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Morphometric study of certain inland water copepods from Nashik, Maharashtra, India

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ABSTRACT

The morphometric study of selected copepods was carried out during year 2018 from Godavari river of Nashik region. In the present study, a total of four copepod genera were selected for carrying out their morphometric measurements in terms of micron. These are *Mesocyclops sps, Macrocyclops fuscus, Tropocyclops prasinus* and *Eucyclops agilis*. The morphometry of various body parts like cephalosome, metasome, urosome, antennae, caudal rami, fural rami and total body length were measured by using ocular micrometer scale. On the basis of measurement obtained in the present study, it can be concluded that *Eucyclops is* the largest of all, *Macrocyclops and Tropocyclops* are intermediate in size whereas, *Mesocyclops* is the smallest of all studied specimens.

Figures : 04 References : 11 Table : 01
KEY WORDS : Cephalosome, Copepods, Metasome, Morphometric study, Urosome.

Introduction

Zooplanktons are minute, microscopic animals which swim in water and are found in both fresh water and marine water. Protozoa, rotifer, copepod, cladocera and ostracoda are important zooplanktons and they feed on minute phytoplanktons & floating plants such as algae. They are the free floating & free living creatures playing important role in aquatic food chain. It is used as source of food for the small fishes and hence playing an important role in the ecosystem. During favourable environmental conditions, they reproduce rapidly and increase by 30 percent per day[7]. In the order Calanoida, mostly males are rare and small in size as compared to females

There are about 7500 known species of the copepods belonging to the seven orders, these are Calanoida, Cyclopoida, Harpacticoida, Poecilostomatoida, Mormonilloida, Mostriloida and Siphonostomatoida of which the Calanoida, Cyclopoida and Harpacticoida are free living[1]. The recent scientific report published by some workers[6] says there are ten copepod orders on the basis of morphological similarities, type of DNA and RNA extracted from 210 copepod species. These ten orders are Platicopoida, Calanoida, Misophrioida, Harpacticoida (polyarthra), Gelyeloida, Harpacticoida (Oligoarthra), Cyclopoida + Poecilostomatoida, Mormonilloida, Mostriloida and Siphonostomatoida. Number of species of copepods are described but addition of new species is continuously going on**.** Most of copepods are parasitic in nature and feed on their host organism.

The copepods are 0.3 to 2.5 mm long, with a teardrop shaped body. The entire body of the copepod is totally transparent and segmented. There are 10 trunk segments present. The body is divided into 3 parts- Cephalosome, Metasome and Urosome. The anterior part is called cephalosome. The broad part is called metasome and posterior part is called urosome. The metasome and urosome are separated by a major articulation. A single eye is present in the middle of the head and it is usually bright red in color. Two pairs of antennae present on cephalosome, the first pair of antennae are long and uniramous in Cyclopoida order and biramous in Calanoida order. The Metasome shows presence of 5 pairs of swimming legs. The Urosome region comprises of the genital segment, anal segment, caudal ramus and fural rami. There are five somites present on

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TABLE-1 : Morphometric details of Water Copepods from Nasik

Genus	Body parts	Length	Width
Mesocyclops sps	Cephalosome	366.6 µm	366.6 µm
	Metasome	232.2 µm	305.5 µm
	Urosome	562.1 µm	97.8 µm
	Antennae	525.5 µm	36.7 µm
	Caudal rami	61.1 µm	60.0 µm
	Fural rami	97.8 µm	34.9 µm
Macrocyclops fuscus	Cephalosome	391.0 µm	366.6 µm
	Metasome	305.5 µm	281.1 µm
	Urosome	541.7 µm	85.5 µm
	Antennae	513.2 µm	52.4 µm
	Caudal rami	85.5 µm	61.1 µm
	Fural rami	122.2 µm	24.4 µm
Tropocyclops prasinus	Cephalosome	488.8 µm	366.6 µm
	Metasome	183.3 µm	329.9 µm
	Urosome	488.8 µm	73.3 µm
	Antennae	574.3 µm	34.2 µm
	Caudal rami	48.9 µm	61.1 µm
	Fural rami	79.4 µm	26.4 µm
Eucyclops agilis	Cephalosome	415.5 µm	378.8 µm
	Metasome	293.3 µm	244.4 µm
	Urosome	708.8 µm	134.4 µm
	Antennae	501.0 µm	55.0 µm
	Caudal rami	61.1 µm	26.9 µm
	Fural rami	110.0 µm	34.2 µm

