimidiata Westw.	7.51
6. *Hispaniella lauri* (Merc.)	1.32
7. *Apterencyrtus microphagus* (Mayr)	0.38
8. *Anaphes gracilis* How.	2.04

In the collected material *Coccophagoides similis* was the dominant[1] (contributing to 58,48%). *Aphytis mytilaspidis*, *Azotus atomon* and *Pteroptrix dimidiata* were influent species. *Aphytis proclia*, *Hispaniella lauri*, *Apterencyrus microphagus* and *Anaphes gracilis* were accessory species.

Author's address:
The Agricultural University,
Rakowiecka 26/30,
02–528 Warszawa, Poland.

LITERATURE

Ahmad R., Ghani M.A. 1971. Laboratory studies on the biology of *Lepidosaphes conchiformis* (Gmel.) (*Hem.*, *Diaspididae*) and of its parasite *Aphytis maculicornis* (Masi) (*Hym.*, *Aphelinidae*). Bull. ent. Res., London, **61**: 69–74.

Bachmann F. 1952–1953. Beitrag zur Kenntnis der Jugoslavischen Schildläusfauna. Zborn. Radova S.A.N., Beograd, **31**: 175–184.

Balachowsky A.S. 1954. Les cochenilles Paléarctiques de la tribu des *Diaspidini*. Paris, 450 pp.

Bodenheimer F. S. 1924. The *Coccidae* of Palestine. Bull. Zionist Org. Inst. Agric. nat. Hist., Tel Aviv, **1**: 48.

Bodenheimer F. S. 1953. The *Coccoidea* of Turkey II. Istanbul Univ. Fak. Mecmuasi (Rev. Fac. Sci. Univ. Istanbul), Ser. B, **18** 16–17.

Borchsenius N.S. 1937. Karantinnye i blizkie k nim vidy kokcid (*Coccoidea*) SSSR, Tbilisi, 267 pp.

Borchsenius N.S. 1949. Opredelitel' červecov i ščitovok (*Coccoidea*) Armenii, Erevan, 209 pp.

Borchsenius N.S. 1950. Červecy i ščitovki SSSR. Moskva-Leningrad, 249 pp.

Borchsenius N.S. 1963. Praktičeskij opredelitel'kokcid kul'turnych rastenij i lesnych porod SSSR, Moskva-Leningrad, 311 pp.

Bouché P.F. 1851. Neue Arten der Schildläus-Familie. Ent. Zeit. Stett., Stettin, **12**: 110–112.

Buščik T.N. 1960. K faune kokcid (*Homoptera*, *Coccoidea*) Zapadnogo Kopet-Daga. Trudy zool. Inst. Akad. Nauk, Moskva-Leningrad, **27**: 164–182.

Danzig E. M. 1964. Opredelitel'našekomych evropejskoj časti SSSR. Moskva-Leningrad, **1**: 616–654.

Dziabaszewski A. 1965. Pająki Wyspy Wolina, cz. I Prace Kom. Biol. Pozn. TPN, Poznań, **31**: 1–99.

Ezzat Y. M. 1958. Classification of the scale insects, family *Diaspididae*, as known to occur in Egypt, Bull. Soc. ent. Egypte, Cairo, **42**: 232–251.

Ferrière Ch. 1965. Faune de l'Europe et du Bassin Méditerranéen, 1 Hymenoptera, Aphelinidae, Paris, 208 pp.

Ferris G. F. 1958. Atlas of the scale insects of North America, Stanford, California, S. II–144, second printing.

Gmelin J.F. 1789. in: Systema Naturae, Ed. 13, I: 2215–2222.

[1] The numbers of dominant species are not lower than 16%, those of influent species vary from 5 to 15% and the numbers of accessory species are lower than 5% (Dziabaszewski 1965).

Gogiberidze A.A. 1938. Kokcidy vlažnych subtropikov Gruzinskoj SSR, Suchumi, 89 pp.

Gómez-Menor J. 1937. Coccidos de España, Madrid, 432 pp.

Gómez-Menor J. 1955–1956. Cochinillas que atacan a los frutales (*Homoptera, Coccoidea*, I, familia *Diaspididae*). Bol. Pat. veg. ent. agr., Madrid, **22**: 1–105.

Hoffmann W.E. 1927. Coccidae from China. Lingnaam agric. Rev., Canton **4**: 73–76.

