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Comparative morphological studies on populations of *Asterodiaspis variolosum* (RATZEBURG) (*Homoptera*, *Coccoidea*, *Asterolecaniidae*) from the Świętokrzyskie Mts. (Poland)

[With 14 figures and 14 tables]

Since 1966 I have been carrying out investigations on the taxonomic status of *Asterodiaspis variolosum* (RATZEBURG), *A. quercicola* (BOUCHÉ) and *A. minus* (RUSSELL) which since RUSSELL'S publication (1941) are widely accepted as three separate species. A few papers containing descriptions of the species in question (RUSSELL 1941, BORCHSENIUS 1960, BORATYŃSKI 1961, APEJI 1964) indicate their great morphological similarity, as well as very similar biology and ecology, thus further studies are indispensable to clarify relationships between them. According to published data *A. variolosum* seems to be morphologically the most isolated of all three species. It differs distinctly from *A. quercicola* and *A. minus* in the first larval stage by lack of the sublateral series of dorsal 8-shaped pores. Furthermore, until results of investigations in Poland (PODSIADŁO 1972) were known, the number of multilocular pores of adult females was given, as a reliable character, to separate the three species; the lowest number was given for *A. minus*, the intermediate for *A. quercicola*, and the highest for *A. variolosum*.

Studies on the genus *Asterodiaspis* SIGNORET were initiated on a material collected in Warsaw on *Quercus robur* L. by PODSIADŁO (1972). All investigated females produced larvae of only one type "*variolosum*" e. g. those lacking sublateral series of dorsal 8-shaped pores. This justified the assumption that the females belonged to *A. variolosum*. Examination, however, of the morphology of those females provided results different from those found in publications.

According to literature data in *A. quercicola* (Bouché) the lowest number of multilocular pores was stated to be 18 (Apeji 1964), and the highest one, accepted after Russell (1941) — 38. In *A. variolosum* the minimal number of multilocular pores was given to be 40 (Russell 1941, Apeji 1964) and the maximal one 73. By contrast, in investigated females of *A. variolosum* the number of said pores varied from 33 to 70, thus in a range of 33–38 it coincided with the number of those given for *A. quercicola*. These facts would suggest, in my opinion, that in the present state of knowledge the upkeeping of *A. variolosum* as a distinct species would be fully justified, assuming, however, that the only stage in which it can be distinguished infallibly from *A. quercicola* (Bouché) is the first larval instar.

Unfortunately, however, these studies could not provide a full picture of the morphology of *A. variolosum* in Poland, since as I have mentioned before, the material was taken in Warsaw area alone and on one tree only, thus could not display a full range of species variability within this country. The examination of material from other stations therefore would be valuable. Morphological studies of *A. variolosum* collected in various localities in the Świętokrzyskie Mts. will probably, to some extent, fill the existing gap.

DESCRIPTION OF THE COLLECTION AREA

The material was taken in two, fairly isolated, stations: "Serwis-Dąbrowa" and Góra Chełmowa (Chełmowa Mt.). Both are situated in Świętokrzyskie Mts. and are part of the Świętokrzyski National Park. "Serwis-Dąbrowa" is situated at a distance of about two km of Łysa Góra (Łysa Mt.), at the eastern edge of Baszowicka Valley. It covers an area of 175.61 ha (Krzysztofik 1959) and constitutes a partial natural reserve. The south-eastern part of the forest where the collection took place consists mainly of young pines with an insignificant admixture of naturally sown oaks.

Chełmowa Mt. is situated to the east of "Serwis-Dąbrowa" and the river Pokrzywianka on Waśniowska Highland. It covers an area of 182.65 ha (Krzysztofik 1959), has a copular shape and reaches 347 m of altitude. This area is an important component of the Świętokrzyski National Park owing to its pure (13.36 ha) reserve of *Larix polonica* Racib. The remaining part of the Park constitutes a partial natural reserve. Chełmowa Mt. is covered by a mixed forest consisting of oaks, larch and pines. The material was taken in the south-western part of the forest.

COLLECTION METHODS

The discussed material was collected on five trees, designed subsequently as stations I–V. These were relatively young and had trunks covered by a smooth,

not wrinkled bark. Since the methods of collecting and material examinations on station I differs slightly from those on others, they are described separately in the text, before an analysis of results from station I. Such arrangement was necessary as my initial observations were not complete and could not be compared with subsequent data.

The presented below description of the collecting method corresponds thus to stations II–V.

The object of investigations were adult females at the time of oviposition and hatching of crawlers. If the whole tree was infested I segregated the females into four groups: 1) females living on one-year old twigs, 2) those living on two-years old twigs, 3) females living on three-four old twigs, 4) females living on a main trunk, or thick, older branches. The specimens were taken together with a piece of bark on which they settled, and then examined under a binocular microscope. Length as well as width of body together with test were measured, and the colouring of test, that of the body and the degree of convexity (fig. 1)

Fig. 1. Degree of convexity of dorsal side of females of *Asterodiaspis* specimens occurring on oak in Poland; a – strongly convex, b – moderately convex, c – feebly convex, d – very feebly convex.

were noted. If larvae were observed outside test, which may have suggested that they were progeny of another female, the were removed. Subsequently females were placed singly in glass tubes closed by means of a cotton tampon where the remaining crawlers emerged. After emergence, the females and their progeny were preserved and used for microscopic slides for further study.

As it may be seen later, the material consisted of only one species – *A. variolosum*. Thus, to avoid unnecessary repetition I renounced from detailed descriptions of larvae and females from each particular station and gave a general description instead; it has been included in the final part of this paper. Variability of only those characters is dealt with which are known to have some taxonomic value.

ANALYSIS OF RESULTS

Station I

Material was collected in 1968 and 1969 on *Quercus petrea* LIEBL. in "Serwis-Dąbrowa". In 1968 young adult females were taken on Nov. 1. All branches of the tree were found to be infested. On one-year old twigs 28 females, on two-year old 17 females, and three-four year old 16 females were collected; no collection

Table I. Size of unmounted females with test, from Station I (in micrometres)

Collection date	Branch age	Length			Width		
		measurements number	range	average	measurements number	range	average
1 XI 1968	one-year old	28	952–1246	1146.50	27	854–1120	989.85
	two-years old	17	952–1232	1104.35	17	840–1078	978.35
	3-4-years old	16	1050–1162	1100.75	16	896–1064	967.75
	main trunk	–	–	–	–	–	–
	together	61	952–1246	1122.75	60	840–1120	980.70

Table II. Size of mounted females from Station I (in micrometres)

Collection date	Branch age	Length			Width		
		measurements number	range	average	measurements number	range	average
1 XI 1968	one-year old	22	840–1176	990.18	20	798–1008	896.70
	two-years old	13	854–1064	956.30	12	714–924	827.16
	3-4-years old	14	868–1036	964.00	13	798–910	840.00
	main trunk	–	–	–	–	–	–
	together	49	840–1176	973.71	45	714–1008	861.77

has been made on the main trunk; altogether 61 females have been taken. This material was supplemented by additional collection made on Nov. 29, 1969. This time only old, last-year females with already emerged, dead larvae under their transparent test were examined. On one-year old twigs 3 females, on two-year old 2 females, on three-four-year old 6 females, and on main trunk 3 females were taken; altogether 14 females were found.

Unmounted females were all much alike: uniformly brown, covered with transparent test, having a slight greenish-yellow hue, rarely clouded.

Size of females expressed by the length and width of body are given separately for young females taken on Nov. 1, 1968, and the dead ones found on Sept. 29, 1969. Since only few specimens of the latter were taken, detailed measurements are given only for females taken on Nov. 1, 1968. On tables I and II these data are presented separately with respect to females collected on branches of various age in order to ascertain the degree of influence of feeding conditions on their size. The best method to compare the size of specimens is by comparison of mean measurement values. As can be seen, the largest were specimens living on new growth (one-year old twigs) which may be explained by best feeding conditions during larval development. Differences in size of these females and those feeding on older twigs were noted to be insignificant.

The unmounted, old, dead females taken on Sept. 29, 1969 measured 1036–1162 μm (av. 1094.00 μm) of length, whereas their width was 840–980 μm (av. 921.66 μm). Mounted females could not yield proper measurement values due their considerable deformation.