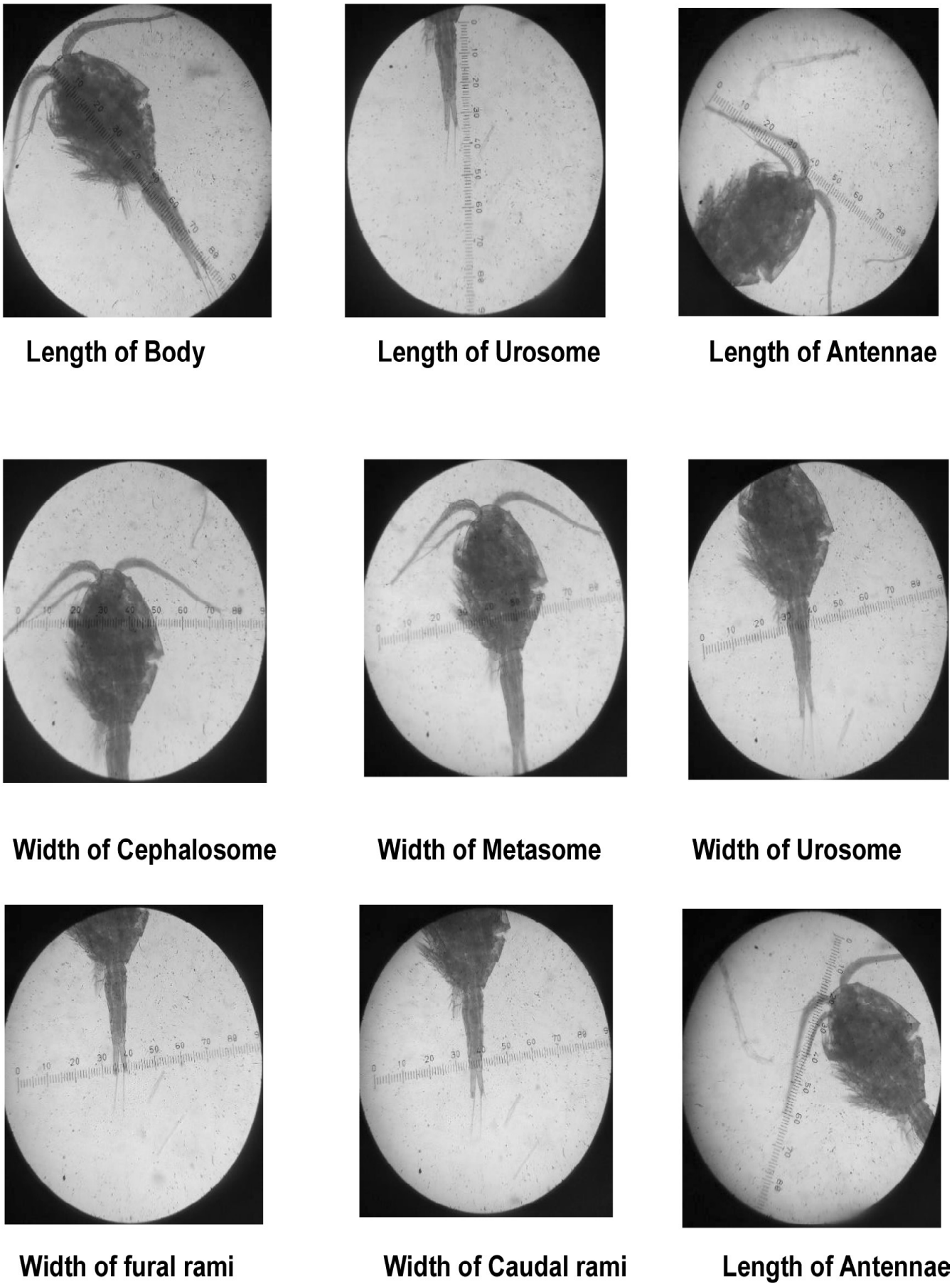


Fig. 1: Morphometric study of *Mesocyclops sps*.

urosome. In the males, all the urosomites are separated, but in females, the second and third urosomites are fused to form genital double somites. The last urosomite is anal somite. The median anus opens terminally or dorsally which bears two posterior caudal rami or fural rami[1].

