THE SYNECOLOGICAL ANALYSIS OF SOME POPULATIONS OF SCARAB BEETLES (INSECTA, COLEOPTERA, SCARABAEOIDAEA) FROM SLANIC MOLDOVA, BACAU COUNTY

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Abstract. Slanic Moldova is situated in the South-West side of Bacau County, in a narrow and long hollow, limited by high heights covered with beech and fir, in the Slanic creek valley. This region has a transition climate (between the characteristic climate for the hilly region and mountainous climate). The vegetation of this valley is influenced by the relief and climate. Hereby, in this region there are beech and fir woods and subalpine meadows. The entomologic material collected from Slanic Moldova during three years of study (2004-2006) was represented by 201 scarab beetles. Systematically, these coleopterans are included into two families (Geotrupidae - 0.5% and Scarabaeidae – 99.5%), four subfamilies (Geotrupinae, Rutelinae, Trichiinae and Cetoniinae), seven genera and eight species. Cetonia aurata (LINNAEUS, 1761) predominates (36.81%), and it is followed by Trichius fasciatus (LINNAEUS, 1758) – 30.35%. Cetonia aurata L., Trichius fasciatus (LINNAEUS, 1758), Gnorimus nobilis (LINNAEUS, 1758) and Anomala solida (ERICHSON, 1847) are euconstant and characteristic species for Slani Moldova. The highest affinity (100%) is between three species: *Lethrus apterus* (LAXMANN, 1770), *Gnorimus octopunctatus* (FABRICIUS, 1775) and *Tropinota hirta* (PODA, 1761). Another group of species is represented by *Trichius* fasci*a*tus L. and *Cetonia aurata* L. (86%).

Key words: Scarabaeoidaea, synecological analyse, coenotic affinities

Rezumat. Analiza sinecologică a unor populaţii de scarabeoidee (Insecta, Coleoptera, Scarabaeoidaea) din Slănic Moldova, judeţul Bacău. Localitatea Slănic Moldova este situată în partea de sud-vest a judeţului Bacău ($26^0$37' longitudine estică şi $46^0$17' latitudine nordică), într-o mică depresiune îngustă şi lungă, mărginită de culmi înalte, acoperite cu fag şi brad, pe valea pârâului Slănic, la o altitudine de 530m. În scopul studierii faunei de scarabeoidee din Slănic Moldova, în perioada 2004-2006 au fost colectate 201 coleoptere, care aparţin la două subfamilii: Geotrupidae (cu o singură subfamilie – Geotrupinae) şi Scarabaeidae (cu 3 subfamilii – Rutelinae, Cetoniinae şi Trichiinae), 7 genuri şi 8 specii. Din cele 201 de scarabeoidee colectate, cele mai multe exemplare aparţin speciei Cetonia aurata (LINNAEUS, 1761). (36,81%), urmată de Trichius fasciatus (LINNAEUS, 1758) cu un procent de 30,35%. Conform analizei sinecologice, Cetonia aurata L., Trichius fasciatus L., Gnorimus nobilis (LINNAEUS, 1758) şi Anomala solida (ERICHSON, 1847) sunt specii euconstante şi în acelaşi timp caracteristice pentru zona cercetată. Analiza sinecologică mai indică şi faptul că cea mai mare afinitate ecologică există între speciile: *Lethrus apterus* (LAXMANN, 1770), *Gnorimus octopunctatus* (FABRICIUS, 1775) şi *Tropinota hirta* (PODA, 1761) – respectiv 100%. O altă grupă de specii este reprezentată de *Trichius fasciatus* L. şi *Cetonia aurata* L. (86%). Această a doua grupă se corelează cu *Gnorimus nobilis* L., afinitatea fiind de aproape 78%.

Cuvinte cheie: Scarabaeoidaea, analiza sinecologică, afinităţi cenotice

INTRODUCTION

Slanic Moldova is situated in the South-West side of Bacau County, in a narrow and long hollow, limited by high heights covered with beech and fir, in the Slanic creek valley (530 m altitude).

This region has a transition climate (between the characteristic climate for the hilly region and mountainous climate). Thus, the temperature here runs to +17.8^o C in summer days and -4.2^o C in winter. The Salt Mines of Slanic are characteristic for this valley. The vegetation of this valley is influenced by the relief and climate. Hereby, in this region there are beech and fir woods and subalpine meadows; the grassy vegetation is represented by crocus (*Crocus Heuffelianus*), primroses (*Primula veris*), bluebells (*Campanula patula*), *Dianthus* sp., *Scilla bifolia*, *Cypripedium calceolus*, *Saxifraga cymbalaria*, *Gentiana asclepiadea*, *Rubus idaeus*, *Sagittaria sagittifolia*, *Menta* sp., etc. The fauna is well represented: mammals, birds, reptilians, amphibians and invertebrates (ALBOTĂ M., 1983).

