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The Dipteran Larvae (Insecta) of Karasu Stream (Sinop, Turkey)

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Abstract – Karasu Stream where the study was conducted located in Erfelek Town, Sinop Province (Northern Turkey). Samplings were carried out monthly between 2 February 2013 and January 2014 at 10 sampling site. Samples were collected by kick-sampling method. As a result of the study, a total of 2477 dipteran larvae belonging to 13 taxa were collected".

Keywords – *Sinop, Fauna, Diptera, Lotic systems, Benthic invertebrates*

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Karasu Çayı'nın (Sinop, Türkiye) Larval Diptera (Insecta) Faunası

Özet – Araştırmanın yapıldığı Karasu Çayı, Türkiye'nin kuzeyinde, Sinop İlinin Erfelek İlçesi sınırları içerisinde kalmaktadır. Örneklemeler Şubat 2013 ve Ocak 2014 tarihleri arasında 10 örnekleme noktasından aylık olarak yapılmıştır. Örnekler Tekme Örnekleme Metodu ile alınmıştır. Çalışma sonucunda 13 taksa dahilinde toplam 2427 birey incelenmiştir.

Anahtar Kelimeler – *Sinop, Fauna, Diptera, Lotik sistemler, Bentik omurgasızlar*

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1. Introduction

Lotic systems are well known for their high species richness of invertebrates (Merritt and Cummins, 1996). The Diptera is one of the most abundant orders of Insecta consisting of approximately 120.000 species belonging to 4 suborders and 188 families (Civelek and Tezcan, 2005; Thompson and Fairman, 1999).

Generally, Order Diptera constitutes one of the largest orders of insects, and its members are abundant in individuals and species almost everywhere. The larvae (maggots) are generally abodes and wormlike (Ebrahim, 2010). The larvae that feed on plants generally live within plant tissue, as leaf miners, some being responsible for conspicuous gall formations, stem borers, or root borers (Teskey, 1976). The predaceous larvae live in many

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different habitats, in water, in the soil, under bark or stones, or on vegetation. Many species feed during the larval stage on decaying plants or animal matter. (Ebrahim, 2010, Ferrar, 1987). More interest in dipteran ecology has been shown for populations from unusual habitats such as hot springs and alkaline environments (Keiper *et al*., 2002; Collins, 1980a, 1980b, 1975; Collins *et al.,* 1976; Brock *et al.,* 1969). In this study we aim to contribute to dipteran larvae fauna of Karasu Stream with some ecological parameters.

2. Materials and Methods

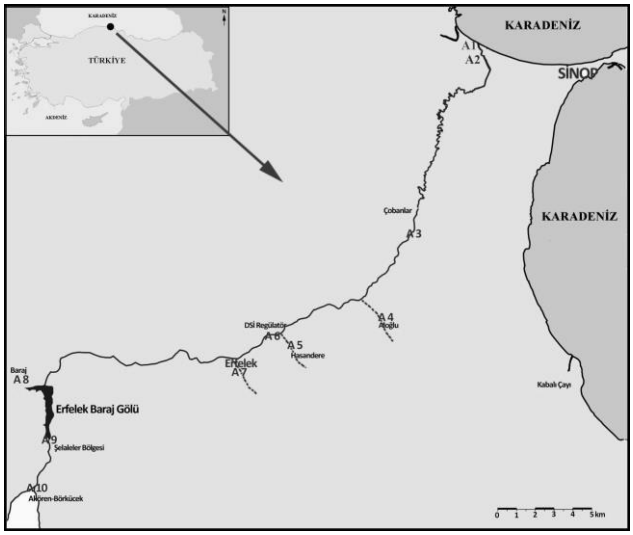

Figure 1. Study area and sampling sites

Karasu Stream where the study was conducted, located in Erfelek District, Sinop Province (Northern Turkey). Samplings were carried out monthly between Februray 2013 and January 2014 at 10 sites. At each sampling site (*Figure* 1; Table 1), A 5-minute kick-net method (frame 25x25 cm, mesh size 500 µm) was used to collect dipteran larvae disturbing the benthic substrate of 1.25 m^2. Physico-chemical factors of water were measured in vivo by portable measuring equipment. First fixation of the benthic samples were mase in 96% formaldehyde solution in the field. Later they were preserved in 75% alcohol until identification to genus level after washing in the laboratory. For taxonomical identification of the specimens, Ebrahim (2010) was used.

