SHILAP Revista de lepidopterología, 44 (174) junio 2016: 303-312 eISSN: 2340-4078 ISSN: 0300-5267
https://doi.org/10.57065/shilap.637

Parasitoids of *Phyllonorycter populifoliella* (Treitschke, 1833) on *Populus balsamifera* L. (Salicaceae) in western European Russia (Lepidoptera: Gracillariidae)

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Abstract

The assemblage of hymenopteran parasitoids associated with the poplar leaf blotch miner moth *Phyllonorycter populifoliella* (Treitschke, 1833) (Lepidoptera: Gracillariidae) developing on the Balsam Poplar (*Populus balsamifera* L., 1753) was studied in Izhevsk. The assemblage included 35 species of parasitoids belonging to the Eulophidae (Eulophinae, Entedoninae, and Tetrastichinae), Pteromalidae, Encyrtidae, Ichneumonidae, and Braconidae, with 18 species being reported as *Ph. populifoliella* parasitoids for the first time. *Sympiesis sericeicornis*, *Chrysocharis laomedon* and *Sympiesis gordius* were major elements of the assemblage. While *S. gordius* showed a confident negative correlation with the population density of the miner, none of the other two species had confident relationships with the population density of the host. Possible causes of the low efficacy of the parasitoid assemblage on *Ph. populifoliella* population are briefly outlined.
KEY WORDS: Lepidoptera, Gracillariidae, Hymenoptera, Eulophidae, parasitoids, *Phyllonorycter populifoliella*, Balsam Poplar, population dynamics, Russia.

Parasitoides de *Phyllonorycter populifoliella* (Treitschke, 1833) sobre *Populus balsamifera* L. (Salicaceae) en el oeste europeo de Rusia (Lepidoptera: Gracillariidae)

Resumen

Fue estudiado en Izhevsk la asociación de himenópteros parasitoides asociados al minador de hojas *Phyllonorycter populifoliella* (Treitschke, 1833) desarrollándose sobre el álamo balsemífero (*Populus balsamifera* L., 1753). La asociación de parasitoides incluyen 35 especies perteneciendo a los Eulophidae (Eulophinae, Entedoninae y Tetrastichinae), Pteromalidae, Encyrtidae, Ichneumonidae y Braconidae, con 18 especies que se citan por primera vez sobre *Ph. populifoliella*. *Sympiesis sericeicornis*, *Chrysocharis laomedon* y *Sympiesis gordius* fueron los más abundantes. Mientras que *S. gordius* mostraba una correlación negativa con la densidad de población del minador, ninguna de las otras dos especies estaban relacionadas con la densidad de la planta del minador. Se da una idea general de las posibles causas de la baja eficacia de las reunión de parasitoides sobre la población de *Ph. populifoliella*.
PALABRAS CLAVE: Lepidoptera, Gracillariidae, Hymenoptera, Eulophidae, parasitoides, *Phyllonorycter populifoliella*, álamo balsamífero, dinámica de poblaciones, Rusia.

Introduction

The poplar leaf blotch miner moth *Phyllonorycter populifoliella* (Treitschke, 1833) (Lepidoptera: Gracillariidae) is a typical Palaearctic species (DAVIS & DESCHKA, 2001) and a common element in the fauna of populated areas in the European Russia (POLEZHAEV, 1934; RUMYANTSEV, 1934; STROKOV, 1956; BELOVA, 1981, 1985; BELOVA & VORONTSOV, 1987; SULKHANOV, 1990, 1992; BONDARENKO, 2008; YEFREMOVA *et al.*, 2009, 2011; SELIKHOVKIN, 2010), Western Siberia (BARANNIK, 1979; GRODNITSKIY, 1997; KOLOMIETS & BOGDANOVA, 1992; BAKULIN, 2005; EREMEEVA, 2008; SELIKHOVKIN, 2010), Eastern Siberia (FROLOV, 1948; TOMILOVA, 1973; SELIKHOVKIN, 2010), and Far East (YURCHENKO, 2006).

Occasional outbreaks of the moth may last considerable length of time. Thus, the eruptive (>1 mine per leaf) density of the moth population was observed in 1969-1980 in some parks of Yekaterinburg (DANILOVA *et al.*, 1984). An outbreak of the miner in Moscow lasted from 1974-1989 (BELOVA, 1994).

