Investigation on Cladoceran and Rotifer Groups In Duya Inn, Hinthada Township

Su Wai Hnin[1], Min Zaw Latt[2], Swe Swe Win[3]

Abstract

The present study dealing with the different zooplankton groups in Duya Inn, Hinthada Township was investigated by monthly surveys during January- August, 2022. Samples of zooplankton were taken at four sampling sites along the bank of Duya Inn. A total of 28 species in 21 genera belonging to nine families from four orders of two classes under two phyla was investigated. The cladoceran was the dominant group of zooplankton followed by rotifer. The most abundant species was recorded in site II, III and IV. The highest number of species was observed in February. The significant species of rotifer were three species, seven species in cladoceran groups that were investigated throughout the study period. Moreover, the present study involves the analysis of biological water parameters which reflect an abiotic status of an ecosystem. The relationship of species abundance with biological parameters of an aquatic ecosystem was analyzed. In this study, water temperature and pH level showed significant relationships with the abundance of zooplankton species.

Keywords: cladocean, rotifer, water parameters

INTRODUCTION

The word plankton is derived from Greek *planktos,* meaning wandering. They are microscopic organisms that drift on the water currents, freely floating in aquatic habitats (Powell *et al.*,1975 and Murugan *et al.*,1998). Phytoplankton is the pioneer of an aquatic food chain. Zooplankton passes this food energy to the higher tropic levels and a link between energy producers and the consumers (Jakhar, 2013). In addition, because of their critical role as a food source for larval and juvenile fish, the dynamics of zooplankton population, their reproductive cycles, growth, reproduction and survival rates are all important factors that influence recruitment to fish stocks (Harris *et al.*, 2000).

The major groups of zooplankton observed that were Rotifera, Ostracoda, Cladocera, Copepoda and Protozoa at various depths in their own niches in every types of aquatic environment (Majagi and Vijaykumar, 2009). Freshwater zooplankton are found in wetland areas such as lakes, streams and swamps. They are the most abundant nearer the surface as they eat phytoplankton which need light for photosynthesis.

Many species of freshwater zooplankton are small (less than 1 mm long) and relatively transparent. Rotifers are distinct little animals, with most species occurring in only in freshwater. Most rotifers are 0.1-0.5 mm long and often the most abundant in standing and running waters (Shiel, 1995). Rotifers are indicators for pollution and eutrophication because of their high reproductive rate and sensitivity to any ecological changes in water (Lucinda *et al.*, 2004).

Most cladocerans are less than 1-2 mm long and are present in a wide variety of freshwater habitats: lakes, ponds and wetlands. Cladocerans themselves are a very important food source for many fish species (Boehler *et al.*, 2012).

Their distribution and abundance depend on the water body with a complex of factors such as change of climatic conditions, physical and chemical parameters and vegetation cover

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of their habitat (Mukharjee, 1997 and Rocha *et al.*, 1999). Therefore, they are important biological indicator of water quality and trophic state of aquatic ecosystem (Jakhar, 2013).

Duya Inn is designated as a research Inn in Hinthada Township. It has suitable environmental conditions such as trophic level and good aquatic environment for surviving of aquatic life. Many fish species are abundant in this Inn and it provides to increase demand fish for local people as food sources. Research of planktons in freshwater ecosystems such as creeks, rivers, inns and ponds or lakes are still rare in Myanmar. Although zooplankton plays a vital role as indicators in food chain, food web and water quality parameters in aquatic ecosystem; data and information on them are very rare in own country. In addition, previous works had rarely been done of zooplankton in the Duya Inn. Thus, the present study was carried out to know the zooplankton species of different groups in different sites of Duya Inn.The present study was conducted with the following objectives:

- to observe the species diversities of different groups of zooplankton
- to study the physicochemical parameters of water body
- to investigate the association or relationship between zooplankton species and different water parameters

MATERIALS AND METHODS

Study area and study period

Duya Inn (about 6.712 sq.km) was selected in Hinthada Township, at coordinates 17° 33´44´´ N and 95° 28´ 55´´ E. It was divided into four sampling sites; namely, Htan-Ta-Pin village (Site I, 17° 33.016´ N and 95° 29.023´ E), two sites from Duya village (Site II, 17° 33.736´ N and 95° 28.98´ E; and Site III, 17° 33.483´ N and 95° 29.044´ E) and Pauk-Yoe village (Site IV, 17° 33.34´ N and 95° 29.112´ E) (Fig.1).The study period was lasted from January to August, 2022.

