

Elżbieta PODSIADŁO

**Life cycle of *Asterodiaspis variolosa* (RATZBURG, 1870)  
(Homoptera, Coccoidea, Asterolecaniidae) in Poland**

[With 4 text-figures and 3 tables]

INTRODUCTION

Despite a broad distribution of *A. variolosa* (RATZ.), little seems to be known on the life cycle of that species. General observations on the biology of *Asterodiaspis* SIGNORET, 1876, living on oaks in England were made by BORATYŃSKI (1961). A broader elaboration of that problem was undertaken by APEJI (1964) but his work has not been published. SCHMUTTERER (1952) gives a short description of the life cycle of "*A. variolosum*" from the Federal Republic of Germany, however, due to changing views on taxonomic status of *A. variolosa* (RATZ.) and *A. quercicola* (BOUCHÉ, 1851) (RUSSELL, 1941; BORATYŃSKI, 1961; APEJI, 1964; PODSIADŁO, 1972, 1974a, 1974b), the given informations could involve not only *A. variolosa* (RATZ.) but also *A. quercicola* (BOUCHÉ), considered by the author as being one species.

The present study was undertaken in order to obtain basic data on the life cycle of *A. variolosa* (RATZ.) in Poland.

MATERIAL AND METHOD

Preliminary observations were made in 1965–1969. Investigations were carried out in Warsaw, in Bemowo district, in 1973. The material was collected on one single tree — relatively young, 3 m high, of *Quercus robur* L. Reproductive females were taken from 15th of May to 5th of September in 10–11-day intervals. Each time 20–48 (30) adult females have been studied. Test length of

females, measured before oviposition, varied from 1190  $\mu\text{m}$  to 1890  $\mu\text{m}$  (1584  $\mu\text{m}$ ), its width 1050–1680  $\mu\text{m}$  (1384  $\mu\text{m}$ ). Population density on host plant was negligible and could neither influence female size nor their reproduction.

Maturation of eggs within female body, their oviposition, hatching and emergence of crawlers are in particular females overlapping processes which makes particularly difficult their fecundity evaluation. The brittle, easily damaged eggshells are not easily to count, either. Therefore only eggs and crawlers under the test of females were counted. Thus obtained results are indices of reproduction process only, e.g. they indicate the beginning of oviposition and larva hatching, their maximum and termination.

At the same time observations on age structure of the population of *A. variolosa* (RATZ.) in ten-day periods — from 15th of May to 5th of Oct., 1973 — were made. For this purpose, pieces of bark or smaller branches were cut off and examined under a binocular and all specimens then taken irrespective of their stage. Specimens number in particular samples varied from 100 to 324. Microscopic slides in Faure fluid were then made and segregated according to instars involved. Following stages were thus separated: reproductive females, larvae of first stage, larvae of second stage, young adult females. Finally, percentage of each stage in population in subsequent month decades was counted.

## DISCUSSION OF RESULTS

### Reproduction

As previously mentioned, investigations began in the first decade of May, 1973. At that time, the females were filled to capacity with eggs. The body of females was, however, not contracted and closely adhering to test.

In the third decade of May a contracting of body was observed in 57% of all examined females — a process indicating a soon beginning of oviposition.

Oviposition was observed in the first decade of June. In Table I the percentage of females with eggs under the test is indicated. Fig. 1 illustrates graphically the above data. As it may be seen, the oviposition started fairly simultaneously in the majority of females — it has been noted in 79% of females investigated. In the second and third decade of June, all studied females were lying eggs. First females which completed their reproduction appeared in the first decade of July. From that period on, the number of egg-laying females gradually diminished and in the third decade of August last females with the eggs under the test were observed.

First crawlers were observed under the test in the second decade of June. From this moment on, a mixture of eggs, crawlers and eggshells have been noted under the test. Gradually, during reproduction the number of eggshells increased, but the number of eggs and crawlers diminished. Last crawlers under the test were observed, similarly as eggs, in the third decade of August.