Komosińska H. 1969. Badania nad tarcznikami (*Homoptera, Coccoidea, Diaspididae*) Polski I. Fragm. faun., Warszawa, **15**: 267–271.

Komosińska H. 1974. Studies on the morphology of *Mytilaspis conchiformis* forma *conchiformis* (Gmelin) (*Homoptera, Coccoidea, Diaspididae*). Ann. zool., Warszawa, **31**: 343–371.

Koronéos J. 1934. Les Coccidae de la Grèce. Athènes, pp. 70–72.

Kosztarab M. 1959. Biological notes on the scale insects of Hungary. Ann. ent. Soc. Amer., Columbia, Ohio, **52**: 401–420.

Leonardi G. 1920. Monografia delle Cocciniglie Italiane, Portici, pp. 151, 163.

McKenzie H. 1956. The armored scale insect of California, Berkeley and Los Angeles, p. 121.

Nikol'skaja M.N. 1952. Chal'cidy fauny SSSR, Moskva-Leningrad, 574 pp.

Nikol'skaja M.N., Jasnoš W. A. 1966. Opredelitel po faune SSSR, Afelinidy evropejskoj časti SSSR i Kavkaza (*Chalcidoidea Aphelinidae*), Moskva, Leningrad, 295 pp.

Przybylski Z. 1958. Niektóre uwagi o fenologii dla potrzeb ochrony roślin. Biul. Kwarantanny i Ochrony Roślin, Warszawa, Rok II, Nr 1 (6), 148–153.

Przybylski Z. 1962. Obserwacje nad rozwojem niektórych gatunków szkodliwych pluskwiaków równoskrzydłych (*Homoptera*) w sadzie na tle zjawisk fenologicznych. Pol. Pism. ent., Wrocław, Ser. B, Nr 22, 247–256.

Schmidt L. 1956. Štitaste uši Hrvatske (scale insects) (*Coccoidea* of Croatia). Záštita bilia, Beograd, **36**: 3–11.

Schmutterer H. 1952. Die Okologie der Cocciden (*Homoptera, Coccoidea*) Frankens. Z. angew, Ent., Berlin -Hamburg, **33**: 544–584.

Schmutterer H. 1959. Schildläuse oder *Coccoidea* I. Deckelschildläuse oder *Diaspididae*. Die Tierwelt Deutschlands und der angrenzenden Meeresteile, Jena, **45**: 167–169.

Seabra A. F. 1918. Observations sur quelques aspèces de Cochenilles du Portugal. Bull. Soc. portug. Sci. nat., Lisbonne, **8**: 72–81.

Signoret V. 1870. Essai sur les cochenilles ou gallinsectes (*Homopteres-Coccides*). Ann. Soc. ent. France, Paris, **10**: 89–110.

Smirnov E., Polejaeff W. 1934. Density of population and sterility of the females in the coccid *Lepidosaphes ulmi* (L.). J. Anim. Ecol., Cambridge, **3**: 29–40.

Stafford E.N., Barnes D.F. 1948. Biology of the fig scale in California, Hilgardia, Berkeley, Ca., **18**: 567–598.

Takahashi R. 1955. Lepidosaphes of Japan (*Diaspididae, Coccoidea, Homoptera*). Bull. Univ. Osaka Pref., Ser. B, **5**: 67–78.

Tereznikova E. M. 1963. Ekologo-faunisticnij ogljad kokcid (Homoptera, Coccoidea), Ukrains'kogo Polissja. Praci inst. zool. A. N. USSR, Kiiv, **19**: 41–56.

Tereznikova E. M. 1966. Ekologo-faunističnij ogljad kokcid (*Homoptera Coccoidea*) Zakarpats'koi oblasti. Respublikans'kij mižvidomčij zbirnik, A.N. USSR, Kiiv, 20–37.

Thiem H. 1931. Eine rote Kommaschildläus der deutschen Coccidenfauna (*Lepidosaphes rubri* n. sp.). Die Gartenbauwissenschaft, Berlin, Band **5**: 557–567.

Umnov M. P. 1940. Karantinnye i drugie vrednye kokcidy (*Coccoidea*) Kryma, Simferopol', p. 57.

Żak-Ogaza B. 1958. Materiały do znajomości bleskotek (*Hym. Chalcidoidea*) pasożytujących u czerwców (*Hom. Coccoidea*). Pol. Pismo ent., Wrocław, **28**: 141–150.