The morphometric study of copepods is lacking in India. As it is microscopic creature, this group is always being neglected, hence almost negligible literature is available from India. Study of copepods are economically important because it is the host of *Dracanuculus medinensis*, the Guinea worm-Nematode, which causes the dracunculiasis disease in humans. Hence, the present study is undertaken to provide the measurement of length and width of some copepods from inland waters; the Godavari River at Panchavati area, Nashik.

Study Area: River Godavari flows through Nashik and its northern part is called as Panchavati. Panchavati is just 4.2 km from Nashik. It lies at $20^0$00'28" north latitude and $73^0$47'31'' east longitude. This place is spot for the Kumbh Mela bathing and gets full of pilgrims from every corner of world during the occasion.

Material and Methods

Sampling was done early in the morning at 7:30 am to 8:00 am, during the year 2018. Zooplankton sample were collected by filtering 50 liters of water through muslin cloth. Filtered sample was preserved in 4% formalin. For staining of zooplankton Rose Bengal stain was used. Only one copepod was isolated on the slide and excess water and planktons were removed with the help of filter paper. Then a drop of glycerin was added over the copepod to avoid hardening. After that coverslip was placed slowly over it and then borders of coverslip was sealed with DPX. The slides were kept as it is for few days and then used for observing and measuring their size. The slide was adjusted at 10X magnification with 10X eye piece. In the eye piece, ocular micrometer scale was placed which was previously calibrated with stage micrometer on the same microscope. Cephalosome length was measured from the projection of head to the flexure joint between the cephalosome and metasome. Metasome length was measured from flexure joint between the cephalosome and metasome to flexure joint of metasome and urosome. Urosome length was measured from the flexure joint of metasome and urosome to insertion of caudal rami. The width of copepod body parts were measured from border to border.

Result and Discussion

In the present study, a total of 4 genera of copepods were encountered from the Panchavati area which belong to order Cyclopoida. The morphometric measurements are widely used to identify differences between the various copepods.

The *Mesocyclops sps.* has a slender body which is clearly demarcated into anterior and posterior parts. Cephalosome is oval, 366.6 µm in length and 366.6 µm in width. Metasome 3 segmented which is 232.2 µm in length and 305.5 µm in width. Urosome is 4 segmented which bears genital segment, anal segment, caudal rami and fural rami. The urosome is 562.1µm in length and 97.8µm in width. Caudal rami are 61.1µm in length and 60.0µm in width. Fural rami are located below caudal rami which is 97.8µm in length and 34.9µm in width. The antennae is a 17 segmented which reaching slightly beyond the metasome. The antennae measures 525.5µm in length and 36.7µm in width. The total body length of the *Mesocyclops* is 1160.9µm. Seasonal variation in copepod size was studied by some researchers[4] in south eastern Lake Michigan during 1975-1981. They reported smallest copepods during summer and early fall whereas largest animals in the winter & spring. Phytoplankton concentration was positively correlated with the copepod body weight.

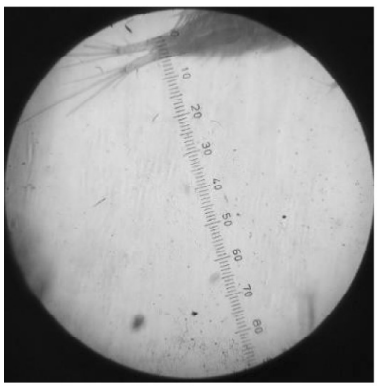
The *Macrocyclops fuscus* has anterior and posterior parts of body which is clearly demarcated. Cephalosome is 391.0µm in length and 366.6µm in width. Metasome measures about 305.5 µm in length and 281.1 µm in width. Urosome measures about 541.7µm in length and 85.5µm in width. Urosome consists of anal segment, caudal rami and fural rami. Caudal rami measures about 85.5µm in length and 61.1 µm in width. Fural rami is posterior part of body which is 122.2µm in length and 24.4µm in width. The Antenna is 17 segmented and measures about 513.2 µm in length and 52.4µm in width. The total body length of the *Macrocyclops fuscus* is 1222.0µm. The morphometric variables and individual volume of *Macrocyclops albidus* was studied by researcher[8]. He reported that the ratio of length and width of prosome was 1.096 mm in December (1999) whereas it was 1.097 mm in March (2000). The length and width ratio of urosome was 1.127 in December (1999) and 1.122 in March (2000). The inverse relationship was observed between copepod (Calanoida) body length and temperature whereas there was a direct effect of phytoplankton concentration reported by researchers[11] from northen Baltic Sea.

