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Arboreal myrmecofauna of Warsaw parks

[With 4 tables in the text]

Abstract. Nesting of ants in tree trunks in Warsaw parks was studied. In 3 parks studied a total of 677 trees was inspected, and 237 nests of 8 ant species were recorded. The most frequently recorded were colonies of *Lasius brunneus* (LATR.) – 40,5%, *Myrmica laevinodis* NYL. – 29.5%, and *L. niger* (L.) – 26.6%. The ant nests were found in trees belonging to 36 species. The most frequently inhabited trees were limes – 25%, maples – 20%, and oaks – 16% of all colonies.

Zoocoenological investigations in the habitats of urban green in Warsaw were carried out in the seventies (CZECHOWSKI 1986, 1990a). They yielded, among others, several myrmecological papers (PISARSKI, CZECHOWSKI 1978, PISARSKI 1981, 1982, CZECHOWSKI, PISARSKI 1990, CZECHOWSKI 1990b). They were made on the basis of material from Barber pitfall traps and soil samples – the standard methods of estimating the abundance of the epigeic and soil fauna. Apart from this three Warsaw parks were searched in 1976 for ant-hills situated (completely or partially) in the wood (touchwood, under the bark) of growing trees. The results of these studies are given in the present paper.

The objects of the investigations were: a suburban manor park (5 ha) in Ursynów and two central parks the – Saxon Garden (Ogród Saski) (16 ha) and Łazienki Królewskie (86 ha); in all of them the tree stands are rich, differentiated in respect of age and species, and they are more or less carefully cultivated. More detailed geobotanic characteristics of these parks are given in a paper by KUBICKA et al. (1986). 677 trees were inspected in all the parks: 97 in Ursynów, 100 in the Saxon Garden and 480 in the Łazienki park. Old trees potentially suitable as nesting places for ants were taken into consideration. In a few cases, particularly lush bushes were inspected, too.

RESULTS

Ant-hills were found in 209 trees, i.e. in 31% of those inspected. 237 nests were recorded there (some trees had 2 or 3 colonies of different species). The percentage of trees inhabited by ants was not the same in the tree stands of particular parks. In the Saxon Garden there were 22 trees (22%) with at least one nest, in Ursynów – 27

(28%), in Łazienki – 160 (33%). The difference in the percentage of trees with or without ants was statistically very important ($\chi^2 = 11.86$, $P < 0.01$). The same sequence of the parks studied was found in respect of the number of species nesting in trees: 2 ant species were recorded in the Saxon Garden, 4 – in Ursynów, 6 – in Łazienki. The entire arboreal myrmecofauna consisted of 8 species. *Lasius brunneus* (LATR.), a typical dendrophile, a south-Euro-Siberian oligotope of deciduous moist forests was the dominant there — 40.5% of all colonies. Palaearctic eurytopes (ubiquitous species), occasionally nesting in trees, were the subdominants: *Myrmica laevinodis* NYL. (29.5%) and *Lasius niger* (L.) (26.6%). The other species, including the dendrophilous *Lasius fuliginosus* (LATR.) and *Dolichoderus quadripunctatus* (L.), occurred sporadically. The general dominant, *L. brunneus*, had a slight quantitative advantage over the local subdominants in 2 parks – in the Saxon Garden and in Łazienki. It did not occur in the park in Ursynów which was unquestionably dominated by *L. niger* (Tab. I).

L. brunneus inhabited 14% of all the trees inspected in the Warsaw parks, and among these 12% of the trees in the Saxon Garden and 17.5% of the trees in Łazienki. *M. laevinodis* occurred in 10% of the park trees in Warsaw, and among these in 14% of the trees in Łazienki and in 1% of the trees in Ursynów. *L. niger* was recorded in 9% of all the trees, and among these in 24% of the trees in Ursynów, in 11% of the trees in the Saxon Garden, and in 6% of the trees in Łazienki (Tab. I).

