



Observations on taxonomy, percentage composition, density and seasonal variations of rotifers of the genus *Lecane* in a pond ecosystem of Tripura, India

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Abstract

The observation recorded the presence of 7 species of rotifers of the genus *Lecane* viz., *Lecane luna*, *Lecane ungulata*, *Lecane quadridentata*, *Lecane curvicornis*, *Lecane (Monostyla) bulla*, *Lecane (Monostyla) lunaris* and *Lecane (Monostyla) closterocerca* in the studied pond ecosystem of Tripura, India. The detailed taxonomical characteristics of different species of the genus *Lecane* were observed. The density of different rotifer species of the genus *Lecane* in the studied pond ecosystem was observed. The percentage composition of different species under the genus *Lecane* was also recorded. Seasonal variation of the different species showed highest density in the summer season and lowest density in the winter season. The study infers that different species of *Lecane* although prefer different environmental requirements, co-exist successfully in the same pond and dynamic nature of the lentic ecosystem as well as the impact of competitive interactions may be expected to influence the seasonal variation of *Lecane* population. The study also infers that although the different species of the genus *Lecane* were reported earlier from different states of India and abroad, the present observation also confirms its nature of cosmopolitan distribution.

Keywords: Rotifer, *Lecane*, Taxonomy, Percentage Composition, Density, Seasonal Variations

Introduction

Amongst the different generic groups of rotifers, the genus *Lecane* has been recognized the most diversified in Southeast Asia (Segers, 1995), Mexico (Nandini et al., 2005; Sharma and Sharma, 2014), Guatemala, Belize (Garcia-Morales and Elias-Gutierrez, 2007), and Brazil (Garraffoni and Lourenco, 2012), as well as in other countries of the globe. The genus, *Lecane*

with about 200 species, is considered among the most species-rich monogononts (Segers, 2008). The key taxonomic characteristics of lecanids are the shape of the lorica, the contour of the anterior margin of the lorica, and the shape of the foot and toes (Arora, 1965; Koste and Shiel, 1990; Baribwegure and Segers, 2000; Wei and Xu, 2010). The availability of food sources, as well as

biotic relationships such as competition or predation also affects the rotifer species composition (Nogrady et al., 1993). The genus *Lecane* is characteristic of littoral environments, inhabiting the zones of nymphaeids, submerged macrophytes as well as helophytes (Pejler, 1995; Pholpunthin and Chittapun, 1998). Seasonal variations of rotifers is due to complex interactions of various physical, chemical, biological and ecological parameters and all these factors play an individual role in the formation of rotifer assemblages (Hulyal and Kalwal, 2008; Chakrabarti, 2021). Rotifers are r-strategist organisms which are adapted to fast population growth in the favourable season and whose densities change with temperature in a short span of time (Galkovskaya, 1987). The different species of the genus *Lecane* do not competed among themselves as they shared exploitation of the food resources in a particular trophic niche or in their common occurrence in space and time (Kuczy ska-Kippen, 2007). Pond ecosystem play very significant role in ecological investigations as they harbour abundant faunal resources of natural, local and regional significance and diversity of zooplankton are quite high in fertile standing water like pond (Chakrabarti, 2013). In Tripura, no in-depth studies were made on taxonomy, species composition, density and seasonal variations of rotifers of the *Lecane* in lentic ecosystem till date. In the present observation, an attempt was undertaken to observe the taxonomy, percentage composition, density and seasonal variations of rotifers of the genus *Lecane* in a pond ecosystem of Tripura, India.

Materials and Methods

Study area

The present observation was carried out in a freshwater pond located at Dashamighat area, Ramnagar, Agartala, Tripura, India during a period from March 2020 to February, 2022. The studied pond lies geographically at the Latitude 23° 50' 9.78" N and Longitude 91° 16' 45.80" E. The studied pond is perennial and rectangular shaped. The surface area of the pond is about

1.8 ha. The mean depth of the water column of the pond fluctuates from 1.0 m during summer to 2.2 m in the monsoon. The littoral zone of the studied pond harbours some macrophytes such as *Eichhornia crassipes* and *Typha*.