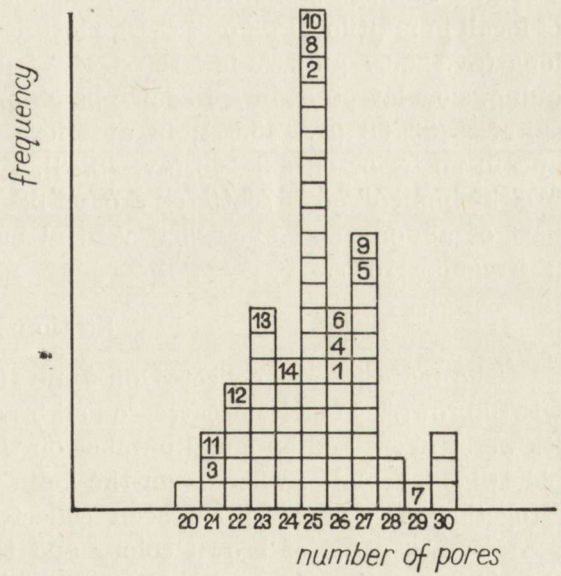

Fig. 2. Number of multilocular pores in females from Station I; not numbered squares – female which did not produce larvae; numbered squares – female which left a larval progeny.

The number of multilocular pores in all females taken on this station is presented by means of a histogram (fig. 2). It depicts the frequency of occurrence of specimens in subsequent sections which stand for the number of pores. Empty squares designate females collected on Nov. 1, 1968, which did not produce larvae. Squares with a number within stand for females taken on Sept. 29, 1969 which left a progeny. The number of collected larvae obtained from each of 14 females examined is given in table III.

Table III. Number of examined larvae hatched from eggs laid by females from Station I

Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
number of multilocular pores in female	26	25	21	26	27	26	29	25	27	25	21	22	23	24
number of examined larvae produced by it	8	3	4	30	5	2	36	23	4	7	3	2	1	2

Althogether 130 larvae have been examined. All were of the "*variolosum*" type e. g. devoid of sublateral series of dorsal 8-shaped pores; aside from marginal series of said pores, there were only one pair on dorsal side.

The presence of larvae of only one type "*variolosum*" indicates that the material examined consisted of only one species. Larval characters identify it as *Asterodiaspis variolosum* (RATZEBURG).

The number of multilocular pores in females 20–30 (av. 25.01). Number of loculi in multilocular pores 4–10, most usually 5 —9. Tubular ducts 22–36 μm long (av. 25.07 μm). Apical setae 24–34 μm long (av. 28.24 μm). Number of quinquelocular pores in spiracular bands including a group of such pores near spiracles 33–68 (av. 45.67); in anterior spiracular bands 33–61 (av. 43.01), and in posterior ones 34–68 (av. 48.48). Marginal 8-shaped pores 8.5 μm long. "Dark-rimmed" pores scattered around beak, in area of spiracles and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores consisting of 2 irregular rows.

Station II

The material was collected on June 18, 1969 on *Quercus robur* L. in "Serwis-Dąbrowa". Females occurred on all braches. On one-year old twigs 10 females were taken, and an equal number on the two-year ones; on three-four-year old twigs 8 females, whereas on the main trunk again 10 females were found; altogether 34 females have been collected.

Females were of brown colour and test was transparent with a yellow--greenish or yellow shade, very rarely a slightly clouded. The degree of convexity of the dorsal side is presented on table IV.

Table IV. Degree of convexity of dorsal side of females from Station II

Age of branches on which females were taken	Number of collected females	Degree of convexity			
		very feebly convex	feebly convex	moderately convex	strongly convex
branches one-year old	10	–	1	9	–
branches two-years old	10	–	1	9	–
branches 3-4-years old	8	–	–	8	–
main trunk	10	–	–	1	9

As can be seen, the convexity of female increased with branch age. On one-year and two-year old twigs the majority of females taken were moderately and some feebly convex. On three-four-year old twigs the flatter specimens have not been found, all specimens were moderately convex. On the main trunk only one moderately convex female was observed, all remaining ones having a strongly convex body.

Only size of unmounted females with test are taken here into consideration, similarly as those from other stations. Unfortunately, valid measurements could not be obtained from specimens mounted after oviposition due to their deformation. Measurements value of unmounted females are given on table V.

The comparison of mean values shows that the females living on one-year old twigs had the largest size, although the difference in size between them and those living on older branches were negligible.

Length of mounted females (taken from 18 specimens) 910–1204 μm (av. 1052.33 μm); width (taken from 19 specimens) 868–1092 μm (av. 968.21 μm).

The number of multilocular pores is presented on a histogram (fig. 3).

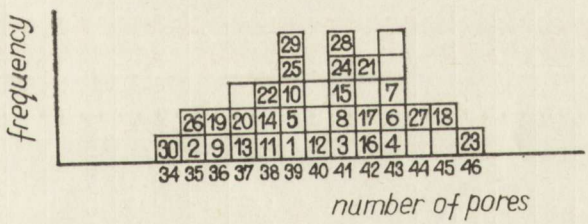

Fig. 3. Number of multilocular pores in females from Station II; not numbered squares – female which did not produce larvae; numbered squares – female which left a larval progeny.

The larval material was provided by breeding of 30 females. Number of examined larvae from each of them is given on table VI. Altogether 281 larvae have been examined. All larvae proved to be of the type "*variolosum*". They were provided on dorsal side with one pair of 8-shaped pores; sporadically, one single pore, or three of them, were found.

The presence of larvae of only one type indicates that only one species is involved: *Asterodiaspis variolosum* (RATZEBURG).

Table V. Size of unmounted females with test, from Station II (in micrometres)

Collection date	Branch age	Length			Width		
		measurements number	range	average	measurements number	range	average
18 VI 1969	one-year old	10	1330–1414	1376.20	10	938–1232	1155.00
	two-years old	10	1148–1428	1253.00	10	952–1232	1135.40
	3-4-years old	8	1232–1540	1337.00	8	1036–1302	1116.50
	main trunk	10	1190–1400	1303.40	10	980–1190	1066.00
	together	38	1148–1414	1316.36	38	938–1302	1118.52

Table VI. Number of examined larvae hatched from eggs laid by females from Station II

Female No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
number of multilocular pores in female	39	35	41	43	39	43	43	41	36	39	38	40	37	38	41
number of examined larvae produced by it	9	6	15	13	5	2	24	4	3	14	27	5	4	5	14

female No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
number of multilocular pores in female	42	42	45	36	37	42	38	46	41	39	35	44	41	39	34
number of examined larvae produced by it	2	9	1	5	2	35	12	13	11	6	3	4	20	6	2

Number of multilocular pores in females 34–46 (av. 40.21). Number of loculi in these pores 4–11, most usually 10, less frequently 9; multilocular pores with 4 and 11 loculi occurred sporadically. Tubular ducts 29–39 μm long (av. 33.43 μm). Apical setae 22–36 μm long (av. 30.58 μm). Number of quinquelocular pores in spiracular bands together with those near spiracles 36–75 (av. 49.11); number of pores in anterior spiracular bands 36–75 (av. 46.48), and in posterior ones 39–64 (av. 51.65). Marginal 8-shaped pores 8–9 μm long. "Dark-rimmed" pores scattered around beak, between spiracles and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores consisting of 2–3 irregular rows.

Station III

The material was collected on June 18, 1969 on a hybrid of *Quercus robur* L. and *Q. petrea* LIEBL. in "Serwis-Dąbrowa". Females were found on all branches. On one-year old twigs 21 females were taken, on two-year old 13, on three--four-year old ones 6, and on main trunk 11 females were found; altogether 51 females have been collected.

Colouring of female brown and the covering test transparent with yellowish--greenish or yellowish shade, very infrequently slightly clouded. Degree of convexity of dorsal side in females is presented on table VII.

Table VII. Degree of convexity of dorsal side of females from Station III

Age of branches on which females were taken	Number of collected females	Degree of convexity			
		very feebly convex	feebly convex	moderately convex	strongly convex
branches one-year old	21	–	–	21	–
branches two-years old	13	–	–	13	–
branches 3-4-years old	6	–	–	6	–
main trunk	11	–	–	6	5

It can be seen that females from one-year, two-year and three–four-year old twigs were all moderately convex, whereas of those taken on main trunk some were moderately and others strongly convex. Thus even here a tendency could be observed toward increase of convexity in females living on older branches.

Data with respect to size of unmounted females are presented on table VIII.

A comparison of mean measurement value shows too that females associated with one-year old twigs were the largest.

Length of mounted females (measurements of 20 specimens) 854–1400 μm (av. 1090.60 μm), width (taken from 20 specimens) 728–1232 μm (av. 977.90 μm).

Number of multilocular pores is presented on a histogram (fig. 4).