More than one nest was recorded in one tree in the Saxon Garden (5% of the inhabited ones) and in 26 trees in Łazienki (16% of the inhabited ones). In two cases 3 ant species coexisted there, in the other cases – 2 species. The most frequently coexisting species were: *L. brunneus* and *M. laevinodis* (16 cases), *L. niger* and *M. laevinodis* (6 cases), and *L. brunneus* and *L. niger* (4 cases) (Tab. II). No separate ant-hills of the same species coexisting in one tree were recorded.

Ant nests were found in trees of 36 species. The greatest number of ant-hills (of all the species in all the parks together) was recorded in limes (*Tilia* spp.) – 25%, maples (*Acer* spp.) – 20%, oaks (*Quercus* spp.) – 16%, horse chestnuts (*Aesculus* spp.) – 8%, and in poplars (*Populus* spp.), hornbeams (*Carpinus betulus* L.), and ashes (*Fraxinus* spp.) – about 7% of nests in each. Most *L. brunneus* nests were found in maples (21%), oaks and limes (19% in each), horse chestnuts (13.5), and ashes (8%). *L. niger* mainly inhabited limes (38%) and maples (17%); *M. laevinodis* – limes (26%), oaks (20%), maples (17%), and ashes (10%) (Tab. III).

DISCUSSION OF THE RESULTS

The value of the percentage of trees inhabited by ants in the tree stand of a given park may be interpreted as a picture of its health condition. This condition depended on the age structure of the tree stand and the intensity of horticultural treatments (removal of rotten parts, chemical protection of wounds, filling in holes). The lowest number of trees with ant nests was recorded in the Saxon Garden – a park with a high percentage of relatively young (therefore healthy) trees planted after the

Table I. Occurrence of ants in trees of Warsaw parks (N – number of nests, %_n – percentage of a species in the arboreal myrmecofauna, %_t – percentage of trees inhabited)

No	Species	Park (no. of trees: inspected/inhabited)			Ursynów (97/27)			Saxon Garden (100/22)			Łazienki (480/160)			All the parks (677/209)		
		N	% _n	% _t	N	% _n	% _t	N	% _n	% _t	N	% _n	% _t			
1	<i>Myrmica laevinodis</i> (NYL.)	1	3.7	1.0	–	–	–	69	36.9	14.4	70	29.5	10.3			
2	<i>Leptothorax (Mychothorax) muscorum</i> (NYL.)	1	3.7	1.0	–	–	–	–	–	–	1	0.5	0.1			
3	<i>Dolichoderus (Hypoclinea) quadripunctatus</i> (L.)	–	–	–	–	–	–	1	0.5	0.2	1	0.5	0.1			
4	<i>Lasius (Lasius) brunneus</i> (LATR.)	–	–	–	12	52.2	12.0	84	44.9	17.5	96	40.5	14.2			
5	<i>Lasius (Lasius) niger</i> (L.)	23	85.2	23.7	11	47.8	11.0	29	15.5	6.0	63	26.6	9.3			
6	<i>Lasius (Cautolasius) flavus</i> (FABR.)	2	7.4	2.1	–	–	–	–	–	–	2	0.8	0.3			
7	<i>Lasius (Dendrolasius) fuliginosus</i> (LATR.)	–	–	–	–	–	–	2	1.1	0.4	2	0.8	0.3			
8	<i>Formica (Serviformica) fusca</i> (L.)	–	–	–	–	–	–	2	1.1	0.4	2	0.8	0.3			
Total		27	100.0	27.8	23	100.0	22.0 ¹	187	100.0	33.3 ¹	237	100.0	30.9 ¹			

¹ These values are not a sum of the values for particular species because in some trees there were more nests than only one.

