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NOCTUID MOTH (*LEPIDOPTERA, NOCTUIDAE*) COMMUNITIES IN URBAN PARKS OF WARSAW

ABSTRACT

A total of 40 noctuid moth species were recorded in four parks of Warsaw. Respective moth communities consisted of a similar number of species (17–25), but differed in their abundance index (3.5–7.9). In all the parks, the dominant species were *Autographa gamma* and *Discrestra trifolii*. The subdominant species were represented by *Acronicta psi*, *Trachea atriplicis*, *Mamestra suasa*, *Mythimna pallens*, and *Catocala nupta*. There were differences in the species composition and dominance structure among noctuid moth communities in urban parks, suburban linden-oak-hornbeam forest, and natural linden-oak-hornbeam forest. In the suburban and natural linden-oak-hornbeam forests, the number of species was higher by 40% and their abundance was 5–9 times higher than in the urban parks. The species predominating in parks occurred in very low numbers in suburban and natural habitats. Only *T. atriplicis* belonged to the group of most abundant species in all the habitats under study.

INTRODUCTION

In recent years, the interest of ecologists in urban habitats has been increasing as they proved to be rich in plant and animal species.

The vegetation of urban green areas is sufficiently well known since its species composition and spatial structure are shaped by gardening treatment. But the fauna of these areas is poorly known, and regular zoological investigations in urban green areas were started not so long ago, when urban green was recognized as one of the most important factors of the urban "natural" habitat (Ciborowski 1976).

In Warsaw, regular zooceonological studies have been carried out in various types of urban green areas over the last few years. Data on many animal groups, mostly invertebrates, were collected. One of these groups were noctuid moths.

The species composition of noctuid moths occurring in Warsaw was described earlier (Winiarska 1982), and this paper is focused on the structure of noctuid moth communities in Warsaw parks as compared to their communities living in suburban and natural habitats of the Mazovian Lowland.

The earlier faunal studies on noctuid moths of central Poland were mostly concentrated in the Mazovian Lowland and were carried out only in Warsaw (Slaszczewskij 1911, Adamczewski 1949, 1951, 1964, Winiarska 1982) and its surroundings (Kreczmer 1910, 1911, Kremsky 1924, Adamczewski 1936, 1937, 1950, 1962, 1966, Patryn 1937, 1939, 1947, Winiarska 1981, 1982). Unfortunately, most of these papers go back to the times when the interest of research workers was focused on preparing a possibly complete list of species and not on investigating their abundance. The only paper of a zoocoenological character analyses noctuid moth communities occurring in different habitats of a peripheral district of Warsaw, Białołęka Dworska (Winiarska 1981).

STUDY AREAS, METHODS, MATERIAL

The material was collected from the study plots situated in green complexes of Warsaw parks. The term green complex is used for a park, sometimes with adjacent streetside green.

Four such complexes were under study: the Łazienki Park (a streetside plot at Ujazdowskie Avenue and plot II in the park, the park at the Cemetery of Soviet Soldiers (a streetside plot at Żwirki i Wigury Avenue, and plots I and II in the park), the Saxon Garden (plots I, II, III), the Praski Park (plots I and II).

A detailed description and phytosociological characteristics of the parks and plots are given by Kubicka et al. (1985).

The control habitats comprised a suburban linden-oak-hornbeam forest (*Tilio-Carpinetum*) at Białołęka Dworska and a natural forest of the same type in the Jaktorowska Forest near the village of Hamernia. The linden-oak-hornbeam forest is the potential plant community for most of the Warsaw are. The suburban forest is described by Bańkowska and Garbarczyk (1981) and the natural forest by Nowakowski (1981).

The study in urban green areas of Warsaw was conducted in 1974—1978. The basic material was collected with Moericke's traps suspended on trees, mostly lindens. On each plot, three trees were chosen and three traps were placed on each. Insects were removed from the traps at 5 and 10 day intervals alternately, from May to October each year. More than 600 adult noctuid moths were collected.

Using the same method in the suburban and natural habitats, about 2,700 adult noctuid moths were collected in 1976—1977, including 700 individuals in the linden-oak-hornbeam forest at Białołęka Dworska and 2,000 individuals in the Jaktorowska Forest.

The material obtained by additional methods (Barber's pitfall traps, sweep-net) was scarce and it is not included the present analysis. The methods used for collecting urban fauna are described by Czechowski and Mikołajczyk (1981).

The species composition of noctuid moth communities and the abundance of

individual species occurring in urban, suburban, and natural habitats are shown in Table 1 (taxonomic order after Forster and Wohlfahrt 1971). Abundance index was calculated as the number of individuals caught over 10-day periods in ten Moericke's traps.

For constant species from urban park complexes, that is, occurring in at least three out of four complexes, zoogeographical ranges are given, along with their food and habitat preferences (after Hruby 1964). Unpublished data by Kostrowicki were used in the descriptions of the relationships between individual species and different plant communities of Poland.

The similarity of noctuid moth communities was characterized by the Sörensen index (after Trojan 1975), Morisita index (after Horn 1966) and species richness index[1].

COMMUNITY CHARACTERISTICS

A total of 40 species was recorded from the urban parks under study (Tab. 1). Only six of them occurred in all these parks. They comprised *Scotia segetum*, *Amathes c-nigrum*, *Discestra trifolii*, *Mythimna suasa*, *Mythimna pallens*, and *Autographa gamma*. Two of them, *D. trofolii* and *A. gamma*, were recorded from all the study plots. They belong to the dominant species in urban green areas of Warsaw.

The Łazienki Park. The noctuid moth community occurring in is green complex was made up of 25 species, of which 23 species were recorded from the park and only 11, from the streetside plots. The mean abundance index of the community was 4.15 On the park plot, its value was twice as high as on the streteside plot (Tab. 1).

The most abundant species in the Łazienki Park was *Autographa gamma*. Their abundance on the two plots was similar, but their proportions varied from 16.9% of the community in the park to 40.9% at the street, being 23.8% on the average (Tabs 1 and 2).

A. gamma belongs to the most common species of the family *Noctuidae*. It occurs throughout Poland and Holarctic. In Poland it was recorded from spring to late autumn (two generations). This is a typical eurybiont inhabiting open areas such as dry and moist meadows and croplands (in the years of outbreaks this is a crop pest), and also coniferous and broad-leaved forests. Larvae feed on herbaceous plants, but in the years of outbreaks they may also forage on trees, including fruit trees. Adults are active during the day and also at night.

The abundance of the next most abundant species in the Łazienki Park, *Discestra trifolii*, was twice as high in the park as at the street (0.87 and 0.37, respectively). No differences were observed, however, in its proportion between the two plots, which was about 15% (Tabs. 1 and 2, Fig. 1).

[1] $d = \frac{S}{\sqrt{n}}$, where S is the number od species and n is the index of commnuity abundance.

