SUPPORTING NEGATIVE IMPACTS OF LOCAL FAT PLANT (ERZURUM, TURKEY) ON THE POPULATION AND VARIETY OF AQUATIC COLEOPTERA IN KARASU RIVER BY PHYSICO-CHEMICAL PARAMETERS

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ABSTRACT: Negative impacts of the local fat plant (Doyasan) (Erzurum, Turkey) on the population and variety of Aquatic Coleoptera at Karasu River were supported by the physico-chemical parameters. Aquatic Coleoptera species, sampled before and after discharge point of plant, belonging to Helophoridae, Hydrophilidae, Hydrochidae, Dytiscidae and Hydraenidae families, were identified and listed at species level. Both physical (total dissolved solids, temperature) and chemical (pH, dissolved oxygen, conductivity, hardness, organic matter, chloride, phosphate and some metal ions) parameters of two inhabited water were measured and compared.

KEY WORDS: Aquatic Coleoptera, River, Physico-Chemical Parameters, Population and Variety.

Although less than 3% of all species of insects have aquatic stages (Daly, 1984), in some freshwater biotopes insects may comprise over 95% of the total individuals or species of macro invertebrates. Aquatic insects exhibit a vast array of morphological, physiological, and behavioral adaptations enabling inhabitation of virtually all bodies of water. Aquatic stages of insects occur in hot and cold springs, intertidal pools, temporary and constant ponds, water-filled tree holes, intermittent streams, and saline lakes as well as in less severe running and standing-water habitats (Ward, 1991).

Members of Aquatic Coleoptera inhabit freshwater, brackish, and marine environments. The most diverse and abundant fauna occurs in well-vegetated freshwater habitats. Members of a few families, however, reside primarily in rocky-bottomed rapid streams.

Aquatic Coleoptera fauna are easily affected by deteriorating water quality and therefore many species migrate to the other suitable habitats. In the light of this, these beetles may be used as environmental monitor.

Local fat plant (Doyasan) (Erzurum, Turkey) (Figure 1) works as a butter-factor during all summer season and wastages are drained into the Karasu River without filtering process.

In this study, negative impacts of the Local fat plant (Doyasan) on the population and variety of Aquatic Coleoptera at Karasu River have been investigated and shown with quantitative information obtained.

MATERIALS AND METHODS

Sampling

Specimens of Aquatic Coleoptera were collected from two stations (one is 50 m before discharge point of fat plant, and the other is 50 m after discharge point of the fat plant) (Figures 2a, b). Water samples of inhabited water were taken monthly (Table 1) in summer season of 2007 and various water quality parameters (pH, Dissolved oxygen and Temperature were measured in site by a portable multi-parameter (WTW multiline P-4 F SET-3) and (TDS) Total Dissolved Solids (Hanna Instruments).

Analysis

Total Hardness, chloride, phosphate measurements were made according to Standard Methods (AWWA, APHA, WPCF, 1985). Total Organic Matter levels were determined as Total Organic Carbon by a TOC Analyzer (Teledyne-Tekmar Apollo 9000). Metal ions (Fe, Cu, Mn, Zn, Pb, Cd) were measured by an Atomic Absorption Spectrophotometer (Perkin-Elmer). The analytical determination of boron was done potentiometrically by means of mannitol, which forms a complex compound with boric acid. For this purpose, boron analysis was carried out as follows: Solution pH was adjusted to 7.60 after sample was filtered. Then, 5 g mannitol was added to the solution. The solution was titrated with 0.5 N KOH until solution pH became 7.60 (Yılmaz et al. 2005).

RESULTS

Obtained analysis results are presented in table 1. Station-I and station-II represents the sampling points shown in figure 1 respectively. Levels of water quality parameters were determined and evaluated according to Turkish Water Pollution and Control Regulations (TWPCR). There are four main classification according to TWPCR including high quality water (I), weakly polluted water (II), polluted water (III) and highly polluted water (IV) (TWPCR, 2004).

DISCUSSION

First of all, further existence of aquatic Coleoptera depends on the existence of its own habitats as in most living species. Imagines of most aquatic coleopterans are active flyers and leave the water only for dispersal flights (generally migrates to another habitat when its habitat changes negatively).