Table II. Coexistence of colonies of different ant species in one tree in the Warsaw parks (the asterisk denotes a case from the Saxon Garden; the others refer to the Łazienki park)

Species of ants	Trees	
	Species	Number
<i>Lasius brunneus</i> and <i>Lasius niger</i>	<i>Quercus robur</i>	3
	<i>Aesculus hippocastanum</i>	1*
<i>Lasius brunneus</i> and <i>Myrmica laevinodis</i>	<i>Quercus robur</i>	5
	<i>Acer platanoides</i>	3
	<i>Fraxinus excelsior</i>	2
	<i>Robinia pseudoacacia</i>	1
	<i>Tilia platyphyllos</i>	1
	<i>Tilia cordata</i>	1
	<i>Tilia × euchlora</i>	1
<i>Lasius brunneus</i> and <i>Formica fusca</i>	<i>Betula verrucosa</i>	1
<i>Lasius niger</i> and <i>Myrmica laevinodis</i>	<i>Quercus robur</i>	1
	<i>Carpinus betulus</i>	1
	<i>Tilia cordata</i>	1
	<i>Acer platanoides</i>	1
	<i>Aesculus hippocastanum</i>	1
<i>Myrmica laevinodis</i> and <i>Dolichoderus quadripunctatus</i>	<i>Carpinus betulus</i>	1
<i>Lasius brunneus</i> , <i>Lasius niger</i> and <i>Myrmica laevinodis</i>	<i>Tilia tomentosa</i>	1
<i>Lasius brunneus</i> , <i>Myrmica laevinodis</i> and <i>Formica fusca</i>	<i>Quercus robur</i>	1

Second World War (during the war the park had been almost completely destroyed). The arboreal myrmecofauna there was also the poorest in respect of quality, but *L. brunneus*, a typical dendrophile, was fairly abundant there. It found suitable conditions in old trees that had remained after the war and which were very rotten (mainly limes, maples and horse chestnuts). Neither this species nor any other dendrophile occurred in the suburban park in Ursynów, in spite of a profusion of potentially suitable old trees (mainly limes) and in spite of the fact that *L. brunneus* was fairly abundant in the adjacent, wild part of the Vistula escarpment (CZECHOWSKI, PISARSKI 1990). However, the tree stand of this park was very carefully cultivated and it seems that typically dendrophilous ants could not find suitable conditions there. In such a situation all the available places had been utilized by *L. niger* – ants far less exacting in this respect (their nests were situated rather at than in tree trunks). The percentage of trees invaded by *L. niger* was in the tree stand of Ursynów incomparably higher than in the parks inhabited by *L. brunneus* (Tab. I).

The greatest number of trees inhabited by ants was recorded in Łazienki – a huge park with the tree stand richest in quality and the highest variety of habitats. Apart from trees growing (usually planted) on lawns there is a dense paranatural tree stand on the Vistula escarpment. The arboreal myrmecofauna was

the richest. There occurred 3 dendrophilous species (*L. brunneus*, *L. fuliginosus*, *D. quadripunctatus*) inhabiting 18% of the trees inspected. However, the tree stand was under careful management and therefore ants loosely connected with trees were more frequent there (21% of the trees inspected); that was particularly true for *M. laevinodis* (Tab. I).

The problem of ant colonies of different species existing side by side (in the same tree) is interesting. *L. brunneus* and *M. laevinodis* were the most frequent partners in the park trees (Tab. II). Other pairs of dominant species: *M. laevinodis*/*L. niger* and *L. brunneus*/*L. niger* coexisted far more seldom than chance would have it (if the quantitative ratios of the colonies are considered). It is well known that *M. laevinodis* and *L. niger* actively compete for food and nesting places (CZECHOWSKI 1985). It may be assumed that an equally strong, if not stronger competition takes place between *L. brunneus* and *L. niger* as species closely related and with similar requirements. That would explain why their coexistence was so sporadic in the Warsaw parks. On the other hand, the frequent coexistence of *L. brunneus* and *M. laevinodis* may indirectly lead to a conclusion that competition between these ants is weak.

There are no objective data on the percentage of various tree species in the parks studied. Out of the trees inspected only those with ant nests were described and this provides no direct proof for the preference of ants (or their particular species) for particular tree species. However, on the basis of the available material (Tab. III) it seems that such preferences, if they exist, did not play a major part in the habitat studied. The trees inhabited by ants – *Acer platanoides*, *Quercus robur*, *Tilia cordata*, *T. platyphyllos*, *T. × euchlora*, *Aesculus hippocastanum*, and others – are simply the most common trees in the urban green of Warsaw (KUBICKA et al. 1986).