Table 1. Occurrence and abundance of noctuid moths in natural and suburban habitats, and in

No.	Habitat location, plot / Species	Natural (Jaktorowska Forest)		Suburban (Białołęka Dworska)		Łazienki Park			
						Ujazdowskie Ave		II	
		n	%	n	%	n	%	n	%
1	2	3	4	5	6	7	8	9	10
1	*Euxoa tritici* (L.)	—	—	0.03	+	—	—	—	—
2	*Euxoa nigricans* (L.)	—	—	0.05	+	—	—	—	—
3	*Scotia segetum* (Schiff. et Den.)	0.59	1.4	0.69	3.0	0.23	9.7	0.13	2.1
4	*Scotia exclamationis* (L.)	1.44	3.3	1.09	4.7	—	—	0.13	2.1
5	*Scotia ipsilon* (Hufn.)	—	—	0.09	+	—	—	—	—
6	*Noctua pronuba* (L.)	2.67	6.2	0.20	+	—	—	0.17	2.9
7	*Noctua orbona* (Hufn.)	—	—	0.03	+	—	—	—	—
8	*Noctua fimbriata* Schreber	0.03	+	—	—	—	—	—	—
9	*Noctua ravida* (Schiff. et Den.)	0.02	+	—	—	—	—	—	—
10	*Graphiphora augur* (Fabr.)	0.02	+	—	—	—	—	—	—
11	*Diarsia mendica* (Fabr.)	0.03	+	—	—	—	—	—	—
12	*Diarsia brunnea* (Schiff. et Den.)	0.38	+	—	—	—	—	—	—
13	*Diarsia rubi* (Vw.)	—	—	—	—	—	—	—	—
14	*Amathes c-nigrum* (L.)	—	—	0.26	1.1	0.1	4.2	0.07	1.2
15	*Amathes triangulum* (Hufn.)	1.95	4.5	0.06	+	—	—	—	—
16	*Amathes xanthographa* (Shiff. et Den.)	—	—	0.08	+	—	—	—	—
17	*Eurois occulata* (L.)	—	—	0.06	+	—	—	—	—
18	*Anaplectoides prasina* (Schiff. et Den.)	2.20	5.1	—	—	—	—	—	—
19	*Discestra trifolii* (Hufn.)	0.10	+	0.06	+	0.37	15.6	0.87	14.7
20	*Polia hepatica* (Cl.)	0.02	+	—	—	—	—	—	—
21	*Polia nebulosa* (Hufn.)	2.90	6.7	0.20	+	—	—	—	—
22	*Mamestra brassicae* (L.)	0.47	1.1	0.43	1.9	—	—	—	—
23	*Mamestra persicariae* (L.)	0.10	+	1.34	5.8	—	—	—	—
24	*Mamestra w-latinum* (Hufn.)	0.02	+	0.05	+	—	—	—	—
25	*Mamestra thalassina* (Hufn.)	0.15	+	—	—	—	—	—	—
26	*Mamestra suasa* (Schiff. et Den.)	—	—	0.29	1.2	—	—	0.07	1.2
27	*Mamestra oleracea* (L.)	0.05	+	0.43	1.9	—	—	0.13	2.1
28	*Orthosia cruda* (Schiff. et Den.)	0.11	+	—	—	—	—	—	—
29	*Orthosia incerta* (Hufn.)	0.06	+	—	—	—	—	—	—
30	*Mythimna turca* (L.)	0.06	+	0.01	+	—	—	—	—
31	*Mythimna conigera* (Schiff. et Den.)	—	—	0.03	+	—	—	—	—
32	*Mythimna ferrago* (Fabr.)	0.02	+	0.16	+	—	—	—	—
33	*Mythimna albipuncta* (Schiff. et Den.)	0.03	+	0.12	+	0.13	5.5	0.23	3.9
34	*Mythimna pallens* (L.)	0.05	+	0.44	1.9	0.07	3.1	0.30	5.1
35	*Mythimna l-album* (L.)	—	—	—	—	—	—	—	—
36	*Amphipyra pyramidea* (L.)	1.96	4.5	0.84	3.6	—	—	—	—

park complexes of Warsaw; n—abundance index, +—proportion less than 1%

Urban parks (Warsaw)															
Cemetery of Soviet Soldiers						Saxon Garden						Praski Park			
Żwirki i Wigury Ave		I		II		I		II		III		I		II	
n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.07	3.1	—	—	—	—	0.20	6.4	—	—	0.10	2.8	—	—	—	—
—	—	0.35	3.8	—	—	0.24	7.6	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	0.10	2.8	—	—	—	—
—	—	0.50	5.4	0.80	6.5	—	—	—	—	—	—	—	—	0.35	4.4
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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0.07	3.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.05	2.4	—	—	0.07	+	0.30	9.5	—	—	—	—	0.35	10.2	—	—
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0.32	14.4	0.25	2.7	2.10	17.1	1.20	38.2	0.10	2.7	0.20	5.6	0.90	26.1	0.52	6.5
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0.30	13.5	0.20	2.2	0.15	1.2	0.10	3.2	0.20	5.3	0.30	8.3	—	—	0.81	10.1
—	—	0.25	2.7	—	—	—	—	—	—	—	—	—	—	—	—
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0.07	3.1	1.05	11.4	1.32	10.7	0.10	3.2	0.10	2.7	0.20	5.6	0.20	5.8	—	—
—	—	0.50	5.4	0.7	5.7	0.10	3.2	0.20	5.3	0.20	5.6	—	—	—	—
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0.25	11.3	0.15	1.6	—	—	—	—	—	—	—	—	—	—	—	—
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0.07	3.1	—	—	—	—	—	—	—	—	—	—	0.34	9.9	0.4	5.0
—	—	0.92	10.0	1.12	9.1	0.10	3.2	0.10	2.7	0.10	2.8	—	—	0.9	11.3
—	—	0.20	2.2	0.25	2.0	—	—	—	—	0.10	2.8	0.35	10.2	0.17	2.1
—	—	—	—	0.07	0.6	—	—	—	—	—	—	—	—	—	—

1	2	3	4	5	6	7	8	9	10
37	*Amphipyra tragopoginis* (L.)	0.17	+	–	–	–	–	–	–
38	*Dipterygia scabriuscula* (L.)	0.23	+	0.30	1.3	–	–	0.07	1.2
39	*Rusina ferruginea* (Esp.)	0.07	+	0.30	1.3	–	–	–	–
40	*Talpophila matura* (Hufn.)	–	–	0.12	+	–	–	–	–
41	*Trachea atriplicis* (L.)	6.42	14.8	3.97	17.1	0.10	4.2	0.67	11.3
42	*Euplexia lucipara* (L.)	0.42	+	0.12	+	–	–	–	–
43	*Ipimorpha subtusa* (L.)	0.09	+	–	–	–	–	–	–
44	*Enargia paleacea* (Esp.)	0.15	+	0.02	+	–	–	–	–
45	*Enargia ipsilon* (Shiff. et Den)	0.02	+	–	–	–	–	–	–
46	*Cosmia affinis* (L.)	–	–	–	–	–	–	–	–
47	*Cosmia trapezina* (L.)	6.20	14.3	3.57	15.4	0.10	4.2	0.17	2.9
48	*Cosmia pyralina* (Schiff. et Den.)	–	–	0.03	+	–	–	–	–
49	*Apamea monoglypha* (Hufn.)	4.69	10.8	1.70	7.32	0.10	4.2	–	–
50	*Apamea lithoxylea* (Schiff. et Den.)	–	–	0.90	+	–	–	–	–
51	*Apamea sublustris* (Esp.)	0.14	+	–	–	–	–	–	–
52	*Apamea crenata* (Hufn.)	0.07	+	–	–	–	–	–	–
53	*Apamea furva* (Schiff. et Den.)	–	–	0.03	+	–	–	–	–
54	*Apamea remissa* (Hbn.)	0.16	+	0.09	+	–	–	–	–
55	*Apamea pabulatricula* (Br.)	0.15	+	–	–	–	–	–	–
56	*Apamea anceps* (Schiff. et Den.)	0.14	+	0.05	+	–	–	–	–
57	*Apamea sordens* (Hufn.)	0.07	+	0.08	+	–	–	–	–
58	*Apamea scolopacina* (Esp.)	0.09	+	–	–	–	–	–	–
59	*Oligia ophiogramma* (Esp.)	0.11	+	–	–	–	–	–	–
60	*Oligia strigilis* (L.)	0.07	+	0.06	+	–	–	–	–
61	*Oligia latruncula* (Shiff. et Den.)	0.44	+	0.50	2.2	–	–	–	–
62	*Miana furuncula* (Schiff. et Den.)	0.13	+	0.19	+	–	–	–	–
63	*Mesapamea secalis* (L.)	3.43	7.90	0.25	+	–	–	–	–
64	*Amphipoea fucosa* (Tr.)	–	–	1.20	5.2	–	–	0.23	3.9
65	*Celaena leucostigma* (Hbn.)	–	–	0.02	+	–	–	0.13	2.1
66	*Archanara geminipuncta* (Haw.)	–	–	–	–	0.10	4.2	–	–
67	*Meristis trigrammica* (Hufn.)	–	–	0.03	+	–	–	–	–
68	*Hoplodrina alsines* (Brahm.)	–	–	0.02	+	–	–	–	–
69	*Hoplodrina blanda* (Schiff. et Den.)	0.06	+	0.08	+	–	–	–	–
70	*Hoplodrina ambigua* (Schiff. et Den.)	–	–	–	–	–	–	0.07	1.2
71	*Caradrina morpheus* (Hufn.)	–	–	0.02	+	–	–	–	–
72	*Caradrina clavipalpis* (Scop.)	–	–	0.02	+	–	–	–	–
73	*Lithophane socia* (Hufn.)	–	–	0.04	+	–	–	–	–
74	*Griposia aprilina* (L.)	0.03	+	–	–	–	–	–	–
75	*Eupsilia transversa* (Hufn.)	–	–	–	–	–	–	0.17	2.9
76	*Conistra vaccinii* (L.)	0.18	+	–	–	–	–	–	–
77	*Agrochola circellaris* (Hufn.)	0.01	+	–	–	–	–	–	–
78	*Agrochola litura* (L.)	–	–	0.09	+	–	–	–	–
79	*Cirrhia gilvago* (Shiff. et Den.)	–	–	–	–	–	–	–	–
80	*Cirrhia fulvago* (Cl.)	–	–	0.04	+	–	–	–	–

