

SPECIES RICHNESS OF CLICK-BEETLES (COLEOPTERA: ELATERIDAE) OF FRESH MEADOWS IN LASY JANOWSKIE LANDSCAPE PARK

Krzysztof Pawłęga

Department of Zoology, University of Life Sciences in Lublin
Akademicka str. 13, 20-950 Lublin, krzysztof.pawlega@up.lublin.pl

Summary. A study on the click-beetles of the fresh meadows in Lasy Janowskie Landscape Park was conducted in meadow associations of the class *Molinio-Arrhenatheretea*. Eighteen Elateridae species were found, among which species characteristic of meadows and wet environments were dominant: *Hemicrepidius niger*, *Synaptus filiformis*, *Actenicerus siaelandicus* and *Agriotes obscurus*. The last three of these also had the highest index of constancy of occurrence in the samples (C) and the highest ecological significance (Q). The click-beetle fauna was characterised by high species diversity – Simpson Index of Diversity was 0.87. The number of species was equal to or greater than that found in other communities studied in the park and in other areas of Poland.

Key words: click-beetles, south-eastern Poland, park, fresh meadows, species diversity, ecology, zoogeography

INTRODUCTION

Click-beetles (Elateridae) are a family of beetles that has been unevenly and insufficiently researched in most regions of Poland [Tarnawski 2000]. The literature on click-beetles of meadow biotopes is also rather poor, with most studies dealing with soil fauna [Pawelska 1950, Honczarenko 1956, 1962, 1970, Tarnawski 1987]. In order to further the characterisation of Elateridae populations of south-eastern Poland, particularly protected areas, a study was carried out in the years 1997–2001 on the click-beetle fauna of 12 types of plant community in Lasy Janowskie Landscape Park, including fresh meadows.

STUDY AREA

Lasy Janowskie Landscape Park is situated in south-eastern Poland, in the northern part of the Sandomierz Basin [Kondracki 2000]. It is one of the largest continuous forest complexes in Poland, with high natural values owing to such characteristics as its large surface area, its network of water bodies, its diversity of habitats, and the diverse plant communities within them [Radwan *et al.* 1996, Fijałkowski 1997].

Click-beetles were collected in the Park in meadow associations of the class *Molinio-Arrhenatheretea*. These were *Arrhenatheretum elatioris*, *Poo-Festucetum rubre* and *Lolio-Cynosuretum*. The first of these consists of well-fertilised, highly productive fresh meadows. This association forms in eutrophic river valleys, on fertile, fine-grained brown soil and brown alluvial soils. *Poo-Festucetum rubre* is a type of meadow in which Smooth Meadow-grass (*Poa pratensis*), Red Fescue (*Festuca rubra*) and Creeping Bentgrass (*Agrostis stolonifera*) are dominant. It forms on mesotrophic silt/peat soils. This is the dominant meadow association in the park. The *Lolio-Cynosuretum* association, in which Perennial Ryegrass (*Lolium perenne*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Red Fescue and Smooth Meadow-grass are dominant, occurs in the park on the edges of river valleys with a mineral/peat substrate [Fijałkowski 1997, Matuszkiewicz 2001].

MATERIALS AND METHODS

Elateridae adults were collected using a sweep net. One quantitative sample was the sum of 100 net strokes (4×25 sweeps). For the few quantitative samples taken, the number of repetitions of the 25 sweeps varied depending on the size of the area investigated. The samples were taken at 6 study sites in the following locations: 1. Kolonia Sokołówka (FB 10, 50°39'20"N i 22°40'23"E) – a mown meadow near grain crops, 2. Flisy (FB 01, 50°39'34"N i 22°29'24"E) – a mown meadow in the Branew River valley, 3. Gierlachy (EB 91, 50°40'24"N i 22°21'17"E) – a section of fresh meadows in the Trzebensz River valley, 4. Łązek Ordynacki (EB 90, 50°38'53"N i 22°16'38"E) – a mown meadow at the edge of a forest, 5. Gielnia (EB 71, 50°42'42"N i 22°07'08"E) – a meadow within a forest, and 6. Szwedry (50°36'58"N i 22°13'07"E) – sections of meadows (a site used irregularly only for qualitative samples). The click-beetles were collected during the years 1998–2001, twice a month from mid-April to mid-August.

