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Changes in the coprofagous beetle fauna of the Scarabaeoidea (Coleoptera) superfamily on the Krakow-Czestochowa Upland

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ABSTRACT. The research was conducted between 1994 and 2004 on the area of the Krakow-Czestochowa Upland. Insects were collected using the floatation and baited trap methods. Based on the data from the Catalogue of Polish Fauna, it was determined that 63 species of coprofagous Scarabaeoidea occurred in the Upland between 1866 and 1983. The current research confirmed the presence of 36 species of coprofagous beetles. Of the 63 species found in the past, 26 species were not confirmed as present. It turned out that 13 species of this group were found between 1866 and 1910, but their presence in this area was not confirmed until 2004. The disappearance of many species applies mainly to taxa with higher habitat requirements.

KEY WORDS: Coleoptera, Scarabaeoidea, dung beetles.

INTRODUCTION

The Krakow-Czestochowa Upland features a specific geological structure, geomorphologic relief and climatic conditions. This set of abiotic conditions leads to a large diversity of habitats and vegetation, and consequently differentiates fauna groupings on this area.

The first faunistic research of beetles was conducted in the Upland area in the 19th century. At that time, 49 species of coprofagous beetles were identified. Further studies in 1950s and 1970s led to finding another 14 new species of coprofags in the Upland. The publication of the Catalogue of Polish Fauna edited by BURAKOWSKI (BURAKOWSKI et al. 1983) constituted a breakthrough in the faunistic/systematic research of beetles. On the basis of the Catalogue contents, it was established that 63 species of coprofagous Scarabaeoidea had been found in the Upland between 1866 and 1983.

The number of species living in a given area is dynamic and keeps changing. For this reason, research was undertaken to identify changes in the species composition of coprofagous beetles in the Upland area and to try to define the biotic and abiotic conditions driving the changes in the number of species of this beetle group.

MATERIAL AND METHODS

The faunistic research lasted from 1994 to 2004. It covered the area of the K-C Upland (Fig. 1). Insects were caught using the floatation method and baited traps of the DIDONIS and MILLER type (BUNALSKI 1991).

Insects were caught using the floatation method and baited traps throughout the pasturing season, i.e. from the beginning of May to the end of October. The systematics and names of species are based on BARAUD (1992).

Fig. 1. Krakow-Czestochowa Upland.

RESULTS

During the entire research period, 36 species of the Scarabaeoidea superfamily were confirmed as present. A species new to the Upland is *Aphodius contaminatus,* which is very rarely found in the Polish territory. *Aphodius porcus*, *A. melanostictus* as well as *Geotrupes murator* and *T. vernalis* were found again after about 100 years. The research did not confirm the presence of 26 species out of the total of 63 species ever found (Table 1).

Table 1. List of the species from the Scarabaeoidea family recorded in the area of the Krakow-Czestochowa Upland.

No.	Species	Publications from years, period of investigations of author				Environmental preferences
		1860 - 1910	1911 - 1955	1956 - 1976	1994 - 2004	
-1-	**-2-**	**-3-**	**-4-**	**-5-**	**-6-**	**-7-**
1	*Euoniticellus fulvus*	+	-	-	-	xerophil, thermophil
2	*Copris lunaris*	+		+	+	stenotop
3	*Caccobius schreberi*	+	-	-	-	psammophil
4	*Onthophagus coenobita*	+	+	+	+	eurytop, coprophag
5	*Onthophagus fracticornis*	+	+	+	+	eurytop, xerophil, coprophag
6	*Onthophagus gibbulus*	+	-	-	-	xerophil
7	*Onthophagus joannae*	+	-	+	+	eurytop, xerophil, praticol
8	*Onthophagus nuchicornis*	+	-	+	+	stenotop, psammophil
9	*Onthophagus ovatus*	+	+	-	+	eurytop, xerophil, praticol
10	*Onthophagus ruficapillus*	-	+	-	-	xerophil
11	*Onthophagus semicornis*	+	+	+	-	xerophil, rodentophil
12	*Onthophagus similis*	-		+	-	eurytop, psammophil
13	*Onthophagus taurus*	+	-	+	+	stenotop, thermophil, coprophag
14	*Onthophagus vacca*	+	-	-	-	stenotop, xerophil
15	*Onthophagus verticicornis*	+	-	-	-	sylvicol
16	*Onthophagus vittulus*	+	+	+	+	stenotop, thermophil, rodentophil
17	*Ochodaeus chrysomeloides*	+	-	+	-	xerophil, thermophil
18	*Geotrupes mutator*	+	-	-	+	stenotop

