

## Original Article

# Biodiversity of Aquatic Insects of Zayandeh Roud River and Its Branches, Isfahan Province, Iran

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(Received 15 Apr 2013; accepted 5 Feb 2014)

## Abstract

**Background:** Aquatic insects are the major groups of arthropods that spend some parts of their life cycle in the water. These insects play an important role for transmission of some human and animal diseases. There is few information about the aquatic insects fauna of Iran.

**Methods:** To study the aquatic insects fauna, adult, nymphal and larval collections were carried out from different habitats using the standard technique in Zayandeh Roud River, Isfahan Province, central Iran, during summer 2011.

**Results:** In total, 741 specimens of aquatic insects were collected and morphologically identified. They include 7 families and 12 genera representing 2 Orders. The order of Diptera (92.31%) and Coleoptera (7.69%). The families Culicidae, Syrphidae and Chironomidae from Diptera order, Gyrinidae, Dytiscidae, Haliplidae, Hydrophilidae from Coleoptera order were identified.

**Conclusion:** Some aquatic insects play an important role for transmission of human and animal diseases. These insects also are important for biological control. Therefore ecological study on aquatic insects can provide information about ecology of insects in an area for any decision making.

**Keywords:** aquatic insects, Zayandeh Roud River, Iran

## 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 (Merritt and Cummins 1996).

Some species of aquatic insect are medically important vectors that transmit diseases such as malaria, dengue, filariasis, yellow fever, and some other main arboviruses (Foil

1989). Furthermore few number of them have a painful bite that cause dermatological effect on human and animal host (Villiers 1987). Some of them act as a host of termatods such as dragonfly and damselfly (Chae et al. 2000).

In some countries dragonfly are considered as a threat to the poultry industry because they transmit a parasitic flatworm of *Prosthogonimus spp* (Angel 1973). Some aquatic insects are used as an indicator of water contamination. Water quality is evaluated by comparing the number of tolerant species (some midge larva) to the number of intolerant species (Ephemeroptera, Plecoptera,

and Trichoptera orders) (Voshell 2002). Furthermore some of these insects are used in toxicological researches in primary stages (Merritt and Cummins 1996). Aquatic insect are found in a wide variety of aquatic habitats from pond, spring, stream to rivers which are different in salinity, pH and other characteristics. Apart from medically importance of aquatic insects, they play an important role in the ecosystem. For instance they serve as food for fish, amphibians, and water birds. They are also involved in the breakdown of organic matter and nutrients. Some of the aquatic insects are responsible for breaking down the dead leaves and plant parts that fall on the water surface. This material provides the base of the food chain in some aquatic environments. Some of them filter suspended particles in water and cause light reach to bottom of streams where algae grow. 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. Additionally, predator aquatic insects reduce the numbers of other invertebrates and help keep to have a balance among different organism and food reservoir (Voshell 2002).

This paper attempts to investigate aquatic insect fauna in Isfahan Province. Apart from researches that have been conducted on Culicidae family members, there is a few studies on aquatic insects.

## Materials and Methods

### Study area

Present study conducted in the Zayandeh Roud River of Isfahan Province during summer 2011. The Isfahan Province located in the center of Iran and situated 340 kilometers far away of Iran's capital. Isfahan region has generally arid climate with hot summer with maximum temperature around

36 °C and cool winter. It has an average annual rainfall of 150 millimeter Zayandeh Roud River in this region provides a suitable habitat for aquatic insect. Isfahan Province is surrounded by Qom, Semnan and Markazi Provinces to the north, Fars and Kohkiloie Province to the south, Yazd Province to the east, and Lorestan, Khuzestan and Chaharmahal to the west. With a total area of around 105, 937 square kilometers (6.57 % total area of Iran). It lies at an altitude of 1575 meters above sea level at a latitude of 30° 42' N to 34° 30' N and a longitude 49° 36' E to 55° 32' E. The climate is temperate. It has the warm and semi-humid climate in north and east parts and cold climate in south. The studied areas were selected by clustered random sampling consist of several localities in the study area. We started our survey from Zarinshahr City, ca. 1684 m (32° 22' N, 51° 22' E) to Baghbahadoran City, ca. 1751 m (32° 23' N, 51° 10' E), (Fig. 1).

