

SPECIES COMPOSITION OF GROUND BEETLES (CARABIDAE, COLEOPTERA) COLLECTED BY HIBERNATION TRAP-BANDS IN AGRICULTURAL LANDSCAPES, BOZDAGLAR MOUNTAIN OF WESTERN TURKEY

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The method of hibernation trap-bands used for the first time for collecting carabid species in agricultural landscapes, in Turkey during the years of 2005-2007. We have recorded a total of 492 specimens of 30 species belonging to seven subfamilies and some ecological considerations on those species are given. *Calathus* (s. str.) *erythroderus* Gemminger & Harold, 1868 was the most abundant species in the study with percentages of 20.93 %. Species richness of carabids was highest in apple orchards for per trapping (12 species, 94 specimens).

Key words: Ecology, faunistic, hibernation trap-bands, Bozdaglar Mountain, Turkey, Carabidae.

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INTRODUCTION

The beetle family Carabidae, or ground beetles, is one of the biggest family belonging to Coleoptera, more than 40.000 species worldwide (Lovei & Sunderland 1996). According to Casale et al. (1999), some about 1.100 carabid species

have been recorded from Turkey. Carabid beetles occur in nearly every available habitat, mostly in decaying animal or plant matter, in leaf litter and under stones or bark in many forest and unforest habitats. As well as, ground beetles are abundant and diverse in agricultural ecosystems. Relatively many Carabid species are of great economic importance especially in agricultural landscapes.

Carabids can consume up to their body weight daily. Thus, by consuming a variety of weed seeds and insect pests they can help protect crops from pest damage.

Up to now, the publications of Avgin, (2006a, b), Tezcan et al. (2007), Aslan et al. (2008), Luff & Avgin (2009) are the studies focusing on ecology of Carabidae of Turkey, while all other contributions for the Turkish Carabidae are concerned with taxonomic or faunistic problems.

Many carabid species hibernate or hide during the winter. Tree holes, leaf litter, and under rocks are mostly shelters for overwintering adult carabids. Pitfall traps have been used very common in many studies of the abundance of ground beetles. But this methods is not sufficient for collecting overwintering carabids. Artificial hibernation trap-bands were used for the first time with respect to Carabidae in this study. This method previously were used in same biotopes by Anlaş et al. (2009) to collecting Dermaptera specimens.

The aim of this study is to evaluate the Carabidae fauna in agricultural landscapes, Bozdaglar mountain, Western Turkey by hibernation trap-bands. The results of this study also provide some ecological data of ground beetles in western Turkey.

MATERIAL AND METHODS

Study Area

Studies have been conducted in Kuşlar, Ovacık and Çıkrıkçı counties (orchards of cherries, walnuts, apples, figs, pears and olives, as well as nature chestnuts and pines biotopes) by hibernation trap-bands at Bozdağlar Mountain (2157 m), Western Turkey (Figure 1), (also see Anlaş et al., 2010).

The material referred to in this study is deposited in the Lodos Entomological Museum (LEMT), Department of Plant Protection, Ege University (Izmir, Turkey), and in the private collection of the first author. Material were identified by the first author. Classification and nomenclature of

ground beetles suggested by Löbl & Smetana (2003) have been followed. Material have been collected by hibernation trap-bands method.

Sampling

At each biotope hibernation trap bands in 70 x 250 cm size made of hemp sack were rounded to the trunk of six trees in the beginning of October and removed in next February and collected material were determined. A total of 18 hibernation trap-bands were placed in each biotope. In the gardens which have only occur the related trees (each orchard has only one tree species).

Detailed information on the biotopes of hibernation trap-bands is given in Table 1.

RESULTS

In this study, totally 492 specimens representing 30 species of Carabidae were collected at three counties during the autumn and winter periods of the years of 2005-2007 (Table 2). Results showed that five species of Carabidae dominated in the 30 species captured: *Calathus* (s. str.) *erythroderus* Gemminger & Harold, 1868 with 20.93 %, *C.* (s. str.) *libanensis* Putzeys, 1873 with 10.57 %, *Bembidion* (s. str.) *quadripustulatum* Audinet - Serville, 1821 with 9.15 %, *Harpalus* (s. str.) *attenuatus* Stephens, 1828 8.54 %, *Carabus* (*Procrustes*) *coriaceus cerisyi* Dejean, 1826 with 8.33 % (see Table 2).

