POLSKA AKADEMIA NAUK
ZAKŁAD ZOOLOGII SYSTEMATYCZNEJ I DOŚWIADCZALNEJ

ACTA ZOOLOGICA CRACOVIENSIA

Tom XIX Kraków, 31. XII. 1974 Nr 20

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Taxonomic Studies on the Species of *Asterodiaspis* SIGNORET, 1876 (*Homoptera, Coccoidea, Asterolecaniidae*) on Oak in Poland

[Pp. 487—530, 29 text-figs., pls. XVIII—XXII]

Taksonomiczne studia nad gatunkami z rodzaju *Asterodiaspis* SIGNORET, 1876 (*Homoptera, Coccoidea, Asterolecaniidae*) występującymi na dębach w Polsce

Таксономические исследования видов из рода *Asterodiaspis* SIGNORET, 1876 (*Homoptera, Coccoidea, Asterolecaniidae*) выступающих на дубах в Польше

Abstract. *Asterodiaspis minus* (RUSSELL) has been recognized as synonymous with *Asterodiaspis quercicola* (BOUCHÉ). It has been demonstrated that *A. quercicola* occurs in populations which differ much from each other in morphological characters. The status of *Asterodiaspis variolosum* (RATZEBURG) as a separate species has been confirmed.

CONTENTS

I. INTRODUCTION

This paper presents the results of the continuation of the studies on the taxonomic status of *Asterodiaspis variolosum* (RATZEBURG, 1870), *Asterodiaspis quercicola* (BOUCHÉ, 1851) and *Asterodiaspis minus* (RUSSELL, 1941) carried out by the author on material derived from Poland.

The first stage of the study was devoted to the elucidation of the taxonomic status of *A. variolosum*. As a result (PODSIADŁO, 1972), the status of *A. variolosum* as a distinct species was maintained, but its reliable identification was found to be possible only in the first larval instar. Moreover, it was demonstrated (PODSIADŁO, 1974) that this species occurs in populations which differ very much from each other in morphological characters.

The main purpose of the present study is to elucidate the taxonomic status of *A. quercicola* and *A. minus*. Further investigation on *A. variolosum*, aiming at checking the results obtained previously, is a secondary purpose.

The taxonomic characters of females and larvae of the first instar, which since RUSSELL'S study (1941) have been regarded as specific characters, will be discussed below.

The number of multilocular pores was considered to be the most important specific character of females, the one having no concurrent values. The data concerning this character obtained so far are presented in the form of a graph in Fig. 1. An analysis of the data for *A. quercicola* and *A. minus* shows that the variation of this character within either species is very great and the differences between the species very small. Hence it becomes doubtful if the number of multilocular pores may be regarded as a specific character, differentiating the females of *A. quercicola* from those of *A. minus*. APEJI (1964) mentions the number of loculi in the multilocular pores as another specific difference of the females of *A. minus*, but the numerical data given by him, 4—5 loculi in *A. minus* and 6—10 in *A. quercicola*, also throw doubt upon the recognition of this character as a specific one.

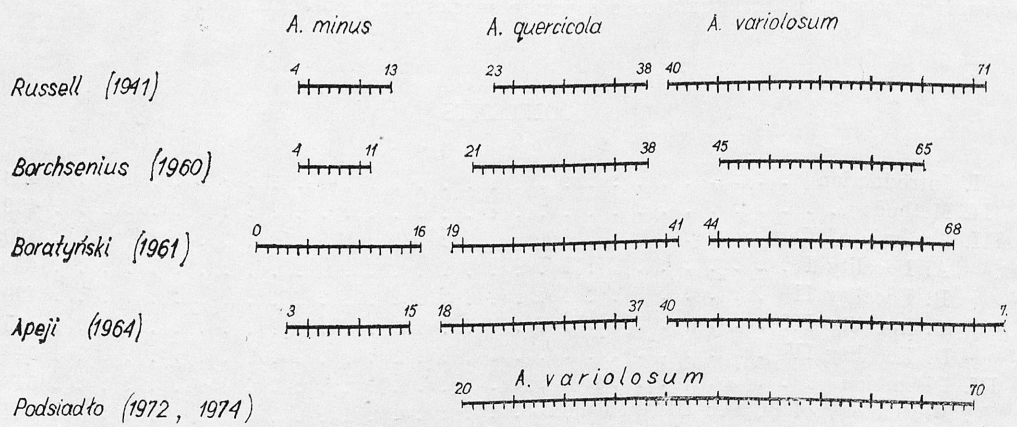


Fig. 1. Data from literature concerning the number of multilocular pores in females of *Asterodiaspis minus*, *A. quercicola* and *A. variolosum*

In the light of the data from literature the number of 8 - shaped pores in the submedian series should be considered to be the most important taxonomic character differentiating the larvae of the first instar of *A. minus* from those of *A. quercicola*; it is thought that in *A. quercicola* this series is not quite as complete as it is in *A. minus*. BORATYŃSKI (1961) writes that *A. minus* has 10 pairs of 8-shaped pores in two submedian series, of which several posterior ones may be missing, and *A. quercicola* 1—4 pairs. However, according to other authors, this character has also concurrent values, e.g. RUSSELL (1941) and BORCHSENIUS (1960) report that each submedian series consists of 1—4 8-shaped pores in *A. quercicola* and 4—5 in *A. minus*. In addition to this character some differences between the larvae of the first instar of *A. minus* and those of *A. quercicola* have been found in the length of apical setae, which, e.g. according to RUSSELL (1941), is about 54 μm in *A. minus* and about 66 μm in *A. quercicola*, the difference being therefore rather small.

II. METHODS

Method of Collecting and Studying of Field Material. Material was collected from 4 trees, in the further part of this paper referred to as Localities I—IV. The first two of them were situated in Warsaw, one at Piaseczno in the Warsaw Province, and one at Karpacz in the Wrocław Province.

The females from particular trees, observed in situ, were often ununiform as regards external appearance and formed differentiated groups. Specimens belonging to different groups differed in size, sometimes in the degree of convexity of the dorsal side, and in body coloration. The classification of a single female in a definite group did not generally present difficulties, but there was a small number of females with intermediate characters and such that should be classified in one group on the basis of one character and in another group considering another character, and these females escaped correct grouping.

The foregoing observations marked out the following method of collecting and studying material:

Adult females were collected in the period when they were laying eggs, from which larvae hatched, and divided into four groups: 1) females living on one-year-old branches, 2) females from two-year-old branches, 3) females from 3—4-year-old branches, and 4) females from the main trunk or old thick branches. It should be emphasized that specimens of *A. variolosum*, *A. quercicola* and those determined as *A. minus* were found on old branches only when these had smooth and uncracked bark.

A piece of bark with females attached to it was cut off and the unmounted females were examined under a binocular microscope. The length and width of the test were measured, the colour of the body and test noted, and the degree of convexity of the dorsal side of body estimated.

If there were any crawlers outside the test, which may have derived from

another mother, they were removed. Next each female was placed separately in a tube stopped with cotton wool, where it continued breeding. After breeding, the females and their larval progeny were used to make microscopic preparations.

The proper study was preceded with a preliminary study, in which young females having no larval progeny and sometimes larvae of the first instar but already attached to a branch and therefore such as could not be ascribed to any definite mother were also collected and examined; moreover, some observations were omitted, especially those concerning the external appearance of specimens and material was not taken from all the four above-mentioned sorts of branches, e. g. at Locality IV it was gathered only from one-year-old branches. Nevertheless, these materials have been included in the present study, because they contribute greatly to the solution of the problem set.

Method for Carrying on Individual Cultures. A somewhat modified APEJI'S (1964) method of breeding adopted in this study presents itself as follows:

Three-year-old oaks *Quercus robur* L. were planted singly in clay pots after they had been found free from the infestation with any species of the *Coccoidea*. One female was placed on each plant by tying a piece of bark with it to a branch. Thus each female gave rise to one culture, in which sister larvae developed and metamorphosed into adult females towards the end of summer. Some of these adult progeny were gathered before the outset of their breeding season, some while they were laying eggs or while larvae were hatching; they were isolated in tubes, as mentioned above, to produce their larval progeny.

The purpose of individual cultures was 1) to find whether the transfer of females to other trees influences the morphology of their progeny and 2) to check the number of the multilocular pores in sister females, i.e. those derived from the same mother.

III. ANALYSIS OF RESULTS

At a microscopic examination of material from particular trees attention was chiefly given to the characters which in the light of the data from literature are of taxonomic importance. A detailed description of the morphology of adult females and larvae of the first instar is given at the end of this paper.

A. Locality I

Place of collection: Wrońskiego Street, Warsaw
Host plant: *Quercus robur* L. × *Q. petrea* LIEBL, hybrid with predominating characters of *Q. robur* L.
Material: 27 July 1966 — 5 females after egg-laying and hatching of larvae; 3 larvae of the first instar already attached to branches. 30 June 1967 — 16 females with hatched larvae under the test. 2 Dec. 1968 — 73 young females. 14 June 1969 — 34 females in the phase of egg-laying; each of these females was isolated in a tube, in which next the larvae hatched.

Adult Females. With respect to external appearance the females divided into two groups. In an examination of the morphological characters of mounted females and larvae produced by them these groups appeared distinctly separated. The group consisting of females of smaller dimensions, usually more flattened, and lighter in body colour should have been determined as *A. minus* on account of their morphological characters and, above all, the number of multilocular pores. The females of greater dimensions, belonging to the other group, were identified as *A. variolosum* on the basis of their morphological characters and, mainly, the type of larvae produced by them.

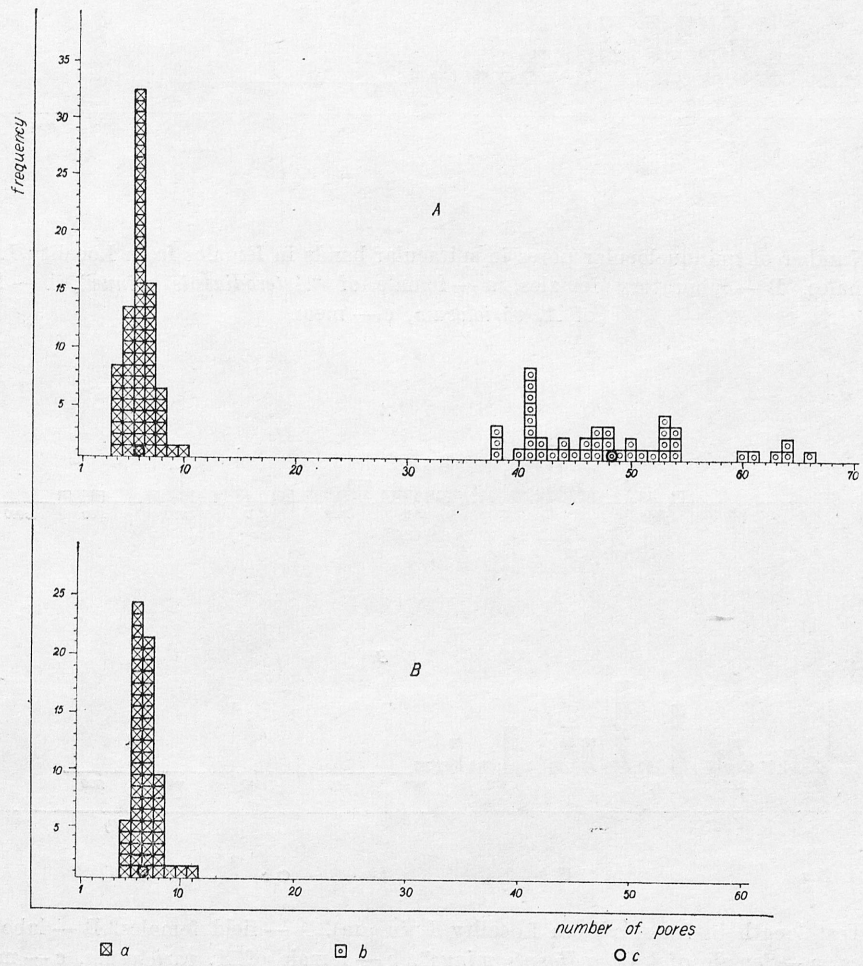


Fig. 2. Number of multilocular pores in females from Locality I. A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. variolosum*, c — mean

The morphological characters of these females are given in Part A of Table I. The variation of some characters is graphically illustrated in Figs. 2A, 3A, 4A and 5A.

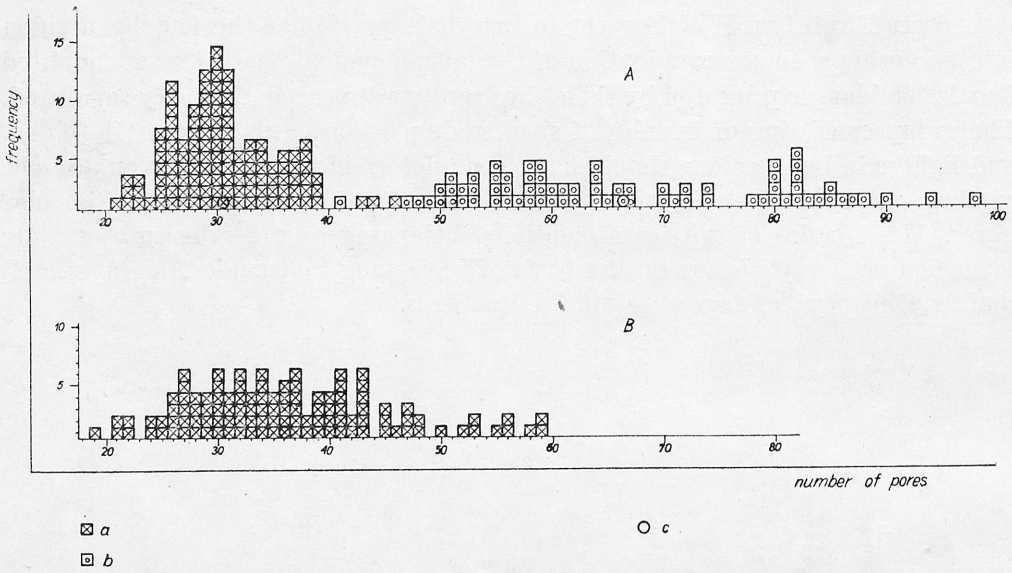


Fig. 3. Number of quinquelocular pores in spiracular bands in females from Locality I. A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. variolosum*, c — mean