The *Tropocyclops prasinus* shows well developed body and antennae which was reaching at the end of the metasome. The cephalosome is 488.8 µm in length and 366.6 µm in width. Metasome 3 segmented and measures about 183.3µm in length and 329.9µm in width. Urosome is 488.8µm in length and 73.3µm in width and it is 4 segmented. Caudal rami measured about 48.9µm in length and 61.1µm in width. Fural rami measures about 79.4µm in length and 26.4µm in width. The long antennules is 12 segmented and measures about

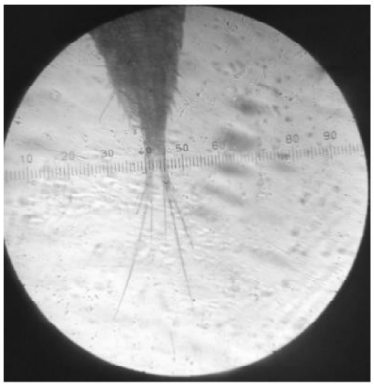
Length of Body

Width of Cephalosome

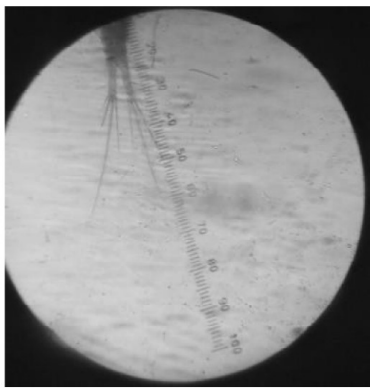
Width of Metasome



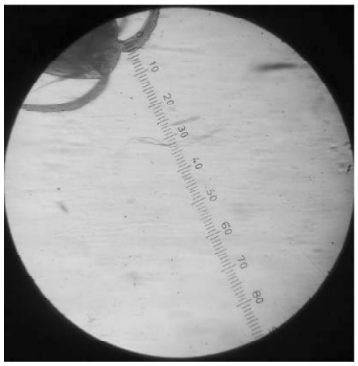
Width of Caudal rami



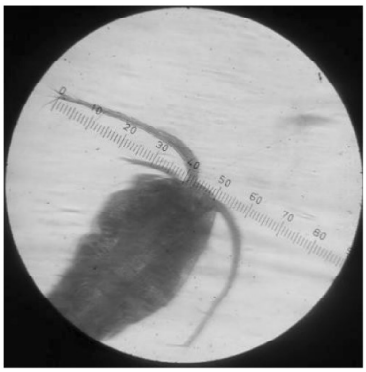
Width of Fural rami



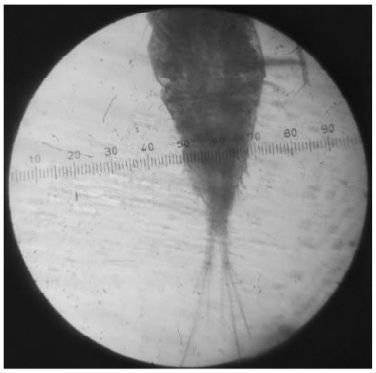
Length of Fural rami



Width of Antennae



Length of Antennae



Width of Urosome

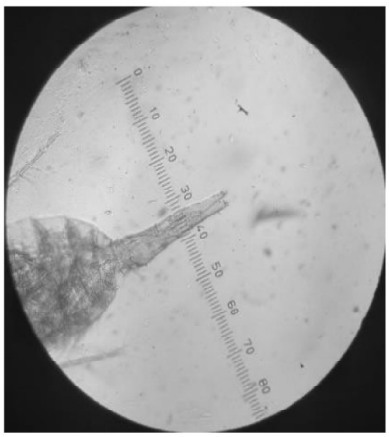
Fig. 2: Morphometric measurement of *Macrocyclops fuscus*

