

Investigations on the Aquatic Coleoptera (Classis: Insecta) Fauna of Some Mountain Lakes in the Eastern Black Sea Range (Turkey)

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Özet: Doğu Karadeniz dağ silsilesindeki bazı dağ göllerinin sucul Coleoptera (Classis: Insecta) faunası üzerine araştırmalar. Doğu Karadeniz (Türkiye) dağ silsilesindeki yüksek dağ göllerinin sucul Coleoptera faunasını belirlemek amacıyla yapılan bu araştırma, 2005-2007 yıllarında Temmuz ve Ağustos aylarında 22 gölde gerçekleştirilmiştir. Örneklemeler göllerin littoral bölgesinde ve el kepçeleri kullanılarak yapılmıştır. Toplanan örneklerin taksonomik açıdan incelenmesiyle, 4 familyaya ait 21 takson (Dytiscidae 11, Helophoridae 7, Hydraenidae 2, Elmidae 1) tespit edilmiştir.

Anahtar Kelimeler: Doğu Karadeniz, Dağ gölü, Coleoptera, Kaçkar, Türkiye

Abstract: A total of 22 lakes were investigated in order to determinate the aquatic Coleoptera fauna of high-altitude lakes located in the Eastern Black Sea Range (Turkey) between 2005-2007 period (in July and August months). Samplings were carried out on the littoral zone by hand net. As a result of taxonomic studies of the specimens, 21 taxa belong to 4 families (Dytiscidae 11, Helophoridae 7, Hydraenidae 2, Elmidae 1) were identified.

Key Words: East Black Sea, Mountain lake, Coleoptera, Kaçkar, Turkey

Introduction

Turkey is of great diversity in species based on evolution caused by adjustment to changing climatic conditions during interglacial warming periods which occurred in glacial ages prevailing in Anatolia (Demirsoy, 1999).

Turkey covers flora and fauna remarkably rich in living organisms inhabiting water columns which filled collapsing grounds due to deep valleys and their associated microclimatic influences among successions of mountains in high altitudes (Eken and Ataol, 2010).

Mountain lakes and close basin lakes are those areas with highest physical and environmental isolation from neighbouring territories, thus housing a great variety of organisms unique to the region (Eken and Ataol, 2010).

In this respect, Eastern Black Sea succession of mountains are those that location south wards along the Black Sea in northeastern Anatolia with the highest peak being Kaçkar (3932 m) (Çiner, 2003).

Mountainous successions appeared and were heightened by orogenic and epirogenic movements which emerged during previous geologic ages. Their parts higher than 2500 m were significantly glaciated in the last glacial period (Atalay and Mortan, 1997).

Lakes in the region seem to be of small dimensions with more than one lying in groups of lakes fed by drains of thawing snow which are mostly iced and therefore not dried out almost all the year round (Atalay and Mortan, 1997).

Most lakes can only be reached by people on foot or with a guided tour just because all the lakes but Uzungöl, an alluvial set lake (Çaykara-Trabzon) 1100 m high are on

altitudes higher than 2500 m and above and therefore any paths or roads hardly exist to drive up there.

The literature has yet to include any studies concerning aquatic Coleoptera in the lakes in the region. However, some samples are known to have been previously collected from aquatic environments other than lakes in the region and systematically studied.

Angus (1988) was the first to identify *Helophorus (Atrathelophorus) ponticus* (Coleoptera: Helophoridae) in one of the locations above 3300 m across Kaçkar mountain.

Erman *et al.* (2005) were the first to find and record *Hydroporus nigellus* Mannerheim 1853 and *Agabus lapponicus* (Thomson 1867) (Coleoptera: Dytiscidae) in Anzer plateau (İkizdere-Rize) for Turkey.

Erman and Erman (2008) identified 24 species and 4 subspecies in their study into Dytiscidae in Artvin and Rize provinces.

Fery and Erman (2009) identified 5 new species from genus *Hydroporus* (Coleoptera: Dytiscidae) in northeastern Anatolia in Turkey, of which *Hydroporus cagrankaya*, *Hydroporus sivrikaya*, *Hydroporus lundbergi* were found in İkizdere (Rize), *Hydroporus toledo* in Çamlıhemşin (Rize) and *Hydroporus artvinensis* in Karagöl (Şavşat-Artvin) respectively.

