



TERRESTRIAL GASTROPODS OF THE PARK IN OBRZYCKO

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ABSTRACT: Species composition and structure of the malacocoenosis of the park in Obrzycko are described. Thirty species of terrestrial snails were identified, with *Arianta arbustorum* as superdominant, and eudominants represented by *Succinea putris* and *Helix pomatia*. The dominants included *Clausilia bidentata*, *Arion subfuscus*, *Trichia hispida* and *Cochlicopa lubrica*. The malacocoenosis is polymictic; the indices of species diversity ($H' = 3.11$) and equitability ($J' = 0.63$) are high. Synanthropic and euryoecious species prevail; biogeographically European and Holarctic species are the most numerous.

KEY WORDS: terrestrial gastropods, park, Poland, malacocoenosis structure

INTRODUCTION

The park in Obrzycko is situated within the Poznańskie Lakeland. The palace with its park date from the second half of the 19th century. The park is century 19 ha in area, including fallow land (former gardens and fields); its shape is irregularly polygonate, elongated eastward along the Warta River. It is crossed by drainage ditches, prolonged as deep ravines opening to the river. Most of the park is covered by forest-park vegetation. There are potential oak-hornbeam stands, with dominance of high oak-hornbeam forest in the northern and central part of the area. The vegetation of the ravines and the southern slopes is of

riverine forest character. The tree stands are a mixture of alien and native species, departing from natural native forests. In larger open spaces in the park, usually in slightly more humid and less shaded places, patches of herb verges appear. On the slopes facing the Warta R. valley fragments of degraded slope riverine forest have been preserved, while the ravines opening to the river are covered by elm-ash riverine forest.

The study was aimed at determining the species composition and structure of the park's malacocoenosis.

METHODS

The fauna of the park in Obrzycko was studied in 1988–2001. Quantitative samples were taken in May and August 1988 and July 1989. On each occasion, 16 samples were taken with 25 × 25 cm Oekland frame, totalling 1 m² litter and soil. The sampling was supplemented with visual search. From June 4th till 12th 2001, I took a total of 2 m² ground cover and collected semi-quantitatively (visual search of a total time of 20 hrs). Both quantitative and qualitative studies included various habitats in the park. The samples

were sorted under stereomicroscope, and only live snails were considered.

The following indices were used to characterise the malacocoenosis: abundance, density, dominance, frequency, species diversity index (TDI), Shannon-Weaver species diversity index (H'), Pielou's equitability index (J'); the species were classified into ecological groups and biogeographical elements (PIELOU 1974, KASPRZAK & NIEDBAŁA 1981, ŁUCZAK & WIERZBOWSKA 1981, ALEKSANDROWICZ 1987, RIEDEL 1988, TROJAN 1992).

Table 1. Species composition, abundance, frequency (C) and dominance (D) of the park malacocenosis

