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Butterflies and moths (*Lepidoptera*) in urban habitats: II. The butterflies (*Rhopalocera*) of Warsaw

Abstract: 104 species of *Rhopalocera* (families: *Hesperiidae, Papilionidae, Pieridae, Lycaenidae* and *Nymphalidae*) have been recorded in Warsaw to date. Of these, 98 species were recorded in historical times. Recent records from Warsaw are not available for 30 of them, but they still occur in Poland. This group consists of: *P. serratulae, A. crataegi, C. palaeno, C. argiades, G. alexis, P. baton, M. arion, P. optilete, B. daphne, N. xanthomelas, E. aurinia, M. phoebe, M. aurelia,* and the migratory *N. vaualbum*, which is the only species not recorded from Poland since 1922. Contemporary records (1961 – onwards) list 75 species. Most of them (e.g. *P. brassicae, P. napi. P. rapae, A. cardamines, C. hyale, L. sinapis, I. io, G. rhamni, L. phlaeas, L. tityrus)* are common throughout the country, but some are regarded as rare (*I. podalirius, M. teleius*). Three species: *C. croceus, V. atalanta* and *V. cardui*, are more or less frequent visitors.

Key words: *Hesperiidae, Papilionidae, Pieridae, Lycaenidae, Nymphalidae, Lepidoptera*, urban habitats, Warsaw

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INTRODUCTION

While butterflies (*Rhopalocera*) are a well-researched taxon, little is known about their occurrence in urbanized habitats, especially in the past. Even though Warsaw (the city and its environs) is among the best-studied areas with respect to *Lepidoptera* fauna, no significant papers on the species composition of local *Rhopalocera* had been published until the end of the 19th century. The earliest contributions of value date back to the first half of the 20th century: a paper by Slastshevsky (SLASTSHEVSKY 1911), containing detailed data on the species composition of *Macrolepidoptera* in Warsaw and the then nearby towns, such as Pyry, Pomiechówek, Milanówek and Rembertów, and a paper by Patryn (PATRYN 1947), who conducted observations in Bielany, Grochów, Rembertów, Młociny – suburbs of Warsaw. Systematic studies of the species composition of butter-

flies in Warsaw were started only in 1986 as materials were collected for the Atlas of Distribution of Butterflies in Poland (BUSZKO 1997). Other research is being carried out, e.g. permanent monitoring of Lepidoptera fauna in the area of the Ursynów Escarpment, where a very rare species of *Lycaenidae* has been found (SIELEZNIEW 2001a) and the occurrence of the ecology of *Maculinea teleius* (SIELEZNIEW 2001b).

The present paper is based on data from relevant literature, the collections of the Museum and Institute of Zoology, PAS and previously unpublished materials collected by Adamczewski in the years 1963–1980 and by Winiarska in the years 1986–2001 in the centre of Warsaw. It contains a list of species recorded in Warsaw from historical times until 2001 accompanied with brief comments. It is the second part of a series of papers being prepared at the moment and aiming to show the species composition of communities of individual families of *Lepidoptera* occurring in urban habitats. Moreover, these publications will form a basis for a comprehensive monograph describing the process of colonization of urban habitats by *Lepidoptera* and changes that occur in communities of these insects under the influence of increasing anthropogenic pressure as the city develops.

The names and systematic arrangement of taxa at family level in Table 1 are based on the checklist of European *Lepidoptera* (KARSHOLT & RAZOWSKI 1996) with some modifications introduced to the Danish list (KARSHOLT & NIELSEN 1998) and adapted for the Polish checklist (BUSZKO & NOWACKI 2000). Two periods are distinguished (as in BUSZKO & NOWACKI 2000): early 19th century – 1960 (historical records) and from 1961 onwards (contemporary records). Data on the abundance of individual species, their biology and distribution in Europe have been excerpted from Buszko (BUSZKO & MASŁOWSKI 1993, BUSZKO 1997) and Romaniszyn (ROMANISZYN 1929).

