http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 10 (6): 928-931, 2007
ISSN 1028-8880

Fauna Aquatic Insects in Sewage Maturation Ponds of Kashan University of Medical Science 2005

[1]Rouhollah Dehghani, [1]Mohhamad Bagher Miranzadeh,
[2]Mehrnoosh Yosefzadeh and [2]Soheyla Zamani
[1]Scientific Members of Kashan Medical Sciences University, Iran
[2]Department of Environmental Health Kashan Medical Sciences University, Kashan, Iran

Abstract: Organic materials in maturation ponds, the personal study was carried out to determine the aquatic insects living in the maturation pond of Kashan University of Medical Sciences in 2005. This was a descriptive study, 9 series of sampling including 1032 of larva, nymph and adults were collected and sent to a laboratory. Then they were diagnosed using stereo microscope and morphologic identification key. At of 1032 collected samples from 4 maturation ponds, the orders if Diptera (52%), Hempitera (24%), Ciclopodidade (12%), Hydroacarina (9.5%), Coleptera (0.77%), Aranida (0.67%), Hymenoptera (0.58%), Odonata (0.48%), were determined. The families of Chironomidae and Culicidae from Diptera order, Corixidae, Notonectidae, Cupepodae and Copepodidae families from Hemiptera order, Hydrophilidae family from Coleptera order, Aranidae family from Aranida order, Vospidae family from Hymenoptera order, Anizoptera suborder from Odonata order were determined. Maturation ponds are the artificial places where are appropriate for the growth and development of aquatic insects and also for their predators with taking in to account that some of these insects are the carriers of pathogens, make inconvenience for human and also has significant role in the cycle of changing materials, it is recommended that further specialized studies carry out in this regard.

Key words: Fauna, insect, aquatic, maturation pond, sewage, Kashan

INTRODUCTION

Aquatic insects are a group of arthropods which live a half of their life cycle in water; therefore, they are called aquatic insects. Some of them live near water or their life to some extent depends on water. These insects are called semi aquatic insects, they are important regarding either transmitting pathogens in some stages of their life, or concerning water contamination indexes (Merrit *et al*., 1996). Adult insects lay their eggs in various ways near or into water. Some of them lay their eggs one by one, while others do them in compounding from in water. Except Culicidae mosquitoes which are significant in medicine, some aquatic insects are able to transmit various pathogens to both human and animals. Some diseases transmitted by these arthropods include anthrax, The agent causing Tularemia disease, the probable vector of lyme disease (Foil, 1998).

Aquatic insects like caddis fly, mayfly, stonefly, dams fly and dragonfly are contaminated by metacercaria of some teramatods (Chae *et al*., 2000). Blackfly and Horsefly are able to transmit severe diseases to human via biological or mechanical route. Some insects in the maturation stage have the habit of blood sacking and yields some inconvenience for human which it may cause some acute or chronic dermatological allergy and dermatitis; hence, they are significant because of these characteristics (De Villiers, 1987). Aquatic insects are found in various water environments expect seas and the oceans. They are prevalent in large water environment and the sea-shore and rivers. Almost all water ecosystems can be considered an appropriate environment for some special species of aquatic insects. The most important dwelling places for them include large and small rivers, streams, beaches, shallow holes with stagnant water, pools and floodgates, lakes, mineral water and drinking water pools. Having various ecosystem and small and large flowing waters and also the presence of lakes, dams, natural and artificial rivers, Iran is an appropriate place for the growth of these arthropods which are considered as the national treasure of Iran's enriched environment. Kashan is situated in the central of Iran. It is at the north of Isfahan province. It has hot climate. Given that sewage treatment, maturation ponds are used in hot climate regions; therefore, Kaskan is suitable for this purpose. In Iran only one order of aquatic insect well studied

Corresponding Author: Mohhamad Bagher Miranzadeh, Scientific Members of Kashan Medical Sciences University, Kashan, Iran

(Tirgari, 1979). Although there is a list of orders and families of aquatic insect from small rivers and streams in Kashan (Dehghani *et al*., 2005), not include fauna of maturation pond.

