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Studies on the Ground Beetles (Coleoptera: Carabidae) of the Sağlık Plain - Gavur Lake Marsh Area, Kahramanmaraş, Turkey

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Abstract.- This research was carried out in and around Gavur Lake Marsh (Sağlık Plain) because of its biogeographical location and ecological situation and especially for its current agricultural importance. Many carabid species are important predators of agricultural pests, hence the objective of the study was to obtain data on the occurrence of carabid species and to quantify the influence of habitat type on their activity and distribution. A total of 796 ground beetles representing 48 different species were discovered. Of those, 38 (79%) species were sampled by pitfall traps from places 3 km away from lake, 12 (25%) species were sampled by pitfall traps and hand from these places 3 km distance from lake and 10 (21%) species were sampled by hand and aspirator nearer to Gavur Lake. Species having Turano-European and Mediterranean chorotypes are the most widespread and common in the study area.

Key Words: Carabidae, Gavur Lake Marsh, agricultural landscape, potentially beneficial beetles.

INTRODUCTION

Studies of the distribution, habitat choice, and diversity of Carabidae in Turkey are very recent (Avgın, 2006a,b). Because of its location, geography, and history, Gavur Lake Marsh and environs have always attracted researchers for studies on birds and fish. However, there is hardly any study on insects, particularly on species belonging to Carabidae in this region. This study was aimed to obtain data on the occurrence of carabid species in a Turkish lake marsh and to quantify the influence of habitat type and location on their activities and distributions.

Most carabids are generalist predators (Thiele, 1977), although two very large Holarctic tribes (Harpalini and Zabriini) are seed predators (Erwin, 1979). The generalist predators feed on various insect larvae and eggs, Collembola, juvenile salamanders, earthworms, mollusks, spiders, centipedes, and isopods (Currie and Digweed, 1996; Vasconcelos *et al*., 1996; Werner and Raffa, 2000). Because of their significance as bioindicators and their role as agents of biological control of agricultural pests, carabids have been extensively used to assess the impact of soil management on ground-dwelling arthropods in many crops (Miñarro and Dapena, 2003). In addition, carabid beetles are exceptionally useful for examining biogeographical changes as they were highly sensitive to the effects of landscape changes, such as fragmentation (Niemelä *et al*., 2000; Magura *et al*., 2001).

The role of carabid beetles in the ecosystem is very important. Thus, many studies have been carried out on the habitat, diversity and way of life of these species throughout the world. Some of these studies were carried out on the speices occurring around lakes. For example, Good (2004) studied in lake-shore fens and reed-beds as a habitat for Staphylinidae and Carabidae (Coleoptera) in the East Burren area of County Clare, Ireland. Zalewski and Ulrich (2006) focused on dispersal as a key element of community structure: the case of carabid beetles on lake islands. In Turkey, the studies on the diversity and habitat of Carabidae have been done recently by Avgın (2006a, b). The theme is extended here in the present study as we examine the Carabidae in and around the Gavur Lake Marsh on the Sağlık Plain in order to initiate the building of a multifunctional database on predatory beetles for this historically important area.

MATERIALS AND METHODS

Study area

The research area is located near the border of Türkoğlu, Kahramanmaraş. Kahramanmaraş is a province in Turkey's Mediterranean region. It lies