SPECIES COMPOSITION

As many as 104 species of the families *Hesperiidae, Papilionidae, Pieridae, Lycaenidae* and *Nymphalidae* have been recorded in Warsaw to date, representing about 65% of the total number of *Rhopalocera* species ever reported from Poland (Table).

Historical records

98 species of *Rhopalocera* were registered in Warsaw during the historical period (Table). As many as 70% of these species can still be found in Warsaw. The remaining 30% have not been reported since 1960. One of them, *Nymphalis vaualbum*, has entirely disappeared from Poland.

The distribution range of *N. vaualbum* extends from Central-Eastern Europe to China. It has also been found in Canada and northern states of the USA. Migrating individuals of this species used to be observed in many regions of Poland, but it has most probably been absent from our country for several dozen years. *N. vaualbum* is associated with forest edge zones, forest clearings and tracks cutting through forests. The caterpillars feed on such deciduous trees as birch, willow, asp and elm.

The most numerous group of species no longer found in the Warsaw area includes those which still occur in other regions of Poland but are not abundant there, being

sometimes classified as rare or even threatened with extinction. Their habitat preferences are broadly diversified. These species include: *Pyrgus serratulae*, *Aporia crataegi*, *Colias palaeno*, *Cupido argiades*, *Glaucopsyche alexis*, *Pseudophilotes baton*, *Maculinea arion*, *Plebejus optilete*, *Brenthis daphne*, *Nymphalis xanthomelas*, *Euphydryas aurinia*, *Melitaea phoebe* and *M. aurelia*.

P. serratulae has been reported from few localities in central and southern Poland. It is a relatively rare and not abundant species. *A. crataegi* is found in various habitats (deciduous forests, rural environment, meadows) at scattered locations in north-eastern and southern Poland. *C. palaeno* is associated with bog-pine forests and raised bogs. It has insular distribution. Nowadays it is found in southern and eastern Poland. *C. argiades* used to occur throughout the country, but now can only be found in eastern and southern Poland on forest meadows, clearing and at forest edges. *G. alexis* occurs at very few sites in Poland on forest meadows and clearings. *P. baton* occurs on dunes with low-growing herbs and on dry forest meadows still present, at a few sites in upland areas in southern Poland. *M. arion* is reported from eastern and southern Poland and from an isolated site near Szczecin. It has become extinct in the western part of the country. *P. optilete* occurs in bog-pine forests and on raised bogs at scattered locations throughout the country. *B. daphne* can be found on forest meadows and clearings in north-eastern Poland, in the Noteć Primeval Forest and the Bieszczady Mountains. *N. xanthomelas* inhabits forest clearings and edges at a few sites in southern and eastern Poland. *E. aurinia* can be found in moors, wet meadows and forest clearings at a few sites in eastern Poland. The number of localities where it occurs has recently considerably decreased. *M. phoebe* sporadically invades Poland from the east. There is no established permanent population of this species in Poland (one individual was captured in the Białowieża Primeval Forest in 1987). *M. aurelia* inhabits wet forest meadows, forest clearings and forest edges. It has only been recorded at one site near Zawiercie.

Some of the species that have disappeared from Warsaw are still quite abundant in other areas, also throughout the country. They include, among others, *Coenonympha tullia*, a species found locally throughout the country and reaching relatively high abundances in characteristic habitats (wet meadows, sedge fields); *Hipparchia statilinus*, associated with coastal and inland dunes, dry pine forests and heather fields (known from scattered stands in central and northern Poland and is sometimes quite abundant); and *Aricia eumedon*, preferring wet forest meadows and clearings (an insular distribution, found most frequently in eastern and south-western Poland, sometimes at high abundances).

Contemporary records

The 75 species recorded in Warsaw in recent times represent about 46% of the species in this group of *Lepidoptera* found in Poland (Table). This group includes both species common to Poland and regarded as abundant everywhere, associated with particular habitats in open areas and forests (including species that migrate to Poland from the south of Europe) as well as rare species which are only sporadically reported from Poland and have special habitat preferences.

