Research Article

DCSI 07: 117 - 121 (2012)
Received: 08 March, 2012
Revised: 20 April, 2012
Accepted: 10 May, 2012
www.dcsi.in/

Ecological Analysis of Chironomid Larvae (Diptera: Chironomidae) In Harsul Tank, Aurangabad (India)

P. R. Bhosale, R. J. Chavan & A. M. Gaikwad
Department of Zoology,
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India.
(Correspondence: bhosalepr22m@gmail.com)

Abstract:

In present study, chironomid larvae were sampled and studied periodically during one year (from Oct.2009 to Sept.2010) from Harsul tank (19°55’45”N; 75°20’10”E). The quantitative data on distribution of chironomid larvae was analyzed in relation to some physico-chemical parameters at four different localities in the tank. During the study, Chironomidae larvae of 10 different taxa belonging to two subfamilies were found with the density 156 individuals per m^2. Larval diversity was found higher in July (H= 0.84). *Chironomus stigmaterus* was dominant species (28.42%). Larval density showed relationship with nutrient level of water.

Keywords: Chironomids, Harsul dam, distribution, diversity.

Introduction:

The chironomid family (Insecta: Diptera: Chironomidae) commonly referred to as non-biting midges, are frequently the most abundant insect found in freshwater ecosystems. It includes the most diverse group of aquatic insects, including many different feeding groups, habitat references, tolerance levels to different environmental conditions and often makes up about one third of the micro-invertebrate fauna of freshwater stream and rivers (Epler, 2001). Chironomids are the free-living holometabolous insects which have four stages (egg, larva, pupa and adult) in their life cycle. These insects spend the greatest part of their life cycle in larval form, occupying a wide range of habitats compared to other insects.

Chironomids are an extremely important component of the aquatic ecosystem; they are a valuable source of food for freshwater fish, insectivorous birds and other aquatic organisms. They play an important role in the cycling of nutrients through the aquatic ecosystem and they serve as critical nexus between primary producers and secondary consumers.

Chironomids have long been used by limnologists and aquatic ecologists as biotic indicators to classify lakes in terms of trophic status and hypolimnetic oxygen concentration. These are now increasingly being used by paleolimnologists to reconstruct past lake conditions and to access the impact of environmental change and pollution on the structure and function of aquatic communities. (Brooks & Birks, 2003; Rossaro *et al.,* 2006; Maskey, 2007; Nazarova *et al.,* 2008; etc.)

Until now, there is no study which was performed on ecological analysis of larval chironomid composition in Harsul tank. Therefore in this study, both the larval chironomid fauna of tank and the influence of some physico-chemical variables to density and distribution of the larvae were discussed.

Material and Methods:

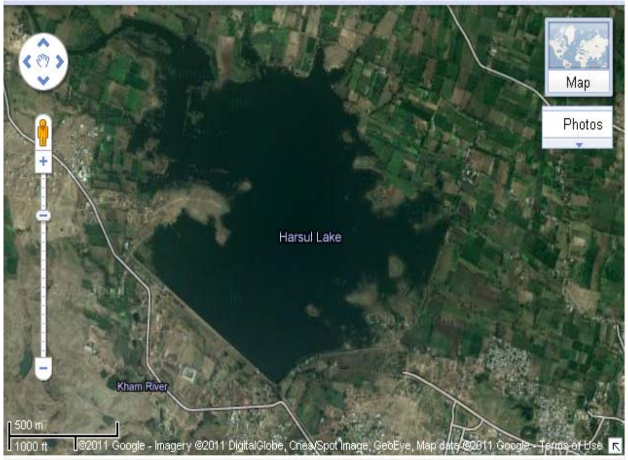
Harsul tank is a small percolation tank, formed due to construction of dam across Kham river which is located at $19^0$55'45"N; $75^0$20'10"E near urban area of Aurangabad city. Four different sites located at same difference apart were studied monthly during one year (Oct. 2009- Sep. 2010). Majority of tank bottom consists of rocks.

Samples were collected twice at each station and Chironomidae larvae were preserved in 70% alcohol and evaluated for per m^2. Slides were prepared for identification by method given by Epler (2001). Larvae were identify at the lowest possible taxonomic level by using keys of Epler (2001), Papp and Darvas (2000), Oliver and Roussel (1983).

All the chemicals used were of AR grade. Analysis was carried out for most water quality influencing 6 Physical and 11 chemical parameters. Out of which 5 (pH, Conductivity, TDS, Turbidity and Salinity) are analyzed with Deluxe Soil and Water analysis kit while remaining are analyzed by methods given in APHA (1997), Trivedi *et al.,* (1995) and Kodarkar (1992).