There is no important difference between the levels of metal ions of station-I and II (Table 1). Manganese concentration is a bit high only for station-II. In station –I, phosphate ion was not present, but this ion was measured low levels only in July and August at station-II. Due to our observations, it can be said that the phosphate ion originates from the faces of the animals. Dissolved oxygen concentration in station-I is extremely high (Table 1). It results from the dense layer of moss. On the contrary in station-II, dissolved oxygen concentration has sharply decreased down to critical levels for aerobic organisms. The reason of this dramatic fall is probably due to the discharge of the wastewaters from local fat plant (Doyasan) because wastewater includes the organic matters which can be oxidized by the micro organisms and this oxidation process consumes the dissolved oxygen. Beetles species, placed in station-I, are less represented or absent at station II (Table 2). These results show that local fat plant (Doyasan) has negative effect on the population and variety of aquatic Coleoptera.

Nomenclature

t: Temperature (^oC); DO: Dissolve Oxygen (mg/l); Cl: Total Chloride Concentration (mg/l); P: Phosphate Concentration (mg/l); TDS: Total Dissolved Solids(mg/l); TH: Total Hardness (mg $CaCO_3$/l); C: Total Organic Carbon (mg/l); Fe: Iron Concentration (µg/l); Cu: Copper Concentration (µg/L); Mn: Manganese Concentration (µg/l); Zn: Zinc Concentration(µg/l); Pb: Lead Concentration (µg/l); Cd: Cadmium Concentration (µg/l).

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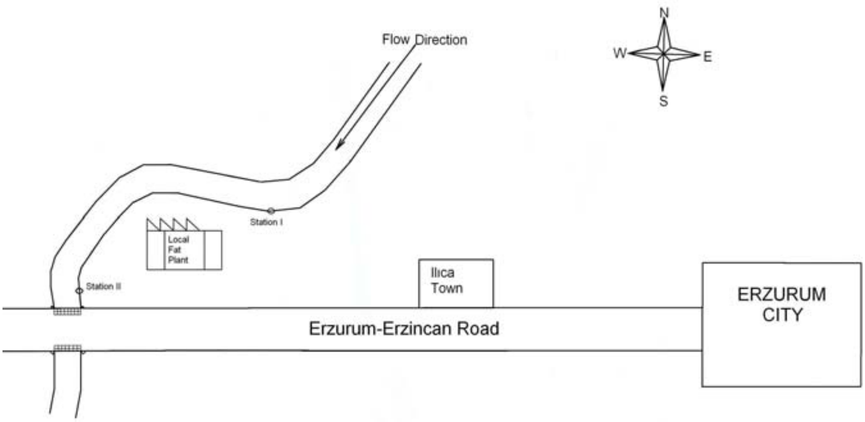
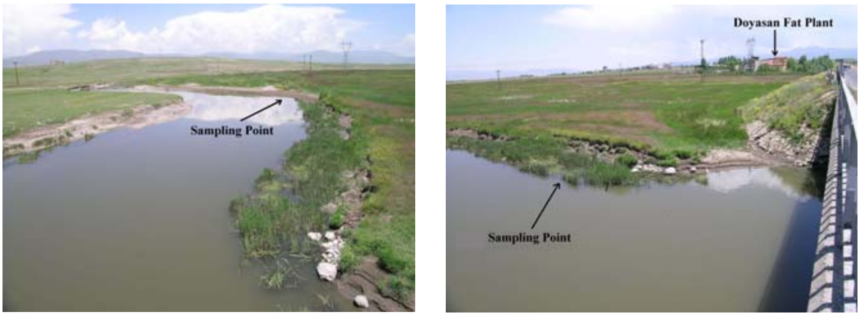


Figure 1. Sketch of research area.



A B

Figure 2. A) First sampling station (50 m before the discharge point of fat plant). B) Second sampling station (50 m after discharge point of fat plant). (Sampling points are marked on the photographs with arrow).

Table 1. Water quality parameters for station I and II.