The total number of specimens collected during two years in Çıkrıkçı was 248 (50.41 %) and in Ovacık 145 (29.47 %). It was 99 (20.12 %) specimens in Kuşlar during three years collection period.

Among the biotopes, the majority of the specimens were collected from cherry biotope (100) in Kuşlar and Ovacık counties, and apple biotope (94) in only Ovacık county; the least specimens were collected from chestnut biotope (14) in only Kuşlar county, and pine biotope (15) in Ovacık county. The majority of the species were collected from apple (12) and fig (10) biotopes; the least species were collected from

Table 1. Detailed information on biotopes of hibernation trap-band methods [*setting period of trap-bands (October), collected February the following year].

Region	Prov.	County	Years*	Biotopes	Coordinate	Altitude (m)
1	Manisa	Çkırkçı	2005 & 2006	Fig	38°28'24"N/ 27°49'30"E	120
				Olive	38°28'22"N/ 27°49'28"E	120
				Pear	38°28'21"N/ 27°49'31"E	120
2	Manisa	Kuşlar	2005, 2006 & 2007	Cherry	38°21'44"N/ 27°49'58"E	820
				Chestnut	38°21'48"N/ 27°49'57"E	820
				Walnut	38°21'41"N/ 27°49'56"E	820
3	Manisa	Ovacık	2005 & 2006	Apple	38°22'45"N/ 27°51'06"E	930
				Cherry	38°22'45"N/ 27°51'06"E	930
				Pine	38°22'45"N/ 27°51'06"E	930

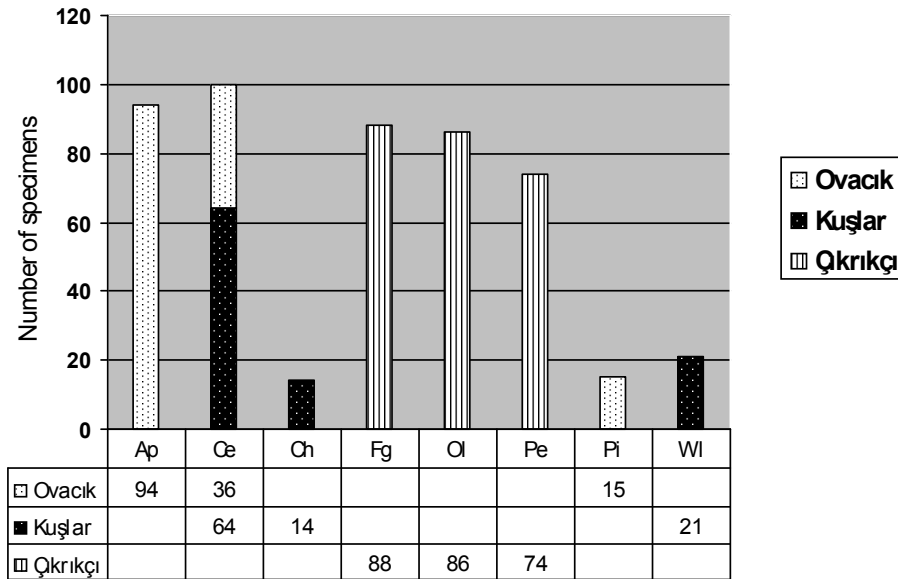


Figure 1. Biotopes of *Carabidae* species collected by hibernation trap-bands in Western Turkey [Ol (Olive), Ap (Apple), Fg (Fig), Pe (Pear), Ce (Cherry), WI (Walnut), Pi (Pine), Ch (Chestnut)].

Table 2. Number of specimens collected by hibernation trap-bands at different counties and their percent dominance values