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between the 37°11' – 38°36' N, 36°15' – 35°42' E (K.H.G.M., 1997; Yılmaz, 2006). Gavur Lake Marsh is located on the Sağlık Plain, in the north east of Adana, not too distant from the Mediteranean Sea, at the very northwest end of wetland places of the Great Rift Valley which begins in Mozambique, Africa, and ends in Kahramanmaraş, Turkey (Gürbüz *et al*., 2003; Dikici and Yilmaz, 2006; Yılmaz, 2006). Gavur Lake was one of the wettest landscapes in the southern regions of Turkey in the recent past (Yarar and Magnin, 1997; Kara, 2004). It is well known that the present Sağlık Plain used to be a 55.86 km^2 lake in the past. Unfortunately, its importance as a rich biodiversity landscape and bird migration center ended when it was drained in the 1950's down to its present 8.9 km^2 (Gürbüz *et al*., 2003; Dikici and Yilmaz, 2006; Yılmaz, 2006). The swamp provided habitats for a wide variety of flora and fauna (Dikici and Yilmaz, 2006). Common reed [*Phragmites australis* (Cav.) Trin. ex Steud.] and cattail (*Typha domingensis* Pers.) were the dominant vegetation along with many other aquatic plants such as duckweed (*Lemna* spp.), pondweed (*Potamogeton* spp.), naiad (*Najas* spp.), and bulrush (*Schoenoplectus* spp.) (Gürbüz *et al*., 2003). Richness of fish and bird species used to attract fishers and hunters of the region." Then came the peat fires, which besides increasing the fertility of soils (Romanya *et al*., 1994; Dumontet *et al*., 1996; Ivanauskas *et al*., 2003; Ilstedt *et al*., 2003), and their use as a management tool in some regions (Cade-Menun *et al*., 2000; Caldwell *et al*., 2002), had long-term negative effects on below-ground systems and ecosystem sustainability (Neary *et al*., 1999). Of course, our concern is for the potentially beneficial carabid beetles. It is not likely they will survive in peat fires.

Climate features

Gavur Lake Marsh is located in the north east of the Mediterranean region and is in the Mediterranean - Continental climate transition zone. Due to its location at the cross section of three geographical regions, namely Mediterranean, East Anatolian, and Southeast Anatolian regions and other factors, its climate is a "modified" mediterrenean climate.

The average temperature ranges between 15.6°C and 18.1°C in this region. The lowest temperature is in January and the highest is in August. The average precipitation is 691.5 mm in a year (Gürbüz *et al*., 2003; Yılmaz, 2006). However, it is reported that the average temperate is over 23°C in four months (June, July, August, September) at the Gavur Lake landscape (Gürbüz *et al*., 2003; Yılmaz, 2006).

There is rich organic as well as inorganic soils in the study area (Yılmaz, 2006) and most of the old lake bed is thick peat (Dikici and Yilmaz, 2006).

Vegetation

The dominant vegetation in the Gavur Lake Marsh area is that mainly found in Mediterranean phytogeographic region. There are three vegetation belts determined by both ecological and antropogenic conditions in the area. These are brush and forest formations which consist of scrub vegetation and broad-leaved trees standing with coniferous trees, respectively, and also a grass formation (Grübüz *et al*., 2003; Yılmaz, 2006).

Sampling for this study focused in two proximate areas. The following list gives each site name followed by Area 1 or Area 2 code by which it is referred to in the remainder of this paper; plus we give the dominant vegetation profile at the sites.

Kahramanmaraş-Türkoğlu (Tigem),
Code Area 1:

The dominant plants are: *Artedia* sp. (Apiaceae), *Cyperus* sp. (Cyperaceae), *Fraxinus* sp. (Oleaceae), *Poa* sp. (Poaceae), *Ranunculus* sp. (Ranunculaceae), *Rubus* sp. (Rosaceae), *Rumex* sp. (Polygonaceae), *Scrophloria* sp. (Scrophloriaceae). This site is 3 km distant from the lake.

Kahramanmaraş - Gavur Lake (near water),
Code Area 2:

The dominant plants are *Alisma plantago-aquatica* L. (Alismataceae), *Althaea officinalis* L., (Malvaceae), *Apium nodiflorum* (L.) Lag. (Apiaceae), *Artedia squamata* L., (Apiaceae), *Inula* sp. (Asteraceae), *Malva neglecta* Wallr. (Malvaceae), *Phragmites australis* (Cav.) Trin. ex Steud. (Poaceae), *Plantago major* L.

(Plantaginaceae), *Poa* sp. (Poaceae), *Polygonum amphibium* L. (Polygonaceae), *Polygonum bisorta* L. (Polygonaceae), *Potamogeton nodosus* Pioret (Potamogetonaceae), *Ranunculus sphaerospermum* Boiss and Blanche, (Ranunculaceae), *Rumex* sp. (Polygonaceae), *Turgenia latifolia* (L.) Hoffm. (Apiaceae), *Verbascum* sp. (Scrophloriaceae), *Xantium* sp. (Asteraceae). This site is near the lake.

