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Ślęża Landscape Park – a hot-spot of ant biodiversity in Poland (Hymenoptera: Formicidae)

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ABSTRACT. **Ślęża Landscape Park – a hot-spot of ant biodiversity in Poland (Hymenoptera: Formicidae).** Research into the myrmecofauna of the Ślęża Landscape Park and its buffer zone, conducted from 2009 to 2012, yielded a total of 52 ant species. This is the highest number of ant species found during a faunal inventory in Poland and Central Europe. The species richness of ants in the research area is 52% of all the species confirmed native to Poland and 85% of all the species recorded in Lower Silesia. *Myrmica lonae*, *Formica lemani* and *Tetramorium impurum* were recorded for the first time from Lower Silesia.

KEY WORDS: ants, biodiversity hotspot, Poland, Lower Silesia, faunistics.

INTRODUCTION

In recent years the Polish ant fauna has been intensively researched (Borowiec & Borowiec 2013, Salata & Borowiec 2013, 2014, Rzeszowski *et al.* 2013, Taszakowski *et al.* 2013, Salata 2014, Salata *et al.* 2015). To date, 99 native ant species are known to occur in Poland (Czechowski *et al.* 2012, Salata & Borowiec 2013). The latest results show changes in the ant fauna composition in different regions of the country. For example, in the last few years, 23 species have been recorded as new for Lower Silesia (Borowiec 2007, 2011, Salata & Borowiec 2011, 2013, 2014, Borowiec & Borowiec 2013).

There are only a few publications on the ant fauna of National or Landscape Parks in Poland (Czechowska 1976, Czechowski 1992, Dylewska & Wiśniowski 2003, Koehler 1951, Krzysztofiak 1984, Parapura & Pisarski 1971, Rzeszowski *et al.* 2013, Salata 2014, Wiśniowski 2000, Włodarczyk 2010). Unfortunately, most of them are studies of Polish bioregions and provide only partial data on the ant biodiversity of protected areas.

Our research is one of two studies carried out on insects occurring in the Ślęża Landscape Park (ŚLP). The previous one, published by Borowiec (1987), provided information about the Chrysomelidae of the Łąka Sulistrowicka Nature Reserve. With regard to other invertebrates in the ŚLP, only the spiders have been investigated so far (Czajka 1966).

Here we present the results of a study – from spring 2009 to late summer 2012 – into the ant fauna of the ŚLP and its buffer zone. The choice of this area was informed by the specific composition of both anthropogenic and natural habitats, from which we inferred that the ant species composition in this region is highly diverse.

MATERIAL AND METHODS

The study encompassed the ŚLP and its buffer zone (15 640 ha). The Ślęża (718 m amsl) and the Radunia (573 m) are the highest elevations of the Ślęża Massif. Moreover, both are surrounded by a range of smaller hills with a maximum altitude of ca 300 m (Wójcicka-Rosińska & Kowalczyk 2012). Geologically, the Ślęża Massif is composed mainly of serpentinite, but granite, amphibolite and gabbro are also common. This broad diversity of mineral resources gave rise to the mining industry here in past centuries. Mining activity is the source of many old, abandoned quarries and mines (Anioł-Kwiatkowska *et al*. 1992), most of which have become overgrown by young, deciduous forests or meadows.

Other features enhancing the diversity of habitat composition in the Ślęża Massif are the high annual rainfall, the montane climate and the considerable relative height (500 m). All these factors are due to the position of the massif, which is the only elevation in the Sudeten Foreland (Anioł-Kwiatkowska *et al.* 1992).

The flora of the Ślęża Massif is to a large degree synanthropic: the dominant types of habitat are mixed forests and meadows. To protect the valuable areas in the ŚLP, three nature reserves were created: "Góra Ślęża", "Góra Radunia" and "Łąka Sulistrowicka" (Wójcicka-Rosińska & Kowalczyk 2012).

Our research material consisted of that which we collected ourselves from April to September 2011 and the samples collected by members of the Department of Biodiversity and Evolutionary Taxonomy from the University of Wroclaw in 2009-2012. Specimens were collected by hand or with a pooter and were immersed in test tubes containing 75 % ethanol.