Estimation and Identification of Lecanid rotifers

Lecanid rotifer samples were collected using plankton net made of bolting silk cloth no.25 (mesh size 55 microns) from the littoral zones of the studied pond at weekly intervals. The collected samples were immediately transferred unaltered to the laboratory for further examination. Identification of loricate lecanid rotifers was carried out by observing the lorica morphology of contracted rotifer specimens using the collected sample fixed and preserved in 4 per cent formaldehyde. Enumeration is being done quantitatively in the laboratory through Sedgewick Rafter Plankton Counting Cell (Biocraft, model - BSW 15) and results were expressed as ind/lit. Identification up to species level of the genus *Lecane* was done following keys of Pennak(1978), Battish (1992), Edmondson(1992) and Segers(1995). The image capture of live and preserved rotifer samples were done using Trinocular compound microscope (Model-MLX TR) having an inbuilt 5.0 megapixel camera. Camera lucida drawings also have been done in order to get a clear concept of body structure of different species of *Lecane*.

Results and Discussion

In the present observations, 7 species of rotifers of the genus *Lecane* have been recorded in the pond ecosystem of Tripura, India. The species recorded were *Lecane luna*, *Lecane unguolata*, *Lecane quadridentata*, *Lecane curvicornis*, *Lecane (Monostyla) bulla*, *Lecane (Monostyla) lunaris* and *Lecane (Monostyla) closterocerca*.

Lecane luna Muller, 1776

Lorica flexible; the anterior margin does not have a deep, lunate sinus; the dorsal and ventral plates of the same width; the end of toes has a slight swelling (Fig.1a, 2a).

Measurements:

Length of dorsal plate 124 μ ; Length of ventral plate 132 μ ; Width of dorsal plate 112 μ ; Width of ventral plate 112 μ ; Width of anterior end 73 μ ; Foot 18 μ ; Toe 41 μ ; Claw 8 μ .

Lecane unguolata Gosse, 1887

Lorica ovoid; dorsal plate is without any surface markings; ventral plate with irregular transverse folds; dorsal plate is wider than the ventral plate in the middle portion; toes straight, parallel-sided, toes ending in a stout, long pointed claw (Fig.1b, 2b).

Measurements:

Length of dorsal plate 215 μ ; Length of ventral plate 264 μ ; Width of dorsal plate 160 μ ; Width of ventral plate 180 μ ; Toes 80 μ ; Claws 40 μ .

Lecane quadridentata Ehrenberg, 1832

Dorsal plate has a deep sinus at the anterior end flanked by two stout slightly out curved spines; V-shaped sinus on ventral plate; toe long; toe terminating in a long acutely pointed claw (Fig.1c, 2c).

Measurements:

Length of dorsal plate 99 μ ; Length of ventral plate 123 μ ; Width of dorsal plate 71 μ ; Width of ventral plate 75 μ ; Width of anterior end 45 μ ; Foot 18 μ ; Toe 45 μ ; Claw 21 μ .

Lecane curvicornis Murray, 1913

Lorica pyriform; anterior margins coincident with broad v-shaped sinus; two large prominent spines at the external angles; dorsal plate projecting beyond the ventral plate at the postero-lateral angles; toes long, parallel-sided, terminating in a short claw (Fig.1d, 2d).

Measurements:

Length of dorsal plate 111 μ ; Length of ventral plate 117 μ ; Width of dorsal plate 89 μ ; Width of

ventral plate 96 μ ; Width of anterior end 66 μ ; Foot 15 μ ; Toe 54 μ ; Claw 9 μ .

Lecane (Monostyla) bulla Gosse, 1851

Lorica firm; width of the lorica is about three fifths of its length; dorsal margin with a shallow anterior sinus; a large median notch on anterior sinus; long slender toe (Fig.1e, 2e).

