# SUMMARY

In the present study, the aquachemistry of one lotic and three lentic water bodies was investigated. As part of this I also examined density and diversity of rotifer species. The physico-chemical parameters of water such as temperature, pH, dissolved oxygen, TDS, electrical conductivity, total hardness, transparency and turbidity were evaluated. Correlation between rotifers and these parameters was also investigated.

Sampling was done on monthly basis between 9.0 A.M. to 1.0 P.M. from October 2011 to September 2012. For rotifer collection from lotic water, 50 litre of water was passed through standard plankton net of 37 µm mesh size by towing the net horizontally for 2 to 3 minutes from a depth of 15-25 cm. From lentic water, 40 litre of water was collected in a plastic bucket and this water was passed through a sieve of 341 µm mesh size. Filtered water was filtered again through a sieve having 37µm mesh size. The contents of the sieve were washed in a small plastic tub. Rotifers were preserved in 4% formaldehyde solution in 50 ml plastic bottles.

Rotifer species were counted in a Sedgewick-Rafter chamber at 60-100 x magnification by inverted OLYMPUS microscope. The body shape, morphological features and behaviour of the rotifers were observed for identification by using the keys of Hyman, 1951; Ward and Whipple, 1959; Pennak, 1978; Segers, 2007.

In the present work, 115 rotifer species belonging to 27 genera and 15 families have been collected and identified from lentic and lotic waters. This is the largest number of rotifer species collected in Pakistan. Among 15 families, the maximum of 7 genera belonged to the family Brachionidae and followed by Notommatidae with 3 genara. *Brachionus, Lepadella, Lecane* and *Trichocerca* were the most diverse genera that found throughout the study period.

Analysis of variance of lentic and lotic waters showed that water temperature, dissolved oxygen, TDS, electrical conductivity, total hardness, transparency and turbidity statistically significant, while pH was non-significant.

Lentic and lotic waters showed similar trends with respect to impact of water parameters on population density and diversity of rotifers. Rotifers reflected positive correlation with temperature, pH, electrical conductivity, total dissolved solids, total hardness and turbidity, while negative correlation with dissolved oxygen and transparency.

From lotic water (Nandipur Canal), 28 rotifer species of 10 families and 14 genera were identified. The highest (42.3±13 ind/ml) mean population density was in June and lowest (12±5 ind/ml) in January. The most dominant species was *Brachionus calyciflorus* with 23.6±6.1 ind/ml mean density. *Lecane ungulata* had lowest (2.0±0.5 ind/ml) population density, found only in January and May. Rotifer diversity showed increasing trend from spring to summer being the the highest (23 species) in June and the lowest (12 species) in January.

In study area 1, 59 rotifer species were present, belonging to 20 genera and 11 families. The highest (127±34 ind/ml) mean population density was in June and lowest (59.3±20 ind/ml) in January. *Brachionus calyciflorus* showed highest density (49.7±13.9 ind/ml), found throughout the study period. The lowest (5.3±1.8 ind/ml) population density was of *Anuraeopsis fissa* and found only in four months. Population density of rotifers was seen rising in summer and decreasing in winter. Diversity of rotifer species was maximum (48 species) in September and October and minimum (25 species) in January.

In total 74 rotifer species were identified belonging to 14 families and 24 genera from study area 2. Month of June reflected the highest (128.7±40.ind/ml) mean population density and lowest density (64.9±22 ind/ml) in January. *Brachionus havanaensis* was the dominant species with 40±11.9 ind/ml mean population density, whereas *Philodina roseola* with lowest population density (3±1.2 ind/ml). June reflected the highest diversity (52 species) and lowest diversity (26 species) in January.

Study area 3, revealed 45 rotifer species, belonging to 10 families and 12 genera. The mean population density of rotifers, extended from 97±26 ind/ml to 45.6±8 ind/ml being the highest in June and lowest in January. *Brachionus havanaensis* showed the

highest (43.7±8.9 ind/ml) mean population density. *Trichocerca porcellus* showed lowest (3.6±1.1 ind/ml) mean population density and represented in June, July, August and September. Diversity of rotifer species was highest (38 species) in three months (August, September and October) and lowest (20 species) in January.