Analysis of data:

Shannon- Wiener diversity index was applied to obtain statistical data about the distribution of larvae for each month (averaged for all stations) as $H = -\sum(Pi.lnPi)$. Pearson correlation index was used to determine if there was any



relation between the numbers of Chironomidae larvae and the physicochemical composition of water.

Result and discussion:

Between October 2009 and September 2010, an average 156 individuals in per m^2 for 10 different larval Chironomidae species were found in Harsul tank. Two subfamilies; Chironominae and Tanypodinae were found, Chironominae comprises of 8 taxa. Chironominae was the more abundant subfamily than Tanypodinae, which includes *Cladopelma sp., Cryptochironomus sp., Paraleuterborniella sp., Polypedilum sp.*, *Chironomus stigmaterus, Chironomus riparius, Glyptotendipes sp.* and *Kiefferulus sp.* Tanipodinae comprises *Bethbilbeckia sp.* and *Macropelopia sp*. The dominant species was *Chironomus stigmaterus* with 28.42% abundance. It was followed by *Chironomus riparius* (19.76%). Considerable differences for the species and number of Chironomus larvae were observed during each month of year (Table 2).

Minimum larval density was observed during the months Nov., Dec., Jan. and Feb. (i.e. 74, 91, 85 and 91 respectively), while maximum density observed during August (254), Followed by July (228) and June (217). Ozkan and Camur- Elipek (2006), reported that, 'the greatest average number of larvae was observed in summer whereas decrease during winter'. In current study, average density of larvae was less in winter but maximum in mansun followed by summer. Fluctuation in abundance of Chironomidae larvae due to season also reported by Telloglu, *et al.,* (2007).

Results were also supported statistically. Shannon- Wiener diversity index was determined the highest in July (0.84) followed by June (0.80) and August (0.79). Lowest density was found in December (0.60).

Results for physic-chemical parameters are noted in table o. 1. Strong correlation of density was observed with nitrates (r=0.70) and phosphates (r=0.67) followed by temperature (r=0.66), turbidity (r=0.60) and pH (r=0.41). Ozkan & Camur-Elipek (2006) also observed positive correlation of number of larvae with temperature and pH. Warusawithana & Yatigammana (2007) observed Positive correlation between larval density and phosphate and nitrate concentration while negative correlation with temperature and pH. Chironomidae larvae showed considerable seasonal variations abundance which was also noted by Tellioglu, *et al.,* (2007).

References:

APHA (1997): Standard methods for the examination of the water and wastewater 21st Ed. American Public Health Association, Washington D C.

Brooks, S. J. and Birks, H. J. B. (2004): The dynamics of Chironomidae (Insecta: Diptera) assemblages in response to environmental change during the past 700 years on Svalbard. Journal of Paleolimnology **31**: 483-498.

Epler, J. H. (2001): Identification manual for the larval Chironomidae of North and South Carolina. (http://www.esb.enr.state.nc.us/ BAUwww/ Chironomid.htm)

Kodarkar, M. S. (1992): Methodology for water analysis. *Indian Association of Aquatic Biologists*, Publication No.2.

Maskey, A. E. (2007): The Chironomidae (Insecta: Diptera) of Lake Superior: Ecology, Natural history, and Distribution in the nearshore waters of the south central coast. A thesis submitted to Northern Michigan University.

Nazarova, L., Pestryakova, L., Ushnitskaya, L. and Hubberten, H. (2008): Chironomids (Diptera: Chironomidae) in lakes of central Yakutia and their indicative potential for paleoclimatic research. Contemporary Problems of Ecology, Vol. 1, No. 3, pp. 335-345.

Oliver, D. R. and Roussel, M. E. (1983): The Insects and Arachnids of Canada Part 11. *Biosystematics Research Institute Ottawa, Ontario, Research Branch Agriculture Canada.*

Ozkan, N. and Camur-Elipek, B. (2006): The dynamics of Chironomidae larvae (Diptera) and the water quality in Meric River (Edirne/Turkey). *TISCIA* 35, 49-54.

Ozkan, N., Moubayed-Breil, J. and Camur-Elipek, B. (2010): Ecological Analysis of Chironomid Larvae (Diptera, Chironomidae) in Ergene River Basin (Turkish Thrace). *Turkish Journal of Fisheries and Aquatic Sciences* 10: 93-99.

Papp, L. and Darvas, B. (2000): Manual of Palaearctic Diptera. *Science Herald, Budapest Publication.*

Rossaro, B., Lencivoni V., Boggero A. and Marziali L. (2006): Chironomids from southern Alpine running waters: Ecology, Biogiography. *Hydrobiologia*, 562: 231-246.