Measurements:

Length of dorsal plate 92 μ ; Length of ventral plate 97 μ ; Width of dorsal plate 60 μ ; Width of ventral plate 60 μ ; Width of anterior end 51 μ ; Foot 12 μ ; Toe 42 μ ; Claw 18 μ

Lecane (Monostyla) lunaris Ehrenberg, 1832

Lorica broadly ovoid; narrow dorsal plate on anterior margin with a v-shaped sinus; wide ventral margin with deep sinus on it; very long toe, almost half of its total length (Fig.1f, 2f).

Measurements:

Length of dorsal plate 129 μ ; Length of ventral plate 144 μ ; Width of dorsal plate 99 μ ; Width of ventral plate 93 μ ; Width of anterior end 60 μ ; Foot 15 μ ; Toe 54 μ ; Claw 15 μ .

Lecane (Monostyla) closterocerca Schmarda, 1853

Lorica subcircular; anterior margins forming a shallow, broadly v-shaped sinus; toe long, tapering to a slender acute point (Fig.1g, 2g).

Measurements:

Length of dorsal plate 72 μ ; Length of ventral plate 79 μ ; Width of dorsal plate 69 μ ; Width of ventral plate 62 μ ; Width of anterior end 41 μ ; Toe 33 μ .

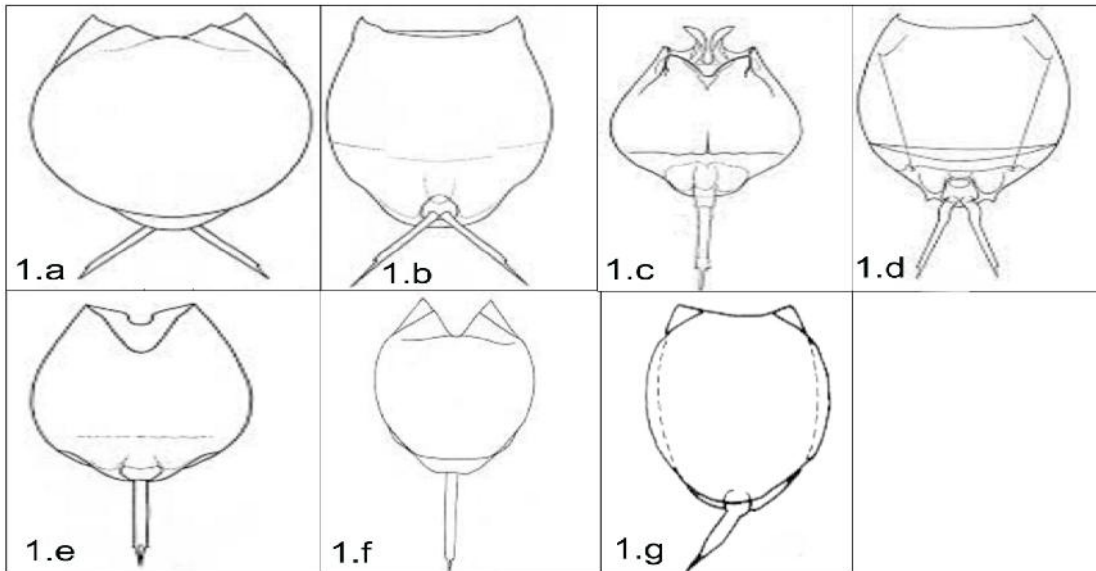


Figure 1. Camera Lucida drawings of different *Lecane* species in the studied pond of Tripura.
 1a. *Lecane luna*; 1b *Lecane ungulata*; 1c. *Lecane quadridentata*; 1d. *Lecane curvicornis*; 1e. *Lecane (Monostyla) bulla*; 1f. *Lecane (Monostyla) lunaris*; 1g. *Lecane (Monostyla) closterocerca*