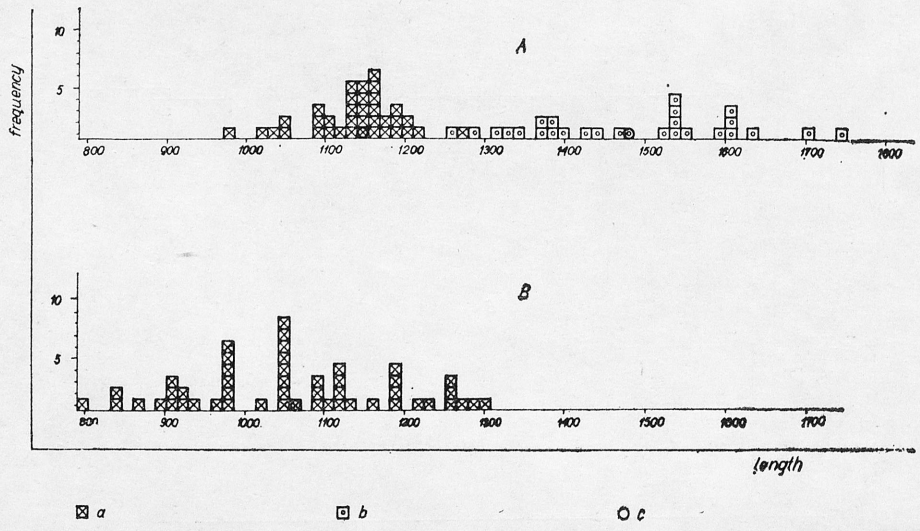


Fig. 4. Test length in females from Locality I (in μm). A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. variolosum*, c — mean

Individual cultures were laid down on 11 June 1969. Five females in the phase of egg-laying were selected for this purpose from the population examined and referred to as *A. minus*. The reliable assignment of these, living and unmounted females to the form which used to be determined as *A. minus* was possible, because, as has been mentioned above, on the basis of some characters of the

external appearance we were in the position to classify most of them correctly among the forms referred to as *A. minus* or in the species *A. variolosum*. Therefore "typical" females referred to as *A. minus*, i. e. those characterized by small body dimensions, slightly convex, and yellow in body colour, were picked out and placed separately, one on each single young oak-tree, giving rise to five individual cultures. The adult female issue was collected between 16th and 30th April 1970, the numbers obtained being as follows: 15 females from culture

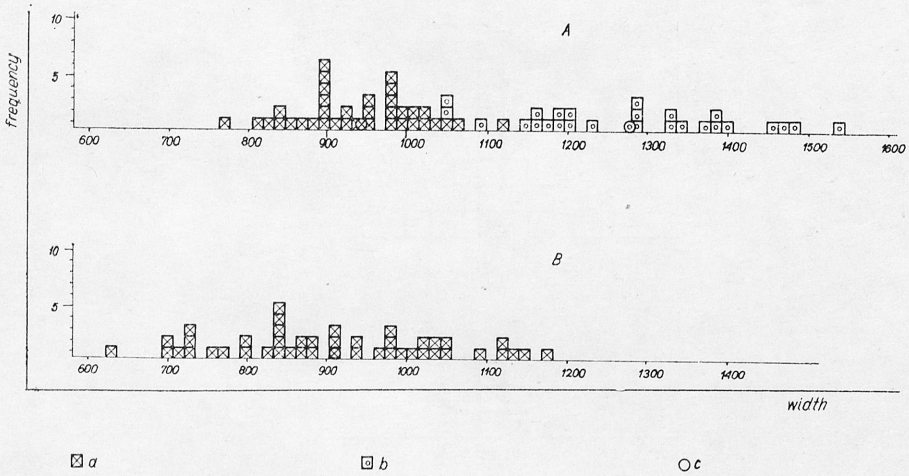


Fig. 5. Test width in females from Locality I (in μm). A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. variolosum*, c — mean

No. 1, 17 from culture No. 2, 5 from culture No. 3, 9 from culture No. 4, and 16 from culture No. 5; altogether 62 females. Fig. 6 presents the numbers of the multilocular pores in sister females, i. e. those derived from the same mother. In the figure there are five histograms, one for each individual culture. The progeny of one mother is illustrated by one histogram. The number of multilocular pores of the maternal female in culture No. 1 is not given, because the specimen has been destroyed.

On the other hand, the morphological characters of all the 62 laboratory females referred to as *A. minus* are given jointly in Part B of Table I. Some of these characters are represented graphically in Figs. 2B, 3B, 4B and 5B.

An analysis of the morphological characters of all the females examined from Locality I will be carried out below. Females collected in the field will be discussed in the first place (Figs. 2A, 3A, 4A and 5A).

Fig. 2A illustrated the number of multilocular pores in the field females. The histogram shows two groups of specimens, sharply separated from each other in respect of this character. The females which might be determined as *A. minus* have a considerably smaller number of multilocular pores than those of *A. variolosum* have. The graphs showing the numbers of quinquelocular pores in the spiracular bands (Fig. 3A) and the lengths (Fig. 4A) and widths (Fig. 5A)

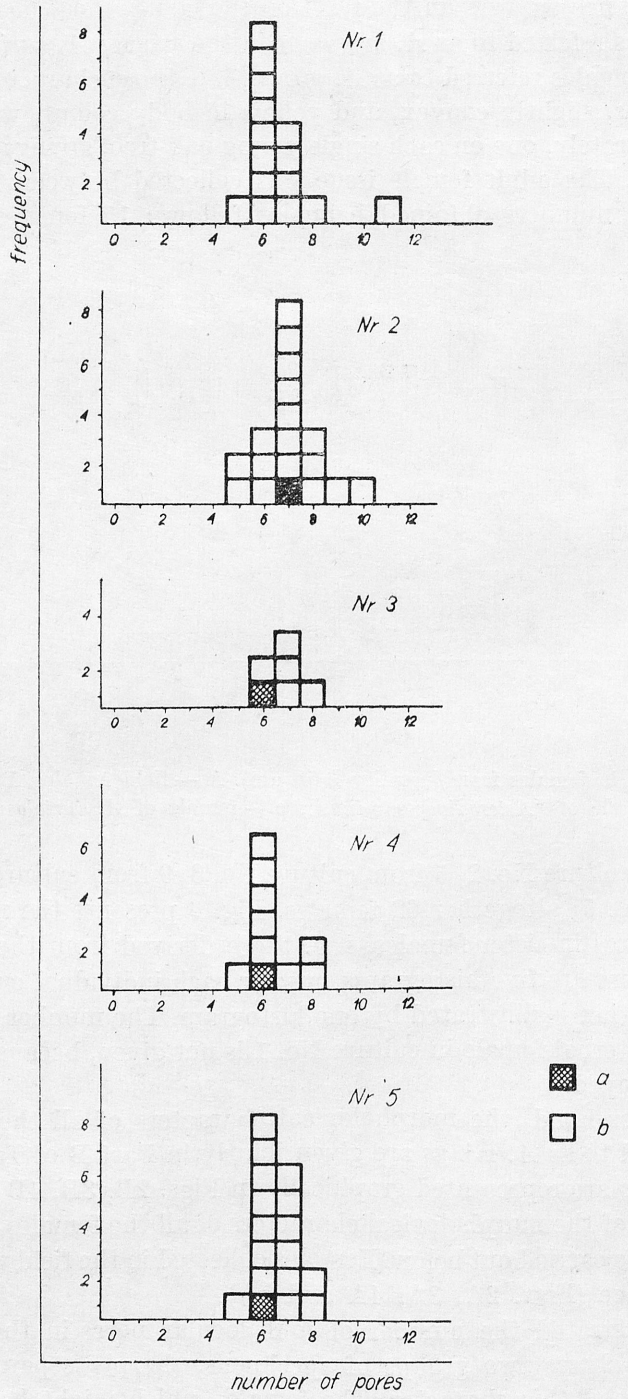


Fig. 6. Number of multilocular pores in females in 5 individual cultures started with the material of "*Asterodiaspis minus*" collected at Locality I. a — mother female, b — daughter female

of the test present a similar picture only that the two groups distinguished have the same values of these characters with in some ranges.

The graphs of the above-mentioned characters in the laboratory females referred to as *A. minus* are given in Figs. 2B, 3B, 4B and 5B.

As can be seen from the histograms, the laboratory and field females referred to as *A. minus* were very similar to each other, the same being shown by other morphological characters, not illustrated by graphs but only numerically in Table I.

This indicates that the transfer of females referred to as *A. minus* to other trees had no essential effect on the morphology of their adult progeny. The females bred in the laboratory kept the morphological characters of females belonging to the population from which their mothers had been derived.

Larvae of the First Instar. Larvae were obtained from 22 females referred to as *A. minus* and 8 females of *A. variolosum*. The number of larvae coming from each of these females will be found in Tables II and III, in which the females marked with progressive figures are arranged according to the increasing number of multilocular pores.

Altogether 160 larvae obtained from the forms referred to as *A. minus* were examined. Eight females of *A. variolosum* provided 104 larvae. In addition, 29 larvae of *A. variolosum* whose mother had been destroyed while being mounted were also included in the analysis. Thus the total of larval *A. variolosum* examined was 133.

Some morphological characters of the larvae under study are summarized in Table IV.

The larval progeny of the form referred to as *A. minus* had both the sublateral and the submedian series of 8-shaped pores, of which the latter was complete to a varied degree. Moreover, it was found that the number of 8-shaped pores in the submedian series was often different on either side of body in the larval „*A. minus*", and thus frequently some segments had a pore of this type on one side of body only. For this reason, the total number of these pores on both sides of body together is given instead of the number of their pairs. Fig. 7 illustrates the frequency of specimens with a definite number of 8-shaped pores in the submedian series. Each larva is represented by a dot. The larvae placed in the vertical column were descended from one and the same mother. The number of multilocular pores in the mother of the larvae and the mother's serial number are given on the abscissae and the number of 8-shaped pores in the submedian series of each larva on the ordinates.

As can be seen, the larvae having 6 pores on both sides of body together were the most numerous in the material examined, in which case 3 pairs of pores were the commonest occurrence, but there were also larvae with 2 pores on one side and 4 on the other. There was great variation in this character in the larval progeny of the same mother. The greatest variation was found in females Nos. 12 and 17, whose larval progeny had, respectively, 2—8 and 3—9 pores.

Table 1

Some morphological characters of adult females from Locality I

Character	A		B
	Field material		Laboratory material
	"A. minus"	*A. variolosum*	*"A. minus"*
test length	980—1274 μm (1140 μm)	1260—1750 μm (1482·84 μm)	798—1302 μm (1062·04 μm)
test width	770—1120 μm (943·29 μm)	1050—1540 μm (1277·76 μm)	630—1176 μm (910·00 μm)
length of mounted females	812—1092 μm (949·72 μm)	1008—1470 μm (1254·32 μm)	616—1134 μm (903·66 μm)
width of mounted females	700—952 μm (835·45 μm)	882—1330 μm (1138·44 μm)	546—1050 μm (792·50 μm)
number of multilocular pores	4—11 (6·12)	38—66 (48·25)	5—11 (6·74)
number of loculi in multilocular pores	3—5, most often 4	6—12, usually 10, rarely 9 and 8, the others sporadically	3—6, most often 4
length of tubular ducts	15—29 μm (21·36 μm)	19—36 μm (27·70 μm)	18—27 μm (21·78 μm)
length of apical setae	16—31 μm (25·98 μm)	24—45 μm (34·13 μm)	19—34 μm (26·36 μm)
number of quinquelocular pores in spiracular bands *	21—44 (30·65)	41—98 (66·45)	19—59 (36·23)
length of marginal 8-shaped pores	8—9 μm	9—10 μm	8—9 μm
"dark-rimmed" pores	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen
submarginal ventral band of 8-shaped pores	composed of 1—2 irregular rows	composed of 2—3 irregular rows	composed of 1—2 irregular rows

* Two measurements, one for the anterior spiracular band and one for the posterior one, were taken on each specimen.

Table II

Number of larvae obtained from females of "*Asterodiaspis minus*" collected at Locality I

Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Number of multilocular pores in female	4	4	5	5	5	6	6	6	6	6	6	6	6	6	6	6	7	7	7	8	8	8
Number of larvae obtained from it	3	10	2	1	1	1	10	13	18	13	1	23	6	2	8	12	6	5	4	12	6	3

Table III

Number of larvae obtained from females of *Asterodiaspis variolosum* collected at Locality I

Female No.	1	2	3	4	5	6	7	8
Number of multilocular pores in female	42	48	48	49	50	50	51	66
Number of larvae obtained from it	25	4	17	7	18	27	2	4

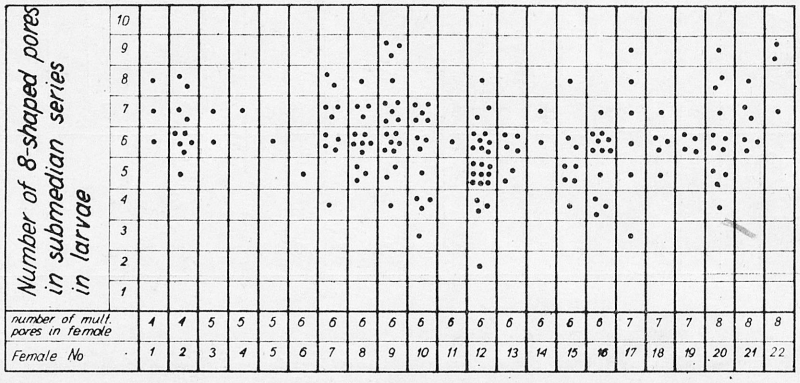
Table IV

Some morphological characters of larvae of the first instar from Locality I

Character	"*A. minus*"	*A. variolosum*
sublateral series of 8-shaped pores	present, composed of 7—10 pairs pores, usually 9—10 pairs	absent
number of 8-shaped pores in submedian series	2—9 (6·08) pores on both sides of body together	usually 2 pores, rarely 1 pore, sporadically none in the submedian area
length of apical setae	55—66 μm (61·83 μm)	60—70 μm (64·20 μm)

Distribution of Populations on Tree. The data concerning the distribution of specimens on the branches of the tree were obtained on the basis of 107 adult females. Females were collected only from branches within reach. These were 1, 2 and 3—4 years old and owing to the fact that the 1-year-old branches were the easiest to reach, followed by the 2-year-old branches in this

respect, while the 3-4-year-olds were the hardest to reach, the number of females collected from these branches was various. Seventy-two females were gathered on the 1-year-old branches, 31 on the 2-year-old branches, and 4 on the 3—4-year-old ones.



• a

Fig. 7. Number of 8-shaped pores in the submedian series on both sides of body together in the larvae of the first instar derived from the females of "*Asterodiaspis minus*" from Locality I.
a — larva

Table V gives the specific status of the females collected. It shows that the form referred to as *A. minus* predominated numerically on this tree, but its predominance was different on particular branches. On the 1-year-old branches the predominance of the form referred to as *A. minus* over *A. variolosum* was slight, they occurred in nearly the same numbers, whereas on the 2-year-old

Table V

Distribution of populations of "*Asterodiaspis minus*" and *A. variolosum* on branches of the same tree at Locality I

Age of Branch	"*A. minus*"	*A. variolosum*	Total
1-year old	38	34	72
2-year old	25	6	31
3—4 year old	4	—	4
Total	67	40	107

branches this predominance was noticeable. This would point to a distinct tendency for *A. variolosum* to settle on 1-year-old branches and some indifference of the form referred to as *A. minus* towards the age of branches, which form was more uniformly distributed on the 1 — and 2-year-old branches. The

scantiness of material collected on the 3 — 4-year-old branches allows no conclusion as to the occurrence of the forms under study on them. However, the fact that all the 4 females found belonged to the form referred to as *A. minus* seems to confirm its indifference towards the age of branches.

