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Mansoreh Sahyeghi

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Hassan Vatandoost

(1) Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

(2) Institute for Environmental Research, Tehran University of Medical Sciences, Tehran Iran

Azim Paksa

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Masome Amin

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Homa Yousefi

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Sara Rahimi

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Madineh Abbasi

Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

Amir Ahmad Akhavan

(1) Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

(2) Institute for Environmental Research, Tehran University of Medical Sciences, Tehran Iran

Correspondence**Hassan Vatandoost**

(A). Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran Iran

(B). Institute for Environmental Research, Tehran University of Medical Sciences, Tehran Iran

Identification of common aquatic insects of Jajroud River

Mansoreh Sahyeghi, Hassan Vatandoost, Azim Paksa, Masome Amin, Homa Yousefi, Sara Rahimi, Madineh Abbasi and Amir Ahmad Akhavan

Abstract

Some species of aquatic insect are medically important vectors that transmit diseases. Some of them also are used as an indicator of water pollution. There is little information about the aquatic insect's fauna of Iran.

To study the aquatic insects fauna, adult, nymphal and larval, species collection was done at five random points along Jajroud River in the protected area of Jajroud, Pardis is one of the cities of Tehran province, during summer 2015.

Totally, 306 samples were collected belonging to four orders: Diptera, Trichoptera, Ephemeroptera, and Coleoptera. Five genus identified, include *Blepharicera*, *Simulium*, *Hydropsyche*, *Baetis*, and *Hybius*. The most predominant genus was Simuliidae (80%).

Some species of aquatic insect are medically important vectors that transmit diseases. These insects are used as an indicator of water pollution and biological control. Therefore study on aquatic insects and understanding ecology of aquatic insects can use as bio-indicator of water quality and biological control.

Keywords: Aquatic insect, Diversity, Water quality, Jajroud River, Iran

1. Introduction

Aquatic insects are a major group of arthropods which at least one stage of their life cycle occurs in water. Most of them live in water in primary stages that followed by terrestrial adult (eg, Ephemeroptera, Odonata, Plecoptera, Trichoptera, Megaloptera). Semi aquatic insect are only associated with aquatic and semi aquatic vegetation, the water's surface, or the margins of water habitats. Some species of aquatic insect are medically important vectors that transmit diseases such as malaria, dengue, filariasis, yellow fever, and some other main arboviruses ^[1, 2]. Some aquatic insects are used as an indicator of water pollution. Water quality is measured by comparing the number of tolerant species (some midge larva) to the number of intolerant species (Ephemeroptera, Plecoptera, and Trichoptera orders). In addition, some of these insects are used in toxicological researches in primary stages. Aquatic insect are found in a wide range of aquatic habitats from pond, spring, stream to rivers which are different in salinity, pH and other characters ^[3, 4].

Apart from medically importance of aquatic insects, they play an important role in the ecosystem. For example they serve as food for fish, amphibians, and water birds. They are also involved in the breakdown of organic matter and nutrients. This material provides the base of the food chain in some aquatic environments. Another kind of aquatic insects mix soft sediment of bottom while searching for food and this makes bottom appropriate for organisms and this phenomenon is due to oxygen enrichment of the bottom. In addition, predator aquatic insects reduce the numbers of other invertebrates and help keep to have a balance among different organism and food reservoir ^[5].

Many insects that we see flying around water actually spend their juvenile stage under the water. Such insects include dragonflies, damselflies, mayflies, stoneflies, caddis flies, and whirligig beetles. The nymphs and adults often look nothing alike, but each can be identified by unique morphological features, such as tails, gills, and overall shape [provide reference]. Here provide objective of your study clearly.

2. Materials and Methods**2.1 Study area**

Pardis is one of the cities of Tehran province. The county's eastern borders are with Damavand, and its western borders are with Tehran metropolitan.

In addition, it is bounded on the north by Shemiran and on the south by Pakdasht and is subdivided into two districts, i.e., Bumehen and Jajroud. The protected area of Jajroud is in 30, 35 to 50, 35', N, and 30, 50 to 00, 52' E, and it's bounded by the road which extends from Letian dam and Rasnan village on the north, the Alborz mountain ranges on the east, Khavaran on the south and Tehran on the west. Moreover, the protected region has an area of 56624 hectares. Arakoo Mountain with a 2649-meter peak is the highest point and Sangtarashan plain with the height of 1100 meters is the lowest point.

Being close to different climate zones (half-deserted, Mountainous, mild and semi-arid), this region has a great diversity of climates. The highest and lowest temperatures ever recorded in this area are 42 degrees Celsius in summer and -30 degrees Celsius in winter and the lowest annual rainfall is 193 and the highest is 731 millimeters respectively. There are two important rivers named Jajroud and Dmavand in the protected area of Jajroud. Jajroud River is approximately 140 kilometers long and begins in the southern ranges of Alborz Mountains. The most important mainstream begins at the southern ranges of Kharsang Mountain, while the other mainstream starts at Koloon Bastak mountain ranges and after passing through Darband, Shemshak and Meygon, it flows into the mainstream of kharsang and forms Jajroud River. After passing through the letian dam, it flows into Damavand River [6-8].