No.	Species	Abundance					Total individuals	D%			
		Quantitative samples		Qualitative samples		C %		Quantitative samples	Qualitative samples	Quantitative and qualitative samples jointly	
		26. 05. 1988 29. 08. 1988 04. 07. 1989 3 m ²	4-12. 06. 2001 2 m ²	05-09. 1988-1999	Visual search (20 hrs) 4-12. 06. 2001						Adults
1.	<i>Clausilia bidentata</i>	17	6	17	97	39	176	13.4	9.3	8.4	8.5
2.	<i>Ena obscura</i>	3	-	2	-	-	5	1.8	1.2	0.1	0.2
3.	<i>Zonitoides nitidus</i>	1	-	3	-	3	7	0.9	0.4	0.3	0.3
4.	<i>Vibrea crystallina</i>	7	-	-	-	-	7	1.8	2.8	-	0.3
5.	<i>Vibrea contracta</i>	4	-	-	-	-	4	1.8	1.6	-	0.2
6.	<i>Aegopinella nitidula</i>	5	-	3	-	-	8	2.7	2.0	0.2	0.4
7.	<i>Aegopinella pura</i>	12	-	-	-	-	12	3.6	4.9	-	0.6
8.	<i>Nesovitrebra hammonis</i>	4	-	3	-	-	7	3.6	1.6	0.2	0.3
9.	<i>Oxychilus cellarius</i>	1	-	5	-	-	6	0.9	0.4	0.3	0.3
10.	<i>Carychium minimum</i>	3	-	-	-	-	3	0.9	1.2	-	0.1
11.	<i>Vallonia pulchella</i>	6	-	-	-	-	6	4.5	2.4	-	0.3
12.	<i>Vallonia costata</i>	2	-	-	-	-	2	1.8	0.8	-	0.1
13.	<i>Vitrina pellucida</i>	2	-	-	-	-	2	1.8	0.8	-	0.1
14.	<i>Succinea putris</i>	27	-	60	249	27	363	5.4	10.9	18.4	17.5
15.	<i>Succinea oblonga</i>	3	-	2	-	-	5	1.8	1.2	0.1	0.2
16.	<i>Discus rotundatus</i>	-	-	1	-	-	1	-	-	0.1	0.1
17.	<i>Trichia hispida</i>	9	1	169	2	4	185	7.1	4.0	9.6	8.9
18.	<i>Perforatella incarnata</i>	1	-	62	-	6	69	0.9	0.4	3.7	3.3
19.	<i>Perforatella bidentata</i>	-	-	2	-	-	2	-	-	0.1	0.1
20.	<i>Arianta arbustorum</i>	-	16	2	421	223	662	8.9	6.5	35.3	31.9
21.	<i>Helix pomatia</i>	-	1	6	108	148	263	0.9	0.4	14.3	12.7
22.	<i>Cepaea nemoralis</i>	-	-	14	-	-	14	-	-	0.8	0.7
23.	<i>Cepaea hortensis</i>	-	-	3	-	-	-	-	-	0.2	0.1
24.	<i>Cochlicopa lubrica</i>	104	2	-	-	1	107	25.0	42.9	0.1	5.2
25.	<i>Bradybaena fruticum</i>	-	-	5	8	1	14	-	-	0.8	0.7
26.	<i>Euconulus fulvus</i>	-	-	3	-	-	3	-	-	0.2	0.1
27.	<i>Arion subfuscus</i>	2	7	8	48	52	117	4.5	3.6	5.9	5.6
28.	<i>Arion fasciatus</i>	-	-	2	-	-	2	-	-	0.1	0.1
29.	<i>Limax maximus</i>	-	1	2	7	8	18	0.9	0.9	0.9	0.9
30.	<i>Devoceras reticulatum</i>	-	-	4	-	-	4	-	0.2	0.2	0.2
Total		213	34	378	940	512	2,077	-	-	-	-



CHARACTERISTICS OF THE MALACOCOENOSIS

Thirty species of terrestrial gastropods of 15 families were found in the park. The most numerous represented families were Helicidae – 7 species and Zonitidae – 6 species. The quantitative samples of a total area of 5 m² contained 247 specimens of 22 species, while visual search yielded 1,830 specimens of 23 species. The most abundant species in the quantitative samples was *Cochlicopa lubrica* (106 specimens), and among species found visually the most abundant were *Arianta arbustorum* (646), *Succinea putris* (336), *Helix pomatia* (262), *Trichia hispida* (175) and *Clausilia bidentata* (153). The composition of the malacofauna is presented in Table 1.

The mean snail density was 49 individuals per m², the maximum and minimum values were 118 indiv. m⁻² and 17 indiv. m⁻², respectively. The following species showed the highest mean density: *Cochlicopa lubrica* – 21 indiv. m⁻², *Succinea putris* and *Clausilia bidentata* – 5 indiv. m⁻². Changes of the maximum density through time are presented in Table 2.