	SD									
	STATION-I					STATION-II				
Parameters	Jun	July	Aug	Sep	Nov	Jun	July	Aug	Sep	Nov
t (°C)	21.6 (I)	24.4 (I)	21.0 (I)	17.5 (I)	15.0 (I)	22.1 (I)	22.7 (I)	21.0 (I)	16.0 (I)	14.O (I)
pH	8.09 (I)	8.31 (I)	7.96 (I)	8.10 (I)	7.95 (I)	7.56 (I)	7.47 (I)	7.53 (I)	7.61 (I)	7.50 (I)
DO (mg/L)	8.10 (I)	8.00 (I)	9.35 (I)	5.50 (II)	6.50 (II)	1.10 (I)	2.10 (I)	0.80 (I)	1.00 (I)	1.03 (I)
Ch (mg/L)	51.00 (II)	81.20 (II)	70.40 (II)	32.90 (II)	44.53 (II)	82.00 (II)	69.00 (II)	84.30 (II)	43.20 (II)	51.63 (II)
P (mg/L)	NA (I)	NA (I)	NA (I)	NA (I)	NA (I)	NA (I)	0.50 (III)	0.86 (IV)	NA (I)	NA (I)
TDS (mg/L)	370 (I)	730 (II)	660 (II)	495 (I)	421 (I)	535 (II)	725 (II)	633 (II)	570 (II)	560 (II)
C (mg/L)	1.43 (I)	2.5 (I)	1.5 (I)	4.13 (I)	2.8 (I)	3.72 (I)	1.93 (I)	2.33 (I)	6.77 (II)	3.50 (I)
H (mg $CaCO_3$/L)	94.20 (I)	151.80 (II)	142.00 (II)	123.60 (II)	110.40 (II)	104 (II)	99.2 (II)	102.2 (II)	104 (II)	103.5 (II)
B (µg/L)	1060 (II)	320 (I)	370 (I)	1170 (II)	660 (I)	1170 (II)	300 (I)	770 (I)	1530 (II)	960 (I)
Fe (µg/L)	71.6 (I)	77 (I)	68 (I)	65.2 (I)	71.2 (I)	66.7 (I)	61.5 (I)	64.9 (I)	78.5 (I)	67.9 (I)
Cu (µg/L)	0.71 (I)	1.25 (I)	0.89 (I)	1.07 (I)	1.32 (I)	2.5 (I)	1.79 (I)	2.68 (I)	3.4 (I)	2.76 (I)
Zn (µg/L)	3.1 (I)	3.6 (I)	3.8 (I)	4.1 (I)	3.4 (I)	5.4 (I)	4.6 (I)	5 (I)	4.3 (I)	4.9 (I)
Mn (µg/L)	3.24 (I)	3.04 (I)	3.38 (I)	2.7 (I)	2.97 (I)	47.52 (I)	43.26 (I)	50.9 (I)	47.02 (I)	45.86 (I)
Pb (µg/L)	60.43 (IV)	57.95 (IV)	60.53 (IV)	59.05 (IV)	59.97 (IV)	73.63 (IV)	74.35 (IV)	73.49 (IV)	73.88 (IV)	74.15 (IV)
Cd (µg/L)	82.8 (IV)	80.5 (IV)	80.1 (IV)	83.8 (IV)	81.6 (IV)	76.6 (IV)	81.4 (IV)	73.8 (IV)	77.1 (IV)	81.2 (IV)

NA: Not Available

Table 2. Aquatic Coleoptera population and variety of both stations (under I shows first station's species number, under II shows second station's species number).

Family	Species	June		July		August		September		November	
		I	II	I	II	I	II	I	II	I	II
Helophoridae	*Helophorus brevipalpis*	13	6	7	3	2	-	-	-	-	-
	Helophorus hilaris	-	-	2	-	1	-	-	-	-	-
	Helophorus frater	1	-	2	1	-	-	3	2	-	-
Hydrophilidae	*Laccobius syriacus*	3	-	-	-	2	-	-	-	1	-
	Laccobius simulatrix	-	-	4	1	2	2	-	-	3	-
	Enochrus fuscipennis	6	3	2	-	1	-	-	-	-	-
	Enochrus bicolor	-	-	-	-	4	3	3	1	2	-
Dytiscidae	*Hydroglyphus pusillus*	1	-	4	-	4	-	2	1	1	-
	Ilybius fuliginosus	-	-	-	-	1	-	-	-	-	-
	Dytiscus marginalis	2	-	-	-	-	-	-	-	-	-
Hydraenidae	*Ochtebius poliginskiyi*	8	-	6	-	4	1	2	-	-	-
	Limnebius papposus	45	-	32	-	54	1	47	-	26	-
	Limnebius stagnalis	12	-	4	-	6	-	-	-	-	-