Table I. Percentage of females with eggs under the test

Date	25 V	5 VI	15 VI	25 VI	5 VII	15 VII	25 VII	5 VIII	15 VIII	25 VIII	5 IX
% of females	0	79	100	100	96	80	58	20	10	10	0

Table II. Average number of eggs and crawlers under the test of one female

Date	25 V	5 VI	15 VI	25 VI	5 VII	15 VII	25 VII	5 VIII	15 VIII	25 VIII	5 IX
Average number of eggs	0	10.44	40.74	27.13	8.03	3.25	2.58	0.84	0.25	0.24	0
Average number of crawlers	0	0	14.10	16.09	3.11	0.70	0.69	0.20	0.83	0.16	0

Table III. Percentage of particular instars of one population in life cycle

Date	25 V	5 VI	15 VI	25 VI	5 VII	15 VII	25 VII	5 VIII	15 VIII	25 VIII	5 IX	15 IX	25 IX	5 X
Reproductive adult females	100	100	96	4	2	1	1	<1	<1	<1	0	0	0	0
First stage larvae	0	0	4	96	98	93	63	14	2	1	<1	<1	0	0
Second stage larvae	0	0	0	0	0	6	36	80	33	7	5	1	<1	<1
Young adult females	0	0	0	0	0	0	0	6	65	92	95	99	100	100

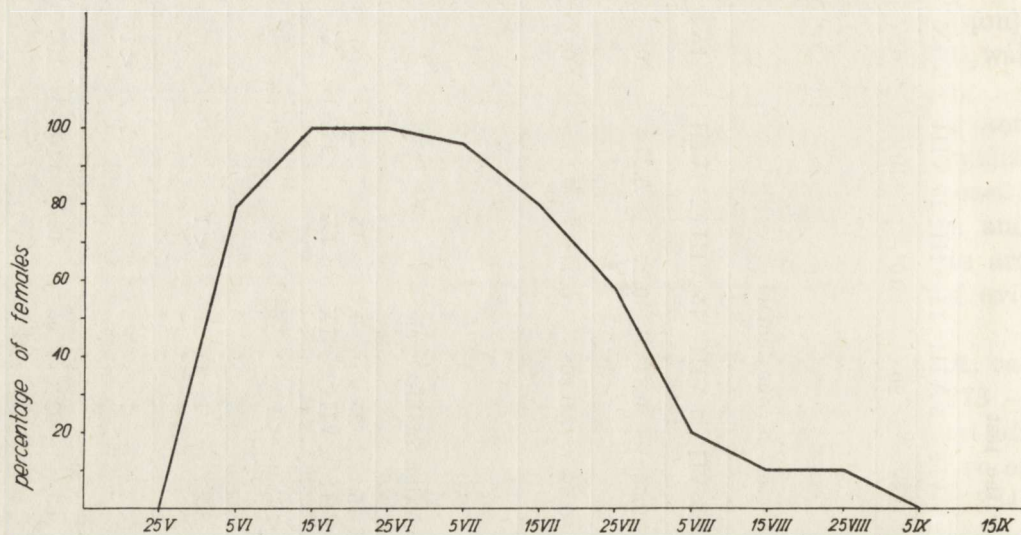


Fig. 1. Percentage of females with eggs under the test.