Location and year Species	Ovacık		Kuşlar			Çıkrıkçı		Sum	Dominance Value (%)	
	2006	2007	2005	2006	2007	2006	2007			
1. Subfamily Brachinae Bonelli, 1810										
Tribe Brachini Bonelli, 1810										
<i>Brachinus explodens</i> Duftschmid, 1812	0	1	4	0	5	5	1	16	3.25	
2. Subfamily Carabinae Latreille, 1802										
Tribe Carabini Latreille, 1802										
<i>Carabus coriaceus cerisyi</i> Dejean, 1826	12	4	7	6	1	4	7	41	8.33	
<i>Carabus graecus morio</i> Mannerheim, 1830	0	2	0	1	0	0	0	3	< 1	
<i>Carabus microderus</i> Chaudoir, 1867	0	0	1	6	4	12	11	34	6.91	
3. Subfamily Harpalinae Bonelli, 1810										
Tribe Harpalini Bonelli, 1810										
<i>Dixus obscurus</i> (Dejean, 1825)	0	0	0	0	0	1	4	5	1.02	
<i>Harpalus attenuatus</i> Stephens, 1828	12	10	4	0	1	7	8	42	8.54	
<i>Harpalus smaragdinus</i> (Duftschmid, 1812)	4	0	0	0	0	8	3	15	3.05	
<i>Ophonus subquadratus</i> (Dejean, 1829)	0	0	0	1	0	0	0	1	< 1	
<i>Parophonus planicollis</i> (Dejean, 1829)	5	0	0	0	0	0	0	5	1.02	
Tribe Licinini Bach, 1851										
<i>Licinus silphoides</i> (Rossi, 1790)	0	0	0	0	0	2	2	4	< 1	
4. Subfamily Lebiinae Bonelli, 1810										
Tribe Lebiini Bonelli, 1810										
<i>Cyminidis axillaris palliata</i> Fischer von Waldheim, 1823	0	2	0	0	1	0	7	10	2.03	
<i>Lionychus orientalis</i> K. Daniel, 1900	0	0	2	4	0	0	0	6	1.22	
5. Subfamily Nebriinae Laporte, 1834										
Tribe Nebriini Laporte, 1834										
<i>Leistus spinibarbis rufipes</i> Chaudoir, 1843	0	0	2	0	0	0	0	2	< 1	
<i>Nebria brevicollis</i> (Fabricius, 1792)	2	7	0	1	0	16	2	28	5.69	
6. Subfamily Pterostichinae Bonelli, 1810										
Tribe Platynini Bonelli, 1810										
<i>Calathus erythroderus</i> Gemminger & Harold, 1868	11	20	2	7	4	38	21	103	20.93	
<i>Calathus libanensis</i> Putzeys, 1873	13	6	12	8	7	5	1	52	10.57	
<i>Olisthopus glabricollis</i> (Germar, 1817)	0	0	0	0	0	7	9	16	3.25	
Tribe Pterostichini Bonelli, 1810										
<i>Pterostichus macer</i> (Marsham, 1802)	0	3	0	0	0	0	0	3	< 1	
Tribe Zabriini Bonelli, 1810										
<i>Amara aenea</i> (DeGeer, 1774)	1	2	0	0	1	4	7	15	3.05	
<i>Amara ovata</i> (Fabricius, 1792)	0	0	0	0	0	1	2	3	< 1	
<i>Zabrus graecus orientalis</i> Apfelbeck, 1904	1	0	0	2	4	3	3	13	2.64	
7. Subfamily Trechinae Bonelli, 1810										
Tribe Bembidiini Stephens, 1827										
<i>Bembidion leucoscelis</i> Chaudoir, 1850	2	0	0	0	0	3	0	5	1.02	
<i>Bembidion properans</i> (Stephens, 1828)	0	0	0	0	0	4	2	6	1.22	
<i>Bembidion quadripustulatum</i> Audinet - Serville, 1821	8	2	0	0	0	14	21	45	9.15	
<i>Bembidion varius</i> (Olivier, 1795)	2	3	0	0	0	0	0	5	1.02	
<i>Ocydromus concoeruleus</i> (Netolitzky, 1942)	0	1	0	0	0	0	0	1	< 1	
<i>Ocydromus siculus smyrnensis</i> (Apfelbeck, 1904)	3	0	0	1	0	0	0	4	< 1	
Tribe Trechini Bonelli, 1810										
<i>Tachyura diabrachys</i> (Kolenati, 1845)	0	1	0	0	0	0	0	1	< 1	
<i>Trechus tristis</i> (Duftschmid, 1812)	3	2	0	0	0	0	0	5	1.02	
<i>Trechus quadristriatus</i> (Schränk, 1781)	0	0	0	0	0	3	0	3	< 1	
TOTAL	79	66	34	37	28	137	111	492	100	
	145		99			248				

pine (2) and walnut (4) biotopes. According to the study, relatively, species richness of carabids was highest in apple orchards for per trapping (Figure 1).