Soil

Entisol, inseptisol, vertisol, hydromorphic and organic soils exist at drained places in the Gavur Lake Marsh (Yılmaz, 2006).

Sampling

This study was carried out at the two localities during different climate conditions and the years 2004-2005. The geographical coordinates and altitudes of the sites are summarised in Table I.

Table I. Details of sites where the species were collected.

Site	Area 1	Area 2
Latitude (°,',"N)	37 17 55	37 17 58
Longitude (°,',"E)	36 47 59	36 48 09
Altitude (m)	550	474

Field studies at Gavur Lake Marsh and environs were made mostly in 2004 and also a few field days in 2005. Some specimens were collected with an aspirator, by hand from under stones and plants remnants, but mostly in pitfall traps. Most of the specimens were collected by hand or pitfall traps in Area 1, that is, 3 km away from the lake and by hand from under stones and plants remnants from Area 2, that is, near the lake. Twenty pitfall traps were buried at the places in Area 1 with a predicted high probablility of carabid activity. The traps consisted of plastic cups filled with 25% ethylene glycol set into the ground. The study sites were visited once every fifteen days (or once a month) whenever possible (Armstrong and McKinlay, 1997; Magura *et al.,* 2000). Specimens were dissected in the laboratory, and preparations made of male genitalia. Material was then identified to species using keys in Müller (1926), Jeannel (1941, 1942), Shilenkov (1983), Trautner and Geigenmüller (1987), Hurka (1988, 1996), and Casale and Vigna Taglianti (1999). The specimens are deposited in the Biology Department of Çukurova University.

Generic and species nomenclature in each carabid genus are in accordance with Lorenz (2005a, b). The identification of plant species was made by Asst. Prof. Dr. Ahmet İlçim (Turkey).

Chorology

The distribution of species in the Gavur Lake Marsh were given. Our present zoogeographical characterization is based on the chorotype classification of Anatolian fauna, recently proposed by Taglianti *et al*. (1999). Species distribution and chorotypic information are from Taglianti *et al.* (1999), and Casale and Taglianti (1999), respectively.

RESULTS

A total of 796 carabid beetles, representing 24 genera and 48 species, were captured during this study (Table II). There we summarize the numbers of individuals and species (species-richness) caught in each site/year combination. It is probable that most of these species are newly recorded at Gavur Lake Marsh and environs. The most abundant species, in decreasing catch order, were: *Poecilus anatolicus* (172), *Anchomenus dorsalis* (117 individuals), *Poecilus reicheianus* (88). Adult members of these species were collected by pitfall traps or by hand from Area 1, however, very few of the species sampled by pitfall traps were also collected by hand. No different species were collected by hand from Area 1 than those sampled by pitfall traps. The richness of species in Area 1 was more than that in Area 2, and we belive that this is due both to a different vegetation type and to the fact that Area 1 was sampled more rigorously by the use of pitfall traps for this study than was Area 2. Although there are species having different chorotypes because of the central location of the Gavur Lake Marsh area, the species having Turano-European and Mediterranean chorotypes are most commonly found (Table III).

Table II.- List of species of Family Carabidae found in the Gavur Lake area with chorological notes and collecting methods. TIGEM is the Turkish acronym for "General Directorate of State Owned Farm Operations." Classification follows Lorenz (2005a,b).