Table. Checklist of *Rhopalocera* occuring in Warsaw and Mazovia; L – larger colonies in the vicinity of Warsaw, M – migratory species, WA – whole area of Poland, AWA – almost whole area of Poland, PP – part of Poland, R - rare

No	Species	Period		Distribution in		Notes
		up to 1960	From 1961 to 2001	Mazovia	Poland	
1	2	3	4	5	6	7
	Hesperiidae					
	Pyrginae					
1	*Erynnis tages* (L.)	+	+	+	WA	
2	*Carcharodus alceae* (ESP.)	+	+	+	WA	
3	*Carcharodus floccifera* (ZELL.)			+	PP,R	
4	*Pyrgus carthami* (HBN.)	+		+	AWA	
5	*Pyrgus malvae* (L.)	+	+	+	WA	
6	*Pyrgus serratulae* (RAMB.)	+		+	PP	
7	*Pyrgus alveus* (HBN.)	+		+	PP	
	Heteropterinae					
8	*Heteropterus morpheus* (PALL.)	+	+	+	PP	
9	*Carterocephalus palaemon* (PALL.)		+	+	AWA	
10	*Carterocephalus silvicola* (MEIG.)		+	+	AWA	
	Hesperiinae					
11	*Thymelicus lineola* (OCHS.)	+	+	+	WA	
12	*Thymelicus silvestris* (PODA)	+	+	+	WA	
13	*Thymelicus acteon* (ROTT.)			+	PP	
14	*Hesperia comma* (L.)	+		+	WA	
15	*Ochlodes faunus* (TURATI)	+	+	+	WA	
	Papilionidae					
	Papilioninae					
16	*Iphiclides podalirius* (L.)	+	+	+	PP	L
17	*Papilio machaon* (L.)	+	+	+	WA	
	Pieridae					
	Dismorphinae					
18	*Leptidea sinapis* s.l.	+	+	+	WA	
	Pierinae					
19	*Anthocharis cardamines* (L.)	+	+	+	WA	
20	*Aporia crataegi* (L.)	+		+	PP	
21	*Pieris brassicae* (L.)	+	+	+	WA	
22	*Pieris rapae* (L.)	+	+	+	WA	
23	*Pieris napi* (L.)	+	+	+	WA	
24	*Pontia daplidice* (L.)	+	+	+	WA	
	Coliadinae					
25	*Colias palaeno* (L.)	+		+	PP,R	
26	*Colias croceus* (FOURC.)	+	+	+	PP	M
27	*Colias myrmidone* (ESP.)	+		+	PP	
28	*Colias hyale* (L.)	+	+	+	WA	
29	*Gonepteryx rhamni* (L.)	+	+	+	WA	

