Boll. Zool. agr. Bachic.
Ser. II, 33 (3): 239-248

B. LAGOWSKA

Zoogeographical analysis of the scale insect fauna of Poland

Abstract - A list of 137 scale insects species from Poland, belonging to 9 families is presented. The species that occur in Poland can be divided to three groups: 1) species restricted to the Palearctic region (106 species, 77.4% of the total fauna), 2) species whose range is limited to 2-3 zoogeographical regions (22 species, 16.0% of the total fauna), 3) cosmopolitan species (9 species, 6.6% of the total fauna). The Palearctic species are divided into the following subgroups: a) species widely distributed in the Palearctic region (50% species, 47.2%), b) species distributed in two subregions (31 species, 29.2%), c) species restricted only to Euro-Siberian region (25 species, 23.6%). Among the latter, there are 12 species which occur only in a few countries. A brief comment is given on each group. The ratio of species per genera was also calculated.

Key words: Hemiptera, Coccoidea, zoogeography, Poland.

INTRODUCTION

The zoogeographical affinities of the Coccoidea of Poland have not yet been analyzed so far, excluding of some early considerations. However, those attempts were initiated when the fauna of Poland was not completely known (Zak-Ogaza 1979) or directed at separate regions of Poland (Koteja & Zak-Ogaza, 1983; 1989; Lagowska & Koteja, 1996).

The present paper considers the numbers of species that occur in Poland and relates them to different levels of zoogeographical units.

MATERIALS AND METHODS

The analyses were based on Koteja`s (1996) checklist supplemented by records until 2001. The introduced species living on ornamental plants in the greenhouses and homes that originated from the subtropical and tropical parts of the world are excluded from this analysis. The structure of families and genera and the data for the distribution of the species are according to the catalogues by Ben-Dov (1993; 1994), Kozár (1998)

and Miller & Gimpel (2000). The genera and species in table 1 are listed in an alphabetical order. While distinguishing particular zoogeographical elements, the division of Palearctic suggested by Emelyanov (1974) and applied by Kozár (1995, 1998) was used.

RESULTS

The Polish scale insect fauna includes 137 species in 62 genera and 9 families (Table 1), while Koteja (1996) reported 140 species and divided them among 75 genera and 14 families. The most abundant family is Pseudococcidae (50 species), Coccidae (33 species), Diaspididae (20 species) and Eriococcidae (19 species). The other families are represented by six Margarodidae, four Ortheziidae, two Kermesidae and Asterolecaniidae, one Cerococcidae species.

The average number of species per genera in Poland is 2.2:1 (Table 2), and this number is close to the ratio calculated for the Palearctic region (2.9:1) given by Kozár (1995). The ratio of species to genera differs between families with the highest ratio (6.3:1) being found in the Eriococcidae (Table 2). The species number per genera in Pseudococcidae is 2.4:1, and it is close to the mean of 2.0:1 for the Pseudococcidae in the Middle East, Japan and Central Europe (2.6:1) but lower than the averages for Australia (3.2:1), New Zealand (4.0:1) and California (5.5:1) (Ben-Dov, 1990). Also, the average number of species per genera for Coccidae in Poland is 2.4:1. This number is much lower than the average for the Coccidae in the Palearctic (5.2:1) given by Hodgson (1997). In Poland species-rich scale insect genera include *Eriococcus* (17 species), *Trionymus* (11 species) and *Diaspidiotus* (8 species).

Based on the distribution records of the species, the Polish scale insect fauna can be classified into three fundamental groups. The first one includes the species occurring exclusively in the Palearctic region (106 species, 77.4% of the fauna). This group can be divided into the following subgroups:

- species widely distributed in all three or four subregions of the Palearctic region. This is the dominant group constituting 50 species.
- species distributed in two subregions (31 species, 29.2% of the Palearctic elements) and the most numerous group (23 species) was composed of species that occur both in the Euro-Siberian and Mediterranean subregions. The small groups were represented by the species whose range is limited to the Euro-Siberian and Far-Eastern or to the Euro-Siberian and Irano-Turanian subregions.
- species restricted only to Euro-Siberian region. This group, comprising approximately 24% of the Palearctic elements, includes the species widely distributed in the whole region (13 species) and those that are distributed in only few countries. This latter group contains the following species: *Balanococcus singularis* (Schmutterer), *Boreococcus ingricus* Danzig, *Rhodania occulta* Schmutterer, *Saccharicoccus penium* Williams, *Trionymus phalaridis* (Green), all of these are known from three or four countries, and *Longicoccus festucae* (Koteja),

Table 1 - List of scale insects (Hemiptera, Coccoidea) recorded from Poland and their distribution in other zoogeographical regions. (ES - Euro-Siberian, M - Mediterranean, IT - Irano-Turanian, FE - Far Eastern subregions).