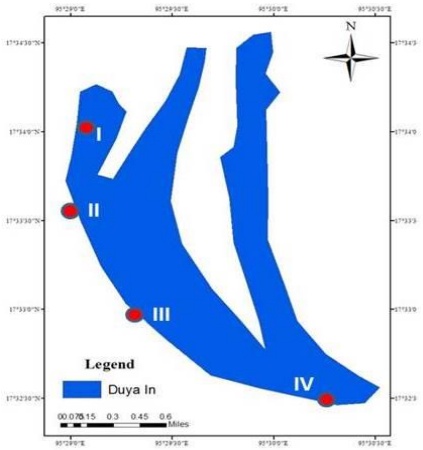


Fig.1 Map of Duya Inn

(Source: Geology Department, Hinthada University)

Equipments and apparatuses utilized

Plankton net, concave slides, pipettes, formalin, digital camera, plastic containers and compound light microscope were utilized.

Sample collection

It was fortnightly collected from each study site in the morning 7:00 – 9:00 am from the chosen study sites. Water samples containing zooplankton were collected from the surface

water-body using 25 liters of plankton net (25 cm diameter and mesh size 0.1 mm ×0.1 mm) with 40 ml sample bottle at approximately 0.5 - 1 m depth of water. Filtered samples were made up to a standard volume of 10 ml and preserved in plastic bottle containers with 0.04 ml of 5% formalin and brought to the laboratory of Zoology Department, Hinthada University.

Preparation of microscope slides

Collected specimens preserved in 5% formalin were shaken for 10 seconds and 0.5 ml of collected water sample was taken by using a pipette and placing on the concave slide. Specimens were observed, identified and counted under a compound light microscope at the magnification of 40x. All specimens were examined within one week after collection.

Species identification

Identification was followed after Edmonson (1959), and Sharma and Sharma (2008).

Water quality parameters: The water temperature was measured at the representative site by a thermometer at a depth of approximately 0.5 m below the water surface. Other water parameters (such as pH, Dissolved oxygen, Phosphate, Ammonium, Nitrate and Nitrite) were measured by using water quality test kit (VISOCOLOR ECO Test Kit, Macherey-Nagel, Germany) from Zoology Department, Hinthada University.

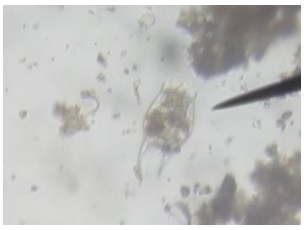
Data Ana: The degree of Pearson Correlation Coefficient (*r*) of association or relationship between zooplankton species and different physicochemical parameters was analyzed, and significant of correlation coefficient (*t* value) and percentage of species composition were calculated.

RESULTS

A total of 28 species of zooplankton in 21 genera belonging to nine families from four orders of two classes under two phyla were recorded from the four different sites in the Duya Inn (Table 1 and Plate 1, 2).

Table 1. Recorded zooplankton species and their classification from the study area