B. Locality II

Place of collection: Garden of Agriculture University, Rakowiecka Street, Warsaw.
Host plant: *Quercus robur* L.
Material: 7—16 June 1969 — 36 females at the phase of egg-laying. Each of the females was placed separately in a tube, in which its larvae hatched.

Adult Females. As regards body size, two groups of females can be distinguished, one of smaller specimens and the other of larger ones. An examination of the morphological characters of the mounted smaller females and their larval progeny showed a uniformity within this group. On the basis of the morphological characters of the females and larvae of the first instar and, above all, in view of the number of multilocular pores of the females, this group of 14 specimens should be determined as *A. minus*.

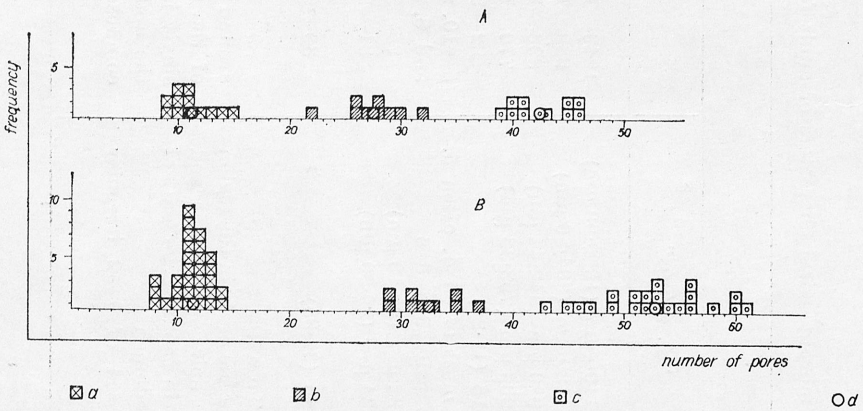


Fig. 8. Number of multilocular pores in females from Locality II. A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. quercicola*, c — female of *A. variolosum*, d — mean

An examination of the morphological characters of the mounted larger females and, above all, their larval progeny showed their differentiation into two groups. One of them was determined as *A. quercicola* and consisted of 9 females. The other group, numbering 13 females, was identified as *A. variolosum*. The morphological characters of the females of these three groups are listed in Table VI. The variation of some of the characters is illustrated by the graphs in Figs. 8A—11A.

The laying down of individual cultures preceded the microscopic examination of the morphology of the females living on this tree and for this reason

Table VI

Some morphological characters of adult females from Locality II

Character	Field material		
	"A. minus"	*A. quercicola*	*A. variolosum*
test length	854—1190 μm (1050·00 μm)	1246—1400 μm (1320·66 μm)	1316—1540 μm (1408·16 μm)
test width	700—1120 μm (884·80 μm)	980—1162 μm (1050·00 μm)	1078—1316 μm (1186·50 μm)
length of mounted females	686—980 μm (842·44 μm)	896—1224 μm (1050·80 μm)	1022—1176 μm (1109·11 μm)
width of mounted females	616—966 μm (793·33 μm)	770—1008 μm (891·60 μm)	868—1134 μm (1051·55 μm)
number of multilocular pores	9—15 (11·25)	22—32 (27·55)	39—46 (42·60)
number of loculi in multilocular pores	3—6, most often 4, often 5, sporadically 3 and 6	5—10, most often 10, often 9 and 8, rarely 7, 6 and 5	6—10, usually 10, rarely 9 and 8, sporadically 7 and 6
length of tubular ducts	25—32 μm (29·10 μm)	25—34 μm (30·16 μm)	29—34 μm (32·16 μm)
length of apical setae	24—34 μm (29·90 μm)	31—38 μm (33·28 μm)	24—34 μm (32·36 μm)
number of quinquelocular pores in spiracular bands *	24—46 (32·35)	39—61 (47·81)	38—59 (47·38)
length of marginal 8-shaped pores	8—9 μm	9—10 μm	9—10 μm
"dark-rimmed" pores	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen
submarginal ventral band of 8-shaped pores	composed of 1—2 irregular rows	composed of 2 irregular rows	composed of 2—3 irregular rows

* See: Table I

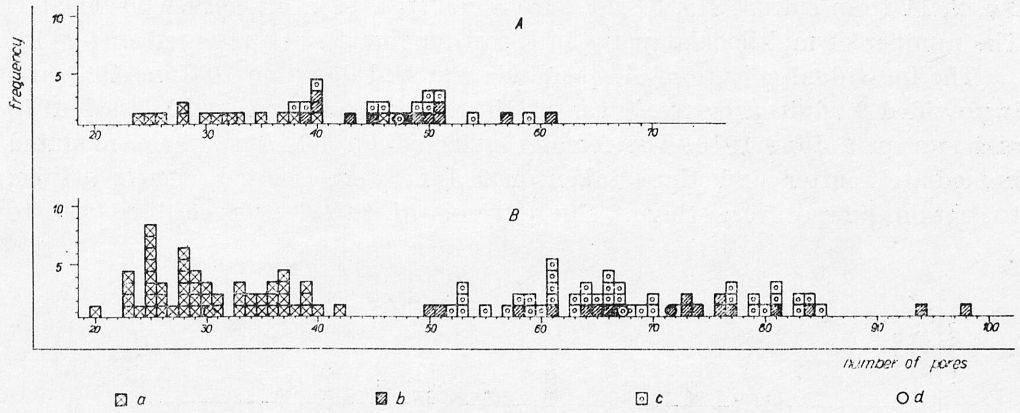


Fig. 9. Number of quinquelocular pores in the spiracular bands of the females from Locality II. A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. quercicola*, c — female of *A. variolosum*, d — mean

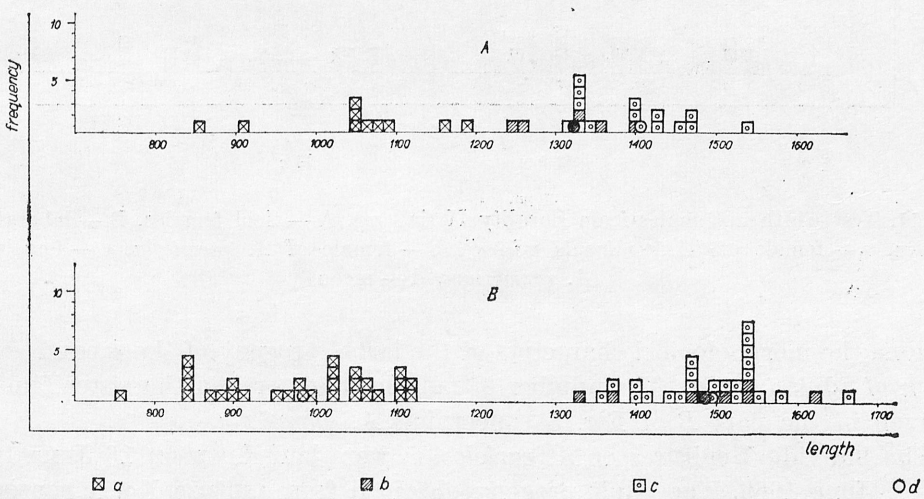


Fig. 10. Test length in females from Locality II (in μm). A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. quercicola*, c — female of *A. variolosum*, d — mean

the selection of maternal females was based exclusively on macroscopic observations of unmounted specimens. Four specimens of the group of smaller females and 3 of the group of larger ones were chosen for breeding. As was next shown by microscopic examination all the 4 smaller females belonged to the form referred to as *A. minus* and out of the 3 larger females, 1 belonged to *A. quercicola* and 2 to *A. variolosum*.

The individual cultures of the form referred to as *A. minus* were laid down on 10 June 1969 and the adult progeny was collected from 2 to 16 April 1970. A total of 30 adult females were obtained: 11 from culture No. 1, 6 from culture

No. 2, 11 from culture No. 3 and 2 from culture No. 4, altogether 30 females. The number of multilocular pores in the sister females is presented in fig. 12.

The individual culture of *A. quercicola* was laid down on 10 June 1969 and it provided 9 adult progeny. Seven of them were collected on 30 April 1970 and two on 9 June 1970. The females collected on 30 April were mounted immediately after and those taken on 9 June were isolated, one in a tube, to obtain larvae from them. The purpose of this last procedure was to

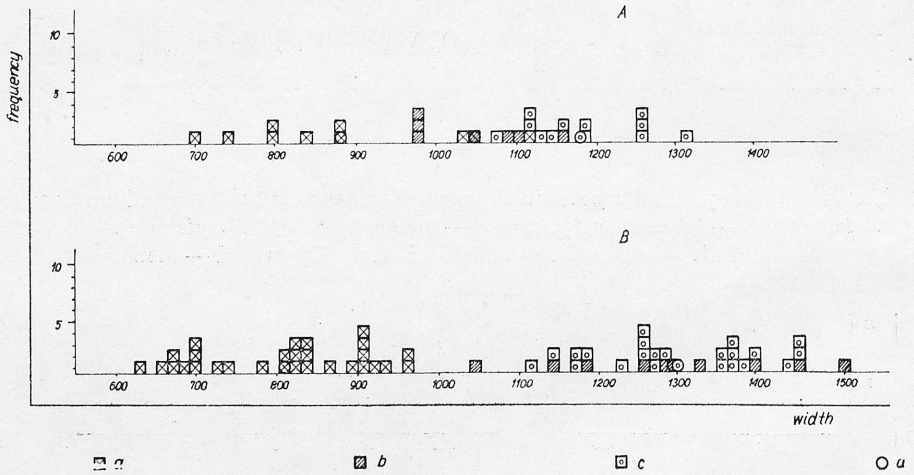


Fig. 11. Test width in females from Locality II (in μm). A — field females, B — laboratory females, a — female of "*Asterodiaspis minus*", b — female of *A. quercicola*, c — female of *A. variolosum*, d — mean

examine the morphological characters of the larval progeny of the second generation of adult females. The number of multilocular pores in the sister females is given in the part *B* of Fig. 8 concerning *A. quercicola*.

The individual cultures of *A. variolosum* were laid down on 16 June 1968 and 10 June 1969. The adult progeny obtained from culture No. 1 consisted of 13 females, of which 5 were taken in October 1968 and 8 on 10 July 1969, after the hatching of larvae. A small number of mostly dead larvae were found under the tests of these last females; they, too, were mounted and examined. Nine adult females were obtained from culture No. 2; 7 on 30 April 1970 and 2 on 9 June 1970. Preparations of some of these females were made immediately, the remaining specimens were isolated in tubes to produced larvae. The number of multilocular pores in the sister females is presented in Fig. 13.

The morphological characters of all the females bred, both the females referred to as *A. minus* and those of *A. quercicola* and *A. variolosum*, are listed in Table VII. The variation of some characters is illustrated by graphs in Figs. 8B, 9B, 10B and 11B.

An analysis of the morphological characters of all the females examined from Locality II will be carried out below.

Figs. 8A, 9A, 10A and 11A illustrate some morphological characters of the females collected directly in the field. Fig. 8A, presenting the numbers of multilocular pores, shows 3 groups of specimens, sharply demarcated from each other in respect of this character. The females referred to as *A. minus* had the smallest number of multilocular pores, the females of *A. quercicola* an intermediate

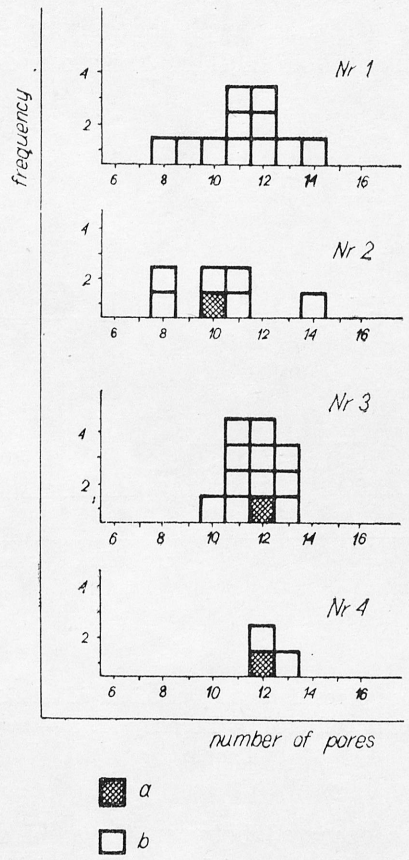


Fig. 12. Number of multilocular pores in females in 4 individual cultures started with the material of "*Asterodiaspis minus*" collected at Locality II. a — mother female, b — daughter female

number, and those of *A. variolosum* the largest one. As regards body size (Figs. 10A and 11A), the females referred to as *A. minus* were obviously the smallest; the females of *A. quercicola* on the average smaller than those of *A. variolosum*, but because of the very small number of measurements taken, this statement cannot be regarded as quite reliable. The form referred to as *A. minus* had also the smallest mean number of quinquelocular pores in the spiracular bands (Fig. 9A); *A. quercicola* and *A. variolosum* much resembled each other in this character.

Figs. 8B, 9B, 10B and 11B represent the above-mentioned characters graphically for the females referred to as *A. minus* and those of *A. quercicola* and *A. variolosum* bred in the laboratory. As can be seen from the histograms, the

laboratory females were, in general, similar to the field specimens. The greatest similarity was found between the field and laboratory specimens of the females referred to as *A. minus*, and it is also visible as regards other characters Tables VI and VII).

The data obtained indicate that the transfer of the females referred to as *A. minus* on to other trees had no essential effect on the morphology of their progeny. The laboratory females morphologically resembled the females of the populations from which their mothers had been derived.

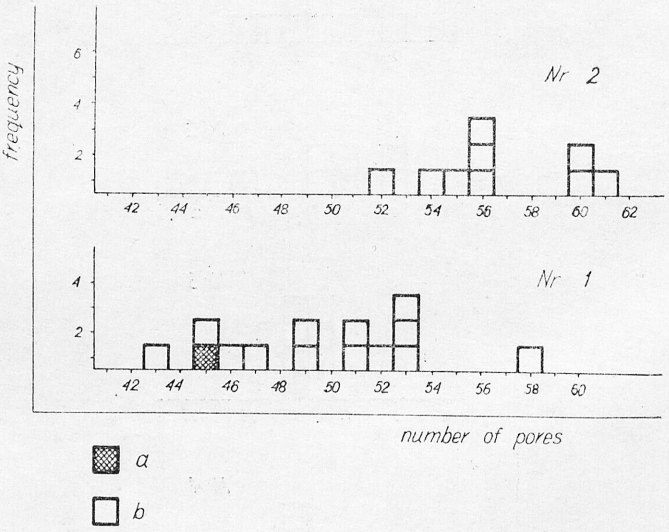


Fig. 13. Number of multilocular pores in females in 2 individual cultures started with the material of *Asterodiaspis variolosum* collected at Locality II. a — mother female, b — daughter female

A smaller resemblance occurred between the field and laboratory females belonging to *A. quercicola* and *A. variolosum*. Especially the number of quinquelocular pores in the spiracular bands was considerably larger in the laboratory females than in the field ones. However, in view of the small number of specimens measured this statement is unreliable.

