

A COW DUNG INVESTIGATION ON CARABIDAE (COLEOPTERA) IN WESTERN TURKEY

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Eight species of Carabidae are recorded in cow dung in two localities in western Turkey. Seasonal dynamics of those species are evaluated. *Calathus longicollis* Motschulsky, 1864 were the most abundant species in the study with percentages of 51 %.

Key words: Carabidae, cow dung, seasonal dynamics, ecology, Turkey.

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INTRODUCTION

The beetle family Carabidae, or ground beetles, is one of the most diverse family of Coleoptera, with over 40.000 species worldwide (Lovei & Sunderland 1996). Most species are probably predators of soil dwelling insects, including caterpillars, maggots, wireworms, ants, and other small invertebrates as far as known. They are important biological control agents in agroecosystems and generally regarded as beneficials in field ecosystems. They can reduce insect pests (Varchola & Dunn 1999). In addition, Several ground beetle species feed on plants and carrion.

According to Casale et al. (1999), more than 1.100 carabid species have been recorded from Turkey. Up to now, only two studies focusing ecology of Carabidae of Turkey have been published.

In the studies of Tezcan et al. (2007), a total of fortyone species belonged to Caraboidea of the ecologically managed cherry orchards of western Anatolia have been recorded. In the other study, habitat selection and diversity of Ground beetles of Ahır Mountain, Kahramanmaraş, Turkey have been reported (Avgin 2006). According to our knowledge on this field, there has not been any study reported on dung inhabiting Carabidae of Turkey up to now.

The aim of this study is to evaluate the Carabidae fauna of cow dung at two locations at different altitudes in western Turkey. The results provide the first data on seasonal dynamics of these beetles in Turkey.

MATERIAL AND METHODS

The seasonal activity of the ground beetles was monitored in 2004 and 2006 in two locations (ca 3 ha each) situated in different altitudes (600 m a.s.l. and 900 m a.s.l.) near Dagmarmara, Manisa province, Western Turkey. The coordinates of the locations at 600 m and 900 m are 38°23'37"N, 27°49'09"E and 38°20'09"N, 27°50'47"E, respectively.

The location at 600 m a.s.l. is situated about 2 km north of Dagmarmara village within farm lands. From May to November there is a rainless period at this locality. There are pastures of various sizes situated among the plantations of *Pinus brutia* Ten., *Quercus* spp., *Castanea sativa* Mill. and the orchards of *Prunus avium* L., *Pyrus malus* L., *Cydonia vulgaris* Pers. on this locality. On the pastures, *Polypodium* sp., *Cistus creticus* L., *Trifolium bocconei* Savi, *Medicago* × *varia* (Martyn) Arcang., *Rubus canescens* L. occur except of grasses. On the pasture where the samples were collected, cows feed all day long on the pasture and they are brought back to their shelters at night.

The location at 900 m a.s.l. is situated ca. 5 km southeast of the pasture at 600 m, out of the agricultural land and is therefore less impacted by human activities. The samples were collected on a large pasture surrounded by the forest of *Pinus nigra* (Arnold). Except of grasses, *Polypodium* sp., *Verbascum* sp., *Juniperus oxycedrus* L., *Pyrus amygdaliformis* Vill., *Rosa canina* L., *Cistus laurifolius* L. were common on the pasture. The cows on this pasture feed all day long without going back to their shelters at night from April up to November. The locality is more humid, with scarce rain even through summer period.

For this study, both localities were visited in ca. 14-day intervals from mid April to the mid November. During the winter, cow were not present on the pastures and the beetles were therefore not sampled in this period. Samples were collected randomly by a handle shovel, placed into a plastic jars and transported to the laboratory, where the insects were separated from the dung. Fifteen samples of ca. 50 g of dung were collected during each visit on the locality. The material referred to

in this study is deposited in the Lodos Entomological Museum (LEMT), Department of Plant Protection, Aegean University (Izmir, Turkey) and first author's private collections. Taxonomy and higher classification follows Löbl & Smetana (2003). In the previous parts of these studies, species belonged to Histeridae (Anlaş et al. 2007), Hydrophilidae (Anlaş et al. 2008) and Scarabaeoidea (Anlaş et al. 2011) have been published.

RESULTS

In this study, eight species belonged to the family Carabidae were recorded from cow dung samples. Amongst them, *Calathus longicollis* Motschulsky, 1864 is the most abundant species in the study with percentages of 51 %. In this study, ecological data based on 149 specimens of Carabidae collected in cow dung located in 2004 and 2006 were evaluated.