-1-	-2-	-3-	-4-	-5-	-6-	-7-
19	*Geotrupes spiniger*	+	-	+	+	eurytop, praticol, coprophag
20	*Anoplotrupes stercorosus*	+	+	+	+	eurytop, sylvicol
21	*Geotrupes stercorarius*	+	+	+	+	eurytop, coprophag
22	*Trypocopris vernalis*	+	-	-	+	stenotop, psammophil, coprophag
23	*Oxyomus silvestris*	-	-	+	+	eurytop, coprophag/saprophag
24	*Aphodius fossor*	+	-	+	+	eurytop, coprophag
25	*Aphodius erraticus*	+	+	+	+	stenotop, xerophil, praticol
26	*Aphodius subterraneus*	+	+	+	+	stenotop, xerophil, praticol
27	*Aphodius haemorrhoidalis*	+	+	+	+	eurytop, coprophag
28	*Aphodius brevis*	+	-	+	-	xerophil
29	*Aphodius satellitius*	+	-	-	-	xero-thermophil
30	*Aphodius arenarius*	+	-	+	-	sylvicol
31	*Aphodius depressus*	+	-	+	+	sylvicol
32	*Aphodius luridus*	+	-	-	-	xerophil
33	*Aphodius rufipes*	+	+	+	+	eurytop, coprophag
34	*Aphodius scrofa*	+	-	+	-	psammophil
35	*Aphodius conspurcatus*	+	-	-	-	stenotop
36	*Aphodius distinctus*	-	-	+	+	eurytop, coprophag
37	*Aphodius contaminatus*	-	-	-	+	stenotop, psammophil, coprophag
38	*Aphodius melanostictus*	+	-	-	+	xerophil
39	*Aphodius sticticus*	+	-	+	+	eurytop, xerophil, sylvicol
40	*Aphodius paykulli*	-	-	+	-	sylvicol
41	*Aphodius consputus*	+	-	-	-	thermophil
42	*Aphodius prodromus*	+	+	+	+	ubicvist, coprophag
43	*Aphodius sphacelatus*	+	-	+	-	hygrophil
44	*Aphodius merdarius*	+	-	+	+	stenotop, praticol, coprophag
45	*Aphodius porcus*	+	-	-	+	stenotop, xerophil, praticol
46	*Aphodius biguttatus*	-	-	+	-	stenotop xerophil
47	*Aphodius coenosus*	-	-	-	+	stenotop, xerophil, psammophil, praticol
48	*Aphodius paracoenosus*	-	-	+	+	eurytop, coprophag
49	*Aphodius pusillus*	+	+	+	+	stenotop, xerophil, praticol
50	*Aphodius quadriguttatus*	+	-	-	-	thermophil
51	*Aphodius granarius*	+	-	-	+	eurytop, coprophag/saprophag
52	*Aphodius corvinus*	+	-	+	-	sylvicol
53	*Aphodius fimetarius*	+	+	+	+	ubicvist, coprophag/saprophag
54	*Aphodius foetens*	+	-	+	+	stenotop, praticol, coprophag
55	*Aphodius foetidus*	+	-	-	-	xerophil

56	*Aphodius ictericus*	+	-	+	-	psammophil
57	*Aphodius immundus*	-	-	+	+	stenotop, thermophil, coprophag
58	*Aphodius rufus*	+	+	+	+	eurytop, coprophag
59	*Aphodius sordidus*	+	-	+	+	stenotop, praticol, coprophag
60	*Aphodius ater*	+	-	+	+	eurytop, coprophag
61	*Aphodius uliginosus*	+	-	+	-	sylvicol
62	*Aphodius nemoralis*	-	-	+	-	sylvicol
63	*Euheptaulacus sus*	+	-	-	-	psammophil
64	*Heptaulacus testudinarius*	+	-	-	-	xerophil