Larvae of the First Instar. The larval progeny was obtained from 8 field females referred to as *A. minus*, from 5 field females and 2 laboratory females of *A. quercicola* and from 10 field females and 5 laboratory females of *A. variolosum*. The numbers of larvae obtained from particular females are given in Tables VIII and IX.

Totals of 20 larvae from the 8 females referred to as *A. minus*, 43 larvae from the 7 females of *A. quercicola* and 190 larvae from the 15 females of *A. variolosum* were examined. In addition, 25 larvae of *A. variolosum* whose mothers had been destroyed while being mounted were also examined. Thus, the total

Table VII

Some morphological characters of adult females from Locality II

Character	Laboratory material		
	"A. minus"	*A. quercicola*	*A. variolosum*
test length	756—1120 μm (981·40 μm)	1330—1624 μm (1485·55 μm)	1358—1666 μm (1491·63 μm)
test width	630—966 μm (810·06 μm)	1050—1512 μm (1292·66 μm)	1120—1456 μm (1301·36 μm)
length of mounted females	756—1036 μm (875·38 μm)	882—1246 μm (1115·33 μm)	1092—1330 μm (1196·00 μm)
width of mounted females	616—856 μm (725·41 μm)	770—1176 μm (1017·33 μm)	1022—1204 μm (1098·00 μm)
number of multilocular pores	8—14 (11·30)	29—37 (32·44)	43—61 (52·72)
number of loculi in multilocular pores	3—7, most often 4, often 5, rarely 6, sporadically 3 and 7	4—10, usually 8—10, rarely 7, sporadically 6, 5 and 4	6—12, usually 10, rarely 9 and 8, the others sporadically
length of tubular ducts	23—31 μm (28·61 μm)	25—35 μm (29·58 μm)	25—36 μm (29·22 μm)
length of apical setae	21—35 μm (29·27 μm)	31—40 μm (36·57 μm)	31—38 μm (33·94 μm)
number of quinquelocular pores in spiracular bands *	22—42 (30·37)	50—98 (71·55)	52—85 (67·30)
length of marginal 8-shaped pores	8—9 μm	9—10 mμ	9—10 mμ
"dark-rimmed" pores	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen
submarginal ventral band of 8-shaped pores	composed of 1—2 irregular rows	composed of 2 irregular rows	composed of 2—3 irregular rows

* See: Table I

Table VIII

Number of larvae obtained from females from Locality II; a — larvae obtained from field females of "*Asterodiaspis minus*"; b — larvae obtained from field females of *A. quercicola*; c — larvae obtained from laboratory females of *A. quercicola*

	a								b					c	
Female No.	1	2	3	4	5	6	7	8	1	2	3	4	5	1	2
Number of multilocular pores in female	9	9	10	10	11	11	14	15	22	26	27	28	29	35	37
Number of larvae obtained from it	1	4	6	1	2	1	1	4	2	8	12	1	5	1	14

Table IX

Number of larvae obtained from females of *Asterodiaspis variolosum* from Locality II; a — larvae obtained from field females; b — larvae obtained from laboratory females

	a										b				
Female No.	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
Number of multilocular pores in female	39	40	40	41	41	43	45	45	46	46	46	52	60	61	52
Number of larvae obtained from it	11	4	11	1	15	42	24	14	11	20	1	1	11	22	2

of the larvae of *A. variolosum* was 215. Some of the morphological characters of the larvae examined are listed in Table X.

The larvae referred to as *A. minus* and those of *A. quercicola* had both the sublateral and the submedian series of 8-shaped pores, of which the latter were complete to a varied degree.

Table X

Some morphological characters of larvae of the first instar from Locality II

Character	"*A. minus*"	*A. quercicola*	*A. variolosum*
sublateral series of 8-shaped pores	present, composed of 8—10 pairs pores	present, composed of 8—9 pairs pores, usually 9 pairs	absent
number of 8-shaped in submedian series	4—12 (7·65) pores on both sides of body together	2—5 (2·81) pores on both sides of body together	usually 2 pores, rarely 1 pore, sporadically none in submedian area
Length of apical setae	52—66 μm (56·50 μm)	60—69 μm (64·40 μm)	59—69 μm (63·11 μm)

Fig. 14A illustrates the frequency of specimens with a definite number of 8-shaped pores in the submedian series in the form referred to as *A. minus*. As will be seen from this figure, the larvae having 7 pores on both sides together were the most numerous in the material under study. The commonest configuration of this number of pores were 3 pores on one side and 4 on the other, but there were also larvae with 2 pores on one side and 5 on the other. The larval progeny of the same mother showed great variation in this character. This is best seen in the cases in which I managed to examine a fairly large number of larvae obtained from one mother, e.g. the larvae of female No. 5 had 7 and 12 pores, the larvae of female No. 8: 6—11 pores, and those of female No. 3: 4—9 pores.

Figure 14B and C presents the frequency of specimens of *A. quercicola* with a definite number of 8-shaped pores in the submedian series separately for the larval progeny of the field females (B) and that of the laboratory females (C) so as to show how this character is inherited in the second generation. It indicates that the larvae of the second generation did not differ from those of the previous generation in respect of this character and for this reason this last will be discussed for both groups together.

The most numerous larvae of *A. quercicola* had 2 pores, which always made a pair. There was little variation in this character in the larvae of the same mother; the greatest variation occurred in the larval progeny of field females Nos. 2 and 3 and in that of the laboratory female No. 2, being 2—4 pores in all three of them.

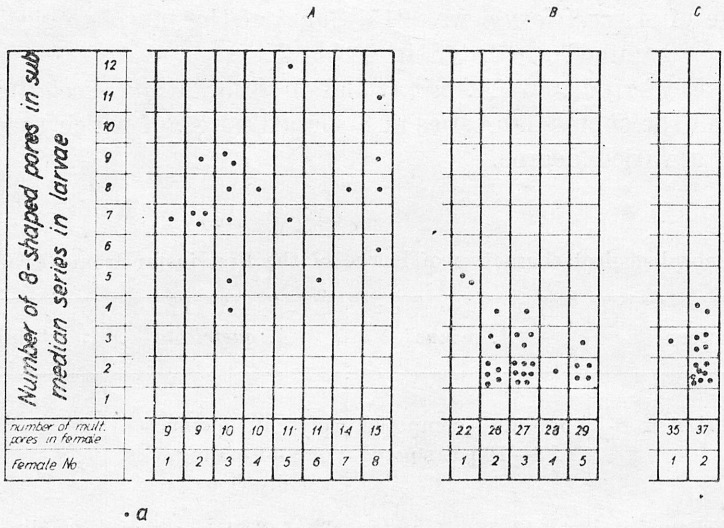


Fig. 14. Number of 8-shaped pores in the submedian series on both sides of body together in the larvae of first instar derived from females from Locality II. A — larval progeny of field females of "*Asterodiaspis minus*", B — larval progeny of field females of *A. quercicola*, C — larval progeny of laboratory females of *A. quercicola*, a — larva

To sum up, it must be admitted that the morphological differences between the larvae of the first instar referred to as *A. minus* and those of *A. quercicola* were not sharply defined. Although the former larvae had, on the average, more 8-shaped pores in the submedian series than the latter had, the numbers of 8-shaped pores found for these two groups overlapped within the interval of 4—5 pores.

Table XI

Distribution of populations of "*Asterodiaspis minus*", *A. quercicola* and *A. variolosum* on branches of the same tree at Locality II

Age of Branch	"*A. minus*"	*A. quercicola*	*A. variolosum*	Total
1-year old	2	3	5	10
2-year old	1	—	7	8
3—4 year old	—	3	1	4
main trunk	11	3	—	14
Total	14	9	13	36

Distribution of Populations on Tree. The data on the distribution of the specimens on the branches of the tree concern 36 adult females. The females were taken from branches 1, 2 and 3—4 years old and from the main trunk. Ten females were collected from 1-year-old branches, 8 from 2-year-olds, 4 from 3 — 4-year-olds and 14 from the trunk.

The distribution of the specimens of the 3 populations under study on particular sorts of branches is given in Table XI. It shows that *A. variolosum* occurred chiefly on young, 1 — and 2-year-old, branches, *A. quercicola* seemed to be uniformly distributed on branches varying in age, whereas the form referred to as *A. minus* clearly prevailed on the trunk e.g. on the oldest sections of the tree.

C. Locality III

Place of collection: Piaseczno, Warsaw Province
Host plant: *Quercus robur* L.
Material: 15 June 1969 — 45 adult females at the phase of egg-laying. Each of the females was isolated in a separate tube, in which its larvae hatched.

Adult Females. As regards size, two groups of adult females were distinguished, a group of smaller specimens and that of larger ones. At examination of the morphological characters of the females mounted and larvae produced by them these two groups were readily told apart.

The group of smaller females numbered 35 specimens. Morphologically it was uniform in respect of the characters of both females and larvae of the first instar, which clearly indicated that it was a population of one species. Regarding the morphological characters, above all, the number of multilocular pores, the females of this species made an intermediate link between *A. minus* and *A. quercicola* from literature, with a shift towards *A. minus*.

The group of larger females consisted of 10 specimens, identified as *A. variolosum* on the basis of the morphological characters of the females themselves and their larval progeny.

The morphological characters of these females are listed in Table XII. Variation in some characters is shown in the form of graphs in Figs. 15, 16, 17 and 18.

As shown by the histograms, the females having characters intermediate between the form referred to as *A. minus* and *A. quercicola* were characterized by a smaller number of multilocular pores and quinquelocular pores in the spiracular bands and a smaller body size than the females of *A. variolosum*. Moreover, they had smaller numerical values of many other morphological characters, not represented graphically, but given in Table XII.

Larvae of the First Instar. The larval progeny was obtained from 31 adult females with intermediate characters between the form referred to as *A. minus* and *A. quercicola* (Table XIII) and 10 females of *A. variolosum* (Table XIV). Totals of 163 larvae of the first form and 147 larvae of *A. variolosum* were examined. Some morphological characters of the larvae under study are shown in Table XV.

The larvae with intermediate characters between the form referred to as *A. minus* and *A. quercicola* had both the sublateral and the submedian series

Table XII

Some morphological characters of adult females from Locality III

Character	Field material	
	Females with intermediate characters between "*A. minus*" and *A. quercicola*	*A. variolosum*
test length	910—1288 μm (1160·64 μm)	1288—1638 μm (1460·66 μm)
test width	728—1134 μm (997·73 μm)	952—1442 μm (1234·00 μm)
length of mounted females	700—1054 μm (933·79 μm)	1085—1317 μm (1206·87 μm)
width of mounted females	651—992 μm (851·72 μm)	837—1271 μm (1074·55 μm)
number of multilocular pores	11—19 (16·25)	38—59 (44·70)
number of loculi in multilocular pores	4—9, most often 4—6, often 7, rarely 8 and 9	7—10, most often 10, rarely 8 and 7
length of tubular ducts	26—36 μm (29·91 μm)	31—36 μm (32·50 μm)
length of apical setae	24—37 μm (32·08 μm)	28—36 μm (31·00 μm)
number of quinquelocular pores in spiracular bands *	19—44 (30·18)	47—113 (65·47)
length of marginal 8-shaped pores	9 μm	9—10 μm
"dark-rimmed" pores	around the beak, in the region of the spiracular bands and singly in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen
submarginal ventral band of 8-shaped pores	composed of 1—3 irregular rows	composed of 2—3 irregular rows

* See: Table I

of 8-shaped pores, these last being complete to a varied degree. Fig. 19 shows the number of 8-shaped pores in the submedian series in these larvae.

As can be seen from this figure, the larvae having 8 pores on both sides of the body together were the most numerous in the study material. Then, the pores were most frequently arranged in 4 pairs, but the larvae with 3 pores on one side and 5 on the other were also fairly common. Variation in this character in the larvae derived from the same mother was very great. It was the greatest in female No. 6, whose larvae had 7—15 pores, and next in females Nos. 1 and 23, whose larvae had, respectively, 10—17 and 6—13 pores.

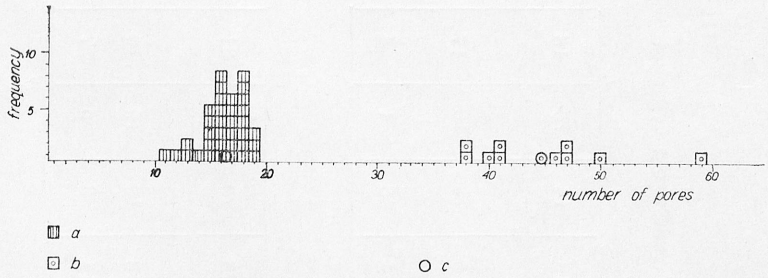


Fig. 15. Number of multilocular pores in females collected at Locality III. a — female with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola*, b — female of *A. variolosum*, c — mean

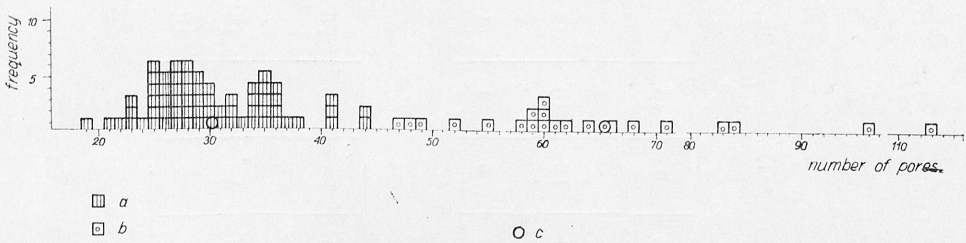


Fig. 16. Number of quinquelocular pores in the spiracular bands in females collected at Locality III. a — females with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola*, b — females of *A. variolosum*, c — mean

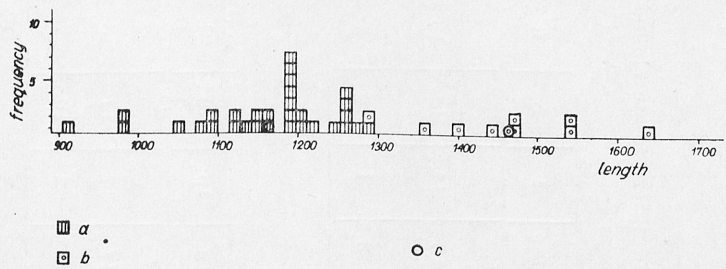


Fig. 17. Test length in females collected at Locality III (in μm). a — female with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola*, b — female of *A. variolosum*, c — mean