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Ortheziidae							
Arctorthezia cataphracta (Olafsson)	ES, M, IT, FE	+					
Newsteadia floccosa (De Geer)	ES, M						
Orthezia urticae (L.)	ES,M,IT,FE	+	+		+	+	
Ortheziola vejdovskyi Sulc	ES, M						
Margarodidae							
Matsucoccus pini (Green)	ES, M						
Nemargarodes festucae (Archangelskaya)	ES						
Palaeococcus fuscipennis (Burmeister)	ES,M,IT						
Porphyrophora polonica (L.)	ES						
Steingelia gorodetskia Nassonov	ES						
Xylococcus filiferus Löw ES, M							
Pseudococcidae							
Atrococcus cracens Williams	ES, M						
Atrococcus paludinus (Green)	ES,M,IT,FE						
Balanococcus boratynski Williams	ES, M						
Balanococcus lianae Koteja	ES						
Balanococcus singularis (Schmutterer)	ES						
Boreococcus ingricus Danzig	ES						
Brevennia pulveraria (Newstead)	ES				+		
Coccura comari (Künow)	ES,M,IT,FE						
Chaetococcus sulci (Green)	ES, IT						
Dysmicoccus balticus Koteja & Lagowska	ES						
Dysmicoccus walkeri (Newstead)	ES,M,IT,FE						
Euripersia europaea (Newstead)	ES,M,IT,FE						
Euripersia tomlini (Newstead)	ES,M,IT,FE						

(Table 1. continued)

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Heliococcus bohemicus Sulc	ES,M,IT,FE						
Heliococcus danzigae Bazarov	ES,M,FE						
Heliococcus slavonicus Borchsenius &Tereznikova	ES, IT						
Heliococcus sulci Goux	ES,M						
Heterococcus nudus (Green)	ES,M,IT	+					
Longicoccus festucae (Koteja)	ES						
Longicoccus psammophilus (Koteja)	ES,M,FE						
Metadenopus festucae Sulc	ES,FE						
Peliococcus balteatus (Green)	ES						
Peliococcus manifectus Borchsenius	ES,M, IT						
Peliococcopsis parvicerarius (Goux)	ES,M						
Phenacoccus aceris (Signoret)	ES,M,IT,FE	+					
Phenacoccus bicerarius Borchsenius	ES, IT						
Phenacoccus evelinae Tereznikova	ES, M, IT						
Phenacoccus hordei Lindeman	ES,M,IT						
Phenacoccus interruptus Green	ES,M,IT,FE						
Phenacoccus phenacoccoides (Kiritshenko)	ES,IT,FE						
Phenacoccus piceae (Löw)	ES,M,FE						
Planococcus vovae (Nassonov)	ES,M,IT		+				
Puto pilosellae Sulc	ES,M,IT,FE						
Puto superbus (Leonardi)	ES,M,IT,FE						
Rhodania occulta Schmutterer	ES						
Rhodania porifera Goux	ES,IT,FE						
Ripersiella halophilus (Hardy)	ES						
Saccharicoccus penium Williams	ES						
Spinococcus calluneti (Lindinger)	ES						

(Table 1. continued)

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Trionymus aberrans Goux	ES,IT,FE						
Trionymus hamberdi (Borchsenius)	ES,M,IT						
Trionymus isfarensis (Borchsenius)	ES,IT,FE						
Trionymus multivorus (Kiritchenko	ES,M,IT						
Trionymus newsteadi (Green)	ES,M,IT						
Trionymus perrisii (Signoret)	ES,M,IT,FE						
Trionymus phalaridis (Green)	ES						
Trionymus radicum (Newstead)	ES,M						
Trionymus subterraneus (Newstead)	ES,M,IT						
Trionymus thulensis Green	ES,FE						
Trionymus tomlini (Newstead)	ES,M,IT,FE						
Eriococcidae							
Cryptococcus fagisuga Lindinger	ES,M,IT						
Eriococcus aceris (Signoret)	ES,M,IT						
Eriococcus agropyri (Borchsenius)	ES,M,IT,FE						
Eriococcus brachypodii (Borchsenius & Danzig)	ES,M,IT						
Eriococcus cantium Williams	ES						
Eriococcus *danzigae* (Miller & Gimpel)	ES						
Eriococcus devoniensis (Green)	ES,M						
Eriococcus glyceriae Green	ES,M,IT,FE						
Eriococcus gouxi (Balachowsky)	ES,M						
Eriococcus greeni Newstead	ES,M,IT	+					
Eriococcus herbaceus (Danzig)	ES,M						
Eriococcus inermis Green	ES						
Eriococcus insignis Newstead	ES,M,IT	+					