The following biocenotic indices were used to analyse the material collected: dominance (D%), constancy of occurrence in the samples (C%), ecological significance index (Q%), Margalef diversity index (d) and Simpson diversity index ($1 - D$). Ecological and zoogeographical analyses were also conducted. Species were assigned to particular zoogeographical elements according to Tarnawski [2000]. In the Discussion, Jaccard formula I (J)

was used to compare qualitative similarities of the click beetle populations of fresh meadows with click-beetle fauna described in the literature.

RESULTS

Eighteen Elateridae species were noted in the fresh meadow communities of Lasy Janowskie Landscape Park. One of these – *Cardiophorus ruficollis* – was found only in the qualitative samples. The click-beetle fauna was characterised by high species diversity, indicated by high values for both the Margalef index ($d = 7.3$) and the Simpson Index of Diversity ($1 - D = 0.88$). Most frequently collected were species characteristic of meadows and wet environments. These were *Hemicrepidius niger* and *Synaptus filiformis* ($D = 20.1\%$ for each), *Actenicerus siaelandicus* ($D = 14.9\%$) and *Agriotes obscurus* ($D = 11.7\%$) which formed the eudominant group ($D > 10\%$). The last three of these species also had the highest index of constancy of occurrence in the samples (C) – 42.4, 27.3 and 48.5% respectively. Dominance values for the remaining species are given in Table 1. The Table also shows the constancy of occurrence values (C) for each species. No species with very high ecological significance ($Q > 40.0\%$) were found in the click-beetle population of the park's fresh meadows. The eudominants were characterised by high ecological significance ($40\% > Q > 20.1\%$) (Tab. 1). The ecological significance of *Agriotes lineatus* was average ($20.0\% > Q > 10.1\%$), while that of 8 species was low ($10.0\% > Q > 2.1\%$) (Tab. 1). Very low Q values were found for *Athous vittatus*, *Prosternon tessellatum*, *Ectinus aterrmus* and *Agriotes sputator* ($Q = 1.3\%$ for each).

Adults can migrate to various atypical environments, while settled larvae remain in habitats characteristic for their species. For this reason, the environmental requirements of larvae are one of the criteria for classifying click-beetles into particular ecological groups. Analysis based on the habitat preferences of Elateridae showed that the click-beetle fauna of the fresh meadows was in fact dominated by species characteristic of meadows and moist environments (38.9% qualitative and 82.4% quantitative share). The qualitative share of forest species, sometimes found in non-forest environments, was not much smaller (33.3%), but the number of specimens representing these species was small (7.5%). Far fewer eurytopic species (16.7%) and species typical of xerothermic grasslands (11.1%) were noted. The frequency of occurrence of these species was also low. Analysis of development microhabitats, which was the other criterion used to classify species into ecological groups, showed that the click-beetle fauna of the fresh meadows was dominated by species that develop exclusively in soil microhabitats (72.2%). The remaining 27.8% were species developmentally associated with soil, sometimes found in microhabitats of decaying wood. Similar proportions were observed in the qualitative share.

Table 1. Frequency and selected analytical indices of click-beetles of fresh meadows in Lasy Janowskie Landscape Park in the years 1997–2001

Species	L	Biocenotic indices			Examined stations					
		D%	C%	Q%	1	2	3	4	5	6
<i>Agrypnus murinus</i> (L., 1758)	6	3.9	12.1	6.9	+	+				
<i>Cidnopus pilosus</i> (Leske, 1758)	3	1.9	9.1	4.2	+			+		
<i>Cidnopus aeruginosus</i> (Oliv., 1790)	4	2.6	9.1	4.9		+				
<i>Hemicrepidius hirtus</i> (Herbst, 1784)	2	1.3	6.1	2.8		+	+			
<i>Hemicrepidius niger</i> (L., 1758)	31	20.1	24.2	22.1	+	+				
<i>Athous vittatus</i> (Gmelin, 1790)	1	0.6	3.0	1.3		+				
<i>Athous haemorrhoidalis</i> (Fabr., 1801)	5	3.2	6.1	4.4		+				
<i>Actenicerus siaelandicus</i> (O. F. Müll., 1764)	23	14.9	27.3	20.2	+	+		+		
<i>Prosternon tessellatum</i> (L., 1758)	1	0.6	3.0	1.3	+					
<i>Selatosomus aeneus</i> (L., 1758)	3	1.9	9.1	4.2		+				
<i>Synaptus filiformis</i> (Fabr., 1781)	31	20.1	42.4	29.2		+				
<i>Adrastus pallens</i> (Fabr., 1792)	7	4.5	6.1	5.2		+				+
<i>Adrastus rachifer</i> (Fourcr., 1785)	8	5.2	6.1	5.6		+				
<i>Ectinus aterrimus</i> (L., 1761)	1	0.6	3.0	1.3					+	
<i>Agriotes obscurus</i> (L., 1758)	18	11.7	48.5	23.8	+	+	+		+	
<i>Agriotes lineatus</i> (L., 1767)	9	5.8	21.2	11.1	+	+				
<i>Agriotes sputator</i> (L., 1758)	1	0.6	3.0	1.3		+				
<i>Cardiophorus ruficollis</i> (L., 1758)	-	-	-	-						+