Over all, maturation ponds is an artificial place where sewage is kept for some specific time under the influence of microorganism and natural environment so that the effluent can be disposed or recycled based on standard quality criteria (Nadaffi *et al*., 1996). The ponds are good for the growth of aquatic insects in some cases. Shade environment is needed for the reproduction and growth of insects living in the ponds. This is provided by the growth floated grass and sewage on the surface of the water or the walls of the ponds (Miranzadeh, 2004). Our hypothesis was that maturation pond may have a variety of aquatic insect, which could play an importance role in maintaining the organism or transmitting it to human. Considering the significance of aquatic insects regarding transmitting pathogens and also their role in changing organic materials in life cycle, the current study was conducted to determine the Fauna of aquatic insects dwelling in the maturation pond of Kashan University of Medical Sciences in 2005.

MATERIALS AND METHODS

The current study was performed during 2004 to 2005 in Kashan, in central of Iran. The study was performed on the maturation pond which received flow rate of 300 m^3/day. The sewage treatment method was in the from of black mud with wide *blowing. The effluent produced via this method was disposed to the complementary pond for final disinfection and then it was used for irrigating university gardens *and fields. The system was composed of net garbage-collector, two aeration tanks, one sedimentation tank and 4 complementary ponds with detention deposit time of 10 days (Miranzadeh, 2005). The average TSS, BOD and COD of raw sewage was 502,189, 213 mg L^{-1}, respectively. The average BOD and COD in the effluents in the complementary ponds were estimated 17.62 and 88.88 mg L^{-1}, respectively (Miranzadeh, 2004).

This was a descriptive study. Having fulfilled 9 times sampling, we collected nearly 1032 samples from 4 corners of 4 complementary ponds: A,B,C,D using ladle and net pupa and larva were gained using net from the distance of 30-40 cm above the surface of the pond. Then they were sealed in an individual jars containing some water obtained from the corners of the pond. Next, the insects were put in jars contained 70% ethylic alcohol.

The samples were studied using stereo-typed microscope and the numbers were determined. The results were recorded on a data sheet based on the pond, the order and family. After drawing the figures and designing the tables, we analyzed the results.

RESULTS

During 9 time sampling, total 1032 sampling including larva, pupa and matured aquatic insects from the maturation pond were obtained.

Among them, the order of Diptera: (n = 534, 51.74%) which were the most prevalent order and other order were found including: Hemiptera (n = 522, 21.41%), Cyclopes: (n = 122, 11.52%), Acarina: (n = 98, 9.49%), Coleoptera: (n = 8, 0.77%), Aranida: (n = 7, 0.67%) Hymenoptera: (n = 6, 0.58%) and the least prevalent order, Odonata: (n = 5, 0.48%), (Table 1). Out of the order Diptera, the most prevalent orders (n =534) were collected they included larva and pupa. Among them, Culicidae: (n = 453, 43.89%) and Chironomidae: (n = 81, 7.84%) which belong to the suborder of nematocera the greatest number of samples were collected from the pond D, then the ponds C,B and A. Out of the order Hemiptera, two families of Notonectidae: (n = 216, 20.93%) and Corioxidae: (n = 36, 3.48%) were collected.

The most prevalent family, Notonectidae, was collected from the pond B: (n = 69, 6.68%), then from the ponds C, D and A, respectively. The highest number of Corixidae was collected from the pond B: (n = 15, 4.65%), then from the ponds C, D, respectively. Regarding Crustacean, totally the families Copepodidae and Cyclopes: (n = 122, 11.82%) were collected. The highest number was obtained from the pond C: (n = 48, 4.56%), then from the ponds B, D and A; correspondingly. Regarding the order Acarina, the family Hydroacarinidae: (n = 98, 9,49%) was obtained from the pond B (the highest number was found there (n = 45, 4.36%), then from the ponds C, D and A; as well. Concerning the order Coleoptera, the family Hydrophilidae: (n = 8, 0.77%) was found in the pond D: (n-4,0,38%), then from the ponds C and B, respectively.