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0.25	11.3	1.10	11.9	0.55	4.5	—	—	—	—	—	—	—	—	1.10	·13.8
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—	—	0.65	7.0	1.05	8.5	—	—	0.20	5.3	—	—	—	—	—	—
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—	—	—	—	1.05	8.5	—	—	0.10	2.7	—	—	—	—	—	—
—	—	—	—	—	—	0.10	3.2	0.20	5.3	0.20	5.6	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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0.07	3.1	—	—	—	—	—	—	—	—	—	—	0.35	10.2	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.25	3.1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	0.20	2.2	0.47	3.8	—	—	—	—	0.20	5.6	—	—	0.25	3.1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	0.17	5.0	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

1	2	3	4	5	6	7	8	9	10
81	*Cirrhia citrago* (L.)	0.22	+	–	–	–	–	–	–
82	*Pyrrhia umbra* (Hufn.)	–	–	–	–	–	–	0.30	5.1
83	*Cryphia fraudatricula* (Hbn.)	0.03	+	–	–	–	–	–	–
84	*Axylia putris* (L.)	0.10	+	0.61	2.6	–	–	–	–
85	*Daseochaeta alpium* (Osb.)	0.39	+	–	–	–	–	–	–
86	*Subacronitca megacephala* (Schiff. et Den.)	0.18	+	0.11	+	–	–	–	–
87	*Acronicta aceris* (L.)	0.09	+	1.53	6.6	–	–	0.07	1.2
88	*Acronicta leporina* (L.)	–	–	0.05	+	–	–	–	–
89	*Acronicta psi* (L.)	0.06	+	0.62	2.7	0.10	4.2	0.57	9.5
90	*Acronicta rumicis* (L.)	0.06	+	0.16	+	–	–	–	–
91	*Bena prasinana* (L.)	1.59	3.7	–	–	–	–	–	–
92	*Autographa gamma* (L.)	–	–	0.06	+	0.97	40.9	1.00	16.9
93	*Autographa confusa* (Steph.)	–	–	–	–	–	–	0.23	3.9
94	*Plusia chrisitis* (L.)	–	–	–	–	–	–	0.07	1.2
95	*Abrostola triplasia* (L.)	–	–	–	–	–	–	–	–
96	*Astiodes sponsa* (L.)	0.71	1.6	–	–	–	–	–	–
97	*Catocala fraxini* (L.)	0.32	+	–	–	–	–	–	–
98	*Catocala nupta* (L.)	0.24	+	–	–	–	–	–	–
99	*Catocala elocata* (Esp.)	–	–	–	–	–	–	–	–
100	*Catocala promissa* (Schiff. et Den.)	0.15	+	–	–	–	–	–	–
101	*Ephesia fulminea* (Scop.)	0.02	+	–	–	–	–	–	–
102	*Scoliopteryx libatrix* (L.)	0.02	+	–	–	–	–	0.07	1.2
103	*Lygephila craccae* (Schiff. et Den.)	0.03	+	–	–	–	–	–	–
104	*Hypena proboscidalis* (L.)	–	–	0.08	+	–	–	–	–
	Total	43.35		23.32		2.37		5.92	
	Number of species	67		61		11		23	

D. trifolii has a wide geographical range (Holarctic) and it is common in Poland. It occurs over the country, mostly in open habitats such as meadows and crops, and also in carrs. Larvae feed on herbaceous plants.

The proportions of the third and fourth most abundant species, *Trachea atriplicis* and *Apatele psi*, differed for the individual plots, being 11.3% and 9.5%, respectively in the park and only 4.2% in the street. Their mean proportions in this green complex were 9.2 and 8.1%, respectively (Fig. 1). The abundance of each of these species was 6 times higher in the park than at the street (Tab. 1).

T. atriplicis is a Euro-Siberian species. It is common all over Poland and occurs from May to September (two generations) in open habitats such as croplands, moist meadows, and wet meadows. Larvae feed on herbaceous plants. In the Mazovian Lowland, *T. atriplicis* is a dominant in suburban and natural linden-oak-hornbeam forest (Winiarska 1981, and unpublished materials).

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	0.20	1.6	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	0.80	6.4	0.10	3.2	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	0.50	13.3	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.25	11.3	0.75	8.1	0.20	1.6	0.20	6.4	0.40	10.6	0.80	22.1	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.45	20.3	1.12	12.1	1.35	11.0	0.30	9.5	1.25	33.3	0.20	5.6	0.58	16.8	1.61	20.2
—	—	—	—	—	—	—	—	0.10	2.7	0.10	2.8	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.35	4.5
—	—	—	—	—	—	0.10	3.2	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	1.05	11.4	0.07	0.6	—	—	0.10	2.7	0.40	11.0	0.20	5.8	0.78	9.7
—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.50	6.3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2.22		9.24		12.32		3.14		3.75		3.60		3.43		7.99	
12		16		18		13		15		15		9		13	

A. psi is also a common Euro-Siberian species, but it differs in its habitat and food requirements from *T. atriplicis*. *A. psi* occurs in wooded habitats such as carrs, linden-oak-hornbeam forests and coniferous forests. Larvae feed on broad-leaved trees.

Only two species from the Łazienki complex, *Scotia segetum* and *Amathes c-nigrum*, had higher abundance on the streetside plot than in the park (0.23 and 0.13 for *S. segetum* and 0.10 and 0.07 for *A. c-nigrum*, respectively). The proportions of these species in the whole community averaged 4.3 and 2.0, respectively) (Tabs. 1 and 2).