Tellioglu, Ayda, Citil, Cihan and Sahin, Ibrahim (2008): Distribution of Chironomidae (Diptera) larvae in Hazar Lake, Turkey. *Journal of Applied Biological Sciences* 2 (1): 77-80.

Trivedy, R. K., Goel, P. K. and Trisal, C. L. (1995): Practical methods in Ecology Environmental Science. *Environmental Publicatons*, Karad.

Warusawithana, L. and Yatigmmana, S. K. (2007): Species composition of the family Chironomidae and their relationship to Limnological Variables in Kandy Lake. *Proceedings of the Peradeniya University Research Sessions, Sri Lanka*, Vol. 12, Part I.

Table 1: Range of different Physico-Chemical parameters for each month in Harsul tank (Oct.2009- Sep.2010).

Parameters / Months	Oct	Nov	Dec	Jan	Feb	Mar	Aprl	May	June	July	Aug	Sept
WT(ºC)	25	24	22	20	18	26	26	27	26	25	25	26
pH	7.75	7.24	8.02	8.96	8.3	7	8.5	8.5	8.98	9.02	8.15	8
Conductivity (µS/cm)	490	500	500	280	390	400	600	750	700	500	550	800
TDS (ppm)	280	250	370	260	280	300	270	270	240	200	170	360
Turbidity (NTU)	4	3	2	4	4	5	4	3	5	4	7	6
Salinity (ppm)	300	300	400	300	400	300	300	400	300	200	200	300
Dissolved O2 (mg/l)	9.89	7.27	8.89	11.12	11.52	11.53	7.68	8.89	5.66	6.87	8.37	10.19
Free CO2 (mg/l)	13.6	13.2	12	39.6	17.6	26.4	13.2	17.6	0	8.8	4.4	17.6
PHTH Alkalinity (mg/l)	0	0	0	0	0	0	0	0	30	0	0	0
Total Alkalinity (mg/l)	240	290	300	260	310	300	280	290	190	180	210	230
Phosphates (mg/l)	0.02	0.04	0.04	0.05	0.02	0.08	0.06	0.05	0.08	0.1	0.05	0.03
Nitrates (mg/l)	0.04	0.06	0.08	0.08	0.05	0.09	0.12	0.07	0.15	0.11	0.1	0.06
Hardness (mg/l)	136	180	196	154	172	170	174	140	164	124	146	182
Calcium (mg/l)	33.66	30.56	40.88	33.66	34.47	38.48	33.67	30.46	30.46	24.05	36.07	41.68
Magnesium (mg/l)	16.82	10.64	24.36	17.06	20.95	16.82	22.42	8.77	21.44	15.59	13.64	19
Chlorides (mg/l)	30.14	28.4	29.08	29.82	31.24	29.82	22.72	28.4	28.4	18.46	20.2	20.2
BOD (mg/l)	2.84	4.28	3.31	1.21	2.82	6.47	1.62	5.28	3.24	2.83	4.31	4.45

Table 2: Numerical Distribution of Chironomidae larvae in Harsul tank (Oct. 2009- Sep. 2010).

Species / Months	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ave	%
Chironominae														
Ch. riparius	15	_	19	11	15	45	45	51	42	46	53	28	30.8	19.76
Ch. stigmaterus	37	22	27	20	18	48	56	48	62	65	74	55	44.3	28.42
Cladopelma sp.	7	_	_	_	_	_	_	12	_	_	_	10	2.4	1.55
Cryptochironomus sp.	_	10	26	8	24	27	26	33	28	29	37	23	22.6	14.48
Glyptotendipes sp.	_	_	_	_	_	_	_	_	20	16		_	3.0	1.92
Kiefferulus sp.	_	13	_	11	6	20	16	_	16	15	21	_	9.8	6.30
Paraleuterborniella sp.	21	8	_	_	_	22	_	16	24	21	18	13	11.9	7.64
Polypedilum sp.	_	_	_	_	_	_	_	_	_	13	19	_	2.7	1.71
Tanypodinae														
Bethbilbeckia sp.	16	_	19	17	12	26	25	18	25	23	32	19	19.3	12.39
Macropelopia sp.	25	21	_	18	16	_	31	_	_	_	_	_	9.3	5.93
Total	121	74	91	85	91	188	199	178	217	228	254	148	156.2	
SWI	0.73	0.67	0.6	0.76	0.75	0.75	0.74	0.72	0.8	0.84	0.79	0.71		
Number of taxa	6	5	4	6	6	6	6	6	7	8	7	6		