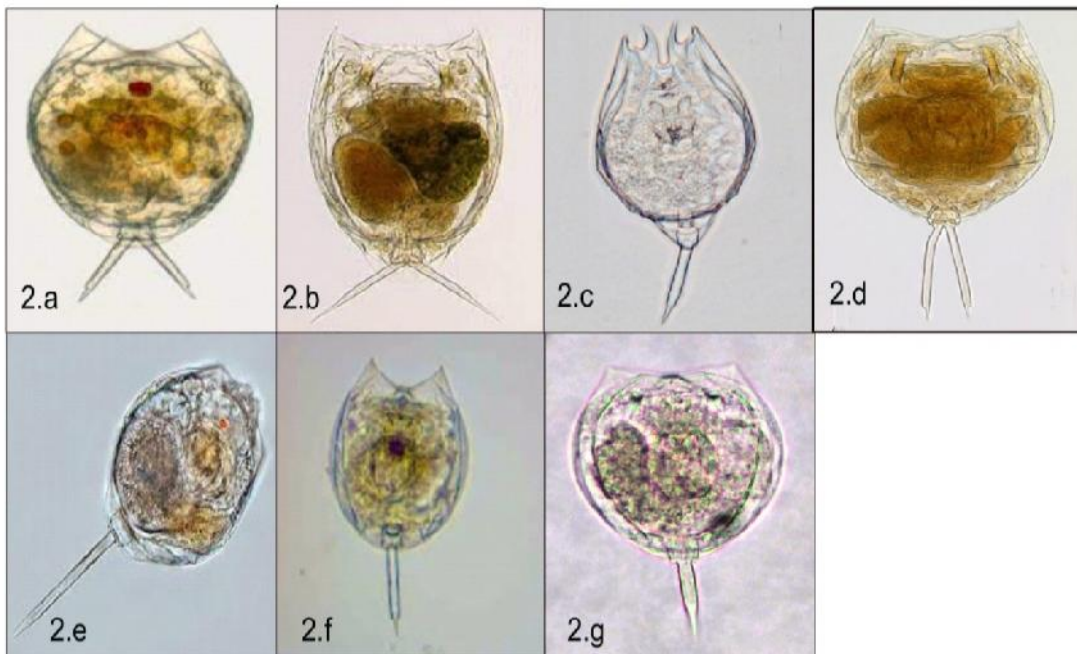


Figure 2. Photomicrographs of different *Lecane* species in the studied pond of Tripura.
 2a. *Lecane luna*; 2b. *Lecane ungulata*; 2c. *Lecane quadridentata*; 2d. *Lecane curvicornis*; 2e. *Lecane (Monostyla) bulla*; 2f. *Lecane (Monostyla) lunaris*; 2g. *Lecane (Monostyla) closterocerca*

Amongst rotifers of the genus *Lecane* under the family Lecanidae, the percentage composition of the *Lecane (Monostyla) lunaris*, *Lecane (Monostyla) bulla*, *Lecane luna*, *Lecane*

quadridentata, *Lecane ungulata*, *Lecane (Monostyla) closterocerca* and *Lecane curvicornis* were 43%, 21%, 13%, 9%, 7% , 5% and 2% respectively.

