

HABITAT SELECTION AND DIVERSITY OF GROUND BEETLES (CARABIDAE) ON AHIR MOUNTAIN (K.MARAŞ, TURKEY), IN MEDITERRANEAN REGION

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ABSTRACT: This study was carried out on Ahır Mountain (Kahraman Maraş, Turkey), in the Mediterranean Region between April and October of 2004 and 2005. In this region, there is not any work about ground beetles (Coleoptera, Carabidae) so far. A total of 24 ground beetles species were recorded in the pitfall traps. Among them, *Calathus (Calathus) libanensis pluriseriatus* Putzeys, 1873 and *Calathus (Calathus) syriacus* Chaudoir, 1863 were the most abundant species. Separately, habitat selection (grassland, forest edge and forest interior) of all species, diversity, monthly distribution and chorotypes, ecology of these species are given in this study. It was recorded that the diversity of ground beetles was significantly higher in the forest edge and grassland than in the forest interior. There was no significant difference in the diversity of ground beetles of the grassland and the forest edge in Ahır Mountain.

KEY WORDS : Carabidae, ground beetle, Ahır mountain.

Ahır mountain is the chain of the Southeast Toros mountains and this area is located within the boundaries of Kahraman Maraş province, Turkey, in the Mediterranean. The altitude of Ahır mountain changes between 600 metre and 2301 metres. This area has a Mediterranean climate, the main characteristics of which are : dry summers and warm and rainy winters. The seasonal precipitation regime during the year is winter, spring, autumn and summer. This is a typical first variant of the East Mediterranean climate (Akman, 1990; Varol, 2003).

The study area lies within the Mediterranean phytogeographical region. This region is dominated by the forest species *Pinus brutia* Ten., *Pinus nigra* J.F. 7411 hectare forest field is present in Ahır mountain. 4532 hectare of this forest is fertile but 2879 hectare of it is infertile. This region is important for its forest in Turkey. The grass and bushes dominated in Mediterranean Region are found at the forest edge and unforest regions. In this region, research about insects is rare and there is not any work about ground beetles (Coleoptera, Carabidae) so far.

Ground beetles are very important on the biological agenda. They are generalist predators which can greatly reduce insect pest (Varchola & Dunn, 1999). The ground beetles have been an important study group in ecological research. Because they are diverse and abundant, their ecology and systematics are relatively well known, and they seem to be highly sensitive to habitat changes and, thus, good indicators of environmental change (Thiele, 1977; Ings & Hartley, 1999 ; Magura et al. 2000 ;

Melnychuk et al., 2003). There are many quantitative studies on the distribution of ground beetles in various habitats in the world. For example, some research has reported distribution of ground beetles in jack pine, oak and maple, and on aspen stands with various histories of defoliation and different soil types (Epstein & Kulman, 1990). It was discovered in a work on the effects of habitat structure on the ground beetle community composition of a regenerating native forest in the Deeside region of northeast Scotland (Ings & Hartley, 1999). Similar findings have been reported by Magura et al., 2000 and Gutierrez et al., 2004. In addition, much of the previous work using carabids as environmental indicators has concentrated on moorland habitats (Gardner et al., 1997; Ings & Hartley, 1999). Most studies on the carabid communities of woodlands have concentrated on the effects of management practices such as afforestation of uplands (Butterfield et al., 1995), soil scarification (Parry & Rodger, 1986) and pest control (Walsh et al., 1993). However, only a few studies have been carried out in pine forest (Young & Armstrong, 1995; Ings & Hartley, 1999).

In the literature much of the distribution of ground beetles in various habitats in the world were recorded (Epstein & Kulman, 1990; Gandhi et al., 2001; Armstrong & McKinlay, 1997; Allegro & Sciaky, 2003; Döring & Kromp, 2003).

Although many studies were carried out about the effect of different habitats, different climate, different altitude and different season on ground beetles in different countries, in Turkey such studies are very rare. The main aim of the present study is to determine habitat selection (grassland, forest edge and forest interior), diversity, monthly distribution and ecology of ground beetles in Ahır Mountain (Kahraman Maraş, Turkey), in the Mediterranean Region. The study focusses on the use of carabids as biological agenda forming the base. It also aimed to open the way to the works on the ecology of ground beetles in Turkey. This is the first study with this aim done about ground beetles in Turkey.