Analysis of the taxonomic composition of parasitoids of *Ph. populifoliella* is fragmentary and represented in only few publications. Studied are some areas in Europe (FULMEK, 1962; BOUÈEK & ASKEW, 1968), the Caucasus (MIRZOYAN, 1977), Iran (ZARGARAN *et al.*, 2010; SADEGHI & LOTFALIZADEH, 2013), and Kyrgyzstan (ROMANENKO, 1959). In Russia, Moscow received the best coverage (POLEZHAEV, 1934; RUMYANTSEV, 1934; STROKOV, 1956; BELOVA, 1981, 1985; BELOVA & VORONTSOV, 1987; SULKHANOV, 1990, 1992). Some information exists for St. Petersburg (STROKOV, 1956), Ulyanovsk Region (YEFREMOVA *et al.*, 2009, 2011) and Maritime Territory (ALEEKSEEV *et al*., 2012).

According to published data, the assemblage of *Ph. populifoliella* parasitoids includes 48 species (Table 1). Representatives of Eulophidae constitute 82.6%, Ichneumonidae and Braconidae make up 6.5%, while Pteromalidae and Encyrtidae amount to 2.2%. The assemblage also includes unidentified species in the following genera: *Pteromalus* and *Eulophus* (RUMYANTSEV, 1934; FULMEK, 1962; ZARGARAN *et al.*, 2010), *Pnigalio* (MIRZOYAN, 1977; BELOVA, 1985; BELOVA & VORONTSOV, 1987; SULKHANOV, 1990, 1992), *Sympiesis* (MIRZOYAN, 1977; SULKHANOV, 1990, 1992), *Cirrospilus* (POLEZHAEV, 1934; RUMYANTSEV, 1934; FULMEK, 1962), *Derostenus* (ROMANENKO, 1959; FULMEK, 1962), *Chrysocharis* (BELOVA, 1981; SULKHANOV, 1990, 1992; FULMEK, 1962), *Tetrastichus* (POLEZHAEV, 1934; ROMANENKO, 1959), and *Mesochorus* (SULKHANOV, 1990, 1992).

All previous studies dealt with parasitoids of the poplar leaf blotch miner moth developing on the Black Poplar (*Populus nigra* L., 1753). Our research targeted the species composition of parasitoid assemblage of the poplar leaf blotch miner moth *Ph. populifoliella* developing on the Balsam Poplar (*Populus balsamifera* L., 1753) in Izhevsk and its role in the miner outbreak control. The natural distribution of the Balsam Poplar covers northern regions of the USA and almost entire Canada. In Russia, it naturally occurs only in the eastern Chukotka where it forms low shrubs (KATENIN, 1993). The Balsam Poplar is commonly used for planting green belts in European Russia (e.g., URAZGILDIN *et al.*, 1997; IGNATJEVA & KONECHNAYA, 2004; BUKHARINA *et al.*, 2012; MINGALEVA, 2012), the Urals, Western and Eastern Siberia (DANILOVA, 1970; BAKULIN, 1990; SELENINA *et al.*, 2011; SOKOLOVA *et al*., 2011; VOITYUK, 2011; RUNOVA & GNATOVICH, 2013).

Table 1.– Parasitoids of *Ph. populifoliella* based on published data.

Nº	Family	Species	Source
1	Pteromalidae	*Schimitschekia populi* Bouèek, 1965	ALEEKSEEV *et al*., 1978
2		*Halticoptera polita* (Walker, 1834)	SADEGHI & LOTFALIZADEH, 2013
3	Encyrtidae	*Ageniaspis testaceipes* (Ratzeburg, 1848)	ROMANENKO, 1959; ALEEKSEEV *et al.*, 1978; FULMEK, 1962
4	Eulophidae	*Pnigalio agraules* (Walker, 1839)	ALEEKSEEV *et al*., 1978; YEFREMOVA *et al.*, 2011; BOUČEK & ASKEW, 1968
5		*Pnigalio longulus* (Zetterstedt, 1838)	FULMEK, 1962; BOUČEK & ASKEW, 1968
6		*Pnigalio pectinicornis* (Linnaeus, 1758)	YEFREMOVA *et al.*, 2011; FULMEK, 1962; BOUČEK & ASKEW, 1968

