

Orijinal araştırma (Original article)

Insect fauna of Kovada Lake National Park Basin (Isparta, Turkey)¹

Kovada Gölü Milli Parkı (Isparta, Türkiye) Havzasının böcek faunası

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Summary

The study was conducted to determine insect fauna of Kovada Lake National Park Basin in Isparta province of Turkey between April 2007 and October 2008. In the study, various collecting methods, including pitfall trap, sweeping, air-sweepnet, drop sheet and light trap were used in nine different habitats selected from the region. The insect specimens were collected by weekly samplings. A total of 240 insect species and subspecies belonging to 75 families and 11 orders were recorded from the national park basin.

Key words: Insect, fauna, sampling methods, Kovada Lake, Turkey

Özet

Çalışma, Isparta ili sınırları içerisinde yer alan Kovada Gölü Milli Parkı Havzası böcek faunasının belirlenmesi amacıyla Nisan 2007-Ekim 2008 tarihleri arasında yürütülmüştür. Çalışma kapsamında, alandan seçilen farklı özellikteki dokuz habitatta çukur tuzak, süpürme, hava atrabı, Japon şemsiyesi ve ışık tuzağı yöntemleri kullanılmıştır. Örnekler, haftalık periyotlar şeklinde düzenli örneklemelemlerle toplanmıştır. Sonuç olarak, milli park havzasında 11 takıma bağlı, 75 familyadan 240 böcek tür ve alttürü saptanmıştır.

Anahtar sözcükler: Böcek, fauna, örnekleme yöntemleri, Kovada Gölü, Türkiye

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Introduction

Insects are the largest group in the world in terms of diversity. They live in every region of the earth and comprise a very large group of the food chain, providing the mechanism that allows the balance of nature. The number of species living on Earth is approximately 1,300,000 (Mora et al., 2011) and most of them are insects (Trautwein et al., 2012).

Turkey is located at the crossroads of three continents and has an extremely important position for biological diversity in the world. The Conservation International (CI) organization identified 34 hotspots around the world that are specific areas of the Earth's land surface that have a disproportionately large number of extant species (Myers, 2001). The Mediterranean basin, including Turkey's western and southern coastlines, is one of those hotspots (Myers et al., 2000).

The selected study area, Kovada Lake, is located within the boundaries of the city of Isparta in southern Turkey. Since 1970 it has had the status of National Park. The National Park concept includes scientific and aesthetic values, national and international protection of rare natural and cultural resource values, recreation and tourism areas of the nature. The study area was defined as a first level protected area in 1992, covering an area of 6534 hectares with its surroundings. The Lake has karstic morphology and a total area of about 790 ha. The National Park has 259 genera and 361 species of plants belonging to 75 families of which 28 species are endemic (Bayram, 2007). In the study area, 153 waterfowl species were recorded, including wild duck, goose, shelduck, partridge and woodcocks (Anonymous, 2003). It is an internationally important wetland and is also used for drinking water, irrigation, aquaculture, fisheries, hydropower and recreation (Anonymous, 2004).

Although many studies on many topics have been conducted on Kovada Lake, there have been no studies conducted on the insect fauna. Therefore, the aim of this study was to determine the insect fauna of the Kovada Lake Natural Park Basin. The study was a preliminary step in determining the insect families, genera and species. Obviously, the number of the species found in this study may be increased considerably by more specific studies focusing on small groups.

Material and Methods

Study sites

Studies were carried out from April 2007 to October 2008 in Kovada Lake National Park (Figure 1.). The study area was divided into nine different sampling sites because of different plant associations. Aquatic and semi aquatic habitats were ignored within the scope of the study. Details of habitats, including altitude, size and vegetation types, are as follows:

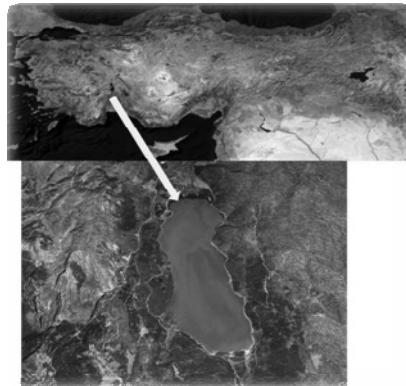


Figure 1. Location of Kovada Lake National Park Basin (Turkey).

Sand Rest Habitat: This is the closest area to the lake. The size of the area is 0.28 ha at an altitude of 927 m. It has rather scarce vegetation, including *Verbascum* spp. and *Platanus orientalis* L. trees commonly.

Maquis and Forest Habitat: The habitat includes a dry stream bed with an altitude of 943 m and 0.294 ha size. *Juniperus oxycedrus* L., *Thuja orientalis* L., *Crataegus monogyna* Jacq, *Cistus ladeniferus* Weisse, *Pistacia lentiscus* L., *Rosa canina* L. and *Platanus orientalis* L. comprise the dominant vegetation of the area.

Meadow Area Habitat: The area is located in the south part of the Kovada Lake at 941 m altitude and is 0.275 ha. Unlike other habitats, it has only annual herbaceous vegetation. *Echium italicum* L., *Glaucium corniculatum* ssp. *corniculatum* (L.), *Trifolium resupinatum* L. var. *resupinatum*, *Anthemis arvensis* L., *Leontodon tuberosus* L., *Achillea multifida* Boiss. and *Cardaria draba* (L.) are the most common plant species.