Mart (2009) identified 28 species and 1 subspecies from aquatic Hydrophilidae and Helophoridae in the two systematic studies which he conducted in Black Sea Region of Turkey (Bayburt, Gümüşhane, Ordu and Trabzon), reporting that he was the first to find species of *Anacaena rufipes* (Guillebeau, 1896), *Anacaena lutescens* (Stephens, 1829), *Cercyon*

ustulatus (Preyssl, 1790), *Cryptopleurum crenatum* (Kugelann, 1794), *Enochrus bicolor* (Fabricius, 1792), *Enochrus fuscipennis* (Thomson, 1884), *Enochrus quadripunctatus* (Herbst, 1797), *Enochrus melanocephalus* (Olivier, 1792), *Helochares obscurus* (O.F. Muller, 1776), *Hydrobius fuscipes* (L., 1758), *Hydrochara dichroma* (Fairmaire, 1892), *Laccobius halophilus* (Gentili, 1982), *Paracymus aeneus* (Germar, 1824), *Paracymus chalceolus* (Solsky 1874) and *Paracymus scutellaris* (Rosenhauer, 1856) for Black Sea Region of Turkey.

Mart *et al.* (2010) established 25 species from Helophoridae at almost the same stations in the region, 6 of which were the first to be identified there.

In their studies on glacial lakes in Uludağ (Bursa), Ustaoglu *et al.* (2008) established *Agabus striolatus* (Gyllenhal 1808) from Lake Kilimligöl and *Stictotarsus griseostriatus* (De Geer 1774) (Coleoptera: Dytiscidae) from Lake Karagöl.

Topkara *et al.* (2009) found a total of 14 taxa belonging to 3 Coleoptera families (Noteridae, Dytiscidae and Hydrophilidae) in the study they made in 9 mountain lakes across the succession of Taurus.

Due to the fact that comprehensive studies have not been conducted on benthic fauna in numerous mountain lakes in the region yet, the study was the first to be made in the region and thus first recorded for the lakes concerned as well.

Material and Method

The study to examine aquatic Coleoptera fauna in mountain lakes across eastern Black Sea succession included 5 field studies when snow and ice had thawed out in summer in which one can only walk to following a long period of snow in June and July between 2005 and 2007.

The sampling process used benthic sieves and webs of 0.5-1 mm in mesh to collect samples which were filled into small glass bottles to which a few drops of Ethyl Acetate were applied to kill beetles in them.

Beetles brought to laboratory were put into damped petri dishes to brush out sediment and mud on them. Aedeagofores of systematical importance were extracted from them using dissection needles and kept in a 10% KOH solution for 1-2 hours to enable muscular tissues on them to be broken.

Small scale samples were stucked on the labels by water base glues and bigger ones attached on to card boards with beetle needles with standard numbers specified by the museum of Fisheries Faculty, Ege University (ESFM-INS).

Study Area

Lake Yedigöller (Lake Üstgöl- Lake Ortagöl): Lake Yedigöller consists of a total of seven ponds. North to village Moryayla following the summit of Ovit Mountain driving up from the road between İkizdere (Rize) and İspir (Erzurum). Although there is a path from the village up to the ponds, one has to walk there for about 1 km farther.

Lake Büyükgöl: one can drive there through the plateau Avusor (Çamlıhemşin-Rize) from which to walk to the pond for 2 km. Because it is a pond frequently visited by guests who

prefer highland tourism in summer, the path can easily be observed to have been worn down by their foot traces. The pond is also variously called Lake Dobecelezane, Avusor or Kemerligöl.

Lake Akçaağıl: It is located on the plateau Hoşmer on the road İkizdere (Rize) to Bayburt, with a depth of 2.5 m.

Lake Çitrik: Ortaköy can be reached on the path to the plateau Viran in İkizdere (Rize) from which to walk up to the pond for about 2 hours. The pond has a depth of 14 m and a surface area of 2.80 ha.

Lake Salar (Cermeniman): It is possible to drive to the plateau Cermeniman from which to walk to the pond with a depth of 2.5 m for 1-1.5 hours.

Lakes Batıaksu, Kuzeyaksu ve Doğuaksu: One can drive to the plateau Kazançukuru on the road İkizdere (Rize)-İspir (Erzurum), from which to walk up to lake Batıaksu for 2-3 hours then to the other pond Kuzeyaksu for 20 minutes and finally to the pond Doğuaksu within 40 minutes.