The picture of the park myrmecofauna presented in this paper is very specific. Quantitatively exposed are species, which do not play any greater part in the general scale. This is especially true for the specialized dendrophiles, with *L. brunneus* at the top. Their presence and abundance in a given habitat depends on the presence and abundance of trees they find suitable to settle in. It also appears that *M. laevinodis*, usually nesting in the soil, had its percentage in the arboreal myrmecofauna considerably higher than that in the soil-epigeal myrmecofauna of the Warsaw parks. *M. laevinodis*, just as all other species of this genus, is sensitive to mechanical destruction of its nests. Nesting in (or at) tree trunks provides a stability much higher than that on cultivated lawns. The Łazienki park with its lawns cultivated extremely carefully (or even too much) can serve as the best example. In that park *M. laevinodis* constituted barely 0.5% of the local ants in respect of the density of individuals in the soil (including the contents of nests; data from soil samples), 1.6% – in respect of the degree of activity of individuals on the surface of the soil (data from pitfall traps) (CZECHOWSKI, PISARSKI, unpublished data), but it reached 37% in respect of the number of colonies in the trees.

A picture of the structure of the myrmecofauna also depends, to a large extent, on the research method used. This is exemplified by a compilation of the hitherto existing data on the myrmecofauna of the habitats in the urban green of Warsaw (Tab. IV).

Table III. Occurrence of ants in particular tree species in the Warsaw parks - number of foreign

No	Tree	Dominant					
		<i>Myrmica laevinodis</i>				<i>Lasius</i>	
		Ursynów	Saxon G.	Łazienki	Total	Ursynów	Saxon G.
1	* <i>Ginkgo biloba</i> L.	-	-	-	-	-	1 (8.3)
2	* <i>Abies concolor</i> ENGELM.	-	-	-	-	-	-
3	* <i>Picea pungens</i> ENGELM.	-	-	1 (1.5)	1 (1.4)	-	-
4	<i>Populus nigra</i> L.	-	-	-	-	-	-
5	* <i>Populus × berolinensis</i> DIPP.	-	-	1 (1.5)	1 (1.4)	-	-
6	* <i>Populus simonii</i> CARR.	-	-	1 (1.5)	1 (1.4)	-	-
7	<i>Salix daphnoides</i> VILL.	-	-	-	-	-	-
8	<i>Salix fragilis</i> L.	-	-	1 (1.5)	1 (1.4)	-	-
9	* <i>Juglans cinerea</i> L.	-	-	-	-	-	-
10	<i>Betula verrucosa</i> EHRH.	-	-	-	-	-	-
11	<i>Carpinus betulus</i> L.	-	-	9 (13.0)	9 (13.0)	-	-
12	* <i>Quercus rubra</i> DU ROI.	-	-	1 (1.5)	1 (1.4)	-	1 (1.3)
13	<i>Quercus robur</i> L.	-	-	13 (18.8)	13 (18.6)	-	-
14	<i>Ulmus laevis</i> PALL.	-	-	-	-	-	-
15	* <i>Sorbaria sorbifolia</i> A. BR.	-	-	-	-	-	-
16	<i>Sorbus aucuparia</i> L.	-	-	-	-	-	-
17	* <i>Prunus cerasifera</i> EHRH.	-	-	-	-	-	-
18	* <i>Cerasus mahaleb</i> MILL.	-	-	-	-	-	-
19	* <i>Cerasus vulgaris</i> MILL.	-	-	-	-	-	-
20	* <i>Sophora japonica</i> L.	-	-	-	-	-	-
21	* <i>Robinia pseudoacacia</i> L.	-	-	1 (1.5)	1 (1.4)	-	-
22	* <i>Actinidia kolomikta</i> MAX.	-	-	-	-	-	-
23	* <i>Tilia tomentosa</i> MOENCH.	-	-	1 (1.5)	1 (1.4)	-	-
24	<i>Tilia platyphyllos</i> SCOP.	-	-	5 (7.2)	5 (7.1)	-	2 (16.7)
25	<i>Tilia cordata</i> MILL.	1 (100.0)	-	10 (14.5)	11 (15.9)	-	2 (16.7)
26	<i>Tilia × euchlora</i> K. KOCH.	-	-	1 (1.5)	1 (1.4)	-	1 (8.3)
27	* <i>Ailanthus glandulosa</i> SWINGLE.	-	-	-	-	-	-
28	* <i>Acer negundo</i> L.	-	-	-	-	-	-
29	<i>Acer campestre</i> L.	-	-	-	-	-	-
30	<i>Acer platanoides</i> L.	-	-	10 (14.5)	10 (14.3)	-	3 (25.0)
31	<i>Acer pseudoplatanus</i> L.	-	-	2 (2.9)	2 (2.9)	-	-
32	* <i>Aesculus hippocastanum</i> L.	-	-	3 (4.3)	3 (4.3)	-	2 (16.7)
33	* <i>Aesculus × carnea</i> HAYNE.	-	-	-	-	-	-
34	<i>Fraxinus excelsior</i> L.	-	-	7 (10.1)	7 (10.0)	-	-
35	* <i>Fraxinus pennsylvanica</i> MARSH.	-	-	1 (1.5)	1 (1.4)	-	-
36	<i>Sambucus nigra</i> L.	-	-	1 (1.5)	1 (1.4)	-	-
Total		1	-	69	70	-	12