Table 2. Temporal variation in the highest density of gastropods from quantitative samples

Date	Species	Density (indiv. m ⁻²)
26.05.1988	<i>Cochlicopa lubrica</i>	46
29.08.1988	<i>Cochlicopa lubrica</i>	40
04.07.1989	<i>Cochlicopa lubrica</i>	18
4–12.06.2001	<i>Arianta arbustorum</i>	8

The superdominant of the malacocoenosis was *Arianta arbustorum*, the eudominants *Succinea putris* and *Helix pomatia*. The dominants included *Clausilia bidentata*, *Arion subfuscus*, *Trichia hispida* and *Cochlicopa lubrica*. Subprecedents constituted the largest group of species (22).

In the quantitative samples the superdominant was *Cochlicopa lubrica*, in visual search – *Arianta arbustorum*. In both kinds of samples only *Succinea putris* was the eudominant, and *Clausilia bidentata* – the dominant. Besides, a dominant in quantitative samples was *Arianta arbustorum*, and in visual search – *Trichia hispida* and *Arion subfuscus*.

In quantitative samples all species were accidental, of a frequency up to 25%.

The number of species in quantitative samples through time changed from 3 to 16 per metre square. The species diversity index H' showed slight changes, ranging from 2.01 to 2.92; it was 3.14 for all the quantitative samples jointly. The species diversity of all the studied malacocoenosis, considering both quantitative and qualitative samples, was 3.11.

The equitability J' for quantitative samples and visual search was 0.63; for quantitative samples it ranged from 0.60 to 0.75.

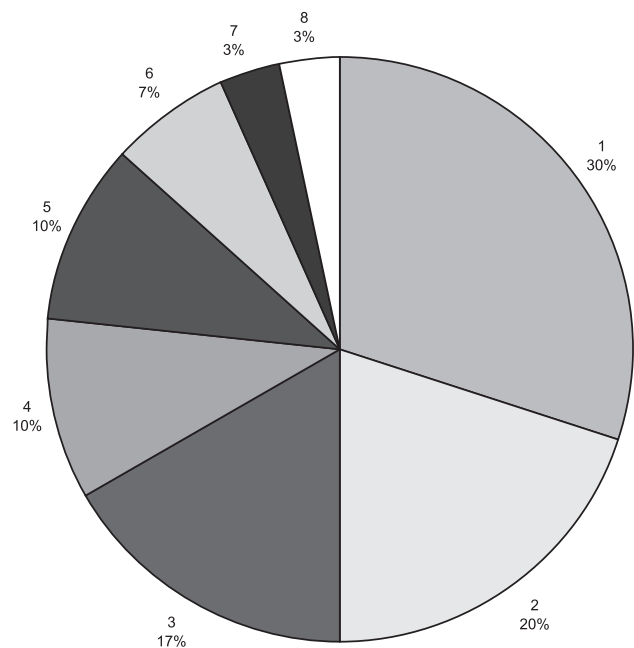


Fig. 1. Ecological structure of the park malacocoenosis – species spectrum. 1–8 ecological groups: 1 – synanthropic, 2 – euryoecious, 3 – typical forest species very rarely found in other habitats, 4 – species occurring mainly in forests but common in parks, gardens and other shady habitats, 5 – species of very humid, wet, periodically flooded habitats, 6 – species of open sites of varied humidity, 7 – forest and shade-loving species typical of very humid habitats, 8 – species of humid (but not wet) habitats with different degrees of shading

The malacocoenosis of the park is polymictic. The value of TDI index 0.98 – close to one – indicates an almost maximum species diversity. For quantitative samples the index was much lower and assumed a value of 0.79.