Mixed Forest Habitat: This habitat was selected from a forest area at 974 m altitude, with a land area of 0.265 ha. *Quercus robur* L. and *Pinus nigra* Arnold are the most common plant species and are mixed with some annual plants like *Ornithogalum oligophyllum* Clarke and *Cyclamen cilicium* Boissier & Heldreich.

Forest Coast Habitat: It includes a land area of 0.278 ha at an altitude of 929 m. The dominant plant species are *Pistacia lentiscus* L., *Q. robur*, *Q. coccifera* and *Carduus rechingeranus* Kazmi.

Open Area Habitat: The area is like a plain dried from the lake. *C. draba* and *A. multifida* are the common species of the vegetation, accompanied by some annual plants.

Fruit Plantation Habitat: The habitat has an altitude of 919 m covering about 0.308 ha land area. An apple orchard is the dominant vegetation together with some other vegetable crops. Shrubs were removed from the area in order to grow apples.

Maquis Coast Habitat: *Platanus orientalis* L. represents the dominant vegetation of the area. The approximate altitude is 911 m and size 0.184 ha. *Xanthium strumarium* L. and some members of the plant family Poaceae were other species observed in the area.

Maquis Habitat: Unlike the other two habitats including maquis, the area has only scrubs. It is at 911 m altitude and is 0.082 ha. Vegetation mainly includes *Pistacia lentiscus* L., *J. oxycedrus*, *Thuja orientalis* L., *C. monogyna*, *C. ladeniferus*, *Q. coccifera* and *R. canina*.

Sampling methods

Studies were carried out from April 2007 to October 2008 in the Kovada Lake National Park Basin, divided into three different main areas and nine sub-areas. Insect samples were collected using pitfall trap, light trap, sweepnet, sweeping and drop sheet weekly. The methods are briefly described below.

Pitfall trap method: In all sampling areas, 10 pitfall traps (15 cm depth and 17 cm diameter) were established at 25 meters intervals. They were carefully maintained in order to keep top of the cup and surface of the ground at the same level. Traps were checked weekly and the trapped insects were collected into the killing bottles. Samples were mounted in the laboratory and identified to family.

Sweeping method: This method was used to capture insects on short plants and herbaceous vegetation, and was used in all habitats except the Mixed Forest Habitat. Samplings were carried out using a 35 cm diameter sweepnet, and an aspirator for sucking small insects, if necessary. Sweep netting included 200 sweeps in each habitat. After every 20 sweeps, insects in the sweepnet were transferred to the killing bottles. At the end of sweeping, the entire mass was transferred to separate plastic bottles and brought to the laboratory for pinning and labeling.

Air-sweepnet method: This method was used to capture flying insect groups. An air-sweepnet, made with light fabric through which air can flow freely and of 30 cm diameter and 90 cm depth was used for a 20 minutes period per week in all habitats.

Drop sheet method: This method was applied in order to capture insects on the branches of shrubs or trees. An ordinary white-colored umbrella was used as a beating sheet. The umbrella was inverted under the branches of trees or shrubs, and the branches sharply beaten with a stick for detaching the insects that shelter in vegetation. The method was used only in Maquis and Forest, Mixed Forest, Fruit Plantation, Maquis Coast and Maquis habitats and was applied ten times for each plant.

Light trap method: The method was used for the sampling of night active insects. A mercury vapor lamp reflected from white cloths of 180x220 cm. The generator was started at sunset and sampling continued until midnight. Attracted insects were collected and transferred to the killing bottles. This method was applied once in each of the three main areas during the first year and a total of six times in the two year study.

Sampling methods and habitats are shown in Table 1. All the collected insect specimens are deposited in the EMIT (Entomological Museum of Isparta, Turkey) at Suleyman Demirel University.

Table 1. Sampling methods and habitats in Kovada Lake National Park Basin

Habitats	Sampling Methods				
	Pitfall Trap	Sweeping	Sweepnet	Drop Sheet	Light Trap
Sand Rest Habitat	+	+	+		
Maquis and Forest Habitat	+	+	+	+	+
Meadow Area Habitat	+	+	+		
Mixed Forest Habitat	+	+	+	+	
Forest Coast Habitat	+	+	+		+
Open Area Habitat	+	+	+		
Fruit Plantation Habitat	+	+	+	+	
Maquis Coast Habitat	+	+	+	+	+
Maquis Habitat	+	+	+	+	

Results and Discussion

A total of 240 insect taxa belonging to 75 families and 11 orders were collected in surveys conducted in 9 different habitats of Kovada Lake National Park basin. Among the samples, 36 taxa were identified to genus level, 10 were identified to family level, and the remainder were identified to species level. Species are listed alphabetically in Table 2 with habitat information, sampling year and abundance data. The numbers of individuals and species collected in 2008 (10,601 individuals belonging to 201 species) were higher than those collected in 2007 (6,652 individuals belonging to 186 species).

