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## Morphological variability in *Phenacoccus interruptus* GREEN 1923 (Coccoidea: Pseudococcidae)

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ABSTRACT. The variation of morphological characters in *Phenacoccus interruptus* GREEN 1923, observed in 10 female specimens collected in the western part of Upper Silesia is described and illustrated.

Keywords: entomology, morphology, Pseudococcidae, morphological variability, circulus, cerarius.

### INTRODUCTION

*Phenacoccus interruptus* GREEN 1923 belongs to the family Pseudococcidae. It is a Palearctic species (ŁAGOWSKA 2001). Its occurrence was noted in several regions of Poland: Mazovian Lowland, Lesser Poland Upland, Kraków-Wieluń Upland, Pieniny Mountains, Western Beskidy Mountains, Western Sudetes (KAWECKI 1985), Świętokrzyskie Mountains (KOTEJA & ŻAK-OGAŻA 1989), Roztocze (ŁAGOWSKA & KOTEJA 1996), Upper Silesia (KALANDYK & WĘGIEREK 2010, SIMON & HERCZEK 2010). *Ph. interruptus* is an oligophagous species feeding mainly on the representatives of the Poaceae family (Scalenet). There is no available data about its voltinism and hibernation stage. It prefers sunlit habitats: pine forests, peatbogs, steppes and rocks (DANZIG 2003). In Poland it was recorded in graminaceous communities and meadows, stream terraces which are partly boggy places, xerothermic grasslands (KOTEJA & ŻAK-OGAŻA 1989, ŁAGOWSKA & KOTEJA 1996), psammophilous grasslands (KOTEJA & ŻAK-OGAŻA 1989, KALANDYK & WĘGIEREK 2010), moorlands and *Nardus* grasslands (SIMON & HERCZEK 2010). In the territory of Poland the species was collected from *Calamagrostis epigejos*,

*Corynephorus canescens*, *Danthonia decumbens*, *Elymus* sp., *Festuca ovina*, *Festuca pratensis*, *Festuca tenuifolia* (KALANDYK & WĘGIEREK 2010).

According the original description of GREEN (1923), this species is characterized by presence of 9-segmented antennae, 9 pairs of cerarii, of which anterior ones are borne on sclerotized plates, well developed legs, claw with a distinct denticle, and presence of little circulus. Descriptions of other authors (BORCHSENIUS 1949, WILLIAMS 1962, KOSZTARAB & KOZAR 1980, DANZIG 2006) show discrepancies, which were noted in material examined here.

#### MATERIAL AND METHODS

The description of 10 female specimens of *Phenacoccus interruptus* is based on material collected in June and August 2011, in moorland of Landscape Park "Cistercian Landscape Compositions of Rudy Wielkie", from roots of *Calamagrostis epigejos*. The atypical set of characters was noted. Drawings were made with a microscope drawing tube attached to a Zeiss microscope.

#### RESULTS

Adult female elongate oval, pale-orange, gently covered with white wax. Antennae near the body margin, mostly 8-segmented (in 2 specimens the last segment incompletely divided), eyes distinct. Labium 89-95  $\mu$  long. and 60-70 wide  $\mu$ . Legs well developed, claw with a distinct denticle. Hind coxae without translucent pores. Circulus present, small and oval. 14 pairs of cerarii, 8 pairs at anterior and 6 at posterior ends of body (Fig 1). Two pairs of dorsal ostioles developed, ostiole lips with many trilocular pores and setae. Spiracles with associated trilocular pores. Anal lobes distinct. Quinquelocular pores present in median area of venter, numerous mainly near labium. Trilocular pores on both body surface. Tubular ducts of 2 sizes, large on body margin. Multilocular pores form transverse rows on last three abdomen sternites. Anal ring located apically.