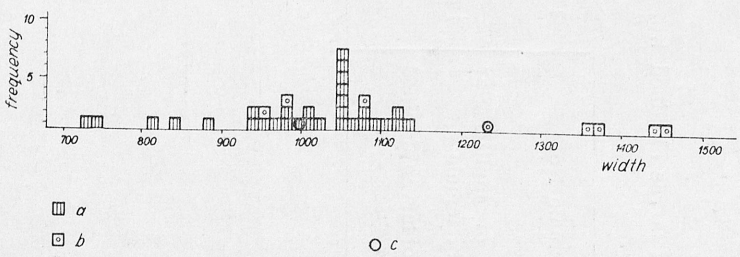


Fig. 18. Test width in females collected at Locality III (in μm). a — female with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola*, b — female of *A. variolosum*, c — mean

Table XIII

Number of larvae obtained from females with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola* collected at Locality III

Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of multilocular pores in female	12	13	13	14	15	15	15	15	15	16	16	16	16	16	16	17
Number of larvae obtained from it	3	5	3	1	5	9	7	8	5	1	1	5	4	5	1	4

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	17	17	17	17	18	18	18	18	18	18	18	18	19	19	19
	2	2	2	10	7	6	13	6	8	10	1	14	3	5	7

Table XIV

Number of larvae obtained from females of *Asterodiaspis variolosum* collected at Locality III

Female No.	1	2	3	4	5	6	7	8	9	10
Number of multilocular pores in female	38	38	40	41	41	46	47	47	50	59
Number of larvae obtained from it	11	9	15	4	17	4	8	21	16	42

Table XV

Some morphological characters of larvae of the first instar from Locality III

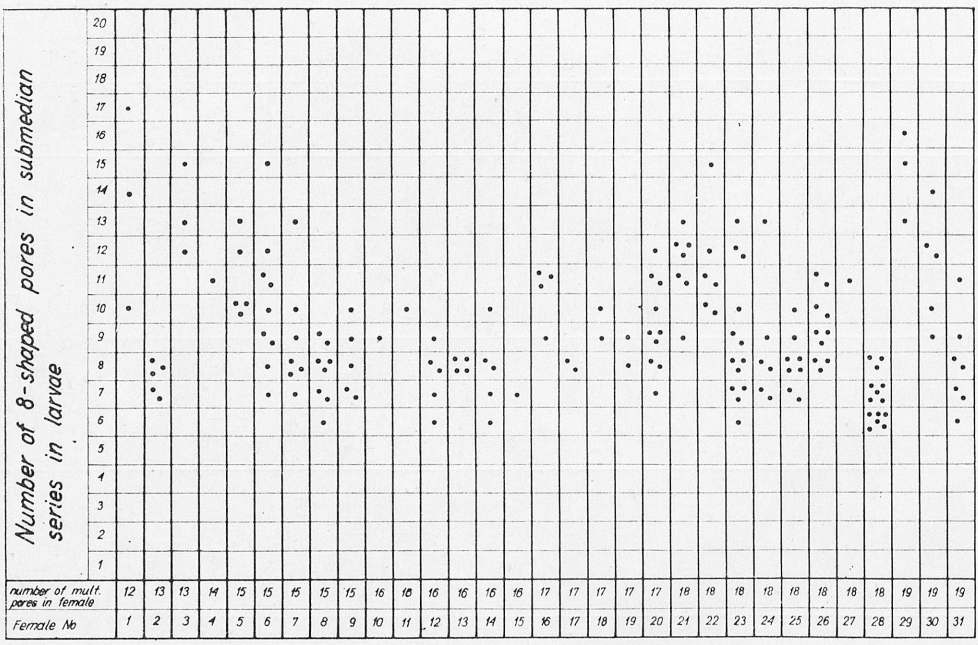
Character	larval progeny of females with intermediate characters between "*A. minus*" and *A. quercicola*	*A. variolosum*
sublateral series of 8-shaped pores	present, composed of 8—10 pairs pores	absent
number of 8-shaped pores in submedian series	6—17 (9·22) pores on both sides of body together	usually none, rarely 2 pores or 1 pore in submedian area
length of apical setae	62—70 μm (64·70 μm)	63—70 μm (65·10 μm)

Table XVI

Distribution of populations of females with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola* and females of *A. variolosum* on branches of the same tree at Locality III

Age of Branch	"*A. minus*" — *A. quercicola*	*A. variolosum*	Total
1-year old	6	6	12
2-year old	7	4	11
3—4-year old	12	—	12
old thick branches	10	—	10
Total	35	10	45

Distribution of Populations on Tree. The data on the distribution of specimens on the branches of the tree concern 45 adult females. They were collected from branches 1, 2 and 3—4 years old and from old thick boughs, on which females of *Asterodiaspis* occurred only when the bark of the boughs was



• a

Fig. 19. Number of 8-shaped pores in the submedian series on both sides of body together in the larvae of the first instar derived from females with intermediate characters between "*Asterodiaspis minus*" and *A. quercicola* from Locality III. a-larva

smooth and uncracked. Twelve females were obtained from 1-year-old branches, 11 from 2-year-olds, 12 from 3—4-year-olds and 10 from old boughs.

The distribution of the females of the two species discussed on particular branches is given in Table XVI. It shows that the females of *A. variolosum* were present only on young, 1 — and 2-year-old, branches and the females with intermediate characters between the form referred to as *A. minus* and *A. quercicola* on all sorts of branches, prevailing on old ones, though.

D. Locality IV

Place of collection: Karpacz, Wrocław Province
Host plant: *Quercus* sp.
Material: 4 June 1968 — 35 adult females, collected shortly before egg-laying. Females were collected only from 1-year-old branches. Each of the females was isolated in a tube, in which they laid eggs and the larvae hatched.

Adult Females. Material was collected at this locality during a preliminary study and for this reason not all the females gathered were examined for their external appearance nor were the length and width of their tests measured.

A study of the adult females mounted and their larval progeny showed that 34 females should be identified as *A. quercicola* and one as *A. variolosum*. The

Table XVII

Some morphological characters of adult females from Locality IV

Character	Field material	
	A. quercicola	*A. variolosum*
test length	1120—1540 μm (1305·04 μm)	—
test width	938—1260 μm (1082·26 μm)	—
length of mounted females	910—1106 μm (1001·36 μm)	1085 μm
width of mounted females	826—1106 μm (944·63 μm)	1148 μm
number of multilocular pores	25—37 (31·70)	47
number of loculi in multilocular pores	5—10, most often 8—10, often 7 and 6, rarely 5	7—10, most often 10, often 9 and 8, rarely 7
length of tubular ducts	24—34 μm (31·18 μm)	33—34 μm
length of apical setae	30—44 μm (36·08 μm)	34 μm
number of quinquelocular pores in spiracular bands *	31—98 (57·00)	50—54
length of marginal 8-shaped pores	9—10 μm	9—10 μm
"dark-rimmed" pores	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen	around the beak, in the region of the spiracular bands and fairly numerously in the anterior part of the abdomen
submarginal ventral band of 8-shaped pores	composed of 2—3 irregular rows	composed of 2—3 irregular rows

* See: Table I

morphological characters of these females are given in Table XVII and variation in some of them is graphically represented in Figs. 20, 21, 22 and 23.

Fig. 20, which illustrates the number of multilocular pores, shows that the female of *A. variolosum* had clearly a larger number of these pores than had the females of *A. quercicola*. On the other hand, as regards the number of quinquelocular pores in the spiracular bands, the females of these species did not differ (Fig. 21). The length and width of test is represented in the form of graphs only for *A. quercicola*, because I had not these data concerning *A. variolosum* at my disposal (Figs. 22 and 23).

Larvae of the First Instar. A total of 213 larvae of *A. quercicola* were obtained from 32 females (Table XVIII), whereas 20 larvae of *A. variolosum*

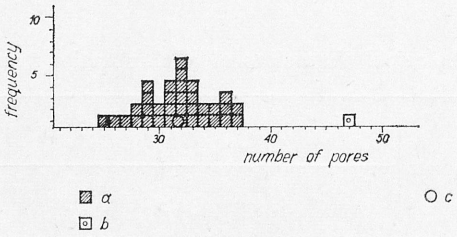


Fig. 20. Number of multilocular pores in females collected at Locality IV. a — female of *Asterodiaspis quercicola*, b — female of *A. variolosum*, c — mean

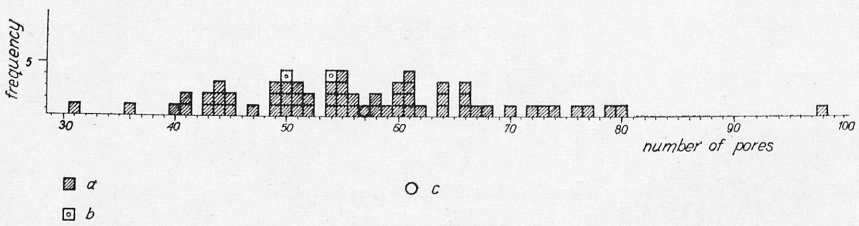


Fig. 21. Number of quinquelocular pores in the spiracular bands in females collected at Locality IV. a — female of *Asterodiaspis quercicola*, b — female of *A. variolosum*, c — mean

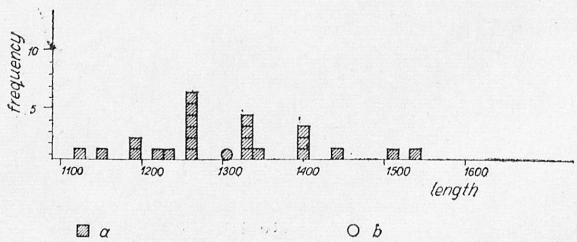


Fig. 22. Test length of females collected at Locality IV (in μm). a — female of *Asterodiaspis quercicola*, b — mean

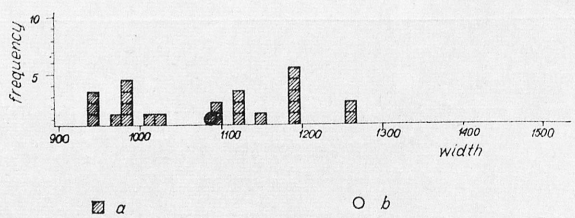


Fig. 23. Test width of females collected at Locality IV (in μm). a — female of *Asterodiaspis quercicola*, b — mean

were the progeny of one mother. Some morphological characters of the larvae examined are listed in Table XIX.

The larvae of *A. quercicola* had both the sublateral and the submedian series of 8-shaped pores, these last being complete to a varied degree. Figure 24 illustrates the frequency of specimens with a definite number of 8-shaped pores in

Table XVIII

Number of larvae obtained from females of *Asterodiaspis quercicola* collected at Locality IV

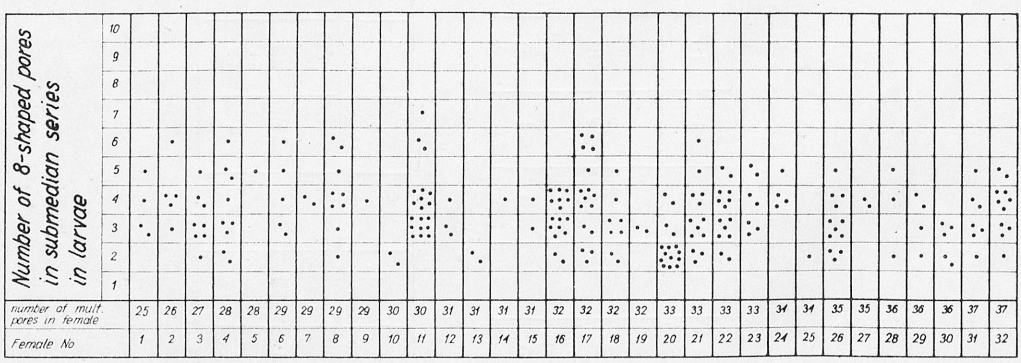
Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of multilocular pores in female	25	26	27	28	28	29	29	29	29	30	30	31	31	31	31	32
Number of larvae obtained from it	4	5	8	9	1	5	2	9	1	2	19	3	2	1	2	16

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
32	32	32	33	33	33	33	34	34	35	35	36	36	36	37	37
16	8	2	15	13	14	7	4	1	12	2	3	4	5	7	11

Table XIX

Some morphological characters of larvae of the first instar from Locality IV

Character	*A. quercicola*	*A. variolosum*
sublateral series of 8-shaped pores	present, composed of 7—10 pairs pores	absent
number of 8-shaped pores in submedian series	2—7 (3·50) pores on both sides of body together	usually 2 pores, rarely 1 pore, sporadically none in submedian area
length of apical setae	61—70 μm (65·13 μm)	63—71 μm (67·00 μm)



a

Fig. 24. Number of 8-shaped pores in the submedian series on both sides of body together in the larvae of the first instar derived from females of *Asterodiaspis quercicola* from Locality IV.
a — larva

the submedian series. It shows that the larvae having 3 and 4 pores on both sides of the body together are the most numerous. The larvae with 3 pores had most commonly 2 of them on one side of the body and 1 on the other. If there were 4 pores, they were most often arranged in 2 pairs, but the larvae with 3 pores on one side and 1 on the other were also frequent. The greatest variation in this character occurred in the larval progeny of females Nos. 4, 8, 17, 21 (2—6 pores) and in that of female No. 11 (3—7 pores).

IV. DISCUSSION

With regard to the morphological characters of their larvae all the females examined split into two distinct groups. The first group consisted of females whose larvae had the sublateral and the submedian series of 8-shaped pores, these last being complete to a varied degree. In literature this group was divided into two species, *A. minus* and *A. quercicola*.

The other group included females whose larval progeny had not the sublateral series of 8-shaped pores and it contained 1 species, *A. variolosum*.