Lake Dipsizgöl and Hatalan: One can only walk to the lakes on the plateau Kurtların Yurdu South to the plateau Anzer (İkizdere-Rize) to the pond Dipsizgöl for about 1 hour first, then to the pond Hatalan in the same walk.

Lake Kartal (Bogolduba): The pond is a glacial process located in one of the deep walleys of the mountain Güngörmez. One can drive to the village Yaylalar from which to walk over steep slopes up to the lake for about five hours.

Lake Karagöl: It is possible to drive to the plateau Sirt from the village Yüksekoba (Yusufeli-Artvin) then walk to the pond north to the plateau for about one hour.

Lake Uzungöl: The pond is 10 km away from Çaykara (Trabzon), surrounded by settlements and available to tourism, in the valley Haldizen through Soğanlı Mountains. The pond is a typical alluvial set process once formed by an alluvial bank proven to have blocked the down stream of the river Haldizen. The Lake Uzungöl was declared as "Natural Park" in 1989 by the Ministry of Forestry (Verep *et al.*, 2002).

Lake Koyun: The pond is located on Demirtepe mountains south to the plateau Kurtların Yurdu (İkizdere-Rize). One can drive to the plateau Koşmer from which to walk up to the pond for about 2 hours. The pond has a maximum depth of 10 m and a surface area of 1.5 ha on the east of the plateau

Koşmer Lake Küçük and Büyük Tobamızga: It is possible to drive to plateau Sirt 45 km away from Ardeşen (Rize) and there from drive along a 10 km path to the lakes Küçük and Büyük Tobamızga which lie adjacent to each other. Lake Küçük and Büyük Çiftegöl: One can drive to the plateau Goleneza away from the plateau Sirtayla for about one hour, walking up to the pond Büyük Çiftegöl for about two hours and finally to the pond Küçük Çiftegöl within a walk of ten minutes from Büyük Çiftegöl.

Lake Büyük Balıklı and Kayakaynak: The asphalt road leads to Kaptanpaşa district from Çayeli (Rize), with a mountain road climbing to the plateau Tahpur on the eastern drive to the plateau where the lakes can be looked down at. The upper sections of the plateau Ambarlık where the lakes

exist can be seen. One can walk up to the pond Büyük Balıklı for about 90 minutes from which to walk to the pond Kayakaynak within half an hour.

Lake Çakırgöl: The pond is 20 km away from the Monastery Sumela (Maçka-Trabzon). It is possible to drive to plateau Karahava then to the pond which is located on the skirt of the summit Deveboynu (3062 m) northwest to Soğanlı Mountains. Water of the pond with a depth of about 4 m is of potable quality as well.

Results

The mountain lakes concerned are located in the line between the mountain Yıldız in the westernmost and the mountain Soğanlı in the south through the Eastern Black Sea succession. Sampling studies were conducted in 22 of the mountain lakes system in the region in July and August from 2005 to 2007.

5 field studies established a total of 21 taxons in families of Dytiscidae, Helophoridae, Hydraenidae and Elmidae.

Uzungöl is 1100 m high in with the highest altitude being Lake Doğuaksu (3120 m) of the lakes studied. On the other hand 15 and 6 of the lakes concerned are 2500-3000 m and above 3000 m in altitude respectively.

The six lakes in the study (Lake Yedigöller (Ortagöl and Üstgöl), Lake Kartal, Lake Doğuaksu, Lake Batiaksu, Lake Kuzeyaksu) are located through the basin of river Çoruh, the other six ponds are in different basins, that is, Lakes Akçaağıl, Çitrik, Salar, Dipsizgöl, Hatalan, Koyun in İyidere basin, while Uzungöl, Karagöl and Çakırgöl are in Solaklı river, Kabisra river and Maçka river basins respectively (Table 1).

Systematic assessment of material collected from the study area determined a total of 21 taxons of 4 families. Most taxons are from Dytiscidae (11), seven from Helophoridae, two from Hydraenidae and one from Elmidae (Table 2).