Żak-Ogaza B. 1961 Badania nad bleskotkami (*Hymenoptera, Chalcidoidea*) pasożytującymi u czerwców. (*Homoptera, Coccoidae*), znanych w faunie Polski. Pol. Pismo ent., Wrocław, **21**: 349–410.

STRESZCZENIE

[Tytuł: Badania and biologią *Mytilaspis conchiformis* forma *conchiformis* (Gmelin) (*Homoptera, Coccoidea, Diaspididae*) w Polsce]

Mytilaspis conchiformis f. *conchiformis* (Gmelin) znaleziono w Polsce na pięciu rodzajach roślin żywicielskich: grabie, brzozie, jesionie, lilaku i lipie. Szczególnie często były porażone lipy rosnące jako drzewa alejowe w miastach.

Najwięcej stanowisk znanych jest dotąd z Palearktyki z dzielnicy śródziemnomorskiej. Lokalizacja na roślinie żywicielskiej: przeważnie części zdrewniałe (pnie, gałęzie, gałązki, pędy). Szkodliwość: notowana w Europie dla wiązów, oliwek i lip a w Kalifornii dla fig.

W badaniach nad rozwojem formy *conchiformis* w Polsce stwierdzono, że występuje jedno pokolenie w ciągu roku. Zimują zapłodnione samice. Na podstawie badań przeprowadzonych w Warszawie w 1969 i 1970 roku określono terminy początku pojawu poszczególnych stadiów rozwojowych: składanie jaj — z końcem kwietnia lub początkiem maja, I stadium larwy — w drugiej lub trzeciej dekadzie maja, II stadium larwy — w trzeciej dekadzie czerwca, pronimfy i nimfy — w pierwszej lub drugiej dekadzie lipca, samice — w drugiej lub trzeciej dekadzie lipca, samce — w trzeciej dekadzie lipca lub w pierwszej dekadzie sierpnia. Określono też czas trwania rozwoju poszczególnych stadiów przedimaginalnych w dniach: jajo — 20, I stadium larwy — 31, II stadium larwy męskiej — 22, II stadium larwy żeńskiej — 26, pronimfa i nimfa — 14 dni. Określono też sumę dni potrzebnych do początku pojawu samic (od początku pojawu jaj) — 77 dni i samców — 87 dni. Różnice w początku wylęgu larw w 1969 roku wyniosły od dwóch tygodni (Warszawa — Głogów) do jednego miesiąca (Warszawa — Przełazy, las). Prześledzono zmianę struktury wieku i dominacji poszczególnych stadiów w okresie rozwoju. Kiedy rozpoczyna się wyląg, samice kontynuują składanie jaj. Na początku wylęgu liczba jaj znajdujących się jeszcze w ciele samicy wynosi od 4–11% płodności. Wpływa to na równoczesne występowanie w populacji stadiów różnie zaawansowanych w rozwoju.

Eksperymentalnie stwierdzono brak partenogenezy. W izolatorze w którym było 9 samic i 2 samce, wszystkie samice złożyły jaja, z których wylęgały się larwy.

Płodność samic obliczano na początku wylęgu, sumując osłony jajowe, jaja pod tarczką i jaja znajdujące się jeszcze w ciele samicy, które liczono na

preparatach samic zamkniętych w płynie Faure'a. Za początek wylęgu przyjęto taki etap tego procesu, w którym osłony jajowe nie stanowiły więcej niż 10% płodności. Wyeliminowano z badań te samice, które do początku wylęgu nie zaczęły składać jaj. Stwierdzono, że lipa, lilak i brzoza są w zasadzie równorzędnymi żywicielami z punktu widzenia ich wpływu na płodność f. *conchiformis*. Badano też wpływ zagęszczenia, stanowiska i ekspozycji (N–S) na płodność. Uzyskane wyniki mogą świadczyć o pewnym wpływie dwóch pierwszych czynników i o braku wpływu czynnika trzeciego. Średnia płodność przy różnym zagęszczeniu i różnych stanowiskach na lipie wyniosła: 22, 31, 33, 38, 46 i 51 jaj, na brzozie 34 a na lilaku 40 jaj.

Początek pojawu niektórych stadiów rozwojowych odniesiono do zjawisk fito- i zoofenologicznych.