Table VIII. Size of unmounted females with test, from Station III (in micrometres)

Collection date	Branch age	Length			Width		
		measurements number	range	average	measurements number	range	average
18 VI 1969	one-year old	21	1246–1596	1460.00	21	1092–1372	1296.00
	two-years old	13	1260–1526	1366.61	12	1050–1400	1162.00
	3-4-years old	6	1050–1400	1281.00	6	868–1162	1038.33
	main trunk	11	1050–1498	1258.72	11	938–1218	1071.63
	together	51	1050–1596	1371.72	50	868–1400	1183.56

Table IX. Number of examined larvae hatched from eggs laid by females from Station III

Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
number of multilocular pores in female	48	49	48	51	46	48	45	44	43	49	48	49	46	47	47	44	43
number of examined larvae produced by it	13	9	13	9	9	10	16	6	30	12	5	10	1	12	8	3	11

female No.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
number of multilocular pores in female	51	49	45	51	53	46	47	50	53	42	43	56	45	51	44	41	43
number of examined larvae produced by it	6	5	3	6	7	2	5	5	3	1	6	15	3	7	3	15	6

Larval material examined derived from 34 females. Number of examined larvae from each of them is presented on table IX. Altogether, 275 larvae from 34 females have been examined. Furthermore 98 larval progeny of unmounted females from this station were also investigated. Total number of examined larvae 373. All larvae were of "*variolosum*" type. Their dorsal side bore always one pair of 8-shaped pores; larvae which had developed one such pore, as well as one such pore only partly developed if at all, were encountered sporadically.

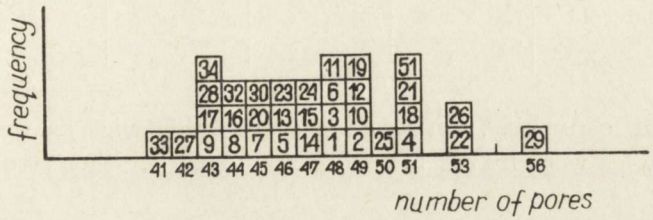

Fig. 4. Number of multilocular pores in females from Station III; numbered squares – female which left a larval progeny.

The presence of larvae of only "*variolosum*" type indicates the presence of one species: *Asterodiaspis variolosum* (RATZEBURG).

The number of multilocular pores in females 41–56 (av. 47. 20). Number of loculi in multilocular pores 5–11, the most numerous 10-locular, and next 9-locular pores. Tubular ducts 27-37 μm long (av. 31.70 μm). Apical setae 32–42 μm long (av. 36.91 μm). Number of quinquelocular pores in spiracular bands including pores near spiracles 38–90 (av. 63.00); anterior spiracular bands with 38–86 (av. 62.32) pores, and posterior with 43–90 (av. 64.79) pores. Marginal 8-shaped pores 9-10 μm long."Dark-rimmed" pores scattered around beak, in vicinity of spiracular bands of quinquelocular pores and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores consisting of 2–3 irregular rows.

Station IV

Material was collected on June 18, 1969 on a hybrid of *Quercus robur* L. and *Q. petrea* LIEBL., majority of characters being those of *Q. petrea* LIEBL., on Chełmowa Mt. Females were encountered on all branches. On one-year old twigs 20 females were found, on two-year old ones 6, on three-four old 2, and on main trunk 3 females were collected; altogether 31 females have been taken.

Female body usually of a brown colour, less frequently pale brownish or yellowish. Test usually transparent with a greenish-yellow hue, very rarely clouded. Convexity of dorsal side shown on table X.

As can be seen from data presented, the convexity of females increased with branches age. On one-year old twigs one female was found to be feebly convex, whereas the remaining ones were moderately convex. On two-year old twigs the females turned out to be moderately convex, except one which

Table X. Degree of convexity of dorsal side of females from Station IV

Age of branches on which females were taken	Number of collected females	Degree of convexity			
		very feebly convex	feebly convex	moderately convex	strongly convex
branches one-year old	20	–	1	19	–
branches two-years old	6	–	–	5	1
branches 3-4-years old	2	–	–	1	1
main trunk	3	–	–	1	2

showed a strong convexity. On three-four-year old twigs as well as on main trunk, few females were taken, but those found were either strongly or moderately convex.

Measurement data of unmounted females are presented on table XI.

As it is evident, females living on one-year old twigs, had, on the average, the greatest size, although differences here were not conspicuous.

Length of mounted females (taken from 13 specimens) 1036–1246 μm (av. 1137.23 μm), width respectively (taken from 16 specimens) 910–1190 μm (av. 1038.63 μm).

Number of multilocular pores is presented on a histogram (fig. 5).

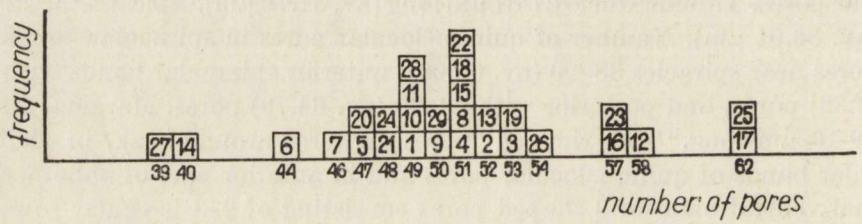

Fig. 5. Number of multilocular pores in females from Station IV; numbered squares – female which left a larval progeny.

Larval material was obtained from 29 females. Number of larvae examined from each of them is given on table XII. Altogether 345 larvae from 29 females have been examined. Furthermore larval progeny (8) of unmounted females from this station was also investigated. Altogether 353 larvae have been examined. All proved to be of "*variolosum*" type. They were always provided with a pair of 8-shaped pores on dorsal side; sporadically larvae were encountered with only one single pore, or with one fully developed and another half-developed pore.

Only one type of larva "*variolosum*" indicates the presence of *Asterodiaspis variolosum* (Ratzeburg).

The number of multilocular pores in females 39–62 (av. 50.68). Number

Table XI. Size of unmounted females with test, from Station IV (in micrometres)

Collection date	Branch age	Length			Width		
		measurements number	range	average	measurements number	range	average
18 VI 1969	one-year old	20	1232–1680	1452.50	20	1022–1428	1224.30
	two-years old	6	1288–1596	1421.00	6	1064–1274	1171.33
	3-4-years old	2	1316–1442	1379.00	2	1162–1260	1211.00
	main trunk	3	1330–1470	1395.33	3	1078–1218	1148.00
	together	31	1232–1680	1436.12	31	1022–1428	1205.80

Table XII. Number of examined larvae hatched from eggs laid by females from Station IV

Female No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
number of multilocular pores in female	49	52	53	51	47	44	46	51	50	49	49	58	52	40	51
number of examined larvae produced by it	43	2	2	22	20	20	3	12	6	22	36	31	15	17	6

female No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29
number of multilocular pores in female	57	62	51	53	47	48	51	57	48	62	54	39	49	50
number of examined larvae produced by it	4	8	4	4	12	6	6	5	5	8	6	2	8	10

of loculi in multilocular pores 6–13, the 10-locular pores the most numerous, 9-locular ones next with respect to number. Tubular ducts 29–42 μm long (av. 36.03 μm). Apical setae 32–44 μm long (av. 38.70 μm). Number of quinquelocular pores in spiracular bands together with pores near spiracles 43–92 (av. 72.03); anterior spiracular bands with 43–88 (av. 70.22) and posterior spiracular bands with 51–92 (av. 73.92) pores. Marginal 8-shaped pores about 10 μm long. "Dark-rimmed" pores scattered around beak, in vicinity of spiracular bands of quinquelocular pores and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores consisting of 2–3 irregular rows.

Station V

The material was collected on June 18, 1969 on *Quercus petrea* LIEBL. in Chełmowa Mt. The tree in question turned out to be feebly infested: females were found only on main trunk. Altogether 11 specimens have been taken. Despite the small number of females found, observations of those in situ shown lack of uniformity in their external appearance. With respect to size, two groups were made out: one of small specimens, and another of larger ones; in width this difference proved to be more conspicuous than in length. The mounted specimens of the two groups turned out to be even more different. The most conspicuous differences were found in the number of multilocular pores. Taking into account this last character below I give particulars separately for each group.

1st group

Here belong six smaller females with less numerous multilocular pores.

Body brown, its transparent test with a yellow hue. Five of females were moderately convex, one strongly convex.

Length of unmounted females measured together with test 1008–1190 μm (av. 1124.66 μm), width 952–1022 μm (av. 982.33 μm). Length of mounted females 840–980 μm (av. 904.40 μm), width 812–882 μm (av. 842.80 μm).

Number of multilocular pores is presented on a histogram (fig. 6).

