Peculiarities of Rotifer Fauna in Lake Hawassa, Ethiopia

Dr. B. Sai Ram Pattnaik
Associate Professor, Department of Biology, College of Natural and Computational Sciences, Wolaita Sodo University, Ethiopia

Abstract: Among the water bodies in Ethiopia, the Lake Hawasa is one of the many freshwater shallow lakes found in the central Ethiopian Rift Valley. The extended littoral vicinity of the Lake was rich of several benthonic and pelagic zooplanktons such as Protozoans, Rotifers, Crustaceans, and several weed bed fauna like annelids, insects as well as fishes.

Rotifers, among all the zooplanktons found abundantly and scattered widely in the lake. The abundance was not only in species but also in population. About eighteen forms of rotifers were recorded in the lake belonging to several orders.

Present study is an attempt to understand their distribution, ecology, diversity and systematic study in this aquatic ecosystem. It was indeed a maiden attempt to bring out first hand information by this visiting investigator for a small period of time paving way for more significant studies to be done in future.

Key words: Brachionus, Keratella, Lake Hawassa, Rotifers, Zooplanktons,

I. Introduction

The Ethiopian rift valley also known as the Afro-Arabian rift valley having the volcano-tectonic basins created long back as a result of faulting later modulated in to lakes. Several fresh water lakes found embedded in this basin, among which Lake Hawasa is a prominent fresh water lake located at a highest topographic position.

II. Area of Investigation

Hawassa Lake is situated 275 km away from the capital city Addis Ababa of Ethiopia towards the south near the city Hawassa that lies in between 6° 33' - 7° 33' N and 38° 22' - 38° 29' E. The Lake stretches 16km from the north east to south west direction and extends 8 km from north-west to south east direction having an approximate water volume 1.3 billion meter cube (45.9 billion ft3). The maximum depth of the Lake is 21.6m (70.9 feet) with mean depth however is 11m (Elias Dadebo, 2000, EFASA-2013).

III. Sampling

Water samples for plankton analysis were collected between November, 2013 to March 2014 by dipping wide plankton net of mesh size of 45 microns just below the surface of water in open condition. Part of the sample was treated with 5-10% formaldehyde for future observations and another part was treated with boiled water and then fixed in formalin. Hot water treatment gives satisfactory results as well as can fix the organism in its natural position which no other relaxing agent can do (Edmondson, 1959). For the observation of Mastax and Trophi specimens were treated with KOH (or also Sodium hypochlorite) and mounted in glycerin. A mild centrifugation of preserved water sample either cool or gentle hot can also bring good result.

For quantitative analysis, of plankton a sub-sample of one ml. was quickly drawn with a wide mouthed pipette resembling that of a stempel pipette and poured into a counting cell similar to that of Sedgwick rafter cell of one ml. capacity and all the organisms of the aliquot were counted. However, when there was a bloom, counting was done only in selected squares in random from which total numbers per liter of water could be calculated. All the body calculations were made by using Occulometer taken in microns and graphics were made using Camera lucida. The classification and the identification of Rotifera was done as given by Edmondson (1959) and that of Koste (1978).

Rotifer species of the Lake
Following rotifer species were obtained from various locations of the lake. They belong to different types of orders and genus.

1. Brachionus calyciflorus
2. B. caudatus
3. B. fulcatus
4. B. bidentata
5. B. quadridentata
6. Keratella cochlearis
7. K. tropica
8. K. valga
9. Lecane luna
10. Lecane papuna
11. Cephalodella gibba
12. Asplanchna seiboldii
IV. Description of species

**Brachionus calyciflorus**
This species was an exceedingly variable species especially in its true size, length of the occipital spines and the location of postero-lateral spines. There are several forms of this species scattered in the lake and observed throughout the research period.

**Measurements:**
- Total length: 218;
- Length of lorica: 96;
- Maximum breadth: 87;
- Breadth of anterior margin: 41;
- Posterior spines: 45.

**Brachionus caudatus Barrois and Daday**
The species was having distinct Lorica having four anterior projections, two dorsal and two marginal of almost equal size in length. The posterior spines were long and slightly curved inwards to inner side.

**Measurements:**
- Total length: 230;
- Length of lorica: 119;
- Maximum breadth: 87;
- Breadth of anterior margin: 59;
- Posterior spines: left: 38, right: 40

**Brachionus falcatus**
Six unequal anterior projections were present, the marginal of which were slightly longer than the medians while the intermediate projections were very long and curved ventrally at their distal ends.