MATERIAL AND METHODS

The researches concerning the Scarabaeoidaea fauna from Slanic Moldova were made in 2004-2006, and the material was collected directly from the plants.

The material was identified using the specialty literature (PANIN S., 1957). The taxonomy and nomenclature used in this paper is conforming to MARY LIZ JAMESON & B. C. RATCLIFF (CHIMIŞLIU CORNELIA, 2002).

In order to make a synecological analysis, some ecological indexes were calculated: abundance, frequency, constancy, dominance, the ecological significance index (W) and the similarity index (VARVARA M. et al., 2001).

RESULTS AND DISCUSSIONS

The entomologic material collected from Slanic Moldova during three years of study (2004-2006) was represented by 201 scarab beetles. Systematically, these coleopterans are included into two families (Geotrupidae and Scarabaeidae), four subfamilies (Geotrupinae, Rutelinae, Trichiinae and Cetoniinae), seven genera and eight species. Comparing the two families, according to the results presented in table 1, the Geotrupidae family was represented by a single specimen (0.5%); the rest of individuals belong to the Scarabaeidae family (99.5%).

The results also indicate that, for the three years of study, *Cetonia aurata* (LINNAEUS, 1761) predominates (36.81%). This specie is followed by *Trichius fasciatus* (LINNAEUS, 1758) – 30.35%. The other two species: *Gnorimus nobilis* (LINNAEUS, 1758) and *Anomala solida* (Erichson, 1847) are also well represented: 19.4% and 11.4% respectively. Four species are represented by a single individual (representing 0.5%): *Lethrus apterus* (LAXMANN, 1770), *Gnorimus octopunctatus* (FABRICIUS, 1775), *Tropinota hirta* (PODA, 1761) and *Oxythyrea funesta* (PODA, 17619).

Table 1. Distribution of species and individuals within the families and subfamilies of Scarabaeoidaea (Slanic Moldova, 2004-2006)
Tabel 1. Repartiția speciilor şi indivizilor în cadrul familiilor şi subfamiliilor de scarabeoidee (Slănic Moldova, 2004-2006)

No	Family	Subfamily	Specie	2004		2005		2006		Total	
				A	%	A	%	A	%	A	%
1.	Geotrupidae	Geotrupinae	*Lethrus apterus* LAXM.	1	2.08	-	-	-	-	1	0.5
2.	Scarabaeidae	Rutelinae	*Anomala solida* ERICH.	3	6.25	8	11.11	12	14.81	23	11.44
3.		Trichiinae	*Gnorimus nobilis* L.	13	27.09	15	20.83	11	13.58	39	19.4
4.			*Gnorimus octopunctatus* FABR.	1	2.08	-	-	-	-	1	0.5
5.			*Trichius fasciatus* L.	16	33.33	21	29.17	24	29.63	61	30.35
6.		Cetoniinae	*Cetonia aurata* L.	13	27.09	28	38.89	33	40.74	74	36.81
7.			*Tropinota hirta* PODA	1	2.08	-	-	-	-	1	0.5
8.			*Oxythyrea funesta* PODA	-	-	-	-	1	1.24	1	0.5
	2	**4**	**8**	**48**	**100**	**72**	**100**	**81**	**100**	**201**	**100**

Comparing the abundance of the species collected in Slanic Moldova it is easy to see that this ecological index is variable (fig. 1).