To begin with, I shall deal with the group of specimens defined as *A. minus* and *A. quercicola*. The numbers of multilocular pores in the females of these two „species" collected on particular trees are represented graphically in order of their increasing mean values in Fig. 25. On the tree designated as Locality II there occurred two morphologically differing groups of these females and this

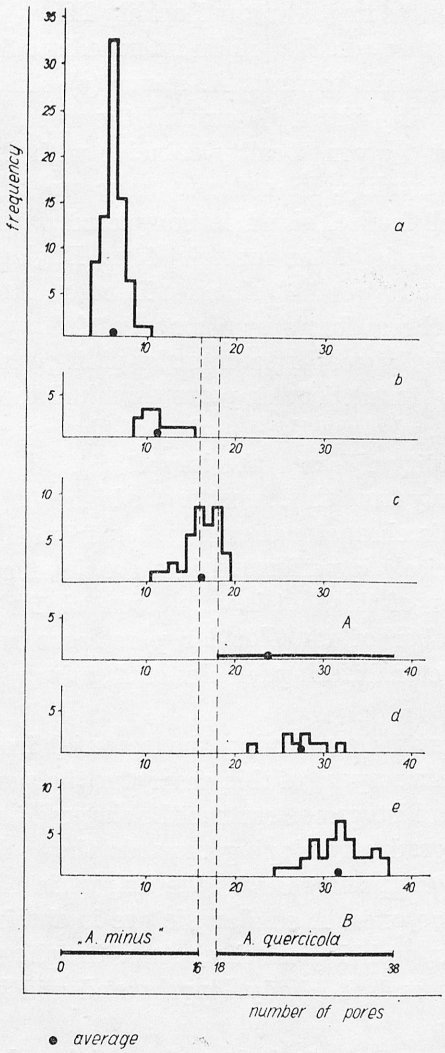


Fig. 25. A comparison of the numbers of multilocular pores in females of *Asterodiaspis quercicola* from 5 populations. a — females of "*A. minus*" from Locality I, b — females of "*A. minus*" from Locality II, c — females with intermediate characters between "*A. minus*" and *A. quercicola* from Locality III, d — females of *A. quercicola* from Locality II, e — females of *A. quercicola* from Locality IV, A — females of *A. quercicola* from Silwood Park near London (Apeji, 1964), B — data from literature (Fig. 1)

is why they are given separately in places corresponding to the size of their means. The lowest and highest numbers of the multilocular pores in the females of *A. minus* and *A. quercicola* drawn from literature are given at the bottom of the figure.

As can be seen from this figure, the females referred to as *A. minus* from Locality I (a) had the smallest number of multilocular pores. Their larger number, but still lying within the range for *A. minus* from literature, was found in the females referred to as *A. minus* from Locality II (b). A still larger number of these pores occurred in the females from Locality III, which females compared with the data from literature constituted an intermediate link between *A. minus* and *A. quercicola*, with a shift towards *A. minus* (c). An analysis of the three histograms based on growing means shows that the upper numbers of multilocular pores in females at a given locality coincide with the lower numbers of these pores at the next locality. In order to keep up this continuity, a link missing in the material from Poland is completed with the data obtained by APEJI (1964) on the basis of the material from England (A). They concern *A. quercicola* collected at Silwood Park near London. APEJI'S material is the most comparable with the author's own material from particular trees, since it was collected in a relatively small area. Females of *A. quercicola* from Locality II (d) had a larger number of multilocular pores than had the females of *A. quercicola* from Silwood Park, whereas the number of these pores in the females of *A. quercicola* from Locality IV was the largest (e).

Considered successively from the lowest to the highest mean, these histograms show that as regards this character the transition from the females referred to as *A. minus* to *A. quercicola* is performed in a continuous manner, and not by leaps. The demonstration of this fact is very essential, for as was mentioned at the beginning, the number of multilocular pores was regarded as the most important specific character differing females of *A. minus* from those of *A. quercicola*.

Moreover, the histograms concerning the material from Poland (Fig. 25a, b, c, d and e) show that in respect of this character the specimens form uniform and compact groups. The histograms assume the shapes of similar figures, towering in the middle and gradually sloping towards the ends of the range. This means that the number of specimens was the largest in the middle classes and the lowest in the extreme ones. A similar picture is obtained with the graphic representation of other morphological characters. Graphs showing the numbers of quinquelocular pores and the body lengths and widths are given in Figs. 26, 27 and 28.

This picture of the morphological characters of females and also the great uniformity of their external appearance within each group indicate that the specific names *A. minus* and *A. quercicola* do not in fact refer to two but to one species, occurring in populations which much differ from each other in morphology. This having been accepted, it was next assumed that one population of this species lived on each of the trees defined as Localities I, III and IV, whereas

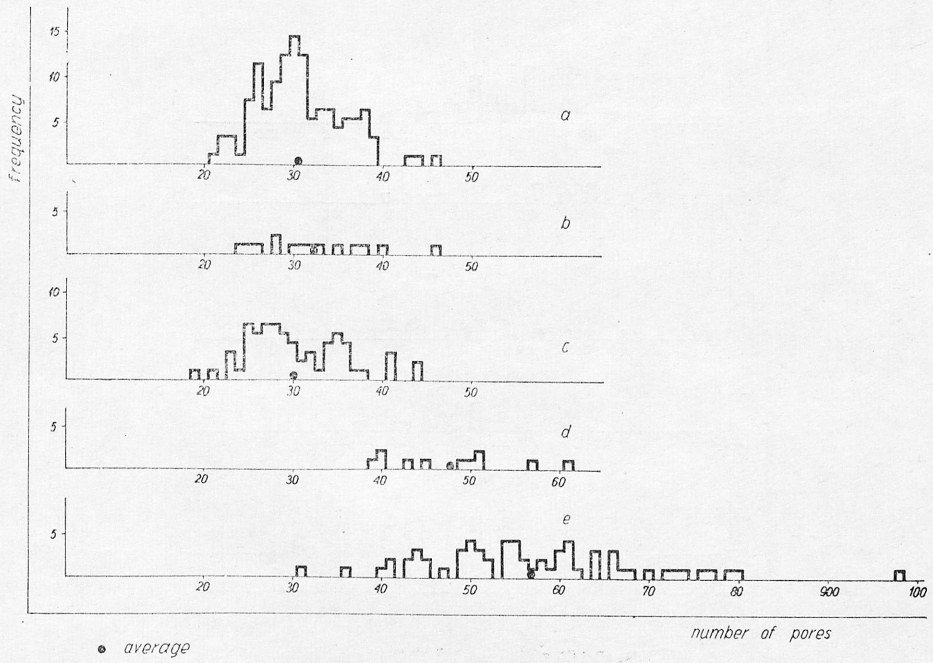


Fig. 26. A comparison of the numbers of quinquelocular pores in the spiracular bands in females of *Asterodiaspis quercicola* from 5 populations. (For designations a, b, c. d, e see Fig. 25)

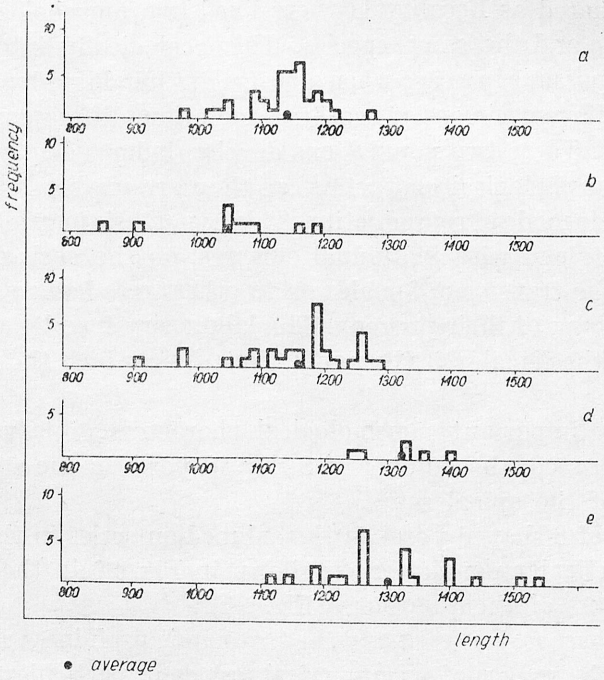


Fig. 27. A comparison of the test lengths (in μm) of females of *Asterodiaspis quercicola* from 5 populations. (For designations a, b, c, d, e see Fig. 25)

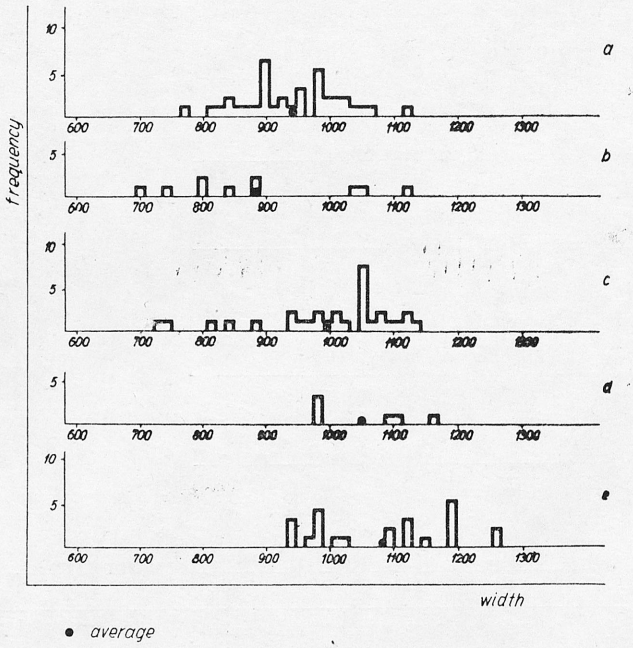


Fig. 28. A comparison of the test width (in μm) of females of *Asterodiaspis quercicola* from 5 populations. (For designations a, b, c, d, e see Fig. 25)

on the tree designated as Locality II there lived two morphologically differing populations of one and the same species. This ecologically interesting coexistence seems to be possible in a case when a host plant inhabited by one population becomes colonized by specimens of another population, differing morphologically from the first one. These two populations develop independently of each other, retaining their morphological characters, as they are unable to cross owing to the parthenogenetic mode of reproduction. This hypothesis may also be supported by the results obtained with individual cultures, on the basis of which it has been found that the transfer of females on to other trees had no essential effect upon the morphology of their progeny. The laboratory females were morphologically similar to the females of the populations from which their mothers were descended.

The two most important morphological characters of larvae of the first instar will be discussed, the number of 8-shaped pores in the submedian series and the length of the apical setae.

The numbers of 8-shaped pores in the submedian series in the larvae of the first instar in particular populations is shown in Fig. 29 in the same order as are the populations of their mothers (Fig. 25).

However, the best way to estimate the taxonomic usefulness of this character is by comparing the ranges of its numerical values in particular populations in the order of their increasing means or: d, e, a, b, c. An analysis of these histograms shows that the upper numbers of 8-shaped pores in the submedian series of the

larvae of a given population always coincide with the lower numbers of these pores in the next population. Thus, the increase of the number of these pores in successive populations is also continuous and not by leaps. The number of 8-shaped pores in the submedian series is a very variable character, different in various populations of this species.

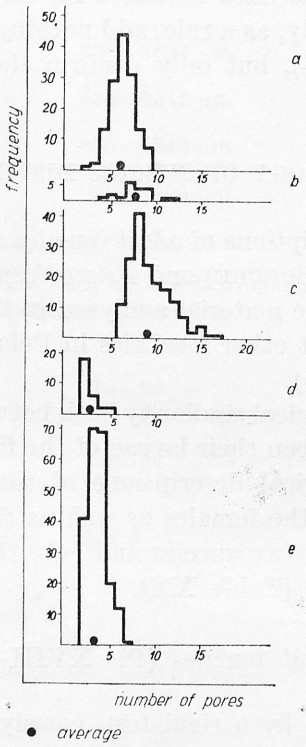


Fig. 29. A comparison of the numbers of 8-shaped pores in the submedian series on both sides of body together, in the larvae of the first instar of *Asterodiaspis quercicola* from 5 populations. (For designations a, b, c, d, e see Fig. 25)

The other character of the larvae discussed in this part of the paper will be the length of their apical setae. The data concerning this character in particular populations are given in Tables IV, X, XV and XIX. They show, in spite of various means, that there are no well-defined differences between individual populations in so far as the length of these setae is concerned.

Summing up the results obtained from the study of the larvae of the first instar, denoted by the specific names *A. minus* and *A. quercicola*, we may state that the data collected indicate clearly that they are larvae of one species.

As mentioned in the introduction, the secondary purpose of this study was further taxonomic investigation on *A. variolosum*, whose status of a separate species had been maintained (PODSIADŁO, 1972 and 1974).

In the material discussed in this paper *A. variolosum* occurred in all the four localities. The females of this species differed in general from the females of

A. quercicola living on the same trees in their larger size of body and in the size and number of many morphological structures, although the upper values of these characters in *A. quercicola* often coincided with the lower values in *A. variolosum*. However, the larvae of the first instar of *A. variolosum* differed clearly from the corresponding larvae of *A. quercicola* in lacking the sublateral series of 8-shaped pores. Thus, the data obtained for *A. variolosum* collected at all the four localities under study, as a rule, add nothing new to the previous results (PODSIADŁO, 1972 and 1974), but only confirm them.

V. MORPHOLOGY OF SPECIES DISTINGUISHED

The morphological descriptions of adult females and larvae of the first insta of *Asterodiaspis quercicola* (BOUCHÉ) and *Asterodiaspis variolosum* (RATZEBURG) given below are based on the material analysed in this study and the materials of *A. variolosum* collected at other localities in Poland and investigated earlier (PODSIADŁO, 1972 and 1974).

Owing to great morphological similarity both between females of *A. quercicola* and *A. variolosum* and between their larvae of the first instar, it seems needless to give detailed morphological descriptions of these stages for each species separately. For this reason the females as well as the larvae of the first instar are described jointly for the two species and only the characters in which they differ are listed at the end (Table XX).

A. Adult females (Pls XVIII—XX)

The body (A) is covered by a rigid test, closely clinging to it. It is nearly round, usually somewhat longer than wide, rarely quite round and very rarely slightly wider than long. The posterior tip of the body is slightly produced. The dorsal side is convex to a very various degree, from nearly flat to strongly convex. The body covering test is glossy, transparent and greenish-yellow or yellow in colour, very rarely somewhat clouded. It has a whitish waxy fringe all round the margin.

The body colour of females changes with age. Young females are generally yellow, very often with dark pigment, which against the yellow ground colour forms a characteristic pattern, a dark broad band round the body, two semicircular bands in the vicinity of the midline of the body, touching each other at both the anterior and the posterior end, and a band along the midline. Sometimes the pigment does not form such a pattern, but irregular dark patches. Old females are most often brown in colour, rarely light brown or yellow. After egg-laying their bodies were shrunk in the form of a crescent occupying only the anterior part of the space under the test; the remaining part was filled with eggs.

Tests: length 756—1750 μm, width — 630—1582 μm. Females after preparation: length — 616—1526 μm, width — 546—1330 μm.

Table XX

Differences between *Asterodiaspis quercicola* (BOUCHÉ) and *A. variolosum* (RATZEBURG)

Character	*A. quercicola*	*A. variolosum*
Adult female		
test length	756—1624 μm	952—1750 μm
test width	630—1512 μm	840—1582 μm
length of mounted females	616—1246 μm	840—1526 μm
width of mounted females	546—1106 μm	714—1330 μm
length of tubular ducts	15—36 μm	19—39 μm
submarginal band of 8-shaped pores	composed of 1—3 irregular rows	composed of 2—3 irregular rows
number of quinquelocular pores in spiracular band	19—98	33—113
number of multilocular pores	4—37	20—70
number of loculi in multilocular pores	most often 4—10	most often 8—10
length of apical setae	16—44 μm	22—45 μm
Larva of the first instar		
dorsal sublateral series of 8-shaped pores	present	absent
dorsal submedian series of 8-shaped pores	present, composed of 2—17 pores on both sides of body together	1—3 pores, usually 2, sometimes none in submedian area

Dorsal Side. Small dorsal 8-shaped pores (N), 3.5 μm long, dorsal simple pores (0), 1 μm in diameter, and tubular ducts (M), 15—39 μm long, scattered all over surface.