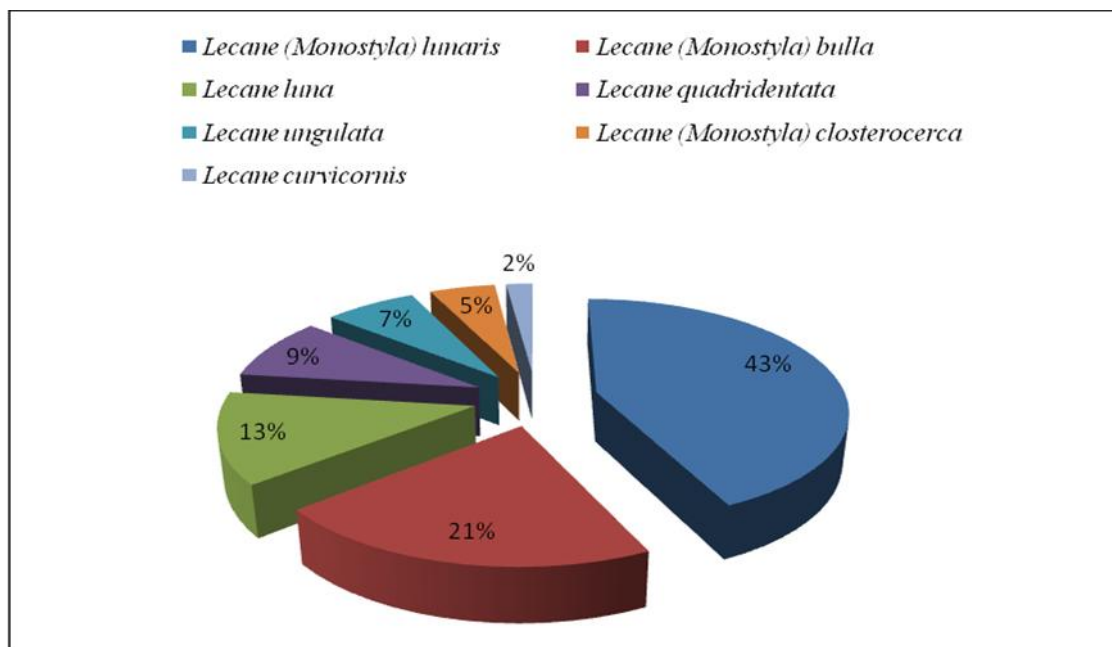


Figure 3. Percentage composition of different species of the Genus *Lecane* in the studied pond ecosystem, Tripura

The seasonal variations in the density (mean density) of rotifers of the genus *Lecane* exhibited a definite rhythm of seasonal succession showing highest density in the summer (March to May)

and lowest density in the winter (November to February) during two years study period from March 2020 to February 2022 (Fig.4).