From the geographical viewpoint, the protected area of Jajroud has sedimentary and igneous rocks. Furthermore, it includes 517 plant species, 38 mammal species, 115 bird species (migrant and resident), 6 species of fish and 2 species of amphibians [6,7,8] (Fig.1).

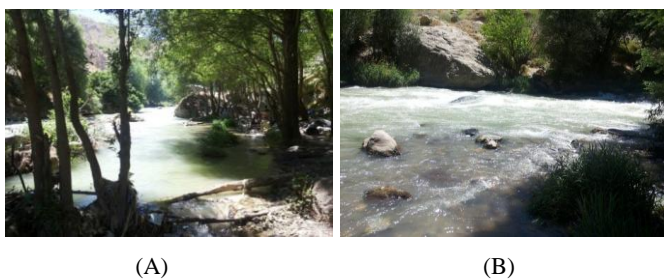


Fig 1: Two sampling sites, Jajroud River, Tehran, Iran (a, b).

2.2 Sampling method

Species collection was done at five random points along Jajroud River in the protected area of Jajroud during summer 2015. The sampling duration considered for each place was five minutes and two sampling iterations were considered for each place. The samples were collected from the rocks near the river, the stones on the river bed, the plants existing in and around the water, floating chlorophyll on the water, stones and sands of the river bed and also from the ponds of standing water near the river.

Different types of instruments such as a D-Frame net (D frame), a shovel, forceps, a ladle, and glass and plastic pipettes were used to collect samples. After collection, the samples were placed into glass petri dishes containing clean water and after being washed by forceps, they were transferred to some glasses. The glasses contained 70% ethanol and some information including the place and date of catch was labeled on each of them [3]. Finally, the samples were transferred to the insect systematic laboratory of the School of Public Health at Tehran University of Medical Sciences and were identified using microscope, loop and valid systematic identification keys [9].

3. Statistical analysis

The statistical analysis was used to compare the abundance of genus and orders in the breeding places using P value

4. Results and Discussion

Totally, 306 samples were collected which belongs to four orders: Diptera, Trichoptera, Ephemeroptera, and Coleoptera (Table 1). Five genus (*Blepharicera*, *Simulium*, *Hydropsyche*, *Baetis*, and *Hybius*) from five families (Blephariceridae, Simuliidae, Hydropsychidae, Baetidae, Dytiscidae) were identified. The most predominant one was Simuliidae (80%) belonging to order Diptera. It was followed by Baetidae (9%) from order Ephemeroptera. Blephariceridae (order: Diptera) had the lower population size (3%). The identified species are listed in Table 1 and Fig. 2. Also the captured nymphs and larvae of samples are shown in Fig 3.

Table 1: The prevalence of some aquatic insects in the study area.

Order	Family	Genus	Sample No.
Ephemeroptera	Baetidae	<i>Baetis</i>	larvae: 30
Diptera	Blepharicerida	<i>Blepharicera</i>	larvae: 12
	Simuliidae	<i>Simulium</i>	larvae: 203, pupa: 69
Coleoptera	Dytiscidae	<i>Hybius</i>	larvae: 14
Tricoptera	Hydropsychidae	<i>Hydropsyche</i>	larvae: 14
Total			larvae: 237, pupa: 69