**Measurements:**
- Total length: 240;
- Intermediate spines: 47;
- Posterior spines: 95;
- Maximum Breadth: 85;
- Length lorica: 100;

**Brachionus bidentata**
The Lorica was ornamented with well developed dorsal, ventral and basal plates. Six Occipital spines were present of which the marginals and intermediates were of equal length. The posterior spines were very small.

**Measurements:**
- Total length: 108;
- Anterior spine: 15;
- Breadth of anterior margin: 47;
- Maximum spine: 58;

**B. quadridentata**
The Lorica was abit broader than length and stippled. Six anterior spines, two marginal, two median and two intermediate were observed. Median spines were comparatively longer than the others. Two small posterior spines were present.

**Measurements:**
- Total length: 189;
- Maximumbreadth:138;
- Posterior spine: 26;
- Anterior laterals: 16;
- Anterior margins: 56;
- Median spines: 20

**Keratella cochlearis (Gosse)**
The lake was well distributed with these species. The Lorica contains symmetrically arranged plaques on either side of a median longitudinal line and a stout median posterior spine of variable length, were the important identifying characters.

**Measurements:**
- Total length: 141;
- Breadth of anterior margin: 28;
- Maximum breadth: 43;
- Length of lorica: 51;
- Posterior spine: 28.
Keratella tropica (Apstein)

Presence of three hexagonal plaques on the dorsal plate and a small four sided one between the posterior border of lori and a hexagon at last were the important characters to identify this species.

**Measurements:**
- Total length: 188;
- Length of lori: 79;
- Maximum breadth: 32;
- Anterior margin: 41;
- Posterior margin: left 29, right 58.

K. valga

On the dorsal plate of the lori, three median plaques were present. The posterior one is pentagonal terminating in a short median line. The species was not frequent but occurs with every new spell of rain.

**Measurements:**
- Total length: 88;
- Length of lori: 56;
- Maximum breadth: 31;
- Occipital margin: 14;
- Posterior margin: 18;
- Anterior median spines: 10;

Lecane luna (Muller)

More abundant in the Lake. Loria nearly round. Dorsal and ventral plates were having crescent shaped. Ventral plate was narrower than the dorsal with a transverse fold in front of the foot. First foot joint was indistinct; the second was large and sub square. Toes parallel sided with a distinct claw and small basal spicule.

**Measurements:**
- Total length: 115;
- Length of lori: 76;
- Maximum breadth: 69;
- Caudal median spines: 11;

Lecane papuna

The species was also found in the month of December and January especially during winter months. Presence of median spine and well shaped loria was the identifying features of the species.

**Measurements:**
- Total length: 103;
- Length of lori: 67;
- Maximum breadth: 75;
- Median spines: 11;

Cephalodella gibba Ehrenberg

Body was slender and compressed with loria fairly flexible and weakly developed. Foot was prominent, toes long, stout at the base and gradually taper into acute points.

**Measurements:**
- Total length: 129;
- Toes: 34;
- Breadth: 31;
- Foot: 20;

Asplanchna sieboldii

Body spherical, soft and elongated. The length and breadth was nearly equal. Horse-shoe shaped vitellarium with 28 nuclei. Trophy was incudate with transparent mastax.

**Measurements:**
- Total length: 540;
- Maximum breadth: 311.

Asplanchna intermedia (Hudson)

The species was similar to A. intermedia having enlarged, transparent, thin and sacciform body. Trophy was incudate with rami possessing horn like projections at four margins of the base. Well developed digestive system and germo-vitellarium with 36 nuclei.

**Measurements:**
- Length of body: 850;
- Breadth: 399;
Polyarthra sp.
Only species with lateral antennae lying well anterior to the posterior corners of the body. Eight nuclei were present in the vitellarium. The species observed similar to that of Polyarthra vulgaris.

Measurements:
- Length of body: 98;
- Length of paddles: 61;

Filinia longiseta Ehrenberg
The species was found to be with long spines. The Mastax was malleo-ramate. There was a circum apical ring of cilia near the stomodium. Trochal discs also bear cilia which are longer than those at the circumapical ring. The lateral spines were prominent.

Measurements:
- Body length: 119;
- Maximum body breadth: 54;
- Length of each lateral spine: 163;

Filinia sp.
The present specimen was identified as *F.pejleri* based on the diagnosis given by Hutchinson (1964).

