

PRELIMINARY OBSERVATIONS CONCERNING THE SUCCESSION OF SCARABEOID BEETLES (INSECTA: COLEOPTERA: SCARABAEOIDEA) ON BOVINE DUNG IN THE MEDEAW OF THE SIRET RIVER AREA (BACĂU COUNTY, ROMANIA)

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Abstract. The observations concerning the succession of scarabeoid beetles on bovine dung were made in June 2007, in Holt Village (Letea Veche Commune, Bacău County). For this study, 472 specimens of scarabeoid dung beetles were collected (seventeen species that belong to twelve genera, respectively two families – Scarabaeidae and Aphodiidae). The results indicate that a small number of species and specimens populated the dung exposed for less than twenty-four hours. The diversity and the density of species increased after twenty-four hours of exposure. For the first thirty-two hours of exposure, *Aphodius fimetarius* (LINNAEUS 1758) was very well represented (78 individuals). This species was followed by *Onthophagus taurus* (SCHREBER 1759) with 30 specimens. For the dung that was exposed for 216 hours, it was identified a number of three species: *Oxyomus sylvestris* (SCOPOLI 1763) (75.17%), *Aphodius fimetarius* L. (23.80%), and *Teucheste fossor* (LINNAEUS 1758) (1.03%).

Keywords: bovine dung, scarabeoids, succession.

Rezumat. Observații preliminare privind succesiunea scarabeoideelor (Insecta: Coleoptera: Scarabaeoidea) în dejecții de bovine din zona de luncă a Siretului (județul Bacău, România). Observațiile privind succesiunea scarabeoideelor în dejecțiile de bovine au fost realizate în iunie 2007, în zona de luncă a Siretului (județul Bacău). Pentru acest studiu, au fost cercetate unsprezece probe de dejecții de bovine expuse timp de două, patru, șase, opt, zece, douăzeci și patru, douăzeci și șase, douăzeci și opt, treizeci, treizeci și două și respectiv 216 ore. Astfel, în iunie 2007 au fost colectate 472 scarabeoidee. Din punct de vedere taxonomic, aceste coleoptere aparțin la două familii: Scarabaeidae (cu o singură subfamilie – Scarabaeinae) și Aphodiidae (cu subfamilia Aphodiinae), doisprezece genuri și șaptesprezece specii. Conform rezultatelor obținute, dejecțiile expuse mai puțin de douăzeci și patru de ore au fost populate de un număr redus de specii și indivizi. Diversitatea și densitatea speciilor a crescut după primele douăzeci și patru de ore de expunere. Pentru primele treizeci și două de ore, *Aphodius fimetarius* (LINNAEUS 1758) a fost foarte bine reprezentat (78 de indivizi). Această specie a fost urmată de *Onthophagus taurus* (SCHREBER 1759) cu 30 de exemplare. În dejecțiile care au fost expuse timp de 216 ore, au fost identificate trei specii: *Oxyomus sylvestris* (SCOPOLI 1763) (75,17%), *Aphodius fimetarius* L. (23,80%) și *Teucheste fossor* (LINNAEUS 1758) (1,03%). Specia *Aphodius fimetarius* L. a fost prezentă în toate probele analizate.

Cuvinte cheie: dejecții de bovine, scarabeoidee, succesiune.

INTRODUCTION

Scarabaeoidea Superfamily represents a large heterogeneous group of coleopterans – their ecology, biology and diet are very diverse. With regard to their diet, some species feed on living plants; other species of scarabeoid beetles feed on decaying vegetation or on dung of grazing animals.

The dung beetles are represented by three scarabeoid families: Aphodiidae, Scarabaeidae and Geotrupidae. Their role is very important – they aid in the decomposition of dung. These coleopterans incorporate the dung into the soil – the soil fertility increases and the nutrient cycling is assured. Rapidly, their abundant populations succeed in removing the dung from the pasture, increasing the development of the vegetation. Their activity is in correlation with ecological factors and the quality of the food sources. Regarding the food, some species prefer fresh dung; others can be found on dry faeces.

In Romania, numerous authors studied the diversity of scarabeoid beetles in different areas, especially in the south-west of our country. There are not many researches concerning the influence of different factors on the diversity of scarabeoid beetles. The aim of this work is to study the correlation between the quality of the food (in this case the humidity and the composition of dung that are directly influence by the time of exposure and meteorological conditions) and the diversity of coprophagous beetles. In this paper there are presented the preliminary results regarding the succession of scarabeoids on faeces that were exposed for different periods of time.