In selecting our study localities, we took into account the variety of microhabitats, suggesting a high diversity of species. Apart from the nature reserves, we examined old quarries and mines for preference, our decision being vindicated by the high number of extremely varied microhabitats occurring there. A typical abandoned quarry consisted of bare rock shelves on its walls, dry grasslands or warm deciduous woodlands at the top and water bodies or flooded areas in its central part. Additionally, the whole surface was usually covered with stones and rock rubble. The diversity of microhabitats occurring in quarries and their abundance throughout the Park made them the main research area. The nature reserves, given their importance for biodiversity, were included in the project as well. Table 1 lists the locality numbers, coordinates, altitudes above sea level and provides descriptions of the habitat type at particular localities.

Ants were identified on the basis of keys to the Polish (Radchenko *et al.* 2004) and Central European (Seifert 2007) species.

Table 1. Description of localities with their coordinates, codes and altitudes above mean sea level.

Tabela 1. Opis stanowisk z ich współrzędnymi, numeracją oraz wysokością bezwzględną.

Code and coordinates of locality Numer i współrzędne stanowiska	**Altitude (m amsl)** Wysokość bezwzględna	**Description** Opis
"0" 50°54'18.27"N 16°42'11.13"E	168 m	A flooded granite quarry in Sobótka Zachodnia. Both rock walls and rock piles are overgrown with mixed forest, birch and pine being dominant.
"1" 50°49'59.08"N 16°50'0.57"E	255 m	An old serpentinite quarry, partly overgrown by orchard and dry grassland (*Festuco-Brometeaclass*).
"2" 50°51'54.71"N 16°49'1.03"E	171 m	An old serpentinite quarry overgrown by dry grasslands and surrounded by fields. In the central part there is a small water body, partly covered with swampy meadows.
"3" 50°49'5.58"N 16°40'30.28"E	293 m	A small cherry orchard surrounded by abandoned fields, bordering on a mixed forest. Situated close to the village of Jędrzejowice.
"4" 50°48'59.93"N 16°40'41.53"E	318 m	An old serpentinite quarry completely overgrown by mixed forest consisting mainly of birches and pines.
"5" 50°49'1.37"N 16°40'15.69"E	292 m	A small patch of mixed forest, surrounded by fields and divided into three parts by a road. The first consists of birches and hazels, the second of coniferous trees and the third of a mixture of the previous two.
"6" 50°51'9.51"N 16°47'0.09"E	251 m	An old serpentinite quarry. The rock walls are covered by a layer of rock debris. A water body is present in the centre. The whole area is covered with ruderal flora.
"7" 50°49'37.83"N 16°44'27.31"E	330 m	An old serpentinite quarry situated in a mixed forest. The interior of the quarry is overgrown by dry meadow (*Festuco-Brometea* class), partly covered by rocks of medium and small size.
"8" 50°53'38.42"N 16°41'32.18"E	198 m	The wall of this sand quarry has a south-westerly exposure and is covered with small rocks. Birches and oaks grow at the top of the quarry.
"9" 50°53'34.68"N 16°41'43.72"E	208 m	An old granite quarry with a flooded centre. The walls of the quarry are covered with piles of sand and rock rubble partly overgrown with deciduous woodland.
"10" 50°52'33.49"N 16°40'11.60"E	237 m	An old granite quarry overgrown with mixed woodland with two streams along the woodland margins. Oaks and beeches grow at the top the quarry.