DISCUSSION

The data contained in the Catalogue of Polish Fauna by BURAKOWSKI (1983) for years 1966-1983 indicates that 63 species of coprofagous beetles of the Scarabaeoidea superfamily had been found in the Krakow-Czestochowa Upland area (Table 1). During the research conducted in 1994-2004, the author found 36 species of that superfamily. A species new to the Upland is *Aphodius contaminatus,* which is very rare in the Polish territory. *Aphodius porcus*, *A. melanostictus* as well as *Geotrupes murator* and *T. vernalis* were found again after about 100 years (BURAKOWSKI et al. 1983). The research did not confirm the presence of 26 species of the total of 63 ever found. It turned out that 13 of them had been found in 1866-1910, and their presence in that area had not been confirmed until 2004. According to KOCH (1989), all these species prefer xerothermal habitats with sandy soil (Table 1).

The remaining 13 absent species are characterised either by very narrow food specialisations or prefer xerothermal, sandy habitats (Table 1). The species with very narrow food specialisations include: *Aphodius arenarius* (OLIV.), *A. paykulli* BED., *A. corvinus* ER., *A. nemoralis* ER., *A. uliginosus* (HARDY) (BURAKOWSKI et al. 1983). The first one feeds on the excrement of sousliks and moles, and the other four on that of wild boar and deer. In recent years, the numbers of wild animals in the Upland were small, e.g. the density of deer (*Cervus elaphus* L.) in the southern part of the Upland amounted to less than 2 head per 1,000 ha of forest, and no deer at all were found in the north of the Upland (SZMYD 2000). The Upland is highly urbanised and deforested, so it does not offer good conditions for wild animals.

The disappearance of many species from the analysed area is caused by the gradual increase of the anthropogenic pressure in the last 150 years.

Among the main drivers of these significant faunistic changes, it is worth mentioning the intensification of farming and forestry with the use of chemicals poisoning the living environment, as well as the abandonment of the free grazing of cattle from small farms, so

ubiquitous before the second half of the 20th century. The abandonment of grazing is, in turn, the reason for the dramatic reduction of farm animal breeding not only in the area under analysis, but throughout Poland (Figs 2-4).

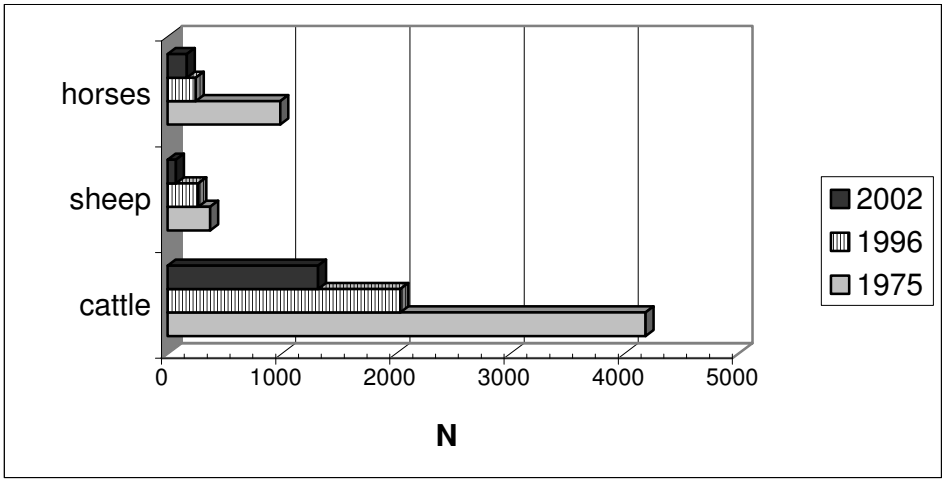

Fig. 2. Changes in number of livestock in the Skała commune in the years from 1975 to 2002.