In this study, inverse relationship with increasing temperature was seen in four genera: *Lecane, Lepadella, Notholca,* and *Testudinella*. Their density and diversity increased in colder months and decreased in hot months.

In lotic water (Nandipur canal), the mean value of species richness was highest in June and lowest in January. In lentic water, study area 1 and 3, reflected highest species richness in October and lowest in January. In study area 2, value of richness was noted highest in March and lowest in January. Values of species evenness indicated even distribution of rotifer species.

PCA of rotifer species indicated high abundance in summer months as compared to winter in lentic and lotic waters. In lotic water, species present on the right side of the graph were positively correlated with the April to August and October but negatively correlated with the months of January to March, September and November to December on the left side of the graph. *Brachionus angularis, B. quadridentatus, B. calyciflorus, C. forficula* and *Euchlanis lyra* were positively correlated with the month of June. *Polyarthra vulgaris, Platyias quadricornis, Euchlanis dilatata, B. bidentatus, Rotaria rotatoria, Filinia longiseta* and *Colurella uncinata* were highly positively correlated with July and August. *L. patella* was strongly correlated with May. On left side of the graph, *Notholca acuminata* was highly positively correlated with March. *Lecane ungulata* and *L. curvicornis* were strongly positively correlated with September and December.

In lentic water study area 1, rotifer species *K. valga, Filinia longiseta* and *B. diversicornis* were highly positively correlated with July and *C. gibba, P. vulgaris* and *K. tropica* were positively correlated with June. *B. forficula, T. similis, B. falcatus* and *F. terminalis* were positively correlated with May. On left side of the graph *Testudinella tridentata* was positively correlated with March. *L. bulla, L. ungulata, L. inermis, L. luna* and *N. acuminata* were positively correlated with February and January.

In study area 2, *B. havanaensis, F. opoliensis, K. valga, T. capucina, B. angularis* and *P. dolichoptera* were positively correlated with June. *B. forficula, P. vulgaris, B. budapestiensis* and *Notommata copeus* were associated with May and July. *D. forcipatus, N. aurita* were positively correlated with August. On the left side of the graph, *T. longiseta* and *T. emarginula* were positively correlated with November. *L. ungulata, N. labis* and *N. striata* were positively correlated with February.

Rotifers of the study area 3 were positively correlated with the months of April, May, June, July, August, September and October on right side of the graph. These species were negatively correlated with the months of December, January, February, March and November on the left side of the graph. *Filinia passa* and *F. cornuta* were positively correlated with June on right side. *B. quadridentatus, B. dichotomus* and *C. gibba* were highly positively correlated with July on left side.

Hierarchical cluster analysis was performed between rotifer species on the basis of their density. 28 rotifer species of lotic water showed six clusters at eucladian distance 3. In lentic water, study area 1 exhibited eight clusters of 59 rotifer species and study area 2 was represented by 74 rotifer species which reflected eleven clusters at eucladian distance 2. Nine clusters were formed of 45 species at eucladian distance 3, study area 3.

CCA exposed that most of the rotifer species showed their excess in summer months during high temperature, pH, total hardness and electrical conductivity as compared to the winter when there were low oxygen and visibility. During summer when temperature was maximum, decomposition of organic matter was on its peak, providing the plenty of food, so number of rotifers increased. During winter as quantity of food decreased, number of rotifers also decreased.

Average abundance of rotifers in lotic water was very low as compared to lentic water. In lotic water low food availability as a result of low primary productivity was the reason of their decreased population. Lentic water provided the suitable environment for the growth and reproduction of rotifers because of better light penetration and warmer water. Temperature and availability of food were the most important elements for trolling abundance of rotifers.