Table 2. List of recorded insect taxa of Kovada Lake National Park Basin during 2007 and 2008, with collected habitats, number of individuals and abundances

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
Coleoptera					
Brachyceridae					
<i>Brachycerus sinuetus</i> Olivier	MFH,FCH,FPH,MCH	66	120	186	1,078
Buprestidae					
<i>Anthaxia sponosa</i> Kiesenwetter	OAH	34	9	43	0,249
<i>Capnodis miliaris</i> (Klug)	SRH,MFH	16	25	41	0,238
<i>Meliboeus amethystinus</i> (Oliver)	MFH	15	24	39	0,226
<i>Perotis chlorana</i> Laporte & Gory	MFH	4	13	17	0,099
Cantharidae					
<i>Cantharis livida</i> L.	MFH,FCH,MAH,MCH, MH	24	48	72	0,417
Carabidae					
<i>Amara aenea</i> (De Geer)	MAH,MFoH,FCH, OAH,FPH	81	145	226	1,310
<i>Amara familiaris</i> (Duftschmid)	FCH,OAH	39	-	39	0,226
<i>Aptinus cardiacollis</i> Chaudoir	FCH	29	43	72	0,417
<i>Brachinus crepitans</i> (L.)	OAH	25	47	72	0,417
<i>Brachinus explodens</i> Duftschmid	OAH	25	-	25	0,145
<i>Calathus longicollis</i> Motschulsky	MFH,MAH,MFoH, FCH,OAH	178	169	347	2,011
<i>Calathus syriacus</i> Chaudoir	SRH,MAH,MFoH, FCH,OAH,FPH,MCH	53	108	161	0,933
<i>Carabus (Oreocarabus) sp.</i>	FCH,MCH,FPH,MCH	21	61	82	0,475
<i>Chlaenius aeneocephalus</i> Dejean	OAH	19	-	19	0,110
<i>Cicindela campestris</i> L.	SRH,OAH	4	3	7	0,041
<i>Cymindis lineata</i> Quensel	MFH,OAH	35	-	35	0,203
<i>Dixus eremita</i> (Dejean)	MAH,FCH,OAH,FPH	24	168	192	1,113
<i>Harpalus angulatus</i> Putzeys	FPH,MCH	58	29	87	0,504
<i>Harpalus attenuatus</i> Stephens	MFH,FPH	51	-	51	0,296
<i>Harpalus sp.</i>	MFH	2	14	16	0,093
<i>Harpalus subcylindricus</i> Dejean	SRH,MFH,FCH,FPH	46	34	80	0,464
<i>Nebria brevicollis</i> (Fabricius)	SRH,FCH	-	36	36	0,209
<i>Nebria sp.</i>	SRH,MFH,FCH,OAH	-	183	183	1,061
<i>Notiophilus aesthuans</i> (Motsch)	SRH,MAH	12	25	37	0,214
<i>Notiophilus sp.</i>	FCH	-	21	21	0,122
<i>Paracelia dalmatina</i> Dejean	MFH	12	-	12	0,070
<i>Platysma macrum</i> (Marsham)	OAH	29	-	29	0,168
<i>Poecilus cuprens</i> (L.)	MFH,FPH,MCH	17	41	58	0,336

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
<i>Scarites planus</i> Bonelli	FPH,MCH,MH	50	82	132	0,765
<i>Zabrus tenebrionides</i> (Goeze)	MAH,FCH,OAH,FPH, MCH,MH	91	87	178	1,032
Cerambycidae					
<i>Agapanthia kirby</i> (Gyllenhal)	MCH	-	29	29	0,168
<i>Aromia moschata ambrosiaca</i> (Stevens)	OAH,MCH	30	67	97	0,562
<i>Calamobius filum</i> (Rossi)	MAH,OAH,MH	23	79	102	0,591
<i>Clytus</i> sp.	OAH	-	59	59	0,342
<i>Dorcadion anatolicum</i> (Pic.)	SRH,OAH,FPH,MCH	36	115	151	0,875
<i>Purpuricenus budensis interscapilatus</i> Plav.	FCH,OAH	62	87	149	0,864
Cetoniidae					
<i>Oxythyrea</i> sp.	MFH,MCH	21	39	60	0,348
<i>Oxythyrea cinctella</i> (Schaum)	MAH,FCH,OAH,FPH, MCH,MH	76	51	127	0,736
<i>Oxythyrea funesta</i> Poda	FPH,MCH	-	41	41	0,238
<i>Tropinot hirta</i> Poda	SRH,MAH,OAH,FPH, MH	18	142	160	0,927
<i>Potosia cuprea</i> (F.)	FCH,OAH	23	79	102	0,591
<i>Potosia afflicta</i> Gory & Percheron	MH	17	13	30	0,174
Chrysomelidae					
<i>Antia macropus</i> (Illeger)	MCH	21	29	50	0,290
<i>Chaetocnema tibialis</i> (Illiger)	SRH,OAH	43	109	152	0,881
<i>Clytra atrophaxidis</i> (Pallas)	FCH,OAH	-	64	64	0,371
<i>Clytra novempunctata</i> Oliver	OAH	-	49	49	0,284
<i>Clytra</i> sp.	OAH	11	25	36	0,209
<i>Cryptocephalus connexus</i> Oliver	MCH	-	59	59	0,342
<i>Cryptocephalus duplicates</i> Suff.	FCH, OAH	-	29	29	0,168
<i>Cryptocephalus trimaculatus</i> Rossi	FCH,OAH	35	78	113	0,655
<i>Gonioctena fornicata</i> Brüggemann	SRH,MAH,OAH,MCH	51	90	141	0,817
<i>Hypocassida subferruginea</i> (Schrank)	OAH	-	35	35	0,203
<i>Labidostomis asiatica</i> Falderman	MAH,OAH,MCH	-	19	19	0,110
<i>Longitarsus aeneicollis</i> Falderman	SRH,MFH,OAH	53	108	161	0,933
<i>Longitarsus foudrasi</i> Weise	FCH,OAH	34	97	131	0,759
<i>Longitarsus nigrofasciatus</i> (Goeze)	FCH,OAH,MCH	68	93	161	0,933
<i>Longitarsus pratensis</i> (Panzer)	FCH	39	49	88	0,510
<i>Podagrica malvae</i> (Illeger)	MH	-	35	35	0,203
<i>Psilloides chalconeris</i> (Illeger)	SRH,FPH	-	51	51	0,296