(Table 1. continued)

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Eriococcus laeticoris (Tereznikova)	ES,FE						
Eriococcus munroi (Boratynski)	ES,M,IT						
Eriococcus podhalensis Dziedzicka & Koteja	ES						
Eriococcus pseudinsignis Green	ES,M						
Eriococcus spurius (Modeer)	ES,M,IT,FE	+					
Pseudochermes fraxini (Kaltenbach)	ES,M,IT						
Kermesidae							
Kermes quercus (L.)	ES,M,IT						
Kermes roboris (Fourcroy)	ES,M,IT						
Cerococcidae							
Cerococcus cycliger Goux	ES,M						
Coccidae							
Eriopeltis festucae (Fonscolombe)	ES,M,IT,FE	+					
Eriopeltis lichtensteini Signoret	ES						
Eriopeltis stammeri Schmutterer	ES,IT						
Eulecanium ciliatum (Douglas)	ES,M,FE						
Eulecanium douglasi (Sulc)	ES,M,IT,FE	+					
Eulecanium franconicum (Lindinger)	ES,M,IT,FE						
Eulecanium sericeum (Lindinger)	ES,M						
Eulecanium tiliae (L.)	ES,M,IT	+			+		
Lecanopsis festucae Borchsenius	ES,M,FE						
Lecanopsis formicarum Newstead	ES,M,FE						
Luzulaspis dactylis Green	ES,M						
Luzulaspis frontalis Green	ES						
Luzulaspis pieninica Koteja & Zak-Ogaza	ES						
Luzulaspis luzulae (Dufour)	ES,M						
Luzulaspis nemorosa Koteja	ES,M						
Luzulaspis scotica Green	ES						
Nemolecanium graniforme (Wünn)	ES,M						

(Table 1. continued)

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Palaeolecanium bituberculatum (Signoret)	ES,M,IT						
Parafairmairia bipartita (Signoret)	ES,M						
Parafairmairia gracilis Green	ES,M						
Parthenolecanium corni (Bouche)	ES,M,IT,FE	+	+		+		+
Parthenolecanium fletcheri (Cockerell)	ES,M,IT	+					
Parthenolecanium persicae (Fabricius)	ES,M,IT,FE	+	+		+	+	+
Parthenolecanium pomeranicum (Kawecki)	ES,M						
Parthenolecanium rufulum (Cockerell)	ES,M,IT						
Parthenolecanium smreczynskii (Kawecki)	ES						
Phyllostroma myrtilli (Kaltenbach)	ES,M	+					
Physokermes hemicryphus (Dalman)	ES,M,FE	+					
Physokermes piceae (Schrank)	ES,M	+					
Psiloccocus ruber Borchsenius	ES,FE						
Pulvinaria vitis (L.)	ES,M,IT,FE	+	+				+
Sphaerolecanium prunastri (Fonscolombe)	ES,M,IT,FE	+					
Vitacoccus longicornis (Green)	ES						
Asterolecaniidae							
Asterodiaspis variolosa (Ratzeburg)	ES,M,IT,FE	+	+	+		+	+
Planchonia arabidis Signoret	ES,M,IT	+				+	
Diaspididae							
Aulacaspis rosae (Bouche)	ES,M,IT,FE	+				+	+
Carulaspis juniperi (Bouche)	SE,M,IT	+					
Chionaspis salicis (L.)	ES,M,IT,FE				+		
Diaspidiotus alni (Marchal)	ES						
Diaspidiotus bavaricus (Lindinger)	ES,M						
Diaspidiotus gigas (Thiem&Gerneck)	ES,M,IT,FE	+					
Diaspidiotus marani (Zahradnik)	ES,M,IT						

(Table 1. continued)