Species composition

In total, 149 specimens of eight species belonged to 4 genera of the Carabidae were collected at both locations during 2004 and 2006 (Table 1). Those species belonged to *Calathus* (3 species, 100 specimens), *Dixus* (2 species, 19 specimens), *Harpalus* (2 species, 27 specimens), and *Zabrus* (1 species, 3 specimens). In the first five species with the following numbers as percentage of the total catch: *Calathus longicollis* Motschulsky, 1864 51 %, *Harpalus attenuatus* Stephens, 1828 15.4 %, *Calathus erythroderus* Gemminger & Harold, 1868 14.8 %, *Dixus obscurus* (Dejean, 1825) 8.1 % and *Dixus eremita* (Dejean, 1825) 4.7 %. In addition, the remaining species between 1.3-2.7 % as percentage of the total catch. From the species evaluated in present study, six were recorded from area located at 600 m and all species were recorded from area located at 900 m above sea level. In 2004 the number of species was eight and in 2006 it was seven. The total number of specimens collected in the area located at 600 m was 24 and 16.1 % as percentage of the total catch; 125 in the area located at 900 m and 83.9 % as percentage of the total catch. In 2004 the number of specimens was 83 (55.7 %) and in 2006 it was 66 (44.3 %).

Table 1. Number of specimens collected at both altitudes during 2004 and 2006 for this study

Species	2004		2006		Sum	Ratios %
	600 m	900 m	600 m	900 m		
Subfamily Platyninae						
<i>Calathus erythroderus</i> Gem-minger & Harold, 1868	3	6	4	9	22	14.8
<i>Calathus libanensis</i> Putzeys 1873	1	0	0	1	2	1.3
<i>Calathus longicollis</i> Motschulsky, 1864	6	39	4	27	76	51
Subfamily Harpalinae						
<i>Dixus eremita</i> (Dejean, 1825)	0	7	0	0	7	4.7
<i>Dixus obscurus</i> (Dejean, 1825)	0	9	0	3	12	8.1
<i>Harpalus attenuatus</i> Stephens, 1828	0	9	1	13	23	15.4
<i>Harpalus distinguendus</i> (Duftschmid 1812)	2	0	1	1	4	2.7
Subfamily Pterostichinae						
<i>Zabrus orientalis</i> Motschulsky, 1861	0	1	2	0	3	2
Total	12	71	12	54	149	100
	83		66			

Seasonal dynamics

In this study, only one species were collected in August, two species were collected in April, three species were collected in June, July and November, and four species were collected in May, five species were collected in September and October. Most of specimens were collected in September (52) and October (44).

The Carabidae specimens which were collected, generally occurred in the whole period of sampling, but it was absent or showing low abundance in August. The peaks were recorded at the end of September and during October. At 600 m, the specimens generally was absent or showing low abundance during April and in the period ca. from June to September. At 900 m, the specimens is more abundant than at 600 m. in both of 2004 and 2006. The specimens occurred in the whole period of sampling at 900 m. (except in April) both

in 2004 and 2006, with the peak in the second half of September and during October (Fig. 1).

DISCUSSION

We have encountered only a few study regarding the collection of dung-inhabiting carabid beetles in the studies conducted beforehand. But despite this, we have obtained information on the collection of the species belonged to some genera of carabids in dung. Coprophagous beetles were more abundant in dung pats than predatory beetles (Menéndez & Gutiérrez 1999) as well as in our results (95,5 and 4,5 %, respectively). Decaying organic matter, foreexample dung, is consumed by oprophagous species such as certain scarab beetles. As well as some of the beetles found within dung and carrion are in fact predatory, such as the ground beetles, preying on the larvae of coprophagous and necrophagous insects. It seems the recorded species are predator on coprophagous arthropods. According to

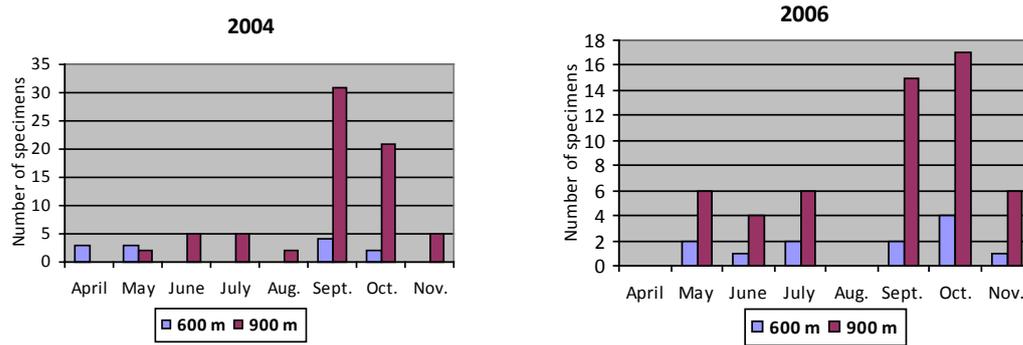


Fig. 1. Seasonal dynamics of the specimens of Carabidae during sampling period (2004 and 2006), April to November.

Brandmayr et al. (2004) the species belonged to genera *Harpalus* and *Zabrus* are both predators and phytophagous. In addition, adults of species belong to *Calathus* and *Dixus* has a zoophagous and phytophagous feeding habit.