The larval material was produced by 5 females. Number of larvae obtained from each of them are given on table XIII. Altogether 39 larvae have been

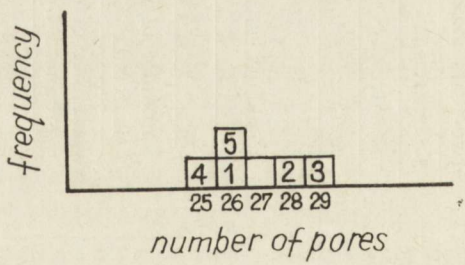

Fig. 6. Number of multilocular pores in females from Station V and belonging to 1st group; not numbered squares – female which did not produce larvae, numbered squares – female which left a larval progeny.

examined. All proved to be of the "*variolosum*" type. Their dorsal side was provided almost always with one pair of 8-shaped pores; only once one female with one single pore was taken.

Table XIII. Number of examined larvae hatched from eggs laid by females from Station V and belonging to 1st group

Female No.	1	2	3	4	5
number of multilocular pores in female	26	28	29	25	26
number of examined larvae produced by it	17	10	2	2	8

The presence of larvae of only "*variolosum*" type indicates that they belonged to *Asterodiaspis variolosum* (RATZEBURG).

The number of multilocular pores in females 25–29 (av. 26. 83). Number of loculi in multilocular pores 4–10, the most numerous 7-locular pores; the 6-locular, 8-locular and 9-locular ones following in that suit. Tubular ducts 27–34 μm long (av. 30.00 μm). Apical setae 29–32 μm long (av. 30.27 μm). Number of quinquelocular pores in spiracular bands together with those near spiracles 35–56 (av. 43.58); anterior spiracular bands with 35–45 pores (av. 40.66), and posterior spiracular bands with 40–56 (av. 46.50) pores. Marginal 8-shaped pores 8.5–9 μm long. "Dark-rimmed" pores scattered around beak, in vicinity of spiracular bands of quinquelocular pores and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores composed of 1–3 irregular rows.

2nd group

It comprises five larger females with more numerous multilocular pores. Body brown, test transparent, usually with a yellow, less frequently greenish shade. Of 5 females examined, 4 were moderately convex, one strongly convex.

Length of unmounted females, measured with test 1288 — 1540 μm, (av. 1456.00 μm), width 1190–1344 μm (av. 1257.20 μm). Length of mounted females 1106–1316 μm (av. 1176 μm), width 994–1204 μm (av. 1082.66 μm).

Number of multilocular pores is presented on a histogram (fig. 7).

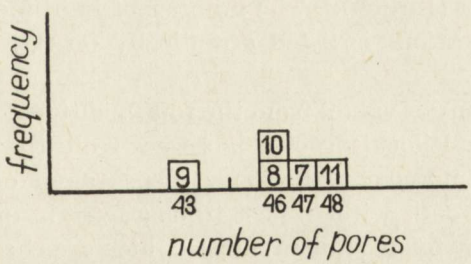

Fig. 7. Number of multilocular pores in females from Station V and belonging to 2nd group; numbered squares — female which left a larval progeny.

Larval material obtained from five females. Number of larvae from each of them is given on table XIV.

Altogether 52 larvae have been examined. All were of the "*variolosum*" type. Dorsal side with one pair of 8-shaped pores. The presence of only "*variolosum*" type among larvae indicates that *Asterodiaspis variolosum* (RATZEBURG) was likewise species involved.

Table XIV. Number of examined larvae hatched from eggs laid by females from Station V and belonging to 2nd group

Female No.	6	7	8	9	10
number of multilocular pores in female	47	46	43	46	48
number of examined larvae produced by it	23	18	7	2	2

Number of multilocular pores in females 43–48 (av. 46.00). Number of loculi in multilocular pores 5–11, the most numerous pores being the 10–locular ones, and 9-locular pores in that order. Tubular ducts 27–39 μm long (av. 33.60 μm). Apical setae 29–39 μm long (av. 35.60 μm). Number of quinquelocular pores in spiracular band together with those near spiracles 42–85 (av. 63.11); the anterior bands consisting of 42–85 (av. 63.00) pores and posterior ones of 53–73 (av. 63.25) pores. Marginal 8-shaped pores about 10 μm long. "Dark-rimmed" pores scattered around beak, in the vicinity of spiracular bands of quinquelocular pores and in anterior part of abdomen. Submarginal ventral band of 8-shaped pores consisting of 2–3 irregular rows.

DISCUSSION

In the comparison of morphological characters of females collected in particular stations, I will first embark on an analysis of number of multilocular pores. As I have already mentioned in the beginning, this character was indicated by various authors as the most important taxonomic feature which enabled separation females of *Asterodiaspis variolosum* (RATZEBURG) from those of *Asterodiaspis quercicola* (BOUCHÉ). The number of multilocular pores in females collected at various stations is listed graphically on fig. 8. First of all I will discuss stations I–IV.

When comparing mean values from the four mentioned stations, it is evident that the number of multilocular pores increases from the first to the last one. Histograms indicate, moreover, that specimens taken on particular stations make fairly uniform groups with respect to character in question.

Histograms display fairly similar shapes which are characterized by a maximal "peak" in the middle with a gradual drop at both sides of the range. This

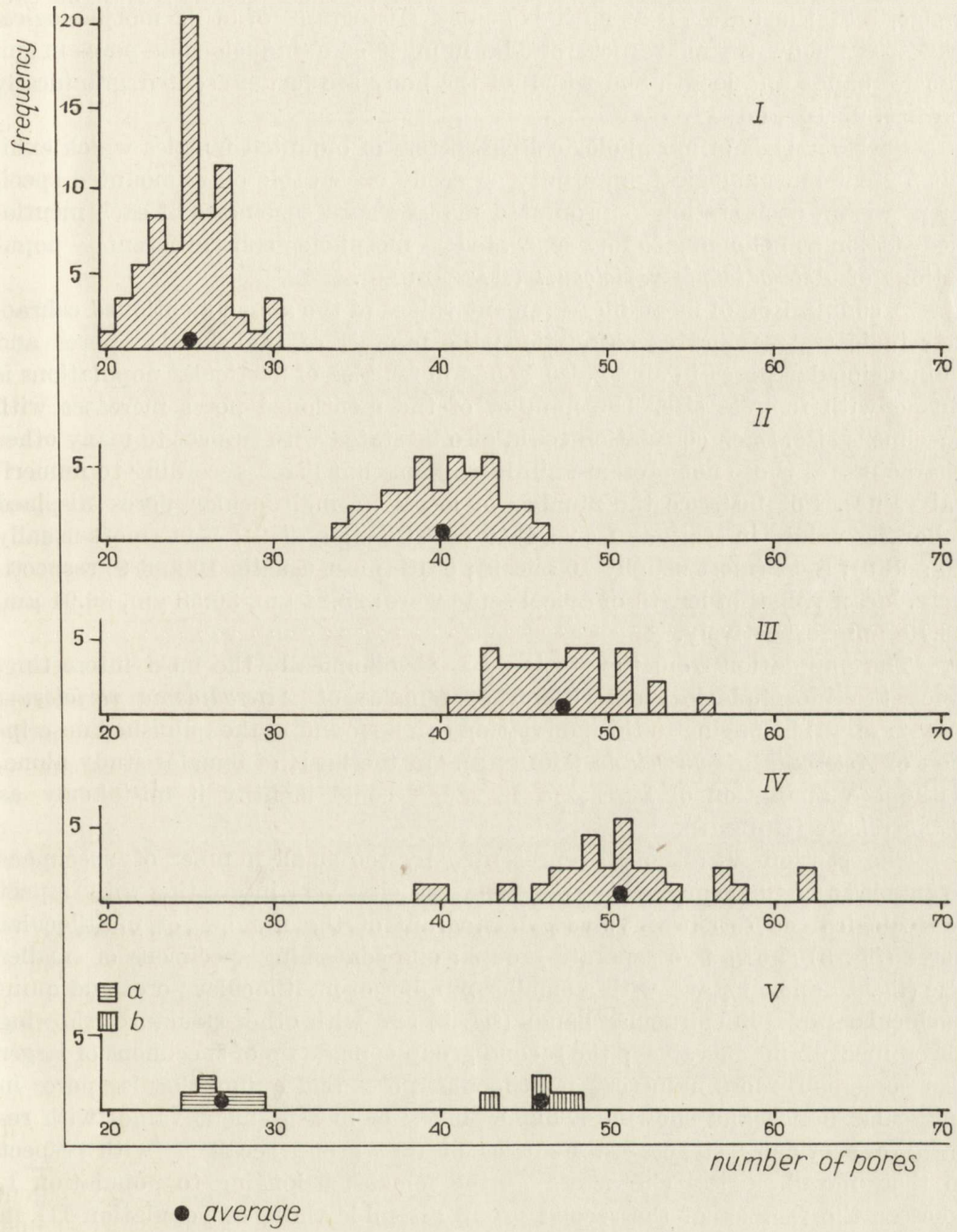

Fig. 8. A comparison of number of multilocular pores in females from Station I–V; a — females from Station V and belonging to 1st group, b — females from Station V and belonging to 2nd group.

means that a highest number of individuals fall within the median part of the range, and the lowest is at both extremes. Histograms of other morphological characters show a similar picture. The number of quinquelocular pores in spiracular bands and length and width of the body are just presented graphically on figs. 9, 10 and 11.