Species	Geographic regions						
	Palearctic (subregions)	Nearctic	Neotropical	Ethiopian	Oriental	Australian	New Zealand and Pacific
Diaspidiotus ostreaeformis (Curtis)	ES,M,IT,FE	+	+			+	
Diaspidiotus perniciosus (Comstock)	ES,M,IT,FE	+	+	+	+	+	+
Diaspidiotus pyri (Lichtenstein)	ES,M,IT				+		
Diaspidiotus zonatus (Frauenfeld)	ES,M,IT						
Dynaspidiotus abietis (Schrank)	ES,M,IT						
Lepidosaphes conchiformis (Gmelin)	ES,M,IT,FE	+	+				
Lepidosaphes ulmi (L.)	ES,M,IT,FE	+	+			+	
Lepidosaphes juniperi Lindinger	ES,M,IT						
Lepidosaphes newsteadi (Sulc)	ES,M,IT						
Leucaspis loewi Colvee	ES,M,IT						
Leucaspis pini (Hartig)	ES,M,IT						
Parlatoria parlatoriae (Sulc)	ES,M,IT						
Rhizaspidiotus canariensis Lindinger	ES,M,IT,FE						

Table 2 - Number of scale insect species per genus in relation to families in Poland.

Family	Number of genus	Number of species	Ratio of species to genera
Ortheziidae	4	4	1:1
Margarodidae	6	6	1:1
Pseudococcidae	21	50	2.4:1
Eriococcidae	3	19	6.3:1
Kermesidae	1	2	2:1
Cerococcidae	1	1	1:1
Coccidae	14	33	2.4:1
Asterolecaniidae	2	2	1:1
Diaspididae	9	20	2.2:1
Total	61	137	2.2:1

Eriococcus podhalensis Dziedzicka & Koteja, *E. cantium* (Williams), *E. danzigae* (Miller & Gimpel), and *Dysmicoccus balticus* Koteja & Lagowska which are distributed in two countries. Only *Balanoccocus lianae* Koteja and *Parthenolecanium smreczynskii* (Kawecki) are known exclusively in Poland.

The second group is composed of the species whose range is limited to 2-3 zoogeographical regions. It comprises 16.0% of the total fauna and includes species which are found in the Palearctic as well as in the Nearctic, Neotropical or Oriental faunal regions, e.g. *Brevenia pulveraria* (Newstead) and *Chionaspis salicis* (L.) which occur in Palearctic and Oriental regions, *Planococcus vovae* (Nassonov) present in Palearctic and Neotropics, *Planchonia arabidis* Signoret, distributed in Palearctic, Nearctic and Australian regions. The group which is restricted to Holarctic region contains 15 species (10.9% of the total).

The last group is represented by 9 cosmopolitan species (6.6% of the total fauna). They are distributed in more than three regions. The following species are included in this groups: *Orthezia urticae* (L.), *Parthenolecanium corni* (Bouché), *P. persicae* (Fabricius), *Pulvinaria vitis* (L.), *Asterodiaspis variolosa* (Ratzeburg), *Lepidosaphes ulmi* (L.), *Aulacaspis rosae* (Bouche), *Diaspidiotus ostreaeformis* (Curtis), *Q. perniciosus* (Comstock). Several of them, e.g. *P. corni, A. variolosa, L. ulmi* are serious pests in Poland.

CONCLUSION

The Coccoidea species of Poland form three fundamental groups: 1) species restricted to the Palearctic region, 2) species whose range is limited to 2-3 zoogeographical regions, 3) cosmopolitan species. The analysis suggests that the Polish scale insects fauna is represented mainly by species which are restricted to Palearctic region. Almost half of them are widely distributed in this region, while relatively few species are known from only a few countries. Futher faunistic studies in region will contribute to explaining whether they are endemic.

The Polish scale insect fauna still needs more detailed studies. Some families and genera, e.g. Lecanodiaspididae, Aclerdidae, *Scythia*, *Poaspis*, *Exaeretopus*, *Rhizopulvinaria*, *Rhodococcus* are not represented in the Polish fauna, while they are present in East and West Europe.

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PROF. BOZENA LAGOWSKA - Department of Environmental Management, Bialystok Technical University, ul. S. Tarasiuka 2, 16-001 Kleosin, Poland.
E-mail: lagowska@cksr.ac.bialystok.pl, lagowska@consus.ar.lublin.pl