The proportions of other species were much lower. The species occurring in very low numbers (the index equal to or lower than 0.1) accounted for 60% of the species on the streetside plot and for 30% in the park.

The similarity of the species composition on the two plots was 53%, and as

Table 2. Constant noctuid moth species in

No.	Species	Proportion (%) in the community					Food preference of larvae			Zoogeographical range		
		Łazienki Park	Cemetery of Soviet Soldiers	Saxon Garden	Praski Park	All parks	Polyphage	Oligophage (on grasses)	Oligophage (on trees)	Holarctic	Euro-Siberian	European
1	*Scotia segetum*	4.3	0.3	2.9	—	1.9	+	—	—	+	—	—
2	*Scotia exclamationis*	1.6	1.5	2.9	—	1.5	+	—	—	—	+	—
3	*Noctua pronuba*	2.0	5.5	—	3.1	2.7	+	—	—	+	—	—
4	*Amathes c-nigrum*	2.0	0.5	2.9	3.1	2.1	+	—	—	+	—	—
5	*Discestra trifolii*	15.0	11.2	14.3	12.4	13.2	+	—	—	+	—	—
6	*Mamestra brassicae*	—	2.7	5.7	7.1	3.9	+	—	—	+	—	—
7	*Mamestra suasa*	0.8	10.3	3.8	1.8	4.2	+	—	—	+	—	—
8	*Mamestra oleracea*	1.6	5.0	4.8	—	2.9	+	—	—	+	—	—
9	*Mythimna albipuncta*	2.9	0.3	—	6.5	2.5	—	+	—	—	—	+
10	*Mythimna pallens*	3.0	8.6	2.9	7.9	5.6	+	—	—	+	—	—
11	*Mythimna l-album*	—	1.9	1.0	4.6	1.9	+	—	—	—	+	—
12	*Trachea atriplicis*	9.3	8.0	—	9.6	6.7	+	—	—	—	+	—
13	*Apamea monoglypha*	0.8	7.1	1.9	—	2.5	—	+	—	—	+	—
14	*Amphipoea fucosa*	2.8	4.4	1.0	—	2.1	+	—	—	—	+	—
15	*Agrochola circellaris*	—	2.8	1.9	2.2	1.7	+	—	—	—	—	+
16	*Acronicta psi*	8.1	5.0	13.3	—	6.6	+	—	—	—	+	—
17	*Autographa gamma*	23.8	12.2	16.7	19.2	18.0	+	—	—	+	—	—
18	*Catocala nupta*	—	2.6	4.8	8.6	4.0	—	—	+	—	+	—

many as 9 of the 11 species occurring on the streetside plot were also recorded from the park.

Only one species, *Archanara geminipuncta*, recorded from the streetside plot at Ujazdowskie Avenue in a small number of individuals, did not occur on any other urban plot, nor in suburban or natural habitats. *A. geminipuncta* is a rare species. In Poland it occurs only at the edges of rivers and standing waters, and its larvae feed on reed (*Phragmites*) stems.

It is likely to be an accidental species in urban fauna, migrating through urban areas. Lepidopteran migrations, including *Noctuidae*, were observed over Warsaw and other towns (Adamczewski 1964). Many migrating individuals stop in the column of warm air over towns, and they are attracted by strong sources of light, especially by neon light.

The park at the Cemetery of Soviet Soldiers. In this green complex the same number of species occurred as in Łazienki, that is, 25. The number of

park complexes of Warsaw

Habitats of occurrence in Poland (after Kostrowicki; unpubl.)

Secalietea	*Chenopodietea*	*Eu-Arction*	*Polygonion avicularis*	*Onopordion acanthii*	*Festuco-Brometea*	*Molinietalia*	*Arrhenatheretalia*	*Cynosurion*	*Phragmitetalia*	*Isoëtion lacustris*	*Corynephoretalia*	*Caricetea curvulae*	*Salici-Populetum*	*Vaccinio-Picetalia*	*Querco-Fagetea*
+	+	+	+	+	+	−	+	+	−	−	+	−	−	+	−
+	+	+	+	+	+	+	+	+	−	−	+	−	+	+	+
+	+	+	+	+	+	+	+	+	−	−	+	−	−	+	+
+	+	+	+	+	+	−	+	+	−	−	−	−	+	+	+
+	+	+	+	+	−	−	+	+	−	+	−	−	+	−	+
+	+	+	−	−	−	−	+	+	−	+	−	−	+	−	+
−	−	−	−	+	−	−	+	−	−	−	−	−	−	+	−
−	+	+	+	+	+	−	−	−	−	−	−	−	+	−	−
+	−	−	−	+	+	+	+	−	−	−	−	−	+	−	−
+	+	+	−	−	+	+	+	+	−	−	−	+	+	−	−
+	+	−	−	−	−	+	+	−	−	−	−	+	+	−	−
−	+	+	+	+	−	+	+	+	−	−	−	−	+	−	+
+	+	+	+	+	−	−	+	+	−	−	−	−	+	+	+
−	−	−	−	−	−	+	+	−	+	+	−	−	+	−	+
−	−	+	−	−	−	−	−	−	−	−	−	−	+	+	+
−	−	−	−	−	−	−	−	−	−	−	+	−	+	+	+
+	+	−	+	+	+	+	+	+	−	−	+	−	+	+	+
−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+

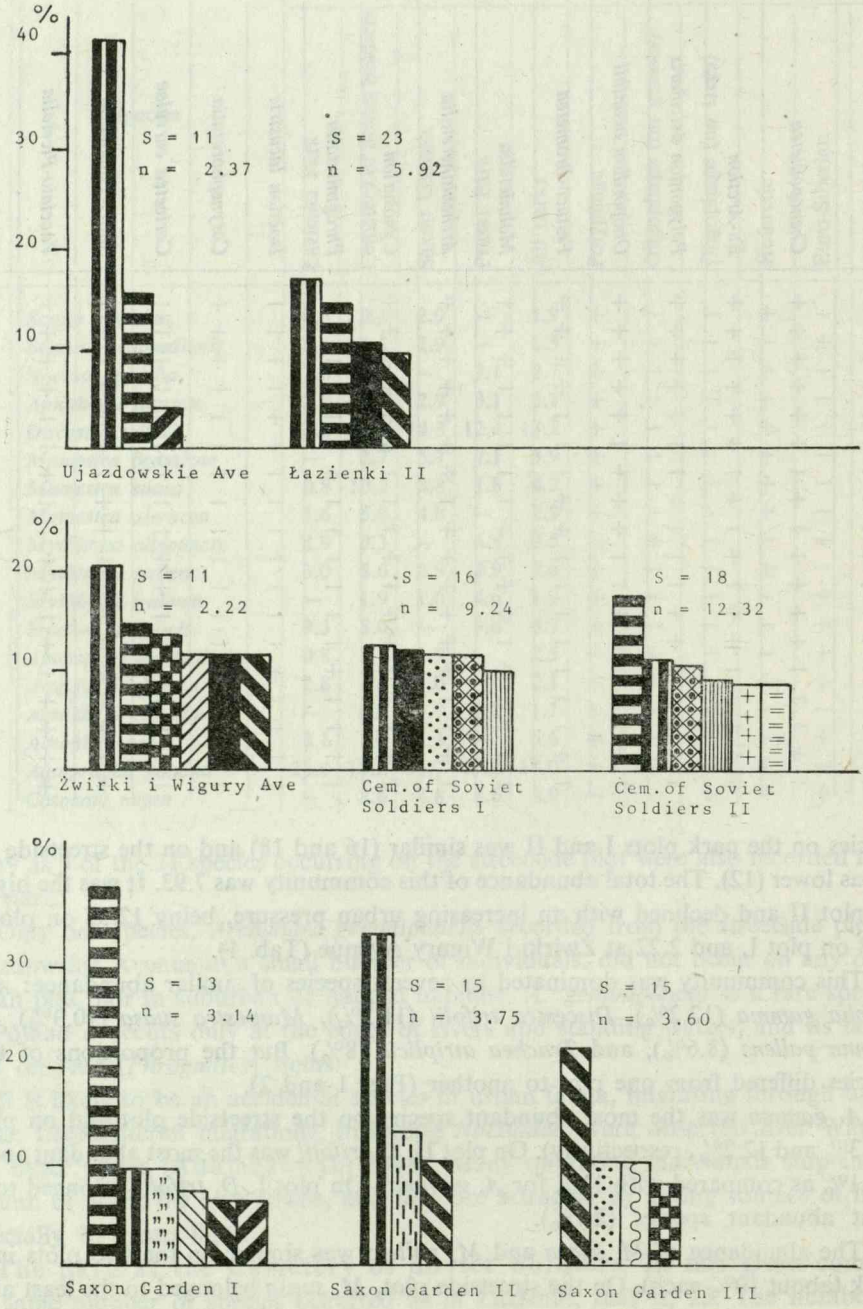
species on the park plots I and II was similar (16 and 18) and on the streetside plot it was lower (12). The total abundance of this community was 7.93. It was the highes, on plot II and declined with an increasing urban pressure, being 12.32 on plot IIt 9.24 on plot I, and 2.22 at Żwirki i Wigury Avenue (Tab. 1).