7		*Pnigalio soemius* (Walker, 1839)	SULKHANOV 1990, 1992; YEFREMOVA *et al.*, 2011; BOUČEK & ASKEW, 1968
8		*Sympiesis acalle* (Walker, 1848)	SULKHANOV 1990, 1992; YEFREMOVA *et al.*, 2011; FULMEK, 1962; BOUČEK & ASKEW, 1968
9		*Sympiesis dolichogaster* Ashmead, 1888	ALEEKSEEV *et al.*, 1978; FULMEK, 1962; BOUČEK & ASKEW, 1968
10		*Sympiesis gordius* (Walker, 1839)	POLEZHAEV, 1934; BELOVA, 1981; SULKHANOV 1990, 1992; YEFREMOVA *et al.*, 2009, 2011; FULMEK, 1962; BOUČEK & ASKEW, 1968
11		*Sympiesis grahami* Erdös, 1966	ZARGARAN *et al.*, 2010
12		*Sympiesis sericeicornis* (Nees, 1834)	RUMYANTSEV, 1934; POLEZHAEV, 1934; STROKOV, 1956; BELOVA, 1981; SULKHANOV 1990, 1992; YEFREMOVA *et al.*, 2011; FULMEK, 1962; BOUČEK & ASKEW, 1968
13		*Sympiesis thapsianae* Bouèek, 1974	SULKHANOV 1990, 1992
14		*Sympiesis viridula* (Thomson, 1878)	YEFREMOVA *et al.*, 2011
15		*Sympiesis xanthostoma* (Nees, 1834)	FULMEK, 1962
16		*Euplectrus bicolor* (Swederus, 1795)	BOUČEK & ASKEW, 1968
17		*Cirrospilus diallus* Walker, 1838	YEFREMOVA *et al.*, 2011; BOUČEK & ASKEW, 1968
18		*Cirrospilus elegantissimus* Westwood, 1832	POLEZHAEV, 1934; STROKOV, 1956; ALEEKSEEV *et al.*, 1978; SULKHANOV 1990, 1992; YEFREMOVA *et al.*, 2011; FULMEK, 1962; BOUČEK & ASKEW, 1968
19		*Cirrospilus lyncus* Walker, 1838	BOUČEK & ASKEW, 1968
20		*Cirrospilus pictus* (Nees, 1834)	POLEZHAEV, 1934; STROKOV, 1956; FULMEK, 1962; BOUČEK & ASKEW, 1968; BELOVA, 1985; BELOVA & VORONTSOV, 1987; SULKHANOV 1990, 1992: ZARGARAN *et al.*, 2010
21		*Cirrospilus viticola* (Rondani, 1877)	BOUČEK & ASKEW, 1968
22		*Cirrospilus vittatus* Walker, 1838	POLEZHAEV, 1934; STROKOV, 1956; SULKHANOV 1990, 1992
23		*Elachertus artaeus* (Walker, 1839)	SULKHANOV 1990, 1992
24		*Elachertus charondas* (Walker, 1839)	POLEZHAEV, 1934
25		*Elachertus inunctus* Nees, 1834	SULKHANOV 1990, 1992
26		*Hyssopus nigritulus* (Zetterstedt, 1838)	SULKHANOV 1990, 1992
27		*Pediobius alcaeus* (Walker, 1839)	ALEEKSEEV *et al.*, 1978; SULKHANOV 1990, 1992; BOUČEK & ASKEW, 1968
28		*Pediobius saulius* (Walker, 1839)	BOUČEK & ASKEW, 1968
29		*Entedon chalybaeus* Ratzeburg, 1852	FULMEK, 1962
30		*Closterocerus trifasciatus* Westwood, 1833	POLEZHAEV, 1934; YEFREMOVA *et al.*, 2011; BOUČEK & ASKEW, 1968
31		*Chrysocharis albipes* (Ashmead, 1904)	YEFREMOVA *et al.*, 2011
32		*Chrysocharis collaris* Graham, 1963	YEFREMOVA *et al.*, 2011
33		*Chrysocharis eurynota* Graham, 1963	YEFREMOVA *et al.*, 2011
34		*Chrysocharis nautius* (Walker, 1846)	YEFREMOVA *et al.*, 2011