The number of collected specimens and species of each biotope is given in Figure 1.

DISCUSSION

A few studies (Avgin 2006a, b; Tezcan et al. 2007; Aslan et al. 2008; Luff & Avgin 2009) on the ecology of ground beetles have been conducted in Turkey up to now. The mentioned studies collected the carabid species mainly by pitfall traps and also by yellow sticky traps and by bait traps.

Luff & Avgin (2009), collected Carabid beetles by pitfall trapping from seven different horticultural and agricultural crops (apple, apricot, olive, peach, and walnut orchards, vineyards, and wheat fields) in Turkey. According to the study, a total of 959 ground beetles representing 57

species were reported. Species diversity of individual sites ranged from five in a walnut plantation to 32 in an apple orchard.

Tezcan et al. (2007), 41 species belonging to ten families of Caraboidea were recorded in ecologically managed cherry orchards in western Turkey. Some of the dominant species in the collected material were identical with our study: *Carabus coriaceus cerisyi*, *Brachinus explodens*, *Harpalus smaragdinus* etc.

At the result of the study, it was understood that Carabid beetles could be collected in important number of species and specimens by hibernation trap-bands method besides pitfall traps method. According to Tooley and Brust (2002), utilizing different carabid species at different times of the year can improve biological control. Adults of ground beetles can live between one and four years. Larger species, as well as those that overwinter as larvae, tend to have the longest life spans (Lovei & Sunderland 1996). *Carabid* beetles *hibernate* either as larvae or adults (Thiele, 1977). According to Larsson (1939), most

carabid species are either spring breeders or autumn breeders. Foreexample, autumn breeders hibernate as larvae and complete the development during the following summer. For that reason artificial hibernation trap-bands have great importance in both the protection of fauna and also in extending their life-span. Annual activity patterns are an important part of carabids life cycles. In generally, pitfall traps can use for the studies of annual activity and life cycles of carabid beetles. But our study has been shown that hibernation trap-bands can be used

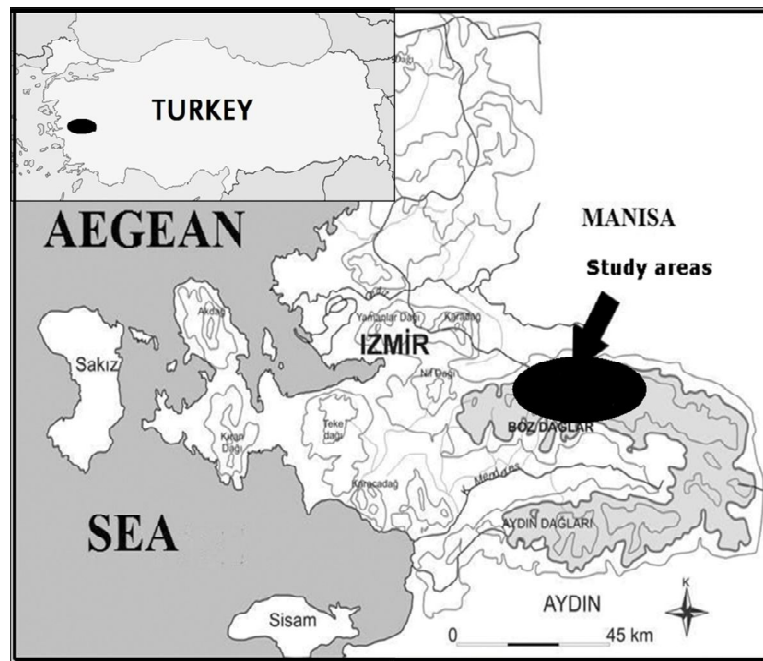


Figure 2. Location of trapping study area and neighbouring fields at Bozdağlar Mountain, western Turkey.

together pitfall traps for relevant studies.

Many carabid species are predators as adults and larvae and they are abundant and diverse in agricultural ecosystems. Most of them are widely distributed near cultivated landscapes. Ground beetles can show a significant advantages in ecologically-based integrated pest management activity that focus on reduction of pest pressure through agricultural practices. For this reason, it is very important to studies on feeding habits of predator carabids, and their preys and activities in terrestrial ecosystems and in agroecosystems as well.

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