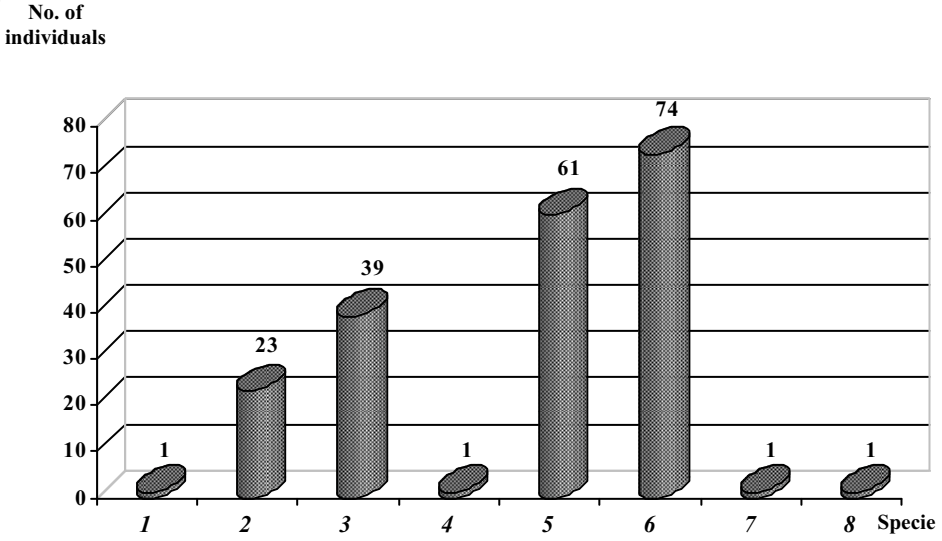

Figure 1. Species of Scarabaeoidaea collected in Slanic Moldova in 2004-2006
Figura 1. Specii de scarabeoidee colectate în Slănic Moldova, în perioada 2004-2006
(1 *Lethrus apterus* LAXMANN; 2 *Anomala solida* ERICH.; 3 *Gnorimus nobilis* L.; 4 *Gnorimus octopunctatus* FABR.; 5.*Trichius fasciatus* L.; 6 *Cetonia aurata* L.; 7 *Tropinota hirta* PODA; 8 *Oxythyrea funesta* PODA)

In table 2 it is presented the synecological analysis for the eight species collected in the Slanic Moldova in 2004-2006. According to the specialty literature, the eudominant and dominant species are influent species, well adapted, with many individuals (VARVARA M. et al., 1997). Thus, the synecological analysis shows that four species are euconstant: (*Cetonia aurata* L., *Trichius fasciatus* L., *Gnorimus nobilis* L. and *Anomala solida* ERICH.) and the other four are accessory species: *Lethrus apterus* LAXMANN, *Gnorimus octopunctatus* FABR., *Tropinota hirta* PODA and *Oxythyrea funesta* PODA. The values of dominance distribute the eight species also into two classes: in this case, the euconstant species become eudominant and the accessory ones become subrecedent species.

The values of the ecological significance index (W) indicate that the euconstant species (eudominant species) are also the characteristic species for Slanic Moldova; the other four species are accessory.

For revealing the coenotic affinities between the species, it was necessary to calculate the similarity index (table 3). Based on the values of this index it was easy to represent graphically the coenotic relationships between the species of Scarabaeoidaea collected from Slanic Moldova (2004-2006). The dendrograme is presented in figure 2.

Table 2. The synecological analysis for the Scarabaeoidaea species collected from Slanic Moldova (2004-2006)
Tabel 2. Analiza sinecologică pentru speciile de Scarabaeoidaea colectate în Slănic Moldova (2004-2006)

No.	Specie	2004	2005	2006	A	C		D		W	
1	*Cetonia aurata* L.	13	28	33	74	100	C4	36.81	D5	36.81	W5
2	*Trichius fasciatus* L.	16	21	24	61	100	C4	30.35	D5	30.35	W5
3	*Gnorimus nobilis* L.	13	15	11	39	100	C4	19.4	D5	19.4	W5
4	*Anomala solida* ERICH.	3	8	12	23	100	C4	11.44	D5	11.44	W5
5	*Lethrus apterus* LAXMANN	1	-	-	1	33.33	C2	0.5	D1	0.17	W2
6	*Gnorimus octopunctatus* FABR.	1	-	-	1	33.33	C2	0.5	D1	0.17	W2
7	*Tropinota hirta* PODA	1	-	-	1	33.33	C2	0.5	D1	0.17	W2
8	*Oxythyrea funesta* PODA	-	-	1	1	33.33	C2	0.5	D1	0.17	W2
	Total	**48**	**72**	**81**	**201**	**-**	**-**	**100**	**-**	**-**	**-**

Table 3. The values of the similarity index calculated for the species of Scarabaeoidaea collected from Slanic Moldova (2004-2006)
Tabel 3. Valorile indicelui de similaritae calculat pentru speciile de scarabaeoidee colectate în Slănic Moldova (2004-2006)

Specie	1	2	3	4	5	6	7
1							
2	85.92						
3	69.02	78					
4	47.42	54.76	70.96				
5	2.66	3.22	5	8. 33			
6	2.66	3.22	5	8.33	100		
7	2.66	3.22	5	8.33	100	100	
8	2.66	3.22	5	8.33	0	0	0