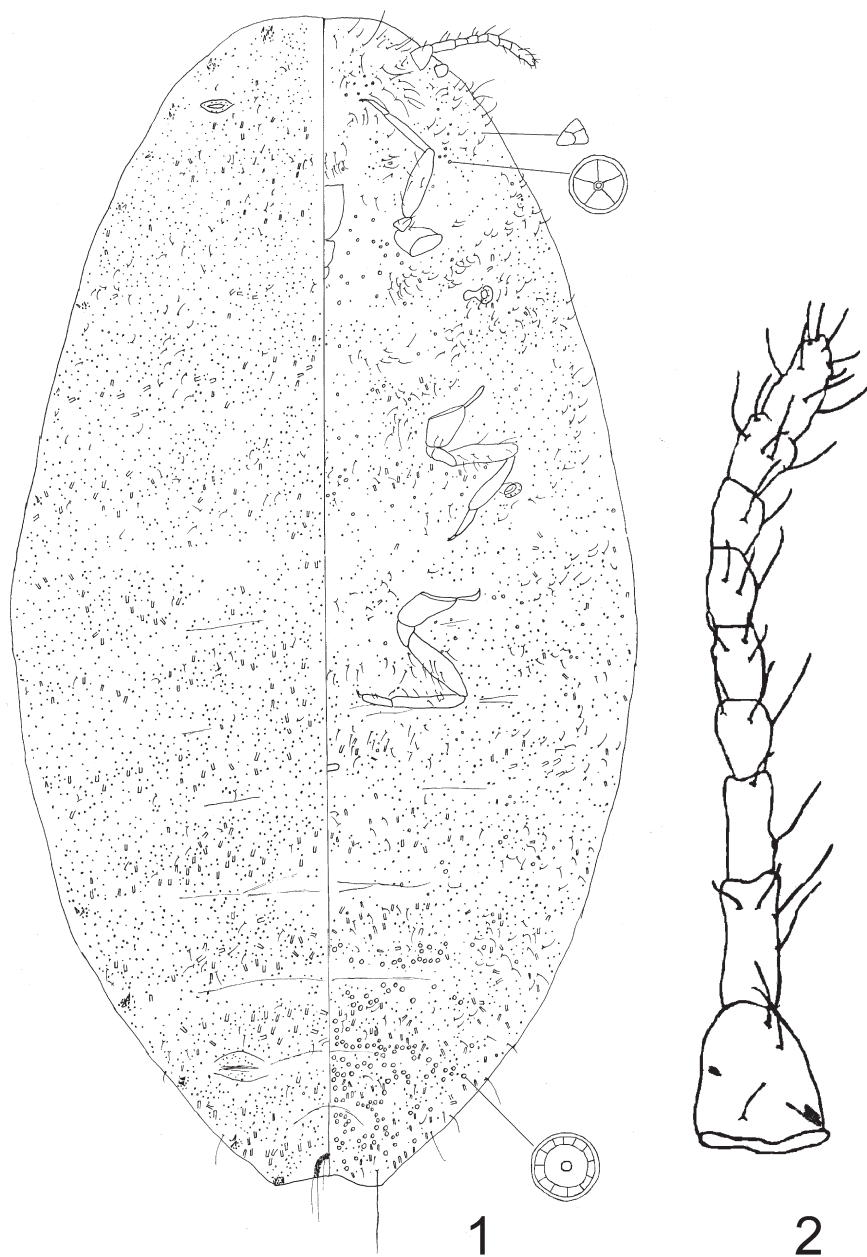
#### DISCUSSION

According to GREEN (1923), WILLIAMS (1962) and KOSZTARAB & KOZAR (1980), there are 9 pairs of cerarii, 5 on the anterior part of the body and 4 on the posterior part. The anterior ones are located on sclerotized plates. BORCHSENIUS (1949) stated that this species possesses 8 pairs of cerarii, 3 on anterior part and 5 on posterior part of the body. The anterior ones and  $C_{18}$  are borne on sclerotized plates (tab. 1).

In the examined specimens there were 14 pairs of cerarii, 8 anterior and 6 posterior ones, but none of them on sclerotized plate. Cerarii  $_{1-3}$  have about 3 lanceolate spines, which is in accordance with description given by BORCHSENIUS (1949) and WILLIAMS (1962), but not with GREEN'S (1923) who noted 5-8 lanceolate spines. On the other hand, DANZIG (2006) says that the number of cerarii varies from 9-18 pairs, but the first three pairs bear 6 or 7 conical spines and are situated on heavily sclerotized prominences (tab. 1).