D% – dominance, C% – constancy of occurrence in samples, Q% – ecological significance, L – number of individuals of Elateridea in quantitative samples

The click-beetle fauna of the fresh meadows in the park represented 6 zoogeographical elements. Wide-ranging species were dominant. The qualitative share of the elements was as follows: Eurasian – 27.8%, Eurosiberian – 22.2%, Pontic-Mediterranean and European – 16.7% each, Holarctic – 11.1% and Palearctic – 5.5%.

DISCUSSION

The Elateridae population of the fresh meadows of Lasy Janowskie Landscape Park numbered 18 species of adults. Compared to the click-beetle fauna of other plant communities studied in the park, this is not a small number. Pawłęga [2003, 2004] noted the same number of species in the park's riparian communities and in its alder communities. 13 species were noted in xerothermic communities on the northern border of the park with its buffer zone, while 10 were found in wet meadows and low moors and 10 in high and transitional moors [Ścibior and Pawłęga 2000, Pawłęga 2004]. The fresh meadow click-beetle fauna exhibited the highest qualitative similarity ($J = 47.6\%$) to mesoxerothermic click-beetle communities. This may be due to certain

similarities in these communities – they were open and exposed to sunlight. The species composition of fresh meadow Elateridae was undoubtedly influenced by the ecological characteristics of the species as well as by proximity to other types of habitats (marshy meadows, forests), which enabled mobile adults to migrate between habitats. This may explain the high qualitative similarity ($J = 44\%$) of fresh meadow click-beetle fauna to that of the marshy meadows which often surrounded them, as well as the 33.3% share of forest species which can sometimes occur in an atypical environment. Similarly, the proximity to moist habitats can explain the significant dominance of species characteristic of meadows and wet areas, such as *Actenicerus sialeandicus* and *Synaptus filiformis*. In the literature on Elateridae of meadow communities, descriptions of the larvae of these beetles dominate, which restricts a broader discussion due to the specific character of such studies. The adult click-beetle population of meadow habitats and pasturelands in the Western Bieszczady Mountains has been described by Burakowski [1971]. The author found 11 Elateridae species, among which *Agriotes obscurus* was dominant. This species was also one of the most frequently occurring in the fresh meadow communities of Lasy Janowskie. The click-beetle fauna of the two areas was 38.1% identical.

CONCLUSIONS

1. The Elateridae population of the fresh meadows of Lasy Janowskie Landscape Park was characterised by high species diversity.
2. The number of click-beetle species in the fresh meadows was not small – it was equal to or significantly exceeded the number of Elateridae species in other types of habitats studied in the park.
3. The species composition of the Elateridae of the fresh meadows was undoubtedly influenced by the ecological characteristics of the species as well as by the proximity of other types of habitats.
4. The species composition of the click-beetle fauna of the fresh meadows was largely similar to that of mesoxerothermic communities.
5. The most frequently caught species were typical of meadows and wet environments.
6. The adult Elateridae fauna of the fresh meadows of Lasy Janowskie Landscape Park showed relatively high qualitative similarity to larval populations of these beetles in meadow habitats in various areas of Poland.