No.	Name of the species	Material examined	Remarks	Chorology
1.	*Nebria* (*Alpaeus*) *hemprichi* Klug, 1832	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 1♀; 07.V.2004 2♂♂, 8♀♀; 01.VI.2004 12♂♂, 8♀♀; 17.V.2005 1♂, 1♀; 24.V.2005 3♂♂, 2♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	E-Mediterranean.
2	*Notiophilus substriatus* Waterhouse, 1833	Kahramanmaraş-Türkoğlu (TIGEM): 04.IV.2004 1♂, 4♀♀.	These specimens were collected in pitfall traps in Area 1.	European.
3.	*Distichus planus* (Bonelli, 1813)	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 2ex.	These specimens were collected in pitfall traps in Area 1.	Afrotropico-Indo-Mediterranean.
4.	*Clivina laevifrons* (Chaudoir, 1842)	Kahramanmaraş-Gavur Lake (near water): 31.V.2004 6ex.; 11.VI.2004 2ex.	These specimens were collected with aspirator or by hand from under stones and plant remnants in Area 2.	Turano-Mediterranean.
5.	*Dyschirius* (*Dyschiriodes*) *chalybaeus resli* Bulirsch, 1996	Kahramanmaraş-Gavur Lake (near water): 11.Vl.2004 1ex.	One specimen was collected by hand under a stone and plant remnants in Area 2.	Mediterranean.
6.	*Bembidion* (*Metallina*) *properans* (Stephens, 1828)	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 2♂♂; 07.V.2004 1♀.	These specimens were collected in pitfall traps in Area 1.	Sibero-Eruropean.
7.	*Bembidion* (*Emphanes*) *normannum* Dejean, 1831	Kahramanmaraş-Gavur Lake (near water): 11.VI.2004 1♀, 1ex.	One specimen was collected by hand under a stone and plant remnants in Area 2.	Mediterranean.
8.	*Bembidion* (*Philochthus*) *inoptatum* Schaum, 1857	Kahramanmaraş-Türkoğlu (TIGEM): 21.V.2004 1ex.	One specimen was collected in a pitfall trap in Area 1.	S-European.
9.	*Bembidion* (*Philochthus*) *escherichi* Ganglbauer, 1897	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 1♂	One specimen was collected in a pitfall trap in Area 1.	Mediterranean.
10.	*Bembidion* (*Peryphanes*) *grandipenne freyi* Netolitzky, 1937	Kahramanmaraş-Gavur Lake (near water): 31.V.2004 2♂♂, 1♀.	These specimens were collected with aspirator or by hand from under stones and plant remnants in Area 2.	E-Mediterranean.
11.	*Bembidion* (*Peryphanes*) *lacrimans* Netolitzky, 1935	Kahramanmaraş-Türkoğlu (TIGEM): 21.V.2004 1♂	One specimen was collected in a pitfall trap in Area 1.	Anatolian.
12.	*Bembidion* (*Peryphanes*) *castaneipenne* Jacquelin du Val, 1852	Kahramanmaraş-Gavur Lake (near water): 31.V. 2004 1♂	One specimen was collected by hand under a stone and plant remnants in Area 2.	E-Mediterranean.
13.	*Bembidion* (*Peryphus*) *subcostatum* (Motschulsky, 1850)	Kahramanmaraş-Gavur Lake (near water): 11.VI.2004 1♀.	One specimen was collected by hand under a stone and plant remnants in Area 2.	Turano-Mediterranean.