35		*Chrysocharis nephereus* (Walker, 1839)	POLEZHAEV, 1934; ALEEKSEEV *et al*., 1978; FULMEK, 1962; BOUČEK & ASKEW, 1968
36		*Chrysocharis nitetis* (Walker, 1839)	RUMYANTSEV, 1934; FULMEK, 1962
		Chrysocharis polyzo (Walker, 1839)	ZARGARAN *et al*., 2010
37		*Chrysocharis submutica* Graham, 1963	YEFREMOVA *et al*., 2011
38		Achrysocharoides altilis (Delucchi, 1954)	ALEEKSEEV *et al*., 1978; FULMEK, 1962; BOUČEK & ASKEW, 1968
39		*Achrysocharoides cilla* (Walker, 1839)	FULMEK, 1962; BOUČEK & ASKEW, 1968
40		*Minotetrastichus frontalis* (Nees, 1834)	POLEZHAEV, 1934; STROKOV, 1956; SULKHANOV 1990, 1992; YEFREMOVA *et al*., 2011; FULMEK, 1962
41		*Aprostocetus zosimus* (Walker, 1839)	FULMEK, 1962
42		*Sigmophora brevicornis* (Panzer, 1804)	FULMEK, 1962
43	Ichneumonidae	*Scambus signatus* (Pfeffer, 1913)	SULKHANOV 1990, 1992
44		*Itoplectis alternans* (Gravenhorst, 1829)	SULKHANOV 1990, 1992
45		*Itoplectis curticauda* (Kriechbaumer, 1887)	FULMEK, 1962
46	Braconidae	*Colastes braconius* Haliday, 1833	FULMEK, 1962
47		*Apanteles bicolor* (Nees, 1834)	BELOVA, 1981; TOBIAS *et al*., 1986; SULKHANOV 1990, 1992
48		*Pholetesor circumscriptus* (Nees, 1834)	ROMANENKO, 1959; BELOVA, 1981; TOBIAS *et al*., 1986; SULKHANOV 1990, 1992; ALEEKSEEV *et al*., 2012

Material and methods

The study was conducted in Izhevsk, the capital of the Udmurt Republic that occupies 42,100 km^2 in the Vyatka-Kama interfluve. Izhevsk (56º 51’ 00” N, 53º 13’ 59” E) is a large (333.2 km^2) city with population over 610,000.

The assessment of survival and parasitoid infestation rate of larvae and pupae of the first generation of the miner was done in the field in 2010. In various parts of the city (including both the centre and suburbs), forty-one Balsam Poplar trees (*P. balsamifera*) (Fig. 1) were selected with the infestation density of 0.4-20 mines per leaf. We divided the sample into two groups. Group I included leaves with miner density of 0-10 mines per leaf (22 trees); group II included leaves with miner density of 10-20 mines per leaf (19 trees).

During moth pupation, the average of 60 mined leaves was collected from first-order branches in the lower crown of the northern exposition of each tree. In total, 4338 mines were cut out with scissors and placed in labelled Petri dishes. Emerging moths and parasitoids were recorded daily. Over 2978 *Ph. populifoliella* and 345 parasitoid specimens were reared during the course of the study.

The following indicators were calculated: the density of the first-generation moths on each tree = (total number of mines on three branches in the lower crown) × (total number of leaves on these branches)$^{-1}$, as number of mines per 100 leaves; survival rate of pupae = (number of moths emerged from mines) × (total number of collected mines)$^{-1}$ × 100%; moth mortality rate caused by parasitoids = (total number of parasitoids) × (total number of collected mines)$^{-1}$ × 100% (ERMOLAEV *et al*., 2011).

The arithmetic mean and error were calculated in each case. The linear correlation (IVANTER & KOROSOV, 2011) was used for the statistical treatment of the material. The significance of differences between samples was estimated by Student’s *t*-test. Percentages were normalized by $\varphi=2\arcsin\sqrt{\chi}$ transformation.