Code and coordinates of locality Numer i współrzędne stanowiska	**Altitude (m amsl)** Wysokość bezwzględna	**Description** Opis
"11" 50°51'58.20"N 16°40'41.23"E	350 m	An old granite quarry located at the foot of a hill, partly overgrown with mixed forest. The walls of quarry are covered by rock rubble and small rocks.
"12" 50°53'48.54"N 16°47'17.18"E	155 m	An old amphibolite and gabbro quarry. Partly overgrown with grasses and wild rose bushes. The area surrounding the quarry consists mostly of grasslands and fallows. To the west of the quarry there is a warm, dry oak forest..
"13" 50°50'34.38"N 16°43'38.87"E	295 m	The "Łąka Sulistrowicka" Nature Reserve, a *Molinio-Arrhenatheretea* meadow situated near the village of Sulistrowiczki, was established to protect endangered plant species and their habitats.
"14" 50°50'17.22"N 16°42'35.84"E	583 m	The "Góra Radunia" Nature Reserve. The subsoil consists mostly of serpentinite, which influences the biogeochemical conditions and microclimate on the mountain. The most valuable habitats in the reserve are dry grassland with *Festucetum pallentis* and Euro-Siberian steppe forest with *Quercus* spp. (*Potentillo albae-Quercetum*)
"15" 50°51'50.92"N 16°42'31.80"E	718 m	The "Góra Ślęża" Nature Reserve. The subsoil consists mostly of gabbro and supports *Asperulo-Fagetum* beech forests as well as rock flora, growing not only on rocks but also on the walls of a church.
"16" 50°49'13.09"N 16°36'12.86"E	326 m	An old serpentinite quarry. The lower part of the quarry is wet and dark, but the upper part is exposed to the Sun and has conditions conducive to the growth of dry grassland (*Festuco-Brometea*) and dry oak forest.

RESULTS

Our research yielded 52 different ant species: this is 53% of the species native to Poland and 85% of the species occurring in Lower Silesia. In the ŚLP we recorded two species new to the Polish fauna: *Lasius sabularum* (Borowiec 2011) and *Lasius carniolicus* (Salata & Borowiec 2011) as well as three species new to Lower Silesia (*Myrmica lonae*, *Formica lemani* and *Tetramorium impurum*). Table 2 shows a full list of species with locality numbers, together with their zoogeographical and ecological classifications based on data given in "The ants of Poland with reference to the myrmecofauna of Europe" (Czechowski *et al.* 2012).

The most common species were *Formica fusca* (16 out of 17 localities) and *Myrmica ruginodis* (14 out of 17 localities). Both are eurytopic species that can live in almost all habitats. Despite the presence of protected areas, the localities with the highest diversity were the old and abandoned quarries Nos. 9 (25 out of 52 species) and 7 (19 species).

Only in the nature reserves of Łąka Sulistrowicka and Góra Radunia was the species richness relatively high (18 each). Quarries were also the most varied habitats in terms of species richness. Nine of the ten species collected in only one locality were found in the quarries. Two ant species from the ŚLP recorded as new to the Polish fauna were also discovered in the quarries.

Table 2. List of species with their zoogeographical and ecological classifications. Zoogeographical types: BM – Boreo-Montane; E – European; EC – Euro-Caucasian; ES – Euro-Siberian; EWS – Euro-West-Siberian; MD – Mediterranean; NP – North-Palaearctic; SE – South-European; T – Tethyan; WE – West-European. Ecological aspects: a) plasticity: E – eurytopic, P – polytopic, O – oligotopic, S – stenotopic; b) habitats: CF – coniferous forests ; DF – deciduous forests; DG – dry grasslands; DH – dry habitats; DDF – dry deciduous forests; DGF – dry grasslands and forests; F – forests; HG – humid grasslands; HH – humid habitats; HGF – humid grasslands and forests; MM – mountain meadows; OH – open habitats; XG –xerothermal grasslands; VOF – various open and forest habitats.

Tabela 2. Wykaz gatunków z ich zoogeograficzną i ekologiczna klasyfikacją. Elementy zoogeograficzne: BM – borealno-górski; E – europejski; EC – eurokaukaski; ES – eurosyberyjski; EWS – eurozachodniosyberyjski; MD – śródziemnomorski; NP – północnopalearktyczny; SE – południowoeuropejski; T – tetydzki; WE – zachodnioeuropejski. Klasyfikacja ekologiczna: a) zakres tolerancji ekologicznej: E – eurytopowy, P – politopowy, O – oligotopowy, S – stenotopowy; b) środowisko: CF – las iglasty; DF – las liściasty; DG – suche łąki; DH – suche środowsko; DDF – suchy las liściasty; DGF – suche łąki i lasy; F – lasy; HG – wilgotne łąki; HH – środowiska wilgotne; HGF – wilgotne lasy i łąki; MM – łąki górskie; OH – środowska otwarte; XG – łąki kserotermiczne; VOF – zróżnicowane środowiska leśne i otwarte.