Phylum	Class	Order	Family	Genus	Species
Rotifera	Monogononta	Ploima	Brachionidae	*Branchionus*	*B.bidentata* Anderson, 1889
					B.forficula Wierzejski, 1891
					B.quadridentatus Hermann, 1783
				Euchlanis	*E.dilatata* Ehrenberg, 1832
				Platyias	*P.patulus* (O.F Muller, 1786)
			Lecanidae	*Monostyla*	*M.bulla* Gosse, 1851
				Lecane	*L.luna* (Mulla, 1776)
			Asplanchnidae	*Asplanchna*	*A.priodonta* Gosse, 1850
		Flosculariaceae	Testudinelllidae	*Horaella*	*H.brehmi* Donnea, 1949
Arthropoda	Brachiopoda	Ctenopoda	Sididae	*Diaphanosoma*	*D.brachyurum* (Lieven, 1848)
		Anomopoda	Daphniidae	*Daphnia*	*D.lumholtzi* Sars, 1885
				Moinodaphnia	*Moinodaphnia* sp.
				Moina	*M.brachiata* (Jurine, 1820)
					M.affinis Birge, 1893
					Moina sp.
			Bosminidae	*Bosmina*	*B.coregoni* Baird, 1857
			Macrothricidae	*Macrothrix*	*M.rosea* (Jurine, 1820)
				Drepanothrix	*D.dentata* (Euren,1861)
				Lathonura	*L.rectirostris* (O.F Muller, 1785)
			Chydoridae	*Alonella*	*A.diaphana* (King, 1853)
					A.globulosa Daday,1898
					A.nana (Baird, 1850)
				Alona	*A.karau* King, 1853
				Camptocercus	*C.oklahomensis* Mackin, 1930
				Chydorus	*C.rectirostris* Schodler, 1862
					Chydorus sp.
				Dunhevedia	*D.crassa* King, 1853
				Leydigia	*L.acanthocercoides* (Fischer, 1854)

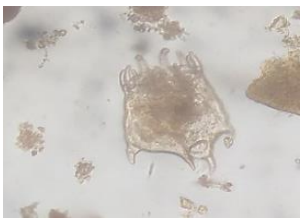


A. *Branchionus bidentata* (100x)

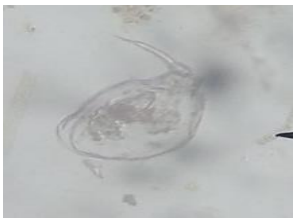
B. *Branchionus forficula* (100x)

C. *Branchionus quadridentatus* (100x)

D. *Euchlanis dilatata* (100x)

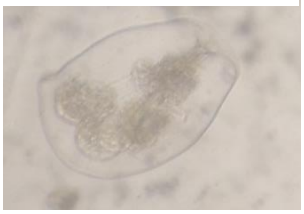


E. *Platyias patulus* (100x)



F. *Monostyla bulla* (100x)

G. *Lecane luna* (100x)

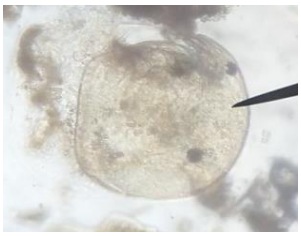


H. *Asplanchna priodonta* (100x)

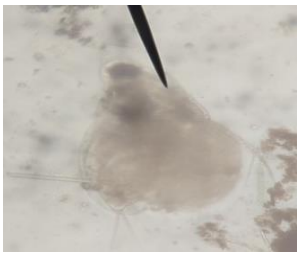
I. *Horaella brehmi* (100x)

J. *Diaphanosoma brachyurum* (100x)

K. *Daphnia lumholtizi* (100x)



L. *Moinodaphnia sp.* (100x)



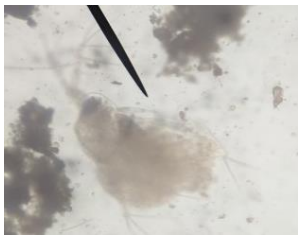
M. *Moina brachiata* (100x)

N. *Moina affinis* (100x)

O. *Moina sp.* (100x)

P. *Bosmina coregoni* (100x)

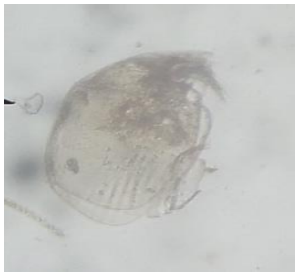
Q. *Macrothrix rosea* (100x)



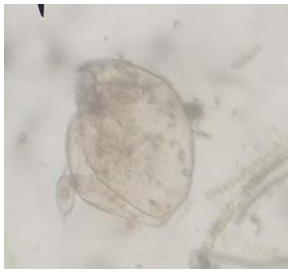
R. *Drepanothrix dentata* (100x)