This community was dominated by several species of similar abundance: *Autographa gamma* (12.2%), *Discestra trifolii* (11.2%), *Mamestra suasa* (10.3%), *Mythimna pallens* (8.6%), and *Trachea atriplicis* (8%). But the proportions of these species differed from one plot to another (Figs 1 and 2).

A. gamma was the most abundant species on the streetside plot and on plot I (20.3% and 12.2%, respectively). On plot II, *D. trifolii* was the most abundant species (17.1% as compared with 11% for *A. gamma*). On plot I, *D. trifolii* belonged to the least abundant species (2.7%).

The abundance of *M. suasa* and *M. pallens* was similar on the two plots in the park (about 10% each). On the streetside plot, *M. suasa* belonged to the least abun-

dant species (3.1%) and *M. pallens* was absent from this plot. Both these species are common in Poland. They prefer open habitats and carrs (Tab. 2). Their larvae feed on herbaceous plants.



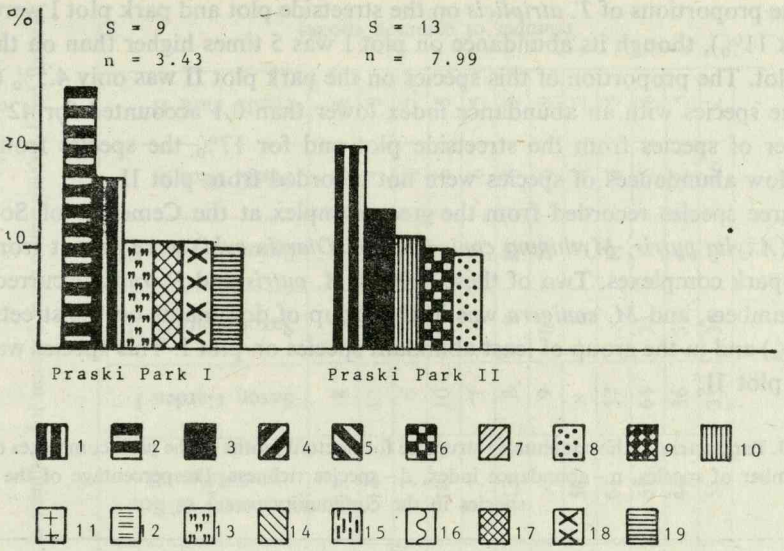


Fig. 1. Dominance structure of noctuid moth communities from the study plots in different park complexes of Warsaw

S—number of species, n—abundance index; 1—*Autographa gamma*, 2—*Discestra trifolii*, 3—*Trachea atriplicis*, 4—*Scotia segetum*, 5—*Acronicta psi*, 6—*Mamestra brassicae*, 7—*Mythimna conigera*, 8—*Catocala nupta*, 9—*Mamestra suasa*, 10—*Mythimna pallens*, 11—*Amphipoea fucosa*, 12—*Apamea monoglypha*, 13—*Amathes* c-*nigrum*, 14—*Agrotis exclamationis*, 15—*Acronicta aceris*, 16—*Cosmia affinis*, 17—*Mythimna* l-*album*, 18—*Hoplodrina ambigua*, 19—*Mythimna albipuncta*

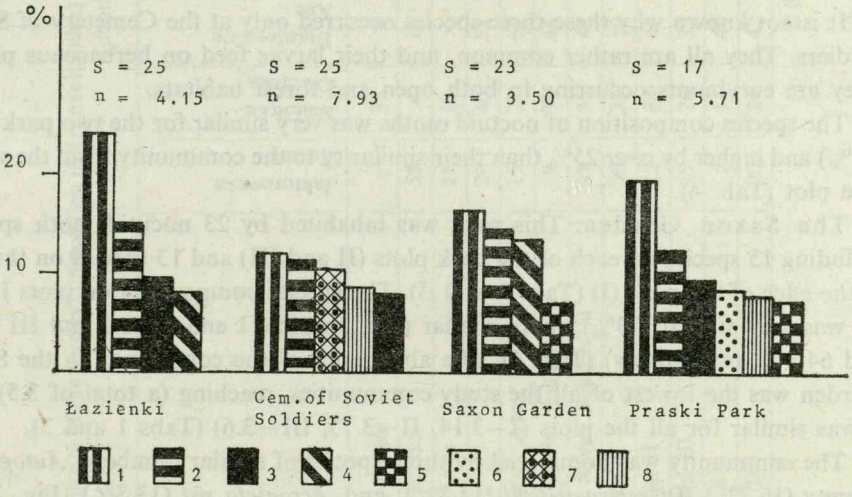


Fig. 2. Dominance structure of noctuid moth communities from different park complexes of Warsaw

S—number of species, n—abundance index; 1—*Autographa gamma*, 2—*Discestra trifolii*, 3—*Trachea atriplicis*, 4—*Acronicta psi*, 5—*Mamestra brassicae*, 6—*Catocala nupta*, 7—*Mamestra suasa*, 8—*Mythimna pallens*

The proportions of *T. atriplicis* on the streetside plot and park plot I were similar (about 11%), though its abundance on plot I was 5 times higher than on the streetside plot. The proportion of this species on the park plot II was only 4.5% (Tab. 1).

The species with an abundance index lower than 0.1 accounted for 42% of the number of species from the streetside plot and for 17% the species from plot I. Such low abundances of species were not recorded from plot II.

Three species recorded from the green complex at the Cemetery of Soviet Soldiers (*Axylia putris*, *Mythimna conigera*, and *Diarsia rubi*) were absent from all the other park complexes. Two of these species, *A. putris* and *D. rubi*, occurred in very low numbers, and *M. conigera* was in the group of dominants on the streetside plot (11.3%) and in the group of least abundant species on plot I. This species was absent from plot II.

Table 3. Parameters of the community structure for noctuid moths in the park complexes of Warsaw
S—number of species, n—abundance index, d—species richness, D—percentage of the dominant species in the community

Parameter	Łazienki Park	Cemetery of Soviet Soldiers	Saxon Garden	Praski Park	Mean
S	25	25	23	17	23
n	4.15	7.93	3.50	5.71	5.32
d	12.3	8.9	12.3	7.1	10.2
D	23.8	12.2	16.7	19.2	18.0

It is not known why these three species occurred only at the Cemetery of Soviet Soldiers. They all are rather common, and their larvae feed on herbaceous plants. They are eurybionts occurring in both open and forest habitats.