Length of Body

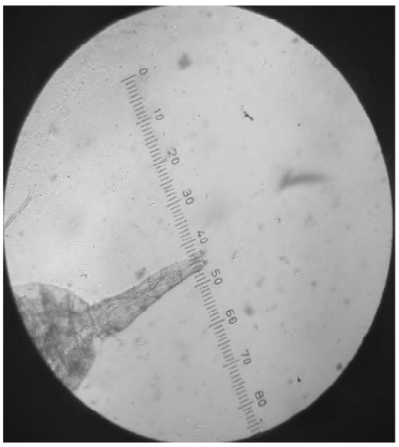
Width of Cephalosome

Width of Metasome

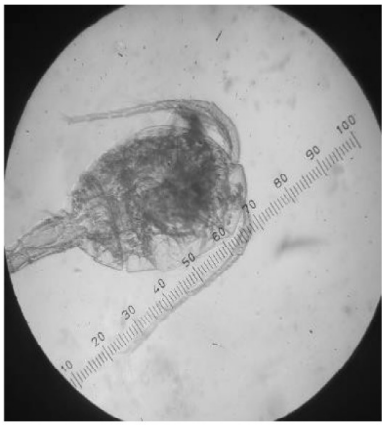
Width of Urosome



Width of Caudal rami



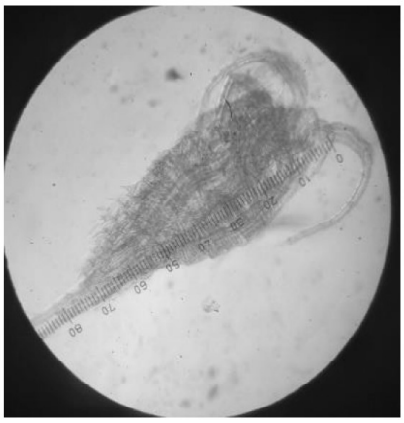
Width of Fural rami



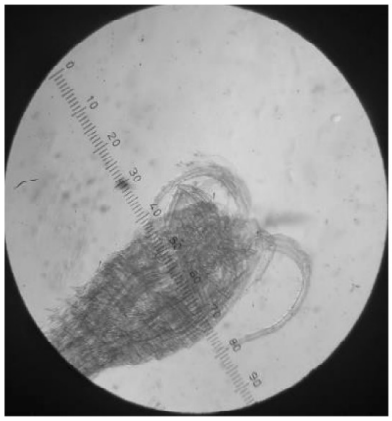
Length of Antennae

Width of Antennae

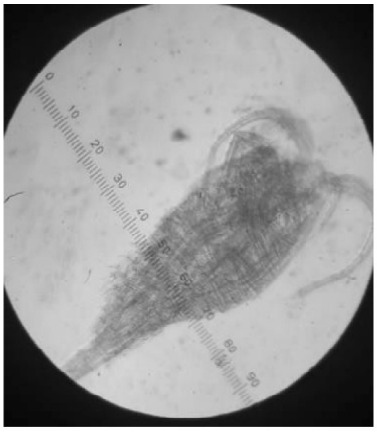
Fig. 3 : Morphometric measurement of *Tropocyclops prasinus*