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
<i>Psilloides kiesenwetteri</i> Schilsky	SRH,OAH	32	41	73	0,423
<i>Smaragdina biornata</i> (Lefevre)	MAH	-	25	25	0,145
<i>Smaragdina limbata</i> (Steven)	FCH	-	11	11	0,064
<i>Smaragdina xanthaspis</i> (Germar)	SRH,OAH,MCH	43	-	43	0,249
Cleridae					
<i>Tilloidea transversalis</i> (Charpentier)	MFH,MAH,OAH,MFH	47	42	89	0,516
Coccinellidae					
<i>Coccinella septempunctata</i> L.	FCH,OAH,FPH,MH	99	80	179	1,038
Curculionidae					
<i>Gymnetron asellus</i> Gravenhorst	MFH,MFoH	37	28	65	0,377
<i>Larinus latus</i> (Herbst)	MFH,MAH,FCH,OAH, MH	93	128	221	1,281
<i>Larinus turbinatus</i> Gyllenhal	MFH,FCH	41	-	41	0,238
<i>Lixus cardui</i> Oliver	MAH,MCH	11	46	57	0,330
<i>Phyllobius incanus</i> Gyllenhal	FCH	27	-	27	0,156
<i>Psallidium maxillosum</i> (F.)	OAH	19	-	19	0,110
Elateridae					
<i>Cardiophorus</i> sp.	MAH,FPH	12	-	12	0,070
<i>Melanotus dichrous</i> (Erichson)	OAH,MCH	19	56	75	0,435
<i>Melanotus</i> sp.	FCH,OAH,FPH	21	62	83	0,481
<i>Mulsanteus guillebeaui</i> (Muls.&Godart)	OAH	21	53	74	0,429
<i>Selatosomus</i> sp.	FCH	27	-	27	0,156
Geotrupidae					
<i>Geotrupes stercorarius</i> L.	FCH,OAH	-	71	71	0,412
<i>Geotrupes spiniger</i> Marsham	MCH	15	-	15	0,087
Glaphyridae					
<i>Amphicoma</i> sp.	SRH,MFH,MFoH, FCH,OAH,FPH,MCH, MH	114	116	230	1,333
<i>Amphicoma vulpes</i> (F.)	MH	13	8	21	0,122
Lucanidae					
<i>Ceruchus chrisomelinus</i> (Hochy.)	MAH,MFoH,FCH	-	29	29	0,168
<i>Lucanus cervus</i> (L)	MFoH,MH	14	29	43	0,249
Histeridae					
** M.s.	SRH,MFH,MFoH, FCH	47	11	58	0,336
Malachiidae					
<i>Malachius aeneus</i> (L.)	MAH, OAH,MCH	36	92	128	0,742

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
Meloidae					
<i>Mylabris quadripunctata</i> (Linnaeus)	MAH,FCH,OAH,FPH, MCH,MH	102	177	279	1,617
<i>Mylabris variabilis</i> (Pallas)	FCH,OAH,MH	40	38	78	0,452
Melolonthidae					
<i>Haplidia</i> sp.	FCH,OAH,MH	9	39	48	0,278
Scarabeidae					
<i>Aphodius</i> sp.	MCH	11	-	11	0,064
<i>Copris hispanus</i> L.	MCH	-	74	74	0,429
<i>Gymnopleurus geoffroyi</i> (Fuessly)	SRH,MAH,FCH,OAH, MH	89	93	182	1,055
<i>Onthophagus fissicomis</i> Steven	MFH,FCH	33	-	33	0,191
<i>Pentodon idiota</i> Herbst	FCH,MH	23	16	39	0,226
<i>Pentodon</i> sp.	MFoH,FCH	7	2	9	0,052
<i>Rhizotrogus</i> sp.	SRH,MFH,FCH,MH	5	51	56	0,325
<i>Sisyphus schaefferi</i> L.	MFoH,FCH,OAH	14	114	128	0,742
Staphylinidae					
M.s.	MFH,FCH	-	35	35	0,203
Tenebrionidae					
<i>Blaps tibialis</i> Reiche	MFoH, FCH,MCH,MH	52	84	136	0,788
<i>Cephalostenus elegans</i> (Brullé)	MFH,FCH,FPH	27	37	64	0,371
<i>Colpotus schusteri</i> Koch	FPH	9	-	9	0,052
<i>Dailognatha quadricollis</i> (Brullé)	SRH,MFH,MAH, MFoH,FCH,OAH,FP H,MCH,MH	771	1122	1893	10,972
<i>Dendarus armeniacus</i> Bandi	SRH,MFoH,FPH	44	37	81	0,469
<i>Dendarus tenellus</i> (Mulsant & Rey)	MAH,MFoH,FPH, MCH,MH	11	91	102	0,591
<i>Pedinus fallax</i> Mulsant & Rey	SRH,MAH,MFoH, OAH,FPH,MCH,MH	93	206	299	1,733
<i>Pedinus femoralis</i> (Linnaeus)	SRH,MCH	7	49	56	0,325
<i>Pimelia subglobosa</i> (Pallas)	MAH,FCH,MCH	55	47	102	0,591
Dermaptera					
Forficulidae					
<i>Forficula auricularia</i> L.	SRH,MFH,FCH,OAH, FPH,MH	-	44	44	0,255
Diptera					
Asilidae					
M.s.	FCH,MCH	-	30	30	0,174