1	2	3	4	5	6	7
	Lycaenidae					
	Riodininae					
30	*Hamaeris lucina* (L.)	+		+	PP	
	Lycaeninae					
31	*Lycaena phlaeas* (L.)	+	+	+	WA	
32	*Lycaena helle* (DEN. et SCHIFF.)			+	PP,R	
33	*Lycaena dispar* (HAW.)	+	+	+	WA	
34	*Lycaena virgaureae* (L.)	+	+	+	WA	
35	*Lycaena tityrus* (PODA)	+	+	+	WA	
36	*Lycaena alciphron* (ROTT.)	+	+	+	WA	
37	*Lycaena hippothoe* (L.)	+	+	+	WA	
38	*Thecla betulae* (L.)	+	+	+	WA	
39	*Neozephyrus quercus* (L.)	+	+	+	WA	
40	*Callophrys rubi* (L.)	+	+	+	WA	
41	*Satyrium w-album* (KNOCH)	+	+	+	WA	
42	*Satyrium pruni* (L.)	+	+	+	AWA	
43	*Satyrium spini* (DEN. et SCHIFF.)	+		+	AWA	
44	*Satyrium ilicis* (Esp.)	+	+	+	AWA	
45	*Satyrium acaciae* (F.)	+		+	PP	
46	*Cupido argiades* (PALL.)	+		+	PP	
47	*Celastrina argiolus* (L.)	+	+	+	WA	
48	*Pseudophilotes baton* (BGSTR.)	+		+	PP	
49	*Pseudophilotes vicrama* (MOORE)			+	PP	
50	*Glaucopsyche alexis* (PODA)	+		+	PP,R	
51	*Maculinea arion* (L.)	+		+	PP,R	
52	*Maculinea teleius* (BGSTR.)		+	+	PP	
53	*Maculinea alcon* (DEN. et SCHIFF.)			+	PP,R	
54	*Maculinea nausithous* (BGSTR.)			+	PP, R	
55	*Plebejus argus* (L.)	+	+	+	WA	
56	*Plebejus idas* (L.)	+	+	+	WA	
57	*Plebejus argyrognomon* (BERG.)	+	+	+	WA	
58	*Plebejus optilete* (KNOCH)	+		+	PP	
59	*Aricia agestis* (DEN. et SCHIFF.)			+	WA	
60	*Aricia artaxerxes* (FABR.)			+	PP,R	
61	*Polyommatus semiargus* (ROTT.)	+	+	+	WA	
62	*Polyommatus amandus* (SCHN.)		+	+	PP	
63	*Polyommatus icarus* (ROTT.)	+	+	+	WA	
64	*Polyommatus eroides* (FRIV.)	+		+	PP,R	
65	*Polyommatus daphnis* (DEN. et SCHIFF.)			+	PP	
66	*Polyommatus bellargus* (ROTT.)	+		+	PP,R	
67	*Polyommatus coridon* (PODA)	+	+	+	WA	
	Nymphalidae					
	Heliconiinae					
68	*Argynnis paphia* (L.)	+	+	+	WA	
69	*Argynnis aglaja* (L.)	+	+	+	WA	
70	*Argynnis adippe* (DEN.et SCHIFF.)	+	+	+	WA	
71	*Argynnis niobe* (L.)	+		+	AWA	

1	2	3	4	5	6	7
72	*Argyronome laodice* (Pall.)			+	PP	
73	*Issoria lathonia* (L.)	+	+	+	WA	
74	*Brenthis ino* (Rott.)	+	+	+	WA	
75	*Brenthis daphne* (DEN. et SCHIFF.)	+		+	PP	
76	*Boloria euphrosyne* (L.)	+	+	+	AWA	
77	*Boloria selene* (DEN.et SCHIFF.)	+	+	+	WA	
78	*Boloria dia* (L.)	+	+	+	WA	
	Nymphalinae					
79	*Vanessa atalanta* (L.)	+	+	+	WA	M
80	*Vanessa cardui* (L.)	+	+	+	WA	M
81	*Inachis io* (L.)	+	+	+	WA	
82	*Aglais urticae* (L.)	+	+	+	WA	
83	*Polygonia c-album* (L.)	+	+	+	WA	
84	*Araschnia levana* (L.)	+	+	+	WA	
85	*Nymphalis antiopa* (L.)	+	+	+	WA	
86	*Nymphalis polychloros* (L.)	+	+	+	WA	
87	*Nymphalis xanthomelas* (ESP.)	+		+	PP	
88	*Nymphalis vaualbum* (DEN. et SCHIFF.)	+		+	-	
89	*Euphydryas maturna* (L.)			+	PP,R	
90	*Euphydryas aurinia* (ROTT.)	+		+	PP,R	
91	*Euphydryas cinxia* (L.)	+		+	AWA	
92	*Melitaea phoebe* (DEN. et SCHIFF.)	+		+	PP	
93	*Melitaea didyma* (ESP.)	+	+	+	PP	
94	*Melitaea diamina* (LANG)			+	AWA	
95	*Melitaea aurelia* NICK.	+		+	PP	
96	*Melithaea britomartis* ASSM.			+	PP	
97	*Melithaea athalia* (ROTT.)	+	+	+	WA	
	Limenitinae					
98	*Limenitis populi* (L.)	+	+	+	WA	
99	*Limenitis camilla* (L.)	+	+	+	WA	
	Apaturinae					
100	*Apatura ilia* (DEN. et SCHIFF.)	+	+	+	WA	
101	*Apatura iris* (L.)		+	+	WA	
	Satyrinae					
102	*Pararge aegeria* (L.)	+	+	+	WA	
103	*Lasiommata megera* (L.)	+	+	+	WA	
104	*Lasiommata maera* (L.)	+	+	+	WA	
105	*Lopinga achine* (SCOP.)			+	PP	
106	*Coenonympha tullia* (MULLER)	+		+	AWA	
107	*Coenonympha arcania* (L.)	+	+	+	WA	
108	*Coenonympha glycerion* (BKH.)	+	+	+	WA	
109	*Coenonympha hero* L.)			+	PP,R	
110	*Coenonympha pamphilus* (L.)	+	+	+	WA	
111	*Aphantopus hyperanthus* (L.)	+	+	+	WA	
112	*Maniola jurtina* (L.)	+	+	+	WA	
113	*Hyponephele lycaon* (ROTT.)	+	+	+	WA	
114	*Erebia medusa* (DEN. et SCHIFF.)	+	+	+	PP	