The species composition of noctuid moths was very similar for the two park plots (77%) and higher by over 25% than their similarity to the community from the streetside plot (Tab. 4).

The Saxon Garden. This park was inhabited by 23 nocutid moth species, including 15 species on each of the park plots (II and III) and 13 species on the plot at the edge of the park (I) (Tabs 1 and 3). The species composition on plots II and III was very similar (73%), more similar than on plots I and II or I and III (57% and 64.3%, respectively) (Tab. 4). The abundance of the community in the Saxon Garden was the lowest of all the study communities, reaching (a total of 3.5), and it was similar for all the plots (I—3.14, II—3.75, III—3.6) (Tabs 1 and 3).

The community was dominated by three species of similar numbers: *Autographa gamma* (16.7%), *Discestra trifolii* (14.3%), and *Acronicta psi* (13.3%) (Fig. 2). *A. gamma* was the most abundant on plot II, *D. trifolii*, on plot I, and *A. psi* (a forest species), on plot III. It is interesting that also subdominant species on plot III, *Catocala nupta* and *Cosmia affinis*, are typical of forest communities. No dominance

Table 4. Similarity of the species composition (Sörensen index) and the number of species in common for noctuid moth communities from natural, suburban, and urban habitats

	Jaktorowska Forest	Białołęka Dworska	Ujazdowskie Ave	Łazienki II	Żwirki i Wigury Ave	Cemetery of Soviet Soldiers I	Cemetery of Soviet Soldiers II	Saxon Garden I	Saxon Garden II	Saxon Garden III	Praski Park I	Praski Park II	Number of common species
Jaktorowska Forest	×	35	8	13	6	12	13	8	9	8	2	8	
Białołęka Dworska	55	×	10	17	10	13	14	12	12	10	5	9	
Ujazdowskie Ave	21	28	×	9	7	6	7	6	6	5	4	5	
Łazienki II	29	40	53	×	9	6	10	10	11	9	6	5	
Żwirki i Wigury Ave	15	27	61	51	×	7	7	7	5	6	6	5	
Cemetery of Soviet Soldiers I	29	34	44	31	50	×	13	8	9	10	5	9	
Cemetery of Soviet Soldiers II	31	35	48	49	47	77	×	9	10	10	6	9	
Saxon Garden I	20	32	50	56	56	55	58	×	8	9	4	5	
Saxon Garden II	22	34	46	58	37	58	61	57	×	11	4	5	
Saxon Garden III	19	26	39	47	44	65	61	64	73	×	5	6	
Praski Park I	5	14	40	38	57	40	44	36	57	42	×	5	
Praski Park II	20	24	42	28	40	62	58	31	36	43	46	×	

Sörensen index

of as many as three species was recorded on any other urban plot, nor in the suburban or natural linden-oak-hornbeam forest.

The species occurring in very low numbers (0.1) accounted for more than 50% of the species on plots I and II and for more than 30% on plot III.

T. atriplicis, one of the most abundant species in urban parks of Warsaw and also in suburban and natural habitats, was not recorded from the Saxon Garden. The reason for its absence is not known.

If *T. atriplicis* were very sensitive to habitat pollution, they should also be absent from the urban habitats even more polluted than the Saxon Garden,[2] and this was not the case. It occurred on singly growing lindens on Konstytucji Square, that is, in the centre of the town (unpublished data).

The Praski Park. In this park only 17 species were recorded, of which 9 occurred at the edge of the park (plot I) and 13 inside the park (II). The similarity of the species composition on the two plots was 46% (Tab. 4). The total community abundance was 5.71, and it was more than twice as high on plot II as on plot I (7.99 and 3.43, respectively) (Tabs 1 and 3).

The community was clearly predominated by *Autographa gamma* (19.2%). The subdominant species comprised *Discestra trifolii* (12.4%), *Trachea atriplicis* (9.6%), *Catocala nupta* (8.6%), and *Mythimna pallens* (7.9%) (Fig. 2).

There were differences in the proportions of the most abundant species between the two plots. *A. gamma* was the dominant on plot II (20.2%) and the subdominant on plot I (16.8%); *D. trifolii* was the most abundant on plot I (26.1%), while on plot II it was in the group of the least abundant species. *T. atriplicis* and *M. pallens* occurred only on the park plot (II), and their proportions were 13,8% and 11.3%, respectively (Fig. 1). *C. nupta* was recorded from the two plots, but it was four times more abundant far from the edge than at the edge of the park (0.78 and 0.2, respectively) (Tab. 1). No species recorded from the Praski Park had abundance lower that 0.1.

On plot I, several specimens of *Cirrhia gilvago* were found. This species was not recorded from any other park of Warsaw, nor from the suburban and natural habitats. This is a rare species. Its larvae live first on poplar catkins and then on herbaceous plants. *C. gilvago* is associated with carrs. This is likely to be the reason for its occurrence in the Praski Park, which is situated on the site of a carr (as the only of the study parks in Warsaw) and adjoins paranatural Vistula carrs.

DIFFERENTIATION OF COMMUNITIES

The study parks in Warsaw differed in their age, size, spatial structure, plant cover, and in their location within the town (Kubicka et al. 1985). However, noctuid communities occurring in them had similar species compositions (Tab. 1) and do-

[2] For Saxon Garden pollution see Kubicka et al. (1986).

minance structures (Tabs 1 and 2, Fig. 2). They differed only in their abundance (Tab. 3).

The similarity in the species composition of noctuid moth communities from different parks ranged from 45% to 67%, and it was highest between the Saxon Garden and the Łazienki Park, and between the Saxon Garden and the Cemetery of Soviet Soldiers. The numbers of noctuid species in these parks were similar (23, 25, and 25, respectively). The lowest similarity was found for noctuid communities from the Saxon Garden and the Praski Park.

The similarity of the fauna on the plots distant from the park edge ranged from 28% (the Łazienki Park II and the Praski Park II) to 73% (plots II and III in the Saxon Garden). It was higher for the plots situated in the same park than in different parks. The similarity of the fauna on the plots situated at the edges of the green complexes under study, that is, at park edges and along streets, ranged from 40 to 61% (Tab. 4).

The lower similarity of noctuid communities from the Praski Park than of the other communities as compared with the similarity between the other communities was mostly due to a relatively small number of species in the Praski Park (17). This simplification in the species composition rather cannot be related to the specific habitat conditions in the Praski Park. Among different types of forest communities, carrs have the richest noctuid fauna (much richer than the linden-oak-hornbeam forests). Moreover, the Praski Park forms a big green complex with the Zoological Garden and riverside vegetation (Kubicka et al. 1985). As a result, many species from adjacent areas can visit it. It is possible that the simplification of the species composition of noctuid moths in this park is due to a heavy air and soil pollution (the highest of the study parks, Kubicka et al. 1985).

The high similarity in the species composition of noctuid communities in different park complexes shows that a constant group of species is associated with urban green of this type, occurring in each park, independent of local conditions. Of the 40 species recorded in the park complexes of Warsaw, 18 species occurred in at least three of them (Tab. 2). These constant species share many features allowing them to persist in the urban habitat, which is generally unsuitable for noctuid moths. They have wide geographical ranges, which is related to their large tolerance of environmental conditions. Holarctic species account for 47% of the group of constant species, Euro-Siberian for 41%, and only two species represent the European element. Almost all of them are eurybionts. Only two species, *Trachea atriplicis* and *Catocala nupta*, prefer specific habitat types. The former is typical of open habitats, though it is native to forest-steppes, the latter is associated with forests. A more detailed presentation of the constant species is shown in Table 2. The proportion of constant noctuid moths in park complexes was different for various species and parks (Tab. 2). This group includes the species occurring in similar proportions in all the parks (e.g. *Trachea atriplicis*, *Discestra trifolii*, *Scotia exclamationis*) and also the species with differential proportions (e.g., *Autographa gamma*, *Apamea monoglypha*, *Mamestra suasa*).