No. L.p.	**Species** Gatunek	**Zoogeographical element** Element zoogeograficzny	**Ecological category** Klasyfikacja ekologiczna		**Numbers of localities** Numery stanowisk
			Plasticity Zakres tolarancji	**Type of habitat** Rodzaj środowiska	
1.	*Ponera testacea* Emery, 1985	MD	O	DGF	9
2.	*P. coarctata* (Latreille, 1802)	MD	S	XG	0, 8
3.	*Dolichoderus quadripunctatus* (Linnaeus, 1771)	EWS	O	DF	2, 9, 11, 12, 13
4.	*Tapinoma erraticum* (Latreille, 1978)	T	S	XG	4, 7, 14
5.	*T. subboreale* Seifert, 2012	SE	S	XG	1, 4, 9, 12, 13
6.	*Myrmica rubra* (Linnaeus, 1758)	NP	E	VOF	3, 5, 7, 11, 12, 13, 15, 16
7.	*M. ruginodis* Nylander, 1846	NP	P	F	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
8.	*M. rugulosa* Nylander, 1849	EC	O	DG	0, 9, 14,
9.	*M. gallienii* Bondroit, 1920	EWS	O	HG	10
10.	*M. scabrinodis* Nylander, 1846	ES	P	HH	0, 1, 2, 6, 7, 10, 12, 13, 15, 16

No. L.p.	**Species** Gatunek	**Zoogeographical element** Element zoogeograficzny	**Ecological category** Klasyfikacja ekologiczna		**Numbers of localities** Numery stanowisk
			Plasticity Zakres tolarancji	**Type of habitat** Rodzaj środowiska	
11.	*M. sabuleti* Meinert, 1861	EC	O	DGF	0, 1, 2, 3, 4, 7, 8, 9, 11, 12, 14, 16
12.	*M. lonae* Finzi, 1926	EWS	O	HGF	8
13.	*M. schencki* Viereck, 1903	EWS	O	DGF	2, 7, 9, 10, 12, 15
14.	*Stennama debile* (Förster,1850)	EC	O	DF	3, 11
15.	*Formicoxenus nitidulus* (Nylander, 1846)	NP	O	CF	3
16.	*Leptothorax acervorum* (Fabricius, 1793)	BM	P	F	3, 5, 6, 10, 12, 13, 14
17.	*L. gredleri* Mayr, 1855	E	O	DF	7, 12
18.	*Temnothorax tuberum* (Fabricius, 1775)	ES	P	F	6, 7, 9
19.	*T. unifasciatus* (Latreille, 1798)	EC	O	DF	6, 7, 8, 9, 11, 14, 15, 16
20.	*T. crassispinus* (Karawajew, 1926)	EC	O	CF	1, 2, 3, 7, 8, 9, 10, 13, 14, 15, 16
21.	*T. parvulus* (Schenck, 1852)	MD	S	DDF	9
22.	*T. affinis* (Mayr, 1855)	EC	S	DDF	6, 7, 12
23.	*T. corticalis* (Schenck, 1852)	EC	S	DDF	7
24.	*Solenopsis fugax* (Latreille, 1798)	T	O	DGF	0, 2, 9, 12
25.	*Myrmecina graminicola* (Latreille, 1802)	EC	O	DF	2, 8, 10, 11, 16
26.	*Tetramorium impuru*m (Förster, 1850)	E	O	MM	2, 6, 7, 10, 11, 14, 15
27.	*T. caespitum* (Linnaeus, 1758)	SP	P	DH	0, 1, 2, 4, 7, 8, 9, 12, 16
28.	*Formica rufa* Linnaeus, 1761	NP	O	CF	1, 3, 5, 8, 9, 10, 12, 14
29.	*F. polyctena* Förster, 1850	NP	O	CF	1, 2, 5, 13
30.	*F. truncorum* Fabricius, 1804	NP	O	CF	7, 12, 14, 15
31.	*F. pratensis* Retzius, 1783	SP	P	DH	13
32.	*F. fusca* Linnaeus, 1758	NP	E	VFH	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,16
33.	*F. lemani* Bondroit, 1917	BM	O	MM	15