1	2	3	4	5	6	7
115	*Melanargia galathea* (L.)	+		+	WA	
116	*Minois dryas* (SCOP.)			+	PP	
117	*Hipparchia alcyone* (DEN. et SCHIFF.)	+	+	+	AWA	
118	*Hipparchia semele* (L.)	+	+	+	WA	
119	*Hipparchia statilinus* (HUFN.)	+		+	PP	

Species commonly occurring in Poland and reported from Warsaw include: *Pieris brassicae, P. napi. P. rapae, Anthocharis cardamines, Colias hyale, Leptidea sinapis, Inachis io, Gonepteryx rhamni, Lycaena phlaeas* and *L. tityrus*. Their presence is the result of their wide range of geographical distribution and high environmental tolerance. These butterflies can be found nearly everywhere, also in urbanized habitats. This groups also includes migrant species, such as *Vanessa cardui* or *V. atalanta*. Less abundant species that are also found throughout Poland include: *Papilio machaon, Colias croceus* (migrant species), *Thecla betulae, Satyrium ilicis, S. pruni, Callophrys rubi, L. alciphron* and *Celastrina argiolus*. Warsaw is also home to species regarded as rare and those who are only beginning to penetrate into urbanized habitats, including *Iphiclides podalirius* and *Maculinea teleius*. *I. podalirius* is distributed unevenly in Poland (more frequent in the southern part of the country), with larger colonies near Warsaw and in the Mazury Lake District. This species inhabits forest clearings, ruderal areas in cities, clumps of trees in agricultural landscape and in orchards. The caterpillars feed mostly on trees and bushes of the family *Rosaceae*. *M. teleius* has been reported from numerous sites in the south of Poland. It is associated with moist meadows, swamps and calcareous fens. The caterpillars feed on great burnet. Both species are legally protected in Poland. In an urban environment such as Warsaw, *I. podalirius* is found in ruderal areas, as near railway tracks and in belts of low-growing vegetation under high-voltage lines and *M. teleius* in wet suburbian areas.

CONCLUSIONS

Towns are home to many species of *Rhopalocera*. If the environs of a city represent a variety of habitat types and the urban greens include a large proportion of indigenous species, the *Lepidoptera* fauna is composed of ubiquitous species but will also include a considerable number of species with special habitat preferences. Since in the early 20th century Warsaw occupied a much smaller area, there were large belts of riverside carr along the Vistula river and natural vegetation was mostly preserved in the suburbs, the species composition of *Rhopalocera* was quite rich and varied (including a number of rare species). Over approximately the next 100 years, Poland's landscapes have been subject to considerable anthropogenic impact and Warsaw has become a big city, which has led to a reduction in the number of *Rhopalocera* species by 25–30%. A number of stenotopic species are absent from Warsaw now, though they still survive in other regions. The core of the *Lepidoptera* fauna is formed by ubiquitous and very abundant species which penetrate into the city's environment in search of food. Some can also reproduce in the city (including *Nymphalidae*, whose caterpillars feed on net-

tle, or *Pieridae*, feeding on common cruciferous plants). Since a large conurbation lacks spatial uniformity, ruderal areas afford survival of less abundant species, requiring specific plants to feed on, etc. If such sites are preserved, they support stable populations of rare species (e.g. *I. podalirius* on the outskirts of the part of Warsaw occupying the right bank of the Vistula river).