Synanthropic (30%) and euryoecious species of open or shaded habitats of moderate humidity (20%) (Fig. 1) constituted the greatest proportion. A large proportion (17%) was formed by forest species very rarely found in other habitats. In terms of individuals, the most numerous groups included snails found

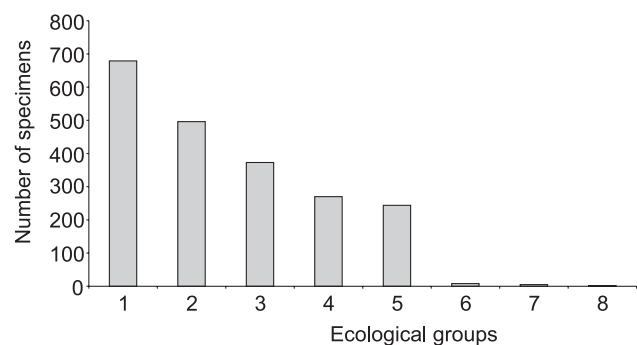


Fig. 2. Ecological structure of the park malacocoenosis – individual spectrum. For explanations see Fig. 1

Table 3. Comparison of species composition of malacocoenoses of the parks of the Wielkopolsko-Kujawska Lowland. Data on other parks from KĘDRA (1972) and KORALEWSKA (1979), “+” – present, “–” – absent

Species	Września region	Chodzież region	Obrzycko	Species	Września region	Chodzież region	Obrzycko
<i>Clausilia bidentata</i>	–	+	+	<i>Arianta arbustorum</i>	–	+	+
<i>Ena obscura</i>	–	+	+	<i>Helix pomatia</i>	+	+	+
<i>Vitrina pellucida</i>	+	+	+	<i>Cepaea hortensis</i>	+	+	+
<i>Zonitoides nitidus</i>	+	–	+	<i>Cepaea nemoralis</i>	–	–	+
<i>Vitrea crystallina</i>	–	+	+	<i>Cochlicopa lubrica</i>	+	+	+
<i>Vitrea contracta</i>	–	–	+	<i>Cochlicopa lubricella</i>	–	+	–
<i>Aegopinella nitidula</i>	–	+	+	<i>Columella aspera</i>	–	+	–
<i>Aegopinella pura</i>	–	+	+	<i>Truncatellina costulata</i>	–	+	–
<i>Nesovitrea hammonis</i>	+	+	+	<i>Vertigo angustior</i>	–	+	–
<i>Oxychilus cellarius</i>	–	–	+	<i>Vertigo pusilla</i>	–	+	–
<i>Carychium minimum</i>	–	–	+	<i>Vertigo antivertigo</i>	–	+	–
<i>Carychium tridentatum</i>	–	+	–	<i>Vertigo pygmaea</i>	–	+	–
<i>Vallonia pulchella</i>	+	+	+	<i>Pupilla muscorum</i>	–	+	–
<i>Vallonia costata</i>	+	+	+	<i>Bradybaena fruticum</i>	+	–	+
<i>Acanthinula aculeata</i>	–	+	–	<i>Euconulus fulvus</i>	+	+	+
<i>Chondrula tridens</i>	+	–	–	<i>Punctum pygmaeum</i>	–	+	–
<i>Succinea putris</i>	+	–	+	<i>Arion rufus</i>	–	+	–
<i>Succinea elegans</i>	+	–	–	<i>Arion circumscriptus</i>	–	+	–
<i>Succinea oblonga</i>	–	+	+	<i>Arion subfuscus</i>	–	–	+
<i>Discus rotundatus</i>	–	+	+	<i>Arion fasciatus</i>	–	–	+
<i>Discus ruderatus</i>	–	+	–	<i>Limax flavus</i>	–	+	–
<i>Trichia hispida</i>	+	+	+	<i>Limax maximus</i>	–	–	+
<i>Perforatella incarnata</i>	+	+	+	<i>Deroceras reticulatum</i>	+	–	+
<i>Perforatella rubiginosa</i>	+	–	–	<i>Euomphalia strigella</i>	+	–	–
<i>Perforatella bidentata</i>	–	+	+	Total	18	34	30

mainly in forests, but common also in parks, gardens and other considerably shaded habitats (33%), as well as synanthropic snails (24%) (Fig. 2).