Regarding the class Arachnoida, the order Aranida (n = 7, 0.67%) was collected, which the highest was found in the pond C: (n = 5, 0.48%), then in the pond B: (n = 2, 0.32%). About the order Hymenopetera, the highest number was obtained from the corner of the pond C: (n=3, 0.29%), then from the ponds A and B, correspondingly regarding the order Odonata, the suborder Anizoptera: (n = 5) was found. The highest number: (n-2,0.19%) was found from the pond B, then from the ponds A, C and D (Table 2).

Table 1: The distribution prevalence rate of aquatic insects dwelling in the maturation pond of Kashan University of Medical Sciences sewage treatment plant based on order

	Place				
Order	Pond A No. (%)	Pond B No. (%)	Pond C No. (%)	Pond D No. (%)	Total (%)
Diptera	66 (6.39)	96 (9.13)	139 (13.46)	233 (22.57)	534 (51.74)
Hemipetera	43 (4.16)	84 (8.13)	70 (6.78)	55 (5.32)	252 (24.41)
Copopodae	18 (1.74)	30 (2.90)	48 (4.65)	26 (2.51)	122 (11.00)
Hydroacarina	6 (0.58)	45 (4.36)	24 (2.32)	23 (2.22)	98 (9.49)
Coleoptera	-	1 (0.09)	3 (0.29)	4 (0.38)	8 (0.77)
Aranida	-	2 (0.19)	5 (0.48)	-	7 (0.67)
Hymenopetera	1 (0.09)	2 (0.19)	3 (0.29)	-	6 (0.58)
Odonata	1 (0.09)	2 (0.19)	1 (0.09)	1 (0.09)	5 (0.48)
Total	135 (13.08)	262 (25.38)	293 (28.39)	342 (33.13)	1032 (100.00)

Table 2: The distributive prevalence rate of aquatic insects dwelling in the maturation pond of Kashan University of Medical Sciences sewage treatment plant based on family

		Place				
Family		Pond A No. (%)	Pond B No. (%)	Pond C No. (%)	Pond D No. (%)	Total (%)
Chironmidae	Larvae	4 (0.38)	10 (0.96)	9 (0.87)	14 (1.35)	37 (3.58)
	Adult	12 (1.16)	13 (1.26)	7 (0.67)	12 (1.16)	44 (4.26)
Culicidae	Larvae	14 (0.62)	84 (8.13)	10 (0.96)	14 (1.32)	45 (4.36)
	Pupa	-	16 (1.55)	22 (2.13)	25 (2.42)	63 (6.10)
	Adult	36 (3.48)	50 (4.84)	91 (8.81)	168 (16.27)	345 (33.43)
Corixidae		-	15 (1.45)	12 (1.16)	9 (0.84)	36 (3.48)
Notonectidae		43 (4.16)	69 (6.68)	58 (5.62)	46 (4.45)	216 (20.93)
Copopodidae		18 (1.74)	30 (2.90)	48 (4.65)	26 (2.51)	122 (11.82)
Hydroacarindae		6 (0.58)	45 (4.36)	24 (2.32)	23 (2. 22)	98 (0.49)
Hydrophilidae		-	1 (0.09)	3 (0.29)	4 (0.38)	8 (0.77)
Aranidae (order)		-	2 (0.19)	5 (0.48)	-	7 (0.67)
Vespidae		1 (0.09)	2 (0.19)	3 (0.29)	-	6 (0.67)
Anizoptera (suborder)		1 (0.09)	2 (0.19)	1 (0.19)	1 (0.09)	5 (0.48)
Total		135 (13.08)	262 (25.38)	293 (28.39)	342 (33.13)	1032 (100.00)