Ventral Side. Antennae in the form of tubercles (B), with two thick curved setae and two small trichoid sensillae. Beak with two pairs of setae. Anterior (C) and posterior (D) spiracles more or less equal in size. Anal opening close to posterior body tip. Anal ring (E) with one pair of setae.

Pores: Marginal 8-shaped pores (H), 8—10 μm long, in regular single row along body margin, their long axis being parallel to circumference. Ventral submarginal 8-shaped pores (K), about 2.5 μm long, in submarginal band consist-

ing of 1—3 irregular rows. Quinquelocular pores (I), 3.5 μm in diameter, in spiracular bands extending from spiracles to body margin, with more or less distinguished group near spiracles; their number fluctuated between 19 and 113; smaller pores with 3—4 loculi occurred sporadically among them. Analogous quinquelocular pores form a single submarginal row beside the marginal 8-shaped pores; this row ends at a certain distance from the body end and is often discontinuous at the front; in the places where the spiracular band of quinquelocular pores approaches the body margin, it is partly doubled. The ventral „dark rimmed" pores (L), about 2 μm in diameter, are scattered round the beak, among the spiracles, and usually also in the region of the spiracular band of quinquelocular pores and in the anterior part of the abdomen. The multilocular pores (G) present in the paravaginal region, 4—70 in number are arranged in four irregular transverse rows. The number of loculi in the multilocular pores is 3—13, pores with more loculi than 10 being very rare.

Setae: There is a pair of apical setae, 16—45 μm long, at the posterior body end, with a pair of smaller interapical setae, 5—10 μm long, and a pair of anteroventral setae, 5—8 μm in length, near it (F). In a typical case the distribution of the setae situated among the multilocular pores (P) is as follows: two pairs in the last row, one pair in each of the preceding rows, and one pair in front of them. Sometimes one of these setae is missing or there is an additional one. The submarginal ventral setae (J), 2—6 μm long, are disposed in a single row round the body.

B. Larva of the first instar (Pls XXI—XXII)

Body (A) membraneous, oval, in crawlers 225—300 μm long and 130—170 μm wide.

Dorsal Side. Small dorsal simple pores (C) in sublateral single row on abdominal segments and several in cephalothoracic area. Dorsal 8-shaped pores present or not, with appropriateness to species, in sublateral (Bb) and submedian (Bc) series. In the first case (Plate XXI) the sublateral series consist of 7—10 pairs of pores, whereas the submedian ones are complete to a varied degree and the number of these pores may be different on either side of the body. The number of 8-shaped pores in the submedian series on both sides of the body together ranged from 2 to 17 or from 1 pair to 8 pairs plus one odd pore. In the other case (Plate XXII) the sublateral series were absent and in the submedian area there was usually a pair of such pores, sometimes only an odd pore or a pair plus an odd pore, more rarely no pores at all.

Ventral Side. Eyes positioned at margin, anterolateral to bases of antennae Antennae 6-jointed. Legs well-developed, with very short tibia, 1/4—1/3 length

of tarsus. Beak pentagonal, with 3 pairs of setae at tip (G). Anterior and posterior spiracles small in size. Anal opening at the end of ventral body side, somewhat retracted inwards. Anal ring (L) sclerotized, with 2 setae, 5—8 μm long.

Pores: Marginal 8-shaped pores (Ba), 6—7 μm long and about 3.5 μm wide, 14 pairs in number, in regular single row, oriented with long axes parallel to body margin. Small „dark rimmed" pores (H) in single sublateral row on either side; there are 6 pairs of these pores on the abdomen, one pair between the spiracles and one in the anterior part of the body, postlaterally to the bases of the antennae. A pair of larger interantennal 8-shaped pores (I) occurs between the bases of the antennae. One quinquelocular pore and one trilocular or, very rarely, quadrilocular pore (J) are situated near the anterior spiracle, and one trilocular pore (K) near the posterior spiracle.

Body setae: At the end of the body there are 1 pair of apical setae (Da), 52—71 μm long, 1 pair of interapical setae (Db), generally 7—10 μm long and very rarely up to 20 μm, and 1 pair of anteroventral setae (Dc), 3—7 μm long. The submarginal ventral setae (E) occur usually in the number of 7 pairs, very rarely up to 9 pairs, on the abdominal segments. At the front of the body there are 2 pairs of anterior marginal setae (F) between the eyes and 2 pairs of setae between the antennae and the beak. A pair of setae or a single seta is sometimes present in the region of the antennae.

VI. CONCLUSIONS

1. On the basis of the taxonomic study of the species of the genus *Asterodiaspis* SIGNORET denominated *Asterodiaspis minus* (RUSSELL), *Asterodiaspis quercicola* (BOUCHÉ) and *Asterodiaspis variolosum* (RATZEBURG) it has been found that these specific names in fact cover two species.

2. *Asterodiaspis minus* (RUSSELL) has been synonymized with *Asterodiaspis quercicola* (BOUCHÉ, 1851).

3. The status of *Asterodiaspis variolosum* (RATZEBURG) as that of a distinct species has been confirmed; its quite reliable discrimination from *Asterodiaspis quercicola* (BOUCHÉ) is possible only in the first larval instar.

4 It has been demonstrated that *Asterodiaspis quercicola* (BOUCHÉ), like *Asterodiaspis variolosum* (RATZEBURG), occurs in populations which differ much from each other in morphological characters.

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STRESZCZENIE

Głównym celem pracy było wyjaśnienie statusu taksonomicznego *Asterodiaspis minus* (Russell) i *Asterodiaspis quercicola* (Bouché).

Materiał zbierano z czterech drzew z rodzaju *Quercus* L., rosnących na terenie Polski. Poszczególne drzewa określane są w pracy jako stanowiska I—IV. Dwa z nich zlokalizowane były na terenie Warszawy, jedno w Piasecznie, województwo warszawskie, jedno w Karpaczu, województwo wrocławskie.

Podstawowym materiałem były samice, zbierane w okresie składania jaj, z których lęgły się larwy.

Badano samice oraz ich potomstwo w pierwszym stadium larwalnym, pochodzące z wyżej wymienionych czterech stanowisk i porównywano ich cechy morfologiczne. Ponadto na młodych drzewkach dębowych hodowano potomstwo samic, pochodzących ze stanowisk I i II.

Spośród cech morfologicznych samic najbardziej szczegółowo analizowano liczbę wielootworowych gruczołów, liczbę pięciootworowych gruczołów w pasmach przetchlinkowych oraz długość i szerokość ciała. U larw pierwszego stadium szczegółowo badano liczbę ósemkowych gruczołów w submedialnych rzędach.

W wyniku porównania tych cech (ryc. 25, 26, 27, 28, 29), autorka doszła do

wniosku, że *Asterodiaspis minus* (RUSSELL) i *Asterodiaspis quercicola* (BOUCHÉ) stanowią jeden gatunek, który występuje w przyrodzie w populacjach silnie zróżnicowanych pod względem cech morfologicznych. Ze względu na pierwszeństwo nazwy gatunkowej „*quercicola*" (BOUCHÉ, 1851), gatunkowi temu przysługuje nazwa *Asterodiaspis quercicola* (BOUCHÉ).

Drugorzędnym celem pracy były dalsze badania nad *Asterodiaspis variolosum* (RATZEBURG), którego status jako oddzielnego gatunku został uznany w wyniku poprzednich badań (PODSIADŁO, 1972, 1974). Dane uzyskane nad *A. variolosum*, zebranym na omawianych czterech stanowiskach, potwierdzają poprzednie wyniki.

Zatem, na podstawie przeprowadzonych badań taksonomicznych nad gatunkami określanymi jako *Asterodiaspis minus* (RUSSELL), *Asterodiaspis quercicola* (BOUCHÉ) i *Asterodiaspis variolosum* (RATZEBURG), uznano, że te nazwy gatunkowe obejmują dwa gatunki: *A. quercicola* (BOUCHÉ) i *A. variolosum* (RATZEBURG). Gatunki te można zupełnie pewnie odróżnić od siebie tylko w pierwszym stadium larwalnym.

РЕЗЮМЕ

Главной целью труда было стремление выяснить таксономический статус *Asterodiaspis minus* (RUSSELL) и *Asterodiaspis quercicola* (BOUCHÉ).

Материал собрано с четырёх деревьев рода *Quercus* L., растущих на территории Польши. Отдельные деревья определены в труде как места №№ I—IV. Два из них находились на территории г. Варшавы, одно в г. Пясечно Варшавское воеводство и одно в г. Карпач Вроцлавское воеводство.

Основным материалом были взрослые самки, собираемые в период откладки яиц, из которых вылуплялись личинки.

Исследовались взрослые самки и их потомство в 1-вой стадии личинки, происходящие с вышеуказанных четырёх мест и сравнивались их морфологические признаки. Кроме того, на молодых дубовых деревьях разводилось потомство взрослых самок, снимаемых с мест №№ I и II.

Из числа морфологических признаков взрослых самок наиболее подробно анализировалось количество многоячеистых желез, количество пятиячеистых желез в дыхальцевых бороздках, а также длину и ширину тела. У личинок 1-вой стадии подробно исследовались количества парных желез в субмедиальных рядах.

В результате сравнения этих признаков (рис. 25, 26, 27, 28 и 29), автор пришла к выводу что *Asterodiaspis minus* (RUSSELL) и *Asterodiaspis quercicola* (BOUCHÉ), составляют один вид, который выступает в природе, с точки зрения морфологических признаков, в сильно дифференцированных популяциях.

Из-за первенства видонаименования „*quercicola*" (BOUCHÉ), этому виду полагается наименование *Asterodiaspis quercicola* (BOUCHÉ).

Второстепенной целью труда были дальнейшие исследования *Asterodiaspis variolosum* (RATZEBURG), статус которого, как отдельного вида, признан был в результате предыдущих исследований (PODSIADŁO, 1972, 1974).

Данные, полученные в исследованиях *A. variolosum*, собранного с упомянутых четырёх мест, подтверждают предыдущие результаты.

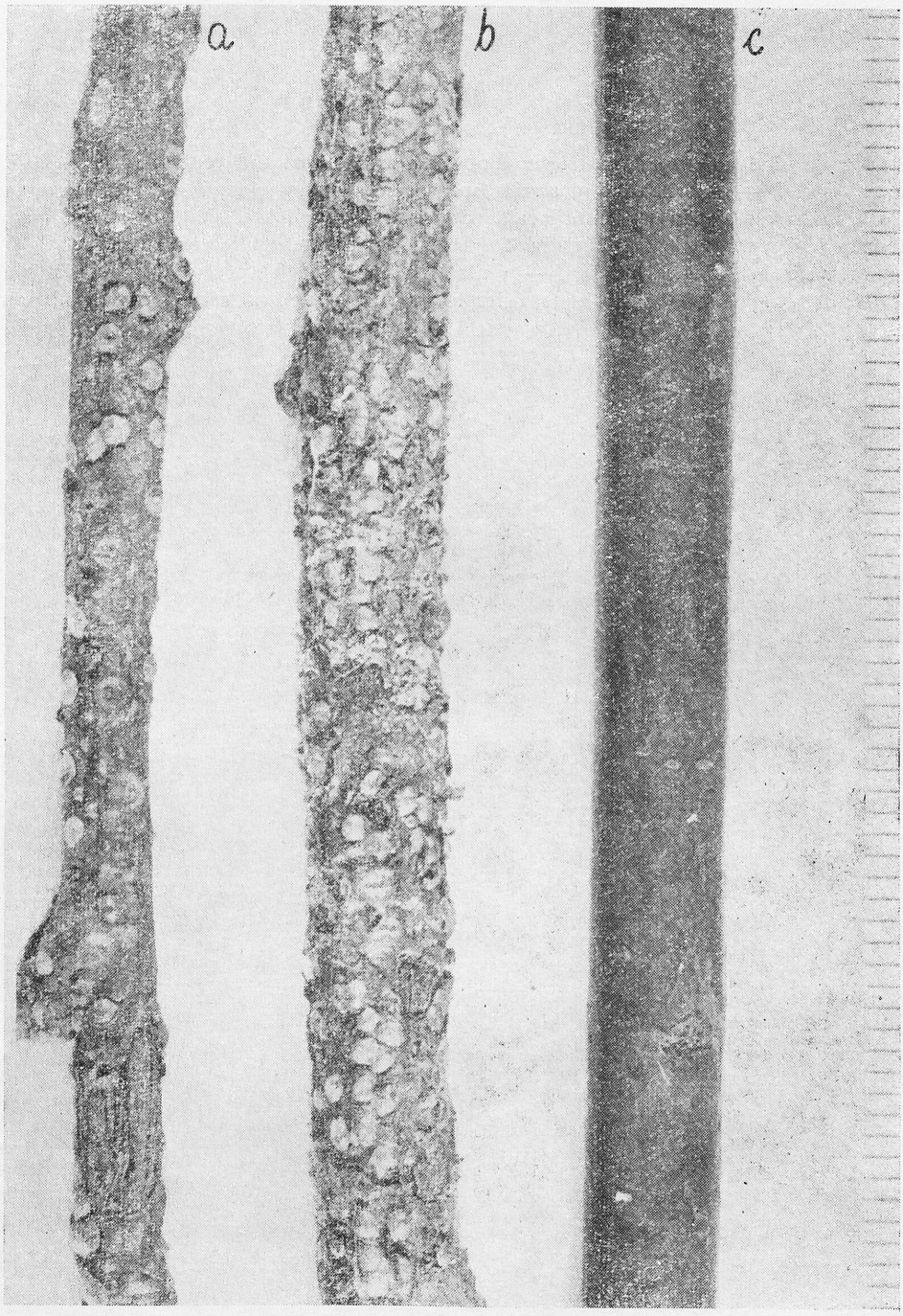
Следовательно, на основании произведенных таксономических исследований видов, определяемых как *Asterodiaspis minus* (RUSSELL), *Asterodiaspis quercicola* (BOUCHÉ) и *Asterodiaspis variolosum* (RATZEBURG), признано, что эти видонаименования касаются двух видов: *A. quercicola* (BOUCHÉ) и *Asterodiaspis variolosum* (RATZEBURG).

Эти виды является возможным с полной уверенностью различать друг от друга в 1-вой личинной стадии.