MATERIAL AND METHODS

The researches concerning the succession of scarabeoid beetles on bovine dung were made in June 2007, in the Siret River area. Geographically, the studied area belongs to Holt Village, Letea Veche Commune, from Bacău County, Romania. The climate of the Siret River area is characterized by a temperature that runs to +20.3°C in July and -3.5°C in January; the annual average rainfall is 554 mm.

The vegetation is represented by different types of vegetal associations: *Phragmitetum vulgaris* (SOÓ 1927), *Typhaetum latifoliae* (LANG 1973), *Glycerietum maximae* (HUECK 1931), *Scirpetum sylvatici* (RALSKI 1931), *Caricetum acutiformis* (EGGLER 1933), *Trifolio-Lolietum perennis* (KRIPPELOVA 1967), *Salci-Populetum* (MEIJER-DREES 1936), *Stellario nemorum - Alnetum glutinosae* (LOHMEYER 1957), *Hippophaë-Berberidetum* (MOOR 1958), *Pruno spinosae - Crataegetum* (HUECK 1931) (MARĂ et. al., 2004).

For this study, the faeces were collected in a bucket immediately after being excreted. These fresh faeces were used to obtain eleven equal hand made dung pads (MARCHIORI, 2003). These eleven samples were placed on the ground at the same time. First five dung pads were investigated after two, four, six, eight, and respectively ten hours of exposure to the free conditions of the biotope. The next five dung pads were analyzed after twenty-four, twenty-six, twenty-eight, thirty, and respectively thirty-two hours of exposure. The last sample was studied after 216 hours of exposure.

The coprophagous beetles collected from the dung have been preserved in alcohol. The material was identified using the specialty literature (DELLACASA, 1983, IENIȘTEA, 1975, IENIȘTEA, 1982, MEDVEDEV, 1965). The taxonomy and nomenclature used in this paper is in accordance with Fauna Europaea.

RESULTS AND DISCUSSIONS

During the summer days, along with the increasing temperature the humidity of the faeces decreases. Thus, in order to study the succession of scarabeoid beetles on bovine dung, the coleopterans were collected from feces after two, four, six, eight, ten, twenty-four, twenty-six, twenty-eight, thirty, thirty-two, and respectively 216 hours of exposure. Thus, in June 2007, 472 specimens of scarabeoid dung beetles were collected from eleven dung pads. All the results are presented in Table 1. Systematically, the 472 coleopterans collected in the Siret River area belong to two families – Scarabaeidae (with Scarabaeinae Subfamily) and Aphodiidae (with Aphodiinae Subfamily), twelve genera, and seven-teen species.

According to the data presented in Table 1, on the dung exposed for less than twenty-four hours, the number of species and specimens is reduced. For example, in the first sample, the author found 2 specimens of *Aphodius fimetarius* (LINNAEUS 1758) (Fig. 1a); for the second sample (the dung that was exposed for four hours), it was identified a number of 6 species – in this case *Onthophagus taurus* (SCHREBER 1759) (Fig. 1b) was the dominant species (9 specimens – 56.25%). In the next four samples (the faeces that were exposed for six, eight, ten and respectively twenty four hours), the density of scarabeoid beetles was low: three, six, four, and respectively two specimens.



Figure 1. Scarabeoid species collected in the floodplain of the Siret River area (June, 2007).

Figura 1. Specii de scarabeoidee colectate în zona de luncă a râului Siret (iunie 2007):

a) *Aphodius fimetarius* L.; b) *Onthophagus taurus* Schr.; c) *Oxyomus sylvestris* SCOP.

The results also indicate that the diversity and the density of species increase after twenty-four hours of exposure. During the first twenty-four hours, the faeces suffer some transformations (aerobic decomposition processes); in the same time, numerous microorganisms colonize the faeces. The scarabeoid beetles use “mature” dung (the faeces must be rich in microorganisms because they are ingested together with the food and they are used for decomposing the cellulose).

Regarding the maturing process, “this is mainly of a microbiological nature. Only after this, does the material, quantitatively measured by the mother, become food for the larva” (GOIDANICH & MALAN, 1962).

Comparing the material present in faeces exposed for two hours to thirty-two hours, it can be noticed that the larger density of scarabeoid beetles is registered in the ninth sample (the dung exposed for thirty hours – 64 specimens). In this sample, *Aphodius fimetarius* L. is well represented (20 coleopterans – 31.25%). This species is followed by *Bodilus lugens* (CREUTZER 1799) with 11 specimens (17.18%).