No. L.p.	**Species** Gatunek	**Zoogeographical element** Element zoogeograficzny	**Ecological category** Klasyfikacja ekologiczna		**Numbers of localities** Numery stanowisk
			Plasticity Zakres tolarancji	**Type of habitat** Rodzaj środowiska	
34.	*F. cinerea* Mayr, 1853	EWS	O	DGF	0
35.	*F. rufibarbis* Fabricius, 1793	EWS	O	DG	2, 5, 9, 12
36.	*F. cunicularia* Latreille. 1798	EC	P	OH	1, 2, 3, 5, 6, 8, 9, 10, 11, 13, 14
37.	*F. sanguinea* Latreille, 1798	SP	P	DH	4, 6, 7, 9, 11, 13, 14, 15,16
38.	*Camponotus herculaneus* (Linnaeus, 1758)	BM	O	CF	3, 7, 13
39.	*C. ligniperdus* (Latreille, 1802)	EC	O	DF	1, 6, 7, 8, 9, 11, 12, 14, 25, 16
40.	*C. fallax* (Nylander, 1856)	EWS	O	DF	3, 12, 13
41.	*C. truncatus* (Spinola, 1808)	MD	S	DDF	12
42.	*Lasius niger* (Linnaeus, 1758)	NP	P	OH	2, 3, 4, 5, 6, 7, 8, 12, 13, 14, 15
43.	*L. platythorax* Seifert, 1991	NP	P	F	1, 3, 4, 6, 9, 10, 11, 13, 14, 15
44.	*L. emarginatus* (Olivier, 1792)	EC	O	DGF	1, 2, 6, 8, 9, 10, 11, 15, 16
45.	*L. brunneus* (Latreille, 1798)	EC	O	DF	1, 3, 5, 7, 10, 12, 13, 14, 15
46.	*L. paralienus* Seifert, 1992	EC	O	DG	9
47.	*L. psammophilus* Seifert, 1992	E	O	DG	9
48.	*L. flavus* (Fabricius, 1782)	SP	E	VOH	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14
49.	*L. carniolicus* Mayr, 1861	ES	O	DDF	9
50.	*L. sabularum* (Bondroit, 1918)	WE	O	DGF	10, 12
51.	*L. umbratus* (Nylander, 1846)	SP	P	HH	5, 12
52.	*L. fuliginosus* (Latreille, 1798)	EWS	O	DF	1, 3, 5, 10

DISCUSSION

These data show that anthropogenic habitats have an influence on ant biodiversity. Being creatures that often display a strong affinity for particular microhabitats, ants can attain a high diversity in places changed by humans (Dekoninck *et al.* 2010, Lundholm & Richardson 2010). Nature reserves are valuable because they are rich in flora species or boast rare habitats, but they are usually uniform in terms of temperature, humidity or degree of insolation. In contrast, quarries are more diverse: flooded holes surrounded

Table 3. Ecological classification of species (based on data given in "The ants of Poland with reference to the myrmecofauna of Europe" (Czechowski *et al.* 2012).

Tabela 3. Podział gatunków na ekologiczne klasy i elementy (stworzony w oparciu o dane podane w monografii "The ants of Poland with reference to the myrmecofauna of Europe" (Czechowski *et al.* 2012).