REFERENCES

- Burakowski B., 1971. The click-beetles (Coleoptera, Elateridae) of Bieszczady (in Polish). *Fragm. Faun.*, 17, 10, 221–272.
- Fijałkowski D., 1997. The flora of Lasy Janowskie Landscape Park (in Polish). Wydawnictwo UMCS. Lublin, 214 pp.
- Honczarenko J., 1956. Occurrence of Elateridae and Scarabeidae (Col.) larvae on Bystrzyca river

- meadows in the Lublin region (in Polish). Ann. UMCS, sec. C, 11, 227–268.
- Honczarenko J., 1962. Soil entomofauna in various meadow communities (in Polish). Soc. Sc. Stett., Wyd. Nauk Przyr.-Roln., Szczecin, 14, 2, 1–47.
- Honczarenko J., 1970. The larvae of Elateridae in meadows biocoenosis of Lubelszczyzna region (in Polish). Pol. Pismo. Ent., (Wrocław), 40, 2, 361–370.
- Kondracki J., 2000. Regional geography of Poland (in Polish). Wydawnictwo Naukowe PWN, Warszawa, 441 pp.
- Matuszkiewicz W., 2001. A guide for plant communities determination in Poland (in Polish). Wydawnictwo Naukowe PWN, Warszawa, 537 pp.
- Pawelska K., 1951. Preliminary research on larvae of Elateridae (Col.) family (in Polish). Ann. UMCS, sec. C, 5, 307–320.
- Pawłęga K., 2003. The click-beetles (Coleoptera: Elateridae) of wet habitat in the Lasy Janowskie Landscape Park. Acta Agrophysica, 1 (3) 2003, 88, 485–491.
- Pawłęga K., 2004. The click-beetles (Coleoptera: Elateridae) of the marshy meadow communities in the Lasy Janowskie Landscape Park. Teka Kom. Ochr. Kszt. Środ. Przyr., OL PAN, 1, 174–179.
- Radwan S., Koproń J., Stępień B., 1996. An outline of the physiography, history and hydrochemistry of the water bodies of Lasy Janowskie Landscape Park (in Polish), in: Radwan S. (ed.) Natural values of Lasy Janowskie Landscape Park. Wydawnictwo UMCS, Lublin, 21–28.
- Ścibior R., Pawłęga K., 2000. Thermophilic species of leaf beetles and click beetles (Col.; Chrysomelidae, Elateridae) inhabiting the limestone slope in Łysaków (in Polish), in: Radwan S., Lorkiewicz Z. (ed.) Problems connected with the protection and use of rural areas with high natural value. Wydawnictwo UMCS, Lublin, 389–394.
- Tarnawski D., 1987. The click-beetles (Coleoptera, Elateridae) of mid-forest meadows in Wrocław (in Polish). Bad. Fizjogr. Pol. (Poznań), 35, 53–56.
- Tarnawski D., 2000. Elateridae click-beetles (Insecta: Coleoptera), part I (general part and subfamilies: Agrypninae, Negastrinae, Diminae i Athoinae) (in Polish). Fauna Polski, Warszawa, 21, 413 pp.

BOGACTWO GATUNKOWE SPRĘŻYKOWATYCH (COLEOPTERA: ELATERIDAE) ŁĄK ŚWIEŻYCH PARKU KRAJOBRAZOWEGO LASY JANOWSKIE

Streszczenie. Badania nad sprężykowatymi łąk świeżych Parku Krajobrazowego Lasy Janowskie prowadzono w zespołach łąkowych z klasy *Molinio-Arrhenatheretea*. Stwierdzono 18 gatunków Elateridae, wśród których dominowały gatunki charakterystyczne dla łąk i środowisk wilgotnych: *Hemicrepidius niger*, *Synaptus filiformis*, *Actenicerus siaelandicus* i *Agriotes obscurus*. Trzy ostatnie cechowały także najwyższe wartości wskaźnika stałości występowania w próbach (C) i znaczenia ekologicznego (Q). Fauna sprężykowatych wykazywała duże zróżnicowanie gatunkowe – wskaźnik Simsona wynosił 0,87. Liczba gatunków była równa lub większa w porównaniu z innymi badanymi zbiorowiskami parku, jak również z elaterofauną łąkową innych obszarów Polski.

Słowa kluczowe: chrząszcze sprężykowate, południowo-wschodnia Polska, park, łąki świeże, różnorodność gatunkowa, ekologia, zoogeografia