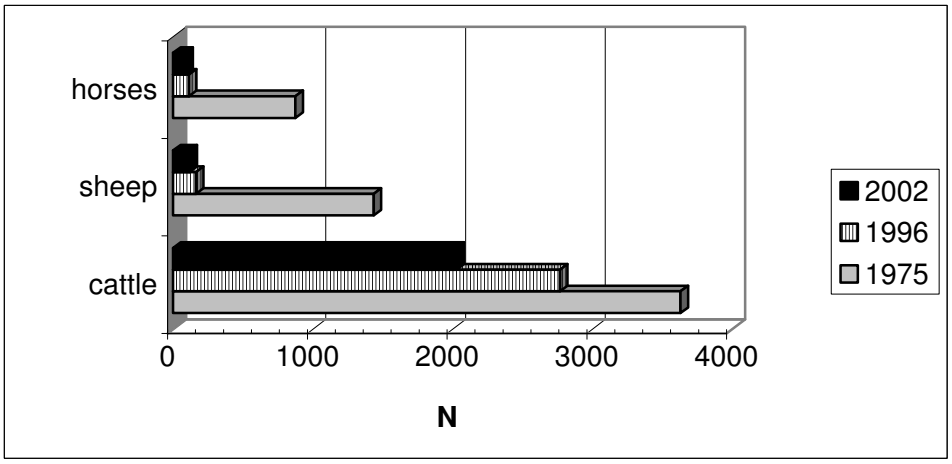

Fig. 3. Changes in number of livestock in the Sułoszowa commune in the years from 1975 to 2002.

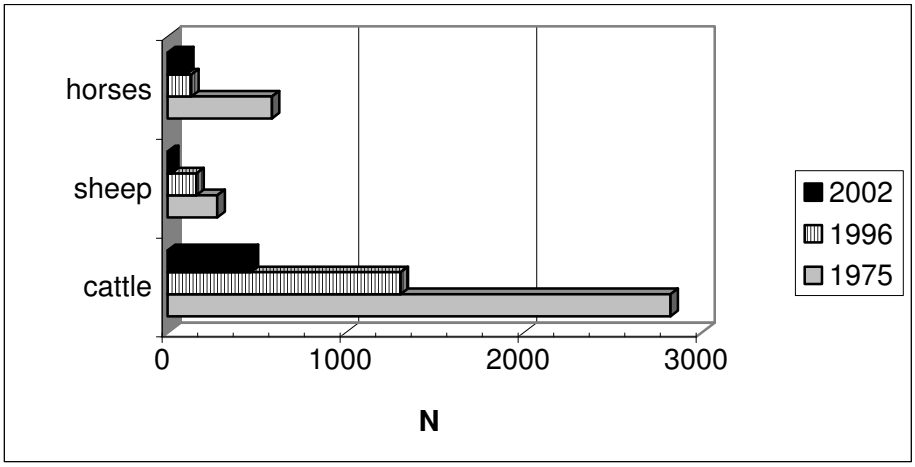

Fig. 4. Changes in number of livestock in the Wielka Wieś commune in the years from 1975 to 2002.

According to HANSKI (1991), the reduction of the food base in micro-habitats suitable for thermophilous, psammophilous and xerophilous species may cause them to become extinct in a given area. The abandonment of grazing on xerothermal areas means that they slowly but successively become overgrown with shrubs, e.g. *Prunus spinosa* (L.), *Crataegus* (L.), *Evonymus* (L.), which, in time, causes the habitat conditions to change (DUBIEL 1988, KORNAŚ & DUBIEL 1990, MICHALIK 1990). Grass burning, commonplace in recent years, also destroys the entire fauna of a given habitat. All these factors may contract the range of species for which southern Poland is the northernmost limit of their occurrence, e.g. *Onthophagus ruficapillus* and *O. semicornis,* which represent the Mediterranean element (STEBNICKA 1976). The Rapoport rule states that the closer the centre of the range of a species is to the equator, the smaller its occurrence range and the narrower the scope of physiological adaptation (WEINER 1999). Such species are more sensitive to changes in habitat conditions. This may explain the disappearance not just from the Upland but from Poland altogether of such species as *Caccobius schreberi*, *Onthophagus gibbulus* or *O. vacca*. Conversely, the same rule may explain why holarctic species like *Aphodius erraticus, A. pusillus, A. fossor, A. prodromus* or *A. fimetarius* are found in all habitat types.

The Upland area features potentially good conditions for various species of coprofages, but their species diversity is strongly modified by the changes taking place in the natural environment. Their future prospects are not rosy, as the farming structure changes and small, individual farms are replaced with large, commercial ones. This process applies not just to the Upland, but to Poland as a whole.

As a result, it may bring about further disappearance of stenotopic species of greater habitat demands.

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