Ecological classification and habitat types Klasyfikacja ekologiczna i typy habitatów	**Ślęża Landscape Park** Ślężański Park Krajobrazowy		Lower Silesia Dolny Śląsk		**Poland** Polska	
	No Nr	%	No Nr	%	No Nr	%
Eurytopic species	**3**	**5.9**	**3**	**4.7**	**3**	**3.1**
Polytopic species	**11**	**21.1**	**11**	**17.5**	**16**	**16.3**
open habitats	2	3.8	2	3.2	2	2.0
forests	4	7.7	4	6.35	6	6.1
dry habitats	3	5.9	3	4.75	5	5.1
humid habitats	2	3.8	2	3.2	3	3.1
Oligotopic species	**30**	**57.6**	**38**	**60.4**	**59**	**60.2**
dry grasslands	4	7.7	5	7.9	10	10.2
dry grasslands and forests	7	13.5	9	14.3	14	14.3
deciduous forests	9	17.3	10	15.9	13	13.3
coniferous forests	6	11.5	6	9.5	8	8.2
coniferous forests and mountain meadows	-	-	2	3.2	2	2.0
coniferous forests and mires	-	-	-	-	2	2.0
humid grasslands	1	1.9	1	1.6	1	1.0
humid grasslands and forests	1	1.9	2	3.2	3	3.1
mountain meadows	2	3.8	2	3.2	3	3.1
mountain meadows and dry grasslands	-	-	-	-	1	1.0
mires and mountain meadows	-	-	1	1.6	1	1.0
urban green	-	-			1	1.0
Stenotopic species	**8**	**15.3**	**11**	**17.4**	**20**	**20.4**
xerothermic grasslands	3	5.9	5	7.9	11	11.2
dry deciduous forests	5	9.6	6	9.5	6	6.1
wet meadows and mires	-	-	-	-	1	1.0
mires	-	-	-	-	2	2.0
Total	**52**		**63**		**98**	

by wetlands, rock shelves covered with rubble and sites supporting dry grasslands or deciduous and mixed woodland are preferred by species with varied environmental requirements.

Table 3 shows the ecological classification of ants. The overall proportions of the ecological classes are similar in the ŚLP and in Poland as a whole, but there are differences regarding habitat types, possibly due to the different proportions of particular habitats in Poland and in the ŚLP. For example, deciduous forests are the most numerous habitat type (17.3%) in the ŚLP, whereas the dominant types in Poland as a whole are dry grasslands and forests. There are also substantial differences in the proportions of dry deciduous forests (9.6% for the ŚLP vs. 6.1% for Poland) and xerothermic grasslands (5.9% for the ŚLP vs. 11.2% for Poland). This is a result of the differences in the composition of particular habitats mentioned above.

Further significant differences between the ant fauna of Poland and the ŚLP are noticeable in their zoogeographical classification (Table 4). In the ŚLP, the dominant zoogeographical types are Euro-Caucasian (25%), North-Palaearctic (15.4%) and Euro-West-Siberian (15.4%), whereas in Poland as a whole they are Euro-Caucasian (19.4%), Euro-West-Siberian (13.3%) and Boreo-Montane (12.2%).

Table 4. Zoogeographical classification of species (based on data given in "The ants of Poland with reference to the myrmecofauna of Europe" (Czechowski *et al.* 2012).

Tabela 4. Podział gatunków na zoogeograficzne klasy i elementy (stworzony w oparciu o dane podane w monografii "The ants of Poland with reference to the myrmecofauna of Europe" (Czechowski *et al.* 2012).

Zoogeographical classification Klasyfikacja zoogeograficzna	**Ślęża Landscape Park** Ślężański Park Krajobrazowy		**Lower Silesia** Dolny Śląsk		**Poland** Polska	
Coniferous forest zone	**11**	**21.2**	**15**	**23.8**	**25**	**25.4**
Boreo-montane	3	5.8	6	9.5	12	12.2
Montane	-	-	-	-	1	1.0
North-European	-	-	-	-	1	1.0
North-Palearctic	8	15.4	9	14.3	11	11.2
Mixed and deciduous forest zone	**34**	**65.4**	**38**	**60.4**	**55**	**57.1**
West-European	2	3.8	2	3.2	4	4.1
European	**3**	**5.8**	**3**	**4.8**	**7**	**7.1**
Euro-West-Siberian	8	15.4	9	14.3	13	13.3
Euro-Siberian	3	5.8	3	4.8	3	3.1
Euro-Caucasian	13	25.0	14	22.2	19	19.4
South-Palaearctic	5	9.6	7	11.1	10	10.2

Zoogeographical classification Klasyfikacja zoogeograficzna	**Ślęża Landscape Park** Ślężański Park Krajobrazowy		**Lower Silesia** Dolny Śląsk		**Poland** Polska	
Semi-arid and arid zones	**7**	**13.4**	**10**	**15.8**	**17**	**17.4**
South-European	1	1.9	1	1.6	3	3.1
Mediterranean	4	7.7	5	7.9	8	8.2
Tethyan	2	3.8	4	6.3	6	6.1