MATERIAL AND METHODS

The material of this investigation was collected from the Ahır mountain (Kahraman Maraş, Turkey) between April and October of 2004 and 2005. This region is mostly dominated by pine forest (*P. brutia* and *P. nigra*). Three habitats, forming a transect, were studied: 1). Forest interior, 2). Forest edge and 3). Grassland. Samples were collected using pitfall traps that were established in each of the 3 habitats. The pitfall traps consisted of plastic cups filled with 25 % ethylene glycol set into the ground. The traps were emptied monthly (Epstein & Kulman 1990, Armstrong & McKinlay 1997, Magura et al. 2000). Specimens were dissected in the laboratory. Materials were then identified to species using keys in Müller (1926), Jeannel (1941), Lindroth (1974), Lindroth (1985), Trautner and Geigenmüller (1987), Hurka (1996). The identification of those which weren't identified were made with Prof. Augusto Vigna Taglianti and Dr.

Paolo Bonavita in Italy. Those which were already identified were checked in Italy with Prof. Augusto Vigna Taglianti and Dr. Paolo Bonavita. The specimens are deposited in the Biology Department of Çukurova University.

RESULTS

In this study many ground beetles collected are a new record for Ahır mountain. A total of 24 ground beetles species were recorded in the pitfall traps, between April and October of 2004 and 2005. The traps were emptied monthly. The species collected in pitfall traps every month are given in table 1. Among them, *Calathus (Calathus) libanensis pluriseriatus* Putzeys, 1873 and *Calathus (Calathus) syriacus* Chaudoir, 1863 were the most abundant species. The information collected about the ecology of ground beetles and chorotypes is given below.

Genus *Brachinus* Weber, 1801

Ecology: In this research, four species belong to this genus were collected in the traps forest edge and mostly in the region where grassland dominated.

“Bombardier Beetles”. These species are found often in open country on clayey soils, mostly in higher numbers. The larvae of all Brachinidae are probably parasitic (Trautner & Geigenmüller, 1987).

Brachinus (Brachinus) ejaculans Fischer von Waldheim, 1828

Chorotype : Turano-European (Casale & Vigna Taglianti, 1999).

Brachinus (Brachynidius) bodemeyeri Apfelbeck, 1904

Chorotype : Turano-European (Casale & Vigna Taglianti, 1999).

Brachinus (Brachynidius) brevicollis Motschulsky, 1844

Chorotype : Turano- Mediterranean (Casale & Vigna Taglianti, 1999).

Brachinus (Brachynidius) explodens Duftschmid, 1812

Chorotype : Asiatic-European (Casale & Vigna Taglianti, 1999).

Genus *Calosoma* Weber, 1801

Ecology: In this study, only one species belonging to this genus were collected in the traps put in the forest interior.

This genus is know from lowlands to mountains, more commonly only at the time of mass occurrence of lepidoptera forest pests (Hurka, 1996). They mostly prey on caterpillars. Larval development is very short, only 2-3 weeks. Larvae are predatory, too (Trautner & Geigenmüller, 1987).

Calosoma sycophanta (Linné, 1758)

Chorotype : Palearctic (Holarctic) (Casale & Vigna Taglianti, 1999).

Genus *Carabus* Linné, 1758

Ecology: In this study, three species belong to this genus were collected in the traps put at the edge and in the interior of the forest but the forest

interior traps, yielded.

They preferably feed on earth-worms, snails, slugs, and numerous insects, however, they do also feed on carrion and sometimes even on vegetable matter. Digestion is extra-intestinal. Usually single eggs are laid in the ground. The larval development takes several weeks. Larvae are predators. Pupation takes place in the ground. Almost all species are mainly active at night. For their defense they can spray acid fluids from their anal glands and salivate digestive ferment. Wings reduced in nearly all species (Lindroth, 1985; Trautner & Geigenmüller, 1987).

***Carabus (Mimocarabus) maurus paphius* L. Redtenbacher, 1843**

Chorotype : South-West Asiatic (Casale & Vigna Taglianti, 1999).

***Carabus (Chaetomelas) morawitzi montesamanus* Mandl, 1967**

Chorotype : South-East Anatolian (Casale & Vigna Taglianti, 1999).

***Carabus (Lamprostus) mulsantianus nurdagensis* Blumenthal, 1967**

Chorotype : South-East Anatolian (Casale & Vigna Taglianti, 1999).

Genus *Leistus* Fröhlich, 1799

Ecology: In this study, only one species belong to this genus was collected in the traps put both in the forest interior and the forest edge.

These species are found in different habitats, some species montane to subalpine. The species of this genus occur among debris in more or less shady places, where they prey upon mites, Collembola, etc. They are nocturnal (Lindroth, 1985; Trautner & Geigenmüller, 1987).