The concerned study established that samples of nine taxons are only in one pond, with *Scarodytes halensis* (Fabricius 1787) being from Doğuaksu, *Agabus bergi* Zaitsev 1913 from Küçük Tobamızga, *Helophorus* (A.) *arvernicius* Mulsant 1846 from Küçük Çiftegöl, *Helophorus* (R.) *discrepans* Rey 1885 from Salar (Lake Cermeniman), *Helophorus* (R.) *seidlitzii* Kuwert 1885 from Akçaağıl (Lake Yeşilgöl), *Oreodytes septentrionalis* (Gyllenhal 1826), *Hydraena dentipalpis* Reitter 1888, *Hydraena* (H.) *plastica terraevastatae* Jäch 1992 and *Stenelmis damascena* Reitter 1907 from Uzungöl.

Table 1. Investigated localities and global positions. (St=Station).

St.	Lakes	Basins	Altitude (m)	Global Position	Sampling Dates
1	Lake Yedigöller (Üstgöl)	Çoruh River	3030	40°38'51"N 40°52'54"E	19.08.2005
2	Lake Büyükgöl	Fırtına River	2670	40°56'13"N 41°12'02"E	30.07.2006
3	Lake Akçaağıl (Yeşilgöl)	İyidere Stream	2940	40°31'19"N 40°30'40"E	02.08.2006
4	Lake Çitrik	İyidere Stream	2850	40°39'31"N 40°46'59"E	03.08.2006
5	Lake Salar (Cermeniman)	İyidere Stream	2820	40°43'28"N 40°52'09"E	03.08.2006
6	Lake Batiaksu	Çoruh River	3050	40°39'13"N 40°50'39"E	04.08.2006
7	Lake Kuzeyaksu	Çoruh River	3070	40°39'19"N 40°50'57"E	04.08.2006
8	Lake Doğuaksu	Çoruh River	3120	40°39'09"N 40°51'06"E	04.08.2006
9	Lake Dipsizgöl	İyidere Stream	2670	40°33'28"N 40°28'25"E	20.08.2006
10	Lake Hatalan	İyidere Stream	2810	40°33'11"N 40°29'24"E	20.08.2006
11	Lake Kartal (Bogolduba)	Çoruh River	2940	40°50'20"N 41°18'04"E	24.08.2006
12	Lake Karagöl	Kabisra Stream	2660	41°09'28"N 41°24'19"E	25.08.2006
13	Lake Uzungöl	Solaklı Stream	1100	40°37'14"N 40°17'44"E	26.08.2006 26.08.2007
14	Lake Koyun	İyidere Stream	3010	40°31'34"N 40°28'58"E	25.07.2007
15	Lake Yedigöller (Ortagöl)	Çoruh River	2960	40°38'51"N 40°52'09"E	26.07.2007
16	Lake Tobamızga	Fırtına Stream	2620	41°02'19"N 41°15'37"E	22.08.2007
17	Lake Küçük Tobamızga	Fırtına Stream	2630	41°02'08"N 41°15'39"E	22.08.2007
18	Lake Büyük Çiftegöl	Fırtına Stream	2600	40°59'24"N 41°15'41"E	23.08.2007
19	Lake Küçük Çiftegöl	Fırtına Stream	2550	40°59'36"N 41°15'49"E	23.08.2007
20	Lake Büyük Balıklıgöl	Fırtına Stream	2990	40°49'28"N 40°52'51"E	25.08.2007
21	Lake Kayakaynak	Fırtına Stream	3080	40°49'17"N 40°52'43"E	25.08.2007
22	Lake Çakırgöl	Maçka Stream	2530	40°34'34"N 39°41'26"E	26.08.2007

Table 2. The distribution of the determined species according to the stations.

Takson	Station Number
Family: Dytiscidae	
<i>Scarodytes halensis halensis</i> (Fabricius 1787)	8
<i>Stictotarsus griseostriatus</i> (De Geer 1774)	1,16,17,22
<i>Oreodytes davisii</i> (Curtis 1831)	14,19
<i>Oreodytes septentrionalis</i> (Gyllenhal 1826)	13
<i>Hydroporus kozlovskii</i> Zaitsev 1927	3,4
<i>Hydroporus pubescens</i> (Gyllenhal 1808)	4,5,7-12,15,20-22
<i>Hydroporus nigellus</i> Mannerheim 1853	5,17,21
<i>Platambus maculatus</i> (Linnaeus 1758)	13,21,22
<i>Agabus bergi</i> Zaitsev 1913	17
<i>Agabus bipustulatus</i> (Linnaeus 1767)	1-7,9,12,14-16,18,21,22
<i>Agabus lapponicus</i> (Thomson 1867)	5,21
Family: Helophoridae	
<i>Helophorus</i> (s.str.) <i>aquaticus</i> (Linnaeus 1758)	3,20
<i>Helophorus</i> (A.) <i>brevipalpis</i> Bedel 1881	12,19
<i>Helophorus</i> (A.) <i>ponticus</i> Angus 1988	3,7,16,22
<i>Helophorus</i> (A.) <i>arvensis</i> Mulsant 1846	19
<i>Helophorus</i> (A.) <i>lewisi</i> Angus 1985	16,17,19,21
<i>Helophorus</i> (R.) <i>discrepans</i> Rey 1885	5
<i>Helophorus</i> (R.) <i>seidlitzii</i> Kuwert 1885	3
Family: Hydraenidae	
<i>Hydraena</i> (s.str.) <i>dentipalpis</i> Reitter 1888	13
<i>Hydraena</i> (H.) <i>plastica terraevastatae</i> Jäch	13
Family: Elmidae	
<i>Stenelmis damascena</i> Reitter 1907	13