DISCUSSION

Given that maturation ponds are used for sewage treatment in hot climate regions where there are various Species of aquatic insects, these ponds are good places for the growth of aquatic insects. In the current study, the most prevalent collected sample was the larva, pupa and adult mosquitoes of the family Culicidae (43.89%). The adult insects of this family are vectors of some diseases like Dengo fever, yellow fever, malaria, etc, while their larva plays an important role in changing organic material. Zaim (1987) reported two species of Aeds genus in drinking water of Aran and Bidgol (Zaim, 1987). Although these insects are obviously prevalent in Kashan, the sampling site was the maturation pond of the university which it was different from the sampling site in Zaim study (Zaim, 1987). In the present study, the red larva of Chironomidae family was recognized. In studies fulfilled in other countries regarding the species of this insect, the allergic reactions have been indicated. These red larvae have hemoglobin in their blood. They have no significant role in transmitting diseases, but can cause some allergic reaction (Merrit *et al*., 1996). In a study carried out by Dehghani *et al*., they have indicated that these insects are prevalent in Kashan (Dehghani *et al*., 2005) this finding is compatible with out finding in the present study, 24% of Hemipetera belonged to the family Notonectidae and Corexidae which can sting human in the case of sting, it can cause severe pain which sustains for several hours these kind of insects are considered as the mighty predators. The study demonstrates that there is enriched fauna of insects in the maturation pond of the university in Kashan (Dehghani *et al*., 2005). 11.82% of studies samples belonged to the order Copopdade and the Genus of Cyclopes. This arthropod is the intermediate host of *Dracunculus medinensis* parasite, which makes dracunculiasis it seems that this study is more specific and identifying aquatic Anthropoid fauna. The family Vespidae from the order Hymenopetera existed. The species of this family can find their food from the surface of water or the land beside water. If they sting human, it can make inconvenience for human. According to the results obtained, the samples belonging to the order Odanata and suborder Anizopetera were recognized. Titgari (1979) has been the only researcher regarding this oder in Iran so far (Tirgari, 1979). His findings are compatible with ours. The aquatic insects fauna in small rivers and streams and adjacent territories of Kashan more families-rich in comparison with the findings in this study in maturation pond (Dehghani *et al*., 2005). Observations in this study allow some conclusions concerning changes in fauna associated with increasing pollution of maturation pond, it is known that some aquatic insects such as mayfly and stonefly are very sensitive to

pollution; many mayfly and stonefly species are biological indicators of water purity of reservoirs (Zhilyasova, 2000). An impoverishment of the mayfly fauna and disappearance of species resulting from severe pollution of maturation pond with sewage water is not observed.

CONCLUSIONS

Given the hot climate of Kashan and also the enriched ecosystem of maturation ponds regarding aquatic arthropoids, we selected the maturation pond of Kashan university as the efficient ecosystem, which all producers and consumers play their role in changing organic material. With establishing these maturation pond in appropriate, one can irrigate the fields using effluent without any apprehension of contamination; therefore, it can be a cost-efficient method for agriculture.

REFERENCES

Chae, S.J., N. Pusterla, E. Johnson, E. Derock, S.P. Lawler and J.E. Madigan, 2000. Infection of aquatic insects whit trematode metacercariae carrying *Ehrlichia risticii*, the case of potomac house fever. J. Med. Entomol., 37: 619-625.

Dehghani, R., H. Almasi and M.A. Asadi, 2005. Fauna aquatic insect in Kashan. Feyz, Kashan University Medical Sciences and Health Services, 8: 24-29.

De Villiers, P.C., 1987. Simulium dermatitis in man clinical and biological features in south African. Afr. Med. J., 71: 523-525.

Foil, L.D., 1998. Tabanids as vectors of disease agents. Parasitol. Today, 5: 88-96.

Merrit, R.W. and K.W. Commius, 1996. An introduction of the Aquatic insects of North America 3reed "Kendall, Hunt. Dubugue, L.A., pp: 320.

Miranzadeh, M.B., 2004. Waste stabilization ponds. Morsal Publication, Kashan, Iran, pp: 160.

Miranzadeh, M.B., 2005. Removal of pathogenic organisms from the effluent of a activated sludge system using maturation pond. J. Sci., 5: 230.

Nadaffi, K. and R. Nabizadeh, 1996. Waste Stabilization Pond, Feyz Publication, Tehran, Iran, pp: 174.

Tirgari, S., 1979. Distribution, frequency and identification key of Odonata order in Iran. Publication of Iran Entomologists Society, 5: 49-54.

Zaim, M., 1987. The Mosquito Fauna of Kashan Public Health Importance and Control. University of Tehran Publication, Iran Desert Research Center, No: 17, pp: 41.

Zhilyasova, L.A., 2000. Fauna of stonefly (Plecoptrea) of Leningrad province, Entomol. Rev., 8: 635-639.