nests (in brackets the percentage shares within the general number of nests) (the asterisk denotes trees of origin)

species		<i>Lasius niger</i>				All the species			
<i>brunneus</i>		Ursynów	Saxon G.	Łazienki	Total	Ursynów	Saxon G.	Łazienki	Total
–	1 (1.0)	–	–	–	–	–	1 (4.4)	–	1 (0.4)
–	–	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	–	1 (0.4)
–	–	1 (4.3)	–	–	1 (1.6)	3 (11.1)	–	2 (1.1)	5 (2.1)
–	–	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	–	1 (0.4)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	2 (1.1)	2 (0.8)
3 (3.6)	3 (3.1)	–	–	–	–	–	–	4 (2.1)	4 (2.1)
–	–	–	–	1 (3.5)	1 (1.6)	–	–	1 (0.5)	1 (0.4)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	2 (1.1)	2 (0.8)
1 (1.2)	1 (1.0)	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	1 (0.5)	2 (0.8)
1 (1.2)	1 (1.0)	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	2 (1.1)	3 (1.3)
3 (3.6)	3 (3.1)	–	–	3 (10.3)	3 (4.8)	–	–	16 (8.6)	16 (6.8)
–	1 (1.1)	–	–	–	–	–	1 (4.4)	1 (0.5)	2 (0.8)
17 (20.2)	17 (17.7)	–	–	4 (13.8)	4 (6.3)	1 (3.7)	–	34 (18.2)	35 (14.8)
1 (1.2)	1 (1.0)	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	1 (0.5)	2 (0.8)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	1 (0.5)	1 (0.4)
–	–	–	–	1 (3.5)	1 (1.6)	–	–	1 (0.5)	1 (0.4)
1 (1.2)	1 (1.0)	–	–	2 (6.9)	2 (3.2)	–	–	3 (1.6)	3 (1.3)
–	–	–	–	1 (3.5)	1 (1.6)	–	–	1 (0.5)	1 (0.4)
–	–	–	–	2 (6.9)	2 (3.2)	–	–	2 (1.1)	2 (0.8)
–	–	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	–	1 (0.4)
2 (2.4)	2 (2.1)	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	3 (1.6)	4 (2.1)
–	–	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	–	1 (0.4)
1 (1.2)	1 (1.0)	–	–	1 (3.5)	1 (1.6)	–	–	3 (1.6)	3 (1.3)
6 (7.1)	8 (8.3)	1 (4.3)	3 (27.3)	2 (6.9)	6 (9.5)	1 (3.7)	5 (21.7)	13 (7.0)	19 (8.0)
5 (6.0)	7 (7.3)	–	1 (9.1)	4 (13.8)	5 (7.9)	1 (3.7)	3 (13.0)	19 (10.2)	23 (9.7)
1 (1.2)	2 (2.1)	8 (34.8)	3 (27.3)	1 (3.5)	12 (19.0)	8 (29.6)	4 (17.4)	3 (1.6)	15 (6.3)
1 (1.2)	1 (1.0)	1 (4.3)	–	–	1 (1.6)	1 (3.7)	–	1 (0.5)	2 (0.8)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	1 (0.5)	1 (0.4)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	1 (0.5)	1 (0.4)
15 (17.9)	18 (18.8)	2 (8.7)	2 (18.2)	3 (10.3)	7 (11.1)	2 (7.4)	5 (21.7)	30 (16.0)	37 (15.6)
2 (2.4)	2 (2.1)	1 (4.3)	1 (9.1)	2 (6.9)	4 (6.3)	1 (3.7)	1 (4.4)	6 (3.2)	8 (3.4)
11 (13.1)	13 (13.5)	1 (4.3)	1 (9.1)	1 (3.5)	3 (4.8)	1 (3.7)	3 (13.0)	15 (8.0)	19 (8.0)
–	–	–	–	1 (3.5)	1 (1.6)	–	–	1 (0.5)	1 (0.4)
7 (8.3)	7 (7.3)	–	–	–	–	–	–	14 (7.5)	14 (5.9)
1 (1.2)	1 (1.0)	–	–	–	–	–	–	2 (1.1)	2 (0.8)
–	–	–	–	–	–	–	–	1 (0.5)	1 (0.4)
84	96	23	11	29	63	27	23	187	237