Plate 1. Recorded rotifer and cladoceran species from the study area

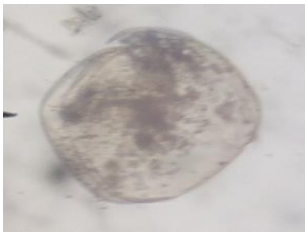
S. *Lathonura rectirostris* (100x)



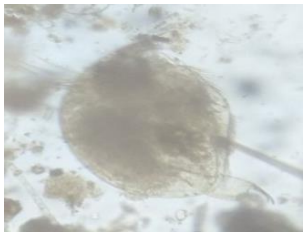
T. *Alonella diaphana* (100x)



U. *Alonella globulosa* (100x)



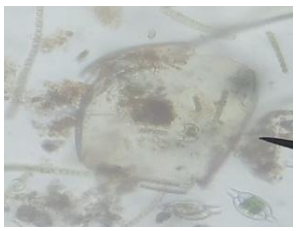
V. *Alonella nana* (100x)



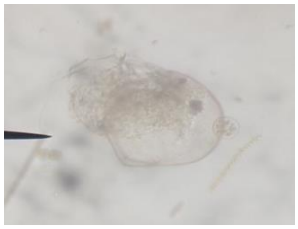
W. *Alona karau* (100x)

X. *Camptocercus oklahomensis* (100x)

Y. *Camptocercus rectirostris* (100x)



Z. *Chydorus sp.* (100x)



AA. *Dunhevedia crassa* (100x)

AB. *Leydigia acanthocercoides* (100x)

Plate 2. Recorded cladoceran species from the study area

Species composition of recorded zooplankton groups

In different two groups of zooplankton species, nine species (32.14%) of rotifer, 19 species (67.86%) of cladoceran, were recorded in the study area.

Among 28 species of zooplankton, eight species (28.57%) of Order Ploima, one species (3.57%) each of Order Floscullariaceae and Order Ctenopoda, 18 species (64.29%) of Order Anomopoda were recorded. The highest number of species was observed in Order Anomopoda and the lowest number was in Order Floscullariaceae and Order Ctenopoda.

Table 2. Species composition and percentage of recorded zooplankton groups by orders in study area

Sr. No	Order	Species	Percentage (%)
1	Ploima	8	28.57
2	Floscullariaceae	1	3.57
3	Ctenopoda	1	3.57
4	Anomopoda	18	64.29
Total		28	100

Occurrence of zooplankton species in Duya Inn

Out of a total of 28 species, 16 species in Site I, 22 species each in Site II and Site III and Site IV were recorded. The most abundance species was studied in Site II, III and IV. In rotifer group, the highest number of species was observed only in Site IV. In cladoceran group, the highest number of species was recorded only in Site III. The lowest number of zooplankton species in different groups was observed in only Site I among the four study sites. In the present study, one species of rotifer and 11 species of cladocerans were recorded in all study sites (Table 3).

Among 28 species of zooplankton, 24 species in February, 15 species in March, 23 species in April, 22 species in May,18 species in June and 17 species in July were recorded. In the present study, three species in the group of rotifer, seven species in group of cladoceran were recorded throughout the study period (Table 4).