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
Bombyliidae					
M.s.	MAH,OAH,MCH	-	28	28	0,162
Muscidae					
<i>Musca domestica</i> L.	SRH,MFH,MAH, MFoH,FCH,OAH, FPH,MCH	102	128	230	1,333
Chironomidae					
M.s.	FCH,OAH,FPH	-	-	-	-
Tabanidae					
<i>Philipomyia aprica</i> (Meigen)	MFH	17	-	17	0,099
<i>Tabanus</i> sp.	SRH,MFH,MAH, MFoH,FCH,MCH	69	62	131	0,759
<i>Tabanus spodopterus</i> Meigen	MAH,MFoH,FCH, OAH,FPH,MCH	35	61	96	0,556
Tachinidae					
<i>Compsilura concinnata</i> (Meigen)	OAH,MCH	59	-	59	0,342
Tipulidae					
<i>Tipula kebele</i> Mannheims	FCH,OAH,MCH,MH	19	53	72	0,417
<i>Tipula verrucosa sinedente</i> Theisehinger	FCH	-	19	19	0,110
Ephemeroptera					
Baetidae					
<i>Cloeon dipterum</i> (L.)	OAH,MCH	19	62	81	0,469
Caenidae					
<i>Caenis luctuosa</i> (Burmeister)	MCH	-	39	39	0,226
Hemiptera					
Alydidae					
<i>Coriomeris hirticarnis</i> (Fabricius)	FCH,OAH	49	7	56	0,325
<i>Camptopus lateralis</i> (Germar)	MFH,FCH	5	14	19	0,110
Cercopidae					
M.s.	MCH	2	5	7	0,041
Cicadellidae					
<i>Euscelis</i> sp.	MAH,OAH,MCH	15	29	44	0,255
<i>Selenocephalus</i> sp.	OAH,MCH	-	42	42	0,243
<i>Thamnotettix</i> sp.	OAH,MCH	-	35	35	0,203
Cicadidae					
<i>Cicada atra</i> Fieber	FCH,OAH	78	62	140	0,811
<i>Cicada orni</i> L.	FCH	-	17	17	0,099

Table 2. Continued

		Individual Number (N)			Abundance
Collected Habitats*		2007	2008	Total	
Coreidae					
<i>Phyllomorpha lacerata</i> Herr. & Schaf.	FCH,MH	-	19	19	0,110
Fulgoridae					
M.s.	OAH	9	14	23	0,133
Lygaeidae					
<i>Eremocoris fenestratus</i> (Herr. & Schaf.)	OAH	23	-	23	0,133
<i>Lygaeus equestris</i> (L.)	MFH,MAH,MFoH	28	-	28	0,162
<i>Lygaeus pandurus</i> Scopoli	FCH,OAH	36	13	49	0,284
<i>Lygaeus saxatilis</i> Scopoli	FCH,MH	-	17	17	0,099
<i>Phytrocoris apterus</i> (L.)	OAH	24	-	24	0,139
Miridae					
M.s.	FCH	-	4	4	0,023
<i>Alloeonotus fulvipes</i> Scopoli	FCH,MH	-	14	14	0,081
<i>Deraeocoris rutilus</i> Herr. & Schaf.	MFH,FCH,FPH,MCH, MH	9	32	41	0,238
<i>Deraeocoris scutellaris</i> (F.)	OAH	-	57	57	0,330
Notonectidae					
<i>Notonecta meridionalis</i> Poisson	FCH,MH	-	14	14	0,081
<i>Notonecta obliqua</i> Gallen	OAH,FCH	17	13	30	0,174
Pentatomidae					
<i>Apodiphus amygdali</i> (Gm.)	OAH	9	27	36	0,209
<i>Carpocoris fuscipinus</i> (Boheman)	FCH,OAH,MH	58	19	77	0,446
<i>Carpocoris mediterraneus</i> Tamanini	OAH,MCH,MH	44	85	129	0,748
<i>Dolycoris baccarum</i> L.	FCH	-	19	19	0,110
<i>Eurydema ornatum</i> L.	FCH	-	16	16	0,093
<i>Graphosoma semipunctatum</i> F.	MFH,MFoH	13	9	22	0,128
Rhopalidae					
<i>Corizus hyoscyami</i> (L.)	MFH	-	13	13	0,075
<i>Stictopleurus abutilon abutilon</i> (Rossi)	FCH	-	9	9	0,052
<i>Stictopleurus abutilon pictus</i> (Fieber)	OAH	-	49	49	0,284
Scutelleridae					
<i>Eurygaster maura</i> (L.)	MAH,OAH	15	44	59	0,342
Stenocephalidae					
<i>Dicranocephalus setulosus</i> (Ferrari)	MAH,OAH	11	7	18	0,104
Hymenoptera					
Andrenidae					
<i>Andrena</i> sp.	MAH,OAH,MCH	14	24	38	0,220