***Leistus (Pogonophorus) spinibarbis rufipes* Chaudoir, 1843**

Chorotype : Cyprus and Anatolian (Casale & Vigna Taglianti, 1999).

Genus *Notiophilus* Duméril, 1806

Ecology: In this study, only one species belonging to this genus was collected and it was collected in the trap which was put in the forest interior.

They live on the litter-layer of forests, heaths, or meadows, some at shores. They are active during the day and hunt by sight. The species are diurnal, sun-loving insects, very rapid in their movement. They are visually hunting beetles, preying upon mites, Collembola and other arthropods. The larvae have specialized on Collembola to a greater extent than have the adults (Lindroth, 1985; Trautner & Geigenmüller, 1987; Hurka, 1996).

***Notiophilus danieli* Reitter, 1897**

Chorotype : East Mediterranean (Casale & Vigna Taglianti, 1999).

Genus *Metallina* Motschulsky, 1850

Ecology: In this study, only one species belonging to this genus was collected and it was collected in the trap which was put in the region where grassland dominated.

They are Brachypterous, rarely macropterous. These live in drier to semi-moist and unshaded *Calluna* heaths, mostly on peaty soil and hills (Trautner & Geigenmüller, 1987; Hurka, 1996).

***Metallina (Neja) sporadica* (J. Sahlberg, 1903)**

Chorotype : East Mediterranean (Casale & Vigna Taglianti, 1999).

Genus *Amara* Bonelli, 1810

Ecology: In this research, two species belonging to this genus were mostly collected in the traps at the forest edge and mostly in the region where the grassland dominated.

They are macropterous, observed in flight (Hurka, 1996). Many species are active at daytime. Imagines are partly or completely phytophagous, they preferably feed on flowers and seeds (e. g. of Cruciferes). Larvae are mostly predatory and live in burrows (Trautner & Geigenmüller, 1987). Very distributed and very common. A xerophilous species living in open country on dry, sandy or clayey soil with rather dense but short vegetation. Notably on heaths and grassland; also on cultivated land, often on lawns in parks and in gardens. The beetle is pronouncedly diurnal, often seen running on the surface in bright sunshine. It feeds on plant seeds and has been reported to be harmful to winter cereals. Breeding takes places in spring (Lindroth, 1985).

***Amara (Amara) aenea* (De Geer, 1774)**

Chorotype : Palearctic (Casale & Vigna Taglianti, 1999).

***Amara (Amara) proxima* Putzeys, 1866**

Chorotype : South European (Casale & Vigna Taglianti, 1999).

Genus *Ophonus* Dejean, 1821

Ecology: In this study, only one species belonging to this genus was collected in the traps at the forest ledge and mostly at the region where grassland dominated.

These species is brachypterous, rarely macropterous. It occurs in dry, open habitats, usually on gravelly, clay-mixed chalky soil with short, sparse vegetation, e.g. in dry meadows and grassland, often on southern hill-sides. The species is regularly found in company with *Harpalus*, *Brachinus*, etc. It is usually considered a typical spring breeder, but finds of newly emerged beetles in mid and late June suggest that autumn breeding may also occur (Lindroth, 1985; Trautner & Geigenmüller, 1987; Hurka, 1996).

***Ophonus (Hesperophonus) subquadratus* (Dejean, 1829)**

Chorotype : Mediterranean (Casale & Vigna Taglianti, 1999).

Genus *Harpalus* Latreille, 1802

Ecology: In this study, only one species belonging to this genus were collected in the traps at the forest edge and mostly at the region where grassland dominated.

Many species are partly or preferably phytophagous, at least as imago (Trautner & Geigenmüller, 1987). These species is found in unshaded habitats; steppe, vineyards, fields, fallows; lowlands to hills (Hurka, 1996).

***Harpalus (Harpalophonus) metallinus* Ménétrié, 1836**

Chorotype : South-West Asiatic (Casale & Vigna Taglianti, 1999).

Genus *Odotoncarus* Solier, 1835

Ecology: In this study, only one species belonging to this genus was collected in the traps at the forest edge and mostly at the region where grassland dominated.

***Odotoncarus asiaticus* (Chaudoir, 1852)**

Chorotype : East Mediterranean (Casale & Vigna Taglianti, 1999).

Genus *Ditonus* Bonelli, 1810

Ecology: In this research, only one species belonging to this genus was collected in the traps at the forest edge and mostly in the region where the grassland vegetation dominated.

These species are mostly phytophagous. They live mostly on sandy and partly saline soils near the coast and for aestivation in the dry summer plantago-seeds are collected and stored in the subterranean burrows (Trautner & Geigenmüller, 1987).