Table 1. Sampling sites and their coordinates.

Sites	Locality		Depth
A1	42°01'56" N	35°03'33" E	0-0,5 m
A2	42°01'52" N	35°03'34" E	0-0,5 m
A3	41°55'05" N	35°06'14" E	0-0,5 m
A4	41°54'16" N	34°59'49" E	0-0,5 m
A5	41°53'32" N	34°56'04" E	0-0,5 m
A6	41°52'46" N	34°51'23" E	0-0,5 m
A7	41°52'59" N	34°47'45" E	0-0,5 m
A8	41°50'53" N	34°46'31" E	0-0,5 m
A9	41°50'26" N	34°46'47" E	0-0,5 m
A10	41°49'24" N	34°46'17" E	0-0,5 m

3. Results and Discussion

The importance of this study is being the first detailed study on macrobenthic fauna of Karasu stream. Taxonomic positions and distributions of the determined taxa according to the sampling site are given in Table 2 In this study 13 taxa and 2427 individuals were determined (Table 2).
Position of stream, diversity of habitats, bottom structure, vegetation and physico-chemical properties are important factors for dwelling of macrobenthic. This preliminary study will be useful for studies in the coming years. Among the measured environmental parameters of water (temperature, dissolved oxygen and pH), temperature and dissolved oxygen are the most effective factors on biodiversity of stations (*Figure* 2)

Table 2. Distribution of the taxa belonging to Diptera larvae in the sites.

Taxon	**Sites**									
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**
Brachycera										
Atherix sp.	+	+	+		+	+			+	+
Tabanus sp.	+	+	+	+	+	+	+	+	+	+
Dolichopus sp.						+	+	+	+	+
Ephydra sp.	+		+			+	+	+	+	
Syrphus sp.							+		+	
Stratiomys sp.			+	+	+	+		+	+	+
Fannia sp.						+				
Tipula sp.	+	+	+	+	+	+	+	+	+	+
Nematocera										
Limonia sp.		+		+	+	+	+	+	+	+
Bezzia sp.	+	+	+	+	+	+	+	+	+	+
Simulium sp.	+	+	+	+	+	+	+	+	+	+
Aedes sp.		+		+	+					
Psychoda sp.						+		+	+	

The value of water dissolved oxygen when viewed; In December, the A1 station (11.8 mg / L) and A4 station highest in July (1.07 mg / L) were found to have the lowest value. The lack of DO value in July is related to a wrong measuring by our tools (may be inaccurate calibration). Water temperature throughout the year in the study area; A5 station in December was the lowest (4.06 °C) and highest station in the A1 and A2 in June (27.6 °C) has a value. Stations are paralleled by months of pH; In January, the A8 station (10.44) and highest station on the A10 in March (6.18) is the lowest value, which was determined based on these data show alkalinity of the Karasu Stream (*Figure 2*).