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
Apidae					
<i>Apis mellifera</i> L.	MAH,OAH,MCH	34	56	90	0,522
<i>Bombus argilleceus</i> (Scopoli)	MAH,OAH,FPH,MH	11	53	64	0,371
<i>Bombus terrestris</i> L.	FCH,OAH,MH	24	7	31	0,180
<i>Xylocopa violacea</i> (L.)	MFoH,OAH,MCH	28	60	88	0,510
Braconidae					
<i>Chelonus popovi</i> Tobias	MFoH,MH	12	-	12	0,070
Colletidae					
<i>Prosopis</i> sp.	MAH	1	-	1	0,006
Formicidae					
<i>Camponotus turkestanus</i> André	MAH,FCH,OAH,MCH, MH	82	193	275	1,594
<i>Cataglyphis setipes</i> Forel	OAH,FPH	38	84	122	0,707
<i>Messor</i> sp.	FCH,FPH	45	35	80	0,464
<i>Pheidole</i> sp.	MFoH	-	27	27	0,156
<i>Stenamma</i> sp.	SRH	-	29	29	0,168
Halictidae					
<i>Halictus</i> sp.	MFH,OAH,MCH	5	11	16	0,093
Ichneumonidae					
M.s.	FPH	-	4	4	0,023
Megachilidae					
<i>Osmia</i> sp.	MFoH	3	-	3	0,017
Mutillidae					
<i>Dasylabris maura</i> (L.)	MFH,FCH,OAH,MH	26	56	82	0,475
<i>Pseudophotopsis</i> sp.	SRH	-	13	13	0,075
Pteromalidae					
<i>Ischyroptyx</i> sp.	FPH	1	-	1	0,006
Scoliidae					
<i>Megascolia maculata</i> (Drury)	MFH,MAH	7	5	12	0,070
Sphecidae					
<i>Ammophila heydeni heydeni</i> Dahlbom	SRH	-	11	11	0,064
<i>Bembecinus tridens</i> (F.)	MAH	5	2	7	0,041
<i>Chalybion femoratum</i> (Fabricius)	SRH	-	5	5	0,029
<i>Sphex funerarius</i> Gussakovskij	SRH	8	1	9	0,052
Vespidae					
<i>Polistes</i> sp.	FCH	12	-	12	0,070
<i>Vespa crabro</i> L.	MFoH	-	17	17	0,099

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
<i>Vespa germanica</i> L.	FCH,OAH,FPH,MCH	30	89	119	0,690
<i>Vespa orientalis</i> L.	MFoH,OAH,MH	26	39	65	0,377
Lepidoptera					
Lycaenidae					
<i>Lycaena phlaeas</i> L.	MCH,MH	15	46	61	0,354
<i>Plebeius agestis</i> (Den. & Schiff.)	SRH,MFH,MAH	14	27	41	0,238
<i>Polyommatus icarus</i> (Rottemburg)	FCH,OAH,FPH	55	62	117	0,678
<i>Polyommatus semiargus</i> (Rottemburg)	FCH	27	-	27	0,156
<i>Satyrrium ilicis</i> (Esper)	FCH	19	13	32	0,185
Noctuidae					
M.s.	FPH	14	-	14	0,081
<i>Chrysodeixis chaleytes</i> (Esper)	MAH,FCH,FPH	36	33	69	0,400
Nymphalidae					
<i>Argynnis niobe</i> (Linnaeus)	MH	6	14	20	0,116
<i>Argynnis pandora</i> (Den. & Schiff.)	MAH,FCH,MCH	38	65	103	0,597
<i>Coenonympha leander</i> (Esper)	FPH	11	17	28	0,162
<i>Hipparchia mersina</i> (Staudinger)	FCH	24	15	39	0,226
<i>Lasiommata maera</i> (L.)	FCH,FPH,MCH	32	46	78	0,452
<i>Limenitis reducta</i> (Staudinger)	OAH	24	49	73	0,423
<i>Maniola jurtina</i> (Linnaeus)	FCH,OAH,FPH,MCH	29	19	48	0,278
<i>Melitaea cinxia</i> (Linnaeus)	FPH	6	-	6	0,035
<i>Melitaea didyma</i> (Esper)	SRH,MAH,MFoH, FCH,FPH	44	45	89	0,516
Papilionidae					
<i>Archon apollinus</i> (Herbst)	FCH	24	15	39	0,226
<i>Iphiclides podalirius</i> (Linnaeus)	MFH,MFoH,FCH	29	13	42	0,243
<i>Papilio machaon</i> (Linnaeus)	MAH,FCH,OAH,FPH, MCH	53	71	124	0,719
Pieridae					
<i>Colias crocea</i> (Fourcroy)	FCH	32	14	46	0,267
<i>Pieris brassicae</i> (Linnaeus)	SRH,MFH,MAH,FCH, MCH	35	64	99	0,574
<i>Pieris napi</i> (Linnaeus)	MFH,MAH,FCH,OAH	54	71	125	0,725
<i>Pieris rapae</i> (L.)	MFoH	20	27	47	0,272
<i>Pontia edusa</i> (Fabricius)	MFoH,FPH	19	23	42	0,243
Satyridae					
<i>Pseudochazara lydia</i> (Staudinger)	FCH	29	-	29	0,168

