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OCCURRENCE OF *CHOREUTIS PARIANA* (CLERCK) (*LEPIDOPTERA*, *CHOREUTIDAE*) AND ITS PARASITOIDS IN APPLE ORCHARDS IN LUBLIN

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ABSTRACT

Studies on the occurrence of *Choreutis pariana* (Clerck), the qualitative structure of the parasitoid complex of this phytophagous species, as well as the level of its parasitization, were conducted in Lublin during the 1996-1998 period. As a result of the study 1,167 larvae and pupae of apple leaf skeletonizer were collected and counted; their numbers varied according to the study sites. At the site where pesticides were regularly applied only one pupa of this species was collected. Numbers of *Ch. pariana* population were reduced by 11 species of parasitic hymenopterans of the *Ichneumonidae* and *Braconidae* families and the *Chalcidoidea* hyperfamily. The dominant species was *Triclistus congener* Holmgr., its contribution to the whole complex of parasitoids was over 45%. Total parasitization of apple leaf skeletonizer larvae and pupae was nearly 25%.

Key words: apple leaf skeletonizer, apple tree, *Choreutis patiana*, *Hymenoptera – Parasitica*, *Lepidoptera*, parasitization

INTRODUCTION

Reports concerning the occurrence and biology of *Choreutis pariana* (Clerck) are very modest and were published in the 20s [3, 10] and the 30s of the 20th century [7]. Little information is also available on the parasitoid insect complex of this species. The only data in the Polish literature may be found in the reports by Minkiewicz [3] and Olszak [4], whereas the most complete list of parasitoids of this species was presented by Zajanckauskas et al. [11].

The aim of the study was to determine the intensity of occurrence of *Ch. pariana* and recognition of the qualitative structure of parasitoid insect complex of this phytophagous species and the determination of the level of its parasitization.

MATERIALS AND METHODS

The study was conducted in Lublin during 1996-1998. The material was collected at 5 study sites. The following 3 sites were located in the western part on the outskirts of the city: the Ethnographic Museum of Rural History, Maria Skłodowska Curie Botanical Garden, and a household garden. The fourth site was located in the centre of Lublin – a city centre garden. At these sites pesticides were not applied. The fifth site was at the Agricultural University Experimental Orchard situated in the eastern outskirts of the city and was regularly treated with pesticides. Three to seventeen apple trees were selected at random at each site. *Ch. pariana* larvae and pupae were collected from leaves within arm's length in the 10-14 day period between June-October. Collected 797 larvae and pupae were kept in an insectarium. Parasitic hymenopterans were identified by Prof. Bartłomiej Miczulski. The term *Hymenoptera-Parasitica* was adopted according to the keys edited by Medvedev (1978, 1981, 1986).

Photo 1. *Choreutis pariana* (Clerck) – larva

RESULTS

From 1996-1998, a total number of 1,167 *Ch. pariana* larvae and pupae were collected from all study sites, both on the outskirts and in the city centre of Lublin. During the entire study period this species occurred in the greatest numbers on apple trees growing on the area of the Ethnographic Museum of Rural History. The mean number of larvae and pupae on one tree ranged from 20-60 at this site. Among the sites where chemical treatments were not applied, the smallest numbers of *Ch. pariana* were observed on apple trees in the household garden in the 1998 growing season – 4 larvae and pupae on one tree, on average. In the orchard of the Agricultural University, where insecticides were regularly applied, only one pupa was collected (tab. 1).

Table 1. Numbers of *Choreutis pariana* (Clerck) larvae and pupae collected from apple trees; the 1996-1998 growing seasons, Lublin

Site & year		No. of trees examined	No. of larvae & pupae collected	Mean number of larvae & pupae on 1 tree
The Ethnographic Museum of Rural History	1996 1997 1998	5 9 6	279 541 118	55.8 60.1 19.7
Maria Skłodowska-Curie Botanical Garden	1997 1998	17 5	107 49	6.3 9.8
Household Garden	1997 1998	3 3	30 11	10.0 3.7
City Centre Garden	1996	6	31	5.2
Agricultural University Experimental Orchard	1996 1998	6 6	0 1	- 0.2

The presence of first generation larvae on apple tree leaves was noted at the end of May and the beginning of June, while the first empty cocoons were observed already in the first ten days of June on leaves. The first moths also emerged in the first ten days of June and until the beginning of July. The first larvae of the second generation were observed from the beginning of July, and moths emerged in August. The greatest number of the second generation larvae was noted at the end of July and the beginning of August. Larvae of the last generation were feeding from the last ten days of August until the middle of September, and the cocoons were noted as late as during the first ten days of October. The first moths from pupae of the third generation emerged at the beginning of September.