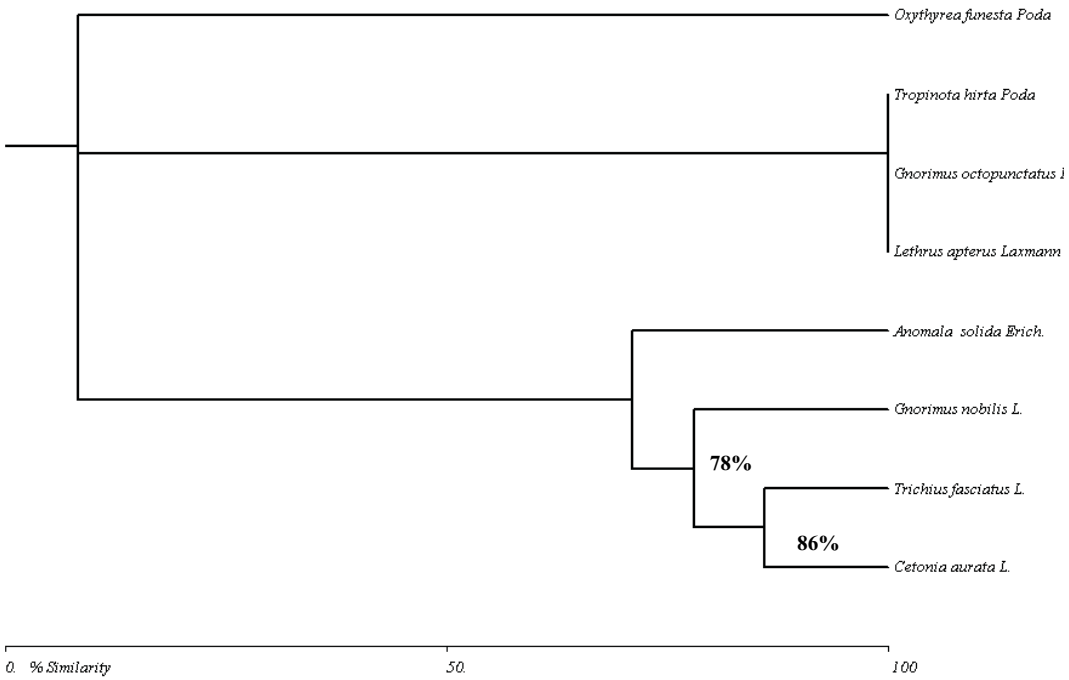

Figure 2. The coenotic affinities between the species of Scarabaeoidaea collected in Slanic Moldova, in 2004-2006
Figura 2. Afinităţile cenotice dintre speciile de scarabeoidee colectate în Slănic Moldova, în perioada 2004-2006

The dendrograme (fig. 2) shows that the highest affinity (100%) is between three species: *Lethrus apterus* LAXMANN, *Gnorimus octopunctatus* FABR. and *Tropinota hirta* PODA. This situation can be explained by the fact that the three species were collected only in 2004 and their abundance has the same value (a single specimen – 0.5%). The dendrograme also reveals another group of species: *Trichius fasciatus* L. and *Cetonia aurata* L. In this case the affinity is

86%. The high affinity is due to the fact that they are best represented species and they were collected in each year of study, but the number of individuals differs (the values of abundance are almost similar). This second group is correlated with *Gnorimus nobilis* L. (according to the values of abundance this is the third specie) – the value of the similarity index is 78%. In the same dendrograme *Oxythyrea funesta* PODA appears as single specie because it was collected only in 2006 (a single specimen).

CONCLUSIONS

1. The Scarabaeoidaea fauna from Slanic Moldova was studied in 2004-2006 and during three years of study, 201 scarab beetles were collected, included into two families (Geotrupidae and Scarabaeidae) four subfamilies (Geotrupinae, Rutelinae, Trichiinae and Cetoniinae), seven genera and eight species. The Geotrupidae family was represented by a single specimen (0.5%); the rest of individuals belong to the Scarabaeidae family (99.5%).

2. *Cetonia aurata* L., *Trichius fasciatus* L., *Gnorimus nobilis* L. and *Anomala solida* ERICH. were collected in each year of study, but values of the dominance of the first two species are over 30%: (36.81% , respectively 30.35%).

3. According to the synecological analysis, *Cetonia aurata* L., *Trichius fasciatus* L., *Gnorimus nobilis* L. and *Anomala solida* ERICH. are euconstant species and the other four are accessory species: *Lethrus apterus* Laxmann, *Gnorimus octopunctatus* FABR., *Tropinota hirta* PODA and *Oxythyrea funesta* PODA.

4. Analysing the values of dominance index it is remarked that the euconstant species are also the eudominants and the accessory ones become subrecedent species.

5. The characteristic species for Slanic Moldova are *Cetonia aurata* L., *Trichius fasciatus* L., *Gnorimus nobilis* L. and *Anomala solida* ERICH. The other four species are accessory.

6. *Lethrus apterus* Laxmann, *Gnorimus octopunctatus* FABR. and *Tropinota hirta* Poda were collected only in 2004 and their abundance has the same value (a single specimen – 0.5%). This fact explains the value of similarity indicator – 100%. The affinity between *Trichius fasciatus* L. and *Cetonia aurata* L. is 86% – these species were collected in each year of study, the individuals are numerous, but the values of their abundance were different. This second group is correlated with *Gnorimus nobilis* L. – 78%.

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