Such analysis of morphological characters of mounted females which exhibit a great morphological uniformity — easily observable on unmounted specimens within each station — prompted me to regard specimens of each mentioned station as belonging to four separated — morphologically different — populations of *Asterodiaspis variolosum* (RATZEBURG).

A comparison of mean measurement values of the above mentioned cahracters indicates a following correlation: the number of multilocular pores and quinquelocular pores in spiracular bands in females of particular populations is linked with females size. The number of the mentioned pores increases with specimens size. Such correlation could also be stated with respect to many other characters — those not presented in histograms but listed according to numerical values. For instance the number of loculi in multilocular pores displaed following values in stations I–IV: 4–10 (most usually 5–9); 4–11 (most usually 10 and 9); 5–11 (most usually 10 and 9); 6–13 (most usually 10 and 9) respectively. Mean values of length of apical setae were: 28.24 μm, 30.58 μm, 36.91 μm, 38.70 μm respectively.

The population from the station I is taxonomically the most interesting, since the morphological description of females of *Asterodiaspis variolosum* (RATZEBURG) belonging to this population can be found in the published description of *Asterodiaspis quercicola* (BOUCHÉ). On the basis of females study alone, without examination of Ist stage larvae, I could identify it mistakenly as *A. quercicola* (BOUCHÉ).

The station V, although represented by too small number of specimens to enable some final conclusions, seems nevertheless very interesting with respect to ecological conditions involved. Histogram of the number of multilocular pores (fig. 8) shows two separate groups: one containing specimens of smaller size (fig. 10 and 11), and with a smaller number of multilocular pores and quinquelocular pores in spiracular bands (fig. 9) and with other structures showing lower measurement values; the second group is made up of specimens of larger size possessing more numerous multilocular pores and quinquelocular pores in spiracular bands and showing a higher index of measurement values with regard to particular structures. Females of first group recall — with respect to their morphological characters — the females belonging to population I, whereas the females of the second group resemble those of population III in the number of their multilocular pores.

This seems to indicate that two separate — morphologically distinct — populations of the same species may live on the same tree. Such coexistence seems to be possible in the case when a host plant inhabited by one population

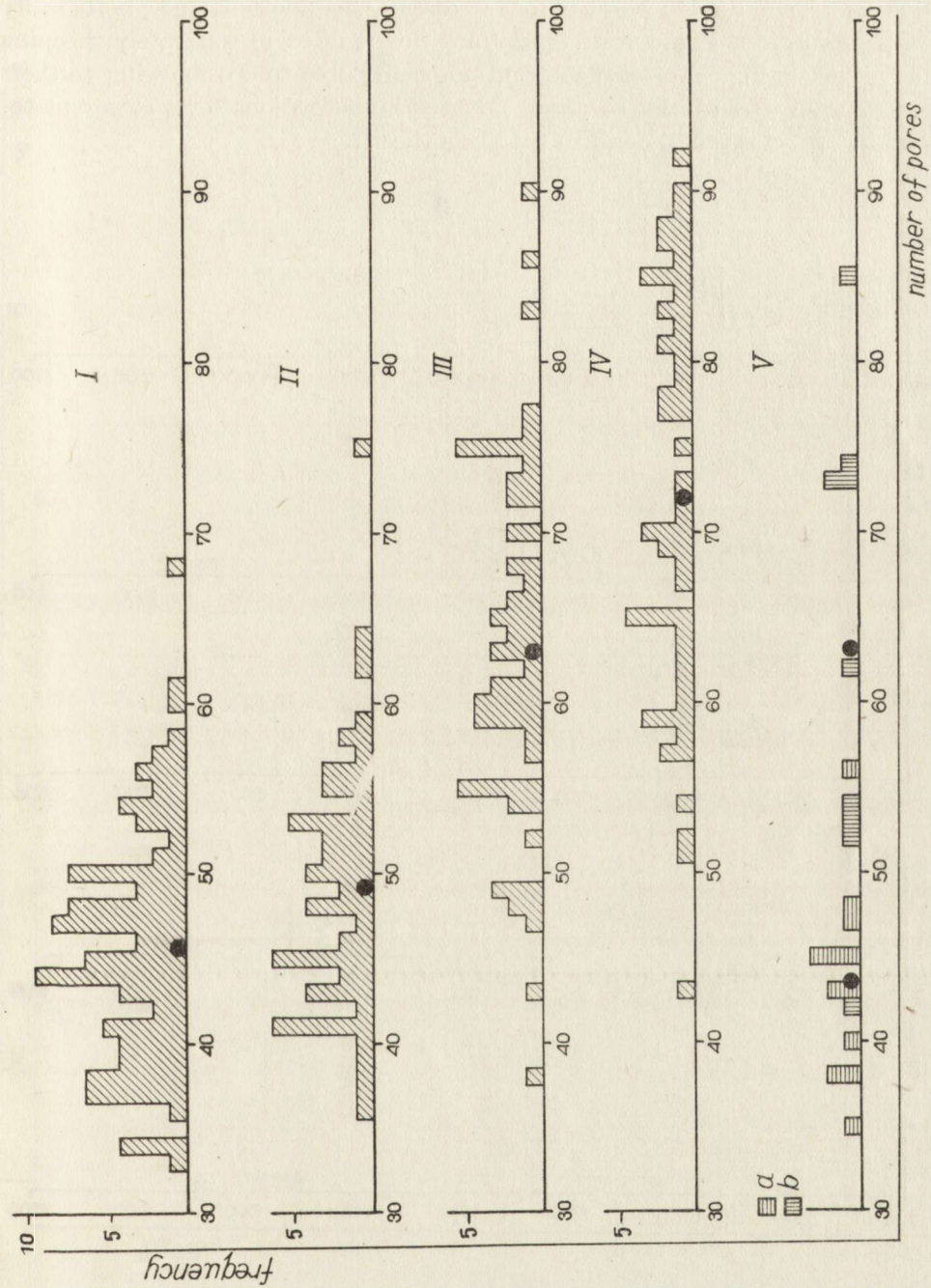

Fig. 9. A comparison of number of quinquelocular pores in spiracular bands in females from Stations I–V; a – females from Station V and belonging to 1st group, b – females from Station V and belonging to 2nd group.

may be colonized, due to wind or other causes, by another, morphologically different population. These two populations might develop separately, keeping their own morphological characters, and not being able to cross, owing to their parthenogenetic way of reproduction. Further investigations on a larger material are however needed to confirm this hypothesis.