So far it has not been found whether all developmental stages of the constant species occur in the parks, or only adult forms. The available data on the preimaginal stages are not sufficient. It is probable that this group consists of the species occurring in the parks in all their developmental stages and also of the species immigrating from nonurban habitats where they develop. The dominant species, *Autographa gamma*, is apparently an immigrant from Africa. According to Adamczewski (1964), native populations of this species do not exist in Poland because they cannot winter here. Each year new populations of *A. gamma* arrive from the south. It is possible, however, that in the towns adult individuals could winter in heated houses, as it is the case of many butterflies, and breed warmer spring months.

Although there were large differences in the abundance of noctuid communities in different park complexes (by a factor of 2 between the Saxon Garden and the park at the Cemetery of Soviet Soldiers), their dominance structures were very similar. The values of the Morisita index varied between 0.69 and 0.82, being the highest for the communities from the Saxon Garden and Łazienki (0.82) and the Praski Park (0.80), and the lowest for the communities from the Saxon Garden and Praski Park (Tab. 5), like in the case of the similarity of the species composition.

Table 5. Similarity of the species composition (Sörensen index) and the dominance structure (Morisita index) for noctuid moth communities in natural, suburban, and urban habitats

	Jaktorowska Forest	Białołęka Dworska	Łazienki	Cemetery of Soviet Soldiers	Saxon Garden	Praski Park
Jaktorowska Forest	×	0.80	0.22	0.34	0.10	0.20
Białołęka Dworska	55	×	0.32	0.40	0.19	0.25
Łazienki	30	31	×	0.75	0.82	0.80
Cemetery of Soviet Soldiers	26	46	60	×	0.73	0.75
Saxon Garden	29	41	63	67	×	0.69
Praski Park	19	23	52	62	45	×

Sørensen index — Morisita index

All the communities were predominated by *Autographa gamma*. Its abundance was slightly higher than that of the subdominants in the park at the Cemetery of Soviet Soldiers and in the Saxon Garden, and much higher in the Łazienki and Praski Parks.

The most abundant species in the communities from particular park complexes formed the dominance structure in a specific sequence: *Autographa gamma* 12—24%, *Discestra trifolii* 11—15%, *Acronicta psi* 5—13%, *Trachea atriplicis* 8—10%, *Mamestra suasa* 2—10%, *Mythimna pallens* 3—9%, *Catocala nupta* 3—9%. The sequence of the first two species was constant in the communities from all the parks, and that of the other species was variable, e.g., in the Łazienki Park: *A. gamma*,

D. trifolii, *T. atriplicis*, and *A. psi*; in the Saxon Garden: *A. gamma*, *D. trifolii*, and *A. psi* (Fig. 2). As it has been already noted (Tab. 2), there were also differences in the proportions of respective species in the communities from different parks. Environmental factors responsible for the rank of a species in the dominance structure of different communities have not been identified.

Although the similarity of the species composition and dominance structure of the noctuid communities from different parks were similar, considerable differences were found in their species richness. The indices of species richness largely varied from 7.1 (Praski Park) to 12.3 (Łazienki and Saxon Garden). The community from the Saxon Garden was rather abundant (the second after that from the park at the Cemetery of Soviet Soldiers), but poor in species, thus its species richness was low. The species richness of the community from the park at the Cemetery of Soviet Soldiers was only slightly higher, though the number of species in it was one of the highest. This community, however, was much more abundant than the other communities (Tab. 3). The species richness of the communities from the Łazienki Park and Saxon Garden was identical, though these parks differed markedly in their size, location in the town, pollution, and the like.

Differential spatial distribution of noctuid moths was found within the park complexes. In Łazienki, in the park at the Cemetery of Soviet Soldiers, and in the Praski Park, the number of species and abundance of noctuid moths delined with increasing urban pressure, that is, from central parts of the parks towards the streets. This is best illustrated by the distribution of the number of species and their abundances in the green complex at the Cemetery of Soviet Soldiers: plot II—18 and 12.32, plot I—16 and 9.24, and the streetside plot—12 and 2.22, respectively (Tab. 1).

The Łazienki Park, the park at the Cemetery of Soviet Soldiers, and the Praski Park are components of large green complexes, as they border on vast green areas such as other parks, allotment gardens, playgrounds, recreation areas, etc. (Kubicka et al. 1985). In these parks noctuid moths are concentrated far from their peripheries where only single individuals of the species less susceptible to pollution can be found. Hence, on streetside plots, the number of species and their abundance were reduced.

In contrast, the number of species and community abundance in the Saxon Garden were similar on all the plots (Tab. 1). This is a small park, surrounded by streets and buildings, isolated from other green areas. Thus, its whole area is polluted. Environmental conditions on its whole area were similar, and, consequently, the distribution of the fauna was uniform.

Some species such as *Agrochola circellaris*, *Amphipoea fucosa*, and *Noctua pronuba* occurred only deep in parks. These species differ in their habitat preferences. For example, *A. circellaris* occur in various wooded areas ranging from carrs to pine forests, and *A. fucosa* inhabit moist and wet meadows, and also carrs.

Other species such as *Discestra trifolii*, *Mamestra suasa*, *Apatele psi*, and *Autographa gamma* occurred throughout the park complexes and dominated everywhere.

Their high abundance in parks is likely to be due to their low susceptibility to traffic and industrial pollution.

A comparison of noctuid communities from different parks of Warsaw to those occurring in suburban (Białołęka Dworska) and natural forests (Jaktorowska Forest) revealed only the most general differences between them, as each of these habitat types was represented by only one study plot. These differences concerned their

Table 6. Parameters of the community structure for noctuid moths in natural, suburban, and urban habitats

S—number of species, n—abundance index; d—species richness

Habitat / Parameter	Natural (Jaktorowska Forest)	Suburban (Białołęka Dworska)	Urban parks[1]
S	67	62	23 (17—25)
n	43.3	23.1	5.3 (3.5—7.9)
d	10.2	12.7	10.2 (7.1—12.3)
Dominant (%)	*T. atriplicis* (14.8) *C. trapezina* (14.3)	*T. atriplicis* (17.1) *C. trapezina* (15.4)	*A. gamma* (18.0) *D. trifolii* (13.2)

[1] mean values and ranges of S, n, and d are given; data for the dominant species concern the park fauna in general

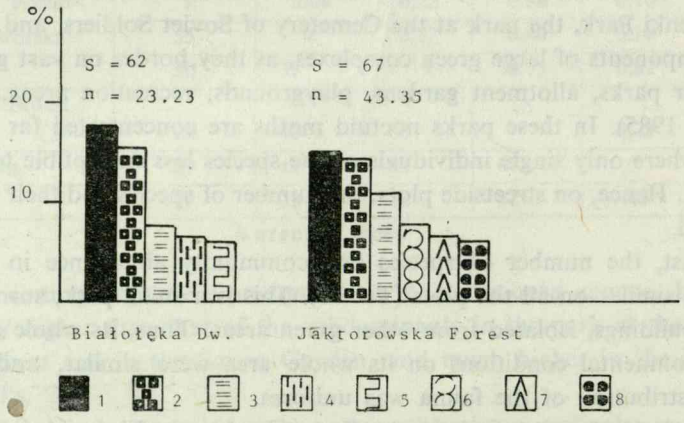


Fig. 3. Dominance structure of noctuid moth communities in linden-oak-hornbeam forests: suburban (Białołęka Dworska) and natural (Jaktorowska Forest)

S—number of species; n—abundance index; 1—*Trachea atriplicis*, 2—*Cosmia trapezina*, 3—*Apamea monoglypha*, 4—*Acronicta aceris*, 5—*Mamestra persicariae*, 6—*Mesapamea secalis*, 7—*Polia nebulosa*, 8—*Noctua orbona*

species composition, abundance, and dominance structure (Tabs 1 and 6, Figs 2 and 3). The number of species in the communities from urban parks accounted for about 60% of that in the communities from the suburban and natural habitats. Their abundance accounted for 20% of that from the suburban habitat and for 10% of that from the natural habitat.