PLATES

Plate XVIII

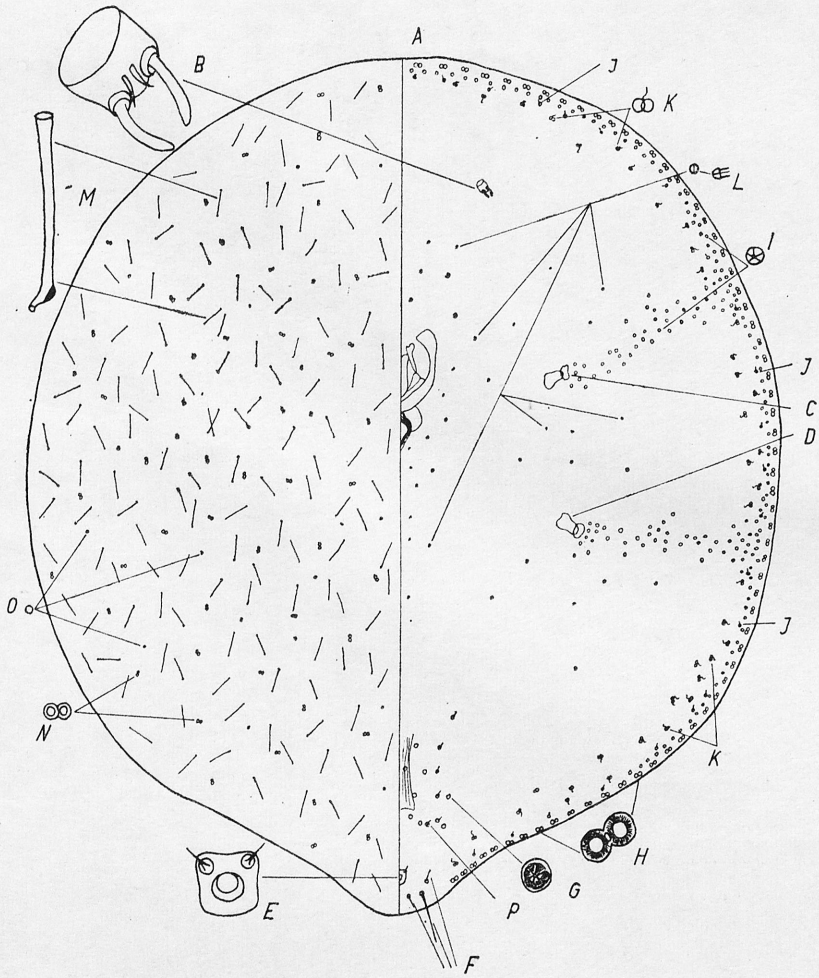
Injuries to branches of *Quercus robur* L., caused by *Asterodiaspis variolosum* (RATZEBURG). a — deformations of branches in the form of characteristic depressions left after the detachment of noxious insects, b — branch intested by noxious insects, c — branch free from insects



E. Podsiadlo
Phot. B. Gałka

Plate XIX

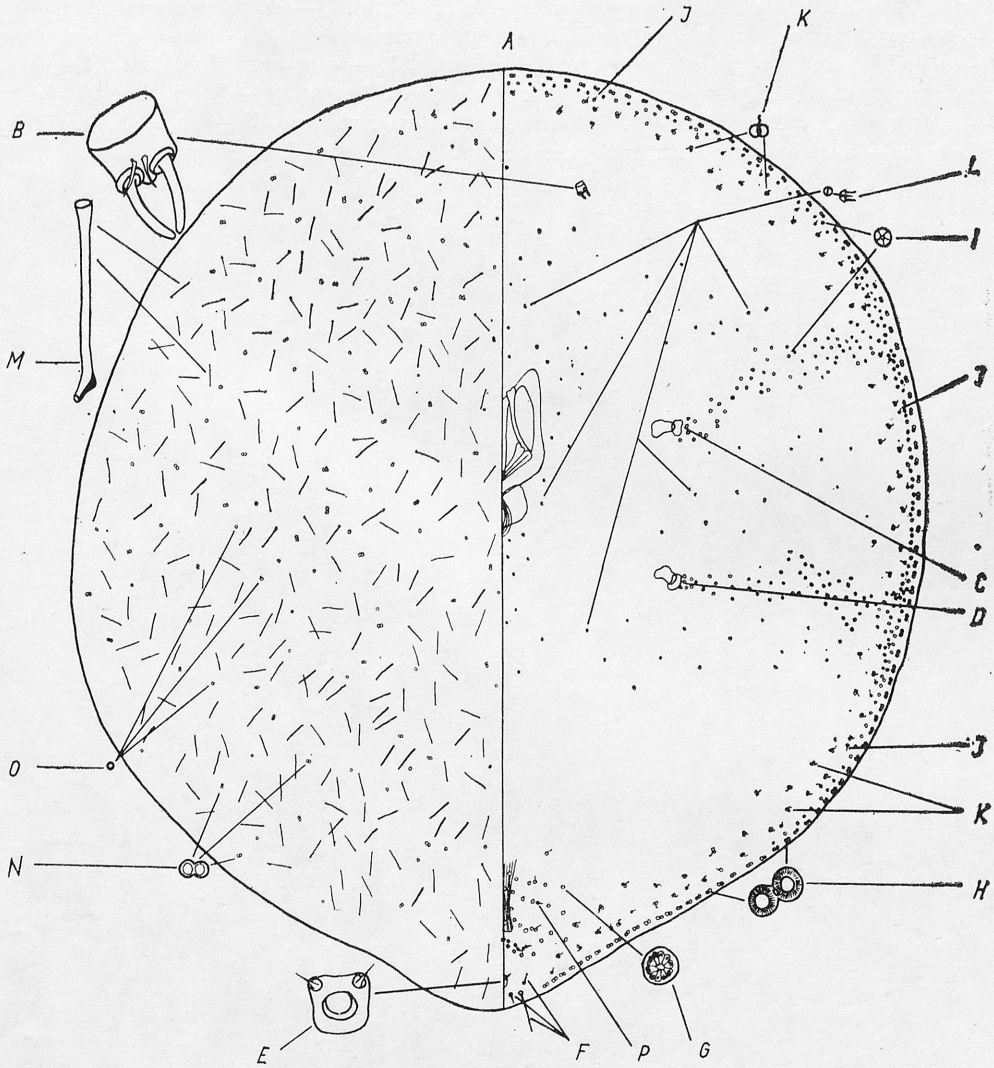
Adult female of *Asterodiaspis quercicola* (BOUCHÉ). A — dorsal and ventral aspects, B — antenna, C and D — anterior and posterior spiracles, E — anal ring, F — apical, interapical and anteroventral setae, G — multilocular pores, H — marginal 8-shaped pores, I — quinquelocular pores: marginal and in spiracular bands, J — submarginal ventral setae, K — submarginal ventral 8-shaped pores, L — ventral "dark rimmed" pores, M — tubular ducts, N — dorsal 8-shaped pores, O — dorsal simple pores, P — ventral setae among multilocular pores



E. Podsiadlo

Plate XX

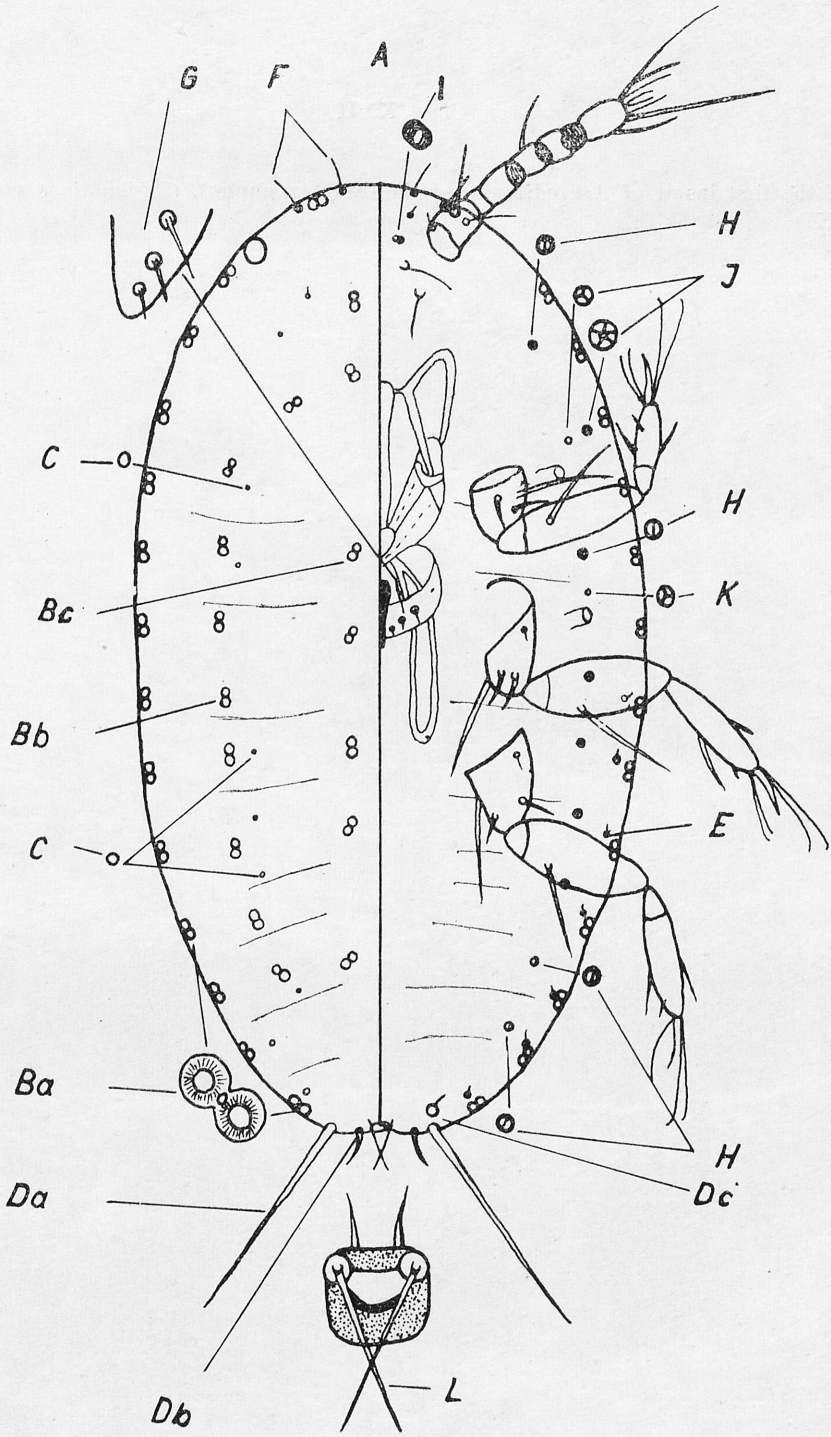
Adult female of *Asterodiaspis variolosum* (RATZEBURG). (Designations same as in Plate XIX)



E. Podsiadło

Plate XXI

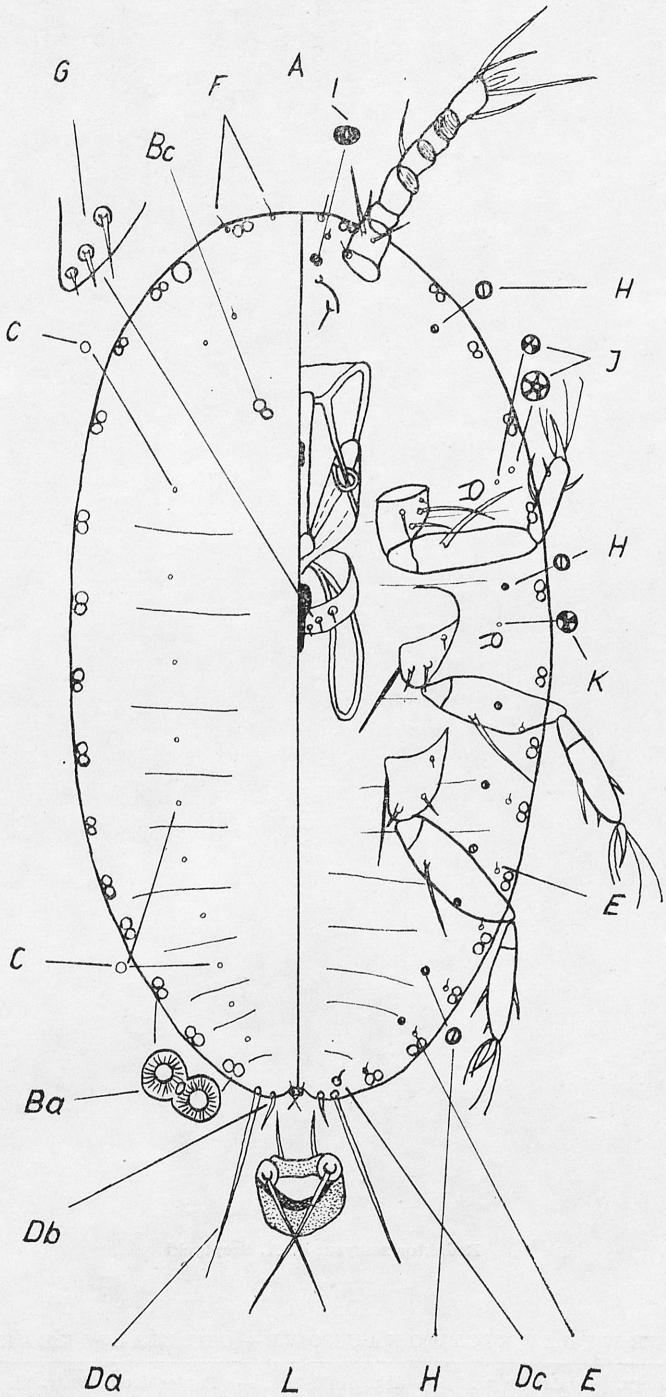
Larva of the first instar of *Asterodiaspis quercicola* (BOUCHÉ). A — dorsal and ventral aspects B — 8-shaped pores: marginal (a), sublateral (b), submedian (c), C — dorsal simple pore, D — apical (a), interapical (b), anteroventral (c) setae, E — submarginal ventral setae, F — anterior marginal setae, G — left half of apex of beak with 3 setae, H — "dark rimmed" pores, I — interantennal 8-shaped pores, J — pores near anterior spiracle, K — pore near posterior spiracle, L — anal opening with anal ring



E. Podsiadlo

Plate XXII

Larva of the first instar of *Asterodiaspis variolosum* (RATZEBURG). (Designations same as in Plate XXI)



E. Podsiadlo

Redaktor zeszytu: dr A. Szeptycki

PAŃSTWOWE WYDAWNICTWO NAUKOWE — ODDZIAŁ W KRAKOWIE — 1974

Nakład 700+90 egz. — Ark. wyd. 3,5 — Ark. druk. $3^{12}/_{16}$ — Papier druk. ilustr. kl. III 70×100 80 g
Zam. 721/74 Cena zł 18.—

DRUKARNIA UNIWERSYTETU JAGIELLOŃSKIEGO W KRAKOWIE