Table 5 shows data from faunal inventories conducted solely in other protected areas in Poland. To avoid misunderstandings regarding the numbers of species recorded in national and landscape parks, we have omitted publications relating to research simultaneously carried out in unprotected areas. Unfortunately, the data from the papers shown in Table 5 are not really comparable: there are differences in time – between 1932 and 2013 several revisions revealed new species and synonymized others – and also in the sizes of the areas studied. Nevertheless, we have decided to provide this data in order to demonstrate the differences between the species richness of these localities and to underscore the gap between the ŚLP and the other protected areas.

The number of species recorded in the ŚLP is impressive. The variety of microhabitats in the landscape park (from warm or dry meadows to cool mountain peaks) may explain such a large species richness. Recent climate warming may also be a factor influencing the ant fauna, favouring as it does the expansion of xerophilous species such as *Camponotus truncatus*, *Temnothorax affinis* or *Tapinoma species* (Czechowski *et al*. 2012, Suchocka *et al.* 2008). Their colonies, considered rare in the past, are nowadays common in the ŚLP and in Lower Silesia generally (Borowiec & Borowiec 2013). The blurring of borders between the seasons, as well as the warming and drying out of the climate, have given rise to many new microhabitats which can be occupied by new species.

In addition, human activities, especially mining, have created many sites abundant in rare and valuable microhabitats which can be inhabited by xerophilous species (Tropek *et al.* 2010). The monograph "Ants of Poland" (Czechowski *et al.* 2002) reported only 40 ant species from Lower Silesia; since then, however, the number has increased to 63. Such an increase cannot be explained only by a greater research effort. Our data show that ants can be good indicators of the changes in the composition of fauna. Through their abundance and migratory potential they are a group of insects in which changes become apparent the earliest. The Ślęża mountain as a biodiversity hot spot consists of a unique mosaic of extremely varied microhabitats, which support the presence of species with very different environmental requirements.

Among the species collected during the research, we confirmed the presence of one mentioned in the Polish Red Data Book of Animals (*Temnothorax affinis*) and four listed in the IUCN Red List of Threatened Species (*Formica polyctena*, *Formica pratensis*, *Formica rufa*, *Formicoxenus nitidulus*).

Table 5. Comparison of species recorded in some other protected areas in Poland.

Tabela 5. Porównanie danych uzyskanych podczas badań faunistycznych na innych chronionych terenach Polski (z podaniem nazwy badanego obszaru, liczby stwierdzonych gatunków i źródła).

Location Badany obszar	**Number of species recorded** Liczba stwierdzonych gatunków	**References** Źródło
Pieniny National Park	47	Koehler 1951
Pieniny National Park	46	Czechowska 1976
Chełmowa Góra in the Świętokrzyski National Park	16	Rzeszowski *et al.* 2013
Stołowe Mountains National Park	32	Salata 2013
Świętokrzyski National Park	37	Krzysztofiak 1984
Ojców National Park	31	Dylewska & Wiśniowski 2003
Szczecin Landscape Park	22	Włodarczyk 2010

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STRESZCZENIE

Ślężański Park Krajobrazowy – hot-spot bioróżnorodności mrówek (Hymenoptera: Formicidae) w Polsce

W wyniku prowadzonych w latach 2009-2012 badań myrmekofauny Ślężańskiego Parku Krajobrazowego i jego otuliny stwierdzone zostały 52 gatunki. Jest to najwyższa w Polsce i Europie Środkowej liczba gatunków mrówek wykazana w wyniku inwentaryzacji faunistycznej obszaru objętego ochroną prawną. Bogactwo gatunkowe badanego terenu stanowi 52% rodzimych gatunków wykazanych z Polski i 85% gatunków stwierdzonych do tej pory na Dolnym Śląsku. *Myrmica lonae*, *Formica lemani* i *Tetramorium impurum* są po raz pierwszy stwierdzane na terenie Dolnego Śląska.

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