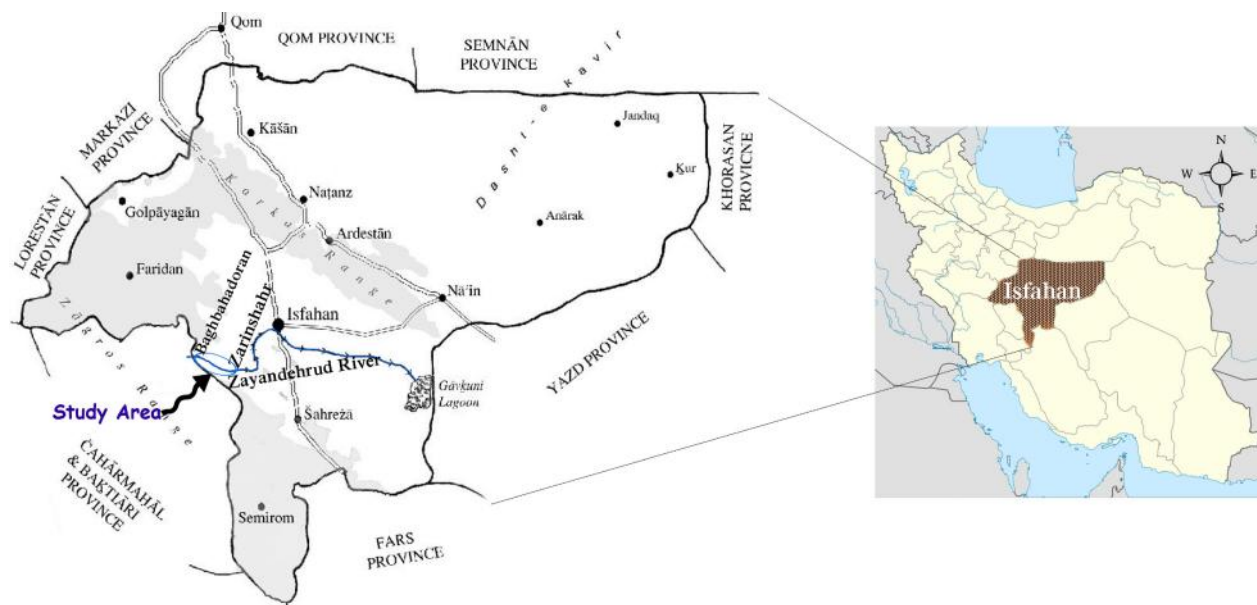
### Data sampling

Aquatic insects collected in different habitats. The sampling was carried out from rifles, under stones, aquatic vegetation, over hanging terrestrial vegetation, within burrows, leaf packs and fine sediment. The specimens collected by D frame net-collector, plastic pipette and forceps. After collection, all specimens were preserved in 70% alcohol, date and time of sampling and place of collection were recorded on each container. The samples were transferred to the laboratory of medical entomology department, Tehran University of Medical Sciences. Then the samples were identified using stereo-typed microscope, and valid identification keys (Clifford 1991, Borror and White 1998, Epler 2001, Bouchard 2004, Sangradub and Boonsoong 2006, Subramanian and Sivaramakrishnan 2007, Azari-Hamidian and Harbach 2009, Mullen and Durden 2009).

## Results

During several times sampling in the study area a total of 741 aquatic insects were collected that including: 2 Orders, 7 families and 12 genera with summarized in Table 1. In the Diptera order there are 3 families: Culicidae (n=384, 51.82%), Syrphidae (n=4, 0.54%) and Chironomidae (n=296, 39.95%) and Coleoptera order was including 4 families:

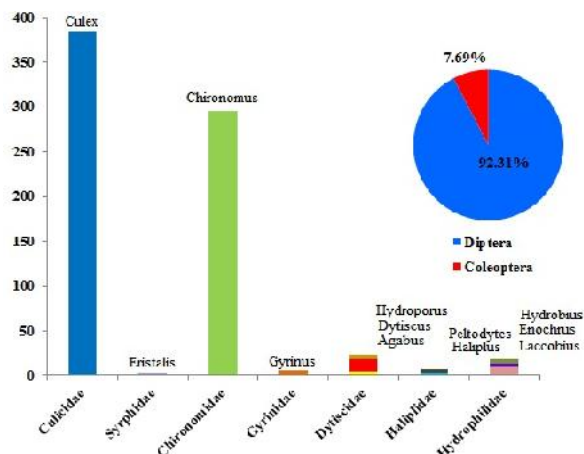
Gyrinidae (n= 6, 0.81%), Dytiscidae (n=24, 3.23%), Haliplidae (n=7, 0.94%), Hydrophilidae (n=20, 2.7%) and *Culex theileri* belong to Culicidae family was the most frequent (51.82%) moreover *Peltodytes* in the Haliplidae family with 0.40% of all collected samples was the least frequent (Table 1 and Fig. 2, 3).