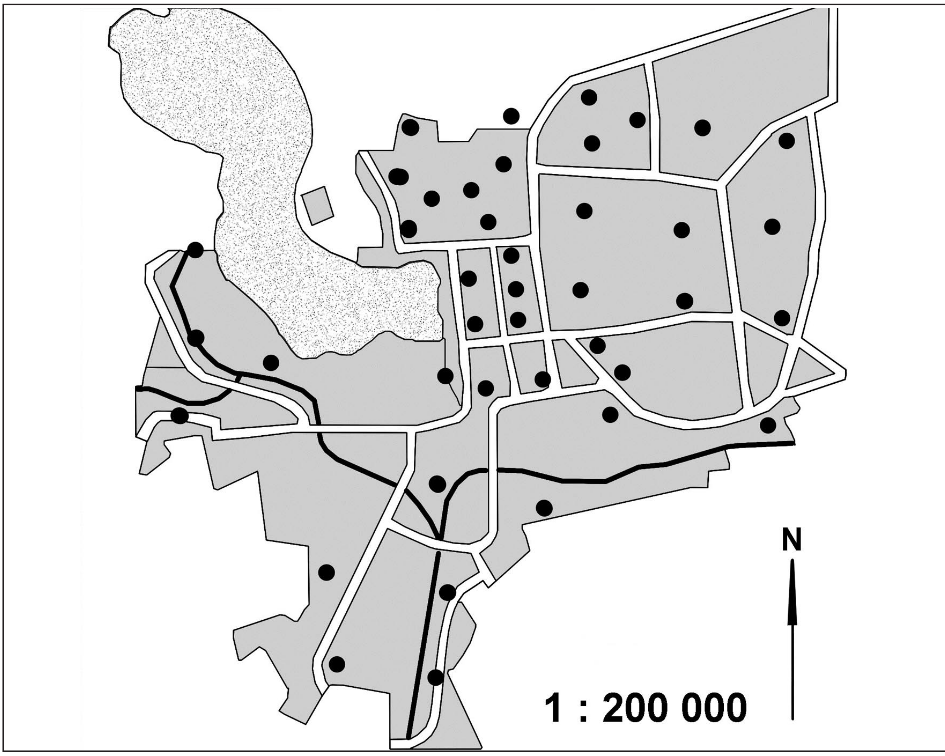

Figure 1.– Schematic distribution of 41 sampled balsam poplar trees (*Populus balsamifera* L.) in Izhevsk.

Results and discussion

The poplar leaf blotch miner moth gives periodical outbreaks in Izhevsk. The last one started in 2002 and ended by the autumn 2010 due to unusually hot weather.

The miner can produce two generations a year under the environmental conditions of Izhevsk (Table 2). Overwintering moths appear on poplar tree trunks by the time when leaves start unfolding (beginning of May), and copulate soon afterwards. Gravid females lay eggs between leaf veins, mainly on the lower surface. Caterpillars finish feeding by the end of June. The pupal stage lasts for about ten days. The mass eclosion of adults happens before or around mid-July. The second generation of the moth develops during August-September, and often does not complete its cycle die due to low temperatures. Adults overwinter in bark crevices, as well as in cracks and on uneven surfaces of nearby buildings.

Table 2.– Phenology of the poplar leaf blotch miner moth *Ph. populifoliella* in Izhevsk in 2010.

Month	**May**			**June**			**July**			**August**			**September**		
Decade	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Egg			+	+	+					+	+	+			
Caterpillar				+	+	+					+	+	+		
Pupa					+	+	+					+	+	+	
Adult	+	+	+	+			+	+	+	+	+			+	+

In the field lab, *Ph. populifoliella* moth eclosion was observed from 5-21 July, i.e. over 17 days (Fig. 2). The majority of adults emerged on 10 July. The survival rate of the first generation pupae was positively and confidently linked to the average density of the moth population (r=0.29, n=41, P<0.05) and constituted 63.7±2.7%.

The mortality rate of pupae was 36.3±2.7% and was in inverse relationship with the population density (r=-0.29, n=41, P<0.05). Mortality due to unknown causes constituted 29.0±2.6%, mortality caused by parasitoids was 7.3±0.7%.

In group I the total mortality is 38.5±2.9 % (7.7±1.0% due to parasitoid effect and 30.8±3.1% due to an unknown factor), and in group II the total mortality is 33.7±4.7% (6.8±0.9.0% due to parasitoids and 33.7±4.71% due to an unknown factor). Our results have demonstrated the absence of significant differences (P<0.05) between these parameters at variable miner density.

In the former case, the confident relationship with the population density of the miner was not established (r=-0.22, n=41, P>0.05); in the latter, the correlation was significantly positive (r=0.45, n=41, P<0.05). Coefficient of correlation between mortality and miner density per leaf in group I due to parasitoids is r=0.22 and due to an unknown factor is -0.10, and in group II due to parasitoids is -0.48 (P < 0.05) and due to an unknown factor is -0.37.

The emergence of parasitoids was observed from 5-23 July, with maximum numbers on 11 July (Fig. 2).