The malacocoenosis of the park includes the following biogeographical elements:

- Holarctic: *Zonitoides nitidus*, *Vallonia pulchella*, *V. costata*, *Cochlicopa lubrica*, *Euconulus fulvus*, *Vitrina pellucida*;
- Palaearctic: *Nesovitrea hammonis*;
- Euro-Siberian: *Carychium minimum*, *Succinea putris*, *Succinea oblonga*;
- European: *Ena obscura*, *Vitrea crystallina*, *V. contracta*, *Aegopinella pura*, *Trichia hispida*, *Arion subfuscus*, *A. fasciatus*, *Deroceras reticulatum*;

- N and NW European: *Clausilia bidentata*;
- W European: *Oxychilus cellarius*, *Cepaea nemoralis*;
- W and C European: *Discus rotundatus*, *Cepaea hortensis*;
- C and SE European: *Perforatella incarnata*, *Helix pomatia*;
- E European: *Perforatella bidentata*, *Bradybaena fruticum*;
- C and NW European: *Arianta arbustorum*;
- Pontic: *Aegopinella nitidula*;
- Introduced (S and W European and N African): *Limax maximus*.

DISCUSSION

The number of collected species and specimens varied with the method, time of collection, atmospheric conditions etc. Quantitative sampling included 73% of all species. Species found in the park in Obrzycko constitute 31% species of the Wielko-

polsko-Kujawska Lowland. In five parks of the region of Chodzież, KĘDRA (1972) found 34 species of terrestrial gastropods, KORALEWSKA (1979) reported 18 species from the region of Września. The two authors mention a total of 42 species found in parks. In the



park in Obrzycko, I found 23 species of this group (Table 3), and furthermore the following seven species: *Cepaea nemoralis*, *Arion fasciatus*, *Limax maximus*, *Oxychilus cellarius*, *Vitrea contracta*, *Arion subfuscus* and *Carychium minimum*. Three of them (*A. fasciatus*, *L. maximus*, *C. nemoralis*) are synanthropic, the other – euryoecious. The park in Obrzycko harbours 61% species recorded from the parks of the Wielkopolsko-Kujawska Lowland.

Like most parks, the park in Obrzycko has no distinct character and its plant communities resemble those of other habitats. However, its microhabitats are fairly diverse, creating very favourable conditions for many gastropod species.

The gastropod density varies with habitat, season and weather, while the density of particular species depends on their life cycle and the tendency of some species to move from litter to logs or tree trunks during certain periods.

The malacocoenosis includes no recedents. The superdominant, eudominants and dominants constitute a group of seven species, while the largest group – subrecedents – includes 73% of all species. Specimens of the dominant species constitute 90% relative abundance of the whole malacocoenosis, and subrecedents form only 7%.

Synanthropic species and mesophiles of considerable ecological tolerance prevail in the malacocoenosis. Compared to the parks of the Września and Chodzież regions, synanthropic species from the park in Obrzycko do not include *Arion rufus* and *Limax flavus*. Synanthropes found in that park and not recorded from the parks just named are: *Cepaea nemoralis*, *Arion fasciatus* and *Limax maximus*.

The species diversity H' of the park malacocoenosis is high and close to the values obtained for malacocoenoses of riverine and oak-hornbeam forests (SZYBIAK 1996, 2002), alder woods (SZYBIAK 2001) and beech forests (SZYBIAK 2002).

The species diversity index TDI is very useful for comparisons of equitability and diversity of malacocoenoses, irrespective from their component taxa. The TDI index for the park malacocoenosis, 0.98, is somewhat higher than such indices for the above forest malacocoenoses (0.66–0.93). Species diversity is proportionate to species richness and equitability (saturation). Deviations are observed in degraded habitats with malacocoenoses of unbalanced structure. The structure of the park malacocoenosis from Obrzycko is balanced. The habitats of the park in Obrzycko provide favourable conditions for the development of malacocoenoses.

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