***Ditonus calydonius calydonius* (P. Rossi, 1790)**

Chorotype : Cyprus and Anatolian (Casale & Vigna Taglianti, 1999).

Genus *Dixus* Billberg, 1820

Ecology: In this research, two species belonging to this genus were collected in the traps at the forest edge and mostly in the region where the grassland dominated.

These species are macropterous. They live on steppe, lowlands (Hurka, 1996).

***Dixus eremita* (Dejean, 1825)**

Chorotype : East Mediterranean (Casale & Vigna Taglianti, 1999).

***Dixus obscurus* (Dejean, 1825)**

Chorotype : East Mediterranean (Casale & Vigna Taglianti, 1999).

Genus *Calathus* Bonelli, 1810

Ecology: In this study, two species belonging to this genus were collected. These species were collected in the traps which were put mostly in the forest interior.

This commonly distributed species usually lives in open country on different kinds of moderately dry ground with sparse vegetation, achieving its greatest abundance on sandy soil. It is a common inhabitant of dry meadows, grassland, dunes and heaths; also on agricultural land and in thin forests, mainly of *Pinus*. It is frequent in the fields up to the lower

alpine region. It is probably chiefly carnivorous (Lindroth, 1985; Hurka, 1996).

***Calathus (Calathus) libanensis pluriseriatus* Putzeys, 1873**

Chorotype : Anatolian (Casale & Vigna Taglianti, 1999).

***Calathus (Calathus) syriacus* Chaudoir, 1863**

Chorotype : South-West Asiatic (Casale & Vigna Taglianti, 1999).

Genus *Anchomenus* Bonelli, 1810

Ecology: In this research, only one species belonging to this genus was collected in the traps at the forest edge and mostly in the region where the grassland dominated.

They are macropterous, observed in flight. They are in unshaded, dry to moderately moist habitats ; fields, steppe, pastures, edges of small woods ; from lowlands to mountains, often gregariously (Lindroth, 1985; Hurka, 1996).

***Anchomenus (Anchomenus) dorsalis* (Pontoppidan, 1763)**

Chorotype : Palearctic (Casale & Vigna Taglianti, 1999).

Genus *Microlestes* Schmidt-Goebel, 1846

Ecology: In this research, only one species belonging to this genus was collected mostly in the region where grassland dominated.

This species is brachypterous, rarely macropterous. They live in rather dry habitats, indifferent to shade: steppe, pastures, brick-yards; lowlands to mountains, often in hills (Hurka, 1996). They are found preferably on sandy or clayey soils which are exposed to sunlight and at least partly poor in vegetation (Lindroth, 1985; Trautner & Geigenmüller, 1987).

***Microlestes maurus* (Sturm, 1827)**

Chorotype : Turano European (Casale & Vigna Taglianti, 1999).

Genus *Lamprias* Bonelli, 1810

Ecology: In this research, only one species belonging to this genus was mostly collected in the region where grassland dominated.

Probably all species are parasites or macropterous, observed in flight. They rarely live in dry to moderately moist, unshaded habitats : steppe, pastures ; lowlands to foothills. On low vegetation in open country, mostly in spring (Trautner & Geigenmüller, 1987; Hurka, 1996).

***Lamprias cyanocephalus* (Linné, 1758)**

Chorotype : Palearctic (Casale & Vigna Taglianti, 1999).

DISCUSSION

In the recent studies, generally the ecology of carabids which have a very important biological agenda has been more important rather than the systematic study of ground beetles. As in this research, much research on

the diversity of ground beetles and on their effect on habitat structure in the forest region of different countries has been investigated (Debinski & Brussard, 1994; Molnar et al., 2001; Gutierrez et al., 2004).

On Ahır mountain it was observed that the diversity of ground beetles was significantly higher in the forest edge and grassland than in the forest interior. There was no significant difference in the diversity of ground beetles of the grassland and the forest edge. Similar results were obtained from research carried out in oak- hornbeam forest in Hungary (Molnar et al., 2001). This also emphasized the edge effect on ground beetles, because forested habitats were usually significantly less diverse than the open areas (Magura & Tothmeresz, 1998; Molnar et al., 2001).

Also, the monthly distribution of carabids collected in pitfall traps was given in this research (table 1) and this information shows seasonal distribution of ground beetles on Ahır mountain. In addition, similar studies have been carried out in many countries, but the results showed some differences according to the climate of that country (Epstein & Kulman, 1990; Armstrong & McKinlay, 1997).

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