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
Neuroptera					
Ascalaphidae					
<i>Libelloides macaronius</i> (Scopoli)	FCH,OAH,MCH,MH	20	63	83	0,481
<i>Libelloides rhomboideus rhomboideus</i> (Schneider)	OAH,MCH	-	61	61	0,354
Myrmeleontidae					
<i>Creoleon plumbeus</i> (Olivier)	MFH,MAH,MH	14	7	21	0,122
<i>Myrmecaelurus trigrammus</i> (Pallas)	OAH	-	37	37	0,214
<i>Palpares libelluloides</i> (Linnaeus)	MH	3	-	3	0,017
Nemopteridae					
<i>Nemoptera sinuata</i> Olivier	MCH	10	21	31	0,180
Odonata					
Aeshnidae					
<i>Aeshna mixta</i> Latreille	FPH	20	-	20	0,116
Coenagrionidae					
<i>Cercion lindenii lindenii</i> (Sélys.)	MFH,MAH,FPH,MH	56	57	113	0,655
<i>Coenagrion ornatum</i> (Sélys.)	MFH,MAH,MFoH,FPH,MCH	56	69	125	0,725
<i>Coenagrion puella puella</i> (L.)	SRH,MAH,MFH,MH	42	47	89	0,516
Gomphidae					
<i>Onychogomphus forcipatus</i> (L.)	SRH,MFH,FPH	58	49	107	0,620
Libellulidae					
<i>Crocothemis erythraea</i> (Brullé)	FPH,MCH,MH	30	67	97	0,562
<i>Orthetrum brunneum</i> (Fonsco.)	FPH,MCH,MH	14	-	14	0,081
<i>Orthetrum cancellatum cancellatum</i> (L.)	MCH,MH	34	67	101	0,585
<i>Libellula depressa</i> L.	MFH,MAH	30	-	30	0,174
Orthoptera					
Acrididae					
<i>Acrotylus insubricus</i> (Scopoli)	SRH,MFH	15	17	32	0,185
<i>Locusta migratoria</i> (Linnaeus)	MAH,MCH	23	78	101	0,585
<i>Calliptamus barbarous cephalotes</i> (Fischer de Waldheim)	FPH,MCH	25	56	81	0,469
<i>Calliptamus italicus</i> (Linnaeus)	SRH,MFH,MAH,FCH,OAH,FPH	129	102	231	1,339
<i>Calliptamus</i> sp.	SRH	-	5	5	0,029
<i>Dociostarus brevicollis</i> (Eversmann)	SRH,OAH	55	-	55	0,319
<i>Dociostaurus maroccanus</i> (Thunberg)	OAH	14	28	42	0,243
<i>Dociostarus</i> sp.	SRH,OAH	-	39	39	0,226
<i>Oedipoda coerulescens</i> (L.)	SRH,FCH	52	26	78	0,452

Table 2. Continued

	Collected Habitats*	Individual Number (N)			Abundance
		2007	2008	Total	
<i>Oedalus decorus</i> (Germar)	SRH,OAH	-	50	50	0,290
<i>Oedipoda miniata</i> (Pallas)	MFH,FCH,OAH	79	65	144	0,835
<i>Oedipoda</i> sp.	SRH	-	6	6	0,035
<i>Omecestus</i> sp.	SRH,OAH	8	9	17	0,099
<i>Sphingonotus theodori</i> Uvarov	SRH	34	-	34	0,197
Gryllotalpidae					
<i>Gryllotalpa</i> sp.	SRH	-	4	4	0,023
Mantidae					
<i>Rivetina</i> sp.	SRH	3	-	3	0,017
Tettigonidae					
<i>Acrida bicolor</i> Thunberg	OAH	13	57	70	0,406
<i>Paucephaloptera bucephala</i> (Brunner von Wattenwyl)	MCH	9	-	9	0,052
<i>Rammeola anatolica</i> Uvarov	OAH	-	57	57	0,330
<i>Saga</i> sp.	FCH	-	5	5	0,029
<i>Tylopsis lilifolia</i> (Fabricius)	FCH,OAH	19	39	58	0,336
Raphidioptera					
Raphididae					
<i>Raphidia friederikae</i> Aspöck & Aspöck	FPH,MCH	-	17	17	0,099
	TOTAL	6652	10601	17253	100

* SRH: Sand Rest Habitat, MFH: Maquis and Forest Habitat, MAH: Meadow Area Habitat, MFOH: M Forest Habitat, FCH: Forest Coast Habitat, OAH: Open Area Habitat, FPH: Fruit Plantation Habitat, MCH: Maquis Coast Habitat, MH: Maquis Habitat

** M.s.: *Morpho* species.

Coleoptera (44%) was the most frequently sampled order with 22 families and 106 species, followed by Hemiptera (16%), Hymenoptera (12%) and Lepidoptera (10%). Species richness of the Carabidae (24), Chrysomelidae (21), Acrididae (14) and Nymphalidae (9) families was higher than that of other families. Distributions of the number of species and families among the 11 collected insect orders are given in Figure 2.