Przeprowadzono badania jakościowe i ilościowe nad bleskotkami (*Chalcidoidea*) u formy *conchiformis*. Wyhodowano 1 809 okazów bleskotek, w tym oznaczono 8 gatunków, z których 4 są nowe dla f. *conchiformis* a 4 nowe dla czerwców Polski. Dominantem był ***Coccophagoides similis***.

РЕЗЮМЕ

[Заглавие: Исследования по биологии *Mytilaspis conchiformis* forma *conchiformis* (Gmelin) (*Homoptera*, *Coccoidea*, *Diaspididae*) в Польше]

Mytilaspis conchiformis f. *conchiformis* (Gmelin) найден в Польше на 5 кормовых растениях: грабе, березе, ясене, сирени и липе. Особенно часто были поражены липы, растущие вдоль городских проспектов.

До настоящего времени большинство известных местонахождений этой формы находится в Средиземноморской провинции Палеарктики. На кормовых растениях она локализируется на деревянистых частях (ствол, ветви, побеги). Вредит в Европе вязам, маслинам и липам, а в Калифорнии фиговым деревьям.

Исследования по развитию f. *conchiformis* показали, что в Польше имеется одно поколение в течение года. Зимуют оплодотворенные самки. На основании исследований, проведенных в Варшаве в 1969–1970 гг., были определены начальные сроки появления отдельных стадий развития, а именно: яйцекладка — конец апреля или начало мая, личинки I стадии — вторая или третья декада мая, личинки II стадии — третья декада июня, пронимфа и нимфа — в первой или во второй декаде июля, самки — во второй или в третьей декаде июля, самцы — в третьей декаде июля или в первой декаде августа. Была определена также продолжительность периода развития отдельных предимагинальных стадий; яйцо — 20 дней, личинка I стадии — 31 день, мужская личинка II стадии — 22 дня, женская личинка II стадии — 26 дней, пронимфа и нимфа всего — 14 дней. Определено суммарное количество дней от момента откладки яиц, необходимое для появления самок — 77 дней и самцов — 87 дней. Различия во времени начала вылупливания личинок составили

в 1969 году от двух недель (Варшава — Глогув) до одного месяца (Варшава — Пжелазы, лес). Произведены наблюдения над изменениями возрастной структуры и доминированием отдельных стадий в период развития. Когда начинается вылупливание личинок, самки продолжают яйцекладку. В начальной стадии вылупливания количество яиц находящихся еще в теле самок составляет 4–11% плодовитости. Таким образом, в популяции встречаются одновременно стадии различного уровня развития.

Экспериментальным путем доказано, что партеногенеза у формы *conchiformis* нет. В изоляторе, в котором находились 9 самок и 2 самца, все самки отложили яйца, из которых вышли личинки.

Плодовитость самок определялась в начале вылупливания личинок путем суммирования количества яйцевых оболочек, яйц под щитком и яиц находящихся еще в теле самки, которые подсчитывались на особях заключенных в жидкости Фора. За начало вылупливания принят такой этап этого процесса, когда яйцевые оболочки составляли не более 10% плодовитости. Не приняты во внимание в исследованиях те самки, которые не начали яйцекладки до начала вылупливания. Констатировано, что липа, сирень и береза являются в принципе с точки зрения их влияния на плодовитость формы *conchiformis* равноценными кормовыми растениями. Исследовано также влияние плотности, стенда и экспозиции (N–S) на плодовитость. Полученные результаты свидетельствуют о том, что первые два фактора оказывают некоторое влияние на плодовитость, третий не оказывает. Средняя плодовитость при различной плотности и различном стенде составила на липе: 22, 31, 33, 38, 46, и 51 яйцо на березе 34, а на сирени 40 яиц.

Начало появления некоторых стадий можно было приурочить к фито- и зоофенологическим явлениям.

Произведены качественные и количественные исследования по хальцидидам (*Chalcidoidea*), формы *conchiformis*. Выведено 1809 особей этих насекомых, относящихся к 8 видам, из которых 4 являются новыми для формы *conchiformis*, а 4 новыми для червецов Польши. Доминировал *Coccophagoides similis* (MASI).

Redaktor pracy — prof. dr J. Nast

Państwowe Wydawnictwo Naukowe — Warszawa 1975
Nakład 990+90 egz. Ark. wyd. 1,75: druk 1³/₈. Papier druk. sat. kl. III, 80 g, B1. Cena zł 15,—
Nr zam. 2201-75 — Wrocławska Drukarnia Naukowa