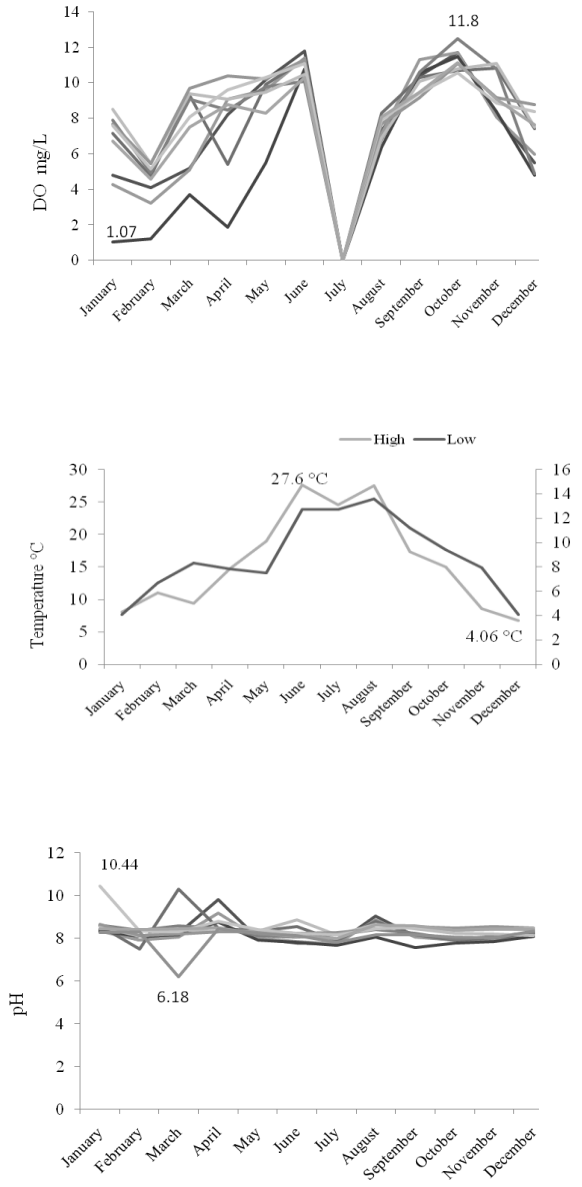

Figure 2. Min-Max value of DO, °C and pH in various monthes.

Temperature is a vital factor for developing, growing and distribution of aquatic organisms (Tanyolaç,1993). Additionally, this parameter is one of the most important factors used in classification of running waters (Schmitz, 1954).

In terms of oxygen contents of water, generally a high concentration of all the sites is clear. However, sites in upstream (close to spring) with clean water and rocky bottom had an expected amount of oxygen and sites with unclean waters and slow velocity of flowing such as A1 and A2 had an oxygen contents more than estimated value.

This confliction could be occurred due to measuring this parameter from surface water of shallow habitats (*Figure 2*). It is clear that contaminants cause an oxygen depletion in aquatic habitats (Barlas, 1988; 1995).

Over the year, the pH value of the water was observed to very between 6.18 and 10.44. So, based on these values Karasu stream has been shown alkaline characteristics (*Figure 2*). The optimum and survival range of pH for aquatic organisms is 6.5-8.6 (Höll, 1979). High pH and low oxygen has a lethal effects on living organisms (Tanyolaç, 1993).

Table 3. Abundance of collected taxa.

Ordo	Subordo	Superfamily	Family	Genus	Taxa	Individuals
Diptera	Brachycera	Tabanoidea	Athericidae	*Atherix*	*Atherix* sp.	85
		Tabanoidea	Tabanidae	*Tabanus*	*Tabanus* sp.	183
		Empidoidea	Dolichopodidae	*Dolichopus*	*Dolichopus* sp.	10
		Ephydroidea	Ephydridae	*Ephydra*	*Ephydra* sp.	55
		Syrphoidea	Syrphidae	*Syrphus*	*Syrphus* sp.	3
		Stratiomyioidea	Stratiomyidae	*Stratiomys*	*Stratiomys* sp.	35
		Muscoidea	Fanniidae	*Fannia*	*Fannia* sp.	1
		Tipuloidea	Tipulidae	*Tipula*	*Tipula* sp.	310
	Nematocera	Tipuloidea	Limoniidae	*Limonia*	*Limonia* sp.	39
		Chironomoidea	Ceratopogonidae	*Bezzia*	*Bezzia* sp.	581
		Chironomoidea	Simuliidae	*Simulium*	*Simulium* sp.	1092
		Culicoidea	Culicidae	*Aedes*	*Aedes* sp.	23
		Psychodoidae	Psychodidae	*Psychoda*	*Psychoda* sp.	10

The most dominant taxa in the studied area are as follows: *Simulium* sp. (1092 individuals) *Bezzia* sp. (581 individuals) and *Tipula* sp. (310 individuals) respectively. *Simulium* was the dominant group while *Fannie* was the less represented group in this study (Table 3). The larvae of *Simulium* is a common member of fast-running waters (Tanyoloç, 2004).

Simuliidae family, 2060 units spread all over the world except the Antarctic continent living, 12 units disappeared (fossil) has a total of 2072 species. 1659 Simulium genus species have species with the highest number of species (Adler and Crosskey 2009). Turkey, has 3% of the world's 63 species of fauna (Kazancı and Ertunç 2008; Ertunç and Kazancı, 2009).

The subgenus *Tipula* (*Lunatipula*) (Edwards, 1931) contains 303 taxa in the Western Palaearctic. So far 83 taxa have been recorded from Turkey, of which 56 (67%) are endemic to the country and 47 (56%) have their type localities in Turkey (Koç and Oosterbroek, 2001, 2005; Koç *et al.*, 2005).