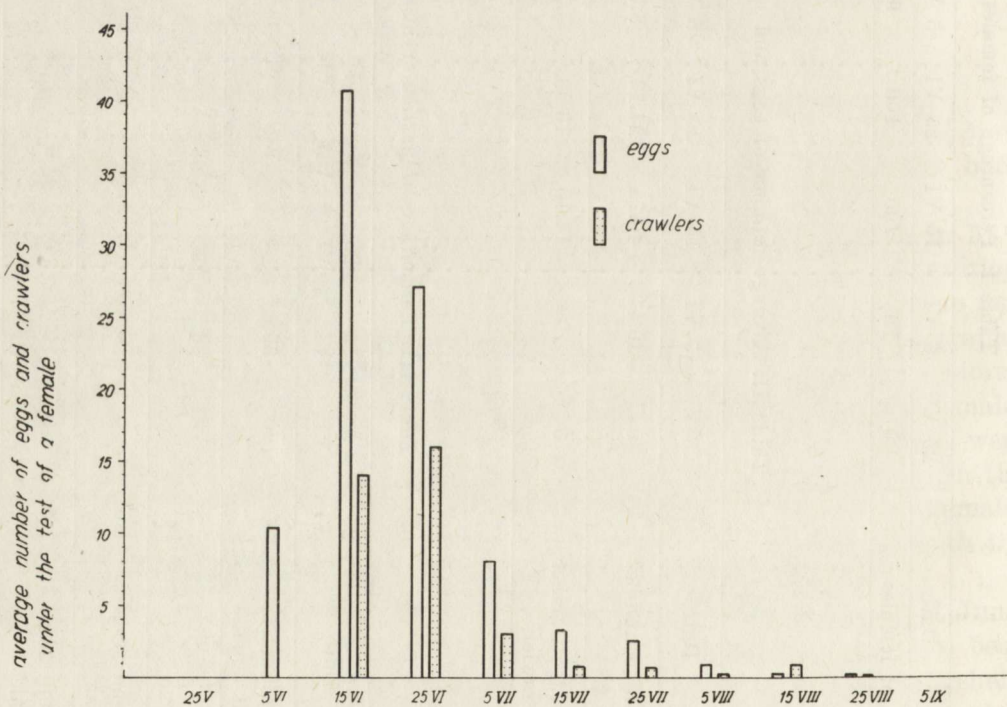


Fig. 2. Average number of eggs and crawlers under the test of one female.

In Table II, an average number of eggs and crawlers under the test of females in particular month decades is given. On Fig. 2 these data are presented graphically. It is evident that the oviposition was the most intensive in the second and subsequently in the third decade of June. 94 was the highest combined number of eggs and crawlers which were found under the test of one female. In the first decade of July, the process of egg-laying abruptly diminished. In the following decades the average number of eggs and crawlers found under the test of one female gradually decreased, which certainly resulted from a gradual increasing of number of those females which terminated wholly their reproduction, as well as with a diminishing of reproduction intensity of females which continued to reproduce. First decade of August, e.g. a period in which on the average only one egg pro female was laid, was assumed as the termination of reproduction period. The oviposition process though continuing sporadically during two subsequent decades could not be regarded as negligible for the necessary restitution of population.

The results obtained were in general in accord with earlier observations; the only exception stated was the presence of crawlers under the test, in another locality, in the first decade of June in 1969, thus several days earlier.

#### Population age distribution

The percentage of each instars in the life cycle is given on Table III, and graphically illustrated on Fig. 3.

It is here evident that in the last decade of May and in the first decade of June, the population consisted entirely of old, last-year females. These females also dominated in the population in the second decade of June, but already in the third decade of June their percentage abruptly decreased up to barely a few per cent of the total population. In the following decades the female share was negligible. This resulted, on one hand, from a continued reproduction and a steady increase of number of crawlers in the population, and a destruction of these females by parasites (*Hymenoptera*, *Acarina*), and their natural death, on the other. In the first decade of September no living last-year females have been found; all females investigated turned out to be dead in that time.

The first stage larvae appeared in the second decade of June, and very strongly dominated in the third decade of June and in the first and second decade of July. They also made a dominant component of the population in the third decade of July, but by that time the second stage larvae were already fairly numerous. From now on, the percentage of the first stage larvae abruptly decreased. In the first and second decade of September they were only sporadically found, so the third decade of August has been assumed as a last period of their occurrence.

The second stage larvae appeared in the second decade of July, and in the third decade of July they were already fairly abundant, becoming finally a dominant component of the population in the first decade of August. They were