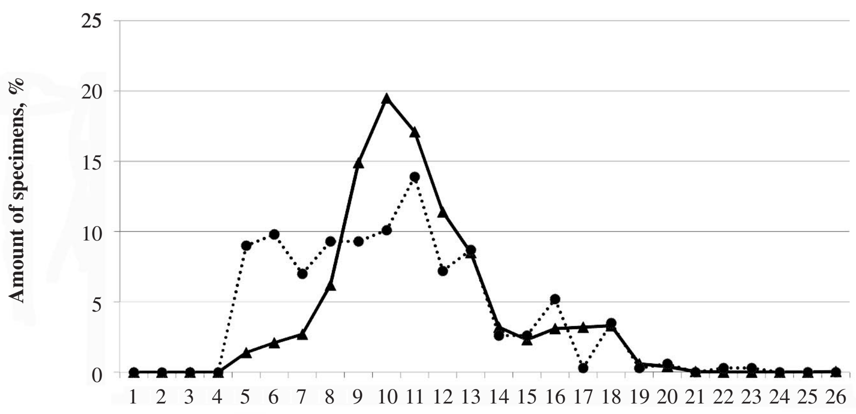

Figure 2.– Dynamics of *Ph. populifoliella* and its parasitoids eclosion in the field lab 2010.

Our study resulted in the discovery of 35 species of parasitoids belonging to three subfamilies of the Eulophidae (Eulophinae, Entedoninae, and Tetrastichinae), as well as to the families Pteromalidae, Encyrtidae, Ichneumonidae, and Braconidae (Table 3). Eighteen species have been reported as the miner parasitoids for the first time, viz *Pnigalio mediterraneus*, *Elachertus fenestratus*, *Elachertus gallicus*, *Elachertus* sp., *Pediobius metallicus, Chrysocharis amanus*, *Chrysocharis crassiscapus*, *Chrysocharis gemma*, *Chrysocharis laomedon*, *Chrysocharis pentheus*, *Chrysocharis phryne*, *Chrysocharis pubicornis*, *Chrysocharis prodice*, *Chrysocharis viridis*, *Chrysocharis* sp., *Neochrysocharis aratus*, *Neochrysocharis cuprifrons*, and *Neochrysocharis formosa.*

Table 3.– The share of *Ph. populifoliella* parasitoids. The asterisk denotes an ectoparasitoid. In all cases, n = 41.

Nº	Species	First recorded as parasitoid of *Ph. populifoliella*	Share, %
1	*Pnigalio mediterraneus* Ferriere & Delucchi, 1957*	+	0.6±0.6
2	*P. pectinicornis* (Linnaeus, 1758)*		0.5±0.3
3	*P. agraules* (Walker, 1839)*		1.4±0.8
4	*P. soemius* (Walker, 1839)*		1.7±0.9
5	*Sympiesis dolichogaster* Ashmead, 1888*		3.9±1.2
6	*S. gordius* (Walker, 1839)*		14.2±3.1
7	*S. sericeicornis* (Nees, 1834)*		22.6±3.3
8	*Cirrospilus diallus* Walker, 1838*		0.8±0.6
9	*C. elegantissimus* Westwood, 1832*		0.5±0.5
10	*C. lyncus* Walker, 1838*		0.3±0.3
11	*C. pictus* (Nees, 1834)*		0.5±0.5
12	*Elachertus charondas* (Walker, 1839)*		0.6±0.4
13	*E. fenestratus* Nees, 1834*	+	0.4±0.3
14	*E. gallicus* Erdös, 1958*	+	0.3±0.3
15	*Elachertus* sp.*	+	0.2±0.2
16	*Pediobius metallicus* (Nees, 1834)	+	0.5±0.4
17	*Closterocerus trifasciatus* Westwood, 1833		3.8±1.3
18	*Chrysocharis amanus* (Walker, 1839)	+	0.8±0.5
19	*Ch. crassiscapus* (Thomson, 1878)	+	0.8±0.5
20	*Ch. gemma* (Walker, 1839)	+	0.6±0.5
21	*Ch. eurynota* Graham, 1963		0.1±0.1
22	*Ch. laomedon* (Walker, 1839)	+	17.2±3.0
23	*Ch. nautius* (Walker, 1846)		1.3±0.5
24	*Ch. nephereus* (Walker, 1839)		0.6±0.3
25	*Ch. pentheus* (Walker, 1839)	+	2.6±0.8
26	*Ch. phryne* (Walker, 1839)	+	0.6±0.5
27	*Ch. pubicornis* (Zetterstedt, 1838)	+	3.9±1.0
28	*Ch. prodice* (Walker, 1839)	+	0.1±0.1
29	*Ch. submutica* Graham, 1963		4.1±1.2
30	*Ch. viridis* (Nees, 1834)	+	2.9±1.0
31	*Chrysocharis* sp.	+	0.1±0.1
32	*Neochrysocharis aratus* (Walker, 1838)	+	0.1±0.1
33	*N. cuprifrons* Erdös, 1954	+	2.3±1.0
34	*N. formosus* Weswood, 1833	+	0.7±0.4
35	*Minotetrastichus frontalis* (Nees, 1834)*		5.7±1.7
	Pteromalidae		0.9±0.6
	Encyrtidae		0.4±0.3
	Ichneumonidae		0.1±0.1
	Braconidae		1.3±0.9