The numbers of *Ch. pariana* population was reduced by parasitic hymenopterans belonging to the *Ichneumonidae* and *Braconidae* families and the *Chalcidoidea* hyperfamily. The total parasitization of larvae and pupae by hymenopterans was nearly 25% during the 3 years of the study. This parasitization varied in individual years. It was only 10% in 1996; whereas in 1997 it was the highest – over 37% and in 1998 reached 28% (tab. 2). The level of parasitization at individual sites ranged from 16% in the city centre garden to over 26% in the Ethnographic Museum of Rural History (tab. 3). Parasitoids of the *Ichneumonidae* family reduced the numbers of *Ch. pariana* to the greatest level, over 20%. Parasitoids of the *Braconidae* family and the *Chalcidoidea* hyperfamily were less abudant. They parasitized about 2% of the *Ch. pariana* population. The contribution to the parasitization of parasitoids of the *Ichneumonidae* family varied in individual years. In 1997 it was the highest – nearly 31%, whereas in 1996 – only 8%. The contribution to the parasitization of parasitic hymenopterans of the *Braconidae* family in all the study years remained on a similar level – approximately 2%. The contribution to parasitization of parasitoids of the *Chalcidoidea* hyperfamily varied in the individual years and ranged from 0.6% in 1996 to over 4% in 1997 (tab. 2).

Table 2. Parasitization of larvae and pupae of *Choreutis pariana* (Clerck) in the 1996-1998 period

Year	Number of larvae & pupae	Parasitization of larvae & pupae by						Total parasitization	
		Ichneumonidae		*Braconidae*		*Chalcidoidea*			
		Number	%	Number	%	Number	%	Number	%
1996	310	24	7.7	6	1.9	2	0.6	32	10.4
1997	310	96	30.9	6	1.9	14	4.5	116	37.4
1998	177	44	24.8	3	1.7	3	1.7	50	28.2
Total	797	164	20.6	15	1.8	19	2.4	198	24.8

As a result of rearing of 797 *Ch. pariana* larvae and pupae, 8 *Ichneumonidae* species from 6 subfamilies, 2 *Braconidae* species from 2 subfamilies and 1 species of the *Chalcidoidea* hyperfamily were collected (tab. 4). Two species of parasitoids – *Gelis areator* Panz. and *Mesochorus* sp. are classified as hyperparasitoids. The first of the above-mentioned species may sporadically occur as the first-level parasitoid. The dominant species in the *Ch. pariana* parasitoids complex was *Triclistus congener* Holmgr. of the *Ichneumonidae* family. Its contribution to the whole complex of parasitoids was over 45% and it parasitized approximately 11% of the *Ch. pariana* population in the study period. The remaining 10 species parasitized nearly 14% of the population of *Ch. pariana* and the contribution of individual species to the complex of parasitoids varied from 0.1% to over 2% (tab. 4).

Table 3. Parasitization of larvae and pupae of *Choreutis pariana* (Clerck) at individul study sites the 1996-1998 growing seasons, Lublin

Site	No. of larvae & pupae		Total parasitization (%)
	in general	parasited	
The Ethnographic Museum of Rural History	629	165	26.2
Maria Skłodowska-Curie Botanical Garden	111	22	19.8
Household Garden	26	6	23.1
City Centre Garden	31	5	16.1

Table 4. Species of *Hymenoptera - Parasitica* emerged from larvae and pupae of *Choreutis pariana* (Clerck) the 1996-1998 growing seasons, Lublin

Species	Study sites				Total	Contribution to the parasitoid complex (%)	Contribution to parasitization (%)
	The Ethno-graphic Museum Of Rural History	Maria Skłodowska-Curie Botanical Garden	Household Garden	City Centre Garden			
Ichneumonidae							
Pimplinae							
**Itoplectis alternans* Grav.	12	1	0	0	13	6.4	1.6
**Itoplectis maculator* F.	2	1	0	0	3	1.5	0.4
**Scambus calobatus* Grav.	7	1	1	0	9	4.4	1.1
Gelinae							
*^*Gelis areator* Panz.	1	0	0	0	1	0.5	0.1
Campopleginae							
**Diadegma* sp.(*aff. Germanica* Horstm., *aff. rectificator* Aubert)	8	6	0	1	15	7.4	1.9
Mesochorinae							
^*Mesochorus* sp.	12	0	0	2	14	6.9	1.8
Ichneumoninae							
**Oiorhinus pallipalpis* Wesm.	16	0	1	0	17	8.4	2.1
Metopiinae							
**Triclistus congener* Holmgr.	76	13	3	0	92	45.3	11.5
Braconidae							
Microgasterinae							
**Apanteles longicauda* Wesm.	13	0	0	1	14	6.9	1.8
Doryctinae							
**Oncophanes laevigatus* Ratz. (syn. *O. lancedator* Nees.)	6 (1)	0	0	0	6 (1)	2.9	0.1
Chalcidoidea							
Pteromalidae							
Habrocytus semotus Walk.	17	0	1	1	19	9.4	2.4
Total	170	22	6	5	203 (198)	100	24.8

^hyperparasitoid
( ) – number of hosts parasitized
* parasitic hymenopterans reared from *Ch. pariana* are reported for the first time in Poland.