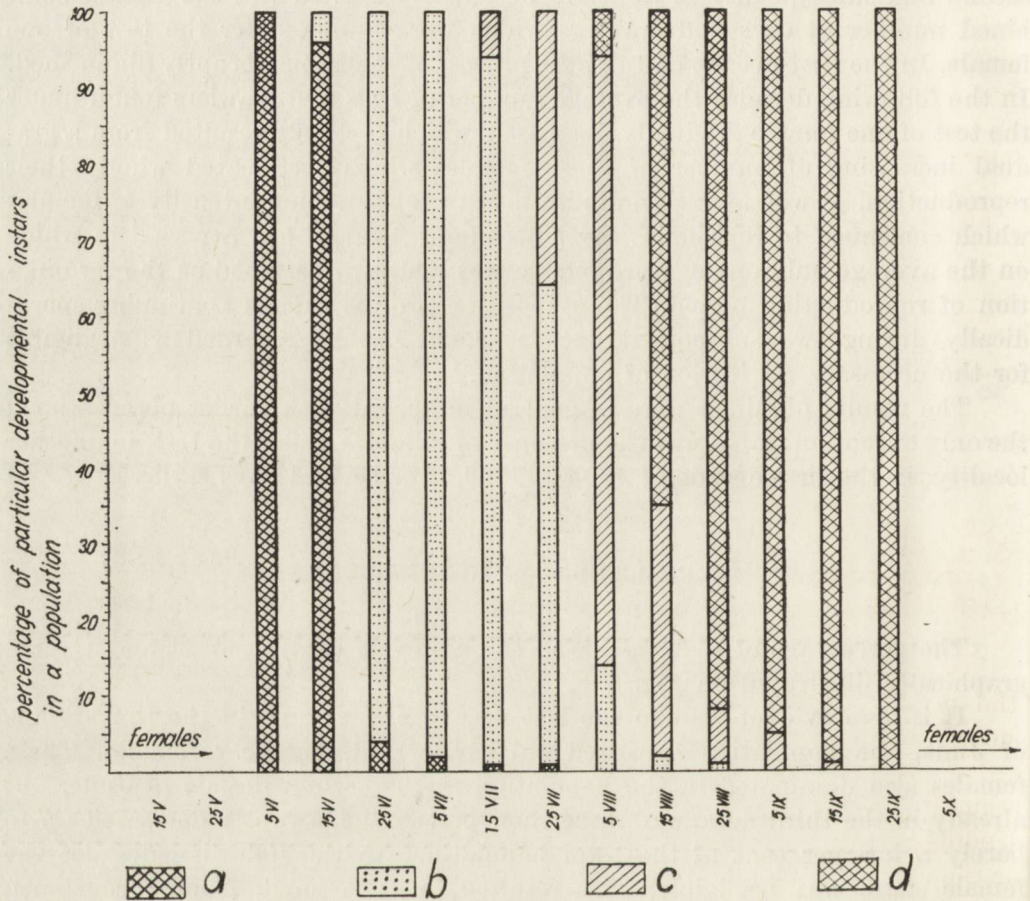


Fig. 3. Population age distribution in life cycle; a – reproductive females, b – first stage larvae, c – second stage larvae, d – young adult females.

still fairly numerous in the second decade of August, however, less than dominant young adult females in that period. In the third decade of August participation of larvae of the second stage amounted only to a few per cent and in the following decades steadily decreased. They were only found sporadically in the third decade of September and in the first decade of October, so the second decade of September has been assumed as a last period of their occurrence.

Young adult females appeared in the first decade of August. They dominated already over other instars in the second decade of August, and from the third decade of September they became an almost sole component, and later even the only component of the population.

## SUMMARY OF RESULTS

On Fig. 4 results on the life cycle of *A. variolosa* (RATZ.) carried out in Warsaw-Bemowo in 1973, are presented graphically. It illustrates the duration of oviposition and period of maximal intensity of this process, and moreover

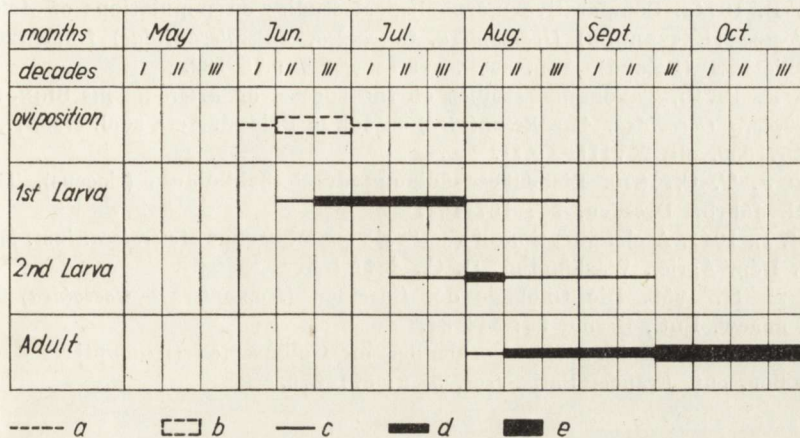


Fig. 4. Life cycle of *Asterodiaspis variolosa* (RATZ.) (Warszawa, Bemowo district, on *Quercus robur* L.); a — duration of the process, b — period of maximal intensity of the process, c — period of the occurrence of the instar, d — period of the dominance of instar in the population, e — period of the exclusive occurrence of the instar in the population.

the periods of appearance, domination in population and disappearance of subsequent developmental stages.