Tab.1. Morphological variability of *Phenacoccus interruptus*

Structure of the body	GREEN (1923)	BORCHENIUS (1949)	WILLIAMS (1962)	KOSZTARAB & KOZAR (1980)	DANZIG (2006)	Present paper
<b>antennae</b>	9-segmented	9-segmented	9-segmented	9-segmented	9-segmented	8-segmented (in 2 specimens there is incompletely divided last segment)
<b>circulus</b>	present “circular medio-ventral osteole”	present, large and oval	absent	absent	absent	present, small
<b>number of cerarii</b>	9 (5 anterior, 4 posterior) C <sub>1</sub> , C <sub>3</sub> on sclerotized plates, bearing 5-8 lanceolate setae	8 (3 anterior, 5 posterior) C <sub>1</sub> , C <sub>3</sub> on sclerotized plates, bearing 3 conical setae, C <sub>3</sub> bearing 4-5 conical setae	9 (5 anterior, 4 posterior) C <sub>1</sub> , C <sub>3</sub> on sclerotized plates, bearing ca. 3 lanceolate setae	9 (5 anterior, 4 posterior) C <sub>1</sub> , C <sub>3</sub> on sclerotized plates, no information about number of setae	9-18 pairs (geographical variability) C <sub>1</sub> , C <sub>3</sub> on sclerotized plates, bearing 6-7 conical setae	14 (8 anterior, 6 posterior) C <sub>1</sub> , C <sub>3</sub> not on sclerotized plates, bearing 3-4 conical setae



1, 2. *Phenacoccus interruptus* GREEN 1923: 1 – adult female of, 2 – antenna

In the former descriptions given by GREEN (1923), BORCHSENIUS (1949), WILLIAMS (1962), KOSZTARAB & KOZAR (1980) and DANZIG (2006) there is information about 9-segmented antennae (tab. 1). Specimens from moorlands located in Landscape Park have 8-segmented antennae, but in 2 of them the last 8th segment is incompletely divided (Fig. 2, tab. 1).

The most interesting character is the circulus. WILLIAMS (1962), KOSZTARAB & KOZAR (1980) and DANZIG (2006) state that *P. interruptus* is devoid of circulus. In the original description provided by GREEN (1923) there is information about presence of 'single, rather obscure, circular medio-ventral osteole'. According to Borchsenius (1949), *Phenacoccus interruptus* is characterized by presence of large and oval circulus. In every specimen from Landscape Park a little circulus was present (tab. 1), which is significant when we take into consideration GREEN'S (1923) illustration of *Phenacoccus interruptus*, in which the same small structure is present.

The morphological variation presented here might show the general tendency in this genus, where variations are often host-induced within the same species (KOSZTARAB & KOZAR 1980). In *Ph. interruptus* the variation in number of cerarii may be correlated with geographical distribution (DANZIG 2006). Specimens from Primorsky Territory, Eastern Siberia and Korea have 15-18 pairs of cerarii, insects from west part of the European range, from Yakutia, Mongolia and Sakhalin don't possess cerarii in central part of the body. The number of circuli in mealybugs is a fairly constant feature of the species, but in some species variability has been reported, e.g. in *Phenacoccus aceris* (SIGNORET 1875) polymorphism (specimens with 1-5 circuli) connected with geographical range and distinct clines (DANZIG 1986) has been shown. In *Trionymus perrisii* (SIGNORET 1875), a single circulus seems to be the more typical condition, but some specimens collected in Great Britain have 2 and in rare cases up to 4 circuli (WILLIAMS 1962). The holotype of *Ph. interruptus* shows a round hole in the position of the circulus but WILLIAMS (1962) suggested that it must be damage, probably caused by a needle. There is no doubt that in every specimen examined here the circulus is present, and it can not be artifact.

A species that is similar to *Phenacoccus interruptus* is *P. evelinae*, differing from *P. interruptus* in the presence of large hourglass circulus, presence of large dorsal conical setae and numerous dorsal tubular ducts formed in transverse bands, 9-10 pairs of cerarii, only last 3 pairs are situated on sclerotized plates. DANZIG (2006) states that *P. evelinae* is probably an intraspecific form of *Ph. interruptus*. Morphological features of specimens collected in the moorland might support this statement.

Based on above facts it is advisable that to the set of morphological variability of *Ph. interruptus* the following should be added: presence of little circulus, absence of sclerotized plates bearing cerarii on anterior parts of the body and 8 segmented antennae. The biology of this species is unknown (KOSZTARAB & KOZAR 1980). DANZIG (2006) only mention of "mode of life" was that this species lives on leaves. Specimens described here were collected from roots. Maybe this morphological variability is caused by the organ of plant which they occupy and depends on the site of feeding, just as in the case of diaspidids – *Chionaspis* and *Lepidosaphes* (DANZIG 1970).

In all representatives of Pseudococcidae the temperature at which females develop can greatly alter the expression of every character used in the identification, and differences in host plant may have similar effect in species with narrow host range (Cox 1987). The range of variation within the same species is discussed by WILLIAMS (1985). Sometimes the differences within a single species are so striking that it is necessary to illustrate different specimens. It is very likely that the situation discussed here reflects all the above presented facts concerning this family of scale insects.

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