The dung that was exposed for thirty two hours (the tenth sample) also presented a large number of scarabeoids – 46 specimens. In this sample, *Aphodius fimetarius* L. was the dominant species, being represented by 21 individuals, respectively 46.65%). The other eleven species identified for this sample were represented by less than 10 specimens.

The dry faeces (that were exposed for 216 hours) were populated only by three species: *Oxyomus sylvestris* (SCOPOLI 1763) (Fig. 1c) with 218 individuals (75.17%), *Aphodius fimetarius* L. with 69 specimens (23.80%) and *Teuchestes fossor* (LINNAEUS 1758) with 3 individuals (1.03%).

Aphodius fimetarius L. was the only species presented in all the samples. For this species, the author analyzed the numerical dynamics (especially for the first thirty two hours of exposure – Fig. 2). Thus, the number of specimens increases after the first twenty-four hours of exposure – 13 individuals in the seventh and in the eighth samples (the dung exposed for twenty-six and respectively twenty-eight hours); the density of this species increases in the next hours – 20 and 21 specimens for the ninth and tenth samples (that correspond to the dung exposed for thirty and respectively thirty-two hours).

Table 1. The succession of the coprophagous scarabeoid species on bovine dung in the floodplain of the Siret River area (June, 2007).
 Tabel 1. Succesiunea speciilor de scarabeoide coprofage în dejecțiile de bovine în zona de luncă a râului Siret (iunie 2007).

No.	Species	2h		4h		6h		8h		10h		24h		26h		28h		30h		32h		216h		TOTAL	
		A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
1	<i>Aphodius fimetarius</i> (LINNAEUS 1758)	2	100	1	6.25	1	33.33	3	50	3	75	1	50	13	72.23	13	61.9	20	31.25	21	45.65	69	23.80	147	31.15
2	<i>Onthophagus taurus</i> (SCHREBER 1759)	-	-	9	56.25	-	-	2	33.33	-	-	1	50	2	11.12	3	14.29	7	10.94	6	13.04	-	-	30	6.36
3	<i>Onthophagus ilyricus</i> (SCOPOLI 1763)	-	-	2	12.5	-	-	-	-	-	-	-	-	-	-	-	-	2	3.13	1	2.17	-	-	5	1.06
4	<i>Onthophagus ovatus</i> (LINNAEUS 1767)	-	-	1	6.25	1	33.33	-	-	-	-	-	-	-	-	-	-	-	-	1	2.17	-	-	3	0.63
5	<i>Onthophagus ruficapillus</i> (BRULLÉ 1832)	-	-	1	6.25	-	-	1	16.67	-	-	-	-	-	-	-	-	8	12.5	3	6.53	-	-	13	2.75
6	<i>Eupleurus subterraneus</i> (LINNAEUS 1758)	-	-	2	12.5	1	33.34	-	-	-	-	-	-	1	4.76	-	1	4.76	-	1	2.17	-	-	5	1.06
7	<i>Onthophagus fraticornis</i> (PREYSSLER 1790)	-	-	-	-	-	-	-	-	1	25	-	-	-	-	-	-	-	-	-	-	-	-	1	0.21
8	<i>Otophorus haemorrhoidalis</i> (LINNAEUS 1758)	-	-	-	-	-	-	-	-	-	-	-	-	1	5.55	3	14.29	7	10.94	4	8.70	-	-	15	3.18
9	<i>Acanthobodilus immundus</i> (CREUTZER 1790)	-	-	-	-	-	-	-	-	-	-	-	-	1	5.55	-	-	2	3.13	1	2.17	-	-	4	0.85
10	<i>Oxyomus sylvestris</i> (SCOPOLI 1763)	-	-	-	-	-	-	-	-	-	-	-	-	1	5.55	-	-	-	-	-	-	218	75.17	219	46.40
11	<i>Agrilus rufus</i> (MOLLER 1782)	-	-	-	-	-	-	-	-	-	-	-	-	1	4.76	5	4.76	5	7.81	3	6.53	-	-	9	1.91
12	<i>Euoniticellus fulvus</i> (GOEZE 1777)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.56	-	-	-	1	0.21
13	<i>Aphodius foetens</i> (FABRICIUS 1787)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.56	-	-	-	1	0.21
14	<i>Bodilus lugens</i> (CREUTZER 1799)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	17.18	3	6.53	-	-	14	2.97
15	<i>Colobopterus erraticus</i> (LINNAEUS 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.17	-	-	1	0.21
16	<i>Calamosternus granarius</i> (LINNAEUS 1767)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.17	-	-	1	0.21
17	<i>Teucheste fossor</i> (LINNAEUS 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1.03	3	0.63
	Total specimens	2	100	16	100	3	100	6	100	4	100	2	100	18	100	21	100	64	100	46	100	290	100	472	100
	Total species	1	6	3	3	3	3	3	3	2	2	2	2	5	5	5	10	10	12	12	3	3	17	17	