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No.	Name of the species	Material examined	Remarks	Chorology
14.	*Bembidion* (*Peryphus*) *persicum* Ménétriés, 1832	Kahramanmaraş-Gavur Lake (near water): 31.V. 2004 1♂, 1♀; 11.VI. 2004 1ex.	These specimens were collected with aspirator or by hand from under stones and plant remnants in Area 2.	SW-Asiatic.
15.	*Elaphropus* (*Tachyura*) *quadrisignatus* (Duftschmid, 1812)	Kahramanmaraş-Gavur Lake (near water): 31.V.2004 1ex.	One specimen was collected by hand under a stone and plant remnants in Area 2.	Europeo-Mediterranean.
16.	*Anchomenus dorsalis* (Pontoppidan, 1763)	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 1♀; 17.IV.2004 1♂, 1♀; 22.IV.2004 7♂♂, 6♀♀; 30.IV.2004 4♂♂, 3♀♀; 07.V.2004 1♂, 3♀♀; 21.V.2004 1♂; 11.VI.2004 3♂♂; 11.VI.2004 5♂♂, 6♀♀; 27.VI.2004 1♂; 30.VI.2004 14♂♂, 21♀♀; 13.XI.2004 23♂♂, 16♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Palaearctic.
17.	*Agonum marginatum* (Linnaeus, 1758)	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 1♀	One specimen was collected in a pitfall trap in Area 1.	W-Palaearctic.
18.	*Agonum* (*Olisares*) *viridicupreum* (Goeze, 1777)	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 3♂♂, 2♀♀	These specimens were collected in pitfall traps in Area 1.	Turano-European.
19.	*Agonum* (*Olisares*) *angustatum* Dejean, 1828	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 1♂	One specimen was collected in a pitfall trap in Area 1.	Turano-European.
20.	*Agonum nigrum* Dejean, 1828	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 2♂♂, 3♀♀	These specimens were collected in pitfall traps in Area 1.	Turano-Europeo-Mediterranean.
21.	*Calathus libanensis* Putzeys, 1873	Kahramanmaraş-Türkoğlu (TIGEM): 26.X.2004 5♂♂, 8♀♀; 13.XI.2004 4♂♂, 7♀♀;	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	E-Mediterranean.
22.	*Calathus syriacus* Chaudoir, 1863	Kahramanmaraş-Türkoğlu (TIGEM): 30.VI.2004 2♂♂, 3♀♀; 26.X.2004 4♂♂, 6♀♀; 13.XI.2004 3♂♂, 2♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Turano-Mediterranean.
23.	*Pterostichus* (*Pseudomaseus*) *fuscicornis* (Reiche and Saulcy, 1855)	Kahramanmaraş-Türkoğlu (TIGEM): 30.IV.2004 1♀; 07.V.2004 1♀; 21.V.2004; 11.VI.2004 1♂; 27.VI.2004 1♀; 13.XI.2004 2♂♂, 3♀♀; 25.V.2005 6♂♂, 9♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	SW-Asiatic.
24.	*Poecilus anatolicus* (Chaudoir, 1850)	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 4♂♂, 10♀♀; 17.IV.2004 3♂♂, 3♀♀; 22.IV.2004 7♂♂, 6♀♀; 30.IV.2004 22♂♂, 14♀♀; 07.V.2004 6♂♂, 11♀♀; 21.V.2004 2♂♂, 1♀; 11.VI.2004 2♂♂, 6♀♀; 30.VI.2004 5♂♂, 2♀♀; 26.X.2004 8♂♂, 9♀♀; 13.XI.2004 18♂♂, 10♀♀; 17.V.2005 5♂♂, 4♀♀; 24.V.2005 5♂♂, 9♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Anatolian.