Table 3. Occurrence of zooplankton species in four study sites

Sr. No	Species	Study sites			
		I	II	III	IV
1	*Branchionus bidentata*	√	√	–	√
2	*Branchionus forficula*	–	–	–	√
3	*Branchionus quadridentatus*	–	–	√	–
4	*Euchlanis dilatata*	–	√	√	√
5	*Platyias patulus*	–	√	–	–
6	*Monostyla bulla*	–	√	√	√
7	*Lecane luna*	–	√	√	√
8	*Asplanchna priodonta*	√	–	–	√
9	*Horaella brehmi*	√	√	√	√
10	*Alonella diaphana*	√	√	√	√
11	*Alonella globulosa*	√	√	√	√
12	*Alonella nana*	–	√	√	√
13	*Alona karau*	√	√	√	√
14	*Camptocercus oklahomensis*	√	√	√	√
15	*Camptocercus rectirostris*	–	–	√	√
16	*Chydorus sp.*	–	√	√	–
17	*Dunhevedia crassa*	√	√	√	√
18	*Leydigia acanthocercoides*	–	√	√	–
19	*Bosmina coregoni*	√	–	–	–
20	*Diaphanosoma brachyurum*	√	√	√	√
21	*Daphnia lumholtizi*	–	–	√	–
22	*Moinodaphnia sp.*	√	√	√	√
23	*Moina brachiata*	√	√	–	√
24	*Moina affinis*	√	√	√	√
25	*Moina sp.*	√	√	√	√
26	*Macrothrix rosea*	–	√	√	√
27	*Drepanothrix dentata*	√	√	√	√
28	*Lathonura rectirostris*	√	√	√	√
	Total	16	22	22	22

Table 4. Monthly occurrence of zooplankton species in Duya Inn

Species	Feb	Mar	Apr	May	Jun	July
Rotifer	6	5	7	4	4	5
Cladoceran	18	10	16	18	14	12
Total	24	15	23	22	18	17

Recorded physico-chemical parameters in Duya Inn

As the monthly variation of water parameters, the ranged of physico-chemical parameters was 23.6 - 31.9°C (29.58 ± 3.003) of temperature, 7 - 7.4 (7.19 ± 0.167) of pH, 9.31 - 9.37 mg/L (9.34 ± 0.05) of dissolved oxygen (DO), 0.58 - 0.75 mg/L (0.696 ± 0.055) of phosphate (PO_4), 0.14 - 0.175 mg/L (0.161 ± 0.02) of ammonium (NH^+_4), 1 - 1.75 mg/L (1.33 ± 0.37) of nitrate (NO^-_3) and 0.01 - 0.035mg/L (0.025 ± 0.05) of nitrite (NO^-_2) respectively.

Correlation of zooplankton with physico-chemical parameters in Duya Inn

Based on the output of Pearson correlation coefficients between mean number of zooplankton species and all water parameters in all study sites, the rotifer was positively correlated with pH and phosphate, but negative correlation was found with dissolving oxygen, ammonium, nitrate, nitrite and temperature. The cladoceran was positively correlated with ammonium, and nitrite, whereas the negative association was found with the rest of other parameters. Almost associations were not significantly different (p>0.05) for all groups of zooplankton, but the significantly different of correlation with nitrite was observed in groups of rotifer (p<0.05) in the study period (Table 5).

Table 5. Correlation of zooplankton with different water quality parameters in the study area

Zooplankton	Tem	pH	DO	PO_4	NH^+_4	NO^-_3	NO^-_2
Rotifer	- 0.18	0.012	- 0.098	0.72	- 0.717	- 0.266	- 0.995
Cladoceran	- 0.409	- 0.257	- 0.36	- 0.65	0.021	- 0.38	0.799

0 – 1= positive correlation, 0 - (-1) = negative correlation, p = 0.05 (Significant level)

DISCUSSION

The different two groups of zooplankton in Duya Inn was studied by monthly surveys in the study period. Among different two groups, the cladoceran was the dominant group of zooplankton followed by rotifer. The Order Anomopoda was observed with the highest number of species. The Family Chydoridae formed the diversified genus and dominant species such as nine species in groups of cladoceran throughout the study period. The present result was agreement with Mie Mie Cho Htun, 2016 showed that the cladocerans were found to be highly diversified genus among different groups in Kan Thone Sint Lake, Pathein.

In the present study, three species in rotifer group such as *Euchlanis dilatata*, *Monostyla bulla* and *Horaella brehmi* were recorded throughout the study period. Aung Kyaw Zaw (2017) similarly found that the significant species was of the genus *Monostyla* in most identified genera of zooplankton was observed throughout the study period. The rotifer species

are the better indicators for water quality assessment and indicative of nutrients status of water body. These species are the indicator species for water quality assessment (San San Hmwe *et al*., 2019).