Author's unpublished materials show that in the case of other natural linden-oak-hornbeam forests these differences can be even higher, and for the number of species they can reach 100%.

The mean index of species richness for noctuid communities from urban parks (10.2) was identical to that for the community from the natural habitat, but much lower than for the community from the suburban habitat (17.4) (Tabs 3 and 6). The high value of the species richness in the suburban habitat is likely to be related to the mosaic character of this habitat (Bańkowska and Garbarczyk 1981), enhancing a permanent causal exchange of species among different habitats.

The similarity of the species composition for the communities compared ranged from about 30% to about 50% for the communities from particular park complexes and Białołęka Dworska, and from 20% to 30% for the communities from park complexes and Jaktorowska Forest (Tab. 4). But only 15% of the species occurring in the parks were not recorded from Białołęka and 25% were not recorded from the Jaktorowska Forest.

There was no similarity in the dominance structure of the noctuid moth communities from the parks of Warsaw and the suburban and natural linden-oak-hornbeam forests (Figs 2 and 3). The dominant species of the fauna of park complexes, *Autographa gamma*, occurred only in the suburban habitat, where it belonged to the least abundant species. *Discestra trifolii* occurred in the two linden-oak-hornbeam forests, but in very low numbers (0.3% of the community abundance at Białołęka Dworska and 0.2% in the Jaktorowska Forest). However, *Trachea atriplicis*, the subdominant species in the parks, was one of the dominant species in both the suburban habitat (17.1%) and the natural habitat (14.8) (Tab. 1).

An opposite pattern to that of *Autographa gamma* and *Discestra trifolii* was observed for *Cosmia trapezina*. In the suburban and natural linden-oak-hornbeam forests, this was one of the dominant species (15.4 and 14.3%, respectively). In the study parks of Warsaw, it occurred in very low numbers and only in the Łazienki Park and the Saxon Garden (Tab. 1).

Ecological and zoogeographical characteristics of the noctuid moths occurring in urban parks, suburban habitats, and natural habitats are compared elsewhere (Winiarska 1982).

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ZGRUPOWANIA SÓWEK (*LEPIDOPTERA, NOCTUIDAE*) PARKÓW MIEJSKICH WARSZAWY

STRESZCZENIE

Badano 4 kompleksy zieleni parkowej Warszawy: Łazienki Królewskie, park przy Cmentarzu Żołnierzy Radzieckich, Ogród Saski i Park Praski. Wykazano łącznie 40 gatunków sówek, przy czym zgrupowania występujące w poszczególnych parkach miały podobną liczbę gatunków (17—25), różniły się natomiast liczebnością (wskaźnik 3.5—7.9). Podobieństwo składu gatunkowego porównywanych zgrupowań wynosiło od 45% do 70%. Stwierdzono 18 gatunków stałych dla parków. We wszystkich parkach dominowały *Autographa gamma* (12—24%) i *Discestra trifolii* (11—15%). Do gatunków liczebnych należały również: *Acronicta psi*, *Trachea atriplicis*, *Mamestra suasa*, *Mythimna pallens* i *Catocala nupta*. Podobieństwo struktury dominacyjnej zgrupowań (wg wzoru Morisity) wynosiło od 0.7 do 0.8.

Wykazano różnice w rozmieszczeniu przestrzennym parkowej fauny *Noctuidae*. W parkach dużych (Łazienki, Cmentarz Żołnierzy Radzieckich, Park Praski) fauna była rozmieszczona nierównomiernie, a liczebność zgrupowań i liczba gatunków zmniejszały się od wnętrza parku do jego skraju, tj. wraz ze zwiększającym się oddziaływaniem czynników urbanizacyjnych. W parku małym, silnie skażonym na całym obszarze (Ogród Saski) fauna była rozmieszczona równomiernie (liczebność i liczba gatunków były podobne na wszystkich stanowiskach).

Zgrupowania *Noctuidae* występujące w parkach Warszawy różniły się liczbą gatunków, liczebnością i strukturą dominacyjną od zgrupowań z podmiejskiego (Białołęka Dworska) i naturalnego (Puszcza Jaktorowska) lasu grądowego. Liczba gatunków w parkach była o 40% mniejsza niż w wymienionych środowiskach kontrolnych. Gatunki dominujące w zieleni parkowej, *Autographa gamma* i *Discestra trifolii*, miały bardzo małą liczebność w środowisku podmiejskim i naturalnym, gdzie dominowały: *Trachea atriplicis* (subdominant zgrupowań parkowych) i *Cosmia trapezina* (jeden z najmniej liczebnych gatunków w parkach Warszawy).

КОМПЛЕКСЫ СОВОК (*LEPIDOPTERA, NOCTUIDAE*) ГОРОДСКИХ ПАРКОВ ВАРШАВЫ

РЕЗЮМЕ

Исследованы 4 парка Варшавы: Лазенки Королевские, парк при Кладбище-Мемориале Советских воинов, Сасский сад и Пражский парк. Констатировано в общем 40 видов совок, причем комплексы, встречающиеся в отдельных парках имели сходное количество видов (17—25), но отличались своей численностью (показатель 3,5—7,9). Сходство видового состава сравниваемых комплексов составляло от 45% до 70%. Констатировано 18 видов, постоянных для парков. Во всех парках доминировали *Autographa gamma* (12%—24%) и *Discestra trifolii* (11%—15%). К многочисленным видам принадлежали также: *Acronicta psi*, *Trachea atriplicis*, *Mamestra suasa*, *Mythomna pallens* и *Catocala nupta*. Сходство структуры доминирования (по формуле Мориситы) составляло от 0,7 до 0,8.

Констатированы различия в пространственном размещении парковой фауны *Noctuidae*. В больших парках (Лезенки, Мемориал Советских воинов, Пражский парк) фауна была размещена неравномерно, а численность комплексов и количество видов снижались в направлении от середины парка к его окраинам, то-есть по мере роста влияния урбанизацион-

ных факторов. В небольшом парке, сильно загрязненном на всем пространстве (Сад Сасский) фауна была размещена равномерно (численность и количество видов были сходны во всех исследованных пунктах.

Комплексы *Noctuidae*, встречающиеся в парках Варшавы отличались по количеству видов, численности и структуре доминирования от комплексов из пригородного (Бялоленка-Дворска) и природного (Пуща Якторовска) леса типа груда. Количество видов в парках было на 40% ниже, чем в упомянутых контрольных биотопах. Виды доминирующие в парковой зелени, *Autographa gamma* и *Discestra trifolii*, были очень малочислены в пригородном и природном биотопе, где доминировали *Trachea atriplicis* (субдоминант парковых комплексов) и *Cosmia trapezina* (один из наиболее малочисленных видов в парках Варшавы).