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No.	Name of the species	Material examined	Remarks	Chorology
25.	*Poecilus reicheanus* (Peyron, 1858)	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 1♀; 30.IV.2004 8♂♂, 3♀♀; 07.V.2004 2♂♂, 3♀♀; 21.V.2004 1♂, 1♀; 11.VI.2004 12♂♂, 6♀♀; 27.VI.2004 6♂♂, 4♀♀; 30.VI.2004 3♂♂, 5♀♀; 26.X.2004 6♂♂, 10♀♀; 13.XI.2004 7♂♂, 4♀♀; 30.VI.2005 2♂♂, 4♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	S-Anatolian.
26.	*Amara similata* (Gyllenhal, 1810)	Kahramanmaraş-Türkoğlu (TIGEM): 11.VI.2004 1♀.	One specimen was collected in a pitfall trap in Area 1.	Asiatic-European.
27.	*Amara proxima* Putzeys, 1866	Kahramanmaraş-Türkoğlu (TIGEM): 25.V.2005 2♀♀.	These specimens were collected in pitfall traps in Area 1.	S-European.
28.	*Amara aenea* (DeGeer, 1774)	Kahramanmaraş-Türkoğlu (TIGEM): 07.V.2004 1♂.	One specimen was collected in a pitfall trap in Area 1.	Palaearctic.
29.	*Amara anthobia* Villa and Villa, 1833	Kahramanmaraş-Türkoğlu (TIGEM): 07.V.2004 1♂; 26.X.2004 3♂♂, 2♀♀.	These specimens were collected in pitfall traps in Area 1.	European.
30.	*Anisodactylus binotatus* (Fabricius, 1787)	Kahramanmaraş-Türkoğlu (TIGEM): 30.IV.2004 1♂, 3♀♀; 07.V.2004 1♂; 21.V.2004 1♂.	These specimens were collected in pitfall traps in Area 1.	Asiatic-European.
31.	*Ditomus calydonius* (Rossi, 1790)	Kahramanmaraş-Türkoğlu (TIGEM): 17.IV.2004 1♂.	One specimen was collected in a pitfall trap in Area 1.	Turano-European.
32.	*Dixus eremita* (Dejean, 1825)	Kahramanmaraş-Türkoğlu (TIGEM): 17.IV.2004 1♂.	One specimen was collected in a pitfall trap in Area 1.	E-Mediterranean.
33.	*Dixus obscurus* (Dejean, 1825)	Kahramanmaraş-Türkoğlu (TIGEM): 17.IV.2004 1♂.	One specimen was collected in a pitfall trap in Area 1.	E-Mediterranean.
34.	*Parophonus dia* (Reitter, 1900)	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 2♂♂; 21.V.2004 1♂; 11.VI.2004 1♂, 2♀♀.	These specimens were collected in pitfall traps in Area 1.	Anatolian.
35.	*Harpalus* (*Pseudoophonus*) *griseus* (Panzer, 1796)	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 2♂♂, 3♀♀; 07.V.2004 3♀♀: 11.VI.2004 9♂♂, 8♀♀; 17.V.2005 4♂♂, 5♀♀; 24.V.2005 1♂, 3♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Palearctic.
36.	*Stenolophus discophorus* (Fischer von Waldheim, 1823)	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 1♂.	One specimen was collected in a pitfall trap in Area 1.	S-European.
37.	*Stenolophus proximus* Dejean, 1829	Kahramanmaraş-Gavur Lake (near water): 11.VI.2004 1♀.	One specimen was collected by hand under a stone and plant remnants in Area 2.	Mediterranean.
38.	*Acupalpus maculatus* (Schaum, 1860)	Kahramanmaraş-Gavur Lake (near water): 31.V.2004 7♂♂, 9♀♀; 11.VI.2004 14♂♂, 19♀♀.	These specimens were collected with aspirator or by hand from under stones and plant remnants in Area 2.	Europeo-Mediterranean.

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No.	Name of the species	Material examined	Remarks	Chorology
39.	*Chlaenius festivus* (Panzer, 1796)	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 2♂♂; 30.IV.2004 3♂♂, 2♀♀; 21.V.2004 2♀♀; 13.XI.2004 2♂♂, 3♀♀;	These specimens were collected in pitfall traps in Area 1.	Turano-European.
40.	*Chlaenius vestitus* (Paykull, 1790)	Kahramanmaraş-Türkoğlu (TIGEM): 30.IV.2004 4♂♂; 21.V.2004 2♂♂; 27.VI.2004 1♂, 1♀; 13.XI.2004 3♂♂, 4♀♀;	These specimens were collected in pitfall traps in Area 1.	Palaearctic.
41.	*Anaulacus* (*Aephnidius*) *ruficornis* (Chaudoir, 1850)	Kahramanmaraş-Türkoğlu (TIGEM): 22.IV.2004 1♂, 1♀; 07.V.2004 2♂♂; 21.V.2004 1♀.	These specimens were collected in pitfall traps in Area 1.	SW-Asiatic.
42.	*Brachinus crepitans* (Linnaeus, 1758)	Kahramanmaraş-Türkoğlu (TIGEM): 25.V.2005 2♂♂; 30.VI.2005 2♀♀.	These specimens were collected in pitfall traps in Area 1.	Palaearctic.
43.	*Brachinus ejaculans* Fischer von Waldheim, 1828	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 2♂♂; 17.IV.2004 1♂; 30.IV.2004 1♂, 1♀; 21.V.2004 3♂♂; 11.VI.2004 3♂♂, 2♀♀; 27.VI.2004 2♀♀; 30.VI.2004 2♀♀; 26.X.2004 3♂♂, 2♀♀; 13.XI.2004 4♂♂, 3♀♀; Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 2♂♂; 30.IV.2004 1♀; 11.VI.2004 1♂, 4♀♀; 24.V.2005 1 ♂; 25.V.2005 2♂♂, 1♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Turano-European.
44.	*Brachinus plagiatus* Reiche, 1868	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 1♂; 21.V.2004 1♀.	These specimens were collected in pitfall traps in Area 1.	Mediterranean.
45.	*Brachinus psophia* Audinet-Serville, 1821	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 1♀; 22.IV.2004 1♂; 07.V.2004 1♀; 11.VI.2004 4♂♂, 6♀♀; 27.VI.2004 2♂♂, 1♀; 30.VI.2004 1♂; 26.X.2004 3♂♂, 4♀♀; 13.XI.2004 4♂♂, 1♀♀; 25.V.2005 1♂, 1♀; 30.VI.2005 2♂♂, 3♀♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Turano-European.
46.	*Brachinus* (*Brachynolomus*) *bodemeyeri* Apfelbeck, 1904	Kahramanmaraş-Türkoğlu (TIGEM): 14.IV.2004 2♂♂, 2♀♀; 17.IV.2004, 2♂♂, 1♀; 26.X.2004 2♀♀; 25.V.2005 1♂; 30.VI.2005 3♂♂, 1♀.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Turano-European.
47.	*Brachinus* (*Brachynolomus*) *explodens* Duftschmid, 1812	Kahramanmaraş-Türkoğlu (TIGEM): 17.IV.2004 1♂; 11.VI.2004 9♂♂, 4♀♀; 12.VI.2004 2♂♂; 27.VI.2004 4♂♂, 1♀; 30.VI.2005 3♂♂.	Most of these specimens were collected in pitfall traps or by hand from under stones and plant remnants in Area 1.	Asiatic-European.
48.	*Brachinus* (*Cnecostolus*) *bayardi* Dejean, 1831	Kahramanmaraş-Türkoğlu (TIGEM): 27.VI.2004 1♀.	One specimen was collected in a pitfall trap in Area 1.	Turano-European.