A confrontation of these results with observations made in 1965–1969. seems to indicate an average value of life-cycle parameters for a given area. Undoubtedly, however, due to climatic oscillations in particular years as well as the microclimatic differences in particular sites, the said value may be subject to a greater or lesser modifications.

Department of Biological  
Foundations of Animal Breeding.  
The Agricultural University of Warsaw,  
Rakowiecka 26/30, 02-528 Warszawa.

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## STRESZCZENIE

[Tytuł: Badania nad cyklem życiowym *Asterodiaspis variolosa* (RATZEBURG, 1870) (*Homoptera, Coccoidea, Asterolecaniidae*) w Polsce]

Badania nad cyklem życiowym *Asterodiaspis variolosa* (RATZ.) prowadzono na terenie Warszawy-Bemowa w roku 1973. Badana populacja zasiedlała dąb szypułkowy, *Quercus robur* L.

Składanie jaj trwało od pierwszej dekady czerwca do pierwszej dekady sierpnia, a największe nasilenie tego procesu miało miejsce w drugiej i trzeciej dekadzie czerwca. Larwy I stadium pojawiły się w drugiej dekadzie czerwca, dominowały w populacji od trzeciej dekady czerwca do trzeciej dekady lipca, a występowały do trzeciej dekady sierpnia. Larwy II stadium pojawiły się w drugiej dekadzie lipca, dominowały w populacji w pierwszej dekadzie sierpnia, a występowały do drugiej dekady września. Samice pojawiły się w pierwszej dekadzie sierpnia, od drugiej dekady sierpnia były dominującym, a od trzeciej dekady września – wyłącznym składnikiem populacji.

Przeprowadzone badania poprzedzone były ogólnymi obserwacjami robionymi w latach 1965–1969. W roku 1969 stwierdzono nieco wcześniejsze rozpoczęcie się cyklu życiowego *A. variolosa*, gdyż pierwsze larwy „wędrowce” obecne były pod osłonkami samiec już w końcu pierwszej dekady czerwca.



## РЕЗЮМЕ

[Заглавие: Исследование жизненного цикла *Asterodiaspis variolosa* (RATZEBURG, 1870) (Homoptera, Coccoidea, Asterolecaniidae) в Польше]

Исследования жизненного цикла *Asterodiaspis variolosum* (RATZEBURG) были произведены на территории Варшавы (район Бемово) в 1973 году. Исследованная популяция населяла дуб черешчатый, *Quercus robur* L.

Откладка яиц длилась с первой декады июня до первой декады августа, а наиболее интенсивно происходила во второй и третьей декаде июня. Личинки I стадии появились во второй декаде июня и встречались до третьей декады августа, доминируя в популяции с третьей декады июня до третьей декады июля. Личинки II стадии появились во второй декаде июля и встречались до второй декады сентября, доминируя в популяции в первой декаде августа. Самки появились в первой декаде августа, со второй декады августа стали доминировать в популяции, а с третьей декады сентября популяция состояла исключительно из самок.

До проведения настоящих исследований были произведены в 1965–1969 гг. общие наблюдения. В 1969 году автор констатировала несколько более раннее начало жизненного цикла у *A. variolosa*, поскольку первые личинки „бродяжки” находились под оболочками самок уже в конце первой декады июня.



Redaktor pracy — prof. dr J. Nast

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Państwowe Wydawnictwo Naukowe — Warszawa 1975  
Nakład 1050+90 egz. Ark. wyd. 0,75, druk.  $\frac{3}{8}$ . Papier sat. kl. III, 80 g B1. Cena zł 8,—  
Nr zam. 890/74. — Wrocławska Drukarnia Naukowa

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