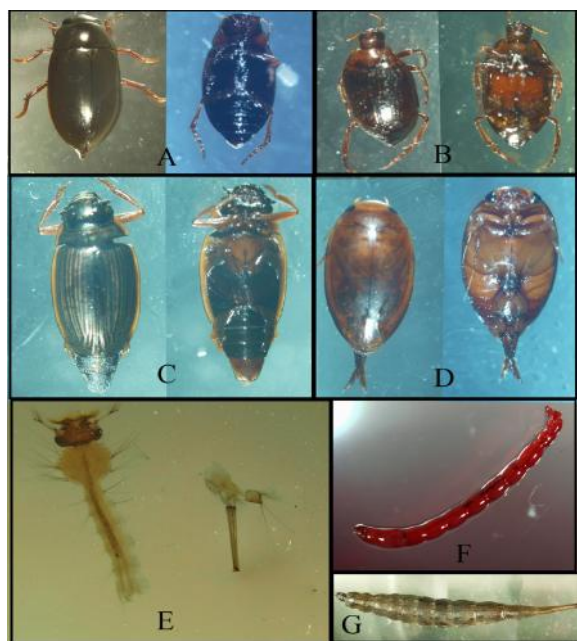
**Fig. 1.** Map of study area in Isfahan Province, Iran

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

Order	Family	Genus	No.	Percent (%)
Diptera	Culicidae	<i>Culex (Culex theileri)</i>	384	51.82
	Syrphidae	<i>Eristalis</i>	4	0.54
	Chironomidae	<i>Chironomus</i>	296	39.95
Coleoptera	Gyrinidae	<i>Gyrinus</i>	6	0.81
		<i>Agabus</i>	5	0.67
		<i>Dytiscus</i>	13	1.75
	Haliplidae	<i>Hydroporus</i>	6	0.81
		<i>Haliphus</i>	4	0.54
		<i>Peltodytes</i>	3	0.40
Hydrophilidae	<i>Laccobius</i>	10	1.35	
	<i>Enochrus</i>	4	0.54	
	<i>Hydrobius</i>	6	0.81	
<b>Total</b>	7 families	12 Genus	741	100



**Fig. 2.** Aquatic insect genus and family composition in study area



**Fig. 3.** Families of collected aquatic insects, A: Hydrophilidae B: Halophilidae C: Gyrinidae D: Dytiscidae E: Culicidae F: Chironomidae G: Syrphidae

## Discussion

Total number of 741 samples belongs to 2 Orders and 7 families and 12 genera were identified using stereo-typed microscope. The results are summarized in Table 1. *Culex theileri* with 51.82% of collected sample was the most abundance frequent

(Table 1 and Fig. 2). In the same study that conducted in the our study area by Shayeghi et al. in 2011, their result were compatible with our result, for the study on the aquatic insects of Isfahan Province and also their probable use of biological control, Coleoptera order was one of the abundance collected aquatic insect and this result was likely to our result (Shayeghi et al. 2012) *Cx. theileri* was one of the collected samples in the study area. Research conducted by Mousa-kazemi et al. in 2002, *Cx. theileri* was the most abundance frequency and their results were agree with our results (Mousa-kazemi et al. 2000). This species is the more prevalent species at higher altitudes in rural areas of Zanzan Province (Ghavami and Ladonni 2005) and East Azerbaijan Province (Abai et al. 2007). Dehghani et al. (2007) conducted a study for studying fauna of aquatic insects in sewage maturation ponds of Kashan. The families of Chironomidae and Hydrophilidae were prevalent. In the other study that conducted by Vafaei et al. 2007 for surveying of the aquatic beetles (Coleoptera: polyphaga) of Markazi Province (central Iran) after investigation In freshwater habitats of study area, 24 species (Coleoptera: Hydrophilidae, Helophoridae, Hydraenidae, Elmidae, and Dryopidae) belonging to 13 genera and five families were identified and in this study Hydrophilidae family was one of the collected samples like present study (Vafaei et al. 2007). Some aquatic insect are an important for biological control of larvae and adults of mosquitoes in the breeding places also some of these insects play an important role in transmission of some human and animal diseases, for example in Iran several species belong to Anophelinae sub family including *Anopheles culicifacies s.l.*, *An. stephensi*, *An. dthali*, *An. fluviatilis s.l.*, *An. superpictus*, are known to be the malaria vectors (Naddaf et al. 2003, Doosti et al. 2006, Oshaghi et al. 2006, Vatandoost et al. 2006, Hanafi-Bojd et al. 2011, Mehravaran et al. 2011,

Oshaghi et al. 2011, Vatandoost et al. 2011, Hanafi-Bojd et al. 2012a, 2012b, 2012c, Vatandoost and Abai 2012a, Soleimani-Ahmadi et al. 2012a, 2012b, Vatandoost and Hanafi-Bojd 2012). Therefore the ecological specifications of these insects could provide a clue for further Arthropod-borne disease control.

## Conclusion

According to the results it could be concluded that there are several species of insects in the study area. They are involved in the food chain of aquatic insects. They also could be considered as biological control agent for vectors as well as bio indicators.

## Acknowledgements

The authors wish to appreciate the staff of Isfahan Health Research Centre, National Institute of Health Research, Tehran University of Medical Sciences (TUMS) for their collaboration along the study. Some partially expenses are founded by Tehran University of Medical Sciences grant Number 11840.

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