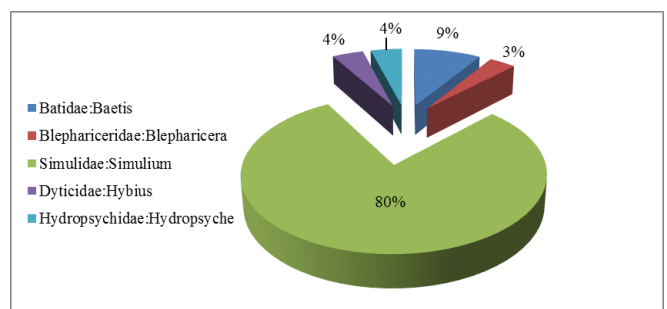


Fig 2: Aquatic insect genus and family composition in study area

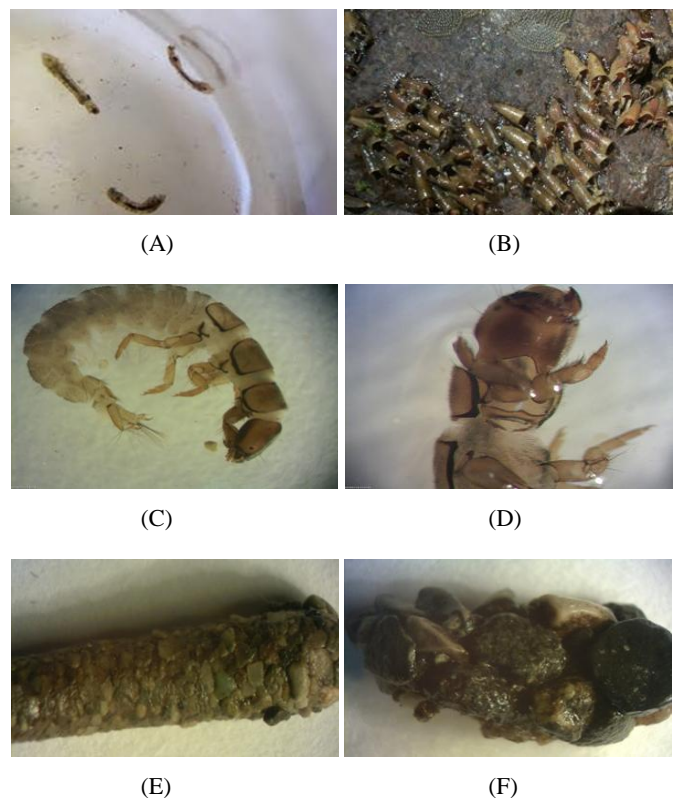




Fig 3: Simuliidae samples: (a) larva (b) pupa, Trichoptera:(c, d) larva(e, f) Pupal cases, Dytiscidae (g, h).

The results of current study showed that 306 numbers of aquatic insects was collected from this river. Results of current study showed that these samples belong to five genera (*Blepharicera*, *Simulium*, *Hydropsyche*, *Baetis*, and *Hybius*), five families (Blephariceridae, Simuliidae, Hydropsychidae, Baetidae, Dytiscidae) and four orders (Diptera, Trichoptera, Ephemeroptera, and Coleoptera), that identified by stereotyped microscope. The most abundant aquatic insects was belong to order Diptera (family Simuliidae); (80 percent) ($P < 5\%$). This family was resistant to water pollution compared to other Diptera families^[10], while base on the similar studies, other aquatic insects (Coleoptera) have the highest number among collected samples^[11]. Family *Simuliidae* spends stages of their lives in running waters with high speed, and studied in other parts of the world in comparison with Iran^[12, 13]. It seems that given the importance of these insects in the transmission of Onchocerciasis disease were investigated in America and Africa frequently, but because of the lack of evidence toward disease transmission it has been ignored by Iranian researchers^[13, 14]. Also, the lowest number of aquatic insects (3%) belongs to the order Diptera (family Blepharicerida), that however, a family has not been reported so far in the conducted investigations. Captured families of order Diptera in the study that conducted in 2014 in Isfahan Province was including families Culicidae, Syrphidae, Chironomidae^[1]. Nine percent of captured samples were belong to order Ephemeroptera, which known as one of the oldest flying insects. Nymphs of this family are found under rocks in rivers and eventually the adult insects came to the surface to take flight^[15]. The only family were captured and identified from this order in the present study were Baetidae that considered as smallest family in this order^[16, 17]. This family was also captured in the south of Urmia Lake which is located in the northwest of Iran. Order Trichoptera was the other aquatic insects that collected from the Jajroud River in this study. This order was also collected from the Lavasan and Zayandehrood River in Isfahan province^[11, 19]. Many studies conducted in order to identifying the order Trichoptera in 2009, namely Trichoptera World Checklist (TWC). Based on this Checklist; the number of existing species of order Trichoptera in Iran was 62 species from 14 families^[20]. The larvae of Order Trichoptera and Ephemeroptera are sensitive to water pollution^[10]. The only captured family of this order was Hydropsychidae that known as cosmopolite species. Numerous surveys that conducted to capturing this family in Kashan^[19, 21], north of Mazandaran^[15], Bojnourd, south and west of Booshehr and Hamedan^[16]. Larvae of this family simply identified through the sclerotized plates of any segment of thoracic and branch gills of abdominal segments^[11]. Larvae of this family are very sensitive to dissolved oxygen in the water and water pollution^[24]. Identified genus of order Trichoptera was *Hydropsyche*, that larva of this family doing the filter feeding and capture the small organism

inside their nests^[25]. The last order identified in this study was Coleoptera (Family Dytiscidae), which *Hybius* was the only identified genus in this investigation. This result was compatible with result of study that conducted in Isfahan 2014^[1].

5. Conclusion

There are around 13 insects' orders which live as aquatic and semiaquatic insects in waters. From them we only able to collect some genus from 4 orders of flies (Diptera), Caddisfly (Trichoptera), mayfly (Ephemeroptera), and beetles (Coleoptera). The predominant was from Diptera. The results of present study indicate the fauna and abundance of aquatic insects in Tehran. Unfortunately, aquatic insects and their role in the food chain and the creation and transmission of the disease have not received more attention in Iran until now. Therefore, it is recommended that more studies be done on a broader level to obtain comprehensive and more complete information regarding aquatic insects.

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