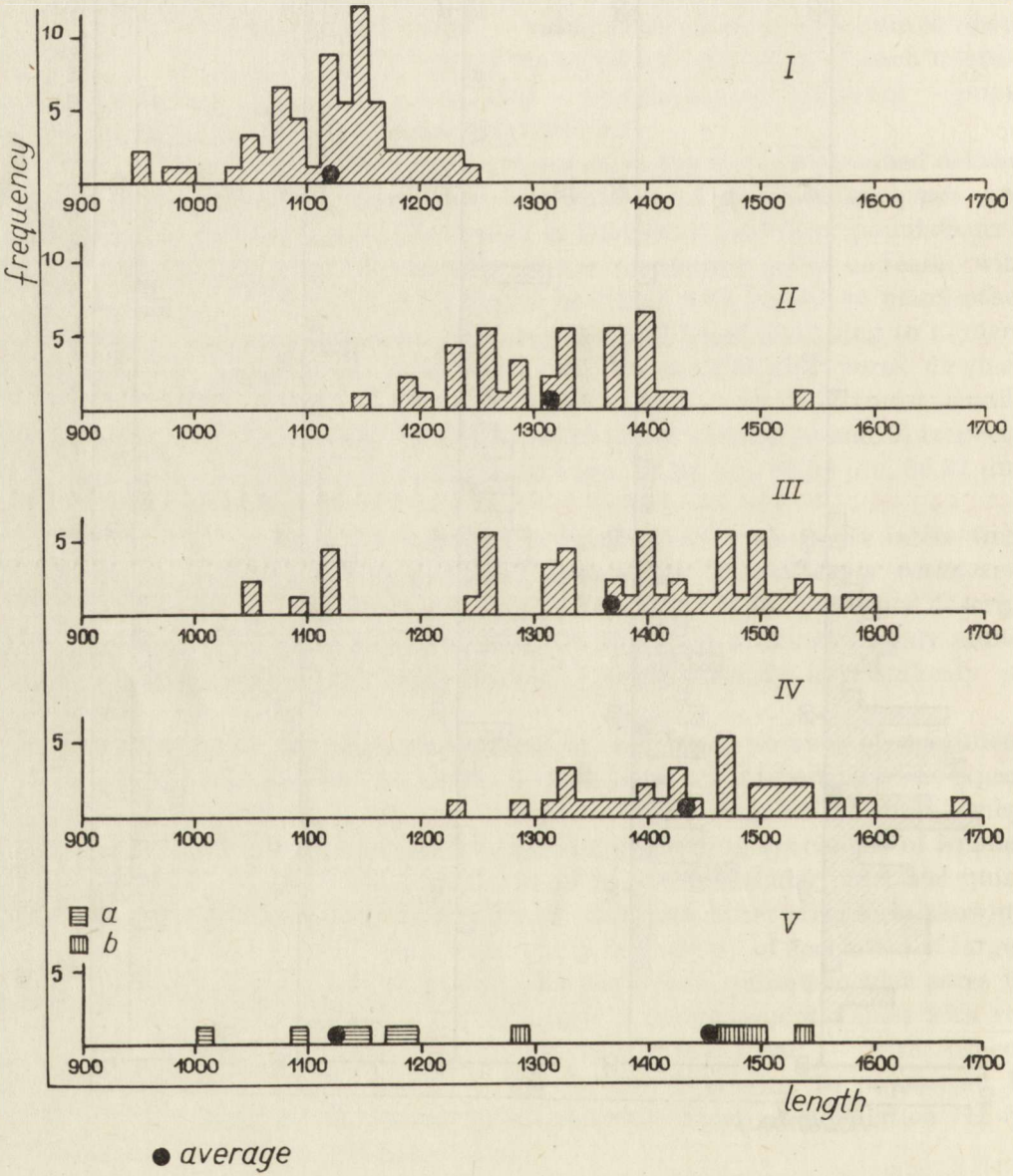

Fig. 10. A comparison of length of unmounted females with test, from Stations I–V (in micrometres); a – females from Station V and belonging to 1st group, b – females from Station V and belonging to 2nd group.

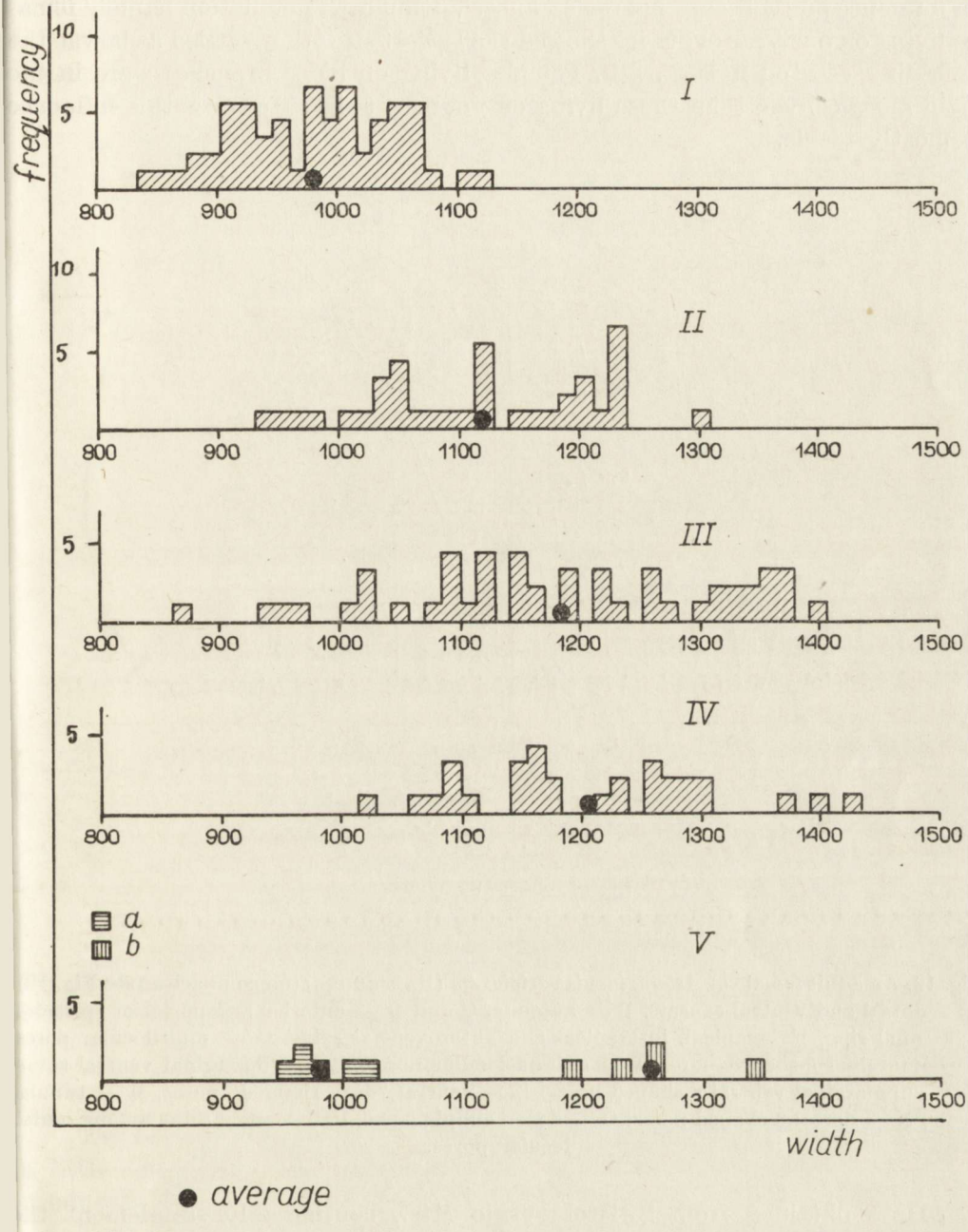

Fig. 11. A comparison of width of unmounted females with test, from Stations I–V (in micrometres); a – females from Station V and belonging to 1st group, b – females from Station V and belonging to 2nd group.

Field observations suggest that habitat of females bears to some extent an influence on their external appearance. Within each population namely females living on one-year old twigs showed the largest size; they settled as larvae the preceding year on new growth. Females living on older branches were in the main more convex than those living on younger twigs. However this influence is mostly feeble.

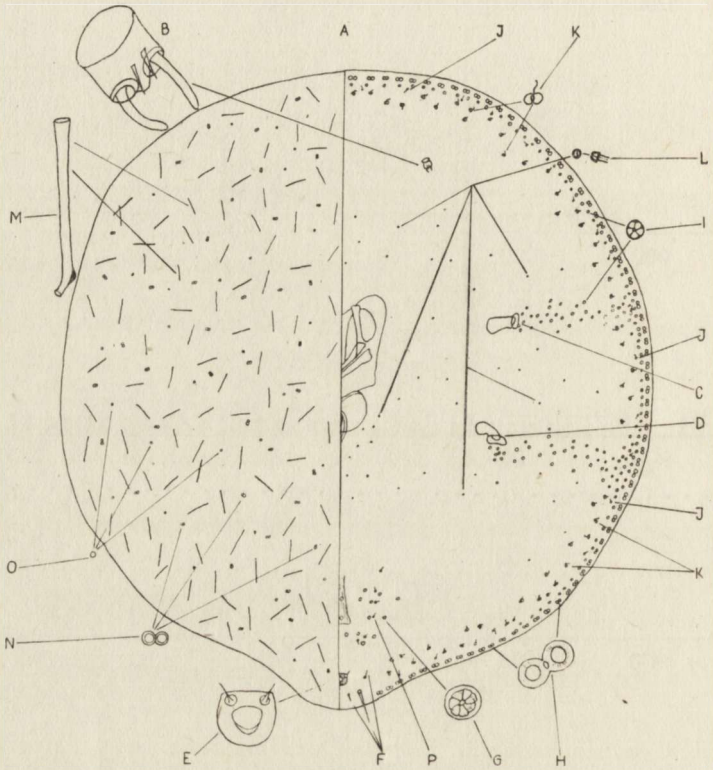

Fig. 12. An adult female of *Asterodiaspis variolosum* (RATZEBURG) (for comparison see Fig. 13); A – dorsal and ventral aspects, B – antenna, C and D – anterior and posterior spiracles, E – anal ring, F – apical, interapical and anteroventral setae, G – multilocular pores, H – marginal 8-shaped pores, I – quinquelocular pores, 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.