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STRESZCZENIE

[Tytuł: Motyle (*Lepidoptera*) w środowisku miejskim, na przykładzie Warszawy. II. Motyle dzienne (*Rhopalocera*)]

Informacje na temat występowania motyli dziennych w środowiskach zurbanizowanych, zwłaszcza w czasach historycznych, są skąpe. Dopiero w pierwszej połowie XX wieku opublikowano prace Slastshevskyego i Patryna, w których można znaleźć szczegółowe dane dotyczące składu gatunkowego motyli większych Warszawy i ówczesnych miejscowości podwarszawskich. Systematyczne badania składu gatunkowego motyli dziennych w Warszawie rozpoczęto dopiero w 1986 r. w ramach ATLASU ROZMIESZCZENIA MOTYLI DZIENNYCH W POLSCE. Prowadzone są też inne badania, np. monitoring motyli dziennych na Skarpie Ursynowskiej i badania nad występowaniem i ekologią *M. teleius*.

Niniejsze opracowanie powstało na podstawie danych z piśmiennictwa, danych pochodzących ze zbiorów znajdujących się w kolekcji Muzeum i Instytutu Zoologii

PAN oraz dotychczas niepublikowanych materiałów zbieranych przez Adamczewskiego (1963–1980) i Winiarską (1986–2001). Zawiera ono wykaz i krótką charakterystykę gatunków wykazanych z Warszawy od czasów historycznych do 2001 roku.

W Warszawie stwierdzono dotychczas występowanie 104 gatunków z rodzin *Hesperiidae, Papilionidae, Pieridae, Lycaenidae i Nymphalidae*, co stanowi ok. 65% ogólnej liczby gatunków *Rhopalocera* z Polski.

W czasach historycznych wykazano 99 gatunków *Rhopalocera*. W grupie tej aż 70% stanowią do dziś występujące w Warszawie. Po 1960 roku nie zanotowano 30% gatunków, w tym jednego – *Nymphalis vaualbum*, który zniknął już z obszaru naszego kraju.

Wśród gatunków niespotykanych już na terenie Warszawy najliczniejszą grupę stanowią te, które wprawdzie nadal występują w innych rejonach Polski, ale należą tam do nielicznych, rzadkich a nawet na krawędzi wymarcia. Są wśród nich: *Pyrgus serratulae, Aporia crataegi, Colias palaeno, Cupido argiades, Glaucopsyche alexis, Pseudophilotes baton, Maculinea arion, Plebejus optilete, Brenthis daphne, Nymphalis xanthomelas, Euphydryas aurinia, Melitaea phoebe* i *M. aurelia*.

Niektóre gatunki, które zniknęły już z Warszawy, nadal dość licznie występują na innych obszarach, także i w całym kraju, np. *Coenonympha tullia, Hipparchia statilinus* i *Aricia eumedon*.

W czasach współczesnych w Warszawie stwierdzono obecność 75 gatunków *Rhopalocera*. Sa wśród nich zarówno gatunki pospolite w naszym kraju (np: *Pieris brassicae, P. napi. P. rapae, Anthocharis cardamines, Colias hyale, Leptidea sinapis, Inachis io, Gonepteryx rhamni, Lycaena phlaeas, L. tityrus*), jak i mniej licznie, jednak występujące na terenie całej Polski (np.: *Papilio machaon, Colias croceus, Thecla betulae, Satyrium ilicis, S. pruni, Callophrys rubi, L. alciphron, Celastrina argiolus*). Spotykamy tu także gatunki rzadkie (np. *Iphiclides podalirius* i *Maculinea teleius*).