The family Ceratopogonidae, distributed worldwide, includes many species of small nematocerous flies, with wing length of 0.6–4.8 mm (Szadziewski *et al*., 1997; Turgut and Kılıç, 2015). Currently, there are known 6501 extant and fossil species of the biting midges (Borkent, 2015; Turgut and Kılıç, 2015). Of these, more than 1000 have been reported in the Palearctic region (Remm, 1988; Turgut and Kılıç, 2015), and 567 in Europe (Szadziewski *et al*., 2015; Turgut and Kılıç, 2015).

According to the results of the recent studies in Turkey conducted on dipteran larvae; 156 species belonging to 12 different subfamilies of family Tabanidae have been reported so far (Kılıç, 1998) which 49 of them were recorded from Lake District Inland of Turkey (Taşdemir and Ustaoğlu, 2005).

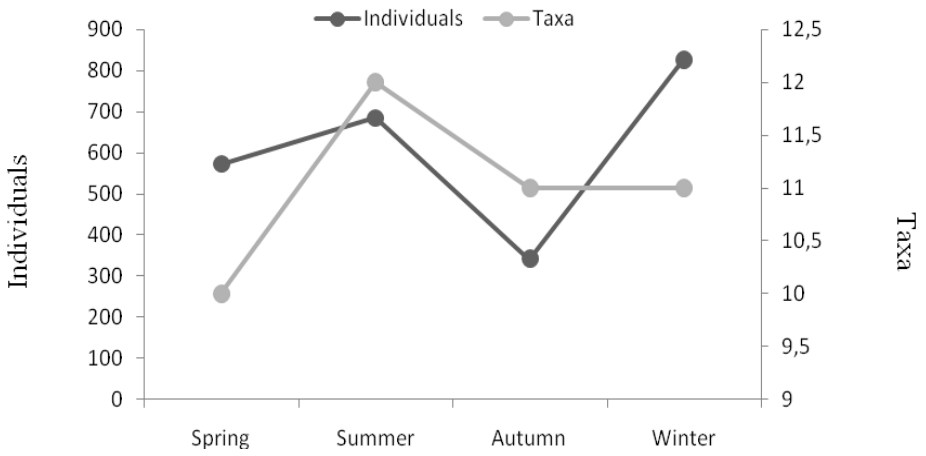

Figure 3. Seasonal distribution of taxa density and number of individuals

During the sampling period, the highest number of the individuals were observed in winter sampling (828 individuals) while the lowest number of the individuals was observed in the autumn sampling (341 individuals) (*Figure 3*).

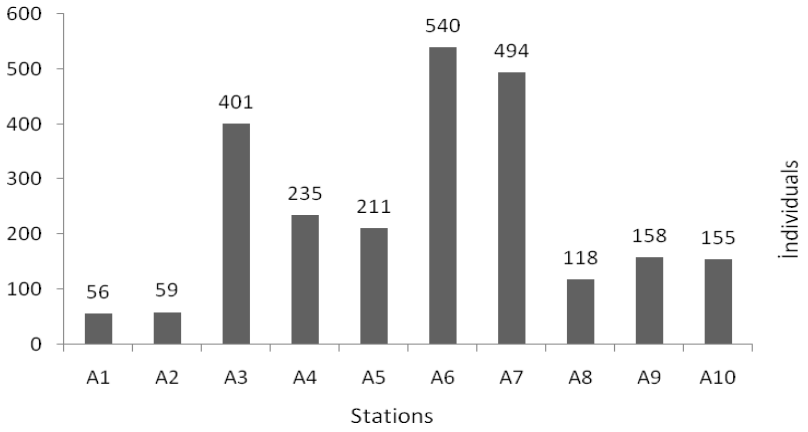

Figure 4. Distribution of the number of individuals sampling site

Bottom structure (shallow rocky bottom) showing the similarities between the A3 (401 individuals), A6 (540 individuals), and A7 (494 individuals), were more individual station numbers (*Figure* 4). This site is more than the diversity of substrates, low tide is one of the reasons that a high number of individuals.

4. CONCLUSION

Karasu Stream supplies good conditions for the benthos and vegetation due to its rich habitat. In this study, the studies in this field in the coming years will shed light on the nature of the data was obtained. In the present study about 13 taxa were recorded for the first time from Karasu stream.

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