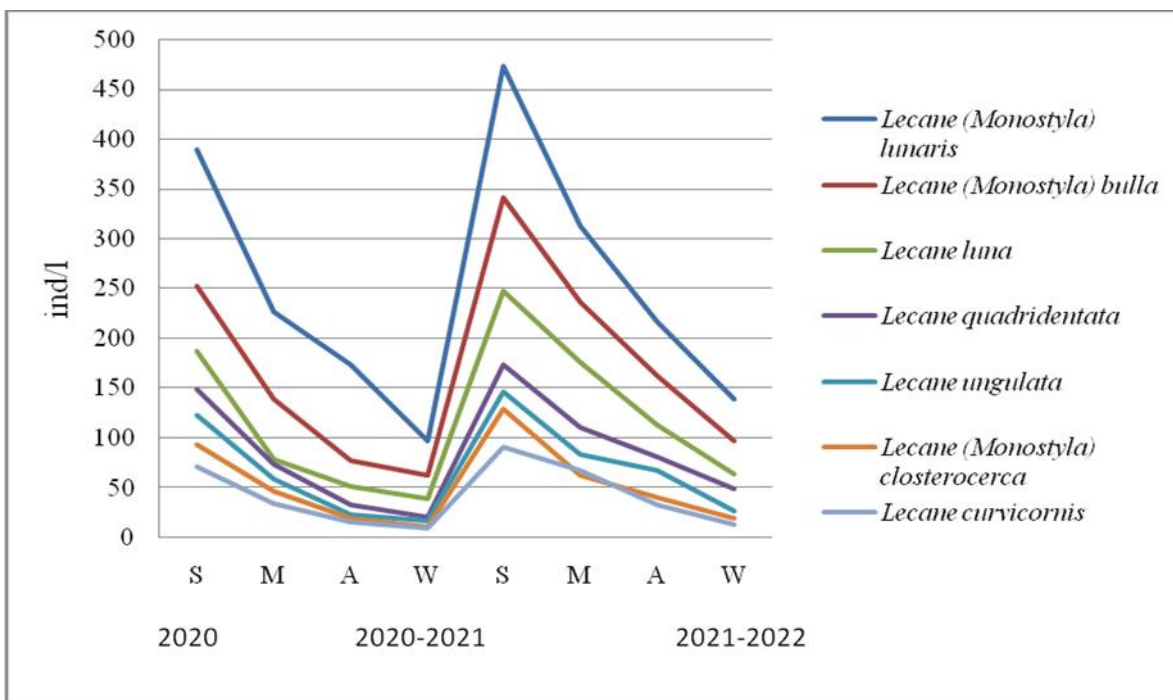


Figure 4. Seasonal variations in the density (mean) of different rotifer species of the Genus *Lecane* in the studied pond ecosystem, Tripura, India.

Abbreviation used: S= Summer (March-May); M=Monsoon (June-August); A=Autumn (September-October); W= Winter (November-February)

Lecane (Monostyla) lunaris showed its highest density (473 ind/lit) in the summer season and lowest density in the winter season (97 ind/lit). *Lecane (Monostyla) bulla* exhibited highest density (341 ind/lit) in the summer season and lowest density in the winter season (63 ind/lit). *Lecane luna* showed its highest density (247 ind/lit) in the summer season and lowest density in the winter season (39 ind/lit). *Lecane quadridentata* showed its maximum density (173 ind/lit) in the summer season and minimum density in the winter season (21 ind/lit). *Lecane ungulata* exhibited highest density (146 ind/lit) in the summer season and lowest density in the winter season (17 ind/lit). *Lecane (Monostyla) closterocerca* showed its highest density (129 ind/lit) in the summer season and lowest density in the winter season (11 ind/lit). *Lecane curvicornis* showed its highest density (91 ind/lit) in the summer season and lowest density in the winter season (9 ind/lit).

During summer season, highest density of rotifers of the genus *Lecane* may be due to decrease in water level in summer that concentrated rotifers in the studied pond. Researchers (Jadhav et al., 2012; Dede and Deshmukh, 2015; Karthika et al., 2017) also have been reported similar summer dominating density of rotifers. Schroder and Schutt (2005) opined that intensity of light and high temperature in the summer season are some of the major limiting factors that have been correlated with the density of rotifers. Researchers (Wadajo and Belay, 1984; Manickam et al., 2014; Bhavan et al., 2015) also reported that during summer season, the rise in the abundance of phytoplankton which serves as suitable prey for rotifers creates an ideal habitat for growth of rotifers. Bhat et al. (2015) and Khaleqsefat et al. (2011) stated that the phytoplankton populations constitutes the prime dietary spectrum of rotifers which increases with the higher water temperature in the summer season which in-turn influences the species density of rotifers. During winter season, the lowest density of rotifers could result from the sharp reduction in the water temperature and as such conditions, the rotifers

are known to undergo diapauses (Sousa et al., 2008; Al-Doori, 2012).

The present observation showed that lecanid rotifers were numerically more abundant under the macrophytes than those of the exposed littoral areas of the studied pond. Kuczyn'ska-Kippen (2007) reported that during the day-light hours, rotifers often seek a refuge among macrophytes as concealment against predators.

Conclusion

In conclusion, it is quite judicious to mention that the density of rotifer species of the genus *Lecane* is highly variable from species to species in the studied lentic ecosystem and seasons have strongly affected the density and species composition in terms of percentage. From the present observation, it is presumed that although the different species of *Lecane* prefer different environmental requirements, they co-exist successfully in the same water body. It is noteworthy to mention that the dynamic nature of the lentic ecosystem as well as the impact of competitive interactions may be expected to influence the seasonal variation of *Lecane* population in the studied pond ecosystem. Although the different species of the genus *Lecane* were reported earlier from different states of India and abroad, the present observation also confirms its nature of cosmopolitan distribution.

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