On the area of the Ethnographic Museum of Rural History, the greatest number of parasitic hymenopterans – 11species was noted; whereas their total number was 170. In the Botanical Garden, 5 species of parasitic hymenopterans and 22 individual insects were collected, while in the household and city centre gardens – only 4 species of parasitoids at each site. Their numbers were on a similar level – 5 and 6 individual insects respectively (tab. 3 and 4).

DISCUSSION

From the larvae of *Ch. pariana* present in the orchards in Lithuania, the most numerous complex of parasitic hymenopterans included 27 species, the majority of which belonged to the *Icheneumonidae* family [11]. In the presented studies, 11 species of parasitic hymenopterans were collected, 10 of which have already been reported by other authors, such as Minkiewicz [3], Zajanckauskas et al. [11] Olszak [4]. Only *Itoplectis maculator* F. was previously known as a parasite of *Swammerdamia pyrella* (Vill.) [2] and *Archips rosanus* (L.) [5].

In Poland, from this host species 7 species of *Hymenoptera-Parasitica* were identified [3, 4]. In own studies, among all species of parasitoids which were observed, 9 have not been previously reported in Poland from this host (tab. 4).

As a result of rearing of larvae and pupae of apple leaf skeletonizer, specimens of *Gelis sp.* and *Mesochorus sp.* of the *Ichneumonidae* family were also obtained, which are hyperparasitoids and were already reported from this host by Zajanckauskas et al. [11] and Olszak [4].

In present studies, in the complex of parasitoids of *Ch. pariana,* the dominant species was *Triclistus congener* Holmgr., which parasitized 11% of the host population and contributed to the complex of parasitoids over 45%. Presented results confirm the hypothesis of Szmidt [8] and Szujecki [9] that in the entomophagous insect complex one species may be of a considerable significance in the regulation of the numbers of the phytophagous species.

In available reports there are only few data concerning the level of parasitization of apple leaf skeletonizer. Olszak [4], quoting Kapustina, reported that the mean parasitization of larvae may reach 24%. The result of presented studies have provided similar data: the mean level of parasitization of the *Ch. pariana* larvae and pupae collected on apple trees growing in Lublin was nearly 25%.

The natural regulation of population of phytophagous insects depends largely on the effectiveness of their natural enemies, among which hymenopterans constitute a large group. This effectiveness is affected by both the features of the biology of an individual species and environmental conditions, such as: availability of plants for host insect species and suitable places for wintering for adults, and the presence of substitute insect hosts [4]. Environmental pollution, mainly due to industry and traffic, exerts a negative effect on beneficial insects occurring in the urban areas. The avoidance of polluted areas by parasitic hymenopterans was confirmed by Beiger and Woroszyło [1]. Environmental pollution in the studied area probably exerted a considerable influence on the numbers and effectiveness of parasitoids. Urban areas are the most strongly transformed anthropogenic environments, with traffic-related and industrial pollution being the primary cause of this transformation [6].

The level of parasitization, the number of species and density of parasitic hymenopterans varied at individual sites examined. The greatest diversity of parasitic hymenopterans were noticed in the Ethnographic Museum of Rural History. The level of parasitization was also the highest and reached 26%, compared to other sites. The variation in the occurrence of parasitoids, and therefore their contribution to parasitization, was influenced by the presence of host plants for the imagines of parasitoids. In the Ethnographic Museum of Rural History many types of flowering plants were growing near trees, which could be a source of nutrition for them, while at the remaining sites there were no flowering plants and the apple trees were surrounded by regularly mowed grass, vegetable plants or coniferous shrubs.

SUMMARY

During the period of the study (1996-1998), *Ch. pariana* occurred most numerously on apple trees growing in the Ethnographic Museum of Rural History and the level of parasitization was also the highest at this site.

In the orchard protected by insecticides during the two year period 1996 and 1998 only a single pupa of *Ch. pariana* was collected, which proved that number of the population of this phytophagous species was on a very low level.

The complex of parasitoids emerged from *Ch. pariana* comprised of 8 species of *Ichneumonidae*, 2 species of *Braconidae* and 1 species of *Pteromalidae,* while *Triclistus congener* Holmgr. was the dominant species in the complex of parsitoid insects.

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