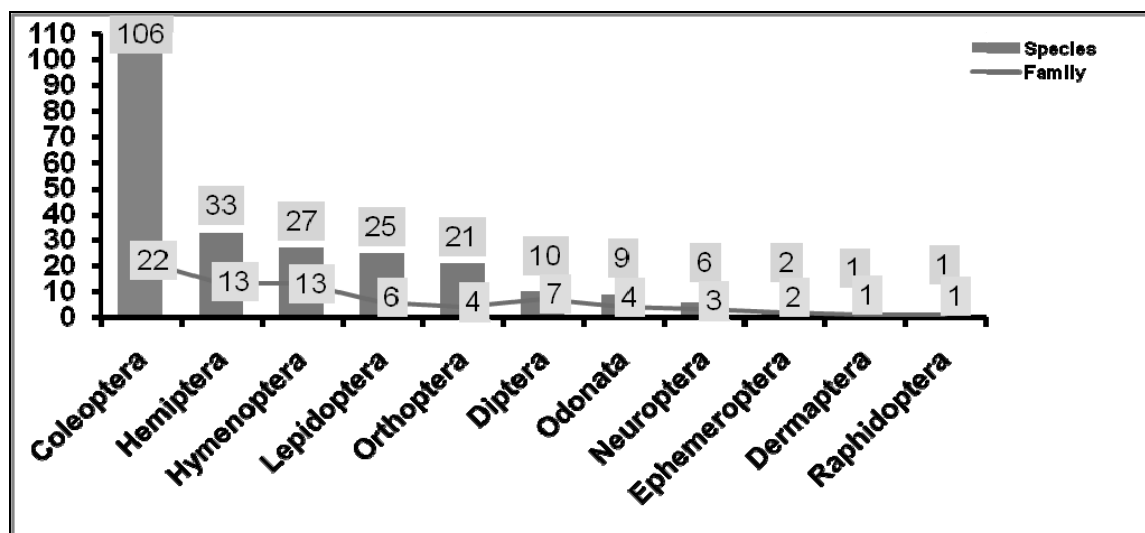


Figure 2. Number of species and families belonging to the twelve orders recorded in Kovada Lake National Park Basin in 2007-2008.

An unidentified species belonging to the family Chironomidae (Diptera) was the most dominant species among all others with a huge individual number. For that reason, it was not included in any further numerical calculations. Apart from it, the most common species were *Dailognatha quadricollis* Brullé (Coleoptera: Tenebrionidae) (10.97%), *Calathus longicollis* Motschulsky (Coleoptera: Carabidae) (1.96%), *Pedinus fallax* Mulsant&Rey (1.74%) (Coleoptera: Tenebrionidae), *Mylabris quadripunctata* (L.) (Coleoptera: Meloidae) (1.61%) and *Camponotus turkestanus* André (Hymenoptera: Formicidae) (1.59%), respectively. *Ischyroptyx* sp. (Hymenoptera: Pteromalidae) (0.01%), *Prosopis* sp. (Hymenoptera: Colletidae) (0.01%) and *Palpares libelluloides* (Linnaeus) (Neuroptera: Myrmeleontidae) (0.02%) were the rarest species. *D. quadricollis* (Coleoptera: Tenebrionidae) was collected in both study years and in all habitats.

The Open Area Habitat was the most diverse area in terms of sampled species and individual numbers. It seems that the most important reason for this result was the collecting method, as with the sweeping method a large number of individuals and species can be collected (Zubareva, 1930). The Open Area Habitat's annual herbaceous diversity supported an abundance of different species.

The Open Area Habitat was closely followed by Forest Coast Habitat. The presence of trees in that habitat, as well as herbaceous plants and perennial plants, positively affected the species composition. However, the Mixed Forest Habitat was the least diverse area, based on number of species and individuals. The possible reason for this is the less diverse and uniform composition of plant species. Similar results were obtained for the Sand Rest Habitat.

Carabidae (24) and Tenebrionidae (9) were the most species-rich families. Carabidae and Tenebrionidae species are usually adapted to the arid areas more than herbaceous lands. Especially, Carabidae species can survive in very different biotypes (Lovei & Sunderland, 1996; Mercan et al., 2004). The presence of individuals belonging to both families in nearly all selected habitats in Kovada Lake National Park supports that contention. Among the sampled species, *D. quadricollis* (10.97%) was the most common. This tenebrionid species is known to have a wide distribution (Tezcan et al., 2004). In a similar study conducted in Kasnak Meşesi Nature Reserve, very close to the study area, *D. quadricollis* was also reported as the most common species (Aslan et al., 2008).

Compared with previous studies conducted in different protected areas, in terms of sampled number of species and individuals, Kovada Lake National Park Basin's insect fauna appears to be poor. Factors such as the park area being open to visitors, illegal hunting, livestock grazing and the contamination of the lake by irrigation water may be responsible. Agricultural activities such as fertilizing and spraying in the surroundings and orchards within the boundaries of the National Park probably also negatively affect the fauna. Reduction or elimination of all of these negative human impacts may positively affect the fauna and also diversity of the Kovada Natural Park.

Turkey is one of the important regions of the world in terms of biological diversity. Approximately 19% of its land area is recognized as important natural areas, although only 20% of these areas are protected (Anonymous, 2008). Kovada Lake itself is recognized one of the most important fresh water resources in Turkey and worldwide.

Increasing the protection of this important natural area, preventing irrigation water from contaminating the lake and closure of the surrounding orchards and gardens would positively affect the diversity of the Natural Park. Similar studies to the present one conducted in different protected areas would help to understand the actual diversity of these lands, and contribute to the protection of Turkey's biological diversity.

This study is a preliminary step in the description of the insect fauna of Kovada Lake National Park Basin and can be used as a reference study for similar faunistic studies in the future.

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