Discussion

Oreodytes septentrionalis (Gyllenhal, 1826) and *Oreodytes davisii* (Curtis, 1831) were first to be established by Erman and Erman (2002) in Erzurum for Turkey. Zaitsev (1972) reported that *Oreodytes davisii* is in Carpathian and Transcaucasian mountains as well as across mountainous regions of Pirines and Alpes in southern and central Europe respectively. Guignot (1947) claimed that both species are found in mountainous areas as Zaitsev (1972) reported, saying that *Oreodytes davisii* is a subalpine species.

Zaitsev (1972) also reported that *Stictotarsus griseostriatus* (De Geer, 1774) is a relict of glacial period across Europe Asia and north Africa, north to Holarctic region. Guignot (1947) likewise reported that it is a boreo-alpine species in the lakes on 2400 m in altitude 1800 m. On the other hand, Zaitsev (1972) maintained that the species above prevails tiny ponds with shallow sandy and pebbled grounds where clean and abundant vegetation is scarce.

The study found *Platambus maculatus* (L., 1758) in Uzungöl (Çaykara-Trabzon), Kayakaynak (Çayeli-Rize) and

Çakırgöl (Maçka-Trabzon). Brancucci (1988) and Zaitsev (1972) stated that it could exist in constantly clean waters in plains or subalpine mountainous zone in altitudes of 2500 m and above. The pond Kayakaynak where the species can be seen is similarly in 3080 m altitude.

Agabus bipustulatus (L., 1767) was found in 15 of the 22 ponds in which the study was conducted, being most available there, which is followed by *Hydroporus pubescens* (Gyllenhal, 1808) in 12 locations.

Erman *et al.* (2005) were the first to establish *Agabus lapponicus* (Thomson, 1867) in the plateau Anzer (İkizdere-Rize, 1600 m and over) for Turkey. The study however found it to live in Lake Salar (2820 m) on İyidere valley and in the pond Kayakaynak (3080 m), Fırtına valley.

Angus (1988) was the first to identify *Helophorus* (*Atracthelophorus*) *ponticus* in one of the location in altitude of 3300 m of Kaçkar mountains. Scientific studies in recent years have reported that the species inhabits provinces of Erzincan and Erzurum (Mart and Erman, 2001; İncekara *et al.*, 2005). Our study also determined the existence of the species in the ponds of Akçaağıl, Kuzeyaksu, Tobamizga and Çakırgöl in 2500 m.

Hydraena trapezuntina was the first to be identified by Janssens (1963) in Trabzon. However, Jäch (1988) in later years compared *Hydraena* (s.str.) *dentipalpis* with *Hydraena trapezuntina* in type specimens to conclude that both are actually the same species. Janssens (1963) reported the species to prevail in Maçka in 600 m and the plateau Karahava in 1800 m in the same region. The study on the other hand established it to inhabit Uzungöl (Çaykara-Trabzon) in 1100 m.

Delève (1963) attracted the attention to the fact that *Stenelmis damascena* prevail across north Anatolia and Syria as well as in the plateau Karahava in Turkey, while our study showed the species to inhabit where the river Haldizen flows into the pond Uzungöl (Çaykara-Trabzon).

We do assume that the studies to be conducted later would be of great use by taking basins into account separately in respect that the region is too extensive and rough to reach all seasons but summer, too high in altitude to climb on present vehicles and with a diversity of alpine ponds in addition to the lakes studied.

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