Measurements:
- Length of body: 69;
- maximum breadth: 23;
- Length of lateral spines: 115, 119;
- length of terminal spines: 101;

Testudinella sp.
Lorica appeared circular in dorsal view. Retractile annulated foot ends in a ciliated cup shaped structure that opened on the ventral side in middle of lower half of the body. The species was similar to Testudinella patina (Hermann).

Measurements:
- Length of lorica: 131;
- Maximum breadth: 99;

Trichocera elongate
Body was long twisted, helical and asymmetric. Toes were unequal. One of the toes was longer similar to the body.

Measurements:
- Length of lorica: 106;
- Maximum breadth: 65.

V. Ecological Peculiarities

Morphological changes
During present investigation some rotifers like *B. calyciflorus* and *B. caudatus* were studied extensibly for seasonal morphological changes. The maximum size of the lorica was observed for both the species of *Brachionus* during the period of high temperature. With the decrease in the temperature, there was a corresponding decrease in the length of the lorica and increase in the length of postero-lateral spines. *B.calyciflorus* was typical for its polymorphic forms and specialized spiny outgrowths. It was felt that the deposition of municipal garbage, domestic sewage, Industrial dumping and biological factors such as presence of predators and rich phytoplankton growth in the lake may responsible for such growth. Herbivorous rotifers ate particles less than 10 µ, with large rotifers taking large particles. *Asplanchana* a predaceous rotifer used to eat particles between 50 to 250µ long having more liking to eat non-spined *Brachious* sp. than spined ones of the same population.

The length of spine in *Brachionus, Keratella* was not only depending upon the length of lorica but also the composition of crustacean and copepod zoo-planktons (Pattnaik, 2014). After a fresh spell of rain, the production and population of phytoplankton goes on increasing resulting in a change of food habits in predators. The malleate or malleo-ramate mastex of herbivores rotifers such as *Brachionus* and *Keratella* was specialized to capture such nano planktons, while the inculcate trophy of *Asplanchana* are specialized for capturing small rotifers. This suggests that prey of the right size but wrong shape is never accepted in predation. Hence, a spine or any such thing at the right place at right time makes the prey unsuitable to its predator (Dodson 1974).
Indicators of trophic nature

Species of the genus *Brachionus* are sensitive to changes in the water quality. Consequently their use as standard bioassay organisms had been universally recognized (APHA, 1998). Species belonging to *Brachionus, Filinia, Polyarthra* and *Testudinela* withstand heavy concentration of chemicals. In the present investigation it was clearly understood that bioassay along with the chemical analysis was also essential to determine the actual nature of water to discriminate the quality of water. *Filinia* especially when present indicates a lot of municipal deposition in water. Hence, it should also be used along with *Brachionus* in analysis related to ecological bioassay.

Dormancy

Dormancy is a pattern or phenomenon, a type of adaptation to escape from some adverse situation or rather a style of safeguarding its own race from extinction exhibited by several species to overcome and withstand certain environmental conditions for brief period.

During the present investigation period it was found that several species were observed in specific conditions only. The species belonging to *B. calyciflorus, Keratella, Lecane, Asplanchna* and *K. pejleri* were found to show some sort of dormancy in fresh water ponds of India, exhibited the same pattern in the present lake. The difference only was in the number and size of the species as well as the population. The presences of mictic eggs or resting eggs which undergo parthenogenesis in certain rotifers, for most of them remain virgin due to lack of a male partner were characteristics of rotifers which carry these eggs for most of the seasons in a year. Most monogonont rotifers are short-lived and complete their life cycle in 8-14 days, on average, at 22°C (Pattnaik, 2010).

Seasonal dynamics

The abundance of zooplanktons has a direct relation with the hydrography, physico-chemico factors and availability of phytoplanktons. Rotifers too no exception to this principle. Biotic factors such as quality and quantity of food, interference competition, predation and ecological conditions induce rotifer communities favoring one species over another. They are more susceptible to the environmental changes due to their small size and permeable integument. The temperature and pH tend to be positively related to species diversity while conductivity and salinity tend to be negatively related. Most of the planktonic rotifers appeared to have potentiall conductivity and salinity favoring one species over another. They are more susceptible to the environmental changes due to their small size and availability of phytoplanktons. Rotifers *h*as been universally recognized (APHA, 1998).

References


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