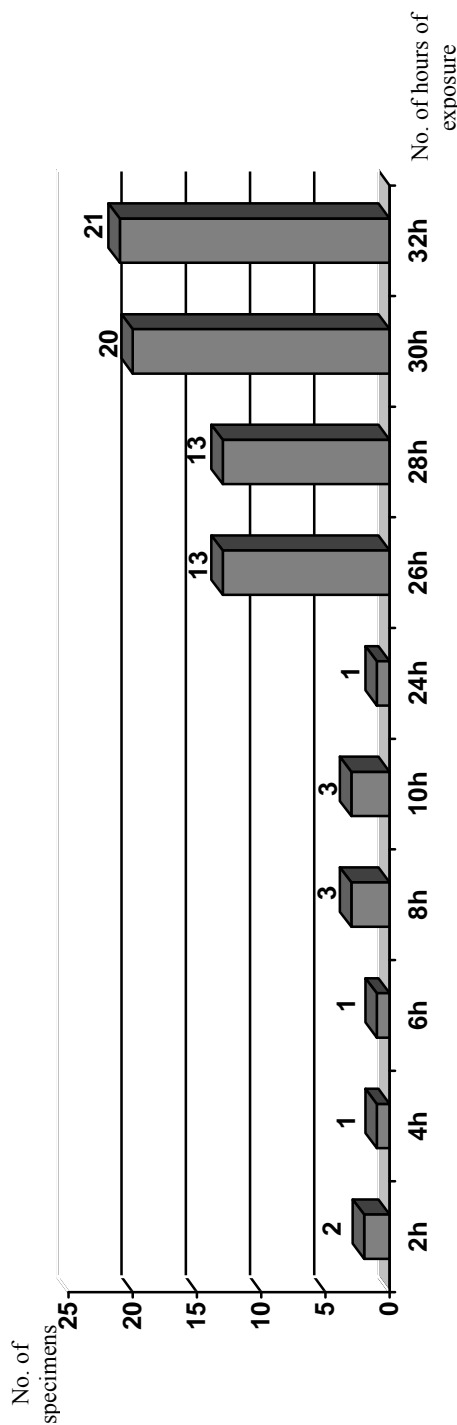


Figure 2. The numerical dynamics of the species *Aphodius fimetarius* L. on bovine dung exposed for two to thirty-two hours (June, 2007).
 Figura 2. Dinamica numerică a speciei *Aphodius fimetarius* L. în dejecțiile de bovine expuse timp de două până la treizeci și două de ore (iunie, 2007).

CONCLUSIONS

1. The researches concerning the succession of scarabeoid beetles on bovine dung were made in the Siret River area, in June 2007. The scarabeoids (472 specimens) were collected from faeces that were exposed for two, four, six, eight, ten, twenty-four, twenty-six, twenty-eight, thirty, thirty-two, and respectively 216 hours.

2. Systematically, the 472 individuals collected in this area belong to two families – Scarabaeidae and Aphodiidae, twelve genera and seven-teen species. *Aphodius fimetarius* L. was the only species presented in all the samples.

3. On the dung exposed less than twenty-four hours, the number of species varied between one and six species and the number of specimens between two and sixteen individuals. On the faeces exposed for only two hours, there were found only 2 specimens of *Aphodius fimetarius* L.; on the dung exposed for four hours, 6 species were identified (*Onthophagus taurus* SCHR. being the dominant species – 56.25%).

4. The diversity and the density of species increase after twenty-four hours of exposure. The larger density of scarabeoid beetles was registered for the dung that was exposed for thirty hours – 64 specimens. In this sample, *Aphodius fimetarius* L. was well represented (31.25%). This species was followed by *Bodilus lugens* (CREUTZ, 1799) with 17.18%.

5. The dry faeces (exposed for 216 hours) were populated only by three species: *Oxyomus sylvestris* SCOP. (75.17%), *Aphodius fimetarius* L. (23.80%) and *Teucheste fossor* L. (1.03%).

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Received: April 19, 2010
Accepted: July 20, 2010