DISCUSSION

This is the first investigation on Carabidae associated with lakes in Turkey, and particularly the important Gavur Lake Marsh agricultural area. Similar studies on carabid species near lakes were conducted in the Irish Republic by Good (2004) and in northern Poland by Zalewski and Ulrich (2006).

Table III.- Contributions to the carabid fauna of Gavur Lake Marsh from various common geographic regions.

Chorotype	Number of species	Percent of species
Afrotropico-Indo-Mediterranean	1	2.08 %
Anatolian	3	6.25 %
Asiatic-European	3	6.25 %
E-Mediterranean	6	12.5 %
European	2	4.17 %
Europeo-Mediterranean	2	4.17 %
Mediterranean	5	10.42 %
Palaearctic	5	10.42 %
S-Anatolian	1	2.08 %
S-European	3	6.25 %
Sibero-Eruropean	1	2.08 %
SW-Asiatic	3	6.25 %
Turano-European	8	16.7 %
Turano-Europeo-Mediterranean	1	2.08 %
Turano-Mediterranean	3	6.25 %
W-Palaearctic	1	2.08 %

Carabid beetles are mostly generalist predators that can greatly reduce insect pests (Clark *et al*., 1994; Varchola and Dunn, 1999). A positive relationship exists amongst natural communities rich in plant species and a correspondingly high number of carabid species (Asteraki, 1994; Varchola and Dunn, 1999), as was also found in the present study. Although the sampling area is small, we believe that the high number of species are sustained by the rich plant vegetation, wet soils, and the area's long history as a marshland. In addition, the area is at the "cross roads" of many zoogeographic provinces.

Now that the carabid fauna of the marsh area is somewhat known, further studies are possible. For example, we need to analyse the effect of grazing on the structural development of local vegetation (cf. Gardner *et al*., 1997) and the effects of forest management practices on the diversity of ground-occurring beetles (cf. Werner and Raffa, 2000). Also possible is the evaluation of measures for enlargement, renaturation, and development of a dry grassland biotope by analysing differences in the carabid fauna (Sieren and Fischer, 2002) and the assessment of the impact of two cropping systems (annual-grain and diversified grain-forage) and two input systems (high level and organic) on carabid beetles (Melnychuk *et al*., 2003).

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