The assemblage of *Ph. populifoliella* parasitoids was apparently formed by polyphages that actively attack various members of Gracillariidae, Nepticulidae, Tischeriidae, Tortricidae and some families of Coleoptera. Thus, fifteen species of parasitoids in Izhevsk are common for both the poplar leaf blotch miner moth and the lime leaf miner *Ph. issikii* Kumata, 1963 (ERMOLAEV *et al.*, 2011): *Pnigalio soemius*, *Sympiesis dolichogaster*, *S. gordius*, *S. sericeicornis*, *Cirrospilus diallus*, *C. lyncus*, *C. pictus*, *Elachertus fenestratus*, *Chrysocharis laomedon*, *Ch. nephereus*, *Ch. phryne*, *Ch. pubicornis*, *Neochrysocharis cuprifrons*, *N. formosa*, and *Minotetrastichus frontalis*. The ratio of ecto- and endoparasitoids in the parasitoid assemblage of *Ph. populifoliella* is 16:19 (Table 2).

The core of the parasitoid assemblage of the poplar leaf blotch miner moth in Izhevsk consists of *Sympiesis sericeicornis* (22.6%), *Chrysocharis laomedon* (17.2%) and *Sympiesis gordius* (14.2%). The species *S. sericeicornis* is a predominantly solitary primary or secondary ectoparasitoid of caterpillars and pupae of mining moths, including representatives of *Phyllonorycter* (BOUÈEK & ASKEW, 1968). *Chrysocharis laomedon* is a primary (sometimes secondary) solitary endoparasitoid, also favouring caterpillars and pupae of Gracillariidae moths (BOUÈEK & ASKEW, 1968). *Sympiesis gordius* is a solitary ectoparasitoid, which acts mostly as a primary parasite and infest caterpillars and pupae of a number of hymenopteran and lepidopteran families, favouring caterpillars of the genus *Phyllonorycter* (Gracillariidae) (BOUÈEK & ASKEW, 1968).

Neither *S. sericeicornis* nor *C. laomedon* had significant relationships with the population density of the host (r=-0.02, n=41, P>0.05 and r=0.13, n=41, P>0.05, correspondingly). Of the three species, only *S. gordius* showed a significant negative correlation of it's parasitism. Coefficient of correlation between mortality and the density of the miner in group I is -0.45 (P<0.05) and in group II is 0.20.

The absence of the effect of parasitoids on the population density of the miner is apparently a usual phenomenon in a large city. The negative correlation of the level of *Ph. populifoliella* parasitism and the average population density of the moth on unspecified species and hybrids of *Populus* had been shown for Moscow (SULKHANOV, 1995a). Inefficacy of parasitoids in centres of cities is complex and defined by at least three factors. First, this is destruction of natural overwintering sites by man. It is widely known that most parasitoids overwinter in leaf litter. Continuous collection, removal and destruction of fallen leaves results in decreasing number of entomophages. Second, this is an exceptionally low number of flowering plants that may provide additional food to parasitoids during the maturation of eggs. Third, a high level of the air pollution inevitably leads to shrinking of the parasitoid species diversity from the periphery to the city centre (SULKHANOV, 1995b).

Acknowledgements

Dr Sergey Sinev (Zoological Institution, Russian Academy of Sciences, St. Petersburg, Russia) is thanked for encouraging the study of hymenopteran parasitoids associated with the poplar leaf blotch miner moth in Udmurtia.

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(Recibido para publicación / *Received for publication* 8-XII-2014)
(Revisado y aceptado / *Revised and accepted* 2-VI-2015)
(Publicado / *Published* 30-VI-2016)