The Species Diversity of Aquatic Insects in Karaj River, Central Iran

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Abstract

Aquatic insects spend some portion of their life cycle in the water. They feed in the same ways as other insects. This study was carried out emphasizing on the fauna of aquatic insects in Karaj River, central Iran. The aquatic insects were collected using several methods such as using D-frame nets, dipping and direct search on river floor stones. Specimens were collected and preserved in Ethanol and identified by standard identification keys. Totally, 436 samples were collected belonging to 3 orders (Ephemeroptera, Diptera and Trichoptera). They include 5 families Leptophlebiidae, Ephemerellidae, Helicopsychae, Hydropsychidae and Chironomidae). The most predominant family was Hydropsychidae. Aquatic insects are useful for water quality monitoring as indicators to assess the water contaminations by different pollutants. In addition they could act as biological control of main important arthropod-borne disease vectors which live in water.

Keywords: Aquatic insect; Fauna; Iran

Introduction

Aquatic insects are important group of insects in the aquatic ecosystem and they occupy various aquatic environments [1]. They play an important role in the ecological dynamics and in monitoring the health of aquatic environments [2]. Some of these aquatic insects are beneficial to humans while some are dangerous [3]. Many insect orders such as: Diptera, Ephemeroptera, Plecoptera, Trichoptera, Neuroptera, Odonata and Hymenoptera spend some of their immature stages in water while the adults are terrestrial [4]. Ephemeroptera, Plecoptera and Trichoptera (EPT) richness are very useful for the establishment of baseline data of aquatic insects faunal in Karaj district of Alborz province, northern Iran.

Material and Methods

Study area

Figure 1: The situation of Karaj River and the study area in Iran map.

Karaj River (Rud-e Karaj), is the second major permanent river in the central Iranian plateau after the Zayandarud river. The river runs...
245 km, with an average slope of 0.8 percent, average annual discharge of 499 mcm (million cubic meters), and precipitation of 625 mm; the basin area is 2,800 km$^2$. It flows from the central Alborz sierra through the city of Karaj and the irrigated plain of Shahriar, then with its tributary Jajrood River meeting in Tehran Province to empty into the Namak Lake basin in Qom Province. The Amir Kabir Dam was constructed across the river for water supply, electricity and irrigation in Tehran, Iran (Figure 1).

**Sampling technique**

The study was conducted in the spring of 2017; samples were collected from five different points using several methods including D-frame nets, dipping, direct search in the river floor stones, aquatic vegetation, over hanging terrestrial vegetation, within burrows, leaf packs and fine sediments. All of the specimens collected were preserved in 70% alcohol container well labeled with the dates of collection, location of study area, temperature and humidity then transferred to the laboratory of medical entomology department, Tehran University of Medical Sciences. Standard keys and stereo-typed microscope were used to identify the samples in the laboratory [10-12]. Table 1 shows the physical characteristics of breeding places.

| Temperature (°C) | pH  | BOD (mg/l) | Nitrate (mg/l) | Amonia (mg/l) | Total Coliform (n/100 ml) |
|------------------|-----|------------|----------------|---------------|--------------------------|
| 20 ± 2           | 8.2 | 1.5        | 2.98           | 0.14          | 100850                   |

**Table 1**: Physicochemical properties of Karaj River. Information includes mean temperature, scale of acidity (PH), biological oxygen demand (BOD), scale of Nitrate, Ammonia and Coliform Bacteria in sample sites.

**Results**

During the sampling in Karaj river, a total of 436 specimens were collected belonging to 3 orders (Ephemeroptera, Trichoptera, Diptera) 5 families (Leptophlebiidae, Ephemerellidae, Helicopsychidae, Hydropsychidae, Chironomidae) Table 2.

| Order          | Family            | No.  | Percentage % |
|----------------|-------------------|------|--------------|
| Ephemeroptera  | Leptophlebiidae   | 164  | 37.6         |
|                | Ephemerellidae    | 41   | 9.4          |
| Trichoptera    | Helicopsycha      | 38   | 8.7          |
|                | Hydropsychidae    | 185  | 42.4         |
| Diptera        | Chironomidae      | 8    | 1.8          |
| Total          |                   | 5    | 100          |

**Table 2**: Aquatic insects collected from the various sampling sites, Karaj River.

| Simpson Index  | 0.3379          |
| Dominance Index| 0.6621          |
| Reciprocal Simpson Index | 2.959 |
| Shannon Index  | 1.787           |

**Table 3**: Simpson Index of different families of aquatic insects collected.

**Figure 2**: Simpson index of different families.

**Figure 3**: Life stages and morphological characters of Trichoptera order, larvae (a), ventral view (b), dorsal view (c), anal proleg and claw (d & e) and pupal case (f).
The most predominant family was Hydropsychidae (42.4%) while Chironomidae had the lowest population size (1.83%). In this study, the Tricoptera order was the predominant with 223 (51.1%) collection while Diptera was the least order with only 8 (1.83%) collections. The Simpson indexes are presented in Table 3 and Figure 2. All the samples collected (100%) were in their nymphal and larvae stages of development. Two families were collected from Ephemeroptera order, while Diptera was the least order with only 8 (1.83%) collections. The most predominant family was Hydropsychidae (42.4%). Fauna of aquatic insects in sewage maturation ponds of Kashan have been reported. A similar study conducted in the study area similar to our findings. Shayeghi et al. [16] in another related study from Sablan River in Ardabil province, reported the two families of the order Diptera (Trichoptera Plecoptera) as the most prevalent (61%) which is similar to our study (Trichoptera 51.1%). They also reported 3 families belonging to Diptera order (Culicidae, Simuliidae, Chironomidae). The families of Chironomidae and Hydrophilidae were prevalent. In the other study that conducted by Vafaei et al. [17] 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. Some aquatic insects 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. Anopheles culicicacies s.l., An. stephensi, An. dhabhi, An. lviiatilis s.l., An. superpictus, are known to be the malaria vectors [18-30]. Therefore, the ecological specifications of these insects could provide a clue for further Arthropod-borne disease control.

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