Most species of Carabidae are capable of flying, but some adults are wingless and other species show variation in wing length (with macropterous, brachypterous and dimorphic species). In our study, *Dixus eremita*, *Dixus obscures*, *Harpalus attenuatus* and *H. distinguendus* are macropterous species and seems good dispersers. For that reason, the species have been also recorded in agricultural landscapes, forest and unforested habitats such as meadows and other grassland, burnt forest, maquis forest by various trapping methods. On the other hand, the remaining recorded species which, *Calathus erythroderus*, *C. libanensis*, *C. longicollis*, and *Zabrus orientalis* are brachypterous and/or dimorphic species. According to Gutiérrez & Menéndez (1997) in stable and climactic habitats, as forests, favour the presence of wingless species while unstable habitats favour macropterous species. In these habitats, driven by human activities, brachypterous species may be the first ones to disappear because they may not be able to quickly colonize nearby suitable sites (Gobbi & Fontaneto 2005).

The climate imposes a marked seasonality on the southern temperate dung-beetle communities of Europe, with a decrease in activity during the

summer droughts, especially at low altitudes (Lumaret & Kirk 1991). According to Palestirini et al. (1995), during the same period predatory beetles showed the highest values of species diversity, species richness, and species abundance. It seems more likely that the late arrival of the predatory beetles during August simply reflects certain traits of their life histories, which, in general, are poorly known. Palestirini et al. (1995), suggested that during the dry season, droppings may become a refuge habitat for predatory beetles (perhaps especially Carabidae), on account of moisture as well as prey availability. Conversely, according our study, carabids which were collected, generally occurred in the whole period of sampling, but it was absent or showing low abundance in August or dried season. The peaks were recorded at the end of September and during October. We also evaluated on the seasonal dynamics of the coprophagous Scarabaeoidea in studied areas (Anlaş et al. in press). The seasonal dynamics of dung-inhabiting Carabidae showed similarity with coprophagous scarab beetles communities in studies areas.

Species of Carabidae are among the important insects of epigeal invertebrates. Local species richness may be controlled by ecological processes acting at larger spatial scales very little is known about the effect of landscape variables on soil biota. It is hoped that current data will be contributed other studies that will be carried out in other locations in Turkey.

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REFERENCES

- Anlaş S., Lackner T. & Tezcan S. 2007. A cow dung investigation on Histeridae (Coleoptera) with a new record for Turkey. *Journal of Baltic Coleoptology* 7 (2): 157-164.
- Anlaş S., Fikacek M. & Tezcan S. 2008. Notes on seasonal dynamics of the coprophagous Hydrophilidae (Coleoptera) in western Turkey, with first record of *Megasternum concinnum* for Turkish fauna. *Linzer biol. Beitr.* 40 (1): 409-417.
- Anlaş S., Keith D. & Tezcan S. 2011. Notes on seasonal dynamics of the coprophagous Scarabaeoidea (Coleoptera) in Manisa, western Anatolia. *Turkish Journal of Entomology* 35 (3): 447-460.
- Avgin S. 2006. Habitat selection and diversity of Ground beetles (Coleoptera: Carabidae) on Ahır Mountain (K.Maraş, Turkey), in Mediterranean Region. *Munis Entomology & Zoology* 1 (2): 257-266.
- Brandmayr P., Zetto T. & Pizzolotto R. 2004. I Coleotteri Carabidi per la valutazione ambientale e la conservazione della biodiversità. APAT manuale operativo e linee guida, Roma.
- Löbl I. & Smetana A. 2003. Catalogue of Palaearctic Coleoptera. Volume I. Archostemata-Myxophaga- Adepaga. Apollo Books. Stenstrup, Denmark. 819 pp.
- Lövei G. L. & Sunderland K. D. 1996. Ecology and behavior of ground beetles (Coleoptera: Carabidae). *Annu. Rev. Entomol.* 41: 231-256.
- Lumaret J. P. & Kirk A. A. 1991. South temperate dung beetles. In: I. Hanski & Y. Cambefort (eds), *Dung beetle ecology*. Princeton University Press, Princeton, New Jersey, pp. 97-115.
- Menéndez R. & Gutiérrez D. (1999) Heterotrophic succession within dung-inhabiting beetle communities in northern Spain. *Acta Oecologica* 20 (5): 527-535.
- Palestrini C. I., Rolando A. & Barbero E. 1995. Analysis of temporal segregation in a dung-inhabiting beetle community at a low-altitude area of the Italian Alps. *Bollettino di Zoologia* 62: 257-265.
- Tezcan, S., Jeanne C. & Keskin B. 2007. Ground beetles (Coleoptera, Caraboidea) of the ecologically managed cherry orchards of Western Anatolia (Turkey) along with some new additional data. *Anadolu Üniversitesi Bilim ve Teknoloji Dergisi*, 8 (1): 53-63.
- Varchola J. M. & Dunn J. P. 1999. Changes in ground beetle (Coleoptera: Carabidae) assemblages in farming systems bordered by complex or simple roadside vegetation. *Agriculture, Ecosystems and Environment* 73: 41-49.

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