Data obtained from Świętokrzyskie Mts., considerably supplement the diagnosis of *Asterodiaspis variolosum* (RATZEBURG) with respect to females. Below is given morphological description of larvae of the first stage and adult females of *A. variolosum* (RATZEBURG) on the basis of material from all five stations.

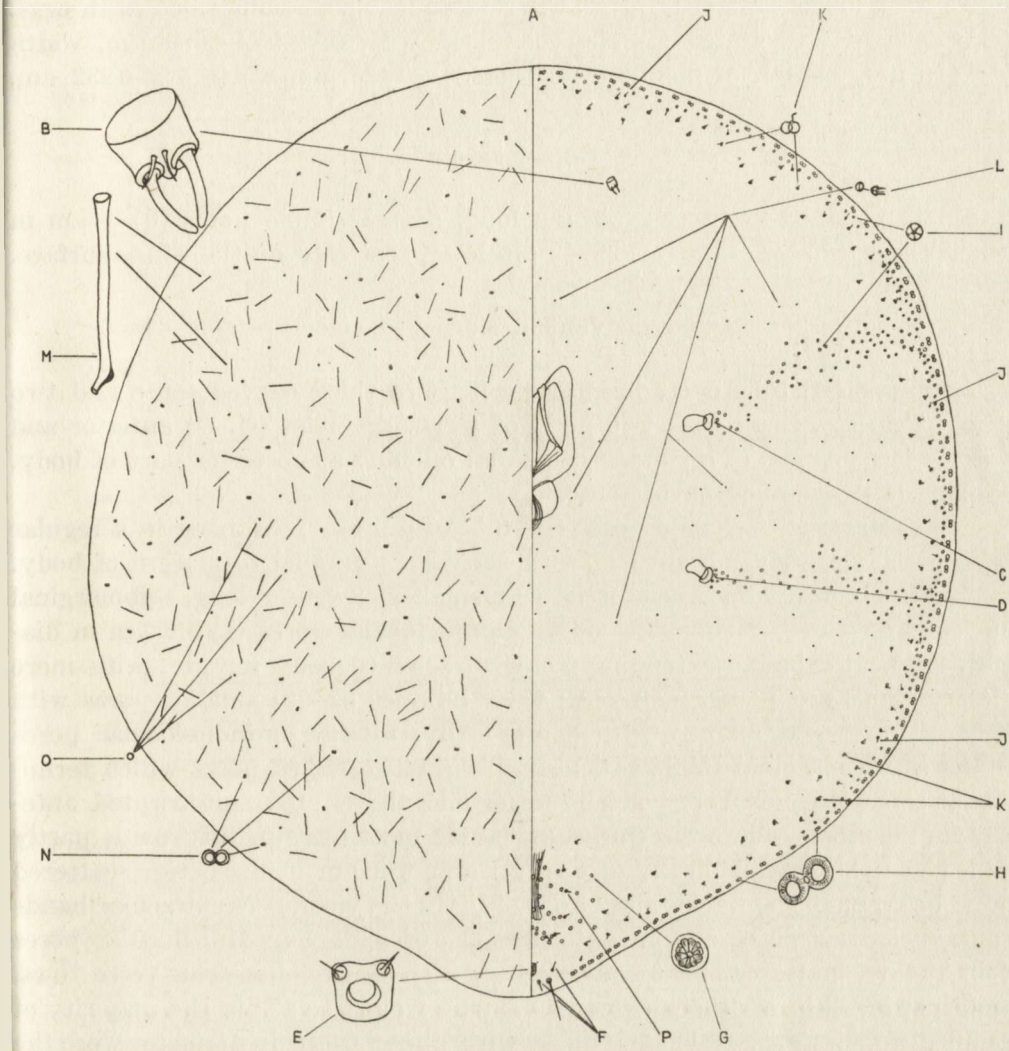

Fig. 13. An adult female of *Asterodiaspis variolosum* (RATZEBURG) belonging to a different population than that shown on Fig. 12 and living on the same tree (Station V). Abbreviations as in Fig. 12.

MORPHOLOGY OF ADULT FEMALE (figs. 12, 13)

The body covered by a rigid, well adhering test of an circular shape, usually a little longer than wide, rarely quite circular. Posterior part of body slightly produced. Dorsal side feebly, moderately or strongly convex.

Test shiny, transparent with a greenish-yellow or yellowish shade, very rarely slightly clouded; with whitish waxy fringe all around the margin.

Body of old females usually brownish, very infrequently pale brown or yellow. After oviposition it shrinks, assumes a crescent shape and is confined

only to the anterior part of the test, the remaining space being filled with eggs.

Length of unmounted females measured with test 952–1680 μm, width 840–1428 μm. Length of mounted females 840–1400 μm, width 714–1232 μm.

Dorsal side

Small 8-shaped pores (N) 3.5 μm long, dorsal simple pores (0) 1 μm in diameter and tubular ducts (M) 22–42 μm long, scattered on the whole surface.

Ventral side

Antennae (B) tubercular in shape, with two thick curved setae and two trichoid sensillae. Beak with two pairs of setae. Spiracles (C, D) anterior and posterior more or less of a similar size. Anal opening at posterior part of body. Anal ring (E) with one pair of setae.

Pores. Marginal 8-shaped pores (H) 8.5–10 μm long, arranged in a regular single row along body margin and with their axes parallel to margin of body. Submarginal ventral 8-shaped pores (K) smaller, 2–3 μm long, submarginal band composed of 1–3 irregular rows. Quinquelocular pores (I) 3.5 μm in diameter, spiracular bands extending from spiracles to body margin, with more or less distinct group near spiracles; their number 33–92; smaller pores with 3–4 loculi scattered among them sporadically. Similar quinquelocular pores forming a sub marginal single row near marginal 8-shaped pores which terminates at some distance from body posterior end and is often interrupted anteriorly; in the places where the spiracular bands meet margin, this row is partly double. Ventral "dark-rimmed" pores (L) about 2 μm in diameter, scattered around beak, among spiracles and also usually in the vicinity of spiracular bands of quinquelocular pores and in anterior part of abdomen. Multilocular pores (G) in the vaginal area, 20–62 in number, in four irregular transverse rows. Number of loculi in multilocular pores varying from 4 to 13; in the majority of examined populations, 10-locular pores with about 6 μm in diameter were the most numerous, but in some populations, smaller, 5–9-locular pores were the most numerous.

Setae: one pair of apical setae 22–44 μm long, and a pair each of smaller, 5–10 μm long, interapical and anteroventral setae situated in posterior part of body (F). Setae among multilocular pores (P) in number of two pairs in the last row, one pair in any of the three preceding ones and one pair situated anteriorly. Submarginal ventral setae (J) 2–6 μm long, situated in one singular submarginal row around the body.

MORPHOLOGY OF FIRST-INSTAR LARVA (fig. 14)

Body membranous, their length in crawlers 244–281 μm, width 133–163 μm.

Dorsal side

Dorsal simple disc pores (C) arranged in sublateral single row on abdomen, several of those also in cephalothoracic area. The 8-shaped pores (Bb) in number

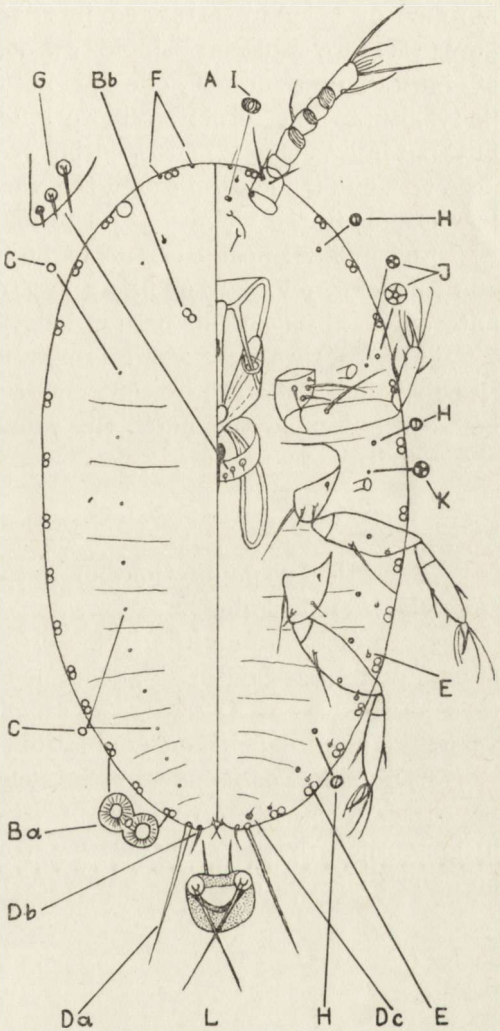

Fig. 14. *Asterodiaspis variolosum* (RATZEBURG). First-instar larva; A – dorsal and ventral aspects, B – 8-shaped pores: Marginal (a), dorsal (b), C – dorsal simple pores, D – apical (a), interapical (b), and anteroventral (c) setae, E – submarginal ventral setae, F – anterior marginal setae, G – left half of apex of beak with 3 setae, H – "dark rimmed" pores, I – interantennal 8-shaped pores, J – pores at anterior spiracle, K – pore at posterior spiracle, L – anal opening with anal ring.

of one pair in the vicinity of median area of anterior part of body; sometimes one of these pores missing, or aside of said pair of pores, one additional pore present.