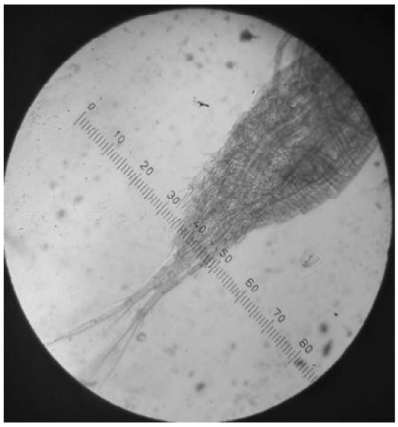
Length of Body



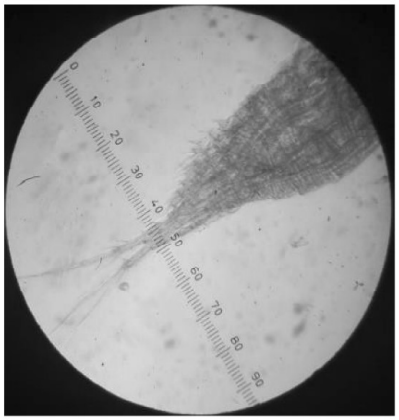
Width of Cephalosome



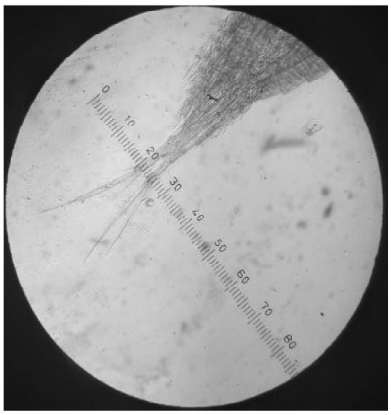
Width of Metasome



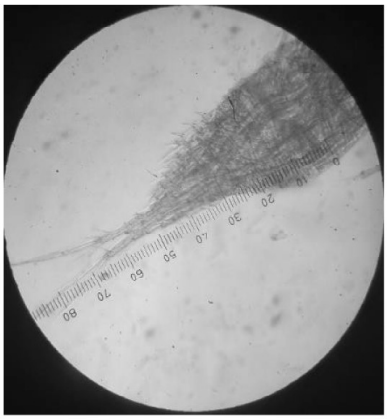
Width of Urosome



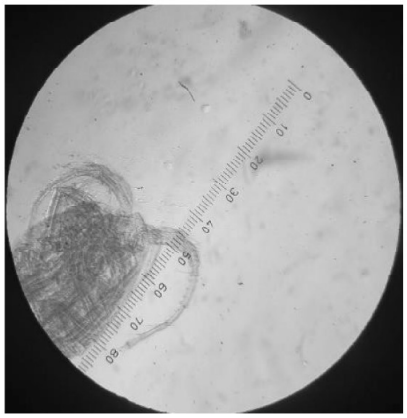
Width of Caudal rami



Width of Fural rami



Length of Urosome



Width of Antennae

Fig. 4: Morphometric measurement of *Eucyclops agilis*

574.3µm in length and 34.2µm in width. The total body length of *Tropocyclops prasinus* is 1185.3 µm. *Tropocyclops prasinus* male and female were studied by some researchers[3]. They reported the body length of female 0.605 mm (605 µm) and body length of male was 0.470 mm (470 µm) from tropical Brazilian lake. Few workers[5] studied seasonal variation in copepod body length in the Lagoon of Venice. According to them, temperature is the primary factor influencing the body length of copepods in the lagoon of Venice but this also changed as per the species. Prosome length & length specific body weight were positively correlated with food concentration reported by some researchers[2].

Eucyclops agilis can be easily recognized due to its morphological characteristic & elongated body. Cephalosome is flattened dorsoventrally which is 415.5µm in length and 378.8µm in width. Below the cephalosome the 3 segmented metasome present which measures about 293.3µm in length and 244.4 µm in width. Urosome measures about 708.8µm in length and 134.4µm in width. Caudal rami is present below the anal segment and measures about 61.1µm in length and 26.9µm in width. Antennule is 11 segmented and just reaching the middle of cephalosome. Antennule measures about 501.0µm in length and 55.0µm in width. The total body length of *Eucyclops* is 1283.1µm. *Eucyclops speratus* was studied by some researchers[10.] According to their report, full body length without setae was 1090 µm and with caudal setae was 1490 µm. The dry weight, carbon & nitrogen contents of some important zooplankton from Inland sea of Japan were studied by scientist[9] and he found that these parameters were found to be highly correlated to the length of copepods.

Conclusion

In the present study, four copepods belonging to different genera, were studied. Out of these *Eucyclops agilis* (1283.1µm) was found to be longest and big sized copepod. Whereas *Mesocyclops sps.* (1160.9 µm) measuring smallest in size as compared to other. The *Tropocyclops prasinus* (1185.3 µm) and *Macrocyclops fuscus* (1222.0 µm) are intermediate sized copepods, because their size range between *Eucyclops agilis* and *Mesocyclops sps.*.

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