Table IV. Occurrence and the percentage shares of the dominant ant species in various habitats of the urban green of Warsaw – according to data obtained by different methods

Species	Method (character of data), habitat	Soil samples (density of individuals) ¹				Pitfall traps (activity of individuals)					Nests in trees (parks)
		Lawns				Lawns ¹				Woodlots (mainly in parks) ²	
		Parks	Housing estates	Streets	In general	Parks	Housing estates	Streets	In general		
<i>Myrmica laevinodis</i> (NYL.)		0.4	1.5	0.6	0.6	5.1	0.4	0.5	1.6	37.9	29.5
<i>Myrmica rugulosa</i> (NYL.)		0.1	13.9	0.1	1.9	14.3	9.9	37.7	23.7	1.1	–
<i>Diplorhoptrum fugax</i> (LATR.)		8.7	–	0.1	4.3	0.2	+	+	0.1	–	–
<i>Lasius brunneus</i> (LATR.)		–	–	–	–	+	+	0.1	0.1	28.2	40.5
<i>Lasius niger</i> (L.)		12.4	70.0	30.7	26.8	70.2	89.0	59.6	70.8	16.8	26.6
<i>Lasius flavus</i> (FABR.)		78.4	13.9	67.3	66.0	9.0	0.1	0.9	2.6	0.3	0.8

¹ After CZECHOWSKI (1990b).

² After CZECHOWSKI (1991) and CZECHOWSKI, PISARSKI (1990).

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STRESZCZENIE

[Tytuł: Myrmekofauna arborealna parków Warszawy]

W 1976 r. w trzech parkach warszawskich (peryferyjnym i dwóch śródmiejskich) zbadano gniazdowanie mrówek w pniach drzew. Skontrolowano łącznie 677 drzew, rejestrując 237 mrowisk ośmiu gatunków w 209 drzewach (31% zbadanych) 36 gatunków. W myrmekofaunie arborealnej dominował (ogółem) typowy dendrofil, oligotop lasów świeżych *Lasius brunneus* (LATR.) – 40,5% mrowisk oraz eurytopy: *Myrmica laevinodis* NYL. – 29,5% i *Lasius niger* (L.) – 26,6%. Liczebność, skład i struktura arborealnych zgrupowań mrówek w poszczególnych parkach zależały od stanu sanitarnego drzewostanu oraz wewnętrznych uwarunkowań konkurencyjnych. Najwięcej mrowisk występowało w lipach (25% gniazd), klonach (20%), dębach (16%) i kasztanowcach (8%) – najpospolitszych drzewach w zieleni miejskiej Warszawy.

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