Ventral side

Eyes situated marginally and anterolaterally to antennae. Antennae 6-jointed. Legs well developed with a very short tibia – three to four times shorter than tarsus. Beak pentagonal with three pairs of setae at apex (G). Anterior

and posterior spiracles small. Anal opening (L) in posterior end of ventral side of body, and slightly invaginated; anal ring sclerotized and provided with two 5–7 μm long setae.

Pores: Marginal 8-shaped pores 6–7 μm long and about 3.5 μm wide, in number of 14 pairs arranged in a regular single row. Small "dark-rimmed" pores (H) in a sublateral single row at each side of body; they occur in number of six pairs on abdomen, one pair between spiracles and one in anterior part of body situated posterolaterally to antennal bases; one pair of larger 8-shaped interantennal pores (I) situated between antennae. There is one quinquelocular pore and one trilocular pore in the vicinity of anterior spiracle, and one trilocular pore (J) in the vicinity of posterior one.

Body setae: posterior end of body with one pair of apical setae (Da) 54–68 μm long, one pair of interapical one (Db) 7–20 μm long, and one pair of anteroventral setae (Dc) 3–7 μm long. Submarginal ventral setae (E) in number 7 pairs, very rarely 9 pairs on posterior segments of body. Two pairs of anterior marginal setae (F) present between the eyes and two pairs of setae found between antennae and beak. Occasionally, one pair of setae or one single seta present in antennal area.

CONCLUSIONS

1. Particular populations of *Asterodiaspis variolosum* (Ratzeburg) differ strongly in morphology.

2. Number of multilocular pores and quinquelocular pores in spiracular bands, as well as body size and dimensions of many other morphological structures of females of *Asterodiaspis variolosum* (Ratzeburg) are subject of strong variability and depend on populations in which they occur.

3. Location of females on branches of various age bear on their external appearance. Females produced by larvae which settled on new growth, grow, in general, to larger size than those found on older branches; females found on older twigs, on the other hand, are more convex.

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REFERENCES

Apeji S. A. 1964. Studies on species of *Asterodiaspis* (*Coccoidea*) on oak in Britain. Unpublished thesis submitted for the Diploma of Imperial College (University of London). 201 pp. and appendix.

Boratyński K. 1961. A note on the species of *Asterolecanium* Targioni-Tozzetti, 1869 (*Homoptera, Coccoidea, Asterolecaniidae*) on oak in Britain. Proc. roy. ent. Soc. London, (B) **30**: 4–14.

Borchsenius N. S. 1960. Podotrjad červecy i ščitovki (*Coccoidea*) semejstva *Kermococcidae, Asterolecaniidae, Lecanodiaspididae, Aclerdidae*. Fauna SSSR, Moskwa--Leningrad, **8**: 1–283.

Hadžibejli Z.K. 1956. Kokcidy (*Homoptera, Coccoidea*) vredjaščie dubam v Gruzii. Ènt. Obozr., Leningrad-Moskwa, **35**: 50–55.

Krzysztofik E. 1959. Lasy Świętokrzyskiego Parku Narodowego. Świętokrzyski Park Narodowy. Zakł. Ochr. Przyr., Kraków, **16**: 35–53.

Massalski E. 1959. Środowisko geograficzne Świętokrzyskiego Parku Narodowego. Świętokrzyski Park Narodowy. Zakł. Ochr. Przyr., Kraków, **16**: 11–34.

Podsiadło E. 1972. A Contribution to the Explanation of the Status of *Asterodiaspis variolosum* (Ratzeburg) (*Homoptera, Coccoidea, Asterolecaniidae*) on the Basis of Materials from Poland. Acta zool. cracov., Kraków, **17**: 389–404.

Russell L. M. 1941. A classification of the Scale Insect genus *Asterolecanium*. Misc. Publ. U. S. Agric., Washington, D. C., **424**: 1–322.

STRESZCZENIE

[Tytuł: Porównawcze badania morfologiczne nad populacjami *Asterodiaspis variolosum* (Ratzeburg) (*Homoptera, Coccoidea, Asterolecaniidae*) z Gór Świętokrzyskich]

W pracy porównywałam cechy morfologiczne dojrzałych samic *Asterodiaspis variolosum* (Ratzeburg), zebranych na pięciu oddzielnych drzewach z rodzaju *Quercus* L., rosnących na terenie Gór Świętokrzyskich. Poszczególne drzewa określone są w pracy jako stanowiska 1–5. Ze stanowiska 1-szego zebrałam 75 samic, z 2-giego 38 samic, z 3-ciego 51 samic, z 4-tego 31 samic, z 5-tego 11 samic.

Najbardziej szczegółowo rozpatrywałam takie cechy morfologiczne jak długość i szerokość ciała samic niespreparowanych, ilość wielootworowych gruczołów i ilość pięciootworowych gruczołów w pasmach przetchlinkowych (rys. 9, 10, 11, 12).

Osobniki ze stanowisk 1–4 uznałam za 4 różniące się morfologicznie populacje jednego gatunku *Asterodiaspis variolosum* (Ratzeburg).

W obrębie tych populacji stwierdziłam pewien niewielki wpływ miejsca osadzenia się samic na drzewie, na ich pokrój zewnętrzny. Największe wymiary osiągały samice osadzone na gałęziach jednorocznych (Tabele I, II, V, VIII, XI), zaś samice umiejscowione na gałęziach starszych miały często bardziej wypukłą stronę grzbietową ciała (Tabele IV, VII, X).

Na podstawie analizy materiału ze stanowiska 5-tego wysunęłam przypuszczenie, że dwie morfologicznie różniące się populacje *Asterodiaspis variolosum* (Ratzeburg) mogą występować również na jednym i tym samym drzewie.

Uzyskane wyniki znacznie rozszerzyły diagnozę *Asterodiaspis variolosum* (Ratzeburg) w odniesieniu do samic.

РЕЗЮМЕ

[Заглавие: Сравнительные морфологические исследования популяций *Asterodiaspis variolosum* (RATZEBURG) (*Homoptera, Coccoidea, Asterolecaniidae*) из Свентокшиских гор (Польша)]

В работе сравнивались морфологические признаки взрослых самок *Asterodiaspis variolosum* (RATZEBURG), собранных с пяти отдельных деревьев рода *Quercus* L., растущих в районе Свентокшиских гор. Отдельные деревья определены в работе как места от 1-го до 5-го.

С 1-го места собрано 75 самок, с 2-го — 38 самок, с 3-го — 51 самок, с 4-го — 31 самок и с 5-го 11 самок.

Наиболее подробно рассматривались автором такие морфологические признаки, как: длина и ширина тела непрепарированных самок, количество многоячеистых желез и количество пятиячеистых желез в дыхальцевых бороздках (рис. 8, 9, 10, 11).

Особи с мест 1-го до 4-го учтены автором как четыре морфологически отличающиеся популяции одного вида *Asterodiaspis variolosum* (RATZEBURG).

В пределах этих популяций автор констатировала некоторое небольшое влияние места осаждаемости самок на дереве, на их наружный покрой. Самые большие размеры достигали самки, осажденные на однолетних ветвях (таблицы I, II, V, VIII, XI), а самки осажденные на более старых ветвях часто имели более выпуклую спинную сторону тела (таблицы IV, VII, X).

На основании материала с 5-го места автором выдвинуто предположение, что две морфологически отличающиеся популяции *Asterodiaspis variolosum* (RATZEBURG), могут встречаться на одном и том же дереве.

Полученные результаты значительно расширили диагноз вида *Asterodiaspis variolosum* (RATZEBURG) по отношению к самкам.

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