Seven species in cladoceran group such as *Alonella diaphana, Alonella globulosa, Alonella nana, Camptocercus oklahomensis, Dunhevedia crassa, Moina sp.* and *Lathonura rectirostris* were also recorded abundantly in the study period. The cladoceran species are also the good water quality indicators and better trophic indicators for aquatic micro-faunal food sources in freshwater ecosystem. The present study was likely agreed with San San Hmwe *et al.*, 2019 also reported that *Dunhevedia crassa* and genus *Moina* in cladoceran group were mostly occurred in Duya Inn throughout the study period. San San Hmwe *et al.*,2019 recorded that these cladoceran species are one of the main food sources for the small fishes at the fingerling stages.

The present study observed that the occurrence of zooplankton community depends on the habitat (with aquatic vegetation) and environmental factors (including water quality parameters). Aung Kyaw Zaw (2012) also stated that the occurrence of species depends on the habitat and environmental factors.

In this study, the maximum number of rotifer species was recorded with normal range of pH levels from 7 to 7.35 and 23.6-31.9°C of temperature. In cladoceran group, the maximum number of species was observed with pH levels in normal range from 7 to 7.1 and 23.6°C-30.5°C of temperature. The present finding pointed that the abundance of species in each zooplankton group depends on optimal water temperature 32°C and stable pH 7 level of its habitat.

The present result was agreed to Kamat (2000) who noted that water temperature ranging between 13.5°C and 32°C reported to be suitable for the development of the planktonic organisms. Therefore, the study area lies at the good productive nature for the abundance of freshwater organisms.

Tarzwell (1957) reported that for supporting life, minimum of 3mg/L DO is required. In the present study, the dissolved oxygen concentration of the Duya Inn recorded that the fluctuation was between 9.31 mg/L and 9.37 mg/L in the study period. The result revealed that the investigation of optimal changes in dissolved oxygen was associated with the abundance of zooplanktons. The natural fluctuations of (DO) concentration in water level will not significantly cause the changes in abundance of freshwater organisms and aquatic ecosystem of this Inn.

According to the EPA (2012), if the phosphate (PO_4) level was of 1.0 ppm or 1.0 mg/L, the conditions become favorable for algae growth. The present result indicated that the normal range of phosphate (0.58 to 0.75 mg/L) was observed to be favorable conditions for freshwater ecosystem. Therefore, the suitable levels of phosphate will not cause harmful effects on algal growth and aquatic organisms in the water body.

The dominant of zooplankton species was occurred at NH^+_4 concentration with ranged between 0.14 and 0.175 mg/L in the present study. Willingham *et al.* (1979) have already pointed out that a high but harmless level of NH^+_4 will be concerned into a high and harmful NH_3 level when the pH of water rises. The present result found that the concentration of NH^+_4 was not changed significantly in the water body of the Inn. Therefore, NH^+_4 concentration in water which will be converted to ammonia NH_3 is ideally needed to monitor in the water body of the study area.

In the present study, the normal range of nitrate NO^-_3 (1 - 1.75 mg/L) and nitrite NO^-_2 (0.01 - 0.035 mg/L) was suitable conditions for the growth and abundance of zooplankton and

aquatic ecosystem of this Inn. EPA (2012) recommended that maximum contaminant level in water was 10 ppm or 10 mg/L for nitrite and 1ppm or 1 mg/L for nitrate, these conditions become favorable for freshwater environment.

Indeed, the present result suggests that trophic status and environmental factors are essentially important in determining the distribution of zooplankton communities and freshwater biodiversity in water body. Many environmental factors interact to provide conditions for their growth and distribution both spatially and seasonally (San San Hmwe *et al.,* 2019). According to the finding results, on the association of zooplankton species with parameters of water quality analyses, the zooplankton in the water body of Duya Inn consists of diverse and dominated assemblage of zooplankton species.

CONCLUSION

As conclusion, the species composition of zooplankton in this Inn were affected by fluctuation in environmental conditions. The present result, highlights the importance of different zooplankton group assemblages as indicators for the trophic level and monitoring of water body in Duya Inn. It could also be concluded that the moderate diversity and abundance of zooplankton could potentially contribute to the survival and growth of fish species in this Inn.

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